USING GEOSPATIAL METHODS TO VISUALIZE FISCAL DATA AT THE ARIZONA BUREAU OF LAND MANAGEMENT

by

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A Practicum
Submitted in Partial Fulfillment
of the Requirements for the Degree of
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Approved:
Alan A. Lew, Committee Chair
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ABSTRACT

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Northern Arizona University, December 2016

Flagstaff, Arizona

Dr. Alan Lew, Thesis Professor

This practicum established a methodology for importing fiscal data from the Bureau of Land Management Budget Office into a geospatial framework using ArcMap software. Fiscal year 2015 data was retrieved from the BLM *Arizona Budget Tool* and imported using independently created Cartesian coordinates. Supporting data was obtained from additional BLM employees in the Geospatial and Budget offices, as well as internal BLM documents, scholarly articles, and class texts.

The purpose of this study was to aid the BLM in achieving their strategic goals by spatially connecting on-the-ground accomplishments to economic data. This was achieved by assigning individual coordinates to each of BLM's field and district offices, then performing a variety of analyses on the imported data. The result is a visual representation of budget allocations and spending, aiding BLM officials in appropriately planning and evaluating both their workload and operational expenditures.

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Dear Dr. Lew,

It is my privilege to write this letter of contribution for Ms. Kayla Resnick, graduate student at Northern Arizona University (NAU). When I first learned that Ms. Resnick was looking for a capstone project for her Master of Science in Applied Geospatial Sciences, I was hopeful she would be able to work on a project I've seen a need for within Bureau of Land Management (BLM) Arizona for some time.

Tracking planned work, program accomplishments and associated budget allocations is important to BLM Arizona financial management. Ms. Resnick's project provided a tool for displaying planned and completed work and budget resources geographically. Translating this financial information into something visually, easily used and understood will go a long way for management and staffs' understanding of our financial and performance management across the state.

Ms. Resnick has made a significant contribution with her geospatial analysis and presentation of the fiscal year 2015 budget and performance data for BLM Arizona. Even though these databases, codes, and budget process were completely new to Ms. Resnick when we began discussions, she quickly understood the agency's key business and the outcomes our agency was hoping to see. She came to our state office in downtown Phoenix several times to meet with the Budget staff, Geographic Information System staff, and the Deputy State Director to learn Arizona BLM's organization structure, funding situation and program elements. It has been almost ten months since we first met with her on this project and I am impressed she was able to turn a huge amount of financial and performance data into geospatial maps as well as designed a process that we can use in budget and performance planning for future years.

Ms. Resnick has a very positive personality and it is very pleasant to work with her. She asked very good questions during our meetings with her and has demonstrated her geospatial capabilities and project management skills throughout the project. Her final presentation was very clear and has helped our leadership team to focus on certain program areas and issues within BLM Arizona. We are very happy Ms. Resnick worked with us for her capstone project and hope that her thesis will be well received.

Sincerely,

Deborah K. Rawhouser
Arizona Associate State Director
Bureau of Land Management

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Acknowledgements

I dedicate this practicum to the family and friends who have supported me throughout my academic career. Thanks also to my professors and advisor at NAU, and the patient, intelligent staff at the Arizona BLM.

Chapter 1: Introduction

1.1 Objective

This practicum was undertaken to aid the Arizona Bureau of Land Management (BLM) in obtaining operational excellence and achieving their strategic goals by spatially connecting on the ground accomplishments to budget and fiscal data. The result is a visual representation of budget allocations and spending, connected geospatially to Arizona BLM Field Offices across the state.

1.2 Background

The BLM is a federal agency tasked with "sustaining the health, diversity, and productivity of America's public lands" (BLM.gov 2012) This involves careful management of National Monuments and Wilderness Areas while regulating various activities such as grazing, recreation, timber use, commercial leases, and energy development. The BLM has an operating budget of over $1 billion and is unusual among federal agencies in the fact that it brings in more revenue than it spends.

The duties of the BLM are carried out across the United States by a hierarchy of Federal, Regional, State, District, and Field offices (Figures 1 & 2). Within Arizona, there is one state office, four district offices, and eight field offices. In addition, the state of Arizona hosts four national monuments/conservation areas, as well as the National Training Center. For the purposes of this project, data was primarily considered at the district and field office levels (Figures 1 & 2).

Figure 1. Arizona District Offices

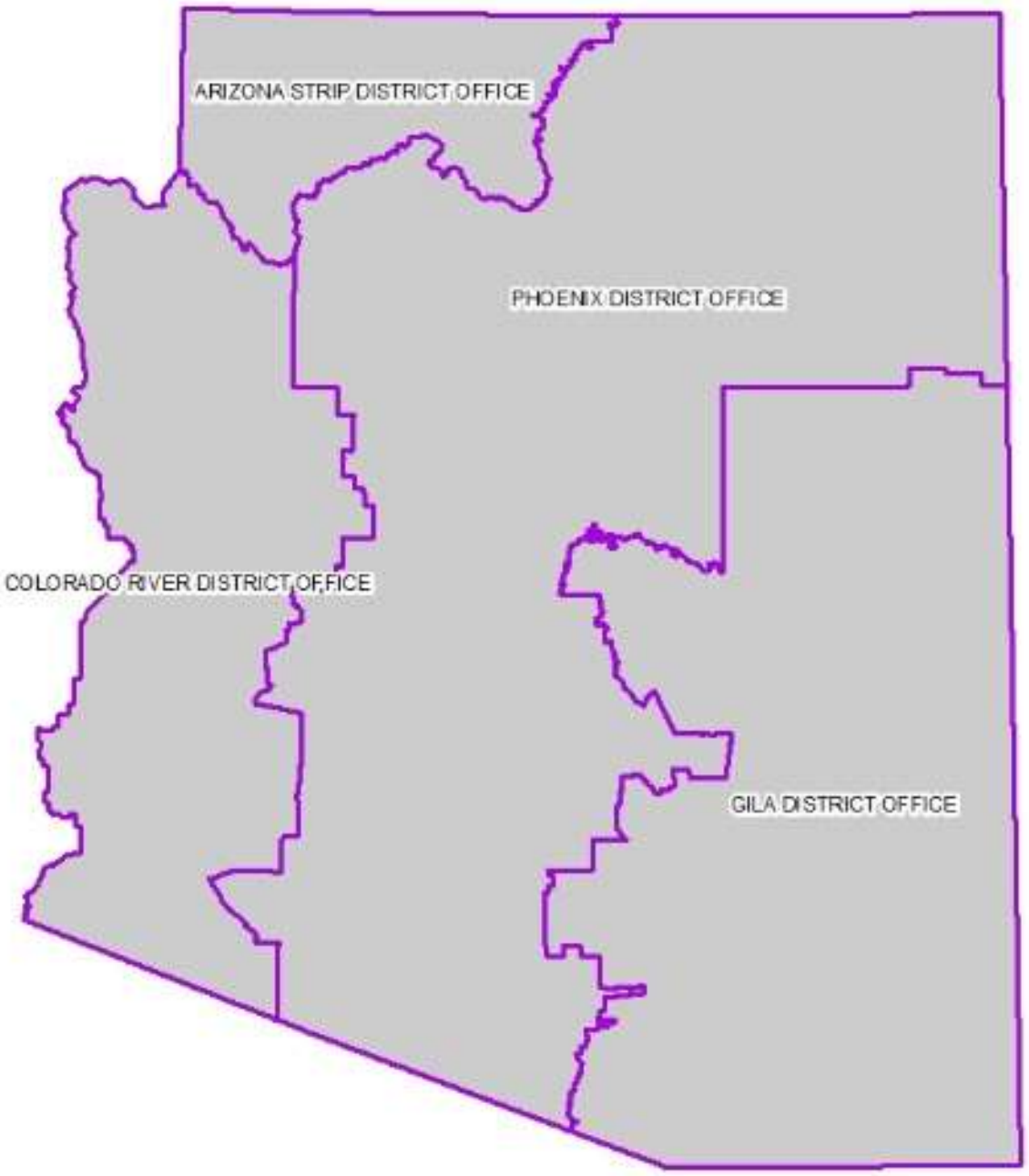


Figure 2. Arizona Field Offices

The research and data collection for this study were conducted at the Arizona State Office in Phoenix, Arizona under the authorization of Deborah Rawhouser, Associate State Director. Extensive additional council was provided by several individuals in two areas: the Budget Office and GIS Department. An in-depth discussion of the data procured for this project will be provided in Chapter 3, but a brief discussion of the information provided by each department is appropriate here.

The Budget Office, under the direction of Budget Officer Man-Yun Chin, coordinated access to BLM Arizona's "Budget Tool". This tool has been implemented by the Arizona BLM in recent years to track obligations and expenditures, and allows employees across the state to enter and track fiscal information. In additional to dollars planned and spent, the Budget Tool utilizes a workload measure known as PMDS, or Performance Management Data Systems. These are quantitative goals in a variety of units that can be applied statewide. Careful use of this tool produced the comprehensive tables of Fiscal Year 2015 financial data to be spatially integrated.

The spatial component of this project was accomplished with the effective guidance of Marisa Monger, GIS Specialist, and the rest of her team. The majority of the spatial data used in this study was downloaded from the publically available "Arizona Mapping Products" page (BLM.gov 2016) and imported into ArcMap 10.3 on the report author's personal computer. These materials include boundary feature classes for both field and district offices, national monuments, and other areas of interest. A small amount of data was also downloaded from a secure BLM server via Citrix. Marisa Monger was also instrumental in supplying general BLM information, including Strategic Goals, organizational charts, and additional GIS knowledge.

1.3 Purpose

The purpose of this practicum was to develop a method for spatially integrating BLM budget data into GIS software. After development, the method can be used to aid BLM officials in making and executing fiscal and workload decisions. This is partially accomplished through pattern recognition and domain knowledge, which are greatly aided by the visual representations of the data.

This practicum is also in line with the BLM Arizona Strategic Goals, which encourage operational excellence through budget effectiveness (Figure 3). In order to achieve these goals, the BLM aims to "Implement budget monitoring tools to track expenditures, and in combination with workload accomplishment data, to monitor cost effectiveness" (BLM 2012: 5). By incorporating both workload and spending data, this study and its deliverables provide valuable insight into how the budget is being planned and executed.

BLM Arizona Strategic Goals: Operational Excellence

Budget Effectiveness

- Emphasize Arizona Strategies to the extent discretion allows in budget requests, allocation and performance accountability.
- Implement budget monitoring tools to track expenditures and, in combination with workload accomplishment data, to monitor cost effectiveness.
- Develop and implement cost reduction plans that improve capacity to accomplish Arizona Strategies.

Figure 3. Arizona BLM Strategic Goals relating to Budget Effectiveness

Aside from the professional purpose and goals of this project, it is the report author's intention that this practicum be useful and provide quantifiable benefit to the practicum agency. In addition, it should demonstrate many of the skills acquired over the course of the M.S. in Applied Geospatial Sciences graduate program.

1.4 Research Questions

- **How well is the BLM of Arizona planning and executing their budget?**

  This question examines budget obligations for fiscal year 2015. Each BLM field and district office report on spending in a variety of ways. Obligations are categorized by physical location, activity and spending type.

- **How well is the BLM of Arizona planning and executing their workload?**

  This question examines workload tracking targets and achievements. These figures measure work completed by defined categories, and can be combined with fiscal data to determine if costs are being accurately estimated.

1.5 Deliverables

There are several components included in the results of this study. First, the BLM receives a comprehensive document outlining procedures for integrating the spatial and fiscal data. This report will allow for future data to be compiled and analyzed with a similar methodology. Spatial data in the form of a geodatabase is also provided, and contains all spatial data created and used in a shareable XML format. These spatial files can be uploaded onto secure servers and viewed by BLM GIS specialists and technicians.

Accompanying the physical deliverables of this practicum is a limited analysis of the project results in relation to the research questions. Over the course of this study, patterns and questions emerged in the data that illustrate the strategies the BLM might implement to get full use of this study. For example, the Tucson field office is highlighted in multiple figures as one that fails to achieve its expectations. After spotting this pattern, one can go back to the fiscal data and discover what precisely is affecting the field office and determine if an intervention is needed.

In this manner, the outcome of this project creates a method for managing data, produces real data, and simultaneously illustrates how the data can be further employed. Therefore, this project satisfies the author's personal goal of providing functional and beneficial conclusions to the BLM in appreciation of their data, time, and expertise.

