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OUTDOOR RECREATION AND RURAL TRANSITIONS IN CENTRAL APPALACHIA: REVISITING THE ECONOMIC IMPACT OF ROCK CLIMBING IN KENTUCKY'S RED RIVER GORGE

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ABSTRACT

Kentucky's Red River Gorge is a popular rock climbing destination located amid longstanding poverty in America's Central Appalachian region. Climbing represents an important part of the outdoor recreation economy and may provide one alternative to mono-economic extractive industry dependency in this region. This study examines the economic impact of climbing in the Red utilizing an online survey of rock climbers and economic impact methodology. The survey examines expenditures in lodging, food purchases, travel, retail purchases, and services. The survey also collected visitation and demographics data. The authors estimate climbers spend \$8.7 million annually (up from \$3.8 million in 2015) and support over 100 jobs in some of the poorest counties in the region and nation. The study reiterates previous findings indicating climbers are well-educated with incomes higher than those typically found in this region. The study's results help reframe the value of climbing's economic impact in rural transitional economies throughout Central Appalachia. These findings also raise policy implications regarding public land access and reducing climber environmental impacts on public lands.

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INTRODUCTION

Kentucky's Red River Gorge (henceforth "the Red") is a popular outdoor recreation destination located in the Daniel Boone National Forest (DBNF). The Red is a famous rock climbing destination popular for its unique sandstone formations and expansive sport climbing opportunities (Bronaugh, 1998; Mellor, 2001; Ellington, 2010; Rickly, 2017). A 2015 study (published in 2017) conservatively estimated climbers spent \$3.8 million per year amid eastern Kentucky's transitional economy while challenging how residents imagined climbers (Maples et al., 2017). Contrary to longstanding local beliefs, data from the study newly indicated climbers are well-educated professionals interested in supporting local businesses (Chrobak, 2017). In recent years, the Red has experienced increased economic activity; entrepreneurs and residents alike have opened new tourism-oriented businesses, local restaurants have enjoyed increased revenues from local votes to allow alcohol sales in the area, and more climbers continue to come to the Red each year (Maples, 2021).

Outdoor recreation economic expenditures represent a thriving sector of the United States economy and may offer eastern Kentucky and Central Appalachia a new form of sustainable economic growth amid the decline of extractive

industries (Maples et al., 2019; Maples, 2021). Central Appalachia's dependency on coal-related jobs created a problematic relationship between economic growth and lack of resilience in times of economic change (Schuman, 2016; Lobao et al., 2016; Nesbitt, 2019). Central Appalachia's economy is the result of uneven economic development, mono-economic reliance, and sacrifice zones set aside for environmental loss amid economic gains elsewhere (Gaventa, 1982; Shifflett, 1991; Lerner, 2012; Eller, 2008; Maples, 2021). As a result, new approaches to economic development in the region have proven necessary with no particular option becoming prevalent to date (Wright, 2012; Lewin, 2019; Vazzana & Rudi-Poloshka, 2019). Today, outdoor recreation jobs are gradually outpacing extractive industries, such as coal, in Central Appalachia (Maples et al., 2019). As such, increased outdoor recreation use in Central Appalachia may offer a far less damaging economic opportunity as the region grapples with deindustrialization and transitioning away from mono-economic dependency. Additionally, whereas extraction often created lasting environmental impacts, outdoor recreation users (particularly climbers) are utilizing education programs designed to limit their environmental impacts (Sharp et al., 2020; Clark et al., 2020).

In this study, researchers examine the economic impact of rock climbers in Kentucky's Red River Gorge. The study investigates climbing expenditures in a five-county study area: Estill, Lee, Menifee, Powell, and Wolfe Counties in Kentucky. Findings indicate over 102,000 climbing visits and \$8.7 million in climber expenditures occur each year in this study area. Climber expenditures support jobs in the tourism sector (restaurants, lodging, and retail) and generate almost half a million dollars in state and local taxes each year. These results help reframe the economic value of outdoor recreation in rural, transitional economies.

A Concise History of Climbing in the Red

Ron Stokley and Dieter Britz recorded the earliest first ascents in the Red in November 1969 at Tower Rock on the DBNF (Bronaugh, 1998). Climbing visitation surged in the late 80s alongside the rise in sport climbing's popularity (Mellor, 2001). Soon, a strong cultural community of sport climbers formed within the Red, centered around Miguel's Pizza in Powell County (Rickly, 2017). Following an archeological dig at Military Wall Shelter, which closed a small portion of an important climbing crag on the DBNF, climbers turned to collectively owning their own climbing areas as a means of opening access to new areas (Maples, 2021). The 2004 founding of Muir Valley (in Wolfe County) and Pendergrass-Murray Recreational Preserve (in Lee County) resulted in the bulk of climbing routes in the region being located outside the Red River Gorge Geological Area and off the DBNF. The Red later served as the location for the 2007 Petzl RocTrip (at The Motherlode in Lee County) which firmly entrenched the region as a world-famed climbing location (Ellington, 2010).

