A recreation ecology perspective on the COVID-19 (SARS-CoV-2) pandemic: Potential parks and protected area impacts relating to visitor spatial use, terrestrial flora and fauna, and management

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Abstract

Measures to limit the spread of COVID-19 require changes in the ways that people travel, gather, and recreate in outdoor spaces. In 2020, to limit human-to-human transmission of COVID-19, US park and protected area managers at all levels of governance implemented closures and restrictions on the types of activities and facilities available for public use. At the same time, the US Centers for Disease Control and Prevention outlined suggestions for social distancing, wearing face masks, and limiting travel and group sizes for social gatherings. This thought piece explores potential shifts in park accessibility and human behaviors that may lead to cascading impacts on visitor spatial use, terrestrial flora and fauna, and park management. We discuss potential changes in visitor spatial behavior and possible subsequent ecological impacts on terrestrial flora and fauna. Additionally, we connect these topics with management implications and emphasize adaptive management and continued monitoring to address current and future pandemic-related issues. We provide park managers, researchers, and other professionals with expected social and ecological implications resulting from managerial and behavioral shifts in response to the COVID-19 pandemic. Furthermore, we suggest management approaches to address and monitor these impacts. This information can help shape how park managers respond to the ongoing pandemic and future human health issues that impact park visitors and flora and fauna. Finally, we offer suggestions for where prospective researchers can direct their focus, especially in areas where recreation ecology and human disease management intersect.

Introduction

Measures to limit the proliferation of the COVID-19 pandemic (caused by SARS-CoV-2) require changes in how people travel, gather, and recreate in outdoor spaces. During 2020, US park and protected area (PPA) managers at all levels of governance implemented closures and restrictions on the types of activities and facilities available for public use. Park managers directed their efforts at reducing the human transmission and associated health impacts of COVID-19. Simultaneously, the US Centers for Disease Control and Prevention outlined suggestions for social distancing, wearing face masks, and limiting travel and group sizes for social gatherings.

In this paper, we outline our thoughts about how potential collective shifts in park accessibility and human behaviors may lead to cascading impacts on visitor spatial use, terrestrial flora and fauna,

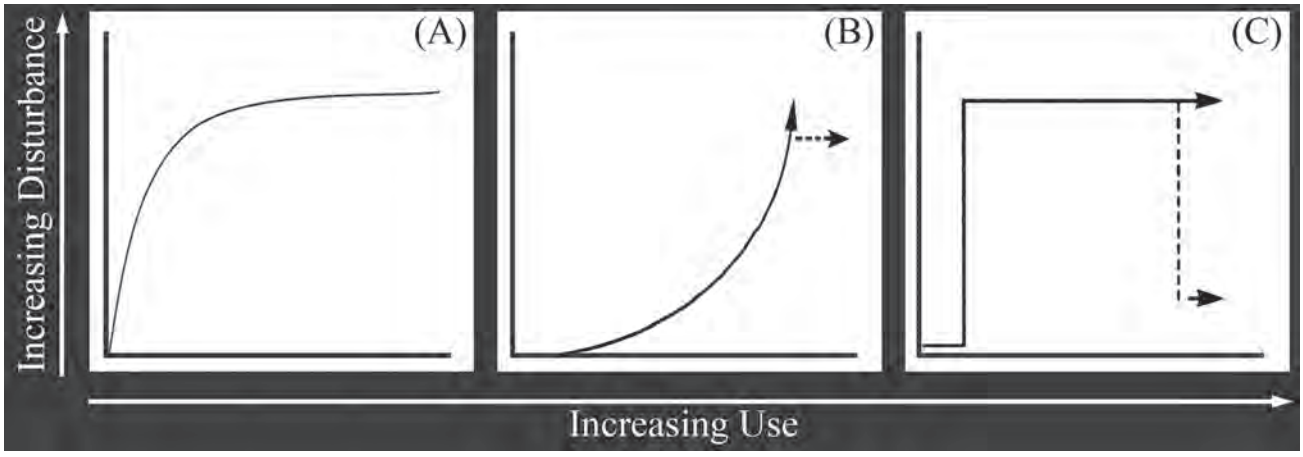
and management in PPAs. Though most recreation ecology literature refers to impacts using the general terms "wildlife" and "vegetation," we chose place- and regional-specific terminology (e.g., "flora" and "fauna") to underline possibilities for place-based stressors and impacts. We discuss potential alterations of outdoor recreationists' spatial behaviors driven by the pandemic and consider the possible subsequent ecological effects on terrestrial flora and fauna. We connect these topics with management implications and emphasize adaptive management approaches and continued monitoring to address current and future human health crises.