Chapter 2: Literature Review

Presenting the intentions and results of this practicum as related to historical and theoretical context is a complex task. The project was requested by Deborah Rawhouser, Associate Director of the Arizona BLM, who believed that there would be value in having the fiscal data spatially displayed. In addition, the ability to compare data from across the state in multiple categories is highly beneficial to the budget office. This practicum represents the first time the Arizona BLM has compiled data in this way, but GIS technology has been spatially demonstrating many types of data for quite some time.

With this in mind, it is helpful to consider the existing literature on the topic. To begin, this literature review will examine the large-scale context of this project by briefly examining the history and importance of visual data. Moving then from general to specific, a discussion of GIS use by government officials is in order. This section will highlight use of GIS by government agencies of all sizes, and is particularly interesting in light of the third and final piece of this literature review: an analysis of GIS use at the Arizona BLM and how it relates to their strategic goals.

Anyone familiar with GIS understands that the world of geographic information systems includes far more than maps and tables. Indeed, in 1997 Danny Dorling and David Fairbairn published *Mapping: Ways of Representing the World,* which encourages readers to consider the theoretical frameworks needed to contextualize the geographical world. A main point from this text is that maps are vehicles that communicate incredible amounts of information on the creator of the map, the intended audience, and the people being depicted (Dorling & Fairbairn 1997). This idea of maps

being representative of more than simple visual data is a good introduction to the strategy of using maps to display non-spatial data, as in this practicum.

Published in 2002 and referencing the book cited above was L. John Old's article on *Information Cartography: Using GIS for Visualizing Non-Spatial Data*. This text describes the history of representing non-spatial data (beginning with trade winds and monsoons) geographically, and notes that it is a "relatively recent practice" (Old 2002: 7). The financial data in this practicum is certainly non-spatial, but becomes spatially referenced through its connection to the ArcMap feature class boundaries. Therefore, it somewhat straddles these discussions, resting somewhere between the non-spatial and truly spatial data.

As "somewhat spatial" data, the results produced from this practicum can be figured into the dialogue of GIS use in government offices. This is a concept that has been well documented, beginning in the mid-90's with Mary Brown's article on *An Empirical Assessment of the Hurdles to Geographic Information System Success in Local Government* (1996) and continuing through to recent years. Most of the literature on this topic does seem to be geared toward local or municipal governments, but much of the information is still relevant to GIS use at the BLM. One reasons is because the national BLM organization gives a great deal of control over GIS practices to the state offices, which in turn utilize field office data. For example, in *The GIS Guidebook for Local Government Officials* (Fleming 2005), many of the authors address concerns that are not unique to local governments. Contributor Donald Oliver explains the challenges that many government offices have in distributing resources to their constituents, an issue the BLM could certainly face while delivering services efficiently and cost-

effectively. Oliver states that GIS technology can help governments "do more with less" (Oliver 2005: 61). By using the information and figures in this practicum, the Arizona BLM can determine which field offices are most productively managing their budgets and workload, and encourage lower performing offices to also "do more with less".

Moving explicitly now to the BLM literature on GIS management, several internal documents influenced this practicum. Among them are a breakdown of the Arizona BLM Strategic Goals as well as a Geospatial Strategic Plan covering fiscal years through 2020. Within the Strategic Goals Summary is the "Operational Excellence" standard. This goal includes Budget Effectiveness as a key component, attempting to "Implement budget monitoring tools to track expenditures and, in combination with workload accomplishment data, to monitor cost effectiveness" (BLM 2012: 5). This practicum falls very cleanly into this category, helping situating it as part of the BLM's larger mission.

The Arizona BLM Geospatial Strategic Plan includes an objective from the National BLM Geospatial Strategic Plan (BLM 2007:1), stating the following:

> "*Managers, resource specialists, analysts, researchers, and policymakers recognize that geospatial information is critical for managing the public lands – for understanding the natural resource relationships, environmental interactions, social and economic impacts, and environmental performance*."

This quote indicates that the BLM understands the importance of geospatial data, while also speaking to its far-reaching implications. Also evident in this document is a historical framework for the use of GIS at the Arizona BLM, noting that Arizona "led the BLM at that time in applying [GIS] technology" (BLM 2016: 1). Since these early days, the Arizona BLM has lagged in its adaptation of technology, and is no longer considered

among the top most GIS savvy states (BLM 2016:1). This practicum and other similar GIS based projects can begin to close that gap, bringing the Arizona offices up the level of their national peers.

Overall, this practicum fits within and adds to the literature on visualizing economic data, using GIS in government offices, and utilizing advanced GIS technology at the Arizona BLM. There are a wealth of opportunities for additional research, beginning with the incorporation of additional data from other years but also including the possibilities of new GIS tools, models, or compilations.

Chapter 3: Methodology

3.1 Introduction

This chapter examines the project data in considerable detail and discusses the procedures and methodology for the spatial integration of the 2015 fiscal data. The data processes are documented chronologically and include figures where appropriate. Regarding the spatial data, all creation and manipulation was handled by the ESRI ArcMap 10.3.1 suite. ArcMap and ArcCatalog function relatively seamlessly with Microsoft Office products, allowing for simple coordination of the fiscal Excel data and spatial ArcMap files.

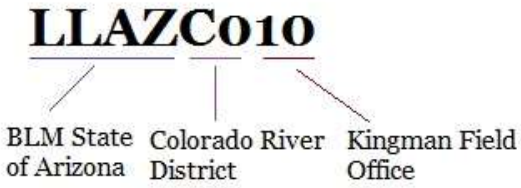
The methodology featured in this chapter was developed after multiple previous attempts were unsuccessful. These early trials will also be examined, as they were an integral part of the formation of this study. A dictionary of terms is available in Appendix A.

3.2 Data

There are two main data components of this practicum: the spatial (ArcMap) and fiscal (Excel). These will be described and defined in this section, though more complete dataset sample can be found in Appendices B and C. All fiscal data referenced in this report was provided by the BLM, and was either by retrieved from the "Budget Tool" or received by personal communication via email. The majority of the spatial information is publically available from either the BLM or other spatial databases. All data manipulation was completed on the author's personal computer, using the software previously mentioned.

3.2.1 Spatial Data

The term spatial data in this practicum refers to any data used in ArcMap to set-up and visualize the fiscal data. This includes boundary feature classes such as the state boundary, district offices, and field offices (Figures 1 & 2). In the BLM, each of the district and field offices are given a 10 digit identification code. These codes each start with the same four digits, and can be broken down as follows:



In the example above, the first four digits identify that the location is in Arizona. The next digits (C0, in this case) denote the Colorado River District, and the last two digits signify that the location is within the Kingman Field Office boundary. These codes

are important, as they are the basis for the connection between the spatial and fiscal data. Each of the codes represent a physical office and boundary, but are also the BLM billing entities or "funds centers" and are referred to as such in the budget tables (Table 1).

Within ArcMap, each funds center has both a spatial location and a set of attributes. For every entry, the attributes include the identification code, administrative name, type of office, global ID, and shape area information. In addition, each location has been assigned by the report author a Cartesian coordinate or (x,y) point representing the latitude and longitude at the center of the area.

Fund Center	Name	Longitude	Latitude
LLAZ9xxxxx	State Office	-116.18700000	33.55100000
LLAZA00000	Arizona Strip District Office	-113.14700000	36.60000000
LLAZA01000	Arizona Strip Field Office	-112.80400000	36.65900000
LLAZA02000	Vermilion Cliffs National Monument	-111.84000000	36.84900000
LLAZA03000	Grand Canyon National Monument	-113.63900000	36.23700000
LLAZC00000	Colorado River District Office	-113.71400000	34.16200000
LLAZC01000	Kingman Field Office	-113.78500000	35.15400000
LLAZC02000	Yuma Field Office	-114.03200000	32.97900000
LLAZC03000	Lake Havasu Field Office	-114.03500000	34.14400000
LLAZG00000	Gila District Office	-110.12200000	33.13000000
LLAZG01000	Safford Field Office	-109.86100000	33.67300000
LLAZG01100	Gila Box Riparian NCA	-109.43700000	32.93300000
LLAZG02000	Tucson Field Office	-110.78600000	31.96700000
LLAZG02100	Las Cienegas NCA	-110.56400000	31.89200000
LLAZG02200	San Pedro Riparian NCA	-110.16700000	31.36200000
LLAZG03000	Ironwood Forest National Monument	-111.44300000	32.45500000
LLAZP00000	Phoenix District Office	-111.94300000	33.13000000
LLAZP01000	Hassayampa Field Office	-111.15600000	35.46400000
LLAZP02000	Lower Sonoran Field Office	-112.46700000	32.66400000
LLAZP03000	Agua Fria National Monument	-112.05200000	34.22200000
LLAZP04000	Sonoran Desert National Monument	-112.42200000	32.90900000

Table 1. Funds Centers and their Cartesian coordinates

An essential note about spatial information references the first entry in the table above, known as Funds Center LLAZ9xxxxx. This funds center is the BLM State Office, located in Phoenix, Arizona. This office does not fit neatly into the district/field hierarchy, and has different responsibilities and fiscal concerns. It behaves differently spatially as well, and does not have the typical boundaries of the other offices. In order to visualize spending at this office, an alternative solution was needed.

The best resolution was to create a separate "shape" within ArcMap and set it spatially to the west of Arizona (Figure 4). Geographically, it is located within California, but for the purposes of this practicum, this square represents spending and obligations from the Arizona State Office. The State Office square is not included in all analyses, but is used when the comparison it provides is helpful, as when comparing workload achievement measures across the entire state (Figure 6).

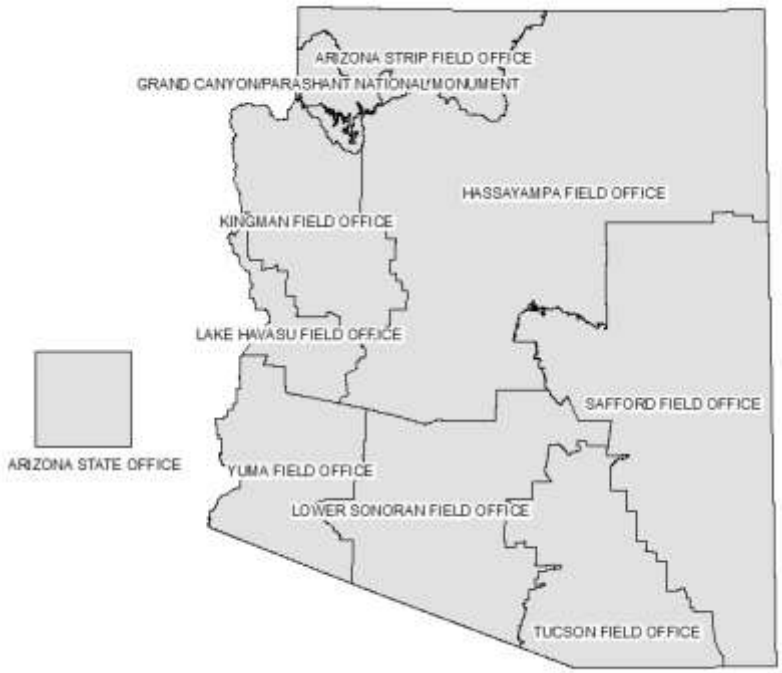


Figure 4. Arizona BLM State Office Representation

A limited amount of additional spatial data was consulted over the course of this study. This data includes feature classes of Wilderness Management Areas, National Monuments, and conservation areas. This data was primarily utilized to verify results, with examples being found in Chapter 4: Results (Figure 8).

The entirety of the spatial data for this practicum is stored in a geodatabase called BLM.mdb created by the report author. The data share a common UTM coordinate system: NAD 1983 UTM Zone 12N. They use the Transverse Mercator projection and the 1983 North American Datum.

3.2.2 Fiscal Data

The fiscal data is primarily comprised of two separate data tables. The first is a 29, 550 KB Excel file known as "Master Budget". Master Budget was received via email from Man-Yun Chin, Budget Officer.

