



Spatial and Hydrologic Analysis of San Bernardino National Forest

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Final Report Outline

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3. Acknowledgements

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4. Executive Summary

The 154,000 acre Sand to Snow National Monument (SSNM) was established by President Barack Obama in February 12, 2016. The SSNM is cooperatively managed by both USFS San Bernardino National Forest and BLM Palm Springs South Coast and Barstow Field Offices, with USFS managing 71,000 acres, and BLM 83,000 acres. Most of this land is within the San Gorgonio Wilderness, where the western half is managed by the USFS, and the eastern half is managed by the BLM. While both agencies have a long history of providing maps to visitors to navigate, explore, and to better locate existing recreational facilities, these maps differ in their overall look and feel. This discrepancy has sometime resulted in confusion for many leading to recreational activities being conducted in unauthorized or closed areas leading to various resource damage such as increased erosion, discarded debris/waste, and impacts to sensitive species and habitats. The creation of a new, detailed map that highlights available recreation infrastructure on both FS and BLM managed lands that has a similar look and feel for the SSNM is the focus of the project. Upon completion, the complete and comprehensive SSNM map would include roads, trails, campsites, and increase overall awareness for visitors providing a satisfying and safe experience.

Building this map required correspondence with many stakeholders, as well as extensive cartographic considerations before it can be published and distributed. The physical size of the map was established to include the extent of the monument as well as the standard 4x9 rectangular ratio of each map panel to make sure visitors had the option to fold and carry this map while hiking. Besides including all the necessary layers and features, portions of the map containing well used and named trails were chosen to be highlighted in a higher resolution which were then presented in the form of several inset maps. The purpose was to better guide visitors wishing to use various trails.

5. Project Objectives

First Opportunity at USDA

Despite growing up in the Los Angeles area, the majority of my research and field work pertaining to topography, geology, and ecology has been conducted in Northern California. Fortunately, being recruited as an intern on the SSNM gave me the opportunity to conduct research in these same areas while learning about two federal agencies specifically how interdisciplinary collaborations govern public lands in Southern California and beyond. While being exposed to the inner-workings of a federal agency for the first time, I gained valuable cartographic skills from the GIS technicians and specialists while collecting map data from various stakeholders and compiling the infographics using agency standards. As an amateur GIS technician and spatial analyst, I hope to garner the skills and knowledge to represent

environmental data in a way that best influences resource decisions and policy. Working for a federal agency brought me one step closer, since I was exposed to the publishing process of a visitors map, and how many more steps are required to bringing a visual to comply with standard requirements while still communicating important information.

Internship Goals

My first goal during this internship was to create a complete visitor's guide, ready for printing and public distribution. Approximately a month into this project proved that much more time was necessary to find, extract, compile, standardize, and refine a map of well over 154,000 acres. To streamline this project, instead of refining individual map layers and getting each one approved before moving on to the next, which would be the typical process for such an undertaking, I reviewed numerous existing layers, selecting and utilizing those based on the agreed upon criteria set by monument manager. Upon uploading all necessary layers, I then minimally refined them based on stated criteria. With further collaboration with the GIS technicians for cartographic and data retrieval assistance, I have successfully created a first draft map of the SSNM.

My second goal during this internship was to help the SBNF Hydrologist, create and update the Water Rights and Uses (WRU) Database. The WRU Database allowed the SBNF to comply with Senate Bill 88 (SB88). SB88 is a recent bill which requires closer monitoring of various water rights, which involves the diversion of 10 acre-feet or more during a calendar year. The SBNF currently has 5 rights that fall under this category, which required migrating site visit dates, corresponding photos, discharge measurements, appropriation orders, and water right applications from a new central document database called Pinyon and paper files to the WRU GIS Database.

My personal goal at the beginning of this internship was to gain knowledge about how federal agencies function, and learn whether sustainability and stewardship were central to the agency mission, as I hoped USFS and BLM would. Looking back at my time on the SBNF, I have witnessed a deep commitment and example of environmental stewardship in and outside of the office. I am truly inspired by the dedication and heart employees of all departments carry through their individual work, as well as to the greater good of the forest and public land day in and day out. Whether it's slowing down on rocky off-road terrain to pick up a discarded plastic bottle, or maintaining strength and being selfless during a raging fire, the attitude of the employees and community members I have met have taught me the most during this internship.

