An Assessment of Informal Trails and Visitor-Created Sites in Rocky Mountain National Park, Colorado:

Project Summary Report on

Bouldering Impacts in the Chaos Canyon and Emerald Lake Areas

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Abstract

Visitor activities in parks and protected areas lead to resource impacts of varying extents and levels. Certain recreational activity types—those that, by their nature, require off-trail access like fly fishing, rock climbing, and bouldering—often create a series of informal trails and visitor-created sites associated with these activities. Rocky Mountain National Park (ROMO), and particularly the Bear Lake Road Corridor, is a popular destination for such activities. The formation of resource impacts, like informal trails and visitor-created sites, can negatively influence both the ecology of the area and the recreational experience of visitors. This report summarizes preliminary results from a larger study to build a geospatial model to predict the formation of informal trails and informal trail networks. As part of this larger study, data was collected in ROMO in the Bear Lake Corridor at destinations where off-trail activities—specifically bouldering—were occurring at high levels. This report focuses specifically on describing the extent and level of resource impacts observed at bouldering areas near Emerald Lake and around Lake Haiyaha in Upper and Lower Chaos Canyons. A node and linkage system of resource impacts, organized around bouldering locations, were observed at both the Emerald Lake and Lake Haiyaha areas. Resource impacts were of moderate to severe levels with the Emerald Lake bouldering areas containing highly impacted sites and the Lake Haiyaha area containing a significant network of informal trails. Many of the resource impacts assessed in 2015 have formed since an intensive survey of resource impacts was conducted in the Bear Lake Road Corridor in 2008/2009. As such, it is recommended that continued monitoring of resource impacts associated with off-trail activities occurs in the Bear Lake Road Corridor. The results from this report will be used in the predictive model of informal trail formation and potentially be combined with social science survey results that were collected by researchers at Penn State University; *those analyses will be completed at a later date and included in separate reports.* This project summary report summarizes the resource assessment of bouldering impacts only.

Introduction

Recreation Impacts in Rocky Mountain National Park

Rocky Mountain National Park (ROMO) is world renown for unique and challenging wilderness experiences. With the recent increases in popularity of outdoor recreation and the growing population in Colorado, there remains a continued demand for quality outdoor recreation experiences. Associated with this ever present demand comes the potential for ecological impacts. Recent investigations in ROMO suggest that a primary mechanism of resource impact is when visitors depart from the well-developed and maintained trail system and seek out alternate pathways to more isolated locations in the park (D'Antonio et al., 2013). This type of behavior often results in the formation of informal trail networks (sometimes called "social" trails), areas of intense disturbance where visitor-created sites form, and larger "polygons" where less spatially organized, more diffuse impacts form.

Our previous study in ROMO (D'Antonio et al., 2013) suggested that these three distinct spatial patterns of impact are prevalent in certain locations in the park, particularly where high capacity developed trails "deliver" many visitors to destinations with a relatively low capacity to confine visitors to developed trails and sites. Moreover, ROMO is a popular destination for several visitor activity types that, by their nature, tend to seek out

areas typically not served by existing trails systems: mountaineers/rock climbers, fly fishers, and boulderers. Given the popularity of these activities, it is likely that numerous areas with the aforementioned impact patterns exist, but at present, only a few locations in the park have been investigated thoroughly (D'Antonio et al., 2013; Svajda, 2014).

Recreation Impacts as an Important Topic of Study

The idea that off-trail impacts are important is also supported empirically by several lines of recreation ecology research. First, recreation use-impact theory (Hammitt et al., 2015; Monz et al., 2013) suggests that initial disturbance by visitors in previously undisturbed areas results in a rapid formation of impact to groundcover vegetation. Once impacts are formed and apparent, these visitor-created trails and sites can attract subsequent use, both increasing the permanence of these impacts and the spatial extent and magnitude. The formation of networks of informal trails has also been shown to be of concern with landscape-level ecological processes, with increases in habitat fragmentation and associated impacts occurring as informal trail networks increase (Leung et al., 2011; Wimpey and Marion, 2011). Last, visitors appear to have thresholds of tolerance for the occurrence and proliferation of informal trails, beyond which these impacts become unacceptable to their experience in a park setting. This groundbreaking work on visitor perceptions of informal trails was conducted in ROMO and numerous locations where the density of these impacts exceeded acceptable levels were found in the Bear Lake Corridor (D'Antonio et al., 2013).

The above points demonstrate the importance of understanding and managing informal trails and associated resource impacts. Management of informal trails is a challenge for several reasons, but it is especially difficult since little is currently known about the influential factors that may result in informal trails forming in one location and not in others. It is likely that there are use-related, behavioral, ecological, and landscape factors that affect the frequency, density, and distribution of informal trails. But little research has been conducted to explore these relationships. This research examines informal trails and associated impact patterns from an inventory perspective to understand their location and extent in ROMO. This study will also create an exploratory statistical and spatial analysis to examine factors that may influence the formation of informal trails on the landscape. Additionally, based on discussions with managers, the increased popularity of bouldering activities in ROMO and resulting impacts is of great interest. As such, the research objectives of this study also focus on inventorying resource impacts in two key bouldering destinations in ROMO.

Research Objectives:

Primary Objectives:

1. Examine patterns of informal trail and visitor-created site formation in the Bear Lake Road Corridor.
2. Use data collected in the Bear Lake Road Corridor during 2008 and 2009 to create a spatial model that can predict where informal trails may form as a result of off-trail use.
3. Validate the aforementioned spatial model using new data collected during the summer of 2015.

Secondary Objectives:

A. Map areas of recreation use that were not assessed in the Bear Lake Road Corridor during the 2008 and 2009 study, specifically the bouldering areas in and around Lake Haiyaha/Chaos Canyon and above Alberta Falls.

B. Pair spatial, ecological data with survey data from boulderers (conducted by Penn State researchers during summer 2015) by mapping resource impacts in the same locations where surveys were conducted.

This project summary reports on results from primary objective 1 and secondary objective A. The remaining objectives, which focus on the creation of a predictive spatial model and relating spatial data to social science data collected by Penn State University are ongoing and will be included in subsequent reports.

The focus of this report will be to describe the methods undertaken during the Summer 2015 field season, present a summary of data collected related to bouldering activities in Chaos Canyon and at Emerald Lake, and highlight changes in the level or extent of recreation resource impacts that may be attributed to an increase in bouldering activities in the Bear Lake Road Corridor from 2008/2009 data to 2015. Important to the context of this study is that a bouldering guide for Rocky Mountain National Park was published in 2011 (Emerson, 2011). This guide makes locating bouldering locations in the Bear Lake Road Corridor much easier in 2015 as compared to 2008/2009 when resource impacts were first assessed in the area.

