July-September 2024 Northern Michigan Search Interest Forecast

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Below are the search interest forecasts for the combined Northern Lower and combined Upper Pensinsula places for July, August, and September 2024. Note that the possible range for historical search interest is normalized to a maximum of 100 and a minimum of 0, but forecasts outside this range are permissible as these values are forecasted to be outside the historical range. In fact, Upper Peninsula forecasts are showing historical high values for July. Northern Lower Peninsula forecasts are near histrical maxiums. However, actuals so far this year have been under forecasts, especially for the Upper Peninsula. For previoius years, Upper Peninsula search interest has been trending upwards but for June realized search interest was almost 10 under forecast. For the Northern Lower, realized search interest was about 5 under forecast for June. Nonetheless, June's forecast (in grey) is similar to July's forecast (in red).

Also provided are barcharts comparing the average search interest for the forecast months (July,August, September) to the same months in previous years. The forecast for both peninsulas is higher than last year.
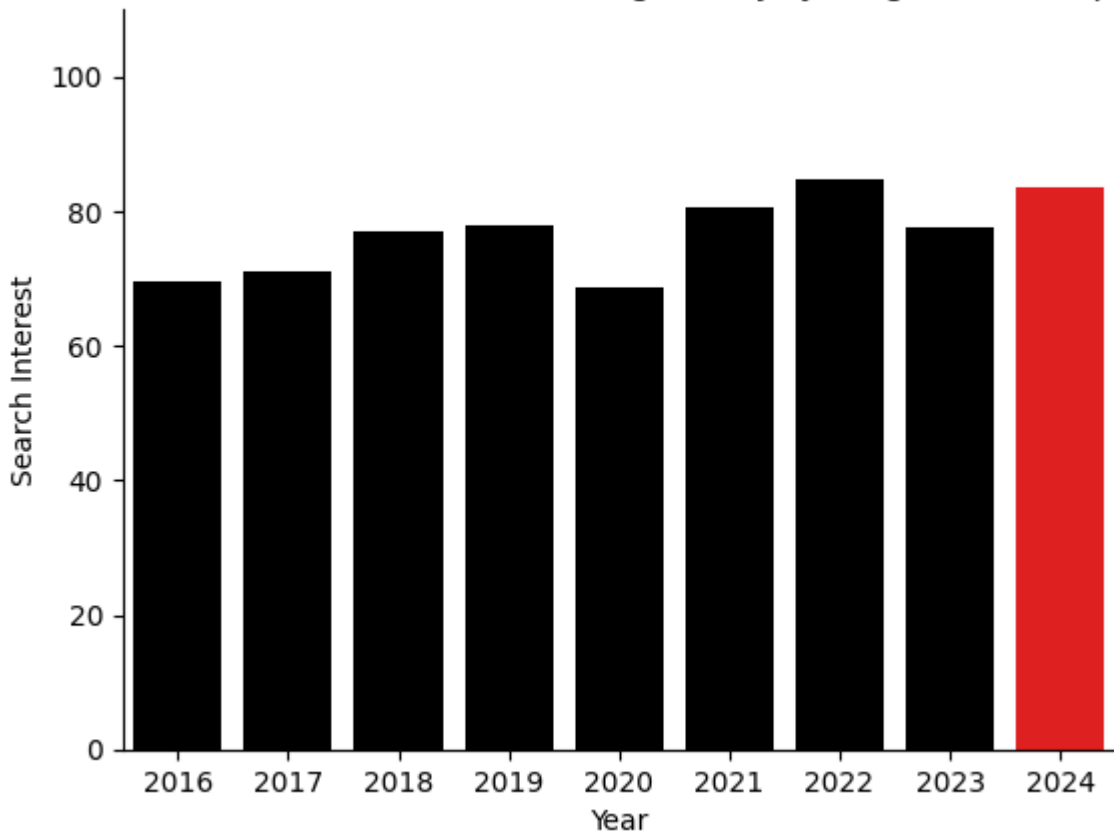
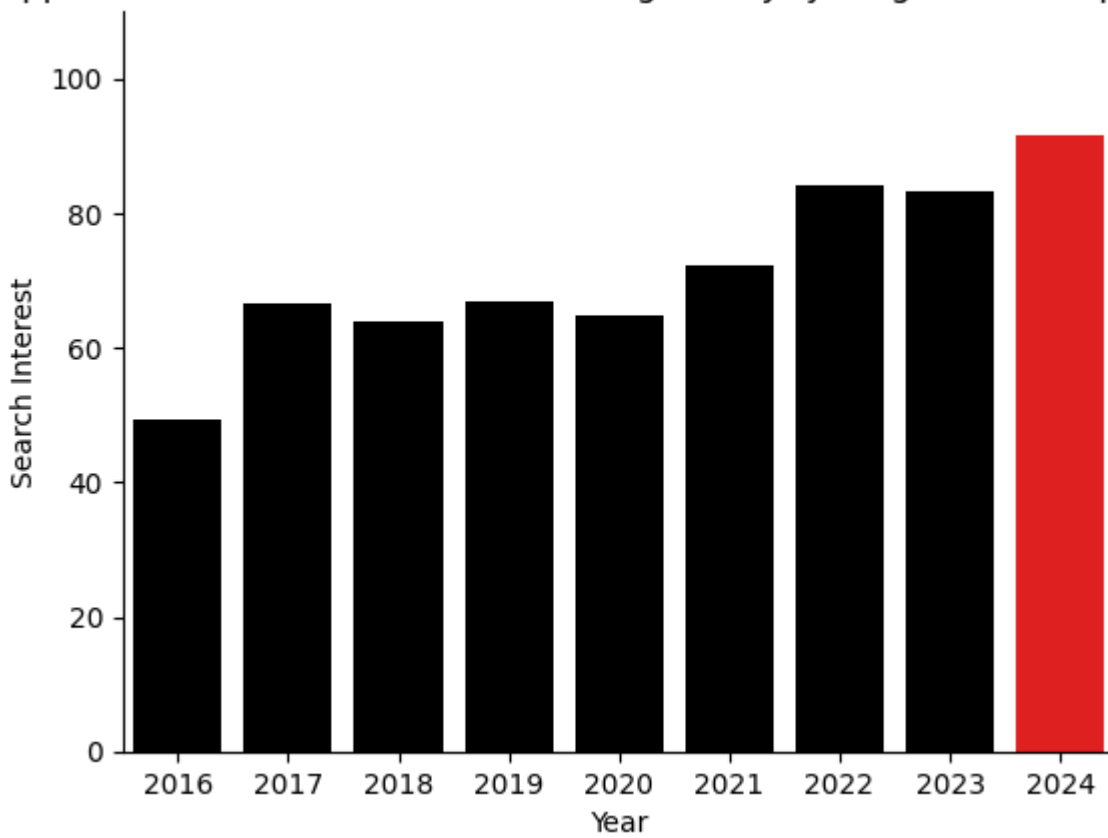Northern Lower Places Google Search Interest Forecast
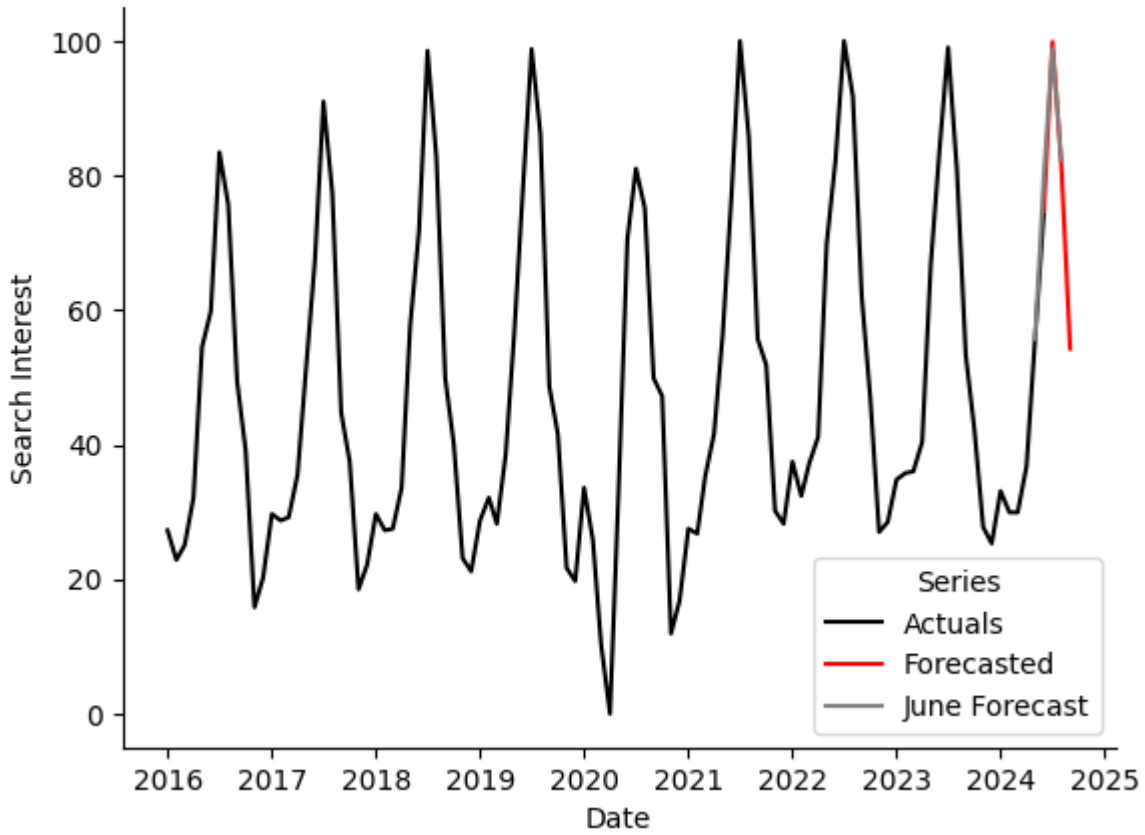
Upper Pensinsula Places Google Search Interest Forecast
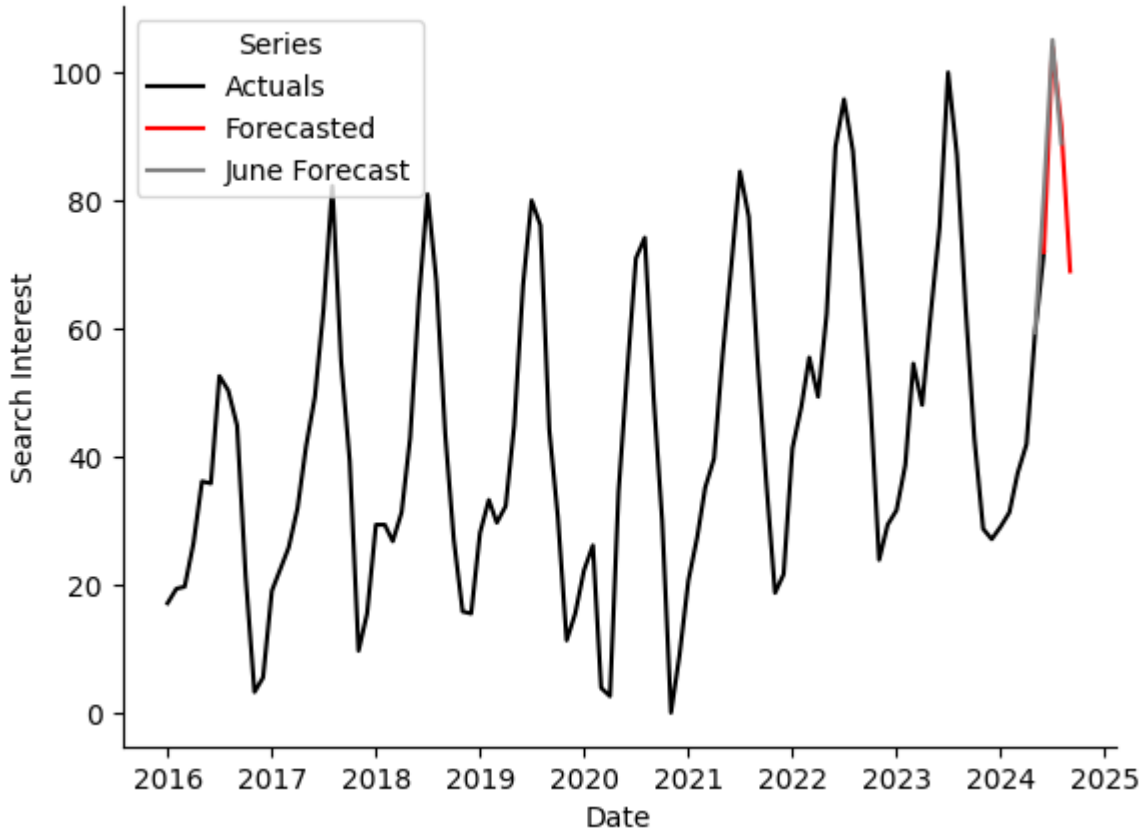
Northern Lower Search Interest Averaged for July, August, and September

