

# Forecasting of Camping Reservations



Sarah DeNike

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## MSDA Graduate Student



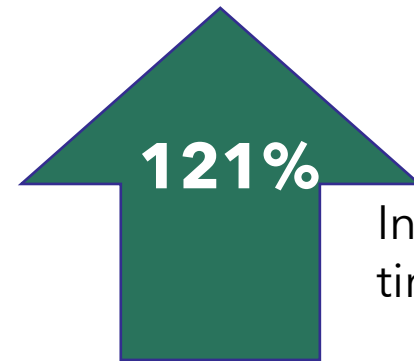
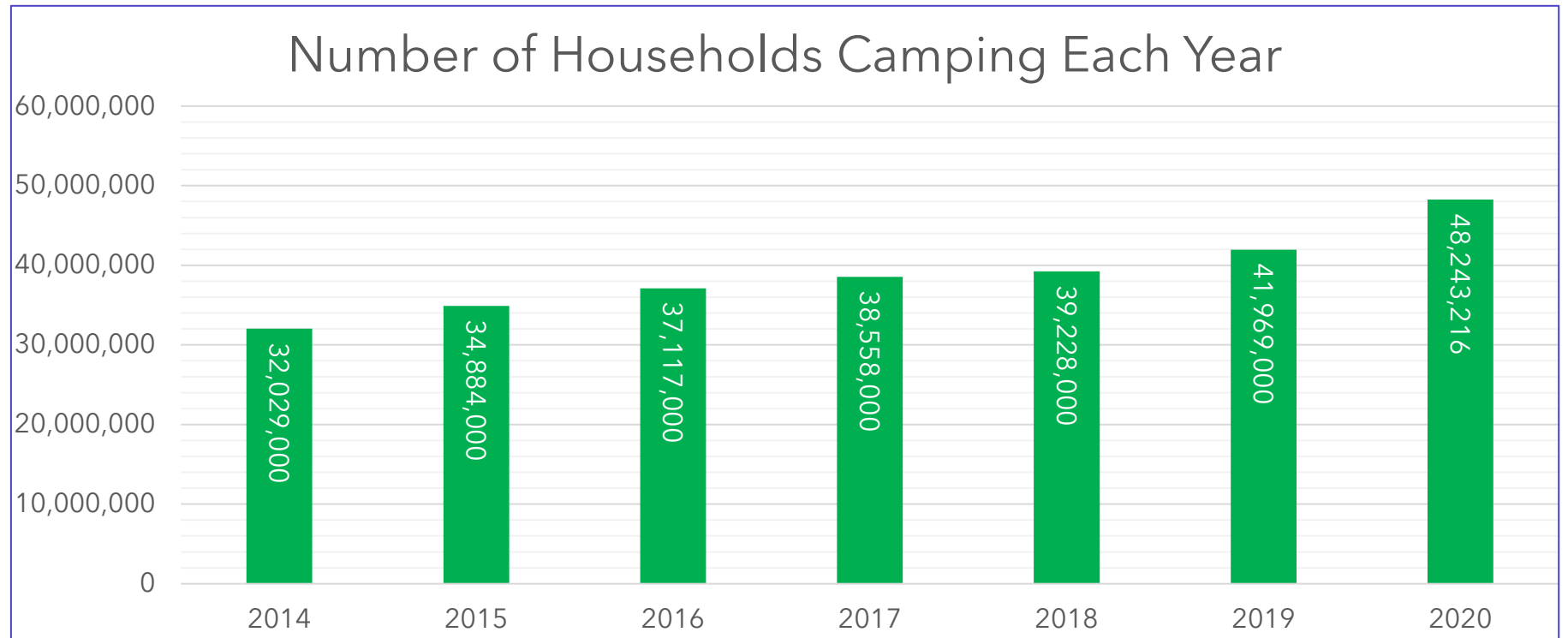
20+ years of marketing experience  
working for software and  
manufacturing companies

B.S. Biochemistry from UCSD

Lives in Sammamish, WA

Avid camper

**More people are camping and people are camping more often, how do we predict demand?**



Increase in households camping 3+ times/year from 2014-2020

# Can time series forecasting accurately predict camping reservations?

## **Null hypothesis:**

2020 pandemic did not affect camping reservations for federal campgrounds in Washington state.

