Final Report:
Crowding, coping, conflicts, and recreation management preferences: A PPGIS analysis on lands managed by Boulder's Open Space and Mountain Parks Department

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Executive Summary

The purpose of this study was to explore the spatial location of crowding and recreation conflict densities, mechanisms of coping that recreation users employ in response to crowding, as well as attitudes towards recreation management alternatives amongst recreationists who visit the City of Boulder Open Space and Mountain Parks (OSMP) lands. This study utilized data from an online Public Participation Geographic Information System (PPGIS) map that enabled respondents to place points to spatially identify areas where they have experienced crowding and/or recreation conflict. These areas were then compared to see if crowding and conflict were related to one another. Additionally, a survey instrument was attached to the PPGIS to gain a better understanding of the respondents' recreation characteristics, behaviors, and management alternative preferences.

A total of 187 respondents placed points on the PPGIS map and answered the survey questionnaire. Areas of high kernel density mean values, statistically significant hot spots, and High-High (HH) clusters for crowding were concentrated around the following trailheads to the north (Sage and Eagle), the foothills trailheads to the west (Chautauqua, Centennial, and Gregory Canyon), trailheads to the south (Doudy Draw, South Mesa, and Marshall Mesa), and South Boulder Creek West trailhead to the east. Additional areas of high kernel densities and statistically significant hot spots and HH clusters for conflict were concentrated around Sawhill Ponds, Teller Farm North, and Teller Farm South. Areas of similarity between crowing and conflict density values were located around Centennial, People's Crossing, Halfway House, Panorama Point, Crown Rock, Gregory Canyon, Chautauqua, Enchanted Mesa, South Mesa, Doudy Draw, and Marshall Mesa trail networks. Recreation users' coping mechanisms to deal with crowding showed a preference for behavioral alterations over avoiding the area of interest, though some respondents

did choose not to go to the area anymore. The management alternative that was widely accepted amongst all the groups was related to education and outreach about trail etiquette. Results from this study include:

- Demonstrating the utility of using online PPGIS and social science methods to better understand spatial distributions of crowding and recreation conflicts.
- Spatial data related to crowding and recreation conflict can be combined with other datasets and can further bolster future recreation management planning.
- Recreational users' coping mechanisms employed result in a greater number of behavioral modifications than avoidance of areas perceived to be crowded.
- Evidence that education and outreach initiatives centered around trail etiquette are widely supported by recreational users.

Abstract

This study expands upon the growing research that is integrating Public Participation Geographic Information Systems (PPGIS) and other social science methods to collect spatial data and respondent characteristics as they relate to the fields of public land and recreation management. An online PPGIS map was developed that allowed respondents to place points on locations where they have experienced crowding (n = 187) and recreation conflicts (n = 75) on Boulder's Open Space and Mountain Parks (OSMP) lands. A coupled online survey instrument solicited responses from 187 respondents who placed the points on the PPGIS maps. This survey was used to understand the participants' demographics and attitudes towards management alternatives. Kernel density calculations and subsequent spatial statistical analysis of crowding and conflict points were used to identify locations of crowding and conflict clustering. A Jaccard similarity coefficient showed moderate similarity between areas of high kernel density mean

values of crowding and recreation conflict. Coping mechanisms to deal with crowded areas showed that most recreational users showed a preference for altering their behavior in these areas instead of avoiding them all together. Finally, recreational users' preferred management action was related to increased educational outreach and the least preferred management action was related to requiring reservations at popular locations. Results from this research can be used to inform OSMP land managers on the spatial distribution of crowding and conflict densities as well as the attitudes towards different management alternatives meant to alleviate these issues.

Keywords: *crowding, recreation conflict, coping mechanisms, management preferences, PPGIS*

Introduction

There is an ever-increasing demand placed on public land management agencies to provide abundant and high-quality recreational experiences to a diversity of recreation groups that are oftentimes reliant on the same resource for their recreational needs. These recreation groups may have conflicting needs and expectations because of their different goals and social values (Newsome, Smith, & Moore 2008). Multi-use trails are seen as sources of conflict between different recreation groups because these groups' recreation activities have a spatial coexistence (Wolf, Brown, & Wohlfart 2018).

Stankey (1971) stipulated that recreation conflicts are a significant issue for land managers since they can influence recreation satisfaction. If conflicts are not mitigated properly by land managers, they can have an impact on the recreationist's desire to return to the site, can negatively impact word-of-mouth recommendations, and hinder the land management agency's ability to build a constituency for their missions (Wolf et al. 2018). Within the recreation literature, two distinct theories of conflict are defined. First, interpersonal conflict theory defines conflict as recreation goal interference because of another's behavior (Jacob & Schreyer 1980).

These conflicts are a result of negative social interactions between recreationists who have a perception that they are being prevented from accruing their expected recreation benefits because of competition for a shared resource (Owens 1985). Second, social values conflict theory defines conflict as a perception of problems with other recreation groups and their recreation activity, even if there is no direct contact with that group (Vaske, Needham, & Cline 2007). Social values conflicts arise in individuals who seek a sense of belonging to a particular recreation group and adopt shared normative beliefs and negative attitudes towards other recreation groups in turn (Rossi, Byrne, Pickering, & Resser 2015). While the personal and psychological sources of recreation conflict have been thoroughly studied, there is a need to understand the spatial dimension of conflict since recreation conflict occurs within a spatial context.

