Outdoor Recreation on State Lands in Washington

What Mobile Device Data Reveal About Visitation

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EARTH ECONOMICS

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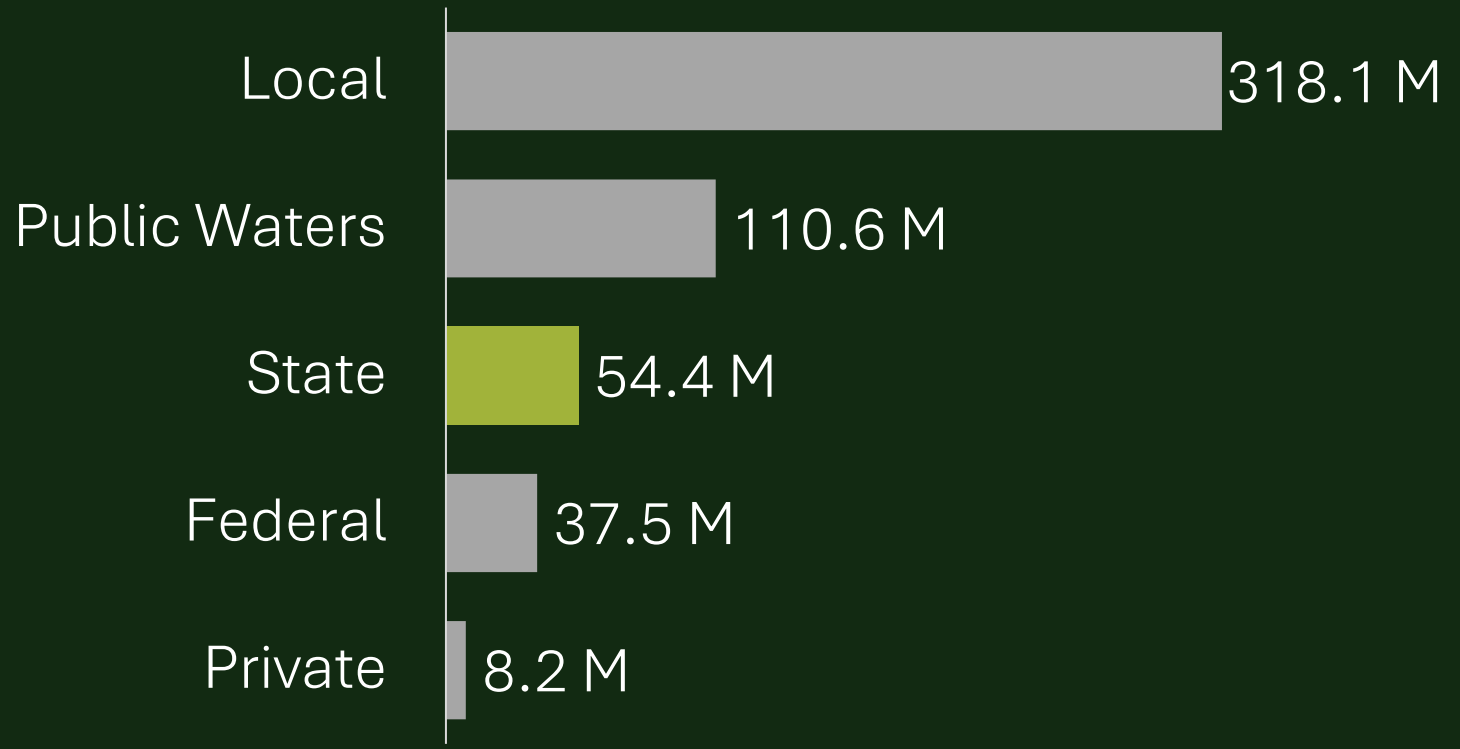
ACES Session 10

