Landscape Trails Database in Arizona BLM

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Trails Inventory with GPS – How and Why!

- BLM has utilized GPS units to inventory transportation systems (including trails) over the past 15 years
- Some believe that this is a time-consuming and potentially costly exercise with limited returns.
- Jefferson County, CO has demonstrated efficient use of trails mapping utilizing Global Positioning System (GPS).

Trails Inventory with GPS – How and Why!

- AZ BLM has used GPS/GIS to develop a statewide trails/transportation dataset
- Will be combined with other BLM States that will become part the agency's national transportation dataset.
- Our challenge: data compilation process, as the agency developed a database that covers a large (12 million acre) landscape.

Trails/Travel Management

- Arizona BLM has been conducting trails (transportation) inventory across the state for over 15 years and has nearly completed Global Positioning System work for over 42,000 miles.

Today's Focus: Trails

- AZ BLM – in partnership with Advanced Resource Solutions --has compiled GIS data across the entire state for the trails, roads, and primitive roads.
- This presentation covers geodatabase design that integrates AZ BLM's trails/transportation data dictionary as well as incorporating attributes from BLM's newly emerging national transportation standard (or "GTLF").

Trails Continued

- BLM has used GPS/GIS to develop a statewide trails/ transportation dataset.

Trails Continued

- We will cover the compilation process, including lessons learned, as the agency developed a database that covers large landscapes.

Geodatabase Objectives

- To present a large-scale trails/transportation database in Arizona BLM
- To present the functionality (i.e. usability) of such a database for the trail manager and the public
- To demonstrate how problems were resolved in developing a database of this magnitude

Benefits of Geodatabase

- Utilization of a standard data dictionary and rigorous data standards can be the basis for a useful trails/transportation data base.
- Relates to Workshop Theme: Trail Managers and Public benefit from an accessible and user friendly trails database.

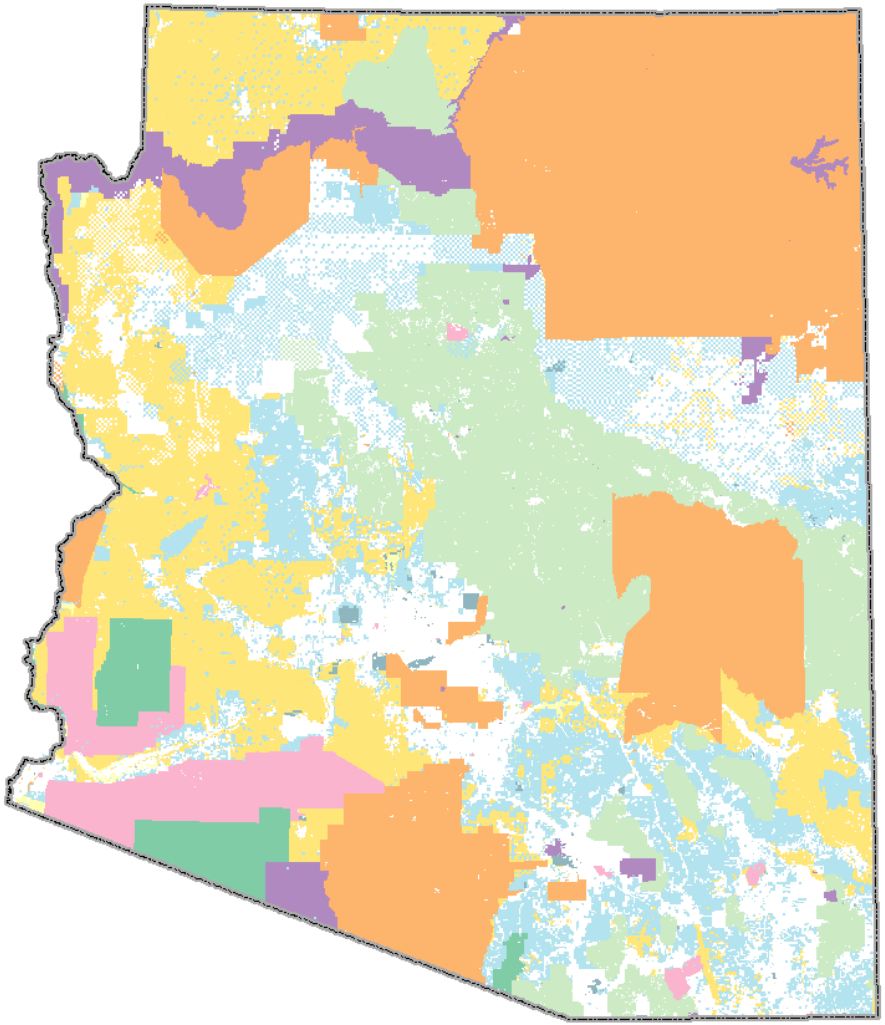
Trails Data Collection

- Utilizes standard Data Dictionary
- Standard data collection protocol
- (available on request, email Bill_Gibson@blm.gov)

BLM Arizona Ground Transportation Linear Features (GTLF)

- Motorized & Non-motorized transportation-related GIS data for Arizona BLM
- Statewide routes dataset contains a combination of GPS'd and digitized routes totaling over 42,000 miles
- Route Inventory Points dataset contain over 64,000 points
- Sign Points dataset contains over 5,000 points

Arizona BLM Statewide Transportation Dataset
(Roads and Trails)