Climbing tourism has held a negative connotation among eastern Kentucky residents since perhaps the 1970s, having only changed in recent years (Chrobak, 2017; Chaney, 2019). A proposed Red River Dam in the 1960s received staunch non-local resistance—largely from the Sierra Club—whose involvement notably increased visitation to the region in coming years to see the area before it was likely lost to the proposed dam and resultant retention lake (Collins, 1976). Flooding has been a longstanding issue in the region and this proposed dam was strongly supported by local residents (Shrake, 1968; Puente, 2020). The dam proposals would eventually be cancelled following a national campaign by the Sierra Club and other opponents much to the disappointment of local residents (Collins, 1976). By chance, climbers arrived at the same time as these protests, leading residents to quickly link climbers to dam protests and label them as outsiders (Chaney, 2019). The context and reception for climbing tourism has changed in recent years following the dissemination of the prior Red climbing study (Maples et al., 2017). Since then, local business owners began actively courting climbers as potential clients amid a flurry of new businesses developing in the region (Chrobak, 2017).

Economic Value and Potential Costs of Climbing

A series of recent studies have quantified climber expenditures in Central Appalachia. As noted, an earlier Red study estimated climber expenditures at \$3.8 million per year (Maples et al., 2017). Another study in western North Carolina

estimated climber expenditures at \$13.9 million over a much larger area that included the Asheville metropolitan area (Maples & Bradley, 2017). Similarly, West Virginia's popular New River Gorge climbing areas attracted \$12.1 million in 2018 (Maples et al., 2019). These economic trends match findings about outdoor recreation which, in 2017, brought an estimated \$887 billion into the nation's economy (Outdoor Industry Association, 2018). Beyond documenting climber expenditure patterns, the previous studies also produced a clear demographic trend among the climbing community: climbers are well-educated professionals interested in focusing expenditures in the areas where they climb, thereby reinforcing climbers' interests in being part of the local community (Rickly, 2017).

Rethinking Climbing as Sustainable Tourism

The premise of the mono-economy has largely defined Central Appalachia's political economy and development (Eller, 2008). Famous examples of mono-economies in Appalachian literature include coal camps and timber mills as early forms of industrialization in the region (Gaventa, 1982; Shifflett, 1991; Dunaway, 1996). Over time, extractive industries controlled great swatches of the region's economy and social organizations, providing them uneven levels of power over government, laws, and social control as well as unequal access to the wealth created through extraction (Gaventa, 1982; Dunaway, 1996). Yet with extractive industries, the true value of the extraction process is realized *beyond* the area where the extraction occurs. For example, West Virginia and Kentucky provided the coal that powered electricity and war production in the first half of the 20th century but retained relatively little of the economic value created by the use of their coal (Shifflett, 1991). As there was little need for local investment beyond keeping mines open, small communities in places like eastern Kentucky also received limited economic investment from extractive industries (Gaventa, 1982).

The long-term costs of mono-economic growth are evident Appalachia's comparatively high poverty, underdevelopment, and limited growth over time. Lobao et al. (2016) explored this issue across the 1990s and 2000s, finding that in the 90s, coal concentrations in Appalachia indicated higher poverty and lower income overall. However, from 2000-2010, this relationship changed with coal employment in Appalachia indicating higher well-being compared to other Appalachian regions. This made the subsequent coal decline post-2010 all the more traumatic for counties overconcentrated in coal jobs (Nesbitt, 2019).

Unlike the financial benefits of selling coal, the environmental costs of extraction (in the form of mountaintop removal zones, sludge ponds, and erosion) are still found throughout eastern Kentucky (Fox, 1999; Lerner, 2012; Eller, 2008). These costs remain on the supply side of the extraction arrangement and are lasting problems for communities throughout Central Appalachia. Moreover, these issues remain even as extractive jobs relocate or simply vanish (Young, 2020). Problems have included water pollution, land erosion, health crises, and environmental disasters (McSpirit et al., 2005). Portions of the region remain effectively set aside as visible long-term costs of the presence of a mono-economic focus on extraction and its longstanding effects on the community (Scott, 2010).

Schumann (2016) argues that exploring sustainable development will be a necessity for changing Appalachia's current economic post-coal crisis. This includes exploring new economic options focused on what is currently available in the region and keeping those resources in the region. Examples have already included ideas like keeping Appalachian college graduates from leaving the area to ensure their incomes and subsequent taxes remain local (Wright, 2012; Vazzana & Rudi-Poloshka, 2019), expanding and diversifying rural job markets (Lobao et al., 2016), and reconsidering the problematic nature of coal cultural ties in the region (Lewin, 2019).