6. Project Approach

Monument Visitors Map

The first step to creating the map of the monument was to understand which specific features were needed for the map, where the data was located, how to access that data, and any other aspects the GIS technicians and the monument manager envisioned for the final product. A conference call between GIS specialists helped me flesh out priorities with the map as well as establish necessary steps to follow. I spent a great deal of time observing the scale, extent, and standard symbol choices of USGS, BLM, and USFS maps around the office after the GIS technicians referred me to them. I first needed to look at the general shape of the monument and what ratio of 4x9 panels would best work while prioritizing paper conservation, and map utility.

There were two drafts of map extent before deciding to leave the Black Lava Buttes (see map in Appendix A) portion of the monument on side 2 of the physical map in order to preserve the scale and definition of the larger monument area. We decided this was a better idea than including the entire 154,000 acres on one side in high resolution. Black Lava Buttes is a few miles north of the larger area, and we decided with the monument manager to create an inset map on side two of the map to not only show it with higher resolution but to showcase the trails on each area without compromising the other. The GIS technicians also pointed out to me how a 1:48,000 to 1:50,000 was generally the standard for USGS maps. However to avoid blank panels and wasting paper, I used a scale of 1:52,000 for the larger area of the monument. I was also introduced to the agency GIS Library and utilized the Reference, Land, and Transportation geodatabases to find the required layers including highways, campsites, and waterway shapefiles. However, these shapefiles were made to comply with different standards, which required me to edit a lot of these layers to optimize labeling placement (see Appendix B). The help of the technicians bridged the gap between the desires of the monument manager, my amateur mapping and cartography skills, and the expertise needed to complete this project with efficiency.

Water Rights and Usage (WRU) Database Migration

Similar to the mapping project, water use data migration was another project that evolved and required different steps as I delved deeper into understanding it. I participated in a two day statewide database training introducing us to the Natural Resource Manager (NRM) GIS interface. The previously set data dictionaries made it very easy to upload missing information for each water right per national forest, and migrate information from physical files. I've only used ArcGIS Online briefly, but the usage of that interface was similar to NRM and Citrix. Since the ArcGIS program was being remotely accessed through Citrix, layer

manipulation was slower. I quickly learned it was imperative to scan paper documents before restarting the Citrix interface to most efficiently upload documents to each water right.

The five water rights belonging to the San Bernardino National Forest include the Two Unnamed Springs, Burnt Flats Springs, Lake Fulmor, Red Rock Flat, and Tahquitz Spring. After familiarizing myself with the contents of each folder given to me by the hydrologist, I then opened the data dictionary of each water right online to examine its level of completion. Besides scanning and uploading the standard water appropriation, order, application, and permit, I also uploaded and described any unique historical features of the right including nearby highways affecting drainage, or apple orchards. Since some of these water rights had not been recently visited, we fulfilled site visits (see Appendix C) to take GPS coordinates to match with metes and bounds units, as well as new discharge data to compare to previous years. After each site visit it was my responsibility to upload images of the point of diversion or point of usage of the water source (which was typically a pipe or spring), and average and convert observed discharge to comply with units of the database (See Appendix D). In the meantime I also assisted with updating WRU using images of site visits stored in a local database. Making sure local and statewide water databases have compatible information is very important for the hydrologist to be able to communicate with other forests while having access to data necessary to make important policy decisions in an efficient manner.

7. Project Outcomes

During the first mapping conference call, the GIS technicians made it known that creating a publishable monument map from scratch in two months was an unrealistic goal. However I refused to accept their expectations as my own, and successfully completed a complete draft of the map itself. The monument manager required room on the physical layout to provide descriptions and images of trails and the history of the monument, which remain as some of the next steps towards completion. I believe my determination to contribute a complete draft of the map itself at least (without refined descriptions) motivated me to work past roadblocks. As previously mentioned, certain spatial layers required additional manipulation to acquire compatibility. By informing the technicians and stakeholders of my GIS data needs ahead of time, I was able to acquire all the needed information.