## **Alternate hypothesis:**

2020 pandemic affected camping reservations in federal campgrounds in Washington state

# Data Used In This Project

The screenshot shows the 'RIDB Recreation Data' download page on Recreation.gov. The page header includes the site logo and navigation links for Home, API Documentation, Data Download, Data Standards, and Sign in. The main content area is titled 'RIDB Recreation Data' and provides instructions for downloading data in CSV or JSON format. Below this, there is a section for 'RIDB/Recreation.gov Historical Reservation Data' with a list of fiscal years from 2006 to 2020. A notice box at the bottom contains important information about API keys and data sets.

RECREATION.gov  
RIDB 1.0

Home API Documentation Data Download Data Standards Sign in

### RIDB Recreation Data

To download all the RIDB recreation area, facility, and site level data in CSV or JSON format, please select the link below. *Updated Daily.*

[CSV Format](#) | [JSON Format](#)

### RIDB/Recreation.gov Historical Reservation Data

Historical Reservation data is available for download from fiscal year 2006 to 2021. As of October 12th, 2018 future Historical Reservation data will be available in a new format. Please select the year to download a compressed CSV file.

*Updated Feb 2021.*

[FY 2006](#) | [FY 2007](#) | [FY 2008](#) | [FY 2009](#) | [FY 2010](#) | [FY 2011](#) | [FY 2012](#) | [FY 2013](#) | [FY 2014](#) | [FY 2015](#) | [FY 2016](#) | [FY 2017](#) | [FY 2018](#) | [FY 2019](#) | [FY 2020](#)

**Notice:**

- Please **DO NOT** share these links as they contain your personal API Key
- Data sets may be large
- For more information on how to use the RIDB data, please visit our [API Documentation](#)
- **By downloading this data, you are agreeing to the RIDB API Access Agreement.**

- Publicly available reservation data from Recreation.gov  
*(Recreation Information Database - RIDB, n.d.)*
- Reservation data from 2010-2020 downloaded
- Federally managed campgrounds including
  - National Park Service
  - US Forest Service
  - US Army Corp of Engineers
  - Bureau of Land Management

- Recreation.gov for csv files
- R and RStudio to prepare and analyze the data
- Power BI for data exploration

# Tools

# Data Preparation Process

## Filter & Select

- Filter for only WA state and overnight reservations
- Select columns for analysis
- Create separate tables for each agency

## Convert

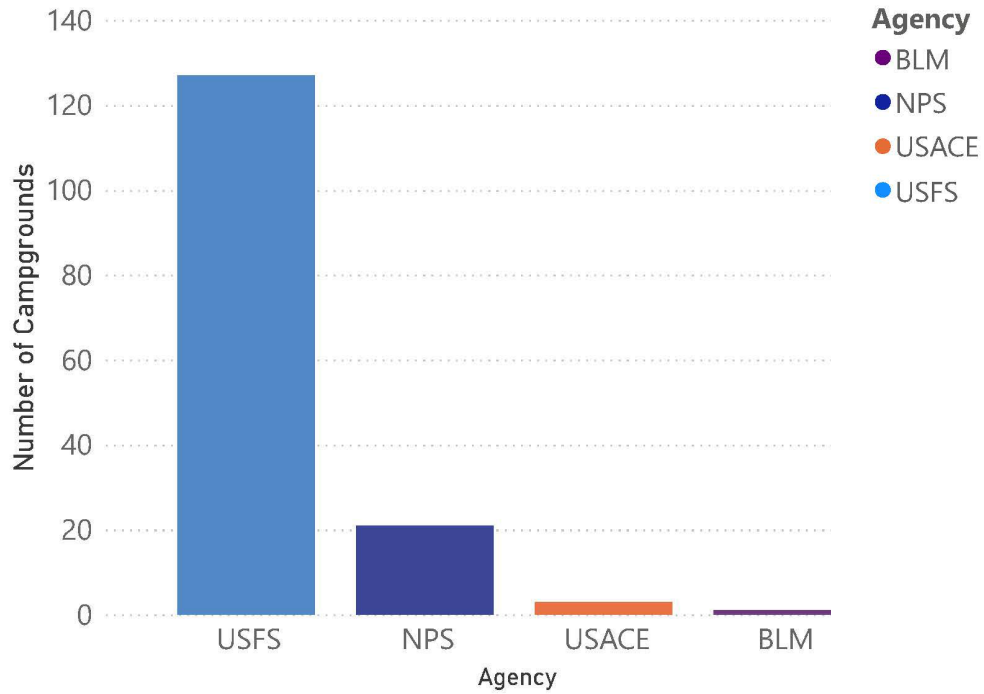
- Use Start Date and End Date to determine what days each reservation was for (Stibu, 2016)
- Sum the number of reservations per day or per month
- Fill in missing dates to get complete year (Nishida, 2018)

