

Developing Quality of Life Indicators for City of Boulder Open Space and Mountain Parks
Management: Final Report on a Three-Pronged Approach

William L. Rice^{1,2*}

Lane Arthur^{1,2}

¹University of Montana Parks, Tourism, and Recreation Management Program

²Wilderness and Recreation Management Research Laboratory

*Corresponding Author: William L. Rice (william.rice@umontana.edu)

Author Note

Funding for this research was provided through a grant from the City of Boulder Open Space and
Mountain Parks

Executive Summary

The City of Boulder Outdoor Space and Mountain Parks manages open space land for its “recreational value and its contribution to the quality of life of the community”—amongst other values (Boulder, Colorado Charter art. XII, sec. 176). Resulting, OSMP is currently utilizing an outcomes-focused management (OFM) approach to understand how OSMP lands affect quality of life and well-being in the community. However, little guidance has been provided in the literature on how to identify which outcomes are most relevant to park and protected area users (Driver & Bruns, 2008). Since 2008, efforts have been made to understand outcome relevancy and how to measure it, but a formalized process has not been produced (Drage et al., 2021; Manning, 2012; Miller et al., 2018; Rice et al. 2019). This study seeks to: 1) formalize a process to measure quality of life and well-being outcomes using a three-pronged approach, 2) inform OSMP management of the most salient outcomes of OSMP users, and 3) inform future inquiry regarding those outcomes. Data collection consisted of posting quick response code-enabled signs at various OSMP trailheads which linked to a survey that gathered: 1) the five most salient outcome domains reported by participants, 2) qualitative data pointing to indicators (or specific outcomes) within each outcome domain, and 3) spatial data concerning where participants obtained outcomes on OSMP properties. We identified the eight outcome domains which impact OSMP users the most. Of those domains, mainly positive indicators such as enjoying getting physical exercise, were coded from participant summaries. Finally, we discovered that outcome domains were reported at a variety of places on OSMP properties, but three most-selected domains were reported with hotspots near the Flatirons and portions of Gregory Canyon and South Mesa. The results of this study include:

- Providing a three-pronged approach to identify quality of life and well-being outcomes.

- Providing a template to OFM researchers and managers for measuring outcomes that most impact users in protected areas.
- Providing OSMP management current outcomes that users are obtaining from their lands as well a baseline for future research measuring the degree to which the outcomes were obtained.

Keywords: outcomes focused management, well-being, parks, recreation, PPGIS

Developing Quality of Life Indicators for City of Boulder Open Space and Mountain Parks
Management: Final Report on a Three-Pronged Approach

The Charter of the City of Boulder (Colorado, USA) states that “Open space land shall be acquired, maintained, preserved, retained, and used” for “recreational value and its contribution to the quality of life of the community.” Such mandates related to quality of life, health, and well-being are increasingly common for protected area administering-agencies (Allen & Newman, 2021). However, it can be challenging to decipher which aspects of quality of life, health, and well-being recreation lands support. To better understand—and support through management—how open space lands support quality of life, and well-being, the City of Boulder has instituted an outcomes-focused management (OFM) approach. OFM is the most recent formal iteration of the benefits approach to leisure (Driver & Bruns, 2008), which aims to maximize beneficial outcomes accrued through recreation-based management of parks and protected areas—while minimizing negative outcomes (Driver & Bruns, 2008). Measurement of these benefits relies on established recreation experience preference (REP) scales, through which larger domains of outcomes (e.g., relaxation) are measured using indicator items (e.g., reduced my anxiety, restored my mind from unwanted stress, etc.) (Driver & Bruns, 2008). However, Driver and Bruns (2008) provide little specific methodological guidance concerning how to identify which outcomes are most relevant to the visitors of a given protected area—or system of protected areas.

Therefore, since 2008, much attention has been given to developing methods for understanding the relevance of outcomes within a given protected area, so that future study might more efficiently assess the relative rates at which these outcomes are attained within this same protected area (Manning, 2012; Miller et al., 2018; Rice et al. 2019). A notable example of

this pursuit was trialed over a two-year period in Grand Teton National Park, where researchers first gathered qualitative visitor feedback concerning their motivations and outcomes and coded this feedback using REP scales (Rice et al., 2019), then assessed the spatial distribution of the most salient outcomes using participatory mapping (Drage et al., 2021), and finally assessed the relative rates at which these outcomes are attained (Rice et al., 2020).

This study seeks to formalize the process for identifying outcomes initially pioneered in Grand Teton National Park. Assessing those outcomes related explicitly to quality of life and well-being—per management guidance and the City of Boulder charter—we refine these methods into a formalized three-pronged approach to be used to identify quality of life and well-being outcomes—and outcome indicators—across contexts: 1) quantitatively assess the saliency of various outcome domains related to quality of life and well-being, 2) qualitatively define relevant indicators (REP scale items) for each of these domains, and 3) identify the spatial distribution of the associated outcome domains. This three-pronged approach is intended to provide managers with a list of outcome domains—and their associated indicators and spatial distributions—most salient to a given protected area and inform future inquiry concerning these outcomes.

Methods

Study Site

The City of Boulder Outdoor Space and Mountain Parks (OSMP) manages more than 45,000 acres of permanently protected land that contains 155 miles of developed and maintained trails (OSMP, n.d.). The land that OSMP oversees “forms a buffer around the city” making the city’s identity unique from neighboring communities. OSMP manages the land according to the city’s charter which states that the land be managed for—among other values—“recreational

value and its contribution to the quality of life of the community” (Boulder, Colorado Charter art. XII, sec. 176).

Study Design

Data collection for this project consisted of an online survey accessed via quick response (QR) code-enabled signage (see Figure 1) placed at an array of trailheads across OSMP that the OSMP staff found to be representative of overall use based on previous research (see Appendix table 1). The sampling schedule for these trailheads was derived from a schedule used in previous OSMP research (Bruce & Kennedy, 2017). Following the methods of Brownlee et al. (2020), signs also contained both a shortened URL and an attached box that contained business cards with the URL and QR code to allow those without immediate access to a smartphone to take the survey. The IP address for the device used to complete the survey was collected and was used to ensure multiple surveys were not completed by a single device.

[INSERT FIGURE 1 ABOUT HERE]

The design of this survey followed previous work conducted to similar ends (Pietilä, 2017; Rice et al., 2019; Smith et al., 2015; Weber et al., 2008) and was informed by the theoretical foundations of Driver and Brun’s (2008) OFM. The first section of this survey asked respondents to select the five quality of life and well-being-related outcome domains “through which City of Boulder OSMP most impact you” from a list of fifteen REP domains—primarily from Driver and Bruns (2008)—chosen in consultation with OSMP staff. The second section of the survey consisted of a series of open-ended questions concerning those domains selected in the first section, asking respondents to provide a few words summarizing the specific ways City of Boulder OSMP lands contribute or take away from their quality of life. Finally, the third section of the survey asked participants to select a point on a provided map of OSMP lands (see

Figure 2) that they perceive “most contributes to” the same outcomes previously identified pertaining to quality of life and well-being, following the methods of Pietilä (2017) and Drage et al. (2021).

Data Analysis

Each of the three sections of the proposed survey were analyzed using unique approaches. In the first section, we calculated the frequency at which each outcome domain was selected. Pearson correlations between outcome domains were also calculated (see Appendix table 11). The data derived from the second section were inductively coded according to REP items identified by Driver and Bruns (2008)—following the methodology of Saldaña (2016). Once the open-ended comments were coded according to outcome indicators (REP items; see Rice et al., 2019), the frequency of each REP item code was also calculated. Geospatial data derived from the third section was analyzed using basic density analysis methods of Pietilä (2017) and Drage et al. (2021). For those outcomes with more than 50 participant-mapped points, kernel density hotspot analysis was undertaken. Following Cox et al. (2019) and Krisp and Špatenková (2010), this analysis used a 100-meter cell size, 3,000-meter search radius, and the upper-third rule to define hotspots—whereas those areas in the top one-third of the resulting density distribution are classified as hotspots (Alessa et al., 2008).

Results

The sample contained 50.2% men, 88.5% of respondents identifying as White, and an average age of 52 years. These demographics align with a previous demographic study of OSMP visitors (VanderWoude & Kellogg, 2018), however our sample is marginally more ethnically diverse. As derived through the first section of the survey, Table 1 displays the frequencies at which respondents selected each quality of life and well-being-related outcome domain—based

on the degree to which they feel most impacted. As seen in Table 1, a natural break in the frequencies occurs between the eighth (n = 123) and ninth (n = 29) most-selected outcomes, thus providing OSMP managers with a clear list of eight outcomes for prioritization in future studies.