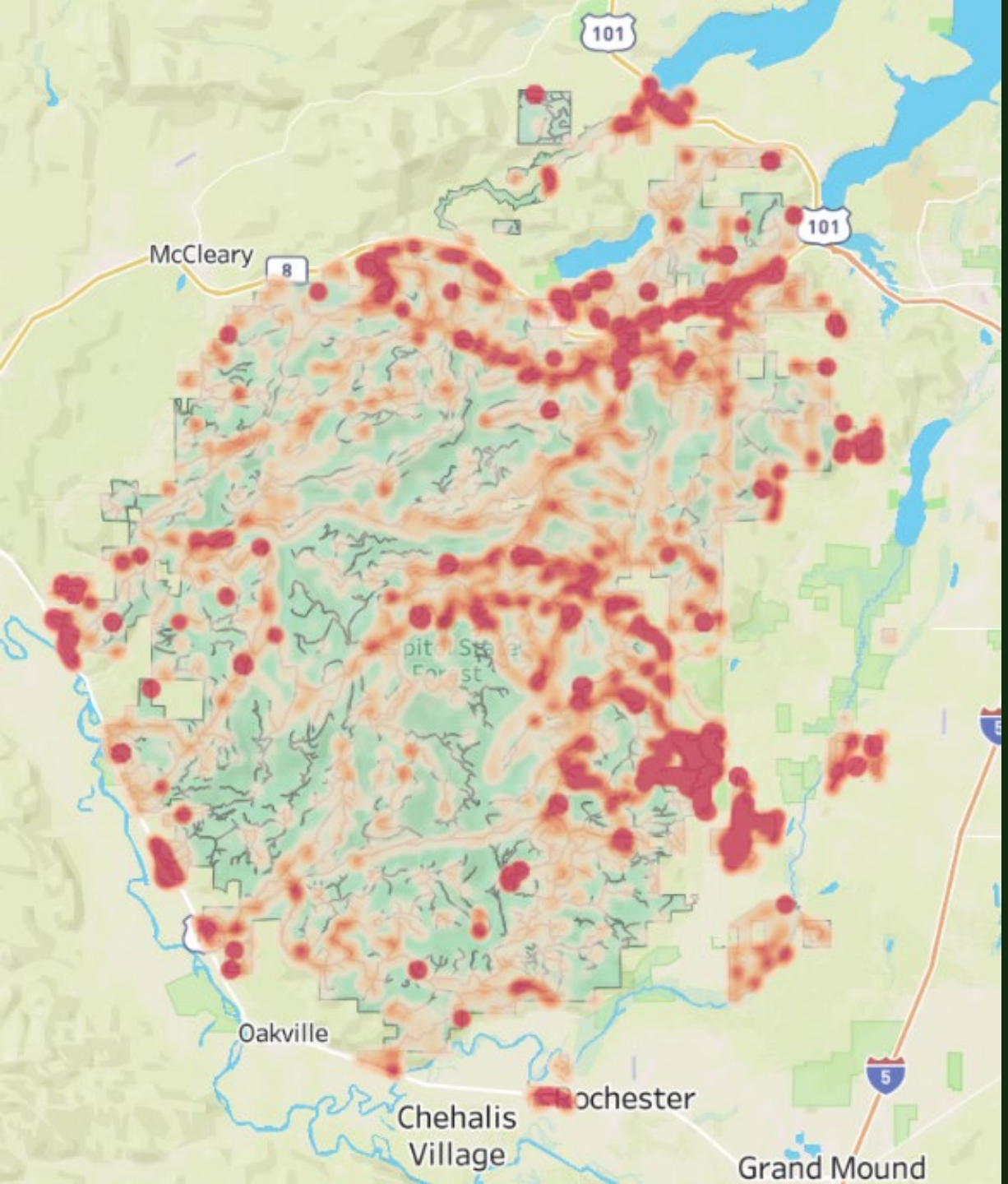
Statewide Outdoor Recreation **Visits**

2019



Tracking Outdoor Visitation **is Challenging**

- Multiple (often uncontrolled) access points
- Property boundaries difficult to identify on the ground
- Diverse & dispersed activities
- Limited resources to count visitors
- Differing methodologies (vehicle counters vs. people counters)



Project **Objective**

Estimate visitation for lands with no records:

- Anonymized mobile device data
- Management unit attributes (size, ft. of shoreline, etc.)
- Control variables (weather, time of year)
- Agencies: State Parks, DFW, DNR

Visitation Data

State Parks Visitor Counts

- January 2019 – December 2023
- 154 sites
- 338,906 data points

WDFW TrafX Vehicle Counter

- January 2019 – June 2021
- 67 sites
- 487 data points

Mobile Devices

Identify visitor types:

- Local v. nonlocal
- Day v. overnight

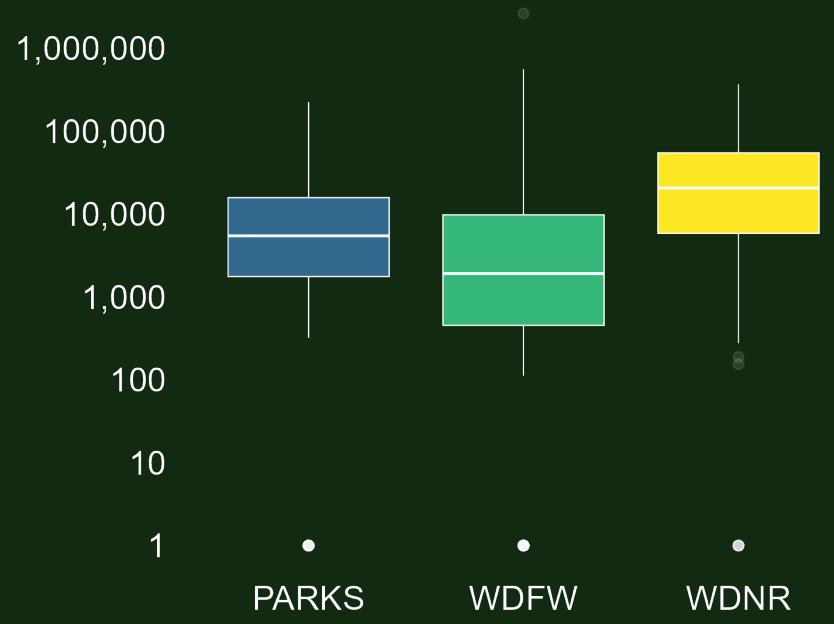
Track visitor origins:

