

Ecological Response Units - Ecosystem Mapping System for the Southwest US

J. C. Moreland, W. A. Robbie, F. J. Triepke,
E. H. Muldavin, and J. R. Malusa



Objectives



- What are Ecological Response Units?
- What is the difference in existing vegetation vs ecosystem mapping?
- Discussion of the process of creating an ecosystem mapping product for resource management
- Lessons learned

Why are we doing this?

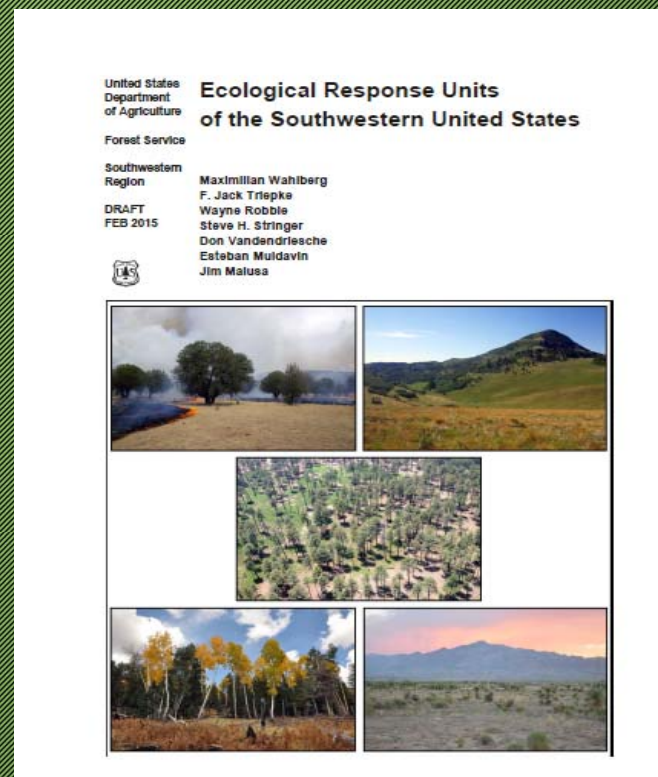


- Natural Resource Management
 - Ecological Assessment of vegetation composition, structure, and process as influenced by past and present conditions, and future trends.
 - Creating a picture of “Then vs Now” to help shape recommendations towards informing a need for change within land management decisions.
 - Facilitates vegetation patch analysis
 - Wildfire Probability Analysis
 - Foundation for implementation monitoring
- Forest, Landscape, Habitat restoration projects
- Regional All-Lands Wildfire Risk Assessment
- Useful in modeling and landscape level analyses

What are Ecological Response Units (ERUs)?



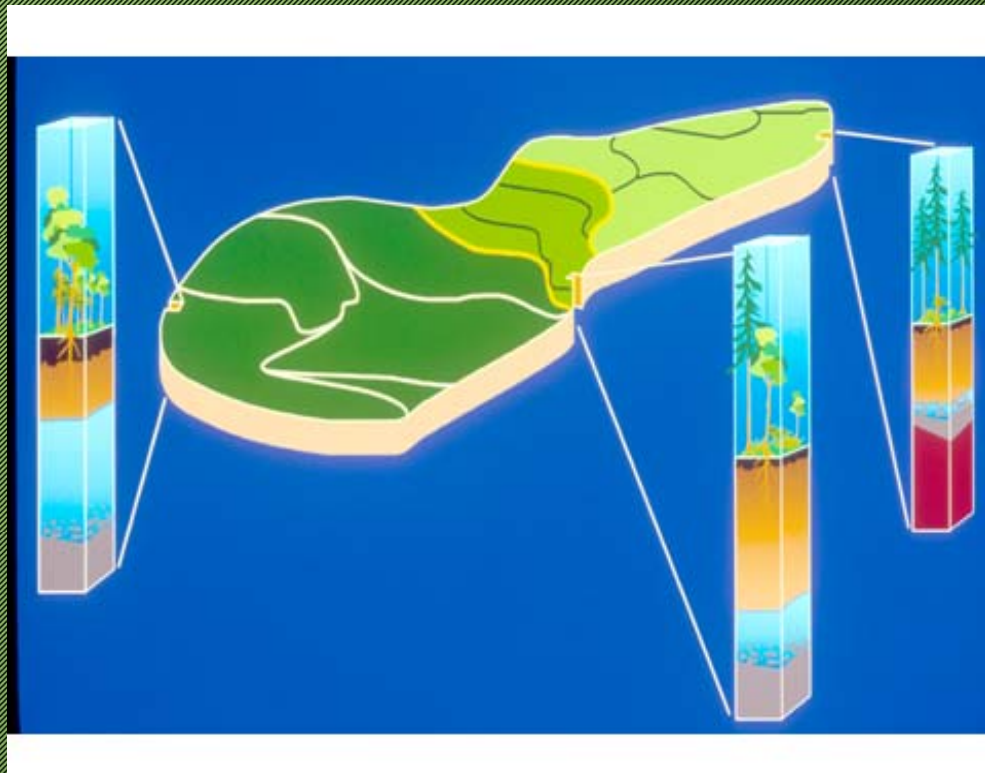
Ecological Response Units facilitate landscape analysis and planning. The framework represents all major ecosystem types of the southwest region, and represents a stratification of biophysical themes.



