

# Assessing Socioeconomic Patterns of Cultural Ecosystem Services Provided by King and Snohomish County Lakes



Lexus Martin, Selene Bogstie, Avery Shinneman, Ph.D., and Jim Gawel, Ph.D.

## ABSTRACT

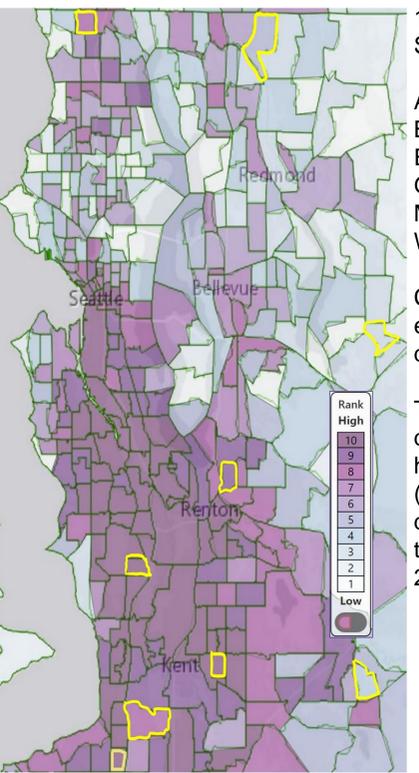
There is little research conducted on the value of cultural ecosystem services (ES) provided by urban lakes in the United States, and even less information regarding the effects of socioeconomic status (SES) on lake use. Consequently, the benefits, uses, and users of urban lakes may not be entirely considered during public policy planning. To address this knowledge gap, we explored which cultural ES Washington lakes provide to users and which uses are currently not met. We observed spatial and time patterns of lake visitation by the public to 17 lakes in King and Snohomish Counties by conducting in-person counts on summer weekends and weekdays. King County staff can use this data to determine effective outreach methods for potential lake users, current uses of lakes, and how lakes can be improved to increase public use. Ultimately, this data will increase equitable access to desired cultural ES while also providing a foundation for more sustainable urban lake management.

## OBJECTIVE AND APPROACH

**Objective:** Find out who is using lakes and how, who is not using lakes and why, and what would make lakes more accessible to all.



Figure 1. Beaver Lake, Sammamish WA, on a cloudy day.



Sampled from the following 17 lakes in King and Snohomish Counties:

- Angle, Beaver, Bitter, Blackmans, Boren, Cottage, Echo, Fivemile, Flowing, Geneva, Haller, Martha, Meridian, Pine, Silver, Steel, Wilderness

Chose lakes based on environmental health disparity (EHD) ratings

There is an unequal distribution of environmental hazards and pollutants (disparities) which disproportionately affect those of low SES (Min et al. 2021)

Figure 2. EHD map of Washington State's King and Snohomish Counties by census code. Darker colors indicate higher disparity and lower SES of residents on a scale of 1 (least disparity) to 10 (most disparity). We chose 18 lakes with varying EHD rankings to examine if and how SES affects lake usage.

## RESULTS

Total Average August:	Dock Present	Dock Absent	Ratio
<b>Lake-Specific Activities</b>	27	7.6	3.5
<b>Fishermen</b>	2.6	0.5	4.8

Table 1. Effects of dock presence on lake use. The total average number of lake-specific usage activities occurring in August was 3.5 times higher when a public dock was available than when a dock was absent. The total number of average fisherman visiting a lake in August was 4.8 times higher when a public dock was available than when it was absent.

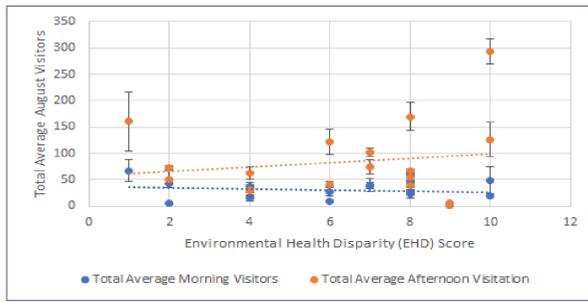


Figure 3. Total average visitors in August to 17 lakes in mornings and afternoons as a function of each lake's environmental health disparity (EHD) score. The orange trendline ( $R^2=0.066$ ) represents afternoon data. The blue trendline ( $R^2=0.032$ ) represent morning data.

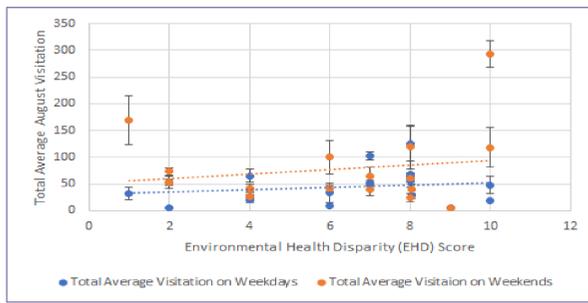


Figure 4. Total average visitors in August to 17 lakes on weekdays and weekends as a function of each lake's environmental health disparity (EHD) score. The blue trendline represents weekday data ( $R^2=0.080$ ). The orange trendline represent weekend data ( $R^2=0.028$ ).

