Exploring Inequity in Park Usage Amidst the COVID-19 Pandemic

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***Abstract*—We analyze detailed mobility data sets to explore changes in the usage of parks, forests, and other public green space during the COVID-19 pandemic. We seek to identify trends in patterns of access to public green space based on granular, county-level data in the United States. We look also at broader global trends, comparing park access patterns between countries. We find large changes in park usage during the pandemic in the United States. These changes are especially pronounced between regions with high income and comparable regions with low income. These disparities are not as evident when analyzing the data at a country level.**

***Index Terms*—Human Mobility and Networks, Park Usage, Equity**

I. Introduction

Access to neighborhood green space has long been associated with better mental and physical health [6]. In fact, contact with nature has been shown to reduce stress [3], depression [1], anxiety [4], and obesity [2], while promoting greater happiness and well-being [10]. In children, access to nature has been shown to improve development, both cognitive and motor [5]. However, access to green space varies, there is significant income-based inequity [7]. Access to urban vegetation is most strongly associated with higher education and income [13]. In March of 2022, the World Health Organization reported that the COVID-19 pandemic triggered a 25% increase in the prevalence of anxiety and depression worldwide. There have been extreme changes in physical activity, sleep, and time use [8].

In this paper we contribute findings that reflect that while park access was already less available in low income regions this trend has only accelerated since the beginning of the pandemic.

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II. Related Work

There have been many recent studies detailing the impact of the pandemic on everyday life. Giuntella et al. found that among young adults the average number of steps taken daily declined from 10,000 to 4,600, time spent socializing declined by over half to less than 30 minutes per day, and that daily screen time more than doubled to over 5 hours [8]. With a focus on green space, Larson et al. surveyed 611 urban residents in North Carolina, USA to to understand how park usage was impacted during the pandemic [11]. They found that 56% of respondents ceased or reduced park usage. Park users also became more homogeneous, with visits declining most in socially vulnerable communities and among individuals with lower-income. Volenec et al. used geotagged social media data from state, county, and local parks throughout New Jersey, USA [14]. They found that shutdown orders caused visitation in closed parks to decline by 76.1%. Hazlehurst et al. [9] found that park access was associated with better mental health among children and parents during the COVID-19 pandemic.

III. Methods

We chose to use Google Mobility data to understand trends in park usage during the pandemic [12]. Google Mobility Reports show movement trends by region, across different categories of places. The data shows how visitors to categorized places change compared to baseline days. A baseline day represents a normal value for that day of the week. The baseline day is the median value from the 5-week period Jan 3 – Feb 6, 2020. This baseline intends to capture mobility in various categories prior to the pandemic. Available place categories include Grocery & Pharmacy, Parks, Transit Stations, Retail & Recreation, Residential, and Workplaces. We focus our attention on the parks data. Parks in this report include: public gardens, castles, national forest, camp grounds, observation decks, and other publicly accessible outdoor spaces.

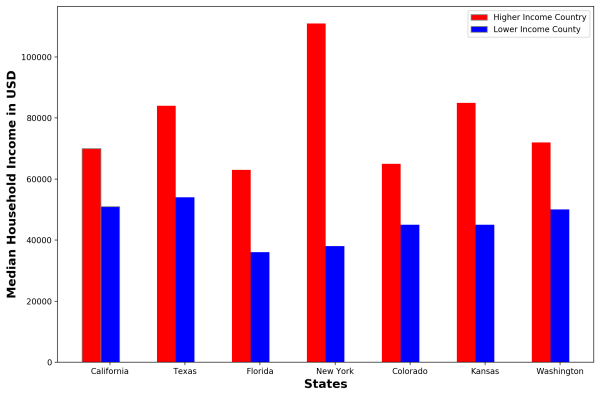


Fig. 1: Median household incomes separated by state: San Luis Obispo and Fresno counties in California, Williamson and Bell counties in Texas, Clay and Putnam counties in Florida, Bronx and Nassau counties in New York, El Paso and Pueblo counties in Colorado, Johnson and Wyandotte counties in Kansas, and Kitsap and Lewis counties in Washington

We use World Bank data to summarize adjusted net national income per capita in various countries. We use US Census data from 2014-2018 to find median household income by county.

IV. Findings

A. Disparity on Single Data Points in the United States

We began our investigation by considering regions in the United States that were geographically similar but economically dissimilar. We chose pairs of counties from representative regions of the United States: west (San Luis Obispo and Fresno counties in California), southwest (Williamson and Bell counties in Texas), southeast (Clay and Putnam counties in Florida), northeast (Bronx and Nassau counties in New York), central (El Paso and Pueblo counties in Colorado and Johnson and Wyandotte counties in Kansas), and northwest (Kitsap and Lewis counties in Washington State). See Figure 1 for median household income for each county.

