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Research Article

Camping in clearcuts: The impacts of timber harvesting on USFS campground utilization

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ABSTRACT

This research applies a temporally and spatially explicit model to analyze timber harvesting's impact on campground utilization on United States Forest Service (USFS) land across the Western U.S. Timber harvesting and camping can occur near one another due to multiple-use management strategies used by the USFS. However, intensive forest management can change the degree of perceived naturalness of a forest and may therefore negatively impact recreation. We investigate several facets of harvesting activity, such as proximity to camping, type of harvesting, regional differences, and persisting lagged impacts of timber harvesting. We find that harvesting activity significantly decreases campground reservations during the year of harvest, and this loss in campground utilization can be expected to have negative impacts on nearby tourism-dependent economies.

Management implications:

- Intensive forest management generally negatively impacts campground utilization during the years of operations
- Public land managers, such as the USFS, may seek to locate timber harvesting operations further from campgrounds if they wish to not negatively impact campground usage
- Alternative, less-intensive, forms of forest management decrease nearby campground utilization less than timber harvesting, so do not necessarily need to be located further from campgrounds to avoid losses in their utilization
- Decreased campground visitation due to timber harvesting may imply lower visitation to nearby gateway communities, and therefore less economic stimulation and spending in their economies, which may create an incentive for gateway communities to be involved in the harvest planning process

1. Introduction

Historically, forest management in the U.S. has focused primarily on timber supply. More holistic management emerged in the latter half of the 20th century that placed value on both timber and non-timber ecosystem services, such as outdoor recreation (Rose & Chapman, 2003; USFS, n.d.-c). Presently, the USFS governs its lands with multiple-use management. Lands and forests are managed for more than one purpose or objective to achieve the greatest possible combination of public benefits. Some objectives are compatible, while others are not (Clawson, 1974; Rose & Chapman, 2003; USFS, n.d.-c). Although extractive activities remain important aspects of USFS management and the national economy, demand for recreation on public lands has increased, and must be managed accordingly. Balancing competing demands of forests is inherently heterogeneous and requires spatial analysis. Timber production can alter biodiversity and affect the attractiveness of a site for recreation, while high volumes of outdoor recreation can impede on biodiversity and land available for timber production (Bolund & Hunhammar, 1999). Thus, choices the USFS makes on the location of timber harvests may directly influence demand for nearby campgrounds, and consequently impact communities dependent on visitors to those campgrounds. In this paper, we

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investigate whether timber harvesting on USFS land impacts nearby USFS campground reservations. We also analyze whether impacts vary across regions, by type of harvest, and whether impacts persist after harvesting activity is completed.

This study uses temporal and spatial data on campground reservations and timber harvesting on USFS lands. Campground utilization is modeled as a function of harvesting activity nearby, harvest characteristics, and campground and year fixed effects. Rather than estimating every factor that influences camping demand at a given campground, such as campground amenities, nearby recreation opportunities, or other attractiveness-related factors, these fixed effects allow us to isolate and identify changes to campground utilization caused by timber harvesting. The magnitude of impacts from harvesting are compared to impacts of three other common management activities undertaken by the USFS.

This study builds most directly on research by Harshaw and Sheppard (2013) who evaluated timber harvesting impacts on recreation opportunities in British Columbia, Canada, and Eggers et al. (2018) who studied the relationship between intensive forest management and the recreational value of forests in Sweden. Both studies integrated spatial and temporal forest management and recreation data. This study, to our knowledge, is the first to use historic temporal and spatial data on USFS land to evaluate the relationship between timber harvesting and camping.

This work adds to the growing body of literature that individuals often choose their leisure location based on the attractiveness and aesthetics of a site. This work can inform land managers' decisions on future locations and types of timber harvesting relative to existing campgrounds and inform implications of current and planned timber harvesting on nearby tourism-dependent communities.

2. Background and literature review

2.1. The evolution of USFS policies

The goals of the USFS have evolved to meet the demands of private and public interests. The agency was established in 1905 to provide quality water and timber, and later "[broadened] its management scope for additional multiple uses and benefits and for the sustained yield of renewable resources such as water, forage, wildlife, wood, and recreation" (USFS, n.d.-c). For most of the organization's history, USFS land has been managed mainly for timber production (Rose & Chapman, 2003; USFS, n.d.-c). Today, the "mission of the Forest Service is to sustain the health, diversity, and productivity of the nation's forests and grasslands to meet the needs of present and future generations" (USFS, n.d.-c). Resource conservation, multiple use mandates, and environmental protection have come to the forefront of public lands policies. Importantly, land, natural resources, human resources, budgets, and time are scarce, so the USFS faces tradeoffs and complex management decisions on how to allocate resources.

Before the creation of the USFS, public forest management legislation, such as the Organic Act of 1897, recognized multiple uses of forests (Rose & Chapman, 2003; USFS, n.d.-a). Despite this, timber interests dominated public forest management decisions for the early years of the USFS, so the agency focused on resource exploitation and commodity flows from the land (Kennedy & Quigley, 1998; Rose & Chapman, 2003).

In the 1960s and 70s, shifting public opinions led to legislation, such as the Multiple Use Sustained Yield Act of 1960, the Clean Water Act of 1970, and the National Forest Management Act of 1976, that changed public land management practices (Government Accountability Office [GAO], 1999, p. 20; Rose & Chapman, 2003; USFS, n.d.-b, n.d.-e). Land managers still held timber harvesting as an important land use, but now as a part of a more holistic multiple-use management approach (Rose & Chapman, 2003). The USFS broadened its scope of outputs and sought to enhance public lands while considering both the environment and local economies.

Today, public opinion, agency values, and legislation push the USFS in the direction of environmental protection and multiple-use management. Differing values on public forests' purposes, such as balancing economic, environmental, or recreational values, and the relationship of timber harvesting levels to forest health shape debates over public land management. Supporters of timber harvesting on public lands cite benefits to the local timber industry, rural timber-dependent gateway community economies, and beliefs that timber harvesting is a tool for forest health (Riddle, 2022, p. 23). Opponents of timber harvesting have concerns about its potential negative impacts to ecological (environmental quality or fish and wildlife habitat) or human (recreation, cultural, or aesthetic values) resources (Riddle, 2022, p. 23).

2.2. USFS timber harvesting decisions

The USFS considers many factors, objectives, and policies when deciding which forest parcels are available for timber harvesting. Timber production from federal lands is driven by a complex interaction of environmental factors, market forces, and land management policies. The USFS is one of only two federal agencies, the other being the Bureau of Land Management, to conduct timber sales as an authorized use, and the USFS conducts most harvests (Riddle, 2022, p. 23).

The USFS oversees approximately 193 million acres of land, of which nearly half is forest land that is producing or can produce timber (Riddle, 2022, p. 23; USFS, 2013). Timber sales, the process in which an entity purchases a contract to harvest timber, are the most common way to allow timber harvesting on federal land. Any timber harvesting that takes place must follow relevant statutes pertaining to forest management, such as the National Forest Management Act of 1976, and environmental protection, such as the National Environmental Protection Act of 1969 (Riddle, 2022, p. 23; USFS, n.d.-d).

Harvest volume and value are heterogeneous across regions and time. They are determined by timber type, timber age class, forest condition, ease of operations, land use limitations, and local wood production industries. In the Western U.S., Region 6 (the Pacific Northwest) is the largest producing region in both private and public forestry (Riddle, 2022, p. 23; Sorenson et al., 2016; USFS, 2021b). After a boom in harvesting from the 1950s–80s of around 10 billion board feet[1] per year, harvest volumes in more recent years have remained between 1.8 and 2.8 billion board feet per year (Riddle, 2022, p. 23). The annual dollar value of timber peaked in 1979 at over $3 billion and has since decreased to between $100 million and $300 million since 2001 (Riddle, 2022, p. 23).

Today, less intensive methods of harvest and other management activities are more common. USFS resources are increasingly dedicated to wildfire mitigation and cleanup (Fox, 2020). Other activities besides timber harvesting, such as brush disposal, hazardous fuel reduction, and restoration, are more common USFS management strategies. Rather than focusing on earlier goals of meeting targets for volume sold, the agency is now concerned with treating the right acres at the right time by working with local and tribal governments and partners in the private sector (Fox, 2020).