Methods

Study Site

The Bear Lake Road Corridor is one of the most popular recreation destinations in ROMO. The area provides a variety of hiking experiences, fishing opportunities, and climbing locations. In 2008/2009 we conducted a study which assessed the location and extent of recreation resource impacts throughout the Bear Lake Road Corridor including around Bear Lake, to Emerald Lake, and to Alberta Falls. Since the completion of that study, managers have acknowledged that bouldering has become an increasingly popular recreational activity in the Bear Lake Road Corridor. And in 2011, the publication of a climbing guide called “Bouldering Rocky Mountain National Park and Mount Evans” made finding bouldering locations in the Bear Lake Road Corridor much easier (Emerson, 2011). As such, as part of the larger study to model informal trail formation in ROMO, key bouldering destinations were chosen as the focus of the 2015 informal trail data collection efforts. The destinations included Lower Chaos Canyon, most of Upper Chaos Canyon, and bouldering locations to the south of the Emerald Lake Trail (see Figure 1). These locations were also chosen to coincide spatially with a social science survey being conducted by researchers at Penn State which also focuses on bouldering activities.

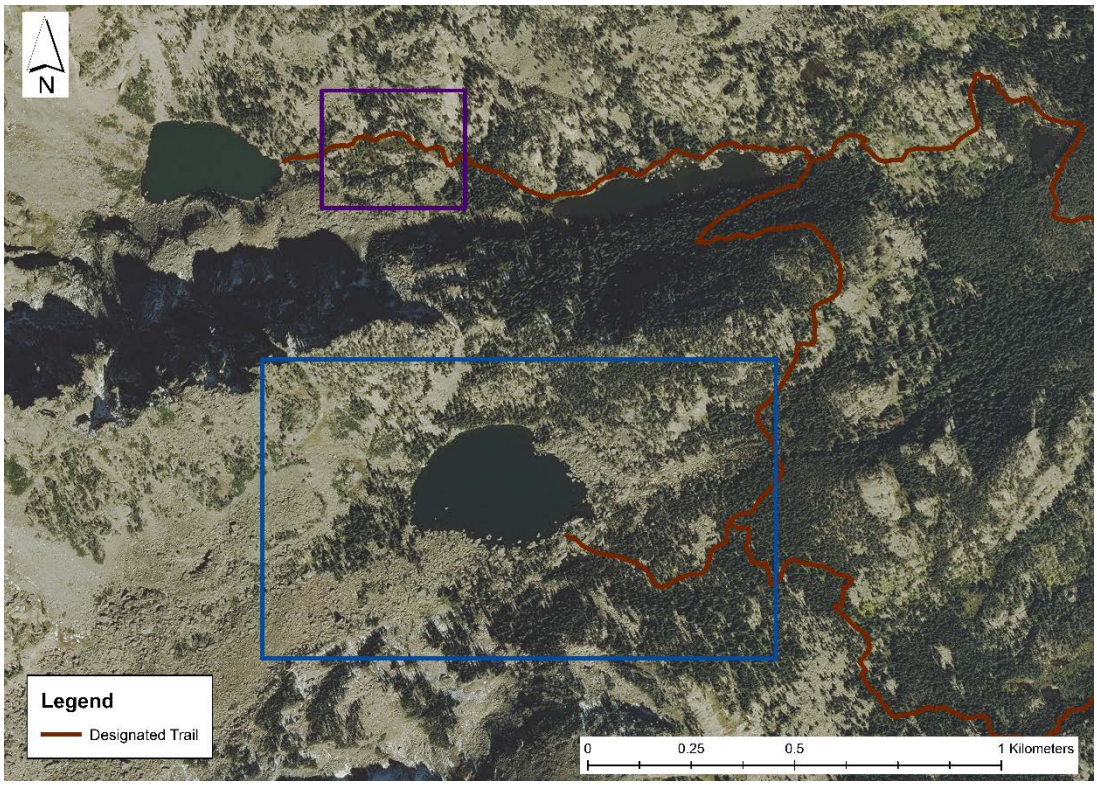

Figure 1: Locations within the Bear Lake Road Corridor where resource impacts were assessed. The blue box highlights the area around Lake Haiyaha, including Upper and Lower Chaos Canyons. The purple box highlights the bouldering area near Emerald Lake.

Data Collection

Resource impacts were located via foot searches using the designated trails as organizing features. Additionally, the bouldering guide "Bouldering Rocky Mountain National Park and Mount Evans," by Jamie Emerson (2011), was used to identify specific bouldering locations (often referred to as bouldering "problems"). Field technicians and researchers navigated to as many bouldering locations as was feasible to visit in the Upper and Lower Chaos Canyon and the Emerald Lake area during the 2015 summer field season. Since other uses also occur in these areas (day hiking, fly fishing), any and all resource impacts that were located in the bouldering areas were assessed, regardless of whether or not they were at a specific named boulder or connecting bouldering locations. Resource impacts that were assessed in 2008/2009 were not re-assessed as part of this study.

When resource impacts were located, the type of resource impact was identified and photographed. High accuracy Trimble GeoXT GPS units, paired with external antennas, were used to map resource impacts to the sub-meter level. The following methods were followed to document and map the location and extent of resource impacts.

Informal Trails: When located, informal trails were recorded as linear features using sub-meter accuracy GPS approaches. Impact parameters were also collected, including trail type (bouldering, visitor-created, fishing, etc.), condition class (see Appendix A), and trail width.

Informal Spur Trails: Informal trail spurs are informal trails that are 5 meters or less in length. Spurs were recorded as point features with sub-meter accuracy along the primary informal trail or designated trail. The approximate width, estimated ocularly, of each spur trail was recorded.

Visitor-Created Sites: Visitor-created sites are locations where visitor activities (including bouldering) create a "node" of impact. Each visitor-created site, including impacts at the base of boulders, was located through foot searches. The center of each visitor-created site was recorded as a high accuracy point feature, and a size category was determined for the site (small or large).

Small: Small visitor-created sites were measured using a meter tape and the size of the site entered into the 'Comments' section of the attribute table of the feature. Additional information related to the level of resource impact was recorded for the site, including the degree of vegetation cover loss, soil type, level of soil disturbance, condition class rating (see Appendix A), and the presence/absence of trash.

*Large (*also known as *Areas of Dispersed Visitor Use):* Large visitor-created sites or areas of dispersed visitor use were mapped as polygon features. Once discovered, the area was scouted to identify natural boundaries and the boundaries of the visitor use. The perimeter of the polygon was then measured to the sub-meter level by mapping the boundaries of the area of dispersed visitor use. Additional information related to the level of resource impact was recorded for the site, including the degree of vegetation cover loss, soil type, level of soil disturbance, condition class rating (see Appendix A), and the presence/absence of trash.