What are Ecological Response Units (ERUs)?



Ecological Response Units (ERUs) are map unit constructs, technical groupings of finer vegetation classes. The suite of vegetation classes that make up any given ERU share similar disturbance dynamics, plant species dominants, and theoretical succession sequence (potential vegetation).



Ecosystem Mapping vs Existing Vegetation



- ERUs are used to define Historic/Reference Conditions within a mapping unit by integrating:
 - Site potential (soil physical and chemical properties, geology, geomorphology, aspect, slope, climate variables, geographic location)
 - Fire regime (historic and contemporary)
 - Neighboring vegetation communities
 - Seral state sequence
- Existing Vegetation = What's out there now

ERU: potential natural vegetation with disturbance



= Gambel Oak Shrubland ERU

+ Fire regime II

Site Potential

+ Fire Regime I

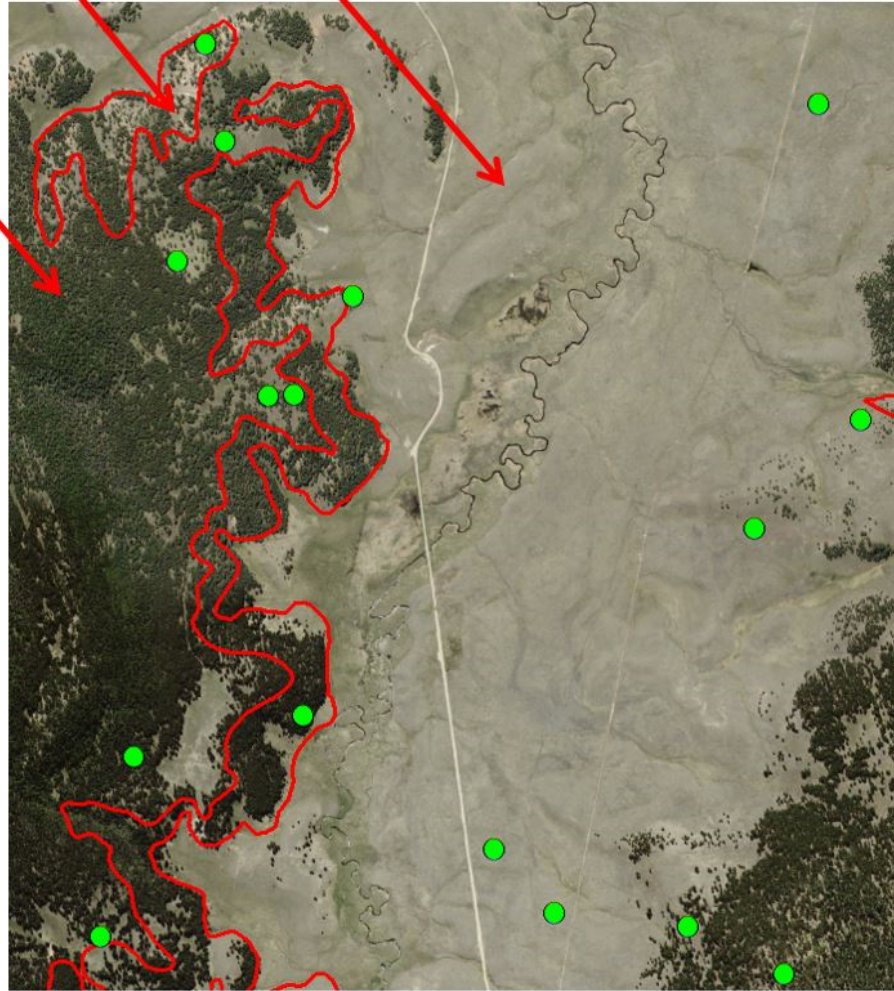


= Ponderosa Pine Forest ERU

Montane / Subalpine Grassland
Tree growth potential but historically grassland

Montane / Subalpine Grassland
Historically grassland

Ponderosa Pine Forest
Historically forested





EXISTING VEGETATION

Dominance type – Quaking aspen

Size class – Small (5-10")