Arizona BLM Statewide Transportation Dataset
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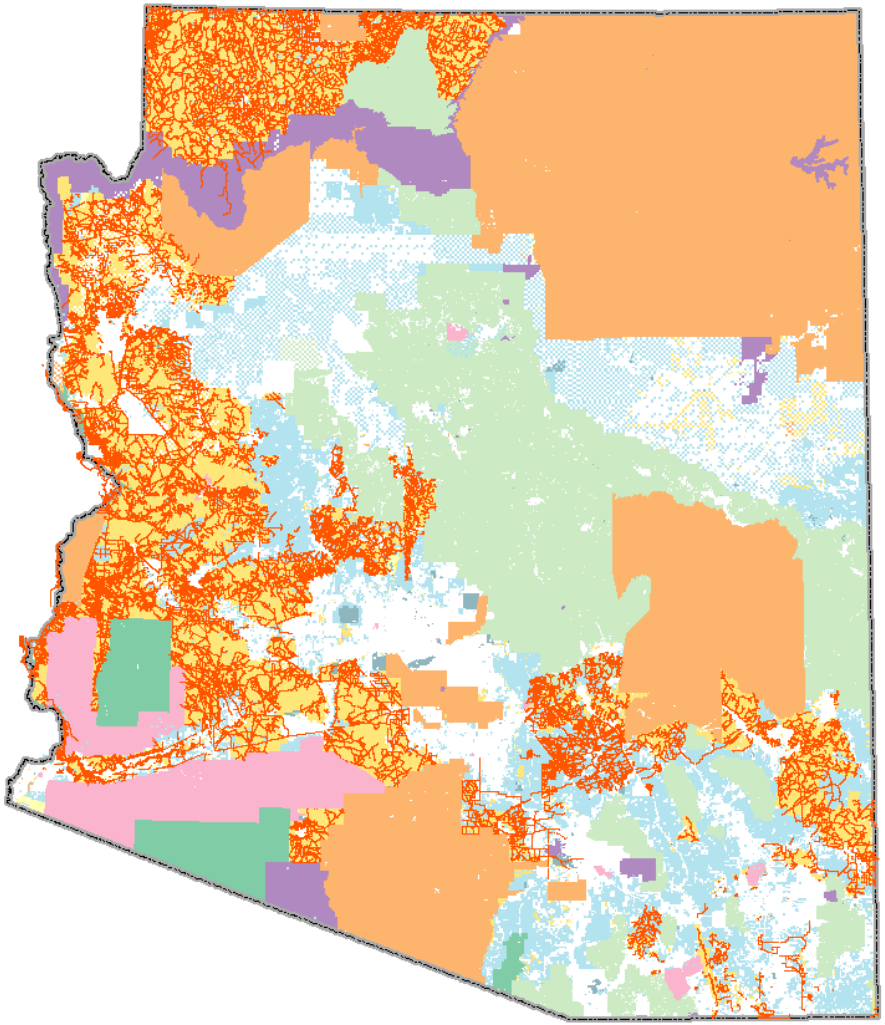
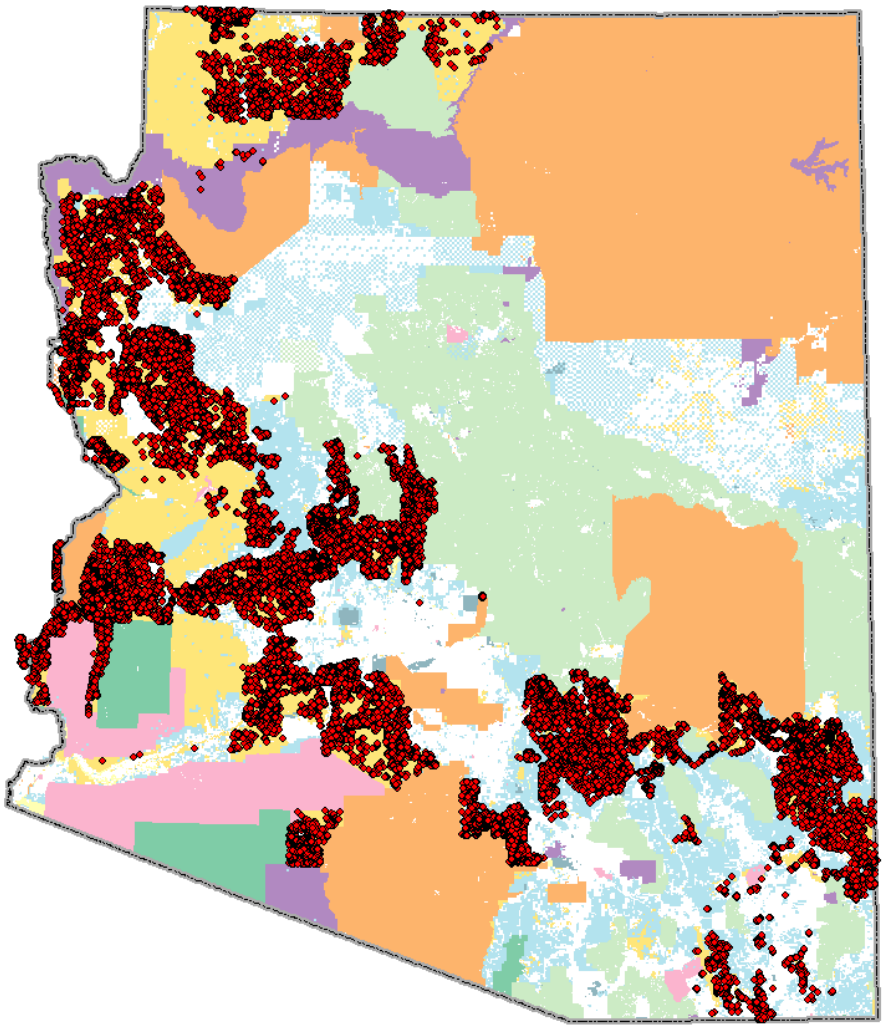
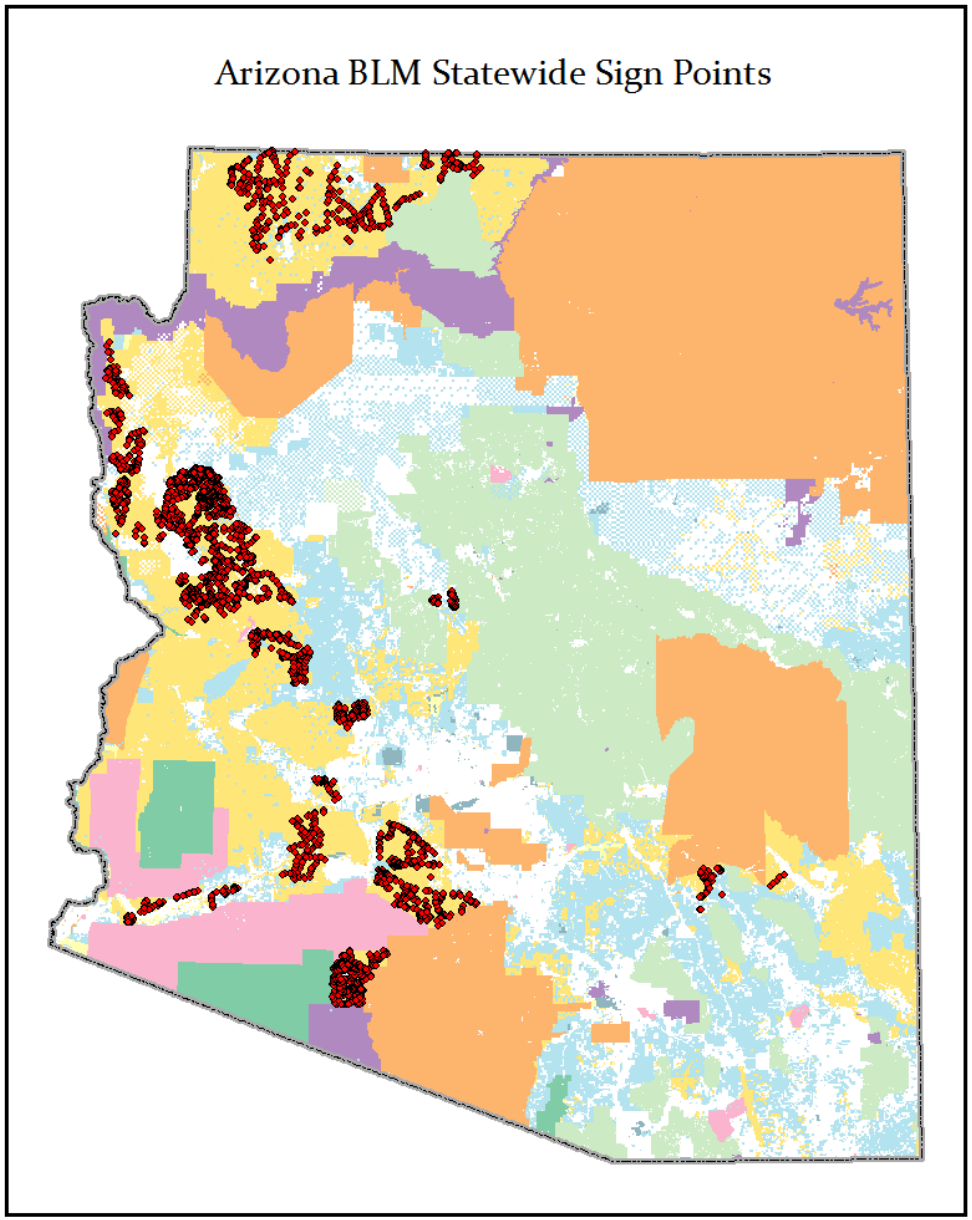


