

Are Wilderness Recreation Experiences More Regulated?

Measuring and Mapping Recreation Confinement in Wilderness and Other Protected Areas in Colorado

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Abstract

Federally designated wilderness in the US is to be stewarded to provide, among other qualities, outstanding opportunities for unconfined recreation—or recreation generally free from rules and regulations. However, compared to other wilderness character qualities, measurement and monitoring of unconfined recreation is often considered less formally. This research seeks to understand the spatial distribution of unconfined recreation across wilderness areas and other federal and nonfederal protected areas in Colorado, and to answer questions related to comparative levels of confinement within and across wilderness-administering agencies. We find that, across all three wilderness-administering agencies in Colorado, wilderness areas are more confined, on average, than the other lands managed by these respective agencies.

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Outdoor recreation, and particularly wildland recreation, is an experience largely defined by freedom (Abbey 1977). Wildland recreation is often used as a vehicle to free individuals from everyday responsibilities, the tethers of digital connectivity, the stress of the workaday world, and other markers of society (Dorman 2019; Lang and Borrie 2021; Nash 2014). But people also go into wildlands to experience the unique freedoms of the outdoors: the freedom to roam, to explore, and to sleep under the stars without physical barriers blocking their connection to nature (Nash 2014). However, often in public land management this freedom is confined, or restricted, for a variety of reasons (Dorman 2019). These confinements most often take the form of rules or regulations, which may involve visitors “losing the internal locus of control” (McCool 2004, p. 16) over their ability to freely select campsites, design their own travel routes, have campfires, determine how long they stay, or determine their date of entry (Griffin 2017).

Recreation Confinement in Wilderness

Wilderness character, in the context of federally designated wilderness in the US, is defined by four primary qualities: (1) natural—containing ecological systems that are substantially free from the effects of modern civilization; (2) undeveloped—retaining its primeval character and influence, essentially without permanent improvement or modern human occupation; (3) untrammelled—essentially unhindered and free from the actions of modern human control or manipulation; and (4) solitude or a primitive and unconfined type of recreation—provid-

ing opportunities for solitude and unconfined recreation. There is scholarship questioning whether “solitude,” “primitive” and “unconfined” were conceptualized by lawmakers as a singular concept under wilderness character or three different concepts (Engebretson and Hall 2019). However, in practice, recreation managers conceptualize the recreation mandate as three somewhat distinct ideas. Research has also conceptualized the wilderness recreation experience as three separate facets: “solitude,” characterized by being alone and away from others (or alone with others; Lee 1977); “unconfined,” characterized by unrestricted access and minimal management regulations; and “primitive,” characterized by a traditional, non-mechanized means of travel (e.g., walking or canoeing) and reliance on personal skills with a spartan management setting (e.g., limited directional signage or structures such as bear boxes) (Seekamp and Cole 2009).

Honoring the recreation mandate in wilderness challenges managers, as there is a tension between the three concepts. For example, limiting use in a wilderness area through a permit system may increase opportunities for solitude, but it degrades the unconfined element of the wilderness experience (Seekamp and Cole 2009). And as Behan (1974) notes, unconfined recreation (i.e., nonrationed use) could be maintained through hardening trail surfaces and campsites, installing toilets, widening trails, and other means of development that could “mitigate user impact” and “increase the carrying capacities” (p. 99). However, such actions have implications for the primitive facet of the wilderness recreation

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experience and the overarching undeveloped quality of wilderness. Additionally, the unconfined portion of the recreation mandate may threaten other elements of wilderness character outlined in the Wilderness Act. Lucas (1983) notes that the act “requires managers to protect and manage wilderness ‘so as to preserve its natural conditions’—an almost impossible mandate if uncontrolled recreational use is allowed” (p. 6). For example, allowing visitors to camp on tundra plants directly next to an alpine lake may provide an unconfined camping experience in a wilderness area, but it would likely degrade the natural conditions over time. In fact, preserving the natural quality of wilderness may be the primary justification for ceding aspects of the unconfined quality.

