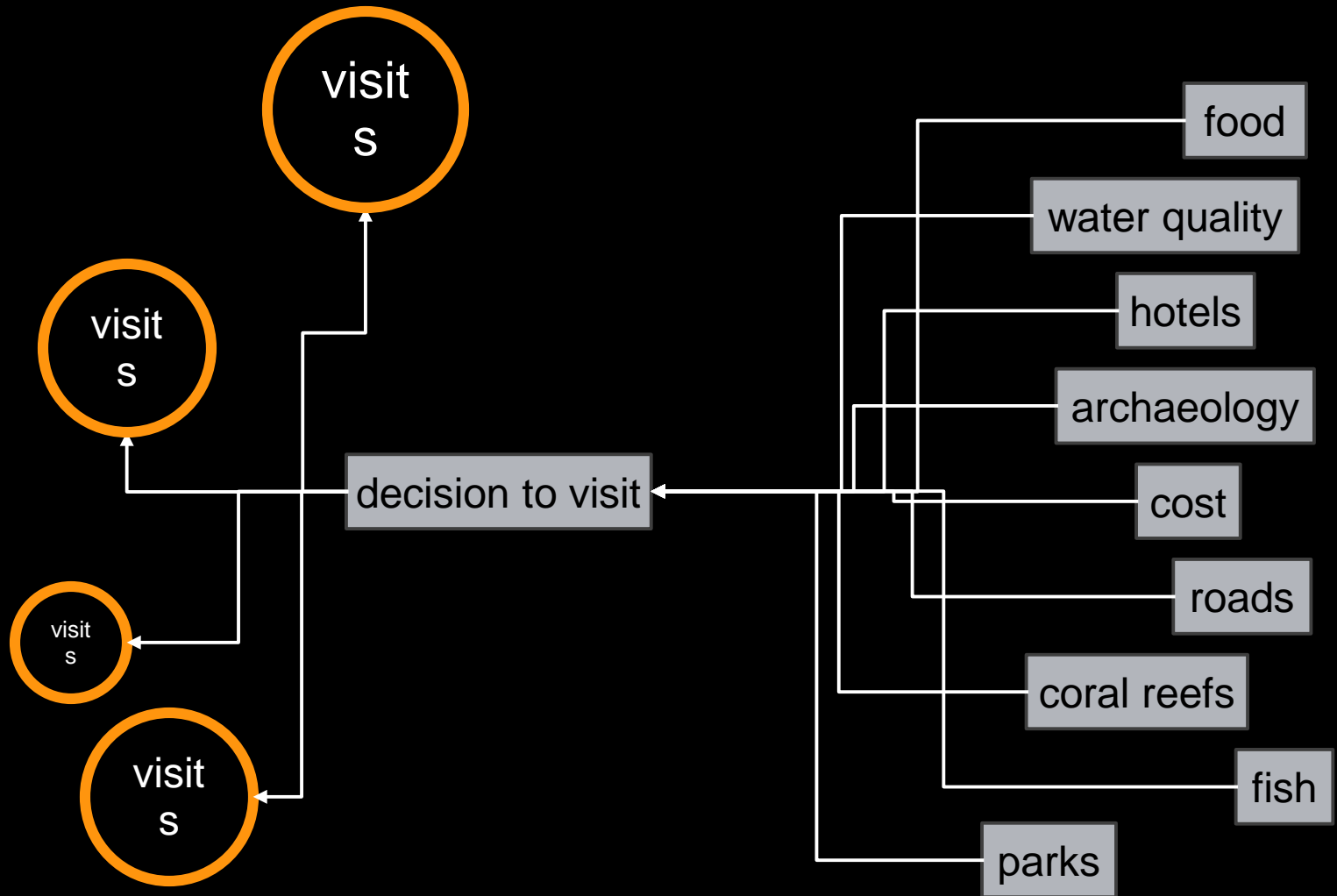
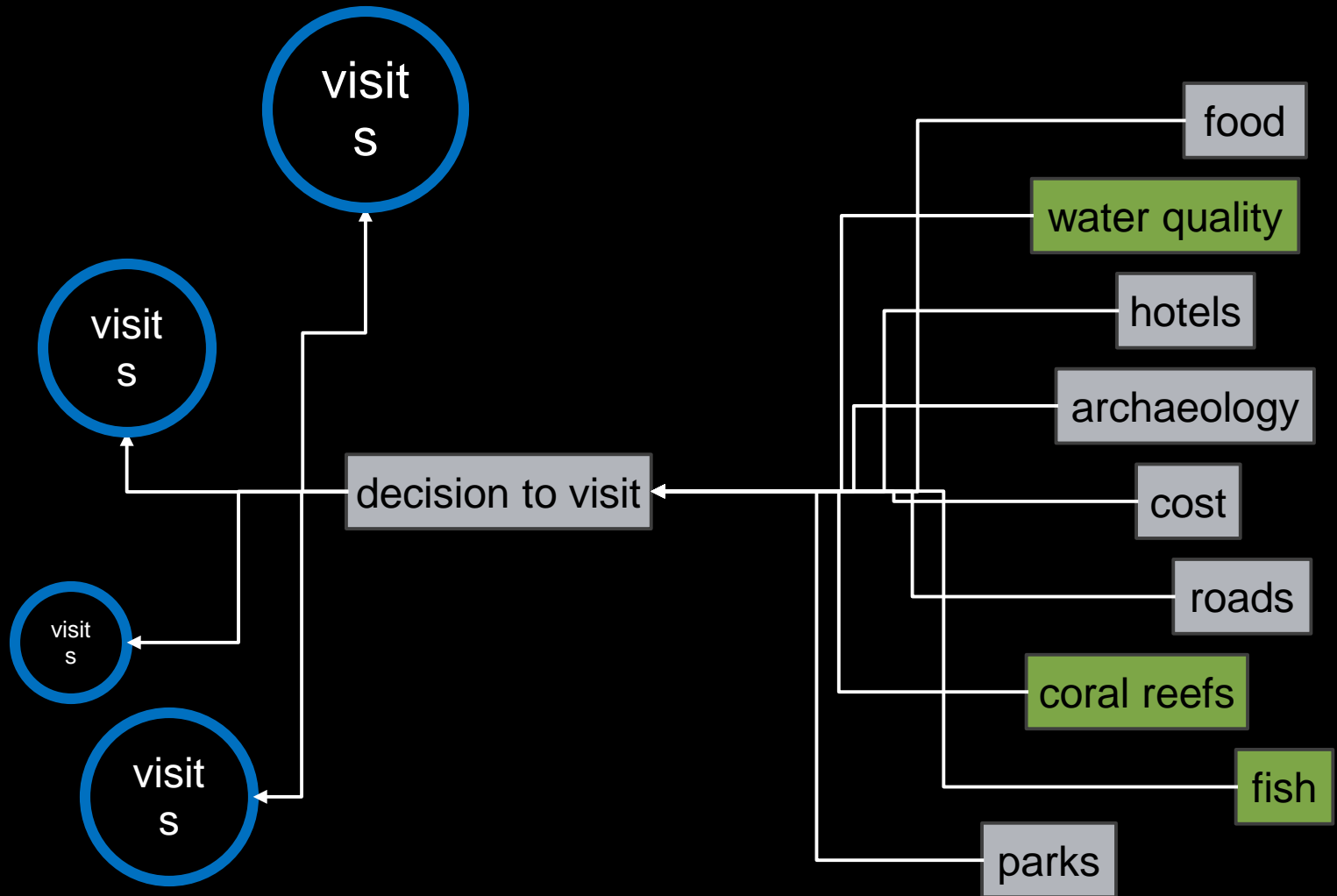