We ruminate about potential recreation resource impacts (i.e., undesirable visitor-related disturbances to natural resources; Huddart and Stott 2019: 1) resulting from shifts in management protocols and recreation behaviors engendered by the pandemic. Assessing and anticipating the severity of recreation impacts on flora and fauna depend on the intensity, type, timing, and geographic extent of visitor use, and the subjectivity of recreation areas and species. In general, increased visitor use does not always result in increased impacts (Figure 1; Monz et al. 2013: 443). The relationship between usage and successive impacts varies on flora but generally follows a curvilinear path (e.g., model A, Figure 1); however, other patterns may emerge if impacts include soil or faunal disturbances (models B and C, Figure 1; Monz et al. 2013: 443). Furthermore, spatial distributions of impacts occur disproportionately across landscapes, with the majority of severe effects concentrating near facilities, campsites, and trailheads (Monz et al. 2010: 556). In areas with low or inconsistent use, small variations in visitation may result in noticeable ecological differences (Monz et al. 2013: 442). Following recreation ecology models (Figure 1), this paper provides insights for managers and researchers to understand how potential management decisions and possible resulting shifts in visitor behavior during human health crises may impact visitor spatial use, terrestrial flora and fauna, and PPA management.

Possible changes to recreation spatial behaviors

Shifts in recreation spatial behaviors may occur between and within recreation sites as visitors engage in social distancing practices and comply with PPA closures and use restrictions. These potential shifts mirror many characteristics of displacement—a phenomenon wherein recreationists shift behaviors to avoid negative stimuli (Hall and Shelby 2000: 436). Most displacement research contextualizes crowding as a driver of visitor spatial shifts between and within recreation sites. However, in the context of the ongoing pandemic, we propose an alternative conceptualization in which visitor responses and potential subsequent displacement stem from managerial decisions guiding the availability of recreation opportunities. Using a displacement lens, we categorize impacts on visitor spatial behaviors into three distinctions: spatial, temporal, and activity (Figure 2). We also discuss how these impacts might occur within and between PPAs.

Figure 1. Recreation ecology response curves underlining the generalized relationships between recreation use and (A) ecological impacts generally; (B) soil erosion; and (C) faunal responses (fight or flight; Monz et al. 2010; Monz et al. 2013). The dashed lines indicate alternative responses where (B) complete soil loss occurs, and therefore, soil damage remains maintained, and (C) animals return after cessation of recreation disturbances (Monz et al. 2010; Monz et al. 2013).



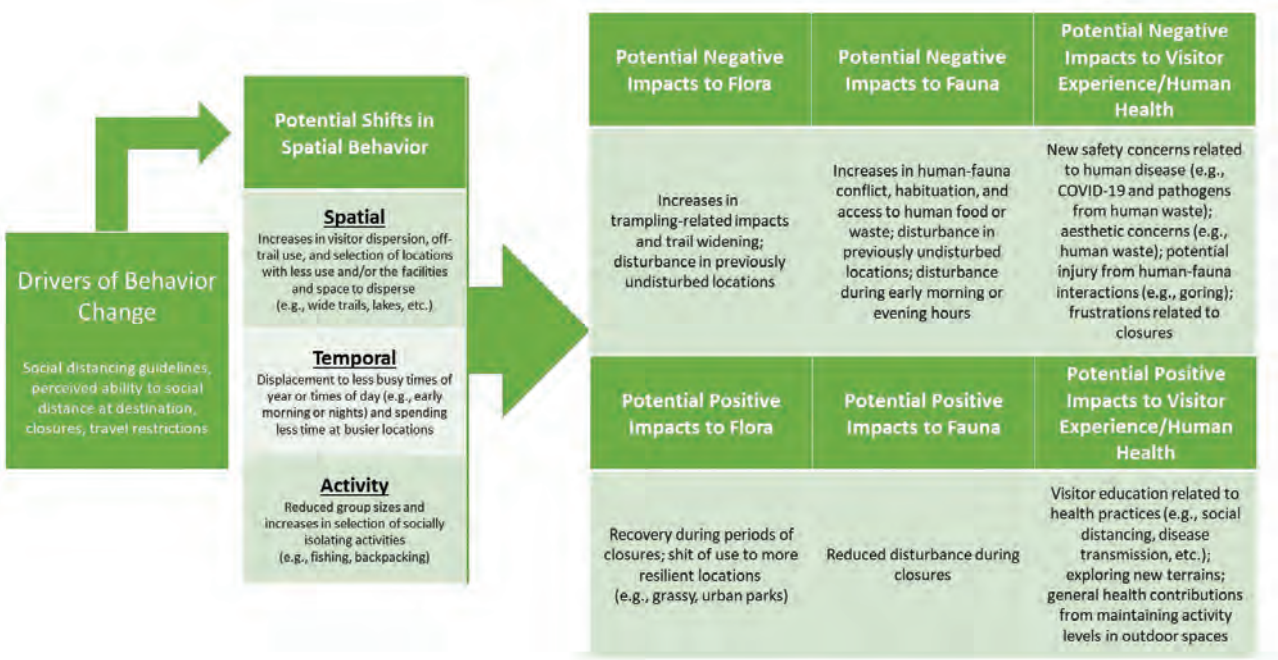


Figure 2. Flow diagram illustrating the drivers of potential shifts in visitor behavior related to COVID-19. These potential changes in visitor spatial and temporal behavior and shifts in activity type could lead to potential positive and/or negative impacts on flora, fauna, visitor experiences, and human health in PPAs.