Setting density, or crowding, is another theoretical paradigm in recreation research that deals with examining humans' responses to encounters with other humans and how that impacts the visitor experience. Manning et al. (1999) identify crowding in a normative sense where individual and group perceptions use the social and environmental conditions of a particular setting. Normative theory, in a recreational management context, separates the concepts of crowding and level of use and helps managers distinguish both independently of one another when developing management plans. Crowding has a psychological meaning that is oftentimes perceived as negative and is a subjective evaluation of visitor density that is dependent on a wide variety of factors. Use level, on the other hand, is a physical concept and is a neutral evaluation of the number of people present within a given area (Haberlein 1977).

Evaluations of crowding are a result of the socially constructed expectations of what human behaviors and environmental conditions are seen as appropriate concerning a particular context and a desired acceptance of stress. If these expectations are not met at a particular

location or the recreation user faces excessive stress while participating in their chosen recreation activity due to crowding, they may resort to coping mechanisms that alter future recreation behavior and spatial choices (Manning and Valliere 2001). A spatial understanding of the perception of crowding coupled with numeric measures of visitor use levels provides managers with a more cohesive picture of what is happening in the landscapes they manage. Additionally, understanding coping behaviors provides managers with a greater understanding of how recreational users deal with crowding at locations.

Spatial data on recreation distribution can be used by land managers to manage crowded areas and recreation conflict, however for most protected areas there is little understanding or data related to recreationists' spatial and temporal distributions (van Schaick 2010). Data that is spatially explicit can be collected from recreation groups through a participatory planning process using public participation geographic information systems (PPGIS). Sieber (2006) defines PPGIS as a method that uses geospatial technology to inform land managers on management decisions by inviting the public to participate and provide geospatial knowledge about their perceived attributes by identifying and marking locations of interest on a map.

Spatial data are also important to land managers for understanding the distribution of recreation users and can give them an understanding of where recreation experiences may be negatively impacted due to conflicts and crowding (D'Antonio & Monz 2016). Wolf, Brown, and Wohlfart (2018) noted that using PPGIS methods in recreation research will be essential for land managers to predict areas of conflict based on perceptions of crowding and to manage these conflicts along trail networks. Additionally, Beccco and Brown (2013) identified the importance of integrating spatial data and other social science methods in the realm of recreation management and called for an increase in the use of spatial data for management decisions.

Using PPGIS and the spatial data obtained from this study provides land managers at OSMP with actual areas that are perceived as crowded by recreational users, coping mechanisms used in these crowded areas, and locations where users have experienced a past recreation conflict across their vast trail network, enabling them to better target their recreation management priorities. Land managers at OSMP can also better develop management plans that support the ability of recreationists to achieve sustainable coexistence of different recreation activities by using the results of this study to gain a more detailed understanding of what underlies these recreation conflicts (Wolf et al. 2018). This study used both PPGIS and a survey instrument to assess perceptions of crowding, crowding coping mechanisms, locations of experienced recreation conflicts, and attitudes towards management actions; areas of concern that OSMP land managers have expressed a desire for additional data to help with management decisions. Spatial data will help managers at OSMP gain a better understanding of the spatial dimensions of crowding and conflicts within their trail system. Survey data will also help managers at OSMP understand attitudes towards different management strategies to address crowding and recreation conflict. Data from this study was used to answer the following questions:

Question 1: Where are the areas with the highest density of perceived crowding and what coping mechanisms are employed by recreational users at these locations?

Question 2: Where are the areas with the highest density of recreation conflict?

Question 3: How do areas with the highest density of perceived crowding relate to areas with the highest density of recreation conflict?

Question 4: What are recreational users' attitudes towards management actions that can be taken to alleviate recreation conflicts?

Methods

Study Design

City of Boulder Open Space and Mountain Parks (OSMP) operates 37 trailheads in and around the greater Boulder area. Data collection for this study took place via an online PPGIS map and coupled online survey that respondents accessed using a quick response (QR) code or website link contained on signs placed at eighteen trailheads. Throughout 2021 OSMP staff systematically rotated the signs between six trailheads during each month of the study.

Data were collected for this study using the online Maptionnaire PPGIS mapping interface (Maptionnaire 2021) that allowed participants to provide spatial data coupled with survey-based questionnaire responses. The PPGIS section of the survey asked respondents to drag and drop color and categorically coded points on an online map that contained data layers pertaining to all OSMP-managed trailheads and trails. These drag and drop points allowed respondents to spatially identify locations where they: (1) have experienced a recreation conflict in the past year and the nature of this conflict and (2) perceive there to be crowding and the coping mechanism that they use at the crowded location. Conflict location and crowding point categories were based on previous PPGIS research conducted by Wolf et al (2018).

After placing points on the map, respondents were directed to an online survey that was also contained within the Maptionnaire PPGIS platform. Survey questions consisted of questions that captured the respondent's chosen recreation activity and socio-demographic characteristics. Additionally, the researcher and OSMP staff added additional Likert-scale questions to gauge respondents' attitudes towards various management actions that OSMP managers may be interested in implementing to address crowding and recreation conflict issues.