- Common evening location by zip code

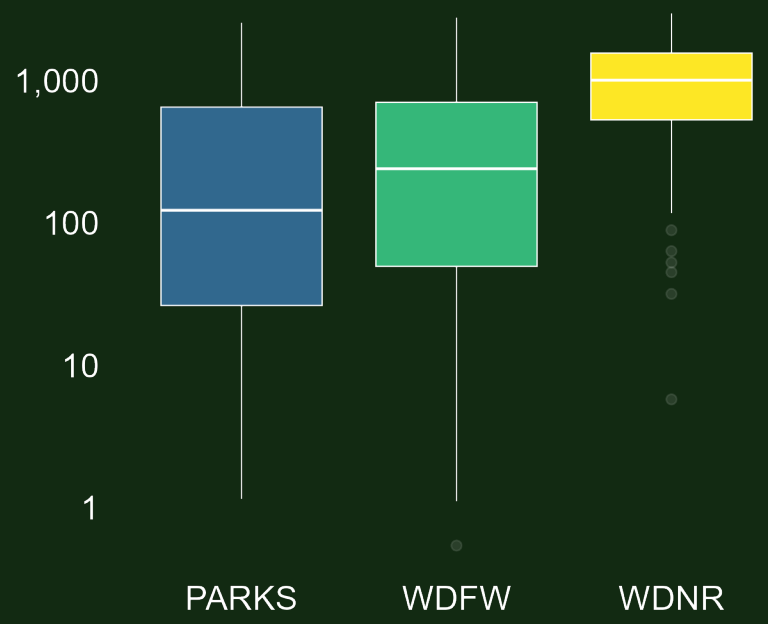
Explanatory **Variables**

Variable	Description	Data Type
State Parks Subregion	Variables describing the area of the state in which the site is located	Dummy
Air Quality Index	The monthly maximum air quality index score at the site	Numeric
Population within 5 miles	Population living within 5 miles of the site	Numeric
Percent developed	Percent of the site that is a developed land cover class	Numeric
Mean elevation	Mean elevation within the site (m)	Numeric
Precipitation	Total monthly precipitation at the site (mm)	Numeric
Feet of shoreline	Length of shoreline within the site boundary (ft)	Numeric
Maximum temperature	The monthly maximum temperature at the site	Numeric
Percent cellular coverage	Percent of the area with cellular coverage (at least 3G)	Numeric
Lockdown	Whether or not WA State was in a COVID-19 lockdown	Dummy
Year	Variables for each year included in the analysis (2019-2023)	Dummy
Month	Variables for each month of the year	Dummy
Unique Device Days	Monthly unique device days, calculated from cellphone pings	Numeric

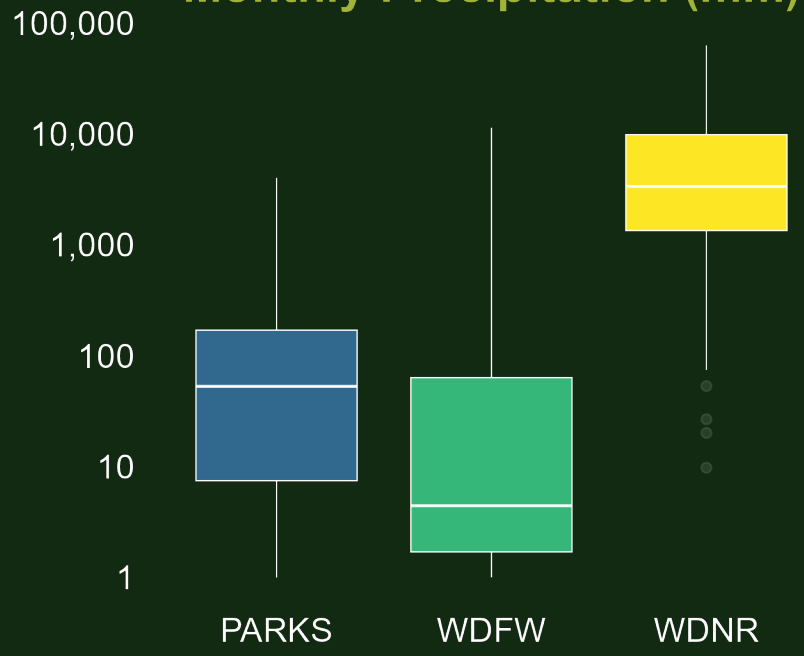
Feet of Shoreline



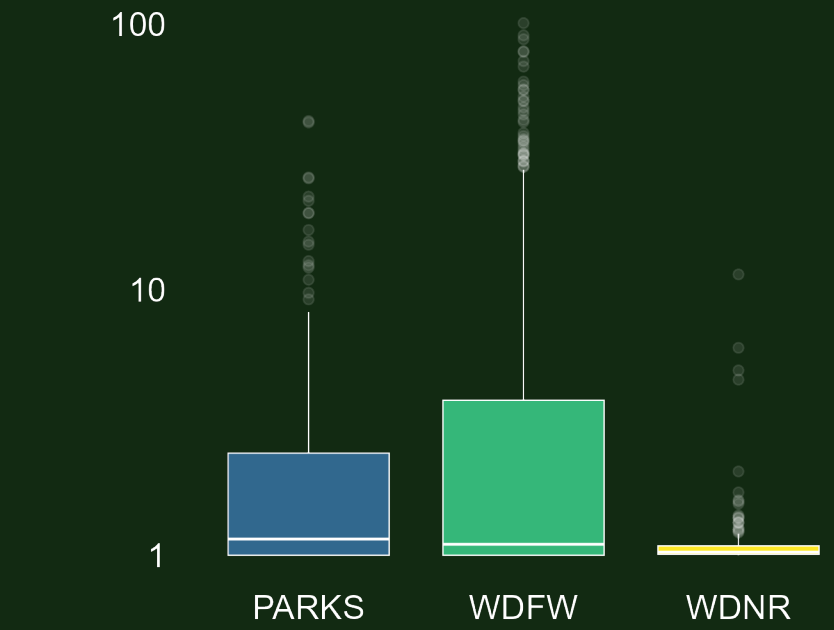
Mean Elevation (m)



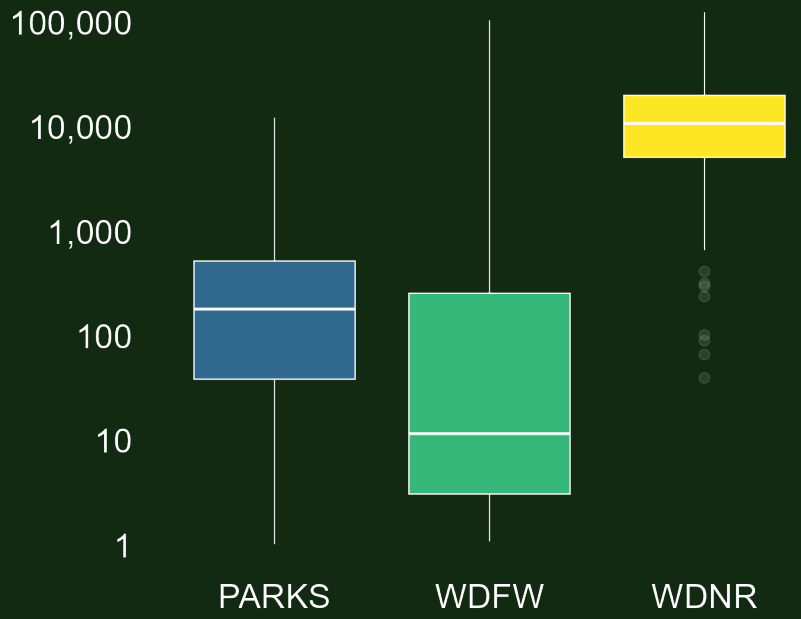
Monthly Precipitation (mm)