	A	B	C	D	E	F	G	H	I	J	K	L
1	ID	Funds_Cente	Subactivitie	PE	Major_Object_Class	BOC	Variable / Fixed	Commitment_Item	Fund	Total_Obligations	Longitude	Latitude
2	1	LLAZ000000	L1010	DJ0000	11	113A0	FIXED	OTP Regular Civilian	15XL1109AF	$ (279.80)	-116.00000000	35.00000000
3	2	LLAZ000000	L1010	DJ0000	11	113G0	FIXED	OTP Leave Assessment	15XL1109AF	$ (61.84)	-116.00000000	35.00000000
4	3	LLAZ000000	L1010	DJ0000	12	121A0	FIXED	Contribution-Medicar	15XL1109AF	$ (4.06)	-116.00000000	35.00000000
5	4	LLAZ000000	L1010	DJ0000	12	121AL	FIXED	Medicare LS	15XL1109AF	$ (0.90)	-116.00000000	35.00000000
6	5	LLAZ000000	L1010	DJ0000	12	121B0	FIXED	Contributions	15XL1109AF	$ (17.35)	-116.00000000	35.00000000
7	6	LLAZ000000	L1010	DJ0000	12	121BL	FIXED	OASDI LS	15XL1109AF	$ (3.83)	-116.00000000	35.00000000
8	7	LLAZ000000	L1010	DJ0000	11	113A0	FIXED	OTP Regular Civilian	15XL1109AF	$ 279.80	-116.00000000	35.00000000
9	8	LLAZ000000	L1010	DJ0000	12	121A0	FIXED	Contribution-Medicar	15XL1109AF	$ 4.06	-116.00000000	35.00000000
10	9	LLAZ000000	L1010	DJ0000	12	121B0	FIXED	Contributions	15XL1109AF	$ 17.35	-116.00000000	35.00000000
11	10	LLAZ000000	L1010	DJ0000	11	113G0	FIXED	OTP Leave Assessment	15XL1109AF	$ 61.84	-116.00000000	35.00000000
12	11	LLAZ000000	L1010	DJ0000	12	121AL	FIXED	Medicare LS	15XL1109AF	$ 0.90	-116.00000000	35.00000000
13	12	LLAZ000000	L1010	DJ0000	12	121BL	FIXED	OASDI LS	15XL1109AF	$ 3.83	-116.00000000	35.00000000
14	13	LLAZ000000	L1210	PC0000	11	111B0	FIXED	Fed W Sys&Adm Det	15XL1109AF	$ (11.49)	-116.00000000	35.00000000
15	14	LLAZ000000	L1210	PC0000	11	111B0	FIXED	Fed W Sys&Adm Det	15XL1109AF	$ 11.49	-116.00000000	35.00000000

Table 2. Master Budget table sample

Several important pieces of information are available in this table.

The first column of interest is Column B, titled Funds_Center. This funds center refers to the BLM identification code referenced earlier. Column C, just to the right of the Funds_center, is titled SubActivity. Subactivities are general BLM categories describing

essential programs such as Administrative Support, Law Enforcement, Wildlife Maintenance and Annual Maintenance. The codes of interest chosen for this study by Rawhouser and her team are:

- L1020 Rangeland Management
- L1210 Wilderness Management
- L1220 Recreation Management
- L1711 National Monument and Conservation Areas

Continuing to the right in the Master Table are the PEs, or Program Elements. This is a category similar to subactivities that provides more specific billing information. These PEs are used in combination with the PMDS tracking system in order to quantify workload targets and accomplishments. Each PE has a unit of measurement attached, as demonstrated below:

- BH - Inventory Abandoned Mine Sites (site)
- FH - Process and Manage special recreation permits (permits)
- EE - Issue grazing permits/leases (permits)
- JA - Apply shrub/grass vegetation (acres)

Master Budget Columns E and F represent another important data classification. The first (Column E) is Major Object Class. These digits are the first two characters parsed from Column F, the Budget Object Class (BOC). Budget object classes distinguish between labor costs (codes beginning with 11 and 12) and operations costs (all other BOCs). These figures were used in analyses that can be found in the results discussion in Chapter 4.

Accompany the Master Budget Table is one other significant table, called "2015PMDS". This table was also received via personal email communication from the BLM budget team, and contains information on the Performance Management Data

Systems (PMDS). Among the columns in this table are the familiar Cost Center, SubActivity (or Budget Activity), Program Element, and the author created Latitude and Longitude entries. Two new and meaningful columns are Target and Actual, which demonstrate the PMDS workload goals and achievements, respectively.

	A	B	C	D	E	F	G
1	Cost Center	FA Budget Activity	PE	Target	Actuals	Longitude	Latitude
2	LLAZ912000	L1050	AE	52	52	-116.18700000	33.55100000
3	LLAZ912000	L1220	AL	56	56	-116.18700000	33.55100000
4	LLAZ912000	L1711	AE	40	40	-116.18700000	33.55100000
5	LLAZ912000	L1711	AL	64	64	-116.18700000	33.55100000
6	LLAZ930000	L1060	HG	0	89	-116.18700000	33.55100000
7	LLAZ930000	L1060	HI	292,000	309,273	-116.18700000	33.55100000

Table 3. 2015PMDS Table sample

3.3 Procedures

In line with the stated purpose of this practicum, the principal procedural goal required the integration of fiscal data into a spatial framework. This was accomplished by adding the Cartesian coordinates to the budget tables and converting those coordinates to individual points within ArcMap. Other technical tasks included formatting data, completing joins/relates, and producing results. Each of these endeavors is examined in this chapter.

It was determined that the best way to visualize how successfully the BLM is managing their budget and workload was to display the data at the field office level. Ideally, the result would show how each field office compares to its neighbors across the state as well as the state as a whole. The initial strategy was simply to import the Excel budget tables into ArcMap and complete a join based on the location code. Unfortunately, there are multiple budget entries for each spatial location, requiring a

"one-to-many" join. In most one-to-many joins, only the first entry is correctly joined, which is exactly what happened when this strategy was attempted.

After much discussion with the BLM GIS team, the idea of creating the Cartesian points for each field office was reached. A single point (Table 1 and Figure 4) near the center of each field office was selected and the coordinates were assigned to each field office in both the Master Budget and PMDS tables. In order for ArcMap to correctly import the data, it is critical that latitude and longitude are separate columns and both columns are formatted as numbers with eight decimal places. For large tables (such as the Master Budget Table), it is also helpful to set the print area in Excel to avoid bringing in unnecessary cells.

Once the Excel data is formatted correctly, the application can be closed as the rest of the process is completed using ArcMap. In ArcMap Version 10.3.1, Excel tables can be added directly from the familiar "Add Data" button, and the navigation window allows for the selection of a particular workbook sheet. After the table is added, it is possible to right-click on the table and select "Display XY Data". After making this selection for the budget table, the Excel entries appear as stacked points at their assigned (x,y) coordinate.

From this stage, ArcMap can easily export the points into a standalone feature class or geodatabase, which allows for far greater functionality. To achieve useful results in this study, the next order of business was to join the existing spatial field office boundaries to the newly created budget points feature class. This was accomplished using a spatial join and selecting the option that joins each point to the polygon that

contains it. The join can be summarized by average or sum, depending on the desired output.

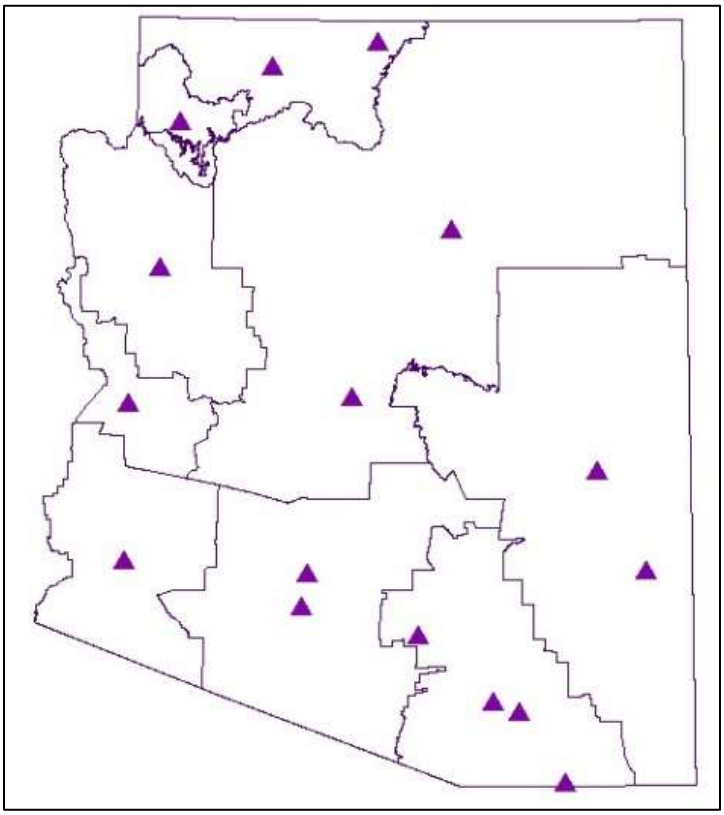


Figure 5. Excel data points

The product of the spatial join is a polygon feature class that mirrors the field office boundaries while incorporating the budget table information as point counts in addition to the selected sum and/or average. This new feature class can then be displayed using ArcMap symbology tools. For example, a graphic can be created illustrating the total amount of dollars spent by each field office by selecting the "sum" option, or demonstrating the average PMDS achieved by each field office by selecting instead for "average". The example below highlights the percent of PMDS workload

measures each field office (including the State Office) achieved in 2015 (Figure 6). A more detailed discussion of the graphics and results is contained in Chapters 4 and 5.

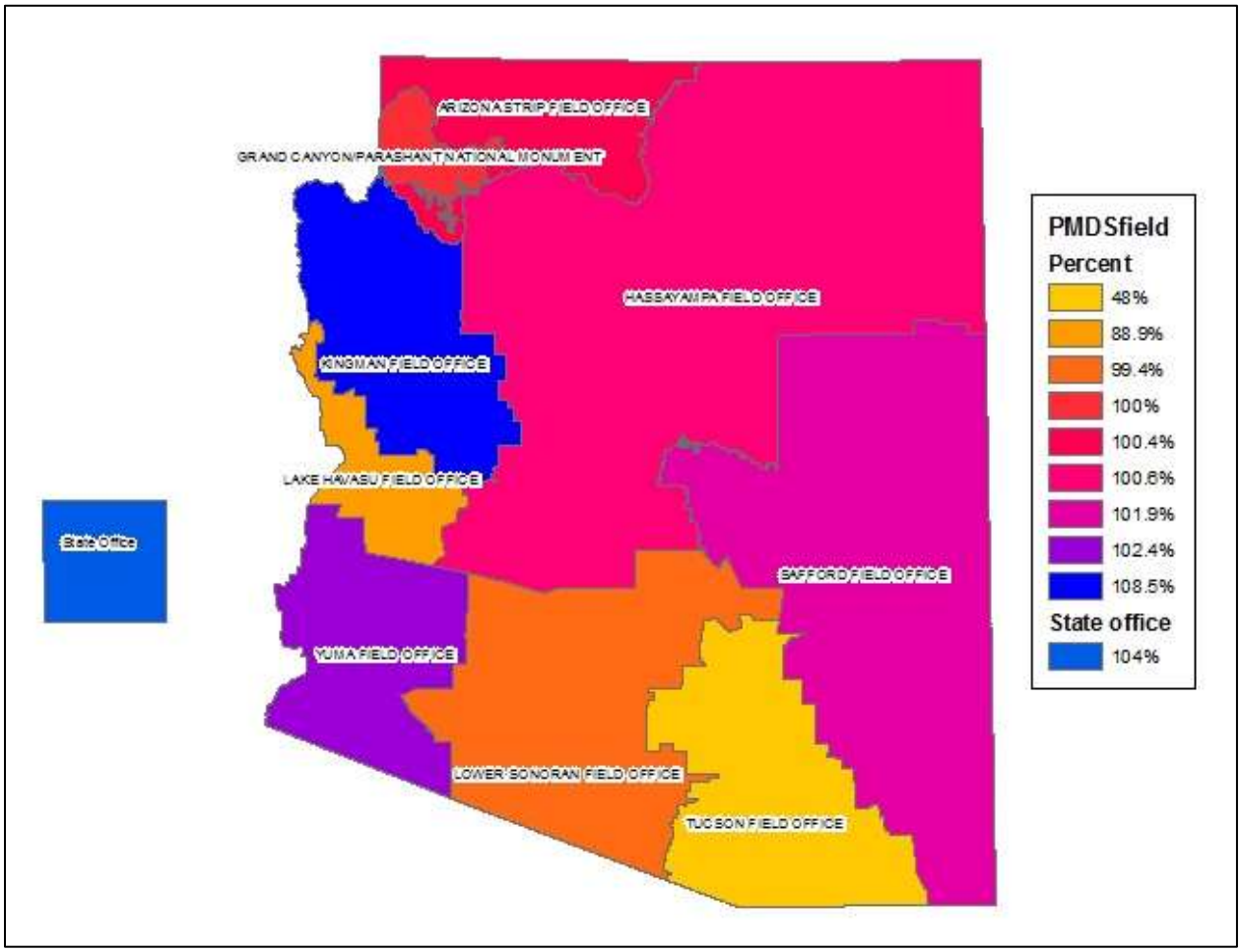


Figure 6. Results example: Percent of PMDS achieved per Field Office

Chapter 4: Results

4.1 Results Outline

The results of this practicum aim to answer the two defined research questions:

- *How well is the BLM of Arizona planning and executing their budget?*

This section examines three categories of data.