Upper Peninsula Search Interest Averaged for July, August, and September

The following table shows the top five places that are forecasted to have the highest search interest compared to the same time period in 2023. From the original research used in this project, we know that many places in the western Lower Peninsula and some places in the Upper Peninsula are particularly sensitive to weather and/or gasoline prices. These places from the western Lower and Upper Peninsula show the largest expected changes. The exception might be free soil, which might show people literally looking for free soil for gardening in the Spring and Summer.

	Place	Peninsula	Difference
0	Free Soil	Lower	9.3
1	Tustin	Lower	8.1
2	Bruce Crossing	Upper	7.3
3	Parkdale	Lower	6.6
4	Crystal Falls	Upper	5.9

Three things impact the value of the search interest forecasts for each place.

1. The previous year's monthly value for each individual place.
2. While not directly impacting the model forecast, seasonal (12 mo) differencing accounts for the fact that search interest is higher in some portions of the year than others (so previous year actual is impacted).
3. Model difference: based on forecasted weather and gas price changes, the model will predict 12 mo changes from the previous year for each individual place. These new levels are aggregated via regression to the peninsula level series.

The two KDE plots below plot the distributions of the individual place actual values for the months of June, July, and August for the previous three years. Note that the values for 2023 serve as the last actual values for 2024. For the Lower Peninsula, the 2023 values are lower than 2021 and 2022. For the Upper Peninsula, the 2023 values are higher than 2021 and simlar to 2022.

Lower Peninsula Place Level Search Interest Averaged for July, August, and September
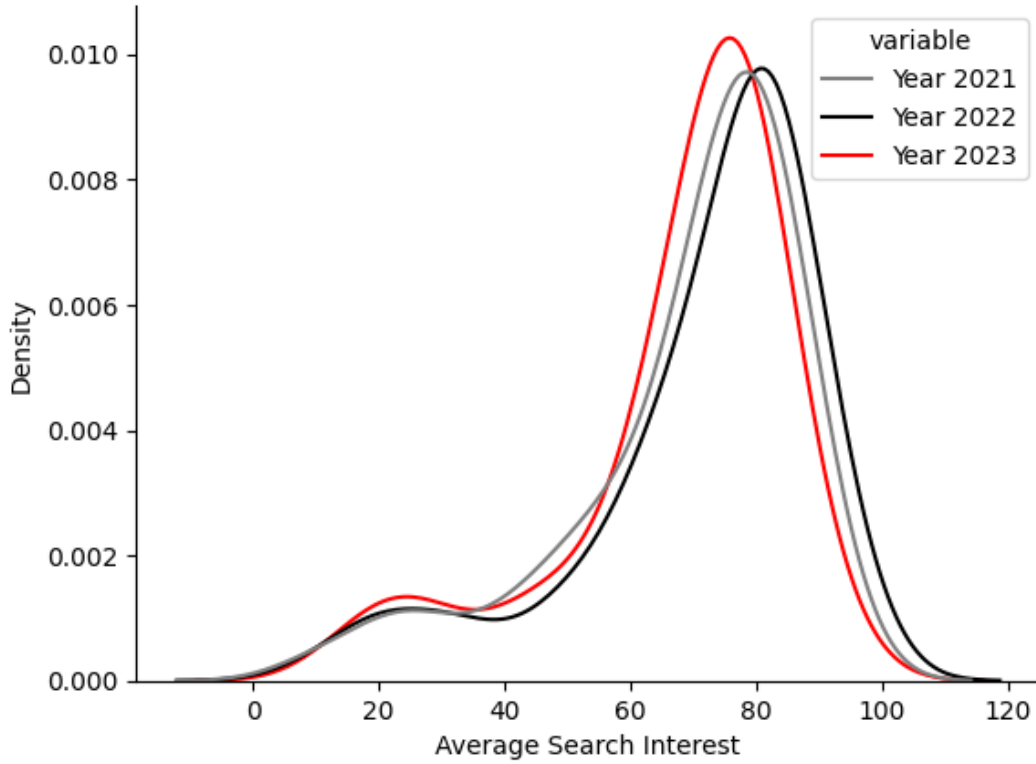