recreation

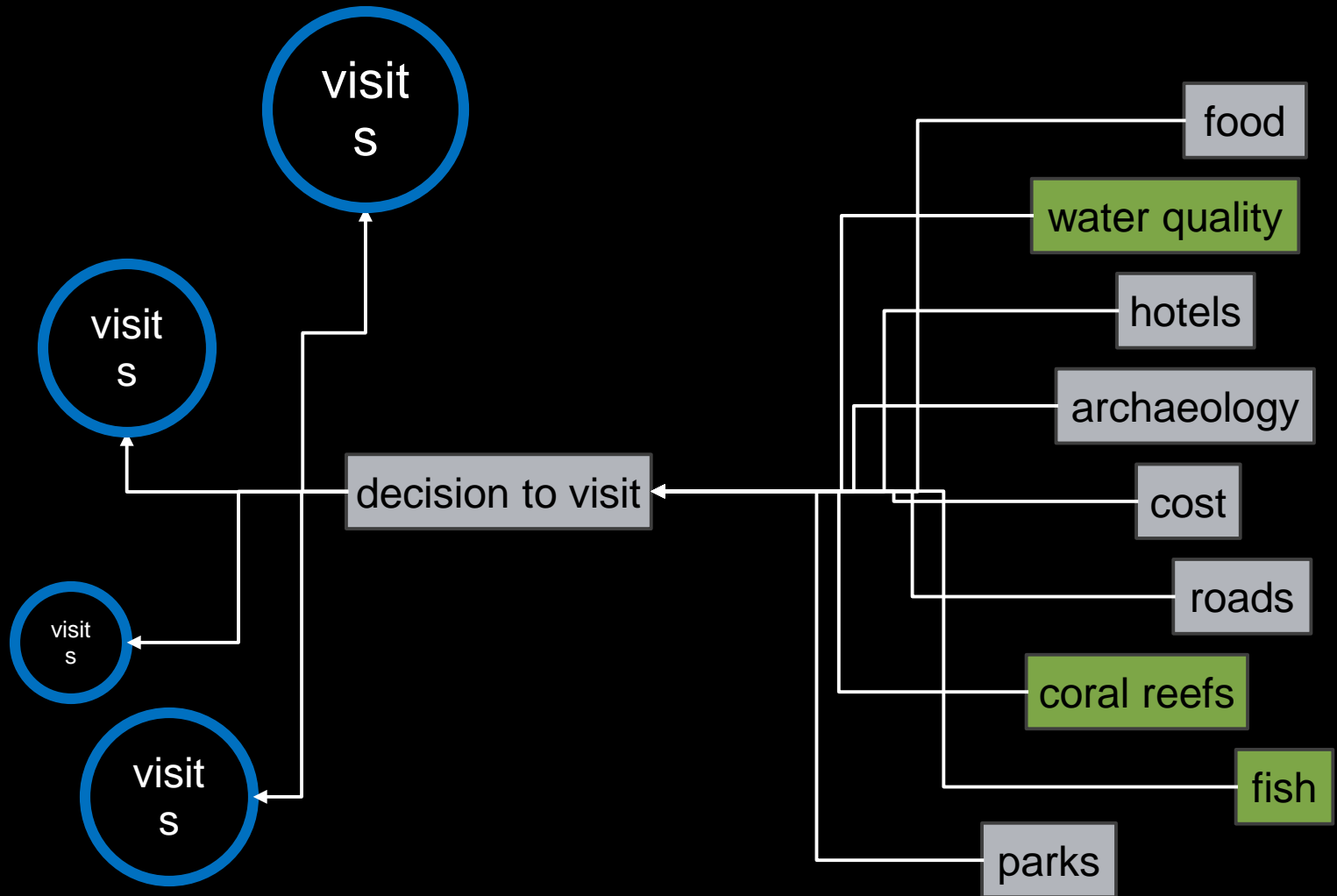
background







visitation rate = predictor + predictor + predictor + predictor



visitation rate = predictor + predictor + predictor + predictor

shellfish collectors = **development** + water quality + abundance + area + access + substitutes

refuge visitors = **ocean** + park area + income + population

wildlife viewers = area + income + population

park visitors = **water activities** + park age + camping + distance to city + distance to town

park visitors = **income** + park age + year

national park visitors = **area** + **fees** + population + substitutes + income + fame

park visitors = **recreational activities** + distance to city + habitats (#) + trails

park visitors = **canyons** + **historic sites** + area + population + boating + wildlife viewing

park visitors = **campsites** + **Lake Superior** + distance to city + population + habitats (#) + trails + bird habitat + bird species + development + built capital + park area

woodland visitors = **population** + **forest attributes** + ownership + parking spaces

etc ...

visitation rate = predictor + predictor + predictor + predictor

shellfish collectors = **development** + water quality + abundance + area + access + substitution

refuge visitors = **ocean** + park area + income + population

wildlife viewers = area + income + population

park visitors = **visitation rate** = $\beta_1 \cdot \text{predictor} + \beta_2 \cdot \text{predictor} + \dots$ distance to town

park visitors = **income** + park age + year

national park = **context dependent** : each place is different (β_i values) same

park visitors = **recreational activities** + distance to city + habitats (#) + trails

park visitors = **canyons** + **historic sites** + area + population + boating + wildlife viewing

park visitors = **campsites** + **Lake Superior** + distance to city + population + habitats (#)

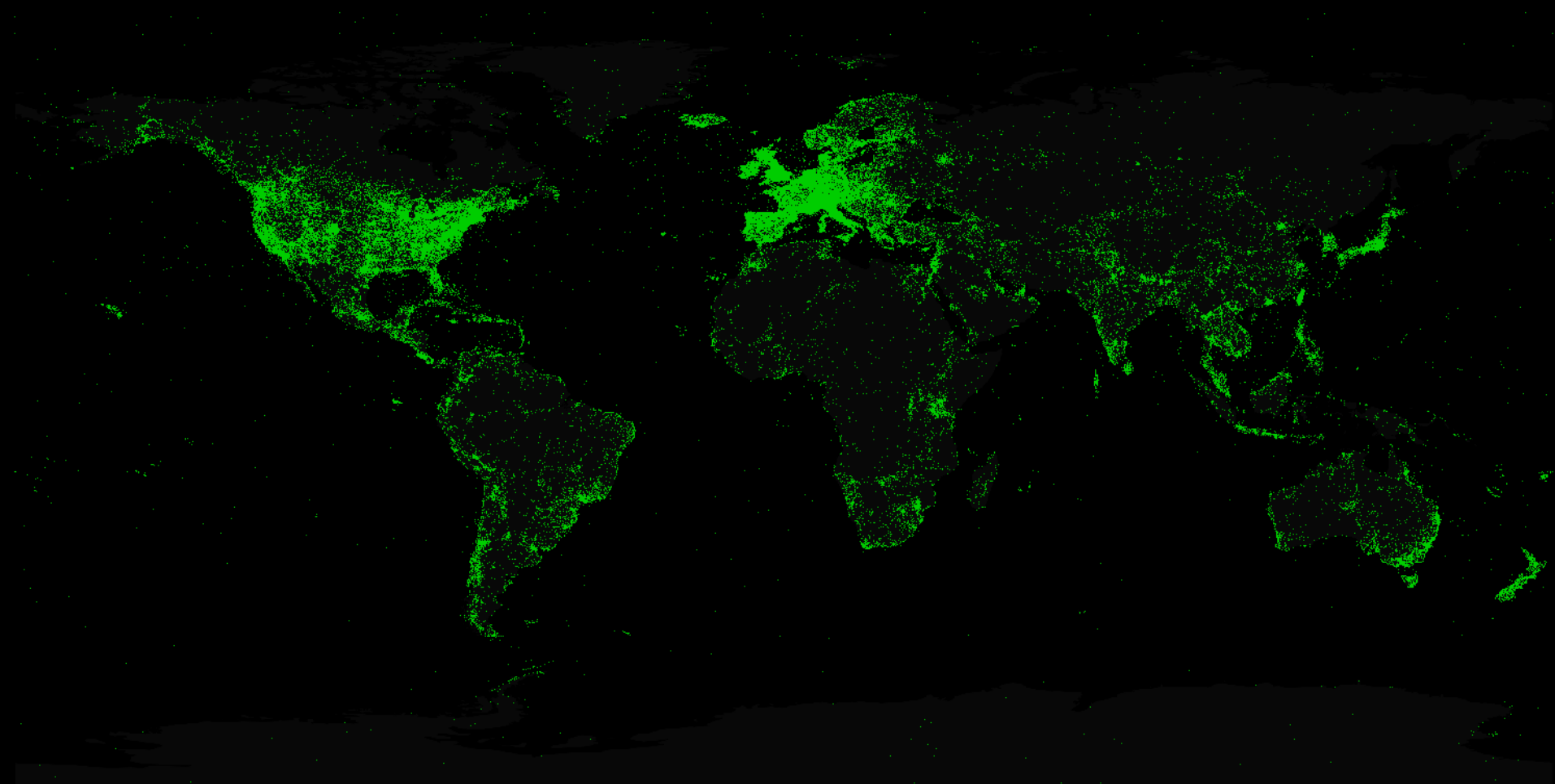
+ trails + bird habitat + bird species + development + built capital + park area

woodland visitors = **population** + **forest attributes** + ownership + parking spaces

etc ...