2.3. Camping management and decisions

Camping is a form of tourism in which individuals spend at least one night away from home in a temporary accommodation, such as a tent, caravan, or recreational vehicle (Brochado & Pereira, 2017; Grande, 2021; Lee et al., 2019). Camping has become a highly specialized tourism sector, and its popularity is rising worldwide (Brochado & Pereira, 2017; Brooker and Joppe, 2013, 2014; Lee et al., 2019; Rice

[1] A "board foot" is a unit of measure for a piece of lumber 12" wide by 12" long by 1" thick.

et al., 2019). Camping in the U.S. alone generates $166 billion annually and is the largest outdoor tourism sub-sector (Outdoor Industry Association, 2017). Current camping and hospitality management literature seeks to understand innovation and competitiveness (Brooker et al., 2012; Grande, 2021), business models in the camping industry (Grande & Camprubi, 2022), determinants of pricing in the camping industry (Saló et al., 2020), and the impact of internal capital (resources and services, such as accommodation facilities) on camping demand (Brooker & Joppe, 2013; Grande, 2021; Lee et al., 2019).

Individuals are motivated to camp for varying reasons, including escaping from routine, enjoying nature, lower accommodation fees, and meeting others (Brochado & Pereira, 2017; Brooker & Joppe, 2013; Lee et al., 2019). A key finding from recent camping management literature is that individuals often choose their leisure location based on the attractiveness and aesthetics of a site (Grande, 2021; Lee, 2020; Ma et al., 2021; Saló et al., 2020). Besides aesthetics and attractiveness, individuals make decisions on where to camp based an interaction of many factors, such as weather and climate (Ma et al., 2020, 2021), amenities and facilities offered at campgrounds (Grande, 2021; Lee, 2020), the price of campgrounds (Saló et al., 2020), seasonality (Ma et al., 2020, 2021; Rice et al., 2019; Saló et al., 2020), and nearby recreation opportunities (Lee, 2020; Saló et al., 2020).

In the context of this study, "camping" means staying overnight for at least one night at a USFS campground. USFS "campgrounds" are designated developed areas designed for camping on USFS land, and many are reservable online. Camping on USFS land can take place in either designated campgrounds, which offer amenities such as water, restrooms, and trash disposal and often require a fee, or in dispersed areas, which are undeveloped and free but rarely offer any services. This research only focuses on developed, reservable campgrounds. Dispersed camping sites are not reservable, so there is a lack of reservation data for these campers. USFS campgrounds are federally owned, though many are operated by private "concessionaires" who take care of routine maintenance, electricity, signage, cleaning, and water management (Bookey, 2011; Carswell, 2014).

2.4. Gateway communities

Gateway communities are towns and cities that border public lands. These communities may be near national or state parks, forests, monuments, grasslands, or bodies of water. They serve as entry points for nearby recreation or natural resource extraction, and therefore, their economies are dependent on the use of nearby public lands.

Resulting from a combination of changing public lands policy, resource exhaustion, and declining profitability, many gateway community economies have become less dependent on natural resource extraction and moved toward tourism and recreation-based economies (Bergstrom & Harrington, 2018; Howe et al., 2012; Keiter, 2013, p. 8; Kurtz, 2010; Stoker et al., 2021). Most of these communities are in the Western U.S. (Stoker et al., 2021). Examples of communities that have moved from extraction-based to tourism-based economies include Estes Park, Colorado (a former mining-based community), Jackson, Wyoming (a former hunting and ranching-based community) and Leavenworth, Washington (a former timber-based community) (Ford, n.d.; Leavenworth Chamber of Commerce, n.d.; Visit Estes Park, n.d.).

However, timber production has historically been, and continues to be, an important economic activity in the U.S. (Eggers et al., 2018; Rose & Chapman, 2003; Sorenson et al., 2016). Harvesting involves planning, preparation, removal, and transportation of trees. All points along this process, and in the processing afterward, sustain jobs and income, particularly in many gateway communities (Sorenson et al., 2016). The U.S. is the world's leading producer of several wood products, as well as the largest single-consumer of those products (Alderman, 2022, p. 31). The highest levels of employment in forestry and logging occur in the Northwestern U.S., where timber is more desirable due to larger trees and non-homogeneous stands and more manual methods of harvest are used (Sorenson et al., 2016).

Recreation is also an important use of public lands and an economic driver, especially in rural communities near national forests. Visitors to national forests often spend money in nearby communities while they are on recreation trips. These direct expenditures create further indirect and induced impacts (Thomas & Koontz, 2021, p. 70; USFS, 2021c, p. 36). The USFS National Visitor Use Monitoring Survey (NVUM) finds that annual spending by recreation visitors in areas near USFS land was about $10 billion in fiscal year 2019 (USFS, 2021c, p. 36). From this direct effect and further indirect and induced effects, about $12.5 billion is reflected in the nation's gross domestic product from visitor spending, and it sustains about 154,000 full and part time jobs (USFS, 2021c, p. 36). White et al. (2013, p. 65) find that among visitors to USFS lands, the lowest average spending of visitors, $33 per party per trip, is from locals on day trips, while the highest average spending, over $983 per party per trip, is from non-locals visiting for skiing and staying overnight nearby.

2.5. Impacts of timber harvesting on recreation

Timber harvesting can alter the amenity value of a forest, either for better or for worse. Depending on the type and intensity of management activity done, wildlife, water supply, and recreation may benefit or suffer. For example, clearcutting can often benefit wildlife that require the thick cover created by a young regenerating forest (Vitz & Rodewald, 2006). However, Eggers et al. (2018) finds that people seeking outdoor recreation prefer mature forests with little sign of human activity, such as clearcuts or ground damage. Harvesting can alter the composition of a forest or a stand, the use of roads, noise levels, and forest aesthetics.

Harshaw and Sheppard (2013) studied timber harvesting's impacts on outdoor recreation in British Columbia, Canada. Evaluating the temporal dimension of forest management is necessary to understand the dynamic nature of forests, changing societal demands for forest products, and visitors' responses to changing resource conditions (Harshaw & Sheppard, 2013). A key insight from this study is that timber harvesting caused a substantial loss of natural settings over several time periods. Once the natural conditions of a forest have been altered, the change may be irreversible. Although individuals engaging in outdoor recreation may seek varying levels of naturalness, if they do seek more natural conditions, it is difficult for a harvested area to appear unchanged from human influence.

Eggers et al. (2018) conducted a similar study in Sweden examining the trade-offs between managing for recreation and wood production. They focused on forests close to urban areas since these forests see the most visitation. They found longer rotation periods in areas with high recreational demand to be beneficial. This practice increased recreational value without banning wood production in prioritized areas.

3. Data

The main empirical analysis uses two spatial datasets available publicly: timber harvest data from the USFS's FSGeodata Clearinghouse and reservation data from the Recreation Information Database (RIDB) (RIDB, 2021; USFS, 2021b). Harvest data include polygons of harvests since the 1800s and reservation data include point locations of all campground reservations made through recreation.gov since 2006.

We combined these datasets to construct a campground capacity utilization metric using camping reservations from 2008 to 2018 and the proportion of harvested area within a 5-km radius of each campground from harvests occurring from 1986 to 2018. The buffered area around campgrounds addresses the aesthetics of a forest, as attractiveness can be an important factor in campground visitors' decisions as addressed in the literature review. Following Rice et al. (2019) and Shartaj and Suter (2020), campground utilization is determined by comparing the total number of sites available to the yearly average number of sites reserved at each campground.

The impacts of three additional management strategies are also estimated. Including these other activities in this study allows us to compare the magnitude of the impact of these activities to the impact of harvesting. These activities, which may overlap, include brush disposal, hazardous fuel reduction, and integrated resource restoration (IRR) (USFS, 2022a; 2022b; 2022c). Polygon data on these three activities are similarly collected from the FSGeodata Clearinghouse and interacted with the RIDB reservation data to determine the impacted campgrounds.

3.1. Timber harvest data

The FSGeodata Clearinghouse is a database provided by the USFS containing spatial data collected and managed by USFS programs. Variables of interest in the harvesting data include the geometry of each harvest, dates of operations, type of harvest, and size of harvest in acres (USFS, 2021b). We subset the harvesting data to the years 1986–2018 and evaluate harvesting activity in the contiguous Western U.S. (USFS Regions 1–6). Fig. 1 depicts a map of the area of study classified by USFS regions (USFS, 2021a).

Duration of harvesting activity is considered in this study. Harvests lasting over multiple years may impact camping in more than one year and are likely to be of larger area or more intensive. However, harvest operations lasting many years are unlikely to have significant activity in each year. Detailed yearly information for harvest activity is not available in the data used, so harvests lasting more than 5 years are excluded. Fig. 2 depicts a histogram of timber harvests classified by the duration of harvesting activity. From Fig. 2, we see that most harvests last 1 year, and Regions 1 (Northern), 5 (Pacific Southwest), and 6 (Pacific Northwest) have the most harvesting activity.

