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Montana Tourism Trends and Forecasting

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TOURISM & RECREATION RESEARCH
UNIVERSITY OF MONTANA

Montana Tourism Trends and Forecasting

Jeremy L. Sage, PhD

7/19/2018



Montana Tourism Trends and Forecasting

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This report summarizes recent trends and forecasted volumes of visitors to Montana, along with key macroeconomic variables impacting volume.

Abstract

This report presents the development of a Montana tourism forecasting model. We forecast not only annual nonresident visitors to the state, but also forecast recreation visits to both Yellowstone and Glacier National Parks. Monthly data between 1992 and 2014 are used in a General to Specific Modeling approach to establish regression coefficients that are then used to ex post forecast 2015-2017, and ex ante forecast 2018-2020 for Montana and 2018-2019 for the National Parks. The forecast models perform well and better than base comparisons using Naïve 1 and Naïve 2 methods as evaluated by Mean Absolute Percent Error (MAPE). Monthly forecasted values may be interactively viewed in relationship to previous years' trends on ITRR's interactive websites for Montana nonresident visitors and both National Parks.¹

Executive Summary

Forecasting and tourism demand modeling is inherently dependent upon secondary data sources as indicators or predictors of expected demand. Such dependence is substantially driven by the influence of the larger economy on travel behaviors. Demand can be, and has been, measured in multiple ways by both a variety of researchers and destination organizations. Measure choice often depends on organization or researcher objectives and available data. In Montana, visitor volume has been consistently collected and reported on a monthly basis since 1991, making it a readily available measure of tourism demand.

Much of Montana tourism directly relates to visitation to both Yellowstone and Glacier National Parks, both of which also maintain monthly visitation numbers.² Though National Park visits and visits to Montana are two distinctly different measurements, each provides an opportunity to explore demand for outdoor tourism and recreation. Given the influence of the two National Parks, this report generates three primary models of estimated demand for:

1. Monthly nonresident visits to Montana;
2. Monthly recreation visits to Yellowstone National Park;
3. Monthly recreation visits to Glacier National Park.

Monthly visits between 1992 and 2014 are used to estimate the model. Data for each are also available for 2015-2017. These final three years are used to compare model estimates to observed visits in evaluating model performance.

¹ ITRR Interactive Data: <http://itrr.umt.edu/interactive-data/default.php>

² Recreation visit estimates at both National Parks are generated based on calculations derived from entrance gate traffic counters. The calculations include estimates of people per vehicle (PPV). Each park periodically updates its calculations to reflect best available estimates and methods.

Expected Nonresident Visits to Montana, and Recreation Visits to Yellowstone and Glacier National Parks

Figure ES- I. Nonresident visitors to Montana (2000-2020).

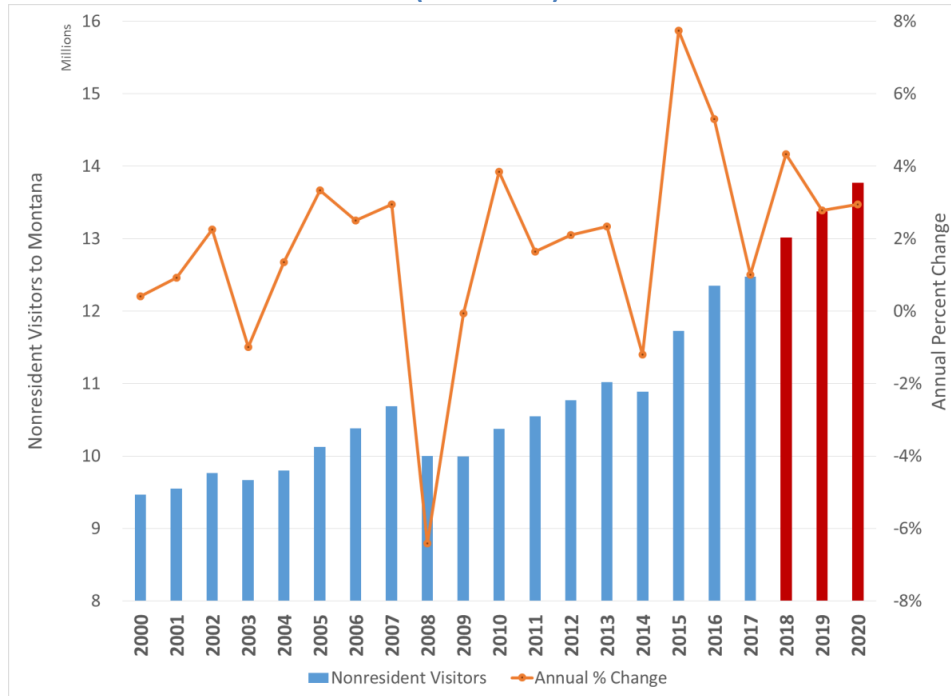


Figure ES- II. Recreation visits to Yellowstone NP (2000-2019).