[INSERT TABLE 1 ABOUT HERE]

Defining outcome indicators

Of exercise/physical fitness, enjoying nature, mental health, lifestyle, and environmental benefit outcomes, the following were the most prominent indicators coded. For the exercise/physical fitness outcome, enjoying getting physical exercise (n = 211), having a variety of outdoor amenities/activities (n = 71), and enjoying a wide variety of environments (n = 49) were the most common domain indicators. For the enjoying nature outcome, enjoying the experience of natural landscapes (n = 210), easy access to natural landscapes (n = 45), and opportunities on natural landscapes (n = 11) were the most common domain indicators. For the mental health outcome, a more holistic sense of wellness (n = 110), improved mental well-being (n = 108), and nature improving wellness (n = 68) were the most common domain indicators. For the lifestyle outcome, avoiding a compromise on the quality of life (n = 91), enjoying the amenities of place (n = 68), and physical fitness/health (n = 22) were the most common domain indicators. Finally, for the environmental benefits outcome, protection of natural landscapes (n = 62), greater protection of plant and animal habitat (n = 57) and reduced negative human impact (n = 22) were the most common domain indicators. A complete list of domain indicators for exercise/physical fitness are provided in Table 2 as an example of the lists compiled for each outcome domain. The remaining tables can be found in the Appendix.

[INSERT TABLE 2 ABOUT HERE]

Defining relative spatial distribution of outcomes

The distribution and relative densities of outcome domains mapped through the participatory mapping exercise are depicted in Figure 2. Distributions vary widely by outcome domain. Exercise/physical fitness, enjoying nature, and mental health outcomes received the highest density of hotspot data with more than 50 observations. Therefore, these three outcomes were selected for kernel density hotspot analysis. Figure 2 contains the distribution of their hotspots, based on the top third of their kernel densities (Alessa et al., 2008; Cox et al., 2019). All three of these outcomes contain rather sweeping hotspots that encompass the Flatirons and portions of Gregory Canyon and South Mesa. Additionally, hotspots for exercise/physical fitness were found in the proximity of Wonderland Lake and near the Douby Draw Trailhead along the Community Ditch trail. An additional hotspot of outcomes related to enjoying nature was identified along the Flatirons Vista trail.

[INSERT FIGURE 2 ABOUT HERE]

Discussion and Conclusions

This research report provides a proof-of-concept for a three-pronged approach to identifying quality of life and well-being outcomes—and outcome indicators—across contexts. While previous research has established the effectiveness of individual prongs within this approach (e.g., Drage et al., 2021; Pietilä, 2017; Rice et al., 2019; 2020), this is the first attempt to formalize the three components in one study to provide managers with an understanding of 1) which outcome domains related to quality of life and well-being are salient to their protected areas (see the top eight outcomes listed in Table 1), 2) which specific indicators within those domains are salient to their protected areas, and 3) how outcomes distribute across space (see Figure 2). Thus, this research provides a model for managers and researchers working within

OFM, so that they might be able to more effectively identify outcomes which are most relevant to the visitors of a given protected area—or system of protected areas (Driver & Bruns, 2008). In the context of City of Boulder OSMP, the findings presented here will be used in future research to measure the degree to which these outcomes are attained (e.g., Rice et al., 2020).

References

- Alessa, L. (Naia), Kliskey, A. (Anaru), & Brown, G. (2008). Social-ecological hotspots mapping: A spatial approach for identifying coupled social-ecological space. *Landscape and Urban Planning, 85*(1), 27–39.
- Allen, D. B., & Newman, S. B. (2021). One hundred years of health in US national parks. *Parks Stewardship Forum, 37*(1), 95–105.
- Brownlee, M. T. J., Sharp, R. L., Dagan, D., Jackson, S., & Nettles, J. (2020). *Evaluation of the bear viewing experience and associated thresholds at Katmai National Park and Preserve and Lake Clark National Park and Preserve*. King Salmon, AK: National Park Service.
- Bruce, M., & Kennedy, D. (2017, December). Exploring potential indicators of recreation quality on City of Boulder Open Space and Mountain Parks. *Denver, CO: Corona Insights*.
- Cox, C., Anderson, C. J., Morse, W. C., & Schelhas, J. (2019). Applying public participation geographic information systems for coastal wading bird conservation. *Coastal Management, 47*(2), 227–243.
- Drage, E., Rice, W. L., Miller, Z. D., Newton, J. N., D'Antonio, A., Newman, P., & Taff, B. D. (2021). Mapping spatial dimensions of Wilderness recreation outcomes: A study of overnight users. *Journal on Protected Mountain Areas Research and Management, 13*(1), 31–40.
- Driver, B. L., & Bruns, D. (2008). Implementing OFM on public nature-based recreation and related amenity resources. In B. L. Driver (Ed.), *Managing to optimize the beneficial outcomes of recreation* (pp. 39–73). Venture Publishing.

- Krisp, J. M., & Špatenková, O. (2010). Kernel density estimations for visual analysis of emergency response data. In M. Konecny (Ed.), *Geographic information and cartography for risk and crisis management* (pp. 395–408). Springer.
- Manning, R. E. (2012). Frameworks for defining and managing the wilderness experience. In D. N. Cole (Ed.), *Wilderness visitor experiences: Progress in research and management* (pp. 158–176). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Miller, Z. D., Rice, W. L., Taff, B. D., Newman, P., Figure, G., & Coleman, J. (2018). Understanding visitor motivations at Jimmy Carter National Historic Site: A principal components approach. *Heritage, 1*, 328–334.
- Outdoor Space and Mountain Parks. (n.d.). *Open Space and Mountain Parks*. City of Boulder. <https://bouldercolorado.gov/government/departments/open-space-mountain-parks/about#main-content>
- Pietilä, M. (2017). Do visitor experiences differ across recreation settings? Using geographical information systems to study the setting-experience relationship. *Visitor Studies, 20*(2), 187–201.
- Rice, W. L., Taff, B. D., Miller, Z. D., Newman, P., Zipp, K. Y., Pan, B., Newton, J. N., & D'Antonio, A. (2020). Connecting motivations to outcomes: A study of park visitors' outcome attainment. *Journal of Outdoor Recreation and Tourism, 29*, 100272.
- Rice, W. L., Taff, B. D., Newman, P. B., Miller, Z. D., D'Antonio, A. L., Baker, J. T., Monz, C., Newton, J. N., & Zipp, K. Y. (2019). Grand expectations: Understanding visitor motivations and outcome interference in Grand Teton National Park, Wyoming. *Journal of Park and Recreation Administration, 37*(2), 26–44.

Saldaña, J. (2016). *The coding manual for qualitative researchers* (3rd ed.). SAGE.

VanderWoude, D., & Kellogg, A. (2018). *2016-2017 visitor survey report*. City of Boulder Open Space and Mountain Parks

Figures



Figure 1. The QR code-enabled sign and business cards used for survey recruitment