Upper Peninsula Place Level Search Interest Averaged for July, August, and September
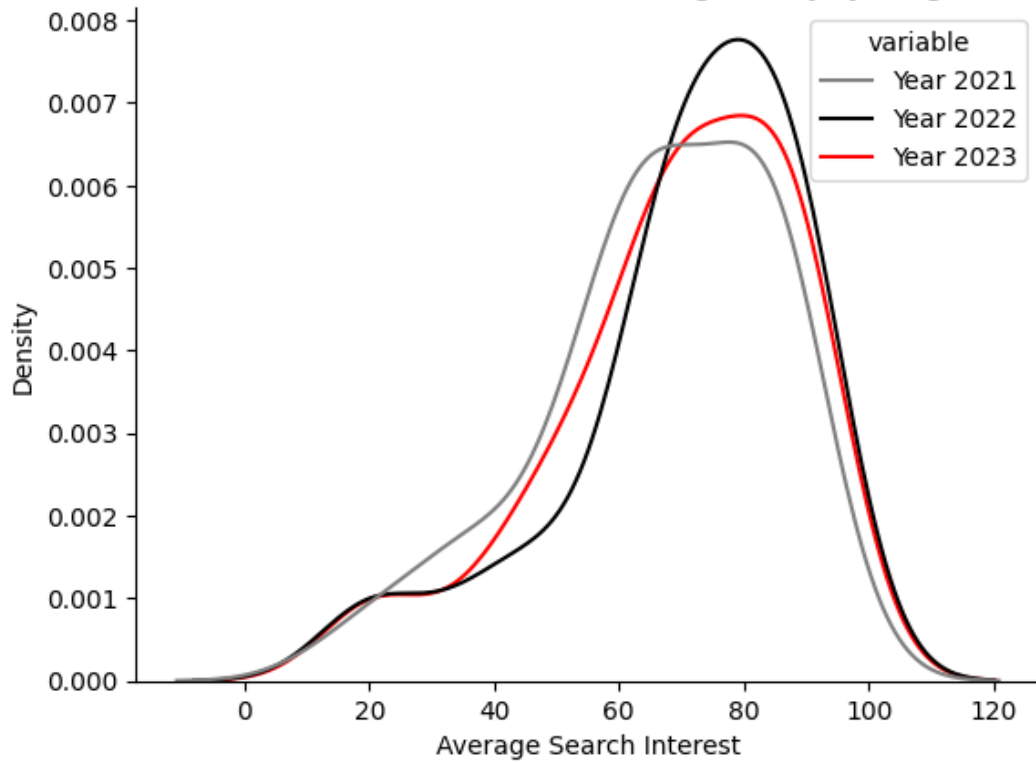

The following figure shows the aggregate average search interest for each calendar month. Both the Upper and Lower Pensinsulas have a seasonal peak in July/August with the Lower Peninsula peak solidly in July.

The Upper Peninsula has higher values for January-March likely due to winter snow sports like snowmobiling. For the July-September forecast period, we should see maximum into falling search interest.

Average Seasonal Values by Peninsula
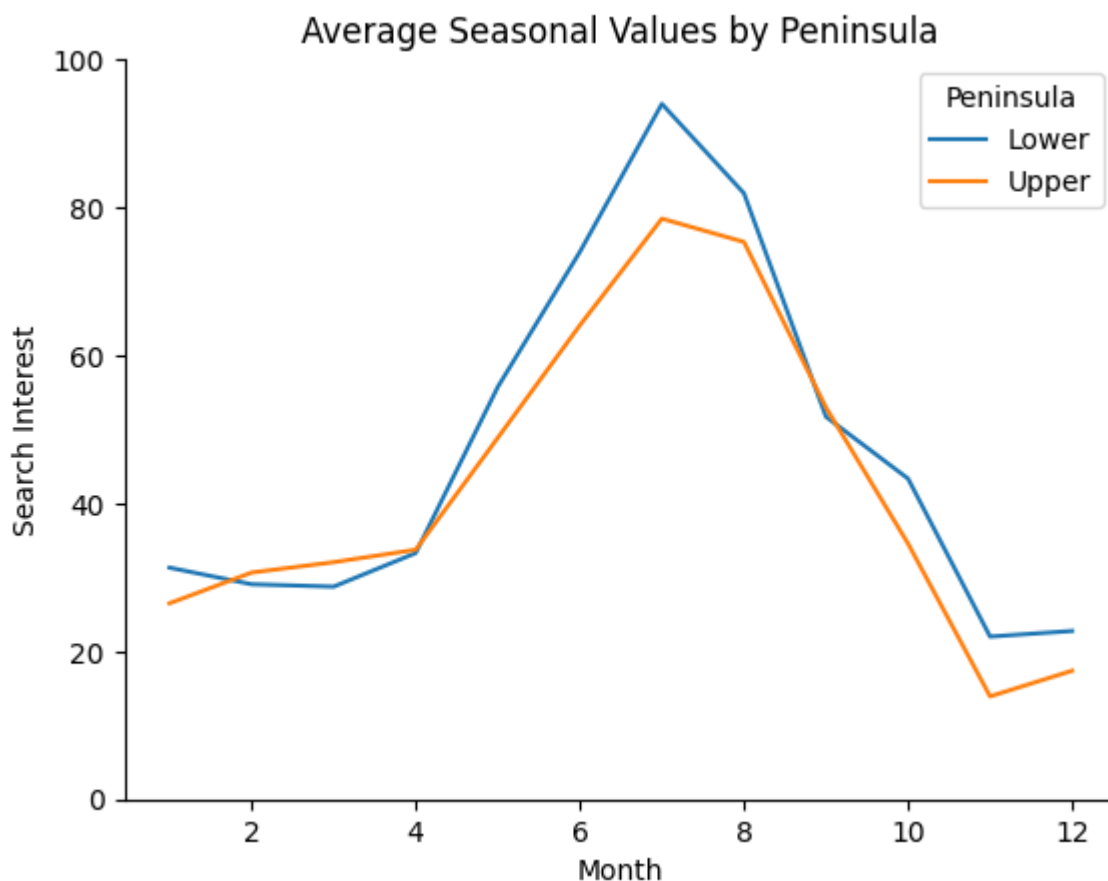
Finally, forecasts are determined by the forecasted place level change from the previous year based on weather and gasoline prices and the intercept capturing past trends. For both peninsulas, the most likely forecasted change from the previous year is positive. However, there are significant negative values especially for the Lower Peninsula. (Note, however, that the final forecast numbers by peninsula are weighted by the size of the contribution of the place to total search interest.)