1) FBMS spending per field office by sub-activity
   - 1020 – Rangeland Management
   - 1210 – Wilderness Management
   - 1220 – Recreation Management
   - 1711 – National Monument and Conservation Areas

2) Direct and Indirect costs
   - Indirect costs: P, X, Y
   - Direct costs: all others

3) Budget Object Codes for labor and operations
   - Labor: 11 & 12
   - Operations: all others

- *How well is the BLM of Arizona planning and executing their workload?*

  This data examines PMDS target and actual achievements per Field Office.

  1) Overall PMDS achieved at state, district, and field office level

  2) PMDS achieved per specific program element
     - BH – Inventory abandoned mine lands (sites)
     - FH – Process and manage special recreation permits (permits)
     - EE – Issue grazing permits/leases (permits)
     - JA – Apply shrub/grass vegetation (acres)

The following chapter develops the answers to these questions and presents the appropriate results graphically. Each category above is a separate analysis and together they paint a well-rounded picture of the Arizona BLM Fiscal Year 2015 financial data.

4.2 Budget Results

With a view towards answering this question, the first issue explored involves the integration of the Financial & Business Management System (FBMS) data. This data includes general spending, procurement, obligations, and expenses. The results are in dollar amounts, making them very easy to compare across field offices. BLM employees

were particularly interested in FBMS spending within four specific subactivities: Rangeland Management, Wilderness Management, Recreation Management, and National Monuments/Conservation Areas. As an example, the 1020 Rangeland Management map is presented here. Additional graphics can be found in Appendix D.

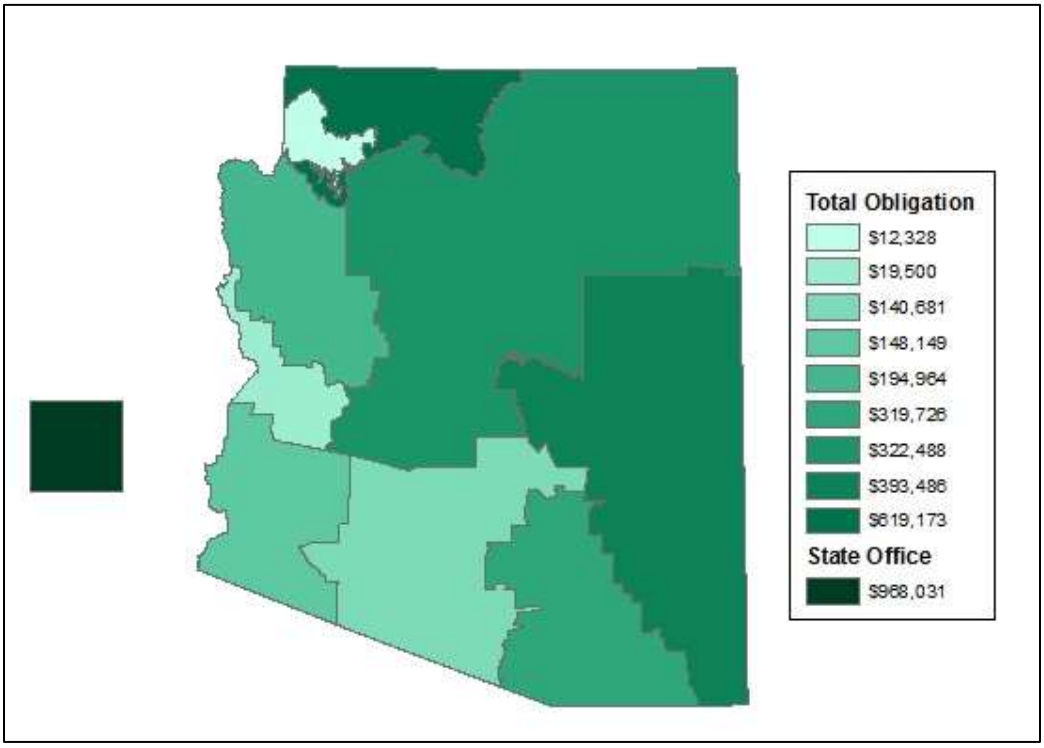


Figure 7. 1020 Rangeland Management FMBS per Field Office

The graphic above illustrates the FBMS obligations across the state of Arizona, specific to Rangeland Management and categorized by field office including national monuments (Figure 7). The values range from $12,328 at the Grand Canyon National Monument to over $968,000 at the State Office. Therefore, it is easy to determine that a significant amount of Rangeland Management funds are spent by the State Office, though the Arizona Strip Field Office isn't far behind.

Graphics such as the Rangeland Management example are especially meaningful to BLM officials who fully understand the implications of such spending. These visuals are particularly compelling as a series, clearly illustrating patterns and comparing field office spending across multiple categories. In the above example, it is easily noted that each field office reports Rangeland Management obligations. This does not hold true for all four of the FBMS categories, a fact clearly displayed by the National Monument and Conservation Area graphic. It is immediately obvious that three of the western field offices do not report any spending in this category, which is a relief as they do not contain monuments or conservation areas.

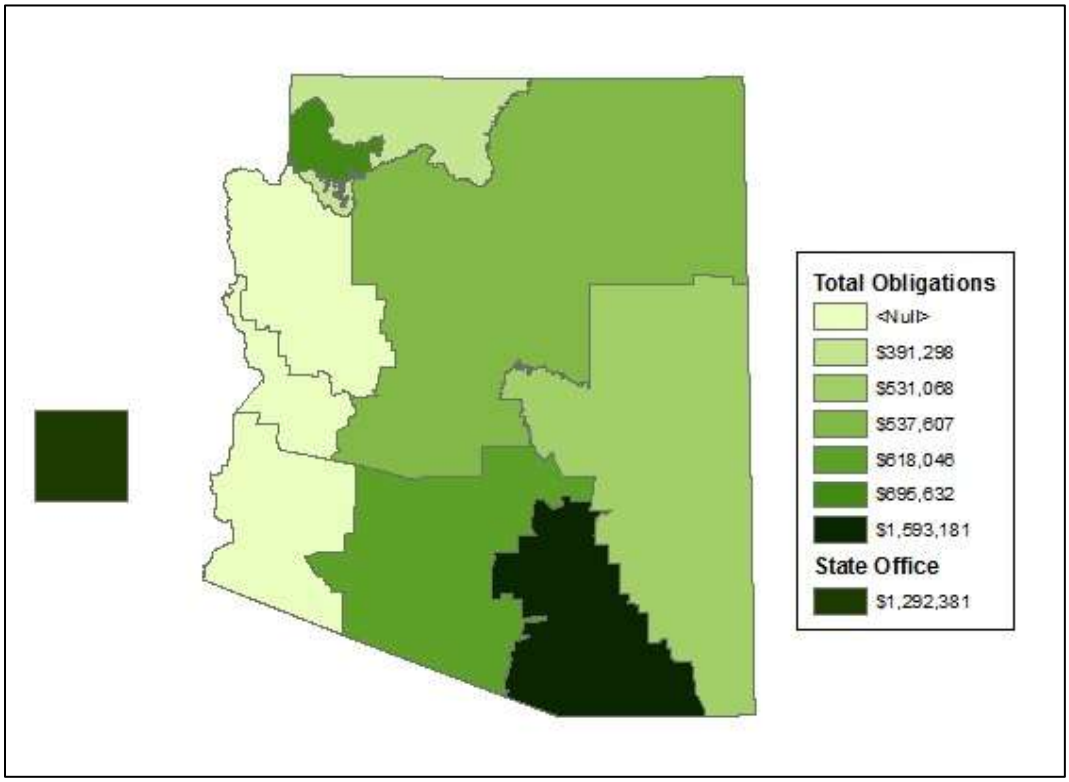


Figure 8. 1711 National Monuments and Conservation Areas

The second dataset employed to explore the BLM budget management strategy draws attention to two types of spending: direct and indirect. Direct spending references costs "directly" associated with a project including materials and labor.

Indirect spending, on the other hand, consists of costs associated with a project but not directly tied to it such as safety gear, computer hardware, and office supplies. These obligations are connected to specific cost centers, but not often to particular projects or entries. Direct versus indirect spending graphics are most valuable when compared side by side, as in the example below.

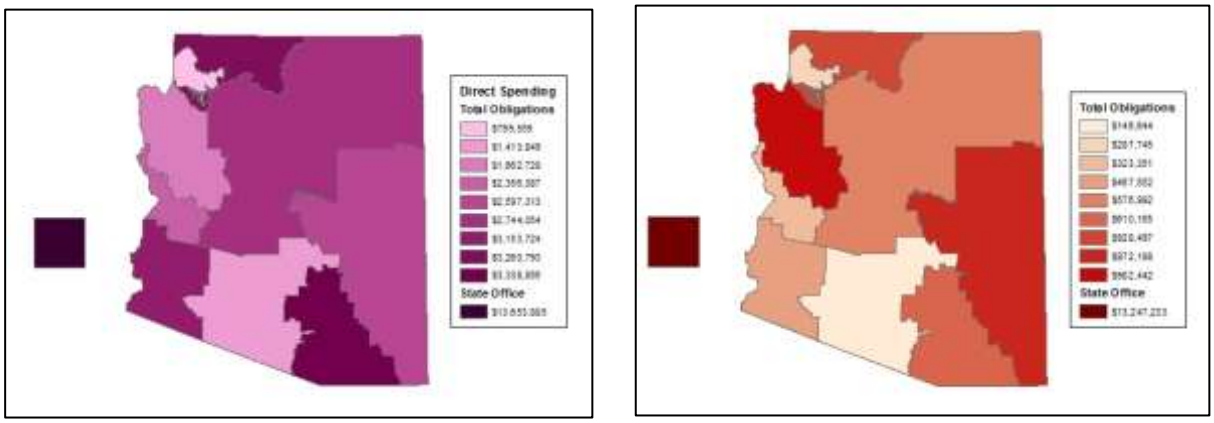


Figure 9. Direct and indirect spending per field office.

A final analysis performed to examine the budget also uses contrasting financial obligations and a labor versus non-labor dichotomy. In the original Master Budget Table, the budget_object_class field (BOC) differentiates between labor and operations costs. Labor costs are exactly what they sound like, the billable labor costs of employees performing BLM activities. Costs that are not directly associated with labor are known as operations or "ops" and are also most helpful when viewed as a set (Appendix D).

4.3 Workload Results

Evaluating workload is a task exclusively suited to the PMDS schematic. There are two principal methods for exhibiting these results; they can be viewed as an overall percent achieved across the state, or broken down by Program Elements (PEs) of interest. The first example provides a nice overall picture of goal achievement at both

the field and district office levels, illustrating that the majority of Arizona achieved greater than 90% of their PMDS targets in FY2015.

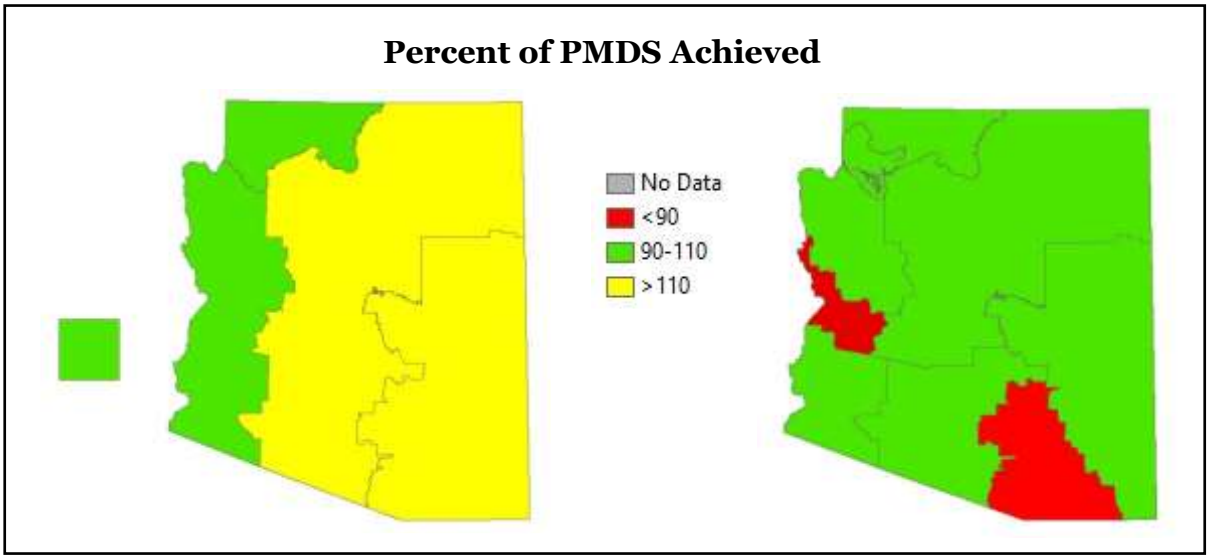


Figure 10. Percent of PMDS targets achieved per district, field office.