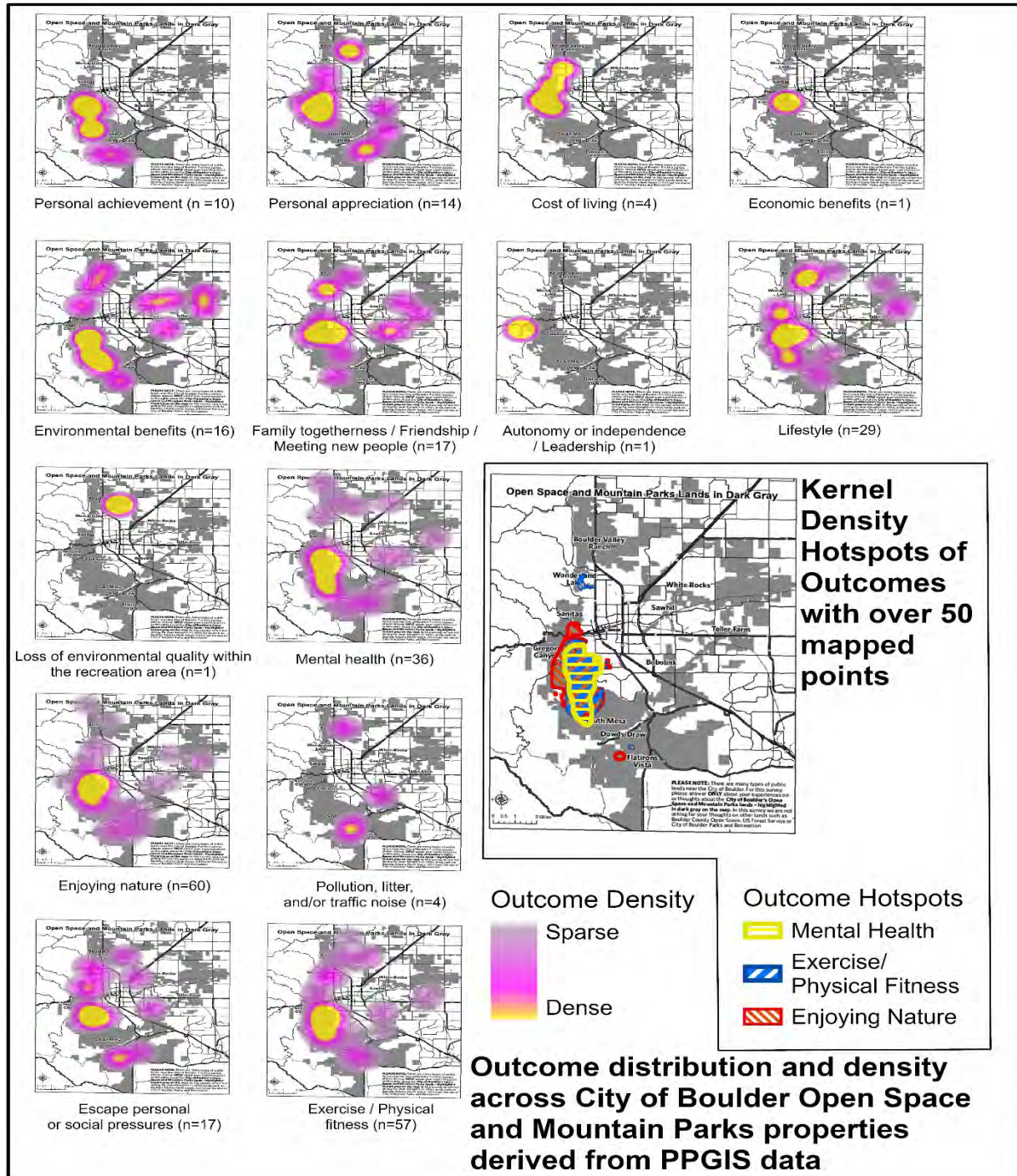


Figure 2. Results of the Participatory mapping exercise including: 1) relative densities for all outcome domains and 2) kernel density hotspots for those three outcomes with over 50 mapped points derived using the top third of densities rule. Note: Social or cultural negative outcomes were not mapped by any respondents and are therefore not depicted here.

Tables

Table 1

Quality of Life and Well-being Outcome Domain Frequencies

| Outcome Domain | n |
|--|-----|
| Exercise / Physical fitness | 356 |
| Enjoying nature | 347 |
| Mental health | 255 |
| Lifestyle | 181 |
| Environmental Benefits | 142 |
| Personal appreciation | 128 |
| Escape personal or social pressures | 128 |
| Family togetherness / Friendship / Meeting new people | 123 |
| Personal achievement | 29 |
| Pollution, litter, and/or traffic noise | 23 |
| Loss of environmental quality within the recreation area | 20 |
| Cost of living | 13 |
| Autonomy or independence / Leadership | 9 |
| Economic benefits | 8 |
| Social or cultural negative outcomes | 0 |
| Total | 877 |

Table 2

Coded Outcome Indicators for Exercise/Physical Fitness

| <u>Indicators</u> | <u>Frequency</u> |
|--|------------------|
| Enjoy getting physical exercise (EGPE) | 211 |
| Variety of outdoor amenities/activities (VOA) | 71 |
| Enjoying wide variety of environments (EWE) | 49 |
| Enjoying outdoor fitness (EOF) | 47 |
| Enjoying frequently participating in desired activities (FPDA) | 36 |
| Access close by (ACB) | 22 |
| Enjoying exercise with pet (EEP) | 18 |
| Enjoying strenuous fitness (ESF) | 11 |
| Negative user conflict (NUC) | 4 |
| Enjoying off-leash pet rules (OLPR) | 3 |
| Motivation for exercise (MFE) | 3 |
| Want more bike trails (WMBT) | 2 |
| Quality of areas (QOA) | 1 |
| Overarching negative outcomes (NEG) | 1 |
| <u>Total</u> | <u>479</u> |

Appendix A.

Table 1

Study Schedule – Time and Location of posted survey signs within OSMP

| April and May 2021 | June and July 2021 | August and September 2021 |
|--------------------------|-----------------------|---------------------------|
| Boulder Valley Ranch | Centennial | Bobolink |
| Crown Rock | Chautauqua | Buckingham Park |
| Greenbelt Plateau | Doudy Draw | Cherryvale |
| Gregory Canyon | Dry Creek | Cottonwood |
| Halfway House | Enchanted Mesa | Flagstaff Summit West |
| Lost Gulch Overlook | Flagstaff Summit East | Foothills |
| Panorama Point | Four Mile Creek | NCAR |
| Realization Point | Settler’s Park | Sawhill Ponds |
| South Boulder Creek West | Teller Farm North | Marshall Mesa |

Table 2

Sample Sizes

| Part 1 – Outcome Domain Multiple Choice | Part 2 – Outcome Qualitative Portion | Part 3 – Outcome Domain Participatory Mapping |
|--|---|--|
| 469 | 297 | 216 |

Table 3

Gender

| Woman | Man | Non-binary | Prefer not to disclose |
|-------|-------|------------|------------------------|
| 46.7% | 50.2% | 0.4% | 2.8% |

Table 4

Race (n = 286)

| White | Asian or Pacific Islander | Hispanic or Latina/Latino/Latinx | Black or African American | Other | Prefer not to say |
|-------|---------------------------------|-------------------------------------|---------------------------------|-------|----------------------|
| 88.5% | 1.4% | 1.7% | 1.0% | 2.4% | 4.9% |

Table 5

Age

| Mean | Std. deviation |
|--------------|----------------|
| 52 years old | 14.6 years |

Table 6

Average Years of Visitation to OSMP

| Mean | Std. deviation |
|-----------|----------------|
| 18.7 year | 15.1 years |

Table 7

Where is your primary residence? (n = 290)

| Primary Residence | Frequency | Percent |
|-------------------------------|-----------|---------|
| Boulder (within city limits) | 139 | 47.9 |
| Unincorporated Boulder County | 44 | 15.2 |
| Other U.S. state | 19 | 6.6 |
| Louisville | 17 | 5.9 |
| Lafayette | 17 | 5.9 |
| Longmont | 16 | 5.5 |
| Metro Denver | 15 | 5.2 |
| Superior | 8 | 2.8 |
| Other area in Colorado | 8 | 2.8 |
| Other city in Boulder County | 4 | 1.4 |
| Other Country | 3 | 1.0 |
| Total | 290 | 100.0 |

Table 8

Please indicate your highest obtained level of formal education (n = 287)

| Highest Obtained Level of Formal Education | Frequency | Percent |
|---|-----------|---------|
| Elementary or some high school | 1 | .3 |
| High school graduate (includes equivalency) | 3 | 1.0 |
| Trade or vocational certification | 1 | .3 |
| Some college, no degree | 13 | 4.5 |
| Associate's degree | 105 | 36.6 |
| Bachelor's degree | 111 | 38.7 |
| Graduate or professional degree | 7 | 2.4 |
| Doctorate | 46 | 16.0 |
| Total | 287 | 100.0 |

Table 9

How many days per week, on average, within the last 12 months did you recreate in City of Boulder Open Space and Mountain Parks? (n = 290)

| Frequency per Week | Frequency | Percent |
|--|-----------|---------|
| <1 day | 19 | 6.6 |
| 1 day | 38 | 13.1 |
| 2 days | 52 | 17.9 |
| 3 days | 40 | 13.8 |
| 4 days | 41 | 14.1 |
| 5 days | 37 | 12.8 |
| 6 days | 28 | 9.7 |
| 7 days | 22 | 7.6 |
| I am not a resident of this area and very rarely recreate in City of Boulder Open Space and Mountain Parks | 13 | 4.5 |
| Total | 290 | 100.0 |

Table 10

Of the quality of life outcomes listed below, please select up to 5 through which City of Boulder Open Space and Mountain Parks most impact you. (n = 469)

| Quality of Life Outcome Domain | Frequency | Percent |
|--|--------------|--------------|
| Exercise / Physical fitness | 429 | 19.86 |
| Enjoying nature | 425 | 19.68 |
| Mental health | 304 | 14.07 |
| Lifestyle | 218 | 10.09 |
| Environmental Benefits | 177 | 8.19 |
| Escape personal or social pressures | 157 | 7.27 |
| Personal appreciation | 157 | 7.27 |
| Family togetherness / Friendship / Meeting new people | 148 | 6.85 |
| Personal achievement | 45 | 2.08 |
| Loss of environmental quality within the recreation area | 28 | 1.30 |
| Pollution, litter, and/or traffic noise | 27 | 1.25 |
| Cost of living | 17 | 0.79 |
| Economic benefits | 13 | 0.60 |
| Autonomy or independence / Leadership | 11 | 0.51 |
| Social or cultural negative outcomes | 4 | 0.19 |
| Total | 2,160 | 100.0 |