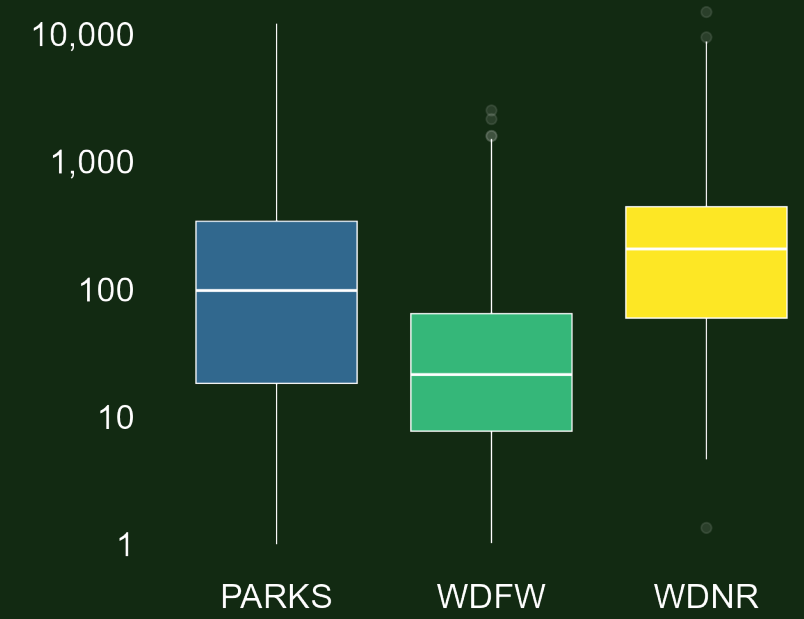
Percent Developed



Site Acres



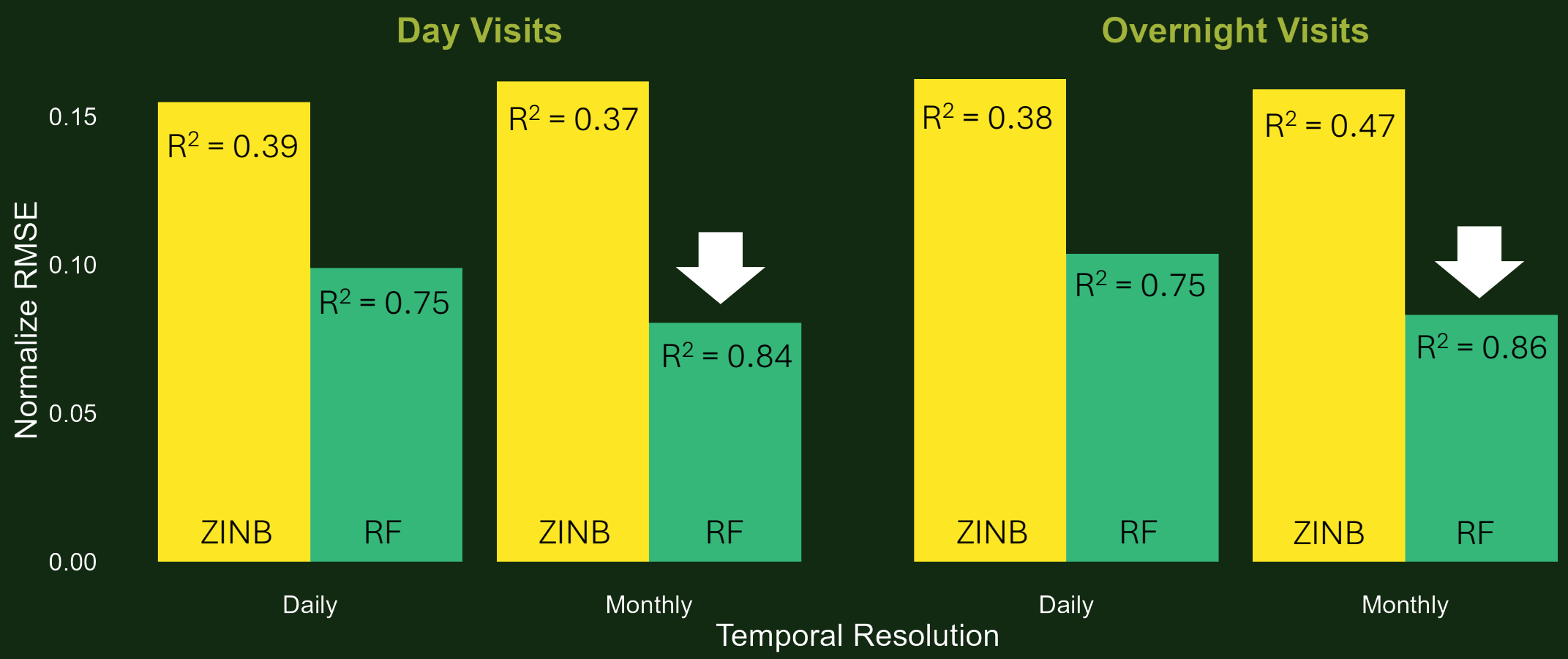
Unique Device Days



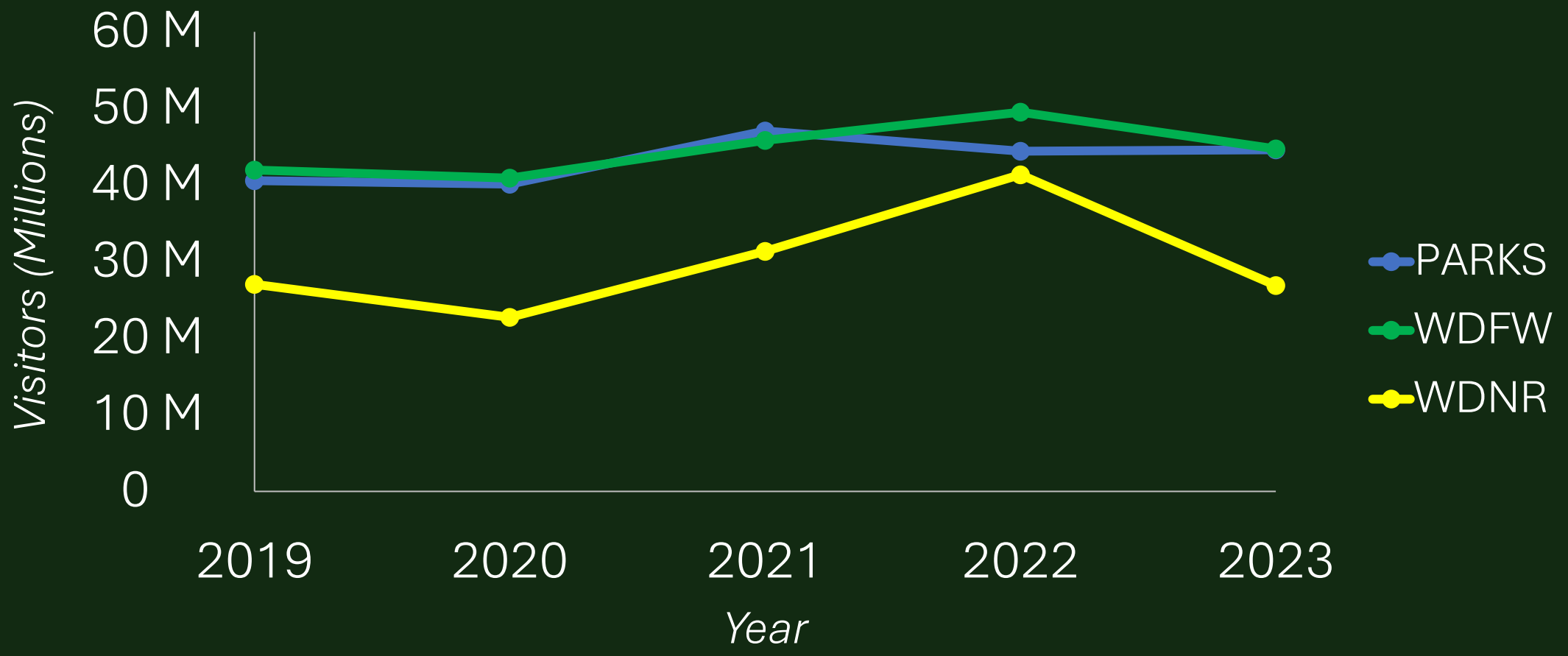
Model **Functional Forms**

	Random Forest Regression	Zero-Inflated Negative Binomial
Handles complex relationships	✓	⚠
Interpretable	⚠	✓
Good with zero-inflated data	⚠	✓
Insensitive to outliers	✓	⚠
Minimal data assumptions	✓	⚠
Computational cost	⚠	✓

