MC1: Entry and Exit Data

Project Title: Traffic Impact on Rose-Crested Blue Pipit Nesting Numbers
Team: Pippa Hodgkins (priscilla.hodgkins@tufts.edu), Yinan Qian (yqian03@tufts.edu), Andreas Moe (andreas.moe@tufts.edu)

Abstract: The goals of this project are to determine if changes (or the lack thereof) in traffic patterns in the Lekagul Nature Preserve over a 1-year timeframe have impacted the nesting habits of the Rose-Crested Blue Pipits, specifically the decline in nesting rates. The system should be able to take the traffic sensor data and provide a visualization of the traffic patterns over the timeframe. Ideally, the system will use a map of the preserve to visualize the data and focus on the changes in traffic patterns of specific vehicle and gate categories. The visualization should be able to provide an easy interpretation of the traffic patterns of the park using colored heatmaps at each sensor to easily distinguish between vehicle types. In addition, the visualization should be able to filter timeframes and track progression in order to identify traffic patterns.

Goals:

- The overarching goal of this project is to determine if traffic within the Boonsong Lekagul Nature Preserve has any effect on the decreasing number of Rose-Crested Blue Pipit nesting pairs.
    - Could depend on a variety of traffic pattern changes such as increased truck traffic, increased unauthorized access to restricted areas, or more overnight campers arriving at the park.
    - It is up to us to use the results from both our data preprocessing/analysis and our visualization system to determine a comprehensive result.
- We need to build a comprehensive visualization system to adequately display our results
    - This system should display the dataset in a way that reflects what the data is trying to model in the real world. It should also enable us to interact with the data and make it easier to glean any insight on the problem at large.
    - Our visualization should provide a clear interpretation of our data and results that do not rely on previous understanding of the data set.
    - The system will likely depend on JavaScript and the d3 library for the majority of the visualizations.
    - Ideally, we would like to visualize the data using density plots on the map of the park. Since we do not know how realistic this is to build, we will first use histograms to visualize the data.
- We also need to build a data pre-processing system to filter and evaluate the given data in a meaningful way.
    - We will likely filter the data based on vehicle and gate types in order to investigate subsets of the data.

    - We will also need to determine if any data cleaning is necessary; i.e. missing months of data or sensors with extremely limited data
    - The exact technology that we will use is not clear yet. A possible tool to handle and filter the data could be the Pandas library in Python.
- Interact with our system to test our hypotheses.
    - Once we have a system that allows us to visualize and interact with the data, we need to filter the data in accordance with our hypotheses.
    - Our data filtering should help to provide insight into the problem, not muddle the bigger picture by unnecessarily segmenting the data.
    - The interactions should be intuitive and easy-to-use, enhancing the results
- Create a professional presentation of our results and building process for this project
    - Keeping track of changes that our system goes through over the course of this project is an important step in the development of the system
    - Our presentation should be unambiguous in its results and carefully provide interpretations of our findings based solely on the data and our visualization system

Data Description: The provided data for this project is a supplied .csv file containing the sensor data for vehicles at 5 locations in and around the park: entrances, general-gates, gates, ranger-stops, and camping. For each vehicle which passes through a sensor, the vehicle's category, id, gate-name, time, and date are recorded. Vehicles can be 1 of 6 categories: 2 axle cars (or motorcycle), 2 axle trucks, 3 axle trucks, 4+ axle trucks, 2 axle buses, and 3 axle buses. Park service vehicles are denoted with the letter "P," though all park service vehicles fall into the 2 axle truck category. The sensors in the park do not observe daylight savings time, and there are certain locations that only vehicles tagged as park service vehicles can pass through. The provided data also includes a map of the park which is 12 miles by 12 miles, with the roadways indicated by white pixels and each sensor indicated by a specific color depending on what type of sensor it is (green for entrances, blue for general-gates, red for gates, yellow for ranger-stops, and orange for camping). The data was collected over a 1-year span between May 1 2015 and May 31 2016. Other relevant information about the dataset is that traffic either passes through the preserve, stays as day campers, or stays as extended campers.