Arizona BLM Statewide Route Inventory Points




Arizona BLM Statewide Sign Points

Geodatabases

- 9 File Geodatabases (GDB) completed in total
- 1 GDB to meet National Ground Transportation Linear Feature (GTLF) Data Standard
  - National GTLF GDB: 19 attribute fields, 9 Domains

7 GDBs	GDB Miles
Arizona Strip DO	8,623
Phoenix DO	7,222
Safford FO	3,083
Tucson FO	5,116
Kingman FO	6,998
Lake Havasu FO	5,258
Yuma FO	5,885

Geodatabases

- 1 GDB for AZ BLM State Office GTLF:
  - Compilation of all AZ BLM Field Office transportation datasets; 89 attribute fields, 53 Domains
  - Includes:
    - Arizona Route Inventory Data Dictionary (22 attribute fields)
    - AZ BLM Data Standards (14 attribute fields)
    - GTLF Data Standards (15 attribute fields)
    - FTDS (Federal Trails Data Standards, (38 attribute fields)

Roads and Trails Dataset Attribute Fields

AZSO BLM Database Schema for Transportation Feature Classes						
FIELD NAME	ALIAS NAME	TYPE	LENGTH	DOMAIN		22 attributes from AZ Route Inventory Data Dictionary
Route_Type	Route Type	Text	20	Yes		14 attributes from AZ BLM Data Standard
Width	Width	Float	4	Yes		15 GTLF Attribute Fields
Wash	Wash	Text	20	Yes		38 FTDS Attribute Fields
Surface_Pr	Surface Primary	Text	20	Yes		89 Total
Surface_Se	Surface Secondary	Text	20	Yes		
Obs_Use1	Observed Use 1	Text	20	Yes		
Obs_Use2	Observed Use 2	Text	20	Yes		
Obs_Use3	Observed Use 3	Text	20	Yes		
Use_Level	Use Level	Text	20	Yes		
Road_No_	Road Number	Text	10	No		
Road_Name	Road Name	Text	30	No		
Road_Num2	Road Number 2	Text	10	No		GTLF = 19 attribute fields
Road_Name2	Road Name 2	Text	40	No		AZ Statewide = 89 attribute fields
Recorder	Recorder	Text	4	No		FO = Range 89 - 111 attribute fields
Comment	Comment	Text	52	No		
Maintenanc	Maintenance	Text	20	Yes		
Max_PDOP	*Max PDOP*	Float	4	No		
Corr_Type	*Correction Type*	Text	36	No		
Rcvr_Type	*Receiver Type*	Text	36	No		
GPS_Date	*GPS Date*	Date	8	No		
GPS_Time	*GPS Time*	Text	10	No		
Feature_Name	*Feature Name*	Text	20	No		
Datafile	*Datafile*	Text	20	No		
Data_Dicti	*Data Dictionary Name*	Text	20	No		

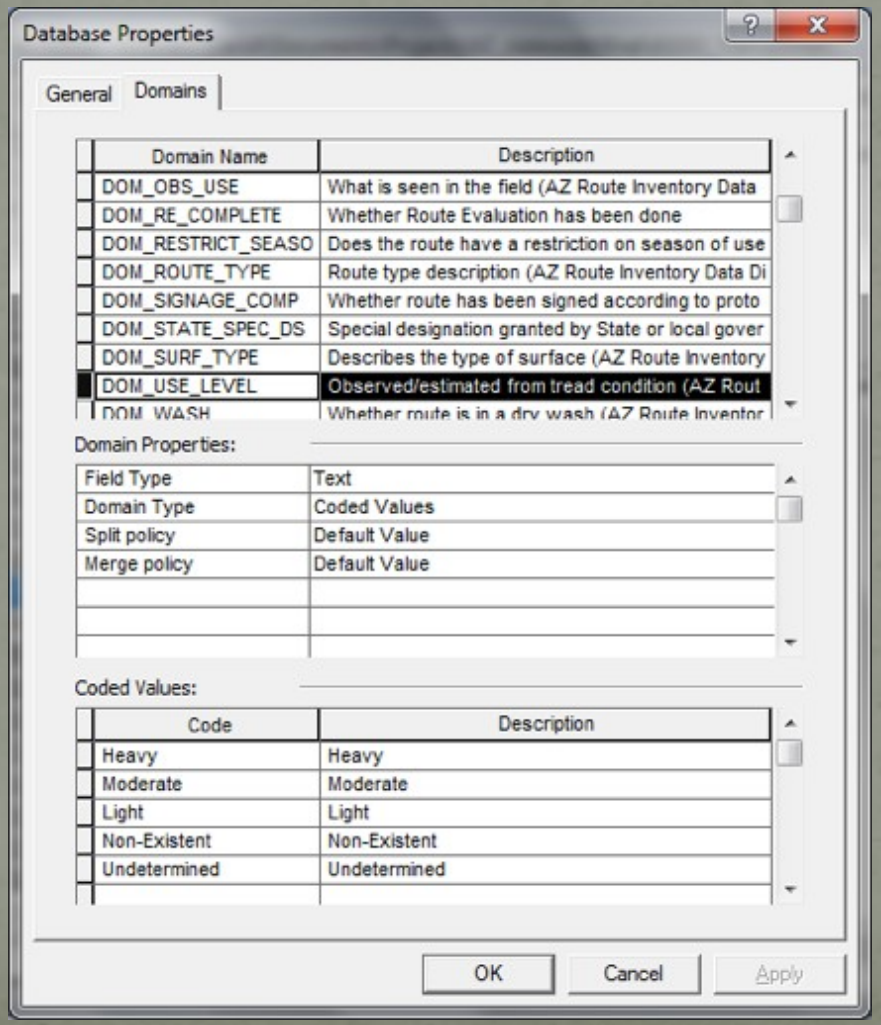
Roads and Trails Dataset Attribute Fields cont.

FIELD NAME	ALIAS NAME	TYPE	LENGTH	DOMAIN
Data_Source_Name	Data Source Name	Text	40	No
COORD_SOURCE_TYP	Coordinate Source Type Code	Text	5	Yes
Rte_Eval_Number	Route Evaluation Number	Text	10	No
RE_Done	Route Evaluation Done	Text	3	No
ACCESS_AUTHORITY	Route Access Authority	Text	40	Yes
RESTRICT_MODE_OF_	Restriction on Mode of Travel	Text	40	Yes
RESTRCT_SEASON	Restriction on Season of Use	Text	10	Yes
MAINTENANCE_INTEN	Maintenance Intensity	Text	1	Yes
IMPLEMENTATION_PL	Implementation Plan	Text	50	No
Signage_Complete	Signage Complete	Text	3	Yes
STATE_SPEC_DSGTN	State Special Trail Designation	Text	4	Yes
TMA_Name	TMA Name	Text	50	No
DISTRICT_OFFICE	District Office Name	Text	20	Yes
MANAGEMENT_UNIT	Management Unit Name	Text	20	Yes
Miles	Miles	Double	8	No
GTLF_ID	GTLF Identifier	Long Integer	4	No
GTLF_PLAN_CAT	GTLF Planning Category	Text	20	Yes
GTLF_FAMSLINK	GTLF FAMS Equipment (Asset) Number	Text	10	No
GTLF_OWN	GTLF Ownership	Text	20	Yes
GTLF_SURFACE	GTLF Surface Material	Text	20	Yes
GTLF_CARTO	GTLF Cartographic Display	Text	3	Yes
GTLF_NOSHOW_RSN	GTLF No Show Reason	Text	20	Yes
GTLF_USE_RESTRICT	GTLF Use Restriction	Text	20	Yes
GTLF_FUN_CLASS	GTLF Functional Classification	Text	10	Yes
GTLF_SPEC_DSGTN	GTLF Special Designation	Text	4	Yes
GTLF_ESMTROW	GTLF Easement or Right of Way Flag	Text	3	Yes
GTLF_USE_CLASS	GTLF Driveability Classification	Text	20	Yes