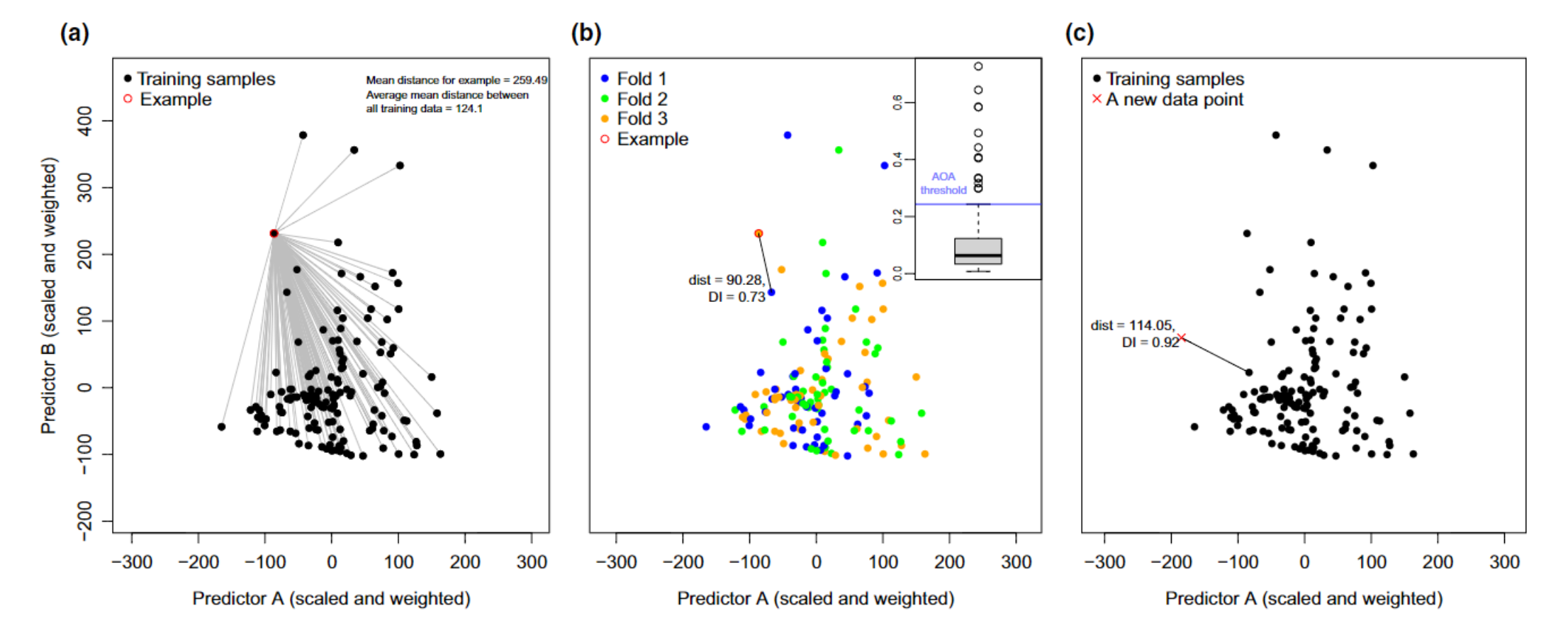
Model **Performance**



Annual Agency **Visitation Predictions**

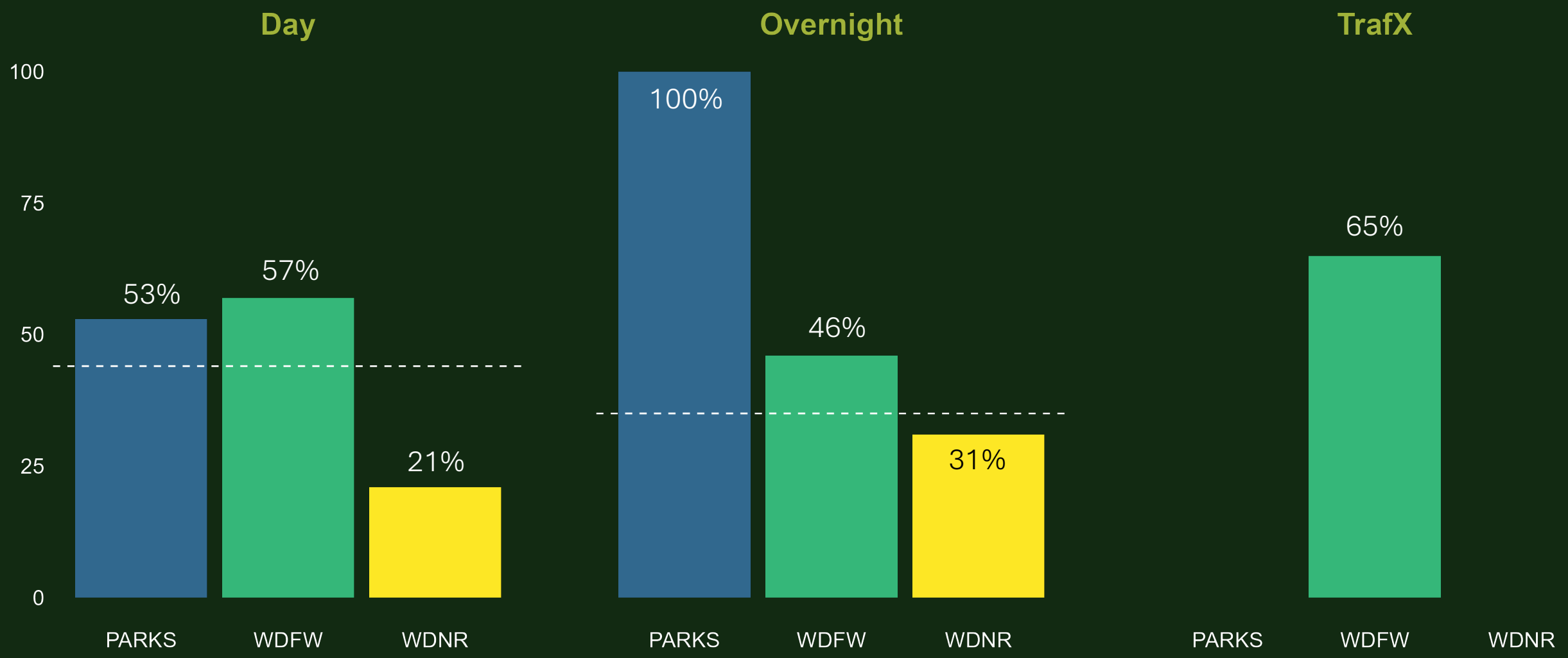


Area of **Applicability** (AOA)



Meyer, H., & Pebesma, E. (2021). Predicting into unknown space? Estimating the area of applicability of spatial prediction models. *Methods in Ecology and Evolution*, *12*(9), 1620-1633.