3 Hypotheses:

1. The increase in traffic, especially larger trucks and buses, is driving nesting numbers down.
2. Non-park vehicles getting past gates and to unauthorized areas are driving nesting numbers down.
3. The increase in overnight campers is driving nesting numbers down.

Timeline:

- Data pre-processing (basic statistics run) (April 5th)
- Preliminary HTML page with dataset upload and preliminary data filtering (April 5th)
- Early bar chart visualization (April 8th)
    - No timeline yet, just filtered statistics over full timeframe
- Add timeline (April 15th)
- Implement interactive map in place of preliminary bar chart (May 5th)
- Final analysis of results (May 11th)

Feature List:

- Interactive map of the preserve based on the provided map in the dataset
    - Serves as a traffic heatmap: circles at each sensor location with width determined by traffic density (nice-to-have)
        - If this seems unfeasible, use histograms or other appropriate charts to display the filtered data.
    - Play button to cycle through the selected timeline. (must-have)
    - Filter by vehicle type- can view the heatmap for 2 axle cars or 3 axle buses depending on selection (must-have) (differentiate vehicle type by color)
    - Filter by time-of-day (must-have)
    - Also filter by sensor type- can only view camping sensors or general-gates depending on preference (must-have)

Team Roles:

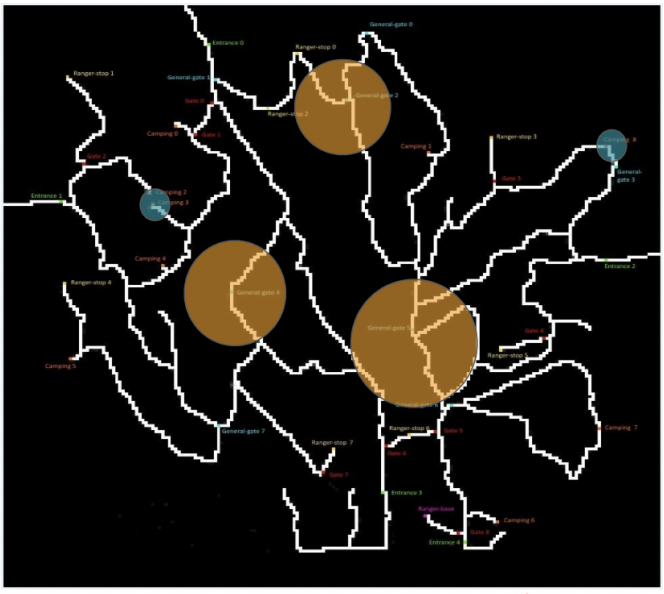
- We plan on splitting the work equally amongst ourselves and working together on the whole project.

Storyboards:

05/01/2015 05/31/2016

Vehicles
- [x] All
- [x] 2-axle car (or motorcycle)
- [x] 2-axle truck (non-park)
- [x] 2-axle truck (park)
- [x] 3-axle truck
- [x] 4-axle (and above) truck
- [x] 2-axle bus
- [x] 3-axle bus

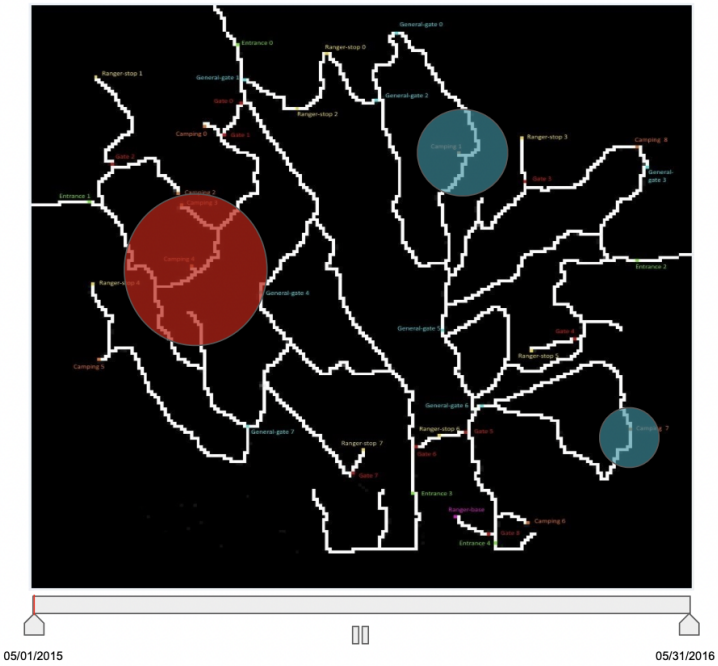
Gates
- [x] All
- [x] Entrances
- [x] General gates
- [x] Gates
- [x] Ranger stops
- [x] Camping