The main methods of harvesting, ranging from most intensive to least intensive, are clearcut, shelterwood and selection (Table 1). Fig. 3 depicts a count of the new USFS harvests each year in the Western U.S. from 1986 to 2018 categorized by type of harvest. There is a general decline in the number of harvests over time. Additionally, the number of clearcut and shelterwood harvests have declined over time, while the selection method remains popular.

3.2. Campground reservation data

Campground reservation data are gathered from the Recreation Information Database (RIDB) spanning the years 2006–2018 (RIDB, 2021). Through recreation.gov, individuals can access recreation site information on federal lands nationwide and make reservations. Historical records of all reservations made through this website are available for download from fiscal year 2006 forward. Variables of interest in the reservation data include the geometry of each site, dates of reservations, type of site (only overnight campgrounds are included), and ownership of the site (only USFS sites are included).

Although data are available starting in 2006, there were no reservations to campgrounds with timber harvesting nearby in 2006 and 2007 (likely due to many campgrounds not yet being available on recreation.gov), so reservation data relevant to this study begins in 2008. In October 2018, the data provider and format of the RIDB historical records changed and cannot be directly compared to the previous format (RIDB, 2021). Therefore, data after 2018 are excluded from this study. The data show the number of campgrounds available for reservation and the number of reservations made on recreation.gov have increased over time. Additionally, the number of reservations made on recreation.gov at campgrounds with some harvesting nearby have increased by over 30 percent between 2008 and 2018.

To determine which campgrounds might be impacted by timber harvesting, we overlaid the campground points and harvest polygons. We created a 5-km buffer around each campground's coordinates to capture areas of forest that are "near" a campground. We chose a 5-km buffer as the main specification as this is the area around a campground that could be easily accessed on foot when campers are moving around their site or recreating nearby. As explored in the literature, campers often make decisions on where to camp with several factors in mind, such as proximity to other recreation destinations, campsite amenities, and campsite aesthetics. The buffering of campground locations addresses the aesthetics of a campground as attractiveness is an important part of the choice of outdoor recreation areas (Grande, 2021; Harshaw & Sheppard, 2013; Lee, 2020; Ma et al., 2020, 2021; Saló et al., 2020). Campgrounds with harvesting activity within their buffer are considered treated, and those without are untreated. Fig. 4 provides an example of the interaction of the reservation data and timber harvesting data.

Table 2 shows the number of treated campgrounds from 1986 to 2018 in all regions. From this table, we see that the number of impacted campgrounds decreases over time. This table also shows that Region 6 (the Pacific Northwest) has the most impacted campgrounds, which is intuitive because this region has one of the highest levels of timber harvesting in the Western U.S., as well as many wood mills (Prestemon et al., 2005; Riddle, 2022, p. 23; Sorenson et al., 2016).

From these impacted campgrounds, we calculate the proportion of harvested area within each buffer, which is our main independent variable. Only the portion of each timber harvest that falls within the buffer is counted toward this total. Both the total proportion harvested and the proportion harvested by type of harvest are calculated. A single timber harvest may impact multiple campgrounds in multiple years. As expected, most campgrounds do not have a large proportion of their buffer area harvested. 63% of campgrounds have less than 5% of their buffer area harvested, and the median percent area harvested is approximately 8%.

3.3. Additional management activities data

In addition to estimating the impact of timber harvesting, the impacts of several other management activities on campgrounds are estimated. Estimating the impacts of these other activities on camping allows us to compare the magnitude of campers' responses to less intensive activities. These activities include brush disposal, hazardous fuel reduction, and IRR. Brush disposal is the cleaning up of left behind brush and other debris resulting from cutting operations (USFS, 2022a). Hazardous fuel reduction projects are aimed at reducing the severity of wildfires by reducing or altering the amount of living or dead fuel through methods such as burning or mechanical treatments (USFS, 2022b). IRR projects include areas treated to sustain watersheds, and treatments can include harvesting, the removal of noxious or invasive plants, or hazardous fuels reduction outside of the wildland-urban interface (USFS, 2022c).

Like timber harvesting data, variables of interest in these datasets include the geometry of each activity and dates of operations. Again, campgrounds impacted by these activities are determined, and the proportion of impacted area within each buffer is calculated.

3.4. Capacity utilization

To create a utilization measure for each campground and year, reservation data for each campsite within the study area are compiled by year.[2] Average utilization is calculated by determining the total number of sites available at a given campground compared to the average number of sites reserved per day. Thus, each campground has one capacity utilization number per year. The data do not include walk-up reservations. Although the number of walk-up reservations to USFS campgrounds is likely a significant portion of campers, to our knowledge, there is no comparable comprehensive dataset detailing these

[2] Following Shartaj and Suter (2020), yearly reservation data is compiled between May 15th to September 15th as nearly all reservations on recreation.gov take place within this range.

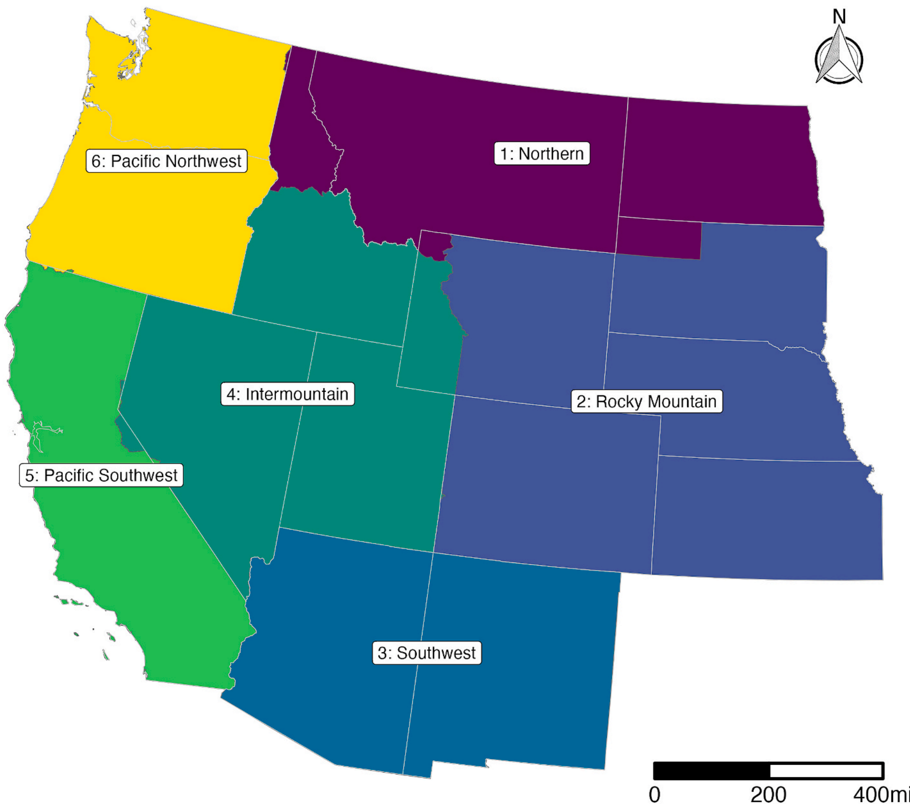

Fig. 1. Map of the USFS regions included in this study.

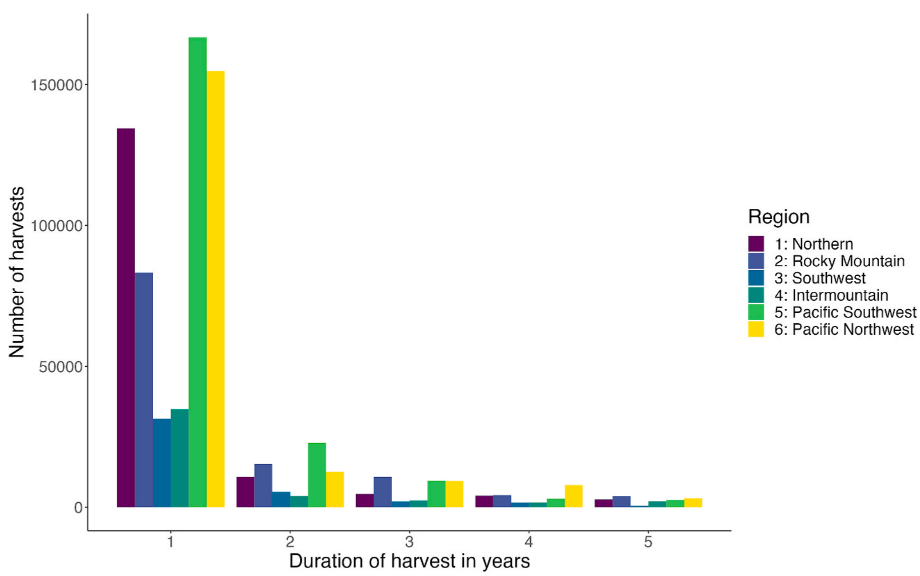

Fig. 2. Duration of timber harvests within 5 kms of campgrounds in the study area, classified by region.

records.

