A Spatial Guide to Southern California Mammals For Field Biologists

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Introduction

The purpose of *A Spatial Guide to Southern California Mammals for Field Biologists* (Mammal Guide) is to provide Psomas field biologists with the technical information necessary to evaluate the presence or absence and provide an analysis of the mammal fauna for any given location in Southern California (Figure 1). Geographic Information Systems (GIS) were used to standardize and input the data into a file geodatabase in order to store and maintain the spatial aspects and tabular attributes for each feature. Mammal data were reviewed, updated, and plotted onto a map of vegetation in the project study area. The data are then visualized, analyzed, and cross-referenced to species accounts and existing mammal data. The end goal was to develop an interactive map and database that field biologists can utilize while completing mammal surveys.

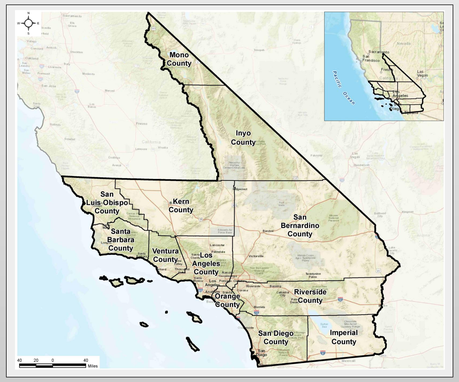

Figure 1. Project Location Map. *This figure depicts an overall view of the project study area. The project study area includes the following counties: Imperial, Inyo, Kern, Los Angeles, Mono, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura.*

Data and Data Sources

The datasets used in the analysis and mapping for this project include the following: Integrated Digitized Biocollections (iDigBio) museum specimen mammal records, California Department of Forestry and Fire Protection's (CAL FIRE's) Fire and Resource Assessment Program (FRAP) vegetation raster, Open Street Map (OSM) layer, National Hydrography Dataset (NHD) streams, the State of California boundary, select county and city locations from the Geographic Names Information System (GNIS), and Esri base layers (Table 1).

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

Dataset	Source and Year
Mammal Subspecies Records	iDigBio.org 2016
Vegetation Raster	CAL FIRE's FRAP 2015
Open Street Map Layer	OSM 2015
World Transportation Layer	Esri 2016
World Street Map	Esri 2016
Rivers and Streams	NHD 2015
World Shaded Relief	Esri 2015
World Topographic Map	Esri 2016
Major City Locations	GNIS 2015
State of California Boundary	Esri 2015
California County Boundaries	Esri 2015

Methodology

The methods used to develop the Mammal Guide are visualized in Figure 2. The chart represents the process of data acquisition, data review and refinement, and data storage.

Using the iDigBio website, the mammal data were downloaded in raw data tabular format and then truncated by the mammalogist to remove unwanted information (e.g., records outside the project boundary and unnecessary attribute information). The remaining data imported from comma-separated values (CSV) format into the project file geodatabase for analysis were species and subspecies name, latitude and longitude, date collected, county, and locality. An expert botanist was consulted for assistance with the FRAP 2015 vegetation layer to group vegetation types into categories. The vegetation polygons were simplified by clipping, grouping, and renaming the FRAP vegetation types and other areas to make the vegetation layer easier to understand and manage.

After revising marginal errors found in the mammal data, the following mapping methods were analyzed for this project: ArcGIS static maps per species using data driven pages, Esri Story Maps supported by ArcGIS Online, QGIS webmap using the qgis2web plugin, and CarryMap Builder and Observer.

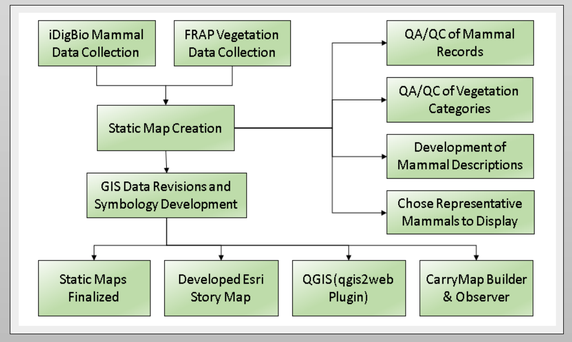

Figure 2. Methodology Flow Chart. *The general overview of the methodology includes data collection; draft static map creation for quality assurance and quality control of project GIS data; description development; and the development of static and interactive representations.*

Timeline

Table 2. *Project Timeline.*

Date	Task Completed
June 18, 2016	Project Coordination and Planning Stage
June 25, 2016	Data Collection Complete for Rodents Initial Static QA/QC Map Creation Complete
July 2, 2016	All Rodent Data Reviewed and Updated
July 9, 2016	Static Maps Updated Representative Mammal Static Maps Finalized Began Creating Esri Story Map
July 16, 2016	Esri Story Map Completed for Representative Mammals
July 19, 2016	CarryMap Interactive and Mobile Map Created QGIS (qgis2web plugin) Web Map Completed for Santa Barbara County
July 23, 2016	Final Touches on All Mapping Methods Complete

Results

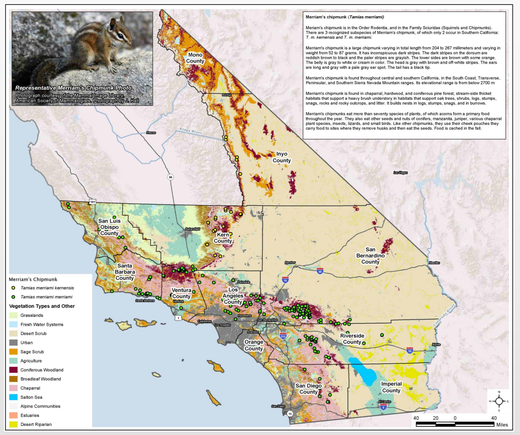

Figure 3. Static Map: Merriam's Chipmunk.