Canopy cover – Open (30-60%)

ECOLOGICAL RESPONSE UNIT

Spruce-Fir Forest



A collaborative project



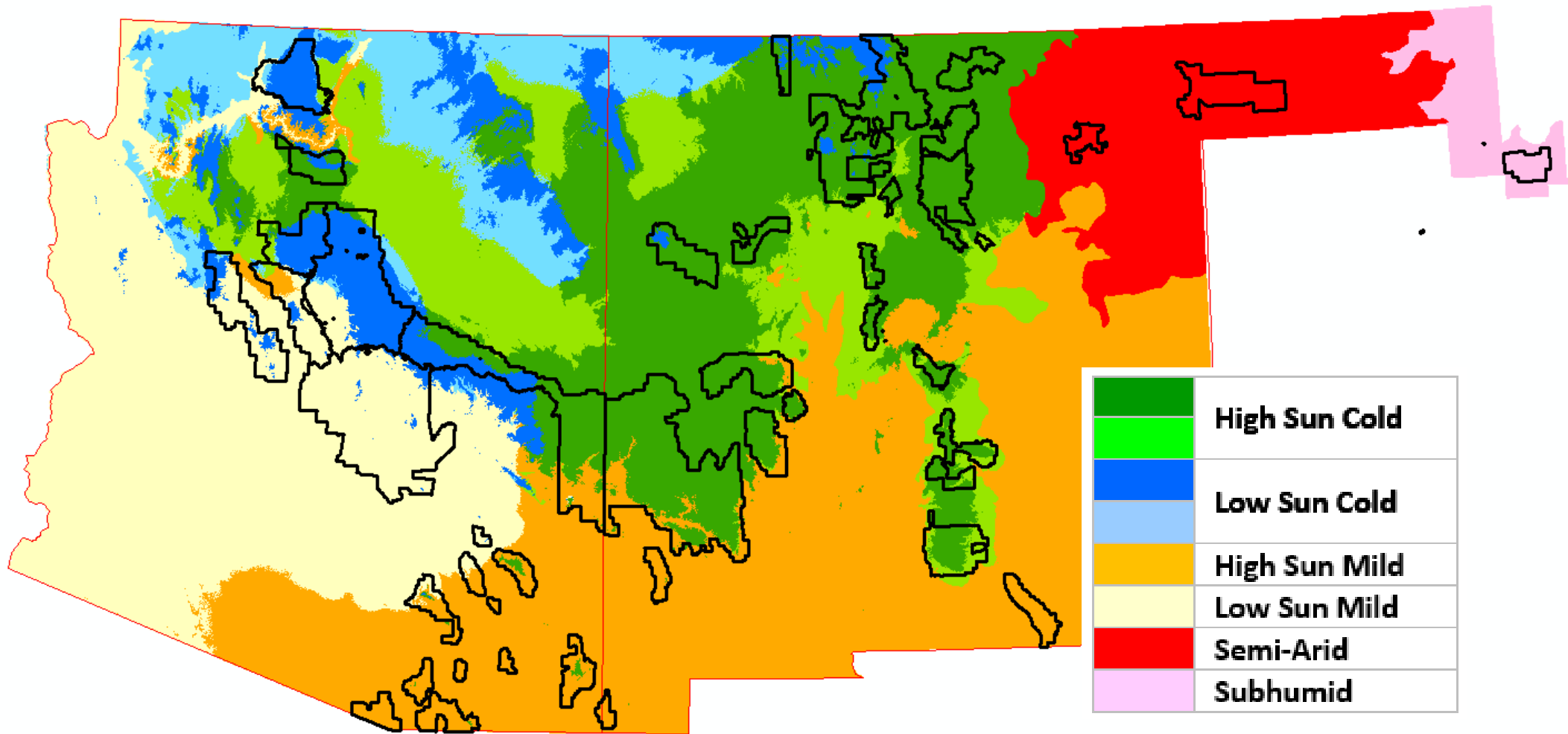
- Resource Specialists from various program areas
 - Fuels
 - Vegetation Ecology
 - Soil Science
 - Geographers
- Specialists from various administrative levels of the Forest Service
 - Ranger Districts
 - Forest Supervisor's Office
 - Regional Office
- Specialists from outside of the agency
 - Universities