The wilderness recreation mandate has three facets, yet in the more than 60 years since the passage of the Wilderness Act, solitude has been prioritized above the other two by both the management and research communities. Cole (2011) alludes to the historical focus: “solitude’ is the one word, beyond the mandate to provide for primitive

and unconfined types of recreation, used to describe the type of experience wilderness should provide” (p. 68). More contemporarily, the focus on solitude is evident in the formal US Forest Service (USFS) effort on wilderness stewardship performance, in which managers of every wilderness area administered by the Forest Service select and track quantifiable “elements” related to wilderness character. With regard to wilderness recreation, managers must track at least one of the two related elements: (1) “opportunities for solitude,” and (2) “opportunities for primitive and unconfined recreation.” Arguably, the decision to combine the primitive and unconfined components is, in and of itself, an indication that solitude is prioritized; the selection of the recreation-related elements reinforces our suggestion. In fiscal year 2025, an internal USFS database showed that, out of 448 wilderness areas, 332 (74%) selected “opportunities for solitude” as a performance metric, whereas 163 (36%) selected “opportunities for primitive and unconfined recreation.” And for the selected element related to “opportunities for primitive and unconfined recreation,” only about 20%

appeared to focus on the unconfined aspect of wilderness recreation.

Behan (1974) expressed concern long ago that confining the wilderness experience and limiting recreation use in wilderness through permit systems was amounting to a “police state wilderness” (p. 98), and he argued that the unconfined quality of wilderness is seen as expendable compared to the primitive or undeveloped qualities. Indeed, Griffin (2017) finds that 59% of the wilderness areas administered by the Bureau of Land Management (BLM) or USFS have at least one recreation rule, whereas 27% of the wilderness areas administered by these agencies have more than five recreation rules. Some wilderness areas have many more. For example the Maroon Bells-Snowmass Wilderness was found to have no fewer than 26 recreation rules. Among the wilderness areas analyzed (669 in total), the most common rules included group size limits, stock restrictions, length of stay limits, and camping restrictions. Nearly 14% of wilderness areas were found to require permits (Griffin 2017). Preserving naturalness is a primary motivation of these regulations.

A more holistic consideration of the recreation mandate in wilderness is likely beneficial for two notable reasons. First, the importance of unconfined recreation is well documented; indeed, the virtue of wilderness has been associated with the freedom of the walker who can journey wherever they please (Thoreau 2013, p. 253), and, as Abbey (1977) plainly states: “We cannot have freedom without wilderness” (p. 235). As Roderick Nash (2014) articulates in his classic book *Wilderness and the American*

Mind: “Because wilderness is a state of mind, the conditions under which one enters it are vital to the overall wilderness experience. Quotas, permits, lotteries, waiting lists, prescribed itineraries, and campsite assignments devastate the feeling of wilderness” (p. 340). He continues, “For some persons just the knowledge that they visit a wilderness by the grace of, and under conditions established by, civilization can destroy the wilderness experience before it begins” (p. 340). Second, research has consistently found a weak relationship between the number of people encountered in wildland recreation and the quality of someone’s experience (Stewart and Cole 2001). Consequently, the degree to which solitude is in tension with unconfined recreation is questioned, particularly given the multidimensionality of solitude as a concept (Lang and Borrie 2021), and the general adaptability of recreationists (Cole 2007).

Study Purpose

In certain areas of the US, confinement, especially confinement via permit systems, in wilderness appears to be increasing. As visitor use increases in these wilderness areas, managers are opting to increase confinement as a means of preserving natural conditions and maintaining or increasing solitude. In Colorado, this trend is particularly evident. By 1973, Rocky Mountain National Park required permits for backcountry camping and the use of existing backcountry campsites in most locations. The Indian Peaks Wilderness—near Boulder and within a reasonable distance for a day trip from Denver—began requiring permits for overnight camping in 1985. In 2020,

the National Park Service (NPS) instituted a use limit in Rocky Mountain National Park, allocating access via a timed-entry reservation system that included day users seeking to hike in the park's wilderness areas. More recently, in 2023, the USFS instituted a reservation-based use-limit for multiple heavily visited areas within the Maroon Bells–Snowmass Wilderness.