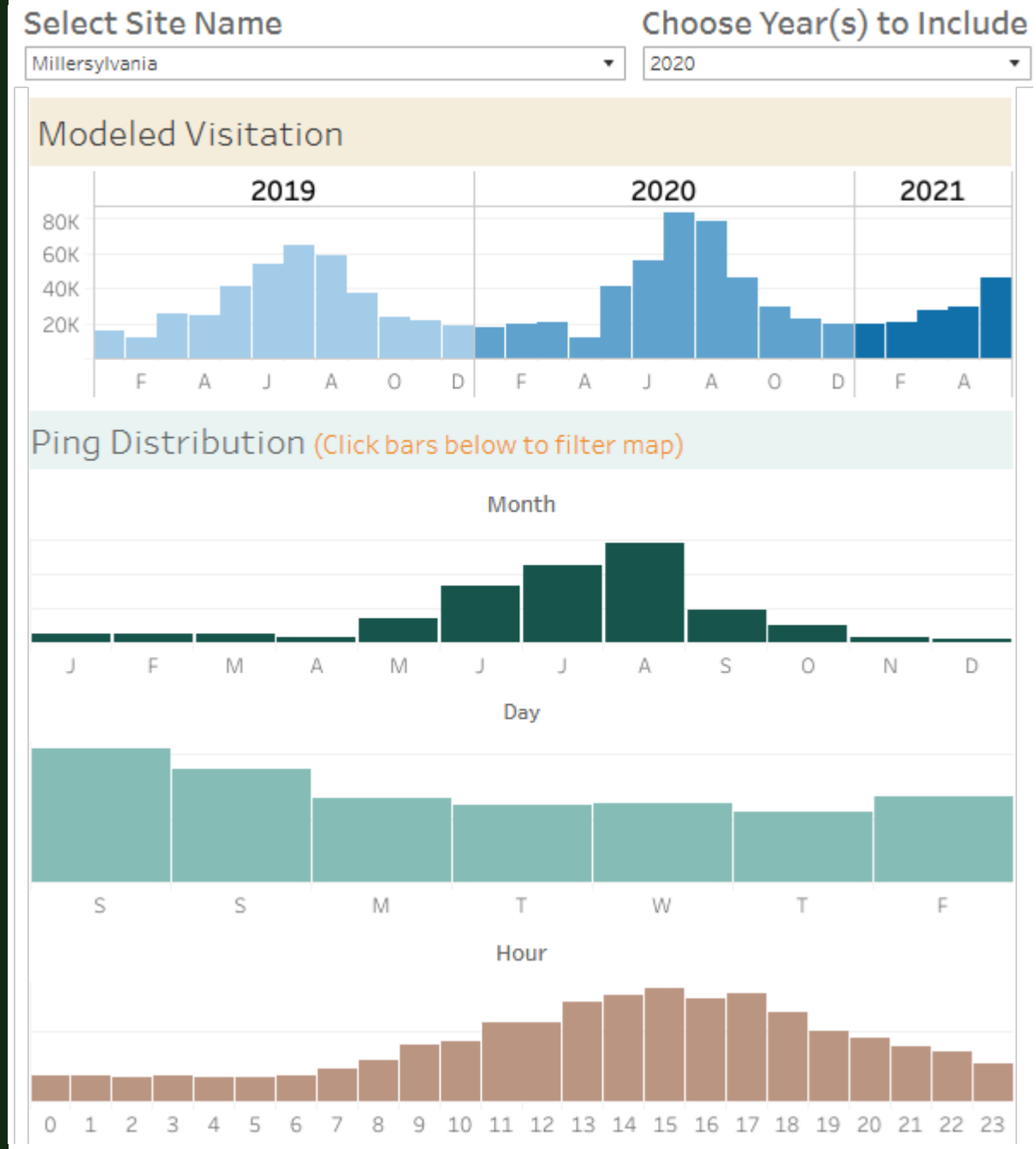
Area of Applicability (AOA) **Results**



Discussion and **Implications**

Results are most useful at the management-unit level.

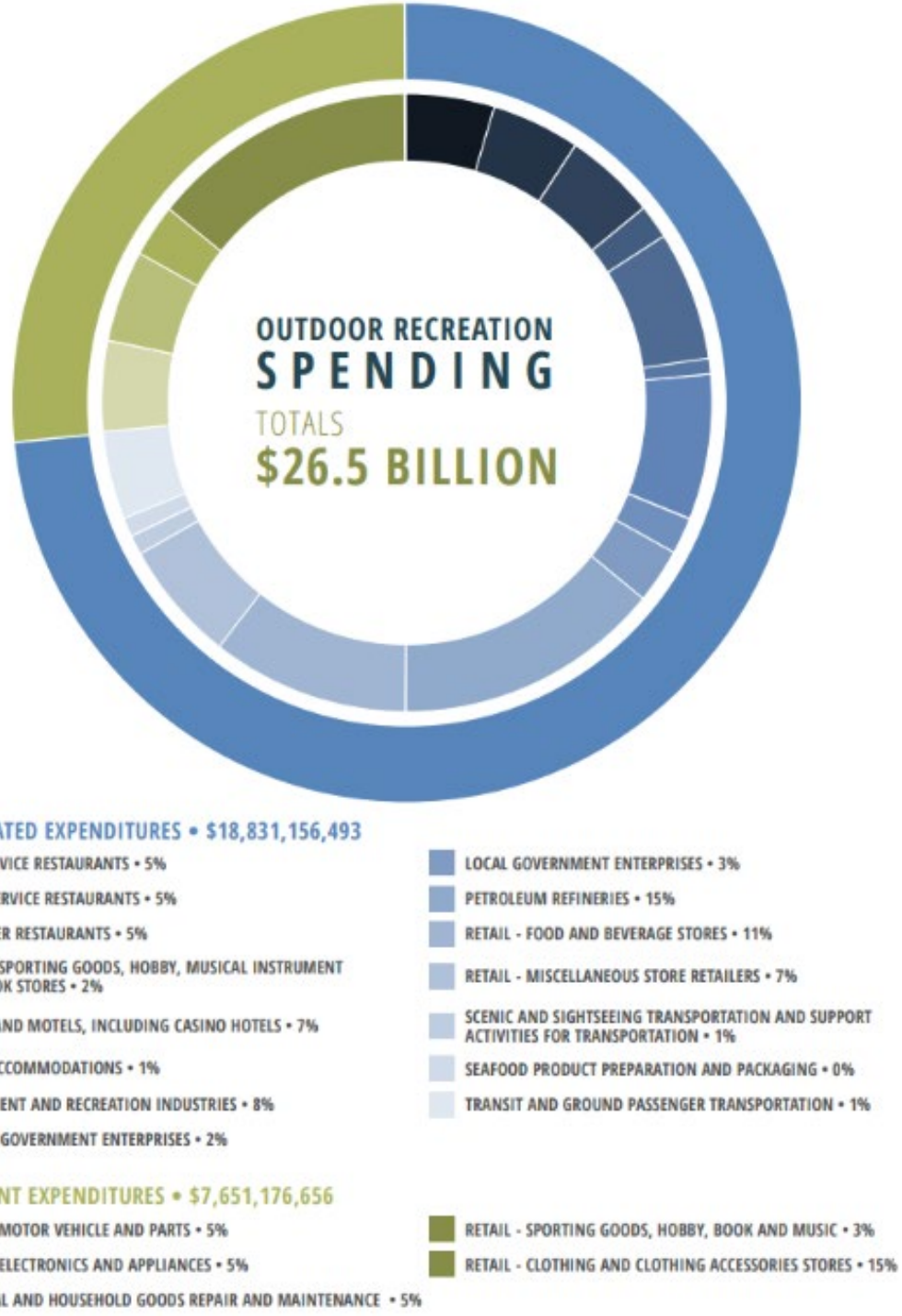
- Small errors add up agency-wide, resulting in unreasonable aggregated totals.
- Management-unit predictions have AOA attached, so agencies can assess reliability of results.
- Need calibration/validation data across **all** agencies.