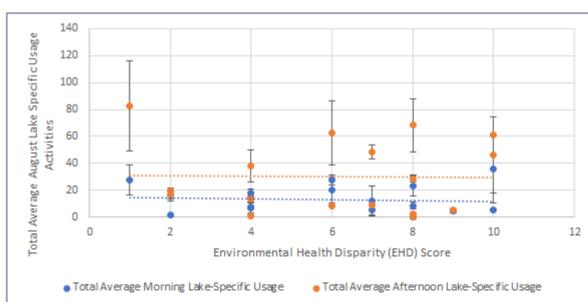


Figure 6. Total average lake-specific usage activities in August for 17 lakes in mornings and afternoons as a function of each lake's environmental health disparity (EHD) score. The orange trendline ( $R^2=0.003$ ) represents afternoon data. The blue trendline ( $R^2=0.008$ ) represents morning data.

Total Average August:	Shelter Present	Shelter Absent	Ratio
<b>Park-Specific Activities</b>	74	24	3.1

Table 2. Effect of shelter presence on lake use. The total average number of park-specific usage activities occurring in August was 3.1 times higher at lakes with a shelter available than lakes without a shelter. Park-specific activities include walking and sitting within the park (not on the lakeshore).

Total Average August:	Weekend	Weekday	Ratio
<b>Visitors</b>	73	42	1.8
<b>Lake-Specific Activities</b>	26	18	1.5

Table 3. Differences between weekend and weekday lake use. The number of total average visitors to lakeside parks in August was 1.8 times higher on weekends than weekdays. The total average number of lake-specific usage activities occurring at lakes in August was 1.5 times higher on weekends than on weekdays.



Figure 4. Lake-specific activities occurring at Lake Cottage, Woodinville, WA on a sunny day.

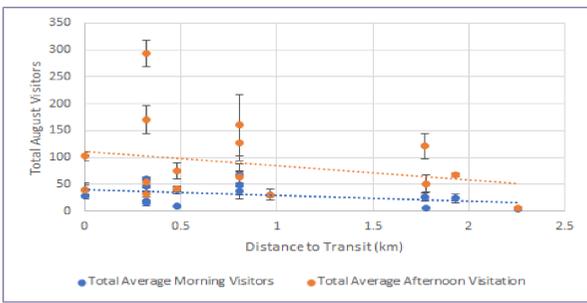


Figure 5. Total average visitors in August to 16 lakes in mornings and afternoons as a function of each lake's distance (km) from the nearest transit stop calculated by Google Maps "directions" function. The orange trendline ( $R^2=0.069$ ) represent afternoon data. The blue trendline ( $R^2=0.17$ ) represents morning data. Flowing Lake (km=11) was far enough away from a transit stop that it visually distorted the graph's pattern and therefore was ignored in this figure.

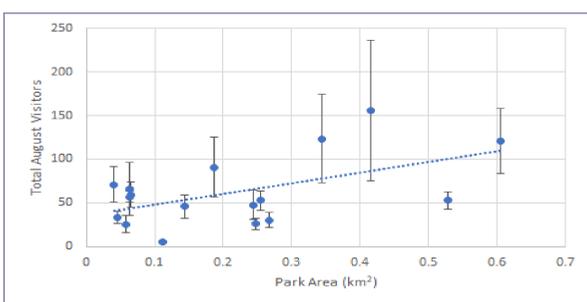


Figure 7. Total average visitors in August to 17 lakes as a function of park area ( $km^2$ ) retrieved from the Washington Department of Fish and Wildlife (WDFW).  $R^2=0.28$ .

## DISCUSSION

- People in areas with high EHD scores take more advantage of lakeside parks, especially on afternoons and weekends.
- Specific resources (docks, shelters) may be positive incentives to visiting a lake.
- Larger parks and parks where people are able to conduct gatherings may be positive incentives to visiting a lake.
- Proximity to public transit may drive increased access, or it may be a proxy for higher population density.
- We did not find relationships between population density of the census code that a lake was in and visitation to that lake.
- The distance from the parking lot to the lakeshore did not affect the average number of lake-specific activities in August.
- Pine Lake (EHD=1) had high visitation rates compared to other lakes of similar EHD score. Pine is very well-shaded, highly accessible to the surrounding neighborhood, and is across the street from an elementary school, all of which could have increased visitation.
- Lake Geneva (EHD=9) had low visitation rates compared to other lakes of similar EHD score. The park and lake are not easily visible from the road, the dock is separate from the small gravelly swimming area, there are no shelters, and the park area is separate from the lake area, which could have decreased visitation.
- Despite a weaker trend caused by Lake Geneva and Pine, people in areas with high EHD scores also engage in more lake-specific activities, especially on afternoons.
- There is indication that people in areas with high EHD use lakes as climate refuge.

## CONCLUSION AND NEXT STEPS

Our data points us in the right direction to learn more about urban lake usage in Washington State. There is evidence that SES status has an effect on lake usage, but more data are needed. Lakes with higher EHD scores see more visitation and lake-specific usage during afternoons, which could indicate that individuals of lower SES use lakes as climate refuge when temperatures increase (such as later in the day). This is a worthwhile research direction as it's possible that lake use as climate refuge will increase with climate change. Although lake usage can't be determined by one variable alone, we also found that specific resources and amenities will draw users to lakes. Continuing to learn about current uses and users of urban lakes will help inform sustainable lake management practices and public policy decisions while simultaneously benefitting the users and increasing equitable access.

## ACKNOWLEDGEMENTS

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