Outdoor recreation jobs could offer a sustainable and predictable alternative as the region transitions away from extractive industries (Maples, 2021). First, recreation economies require little in terms of investments. Attracting, for example, a manufacturer or corporation often entails bartering tax credits to entice them to relocate. Outdoor recreation is quite different. Simply making areas available for use (such as climbing, hiking, and mountain biking) can create opportunities for outdoor recreation expenditures to occur. Second, outdoor recreation creates jobs accessible to a wide demographic base. Recreation tourism most often supports jobs in lodging, dining, retail, and entertainment/recreation, and more indirectly, jobs in manufacturing outdoor recreation gear. Third, it is important to note these jobs are generally not enough to sustain an entire local economy. Maples (2021) argues this is actually beneficial; the outdoor recreation sector is unlikely to become monolithic, pushing the economy to diversify rather than centralizing jobs in one industry. The outdoor recreation sector also is actively limiting its environmental impacts, making them a more

sustainable form of economic activity when compared to extractive industries. Climbing has been a particularly great example of this. Multiple climbing educational programs exist to train climbers to minimize their impacts. Moreover, studies examining these efforts in the Red indicate some level of success as climbers who understand how they impact the environment are more apt to try to reduce that impact (Sharp et al., 2020; Clark et al., 2020). Climber communities and their organizations are often willing to develop sustainable trails and build bridges to minimize environmental impacts, as well, to prevent issues like erosion. Climbers in the Red have also shared their trail systems with hikers, runners, and mountain bikers, attracting further economic use. Ultimately, outdoor recreation results in economic activity with far less environmental impacts compared to extractive industries.

Economic Trends in the Red River Gorge Region

Economic impact study areas are built around the location where the activity being studied (here, climbing) occurs and the cities and towns where visitors are most apt to spend funds as part of their trip. For this analysis, five counties in and around the Red represent its study area: Estill, Lee, Menifee, Powell, and Wolfe Counties. This covers the towns, cities, and places where climbers are likely to spend money during their trip, as well as the main corridors (such as the Bert T. Combs Mountain Parkway) used to access the region. This area also includes portions of the DBNF which also includes the Red River Gorge Geological Area. Notably, this study area is experiencing the effects of generational poverty and uneven development (Eller, 2008).

Table 1. Economic Summary of Study Area.

| Regional Indicator | Study Area Estimates |
|--|----------------------|
| Total Population (2019) | 47,392 |
| Persons in Labor Market (2019) | 22,381 |
| Mean Unemployment Rate (2018) | 6.02% |
| Total Annual Employees (2018) | 5,901 |
| Total Jobs in Area (2019) | 8,916 |
| Median Household Annual Income (2019) | \$30,064 |
| Mean Commute Time (2019) | 35 min |
| Mean Percentage of Persons in Poverty | 12.36% |
| Total Employers (2018) | 575 |
| Total Payroll in 1,000s (2018) | \$163,369 |
| Total Manufacturing Jobs (2018) (excludes Lee) | 463 |
| Total Retail Jobs (2018) | 982 |
| Total Healthcare & Social Assistance Jobs (2018) | 1,879 |
| Total Accommodation & Food Services Jobs (2018) (excludes Menifee) | 628 |
| Total Extraction Jobs (2018) (includes only Estill County) | 44 |

Table 1 lists descriptive economic indicators from the County Business Patterns and American Community Survey for this study area. The population for the study area is around 47,000 persons. There are just shy of 9,000 jobs in this area with an unemployment rate of 6%. Many living in the region choose to commute to other areas (including nearby metropolitan area, Lexington, KY), as evidenced by a 35-minute commute and a stark difference in population and jobs. The mean household income is \$30,064 with around 12% of residents living in poverty. Jobs in the study area are largely concentrated in a few sectors. Healthcare and social assistance are the leading

sector with nearly 1,900 jobs followed by retail at shy of 1,000 jobs. Accommodation and food services are another important area with 628 jobs. It is a common misconception that coal extraction jobs are a major employer in the Red. In truth, coal deposits are further east of this region. Instead, oil supplies are found throughout the region and account for the bulk of extraction work found in the Red. County Business Patterns data are censored in cases with few jobs in a county, and that is the case here as only Estill reported jobs in this sector. As such, the extraction job count should be treated cautiously as it is likely somewhat higher.

There is a great need to consider new economic growth opportunities in areas like eastern Kentucky. The study area is situated among longstanding poverty cycles familiar to Central Appalachians: the region's geographical location, its reliance on mono-economic growth, and the decline of extraction industries have left the area in poor shape. However, there is a glimmer of hope. Going back seven years, two counties in this study area ranked in the top 20 poorest counties in the United States: Lee County was ranked 11th poorest and Wolfe County 14th poorest in the nation. Today, Lee has improved to 20th and Wolfe to 48th. Anecdotally, Wolfe is home to Muir Valley, the first climbing preserve created in the Red (Maples, 2021) while Lee is home to three climbing preserves managed by the Red River Gorge Climbers' Coalition (RRGCC): Pendergrass-Murray Recreational Preserve, Miller Fork Recreational Preserve, and Bald Rock Recreational Preserve. Both Lee and Wolfe Counties have also seen steady increases in climber visitation in the last five years and ostensibly changes in their economic fortunes. While anecdotal, these examples do provide grounds for conversations about how climbing tourism could be beneficial to the region's economy.