In response to this recent perceived uptick in confinement, we seek to understand how recreation confinement varies across all public lands in Colorado and explore the following research questions. First, how does recreation confinement vary by managing agency? Second, how does recreation confinement vary between designated wilderness and other federal public lands, and how does it compare between wilderness-administering agencies?

Methods
Mapping Confinement

To understand how confinement varies across Colorado's public lands, we combined data from the Colorado Trail Explorer (COTREX) and the US Geological Survey Protected Areas Database of the US (PAD-US) to create an index of confinement using methods adapted from those put forward by the Wilderness Character Monitoring Technical Guide (WCMTG; Part 2, section 5.5.1) for measuring confinement. This index measure represents the "relative degree of imposition or inconvenience of certain visitor management restrictions as well as the geographic extent of those restrictions" (WCMTG, p. 307) across public lands included in the PAD-US

within Colorado. Using the WCMTG as a guide, we included 10 categories of regulations considered most likely to impact the visitor's perception of unconfined recreation: area closures, camping restrictions, restrictions on dogs and domesticated animals, campfire restrictions, fees, group size limits, human waste regulations, length of stay regulations, stock use limitations, and mandatory permits. When the type or level of permitting was not specified (i.e., voluntary vs. mandatory), mandatory was assumed and a value of 3 assigned. Deviating from the WCMTG, for this study, swimming and bathing restrictions were omitted because data on these restrictions were uncommon and inconsistently reported. Data on each of these regulation categories were primarily extracted from COTREX and PAD-US; however, in instances when data were not available through these platforms, data were gathered from agency websites or Wilderness Management Record Reports on IWeb for the most recent year available (in most cases, 2023 or 2020).

Following the WCMTG, we assigned the prescribed impact rating from 0 to 3 for each regulation category on rasterized cells of all public lands in Colorado, in which higher ratings indicated stricter regulations that significantly affected visitor activities. For instance, prohibiting all stock in a particular cell (an impact rating of 3) may have required visitors to change their trip plans or may even have precluded some from visiting altogether. Alternatively, stock feed restrictions (an impact rating of 2) may also have required visitors to make advance plans but still allowed permitted recreation with stock animals. If a

particular cell was subject to more than one impact rating within a particular category, the most restrictive rating was assigned. To account for the geographic extent of each impact rating, a weight was assigned based on whether the restriction applied to a subarea of the PAD-US unit (a weight of 1) or to the entire PAD-US unit (a weight of 2). To produce the final index value, we began by calculating a component score for each regulation category by multiplying the impact rating by its assigned geographic weight. Then, the component scores for all 10 restriction categories were summed to produce an index

value for each cell, where a higher index value indicates a higher degree of confinement. We compiled the final index values to produce a raster of confinement with cells of 200 hectares spanning all Colorado protected areas found in the PAD-US (see Figure 1).

Results

Table 1 summarizes the geographically weighted average confinement index scores by managing agency across Colorado. The NPS has the highest average confinement index score, managing relatively more confined areas such as Rocky Mountain, Mesa Verde,