Model Forecasted Change by Peninsula
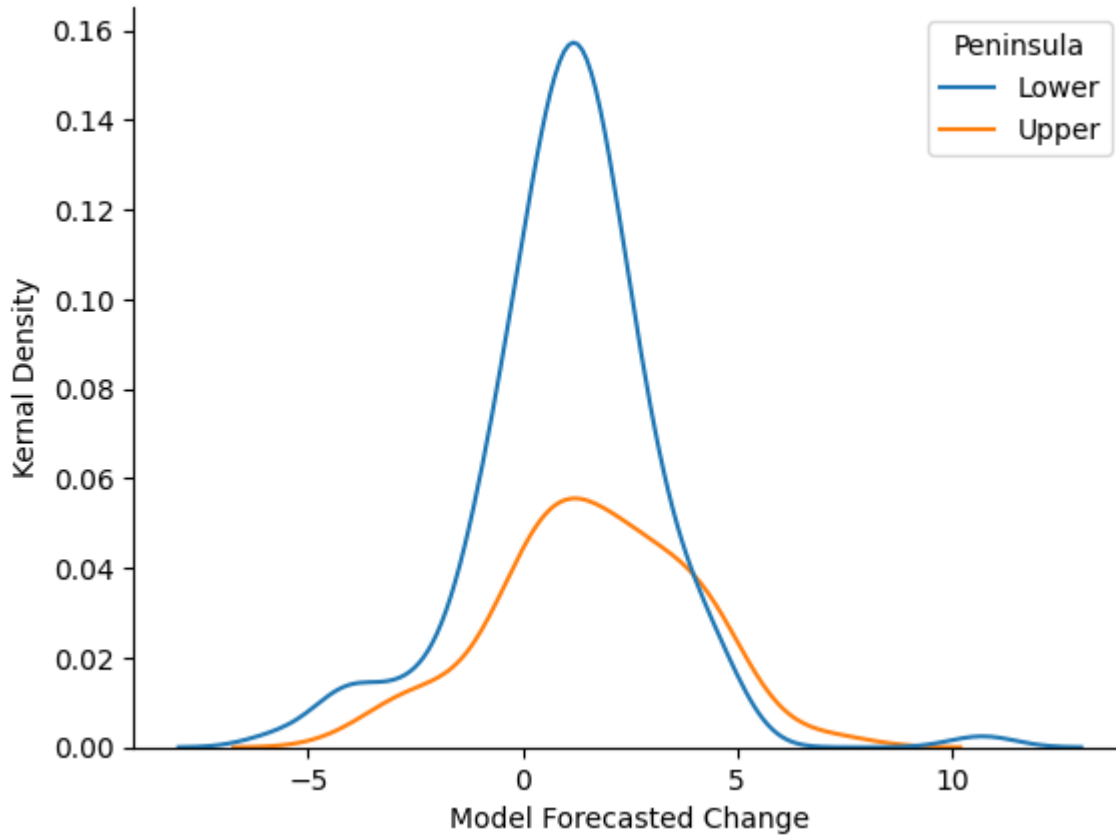
Places Impacted by Weather and Gas Prices

In addition to the above more aggregated analysis, I will now look at places that are impacted by weather and gasoline prices. (Many places are not impacted by these factors in the model and instead have an average increase or decrease year over year.) After identifying the places impacted by weather or gas prices, I then divide these places projected to have higher or lower search interest (on average) during the forecast months from the previous year. This is due to both the impact of weather and gasoline prices and the average trend year over year.

For the Northern Lower Peninsula, 64 of 142 places are impacted by weather or gasoline prices in the model. Of these, 48 are forecasted to have higher search interest during these three months than last year. The remaining are forecasted to have lower search interest than last year. These places are listed and the chart shows their yearly average search interest values for the three forecast months. Here, the verticle line signifies the start of the forecast period.

Northern Lower Places with Weather Impact Higher Interest than Last Year
_____
['glen arbor', 'suttons bay', 'elk rapids', 'au sable', 'charlevoix', 'manistee lak
e', 'harbor springs', 'manistee', 'grayling', 'arcadia', 'hubbard lake', 'onaway', 'a
lanson', 'interlochen', 'benzonia', 'lewiston', 'mio', 'wellston', 'saint helen', 'ea
st jordan', 'cheboygan', 'millersburg', 'omer', 'bay shore', 'harrison', 'scottvill
e', 'ossineke', 'alpena', 'rapid city', 'buckley', 'manton', 'prudenville', 'lakes of
the north', 'skidway lake', 'boyne falls', 'kaleva', 'brutus', 'harrietta', 'beaverto
n', 'grawn', 'reed city', 'parkdale', 'prescott', 'baldwin', 'alba', 'boon', 'tower',
'honor']

_____
Northern Lower Places with Weather Impact Lower Interest than Last Year
_____
['caberfae', 'east tawas', 'tawas city', 'bay view', 'cedar', 'rose city', 'brethre
n', 'maple grove', 'wedgewood', 'oak hill', 'eastlake', 'wolverine', 'norwood', 'turn
er', 'twining', 'chums corner']

