

# A Geospatial Guide to Snakes in Southern California

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## Introduction

The objective of this research was to study species of snakes that are native to Southern California, and create an easy to understand and navigable web map and story map that can be accessed by anyone. My intention for this project was to alleviate some of the stigma surrounding snakes by educating the public through this research and final products. This project is relevant because as humans, we are constantly encroaching into habitats of wild animals. It is important to understand how to correctly interact with those animals if we happen to encounter them.



Figure 1. Map showing study area.

## Data and Data Sources

Basic feature class data for various aspects of Southern California were used to create a basemap and define my study area (Figure 1). The specific files can be seen in Table 1 below. All snake habitat range data was manually generated by me using either internet references or field guides.

Table 1. List of data and data sources used in the project

Dataset	Source
California Counties	Undergraduate Studies in Earthquake Information Technology
Major Roads	Caltrans GIS Data
Hospitals with	Caltrans GIS Data
Heliports	
U.S. State Boundaries	United States Census Bureau
Mexico Boundaries	Upper Canada College
Snake Habitat and Information Data	Peterson Field Guides: Western Reptiles and Amphibians
Rattlesnake Death Data	Wikipedia

## Methodology

Methods consisted of acquiring feature class data that was ready to use for various Southern California features, creating a spreadsheet containing information about all of my snake species, and digitizing the range maps for each snake's habitat. These data were geoprocessed to fit my study area and then used in both types of GIS software: ArcGIS Desktop software and QGIS software. In QGIS, I created a map focusing on rattlesnake data, including which species caused the most deaths and where those deaths have occurred. I then used the *qgis2web* plugin to convert my QGIS project into a web map.

For my story maps, I stored my data in a file geodatabase and then uploaded that onto my Esri Online user account. I used Esri's Story Map Builder to help design and create my guide, focusing on all species of snakes in Southern California. A second story map was also created using Esri's Story Map Builder to display a shorter narrative about the dangers rattlesnakes pose to the human population.

For the static maps created in ArcMap Desktop Software, the ArcGIS Data Driven Pages toolset and toolbar were used to design the overall map theme and implement the overlay of each species habitat range and visual adjustments for the map series.

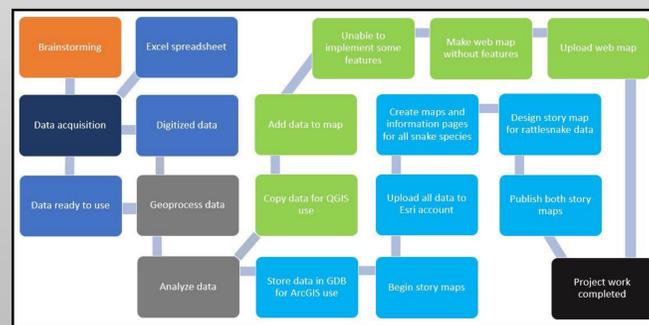


Figure 2. Spatial process model summarizing work done

## Timeline

My proposed timeline for the project ended up being adjusted based on multiple issues I encountered throughout my work.

Table 2. Comparison of project timelines

Proposed Timeline	Actual Timeline
5/13/17: Data gathered and geoprocessed.	5/13/17: Data gathered and ready for processing.
5/20/17: Make basic web map in QGIS	5/20/17: New data created/digitized.
5/27/17: Add interactive features.	5/27/17: Unable to complete interactive features.
5/29/17-6/3/17: On vacation.	5/31/17-6/15/17: Sick, then recovering.
6/10/17: Have nearly completed script.	6/21/17: Decided to make story maps instead.
6/17/17: All technical work complete.	7/24/17: All technical work complete.

## Results

Results include a comprehensive story map designed to serve as a guide to the 30+ snake species in Southern California. A second story map describes the reality of rattlesnake dangers. A web map created using QGIS focuses on rattlesnakes. A set of ArcGIS Data Driven Pages was developed that can be printed and referenced for people going out into the field who may not have internet access (see Figures 3-6).