## Create

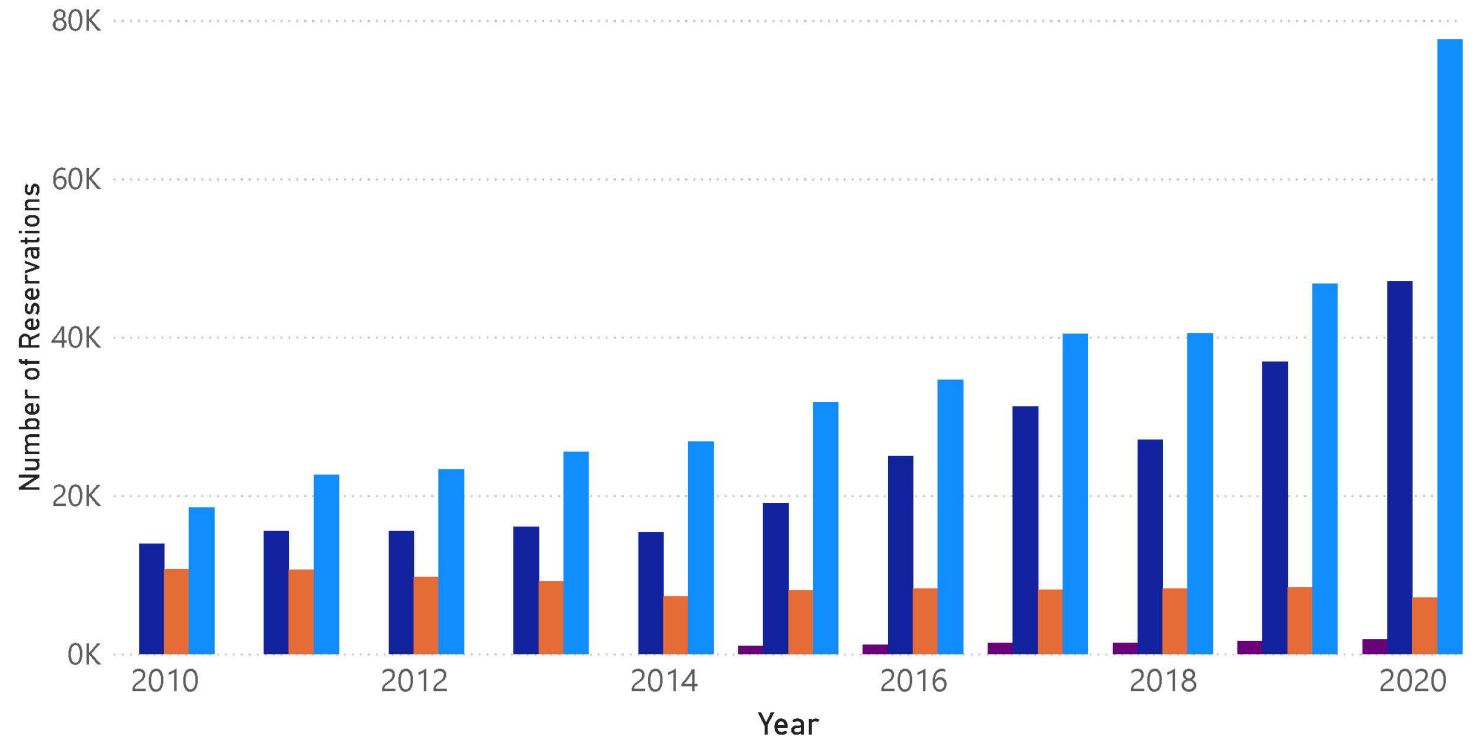
- Create time series objects from reservations per day or month data