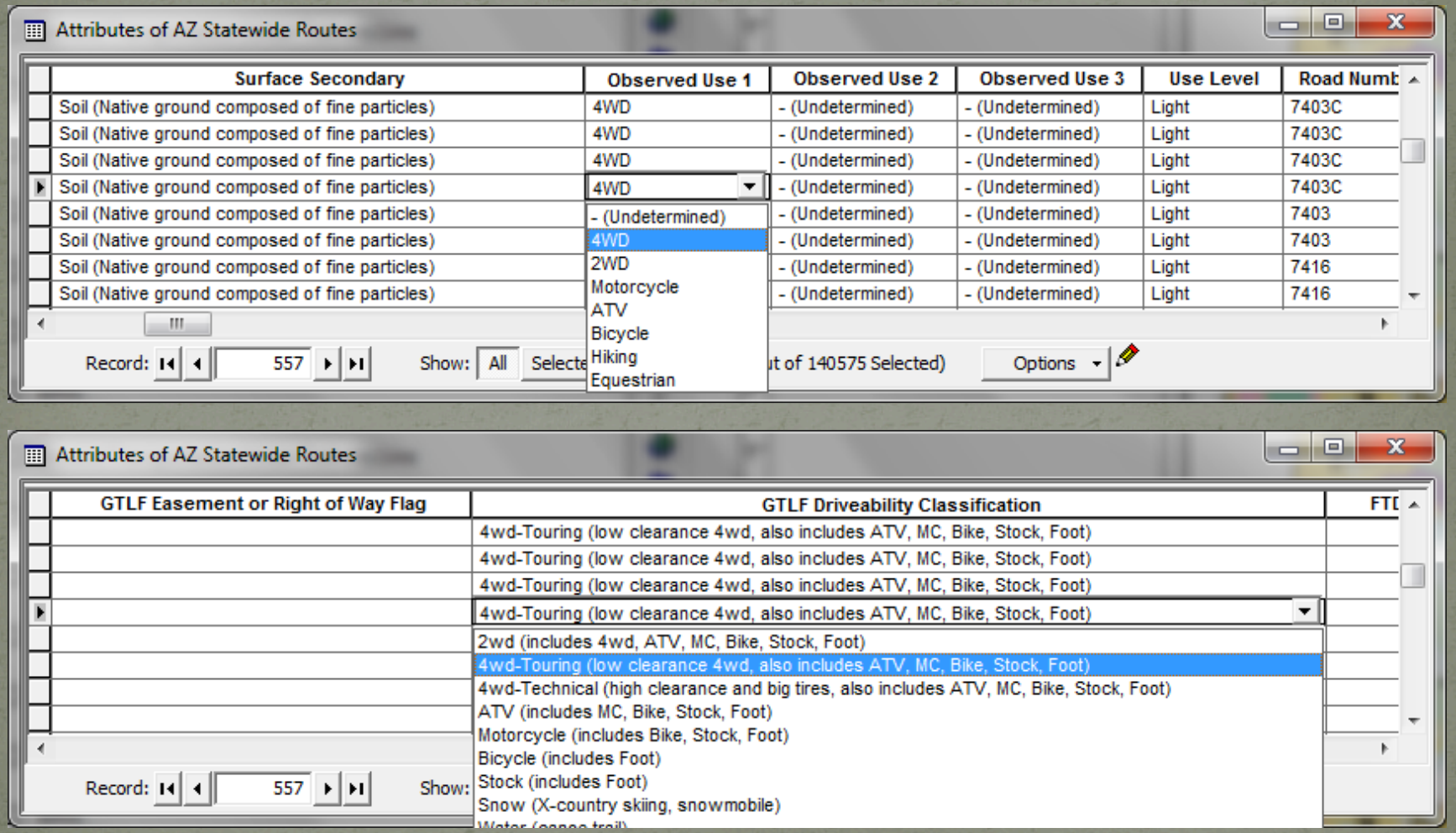
22 attributes from AZ Route Inventory Data Dictionary
14 attributes from AZ BLM Data Standard
15 GTLF Attribute Fields
38 FTDS Attribute Fields
89 Total

FIELD NAME	ALIAS NAME	TYPE	LENGTH	DOMAIN		
ACCESS_STA	FTDS Accessibility Status	Text	40	Yes		22 attributes from AZ Route Inventory Data Dictionary
CONG_DIST	FTDS Congressional District	Text	4	No		14 attributes from AZ BLM Data Standard
COST_AM	FTDS Cost Annual/Cyclic Maintenance	Long Integer	10	No		15 GTLF Attribute Fields
COST_OPS	FTDS Cost Annual/Cyclic Operations	Long Integer	10	No		38 FTDS Attribute Fields
COST_DM	FTDS Deferred Maintenance	Long Integer	10	No		89 Total
COST_FY	FTDS Cost Last Updated	Text	4	No		
COST_IMP	FTDS Cost Improvement/Construction	Long Integer	10	No		
DESIGN_USE	FTDS Designed Use	Text	40	Yes		
INTERAG_ID	FTDS Interagency Code	Text	40	No		
LAND_PLAN	FTDS Land Use Plan	Text	40	Yes		
MANAGD_USE	FTDS Managed Use	Text	40	Yes		
MTR_PROHIB	FTDS Motorized Prohibited	Text	3	Yes		
NAT_TR_DES	FTDS National Trail Designation	Text	80	Yes		
NHTNST_ADM	FTDS NHT NST Trail Administrator	Text	60	Yes		
NHTATRSURF	FTDS NHT Auto-Tour Surface	Text	40	Yes		
NHT_CERT	FTDS NHT Certification Status	Text	40	Yes		
NHT_COND	FTDS NHT Condition Category	Text	10	Yes		
NHT_PU_SEG	FTDS NHT Public Use Segment	Text	40	Yes		
NHT_PU_SIT	FTDS NHT Public Use Site	Text	40	Yes		
NHT_SIT_NM	FTDS NHT Site Name	Text	60	No		
NHT_SIT_NR	FTDS NHT Site Number	Text	40	No		
VISCTR_NAM	FTDS NHT NST Visitor Center Name	Text	100	No		
PR_TR_MNTR	FTDS Primary Trail Maintainer	Text	40	No		
PROHIB_USE	FTDS Prohibited Use	Text	40	Yes		
ROW	FTDS Rights-of-Way	Text	40	Yes		
ROAD_SYS	FTDS Road System	Text	40	Yes		
SHARED_SYS	FTDS Shared System	Text	40	Yes		
SPC_MGT_AR	FTDS Special Management Area	Text	60	Yes		
TR_CLASS	FTDS Trail Class	Text	40	Yes		
TR_COND	FTDS Trail Condition	Text	60	Yes		
TR_NAME	FTDS Trail Name	Text	60	No		
TR_NUM	FTDS Trail Number	Text	40	No		
TR_STATUS	FTDS Trail Status	Text	40	Yes		
TR_SURFC	FTDS Trail Surface	Text	40	Yes		
TR_SYS	FTDS Trail System	Text	40	Yes		
TYPE_RTE	FTDS NHT Type of Route	Text	5	Yes		
TYPE_SITE	FTDS NHT Type of Site	Text	50	Yes		
VISFAC_TYP	FTDS Visitor Facility Type	Text	50	Yes		