Figure 3. An example of one of the species pages within the story map guide

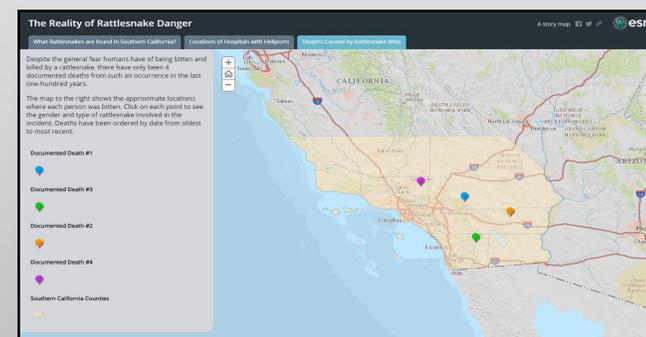


Figure 4. A portion of the story map showing deaths caused by rattlesnake bites

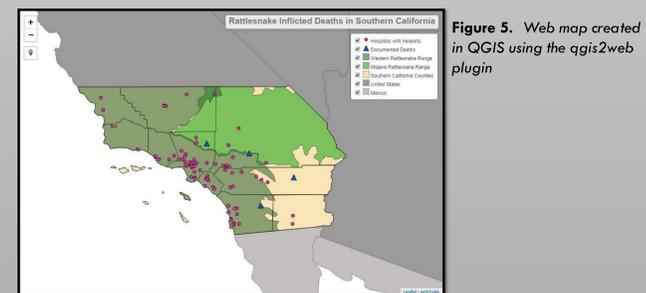


Figure 5. Web map created in QGIS using the *qgis2web* plugin

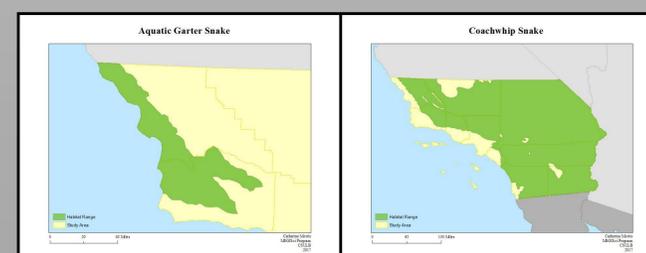


Figure 6. Two of the static maps created using ArcGIS Data Driven Pages

## Discussion

I was able to complete the majority of what I had set out to accomplish with this project. The data and information they contain is significant for helping the general public learn more about the snake species they may encounter in the wild. The completed story map was created to be used as a guide and give the user accurate data and also potentially teach people that most snakes are harmless and should not be feared. The story map that discusses the rattlesnake species and deaths that have occurred in Southern California due to rattlesnake bites is meant to inform people that we vastly overestimate the damage that rattlesnakes inflict upon our population.

The main issues and limitations I ran into had to do with my current GIS skills and knowledge. Certain aspects of my project that I had initially wanted to include or complete had to be adjusted or removed due to timing and my own abilities.

As in all spatial analyses, there are sources of error in this work. For example, I did take personal liberties when using the Peterson Field Guide to digitize the habitat ranges of each snake species. The ranges were not scanned, georeferenced, and then digitized, and as such the boundaries are not spatially accurate.

Much of this project consisted of using varying methods, techniques, and software to display similar material and see how the final results varied. There were pros and cons to each of these methods. While QGIS is a free software, I am less familiar with it than I am with ArcGIS Desktop software, so there was a steep learning curve. However, ArcGIS Desktop software is proprietary and expensive, so not everyone will want to purchase it or use it. Esri's Story Map Builder can help the user create beautiful outputs, but it is limited in its ability to add interactive features. The *qgis2web* plugin allows the user to incorporate more interactive features within their web map, but requires the user to be competent in coding and web design if they want to customize it further.

## Conclusion

While the findings from this project are not groundbreaking, they have given me an even deeper respect for these creatures we so often vilify. I was surprised to learn that rattlesnakes cause far fewer deaths than I had assumed, and the likelihood of a person dying from a rattlesnake bite is very low as long as they promptly seek medical attention. Future work on this project could consist of broadening the species included in the guide, or expanding the guide to include all reptiles or even mammals. If I attempted to redo this project in the future, I would incorporate going out into the field to document species occurrences and gather my own photographs.

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