Initial Project Scope



- Start with previous version ERUv4
- Add in new Terrestrial Ecological Unit Inventory (TEUI) survey data
- Add in corrected data from collaborative assessment made by University of AZ Ecologist Jim Malusa
- Identify anomalous attribution of ERU types using Climate Gradient and correct for most appropriate ERU type
- Product = ERUv5

Climate Gradients of the Southwest



Actual Data inputs



- Terrestrial Ecological Unit Inventory (TEUI)-Field survey data-National Forest System (NFS) lands
- ERUv4 Climate Gradient Corrections-All lands
- Univ. of AZ Ecologist Jim Malusa ERUv4 Review-Selected lands in SE AZ
- ERU corrections using SW Biotic Communities and climate gradient percentages-all lands
- Integrated Landscape Assessment Project (ILAP)-Remote sensing product-all lands
- Regional Riparian Mapping Project (RMAP)-Riparian corridors in AZ and NM-all lands
- ERU subclass updates from ILAP grid analysis-all lands
- Neighbor analysis corrections

The need for standards

Proposed Standard Schema for ERUv5

1/6/2016

| Field Name | Field Type | Field Length |
|-------------------|------------|--------------|
| r3ERU | Text | 100 |
| r3ERUcode | Text | 10 |
| r3ERUsubcl | Text | 100 |
| r3ERUsubclcode | Text | 10 |
| <u>Prov_SubCl</u> | Text | 100 |
| <u>SystemType</u> | Text | 25 |
| Source | Text | 25 |
| TEUI_MUs | Text | 10 |

Any specific data trait can be queried out using the above outlined standardized data schema. Additional fields could be added in the future if required. A tabular example might look like the following given this input of information:

Semi-Desert Grassland – Foothills Grassland in a high sun mild climate gradient from TEUI:

| r3ERU | r3ERUcode | r3ERUsubcl | r3ERUsubclcode | <u>Prov_SubCl</u> | <u>SystemType</u> | Source | TEUI_MUs |
|-----------------------|-----------|---------------------------------------|----------------|---------------------------|-------------------|--------|----------|
| Semi-Desert Grassland | SDG | Semi-Desert Grassland – High Sun Mild | <u>SDGhsm</u> | Foothills Grassland (FHG) | grassland | TEUI | 324 |

Cells without Value

All cells will contain values under one of three scenarios:

1. Actual value – The cell contains the known/actual value for the field, as in the example for Semi-Desert Grassland above.
2. Not applicable – The cell contains the term 'n/a' to denote a field that does not apply. For example, to date subclasses have not been identified for the PJ Sagebrush ERU and fields for subclass and provisional subclass would have the value 'n/a'.
3. Missing data – When the cell should contain a value for a given field, but the information is not known, the cell value is 'missing data'. For the field "r3ERUsubclcode" the value will be 'missing d*' due to field length restrictions.