Table 11

Pearson correlations between quality of life outcomes

| | Personal achievement | Autonomy or independence / Leadership | Family togetherness / Friendship / Meeting new people | Enjoying nature | Exercise / Physical fitness | Escape personal or social pressures | Lifestyle | Mental health | Personal appreciation | Economic benefits | Environmental Benefits | Social or cultural negative outcomes | Cost of living | Loss of environmental quality within the recreation area | Pollution, litter, and/or traffic noise |
|--|----------------------|---------------------------------------|---|-----------------|-----------------------------|-------------------------------------|-----------|---------------|-----------------------|-------------------|------------------------|--------------------------------------|----------------|--|---|
| Personal achievement | 1 | 0.006 | -.083* | .113** | .139** | 0.053 | 0.038 | 0.002 | -0.019 | -0.044 | -.097* | -0.024 | -0.051 | -0.036 | -0.004 |
| Autonomy or independence / Leadership | 0.006 | 1 | -0.054 | .083* | -0.007 | 0.057 | -.083* | 0.004 | 0.000 | -0.021 | 0.017 | -0.012 | 0.050 | 0.027 | .089* |
| Family togetherness / Friendship / Meeting new people | -.083* | -0.054 | 1 | .230** | .186** | -0.014 | 0.063 | 0.060 | -0.014 | 0.071 | -0.023 | -0.049 | 0.038 | -0.041 | -0.075 |
| Enjoying nature | .113** | .083* | .230** | 1 | .688** | .184** | .282** | .372** | .166** | -0.044 | .274** | -0.046 | -0.014 | 0.023 | 0.075 |
| Exercise / Physical fitness | .139** | -0.007 | .186** | .688** | 1 | .230** | .346** | .471** | .221** | 0.061 | .204** | -.145** | 0.006 | -0.055 | -0.023 |
| Escape personal or social pressures | 0.053 | 0.057 | -0.014 | .184** | .230** | 1 | -0.062 | .115** | 0.026 | 0.012 | -0.055 | .089* | 0.031 | -0.012 | 0.011 |
| Lifestyle | 0.038 | -.083* | 0.063 | .282** | .346** | -0.062 | 1 | .161** | -0.014 | -0.047 | 0.021 | -0.066 | -0.031 | -0.061 | -0.022 |
| Mental health | 0.002 | 0.004 | 0.060 | .372** | .471** | .115** | .161** | 1 | 0.076 | 0.026 | 0.054 | -0.005 | -.083* | 0.035 | -0.038 |
| Personal appreciation | -0.019 | 0.000 | -0.014 | .166** | .221** | 0.026 | -0.014 | 0.076 | 1 | 0.012 | 0.038 | 0.042 | 0.031 | -0.012 | -0.044 |
| Economic benefits | -0.044 | -0.021 | 0.071 | -0.044 | 0.061 | 0.012 | -0.047 | 0.026 | 0.012 | 1 | 0.000 | -0.013 | 0.042 | 0.020 | -0.034 |
| Environmental Benefits | -.097* | 0.017 | -0.023 | .274** | .204** | -0.055 | 0.021 | 0.054 | 0.038 | 0.000 | 1 | -0.011 | -0.028 | 0.006 | 0.030 |
| Social or cultural negative outcomes | -0.024 | -0.012 | -0.049 | -0.046 | -.145** | .089* | -0.066 | -0.005 | 0.042 | -0.013 | -0.011 | 1 | .109** | .273** | .179** |
| Cost of living | -0.051 | 0.050 | 0.038 | -0.014 | 0.006 | 0.031 | -0.031 | -.083* | 0.031 | 0.042 | -0.028 | .109** | 1 | 0.008 | .107* |
| Loss of environmental quality within the recreation area | -0.036 | 0.027 | -0.041 | 0.023 | -0.055 | -0.012 | -0.061 | 0.035 | -0.012 | 0.020 | 0.006 | .273** | 0.008 | 1 | .179** |
| Pollution, litter, and/or traffic noise | -0.004 | .089* | -0.075 | 0.075 | -0.023 | 0.011 | -0.022 | -0.038 | -0.044 | -0.034 | 0.030 | .179** | .107* | .179** | 1 |

Note: *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed)

Table 12

For each quality of life outcome listed below, please indicate the degree to which City of Boulder Open Space and Mountain Parks contributes or takes away from your quality of life.

| Quality of Life Outcome Domain | N | Mean | Std. Deviation |
|--|------------|-------|----------------|
| Enjoying nature | 347 | 3.46 | .950 |
| Exercise / Physical fitness | 356 | 3.46 | .968 |
| Personal appreciation | 128 | 3.41 | .808 |
| Mental health | 255 | 3.33 | 1.091 |
| Environmental Benefits | 142 | 3.26 | .980 |
| Lifestyle | 181 | 3.25 | 1.164 |
| Family togetherness / Friendship / Meeting new people | 123 | 3.14 | 1.257 |
| Personal achievement | 29 | 3.14 | 1.156 |
| Economic benefits | 8 | 3.13 | .991 |
| Escape personal or social pressures | 128 | 3.12 | 1.032 |
| Autonomy or independence / Leadership | 9 | 2.33 | 1.323 |
| Pollution, litter, and/or traffic noise | 23 | .65 | 2.854 |
| Cost of living | 13 | -.77 | 3.166 |
| Loss of environmental quality within the recreation area | 20 | -1.50 | 2.763 |
| Social or cultural negative outcomes | 0 | n/a | n/a |
| Total | 877 | | |

Note: Scale: -4 (extremely negatively impactful to +4 (Extremely positively impactful)

Table 13

Coded Outcome Indicators for Personal Achievement

| Indicators | Frequency |
|--|-----------|
| Develop skills and abilities (DSA) | 22 |
| Gaining greater sense of self confidence (GSSC) | 16 |
| Testing endurance (TE) | 9 |
| Being able to tell others about accomplishment (TOA) | 4 |
| *Greater sense of happiness (GSH) | 1 |
| Not achieving personal satisfaction (NAPS) | 1 |
| Having others think highly of you for doing this (OTH) | 0 |
| Total | 53 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 14

Coded Outcome Indicators for Autonomy-Independence

| Indicators | Frequency |
|--|-----------|
| Experiencing greater sense of independence (GSI) | 5 |
| Enjoying exploring on my/our own (EEO) | 3 |
| Being in control of things that happen (BIC) | 2 |
| *Developing skills (DS) | 1 |
| Total | 11 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 15

Coded Outcome Indicators for Family/Friendship/People

| Indicators | Frequency |
|---|-----------|
| Enjoying participating in group outdoor events (EGOE) | 49 |
| Enjoying the closeness of friends and family (CFF) | 48 |
| Relishing group togetherness (RGT) | 43 |
| Enjoying meeting new people with similar interests (NPSI) | 16 |
| *Opportunity to connect (OTC) | 9 |
| *Clean and safe (CAS) | 2 |
| *Easy access (EA) | 1 |
| *Able to walk dog off-leash (WDOL) | 1 |
| *Overarching COVID neutral outcomes (CNEU) | 1 |
| Total | 170 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 16

Coded Outcome Indicators for Enjoying Nature

| Indicators | Frequency |
|--|------------|
| Enjoying experience of natural landscapes (EENL) | 210 |
| Easy access to natural landscapes (EANL) | 45 |
| *Opportunities on natural landscapes (ONL) | 11 |
| *More connected to nature (MCN) | 7 |
| *Positive view on amount of natural landscape (PANL) | 6 |
| *Positive affect on mental health (PMH) | 4 |
| *Area is special place (ASP) | 3 |
| *Enhanced quality of life (EQOL) | 3 |
| *Seeing decline of nature (SDN) | 2 |
| *Litter negative (LNEG) | 1 |
| *Enjoying nature with family animals (ENFA) | 1 |
| *Want more opportunities (WMO) | 1 |
| *Negative view on rangers (NVR) | 1 |
| *Negative view on access (NVA) | 1 |
| *Connection to loved ones (CLO) | 1 |
| *Connecting rural-urban lands (CRUL) | 1 |
| *Thugs messing with people (TMP) | 1 |
| *Negative experience with aggressive dogs (NAG) | 1 |
| *Overarching COVID positive outcomes (CPOS) | 1 |
| Total | 301 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 17