We considered the 5 week period starting with the shutdowns in the United States (March 16, 2020) and found that in some regions there was tremendous difference between the park usage of higher and lower income counties. In most states (with a slight exception in Texas and Washington) we saw that higher income counties either had an increase in park usage or a smaller decrease than their neighboring lower-income counties. See Figure 2a for changes in park usage.

We considered the next 5 week period, from April 20, 2020 to May 24, 2020 to understand longer term trends and found even more stark differences (again, with exceptions in Texas and Washington). See Figure 2b.

Finally, in an effort to understand the persistence of these changes, we considered the 5 week period from January 5, 2021 to February 6, 2021, one full year after the baseline 5 week period. This full-year gap revealed similar changes. See Figure 2c.

We hypothesize that higher income counties have more residents with jobs that went remote during the initial wave of COVID-19, thus offering the possibility of more park visits throughout the day. In many counties in the United States there were K-12 school closures from March 2020 to June 2021, so perhaps caregivers with remote jobs were able to take their children to parks more often.

B. Global Comparisons

Similar trends do not hold at the country-wide level. At the country-wide level, we expect that each country has a mix of residents who were able to work remotely and residents who were not able to work remotely. We sampled countries of high and low income from each continent. The gross national income plot for Singapore and Afghanistan in Asia, Mauritius and Mozambique in Africa, United States and Mexico in North America, Uruguay and Bolivia in South America, Luxembourg and Ukraine in Europe, and Australia and Papua New Guinea in Oceania appears in Figure 3.

We considered the 5 week period starting with the shutdowns in many countries (March 16, 2020) and found that with the exception of North America we saw the reverse trend from what was observed in the United States county wide study. Higher income countries had a larger decrease in park usage than their corresponding lower income countries. See Figure 4a for changes in park usage.

We considered the 5 week period from April 20, 2020 to May 24, 2020. See Figure 4b for changes in park usage.

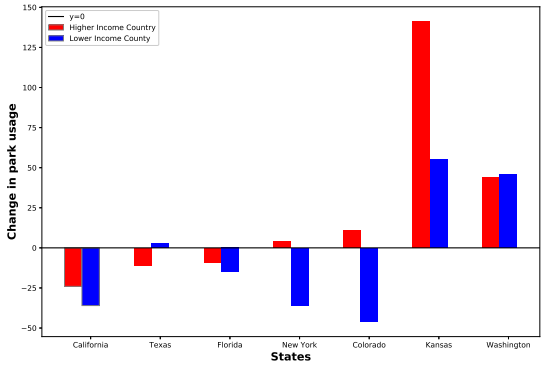
Finally we considered the 5 week period one year after baseline. See Figure 4c for changes in park usage.

V. Threats to Validity

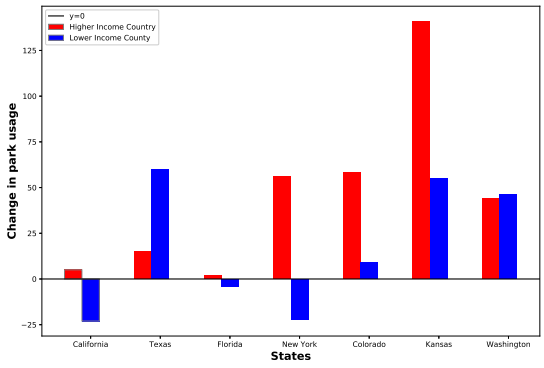
- All Google Mobility Data is compared with a common baseline: the median value from the 5-week period Jan 3 – Feb 6, 2020. It is possible that weather or other local events affected the park usage during that time, then comparisons would be skewed.
- We only chose neighboring counties with large differences in median income. There are 3,143 counties in the United States. We sampled only 14 of these - 7 pairs of geographically adjacent but economically dissimilar.
- We chose a sample of only 12 countries out of 195.

VI. Conclusions and Future Work

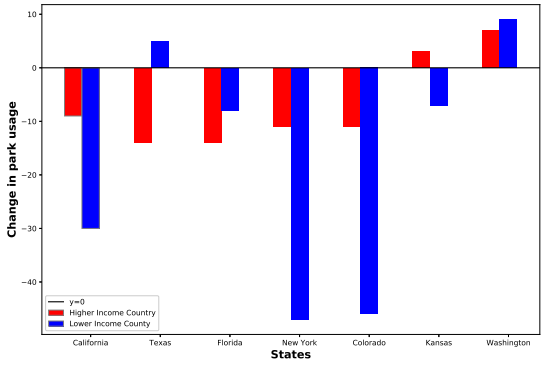
Extensive mobility data sets offer a uniquely detailed view into how people spend time on a daily basis, revealing trends, patterns, and insight into daily lives. When daily lives are disrupted on a wide scale, such as during the COVID-19 pandemic, it is particularly interesting to analyze changes in behavior. In this study we focus on COVID-era usage of public green space, including parks, recreation areas, and other outdoor space. We analyze periods of time before the COVID-19 pandemic and during the height of large-scale ”lock downs.” We find that the COVID-19 lock downs correspond



