

A Survey of Colorado's Fourteeners

Name

Date

Intro to Statistics

Background Information

"Fourteeners" is a term used to describe mountain peaks above 14,000 feet. In Colorado, climbing (and sometimes skiing) all of the fourteeners is a popular pastime for athletic people. The Colorado Fourteeners Initiative estimates that over 500,000 people will climb a fourteener this year. This made me especially interested in environmental degradation on the peaks, especially the more popular peaks with easy summit trails or easy access from Denver. I also hope to climb all of the fourteeners this summer. This made me especially interested in the difficulty of routes available on each peak and the number and type of accidents that occur on each peak.

Data Collection

My sample was all of the peaks over 14,000 feet in the state of Colorado. There are 52 easily agreed upon peaks, which all sources I examined included. There are five other peaks which some sources included, while others did not. Those peaks are Challenger Point, Conundrum Peak, Mt. Cameron, El Diente Peak and North Maroon Mountain. Because each of those peaks had distinct data points to offer I included them in the sample.

Because the mountains cannot speak for themselves I utilized a number of different sources for information. My sources included *Colorado's Fourteeners*, by Gerry Roach (2011), John Kirk's list of fourteeners accidents (2006) and a paper by Jon J. Kedrowski (2008). For more information, see the individual questions and the bibliography.

The questions were:

1. What is your name according to Roach (2011)?
2. What mountain range are you a part of according to Roach (2011)?
3. How tall are you in feet according to Roach (2011)?
4. How far from Denver are you in miles? To answer this question I used the latitude and longitude given by Roach (2011), and the latitude and longitude of my apartment, 39° 44' 21" N and 104° 59' 3" W, and calculated the difference in statute miles with my GPS. When considering this question it's important to keep in mind that this number of miles is as the bird flies, rather than driving, and thus only offers an approximation of distance from Denver for people.
5. Are you considered highly popular, moderately popular or less popular to climb? To answer this question I used the rankings developed by Kedrowski (2008), based on his survey of Colorado Mountain Club summit logs. Peaks rated highly popular had more than 1500 summits a year, while peaks rated moderately popular had between 500 and 1500 summits a year, and peaks rated less popular had less than 500 summits a year.

6. How environmentally degraded are you, in a ranking of all the peaks? To answer this question I used the Fourteeners Environmental Degradation Index (FEDI), developed by Kedrowski (2006). When considering this question it's important to keep in mind that these numbers are an index, based on many factors, which may overemphasize or underemphasize relevant factors and could change over time as a result of restoration, intervention and changing use patterns.
7. How difficult is the most common route to climb you in R-Points? To answer this question I used the route Roach (2011) identified as most popular and the R-Points Index, also developed by Roach (2011). When considering this question it's important to keep in mind that it refers to only one route, of many possibilities on each peak. Moreover, Roach includes elevation gain, length of approach and technical difficulty, but not objective danger, which is also relevant.
8. How many fatalities have there been while climbing you? To answer this question I used John Kirk's list of accidents on fourteeners (2006), based on his survey of back issues of *Accidents in North American Mountaineering*. When considering this question it's important to keep in mind that reporting on mountaineering accidents has been inconsistent, especially prior to the 1990s and when bodies are not recovered, and that the data only goes up to 2006. Finally, this data point does not take into account the popularity of the peak, and thus the relative frequency of fatalities on the peak, or the difficulty of the routes that we being attempted when climbers have died.
9. What is the most common cause of death while climbing you? To answer this question I used John Kirk's list of accidents on fourteeners (2006), based on his survey of back issues of *Accidents in North American Mountaineering*. When considering this question it's important to keep in mind that many mountaineering accidents have multiple contributing causes, but only one proximate cause, and that these data points are based on the reporting of surviving party members or observation of rescuers, and may not be entirely accurate.