MATERIALS AND METHODS

Data for the present study are from a 2020 online survey of rock climbers, examining their expenditure and visitation patterns on their most recent climbing visit to the Red. The survey examined expenditures across the following categories (subcategories in parentheses): lodging (hotel, camping, and cabin/house rentals), travel costs (gasoline and transport/taxi/shuttles), food (dine-in restaurants, fast food restaurants, grocery stores, and convenience store food purchases), and retail/services (non-food retail purchases, recreation gear retail purchases, guiding services, and rental gear). In each area, respondents are asked to provide their expenditures on their most recent climbing trip to the Red in two ways: within 40 miles of the Red and beyond 40 miles of the Red, but still in Kentucky. The survey also included questions about residence zip codes (or home countries for non-US residents), which year they last visited the Red, group size, and length of stay. These are discussed further below. Demographic variables included sex, age (in years), education, personal income, and questions about their climbing habits.

This study utilized a non-probability convenience sampling approach. Non-probability studies have an important place in research when it is not possible to fully study a defined population and the results are not used to generalize findings to a broader population (Landers & Behrend, 2015; Etikan et al., 2016). Convenience samples can run the risk of not being representative of the population because of bias and attracting respondents who feel strongly about the issue being studied but comparing the results to previous studies (as is the case for the current study) can provide some sense of replication of earlier samples (Sousa et al., 2004). Researchers have previously used convenience samples in outdoor recreation studies because the populations being studied are often unknown and there is no single source for equally contacting all of the persons who may participate in the activity being studied (Guo & Schneider, 2015; Hill et al., 2017; Liu et al., 2019). Convenience samples can also be used when one is

studying behaviors in a specific area (such as the Red) and not attempting to broadly apply findings to climbers in other areas (Carter et al., 2020).

Data were collected from March 15, 2020 to November 15, 2020. The survey was released to the Access Fund email/social media lists in both spring and fall, as well as RRGCC and Muir Valley email/social media throughout the year. In all, 2,310 persons initiated the survey. In the event a respondent did not answer a particular question or stopped the survey before completing it, their responses are included up to the moment they discontinued the survey.

Additional data cleaning occurs in economic impact studies to reduce the risk of overestimation and ensure conservative, reliable estimates (White, 2017). These steps include excluding persons who did not climb in the study area over the last year (135 cases), persons who reported abnormal stays (operationalized as three standard deviations from the mean, here over 31 nights—24 cases), groups with eight or more persons (24 cases), and persons who reported primarily living inside the study area (56 cases). Note these responses are still included in summaries of demographic variables. Additional steps to reduce overestimation include recoding retail purchases over \$500 as missing data. In the present study, three persons' expenditures in recreational retail inside the study area were recoded as missing data. One additional case of retail expenditures outside the study area but inside Kentucky was recoded as missing data.

To estimate visitation for the economic impact analysis later in this paper, the research team compiled a dataset of parking areas around climbing locations and the capacities of those lots. Working with visual count data from Muir Valley and RRGCC parking lot observations in 2019 and 2020 and anecdotal climber parking experiences, the research team modeled out the estimated percentage of each lot filled on each day of the year. As not all climbing areas see the same rates of traffic, the dataset modeled rarely visited locations (mostly smaller crags on the DBNF) with lower use rates while frequently used areas (such as those around The Motherlode in Lee County) were modeled with higher use rates. The database takes into account seasonal holiday increases in use, the typical length of the climbing season over the last decade, and the arrival and departure of climbers throughout the day. The end result is an estimation of what climbing visitation looks like in a typical year with typical weather.

Based on this data, the researchers estimate approximately 56,000 climber vehicles are parked in climbing area parking lots during a typical year. The research team estimated there are 1.8 climbers per vehicle based on survey group sizes, interviews with climbers, and observations in the region's parking lots. Using this number, the research team estimates there are approximately 102,000 climber visits per year in the Red. Note this estimate allows for a climber to visit more than once and should not be interpreted as unique climbers. This amount also accounts for 2% of visits being from local residents, which excludes that 2% of visits from economic impact analysis. Although no exact count of local resident climbers exists, anecdotal counts by climbers has put the number under 200 persons.

Visitation and expenditure estimates are built in IMPLAN (IMpacts for PLANning) an economic impact software which allows expenditures to be modeled as they create changes in the economy. IMPLAN provides estimates on how direct expenditures (the point where money is added to the economy) shapes local business purchasing patterns (indirect expenditures) and worker expenditures (induced expenditures) in the study area. IMPLAN also provides three measures of economic impact: job wages created for employees and proprietors, value added (employee compensation and proprietor income plus taxes on production and imports plus other property income), and total output (value added plus intermediate inputs, which is the value of an industry's production). In this study, an estimation of jobs supported by climbing expenditures is also included. Note that jobs estimated can include a mix of part- and full-time jobs, as well as proprietors and owners. For example, 10% of a particular job might involve working only with rock climbers as clients, represented as one tenth of a job in this estimate.

RESULTS AND DISCUSSION

Table 2 summarizes climber expenditure patterns in the study area. This table includes expenditures in lodging, travel, food, and retail/services. On average, climbers spent \$8 per trip

when camping or using RV/travel campers, \$40 per trip when renting cabins or homes, and \$5 per trip when staying at hotels. These estimates also included cases where respondents reported staying in a particular category but reported no expenditures due to a partner or group member paying for the trip. The researchers estimated 80% of overnight climbing visitors utilized camping in some form, 5% utilized hotels/lodges, and 15% utilized cabins/rental homes as lodging in a typical year.