Study Area

The study area was defined as a 30 km x 30 km square around the OSMP trail system obtained by buffering the furthest conflict points by 7 km to avoid an "edge effect" in the spatial analysis (Figure 1).

Data Analyses

Survey and spatial data were analyzed separately from one another. Data from the survey instrument were analyzed using RStudio version 3.6.3. Spatial data were analyzed using ESRI ArcGIS Pro. Prior to data analysis, points placed by respondents outside of OSMP lands were deleted (n = 9 for crowding and n = 4 for conflict points). Points were then spatially joined to the nearest OSMP trailhead or trail for density analysis. Locational densities of crowding and conflict were derived using kernel density methods outlined by Charikar et al. (2021). For crowding density, points were weighted based on three categories with extreme crowding receiving the highest weight (3 = extreme crowding, 2 = moderate crowding, 1 = slight crowding). Density maps were used to provide an initial visual overview of the density distributions of crowding and conflicts.

A hexagonal grid of the study area was created and consisted of 16,256 individual hexagons with diameters of 160 meters. This grid was created to aggregate density crowding and conflict map values for further statistical analysis. Mean density values within each hexagon were calculated and normalized on a scale from 0 to 100. Only hexagons with mean values above zero were displayed. Normalized mean density values within the hexagons were used to perform a hot spot analysis to produce a Getis-Ord General G statistic used to find statistically significant spatial clustering of high or low values for locations of recreation crowding and conflicts. Spatial autocorrelation based on hexagon mean values and spatial location were used to calculate a Global Moran's I spatial statistic. Finally, an Anselin Local Moran's I (LISA statistic) was used to identify

local trends in the spatial location of the intensity of recreation crowding and conflict (García-Palomares et al. 2015). To understand what coping mechanisms were utilized by recreational users at the sites with the highest crowd densities, all hexagons identified as being a hot spot with 99% confidence were selected from the Getis-Ord General G analysis. Crowding points were clipped to the hot spot with a 99% confidence hexagon layer and counts of the coping mechanism were generated. Finally, the hexagon grids for crowding and conflict with mean density values were converted to raster surfaces, and a difference and intersect raster surface was created to compute a Jaccard similarity coefficient (Liao, Hou, & Jiang 2019).

Results

In total, 187 respondents placed PPGIS points amongst OSMP lands and completed the online survey (Table 1). Using the PPGIS online map, respondents placed 187 points related to crowding and 75 points related to recreation conflicts (Table 2). A near analysis and subsequent spatial join of crowding and conflict with trail features identified trailheads that had the largest number of crowding and conflict points (Table 3).

Spatial Statistics

While there were more points placed on the map related to crowding the conflict points have a greater spatial dispersion than those related to crowding and the density map covers a larger area as a result. This is a function of most crowding points being placed in clustered patterns and most conflict points being placed in a more dispersed pattern (Figure 2). A Getis-Ord General G Statistic analysis revealed a trend of concentrations of hexagons with high values (hot spots with 99% confidence) and high statistical significance ($p<0.01$) for both crowding and conflict (Figure 3). Moran's Index indicated strong autocorrelation and the formation of spatial clusters of hexagons with similar mean density values for crowding and conflict ($p<0.01$). Anselin Local

Moran's I statistic was then used to identify areas of the High-High (HH) spatial clusters (Figure 4). The Jaccard similarity coefficient between the crowding and conflict densities raster files was 0.51, meaning that 51 percent of the raster cells in both datasets contained the same mean density values, representing a moderate degree of similarity between crowding and conflict density locations (Figure 5).

Coping Mechanisms

There were 162 crowding points with affiliated coping mechanisms placed within the hexagons that contained the highest confidence in hot spot locations. Most respondents chose to pick a different time to visit locations as their coping mechanism at locations where they perceived there to be crowding (Table 4).

Management Action Preferences

The proposed management action that received the most support from all recreation groups was "Increasing education or outreach about trail etiquette". While the proposed management action that received the least support from all recreation groups was "Requiring a reservation to access high-demand areas during popular times" (Table 5).

Discussion

This study used online PPGIS data collection to identify the spatial distribution of crowding and recreation conflicts within lands managed by Boulder's OSMP department. It provides OSMP managers with important insights into the spatial dimensions of visitors' experiences which Becco & Brown (2013) note is important to managing visitor preferences in recreation. Additionally, a survey questionnaire was attached to the PPGIS map that was used to understand different recreational users' recreation experiences, activity patterns, and attitudes towards different management alternatives that could be carried out by managers at OSMP to alleviate crowding

and recreation conflicts. Together, this information provides managers with spatial locations and characteristics of recreation groups that can be used to prioritize management resource allocation, future recreation experience monitoring, and the development of recreation management plans that are more cognoscente of the spatial complexity of recreational user experiences.