Domains From Data Standards Ensure Consistency

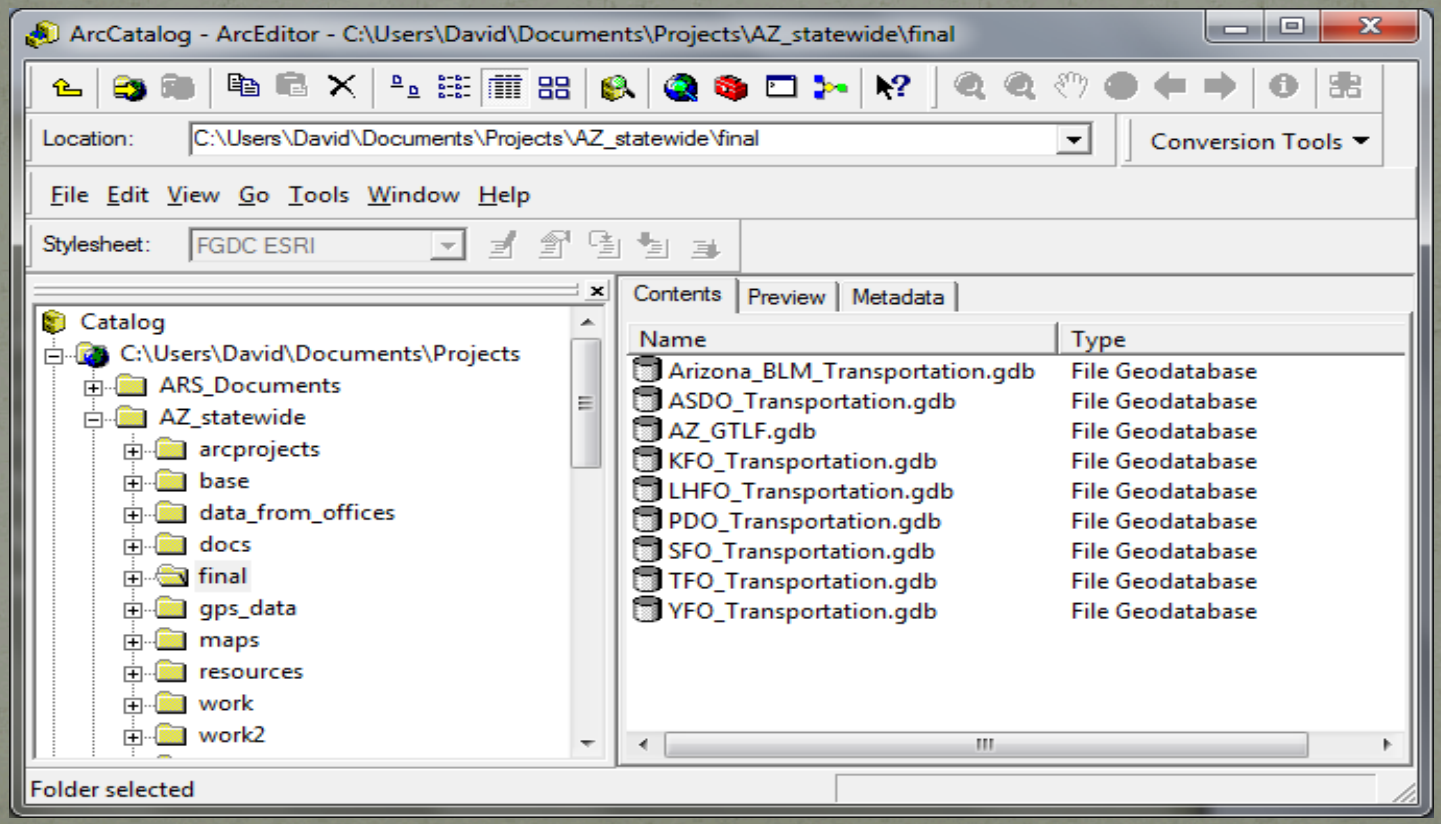


Domain Values Help Maintain Standards



Geodatabases

- 7 GDB for each AZ BLM Field Office (8) that manages own respective transportation GIS datasets

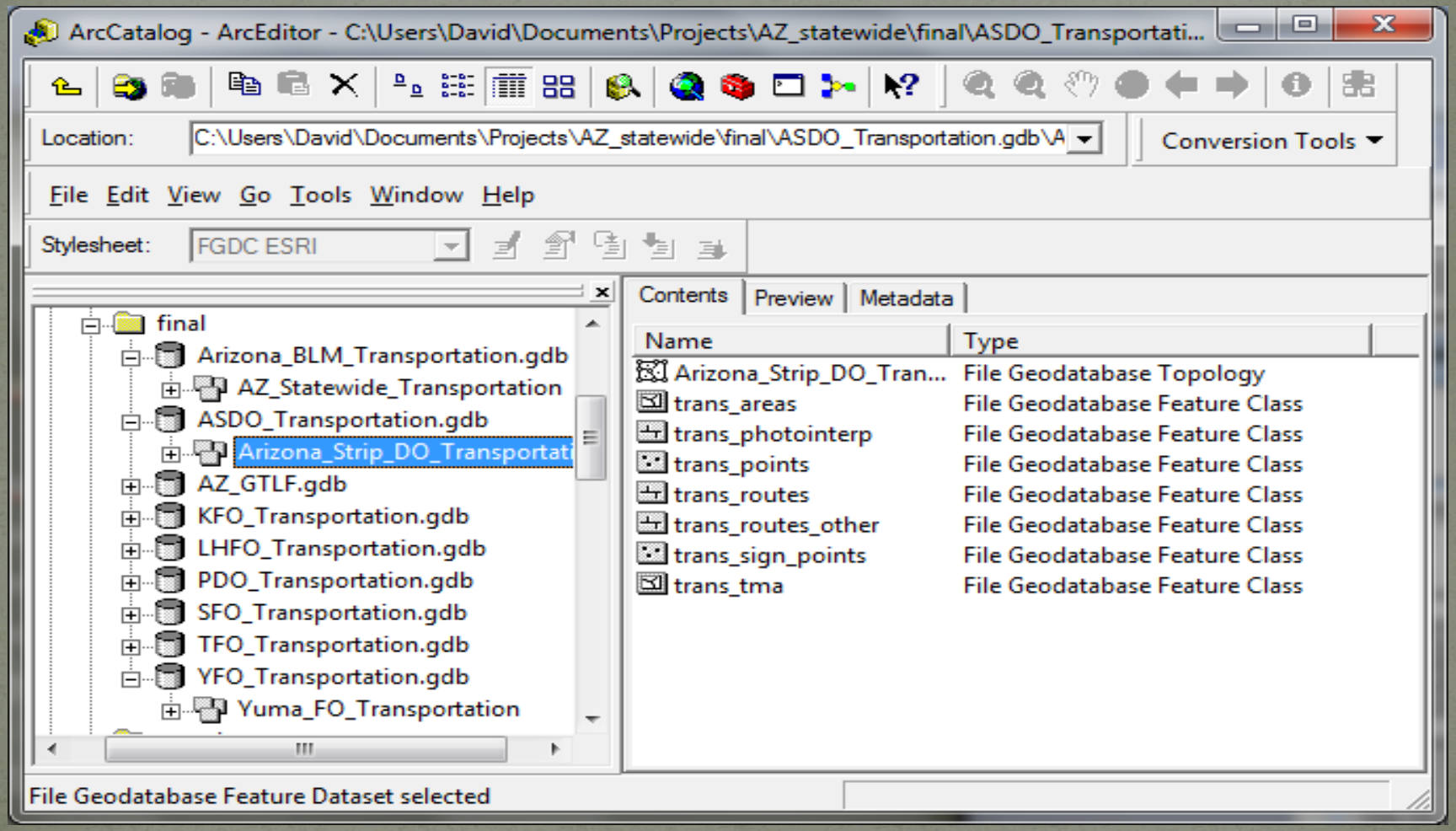


Geodatabases

Geodatabases (GDB) contain feature classes of:

- Routes (Roads , Primitive Roads & **Trails**)
- Photointerpretation
- Route Inventory Points
- Route Inventory Areas
- Sign Points
- Topology (except statewide compilation)
- Routes from Other Jurisdiction (some GDBs)
- TMAs (Travel Management Areas)
- **60 Feature Classes (datasets) created in total**

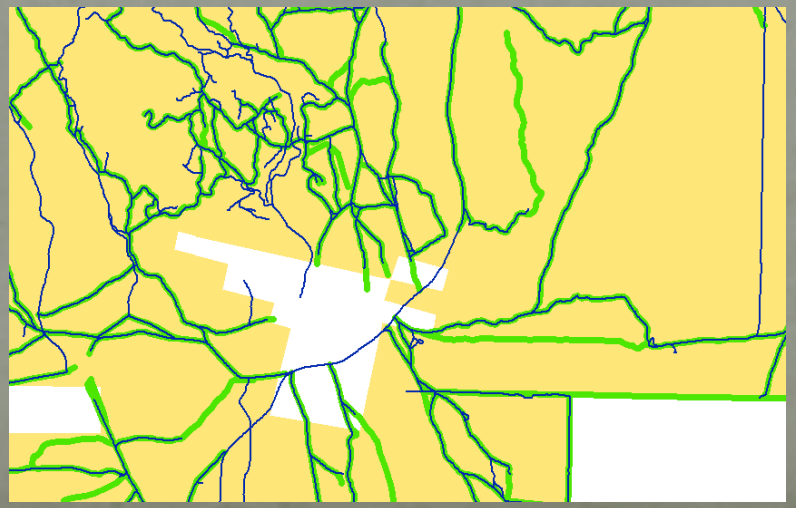
Example of GIS Feature Classes in each Geodatabase



Process for Compilation

Analyzed data received from all 8 BLM Field Offices (FO)

- Received over 350 datasets from GPS inventories and existing corporate GIS data layers
- Analyzed overlapping spatial data at edges of FO boundaries and multiple datasets within each FO. Removed duplicate arcs (lines) and points.



Process for Compilation (cont.)

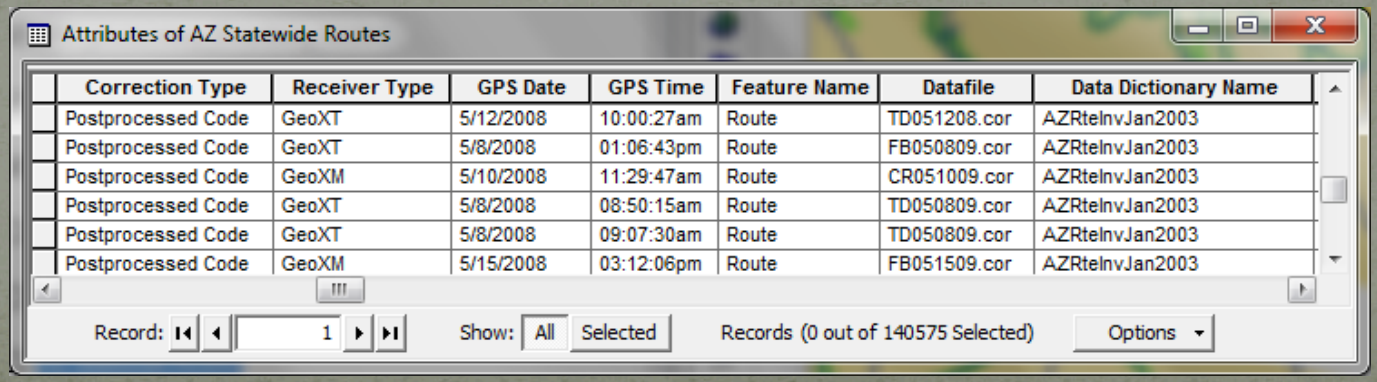
- Analyzed attributes from other data standards and older data dictionary versions
  - GTLF (BLM National Ground Transportation Standards)

SPEC_DSGTN	Special Designation granted by Congress or a State (except for Auto Tour Route which is more informal). The official name for the designation is placed in GTLF_NM2.	String	No	**GTLF_DOM_SPEC_DSGTN** AAR (All-American Road) NSB (National Scenic Byway BCB (BLM Back Country Byway) FSB (National Forest Scenic Byway) SSB (State Scenic Byway) STR (State Tour Route) ATR (Auto Tour Route) NST (National Scenic Trail) NHT (National Historic Trail) NRT (National Recreation Trail) UNK NONE

  - FTDS (Federal Trails Data Standard)
  - Arizona BLM Transportation Data Standards
    - Route Inventory Data Dictionary in place since 1997
    - Data Standards associated with Route Evaluation efforts

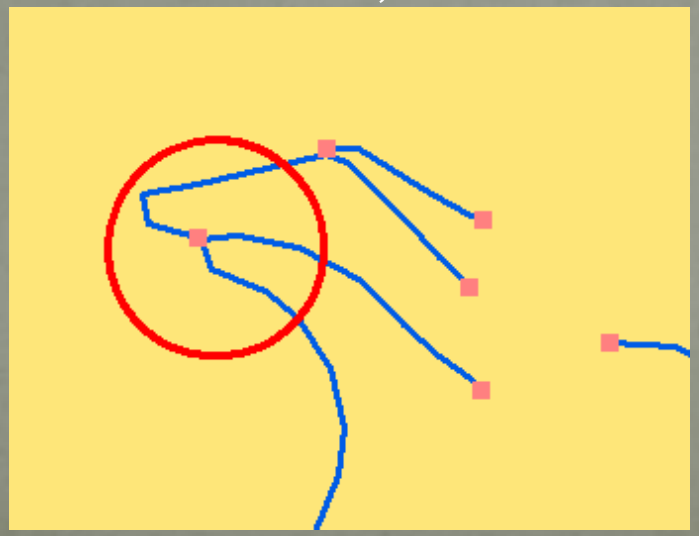
Process for Compilation (cont.)

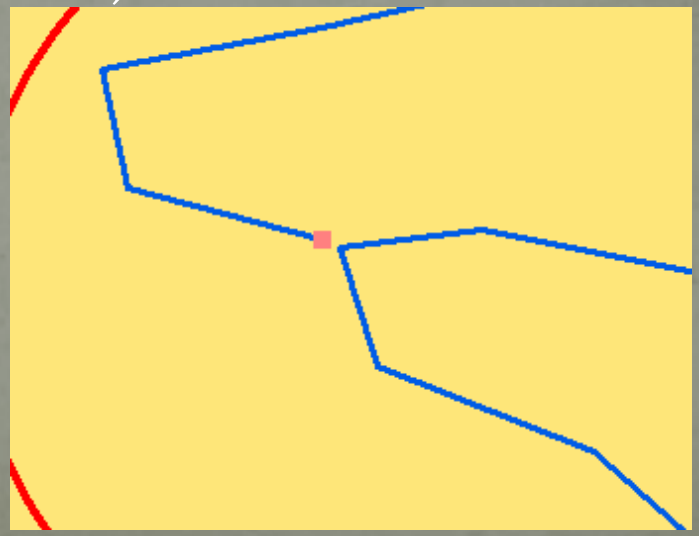
- Verified spatial data projection of all datasets and re-projected points, lines and areas from NAD27 to NAD83 per standard (over 300 datasets – routes, points, areas)
- Determined standard export items for GPS data from Trimble PF Office export (Max_PDOP, Receiver_Type, GPS_Date, etc)