Travel and food are an important part of accessing outdoor recreation areas. Here, climbers spent \$20 on gasoline inside the study area each visit. Few respondents indicated using shuttles as parking is relatively near to climbing areas and carpooling is a common behavior in climbing communities. Anecdotally, this also represents another way that climbers reduce their impacts. On average, climbers spend around \$3 per trip at fast food restaurants. In comparison, climbers spend an average of \$26 at dine-in (wait staff service) restaurants. Climbers spend around \$3 per trip on food from gas stations and convenience stores. Note that this value is similar to the average climber expenditures on fast food with consideration that several local gas stations in the region have displays marketed specifically to climbers. Climbers also spend an average of \$11 per trip on groceries at local grocery stores and farmers' markets.

Table 2. Economic Expenditure Patterns inside Study Area for Climbing Visitors to Red River Gorge.

| Variable | N | Min | Max | Mean | SD |
|------------------------|-------|-----|------|---------|--------|
| Hotel | 1,130 | 0 | 350 | \$5.06 | 29.30 |
| Camping | 1,115 | 0 | 75 | \$8.73 | 13.27 |
| Cabin/Rental | 1,127 | 0 | 1000 | \$40.01 | 107.15 |
| Gas | 1,295 | 0 | 100 | \$20.08 | 19.97 |
| Fast Food | 1,282 | 0 | 40 | \$2.89 | 6.65 |
| Dine In | 1,289 | 0 | 150 | \$26.03 | 30.22 |
| Convenience Food | 1,282 | 0 | 25 | \$3.08 | 5.24 |
| Groceries | 1,270 | 0 | 138 | \$11.70 | 22.34 |
| Retail | 1,290 | 0 | 60 | \$3.42 | 9.57 |
| Rec Retail* | 1,270 | 0 | 100 | \$7.22 | 18.72 |
| Guiding Services | 1,294 | 0 | 37.5 | \$0.06 | 1.40 |
| Transport/Taxi/Shuttle | 1,301 | 0 | 5 | \$0.01 | 0.13 |
| Rental gear** | 1,301 | 0 | 0 | - | - |

*only 20% of this expenditure is used in later modelling; **No expenditures modelled in this study.

Retail purchases are a common expenditure in outdoor recreation trips. Climbers spend around \$3 on general retail purchases at stores like Walmart or Dollar General. Climbers spent around \$7 per trip on climbing gear. Note, as these two forms of retail purchases could hypothetically be used in the future outside the Red, the economic impact analysis later in this study only utilizes 20% of the value of these expenditures in the modeling. Retail expenditures are capped at \$500 to reduce the chance of inflating estimates. Rental gear and guide purchases were less common. Climbers are likely to reuse gear or share gear, leading to purchases rather than rentals. Only four cases of rental gear were reported, and all four were excluded during data cleaning as being atypical results. Though guiding is allowed in most Red River Gorge crags by permit or prior approval, it is more often used by first-time or infrequent visitors.

Each year, the Red is home to Rocktoberfest, a climbing festival currently held at Land of the Arches Campground in Wolfe County. Rocktoberfest averages an annual attendance of 1,200 climbers. Based on attendance of 1,200 and mean expenditures from this study, the research team estimates Rocktoberfest typically generates nearly \$85,000 in annual visitor expenditures. This estimate excludes five percent of attendees as persons living in the study area. It also does not include lodging as most stay on-site during the event as part of their registration costs. The estimate also does not attempt to model the expenditures of organizing and hosting the event or the expenditures of vendors at the event. Rocktoberfest is held as a fundraising event for the RRGCC. It is important to note the above estimate is not a figure going to the RRGCC, but rather

money being spent within the study area economy. The research team also does not include proceeds from this event in its analysis as the RRGCC is located outside the study area.

Based on the results of the study, the researchers estimate climbers visiting the Red spend \$8.7 million dollars annually in the study area. This estimate comes from \$1.1 million in lodging and \$7.4 million in food/gas/retail expenditures during a typical climbing season plus \$84,918 in estimated festival-related expenditures. This estimate is built on total

visitation estimates of 102,484 with 2% of those visits coming from persons living in the study area and 90% of the visits involving overnight stays. Table 3 highlights what occurs when these funds are spent inside the study area. Focusing on labor income (the most conservative measure of economic impact of the three listed) climbing generates an estimated \$2.6 million dollars in labor income inside the study area. Climbing expenditures also support jobs in the study area, supporting around 104 jobs or portions of jobs inside the study area.