PPA closures and use restrictions may alter visitor numbers and the types of recreation activities available in local areas. These potential shifts may occur as a function of recreation opportunities available on temporal and spatial scales, and per activity type. Park visitors may experience reductions in available recreation opportunities, as well as spatial displacement problems, as they pivot activities to accessible parks. Recreation activity preferences could mediate the relationship between displacement and visitation, as recreationists forego or increase engagement in different activities. Furthermore, alterations in travel restrictions and phased reopening plans might create sudden and dynamic shifts in available recreation opportunities across larger geographic scales. For example, a study of European PPA managers documented observed changes in visitor use levels, behaviors, and conflicts due to COVID-19 (McGinlay et al. 2020: 5). A different study during 2020 found significant declines in the frequency of visitors' participation in outdoor recreation, visitor group size, distance traveled to participate in recreational activities, and, for outdoor recreationists living in urban areas, the distance traveled beyond roads (Rice, Mateer et al. 2020). Furthermore, initial pandemic-related PPA closures quickly shifted the spatial location of outdoor recreation to urban-proximate areas; however, over time, recreationists ventured further away from home (Rice, Lawhon et al. 2020: 5). Continued shifts in the spatial movement of recreationists may occur as a result of fluctuating levels of perceived personal safety and reactions to public health guidance and PPA management decisions.

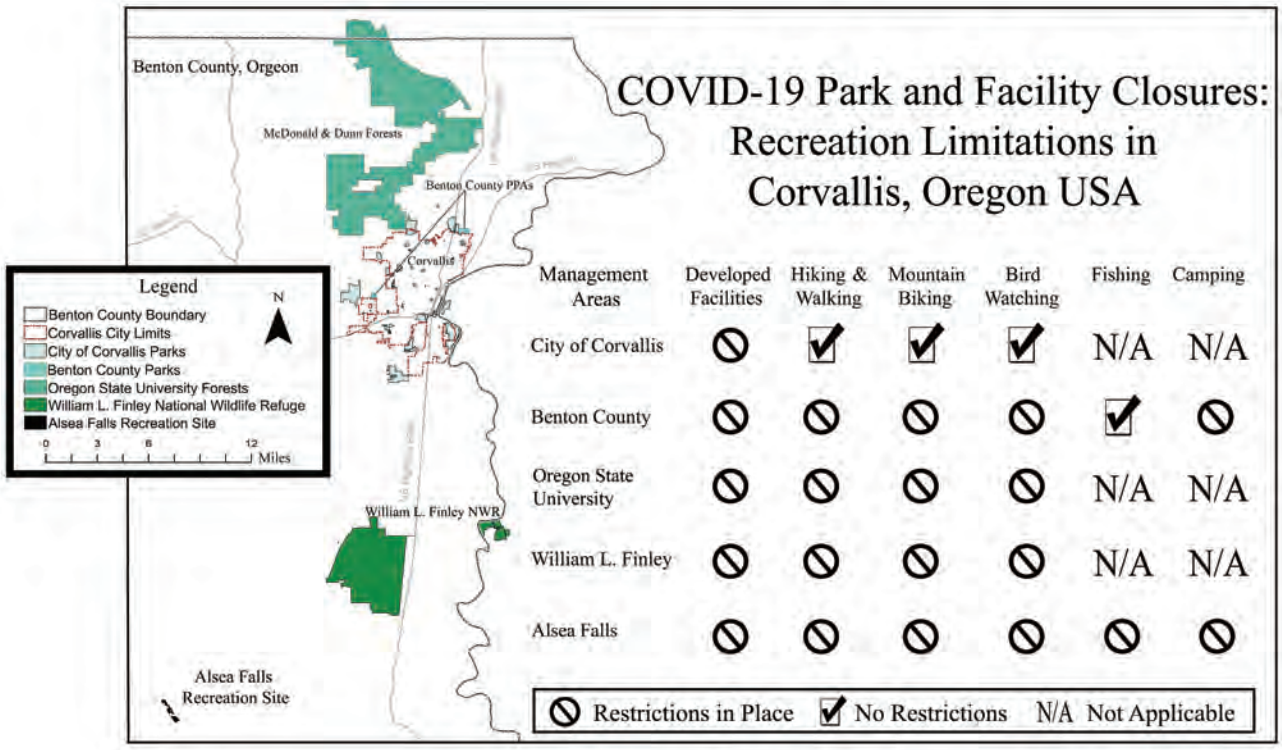
To underline how pandemic recreation protocols may trigger shifts in recreation spatial behaviors, we examine pandemic-related PPA management decisions in the general area of Corvallis, Oregon. This area encompasses a diverse array of PPAs in urban-proximate and urban-distant spaces that are governed by a variety of management entities. Figure 3 outlines how Corvallis-area PPA closures created a matrix of recreation opportunity limitations from March through May 2020. These limitations may have spatially displaced some visitors to urban-proximate areas managed by the city that remained open (approximately 46 parks and recreation areas) and caused alterations in the types of recreation activities pursued due to differences in permitted activities in open urban-proximate areas versus alternative closed areas. For example, mountain bikers who previously frequented Oregon State University forests and federal lands may have experienced spatial and/or activity displacement to city PPAs (e.g., the BMX Track, Bruce Starker Arts Park and