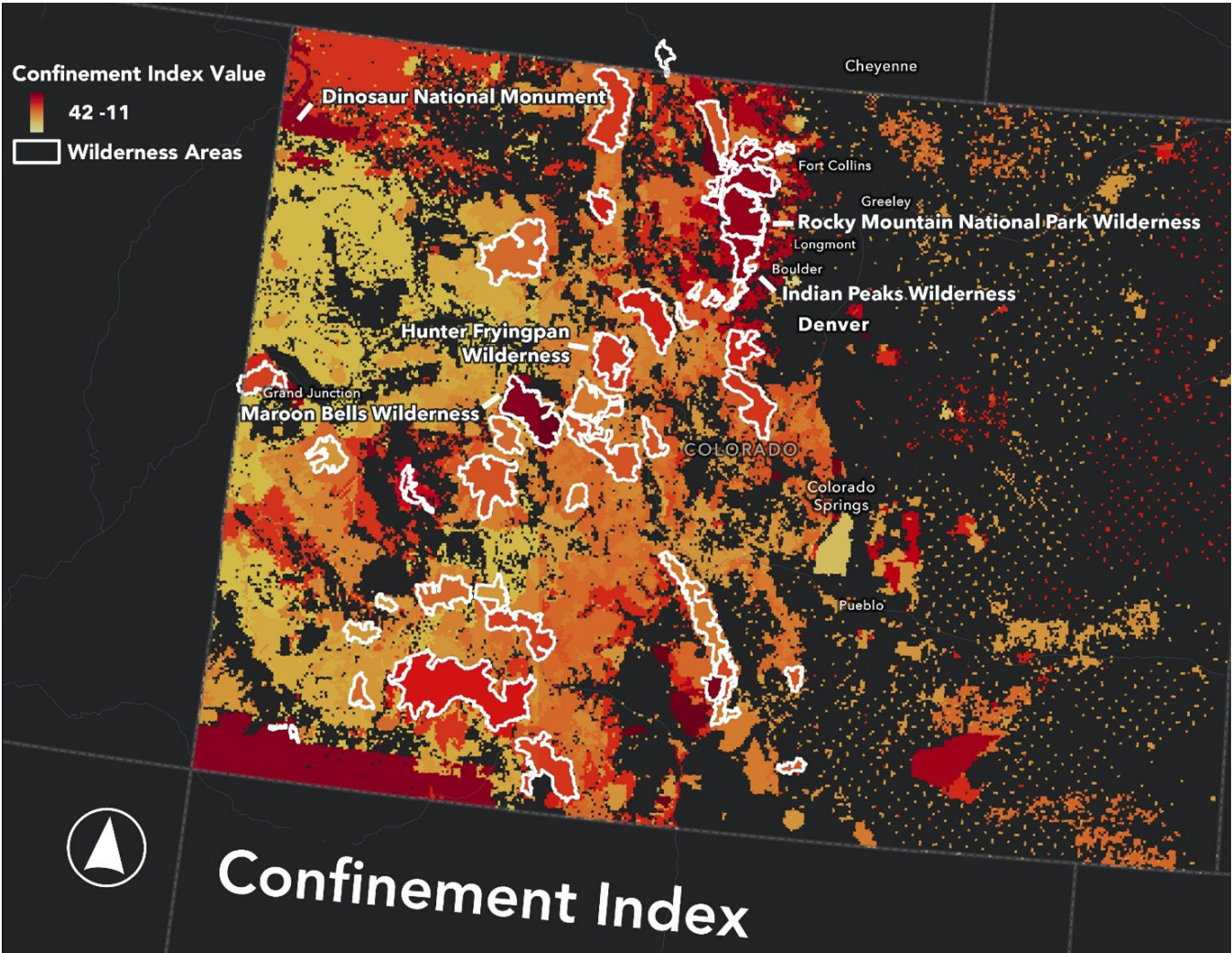


Figure 1 - Confinement Index Values across Colorado (wilderness areas highlighted in white). Darker colors indicate more confinement.

Agency	Minimum	Maximum	Average	Hectares Administered
National Park Service	12	42	26.8	293,116
US Fish and Wildlife Service	12	32	18.4	70,876
US Forest Service	9	32	16.1	5,857,034
Bureau of Land Management	10	44	15.2	3,360,728
State agencies	8	32	14.8	708,764
Local agencies	9	44	14.3	726,865

Table 1 - Confinement Index Scores by Managing Agency in Colorado

Agency	Minimum	Maximum	Average	Hectares Administered
National Park Service	17	42	27.9	197,358
US Forest Service	14	32	18.9	1,283,742
Bureau of Land Management	11	36	17.6	317,100

Table 2 - Confinement Index Scores by Managing Agency in Federally Designated Wilderness in Colorado

and Black Canyon of the Gunnison National Parks, among others. The US Fish and Wildlife Service (USFWS), managing National Wildlife Refuges across the state, is the second-most confining agency, on average. It is important to note that both the NPS and the USFWS have largely preservationist-based mandates, as compared to the largely conservationist-based mandates of the USFS and BLM, which is likely reflected in their index scores. Three federal agencies administer federally designated wilderness areas in Colorado. The geographically weighted average confinement index scores for the wilderness areas they administer are listed in Table 2. For each of these agencies, their respective average confinement index scores across wilderness areas are higher than their overall average index scores (see Table 1 and Figure 1).