Following Shartaj and Suter (2020), average campsite capacity utilization for campground i in year t is:

$$Capacity\ utilization_{it} = \frac{Campsites\ reserved_{it}}{Campsites\ available_{it}}$$

Campground utilization is a proportion between 0 (no campsites were booked through recreation.gov all season) and 1 (all campsites available for reservation at the campground were reserved every night of the season). Fig. 5 depicts the average capacity utilization of all campgrounds in the Western U.S. On average, approximately one-third of reservable campground sites are reserved. In over half of the regions, average capacity utilization is equal or higher in campgrounds without harvesting nearby (Regions 2: Rocky Mountain, 4: Intermountain, 5: Pacific Southwest, and 6: Pacific Northwest) (Fig. 5).

Furthermore, campground utilization from recreation.gov users has been increasing over the study period. Fig. 6 depicts the evolution of average campground capacity utilization over time in each region. In every region, utilization has increased from 2008 to 2018.

Table 1
Timber harvest methods, adapted from Cook (2014); USFS (n.d.-d).

Clearcut	Shelterwood	Selection
Removes essentially all trees in a stand	Some sheltering trees remain after tree removal	Removes select individual or groups of trees
One operation	Several successive operations	Many individual operations
Produces a new age class	Produces several age classes	Little impact to age classes
Most visually extreme	Moderate visual impact	Least visually extreme
Mainly used for extractive purposes	Used for both extractive purposes and forest health	Mainly used for forest health to remove invasive or unhealthy trees

4. Model

To estimate how timber harvests impact changes in individual campground capacity utilization over time, we estimate several separate panel fixed effect models. Each model includes campground and year fixed effects, and standard errors are clustered by campground. The campground fixed effects account for all time-invariant factors at a given campground, such as campground amenities, nearby recreation opportunities, or other attractiveness-related factors, so that the impacts of harvesting can be isolated and identified. The clustering of standard errors accounts for the fact that capacity utilization at each campground is correlated with itself from year to year.

First, a base model is estimated using all harvests in all regions (Equation (1)). The econometric specification is:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + \gamma_t + \epsilon_{it} \tag{1}$$

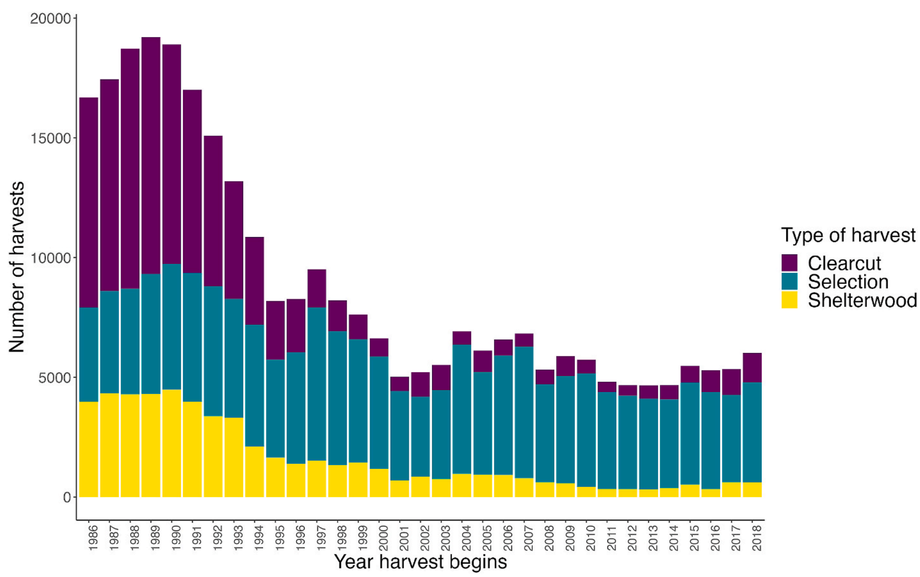

Fig. 3. Number of harvests per year from 1986 to 2018 in the Western U.S.

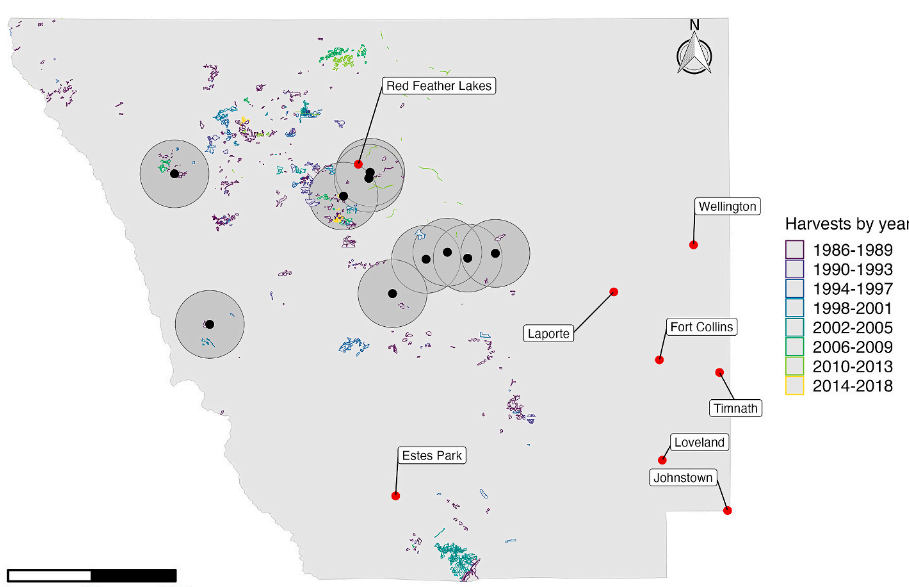

Fig. 4. Timber harvests and all campgrounds in Larimer County, Colorado. Treated campgrounds are indicated by black points. 5-km buffer areas are indicated by gray circles around each treated campground point. Towns and cities are labeled and indicated by red points.

Table 2
Number of campgrounds per year by region with harvesting activity nearby.

	Region						
Year	1	2	3	4	5	6	Total
1986	104	82	8	33	134	197	558
1987	105	91	21	23	109	188	537
1988	101	63	20	33	116	180	513
1989	93	78	29	33	114	178	525
1990	90	68	27	47	132	192	556
1991	98	66	21	24	124	184	517
1992	91	61	18	29	99	169	467
1993	84	54	23	28	73	156	418
1994	75	41	16	28	64	132	356
1995	86	32	12	26	40	110	306
1996	75	37	5	21	52	117	307
1997	79	37	5	28	69	111	329
1998	54	29	13	48	92	110	346
1999	56	32	13	28	92	72	293
2000	45	38	16	28	87	76	290
2001	36	26	14	21	71	63	231
2002	59	29	3	20	68	51	230
2003	48	30	10	17	67	74	246
2004	53	27	15	24	63	105	287
2005	48	28	13	12	52	90	243
2006	38	23	13	25	84	92	275
2007	38	28	11	27	74	82	260
2008	36	38	10	26	54	50	214
2009	37	50	5	39	49	57	237
2010	41	60	19	47	47	69	283
2011	55	55	18	49	61	76	314
2012	45	58	5	63	54	98	323
2013	43	66	17	42	42	93	303
2014	42	56	22	41	23	77	261
2015	49	43	25	35	40	80	272
2016	46	45	21	36	51	79	277
2017	40	54	13	38	54	61	260
2018	30	39	15	27	39	45	195
Total	2020	1564	496	1046	2390	3514	11030

Note: The horizontal line between 2007 and 2008 indicates when the reservation database allows for the analysis of impacted campgrounds.

where Y_{it} is the capacity utilization of campground i in year t, X_{it} is the proportion of the area near campground i that contains a timber harvest in year t, β_1 is the coefficient for the proportion of buffer harvested variable, α_i is a campground fixed effect, γ_t is a year fixed effect, and ϵ_{it} is the error term.