Natural Area, Chepenafa Springs Park Area, Crystal Lake Sports Fields, or other areas where biking can occur) or areas in other communities. Moreover, such displacements could impact recreationists who deem available areas as unsuitable for activities and those who are unable to travel outside of their communities to find accessible recreation options. For example, mountain bikers who did not find city biking paths as suitable as mountain biking paths may have shifted their activities to different geographical regions that did not have restrictions; whereas individuals who could not travel to different geographical areas may have altered their recreation activity types. These park closures and restrictions exemplify how management decisions can lead to shifts in recreation use between and within urban-proximate and urban-distant PPAs.

Within PPAs, the most significant impacts on recreation spatial behaviors may stem from (1) guidelines for social distancing; (2) limited group sizes; and (3) temporary closures of developed facilities (Figure 2). For instance, recreationists who practice social distancing behaviors typically remain six feet away from others. However, many trails do not contain such passing space, so increases in off-trail travel may occur as recreationists maintain social distance (model A, Figure 4). Additionally, visitors might spread away from one another at recreation attraction sites, such as mountain summits or lakeshores, to engage in social distancing. Recreationists may also seek out urban-distant landscapes that contain more space for social distancing, such as meadows or deserts. Recreationists may also shift time budgets spent in specific areas, times of day for recreation, and recreation activity types as methods to personally enforce social distancing (Rice, Lawhon et al. 2020: 1–10).

Visitors may also engage more in socially isolating recreation activities (e.g., motorized recreation, fishing, backpacking, etc.) as the pandemic continues (Figure 2). In contrast, larger group activities (e.g., group camping) may decrease. Finally, developed facility closures may necessitate shifts for certain activities. For example, restroom closures and concerns for safety about using public restrooms may result in behaviors where larger volumes of visitors choose to urinate or defecate in outdoor settings.

Figure 3. COVID-19 park and facility closures: recreation limitations in Corvallis, Oregon, USA. This figure shows Corvallis-area parks and protected areas and the associated recreation impacts stemming from COVID-19 closures and facility restrictions. Developed facilities include restrooms, playgrounds, basketball courts, pavilions, etc.