Discussion

The finding that confinement in wilderness is generally higher than those federal public lands not designated as wilderness runs counter to the notion of wilderness as areas with minimal “management” presence and outstanding “opportunities for solitude or a primitive and unconfined type of recreation.” However, this result also highlights the trade-offs present in wilderness stewardship, wherein confinements are instituted to support other wilderness character qualities such as solitude and naturalness in the face of increasing recreation demand. Reassessing generally highly confined areas (such as those near population centers, such as Denver) provides an opportunity to diversify the recreation portfolio, so that highly confined recreation experiences are complemented with proximate low confinement experiences.

This would provide opportunities for both recreationists who prioritize solitude and are willing to sacrifice some of the unconfined quality in order to obtain it, as well as those who prioritize unconfined recreation and are willing to forgo some degree of solitude.

Considerations for Wilderness Stewardship

A Regional Approach to Unconfined Recreation

One philosophy for managing our public lands, and recreation in particular, is to consider management decisions at the regional level. That is, management decisions around confinement can be supported by considering both the unique circumstances of an individual

public land unit and the level of confinement within the broader, regional system, at a minimum. This was articulated 40 years ago by Schreyer (1985) in the context of river permitting: “Managers and planners have begun to talk about the need to plan for use regulation on a given river by viewing it as part of a larger system of recreational opportunities. . . . Our resources are becoming too precious to plan and manage as isolated entities” (p. 16).

Whereas some may argue that a perfect recreation world would be one without any confinements, such an idea is unrealistic (in all places and at all times), given public land is a highly demanded resource supporting a broad range of preferences and needs (Nash 2014). For instance, a requirement to keep dogs on leash may benefit those afraid of dogs or those interested in wildlife watching. But



Figure 2- Wilderness permit sign seen when entering the Rocky Mountain National Park Wilderness.



Figure 3 - Sign in the Indian Peaks Wilderness indicating that stoves are required for cooking.

implementing confinements is often framed as a last resort, given visitors are drawn to wild places to experience freedoms often lacking in their everyday lives (Dorman 2019; Nash 2014). "Thinking and acting regionally" in the recreation management context can accommodate the various preferences that recreationists have across the broader landscape (McCool and Cole 2001).

Pursuing a regional approach to recreation management is challenging, however, because all four wilderness-administering management agencies have different mandates and priorities, coordination is limited, and managers are often unaware of how particular actions impact surrounding areas (McCool and Cole, 2001). The confinement map presented herein provides, first and foremost, awareness concerning the current state of confinement across the entire state

of Colorado, which can support management decision-making by highlighting the levels of confinement around each individual unit. For example, three proximate wilderness areas within Colorado offer varying degrees of confinement: Maroon Bells–Snowmass (average confinement score = 32), Holy Cross (18), and Hunter–Fryingpan (14). The Maroon Bells–Snowmass Wilderness requires reservation permits for overnight stays in the Maroon Bells. The Holy Cross Wilderness requires registration for overnight camping, but with unlimited access. The Hunter–Fryingpan Wilderness has no such requirements for registration or permits. Although managers are incentivized to prioritize the area under their own jurisdiction before considering other areas (McCool and Cole 2001), there may be an opportunity, with increased awareness (as provided by the maps herein), for managers

to clearly justify and communicate their decisions to confine or not confine areas based on the regional situation. For instance, if the Hunter–Fryingpan Wilderness experienced increased use, and managers felt compelled to consider implementing additional rules and regulations on recreation, there would be an opportunity to incorporate the knowledge that neighboring wilderness areas have higher levels of regulation and restriction.

Recognizing the Dynamic Trade-Offs Between Unconfined Recreation and Other Wilderness Character Qualities

This study offers an opportunity to recognize that the tensions, or trade-offs, between unconfined recreation and other facets of the recreation mandate and other wilderness character qualities (e.g., natural conditions) are dynamic. By dynamic, we are suggesting that the potential trade-off between facets of the recreation mandate and other elements of wilderness character is not static, but subject to change depending on three interrelated factors.