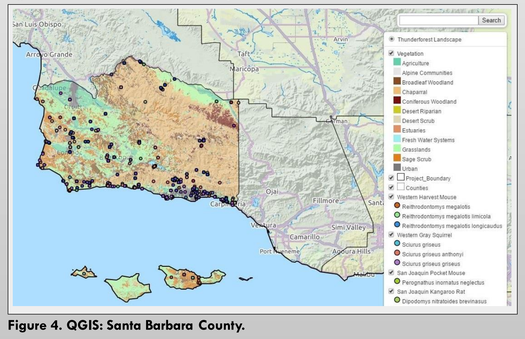

Figure 4. QGIS: Santa Barbara County.

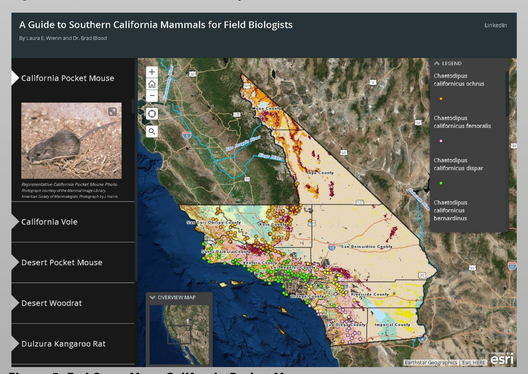

Figure 5. Esri Story Map: California Pocket Mouse.

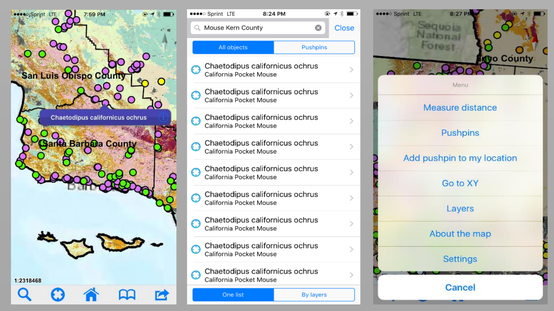

Figure 6. CarryMap Mobile Application.

Discussion

The static maps (Figure 2), CarryMap (figure 6), and Esri Story Maps (Figure 4) proved to be the most desirable and efficient for use with the Mammal Guide project. Issues were experienced using the qgis2web plugin; however, these issues were resolved by focusing on data within one county instead of the entire project boundary, making this method the least desirable and most time consuming.

All GIS datasets (Table 1) were available for free, including the mammal data from iDigBio, FRAP vegetation raster dataset, and all base layers. The software used with this project (Table 3) was also available for use at no cost to this project through either Psomas or California State University, Long Beach.

Similar mapping and data development could be replicated by anyone using open-source software such as QGIS, or by using ArcGIS Online. However, as ArcGIS Desktop, ArcGIS Pro, and CarryMap were necessary tools for this project, it may be costly to anyone trying to duplicate the work presented in this project.

Table 3. *List of software and sources used in the project*

Software	Source and Date
ArcGIS 10.3.1	Esri 2015
ArcGIS Pro 1.3	Esri 2016
QGIS 2.14	QGIS Development Team 2016
CarryMap Builder	Data East 2015
ArcGIS Online	Esri 2016
Story Maps	Esri 2016

Conclusion

As a result of exploring the four mapping methods, it has been determined that static maps will continue to be used in the project review process and in the published guide. For interactive mapping, the final Mammal Guide will use Esri Story Maps and CarryMap Observer. I plan to continue assisting the mammalogist for this project as the lead GIS professional by improving the interface, visualization, and usability of the Mammal Guide. The guide will first be published as an online interactive or mobile map application for Psomas field biologists and later may be made available to field biologists outside of the company.

I would like to thank the following individuals and institutions for their contributions to this project: Dr. Brad Blood for guiding me in this project and sharing his knowledge and love of mammals; Mr. Ian Cain for developing the vegetation categories used in this project; Ms. Julia Black for assisting as editor for this project; Psomas for allowing me to pursue this work; Mr. Michael Shensky for GIS and editing assistance throughout this project; and Dr. Suzanne Wechsler for her guidance and support.

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For additional information please contact: Laura Wrenn via email at laura.wrenn@psomas.com

Esri Story Map:
https://www.arcgis.com/apps/MapSeries/index.html?appid=b94379bea011458c819a6e9ebb012648