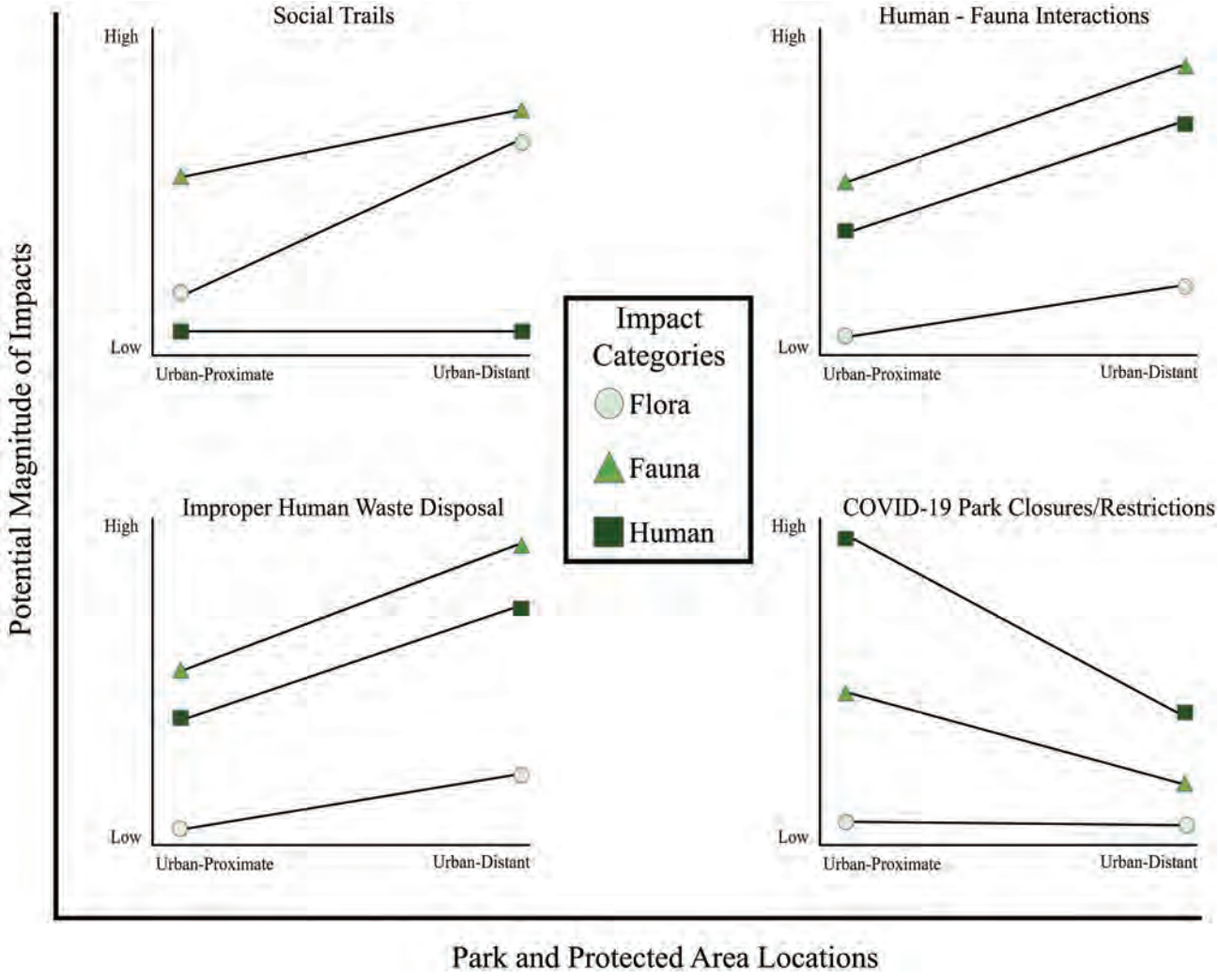


Figure 4. Four potential impact magnitude models across park locations: (A) social trail proliferation; (B) increased human–fauna interactions; (C) improper human waste disposal; (D) PPA closures and restrictions due to COVID-19. We established these models based on our judgment and knowledge of recreation ecology literature. These relationships will depend on the specific PPA and visitor spatial behaviors. This figure demonstrates how impact magnitudes may vary by PPA type and system components (humans, flora, and fauna). "Human" refers to impacts on human health and visitor experiences.

Collectively, these shifts in spatial behaviors could result in impacts on terrestrial flora and fauna.

Possible terrestrial flora impacts

Typical flora impacts associated with outdoor recreation include alterations in plant community composition, variety, and structure (Hammitt et al. 2015: 41–55). Impacts associated with social distancing, travel plan changes, and stay-at-home orders could create positive and negative changes to flora (Figure 2). However, how long the impacts last may vary in different landscapes and species. Social distancing protocols may expand the extent of ecological impacts associated with visitor spatial behavior by creating novel disturbances within previously undisturbed areas. For instance, trailheads, parking lots, and facilities typically contain disproportionate concentrations of visitor use. PPA managers anticipate these behaviors by developing appropriate infrastructure. However, to practice social distancing, visitors may shift their physical locations to the outer edges of the pavement or other hardened surfaces. These shifts could lead to the trampling of the surrounding flora and subsequent soil compaction, thereby altering the severity and spatial extent of pre-existing impacts. Along similar lines, restroom closures may lead to increased off-trail traffic as visitors seek out areas to urinate or defecate. Increases in human fecal matter deposition in surrounding soils and vegetation may cause additional health and ecological problems (model C, Figure 4; Hammitt et al. 2015: 85–89).

Furthermore, social distancing behaviors may create flora and soil problems on trails. As hikers use more space to pass other recreationists, they may unwittingly cause trail widening. Visitors may also refer to social distancing guidelines to justify their decisions to go off-trail. These two behaviors could create cascading problems as new social trails emerge, and existing ones become more pronounced (Figure 5). Moreover, the ecological ramifications of off-trail use may be severe in areas containing steep

Figure 5. Social trail created during the COVID-19 pandemic in a city-managed park in Corvallis, OR. | SUSIE SIDDER (2020)

slopes, turnpikes, or high water tables. Such trail disturbances could complicate soil erosion control and water flow management. Social distancing may also create situations where visitors place more interest in visiting less-frequented locations. Location shifts to previously undisturbed sites could generate more initial impacts on flora and fauna (Figures 1 and 2).