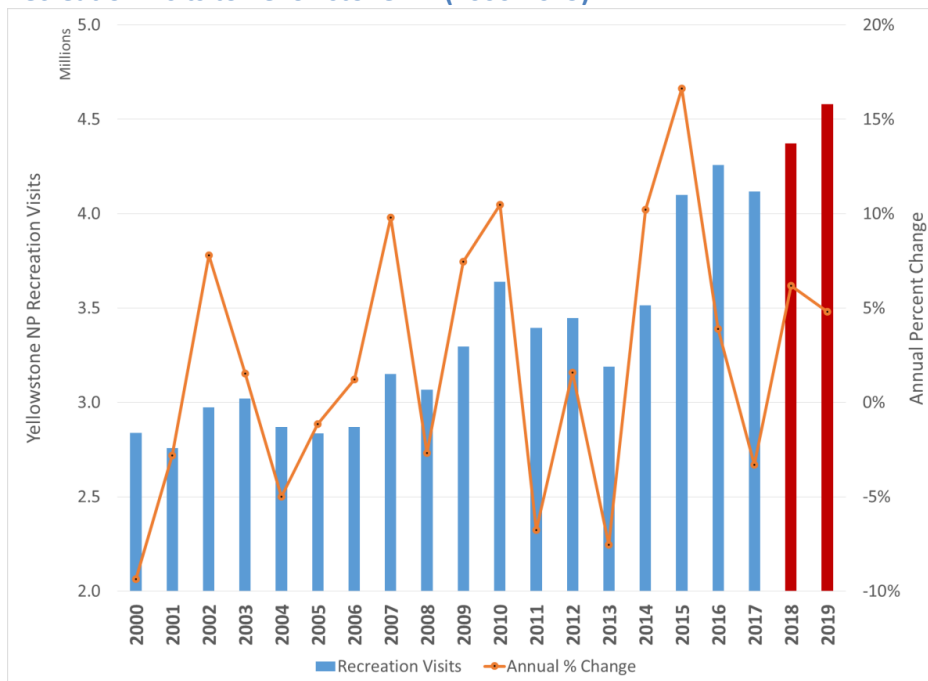
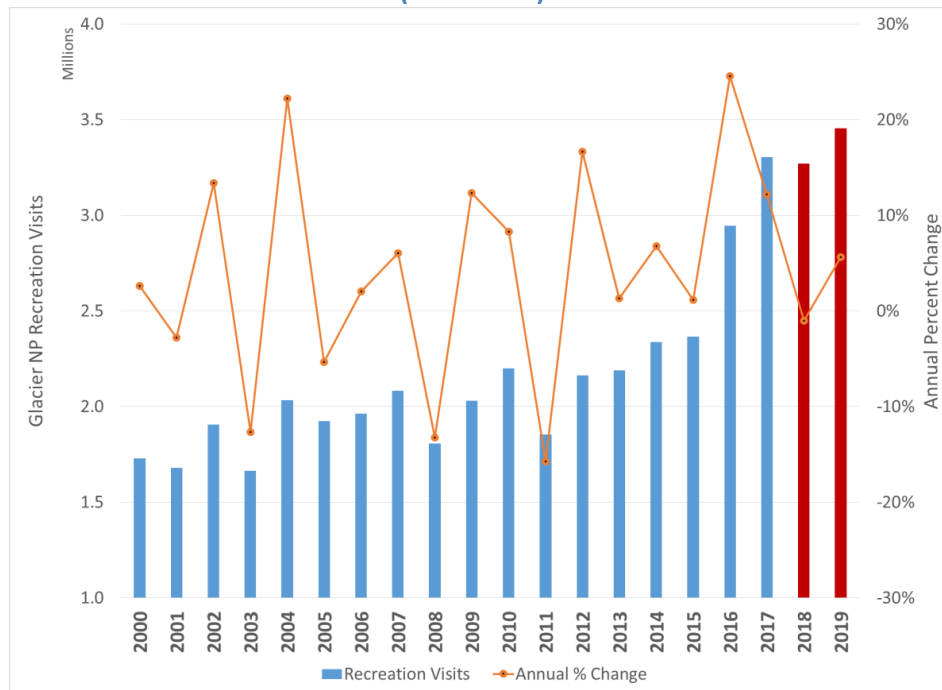


Figure ES- III. Recreation Visits to Glacier NP (2000-2019).



The above forecasted values are significantly dependent upon economic performance of the larger economy. Included economic and population variables, and their direction of impact for each entity are shown in Figure ES- IV. Variable direction of impact on visitation. A positive sign (+) indicates that as the variable increases, so too does visitation, all else being equal. A negative sign (-) indicates that as the variable increases, visitation decreases, all else being equal. For example, an increasing US - Canadian exchange rate makes the purchase of US goods for Canadians more expensive, thus we would expect higher rates to reduce their travel.

Figure ES- IV. Variable direction of impact on visitation.

	Montana Nonresident Visitors	Yellowstone Recreation Visits	Glacier Recreation Visits
Real Fuel Price (Inflation Adjusted)		-	-
US Population	+	+	+
Personal Savings Rate (6 mo prior)		+	
US - Canadian Exchange Rate (6 mo prior)*	-		-
Consumer Price Index (6 mo prior)			-
Consumer Price Index (1 mo prior)	-		

Note: No sign indicates the variable was not used in estimation.

Both Montana and Yellowstone show positive growth in each forecasted year. Montana shows a growth of nearly 5 percent over 2017 numbers, followed by 2-3 percent growth in subsequent years. Yellowstone is forecast to experience moderate, relative to previous highs and lows, growth of 5-6 percent in 2018 and 2019. Meanwhile, we expect to Glacier NP to drop off slightly in 2018 from its previous record year in 2017, before recovering and exceeding this value in 2019.

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Introduction

Tourism and recreation have increasingly been recognized as a leading contributors to the Montana economy in the 21st century. This recognition has come at the hands of steady growth in the volume of visitors recreating in the state. In 1991, an estimated 7,081,000 visitors traveled to the state. In 2017, visitor totals reached 12,475,000, an annual average growth rate of 2.9 percent. While growth over this 26 year period has been relatively steady, it has not been constant. Like any other economic sector, tourism is subject to the whims of the greater economic health of the US and increasingly, the world.

Purpose

This report provides the first of what will become an annual update to trends and expectations in visitation to Montana. Tourism-dependent businesses rely on their ability to satisfactorily match their capacity to supply goods and services to the demand of those same goods and services. Reliable expectations of future visitor volume provides opportunity for tourism-dependent businesses and groups to strategically plan for their upcoming seasons. Further, this report provides multiple key leading economic indicators of visitor performance, thus increasing the opportunity for finer planning adjustments.

Methods – The Demand Model

Forecasted Measures

Forecasting and tourism demand modeling is inherently dependent upon secondary data sources as indicators or predictors of expected demand.³ Such dependence is substantially driven by the influence of the larger economy on travel behaviors. Demand can be, and has been, measured in multiple ways by both a variety of researchers and destination organizations. Frequent measures (dependent variables in regression analyses) include direct visitor expenditures, visitor volume, visitor arrivals by air, and visitor days.^{4 5 6} Measure choice often depends on organization or researcher objectives and available data. In Montana, visitor volume has been consistently collected and reported on a monthly basis since 1991, making it a readily available measure of tourism demand.

Individual visitor volume is only one of four primary components by which tourism generates an economic impact on the state and its communities. The second component lies not in just the raw number of estimated visitors, but in the number of spending groups arriving in the state within which the total number of visitors is organized. The third factor is how long the average visitor group stays in

³ Song, H., Li, G. 2008. Tourism demand modelling and forecasting – A review of recent research. *Tourism Management*, 29, 203-220.