Data Analysis

All spatial data were downloaded from the Trimble GPS units, differentially corrected, manually cleaned in PathFinder Office, and exported to ArcGIS. From this spatial data, summary statistics were calculated to quantify the extent and level of resource impact assessed in 2015.

In 2008 and 2009, researchers were made aware that bouldering activities were occurring in and around Lake Haiyaha and in Chaos Canyon. Attempts were made to find resource impacts resulting from bouldering activities, but very little resource impacts were found at this time. In 2008/2009 a census of resource impacts in and around Emerald Lake was conducted and impacts that could be attributed to bouldering activities were not found. Resource impact data collected during the summer of 2015, which focused on bouldering activities, were visually compared to resource impact data collected in summer 2008 and summer 2009 to examine the changes over time at these key bouldering destinations.

Results for Bouldering-related Impacts Mapped in 2015

Summary of Results from 2015

Numerous visitor-created sites were located in both the Emerald Lake (Figure 2) and Upper and Lower Chaos Canyon (Figures 3 through 5) bouldering areas (see Table 1). Based on average condition class ratings, these sites were of moderate to considerable levels of impacts. Although the average vegetation loss on these sites

was relatively low, most sites had considerable levels of soil damage (possibly due to the use of crash pads at the base of boulders). Many sites also contained trash, and some sites showed observable impacts to trees. Impacts to trees included both intentional impacts (such as the breaking of branches) and unintentional impacts such as wear and tear from leaning against or hanging items on tree branches. The visitor-created sites were generally of relatively small size with a few large sites found at locations where multiple bouldering locations were centralized (ex: Gang Bang boulder). Additionally, between Upper and Lower Chaos Canyon, researchers observed five instances of landing bases being constructed with found or collected wood. And three crash pads were found to be cached in locations proximate to bouldering areas—researchers were not seeking out stashed crash pads, but they were documented when stumbled upon. Appendix B contains a table of the resource impact data collected for visitor-sites that could safely be identified as associated with bouldering activities.

Found within and near these bouldering locations were extensive networks of informal trails and trail spurs (Table 1). The Chaos Canyon area had significantly more informal and spur trails when compared to the Emerald Lake bouldering area. Chaos Canyon included numerous, long informal trails resulting in approximately 4,000 m (or 2.5 miles) of informal trails in the vicinity of Lake Haiyaha. Some of these informal trails were also due to fishing activities and hikers traveling off-trail, but especially in Lower Chaos Canyon, many of these informal trails led to or encircled boulders with known bouldering problems. The scree in Upper Chaos Canyon reduced possible off-trail impacts, as many boulderers traveled over scree to move between bouldering areas.

Informal trails were, on average, between approximately 20 and 40 meters in length. On average, trail condition class ranged from 2–4, indicating that most informal trails were of moderate impact (meaning they were noticeable, had vegetation loss, but the organic layer of soil was mostly present). The majority of trails in Chaos Canyon were less than 0.5 meters in width while trails in Emerald Lake were mostly between 0.5–1.0 meters in width.

Overall, the Chaos Canyon area contained more informal trails both in number and length, but these trails were narrower and had a lower condition class compared to the Emerald Lake area. Informal trails in the Emerald Lake area, while fewer in number and length, had a higher level of impact and were wider when compared to informal trails in Chaos Canyon.

Table 1: The level of resource impacts observed in popular bouldering destinations in the Bear Lake Road Corridor. See Appendix B for data from resource impacts assessed at named boulders.

	Visitor-Created Sites					**Informal Trails**				
Site Location	**# Sites**	**Average CC Sites (± SD)**	**Average Veg Loss (± SD)**	**Average Area (m^2) (± SD)**	**Total Area (m^2)**	**# Trails**	**Average CC Trails (± SD)**	**Average Length (m) (± SD)**	**Total Length (m)**	**# Spurs**
Emerald Lake	11	4 (± 0.7)	35% (± 33%)	32 (± 26)	354	23	4 (± 0.9)	23 (± 16)	532	15
Chaos Canyon	29	3 (± 0.9)	17% (± 24%)	22 (± 22)	579	109	2 (± 0.8)	39 (± 61)	4273	70