Kernel density, hot spot, and spatial clustering analysis showed similar clustering in the analysis of both crowing and conflict. Areas of high kernel densities, statistically significant hot spots, and HH clusters for crowding and conflicts were concentrated around Boulder Valley Ranch trails to the north, the foothills trailheads to the west, and the South Mesa, Doudy Draw, Flatirons Vista, Greenbelt Plateau, Marshall Mesa, and South Boulder Creek West trail systems to the south. Additional areas of high kernel densities, statistically significant hot spots, and HH clusters for conflict were concentrated around Sawhill Ponds, Teller Farm North, and Teller Farm South. Areas of similarity between crowing and conflict density values were located around Centennial, The Peoples' Crossing, Halfway House, Panorama Point, Crown Rock, Gregory Canyon, Chautauqua, Enchanted Mesa, South Mesa, Doudy Draw, and Marshall Mesa trail networks.

The moderate similarity between perceptions of crowding and experience of recreation conflicts in this study can be used to better inform management planning. Crowding is a socially contrived expectation of the number of encounters that recreational users are expecting within a particular setting (Kyle, Landon, & Schuett 2022). Managers at OSMP can use trail count data collected in the field, coupled with crowding density data provided by recreational users, to see if there are relationships in use levels and perceptions of crowding at OSMP trailheads. Having data related to use levels and perceptions of crowding can allow managers to try and develop management plans that seek to maintain a desirable state for all recreational users (Manning & Valliere 2001).

Recreation conflicts at large spatial scales (small geographic areas like OSMP managed lands) are generally individualistic and not based on the recreation group (Hall & Shelby 2000) therefore managers can use the results of frequencies of recreational conflict types within this study in isolation of the chosen recreation activity of the individual that reported the conflict. Most of the conflicts recalled by recreational users were verbal and not physical in nature. Managers can use the locations with high numbers of conflicts to develop communication measures that include communication interventions (i.e., Steckenreuter and Wolf 2013) or develop unselling plans to direct user groups to less crowded trails (Armstrong and Kern 2011). One of the management actions that most recreation users viewed as completely acceptable was "Adding amenities to less frequented areas to disperse visitors across the system". Adding amenities to these less frequented areas and promoting these new additions could be one strategy used by managers to unsell crowded areas.

Recreational users most noted crowding coping mechanism resulted in the users altering their behaviors by choosing to visit the areas that they perceive to be crowded at different times or visit the area despite the crowding instead of avoiding them altogether. Behavioral coping mechanisms employed by individual recreationists that decide to still visit the crowded area can arise as stress-laden adaptations to recreational pursuits. It can also signal undesirable changes to the spectrum of various outdoor recreation opportunities throughout the larger publicly managed landscape (Manning and Valliere 2001). An awareness of what coping mechanisms and behaviors are being utilized by recreational users can allow managers to better understand overall visitor satisfaction by being able to identify recreational usage and visitor decisions on a more complex level. Coping mechanisms can also be used to predict how and where recreational users may shift their recreation habits.

With regards to recreation management alternatives, this study showed that all recreation groups support OSMP managers in increasing education or outreach about trail etiquette. Taff et al. (2014) note that theory-based and science-informed messaging may enable recreation managers to shape visitor expectations and satisfaction levels. OSMP managers can use this study and the acceptance of educational and outreach initiatives amongst all groups to develop clear communication strategies centered around trail etiquette. Setting clear expectations of recreation etiquette can also help OSMP managers build realistic expectations between different recreation groups and encourage behavior that will reduce the perception of crowding and incidences of conflict.

Overall, this study used PPGIS to identify areas that respondents identified as having high occurrences of crowding and recreation conflicts and what coping mechanisms they used to avoid areas with high levels of crowding. It also integrated a survey questionnaire, pairing social science data with spatial data, to better understand the characteristics of the respondents and their attitudes towards management alternatives that may be deployed to address issues of recreation crowding and conflict. As technologies evolve studies like this one that combines spatial methods and social sciences can be integrated into future recreation management plans more easily.

Limitations and Future Research

One of the challenges inherent in conducting an online PPGIS study on recreational users' perceptions of crowding and locations where they have experienced a recreational conflict is that the researcher is relying on the user to accurately remember and recall conditions that took place in the past. Bernard et al. (1984) state that people generally have limited memories of actual events, their behavior during that event, and the physical components of the environment or the exact location of the event itself. Borrie and Roggenbuck (1998) note that recall is more likely to be

328 available to individuals and be highly accurate if the context of the recall is like the context of
329 where the event took place. A PPGIS study that takes place at trailheads managed by OSMP using
330 tablets or paper maps may yield more accurate results or more participation than an online PPGIS
331 study since the external environment of the trailhead can better trigger remembrance. Additionally,
332 users can also report, in a timelier manner, if a conflict took place during their current visit and
333 would not have to rely on recall to report the event.

334 Additionally, the task of reporting events should be straightforward for the user so that they
335 can provide accurate locations of the events and not be in a mood that would not facilitate the
336 triggering of the remembrance of an event. One of the limitations of using Maptionnaire for this
337 study was the fact that each of the trail segments and trailheads had to be loaded into the online
338 environment as individual features resulting in slow loading times for maps that users interacted
339 with to place points. Slow loading times could have altered participants' moods and led to users
340 deciding to not interact with the PPGIS maps. Once the maps loaded, users were asked to place a
341 multitude of points on the PPGIS maps and then to subsequently respond to survey questions.
342 Users may have felt a large burden of time and effort in having to place multiple points on multiple
343 maps and then answer survey questions. A simpler interface that does not take as long to load and
344 subsequently interact with coupled with a shorter survey at the end could increase the response
345 rate for future online PPGIS studies conducted on OSMP lands.