Coded Outcome Indicators for Exercise/Physical Fitness

| Indicators | Frequency |
|--|------------|
| Enjoy getting physical exercise (EGPE) | 211 |
| Variety of outdoor amenities/activities (VOA) | 71 |
| Enjoying wide variety of environments (EWE) | 49 |
| *Enjoying outdoor fitness (EOF) | 47 |
| Enjoying frequently participating in desired activities (FPDA) | 36 |
| Access close by (ACB) | 22 |
| *Enjoying exercise with pet (EEP) | 18 |
| Enjoying strenuous fitness (ESF) | 11 |
| *Negative user conflict (NUC) | 4 |
| *Enjoying off-leash pet rules (OLPR) | 3 |
| *Motivation for exercise (MFE) | 3 |
| *Want more bike trails (WMBT) | 2 |
| *Quality of areas (QOA) | 1 |
| *Overarching negative outcomes (NEG) | 1 |
| Total | 479 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 18

Coded Outcome Indicators for Escaping Personal/Social Pressure

| Indicators | Frequency |
|--|------------|
| Enjoying escape from everyday responsibilities/pressure (EERP) | 67 |
| Releasing mental tensions/stress (RMT) | 29 |
| *Escape from people (EFP) | 3 |
| *Enjoying exercise with pet (EEP) | 2 |
| *Escape close by (ECB) | 2 |
| *Want more bike trails (WMBT) | 1 |
| *Positive view on soundscape (PVS) | 1 |
| *Negative crowding experience (NCE) | 1 |
| Total | 106 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 19

Coded Outcome Indicators for Lifestyle

| Indicators | Frequency |
|--|-----------|
| Avoid compromise on quality of life (CQOL) | 91 |
| *Enjoying amenities of place (EAP) | 68 |
| *Physical fitness/health (PFH) | 22 |
| Living slower pace of life (LSPL) | 13 |
| *Sustainable/Green recreation (SR) | 9 |
| *Being outdoors is motivating (BOM) | 8 |
| *Enjoying amenities of community (EAC) | 7 |
| *Easy access (EA) | 6 |
| *Getting away from society (GAS) | 5 |
| Enjoying maintaining out-of-town country solitude (OCS) | 3 |
| *No-cost outdoor recreation (NOR) | 2 |
| Enjoying the peace and quiet of small-town community (PQST) | 1 |
| *Conducive to pet-based lifestyle (CPL) | 1 |
| *Meeting new people (MNP) | 1 |
| *Enjoying diversity in parks (DIP) | 1 |
| *Too few trails (TFT) | 1 |
| *User conflict (UC) | 1 |
| Enjoying the hustle and bustle of having new people in town (HBNP) | 0 |
| *Shared space for pet-owners (SSP2) | 0 |
| Total | 240 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 20

Coded Outcome Indicators for Mental Health

| Indicators | Frequency |
|---|-----------|
| A more holistic sense of wellness (HSW) | 110 |
| Improved mental well-being (IMW) | 108 |
| *Nature improving wellness | 68 |
| Restored mind from unwanted stress (RMUS) | 61 |
| Diminished mental anxiety (DMA) | 38 |
| Committed close-to-home recreation (CCR) | 14 |
| *Free space and escape | 13 |
| Commitment to pay more to recreate than to pay for health care (PRPH) | 3 |
| *Diminished mental well-being | 3 |
| *Overarching COVID positive outcomes (CPOS) | 3 |
| *Recreating with pets (RWP) | 1 |
| *Negative experience with pets (NEP) | 1 |
| Total | 423 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 21

Coded Outcome Indicators for Personal Appreciation and Satisfaction

| Indicators | Frequency |
|--|-----------|
| Improved appreciation of nature's splendor (ANS) | 59 |
| Awareness area is a special place (ASP) | 29 |
| Appreciation for wildland and park heritage and how managers care for it (WPHM) | 23 |
| Improved understanding of our dependence and impact on public lands (UDPL) | 16 |
| Closer relation to natural world (CRN) | 11 |
| Understanding of how rural/urban landscape affects quality of life (ULQL) | 10 |
| Cultivation of natural resource stewardship ethic (NRSE) | 6 |
| Greater personal enrichment through involvement with others (including pets) (GPE) | 5 |
| More outdoor-orientated lifestyle (MOOL) | 4 |
| Awareness community is special (ACS) | 3 |
| Understanding of wildlife's contribution to personal life (WCPL) | 2 |
| Improved stewardship ethic towards adjoining/host communities (SEAC) | 1 |
| Improved opportunity to view wildlife (OVW) | 1 |
| Improved awareness, learning, and appreciation of other cultures (ALAC) | 1 |
| Greater acceptance of others who are different (AOD) | 1 |
| *Greater freedom from urban living (GFUL) | 1 |
| Improved reconnection to rural roots (IRRR) | 0 |
| Enhanced sense of personal freedom (ESPF) | 0 |
| Greater sense of personal security (GSPS) | 0 |
| Greater sense of adventure (GSA) | 0 |
| Increased appreciation of cultural history (ACH) | 0 |
| Understanding of community's cultural identity (UCCI) | 0 |
| Greater respect for private and local lifestyles (GRPL) | 0 |
| Total | 173 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 22

Coded Outcome Indicators for Economic Benefits

| Indicators | Frequency |
|---|-----------|
| Most positive contributions to local-regional economy (PCLE) | 3 |
| Enhanced ability for visitors to find areas with wanted benefits (VFAB) | 2 |
| Increased local job opportunities (ILJO) | 2 |
| Greater value-added local service/industry (VLSI) | 2 |
| Improved local economic stability (ILES) | 1 |
| Increased property values (IPV) | 1 |
| Maintenance of community's distinctive recreation/tourism niche or character (CDRC) | 1 |
| *Easy access with less need for personal resources (EALR) | 1 |
| Reduced health maintenance cost (RHM) | 0 |
| Increased work productivity (IWP) | 0 |
| Reduced absenteeism from work (RAW) | 0 |
| Increased local tax revenue from visitors (ILTR) | 0 |
| Increased desirability as place to live or retire (DOP) | 0 |
| Increased local tourism revenue (ILTR1) | 0 |
| Greater diversification of local job offerings (GDLJ) | 0 |
| Greater fiscal capacity to maintain community needs (FCCN) | 0 |
| Total | 13 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 23

Coded Outcome Indicators for Environmental Benefits

| Indicators | Frequency |
|--|------------|
| Protection of natural landscapes (PNL) | 62 |
| Greater protection of fish, wildlife, and plant habitat from growth, development, and public use impacts (HAB) | 57 |
| Reduced negative human impact (RNHI) | 22 |
| Soil, air, and water quality (SAWQ) | 17 |
| Stewardship (STW) | 12 |
| Increased awareness and protection of natural landscapes (APNL) | 12 |
| *Appreciation of protection for viewsapes, soundscapes, and more (PVSM) | 11 |
| Reduced wildlife disturbance (RWD) | 7 |
| Conservation of sustainable ecosystems (CSE) | 6 |
| Retention of distinctive natural feature (RNF) | 3 |
| *Need more protection signs (NPS) | 3 |
| *Negative experience with pollution (NEP) | 2 |
| Maintenance of distinct recreation setting (MRS) | 1 |
| Improved maintenance of distinctive community character and identity (IMCC) | 1 |
| Increased ecologically friendly tourism operations (EFT) | 1 |
| *Geology preservation (GEO) | 1 |
| *Wildfire risk (WFR) | 1 |
| *Negative experience with dogs (NED) | 1 |
| *Mental and Physical Health Benefit (NPHB) | 1 |
| Greater retention of community's distinctive architecture and structures (RAS) | 0 |
| Maintenance of distinctive small-town atmosphere (MSA) | 0 |
| Improved maintenance of physical facilities (IMPF) | 0 |
| Reduced looting and vandalism of historic/pre-historic sites (RLV) | 0 |
| Sustainability of community's cultural heritage (SCCH) | 0 |
| Improved respect for private-owned land (RPL) | 0 |
| Improved care for community aesthetics (CCA) | 0 |
| Reduced spread of invasive species (RSIS) | 0 |
| Greater recycling (GR) | 0 |
| Total | 221 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 24

Coded Outcome Indicators for Social and Cultural Negative Outcomes

| Indicators | Frequency |
|--|-----------|
| Decreased family solidarity (DFS) | 0 |
| Reduced ability to cultivate outdoor-orientated lifestyle (RAOL) | 0 |
| Increased exposure of at-risk youth to delinquency (IEAY) | 0 |
| Increased erosion of community's small-town atmosphere (ESTA) | 0 |
| Diminished sense of community cohesion/friendliness (DSCC) | 0 |
| Increased crime (IC) | 0 |
| Greater conflict with outsiders (GCO) | 0 |
| Greater sense of resignation among residents towards continued growth and development (RRGD) | 0 |
| Increased personal disregard for residents (PDR) | 0 |
| Increased personal disregard for other visitors (DOV) | 0 |
| Total | 0 |