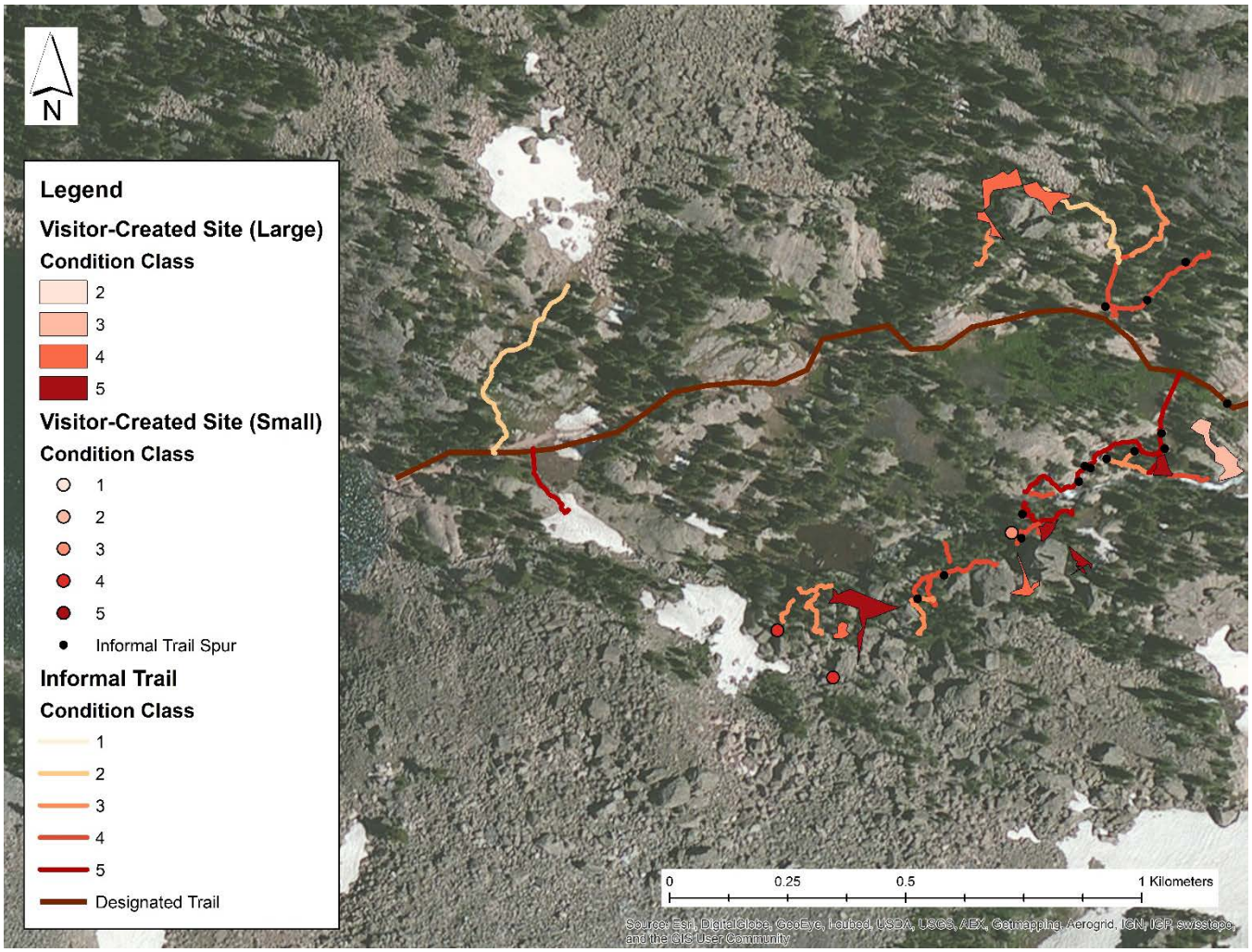

Figure 2: Resource impact locations and levels of impact for the bouldering area near Emerald Lake in the Bear Lake Road Corridor.

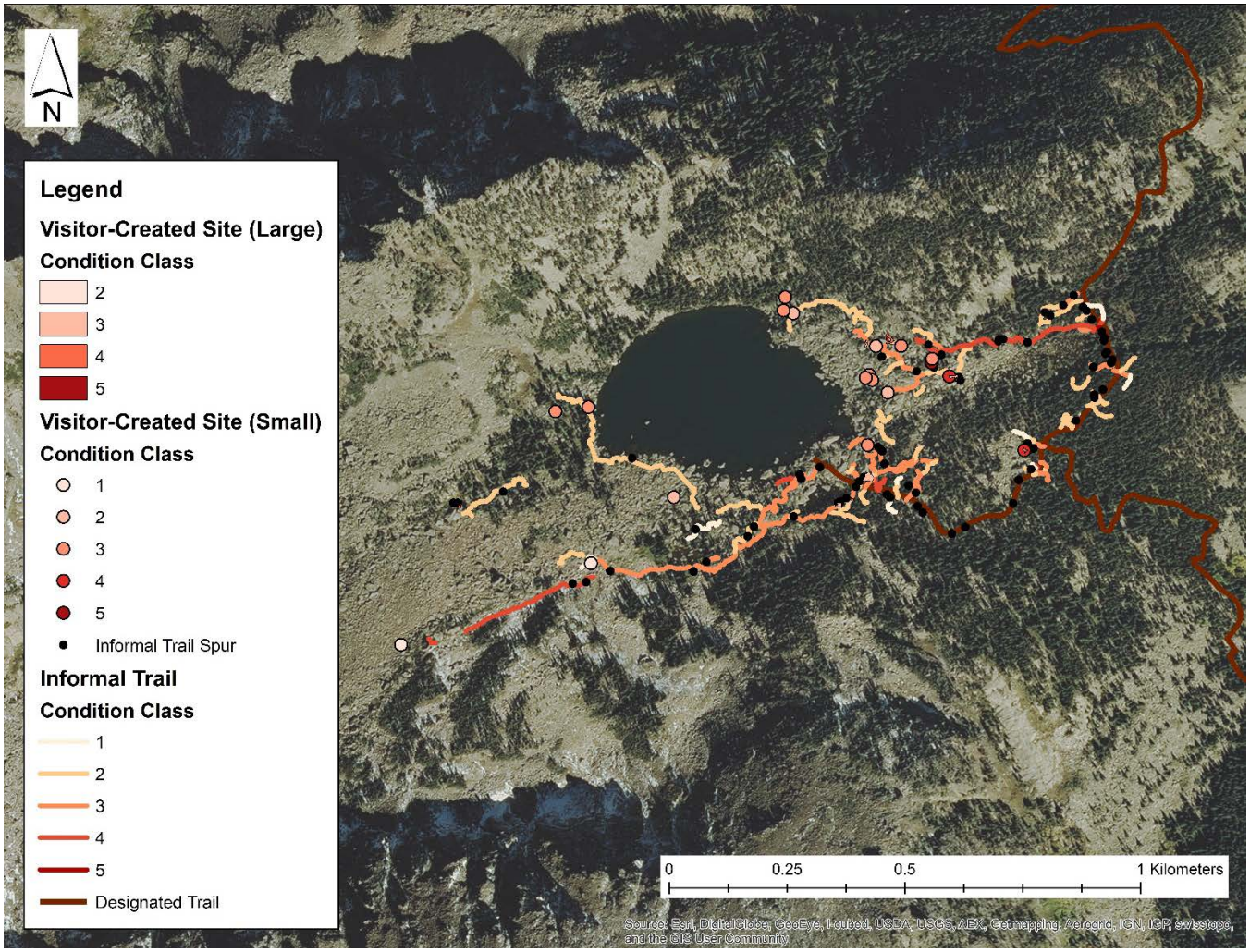

Figure 3: Resource impact locations and levels of impact for the area around Lake Haiyaha in the Bear Lake Road Corridor.