Summary Statistics

For the question how tall are you in feet according to Roach (2011) the mean was 14163.81 feet. The median was 14153 feet. The mode was 14197 feet. The variance was 17478.91 feet. The standard deviation was 132.21 feet. The five number summary was 14001, 14047.5, 14153, 14264.5 and 14604 feet.

For the question how far from Denver are you in miles the mean was 125.23 miles. The median was 115 miles. The data was bimodal, with modes of 105 and 115 miles. The variance was 2030.75 miles. The standard deviation was 45.06 miles. The five number summary was 48, 99, 115, 150 and 215 miles.

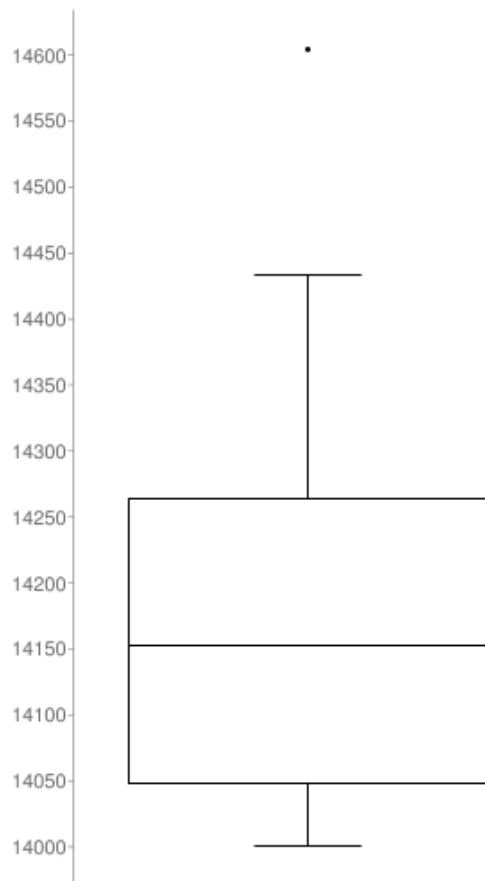
For the question how environmentally degraded are you, in a ranking of all the peaks the mean was 29. The median was 29. The data had no mode. The variance was 275.5. The standard deviation was 16.59. The five number summary was 1, 14.5, 29, 43.5 and 57.

For the question how difficult is the most common route to climb you in r-points the mean was 278.49 r-points. The median was 267 r-points. The data was multimodal, with modes of 47,175,186,210,235,267 and 294 r-points. The variance was 12479.11 r-points. The standard deviation was 111.71 r-points. The five number summary was 96, 192.5, 267, 352 and 535 r-points.

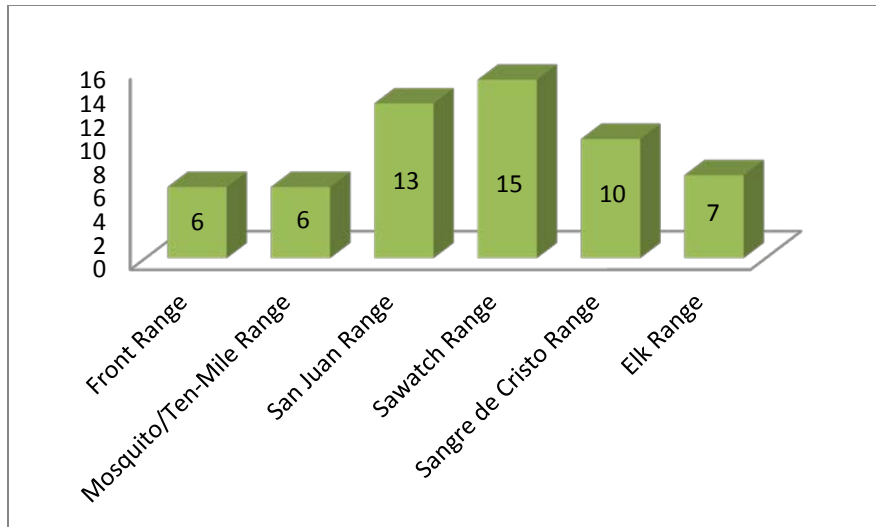
For the question how many fatalities have there been while climbing you the mean of the data was 3.67 deaths. The median was 1 death. The mode was 0 deaths. The variance was 62.05 deaths. The standard deviation was 7.88 deaths. The five number summary was 0, 0, 1, 4 and 56 deaths.