This first factor is the current level of confinement. In the years after the Wilderness Act, as areas were initially designated as wilderness and visitor use was generally lower, we can presume that, across the state of Colorado, the level of confinement was relatively low or nonexistent. But today, we find that wilderness lands in Colorado are, on average, more confined than the other public lands managed by the same federal land management agencies. This finding reinforces the assertion that nationally, solitude is being

prioritized over unconfined recreation—"with preservation of solitude trumping unconfined" (Dorman 2019, p. 144). To be fair, the finding also suggests that wilderness areas in Colorado are among the most visited public lands in the state—as confinements, particularly permits, are typically implemented in a reactionary fashion (Rice et al. 2025). For these reasons, confinements can be used to maintain components of the natural (e.g., thriving tundra plant communities) and untrammelled (e.g., less need for restoration efforts) qualities of wilderness. Regardless, the current state of confinement in Colorado (and perhaps beyond) is, relative to 60 years ago, one of prevalence. Therefore, wilderness recreation managers are currently in a position where each additional confinement adds to an abundance of confinement, rather than creating a map free from confinement. As such, the point made by Lucas (1983) that maximizing wilderness experiences cannot be achieved through a homogenized stewardship regime, in which naturalness and solitude are prioritized over unconfined recreation appears even more salient today.

The second factor is the potential meaning and reframing of restricting or regulating recreation as a last resort. Limiting use, or confining recreation more generally, has traditionally been framed as an action to be avoided at all costs. Writing in 1974, Hendee records, "I think wilderness managers should regard across-the-board rationing of wilderness use as a last resort when all other measures have failed to control unacceptable impacts" (p. 32). All other measures presumably include educational efforts to reduce

visitor impacts and set expectations for the visitor experience, thereby decreasing feelings of crowdedness—and perhaps increasing feelings of wilderness solitude. These measures might also include development and trammeling actions (e.g., restoration efforts) to reduce recreation impacts to the natural quality of wilderness. This sentiment is echoed by Lucas (1983): “Don’t regulate if there are effective non-regulatory alternatives. Establishing a regulation, by itself, achieves nothing out in the real world, although it may provide a sense of satisfaction that something is being done” (p. 8). Although there may be agreement that confining recreation should be treated as a last-resort action, the threshold for deciding when all other options have been exhausted is not agreed upon, nor is it a static threshold. For instance, in the face of increasing recreation impacts, it may have previously been considered adequate to pilot a Leave No Trace education campaign to reduce impacts prior to implementing confinements, but given the current level of confinements However, given the current level of confinements, there may be an opportunity to redefine the threshold of “last resort” to include additional efforts, such as making smaller sacrifices of undeveloped quality—hardening trail surfaces or developing hardened campsites to attract and concentrate use (Arredondo and Marion 2025).

The third factor influencing the dynamic nature of assessing trade-offs is our increased knowledge of the recreation experience. Over time, we have learned that all three facets of the recreation mandate (particularly solitude and unconfined) are normative

concepts. That is, the meaning of solitude, for instance, depends on who you ask. It has long been established that solitude is normative (Lang and Borrie 2021). Research on the unconfined wilderness experience, albeit sparse, also points to the normative nature of the unconfined quality (e.g., Dorman 2019; Seekamp and Cole 2009). Recent research on norms related to wilderness solitude shows that, in three instances across the National Wilderness Preservation System (NWPS), tolerance for encounters with others has increased in recent decades (Kuentzel et al. 2020; Nettles et al. 2020; Rice and Armatas 2024). Although discussion regarding how to respond to this “shifting baseline” of solitude continues, when combining the normative nature of these concepts with research that questions the relationship between encountering people and experience quality (e.g., Lee 1977; Stewart and Cole 2001), we can begin to question the fundamental assumption that sacrificing confinement yields greater feelings of solitude. Returning to Behan (1974), it might prove healthy to question why solitude—and perhaps even the wilderness character qualities of undeveloped, untrammled, and natural—is so often viewed as sacrosanct, while unconfined recreation is so often treated as sacrificial.