05/01/2015 05/31/2016

Vehicles
- [ ] All
- [x] 2-axle car (or motorcycle)
- [x] 2-axle truck (non-park)
- [x] 2-axle truck (park)
- [x] 3-axle truck
- [x] 4-axle (and above) truck
- [x] 2-axle bus
- [x] 3-axle bus

Gates
- [x] All
- [x] Entrances
- [x] General gates
- [x] Gates
- [x] Ranger stops
- [x] Camping



05/01/2015 05/31/2016

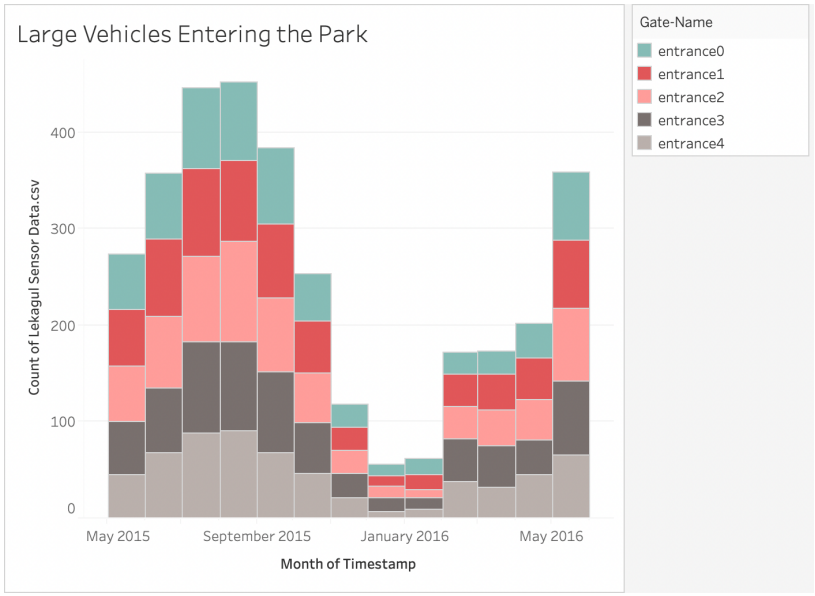
Vehicles

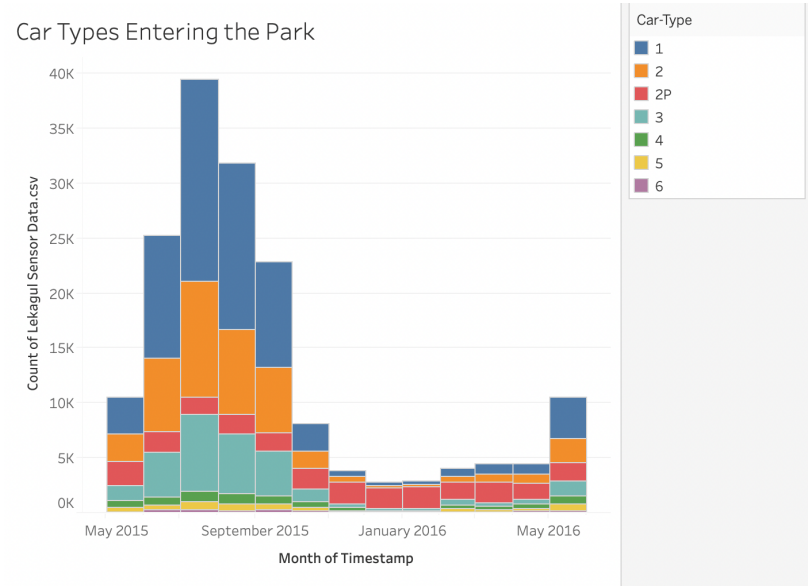
- [ ] All
- [x] 2-axle car (or motorcycle)
- [ ] 2-axle truck (non-park)
- [ ] 2-axle truck (park)
- [ ] 3-axle truck
- [ ] 4-axle (and above) truck
- [x] 2-axle bus
- [ ] 3-axle bus