Table 3. Economic Impact Summary.

| Impact Type | Employment | Labor Income | Value Added | Output |
|--------------|------------|--------------|-------------|-------------|
| Direct | 92.2 | \$2,292,172 | \$2,717,313 | \$4,951,484 |
| Indirect | 5.2 | \$150,665 | \$259,424 | \$586,770 |
| Induced | 7.2 | \$212,081 | \$435,884 | \$841,006 |
| Total Effect | 104.6 | \$2,654,918 | \$3,412,621 | \$6,379,259 |

Table 4 lists jobs categories supported by climbers' expenditures in the study area. Recall these jobs represent portions of jobs and not necessarily whole jobs, so one person might have only 15% of their job and labor income linked to climbing expenditures. Climber expenditures in the study area support the presence of jobs in full-service restaurants (restaurants including wait staff and kitchen work), other accommodations (including campgrounds and rental cabin/houses), grocery stores, gas stations, fast-food

restaurants, and sporting goods stores. Likewise, climbers' activities also support related sectors, such as engaging real estate sales, business accounting, and physicians' offices. Note these last three example activities are most likely utilized by businesses and workers in the study area, not climbers. Climber expenditures also produce taxes at the local, state, and federal level as summarized in Table 5. In all, climbers' estimated expenditures supported \$451,521 in local/state taxes and \$346,672 in federal taxes.

Table 4. Labor Income Generated.

| Description | Total Employment | Total Labor Income |
|---|------------------|--------------------|
| Full-service restaurants | 61.6 | \$1,052,092.60 |
| Other accommodations | 13.4 | \$882,855.80 |
| Retail - Food and beverage stores | 6.1 | \$141,974.70 |
| Retail - Gasoline stores | 5.8 | \$144,655.70 |
| Limited-service restaurants | 4.5 | \$80,742.30 |
| Retail - Sporting goods, hobby, musical instrument and bookstores | 2.1 | \$15,000.00 |
| Real estate | 0.9 | \$9,788.30 |
| Accounting, tax preparation, bookkeeping, and payroll services | 0.4 | \$5,294.70 |
| Offices of physicians | 0.4 | \$31,766.00 |
| All other food and drinking places | 0.4 | \$10,334.80 |

Table 5. Annual Estimated Taxation Generated.

| Tax Type | State/Local Amount | Federal Amount |
|-------------------------------|--------------------|----------------|
| Employee Compensation | \$3,759 | \$259,757 |
| Proprietor Income | \$0 | \$32,584 |
| Tax on Production and Imports | \$379,203 | \$38,797 |
| Households | \$65,951 | \$156,707 |
| Corporations | \$2,608 | \$15,377 |
| Totals | \$451,521 | \$346,672 |

Table 6 summarizes expenditure patterns outside of the Red but still inside Kentucky. Overall, these findings support the idea climbers are finding few reasons to stop before arriving in the Red as whatever expenditures need to be made can be spent in the study area. For example, lodging is almost universally located inside the Red, meaning climbers are staying where they recreate. Note only a handful of cases

reported staying outside the Red. Gasoline typically represents the largest expense for climbers outside the area being studied. In this case, climbers spent an average of \$6 on gasoline outside the area. This suggests a few possibilities: climbers are driving from locations near enough that the trip may be done without filling their gas tank, climbers are refilling before they leave the Red, or climbers simply find

fewer reasons to stop before getting into the Red. Climbers from outside of Kentucky may also simply be filling up outside of Kentucky, which would not be tracked in this study.

Climbers spent fairly small amounts on food while traveling to the Red while in Kentucky. For example, climbers spent (on average) around \$1.50 each on dine-in restaurants and fast food, \$0.26 gas station/convenience store food, and \$2 at grocery stores. This supports the idea that climbers are getting

food inside the study area. Retail purchases outside the study area are also uncommon. In traveling to the Red, climbers spent negligible amounts on general retail and recreation retail. Again, they are instead purchasing things inside the study area. Finally, services represent a small sliver of economic expenditures even as we expand beyond the study area. Expenditures in guide services, taxis, and rental gear are all virtually zero beyond the study area.

Table 6. Economic Expenditure Patterns outside the Red River Gorge Study Area but Still Inside Kentucky.

| Variable | N | Min | Max | Mean | SD |
|------------------------|-------|-----|-----|--------|-------|
| Hotel | 1,131 | 0 | 300 | \$0.76 | 11.97 |
| Camping | 1,131 | 0 | 200 | \$0.42 | 7.56 |
| Cabin/Rental | 1,131 | 0 | 500 | \$1.48 | 19.17 |
| Gas | 1,284 | 0 | 57 | \$5.92 | 11.60 |
| Fast Food | 1,281 | 0 | 20 | \$1.41 | 3.89 |
| Dine In | 1,292 | 0 | 50 | \$1.42 | 6.25 |
| Convenience Food | 1,260 | 0 | 8 | \$0.26 | 1.16 |
| Groceries | 1,285 | 0 | 83 | \$2.21 | 8.54 |
| Retail | 1,294 | 0 | 25 | \$0.13 | 25 |
| Rec Retail | 1,292 | 0 | 50 | \$0.28 | 2.96 |
| Guiding Services | - | - | - | - | - |
| Transport/Taxi/Shuttle | - | - | - | - | - |
| Rental Gear | 1,302 | 0 | 25 | \$0.05 | 1.01 |

Table 7. Climber Demographics.