Next, we separate harvesting impacts by harvest type k (clearcut = C, shelterwood = W, selection = L) (Equation (2)). This econometric specification is:

$$Y_{it} = \beta_C X_{it,C} + \beta_W X_{it,W} + \beta_L X_{it,L} + \alpha_i + \gamma_t + \epsilon_{it}, \tag{2}$$

where Y_{it} is the capacity utilization of campground i in year t, $X_{it,k}$ is the proportion of the area near campground i that contains harvest type k in year t, β_k is the coefficient for the harvest type k variable, α_i is a campground fixed effect, γ_t is a year fixed effect, and ϵ_{it} is the error term.

Then, we separate harvesting impacts by region (Equation (3)). This econometric specification is:

$$Y_{it} = \sum_{n=1}^{6} \beta_n X_{it,n} + \alpha_i + \gamma_t + \epsilon_{it}, \tag{3}$$

where $n = 1:6$ for Regions 1 through 6, Y_{it} is the capacity utilization of campground i in year t, $X_{it,n}$ is the proportion of the area near campground i that contains a timber harvest in year t in Region n, β_n is the coefficient for the timber harvesting variable for each Region n, α_i is a campground fixed effect, γ_t is a year fixed effect, and ϵ_{it} is the error term.

We then model the lagged impacts of timber harvesting activity to investigate whether impacts persist in the years following harvesting activity (Equation (4)). This econometric specification is:

$$Y_{it} = \sum_{j=0}^{J} \beta_j X_{it-j} + \alpha_i + \gamma_t + \epsilon_{it}, \tag{4}$$

where Y_{it} is the capacity utilization of campground i in year t, X_{it} is the proportion of the area near campground i that contains a timber harvest in year t, β_j are a series of coefficients for the lagged timber harvest variables to account for up to J years after a timber harvest, α_i is a campground fixed effect, γ_t is a year fixed effect, and ϵ_{it} is the error term.

Finally, the impact of three additional USFS management activities are estimated using a similar model to the base regression (brush disposal = B, hazardous fuel = H, IRR = R) (Equation (5)). These models are included to compare the magnitudes of impacts to campgrounds by other management activities to the impacts of timber harvesting. This econometric specification is:

$$Y_{it} = \beta_B X_{it,B} + \beta_H X_{it,H} + \beta_R X_{it,R} + \alpha_i + \gamma_t + \epsilon_{it}, \tag{5}$$

where Y_{it} is the capacity utilization of campground i in year t, $X_{it,M}$ is the proportion of the area near campground i that contains management activity M in year t, β_M is the coefficient for activity M, α_i is a camp-

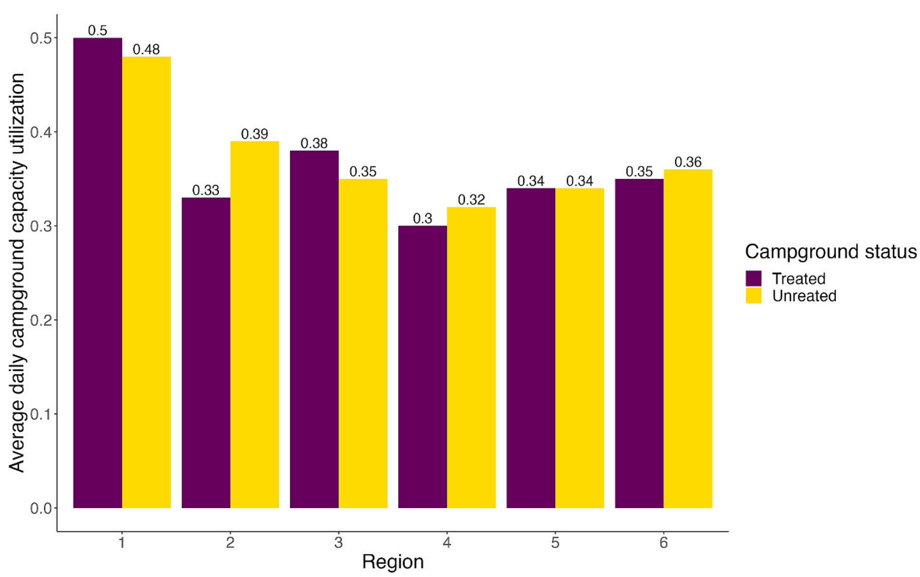

Fig. 5. Average campground capacity utilization across all western regions and all campgrounds, treated vs. untreated, with timber harvesting activity.

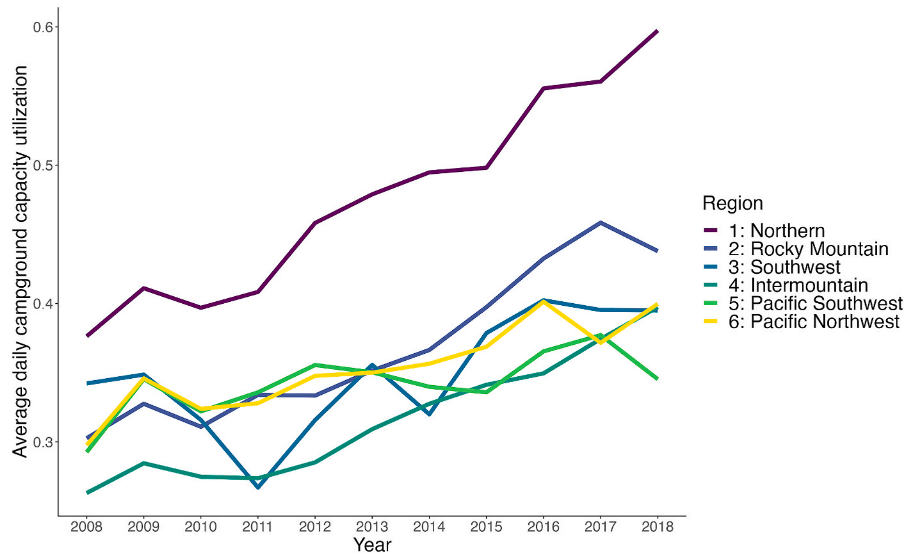

Fig. 6. Average campground capacity utilization for campsites available for reservation across regions and campgrounds (both treated and untreated) over time.

ground fixed effect, γ_t is a year fixed effect, and ϵ_{it} is the error term.

We also performed several robustness checks to investigate our assumptions about which campgrounds were included in the study (restrict to include only campgrounds available for reservation from 2008-2018), how the size of the buffer area impacted our results (change the buffer size to 2km or 10km), and which harvests were included in the lag models (restrict to only harvests lasting one year).

5. Results

Coefficient estimates from the base model are reported in Table 3 and show that the proportion of harvested area within the buffer around a campground reduces capacity utilization in the year a harvest takes place. The base model shows that at the aggregate level, visitors to national forests are changing their camping behavior because of nearby timber harvesting. In the base model, campgrounds are allowed to enter the dataset as they become available to reserve online through recreation.gov. A robustness check that includes only campgrounds available for reservation over the entire duration of study yields similar results to the base model. Therefore, we can conclude that results are not primarily driven by campgrounds entering and exiting the dataset, rather they are driven by individuals' responses to nearby harvesting.

Next, we estimate a model that segments harvesting activity into three types of harvest: clearcut, shelterwood, and selection. Results from the model separated by harvest type show that all harvest types have negative point estimates, but only the selection method has a significantly negative impact on campground utilization (Table 4). The clearcut point estimate is the largest, although it also has a high standard error given the relatively small number of observations (less than half of impacted campgrounds have a clearcut nearby, while over 75% of impacted campgrounds have a selection cut nearby). The results for the selection method are similar to the base regression results, but of slightly smaller magnitude.

Next, we separate campgrounds and harvests by USFS Region to see whether there are regional differences in timber harvesting impacts. We estimate this model both with and without controlling for the type of harvesting done by region. Controlling for the type of harvesting done by region could inform us if any differences observed between regions are driven by regional harvesting trends or by something else. Results from these models separated by region reveal timber harvesting's impact on campground utilization is heterogeneous across the Western U.S. Timber harvests have negative and significant impacts in Regions 1 (Northern) and 2 (Rocky Mountain), but no other region has significant coefficient estimates (Table 5). Separating by region reveals that campers' responses to nearby harvesting varies by region. When the variable controlling for type of harvesting done by region is included, there is very little change to the point estimates. This suggests that regional differences in campground capacity utilization are due to something other than the type of harvesting done by region.

Next, we estimate the model in Equation (4) to see whether impacts to campground demand persist in the years following harvesting activity. If reductions in campground demand persist, gateway communities dependent on the economic stimulation from visitors will be negatively impacted for a longer period of time. For this model, each timber harvest is counted only in the fiscal year it is awarded, rather than allowing

Table 3
Campground capacity utilization, harvesting nearby.