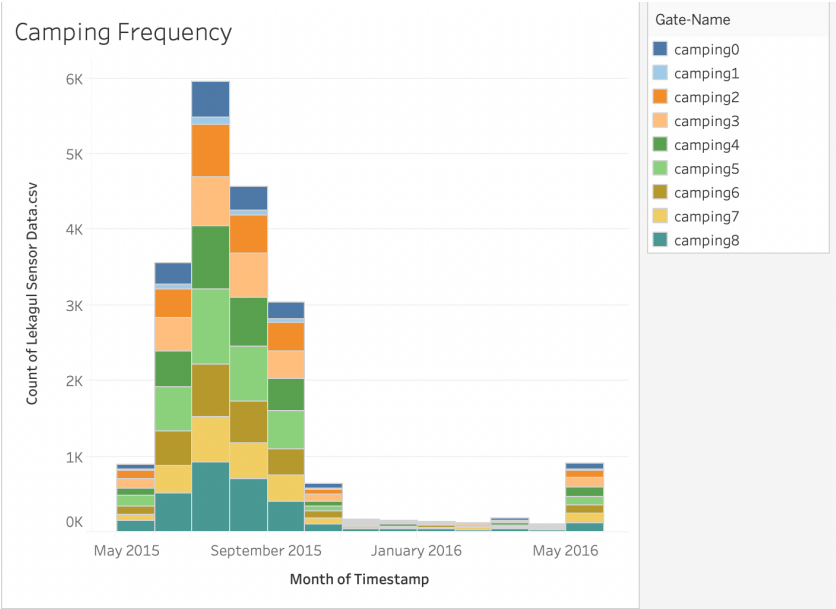
Gates

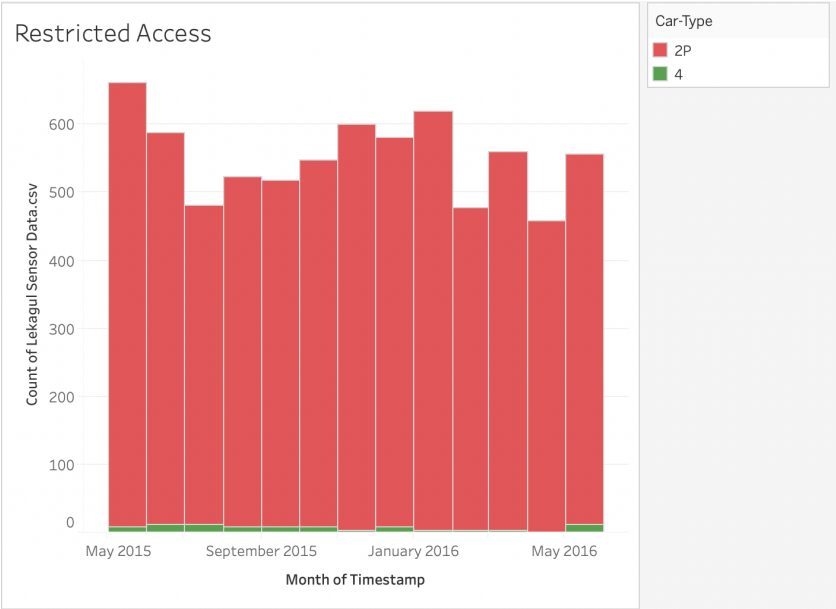
- [ ] All
- [ ] Entrances
- [ ] General gates
- [ ] Gates
- [x] Ranger stops
- [ ] Camping

Preliminary Visualizations:









Updated Timeframe:

- Early bar chart visualization (April 25th)
    - No timeline yet, just filtered statistics over full timeframe
- Add timeline (April 30th)
- Implement interactive map in place of preliminary bar chart (May 5th)
- Final analysis of results (May 11th)