# Data Exploration

Number Of Campgrounds Per Agency

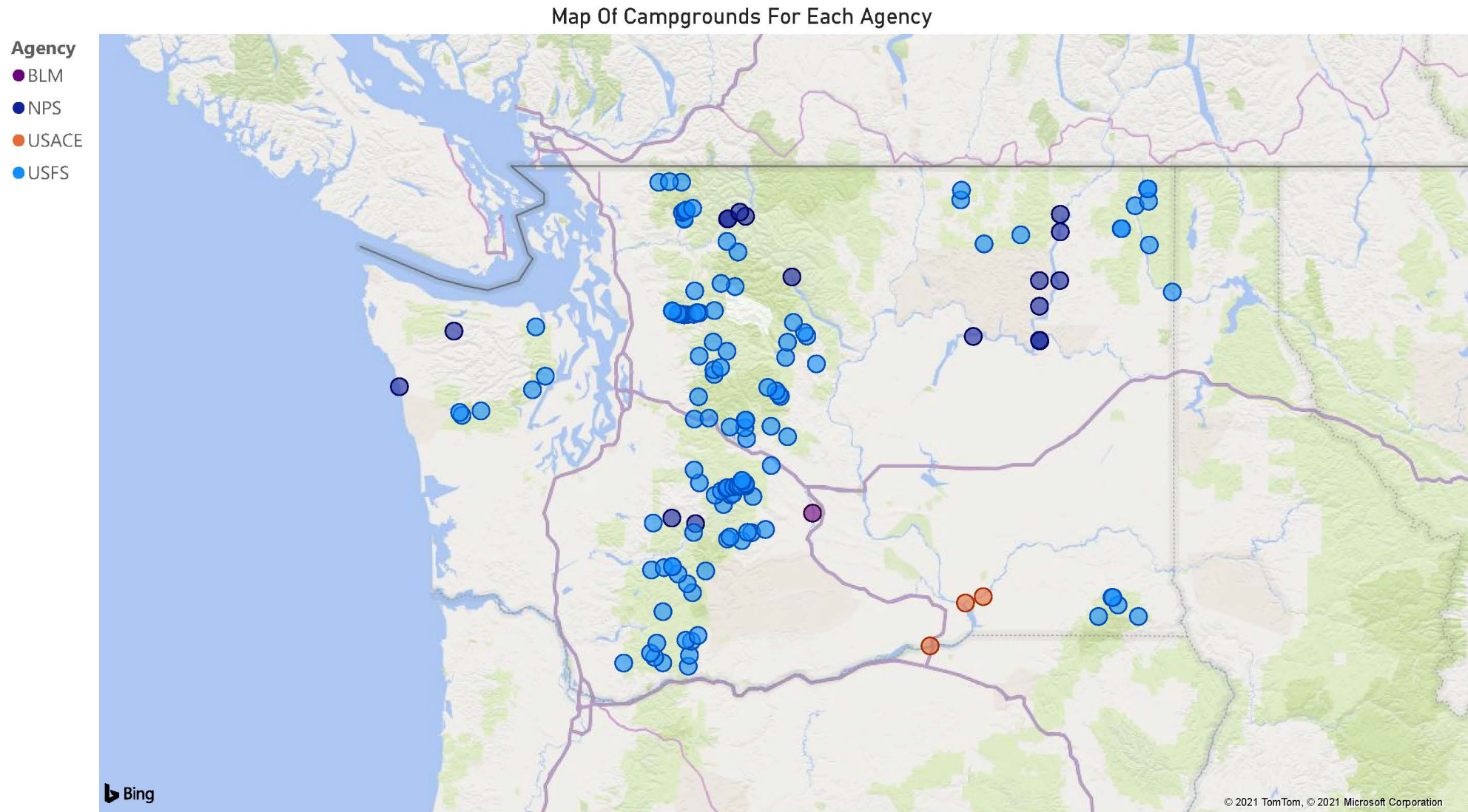


Number Of Reservations For Each Agency Per Year





# Where are the campgrounds?



# Data Analysis Process

## Create

- Create model using `auto.arima` function for each agency using the data from 2019-2020

*(Auto.Arima Function - RDocumentation, n.d.)*

## Check

- Check residuals to make sure model is good  
*(Hyndman & Athanasopoulos, 2018)*