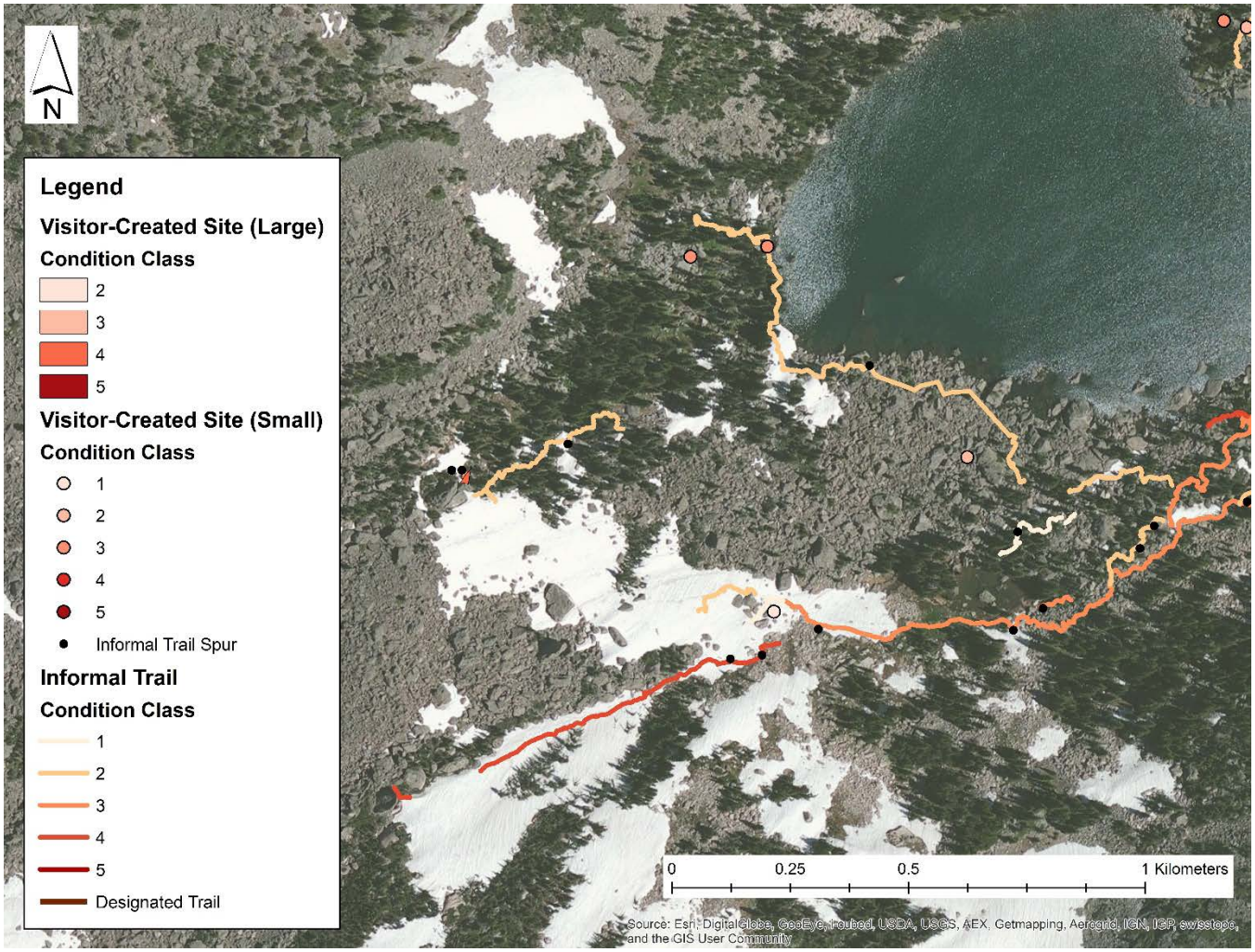

Figure 4: Resource impact locations and levels of impact in the Upper Chaos Canyon area in the Bear Lake Road Corridor.

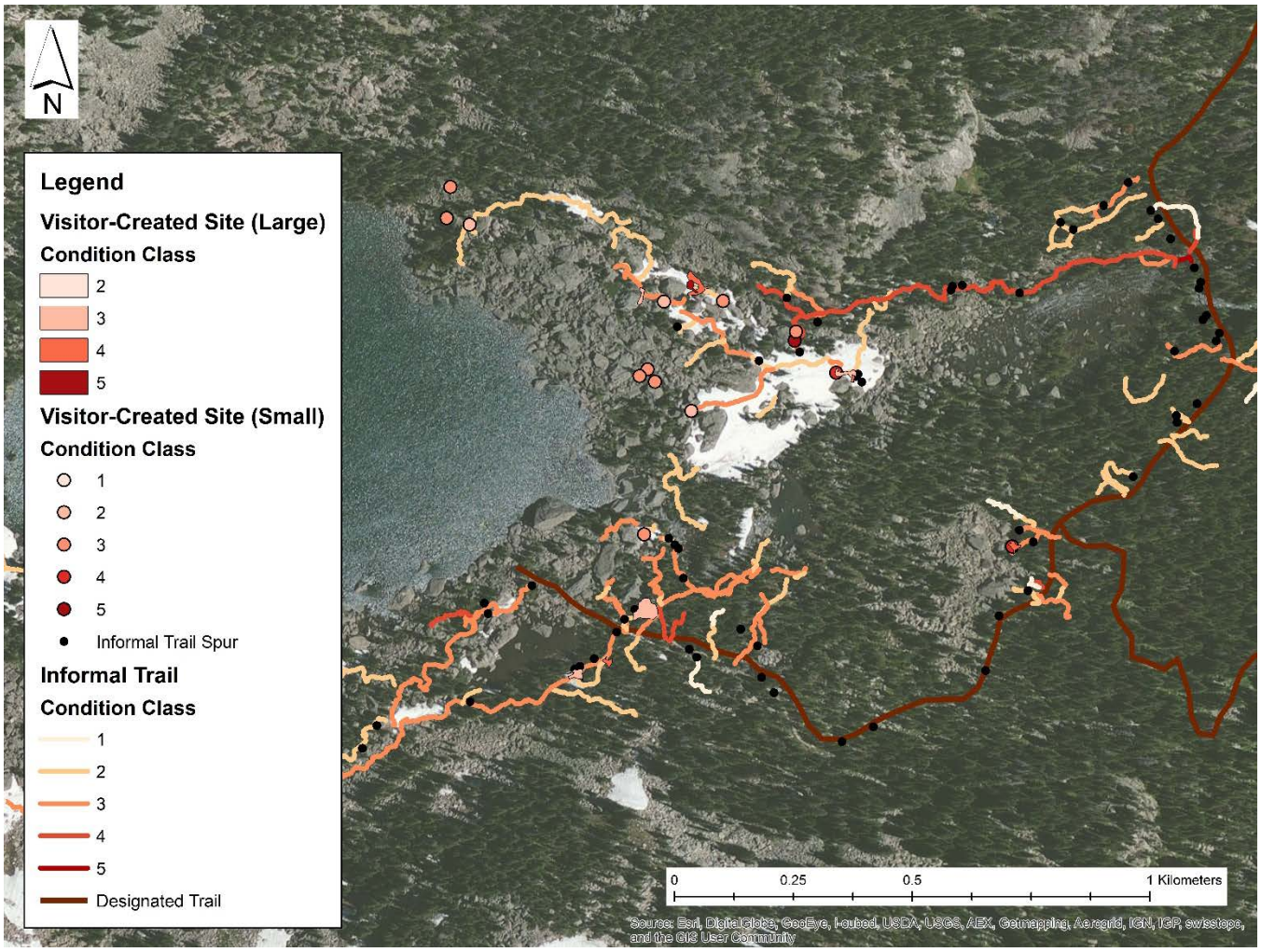

Figure 5: Resource impact locations and levels of impact in the Lower Chaos Canyon area in the Bear Lake Road Corridor.

Comparison with 2008/2009 Data Collection

During data collection in 2008/2009, a significant amount of resource impact was located around Emerald Lake (Figure 6) (D'Antonio et al., 2013; Newman et al., 2010). However, most of this resource impact was attributed to off-trail activities associated with day hikers visiting Emerald Lake. Although an informal trail was mapped into what is now an obvious bouldering area, no visitor-created sites or informal trails connecting bouldering locations were identified during those years. If bouldering activities were occurring, their impacts were minimal and boulderers were not observed by researchers accessing the area during the 2008/2009 field seasons.