⁴ Visit California: <https://industry.visitcalifornia.com/Research/Report/California-Travel-Tourism-Forecast-State-2017>

⁵ Hawaii Department of Business, Economic Development & Tourism: <http://dbedt.hawaii.gov/visitor/tourism-forecast/>

⁶ Louisiana Department of Culture, Recreation & Tourism: <https://www.crt.state.la.us/Assets/Tourism/research/documents/2015-2016/Louisiana%20Tourism%20Forecast%20Report%202016-2019.pdf>

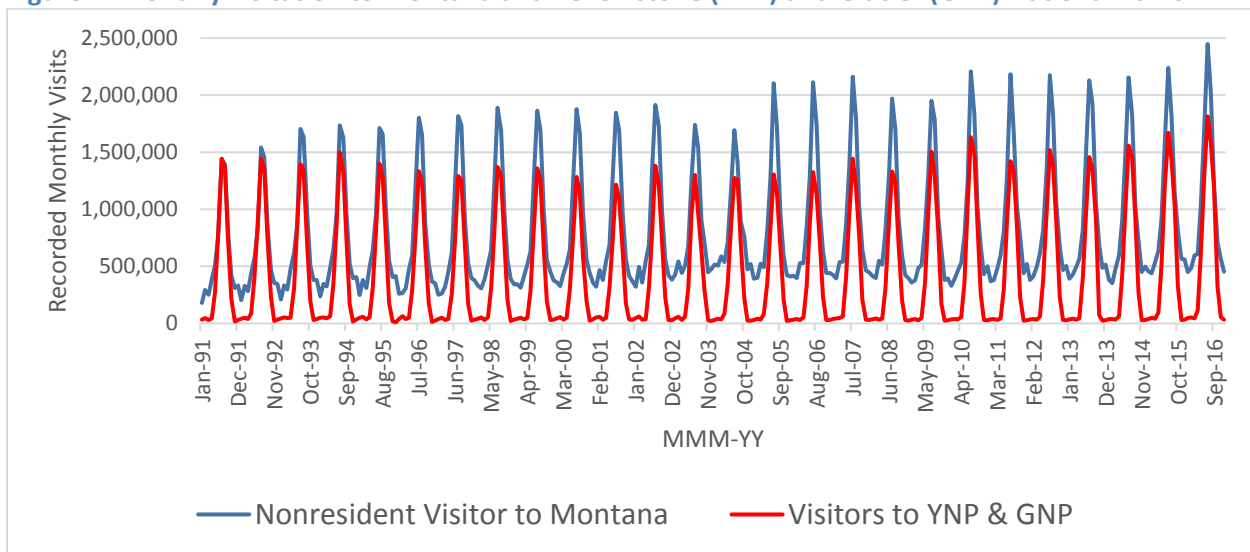
the state, and thus the number of days or nights in which they are spending money. The final component is how much each estimated group spends per day of their visit to the state. The interplay of these four pieces yields the total visitor spending and resulting economic impact. We readily recognize that spending and economic impact is the primary concern for many tourism dependent entities. While visitor expenditures has also been routinely measured and reported, significant changes in data modeling have been made on several occasions, limiting the ability to properly regress spending.⁷ Future iterations of this forecast will seek to overcome these limits and include not only visitor volume estimates, but also spending estimates.

Much of Montana tourism directly relates to visitation to both Yellowstone and Glacier National Parks, both of which also maintain monthly visitation numbers (Figure 1). Though National Park visits and visits to Montana are two distinctly different measurements, each provides an opportunity to explore demand for outdoor tourism and recreation. Given the influence of the two National Parks, this report generates three primary models of estimated demand for:

1. Monthly nonresident visits to Montana;
2. Monthly recreation visits to Yellowstone National Park;⁸
3. Monthly recreation visits to Glacier National Park.⁹

Monthly visits between 1992 and 2014 are used to estimate the model. Data for each are also available for 2015-2017. These final three years are used to compare model estimates to observed visits in evaluating model performance.

Figure 1. Monthly visitation to Montana and Yellowstone (YNP) and Glacier (GNP) National Parks.



⁷ ITRR, Interactive Data: <http://itrr.umt.edu/interactive-data/default.php>

⁸ Yellowstone visitation reporting; <https://irma.nps.gov/Stats/Reports/Park/YELL>

⁹ Glacier Visitation reporting; <https://irma.nps.gov/Stats/Reports/Park/GLAC>

Determinants of Demand

Identifying useful and appropriate explanatory variables in a model of tourism demand can be challenging. In exploring the best model, both price and non-price variables should be evaluated.¹⁰ We began with a consideration of the variables utilized in a recent exploration of macroeconomic effects on national park visitation.¹¹ Using Poudyal et al. as a base, the conceptual model of demand is:

$$\text{Number of monthly visits} = f(\text{travel cost, population, seasonality, macroeconomic variable})$$

Poudyal et al. utilized fuel prices as a proxy for travel cost. Others have also used a destination's Consumer Price Index (CPI) as a tourism cost proxy.¹² We explore both proxy measurements as possible explanatory variables. Both provide utility to the model by controlling for temporal changes in travel costs. We expect that either a higher fuel price or higher CPI will result in negative effects on visitation numbers.

ITRR nonresident survey research indicates that the vast majority of visitors to Montana are US residents.¹³ As such, we use the US population as the variable of interest in determining a measure of the potential customer base. Traditional economic theory would suggest that as the population increases, so too does visitation in each of our three models, thus we expect a positive relationship.

As previously shown (Figure 1), visitation to Montana and both national parks are highly seasonal, with peaks during the summer months. To account for seasonality, we utilize monthly dummy variables. December is used as the month of reference.

Macroeconomic variables considered by Poudyal et al. include: Unemployment Rate, Personal Savings Rates, Business Cycle Index, Consumer Confidence/Sentiment, and Consumer Expected Inflation. In preliminary trials to identify the best fit models, we explore each of these macroeconomic variables in addition to the Canadian Exchange Rate. The Canadian Exchange rate is a potential variable of interest given Montana is bordered to the north by the Canadian provinces of British Columbia and Alberta, and both have nontrivial levels of visitors to the state. Each potential macroeconomic variable was explored individually in trial models to minimize concerns of multicollinearity.¹⁴ We expect a positive relationship to exist for each indicator, suggesting that as the economic strength improves, visitation to Montana and the state's National Parks increases. We expect a negative relationship to exist between the US-Canadian exchange rate (recorded as dollars Canadian equivalent to \$1 US) and total visitation.