	Capacity utilization
Proportion harvested	−0.204**
	(0.080)
Observations	2940
Fixed effects	*Campground & year*
R^2	0.004
Adjusted R^2	−0.367
F Statistic	7.622***
	(df = 1; 2143)

Note: *p<0.1; **p<0.05; ***p<0.01.

Table 4
Capacity utilization, separated by harvest type.

	Capacity utilization
Clearcut	−0.638
	(0.434)
Shelterwood	−0.189
	(0.662)
Selection	−0.146*
	(0.085)
Observations	2940
Fixed effects	*Campground & year*
R^2	0.004
Adjusted R^2	−0.367
F Statistic	3.201**
	(df = 3; 2141)

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

Table 5
Capacity utilization, separated by region.

	Capacity utilization	
	Without clearcut control	With clearcut control
Region 1	−1.133**	−1.130**
	(0.527)	(0.525)
Region 2	−0.207*	−0.207*
	(0.118)	(0.118)
Region 3	−0.114	−0.116
	(0.103)	(0.103)
Region 4	−0.036	−0.034
	(0.153)	(0.153)
Region 5	−0.726	−0.719
	(0.527)	(0.527)
Region 6	0.181	0.183
	(0.283)	(0.283)
Proportion clearcut	–	−0.003
		(0.015)
Observations	2940	2940
Fixed effects	*Campground & year*	*Campground & year*
R^2	0.008	0.008
Adjusted R^2	−0.364	−0.365
F Statistic	2.771**	2.389**
	(df = 6; 2138)	(df = 7; 2137)

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

harvest activity to occur in multiple years. Results reveal a significant negative response in campground utilization during the year of harvesting operations and strong evidence suggesting lasting impacts in the year following harvesting activity (Table 6). However, negative impacts to campground utilization are not observed past a one-year lag. Table 6 shows several iterations of the lagged impacts model, starting with a model that includes only the year a harvest occurs (results are in the "No lags" column), then adding on one-year lagged impacts ("1 year" column), three years of lagged impacts ("3 years" column"), and finally five years of lagged impacts ("5 years" column). The results in Table 6 suggest that individuals' demand for campgrounds continues to be impacted even after operations have ceased.

However, as stated previously, harvests are only counted as the year they are awarded, so continued operations in subsequent years are unaccounted for. To test whether results from this model are driven by harvests lasting multiple years, we estimate a model that includes only harvests lasting one year and exclude harvests that occur over multiple years but find no significant impacts to campground utilization in any iterations of this model. Therefore, harvests lasting one year are not driving the results observed in the lagged model. However, this does not answer the question of whether results from the lagged model in Table 6 were observed because of the lasting aesthetic impacts to campgrounds from harvesting or from harvests lasting multiple years, which requires further research.

Table 6
Capacity utilization, including several year lags.

	Capacity utilization			
	No lags	1 year	3 years	5 years
Harvest year	−0.248***	−0.255***	−0.255**	−0.220**
	(0.093)	(0.095)	(0.102)	(0.095)
1 lag	–	−0.227***	−0.241***	−0.213**
		(0.086)	(0.086)	(0.089)
2 lags	–	–	0.075	0.099
			(0.106)	(0.102)
3 lags	–	–	−0.091	−0.108
			(0.155)	(0.150)
4 lags	–	–	–	0.218
				(0.134)
5 lags	–	–	–	0.333
				(0.240)
Observations	2157	2157	2157	2157
Fixed effects	*Campground & year*	*Campground & year*	*Campground & year*	*Campground & year*
R^2	0.003	0.006	0.007	0.009
Adjusted R^2	−0.675	−0.671	−0.673	−0.672
F Statistic	4.497**	3.961**	2.102*	1.931*
	(df = 1; 1283)	(df = 2; 1282)	(df = 4; 1280)	(df = 6; 1278)

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

Finally, we analyze the impact of three other USFS management activities on campground demand, which allows us to compare the magnitude of the impact of these activities to the impact of harvesting. In Table 7, the impacts of brush disposal activities, hazardous fuel reduction treatments, and IRR on nearby campground capacity utilization are estimated. Activities are counted as the year they are awarded. The results from these models show that hazardous fuel reduction treatments and IRR activities negatively impact nearby campground capacity utilization, while the coefficient on brush disposal is not statistically significant from zero. These USFS activities may not be mutually exclusive to timber harvesting. For instance, brush disposal activities often take place after a harvest has been completed and debris remains in the impacted area. Compared to timber harvesting, the magnitude of impacts to campgrounds by these other activities is much smaller. Timber harvesting appears to impact campground demand more than these other USFS activities.

Additionally, we tested whether the size of the buffered area around campgrounds affects our results. The 5-km buffer was chosen to capture the area near a campground that is easily accessible on foot which can contribute to the attractiveness of a campground. However, depending on land cover, location, recreation opportunities nearby, individual preferences, or other factors, campers may explore a larger or smaller area around their campsite. Therefore, we both contract the buffer to 2 kms and expand it to 10 kms. Campground utilization is not significantly impacted by nearby harvesting when the buffer is contracted to 2 kms. These results may be in part driven by fewer harvests taking place within a 2-km buffer than a 5-km buffer (1521 versus 2940 impacted campgrounds, respectively). Furthermore, a 1% change in a 2-km buffer (0.1257 square kms) is less than a sixth of the size of a 1% change in a 5-km buffer (0.7854 square kms). When the buffer is expanded to 10 kms, we observe a negative, significant, and larger coefficient on campground capacity utilization compared to the 5-km buffer (campground utilization decreases by 0.3 percentage points with the 10-km buffer, compared to a 0.2 percentage point decrease with the 5-km buffer). This makes intuitive sense because a 1% change in a 10-km buffer (3.142 square kms) is a much larger area than a 1% change in a 5-km buffer (0.7854 square kms). These results show that a larger negative response to campground demand is observed when a larger area of impact is included. The highly localized campground aesthetics are not necessarily the largest driving factor of individuals' decisions.

Table 7
Capacity utilization, other activities nearby: brush disposal activities, hazardous fuel treatment reduction, and IRR.

	Capacity utilization
Brush disposal	0.046
	(0.057)
Hazardous fuel	−0.060***
	(0.021)
IRR	−0.034***
	(0.010)
Observations	8648
Fixed effects	*Campground & year*
R^2	0.003
Adjusted R^2	−0.204
F Statistic	6.462***
	(df = 3; 7164)

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

6. Discussion

This work adds to the literature that individuals change their recreation and leisure location based on the attractiveness of a site (Grande, 2021; Lee, 2020; Ma et al., 2021; Saló et al., 2020), the literature that explores campground management and demand (Ma et al., 2020, 2021; Rice et al., 2019), and the literature on spatial and temporal interactions of timber harvesting and recreation (Eggers et al., 2018; Harshaw & Sheppard, 2013).

However, there are several limitations of this work. First, the RIDB dataset is limited in that it only includes data for campsite reservations made through recreation.gov or entered by campground managers for same-day reservations (Shartaj & Suter, 2020; Shartaj et al., 2022; Rice et al., 2019). Therefore, walk-up visitation to campgrounds is largely excluded from this study. Similarly, reservations made through recreation.gov only indicate the intent to camp, not actual camping behavior, so we cannot be certain that individuals who reserved campsites showed up for their reservations (Shartaj et al., 2022).

Additionally, the decisions the USFS makes on the location of timber harvests may impact the validity of our results. The models used in this study essentially assume that timber harvesting, the primary independent variable, occurs randomly. If harvesting occurs in random locations, then the coefficient estimates from our models could reasonably be seen as causal estimates. However, harvesting decisions are likely not random, and the USFS may consider recreation opportunities when deciding which land is suitable for harvesting. If this is the case, our models would have a problem with causal identification. For example, upward bias may occur if the USFS chooses to harvest near campgrounds that are expected to have the lowest utilization in the coming years (potentially to avoid high-use recreation areas and keep campgrounds natural-looking), the econometric models would show harvesting is associated with lower utilization. In this case, harvesting did not cause low utilization, rather low utilization caused harvesting. Conversely, downward bias of our results may exist as well if, for example, the USFS chooses to harvest near campgrounds that are expected to have the highest utilization (potentially to reduce wildfire risk) then the models would show that harvesting is associated with higher utilization. In this case, harvesting did not cause high utilization, rather high utilization caused harvesting. The likelihood of this type of downward bias may be greater than that of upward bias, as fire mitigation and campground maintenance have become more pressing operations for the USFS in recent years.