In 2015 numerous visitor-created sites were located near Emerald Lake that were associated with bouldering activities (Figure 2). These visitor-created sites are already highly impacted (with all sites at condition class 4 or 5). Additionally, the informal trail that is used to access these bouldering areas (the one highlighted in Emerson, 2011) is of a higher condition class than observed in 2008/2009. In 2008/2009 this trail was barely noticeable and included in an area of dispersed visitor use associated with day hikers accessing Tyndall Creek. In 2015, the

trail accessing the bouldering area was obvious and highly impacted (i.e., the highest condition class rating of 5). Trails that were assessed in 2008/2009 that could be used to access the bouldering areas (not those highlighted in Emerson, 2011) were assigned a low condition class (2), meaning the trail was obvious but barely impacted.

The informal trails that have formed near Emerald Lake to access the bouldering locations cross through a very wet and seasonally water-logged area and then cross Tyndall Creek. Day hikers likely also use this trail to access Tyndall Creek at this location. The nature of the location of this access trail has resulted in a very obvious and highly impacted informal trail that was barely present in 2008/2009.

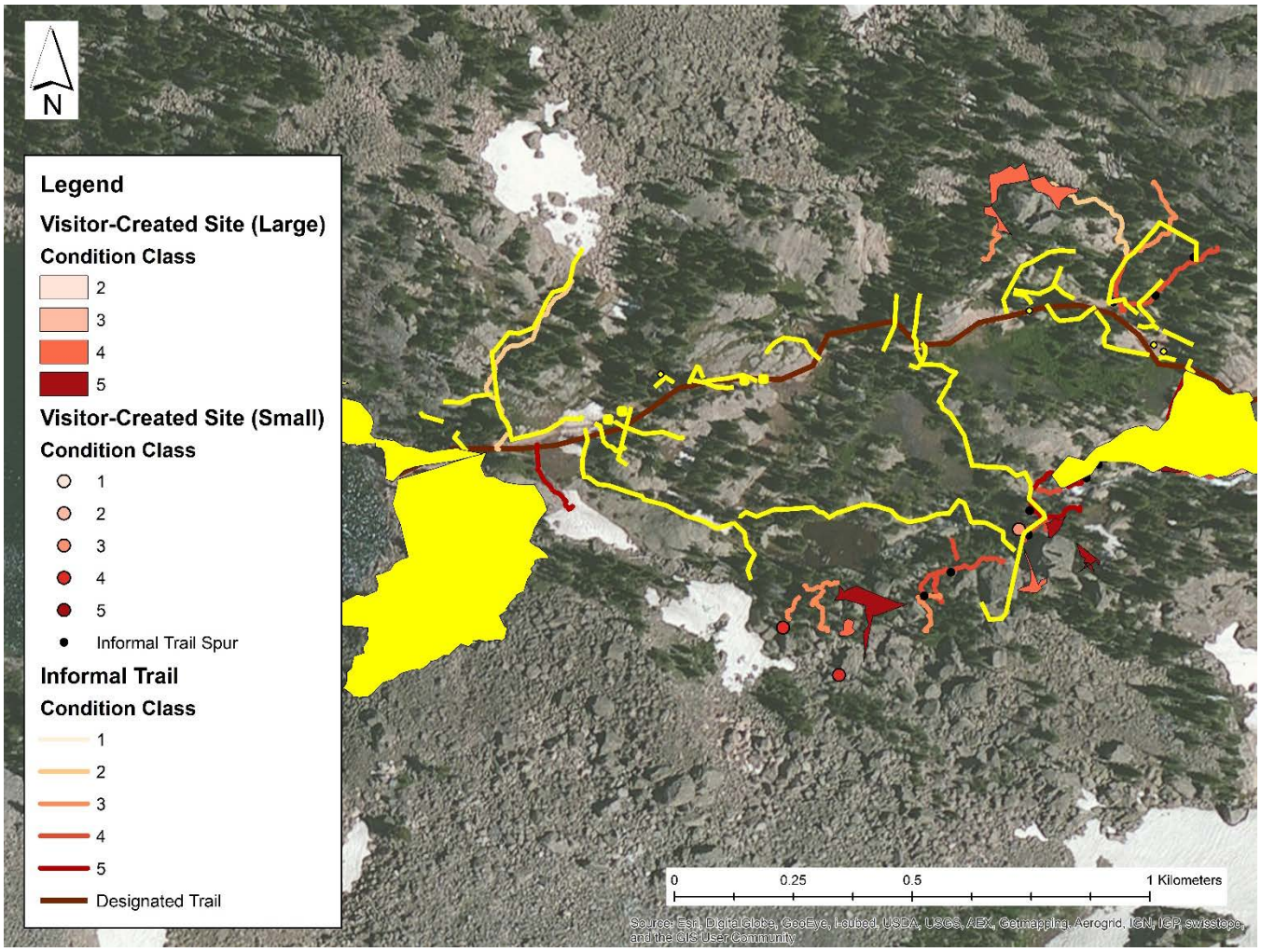

Figure 6: Resource impact locations and levels of impact for the area of Emerald Lake in the Bear Lake Road Corridor with resource impacts assessed during 2008/2009 overlaid in yellow.

In 2008/2009, researchers were told that bouldering activities were occurring in the Lake Haiyaha area. Specific attention was paid to finding these bouldering areas during that field season. Although the access trails to Upper Chaos Canyon and Lower Chaos Canyon were located and mapped (see Figure 7), there was little resource impact otherwise that could be considered associated with bouldering activities. And overall, the Lake Haiyaha area had a minimal network of informal trails and very few visitor-created sites (Figure 7).

During the 2015 field season, an extensive network of informal trails was easily found in both Upper and Lower Chaos Canyon. There also appears to be a trend of increasing intensity of resource impact since 2008/2009. For example, the access trail to Upper Chaos Canyon was a condition class 2 in 2008/2009, and in 2015 the same trail was scored as a condition class 3 and 4. Although the Lower Chaos Canyon access trail was a condition class 4 in 2008/2009 and has remained a condition class 4, this informal trail now travels further into Lower Chaos Canyon and provides an organizing feature supporting a network of informal trails that were not present in 2008/2009.