Noticeably absent from the above discussion is the potential role played by marketing campaigns implemented at the state, region, or convention and visitor bureau (CVB) levels. How much, where, and mediums used in marketing efforts undoubtedly impact future visitation. However, marketing efforts are excluded here for two reasons. First, lies in data availability in a manner consistent with the monthly

¹⁰ Loomis, J.B., Walsh, R.G. 1997. *Recreation economic decisions: Comparing benefits and costs* (2nd ed.). State College, PA: Venture Publishing, Inc.

¹¹ Poudyal, N.C., Paudel, B., Tarrant, M.A. 2013. A time series analysis of the impact of recession on national park visitation in the United States. *Tourism Management*, 35, 181-189.

¹² Morley, C.L. 1994. The use of CPI for tourism prices in demand modelling. *Tourism Management*, 15(5), 342-346.

¹³ ITRR, Interactive Data: <http://itrr.umt.edu/interactive-data/default.php>

¹⁴ Multicollinearity occurs when two or more independent variables are correlated. High levels of correlation indicate that the variables are measuring close to the same thing. They are effectively redundant and may produce unreliable estimates of the dependent variable (number of visits)

data contained in the other dependent and independent variables. Marketing considerations revolve not only around the dollars spent, but also on the effectiveness of a given campaign or marketing strategy that has most certainly evolved over the time period considered here. Additionally, available marketing funds in Montana and at the region and CVB level is related to the volume of visitors spending nights in lodging facilities. This relationship is due to available marketing dollars being generated through the state's 4 percent bed tax. As explained in the next section, the final models included here do account for visitor volume in the previous year. Inclusion of both marketing dollars and previous year visitor volumes would very likely create multicollinearity concerns. Given the explanatory power of the previous year's volume and the structure of the marketing data, we omitted marketing from this model.

General-to-Specific Modeling (GtSM)

We follow the *general-to-specific (GtSM)* modeling approach outlined by Song and Witt.¹⁵ In GtSM, the starting models contain as many variables as practical and suggested to be appropriate by economic theory. In addition to exploring the explanatory variables discussed above, we also begin with the inclusion of a lagged dependent variable (autoregressive) and lagged explanatory variables.

A lagged variable, whether of the dependent or independent type, is a variable from a previous time period (e.g. t-1 or t-6) that may influence the dependent variable in the current time period (t). As an example of a lagged independent variable, it may be reasonable to assume that consumer confidence in January (t-6) of a given year influences the observed number of visitors to Montana six months later in July (t). On its face, this would appear to be rational given many travelers may make summer vacation plans months in advance and thus those travelers' confidence in a strong economy likely plays into their traveling decisions. Similarly, it is reasonable to assume that visits to Montana last July influence visits in the upcoming July. Where the lagged dependent variable shows to be significant may suggest the development of a preference or taste for this July Montana experience.

To identify the most appropriate lag length, we experimented with varied lengths to identify that which provides the best model fit. Only the final lags are shown in the results.

The process of GtSM progresses from a very general model with numerous traditional and lagged variables. As the coefficients on the variables are demonstrated to not significantly differ from zero, they are dropped from the model, thus the model becomes more specific. Those variables and lagged variables showing to be significant (5percent level used here) are retained and a rigorous statistical diagnostic checking is applied.

Once a model was selected, we applied a Mean Absolute Percentage Error (MAPE) criteria to identify how well the model performs in forecasting.¹⁶ MAPE is calculated based on ex post forecasts from 2015-2017. For comparative purposes, the specified models are compared against both Naïve 1 and Naïve 2 forecasts for the same period. The Naïve 1 method states that the forecast value for this period (F_t) is equal to the value actually observed for the last period (A_{t-1}) (e.g. July 2018 is equal to July 2017);

¹⁵ Song, H., Witt, S.F. 2000. *Tourism demand modelling and forecasting: Modern econometric approaches*. Cambridge: Pregamon.

¹⁶ $MAPE = \frac{1}{n} * \sum_{t=1}^n \left(\frac{|e_t|}{A_t} \right) * 100$; n=number of time periods, e_t =forecast error in time period t; A_t =actual number of visitors in time period t.

$F_t = A_{t-1}$. The Naïve 2 method forecast for this period (F_t) is found by multiplying the observed value for the last period (A_{t-1}) by the growth rate between the previous visitation periods;

$$F_t = A_{t-1}(1+(A_{t-1}-A_{t-2})/A_{t-2}).$$

Data Sources

Historic Data

All data sources (Table 1) are based on monthly values. Fuel prices are reported weekly and converted to a monthly average and adjusted for inflation using the Consumer Price Index for all urban consumers: fuels and utilities.

Table 1. Historic data sources for all variables (monthly, 1991-2017).

Variable	Abbreviation	Source
Monthly Montana Visits	MTVIS	ITRR, Annual nonresident survey
Monthly Yellowstone Visits	YELLVIS	NPS Stats, Recreation Visits
Monthly Glacier Visits	GLACVIS	NPS Stats, Recreation Visits
US Population, Thousands	POPTHM	Federal Reserve Economic Data (FRED)
Canada / US Foreign Exchange Rate, Canadian Dollars to One US Dollar	EXCAUS	Federal Reserve Economic Data (FRED)
Consumer Price Index for All Urban Consumers	CPI	Federal Reserve Economic Data (FRED)
University of Michigan: Consumer Sentiment	CSENT	Federal Reserve Economic Data (FRED)
Weekly US Regular Conventional Retail Gasoline Prices	FUEL	US Energy Information Administration
Personal Saving Rate, Percent	PSAVERT	Federal Reserve Economic Data (FRED)
Civilian Unemployment Rate, Percent	UNRATE	Federal Reserve Economic Data (FRED)
University of Michigan: Inflation Expectation, Percent	EXPINFL	Federal Reserve Economic Data (FRED)
NBER based Recession Indicators for the United States	USREC	Federal Reserve Economic Data (FRED)

Projected Data

All projected values (Table 2) are applied as monthly values. Where only annual forecasts are readily available (e.g. PSAVERT), monthly estimates are created based on expected monthly values from the previous three years, given the forecasted annual value.

Table 2. Projected data sources for variables found in final models.