More broadly, during the beginning of the pandemic, disruptions to travel plans and stay-at-home orders resulted in people recreating closer to home (e.g., visiting local and urban-proximate parks; Rice, Lawhon et al. 2020: 3–5). Many of these local parks may contain hardened surfaces and more resistant flora types (e.g., grass) compared to urban-distant PPAs. Therefore, urban-proximate parks may tolerate pandemic-induced use increases with minimal flora impacts. However, in urban-distant PPAs, fewer visitors and delayed re-openings may result in positive consequences for flora. For example, minimal visitation in areas that typically experience high levels of recreation disturbances may help regenerate flora. Effects like these could escalate during peak growing seasons and early spring wet seasons. Therefore, pandemic-related respites in high-use areas may allow previously impacted flora to recover.

Reparability and how long recreation impacts last depend on the variability in ecosystem characteristics (e.g., structure, vegetation, etc.), which sometimes vary widely across sites. Some environments show resistance to changes, while others demonstrate more resilience or interwoven levels of resistance and resilience (Cole 2004: 52–54). Ecosystems with more resistant features can withstand use without much disturbance. Resilient landscapes recover quickly after disturbances; however, these landscapes may possess increased susceptibility to sudden alterations from visitor exposure (e.g., areas with lush grassy vegetation). Seasonal shifts also delineate impact severity; therefore, land managers should consider the expected terrestrial flora impacts in relation to ecosystem variability and seasonal fluctuations (Figure 4).

Possible terrestrial faunal impacts

Recreation impacts on fauna generally result from the physical presence and behaviors of humans. These faunal impacts include animal behavioral disturbances and stressors, alterations in animal physiology and reproduction, habitat modifications, and mortality (Larson et al. 2016: 4; Tablado and Jenni 2017: 227). Faunal impacts accumulate over time and can result in population changes and shifts in community composition (Tablado and Jenni 2017: 227). The magnitude of such effects results from several factors, including recreation activity type, human behaviors, predictability of impacts, and the regularity, extent, timing, and location of activities (Hammitt et al. 2015: 56–57). Therefore, the culmination of alterations in human behaviors, changes in recreation patterns, fluctuating visitation rates, and park management protocols may create positive and negative faunal impacts (Figure 2).

Management decisions that maintain PPA closures, restrictions in visitor numbers, and infrastructure that supports such decisions (e.g., gates, roads, fences) may create distinct environments in PPAs that experience increases or decreases in visitation. Though human and animal behaviors may continue to shift, we expect to see reduced faunal impacts in parks that maintain closures and use restrictions. For example, park visitation reductions that result in empty roads, trails, and campgrounds may result in associated decreases in faunal impacts (model C, Figure 1). However, the extent of recreation impact reductions depends on how long park closures occur and the persistence of shifts in visitation. In contrast, PPAs that remain open may face increased issues.

Spatial shifts in visitation may also create increased human–fauna conflict issues. For example, species habituated to recreation and human presence may lose habitat components, such as anthropogenic food sources and benefits associated with human shielding from predators. Seasonal park closures may allow fauna to habituate to unsuitable areas during times with regular recreation patterns, but this may prove problematic when such areas reopen to park visitors (Figure 3). Most critically, reductions in visitation, staffing levels, and access by conservation groups could embolden the poaching and harassment of protected species (Hockings et al. 2020: 10–12). Therefore, these expectations necessitate continued monitoring to outline the range of impacts on individual faunal species.

Open and accessible PPAs may precipitate increased impacts on fauna. Because of limited recreation opportunities, accessible PPAs may experience

increased visitation rates, particularly in urban-proximate areas. Generally, initial recreation increases coincide with surges in faunal impacts (model A, Figure 1). For example, species located within urban-proximate parks or areas with frequent visitation may possess more human tolerance; however, quickly increasing levels of recreation disturbance may exacerbate issues in areas that contain minimal levels of previous impacts (model A, Figure 1; model B, Figure 4). Moreover, limitations in facilities and trash disposal options could allow some species (e.g., corvids) to proliferate, which could lead to increased issues with other fauna (e.g., predation on various birds). Accumulation and scattering of refuse could prove challenging to remedy and potentially cascade into long-lasting faunal habitat impacts. Increases in recreation disturbance and visitor facility reductions may result in faunal-specific issues; however, effective management decisions may reduce these impacts.

Managing potential ecological and biological impacts

The ongoing COVID-19 pandemic forces PPA managers to address cascading ecological implications, including the spatial impacts of park visitors and subsequent issues with terrestrial flora and fauna. Additional problems relating to park visitor and employee health (e.g., the prevention of human-to-human transmission of COVID-19) present novel issues for managers to overcome. Managing this multitude of problems creates a challenging scenario; however, we suggest a combination of adaptive management approaches and future monitoring to address such challenges. These adaptive management approaches may necessitate ongoing research and data collection (in whatever forms currently collected) to assess the successes, shortcomings, and alterations of management strategy implementations and additional opportunities presented by the pandemic (Jacobs et al. 2020: 485–489). We conceptualize adaptive management as a process instead of a prescriptive list of actions (IVUMC 2020); therefore, this section details generalities and suggestions for managers to apply as they use adaptive management frameworks.