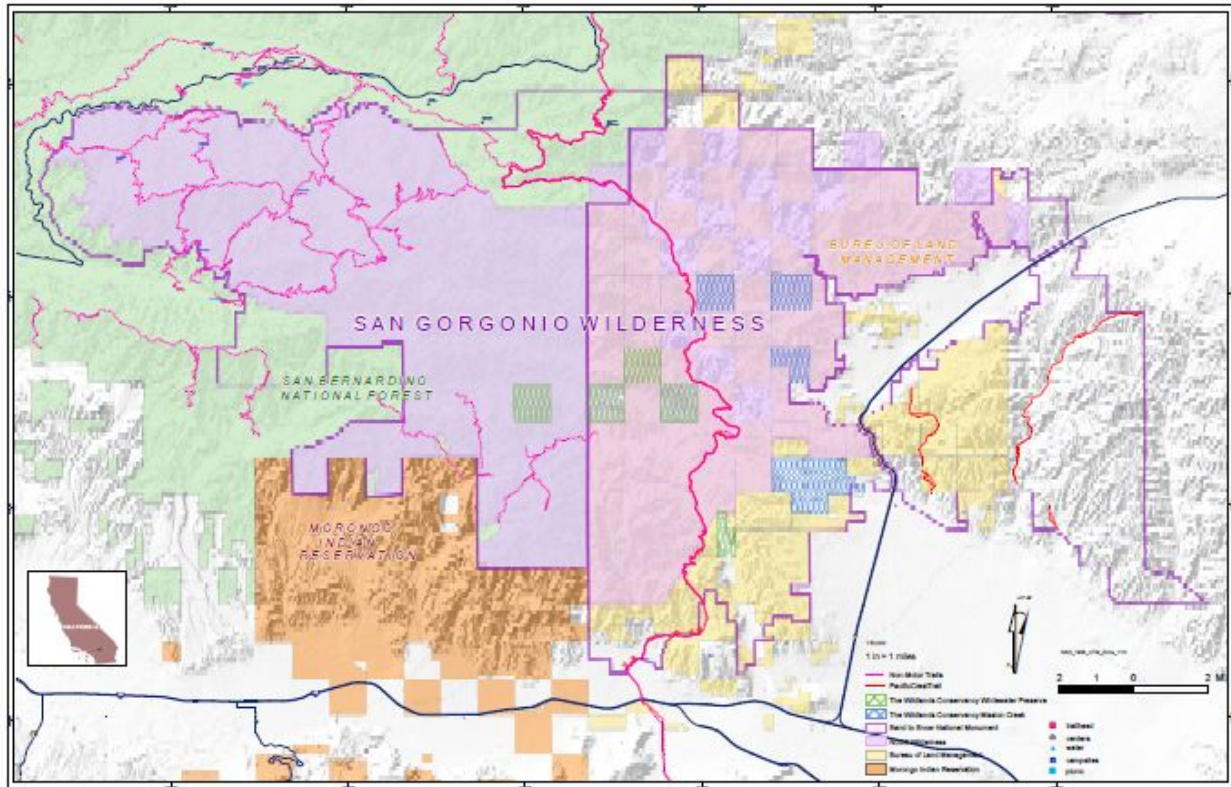
As for WRU migration, the hydrologists patience and assistance allowed me to successfully migrate all remaining physical and electronic data for the five rights owned by the SBNF amidst my map making endeavors.

8. Conclusions

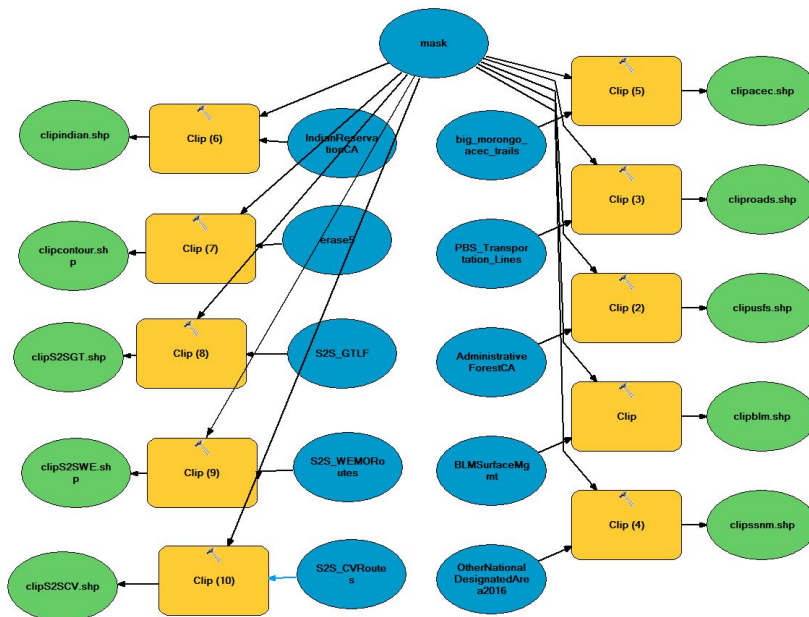
As a visual learner, seeing various corners of the monument in addition to these water right site visits helped me appreciate and better understand the need for my assistance this summer. I was grateful for the time the monument manager and the hydrologist took to show