Within the BLM, a common format for displaying percentage data is demonstrated by the graphic above. In internal documents, the BLM uses yellow, green, and red to illustrate achievements above 110%, between 90-110%, and below 90%, respectively. Additional versions of this graphic, including a gradient, can be found in Appendix D. The above image is also an excellent example of the value of this practicum, as the field offices that are not underachieving workload targets are very apparent. This allows for BLM officials to explore the possible explanations for this, and determine how significant the issue truly is. A more thorough breakdown of the questions raised by these results can be found in Chapter 5: Discussion.

The second strategy for visualizing PMDS data is explore specific Program Elements of interest chosen by BLM. For instance, PE code BH refers to the inventory of abandoned mine sites and is quantified by the number of sites. According to the

2015PMDS table, field office targets range from 5-100 sites. Each field office has a target and actual PMDS record, and can be represented neatly using the percentage of BH PMDS accomplished across the Arizona field offices.

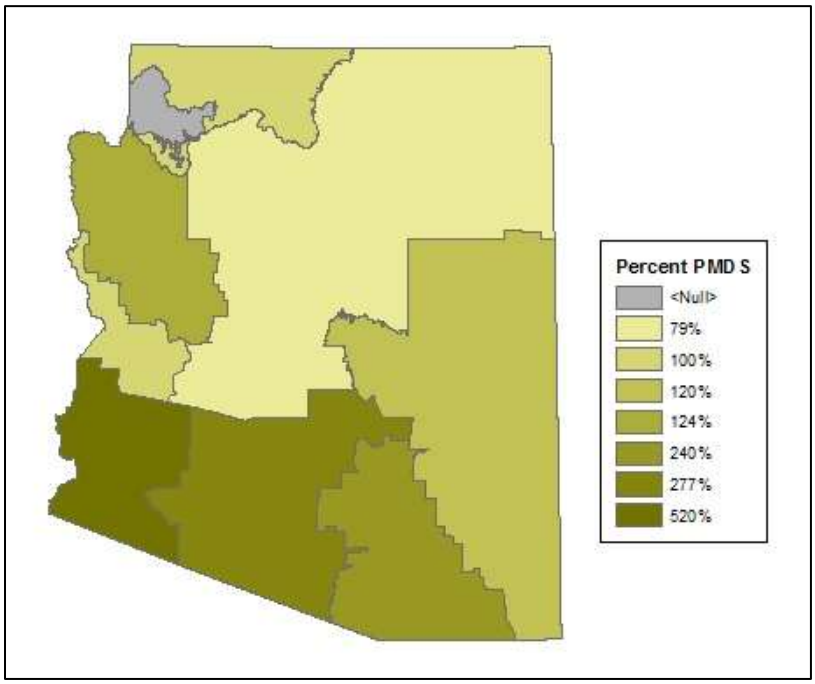


Figure 11. Percent of PMDS targets achieved for PE code BH.

In the above figure, which does not use the BLM color scheme, it is clear the Hassayampa field office is falling short of its goal, while the rest of the state is performing well (Figure 11). The Grand Canyon National Monument is considered "null", as no abandoned mine sites were targeted nor inventoried. While this example is limited to BH spending, three other figures were produced demonstrating other PE codes of interest. These figures can be analyzed as a set, and any field offices consistently performing under expectations can be investigated. In addition, these percentage graphics can be displayed alongside FBMS spending figures, demonstrating exactly how much money each field office spent in achieving their goals.

The practicum results discussed above represent a sample of the figures produced for the BLM. The reasons for this will be developed more fully in Chapter 5: Discussion, but it is worth mentioning in this section that the main intention of this report is to demonstrate the methodology behind the graphic production and explore some of the questions raised by the figures and their implications.

Chapter 5: Conclusions

5.1 Discussion

The purpose of this practicum is to present the Arizona BLM State Office with a visual representation of their fiscal year 2015 budget data. The representations were requested by Deborah Rawhouser, Arizona Associate State Director, who felt they would aid in budget evaluations and decision making. The graphics produced by this practicum are not nearly as useful to individuals unfamiliar with BLM procedures and expenditures, so the following discussion section will examine how a BLM employee might be able to utilize the results. Other implications for the data will also be mentioned, while a general project summary will be saved for Chapter 6: Reflection.

In Chapter 4: Results, a discussion and image (Fig. 9) of PMDS percentages achieved across the state by both field and district offices was presented. The field office graphic serves as an excellent case study for understanding how this data could be used by a BLM budget officer. As a reminder, a copy of the figure is below.

Figure 12. Percent of PMDS per field office

Recalling the BLM percentage scale, the green field offices achieved between 90-110% of their PMDS targets. The red field offices, on the other hand, have underperformed and achieved less than 90% of their overall target. The Tucson field office (indicated with a large blue arrow) is one of these underachieving offices, reporting completion of 48% of its PMDS goal in 2015 (Figure 12).

A BLM budget office might see the figure above and immediately wonder "What's going on with Tucson?" This question encapsulates the major accomplishment of this practicum: the opportunity to spot an issue and dig deeper to find the true cause. In this case, one can refer back to the 2015PMDS table, filter the location code for the Tucson field office, and discover exactly what is holding Tucson back from achieving more

satisfactory results. A sorted sample from this table is available below, and a quick consultation of it exposes significant shortcomings in the first three entries. Of these, two are coded as Program Element MA: evaluating recreation areas.

PE	PE Description	FA Budget Activity	FA Budget Activity Name	Cost Center	PMDS Target	PMDS Actuals	Difference
MA	Evaluate Recreation Areas	L1711	National Monuments & Cons. Areas	LLAZG03000	95000	42750	-52250
MA	Evaluate Recreation Areas	L1220	Recreation Management	LLAZG02000	78503	35336	-43089
BS	Inventory for Presence of Invasive and/or Noxious Weeds	L1711	National Monuments & Cons. Areas	LLAZG03000	42280	0	-42280
MU	Monitor Water Resources	L1010	Soil, Water, and Air	LLAZG01100	1460	1344	-116
BN	Inventory Water Resources	L1711	National Monuments & Cons. Areas	LLAZG01100	4794	4753	-41
MK	Evaluate Weed Treatments	L1711	National Monuments & Cons. Areas	LLAZG03000	50	20	-30
EF	Issue Grazing Use Authorizations	L1020	Rangeland Management	LLAZG02000	116	98	-18
NU	Conduct Patrol Enforcement Activities	L1711	National Monuments & Cons. Areas	LLAZG01100	133	115	-18
MQ	Monitor Terrestrial Habitat	L1711	National Monuments & Cons. Areas	LLAZG03000	10025	10000	-25
JD	Apply Weed Treatments	L1020	Rangeland Management	LLAZG02000	10	0	-10
JP	Implement Species Recovery/Conservation Actions	L1711	National Monuments & Cons. Areas	LLAZG01100	12	3	-9
FL	Process Mining Notices	L1990	Mining Law Administration	LLAZG02000	5	1	-4
EE	Issue Grazing Permits/Leases	L1020	Rangeland Management	LLAZG02000	2	0	-2
ER	Process Right-of-Way Grants	L5101	Major Category Rights-Of-Way Processing	LLAZG02000	2	0	-2
EF	Issue Grazing Use Authorizations	L1711	National Monuments & Cons. Areas	LLAZG01100	6	4	-2
FU	Manage Fee Collection Program for Recreation Use Permits (RUP) and Rec Permits (SUP)	L1711	National Monuments & Cons. Areas	LLAZG01100	22	20	-2
FV	Administer the Recreation Fee Program	L1711	National Monuments & Cons. Areas	LLAZG01100	22	20	-2

Table 4. Tucson PMDS target and actual values

Evaluating recreation areas is measured in acres, therefore the difference between target and actual values can be extreme. In the example above, several thousand acres have gone unevaluated. To a BLM employee, this would be quite meaningful. Perhaps there are good reasons that the Tucson field office did not prioritize this PE, or maybe they are truly falling short. This insight allows budget officials to make more informed decisions, and accordingly evaluate the performance of their field offices.

Aside from the case study cited above, the results of this practicum provide many opportunities for BLM employees to spot unusually high or low performing field offices and look more deeply into the issues causing the variance. If a field office consistently performs above expectations, officials can attempt to adopt their best practices and learn from them. This could lead to better performance statewide, or perhaps even nationally.

Yet another potential use for the data produced by this practicum is to track changes over time. This project presents a snapshot of the fiscal data in 2015. For FY 2016, the BLM made several changes to how programs and activities are billed, allocating even more money down to the field offices to be dispersed. Using the methodology presented in Chapter 3, the 2016 fiscal data could be analyzed and then compared to the project data to see if the changes were successfully adapted.

It is clear that there are numerous analyses that can be completed using the results of this practicum. Ideally, BLM employees can use this project as a template for future work, and continue to add functionality and comparison tools. Regarding the practicum research questions posed in Chapter 1, the report author can postulate that the BLM appears to be effectively managing both their budget and workload. This practicum provides them with an additional tool to monitor their fiscal data, allowing them to answer these questions definitively.

5.2 Recommendations

One challenge that presented itself over the course of this study was the question of project scope. There are several opportunities for future work available using the methodology and data used in this practicum, as well as a handful of possible improvements to the results. This section includes a brief discussion on both of these closely related topics.

Regarding directions for future work, one idea that stands out is to reconfigure the results so the information gathered is more meaningful. This could be achieved in a variety of ways. For example, the FBMS spending per field office could be normalized to ensure the results are comparing "apples to apples". The data could be reworked and displayed as FMBS dollars spent per BLM employee, or even general population. Along

similar lines, the PMDS percent achieved data could be categorized to compare workload measures with similar units. Though the BLM uses the data across all program elements, it could be useful to see acres compared only to acres, versus to sites, agreements, and leases.

As the BLM has been utilizing economic data for many years, it has certain standards in place about how that data should be used and displayed. While many of these standards (such as templates and alpha-numeric codes) do translate well to spatial data, others do not. The BLM standard for displaying percentage data with red, green, and yellow symbology is likely adequate for graphs and pie charts, but does not present visual data well. The graphic that highlights PMDS achievement across field offices (Figure 10) does not differentiate between the 48% of workload measures achieved by Tucson and the 88% from the Lake Havasu Field Office. Gradients, such as those used in Figures 7, 9, and 11, are a more successful way of displaying this type of data.

Therefore, recommendations for future work include taking the data in new and meaningful directions as well as reevaluating current standards for displaying digital information. Other ideas for future projects mentioned elsewhere in this practicum involve the incorporation of future fiscal data to track changes across time, and creating new tools or buttons to automate some of the processes used to achieve the practicum results.

5.3 Reflection

There can be little doubt that this practicum produced valuable information for the Arizona BLM as they strive to manage their fiscal decisions effectively. Several members of the BLM team expressed their appreciation for the project, and felt very grateful that someone had taken the time to complete it. The results have been

presented to several staff members at the Arizona State Office, and there are plans to present it to a larger group of managers from across the region. It will be demonstrated as one tool in an arsenal for understanding fiscal data, and will contribute to the idea that the state of Arizona BLM takes technology and GIS contributions seriously. For these reasons, this project can be considered a success.

On a more personal level, the report author can confidently state that many skills were mastered over the course of this project. First came the clear need to professionally interact with BLM staff members from multiple departments including budget, GIS, personnel, and even facility management. Schedules had to be coordinated for progress report meetings, and demonstrations arranged in advance. Equipment had to be maintained, serviced, and finally returned.

Technically speaking, this practicum was an opportunity to demonstrate the skills learned during two years of rigorous GIS coursework. Insight was drawn from several Northern Arizona University classes, particularly those focusing on programming, geodatabases, and GIS methods. Many steps in this process required the consultation of class texts or internet resources, and knowing where to find necessary information proved to be a very useful skill. Problem solving was another valuable competence strengthened while completing this practicum; a small sample of the issues faced over the course of the project include: incomplete data, inefficient equipment, and evolving expectations.