| Variable | N | Min | Max | Mean | SD |
|---|-------|------|------|-------|-------|
| Respondent Sex (1=Female, 0=Male) | 1,751 | 0 | 1 | 35.12 | .47 |
| Respondent age | 1,761 | 18 | 90 | 34.88 | 10.97 |
| Respondent's first year climbing | 2,039 | 1920 | 2020 | 2008 | 9.87 |
| Started climbing indoors | 2,056 | 0 | 1 | .51 | .47 |
| Started climbing outdoors | 2,056 | 0 | 1 | .27 | .44 |
| Has Bachelor's College degree | 1,764 | 0 | 1 | .44 | .49 |
| Has Advanced degree (PhD/terminal) | 1,764 | 0 | 1 | .40 | .49 |
| Personal income greater than \$50K | 1,647 | 0 | 1 | .63 | .48 |
| Personal income greater than \$99K | 1,647 | 0 | 1 | .26 | .43 |
| Job is in outdoor recreation | 1,740 | 0 | 1 | .19 | .39 |
| Owns a business, any location | 1,756 | 0 | 1 | .15 | .36 |
| Owns outdoor rec business (limited to those who owned a business, any location) | 266 | 0 | 1 | .31 | .46 |

Table 7 summarizes the demographic variables of respondents. In several cases, the variables are dichotomously coded, which means a one equals the presence of the trait being studied and a zero equals the absence of this trait. The mean results can be interpreted as percentages. In all, 35% of respondents identified as being female. The average respondent age was 34. Note persons under the age of 18 did not qualify to participate in this study which certainly impacts this statistic. About half the respondents indicated they began climbing indoors and the average starting year was 2008. As has been found in past studies, climbers are well-educated. In all, 44% indicated having a four year degree while another 40% indicated having

a graduate degree such as master's or doctorate degree. Correspondingly, 63% of respondents noted having personal annual incomes greater than \$50,000 while one in four reported six figure incomes. One in five indicated their job was, in some way, related to outdoor recreation. Fifteen percent of respondents indicated owning their own business, and nearly one third of those respondents indicated their business was related to outdoor recreation.

Discussion

The results of this study provide an exciting opportunity to explore economic and social changes in outdoor recreation

areas over a relatively short period, as well as exemplify how more precise visitation estimates and specific expenditure categories create a clearer estimate of economic expenditures. The researchers utilized the previous Red climbing economic impact study using 2015 data as a baseline. That study estimated climbers spent \$3.8 million annually. Findings in the current study elevate climbers' expenditures in the Red to \$8.7 million annually. As such, it is valuable to explore factors which may explain the difference between these two findings.

First, the current study presents another clear case of outdoor recreation users—specifically climbers—spending a great deal of money in the areas where they recreate. Moreover, as they are increasingly received positively in the area, their expenditures and presence should continue to grow, as suggested by the idea that outdoor recreation users continue to be interested in feeling like they are part of the community by supporting local businesses (Rickly, 2017; Maples, 2021). Climbers' expenditures, and specifically this study, offer a clear example of how rural areas with natural features of interest benefit from outdoor recreation users economically supporting the region. This provides a conduit for new money to be injected into the local economy, thereby encouraging economic growth.

In order to better measure this growth, the current study utilizes a more detailed range of expenditure variables which provide more nuanced information about lodging, food, and retail compared to the previous study. For example, in the current study lodging estimates looked at camping, hotels, and rental cabins, whereas the previous study only collected one figure on lodging as a whole, classifying it as camping in the modelling. Another similar instance of this that was improved in the current study is the dining category in which the dining estimates looked at fast food and dine-in restaurants, whereas the previous study combined fast food and dine in restaurants. The present method of subcategorizing the lodging and dining estimates, as well as including more categories that were not recognized in the previous study (i.e., the recreational spending category), allows for more accurate and comprehensive modelling compared to that of the previous study. The present study also used a more uniform approach to removing points of influence by dropping expenditures three deviations above the mean rather than capping expenditures at a set limit. Additionally, the previous study broke expenditure categories into smaller sub-categories of visitation lengths which, while useful, ended up losing the nuance and comparability of expenditure patterns. That study also made no effort to account for local resident expenditures which are often lower than visitor expenditures. This would likely deflate average expenditures in that study.

Additionally, the context and treatment of tourism in the Red has changed. One major improvement for climbers is the region's booming rental cabin industry, often directly marketing to climbers as clientele. Chrobak's (2017) exploration of local perceptions of climbers pinpoints how Maples and associates' study (Maples et al., 2017) established a known demographic of climbers (as persons who are well-educated professionals interested in local businesses) and therefore changed local resident perceptions when the results were disseminated locally. Presenting the results of that study

to Lee County Tourism and the coverage of the study in the news caused cabin rental companies to consider climbers as clients. This alone created additional expenditures (half million dollars in expenditures not previously captured). On a related note, several new businesses have appeared in the Red since the previous study, while some existing businesses have expanded, creating more spending opportunities. Much like the cabin industry, climbers are being included in new and expanded marketing and branding. Likewise, the inclusion of alcohol by the drink sales in the region have further increased expenditure options.

Next, the present study better represents current visitation. Presently, the United States Forest Service does not measure climbing visitation in its National Visitor Use Monitoring survey. As a result, the previous study elected to use an estimate of visitation based on unique persons climbing in the area and apply that estimate to visitation range lengths in the survey. While possibly more nuanced in terms of how expenditures change based on length of visit, this made it more difficult to understand per visit expenditures. In modeling parking areas, the present study offers a more accurate visitation estimate while also capturing the recent increases in visitation to the Red's climbing areas. This also meant including new climbing preserves in Lee County and new route growth at Muir Valley in Wolfe County over the last seven years.

