Part 2 Extension Plan

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**Motivation / Problem Statement:**

The problem statement I will be addressing in this extension is: “What is the correlation between smoke and AQI in Pahrump, NV to Death Valley attendance?” I was motivated to study something which provided economic or service opportunities to the people who live in Pahrump. Reading Pahrump’s Wikipedia page, I learned that economic activity centers on two wineries and two legal brothels (*Pahrump, Nevada)*. However, it proved challenging to find data directly related to these establishments. A search for Pahrump on TripAdvisor revealed multiple tours to nearby Death Valley National Park (*The 15 best things to do in Pahrump - 2023 (with photos)*). I also found that approximately 19% of adults in Pahrump work in accommodation and food services or arts, entertainment, and recreation industries, well above the total national average of 9% Thus, making it possible that the proximity of Death Valley drives additional employment in these sectors (*Economy in Pahrump, NV*).

Beyond the tourist experience in Pahrump, I was interested to learn where locals spent their time and money. According to a local message board, activities are largely limited to the outdoors and casinos (*Pahrump, NV Reviews)*. It would then appear that Death Valley National Park may play not only an outsized role in tourism, but in family friendly services and activities near town.

From a practical perspective, I believe Death Valley likely creates recreation, employment, and income opportunities for local Pahrump citizens both directly and as tourists stop on their way from Las Vegas to the National Park. Thus, if smoke negatively impacts the number of visitors to the National Park, the town may suffer financially if they cannot find new ways to attract tourists.

Tactically, I hope to learn if annual attendance in Death Valley is correlated with smoke in Pahrump, NV. I believe it is possible that visitors may be deterred by smoke encountered enroute to the park, and it may limit local’s desire to visit as well. Additionally, because there was a limited correlation between Nye County’s AQI measurements and our smoke estimate, I would like to see if average annual AQI has a different or better correlation with Death Valley attendance.

**Impact Focus:**

I believe tracking the relationship between smoke, air quality, and Death Valley attendance primarily touches the “Services” focus area. As noted in the section above, it is likely that tourism to the park drives traffic through Pahrump. Indeed, when one plots a course from Las Vegas to Death Valley on Google Maps, one of the two recommend routes goes directly through town. Tourists may stop to fill up their cars, buy snacks, and gather provisions for the park. Each of these actions has a direct economic benefit to the town. Additionally, Pahrump locals may be employed by the National Park directly or maintain outside infrastructure (e.g., road crews, firefighters) which also supports the town financially.

While I cannot directly track how many Nevada visitors attend Death Valley each year, nor how many of those come from Pahrump, it is likely that many local students and adults also tour the park given its national presence, ecological uniqueness, and geographical proximity.

**Data or Model to be Used:**

For this project I will need at least three sources of data. The first source of information will be the annual smoke estimate for Pahrump, NV which was calculated in Part One of the project. The data used to calculate the smoke estimate comes from the USGS Wildland Fire Data which is in the Public Domain. The data is freely redistributable with proper metadata and attribution. In brief, the smoke estimate assumes smoke is proportional to the size of the fire (burned acres) and inversely proportional to the squared distance from the closest edge of the fire to the center of town. There are other factors involved in calculating the final smoke estimate including a multiplier for previously burned land (80% as smoky), early and inaccurate fire estimates (1.5x smokier than estimated for fires prior to 1984), and prescribed fires (half as smoky as otherwise predicted). To read more about the smoke estimate and raw data which went into it please see my README and data\_processing script located in the [data-512-wildfire-project repo](https://github.com/ekrolen/data-512-wildfire-project).

I will also leverage my AQI estimate from Part One of the assignment. This estimate contains an average annual fire-season AQI measurement taken from all sensors in Nye County. Of note, sensors only measured one kind of particulate and Pahrump is located at the bottom of the irregularly shaped county. For more information, please see my README and epa\_comparison script located in my [data-512-wildfire-project repo](https://github.com/ekrolen/data-512-wildfire-project).

New data for this analysis consists of annual attendance numbers for Death Valley National Park. I am measuring park attendance because it impacts both the service economy and tourism experiences of the citizens of Pahrump. While the land was officially declared a National Park October 31st, 1994, the National Parks Service has kept attendance records for the site since 1933. A link to the dataset can be found [here](https://irma.nps.gov/Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20(1904%20-%20Last%20Calendar%20Year)?Park=DEVA). There are two columns in the dataset, “Year” and “Recreation Visits”. “Year” refers to the year of park visitation, and “Recreation Visits” is the annual total number of recreation visits. Per the National Park Service’s Visitor Use Statistics Page, a “Recreation Visit” is “The entry of a person onto lands or waters administered by the NPS except as defined above for non-reportable and non-recreation visits [e.g., entry into the park by NPS employees or contractors, commuter or through traffic, guides, government personnel with business in the park]. Funeral parties at National Cemeteries, school groups, etc. are reportable as ‘recreation’ use since their use is for the purpose for which the park was established. Visits originating on surface vehicles (trains, boats, other) and aircraft may be counted if they stop and disembark passengers on NPS administrated territory. The applicable rule is that one entrance per individual per day is countable” (NPS visitor use statistics definitions). Per the National Parks Service Disclaimer page, “Copyright law does not protect “any work of the U.S. Government” where “a work prepared by an officer or employee of the U.S. Government as part of that person's official duties” (See, 17 U.S.C. §§ 101, 105). Thus, material created by the NPS and presented on this website, unless otherwise indicated, is generally considered in the public domain. It may be distributed or copied as permitted by applicable law“ (Disclaimer (U.S. National Park Service)). I will acknowledge the NPS as the source of the attendance data in my repository, codes, and final reports.