346 Online PPGIS methods are a relatively new form of data collection in recreation
347 management and the implications of different methods and modes of PPGIS data collection are
348 not well understood (Wolf et al. 2015). Brown and Kyttä (2014) state that there is not a good
349 understanding on how to increase the rate of participation in PPGIS. Wolf et al.'s (2018) PPGIS
350 study on visitor conflict along multi-use trails used two sampling methods to solicit volunteers for

their study. First, they recruited participants in online forums, recreation shops, and local recreation clubs and associations. Second, the intersected participants at popular trails and trailheads in their study area. One suggestion, to increase online participation for all OSMP studies, is to supplement recruitment signs placed at trailheads with outreach utilized by Wolf et al. (2018) outlined above and/or have a dedicated location on the OSMP website for ongoing research solicitation. If managers are worried about individuals submitting more than one survey, some methods can be employed with many of the online survey and PPGIS platforms to ensure that only one response is submitted per respondent.

Finally, at any given time, there may be several studies happening on OSMP lands that may involve an online survey instrument. Users at the trailheads may not be able to differentiate between these studies and may believe that they have already participated in one and therefore do not participate in another decreasing the response rate. Additionally, because the location of sign kiosks at some of the trailheads where recruitment signs are placed is not in a direct line of sight, recreational users may not notice the signs. This could be particularly true of recreationists that participate in activities where they are moving at a higher rate of speed when they reach the kiosk area (i.e., mountain bikers or trail runners). Furthermore, while a QR code is a convenient way for users to access and participate in an online survey, some recreation users may not recreate with a digital device that would allow them to scan the QR code. Having something for users to take with them such as a business card so that they can take the survey at a more convenient time should be used for all future OSMP studies involving online surveys.

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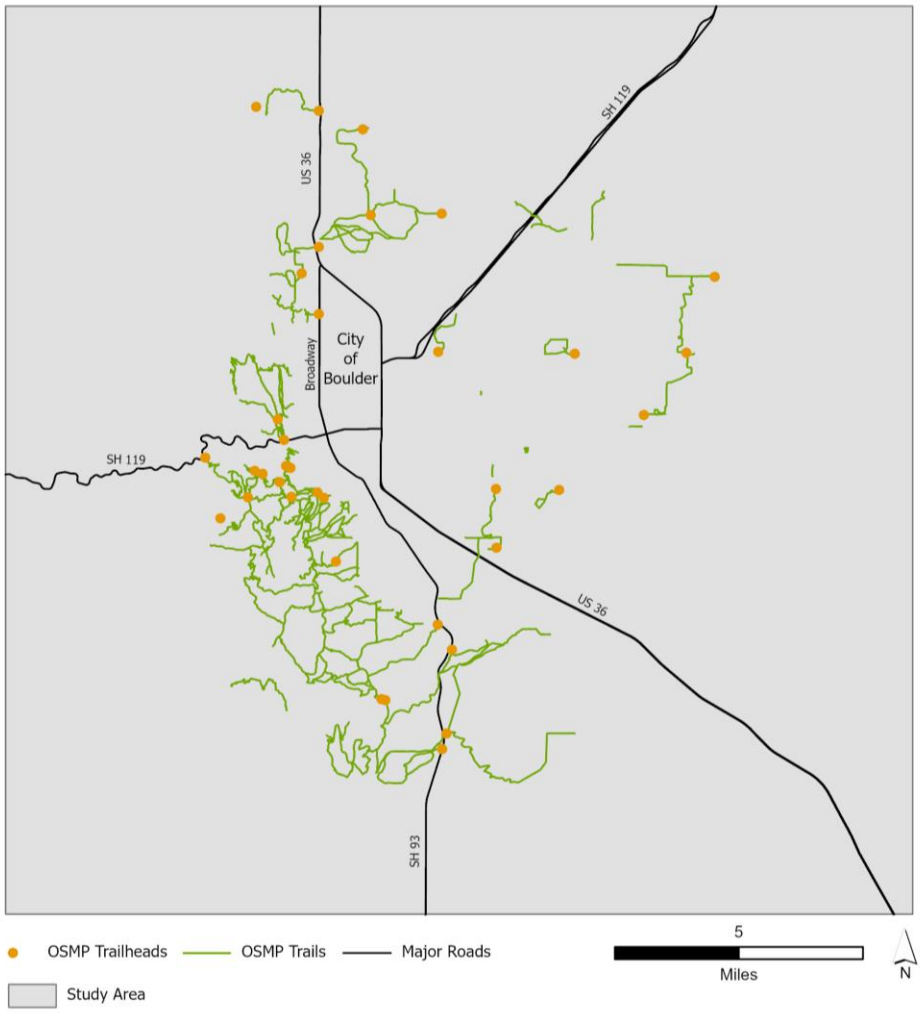

Figure 1. 30km x 30km study area.