Data crosswalks

| Master_ERU_TEUI_xwalk_Std_Schema | | | | | | | | | | | | |
|----------------------------------|--|-----------|---------------------------|----------------|------------|------------|----------|------------|---------|------------|--------------|--|
| OBJECTID * | r3ERU | r3ERUcode | r3ERUsubcl | r3ERUsubclcode | Prov_SubCl | SystemType | Source | TEUI_MUs * | Dist_No | MU_Numeric | xwalk_link * | |
| 904 | Spruce-Fir Forest | SFF | Spruce-Fir - Lower | SFM | <Null> | forest | CIB_TEUI | 668 | <Null> | <Null> | <Null> | |
| 905 | Mixed Conifer - Frequent Fire | MCD | <Null> | <Null> | <Null> | forest | CIB_TEUI | 669 | <Null> | <Null> | <Null> | |
| 906 | Montane / Subalpine Grassland | MSG | <Null> | <Null> | <Null> | grassland | CIB_TEUI | 3 | <Null> | <Null> | <Null> | |
| 907 | Montane / Subalpine Grassland | MSG | <Null> | <Null> | <Null> | grassland | CIB_TEUI | 10 | <Null> | <Null> | <Null> | |
| 908 | Sagebrush Shrubland | SAGE | <Null> | <Null> | <Null> | shrubland | CIB_TEUI | 11 | <Null> | <Null> | <Null> | |
| 909 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 155 | <Null> | <Null> | <Null> | |
| 910 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Bunchgrass | PPG | <Null> | forest | CIB_TEUI | 156 | <Null> | <Null> | <Null> | |
| 911 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 157 | <Null> | <Null> | <Null> | |
| 912 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 159 | <Null> | <Null> | <Null> | |
| 913 | PJ Woodland | PJO | PJ Woodland - Cold | PJOc | <Null> | woodland | CIB_TEUI | 184 | <Null> | <Null> | <Null> | |
| 914 | PJ Woodland | PJO | PJ Woodland - Cold | PJOc | <Null> | woodland | CIB_TEUI | 185 | <Null> | <Null> | <Null> | |
| 915 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 189 | <Null> | <Null> | <Null> | |
| 916 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 190 | <Null> | <Null> | <Null> | |
| 917 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 193 | <Null> | <Null> | <Null> | |
| 918 | Mixed Conifer - Frequent Fire | MCD | <Null> | <Null> | <Null> | forest | CIB_TEUI | 196 | <Null> | <Null> | <Null> | |
| 919 | Mixed Conifer - Frequent Fire | MCD | <Null> | <Null> | <Null> | forest | CIB_TEUI | 197 | <Null> | <Null> | <Null> | |
| 920 | PJ Woodland | PJO | PJ Woodland - Cold | PJOc | <Null> | woodland | CIB_TEUI | 198 | <Null> | <Null> | <Null> | |
| 921 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 253 | <Null> | <Null> | <Null> | |
| 922 | Mixed Conifer - Frequent Fire | MCD | <Null> | <Null> | <Null> | forest | CIB_TEUI | 255 | <Null> | <Null> | <Null> | |
| 923 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 275 | <Null> | <Null> | <Null> | |
| 924 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 301 | <Null> | <Null> | <Null> | |
| 925 | Mixed Conifer - Frequent Fire | MCD | <Null> | <Null> | <Null> | forest | CIB_TEUI | 302 | <Null> | <Null> | <Null> | |
| 926 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 311 | <Null> | <Null> | <Null> | |
| 927 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | CIB_TEUI | 312 | <Null> | <Null> | <Null> | |
| 928 | Montane / Subalpine Grassland | MSG | <Null> | <Null> | <Null> | grassland | CIB_TEUI | 505 | <Null> | <Null> | <Null> | |
| 929 | Colorado Plateau / Great Basin Grassland | CPGB | <Null> | <Null> | <Null> | grassland | KAI_TEUI | 3 | <Null> | <Null> | <Null> | |
| 930 | Montane / Subalpine Grassland | MSG | <Null> | <Null> | <Null> | grassland | KAI_TEUI | 11 | <Null> | <Null> | <Null> | |
| 931 | Colorado Plateau / Great Basin Grassland | CPGB | <Null> | <Null> | <Null> | grassland | KAI_TEUI | 255 | <Null> | <Null> | <Null> | |
| 932 | PJ Woodland | PJO | PJ Woodland - Cold | PJOc | <Null> | woodland | KAI_TEUI | 257 | <Null> | <Null> | <Null> | |
| 933 | PJ Woodland | PJO | PJ Woodland - Cold | PJOc | <Null> | woodland | KAI_TEUI | 260 | <Null> | <Null> | <Null> | |
| 934 | PJ Woodland | PJO | PJ Woodland - Cold | PJOc | <Null> | woodland | KAI_TEUI | 261 | <Null> | <Null> | <Null> | |
| 935 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 265 | <Null> | <Null> | <Null> | |
| 936 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 266 | <Null> | <Null> | <Null> | |
| 937 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 275 | <Null> | <Null> | <Null> | |
| 938 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 276 | <Null> | <Null> | <Null> | |
| 939 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 282 | <Null> | <Null> | <Null> | |
| 940 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 283 | <Null> | <Null> | <Null> | |
| 941 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 284 | <Null> | <Null> | <Null> | |
| 942 | PJ Woodland | PJO | PJ Woodland - Cold | PJOc | <Null> | woodland | KAI_TEUI | 287 | <Null> | <Null> | <Null> | |
| 943 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 290 | <Null> | <Null> | <Null> | |
| 944 | Ponderosa Pine Forest | PPF | Ponderosa Pine/Gambel Oak | PPO | <Null> | forest | KAI_TEUI | 291 | <Null> | <Null> | <Null> | |
| 945 | Mixed Conifer - Frequent Fire | MCD | <Null> | <Null> | <Null> | forest | KAI_TEUI | 605 | <Null> | <Null> | <Null> | |
| 946 | Mixed Conifer - Frequent Fire | MCD | <Null> | <Null> | <Null> | forest | KAI_TEUI | 606 | <Null> | <Null> | <Null> | |
| 947 | Mixed Conifer - Frequent Fire | MCD | <Null> | <Null> | <Null> | forest | KAI_TEUI | 615 | <Null> | <Null> | <Null> | |
| 948 | Spruce-Fir Forest | SFF | Spruce-Fir - Lower | SFM | <Null> | forest | KAI_TEUI | 628 | <Null> | <Null> | <Null> | |