Table 25

Coded Outcome Indicators for Economic Negative Outcomes

| Indicators | Frequency |
|--|-----------|
| High cost of living (HCL) | 6 |
| *Increased real-estate value (IRV) | 1 |
| *Access reduced COL (ARC) | 1 |
| Increased property tax (IPT) | 0 |
| Loss of economic productivity (LEP) | 0 |
| Loss of family legacy (LFL) | 0 |
| Loss of recreation-tourism product character and community's market share (TCMS) | 0 |
| Decreased tourism revenue (DTR) | 0 |
| Inability to cover basic household necessities (ICCN) | 0 |
| Total | 8 |

Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 26

Coded Outcome Indicators for Loss of Environmental Quality

| Indicators | Frequency |
|--|-----------|
| Loss of environmental quality within recreation area (LEQR) | 13 |
| Increased litter, pollution, traffic (LPT) | 9 |
| Increased disregard for natural resources (DNR) | 8 |
| Increased visitor disregard for stewardship (VDS) | 5 |
| Increased urbanization of natural landscape (IUNL) | 2 |
| *Crowding of area (COA) | 2 |
| *Positive view on protection of environment (PVPE) | 2 |
| Transformation of community by growth, development, and modernization (TCGD) | 1 |
| *Negative dogs and environment (NDE) | 1 |
| *Overarching COVID negative outcomes (CNEG) | 1 |
| Rapid loss of distinctive community architecture (LDCA) | 0 |
| Loss of community's defining, distinctive character (LCDC) | 0 |
| Total | 44 |

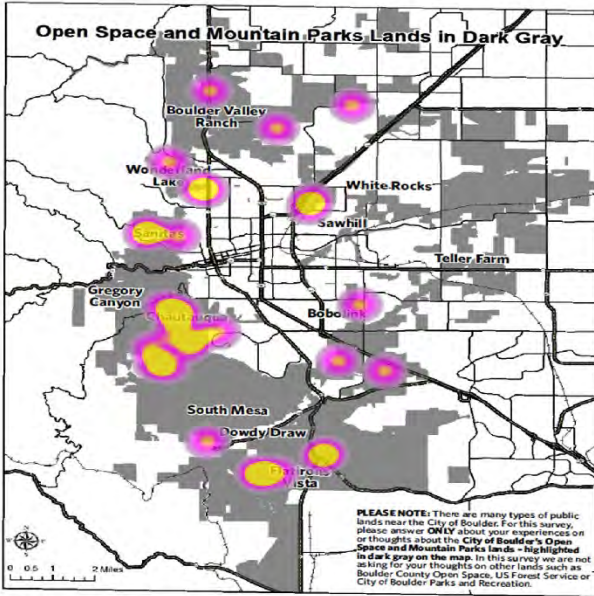
Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.

Table 27

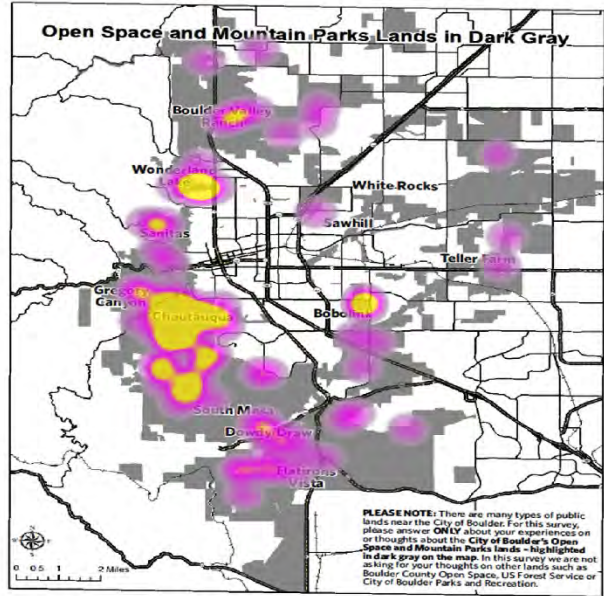
Coded Outcome Indicators for Pollution, litter, traffic noise

| Indicators | Frequency |
|--|-----------|
| Increased traffic noise (IT) | 4 |
| *Negative soundscape effects (NSE) | 4 |
| *Increased positive land stewardship (IPS) | 4 |
| *Positive escape (PE) | 4 |
| Increased pollution (IP) | 3 |
| *Negative dog poop bags (NDPB) | 3 |
| Increased litter (IL) | 2 |
| *Negative impact from crowding (NIC) | 1 |
| Total | 25 |

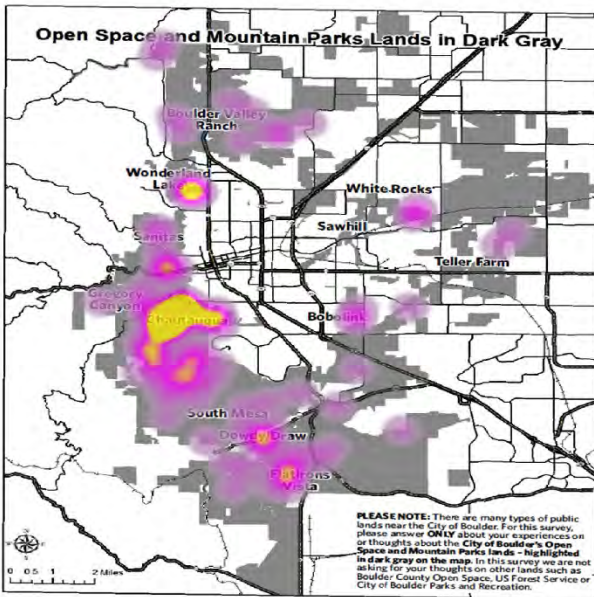
Note: Asterisks in the front of codes are for custom codes developed by the research team for comments that did not match pre-existing REP items.



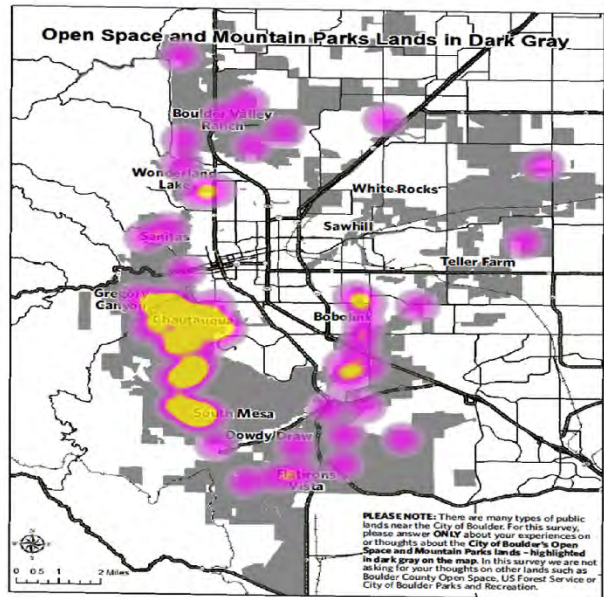
Escape personal or social pressures (n=30)



Exercise / Physical fitness (n=95)



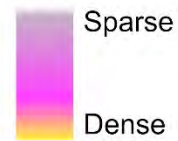
Enjoying nature (n=118)

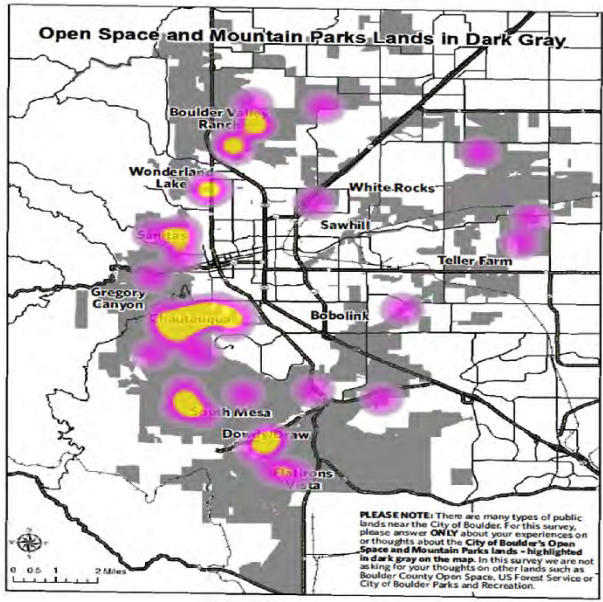


Mental health (n=62)