To map the correlations between smoke, AQI, and Death Valley attendance I will use a linear regression model with both the independent variable (smoke or AQI estimate) and dependent variable (Death Valley attendance) normalized. I will normalize both measurements to ensure they are on the same scale. I have chosen linear regression not only for its visual simplicity, but also for its Pearsons correlation coefficient which describes how much variability in the dependent variable is attributable to the independent variable.

New Data Link: <https://irma.nps.gov/Stats/SSRSReports/Park%20Specific%20Reports/Annual%20Park%20Recreation%20Visitation%20(1904%20-%20Last%20Calendar%20Year)?Park=DEVA>

**Unknowns and Dependencies:**

There are three unknowns which may impact my ability to address the supplementary questions. First, I cannot be sure how much Death Valley uniquely contributes to the local service economy of Pahrump. While one can see that a main route into the park passes directly through town, we cannot know how many people stop for gas, snacks, supplies, etc. Additionally, we have no insight into the average cost of purchases made by tourists who do stop. However, assuming approximately 1.1 million visitors entered the park in 2022, 50% started in Las Vegas, and half of them took the route past Pahrump, at least 275,000 people would have driven by the town. We know from best places that approximately 20% of the people in Pahrump work in food services or arts, entertainment, and recreation industries, so it’s likely that they help serve tourists passing through (*Economy in Pahrump, NV*).

The second unknown which may impact the project is we don’t know how often people from Pahrump tour the park and if they use the same services as tourists. We do know from NPS websites that there are teaching materials available for multiple grades visiting the park, so it’s possible that many of the local population would have visited Death Valley as schoolchildren. Additionally, multiple visitor boards and travel websites suggested visiting the park as a means of recreation. Growing up in Colorado, I regularly went on school and recreational trips to National Parks, so it’s possible this culture exists in Nevada as well. For the purposes of this project, we will assume that the service industry which supports tourists also supports locals visiting the park.

Finally, we cannot know all factors which could cause someone to attend or not attend Death Valley. We assume that smoke would be a deterrent because of poor air quality, lack of visibility, and potential threats of fire. However, it is impossible to know all the reasons someone may or may not to choose to visit. Further, it is possible that smoke in Pahrump could cause opposite effects with locals vs. tourists. Tourists may choose to turn around for fear of a poor experience, whereas locals may go to the park in search of better air. It would be difficult, if not impossible, to conclude what the definitive impact on each population is in the next 2 weeks.

**Timeline to Completion:**

The timeline for completing the supplementary analysis begins by counting backwards from the final presentation (slides due Nov. 30th). Although I have multiple years of experience in management consulting building decks, the PechaKucha format is new to me, so I would like to have all materials ready for slide building by 11/27. This means the bulk of the analysis will need to be completed prior to the Thanksgiving holiday. To that end, I will take the following steps next week:

1. Milestone 1 - Get Data (11/20)
   1. Export the park data as a CSV and save it in GitHub repo
   2. Document the steps and sources as necessary
2. Milestone 2 - Compare Smoke to Attendance (11/21)
   1. Plot Death Valley attendance vs. annual smoke estimates to check for a visual correlation
   2. Normalize Death Valley attendance and annual smoke estimates to derive a measure of correlation
   3. Document the process as necessary
   4. Create takeaways for final presentation and Part 4
3. Milestone 3 - Compare AQI Estimate to Attendance (11/22)
   1. Plot Death Valley attendance vs. annual AQI estimates to check for a visual correlation
   2. Normalize Death Valley attendance and annual AQI estimates to derive a measure of correlation
   3. Document the process as necessary
   4. Create takeaways for final presentation and Part 4

**Sources:**

*The 15 best things to do in Pahrump - 2023 (with photos)*. Tripadvisor. (n.d.). https://www.tripadvisor.com/Attractions-g45986-Activities-Pahrump\_Nevada.html

*Economy in Pahrump, NV*. Pahrump, NV. (n.d.). https://www.bestplaces.net/economy/city/nevada/pahrump

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