Mapping and modeling the impact of climate change on recreational ecosystem services using machine learning and big data

Kyle Manley\textsuperscript{1} and Benis Egoh\textsuperscript{2}

\textsuperscript{1}Department of Earth System Science, Benis Egoh -University of California Irvine
\textsuperscript{2}Affiliation not available

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Introduction

- Recreational ecosystem services (RES) contributed ~$460 billion/yr to the US economy (pre-COVID)
- RES demand is determined by environmental factors, causing high vulnerability to climate change
- Cultural ES (e.g., RES) and climate change impacts to them are understudied, mainly due to data availability issues
- Major lack of connecting social and ecological systems

Methods

Social Media Data

- Recreation data is sparse and low-resolution, gathering such data is difficult/impossible on large scales
- Geolocated social media data offers a novel, globally available, high-res proxy from a beneficiary perspective
- Photo sharing social media data can be used to calculate photos per user per day as a proxy for demand of RES
- We test Flickr data as a proxy for demand of RES in CA

Random Forest Model

- Data driven machine learning model used to connect peak season (July – Sep) RES demand to environmental conditions/features
- These relationships can then be extrapolated into the future
- RF allows us to estimate variable importance and can better handle nonlinear interactions within social-ecological systems

Results

- Variable importance calculations show climate, especially temperature, influence RES demand, but accessibility is also a major factor

Conclusion

- Big data and machine learning offer opportunity to integrate social-ecological systems into climate impacts research and better understand implications for human well-being
- These resources also give us an opportunity to assess understudied data-poor regions