proxy data

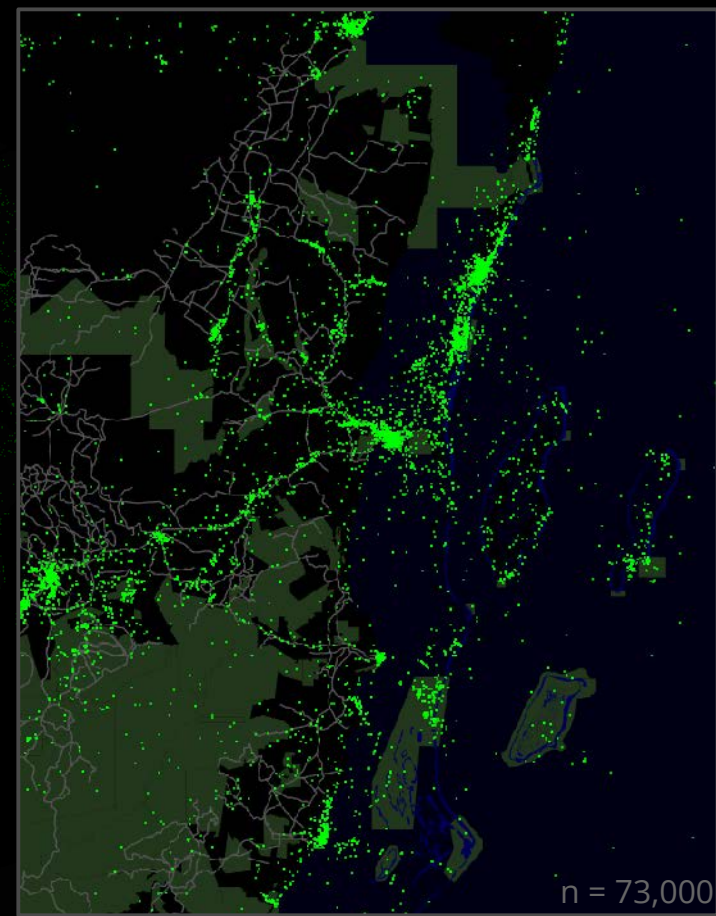
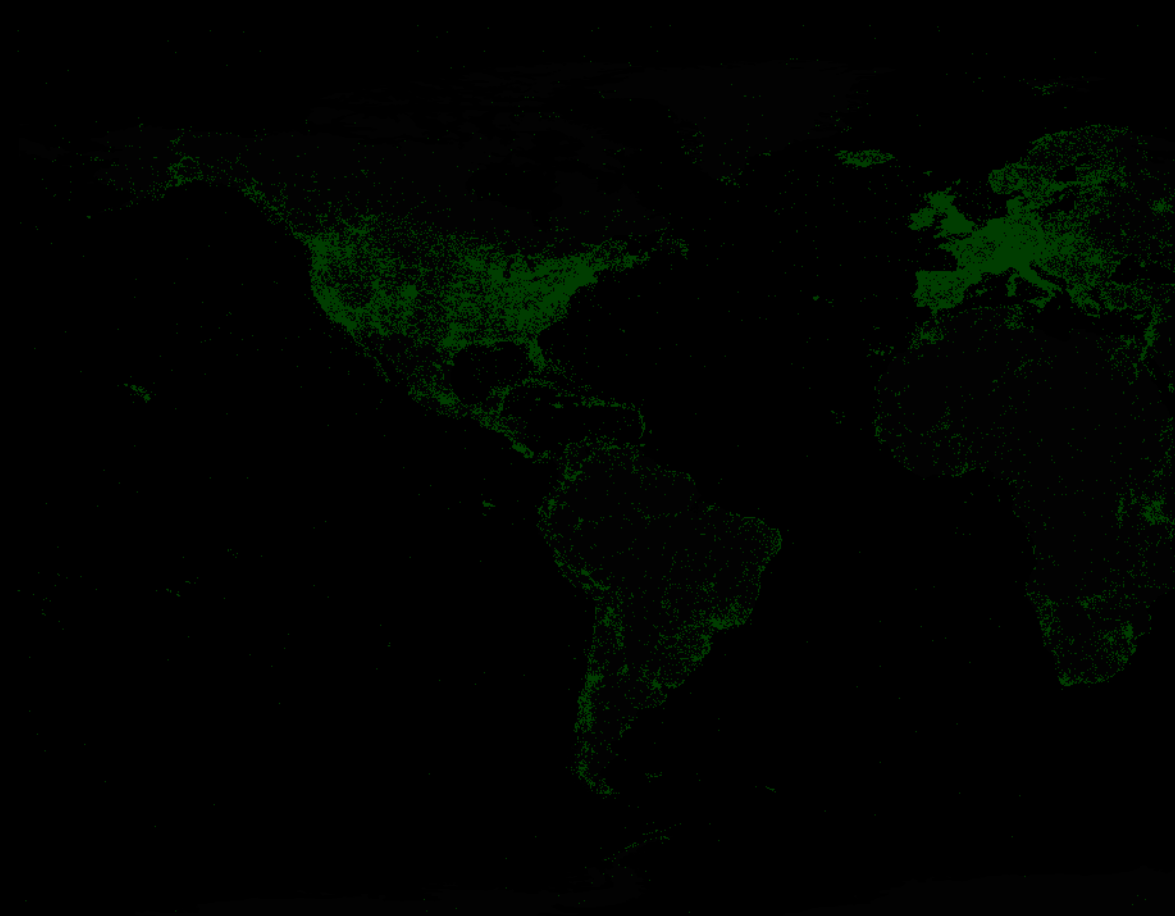
flickr photos



n = 200 million

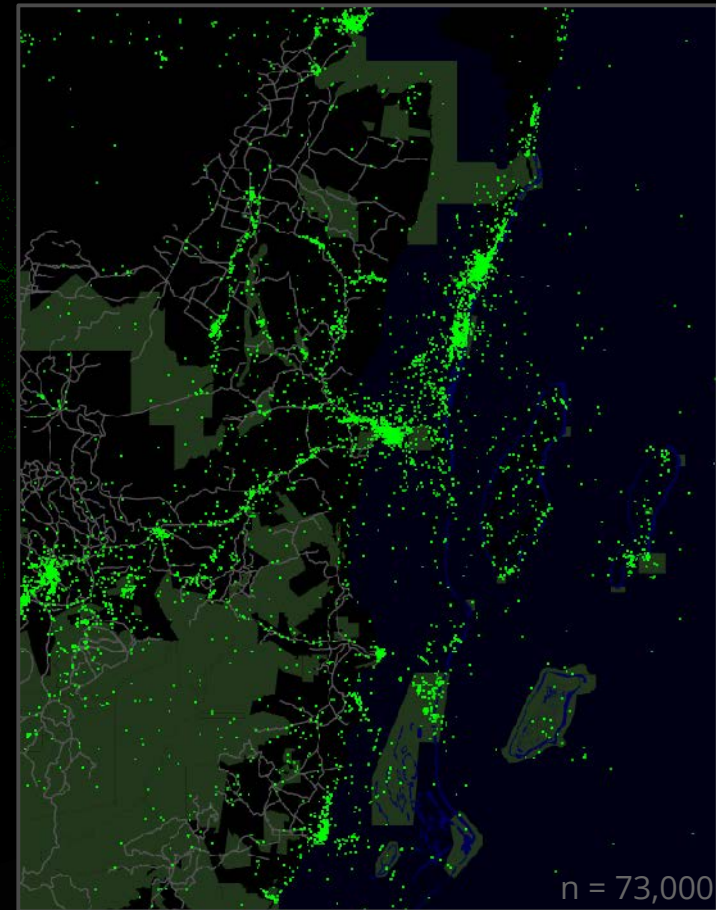
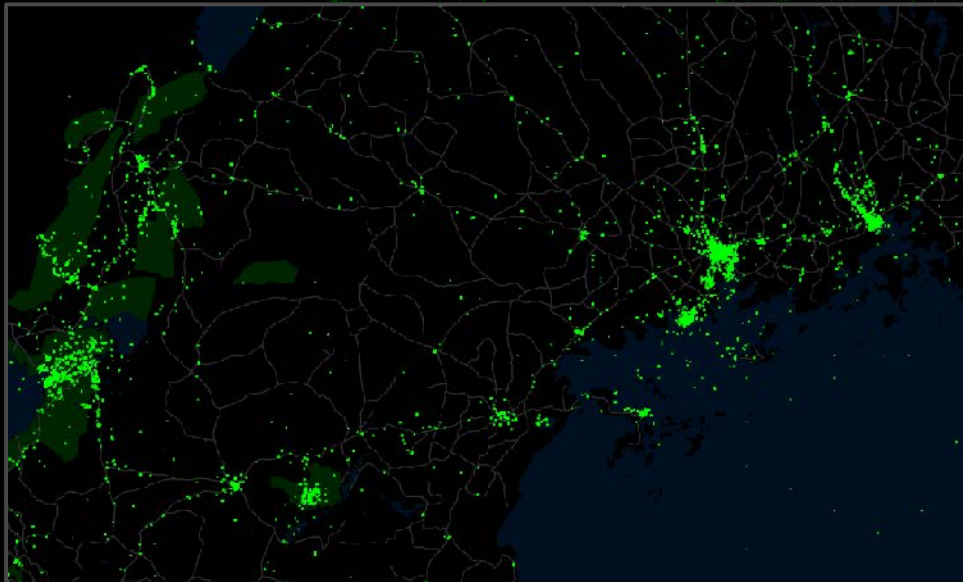
proxy data