(a) Differences in park usage over counties between base line and the averages over the weeks of March 16, 2020 and April 19, 2020



(b) Differences in park usage over counties between base line and the averages over the weeks of April 20, 2020 and May 24, 2020



(c) Differences in park usage over counties between base line and the averages over the weeks of January, 3, 2021 and February 6, 2021 (one year after baseline)

Fig. 2: Differences in park usage over counties in the United States

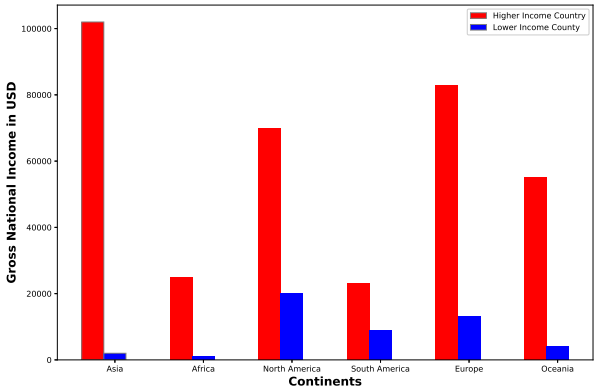


Fig. 3: Gross national income separated by continent: Singapore and Afghanistan in Asia, Mauritius and Mozambique in Africa, United States and Mexico in North America, Uruguay and Bolivia in South America, Luxembourg and Ukraine in Europe, and Australia and Papua New Guinea in Oceania

with significant shifts in the usage of public green space. We further find that changes in green space usage appear to be related to income levels. Using fine-grained county-level data in the United States, we find that, in high income areas, green space usage increased during periods of COVID lockdown. In contrast, in areas with lower per-capita income levels, green space usage decreased.

Our findings are applicable to discussions related to equitable public policy, particular during times of great societal disruption. Our work underscores the value and importance of publicly-accessible mobility data. Future work could explore additional regions around the globe for which granular mobility data exists. We also intend to perform similar analysis with an emphasis on other types of locations beyond green space as well as dimensions other than income level.

VII. Acknowledgements

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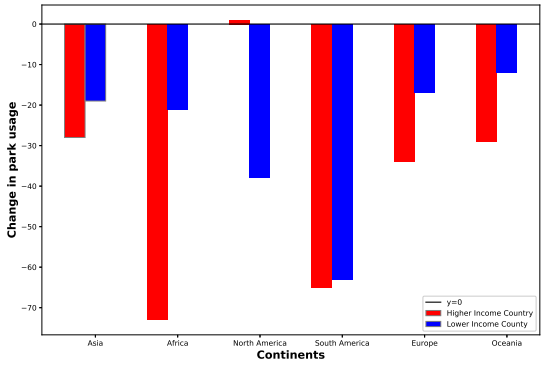
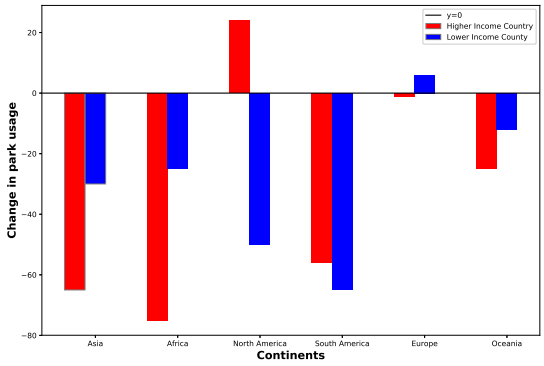
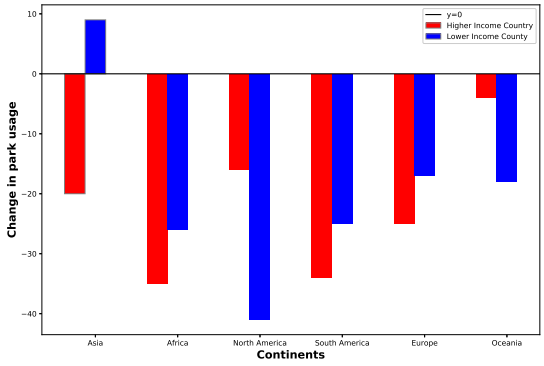


(a) Differences in park usage over countries between base line and the averages over the weeks of March 16, 2020 and April 19, 2020



(b) Differences in park usage over countries between base line and the averages over the weeks of April 20, 2020 to May 24, 2020



(c) Differences in park usage over countries between base line and the averages over the weeks of April 20, 2020 to May 24, 2020

Fig. 4: Differences in park usage over countries

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