Northern Lower Weather Impacted Places, Forecast for July, August, and September
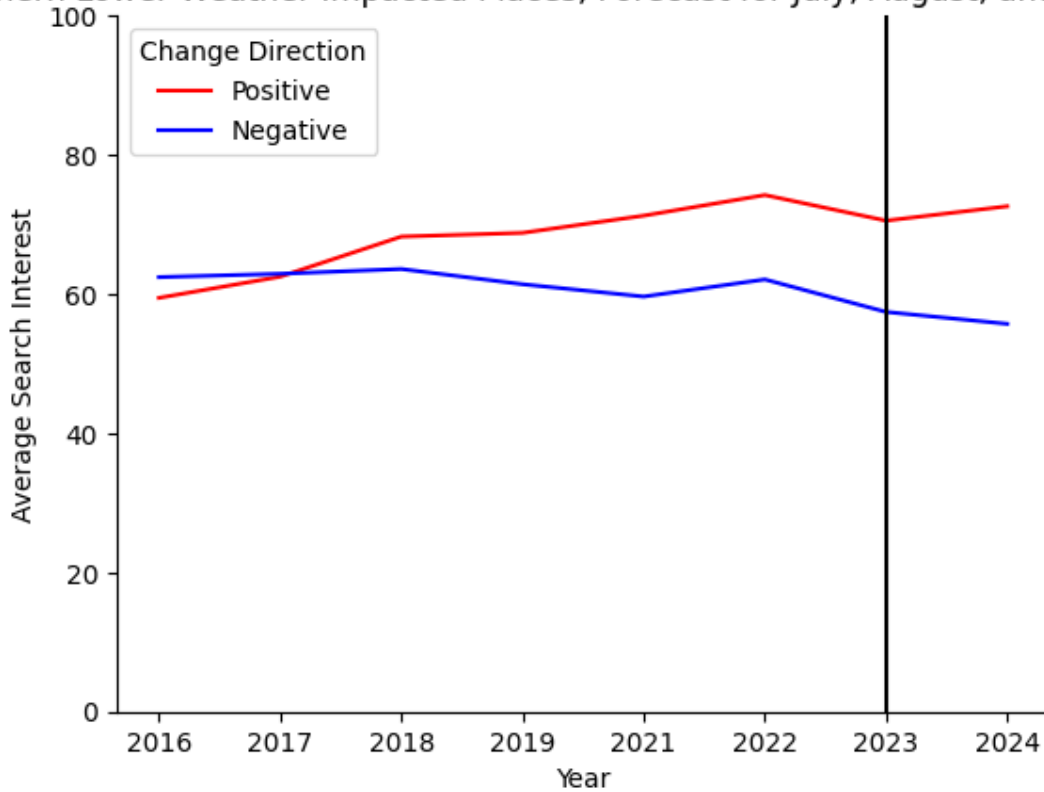
For the Upper Peninsula, 37 of 72 places are impacted by weather or gasoline prices in the model. Of
these, 26 are forecasted to have higher search interest during these three months than last year. The
remaining are forecasted to have lower search interest than last year. These places are listed and the chart
shows their yearly average search interest values for the three forecast months. Here, the verticle line
signifies the start of the forecast period.

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Upper Peninsula Places with Weather Impact Higher Interest than Last Year
_____
['munising', 'garden', 'grand marais', 'newberry', 'houghton', 'eagle harbor', 'big b
ay', 'brimley', 'lake linden', 'white pine', 'escanaba', 'ishpeming', 'hancock', 'pow
ers', 'rapid river', 'wakefield', "l'anse", 'norway', 'bessemer', 'laurium', 'bruce c
rossing', 'rock', 'negaunee', 'three lakes', 'kincheloe', 'caspian']


_____
Upper Peninsula Places with Weather Impact Lower Interest than Last Year
_____
['naubinway', 'mohawk', 'palmer', 'alpha', 'copper city', 'dollar bay', 'atlantic min
e', 'hubbell', 'stephenson', 'quinnesec', 'covington']
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Upper Peninsula Weather Impacted Places, Forecast for July, August, and September

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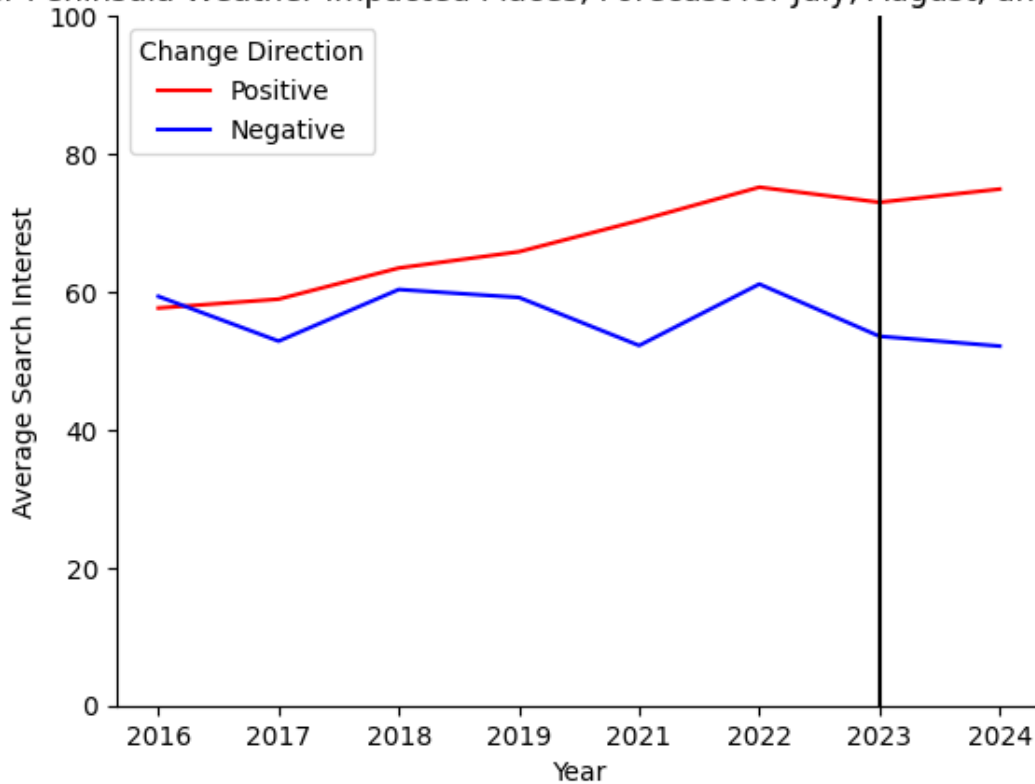
Data Variation and Weather Forecast Accuracy

In addition to what "should" impact search interest forecasts, there is also variation between search values pulled from Google trends. As I described in the original research for this project, search interest results will vary depending on whether you pull data using the pytrends package or from the Googletrends website. Pertinent to this project, results will also vary if you pull data using pytrends at different points in time. The severity of this difference changes from month to month. However, the difference is usually most visible for the Northern Lower and during the low search interst winter months.