Variable	Abbreviation	Projection Source
US Population, Thousands	POPTHM	Trend line projected
Consumer Price Index for All Urban Consumers	CPI	US Travel Association/Oxford Economics Travel Forecast Model
Personal Saving Rate, Percent	PSAVERT	OECD, Household savings forecast
Canada / US Foreign Exchange Rate, Canadian Dollars to One US Dollar	EXCAUS	Longforecast.com
Weekly US Regular Conventional Retail Gasoline Prices	FUEL	US Energy Information Administration, Short-term energy outlook

Results

Results from the three resulting models are included in Table 3. Each model was conducted using logged dependent and independent variables such that the rendered coefficients can be considered as elasticities. All coefficients appear to be correctly signed based on expected economic interactions and each model yields an Adj-R square value in excess of 0.95 indicating the models explain at least 95 percent of the variability of the dependent variable. A high R square value should not be a surprise given the observed seasonality of visitation (Figure 1). In addition to seasonal dummies, population significantly figures into each model, as does visitation the previous year (12 month lag).

The final Montana visitor (MTVIS) model contains two lagged independent variables. The US to Canadian exchange rate is significant at the 0.01 level, with a negative coefficient. The value indicates that for every 1 percent increase in the exchange rate (suggesting US goods are relatively more expensive for Canadians) six months prior to the travel date, a corresponding 0.15 percent decrease in visits is experienced. Similarly, a 1 percent increase in the CPI (proxy for travel cost) one month prior to travel, decreases visitation in the current month by 2.6 percent. Model scenarios with 6-month prior CPI increases also demonstrated significant and negative relationships. A 1-month lag was selected as it generated a better fit. April through October yield significantly more visitors than December, while January yields significantly fewer visitors. As should be expected from Figure 1, July possesses the highest positive coefficient.

Final models for both Yellowstone and Glacier National Park include fuel prices as the proxy for travel cost. Visitation to each is quite inelastic, -0.19 and -0.38 respectively, with respect to fuel cost. Both indicate that as real fuel prices increase, visitation decreases (all else being equal). Similar to the Montana visitor in general, the Glacier model (GLACVIS) includes a 6-month lag for the US-Canadian exchange rate and again demonstrates a negative relationship. Yellowstone visitors (YELLVIS) did not demonstrate a significant relationship with respect to the exchange rate; however, the rate of personal savings does positively and significantly affect visitation rate to Yellowstone. An increase of 1 percent in personal savings rate, marked 6-months prior, increases visits by .1 percent.

Across many modeled lags and other economic variables experimented with in arriving at the final models, it was frequently observed that lags of either 1-month or 6-months were more likely to demonstrate significance as opposed to the current time period or a lag of a full year. These observations would suggest that the lag is reflective of the planning period for many visitors in deciding whether to take a trip to Montana or the two parks.

Table 3. Final regression outputs following General-to-Specific approach.

Models			
	MTVIS (Ln)	YELLVIS (Ln)	GLACVIS (Ln)
Constant	-112.4471(-3.988***)	-7.61996(-1.77.)	-24.28215(-4.756***)
Real Fuel Price (Ln)	-	-0.19226(-2.81**)	-0.38548(-3.711***)
Population (Ln)	6.72186(4.119***)	0.74804(3.345***)	1.58877(5.92***)
January	-0.06448(-2.64**)	0.3151(5.08***)	0.06957(1.037)
February	-0.03032(-1.333)	0.45071(6.679***)	0.19485(2.834**)
March	0.02348(1.051)	0.05935(1.041)	0.42367(5.638***)
April	0.09175(3.757***)	0.32239(5.283***)	0.86724(8.95***)
May	0.22803(6.918***)	1.80765(11.588***)	1.82967(11.162***)
June	0.43293(8.263***)	2.43674(11.784***)	2.55694(11.541***)
July	0.59646(8.377***)	2.66129(11.789***)	3.01395(11.629***)
August	0.54297(8.241***)	2.57362(11.753***)	2.95539(11.599***)
September	0.33184(7.641***)	2.25477(11.71***)	2.54165(11.519***)
October	0.15198(5.535***)	1.4269(11.1***)	1.43744(10.435***)
November	0.01731(0.774)	-0.30547(-4.727***)	0.36522(5.024***)
Lagged Independent Variables			
Personal Savings Rate (Ln) (6 mo.)	-	0.1012(2.511*)	-
US-CAN Exchange Rate (Ln) (6 mo.)	-0.15404(-2.13*)	-	-0.32195(-2.173*)
CPI (Ln) (1 mo.)	-2.58826(-3.707***)	-	-
Lagged Dependent Variables			
MTVIS (Ln) (12 mo.)	0.6162(13.796***)	-	-
YELLVIS (Ln) (12 mo.)	-	0.29572(5.06***)	-
GLACVIS (Ln) (12 mo.)	-	-	0.30455(5.251***)
Adj-R square	0.983	0.983	0.979
Signif Codes: P<0.0001=***, P<0.001=**, P<0.01=*, P<0.05=.			

Model Performance

It is important to understand how well a model performs prior to utilizing it to generate forecasts into future years. Table 4 demonstrates that for each of the three models, performance routinely exceeds that of either the naïve 1 or naïve 2 forecasts; lower values indicate stronger performance. Given these results, the full models generated from the GtSM are used to forecast visitation for Montana out through 2020 and to 2019 for the two national parks. Confidence in expected fuel prices becomes significantly reduced beyond 2019, making forecasts less accurate.

Table 4. Model performance based on MAPE.

MTVIS			
	Full Model	Naïve 1	Naïve 2
2017	5.14	6.23	13.04
2016	7.83	9.11	14.81
2015	6.57	9.89	12.57
YELLVIS			
	Full Model	Naïve 1	Naïve 2
2017	15.76	20.08	51.15
2016	17.29	10.42	18.59
2015	15.45	15.23	28.18
GLACVIS			
	Full Model	Naïve 1	Naïve 2
2017	14.11	23.10	43.49
2016	15.94	17.96	21.64
2015	10.65	15.73	32.19

Conclusions & Recommendations

Expected Change in Explanatory Variables

The following sequence of charts provides insight to the expected values of the explanatory variables used in the visitor models. Actual observed values are shown in blue, while projected values are displayed in red. Sources for each projection are shown previously in Table 2. The signs on the associated coefficients in Table 3 provide indication of the direction of expected impact of the change in the variable on visitation to the respective entity.

Figure 2. Real fuel prices (2010-2019).