Understanding that the results of this practicum are most useful as a methodology and framework, rather than a set of deliverables, was another key point to accept. BLM officials work with these numbers and categories for years, and have a very

good eye for catching interesting patterns and results. The intention of this practicum was to provide them with something they could use and benefit from, and that has been achieved.

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Appendix A: Dictionary of Terms and Acronyms

2015PMDS: Data table containing PMDS targets and achievements

BLM: Bureau of Land Management

BOC: Budget Object Class, Type of spending category, demonstrates labor and operations budget costs

FBMS: Financial & Business Management System, Budget, procurement, obligations, and expenses

GIS: Geographic Information System

Master Table: The master budget Excel table, includes raw data, all expenses and obligations

PE: Program Element, 2 digit tracking codes tied to PMDS to measure workload

Relevant PEs and their measurement units:

BH – Inventory abandoned mine lands (sites)
FH – Process and manage special recreation permits (permits)
EE – Issue grazing permits/leases (permits)
JA – Apply shrub/grass vegetation (acres)

PMDS: Performance Management Data System, Workload tracking method with multiple units of measurement including acres, projects, buildings, evaluations, agreements, permits, and sites

Subactivity: General BLM categories describing essential programs such as Administrative Support, Law Enforcement, Wildlife Maintenance and Annual Maintenance

Relevant subactivities:

1020 – Rangeland Management
1210 – Wilderness Management
1220 – Recreation Management
1711 – National Monument and Conservation Areas

Appendix B: Master Table Sample

Tucson Field Office, PE: EE, JA, and BH

Sub activities	PE	Major_ Object_ Class	BOC	Var./ Fixed	Total_ Obligations	Longitude	Latitude
L1020	EE0000	12	121J0	FIXED	$ 65.38	-110.78600000	31.96700000
L1020	EE0000	12	121J0	FIXED	$ 65.73	-110.78600000	31.96700000
L1020	EE0000	12	121JL	FIXED	$ (13.53)	-110.78600000	31.96700000
L1020	EE0000	12	121JL	FIXED	$ 6.32	-110.78600000	31.96700000
L1020	EE0000	12	121JL	FIXED	$ (6.32)	-110.78600000	31.96700000
L1020	EE0000	12	121JL	FIXED	$ 12.54	-110.78600000	31.96700000
L1020	EE0000	12	121JL	FIXED	$ 13.53	-110.78600000	31.96700000
L1020	EE0000	11	111A0	FIXED	$ 361.14	-110.78600000	31.96700000
L1020	EE0000	11	111G0	FIXED	$ 74.39	-110.78600000	31.96700000
L1020	EE0000	11	111A0	FIXED	$ (107.64)	-110.78600000	31.96700000
L1020	EE0000	11	111A0	FIXED	$ (361.14)	-110.78600000	31.96700000
L1020	EE0000	11	111A0	FIXED	$ (144.48)	-110.78600000	31.96700000
L1020	EE0000	11	111A0	FIXED	$ (1,605.72)	-110.78600000	31.96700000
L1020	EE0000	11	111G0	FIXED	$ (23.79)	-110.78600000	31.96700000
L1020	JA0000	25	252Z0	Variable	$ 198.00	-110.78600000	31.96700000
L1020	JA0000	25	252Z0	Variable	$ -	-110.78600000	31.96700000
L1020	JA0000	25	255C0	Variable	$ 2,534.25	-110.78600000	31.96700000
L1020	JA0000	12	121E0	FIXED	$ 4.64	-110.78600000	31.96700000
L1020	JA0000	12	121EL	FIXED	$ 0.89	-110.78600000	31.96700000
L1020	JA0000	12	121F0	FIXED	$ 18.56	-110.78600000	31.96700000
L1020	JA0000	12	121FL	FIXED	$ 3.55	-110.78600000	31.96700000
L1020	JA0000	11	111G0	FIXED	$ 111.24	-110.78600000	31.96700000
L1020	JA0000	12	121EL	FIXED	$ 1.11	-110.78600000	31.96700000
L1620	BH0000	21	211B0	Variable	$ 14.75	-110.78600000	31.96700000
L1620	BH0000	21	211D0	Variable	$ 648.13	-110.78600000	31.96700000
L1620	BH0000	25	252R0	Variable	$ (1,500.00)	-110.78600000	31.96700000
L1620	BH0000	25	252T0	Variable	$ (90.00)	-110.78600000	31.96700000
L1620	BH0000	26	265F0	Variable	$ (6.51)	-110.78600000	31.96700000
L1620	BH0000	26	269F0	Variable	$ (61.82)	-110.78600000	31.96700000
L1620	BH0000	31	312B0	Variable	$ (108.19)	-110.78600000	31.96700000
L1620	BH0000	31	312B0	Variable	$ (944.80)	-110.78600000	31.96700000
L1620	BH0000	21	211B0	Variable	$ 14.75	-110.78600000	31.96700000
L1620	BH0000	21	211B0	Variable	$ 14.75	-110.78600000	31.96700000
L1620	BH0000	21	211B0	Variable	$ 14.75	-110.78600000	31.96700000
L1620	BH0000	21	211B0	Variable	$ 14.75	-110.78600000	31.96700000
L1620	BH0000	12	121K0	FIXED	$ 424.32	-110.78600000	31.96700000
L1620	BH0000	12	121K0	FIXED	$ (424.32)	-110.78600000	31.96700000

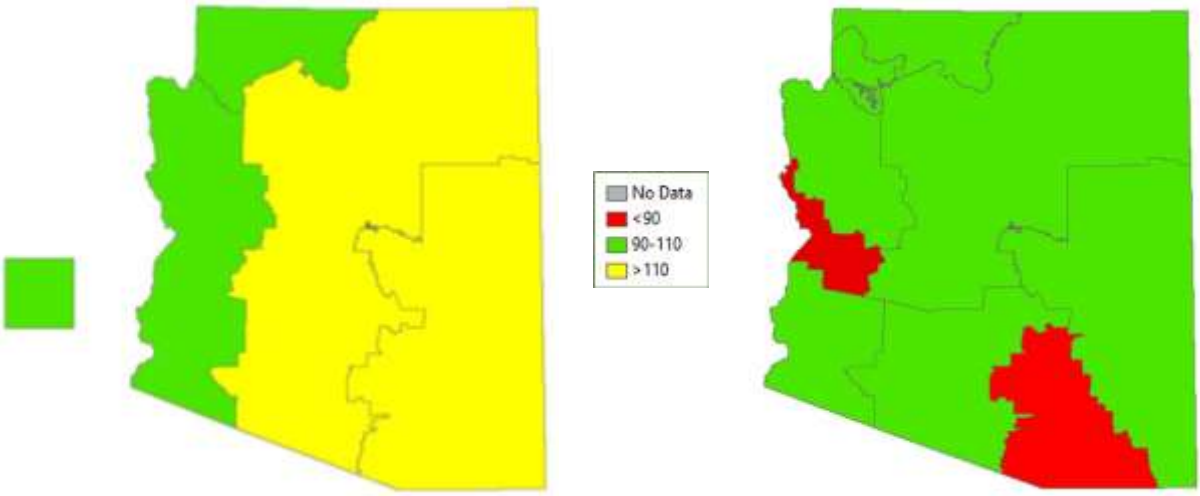
Appendix C: 2015PMDS Table Sample

Tucson Field Office, All PEs codes

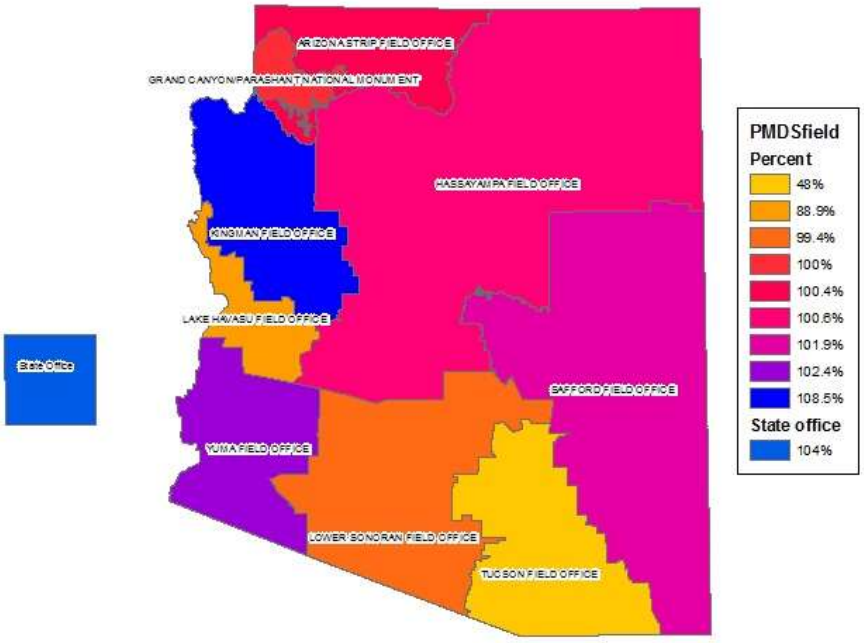
Cost Center	FA Budget Activity	PE	Target	Actuals	Longitude	Latitude
LLAZG02000	L1020	ED	1	0	-110.78600000	31.96700000
LLAZG02000	L1020	EE	2	0	-110.78600000	31.96700000
LLAZG02000	L1020	EF	116	98	-110.78600000	31.96700000
LLAZG02000	L1020	JD	10	0	-110.78600000	31.96700000
LLAZG02000	L1020	MJ	6	7	-110.78600000	31.96700000
LLAZG02000	L1020	ML	22	22	-110.78600000	31.96700000
LLAZG02000	L1020	NA	7	22	-110.78600000	31.96700000
LLAZG02000	L1020	NU	0	8	-110.78600000	31.96700000
LLAZG02000	L1020	NV	1	0	-110.78600000	31.96700000
LLAZG02000	L1030	NU	0	21	-110.78600000	31.96700000
LLAZG02000	L1030	NV	5	11	-110.78600000	31.96700000
LLAZG02000	L1050	AE	2	2	-110.78600000	31.96700000
LLAZG02000	L1050	AJ	22	24	-110.78600000	31.96700000
LLAZG02000	L1050	FD	4	6	-110.78600000	31.96700000
LLAZG02000	L1050	KO	3	0	-110.78600000	31.96700000
LLAZG02000	L1050	MY	6	6	-110.78600000	31.96700000
LLAZG02000	L1050	NU	27	32	-110.78600000	31.96700000
LLAZG02000	L1060	NK	12	18	-110.78600000	31.96700000
LLAZG02000	L1110	KE	9	9	-110.78600000	31.96700000
LLAZG02000	L1110	MQ	1,800	1,805	-110.78600000	31.96700000
LLAZG02000	L1110	MR	12	12	-110.78600000	31.96700000
LLAZG02000	L1110	NU	4	0	-110.78600000	31.96700000
LLAZG02000	L1150	JP	5	5	-110.78600000	31.96700000
LLAZG02000	L1150	MQ	10,390	10,390	-110.78600000	31.96700000
LLAZG02000	L1210	MD	3,632	3,632	-110.78600000	31.96700000
LLAZG02000	L1210	NU	3	3	-110.78600000	31.96700000
LLAZG02000	L1220	AJ	9	0	-110.78600000	31.96700000
LLAZG02000	L1220	AL	0	9	-110.78600000	31.96700000
LLAZG02000	L1220	CE	1	2	-110.78600000	31.96700000
LLAZG02000	L1220	EA	3	3	-110.78600000	31.96700000
LLAZG02000	L1220	FU	3	3	-110.78600000	31.96700000
LLAZG02000	L1220	FV	0	3	-110.78600000	31.96700000
LLAZG02000	L1220	IU	1	1	-110.78600000	31.96700000
LLAZG02000	L1220	LA	1	1	-110.78600000	31.96700000
LLAZG02000	L1220	MA	78,525	35,336	-110.78600000	31.96700000
LLAZG02000	L1220	NU	0	262	-110.78600000	31.96700000