Two Vignettes Applying the Confinement Index

By way of demonstrating the usefulness of the confinement index in future research and management applications, we developed bivariate maps of recreation demand and

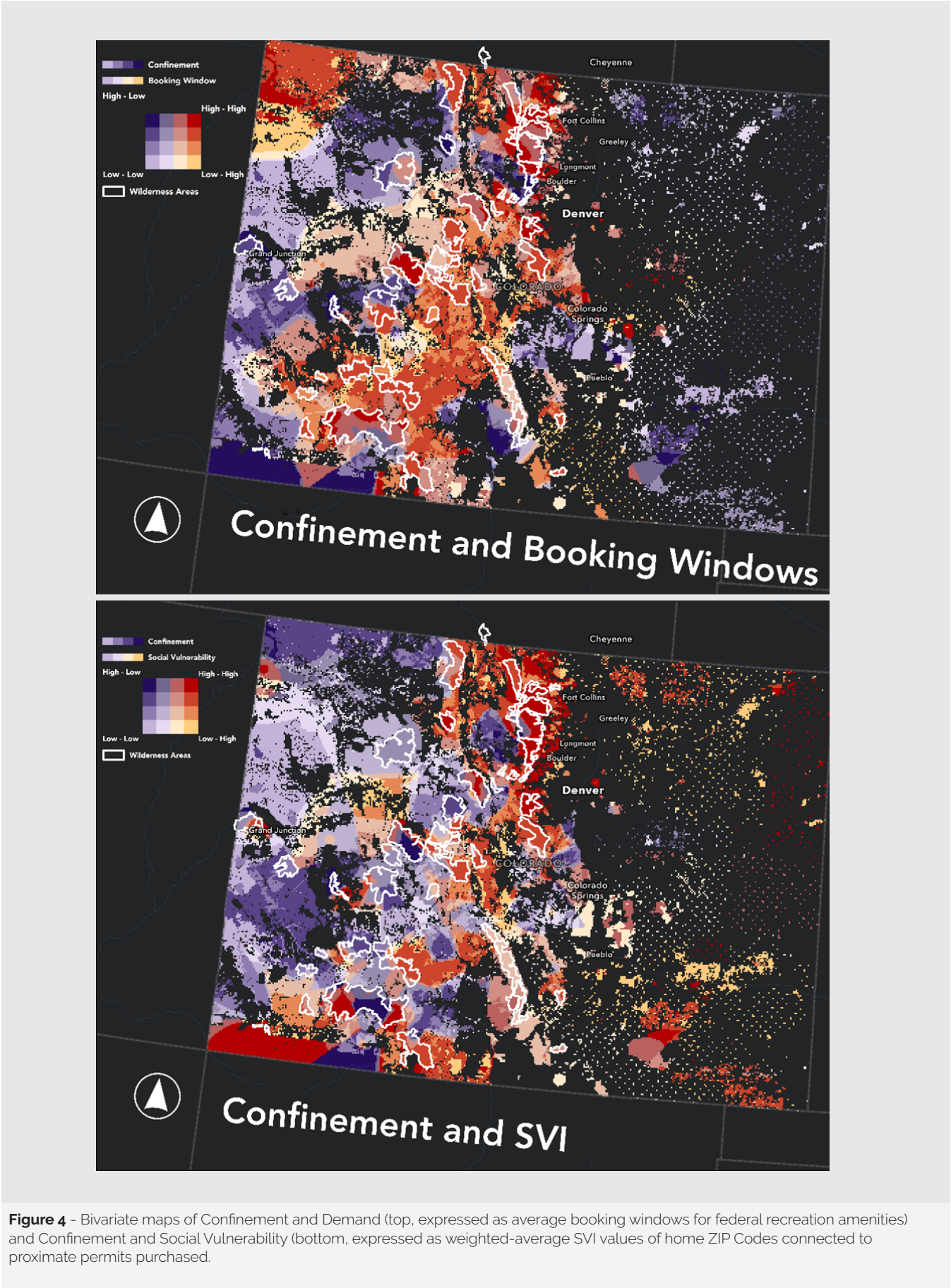


Figure 4 - Bivariate maps of Confinement and Demand (top, expressed as average booking windows for federal recreation amenities) and Confinement and Social Vulnerability (bottom, expressed as weighted-average SVI values of home ZIP Codes connected to proximate permits purchased).