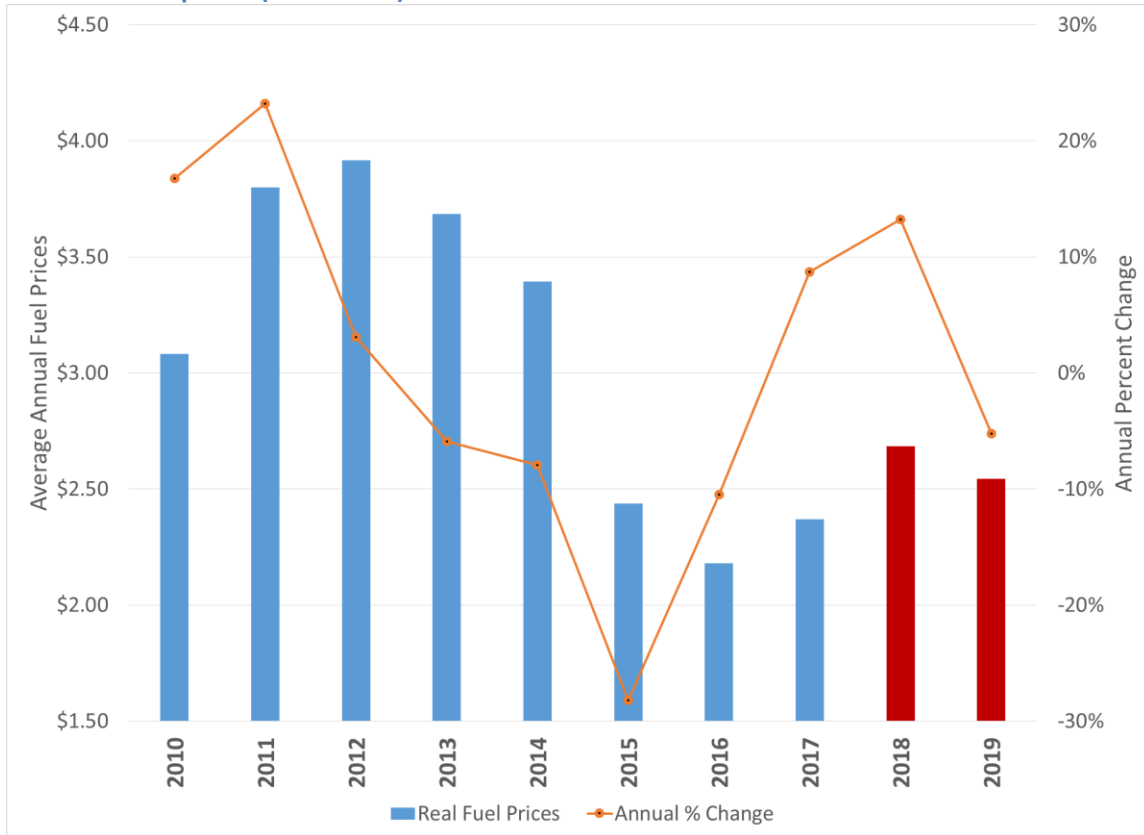


Figure 3. Personal Savings Rate (2010-2019).

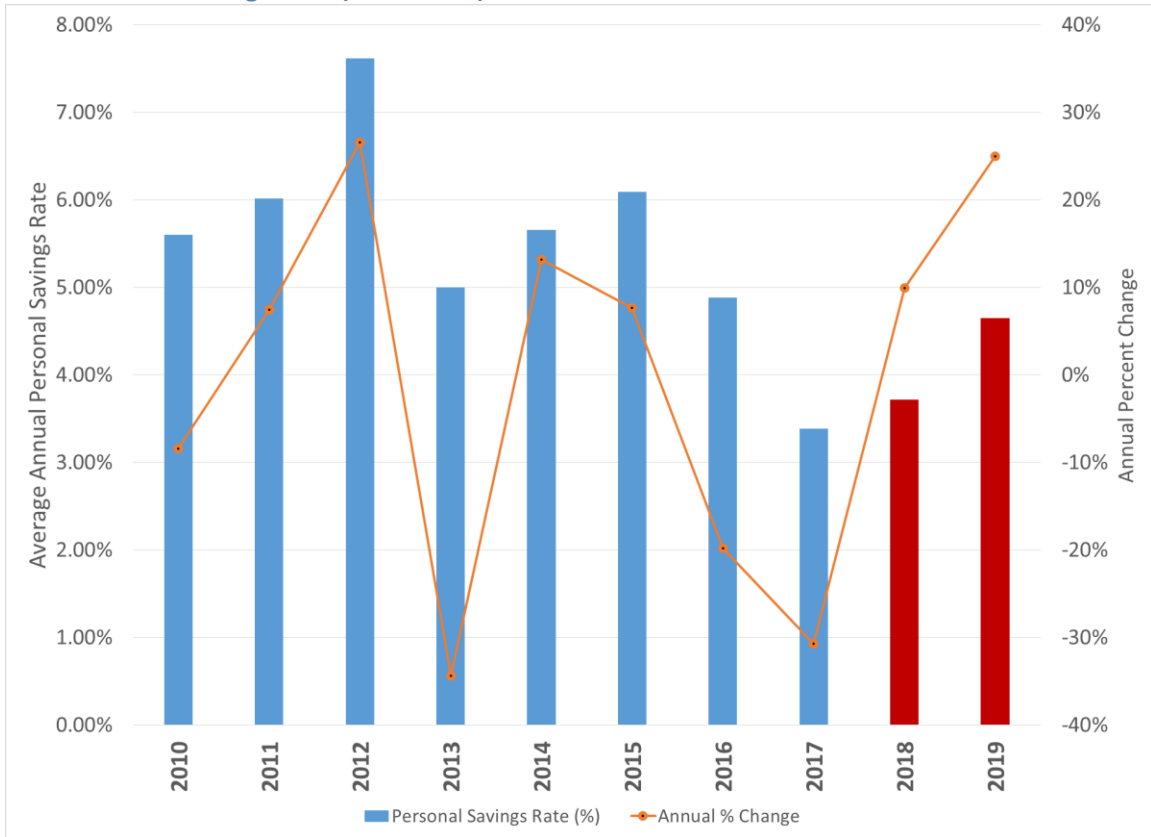


Figure 4. US - Canadian Exchange Rate (2010-2020).