## Forecast

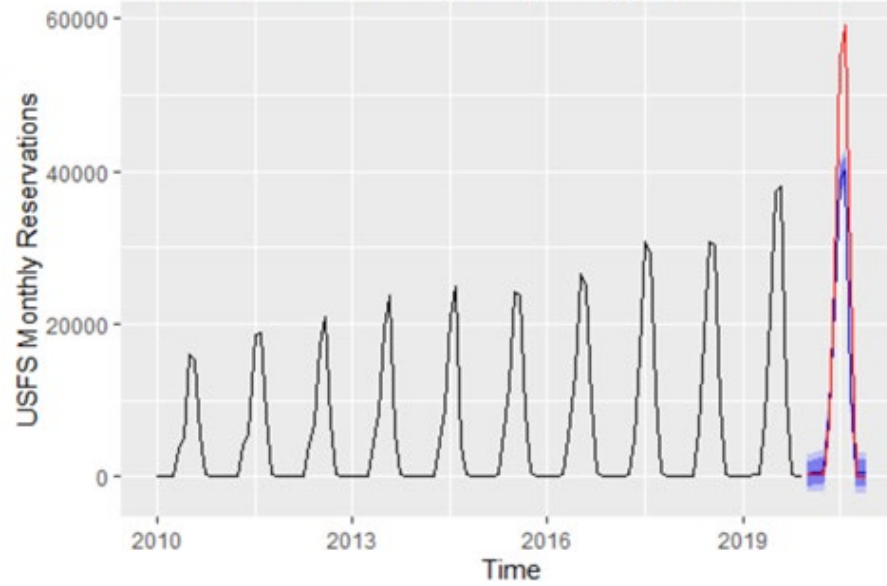
- Use model to create a forecast for 2020 reservations

## Compare

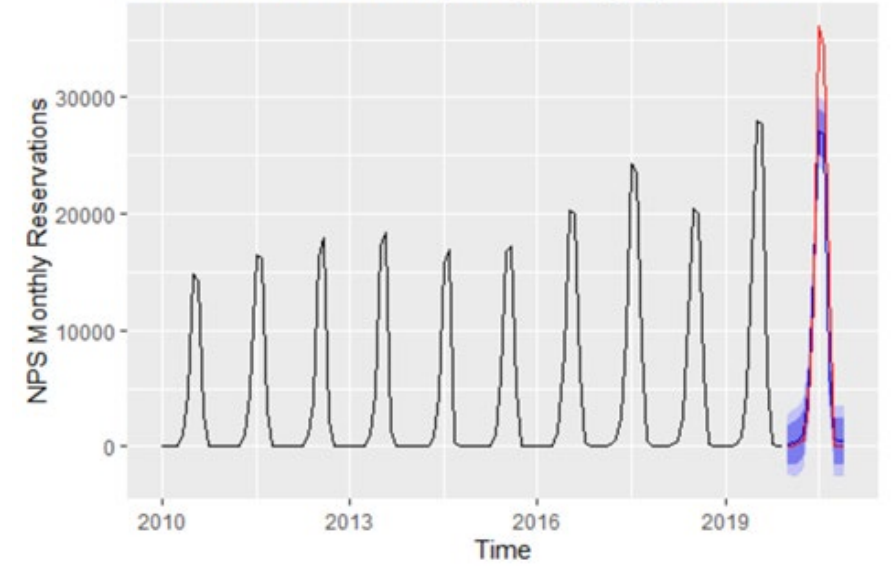
- Plot 2020 actual reservations against forecast
- Calculate the MAPE for each agency  
*(Zach, 2020)*

# Forecast vs. Actual Plots

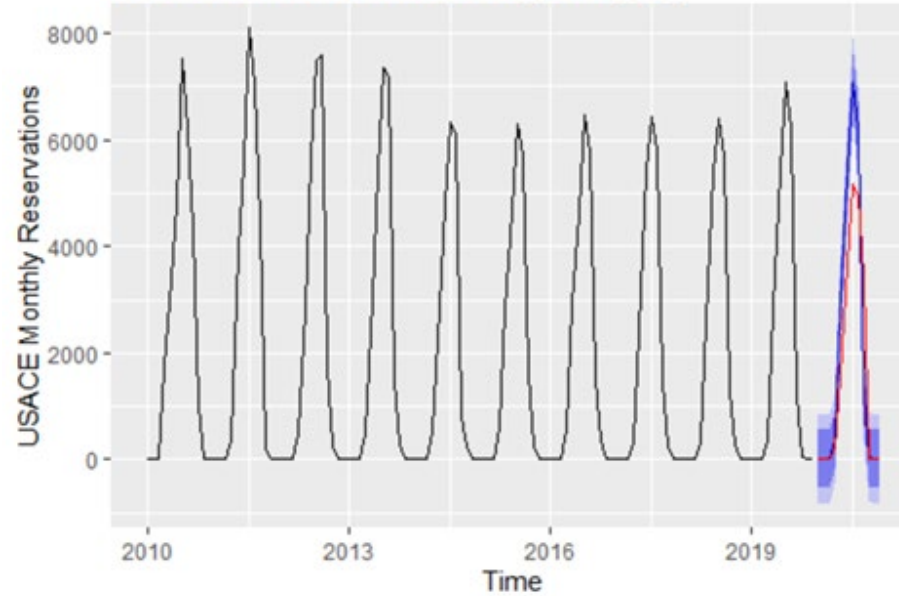
Forecasts from ARIMA(1,0,0)(2,1,0)[12] with drift