Managing potential changes in visitor spatial impacts

As previously outlined, PPA closures and restrictions may lead to shifts in recreation use between and within local PPAs. Managers should anticipate the geographical expansion of recreation-related spatial shifts, especially when forming plans for phased park reopenings. Doing so would prove especially valuable as recreationists continue expanding their willingness to travel further to urban-distant PPAs (Rice, Lawhon et al. 2020: 4). Furthermore, managers should anticipate the impacts associated with recreation displacement and strive to understand their broader matrix of available recreation opportunities in context with urban-proximate and urban-distant geographies. Doing so may help managers identify resource impacts resulting from displacement and the shifting recreation opportunity matrix. Managers should also prepare for fluctuations in the matrix as governing guidelines evolve, and recreationists shift their behaviors accordingly.

We realize that each PPA has specific management concerns such that prescriptive management actions cannot be universally applied. However, managers may need to shift their actions to address problems and needs related to the current pandemic, including (1) increases and decreases in visitation; (2) adjusting park employee numbers to meet visitation fluctuations; (3) managing for novel ecological problems in previously less-traveled areas; (4) preparing for changes in the magnitude and locations of excreted human and pet waste; (5) identifying visitor capacity in local areas and smaller parks; (6) considering the implementation of visitor capacity management strategies and actions (e.g., pandemic permitting systems; however, these may create barriers to access for minoritized and underserved populations); (7) creating new educational signage (Figure 2); (8) establishing human health recommendations for visitor and park employee safety (e.g., social distancing protocols, suggestions for mask-wearing, etc.; Figure 2); and (9) evaluating available opportunities to identify potential shifts in visitor pulses and subsequent impacts on flora and fauna. Many of these items have also been suggested for European PPA managers, thus they may apply worldwide (McGinlay 2020).

Managing potential terrestrial flora impacts

Shifting visitor spatial behaviors may result in a variety of impacts on terrestrial flora. Therefore, managers should consider online (for out-of-area visitors) and on-site indirect educational approaches (e.g., prerecorded video messaging, social media

campaigns, or on-site signage) that encourage visitors to practice social distancing to minimize disease transmission and resource impacts. Extra signage on trails, near restrooms, and in common grouping areas may prove beneficial to meet this need and assist park employees with limiting in-person visitor contact. Managers should create such signage using communication theory and thoughtful designs that garner visitor attention and encourage compliance.

Managers may also need to enact direct behavioral management approaches by cordoning off ecologically sensitive areas to protect resources (Huddart and Stott 2019: 9–11). Additionally, in locations that experience decreased visitation and closures, managers could focus their efforts on restoration projects and collect baseline ecological or impact data. To address any flora-related consequences relating to shifting activity preferences, managers may choose to limit use if activities result in crowding or increased ecological problems. Ultimately, as the prevalence of social distancing increases, PPA managers should anticipate more dispersive spatial behaviors and evolve their strategies to meet the needs of the unique landscapes and settings specific to the areas they manage.

Managing potential terrestrial faunal impacts

Managerial pandemic responses may create a range of scenarios for fauna. PPA managers can take advantage of this by increasing faunal protection and limiting the impacts caused by shifting recreation spatial behaviors. We suggest that managers establish specific indicators and thresholds of acceptability for faunal impacts during global human health crises, and then use these thresholds to (1) apply closures and use restrictions to areas where animals remain most susceptible to recreation impacts (e.g., areas where high rates of visitation did not previously occur); (2) maintain recreation access in areas that typically experience high visitation rates (previous sites with high visitation will experience fewer impacts with continued use; model A, Figure 1); (3) use park closures and restrictions to support habitat restoration efforts for sensitive species, but plan for longer phases of closures in these areas to maintain positive impacts; (4) maintain visitor access to areas where fauna are habituated and rely on human presence; (5) prepare for shifting visitation patterns relating to use type, location, and timing; (6) establish signage and regulations to reinforce pack-out policies for human and pet waste; (7) maintain essential services (e.g. garbage disposal and restroom facilities); and 8) maintain poaching enforcement .

Managing anticipated biological impacts related to human health

In addition to managing needs associated with shifts in visitor spatial behaviors and subsequent impacts on terrestrial flora and fauna, the COVID-19 pandemic presents managers with a new and significant area of focus: managing biological impacts related to human health (Figure 2 and mode D, Figure 4). PPA managers around the country shifted focus from visitors, flora, and fauna to the impacts related to human-to-human disease transmission. Managing human disease prevention creates new challenges for PPA managers to consider for visitors, employees, and volunteers. Though some PPA agencies (e.g., National Park Service) already house health offices that manage for disease, the pandemic caused by SARS-CoV-2 underlined a necessity for increased attention to how human-to-human disease transmission manifests in outdoor spaces and PPA facilities.