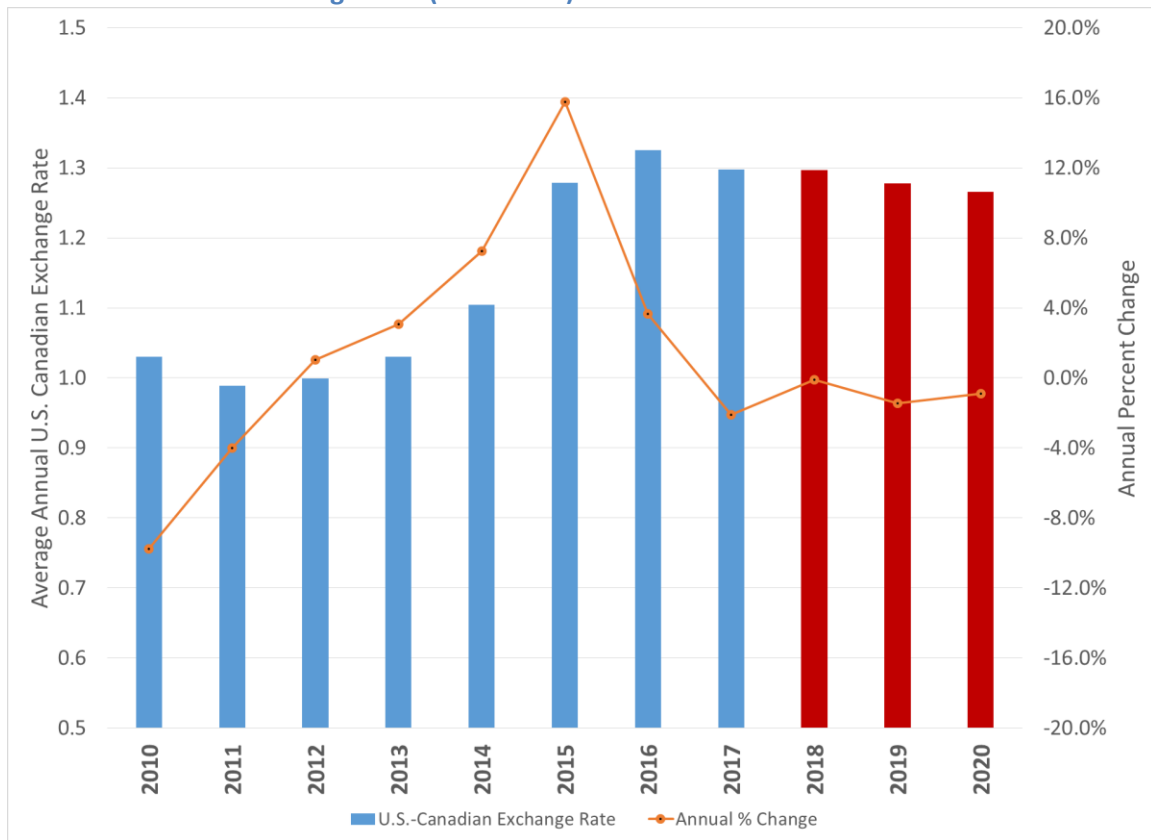
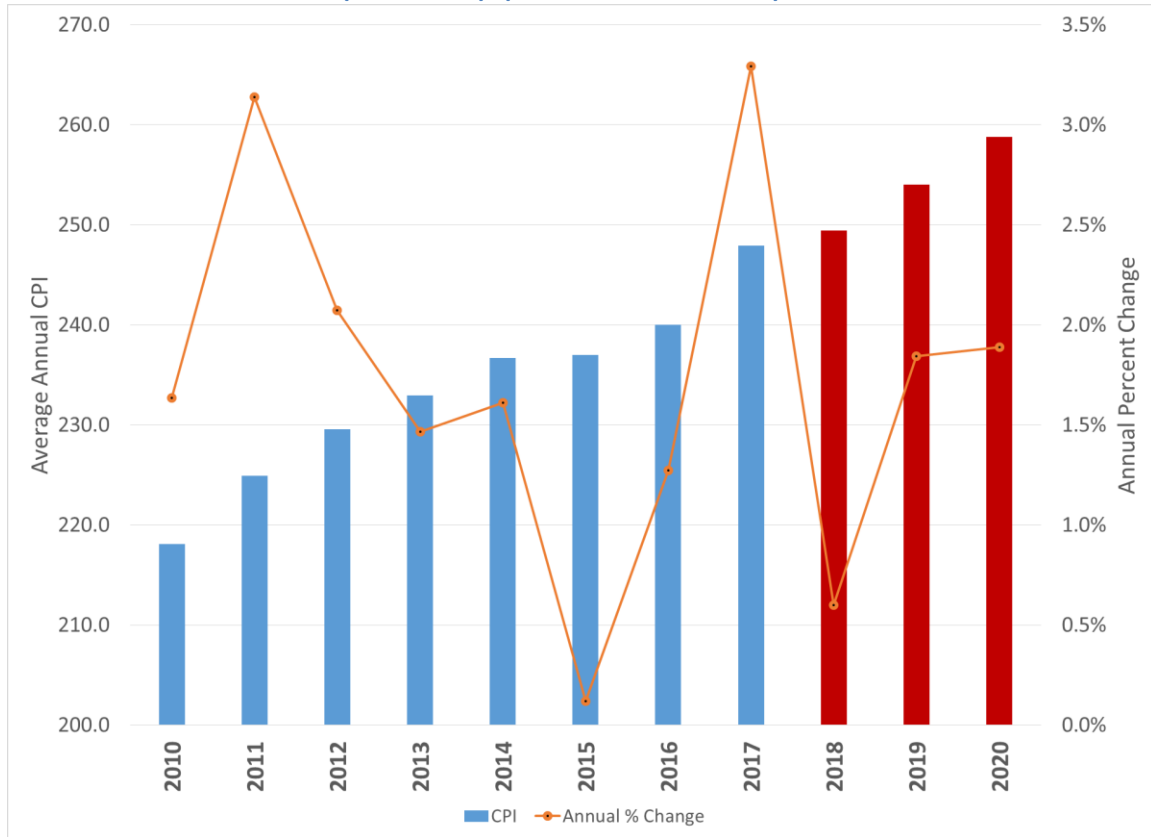


Figure 5. Consumer Price Index (2010-2020): (Index 1982-1984=100).



Visitor Forecasts

The following ex ante forecasts utilize the associated model for each of Montana, Yellowstone, and Glacier. Final forecasted values include adjustments made to bring ex post forecast in line with those observed values in 2015-2017. Both Montana and Yellowstone show positive growth in each forecasted year. Montana shows a growth of nearly 5 percent over 2017 numbers, followed by 2-3 percent growth in subsequent years. Yellowstone is forecast to experience moderate, relative to previous highs and lows, growth of 5-6 percent in 2018 and 2019. Meanwhile, we expect to Glacier NP to drop off slightly in 2018 from its previous record year in 2017, before recovering and exceeding this value in 2019.