flickr photos



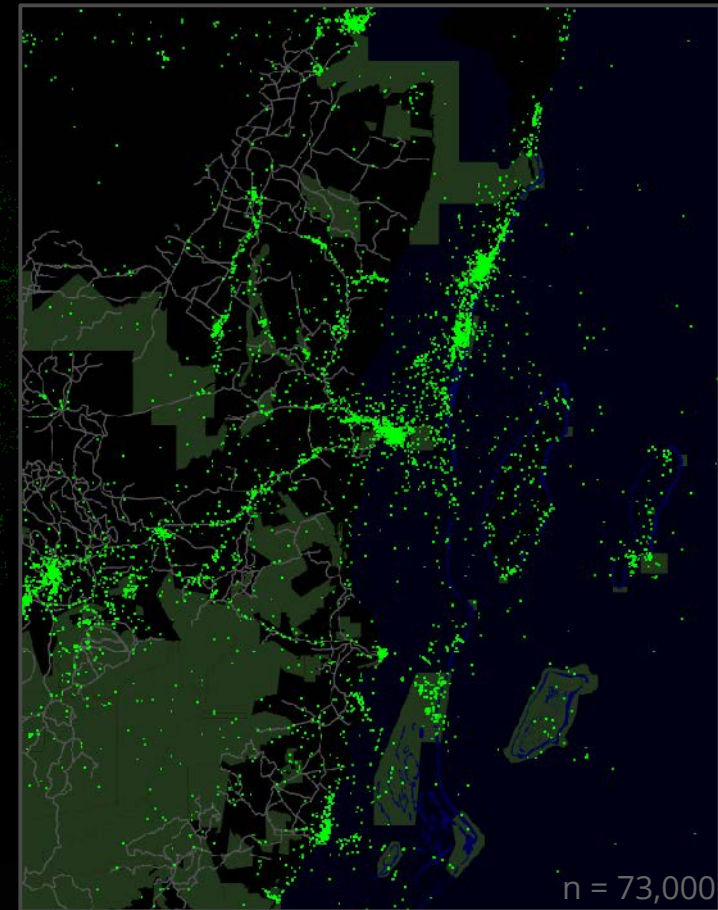
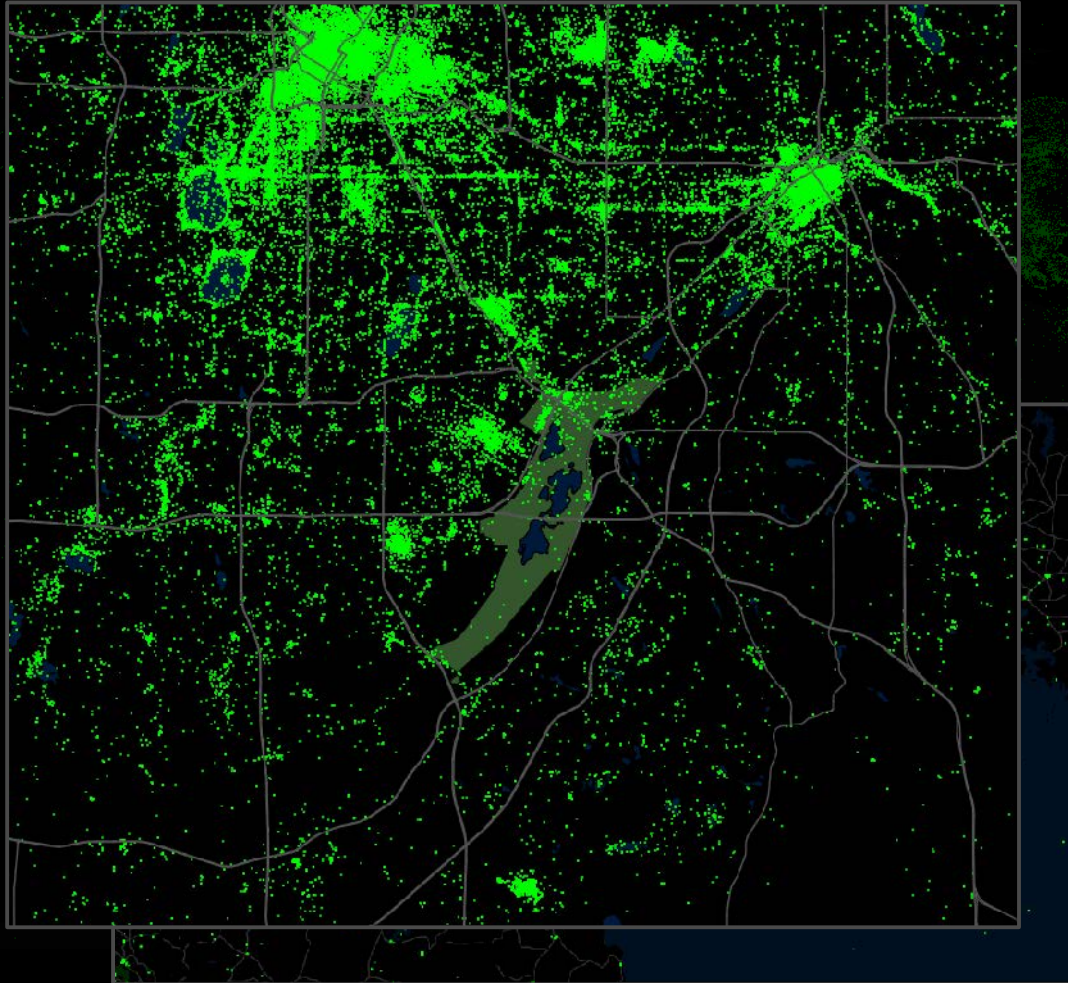
proxy data

flickr photos



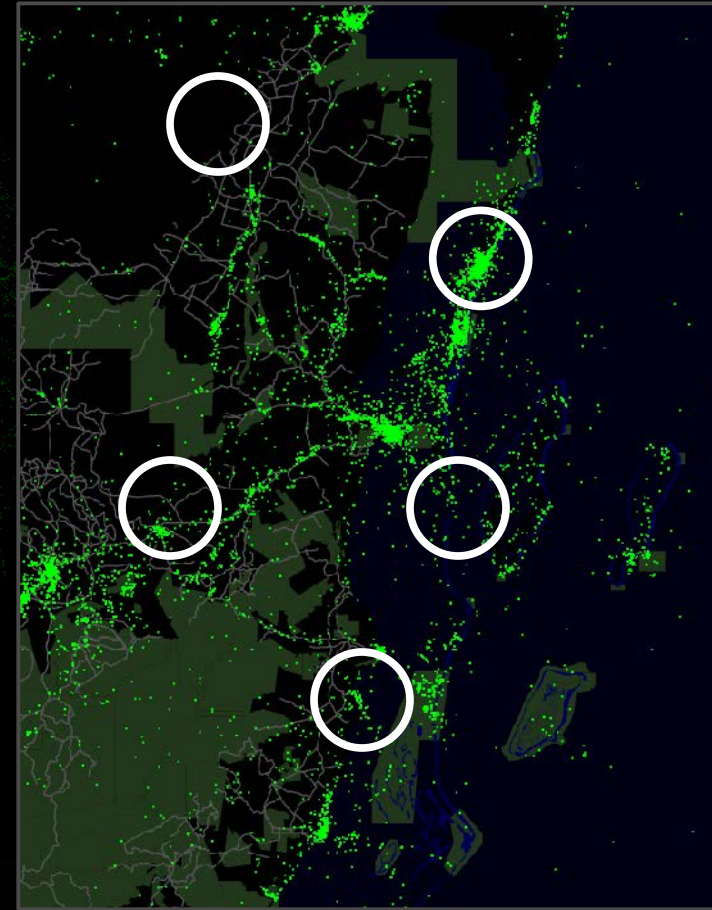
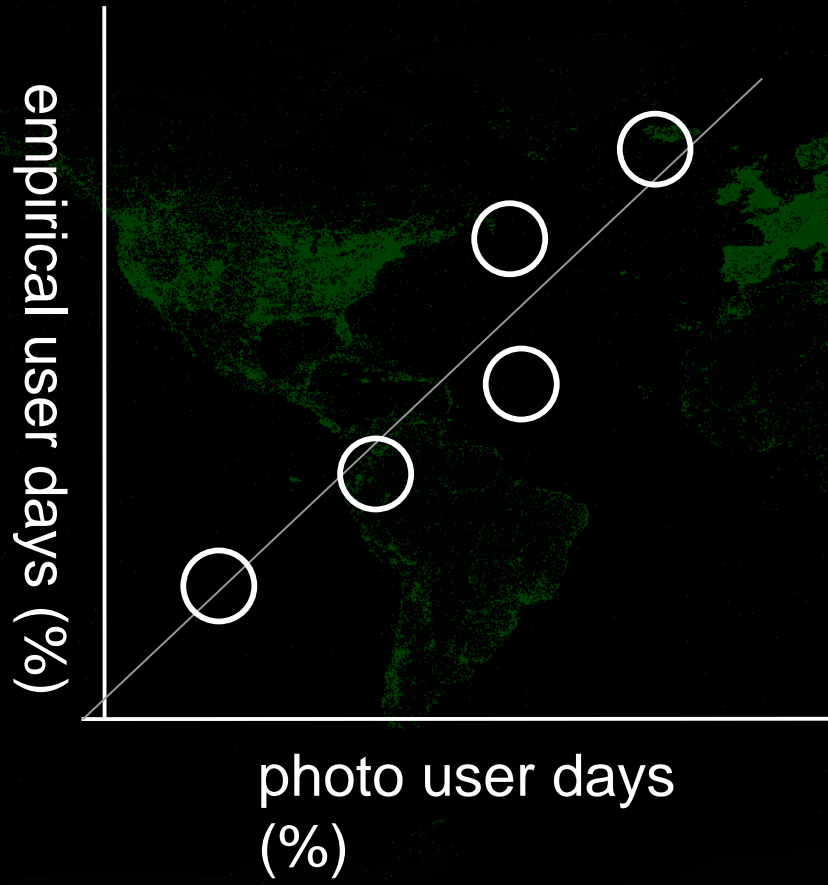
proxy data