The build: A hierarchy of data layers



RMAP

TEUI

Univ of AZ / Climate Gradient / SWBC Eval

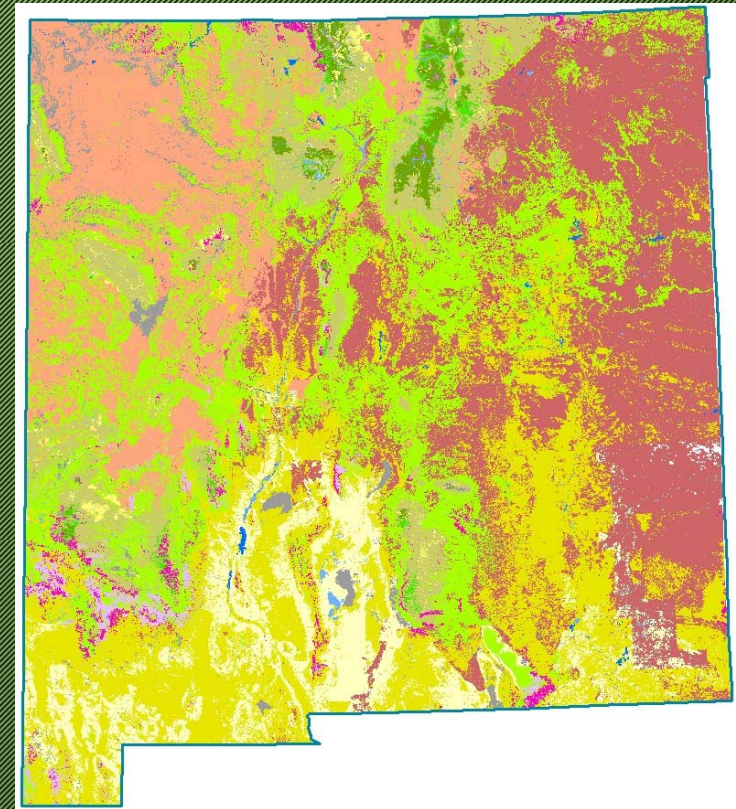
ILAP

ERU Version 4

The product



- Northern and southern products developed separately and independently
- Each evaluated independently
- Joined together via “load” 876,000 features (Single part)
- Additional QA/QC performed afterward
- Released as Beta version
- Corporate version in process and release to public and partnerships coming soon
- Maintenance schedule to incorporate additions and edits to enhance product accuracy and to maintain relevance



Lessons learned



- Time consuming CPU/processor intensive processes
 - 64 bit background geoprocessing
- Create standards early in the process
- Establish a master crosswalk that everyone works with
- Build QA/QC reviews into the process frequently
 - Local level reviews by specialist at the forest
 - Field going personnel with on the ground knowledge weigh in
 - TEUI Surveyors contribution
 - Regional level reviews by specialists at the Regional Office
 - Special review product with analysis metrics
 - Multiple summaries to catch inconsistencies in attribution
- Make no assumptions about how topologically 'clean' your input data is
- If the project is on a set timeline (Forest Plan Revision), establish hard deadlines for review and edits
- GIS and Specialists MUST communicate and learn from one another to understand

Questions