While the most obvious solution to this problem is retaining historical values and keeping them constant, this is more difficult for Google trends data which is internally normalized. Thus, it's much easier to repull the entire series each time. I have a good idea of what my long term solution to this issue is, and I've started to save back each monthly data pull to help make it happen.

Compares Current and Past Month's Northern Lower Data Pull
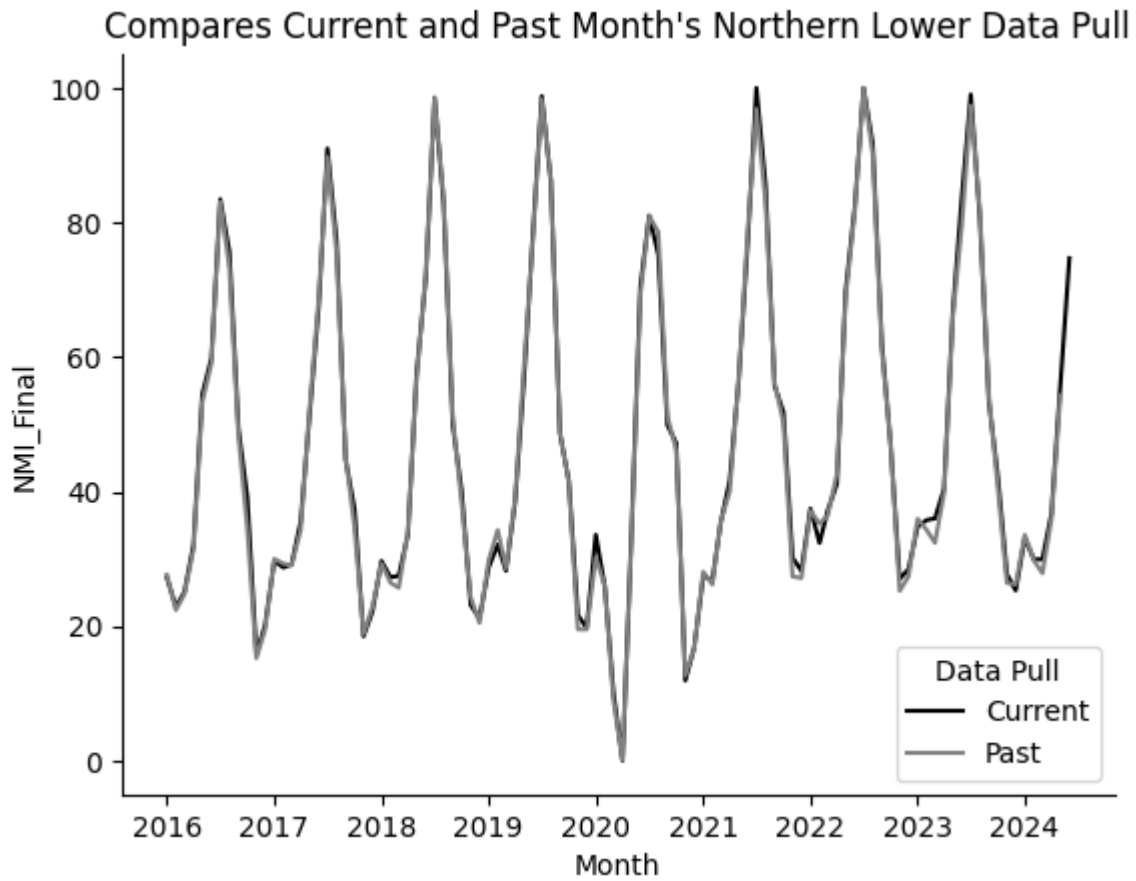
## Compares Current and Past Month's Upper Peninsula Data Pull
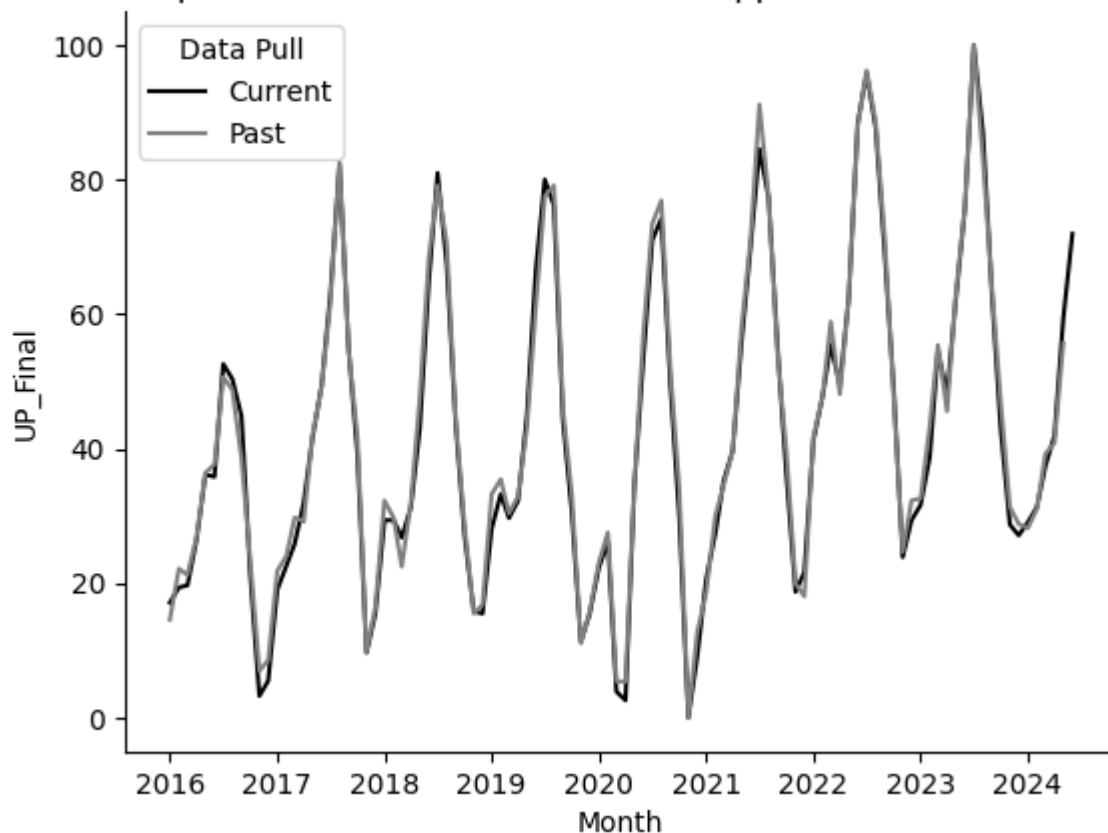
One last factor to consider is my source for weather forecasts, with a focus on temperature. All of my historical weather data used to train my models is from weather.gov. However, I source temperature forecasts from both weather.gov (average of averages) and accuweather (average maximums and average minimums). To some degree, it's difficult to compare these sources because average, maximum, and minimum temperatures are different statistics. Nonetheless, throughout this project, I've found that weather.gov usually forecasts above normal temperatures. To some extent I wonder if forecasts from a government agency are more likely to be high given politics surrounding issues like global warming.