447 **Table 1**. Sample demographics

	n	%
Gender		
Male	95	50.8
Female	89	47.6
Trans Male	2	1.1
Gender non-conforming	1	0.5
Age		
18-20	2	1.1
21-29	16	8.6
30-39	36	19.3
40-49	36	19.3
50-59	45	24.1
60 or older	52	27.8
Recreation Activity		
Hiking/walking	139	74.4
Trail Running	30	16.0
Mountain Biking	12	6.4
Horse Riding	6	3.2

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Table 2. Counts of points related to crowding and recreation conflict

	n
Crowding	
Extreme Crowding	70
Moderate Crowding	77
Slight Crowding	40
Total	**187**
Recreation Conflict	
Guardian with dog off leash – Collision or fall	1
Guardian with dog off leash – Near Collison	5
Guardian with dog off leash – Physical Altercation	2
Guardian with dog off leash – Verbal Conflict	12
Guardian with dog on leash – Near Collision	2
Guardian with dog on leash – Verbal Conflict	4
Mountain Biker –Near Collision	18
Mountain Biker –Verbal Conflict	11
Trail Runner – Near Collision	2
Trail Runner – Verbal Conflict	4
Walker/Hiker – Near Collision	2
Walker/Hiker – Physical Altercation	1
Walker/Hiker – Verbal Conflict	11
Total	**75**

451 **Table 3.** Counts of crowding and recreation conflict points within a distance to trailheads

	n
Crowding	
Doudy Draw	18
South Mesa	18
Chautauqua	16
Marshall Mesa	11
Enchanted Mesa	10
Recreation Conflict	
Boulder Valley Ranch	7
Marshall Mesa	6
Panorama Point	6
Doudy Draw	5
Gregory Canyon	5
South Mesa	5

Note. Search distances were derived from calculating the average distance from trailheads to each point category.

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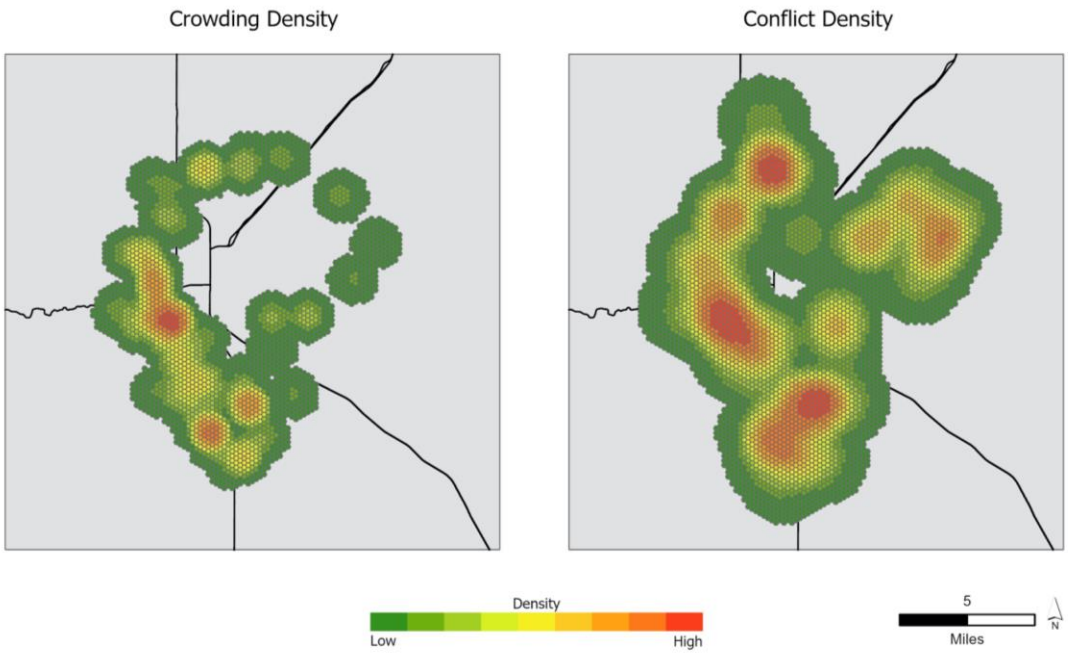

Figure 2. Mean kernel density hexagon values of crowding and conflict.