GIS Processes

- Verified GIS/GPS route data and loaded into geodatabase
- Verified point and area GPS data and loaded into geodatabase
- Cleaned linear topology errors (undershoots, overshoots, self-intersects, etc)



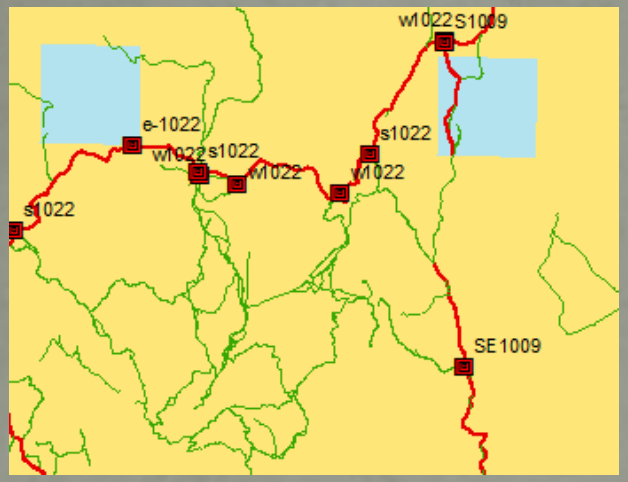


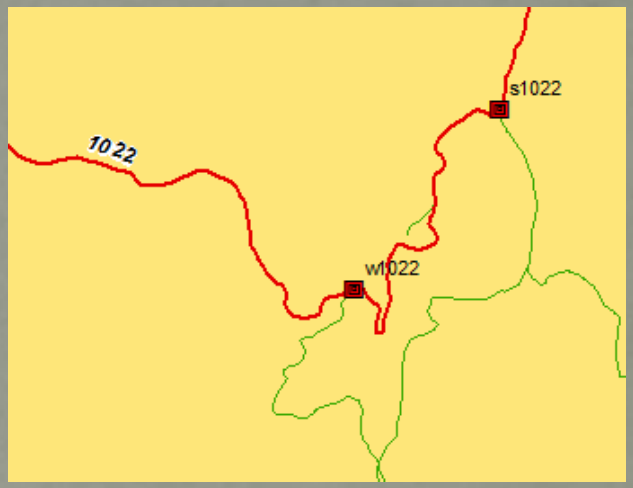
GIS Processes

- Eliminate “knots” from GPS inventory process

Updating Routes Attribute Table

- Update signage route numbers in route dataset from sign points dataset





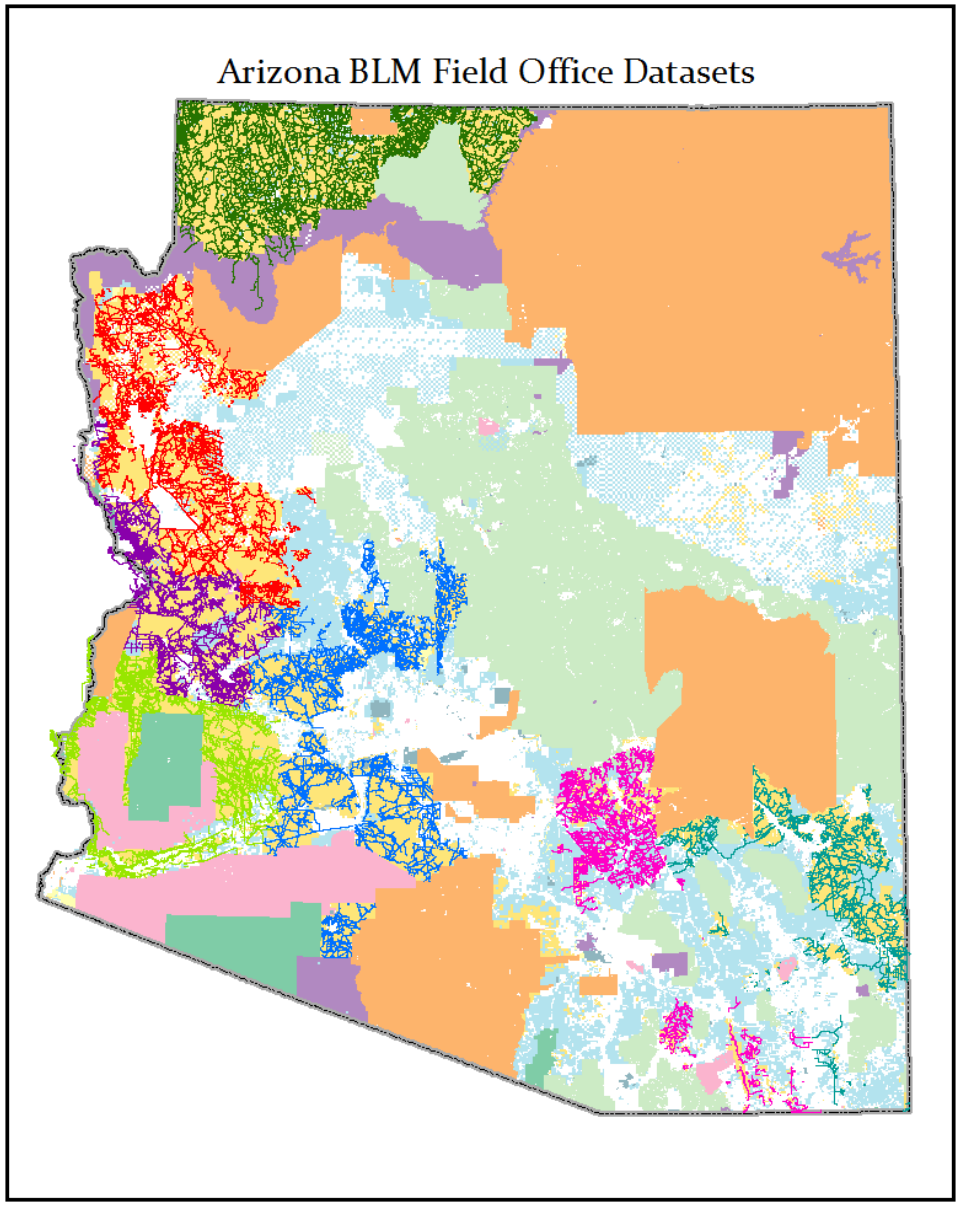
- Add in non-motorized trail info (attribute arcs if already exist or add in new arcs) – both recreational and historic

Ensure Consistency

- Review all attributes across Field Offices to create standardized domain values. Crosswalked values if necessary.
- Loaded data from each Field Office Geodatabase into Statewide Datasets