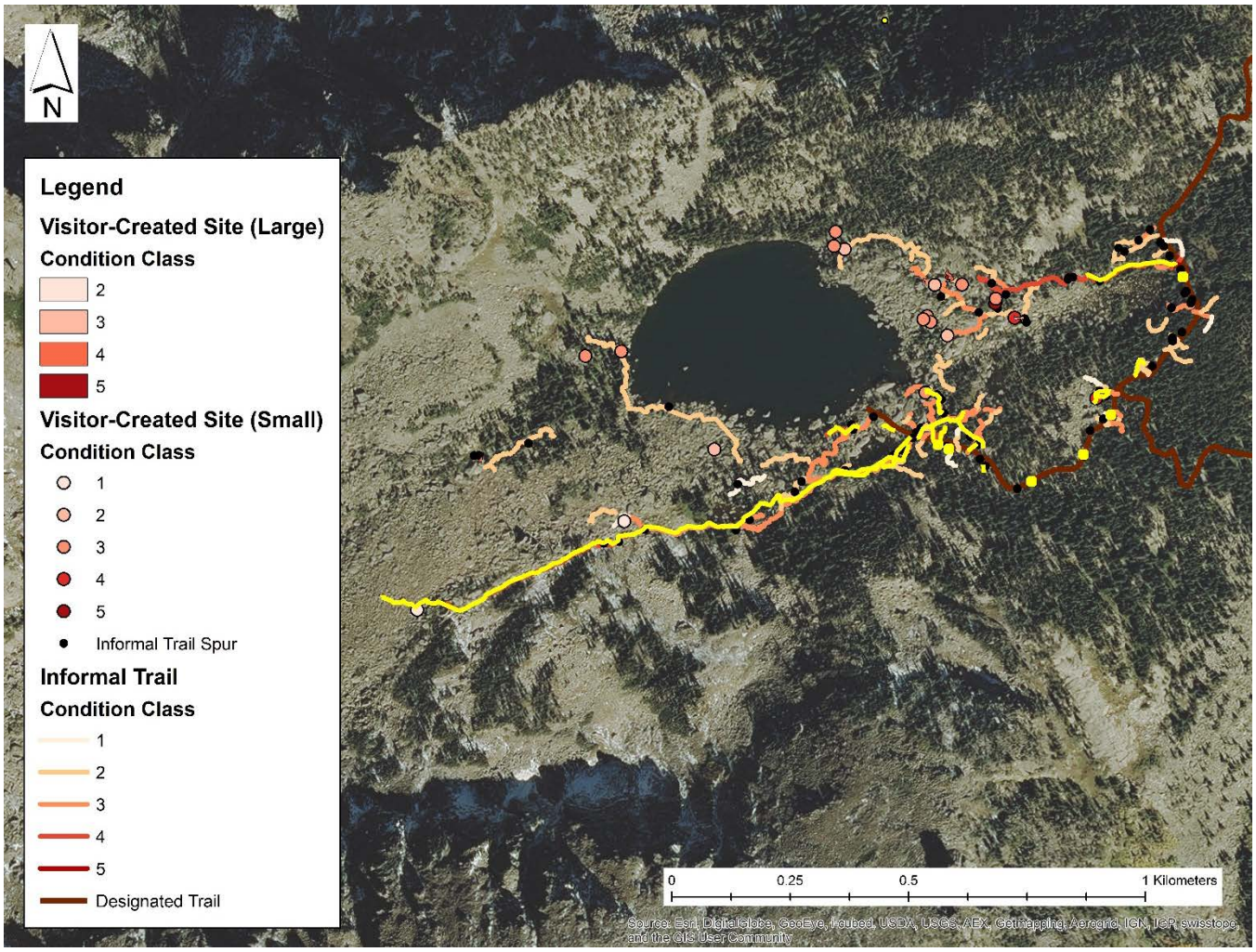

Figure 7: Resource impact locations and levels of impact for the area around Lake Haiyaha in the Bear Lake Road Corridor with resource impacts assessed during 2008/2009 overlaid in yellow.

Summary of Findings

Overall, networks of resource impacts were found in all bouldering areas near Emerald Lake and Lake Haiyaha (Figures 2–5). Bouldering areas and specific bouldering locations are attraction features that result in a channeling of repeated use at specific locations. Over time this results in resource impacts of increasing intensity. All bouldering areas contained a network of informal trails connecting boulders with bouldering problems. Visitor-created sites were observed to be numerous with moderate levels of resource impact. Many of the visitor-created sites did retain some level of vegetation cover, and most of the resource impact on these sites was due to soil damage at the base of boulders.

At Emerald Lake, in addition to a few highly impacted access trails, a greater number of large and highly impacted visitor-created sites were found as compared to the Lake Haiyaha areas (Figure 2). The Upper and Lower Chaos Canyon areas both contain a significant network of informal trails (Figure 3). Many of these areas of impact have appeared since 2008/2009 (Figures 6 and 7). At the Emerald Lake bouldering area, in just 6 years, significant resource impacts have appeared in potentially sensitive, riparian areas that are likely directly due to bouldering activities. In Upper and Lower Chaos Canyons, despite the presence of durable surfaces for travel such as rock falls and scree, informal trails create a spider-web pattern on the landscape emanating from named boulders.

It should be noted that day hikers and fly fishers also use some of these areas and the formation of informal trails could be attributed or perpetuated by these uses as well. However, as noted, many of these resource impacts have appeared since 2008/2009, thus coinciding with an increase in popularity of bouldering in the Bear Lake Road Corridor and post-publication of a bouldering guide for these areas (Emerson, 2011). Researchers also noted that, during field collection, almost all visitors observed in the Upper and Lower Chaos Canyon areas of Lake Haiyaha were boulderers (with the exception of a few fly fishers), and the only visitors observed crossing Tyndall Creek near Emerald Lake were also boulderers.

Management Implications and Future Research Directions

Management Implications

Bouldering could be considered an emergent activity in the Bear Lake Road Corridor of ROMO. Bouldering activities are occurring in areas where historic, “traditional” activities in the area (hiking and fishing) had not previously occurred. The use-impact relationship (Hammitt et al., 2015; Monz et al., 2013) suggests that initial use in an area results in proportionally more resource impacts. These findings provide empirical support for this phenomenon with the relatively rapid (since 2008/2009) formation of informal trail networks and highly impacted sites observed in the bouldering areas in the Bear Lake Road Corridor. Additionally, many of these popular bouldering areas are located in federally designated wilderness, thus potentially making the level of resource impacts and levels of use observed in these areas unacceptable from a management perspective.

These findings emphasize the importance of the management of emergent activities as they increase in popularity. Interpretation and outreach could be used to educate boulderers of ways to minimize their impacts to the environment. Adding to the complication of this issue, the guide book that many visitors are using to

access bouldering areas in the Bear Lake Road Corridor reference access trails which were not designed by managers and thus are not necessarily sustainable (ex: Emerald Lake access trail through a wet, riparian area). Unfortunately, the use of these books by visitors and the descriptions provided in these publications are outside the control of managers. However, managers may consider designating access trails into the bouldering areas, especially near Emerald Lake and to Lower Chaos Canyon, through hardened or more resistant surfaces (of which there are many in Upper and Lower Chaos Canyon) and attempting to restore those trails and visitor-created sites which are located in unsustainable locations.