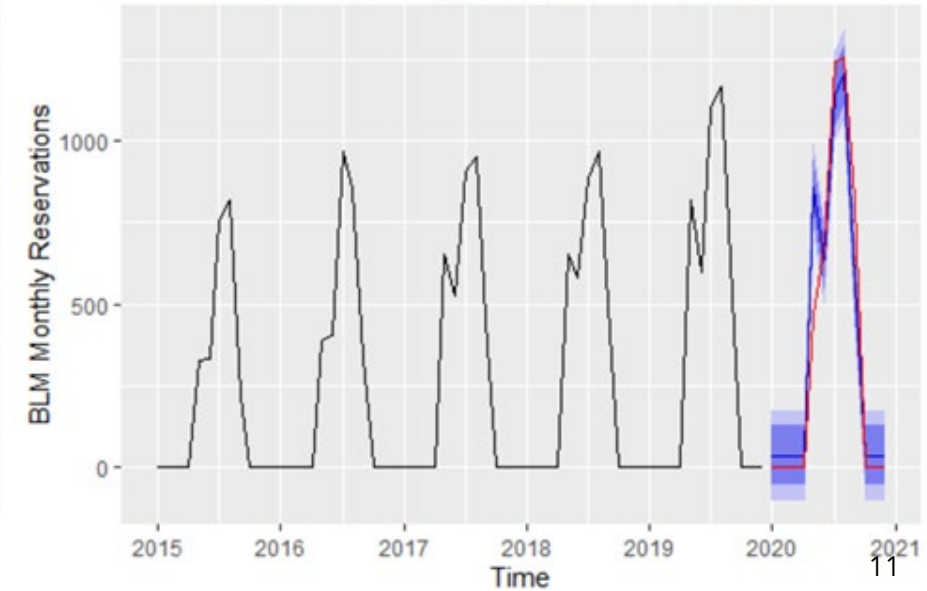
Forecasts from ARIMA(1,0,0)(1,1,0)[12] with drift



Forecasts from ARIMA(0,0,0)(0,1,0)[12]



Forecasts from ARIMA(0,0,0)(0,1,0)[12] with drift



# Results

	<b>USFS</b>	<b>NPS</b>	<b>USACE</b>	<b>BLM</b>
MAPE (Zach, 2020a)	248.01%	177.07%	81.00%	26.74%
Null Hypothesis	Reject	Reject	Reject	Reject
Alternate Hypothesis	Accept	Accept	Accept	Accept

# Limitations

## Data

Online reservation data only, did not include walk-up bookings.

## Tools

R and RStudio slow to process large data sets. Daily data took hours to process.

## Process

More flexibility in defining model if auto.arima isn't used.