me these sites because they helped match the background history I had read in the files, to the physical surrounding environment. The accuracy of my contribution was imperative after seeing the importance of a well-managed monument offering such recreation and natural beauty. Meeting other stakeholders including the San Geronio Wilderness Association volunteers inspired me to make sure my work transcended the standard intern expectations, and adopt stewardship of this land I would live near for a summer. I grew to care about it like I care about the Los Angeles National Forest where I grew up and spend a lot of my free time. This is a perspective and approach that shouldn't be unique to us environmentalists, or to the lands we have grown up on. However the dedication I saw matching between volunteers and employees of these lands inspired me to adopt a higher level of stewardship, which is the greatest lesson I had the honor of learning this summer.

9. Appendix



A. Map of Sand to Snow National Monument



B. ArcMap Workflow

Water Rights and Uses - Site Visit Field Form

State Water Use ID: A006108
 Common Name: A006108 RED ROCK FOUNT
 Region: 05 Forest: San Bernardino National Forest District: Mountaintop Ranger District

C. Red Rock Fount Site Visit Form

Water Source and Use Information

Source 1 Type: Spring
 Source 1 Name: UNNAMED SPRING
 Source 1 Tributary To: STRAWBERRY CREEK THENCE E TWIN CK
 9000 gpd, 1 / 1 - 12 / 31 and [/ - /] (mm/dd); (Rate, [], []))
 Uses: Fire Protection, Fish Wildlife Protection, Other

Components

Component Type: Point of Diversion Structure Type: ND
 Structure ID/Name:
 Specific Source and/or Use for this Component: Spring / UNNAMED SPRING
 Admin Location (PLSS): 27 T2N R3W S30 NW SE, (DD): 34.2283, -117.2315
 GPS Field Collected Location - Latitude:
 GPS Equipment:

Component Type: Point or Place of Use (POU or PLOU) Structure Type: ND
 Structure ID/Name:
 Specific Source and/or Use for this Component: Spring / UNNAMED SPRING
 Admin Location (PLSS): 27 T2N R3W S25 SE SE
 Metes And Bounds: T2N R3W SW 25 SESE use
 Admin Location (PLSS): 27 T2N R3W S30 NW SE
 GPS Field Collected Location - Latitude: N 34.22891 Longitude: W -117.23364
 GPS Equipment:

Site Visit

Visit Date: 07/12/18 Inspectors: Jan S, Bill W, Arac M
 Water Present: ☒ N
 Describe the type and character of the water source: highly vegetated, rocky, steep
 terrain (pipe)

Flow or Stage Measurement(s)

Component 1 - Component Type: pipe Structure Type: POD/POU
 Functioning: Y N Quantity: UOM: Method: Flow Char:
 Component 2 - Component Type: Structure Type:
 Functioning: Y N Quantity: UOM: Method: Flow Char:
 Component 3 - Component Type: Structure Type:

Pipe					Seepage						
POD					POU						
#	v (ml)	t (s)	ml/s	cfs	#	% captured	v (ml)	t (s)	ml/s	cfs	
1	500	45.23	11.05460977	0.000390227	1	75	190	35.05	5.420827389	0.0001914	
2	500	45.37	11.02049813	0.000407108	2	75	290	36.69	7.904061052	0.000279127	
3	500	43.06	11.6117046	0.000410063	3	75	275	46.31	5.93824228	0.000209692	
					4	60	170	47.3	3.594080338	0.000126921	
					5	90	340	40.19	8.459815875	0.000298727	
Total				0.001207398	Total				0.001105867		
Average				0.000402466	Average				0.000221173		
Average				0.000289158							