flickr photos

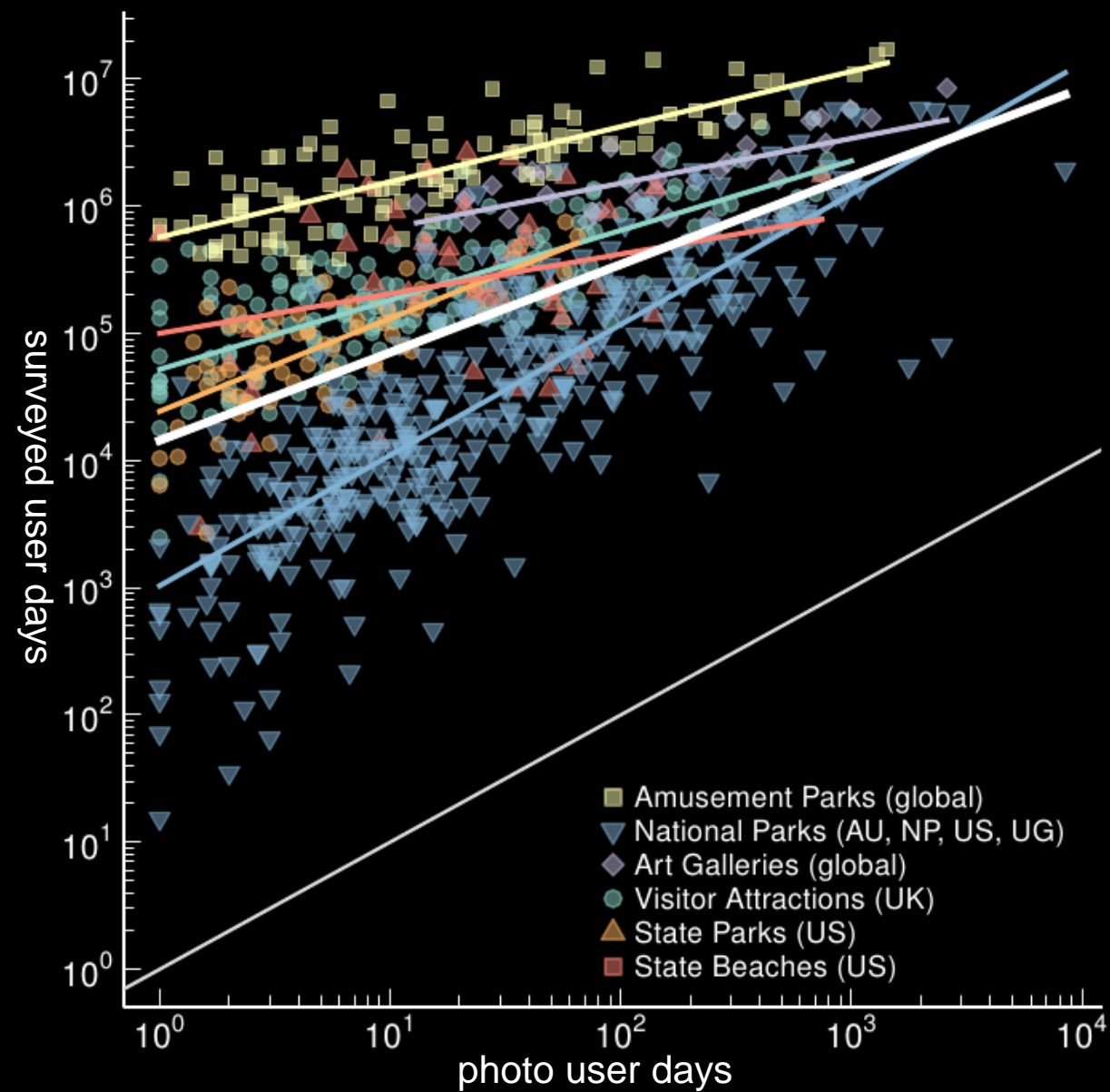


proxy data

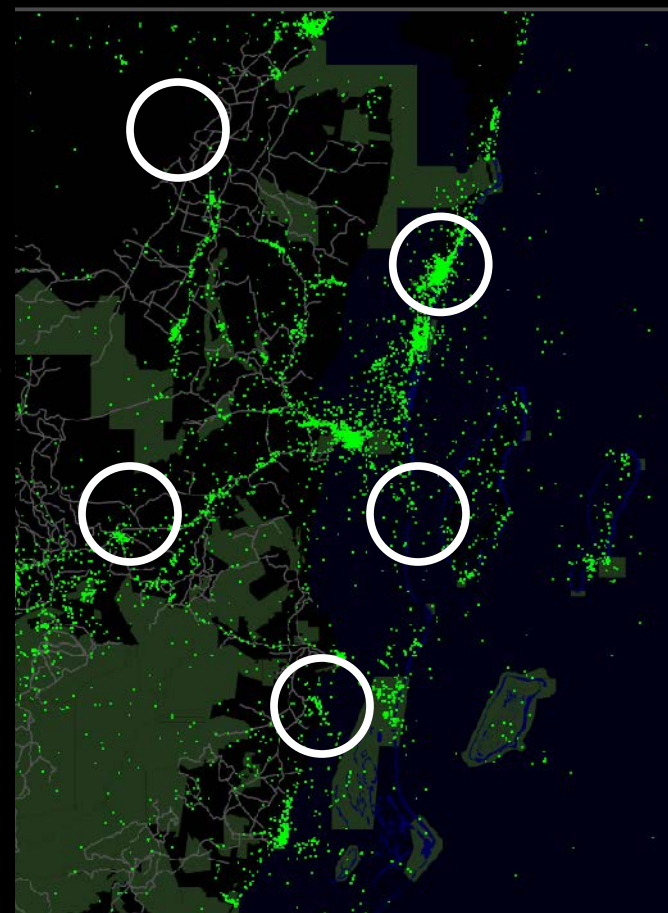
flickr photos



proxy data



flickr photos





OPEN

SUBJECT AREAS:
SOCIOECONOMIC
SCENARIOS
CONSERVATION
ENVIRONMENTAL ECONOMICS
ECOSYSTEM SERVICES

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Using social media to quantify nature-based tourism and recreation

Spencer A. Wood¹, Anne D. Guerry¹, Jessica M. Silver¹ & Martin Lacayo²

¹School of Environmental and Forest Sciences, University of Washington, Seattle, WA, USA, ²Woods Institute for the Environment, Stanford University, Stanford, CA, USA.