LLAZG02000	L1220	NV	74	88	-110.78600000	31.96700000
LLAZG02000	L1220	NY	40	40	-110.78600000	31.96700000
LLAZG02000	L1232	NU	1	3	-110.78600000	31.96700000
LLAZG02000	L1232	NV	1	2	-110.78600000	31.96700000
LLAZG02000	L1330	EP	2	1	-110.78600000	31.96700000
LLAZG02000	L1330	NF	16	25	-110.78600000	31.96700000
LLAZG02000	L1330	NU	1	0	-110.78600000	31.96700000
LLAZG02000	L1430	NU	0	0	-110.78600000	31.96700000
LLAZG02000	L1430	NV	0	0	-110.78600000	31.96700000
LLAZG02000	L1440	EQ	2	2	-110.78600000	31.96700000
LLAZG02000	L1440	ER	13	12	-110.78600000	31.96700000
LLAZG02000	L1440	NH	8	8	-110.78600000	31.96700000
LLAZG02000	L1440	NU	9	6	-110.78600000	31.96700000
LLAZG02000	L1440	NV	0	1	-110.78600000	31.96700000
LLAZG02000	L1492	NH	0	4	-110.78600000	31.96700000
LLAZG02000	L1620	BH	50	120	-110.78600000	31.96700000
LLAZG02000	L1620	HP	75	81	-110.78600000	31.96700000
LLAZG02000	L1630	NU	17	42	-110.78600000	31.96700000
LLAZG02000	L1630	NV	16	29	-110.78600000	31.96700000
LLAZG02000	L1630	NY	6	11	-110.78600000	31.96700000
LLAZG02000	L1630	OA	23	26	-110.78600000	31.96700000
LLAZG02000	L1640	BF	2	3	-110.78600000	31.96700000
LLAZG02000	L1640	NU	46	67	-110.78600000	31.96700000
LLAZG02000	L1640	NV	4	7	-110.78600000	31.96700000
LLAZG02000	L1990	EX	1	3	-110.78600000	31.96700000
LLAZG02000	L1990	FL	5	1	-110.78600000	31.96700000
LLAZG02000	L1990	NI	18	18	-110.78600000	31.96700000
LLAZG02000	L2641	MG	1	1	-110.78600000	31.96700000
LLAZG02000	L5101	ER	2	0	-110.78600000	31.96700000
LLAZG02000	LF100	NU	6	0	-110.78600000	31.96700000
LLAZG02000	LF100	NV	4	0	-110.78600000	31.96700000

Appendix D: Graphics



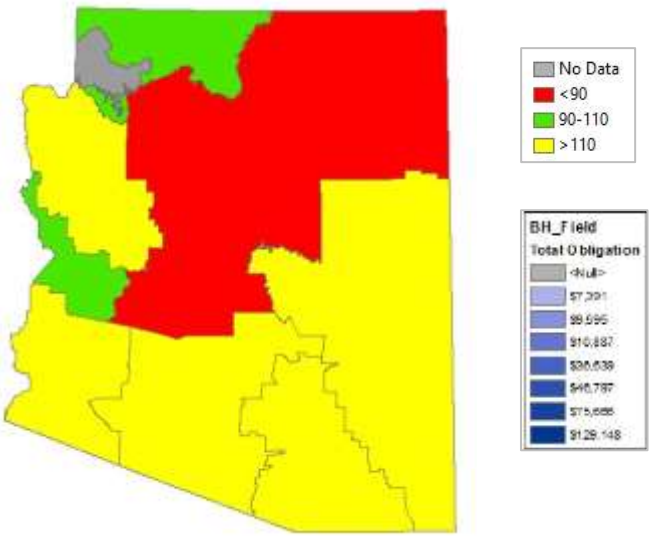
The above graphics represent the percent of PMDS achieved, in total across all PE categories, for district, state, and field offices.



The above graphic represents percent of PMDS achieved across the state, per field office, using a gradient to specifically identify percentages.

BH – Inventory Abandoned mine lands (sites)

Percent of PMDS Achieved

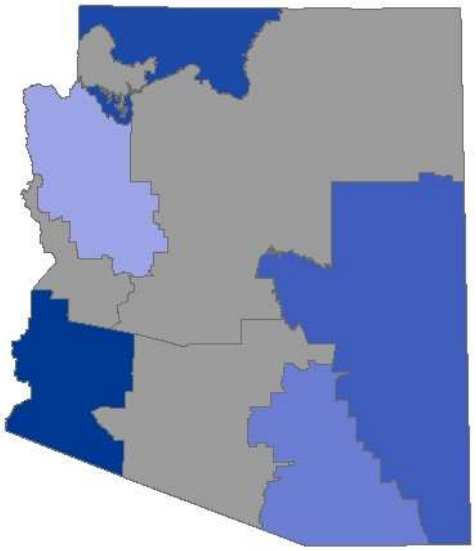


FBMS Spent

FH – Process and Manage Special Recreation Permits (permits)

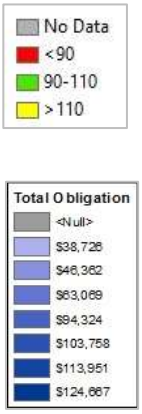
Percent of PMDS Achieved

FBMS Spent



EE – Issue Grazing Permits/Leases (permits)

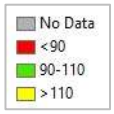
Percent of PMDS Achieved

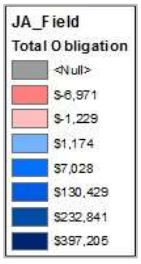


FBMS Spent

JA – Apply Shrub/Grass Vegetation (acres)

Percent of PMDS Achieved

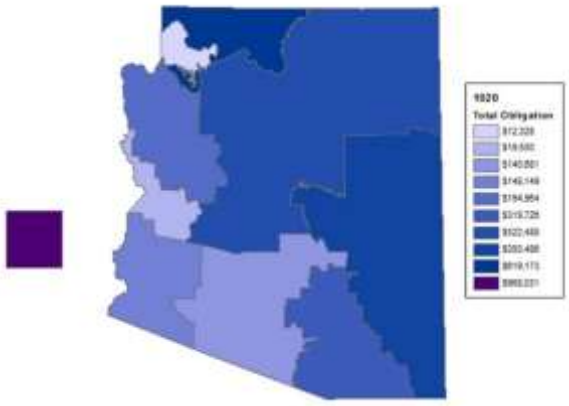




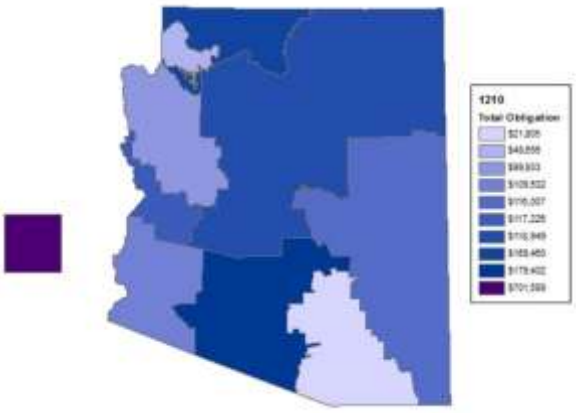
FBMS Spent

FBMS Spent per Subactivity

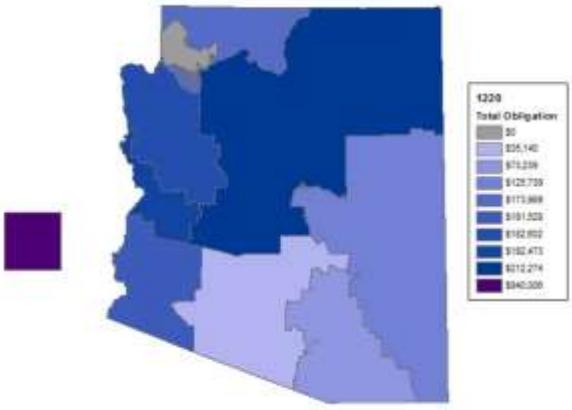
1020 – Rangeland Management



1210 – Wilderness Management



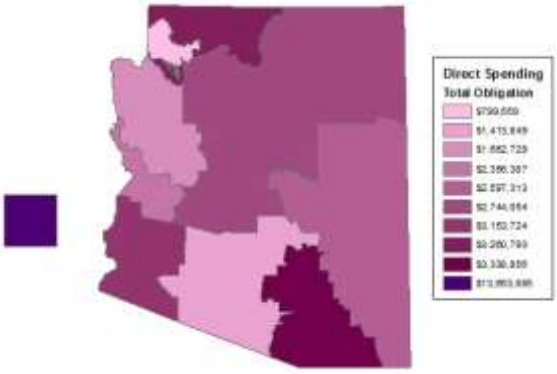
1220 – Recreation Management



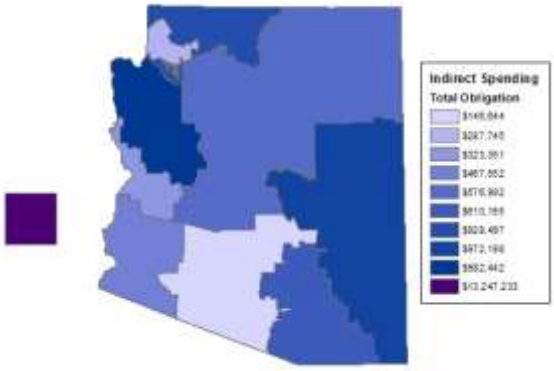
1711 – National Monument and Conservation Areas

Direct and Indirect Spending per Field Office

Direct Spending

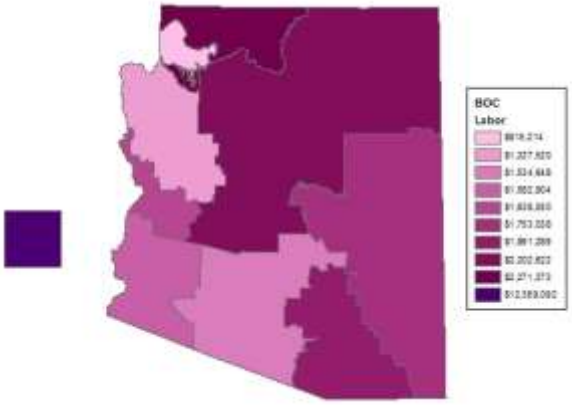


Indirect Spending



BOC Labor and Operations Costs

Labor



Operations

Appendix E: Practicum Timesheet

Dates	Meeting	Independ.	Notes
Dec 2015			
Dec 9th	10		With Deb, setup internship (Phonecall)
Dec 17th	60		Deb, Monica, Other budget
Dec 21st		60	Fingerprint, background forms
Jan 2016			
Jan 7th	60		Monica, Richard, onboarding work
Jan 20th		60	Monica, finished up onboarding, worked at BLM
Feb 2016			
Feb 3rd	120		Monica, Marisa, Deb, Dana. Setup Citrix, discussed objectives
Feb 17th		60	Accesed everything from home, familiarized with Citrix
Feb 24th		60	At BLM office, reviewed field/district office naming conventions
March 2016			
Mar 3rd		60	At BLM: citrix, budget tool work
Mar 7th		90	At home, formating budget data, setting up .mxd
Mar 9th	30	120	Meeting with Marisa
Mar 16th		30	New plan, (x,y) coordinates
March 19th		30	Research
March 23rd		60	created match field office table, added (x,y) data. Went to BLM (no desk).
March 30th		75	Spatial join with (x,y), field statistics.
April 2016			
Apr 5th		45	completed PMDS target/actual map
Apr 10th		30	completed total budget spent map
Apr 14th		60	Review, update preparation
Apr 15th	60		Internship progress update, Deb, Monica, Marisa.
May 2016			
May 31st		60	started creating specific PMDS maps
June 2016			
June 1st		30	1210 map, reviewed join
June 3rd	60		Met with Marisa at BLM 11-2, updated laptop
June 5th		60	Wrote 1 page project summary

June 6th		30	Cleaned out email, downloaded fixed budget data from Monica
June 7th		60	Added WMA, NM to budget table, computed lat,long
June 8th		45	Brought new budget data into ArcMap, created 2 maps.
June 9th		30	Finished creating new maps, lat long table
June 10th	60		Meeting with Marisa and Monica and BLM
June 11th		180	Created presentation, verified data
June 12th		60	Worked on presentation
June 13th		120	Produced PE maps with new data, continued presentation
June 14th		60	Produced BOC maps with new data, finished presentation
June 15th	60		Presentation
June 22nd		60	Formatted new spreadsheet, started adding new lat,longs
June 27th		90	Finished adding x,y to new spreadsheet of 400,000+ records
June 29th		60	Brought new budget spreadsheet into ArcMap
July 2016			
July 1st		60	Setup PMDS spreadsheet, brought it into ArcMap.
July 5th		60	Finished PMDS maps
July 6th		30	PE code maps (FBMS)
July 7th		90	Finished FBMS by PE, started PMDS by PE
July 8th		45	PMDS by PE
July 12th		75	FBMS 1210, 1220, etc
July 13th		45	Started the indirect/direct
July 14th		60	Finished direct and indirect
July 20th		30	Labor and Non-labor
July 23rd		60	Presentation work
July 26th		45	Continuing presentation/figures
August 2016			
August 2nd		60	Complete presentation, organize notes for meeting
August 3rd		45	Meeting notes
August 4th			Meeting with Monica
August 8th			Adding state squares
August 13th			Meeting prep
August 14th			Meeting prep, notes, what's going on with Tucson?
August 15th	x		MEETING CANCELED
Sept. 2016			
September 11th			Review

September 13th	30		Advisor meeting, practicum discussion
September 19th			Practicum outline, literature review
September 24th			Outline, literature review, abstract
September 26th			Introduction, Background
September 27th			Background
October 2016			
October 3rd			Introduction: purpose, outcome, research questions
October 5th			Finished introduction, started methodology
October 6th			Methodology Data
October 8th			Spatial and Fiscal Data
October 10th			Finished up spatial/fiscal data, started Procedures
October 11th			Finished Methodology, started Results
October 12th			Results
October 13th	30	180	Meeting at BLM with Deb, Monica, Marisa. Practicum document.
October 14th		90	Draft finalization, editing.