Graphs

Heights of the Fourteeners

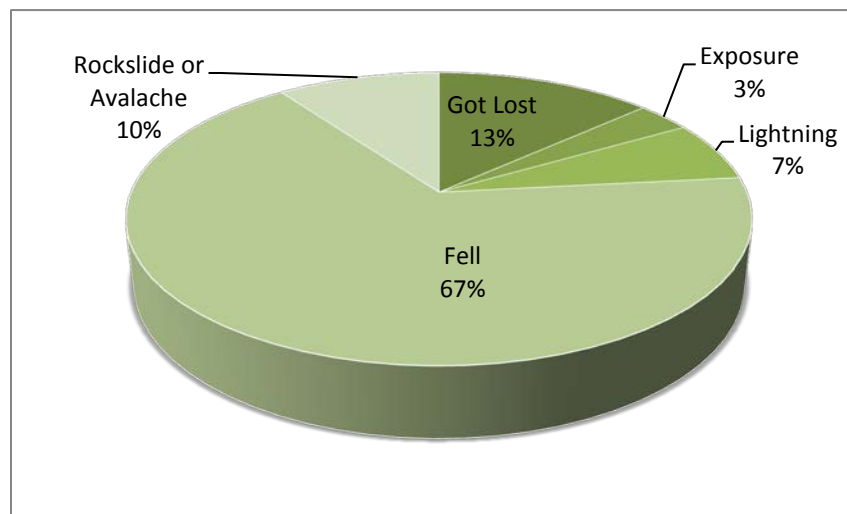


This graph shows the data from the question how tall are you in feet. Because it is a box and whisker plot, it uses the five number summary to show you the range of the data and divide it into quartiles. From this box and whisker plot we can see that most of the peaks are clustered in the low 14000 feet range, while Humbolt Peak, at 14604 feet, is positively skewing the data somewhat.



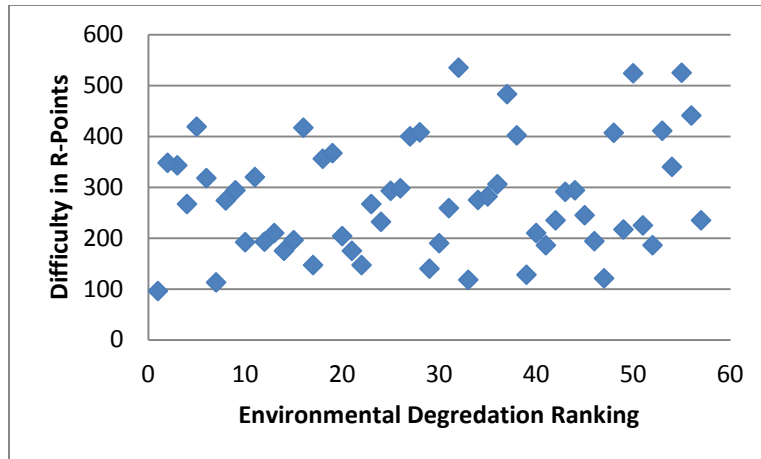
Distribution of Fourteeners Across Colorado's Ranges

This graph shows data from the question what range are you a part of. Because it is a bar chart we can see the relative frequency of each peak. We can see that the Sawatch Range is the most common, and the Front and Mosquito/Ten-Mile Ranges are the least common, but that the peaks are relatively evenly distributed across ranges.



