Synchronous Firefly Mating Display Prediction In Great Smoky Mountain National Park

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The goal of this project was to use weather data obtained from NOAA to analyze historical synchronous firefly mating displays in Great Smoky Mountain National Park in order to help NPS predict peak dates more efficiently to assist with planning for a massive influx of visitors.

Data for weather patterns was obtained from NOAA's Climate Data Search and historical firefly mating display dates were compiled from National Park announcements and research work by Lynn Faust. Data was cleaned, explored, analyzed and visualized in Jupyter Notebook, using pandas for data analysis and matplotlib & seaborn for data visualization.

The analysis started with examining weather earlier in time, and eventually zoomed in on the weeks surrounding the peak display. Comparing season "start" dates with winter weather showed very little correlation, except for possible affects of late winter fluctuations. Late season (end-March) peaks in snowfall and temperatures may have shown an impact.

The next step was to move closer to our average mating season and look at spring weather. In this case, there is a potential link in rainfall from March - June that may give us some clues as to varying weather effects on firefly development into adult stages, which then would impact our adult mating seasons.

For much of this work, the goal was to examine impact on the actual "start" dates of peak mating season, as this would be most beneficial for NPS planning. However, the variations in mating season "length" kept jumping out as an interesting research opportunity, and I wanted to see if "start" date had any relationship to season "length", although it seems it does not.

To examine weather impacts on season "length", precipitation in May & June was examined in a "short" season versus a "long" season, with data showing that more precipitation might encourage a longer mating season - particularly during firefly pupa & adult stages.

The final step was to visualize some of the data using the current methodology of degree days, and the data analysis seems to support this as a sound method of determining firefly mating season start dates.

This research indicates prediction of mating season dates will likely continue to occur near the peak firefly mating season. The data supports the hypothesis that weather most often affects the pupa stage, predicting any earlier than the current dates of end-April for early-June seasons does not seem likely.

However, there is a lot more to explore with this data. I think the most interesting next steps would be to examine the weather impact on firefly mating season length, as this not only is interesting from a tourism perspective, it could also lead to some interesting discoveries that support the conservation of these amazing and unique fireflies in North America.