Based on the rapid formation of resource impacts in the Bear Lake Road Corridor, it is recommended that continued inventorying and monitoring occur. Repeated measures of the level and extent of resource impacts related to bouldering and other day-use activities in the Bear Lake Road Corridor could be of value for understanding how emergent activities cause or perpetuate resource impacts. Additionally, continued monitoring could be used to evaluate the effectiveness of any management actions that may be taken in response to resource impacts such as restoration, education and outreach to boulderers, or the designation of access trails.

Future Research Directions

These related research projects are on-going as of the completion of this report and findings from these projects will be reported in separate, subsequent reports.

Predictive Model Building: This data collection effort was part of a larger project to build a predictive GIS/Spatial model for informal trail formation. Data collected in 2008/2009 will be used to build the model, and the data collected in 2015 and presented here will be used to validate the model and see if the model predictors work for resource impacts resulting from bouldering activities. The goal of the model is to determine factors on the landscape (i.e., slope, tree cover, proximity to water features) that may be used as predictors of where informal trails are likely to form as a result of recreation use.

Combination of Results with Penn State Social Science Survey: Penn State University (PSU) researchers conducted a social science survey aimed at boulderers in some of the same bouldering areas where resource impacts were assessed during the 2015 field season. Researchers from USU will be working with PSU researchers to examine opportunities to collaborate by combining the social science results with the spatial data collected and presented here.

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Appendices

Appendix A: Condition Class Descriptions for Resource Impacts

Informal Trail Condition Class Descriptions:

Class 1: Trail distinguishable; slight loss of vegetation cover and/or minimal disturbance of organic litter.

Class 2: Trail obvious; vegetation cover lost and/or organic litter pulverized in primary use areas.

Class 3: Vegetation cover lost and/or organic litter pulverized within the center of the tread, some bare soil exposed.

Class 4: Nearly complete or total loss of vegetation cover and organic litter within the tread, bare soil widespread.

Class 5: Soil erosion obvious, as indicated by exposed roots and rocks and/or gullying.

Visitor-Created Site Condition Class Descriptions:

Condition Class	Vegetation Damage	O Horizon Loss	Mineral Soil Exposure	Erosion
1	Very slight <1%	None	None	None
2	Slight <10%	Surface scuffing; some loss evident	Slight <10%	None
3	Moderate 10-50%	Moderate loss evident 10-50%	Moderate 10-50%	Slight
4	Considerable 51-90%	Considerable 51-90%	Considerable 51-90%	Some
5	Total Loss >90%	Total Loss of OM	Most of site >90%	Considerable (Root Exposure)

Appendix B: Summary table of resource conditions at visitor-created sites that were located at or near an identified, named boulder or bouldering location. Table does not include all visitor-created sites assessed as part of this study, only those that were likely associated with bouldering activities.

Bouldering Problem Location	Soil Substrate Type	Proximity to Designated Trail	Condition Class Rating	Vegetation Cover (On-Site)	Vegetation Cover (Off-Site)	Mineral Soil Exposed	Level of Soil Erosion	Trash On-Site
access to forest boulder	organic soil	> 10 M	3	6-25%	76-95%	0-5%	None/Slight	some
aquarium site	mineral soil	3-10 M	4	0-5%	6-25%	26-50%	None/Slight	none
back of deep puddle	organic soil	> 10 M	3	0-5%	6-25%	0-5%	None/Slight	none
bloodmoney	gravel	> 10 M	1	0-5%	0-5%	0-5%	None/Slight	some
brown frown boulder	organic soil	> 10 M	4	0-5%	76-95%	6-25%	None/Slight	some
cube/storm shadow area	mineral soil	> 10 M	5	0-5%	26-50%	6-25%	Severe	none
dashboard colt 45	mineral soil	> 10 M	5	0-5%	26-50%	96-100%	Moderate	none
dead raccoon	mineral soil	> 10 M	4	6-25%	26-50%	26-50%	Moderate	some
deep puddle boulder	organic soil	> 10 M	2	0-5%	6-25%	0-5%	None/Slight	some
european bolder	organic soil	> 10 M	3	0-5%	6-25%	6-25%	None/Slight	some
first warm up	organic soil	> 10 M	3	51-75%	51-75%	26-50%	None/Slight	none
first warm up problem	mineral soil	> 10 M	4	0-5%	51-75%	76-95%	Moderate	none
first warmup problem 2	mineral soil	> 10 M	4	0-5%	76-95%	96-100%	None/Slight	none
forest boulder	organic soil	> 10 M	3	51-75%	51-75%	0-5%	None/Slight	some
freshly squeezed	mineral soil	>10 M	2	0-5%	0-5%	6-25%	None/Slight	some
gang bang	mineral soil	> 10 M	4	6-25%	6-25%	26-50%	None/Slight	some
gang bang	mineral soil	> 10 M	5	0-5%	6-25%	96-100%	None/Slight	some
gobot area	organic soil	> 10 M	3	0-5%	0-5%	0-5%	None/Slight	none
herm's boulder	organic soil	> 10 M	3	0-5%	0-5%	51-75%	None/Slight	none
kind traverse boulder	mineral soil	> 10 M	4	0-5%	6-25%	6-25%	Moderate	some
kind traverse access	mineral soil	> 10 M	5	0-5%	6-25%	76-95%	Severe	none
kneebar and belcher boulders	organic soil	> 10 M	4	0-5%	6-25%	76-95%	Moderate	some
large sector	mineral soil	> 10 M	4	0-5%	6-25%	6-25%	None/Slight	some
mikaila boulder	organic soil	> 10 M	2	51-75%	0-5%	N/A	None/Slight	none
revenge boulder area	mineral soil	> 10 M	3	0-5%	0-5%	0-5%	None/Slight	some

satellite boulder	organic soil	> 10 M	3	0-5%	6-25%	26-50%	None/Slight	none
skyscraper	organic soil	>10 M	3	26-50%	26-50%	6-25%	None/Slight	none
small problem near gang bang	mineral soil	> 10 M	3	0-5%	26-50%	6-25%	None/Slight	none
the dashboard	mineral soil	> 10 M	3	0-5%	6-25%	51-75%	Moderate	some
the edge boulder	mineral soil	> 10 M	4	0-5%	76-95%	96-100%	Moderate	some
unknown (near brimstone)	organic soil	> 10 M	1	26-50%	26-50%	0-5%	None/Slight	none
unknown boulder problem	organic soil	Adjacent	3	6-25%	6-25%	0-5%	None/Slight	some
upper chaos access	organic soil	3-10 M	4	0-5%	6-25%	0-5%	None/Slight	none
whispers of wisdom	mineral soil	> 10 M	5	0-5%	26-50%	76-95%	Severe	none
whispers of wisdom the crack	organic soil	> 10 M	3	0-5%	6-25%	26-50%	None/Slight	some