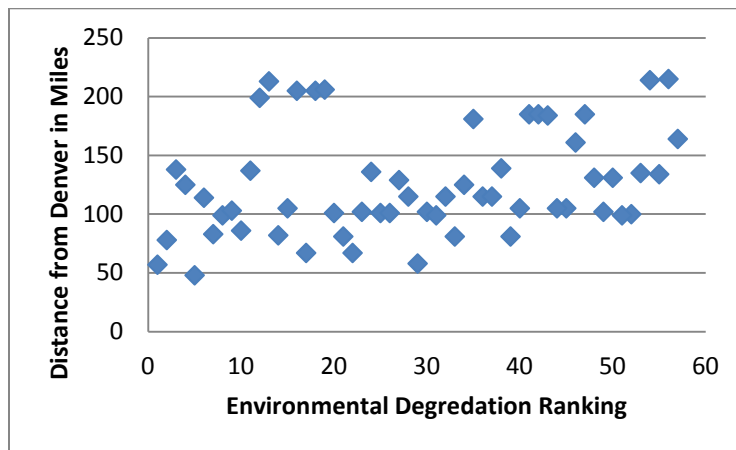
Most Common Accidents on Each Peak

This graph shows data from the question what is the most common cause of death while climbing you. I omitted peaks without any deaths and peaks where there was more than one most common cause of death. Because it is a pie chart we can see the relative proportions of each cause of death. Falls are by far the most common cause of death, accounting for more than half of all deaths. Exposure is the least common.



Correlation of Environmental Degradation and Difficulty

This graph shows a correlation between the data points for the question how environmentally degraded are you, in a ranking of all the peaks and how difficult is the most common route to climb you in r-points. Because this is a scatter plot we can see that there is very little correlation between environmental degradation and difficulty of the most common route.



Correlation of Environmental Degradation and Difficulty

This graph shows a correlation between the data points for the question how environmentally degraded are you, in a ranking of all the peaks and how far are you from Denver, in miles. Because this is a scatter plot we can see that there is a weak positive correlation between environmental degradation and difficulty of the most common route, where peaks closer to Denver are more environmentally degraded. There are a few outlying peaks, further from Denver, which are very environmentally degraded. those points represent very popular peaks outside in the southwestern corner of the state.

Conclusions

I found this project extremely informative. On a personal level, I found the information about fatalities especially helpful, because it made me aware of potential hazards I will encounter. The most surprising result for me were the fatalities on Long's Peak, which is the most popular fourteeners by far. There have been both an accidental shooting and a suicide on Long's Peak.

If I had more time and resources, I would have collected quantitative data about the popularity of each peak. Unfortunately, the only reliable data on the number of climbers on each peak is the summit registers, which are not readily accessible for the public. I was especially interested in the relationship between the popularity of each peak and its level of environmental degradation. I attempted to approximate that relationship by examining the relationships between the environmental degradation and the difficulty of the most common route and between environmental degradation and the distance from Denver in my scatter plots, assuming that peaks with easier routes and easier access from Denver would be more popular. Those relationships were weaker than I would have expected, but I believe that if you created an index to examine both difficulty and distance together, there would be a stronger positive correlation. I would have also been very interested in a correlation of the popularity of each peak and the number of fatalities.

References

- Bluman, A. (2010.) *Elementary Statistics: A Brief Version*. New York: McGraw-Hill.
- Kedrowski, J.J. (2008). Determining the Relative Annual Mountain Climbing Frequency On Colorado's 14,000-foot Peaks. *Mountain Research and Development*, 10(53), p. 82-92. Retrieved from <http://dx.doi.org/doi:10.1659/mrd.1053>
- Kirk, J. (2006). *Fourteeners Accidents Data* [Data Set]. Retrieved from <http://listsofjohn.com/Accidents/14erloc.html>
- Roach, G. (2011.) *Colorado's Fourteeners: From Hikes to Climbs*. Golden, Fulcrum Publishing.