Therefore, going forward I will roughly track the one month forward predictive performance of the weather.gov and accuweather forecasts. First, I will look at the previous month's average temperature and determine if it actually was above historical normals. Next, I will compare the previous month's forecasted accuweather average max and min temperatures to actual values.

For June, the normal average temperature is 63.9 degrees for Houghton Lake and 60.2 degrees for Sault St Marie. The actual average temperature values were Houghton Lake 66.3 and Sault St Marie 62.1. So actual temperatures were, indeed, above normals.

Based on the accuweather forecasts, we see that these were also quite accurate for June. Actual maximum temperatures were higher than forecasted for both places. Minimum temperatures were about the same between actuals and forecast for Sault Saint Marie and actuals were higher for Houghton Lake.

Comparison of Average Maximum Temperatures for Previous Month
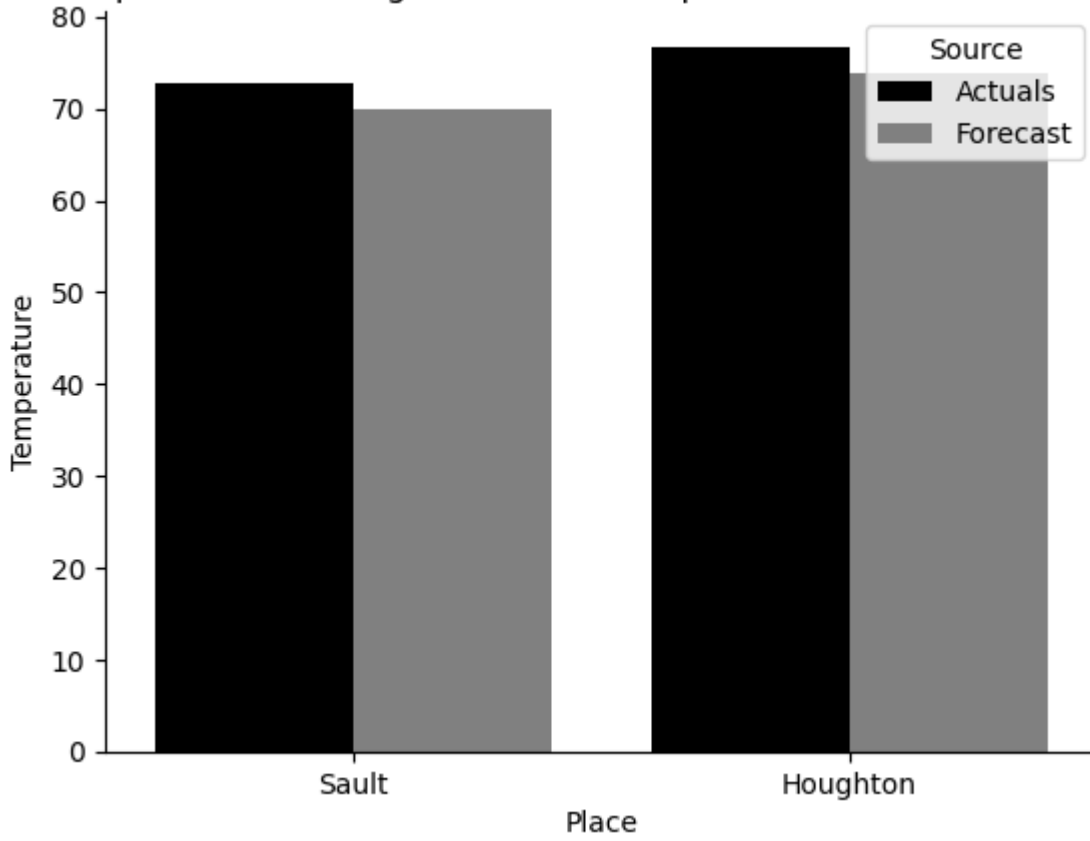
Comparison of Average Minimum Temperatures for Previous Month