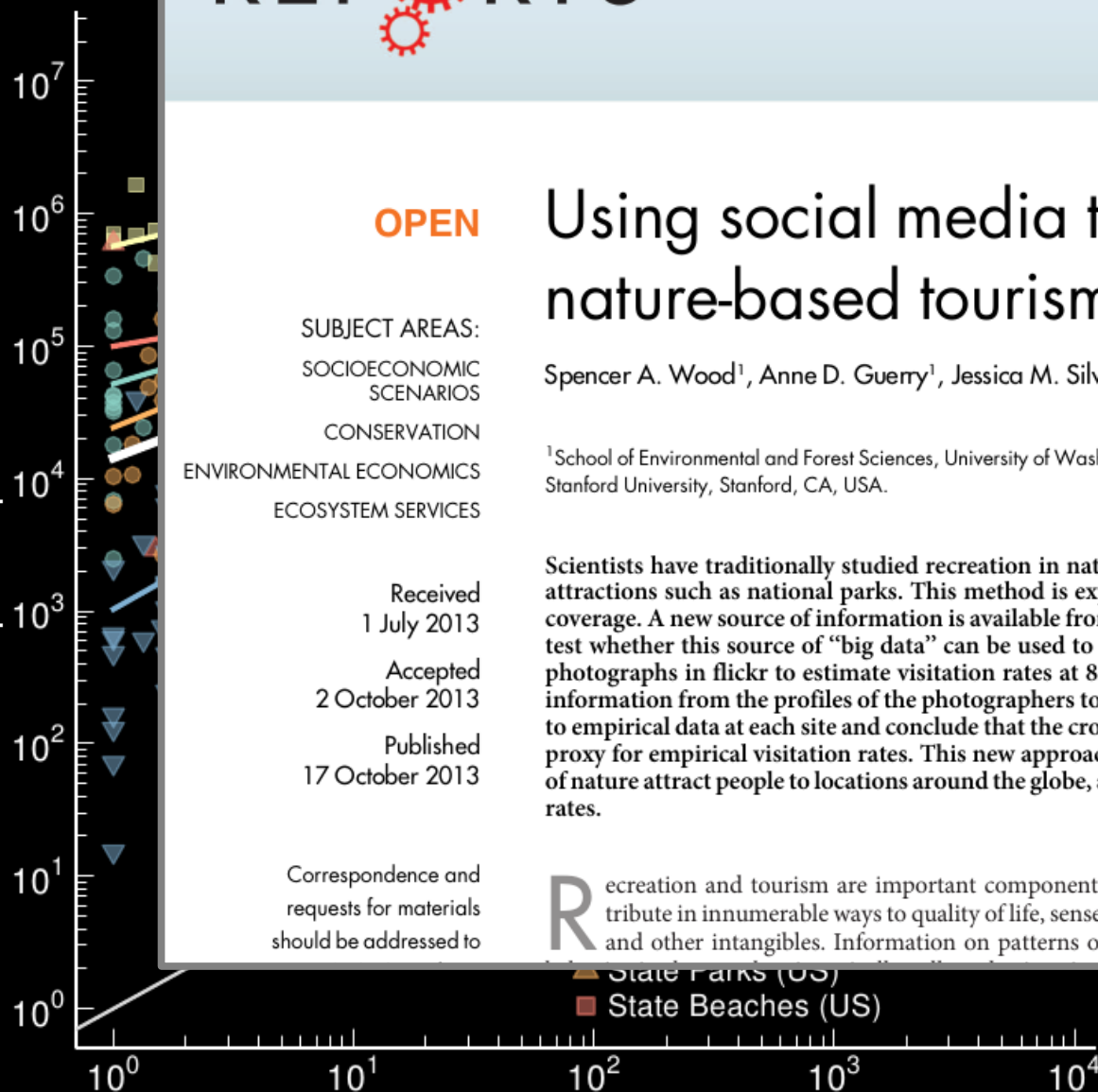
Scientists have traditionally studied recreation in nature by conducting surveys at entrances to major attractions such as national parks. This method is expensive and provides limited spatial and temporal coverage. A new source of information is available from online social media websites such as flickr. Here, we test whether this source of “big data” can be used to approximate visitation rates. We use the locations of photographs in flickr to estimate visitation rates at 836 recreational sites around the world, and use information from the profiles of the photographers to derive travelers’ origins. We compare these estimates to empirical data at each site and conclude that the crowd-sourced information can indeed serve as a reliable proxy for empirical visitation rates. This new approach offers opportunities to understand which elements of nature attract people to locations around the globe, and whether changes in ecosystems will alter visitation rates.

Recreation and tourism are important components of many national and local economies and they contribute in innumerable ways to quality of life, sense of place, social connection, physical wellbeing, learning, and other intangibles. Information on patterns of recreation and tourism and the factors that influence

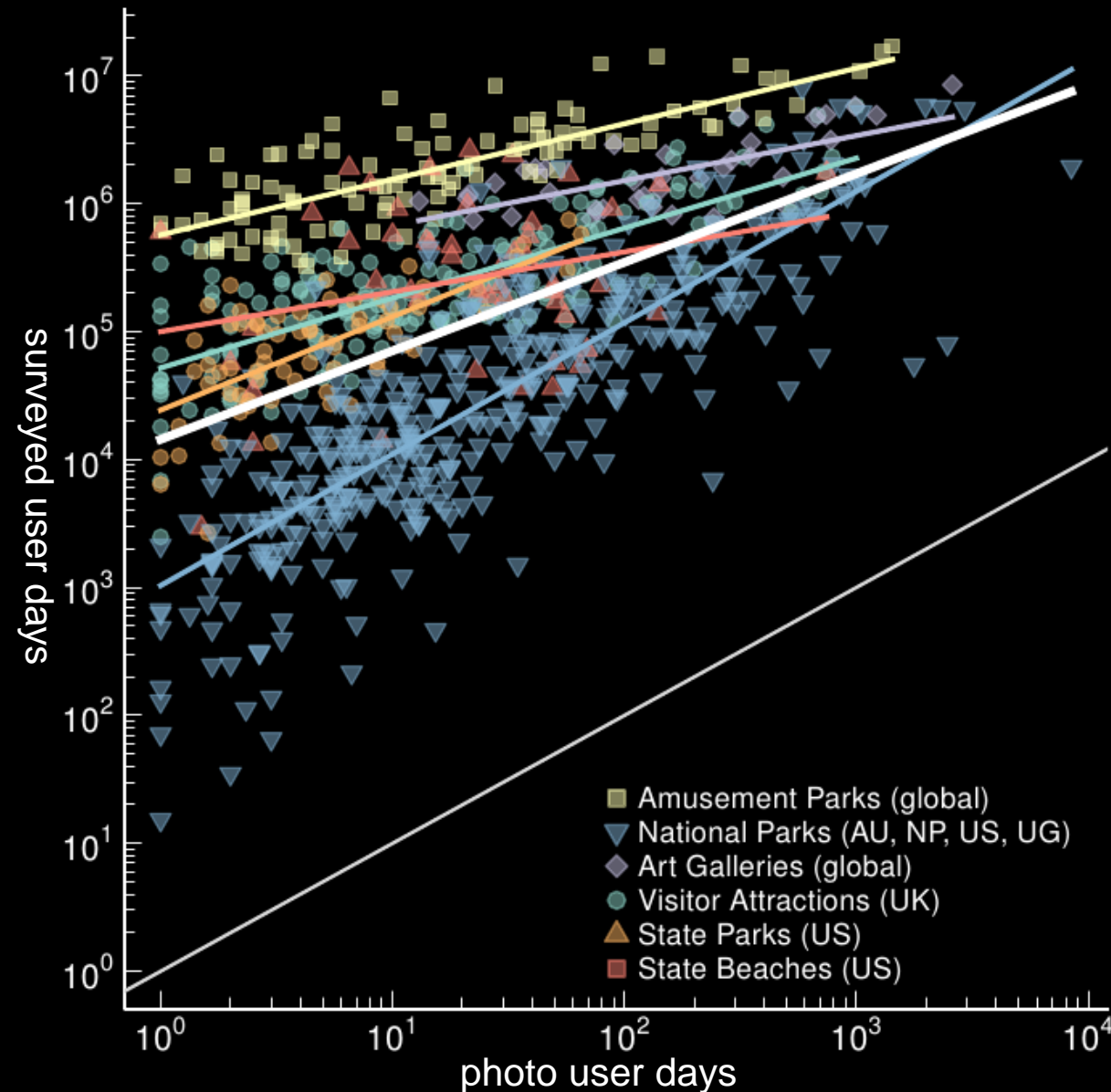
State Parks (US)
State Beaches (US)

surveyed user days

photo user days



proxy data



Pros

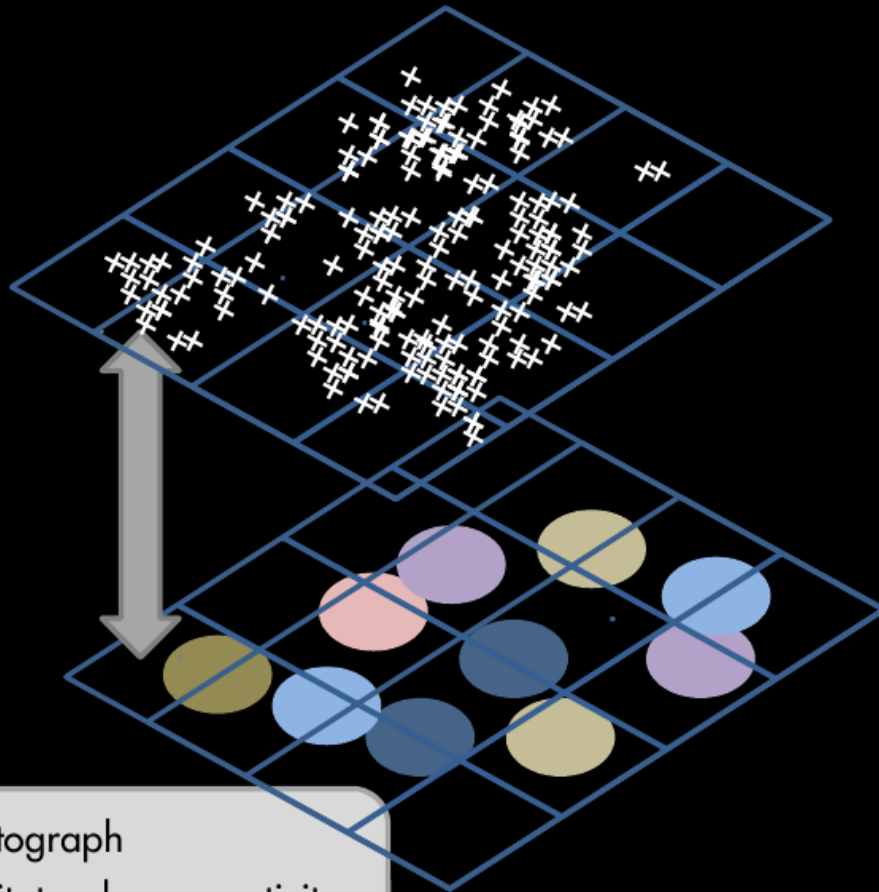
data availability
related to real
visitation