Next, this research finds that reservations for campgrounds with timber harvesting nearby decrease during operations. However, we have no information on how individuals know there is harvesting nearby when they make a reservation. Possibilities of how they obtain knowledge of nearby harvesting could include online reviews from other campers, living nearby the campground with harvesting, or having camped at a site with harvesting nearby previously. Further research is needed to understand the link between the information campers have and reservations.

Finally, the empirical analysis does not consider time-variant factors that may impact a campground's attractiveness beyond timber harvesting, due in-part to a lack of data on these factors. This should not, however, bias our empirical results on the impact of harvesting as long as the time-variant factors are not correlated with harvesting decisions.

7. Conclusions and management implications

Through the interaction of USFS historical timber harvesting data and RIDB campground reservation data, we explored several variables that can influence campground demand. We find significant negative effects to campground utilization during harvest operations in the Western U.S. within a 5-km buffer around campgrounds, and responses to harvesting activity are heterogeneous across USFS Regions. Furthermore, evidence suggests that campground utilization is impacted up to one year after harvesting occurs. Other forest management activities undertaken by the USFS appear to be less impactful to campground utilization than timber harvesting.

Overall, visitors to national forests are changing their camping behavior in response to timber harvesting, indicating potential decreases in welfare. If visitors choose not to camp because of a timber harvest nearby, they may miss out on positive benefits derived from outdoor recreation, such as exercise and health effects and connection to nature (Hartig et al., 2014; Schreyer & Driver, 1989; Frumkin et al., 2017; Winter et al., 2019). The physical attributes of the land affected by timber harvested near a campground reduce the capacity utilization of that campground.

Additionally, decreases in campground visitation may have significant effects on nearby tourism-dependent gateway communities. Due to the reduction in individuals deciding to recreate at certain campgrounds because of timber harvesting, fewer individuals may make recreation trips to the impacted area, and spending in gateway communities near those campgrounds may decrease. This has direct, indirect, and induced economic impacts. The negative impact of timber harvesting on camping reservations represents a complex cost to local communities.

There are several policy implications from the insights provided in this analysis. First, because individuals were found to decrease their reservations at campgrounds with harvesting nearby, if the USFS seeks to not impede camping on its lands by altering the attractiveness of a forest through harvesting, they may alter their plans on harvest locations. The USFS could place more weight on considering the location of campgrounds while planning harvesting activities, and potentially locate harvests further from campgrounds. Second, because alternative forms of forest management were found to have a smaller impact on campground demand than timber harvesting, the USFS may not have to consider the location of campgrounds as heavily while planning the locations of these less-intensive operations. Alternatively, because many of the less-intensive operations are aimed at restoration (like IRR) or creating a landscape more resilient to wildfire (like hazardous fuels reduction), the USFS may even consider locating these operations closer to campgrounds to prevent future, potentially even more aesthetically-damaging, harm to campgrounds, like wildfire. Finally, local tourism-dependent economies may feel the effects of decreased visitation to certain campgrounds due to nearby timber harvesting. Thus, there may be potential benefits for coordination among the USFS and gateway communities during the harvest planning process to ensure gateway communities can advocate for tourism to their localities.

There are several future directions to build on this study. First, different spatial definitions of what is considered "near" a campground could be explored (i.e., alternative buffers). The circular buffer was chosen for both ease of analysis due to the large geographical area this study covers and to capture the area around a campground that could be easily accessed on foot. However, other factors, such as roads, proximity to urban areas, hillshade, landcover, or proximity to major recreation destinations, may alter the demand of areas nearby campgrounds. Unique buffers for each campground based on their surroundings may provide further insights, though this was outside of the scope of this analysis. Second, this analysis excludes data past 2018 due to changes in the data structure which made it difficult to compare 2006–2018 data to 2019 and newer data. Additional research could alter the methods of analyzing the reservation data to include observations from more recent years. Additionally, as previously mentioned, further research is needed to understand how campers know that there is harvesting nearby certain campgrounds when they are making reservation decisions. Finally, our analysis uses an annual measure of campground utilization, so we are not able to directly evaluate seasonal impacts of harvesting on campground demand. Future research could do more to evaluate how harvesting activities during specific times of the year influence subsequent camping over the course of the year, as past research has shown the importance of seasonality in recreation decisions (Ma et al., 2020, 2021; Rice et al., 2019; Saló et al., 2020).

CRediT authorship contribution statement

Kelly Wallace: Conceptualization, Methodology, Software, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Jordan Suter:** Conceptualization, Methodology, Writing – review & editing, Supervision, Funding acquisition. **Daniel W. McCollum:** Conceptualization, Writing – review & editing, Supervision, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Data availability

Data will be made available on request.

References

Alderman, D. (2022). *United States forest products annual market review and prospects, 2015-2021*. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory. Gen. Tech. Rep. FPL-GTR-289 https://www.fs.usda.gov/research/treesearch/64129.

Bergstrom, R. D., & Harrington, L. M. (2018). Understanding agents of change in amenity gateways of the Greater Yellowstone region. *Community Development, 49*(2), 145–160. https://doi.org/10.1080/15575330.2017.1416648

Bolund, P., & Hunhammar, S. (1999). Ecosystem services in urban areas. *Ecological Economics, 29*(2), 293–301. https://doi.org/10.1016/S0921-8009(99)00013-0

Bookey, M. (2011). Forests for sale: As more campgrounds come under private management, what does this mean for campers? *Source Weekly*. https://www.bendsource.com/news/forests-for-sale-as-more-campgrounds-come-under-private-management-what-does-this-mean-for-campers-2137340.

Brochado, A., & Pereira, C. (2017). Comfortable experiences in nature accommodation: Perceived service quality in Glamping. *Journal of Outdoor Recreation and Tourism, 17*, 77–83. https://doi.org/10.1016/j.jort.2017.01.005

Brooker, E., & Joppe, M. (2013). Trends in camping and outdoor hospitality—an international review. *Journal of Outdoor Recreation and Tourism, 3*, 1–6. https://doi.org/10.1016/j.jort.2013.04.005

Brooker, E., & Joppe, M. (2014). A critical review of camping research and direction for future studies. *Journal of Vacation Marketing, 20*(4), 335–351. https://doi.org/10.1177/1356766714532464

Brooker, E., Joppe, M., Davidson, M. C., & Marles, K. (2012). Innovation within the Australian outdoor hospitality parks industry. *International Journal of Contemporary Hospitality Management, 24*(5), 682–700. https://doi.org/10.1108/09596111211237246

Carswell, C. (2014). Concessionaire campgrounds: An explainer. *High Country News*. https://www.hcn.org/articles/the-privatization-of-public-campground-management/concessionaire-campgrounds-an-explainer.

Clawson, M. (1974). Economic trade-offs in multiple-use management of forest lands. *American Journal of Agricultural Economics, 56*(5), 919–926. https://doi.org/10.2307/1239021

Cook, B. (2014). *Timber harvest methods*. Michigan State University Extension. https://www.canr.msu.edu/news/timber_harvest_methods.

Eggers, J., Lindhagen, A., Lind, T., Lämås, T., & Öhman, K. (2018). Balancing landscape level forest management between recreation and wood production. *Urban Forestry and Urban Greening, 33*, 1–11. https://doi.org/10.1016/j.ufug.2018.04.016

Ford, S. (n.d). A brief history of Jackson Hole. Jackson Hole Historical Society & Museum. https://jacksonholehistory.org/a-history-of-jackson-hole/..

Fox, I. (2020). Harvesting trees in the right place at the right time. *Forestry*. https://www.usda.gov/media/blog/2020/10/23/harvesting-trees-right-place-right-time.

Frumkin, H., Bratman, G. N., Breslow, S. J., Cochran, B., Kahn, P. H., Jr., Lawler, J. J., & Wood, S. A. (2017). Nature contact and human health: A research agenda. *Environmental Health Perspectives, 125*(7). https://doi.org/10.1289/EHP1663

Government Accountability Office. (1999). *Forest Service priorities: Evolving mission favors resource protection over production* (p. 20). Washington, D.C.: U.S. Government Printing Office. GAO/RCED-99-166) https://www.gao.gov/assets/rced-99-166.pdf.