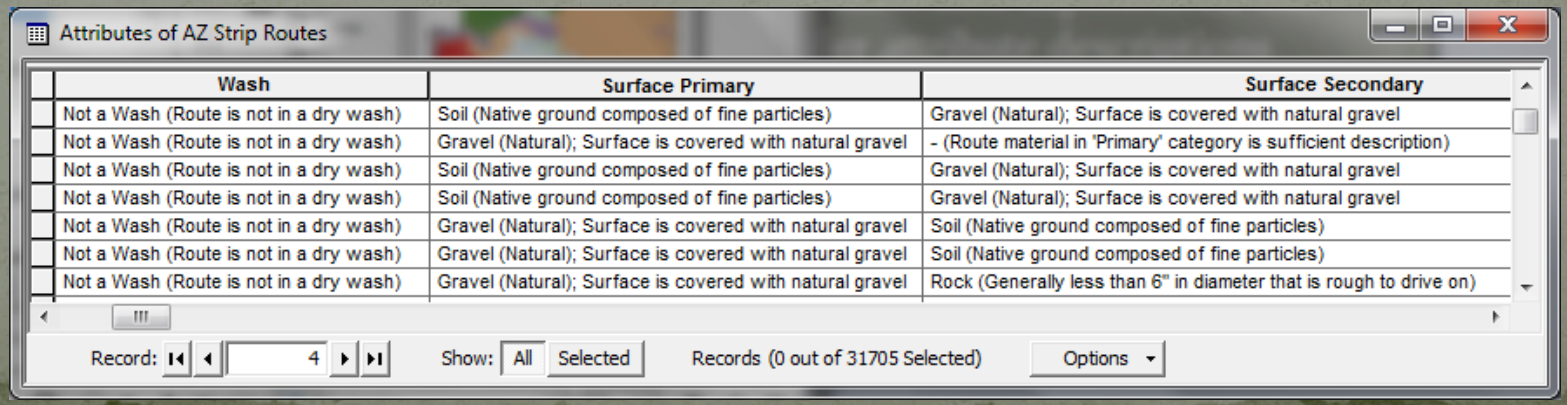
Maintenance of Datasets

- Created 60 datasets initially using domain values to help standardize updates
- For future updates of the 7 Statewide Datasets (Feature Classes) we will use the 'Erase and Replace' option for now
- AZ BLM FO GIS Specialists continue to manage individual Field Office datasets
- Provide most recent FO/DO GDBs to State Office every 6 months to allow recompile (erase/replace)


Arizona BLM Field Office Datasets

How can these datasets be used?

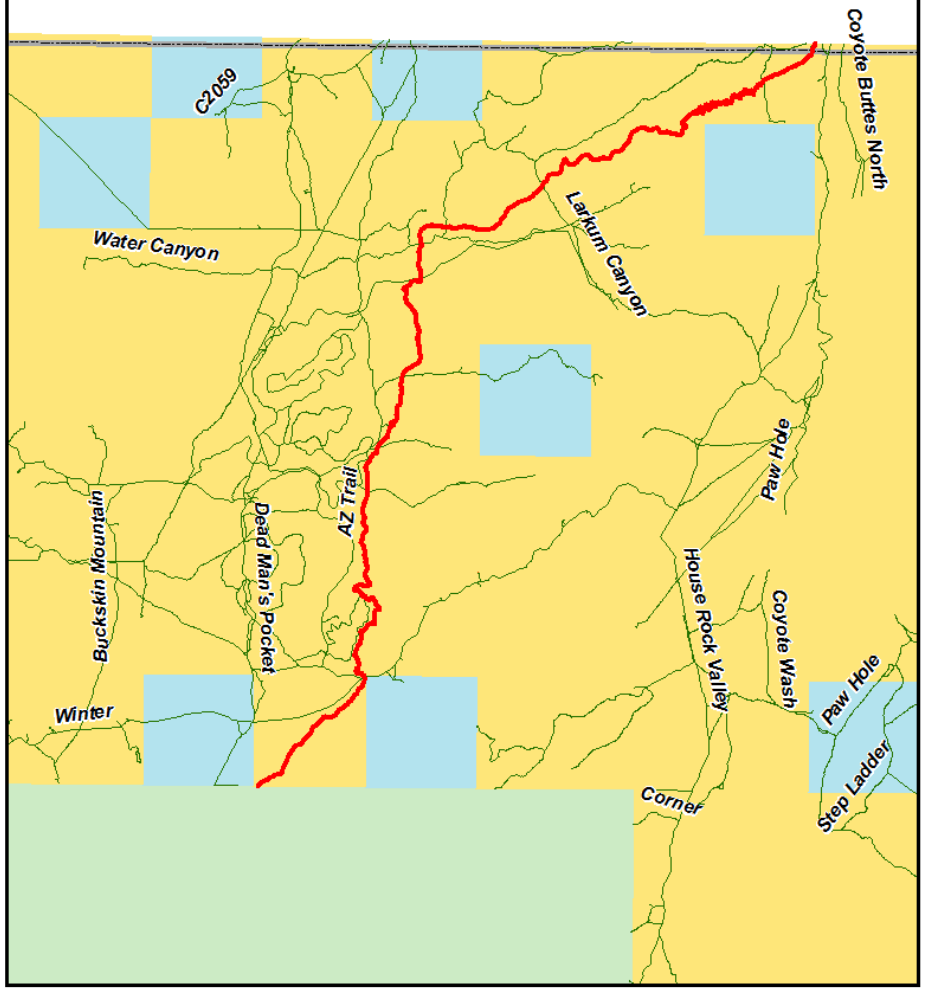
- One stop shopping to get all your transportation information
- Good source for reporting/funding requests
- Easy to make quick maps because clean data is in one place (less time in creation of map/analysis products)
- More usable for even the most non-experienced GIS user (alias names and fuller attribute descriptions allow for clearer explanations in attribute tables)



How can these datasets be used? (cont.)

- More accurate spatial alignment of trails and roads
- Accurate assessments of on-the-ground conditions for implementation work (future signage, trail repair, etc)
- Navigation/trip planning
  - Route Type that is Primary or Secondary Road Unpaved should be faster and easier for a vehicle to travel on than Tertiary
  - Route connectivity for creation of proposed future trail systems
- Regardless of personnel or policy changes it's easy for everyone to utilize accurate datasets
  - Everyone has access to the same data (not in people's heads or on their personal computers).

Arizona National Scenic Trail (Buckskin Passage)
(GPS'd with AZ Route Inventory Data Dictionary)



Lessons Learned

- Put data standards in place early and communicate it to all participants
- Throughout the entire compilation process, continually check in with Data Stewards/GIS Specialists to make sure have most recent GIS datasets (version control)

Lessons Learned

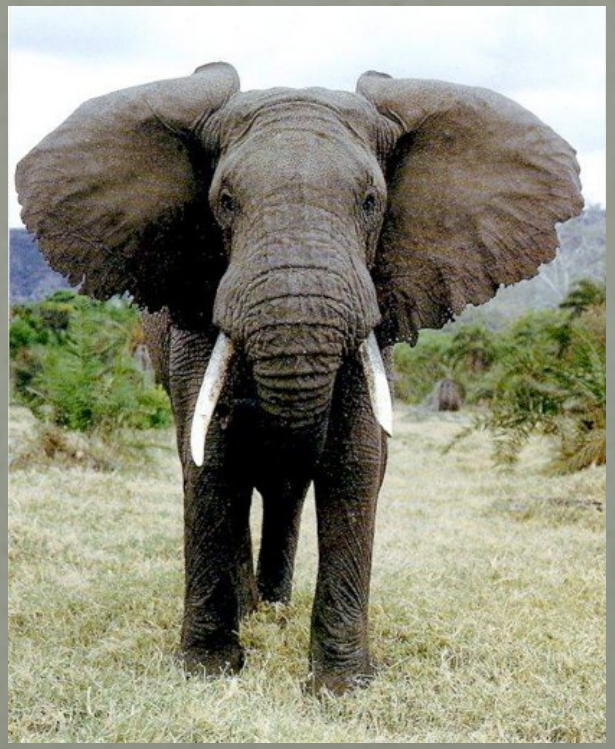
- Very Important!! Ensure that your inventory crews are well trained and understand your protocols.

Lessons Learned

- Compile GIS/GPS data into standardized datasets frequently.
  - Don't let the data remain stagnant for years (Utility)
  - Potential Staff turnover (Data Steward, GIS Specialists)
  - Focus on "complete compilation" – Don't let project languish for years

Lessons Learned

- Even if it is a large task, get started (eat an elephant one bite at a time)



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