And Cons

electro-device-owners
biases in photo-
density

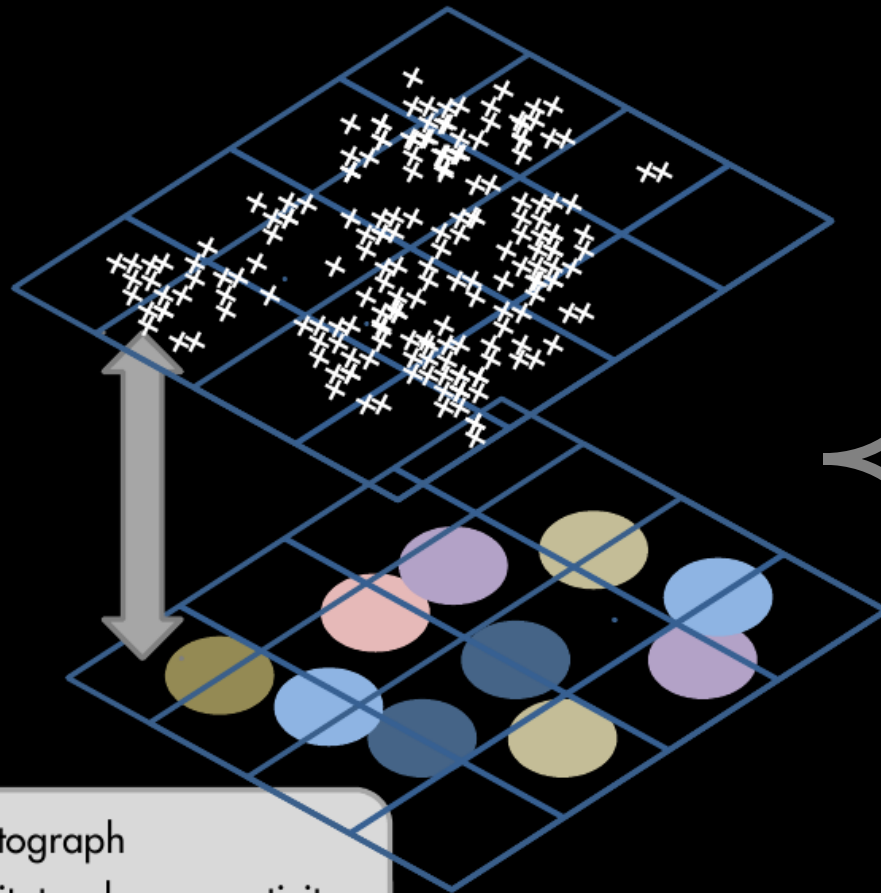
- at different scales
- un/developed countries

visitation rate = f (habitats and human activities)

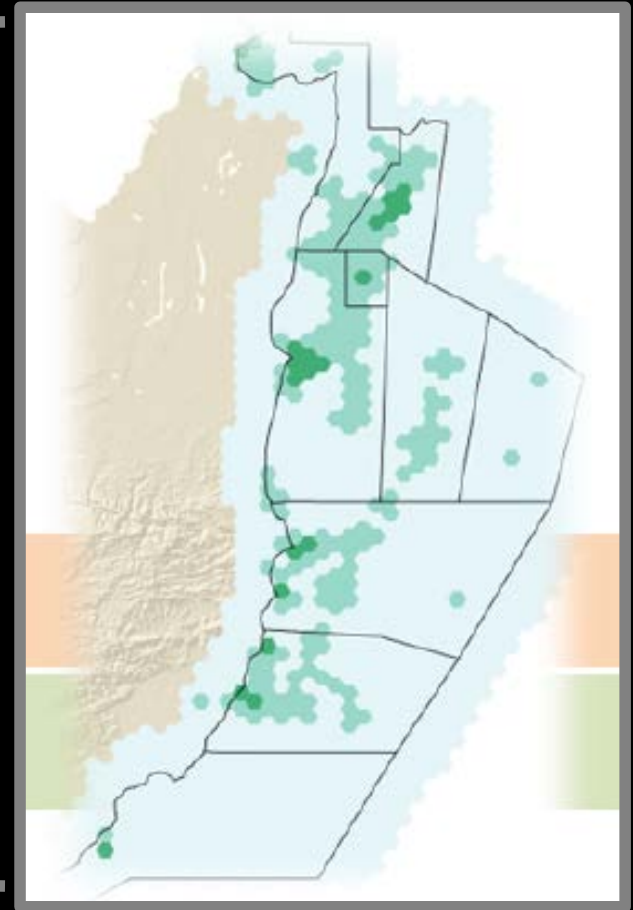


- × photograph
- ■ habitat or human activity
(eg, coral, aquaculture)

visitation rate = f (habitats and human activities)



- × photograph
- habitat or human activity
(eg, coral, aquaculture)





InVEST



integrated valuation of
environmental services
and tradeoffs


Recreation Model - Initial Run


File Development


InVEST Version dev476:2.5.6 [24fb26dae2] (32bit) | [Model documentation](#) | [Report an issue](#)


✓ Workspace  



✓ Area of Interest  


☐ Grid AOI 

Grid type 

Cell size 




Comments 

✓ Data Directory  

☒ Download Data 

☐ Use global datasets.

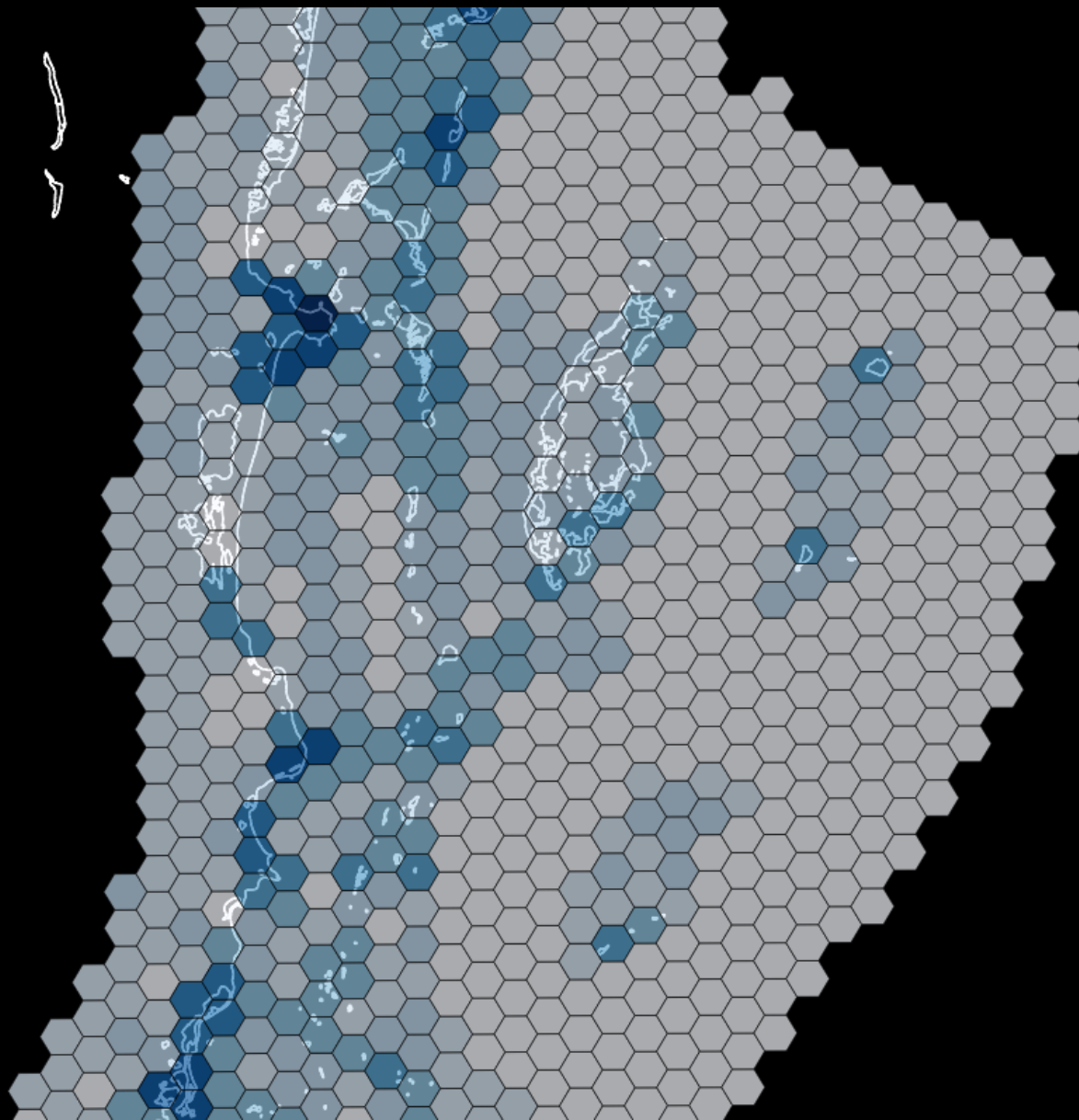
Parameters have been loaded from the most recent run of this model. [Reset to defaults](#)