social vulnerability (Figure 2). For exploratory and demonstrative purposes, we interpolated recreation demand using average booking windows (Rice and Park 2021) for recreation resources (e.g., wilderness permits, campsite reservations, timed-entry permits, etc.) across Colorado with data available through the Recreation.gov Recreation Information Database (RIDB). Because the majority of parks and protected areas (or recreation sites within vast protected areas such as national forests) do not have sites bookable through Recreation.gov, and thus do not have demand data available in RIDB, we used inverse-distance weighted interpolation to model a rough estimate for demand of specific points (e.g., a wilderness area or a campground) to the nearby protected parks and protected. ZIP codes available from reservation records in the RIDB allowed us to create a layer of social vulnerability. The Social Vulnerability Index (SVI) is calculated using data from the American Community Survey across four key areas: socioeconomic status, household characteristics, racial and ethnic minority status, and housing type and transportation. We matched each visitor's ZIP Code to their corresponding community's SVI score and created a weighted average SVI variable for each recreation area, resulting in a layer of estimated visitor SVI scores across Colorado.

These vignettes (Figure 4) present distinct patterns of bivariate relationships between confinement and these layers. In both maps, we see a broad distribution of values across Colorado, and in both cases, we find "High-High" bivariate values along the Front Range—stretching from Fort Collins

to Colorado Springs. Farther away from the Front Range, we see a noticeable pattern wherein many popular recreation areas with relatively high confinement are visited by individuals with lower social vulnerability, such as the Green River through Dinosaur National Monument, the Maroon Bells, and Mesa Verde National Park. This pattern may suggest that these visitors with lower social vulnerability have an advantage in accessing these highly confined and highly demanded locations. In some areas, we see high levels of confinement and high levels of estimated demand (mapped in dark red). However, in other areas, we find relatively high levels of confinement and low estimated recreation demand (mapped in dark purple). These areas may represent potential opportunities to reassess their respective confinements, especially within wilderness areas, to see if unconfined recreation can be maintained or restored in the future.

Limitations

This research is subject to a number of limitations, including data availability, scale of analysis, and assumptions. It is not possible to obtain complete, authoritative data on all possible confinements across public lands in Colorado—even through the review of agency websites. Additionally, data used for recreation demand estimation was pulled from Recreation.gov, drawing only on those sites that are reservable through the platform. Relating to demand, our vignette of a simple bivariate analysis does not account for potentially confounding variables such as land cover, topography, or hydrology. Future

research should consider incorporating additional data into such estimation. Further, a cell size of 200 hectares may not provide a level of measurement precision required to inform management at the scale of recreation (e.g., campsites, trail sections, etc.). Finally, our discussion largely assumes that all wilderness character qualities are of equal importance in supporting the resource of wilderness. Although they are generally weighted equally in definitions of wilderness character, their practical weighting by managers may not be equal.

Conclusion

This study highlights that, in Colorado, there exists a mosaic of confined and unconfined recreation management. We also find that federal agencies offer different levels of unconfined recreation, on average, and that—in Colorado—federally designated wilderness is among the most highly confined public land. For each of the three federal agencies administering wilderness in Colorado, their respective wilderness areas are found to have higher levels of confinement as compared to their nonwilderness lands. This is unquestionably paradoxical, as the Wilderness Act defines wilderness (Section 2c) as having, among other qualities, outstanding opportunities for unconfined recreation. Importantly, however, we also find that there still exists a regional diversity of relative levels of confinement in certain key clusters of wilderness areas across the state. To this end, we offer implications regarding preserving this variety across the landscape and reassessing

the trade-off between unconfined recreation and other wilderness character qualities, such as naturalness and solitude, across the NWPS. In short, this research provides a baseline of recreation confinement at the present moment across Colorado and offers consideration of the question: How many opportunities for unconfined recreation are we willing to cede in favor of other wilderness character qualities? 

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