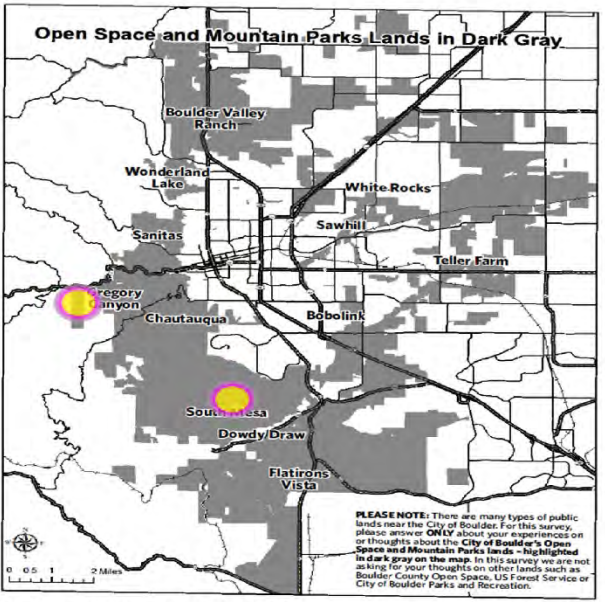
Figure 1a. Outcome distribution and density across City of Boulder Open Space and Mountain Parks properties derived from PPGIS data

Outcome Density

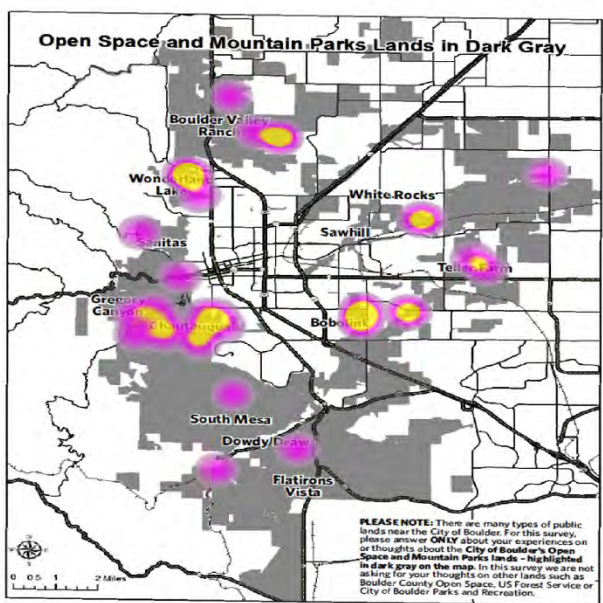




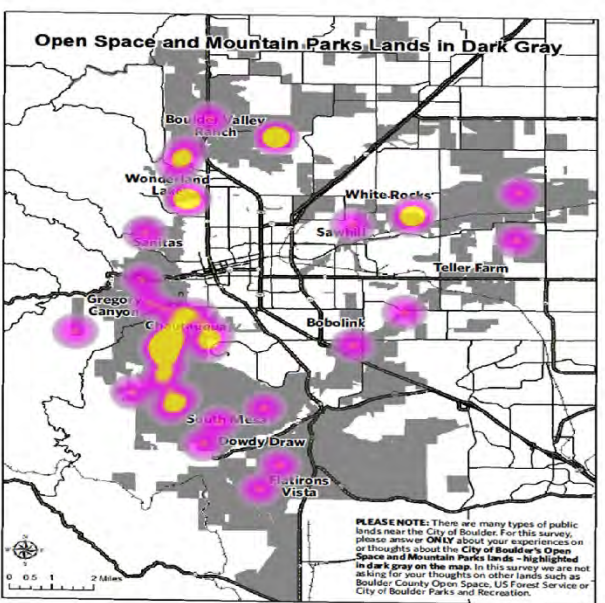
Lifestyle (n=44)



Autonomy or independence / Leadership (n=2)

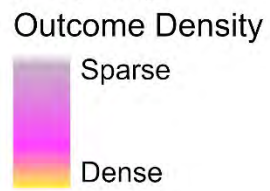


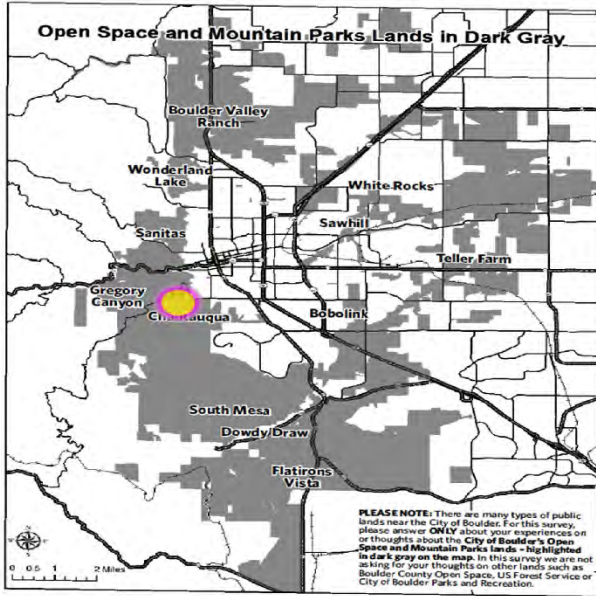
Family togetherness / Friendship / Meeting new people (n=34)



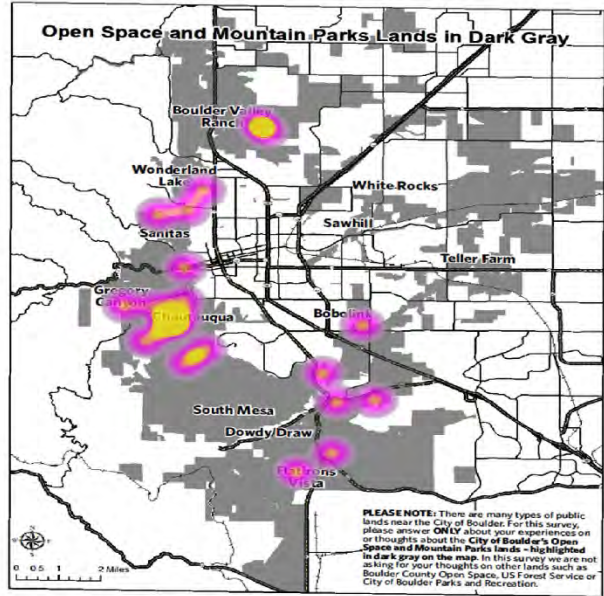
Environmental benefits (n=36)

Figure 1b. Outcome distribution and density across City of Boulder Open Space and Mountain Parks properties derived from PPGIS data

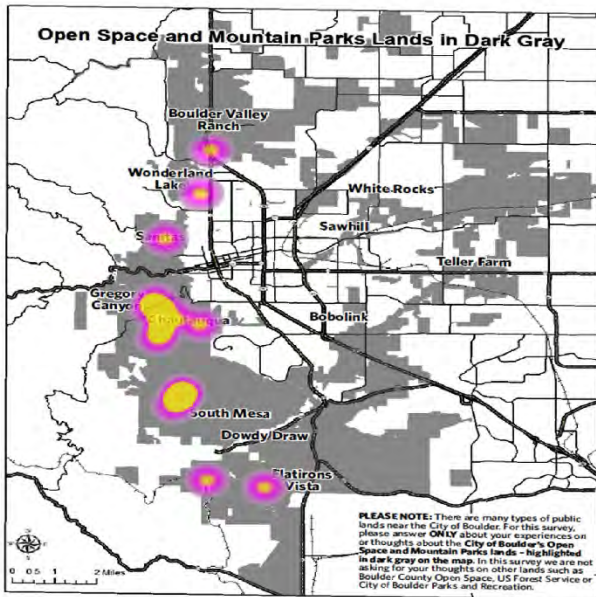




Economic benefits (n=1)

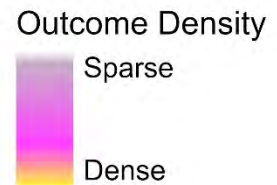


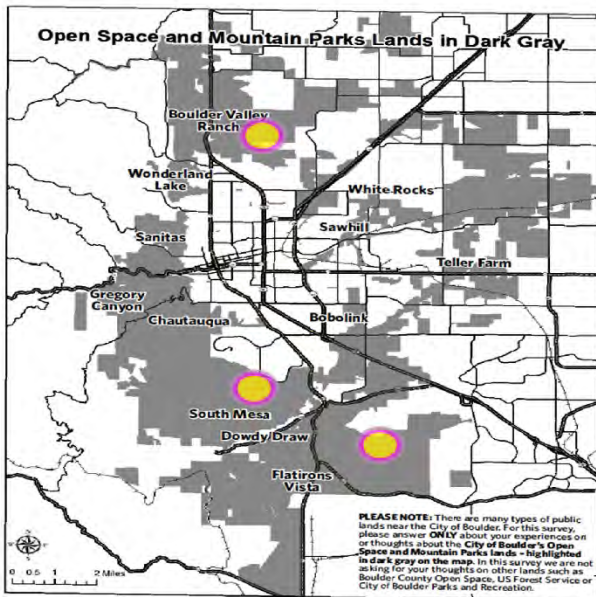
Personal appreciation (n=21)