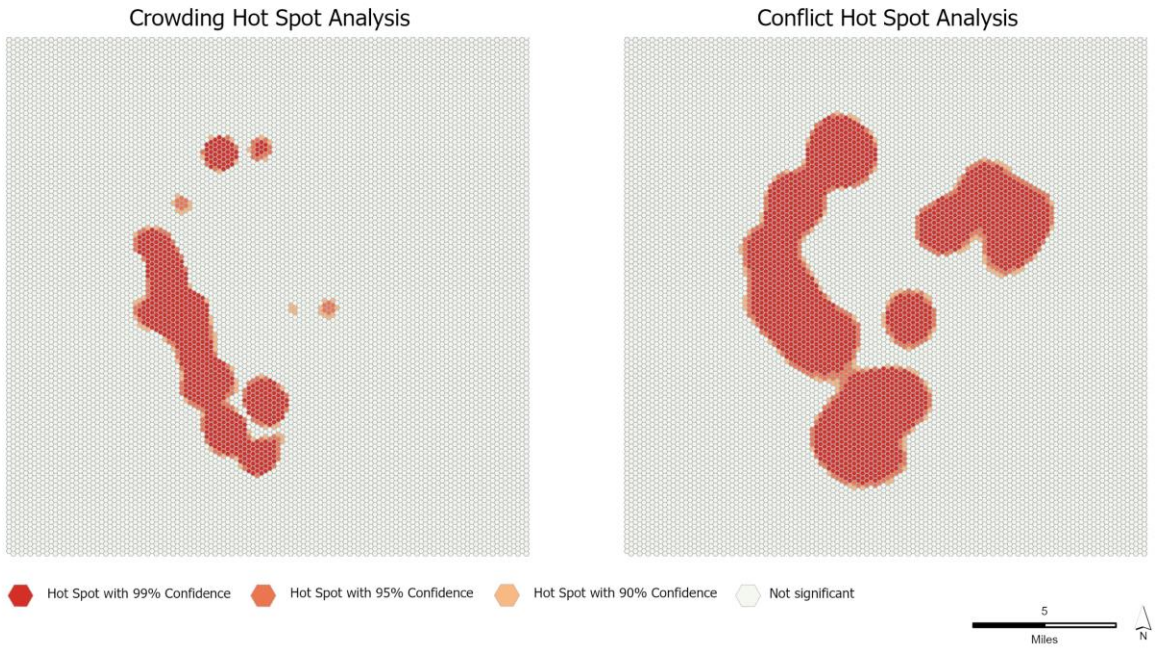

Figure 3. Getis-Ord Genetal G statistic to identify crowding and conflict hot spots.

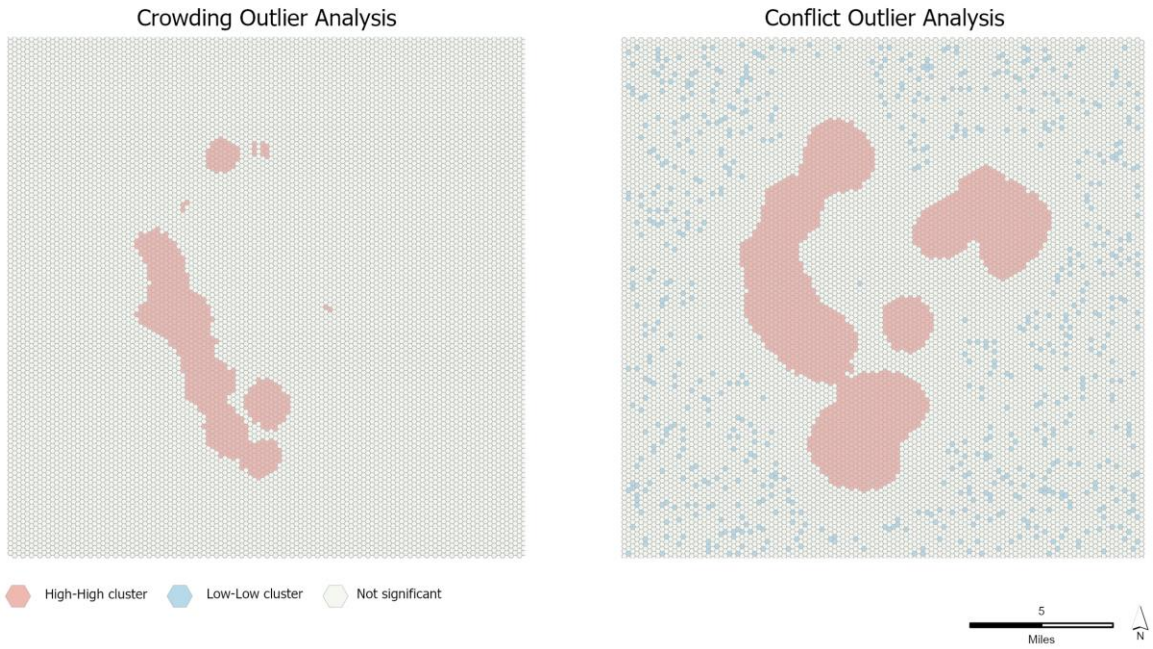

Figure 4. Anselin Local Moran's I statistic for crowding and conflict clusters.