 Reset  Run  Quit

visitor-days per year

invest model

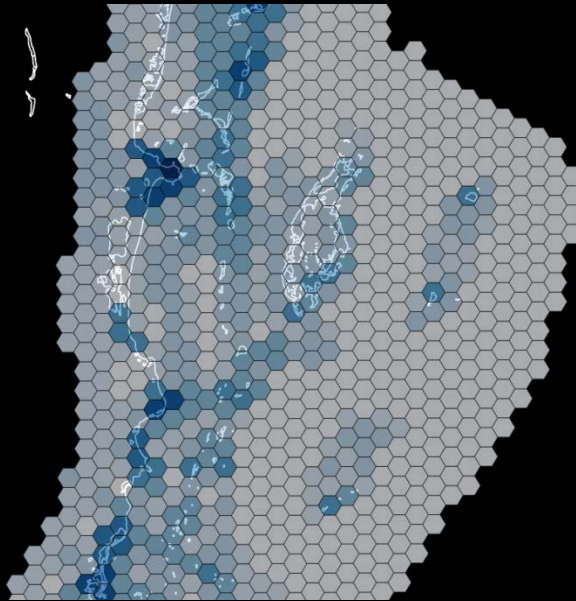
current



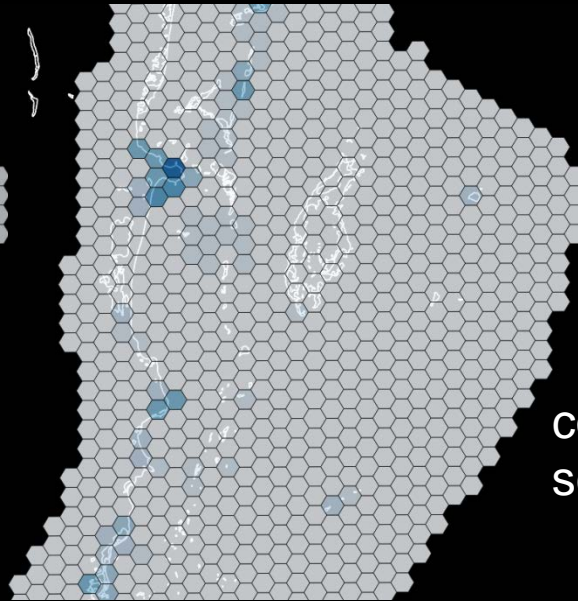
visitor-days per year

invest model

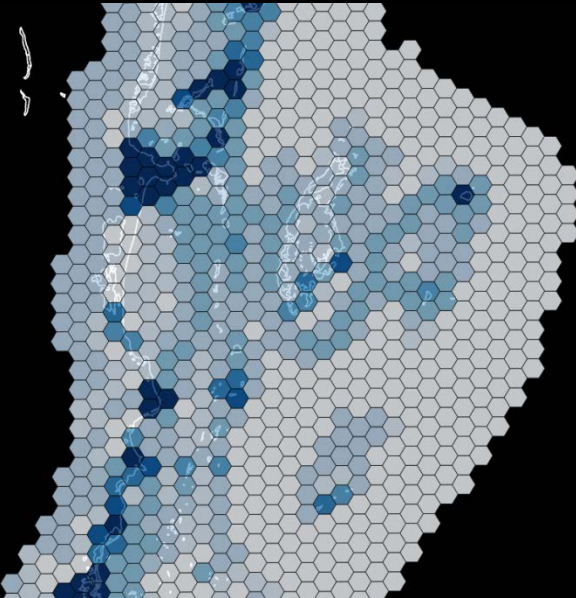
current



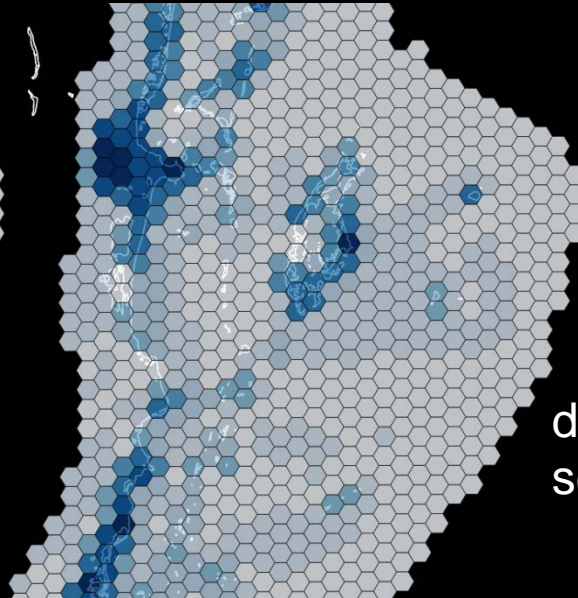
conservation
scenario



informed
management
scenario



development
scenario



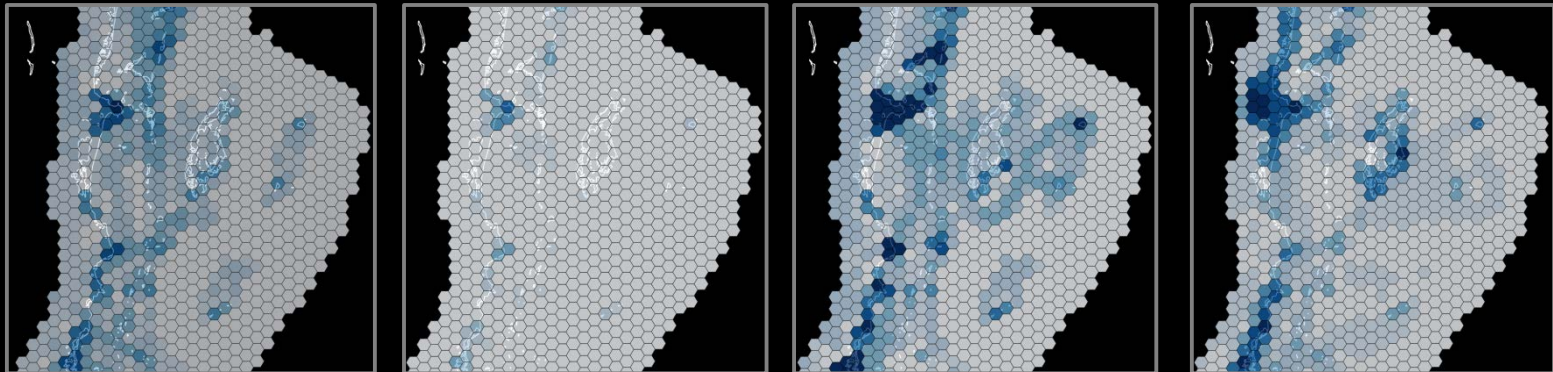
Assumptions and Limitations

photographs as a proxy for visitation

people's preferences do not change over time

linear regression versus random utility models
(eg)

monetary value as expenditures versus travel
costs



Belize Coastal Zone

visitation rate and expenditures
related to coastal development, corals, mangroves, industries,
etc

(Arkema et al. In press. PNAS.)

Freeport Texas Salt Marshes

visitation rate and expenditures
related to salt marsh and expansion of an industrial facility

(Walsh et al. In review.)

Lakes of Minnesota and Iowa

visitation rate, travel time, travel cost
related to water quality, built facilities,
(Keeler et al. 2015. Frontiers in Ecology and the Environment.)