Figure 6. Nonresident visitors to Montana (2000-2020).

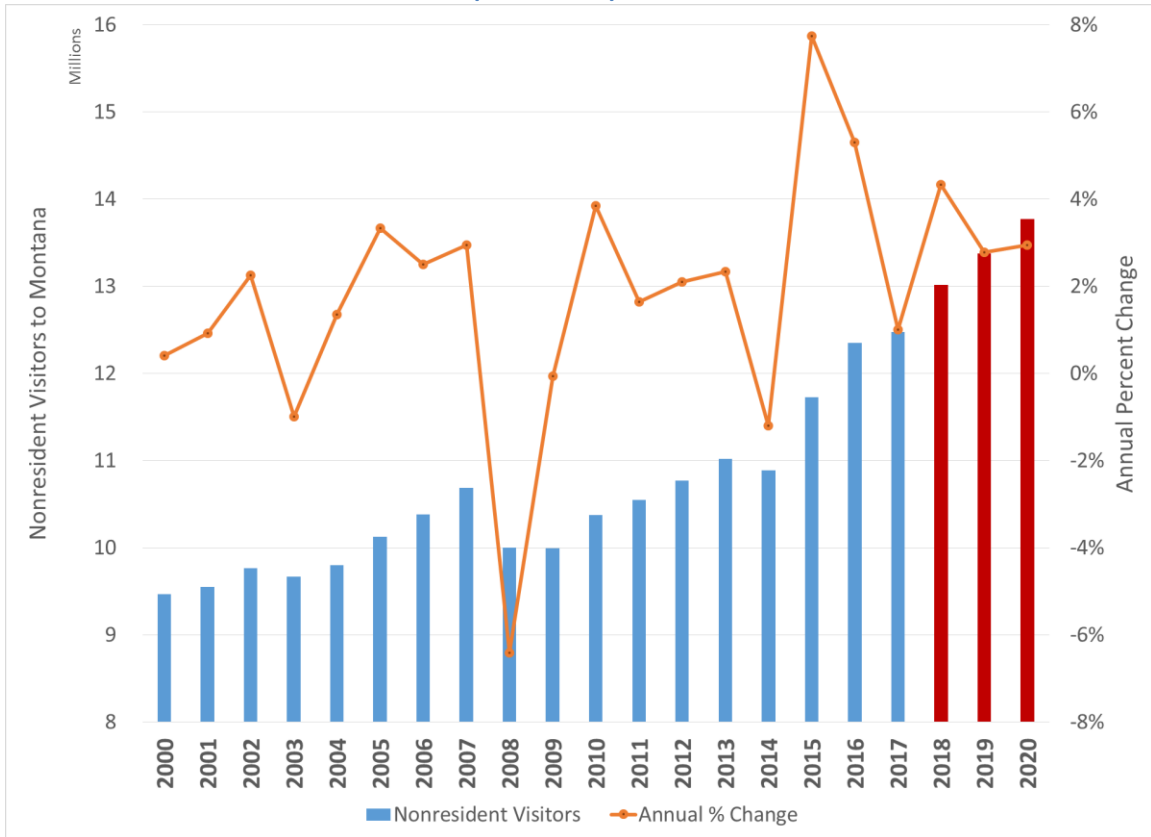


Figure 7. Recreation visits to Yellowstone NP (2000-2019).

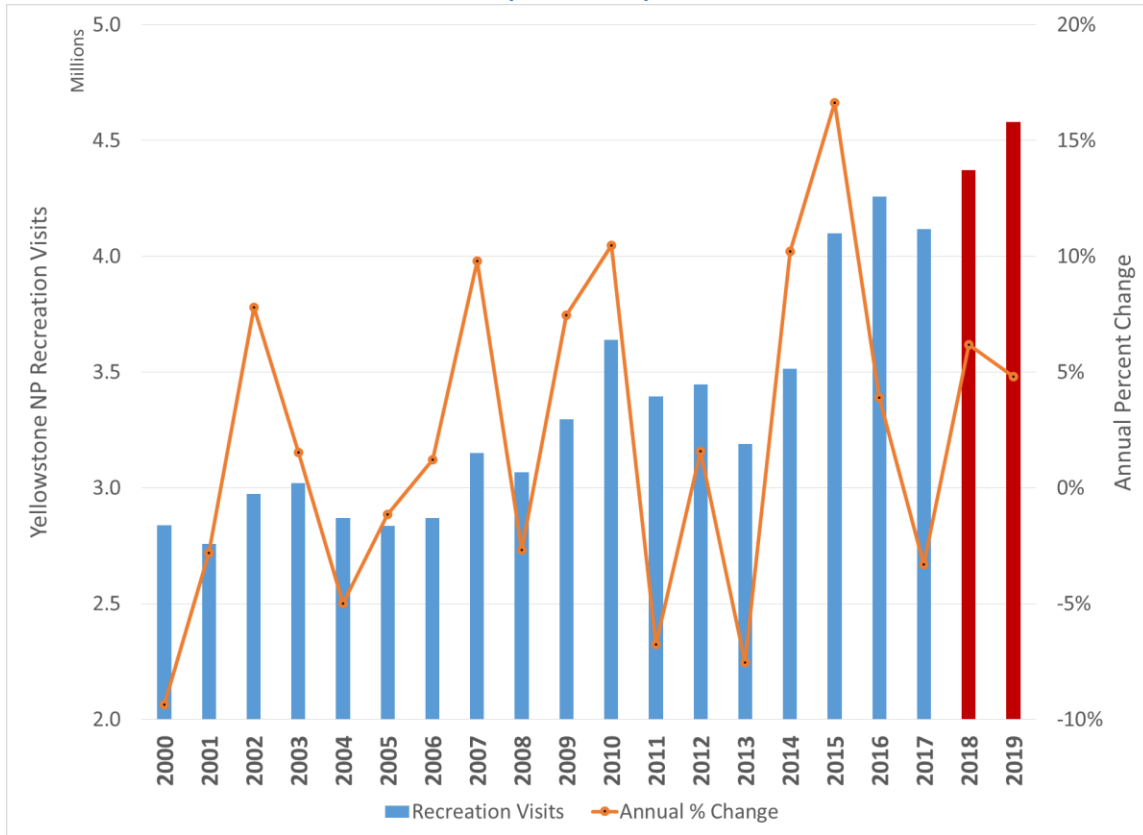


Figure 8. Recreation visits to Glacier NP (2000-2019).