# Recommendations

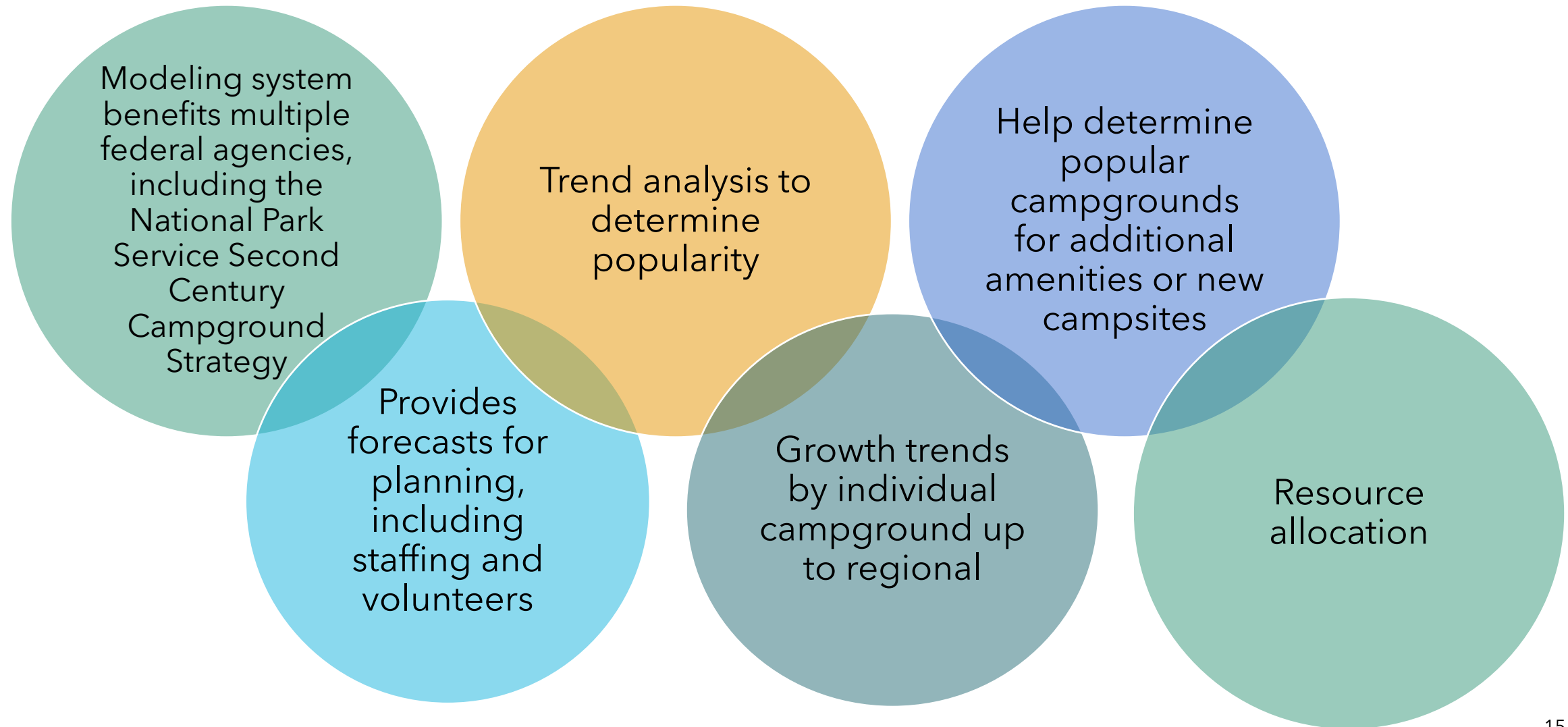
Build models using 2020 and 2021 data

Individual campground models

Compare campgrounds in proximity for popularity differences

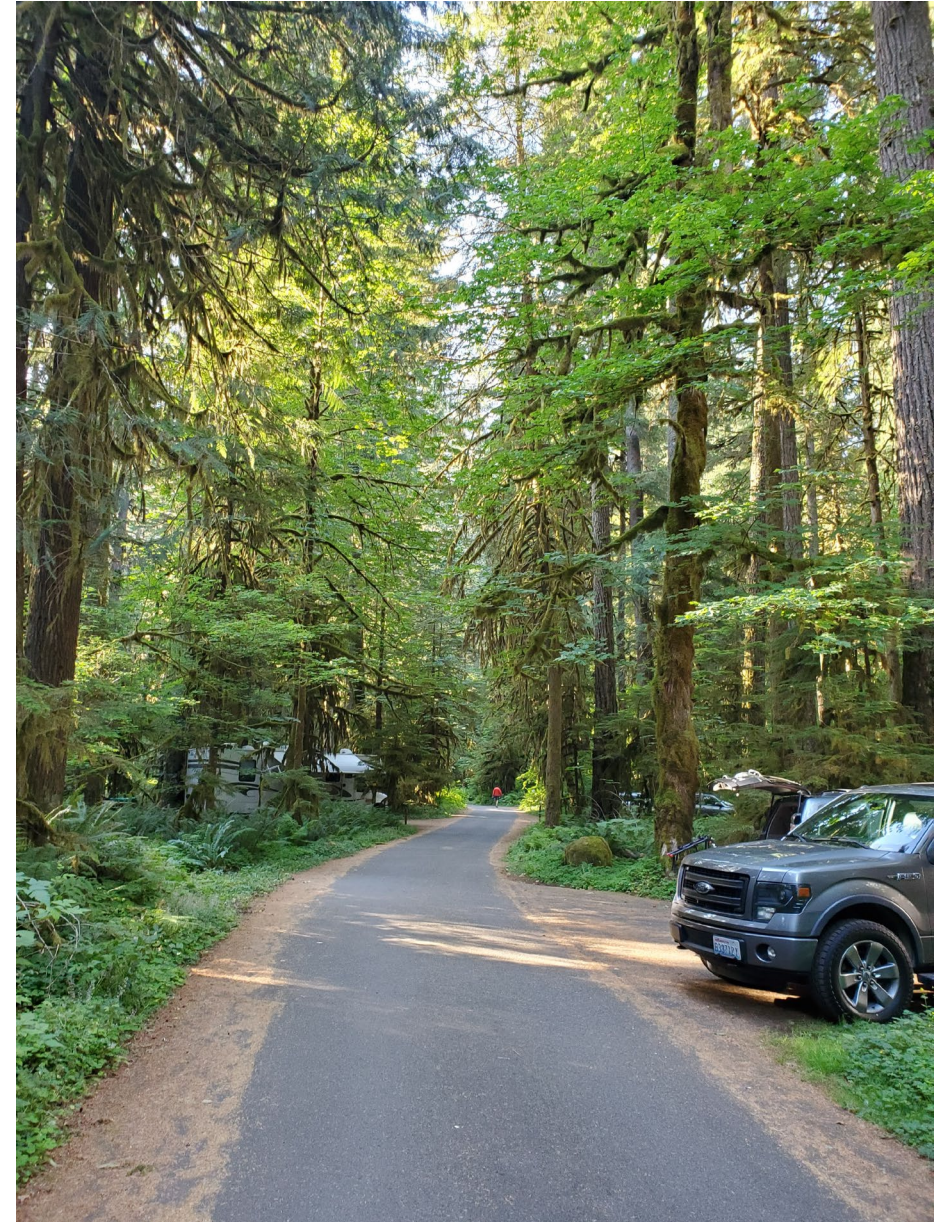
Regional models for differences in growth between regions

# Benefits



# Summary

Camping is growing. By using time series modeling and forecasting, federal agencies can use the results to help with resource allocation, trend analysis and planning.





# References

*auto.arima function - RDocumentation.* (n.d.). RDocumentation. Retrieved September 21, 2021, from <https://www.rdocumentation.org/packages/forecast/versions/8.15/topics/auto.arima>

Hyndman, R., & Athanasopoulos, G. (2018, May). *Forecasting: Principles and Practice (2nd ed)*. OTexts. <https://otexts.com/fpp2/>

*Kampgrounds of America Inc. - 2021 North American Camping Report.* (2021). Koa.Com. <http://koa.uberflip.com/i/1362448-2021-north-american-camping-report/5?>

*National Park Service Second Century Campground Strategy.* (2020). National Park Service. [https://www.nps.gov/subjects/policy/upload/NPS\\_Second\\_Century\\_Campground\\_SLIDEDECK.pdf](https://www.nps.gov/subjects/policy/upload/NPS_Second_Century_Campground_SLIDEDECK.pdf)

Nishida, K. (2018, April 25). *Populating Missing Dates with Complete and Fill Functions in R and Exploratory.* Medium. <https://blog.exploratory.io/populating-missing-dates-with-complete-and-fill-functions-in-r-and-exploratory-79f2a321e6b5>

*Recreation Information Database - RIDB.* (n.d.). Recreation.Gov. <https://ridb.recreation.gov>

Stibu. (2016, March 6). *R: converting start/end dates into data series.* Stack Overflow. <https://stackoverflow.com/questions/35829294/r-converting-start-end-dates-into-data-series?rq=1>

Zach, Z. (2020, April 6). *How to Calculate MAPE in R.* Statology. <https://www.statology.org/mape-r/>

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**Thank you**