Grande, K. (2021). An exploratory analysis of the camping industry as a provider of attractive resources. The case of outdoor hospitality parks (OHPs) in unattractive regions. *Journal of Outdoor Recreation and Tourism, 33*. https://doi.org/10.1016/j.jort.2021.100365

Grande, K., & Camprubi, R. (2022). Analysing the business model canvas of the camping industry using cluster analysis. *Tourism and Hospitality Research.* , Article 14673584221141301. https://doi.org/10.1177/14673584221141301

Harshaw, H., & Sheppard, S. (2013). Using the recreation opportunity spectrum to evaluate the temporal impacts of timber harvesting on outdoor recreation settings. *Journal of Outdoor Recreation and Tourism, 1*, 40–50. https://doi.org/10.1016/j.jort.2013.03.001

Hartig, T., Mitchell, R., De Vries, S., & Frumkin, H. (2014). Nature and health. *Annual Review of Public Health, 35*, 207–228. https://doi.org/10.1146/annurev-publhealth-032013-182443

Howe, J., McMahon, E. T., & Propst, L. (2012). *Balancing nature and commerce in gateway communities*. Island Press.

Keiter, R. B. (2013). *To conserve unimpaired: The evolution of the national park idea*. Washington, DC: Island Press. https://doi.org/10.5822/978-1-61091-216-7

Kennedy, J. J., & Quigley, T. M. (1998). Evolution of USDA Forest Service organizational culture and adaptation issues in embracing an ecosystem management paradigm. *Landscape and Urban Planning, 40*(1–3), 113–122. https://doi.org/10.1016/S0169-2046(97)00103-5

Kurtz, R. S. (2010). Public lands policy and economic trends in gateway communities. *The Review of Policy Research, 27*(1), 77–88. https://doi.org/10.1111/j.1541-1338.2009.00428.x

Leavenworth Chamber of Commerce. History: Learn the history of Leavenworth Washington. https://leavenworth.org/history/.

Lee, C. F. (2020). Understanding the factors determining the attractiveness of camping tourism: A hierarchical approach. *Tourism Planning & Development, 17*(5), 556–572. https://doi.org/10.1080/21568316.2020.1758761

Lee, W. S., Lee, J. K., & Moon, J. (2019). Influential attributes for the selection of luxury camping: A mixed-logit method. *Journal of Hospitality and Tourism Management, 40*, 88–93. https://doi.org/10.1016/j.jhtm.2019.05.004

Ma, S., Craig, C. A., & Feng, S. (2020). The Camping Climate Index (CCI): The development, validation, and application of a camping-sector tourism climate index. *Tourism Management, 80*, Article 104105. https://doi.org/10.1016/j.tourman.2020.104105

Ma, S., Craig, C. A., & Feng, S. (2021). Camping climate resources: The camping climate index in the United States. *Current Issues in Tourism, 24*(18), 2523–2531. https://doi.org/10.1080/13683500.2020.1846503

Outdoor Industry Association. (2017). *The outdoor recreation economy, 19*. Boulder, CO, USA: Outdoor Industry Association. https://outdoorindustry.org/wp-content/uploads/2017/04/OIA_RecEconomy_FINAL_Single.pdf.

Prestemon, J., Pye, J., Barbour, J., Smith, G. R., Ince, P., Steppleton, C., & Xu, W. (2005). *U.S. wood-using mill locations – 2005*. https://www.srs.fs.usda.gov/econ/data/mills/#downloads.

Rice, W. L., Park, S. Y., Pan, B., & Newman, P. (2019). Forecasting campground demand in US national parks. *Annals of Tourism Research, 75*, 424–438. https://doi.org/10.1016/j.annals.2019.01.013

RIDB. (2021). RIDB/Recreation.gov Historical Reservation Data [Data set]. RIDB Recreation Data https://ridb.recreation.gov/download.

Riddle, A. A. (2022). *Timber harvesting on federal lands*. Washington, D.C.: Congressional Research Service. CRS Report No. R45688 https://crsreports.congress.gov/product/pdf/R/R45688.

Rose, S. K., & Chapman, D. (2003). Timber harvest adjacency economies, hunting, species protection, and old growth value: Seeking the dynamic optimum. *Ecological Economics, 44*(23), 325–344. https://doi.org/10.1016/S0921-8009(02)00268-9

Saló, A., Teixidor, A., Fluvià, M., & Garriga, A. (2020). The effect of different characteristics on campsite pricing: Seasonality, dimension and location effects in a mature destination. *Journal of Outdoor Recreation and Tourism, 29*, Article 100263. https://doi.org/10.1016/j.jort.2019.100263

Schreyer, R., & Driver, B. L. (1989). The benefits of outdoor recreation participation. In *Outdoor recreation benchmark 1988: Proceedings of the national outdoor recreation forum, 52* pp. 472–482).

Shartaj, M., & Suter, J. F. (2020). Exploring the local determinants of campground utilization on national forest land. *Western Economics Forum, 18*(2), 114–128. https://doi.org/10.22004/ag.econ.308121

Shartaj, M., Suter, J. F., & Warziniack, T. (2022). Summer crowds: An analysis of USFS campground reservations during the COVID-19 pandemic. *PLoS One, 17*(1), Article e0261833. https://doi.org/10.1371/journal.pone.0261833

Sorenson, C. B., Keegan, C. E., III, Morgan, T. A., McIver, C. P., & Niccolucci, M. J. (2016). Employment and wage impacts of timber harvesting and processing in the United States. *Journal of Forestry, 114*(4), 474–482. https://doi.org/10.5849/jof.14-082

Stoker, P., Rumore, D., Romaniello, L., & Levine, Z. (2021). Planning and development challenges in western gateway communities. *Journal of the American Planning Association, 87*(1), 21–33. https://doi.org/10.1080/01944363.2020.1791728

Thomas, C., & Koontz, L. (2021). *2020 national park visitor spending effects: Economic contributions to local communities, states, and the nation*. Fort Collins, CO: U.S. Department of the Interior, National Park Service, Natural Resource Stewardship and Science (NPS/NRSS/EQD/NRR—2021/2259) https://www.nps.gov/nature/customcf/NPS_Data_Visualization/docs/NPS_2020_Visitor_Spending_Effects.pdf.

USFS. (n.d.-e). Today. https://www.fs.usda.gov/forestmanagement/aboutus/today.shtml..

USFS. (n.d.-a). A Historical Perspective. https://www.fs.usda.gov/forestmanagement/aboutus/histperspective.shtml..

USFS. (n.d.-b). Laws and regulations. https://www.fs.usda.gov/about-agency/regulations-policies/laws-regulations..

USFS. (n.d.-c). Meet the Forest Service. https://www.fs.usda.gov/about-agency/meet-forest-service..

USFS. (n.d.-d). Reforestation Glossary. https://www.fs.usda.gov/restoration/reforestation/glossary.shtml..

USFS. (2013). *By the numbers*. About the Agency. https://www.fs.usda.gov/about-agency/newsroom/by-the-numbers.

USFS. (2021a). *Forest service regional boundaries [data set]*. FSGeodata Clearinghouse. https://data.fs.usda.gov/geodata/edw/datasets.php.

USFS. (2021b). *Timber harvests*. FS Geodata Clearinghouse. https://data.fs.usda.gov/geodata/edw/datasets.php.

USFS. (2021c). *U.S. Forest service national visitor use monitoring Survey results national summary report* (p. 36). U.S. Department of Agriculture, Forest Service. https://www.fs.usda.gov/sites/default/files/2020-National-Visitor-Use-Monitoring-Summary-Report.pdf.

USFS. (2022a). *Brush disposal funded activities [data set]*. FS Geodata Clearinghouse. https://data.fs.usda.gov/geodata/edw/datasets.php.

USFS. (2022b). *Hazardous fuel treatment reduction: Polygon [data set]*. FS Geodata Clearinghouse. https://data.fs.usda.gov/geodata/edw/datasets.php.

USFS. (2022c). *Integrated resource restoration (IRR): Polygon [data set]*. FS Geodata Clearinghouse. https://data.fs.usda.gov/geodata/edw/datasets.php.

Visit Estes Park. History: The origins of exploration in Estes park. https://www.visitestespark.com/plan/about/history/.

Vitz, A. C., & Rodewald, A. D. (2006). Can regenerating clearcuts benefit mature-forest songbirds? An examination of post-breeding ecology. *Biological Conservation, 127*(4), 477–486. https://doi.org/10.1016/j.biocon.2005.09.011

White, E. M., Goodding, D. B., & Stynes, D. J. (2013). *Estimation of national forest visitor spending averages from national visitor use monitoring: Round 2*. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. https://doi.org/10.2737/PNW-GTR-883. Gen. Tech. Rep. PNW-GTR-883.

Winter, P. L., Selin, S., Cerveny, L., & Bricker, K. (2019). Outdoor recreation, nature-based tourism, and sustainability. *Sustainability, 12*(1), 81. https://doi.org/10.3390/su12010081