Appendix F: Meeting Notes – Project Summary

Objective

The objective of this project is to aid the Arizona Bureau of Land Management (BLM) in obtaining operational excellence and accomplishing their strategic goals by connecting on the ground accomplishments to budget and economic data. The result is a visual representation of budget allocation and spending, connected geospatially to Arizona BLM Field Offices across the state.

Summary

To fulfill the requirements of my M.S. in Applied Geospatial Sciences from Northern Arizona University, I am completing a project requested by Deborah Rawhouser, Associate State Director for the BLM. Rawhouser requested a geographical representation of fiscal year 2015 budget data, allowing her to more easily visualize budget spending and allocations in Arizona. These representations would allow her to answer important questions about the state budget, such as:

1) How well are we planning and executing our budget?
2) How well are we planning and executing our workload/labor?

My project endeavored to answer these questions by connecting raw budget data records to the Arziona Field Offices in which they were accomplished and producing visual maps representing these relationships.

Procedure

The procedure for this project was completed in several steps involving both budget tables and spatial data. For the spatial data, the results were requested at the field office level. There are several field offices covering the state of Arizona, each supervised by a district office. Within these field offices are other areas of fiscal interest, including national monuments and wilderness management areas. Each of these areas has a provenance code, which is one of several pieces of information found in the fiscal 2015 budget tables. The tables were secured from "the Tool", a BLM specific application that allows for the exportation of data based on a variety of search criteria. For the purposes of this project, all entries for all field offices in 2015 were selected and exported.

In order to connect the data tables to the field offices and create a visual representation, a join needed to be completed. Unfortunately, a simple join was impossible due to the cardinality of the relationship, so another solution was needed. Ultimately, I determined the best way to join this data was to determine a centralized latitude-longitude point for each field office, and add columns to the data table containing this information. Then, the (x,y) data could be brought into ArcMap as a table, and a point file could be created. This file contains a "stack" of points in the center of each field office, which can then be spatially joined to the polygons themselves.

The result of this spatial join has allowed me to produce several maps to help the BLM visualize their spending and project completions, color coded by category. These maps include: total spending by field office, percentage of work elements completed, and maps of specific program achievements. At this point in the project, I am producing the last of my maps and bringing in additional budget data as it becomes available. There is also still a great deal of documentation to do, as well as presentations to the BLM staff budget and geospatial staff.

April 14th, 2016 Meeting Notes

Questions

1. How well are we planning and executing our budget?

2. How well did we plan and execute our workload?

Outcome

1. Can be viewed by management to make budget decisions.

General Steps

1. Format and export budget data

2. Joining budget data to spatial data

3. Compiling and displaying useful results

Accomplished

1. Format and export budget data
    - I. Exporting
        - a. Fiscal year 2015
        - b. All funds centers, budget activities, and program elements
    - II. Formatting
        - a. Very little required for the raw data
        - b. Creating parsed fields (codes?)

2. Joining budget data to spatial data
    - I. One to Many join – cannot be simply joined in ArcMap
        - a. Averages can be produced per category, but they require a lot of manual work.
        - b. No clear way to visualize
    - II. Give each cost center an (x,y) and use a spatial join
        - a. Determine an (x,y) coordinate for each FIELD OFFICE
        - b. Add 2 fields to Excel (Latitude, Longitude)
        - c. Bring (x,y) data into ArcMap
        - d. Create layer from points
        - e. RESULT: There is a "stack" of points in the center of each field office. One for each entry in the budget table.
        - f. Complete a spatial join with Field Office feature to budget table.

3. Compiling and displaying useful results
    - I. Symbolize by category
    - II. Refer to existing color codes for percent.

Produced

1. Percent of PMDS Achieved (PMDS Actual / PMDS Target) -- Workload
    I. Values range from 96 percent to 132 percent
    II. Includes all program element and budget activities

2. FMBS Spent in Total
    I. In dollar amount

Issues

1. Currently dealing only with Field Offices. Districts are not calculate individually, neither are WMA, State office, or other unusual areas.
    - Partly a data issue
    - Still working on the best way to combine this data
    - Total lines in the FY 2015 table vs. ArcMap budget
        (see RED in Budget Workspace)

2. Some manual calculation still necessary (adding x and y to the MATCHED excel table).
    - It's relatively quick, but there must be a better way.

3. What to produce to answer the original questions

4. How to make this usable for someone else?
    - Programming a tool using Visual Basic?

5. Everything still on my machine (budget data from tool, spatial data from BLM public access website).

June 14th, 2016 Meeting Notes

Objective

The objective of this project is to aid the Bureau of Land Management (BLM) in obtaining operational excellence and achieving their strategic goals by spatially connecting on the ground accomplishments to budget and economic data. The result is a visual representation of budget allocation and spending, connected geospatially to Arizona BLM Field Offices across the state.

Questions

1. How well are we planning and executing our budget?

2. How well did we plan and execute our workload?

Presentation

1: Designed this presentation to "Tell a Story" about the BLM Budget for FY 2015. Examines PMDS targets and achievements, FBMS Spent per field office, Percent of PMDS achieved by

Program Element, FBMS Spent per Sub Activity, Direct and Indirect PE costs, and BOC labor and non-labor costs.

2: Over the entire state, 98.9% of total PMDS were completed. Approximately 69,500 PMDS were not accomplished.

3: Where did we fall short? District PMDS visual demonstrates that the Gila District Office achieved 70% of its target.

4: Within the Gila District, the Tucson Field Office recorded the lowest amount of PMDS achieved. However, it's "average" percent of PMDS accomplished shows that it failed in a couple of specific areas, versus overall low achievement.

5: This slide highlights the issues faced by the Tucson Field Office

6: Total spent accomplishing PMDS = $225,32,776. The vast majority was spent at the field office level, with the district and state level spending far less.

7: Total spent per field office, with Tucson spending the greatest amount. The Lower Sonoran Field Office (and the Grand Canyon National Monument) spent the least amount of FBMS dollars.

8: Percent of PMDS accomplished per field office for 4 specific PE codes – BH, FH, EE, JA. This data includes the National Monuments and Wilderness areas within the Field Office boundaries, which does affect the results.

9. For example, PE (EE) was underwhelming. The Red zones, under 90%, range from 0 (Tucson Field Office) to 43% (Hassayampa).

10. Next is FBMS Spent per Field Office on various Budget Activities.

11 – 13: Self-Explanatory. The Null values are areas that did not record any records for that sub activity.

14: Introduces new maps. This is Direct and Indirect PEs using only the fixed costs.

15: Indirect fixed costs per cost center. District and state office are together, next to the field office visual. Light blue – dark blue – purple – black

16. Same information as previous, but now displayed as a percent.

17 – 18: Same as above but using direct fixed costs instead of indirect.

19: BOC labor costs per cost center.

20: BOC non-labor costs per cost center.

Issues

1. Still want to make sure Field/State/District information is being displayed adequately.

2. Complete more common sense checks (percent adding to 100, etc.)

3. Need to organize spatial and budget data.

4. Will begin comprehensive documentation to include maps, tables, data dictionary, processes.

August 4th, 2016 Meeting Notes

Questions for Monica

1) *General* – Total budget = $76,688,745

Confirmed in Master.xlsx and BLM Budget Points shapefile

2) *Slide 4* – Are these acronyms correct? PMDS, FBMS, PE, BOC

3) *Slide 6* – Checking numbers on PMDS Achieved.

State Office: 428,505/410,903 = 104%

Colorado River District Office – 4,998/5,243 = 95%

Tucson Field Office – 126,429/263311 = 48%

(Confirmed in ArcMap and 2015PMDS.xlsx using G02 + G03)

4) *Slide 8* – FMBS and PMDS % by Program Element (BH)

Safford Field Office FBMS = Null?

(Confirmed in Master.xlsx. No entry for BH in the Safford Field Office G01 + G11)

Hassayampa Field Office PMDS = <90?

Average Actual 59 /Average Target 75 = 79%

Is average misleading when there is only 1 entry per field office??

5) *Slide 11* – FBMS and PMDS % by Program Element (JA)

Kingman Field Office FBMS = $-1,229? (Confirmed in Master.xlsx)

6) *Slide 15* – FBMS Spent 1220 Recreation Management

Grand Canyon National Monument = $0? (Confirmed with Master.xlsx?)

7) *Slide 16* – FBMS Spent 1711 National Monument and Conservation areas

Null values vs. $0. Is this because they don't have national monuments, vs didn't spend anything on them?

No, Lake Havasu has Cactus Plain Wilderness Area. Confirmed no entries in Master.xlsx.

8) *Slide 17* – Direct and Indirect Spending per Field Office

Yuma Indirect (Co2 PE codes non P, X, Y = $467.551 (confirmed with Master.xlsx)

9) *Slide 18* - BOC Labor and Non-labor

Yuma Labor (Co2 BOC 11, 12) = $1582,903 (confirmed with Master.xlsx).

October 13th, 2016 Meeting Notes

Project Update

1 – Introduction: Hello!

2 – Objective: To aid the Bureau of Land Management (BLM) in obtaining operational excellence and achieving their strategic goals by spatially connecting on the ground accomplishments to budget and economic data. The result is a visual representation of budget allocations and spending, connected geospatially to Arizona BLM Field Offices across the state.

3 – Questions and Outcome

4 – Data

5 – Part 1: How well are we planning and executing our workload? This is how I've tackled this issue, and what's coming up next in the presentation.

6 – Percent of PMDS Achieved: **Total State Budget = 76,688,745.**

At the District Office Level:
Colorado River District Office: 95%
Arizona Strip District Office: 100%
Phoenix District Office: 151%
Gila District Office: 326%
At the Field Office Level:
Concerns about Tucson and Lake Havasu.

7 – Breakdown of Field Office PMDS % Achieved, including State Office.

8 – What's going on with Tucson? A brief look into what's causing Tucson's 49% of PMDS achieved. It mostly comes down to Evaluating Recreation areas within National Monuments and Conservation centers.

9 – BH: Inventory abandoned mine lands. Right: What percent of BH PMDS each field office achieved. Left: Total obligations spent achieving the percent. This data comes from two different charts, one specific to PMDS_2015, and the other is the Master Budget List. This is why we see Safford Office achieving a percent of their PMDS, but coming up *null* in their total obligations.

Hassayampa: Achieved 79% of the target (57/75). Spent $75,665 in this endeavor.

10 – FH: 1 entry for the Kingman Field Office for BH in the Master table. They spent $431 on repairs/maintenance.

11 – EE : A known struggle?

12- JA: This one is strange. There are two field offices with NEGATIVE obligations. It is, per Monica, a "reverse labor accrual", and is due to payroll.

13 – Part 2: How ell are we planning and executing our budget?

14 – FBMS spent on 1020 Rangeland Management. Includes State Office.

15 – 17: Same

18 – Direct and Indirect Spending Per Field Office (including State Office).

19 – Labor and Ops spending per Field Office (including State Office)

Codes

- PMDS achieved per specific program element
    - BH – Inventory abandoned mine lands (sites)
    - FH – Process and manage special recreation permits (permits)
    - EE – Issue grazing permits/leases (permits)
    - JA – Apply shrub/grass vegetation (acres)

- FBMS spending per field office by sub-activity
    - 1020 – Rangeland Management
    - 1210 – Wilderness Management
    - 1220 – Recreation Management
    - 1711 – National Monument and Conservation Areas