One valid question is to what degree COVID-19 may have impacted visitation patterns in this study. Beginning in early March 2020, COVID-19 altered access to public lands and shifted visitation patterns across the nation. However, it seems likely the impacts of COVID on visitation were minimal in the Red due to the area's unique climbing season. While climbing is present year-round in the Red, most visits occur from early March until May and again from late September to the end of the year. Of the two, the most active is by far the fall season, with September through November being peak months for the Red.

Closures and COVID likely reduced visitation during the spring climbing season. During the early weeks of the spring climbing season, the DBNF remained largely open following early concerns over COVID while the Red River Gorge Geological Area closed from March 27-May 22, 2020. Similarly, local climbing organizations followed suit to limit climbing visitation by instituting policies to minimize exposure to COVID and restrict sick persons from traveling into the area to protect local residents and other climbers. However, losing the spring climbing season is not uncommon in the Red. For example, a particularly rainy 2019 Kentucky spring shortened the season but led to an increase in summer and fall climbing. This familiar trend appears to have happened in 2020 in the Red. For example, conversations with climbers indicated climbing happening in late June and even July among the cooler, shaded crags. Additionally, the fall season has seen popular areas with socially-distanced lines of climbers waiting to use a route. Climbers have also resorted to visiting less-used crags to reduce crowding, thus spreading visits out over the study area. Regional climate trends also supported the 2020 climbing season in continuing through December 31st. The end result was largely interpreted by the researchers as an

even trade: the abbreviated spring season led to a busier fall season further complemented by desirable weather. As such, the researchers do not find evidence to reduce the economic impact estimates in this study as a result of COVID. While the visitation estimates modeled in this study are meant to represent a typical year, there is ample evidence to support these results are still relevant for the 2020 season.

This study also puts renewed emphasis on future research which can explore how the influx of climbers into these areas might shape the communities over time. For example, an increase in telecommuting in 2020 due to the pandemic resulted in outdoor recreation users relocating to be closer to their favorite areas. Anecdotal evidence indicates a fair number of climbers decided to live in or near the Red in 2020-2021 while telecommuting. In other cases, climbers have purchased homes in the region as primary and secondary residences amid a glut of abandoned houses and available parcels. This has injected taxes into the area but raises valid concerns about rural gentrification in the region which have impacted select outdoor recreation areas such as Moab, Utah and its thriving outdoor recreation community. These should be examined in future studies.

Economic impact studies also experience certain limitations that should be explored in future work. Economic impact studies are always representative of a snapshot in time, so finding new ways to address this static approach (such as Outdoor Industry Association's semi-regular updates of state studies) should be considered. Economic impact studies are not cost-benefit analyses studies, meaning that there is no consideration of the costs of supporting climbing access and the impacts of climbers on things like streets or sidewalks. This is something that could benefit future studies, however. Economic impact studies also do not examine opportunity costs, such as how funds might be differently spent if climbing did not exist. Having firm visitation estimates from the Forest Service NVUM data would also help legitimize the results and could be paired with similar measures in private climbing preserves.

To close, more work is necessary to best understand economic and ecological impacts as visitation increases to the region by multiple forms of outdoor recreation. While climbing may be the best known form of recreation in the area, there are also growing mountain biking and cycling communities in the region. The Sheltowee Trace trail increasingly attracts new backpackers to the region amid a longstanding history of hiking and arch exploration, too. Future studies should continue to explore economic expenditures in these additional areas and other areas as needed to best identify outdoor recreation and tourism economic impacts for the Red and its surrounding region to examine changes in the region over time.

CONCLUSION AND RECOMMENDATIONS

This study provides evidence of the economic benefit of rock climbing in rural transitional economies while supporting growing evidence of outdoor recreation's economic value across the United States. The findings indicate that, while certainly smaller than industries such as timber and coal, outdoor recreation presents an activity whose impacts can be

more easily mitigated and controlled over time with fewer risks of becoming monolithic. Findings further suggest that outdoor recreation users are often highly educated persons overall, often with concomitantly higher incomes capable of supporting desirable expenditure patterns.

This study supports future policy implications. First, opening additional areas to activities like rock climbing can generate economic benefits but must be done so with caution. For example, public land managers should carefully consider when and how areas are opened to climbing to ensure impacts can be adequately mitigated over time. Second, as part of reducing impacts, public lands should include clear counts of rock climbers in public land surveys. This will ensure better data on and analysis of visitor use patterns. Third, areas interested in increasing economic expenditures by outdoor recreation users in general should address key spending patterns to ensure that visitors spend and stay locally during their trips. This is particularly true for rural areas which may not offer diverse economic spending opportunities when compared to more urbanized economies in the surrounding region. Additionally, it behooves tourism corporations to consider how outdoor recreation users are treated and defined by local residents. These interactions can often be subject to longstanding cultural trends or linked to historic events and may negatively impact economic opportunities overall.

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