In response to the current pandemic, the World Health Organization (WHO) called for multiple measures of critical preparedness across countries (WHO 2020). Adapting COVID-19 Community Transmission WHO protocols to PPAs would require managers to consider (1) scaling up emergency response mechanisms (e.g., preventing disease transmission between staff, visitors, and volunteers); (2) implementing education campaigns with visitors using risk communication and community engagement; (3) creating signage and education materials asking visitors to practice responsible hand hygiene, respiratory manners (e.g., mask-wearing), and social distancing; (4) training staff and volunteers about infection prevention and control; and (5) implementing and planning for visitation capacity management (WHO 2020). However, these considerations do not necessarily require park closures. PPA managers should consider a shift in focus to pandemic health-related protocols mostly for visitation to local, urban-proximate, and frontcountry urban-distant areas. However, managers should expect swift behavioral and spatial changes as outdoor recreationists continue to adapt t in the context of COVID-19.

Recent COVID-19 research shows that recreationists base behaviors on clear communications from trusted sources. Therefore, PPA signage and educational programs could potentially influence visitor behaviors, as long as visitors viewed managers as trusted sources of information. Furthermore, some outdoor recreationists altered recreation activity levels due to social distancing guidelines (Rice, Lawhon et al. 2020: 7). Because recreationists seem somewhat responsive to altering their spatial and activity behaviors, managers might consider creating guidelines for expected behaviors in PPAs during public health crises. In doing so, PPA managers can bridge public health needs with positive recreation outcomes without needing to close parks.

The COVID-19 pandemic heightened PPA management concerns relating to visitor spatial impacts and the associated effects on terrestrial flora and fauna. It also necessitated a shift in managerial focus to managing human diseases. These changes provide opportunities for researchers and managers to work together to monitor the associated impacts of human health crises in PPAs. Current research needs include ongoing monitoring to quantify changes in visitor spatial and behavioral patterns, and any resulting flora and faunal impacts. Remote monitoring techniques (e.g., trail and traffic counters) could support these efforts. Additionally, managers and researchers could use these unusual times to develop pandemic protocols and monitor the efficacy of adaptive management methods. Managers should also prioritize the maintenance of existing monitoring systems and ensure that recovery efforts and surveillance of restoration areas continue (Hockings et al. 2020: 16–17).

Conclusion

This paper provides park managers, researchers, and other recreation professionals with expected social and ecological implications resulting from managerial and behavioral shifts related to the COVID-19 pandemic. Furthermore, it includes adaptive management considerations to address and monitor these impacts. This information can help shape how park managers respond to the ongoing pandemic and future human health problems that impact park visitors and flora and fauna. Finally, this paper suggests directions where future researchers can direct their focus, especially where recreation ecology intersects with global health problems. In conclusion, pandemics may create cascading impacts on PPAs; however, adaptive management approaches, continued monitoring, and future research may reduce the magnitude of impacts on visitors, flora, and fauna.

Acknowledgments

The corresponding author offers gratitude to the Ford Foundation, Indigenous Education, Inc., and the Achievement Rewards for College Scientists Foundation for funding support. Mvto (thank you) also to Greg Jacobs for map consultation.

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The Interdisciplinary Journal of Place-based Conservation

Co-published by the Institute for Parks, People, and Biodiversity, University of California, Berkeley and the George Wright Society. ISSN 2688-187X

Citation for this article

Jacobs, Lara A., Susan A. Sidder, Jenna Baker, Evan M. Bredeweg, Rosario Allende, and Ashley D'Antonio. 2021. A recreation ecology perspective on the COVID-19 (SARS-CoV-2) pandemic: Potential parks and protected area impacts relating to visitor spatial use, terrestrial flora and fauna, and management. *Parks Stewardship Forum* 37(2): 368–378.

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A montage of images from One Tam, a collaborative partnership to manage the landscape of Mount Tamalpais in California, along with one from Alcatraz Island in Golden Gate National Recreation Area.

TOP RAY LEE / RAY LEE PHOTOGRAPHY
SECOND ROW LEE JESTER; VIVIEN KIM THORP / GOLDEN GATE PARKS CONSERVANCY; PAUL MYERS / GOLDEN GATE PARKS CONSERVANCY
THIRD ROW PAUL MYERS / GOLDEN GATE PARKS CONSERVANCY (BOTH PHOTOS)
BOTTOM RYAN CURRAN WHITE / GOLDEN GATE PARKS CONSERVANCY
COVER LAYOUT GARY E. DAVIS & DOROTHY A. DAVIS