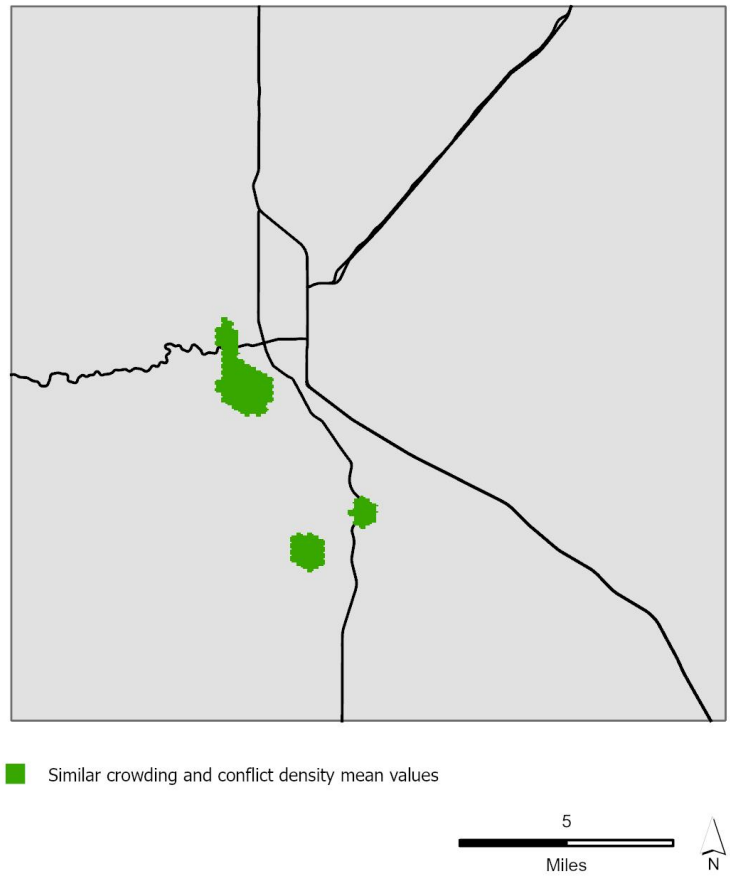

Figure 5. Jaccard similarity raster cells.

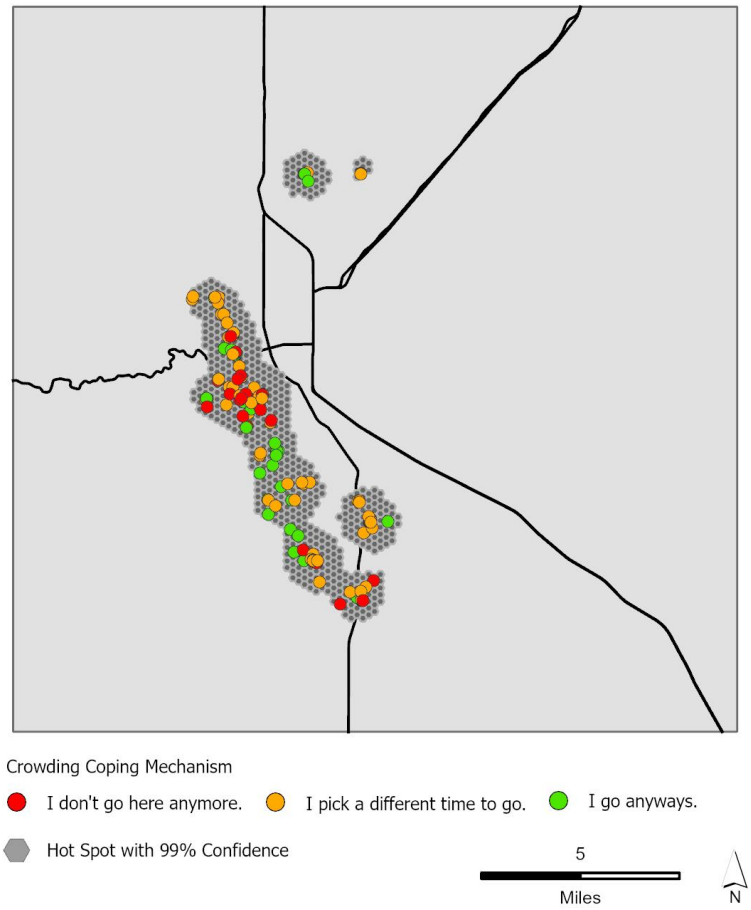

Figure 6. Coping mechanisms of recreation users.

468 **Table 4.** Counts of coping mechanisms at 99% confidence hot spot locations

	n
I pick a different time to go.	88
I go anyways.	39
I don’t go there anymore.	30

469

Table 5. Frequency of responses to recreation management alternatives.

	All Recreation Users (n=187)				
Management Actions	CA	SA	N	SU	CU
Increasing education or outreach about trail etiquette.	**116**	45	19	4	3
Requiring dogs to be leashed on more trails.	46	29	27	32	**53**
Increasing enforcement and ranger patrols	**83**	47	33	16	8
Widening, hardening, or redesigning trails to support high visitation levels	**59**	12	27	53	36
Charging for parking at more OSMP trailheads	37	38	28	**48**	36
Providing low- or no-cost shuttles to trailheads	**58**	**58**	45	11	15
Adding amenities to less frequented areas to disperse visitors across the system	**82**	44	45	11	5
Separating uses such as hiking, biking, and horseback-riding by time and/or place	**63**	17	14	53	40
Closing OSMP parking lots when full and only letting cars in when someone leaves	50	18	28	**52**	39
Requiring a reservation to access high-demand areas during popular times	18	30	23	50	**66**

Note. 5-point scales (CA = Completely acceptable; SA = Somewhat acceptable, N = Neutral, SU = Somewhat unacceptable, CU = Completely unacceptable). Numbers in bold represent the most frequent answer to each question.