Future **Applications**

Inform statewide analysis of all recreation lands

- Calculate economic contributions of outdoor recreation on State lands



Future **Applications**

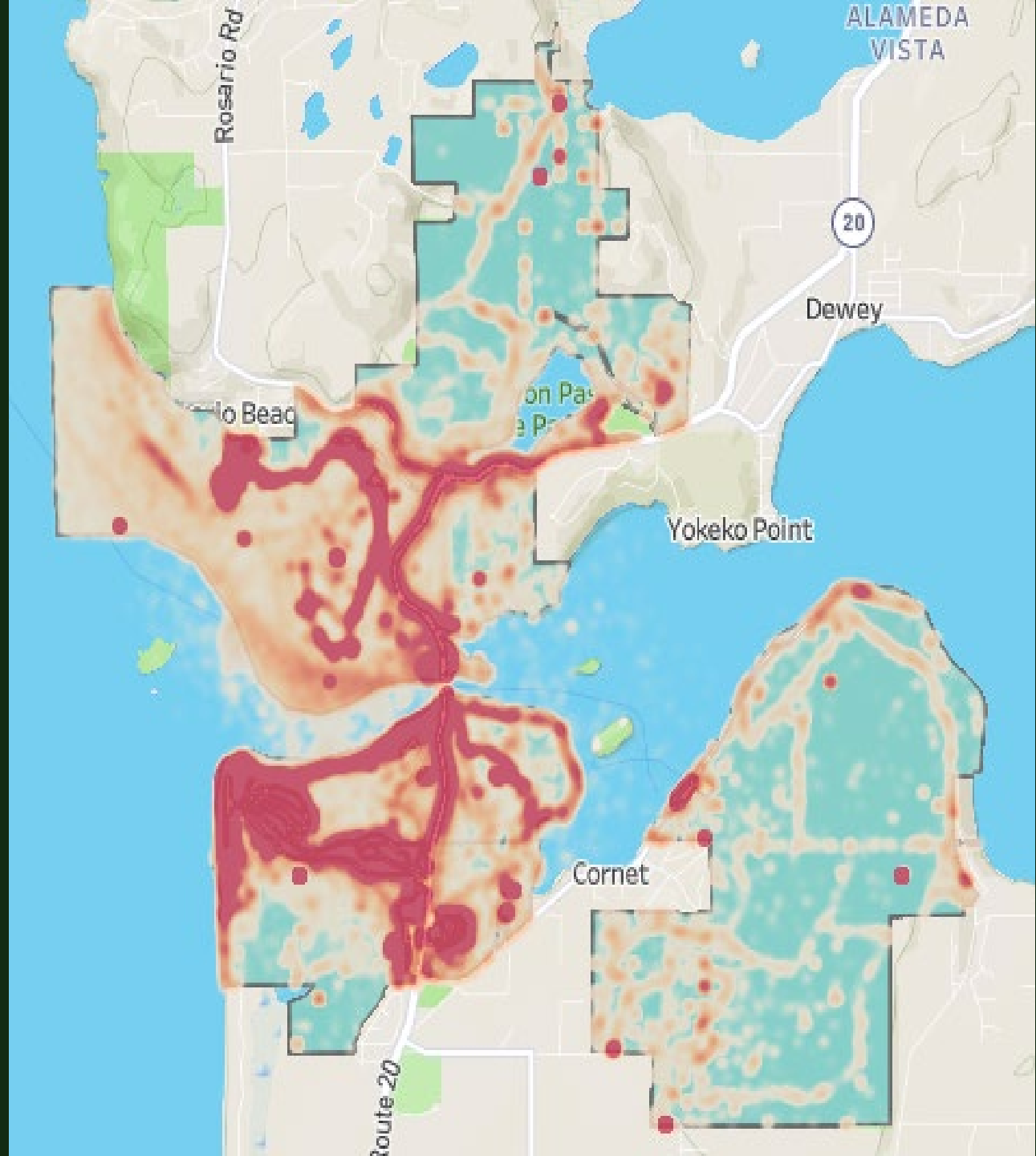
What are agencies using the data for?

- “see the **distribution and intensity of use** [of a site]”
- “for **grant applications** to show the economic impact of a particular site.”
- “**program planning**”
- “as a **political support tool**”
- “advertise the merits of rec sites to local taxing districts”
- “help inform **master planning** at Mount Spokane State Park”
- “to determine if the park is a local, regional or national/international draw”
- “identify **use trends on unsanctioned trails**”
- “identify **high-use hotspots** and temporal use **trends over time**”

Future **Applications**

Site Usage Patterns

- Identify optimal locations for trail, vehicle counters to generate future data for calibration & validation



Thank You!

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Questions?

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