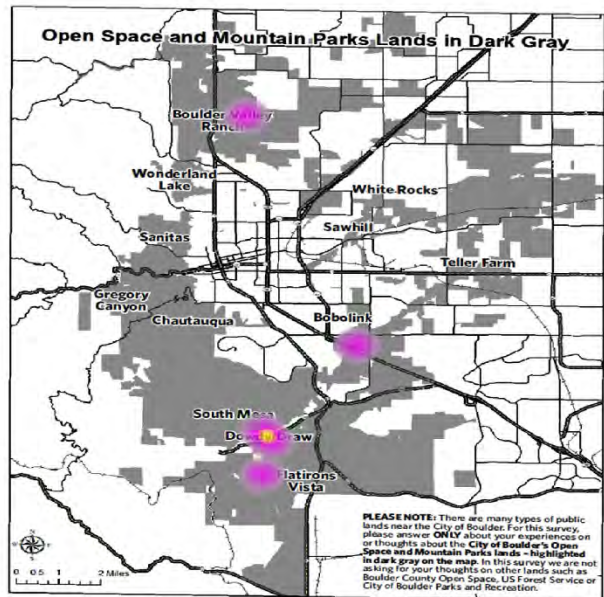
Personal achievement (n=14)

Figure 1c. Outcome distribution and density across City of Boulder Open Space and Mountain Parks properties derived from PPGIS data

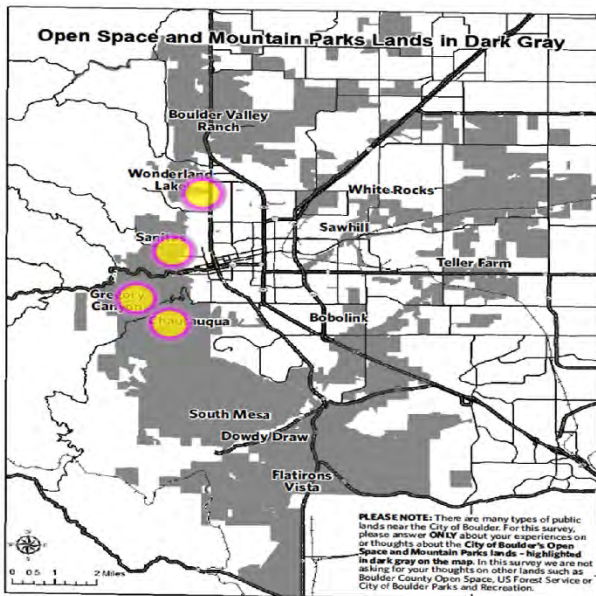




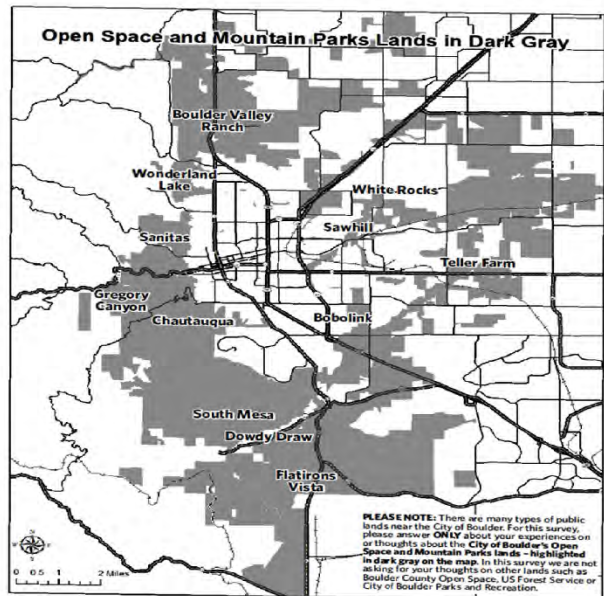
Loss of environmental quality within the recreation area (n=3)



Pollution, litter, and/or traffic noise (n=5)

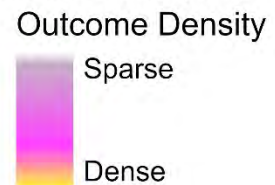


Cost of living (n=4)



Social or cultural negative outcomes (n=0)

Figure 1d. Outcome distribution and density across City of Boulder Open Space and Mountain Parks properties derived from PPGIS data



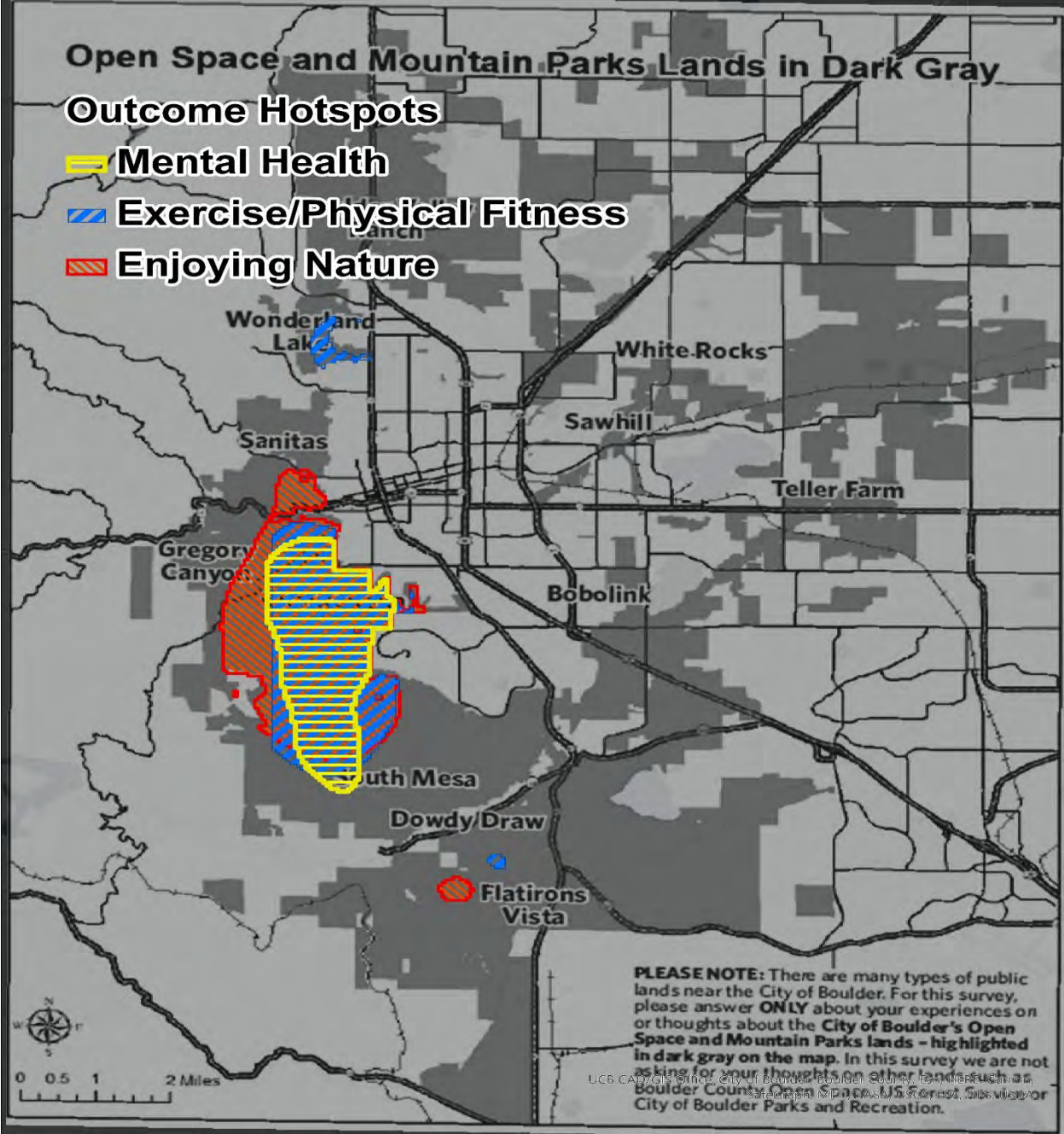


Figure 2. Hotspots of outcome densities for those outcomes having more than 50 observations based on top third of kernel densities.