



# Implementation of Terrestrial Ecological Unit Inventory Geospatial (TEUI) Toolkit for Mapping Sky Island Ecosystems of the Coronado National Forest, Arizona USA.



**Mark A. Casillas<sup>1</sup>, Robert Wright Ballard<sup>2</sup>, Patricia L. Boness<sup>2</sup>, Wayne A. Robbie<sup>3</sup> and David R. Watson<sup>2</sup>, (1)Terrestrial Ecological Unit Inventory, USDA Forest Service- Southwestern Region, Phoenix, AZ, (2)Terrestrial Ecological Unit Inventory, USDA Forest Service- Southwestern Region, Tucson, AZ, (3) Terrestrial Ecological Unit Inventory, USDA Forest Service- Southwestern Region, Albuquerque, NM**

## Terrestrial Ecological Unit Inventory (TEUI)

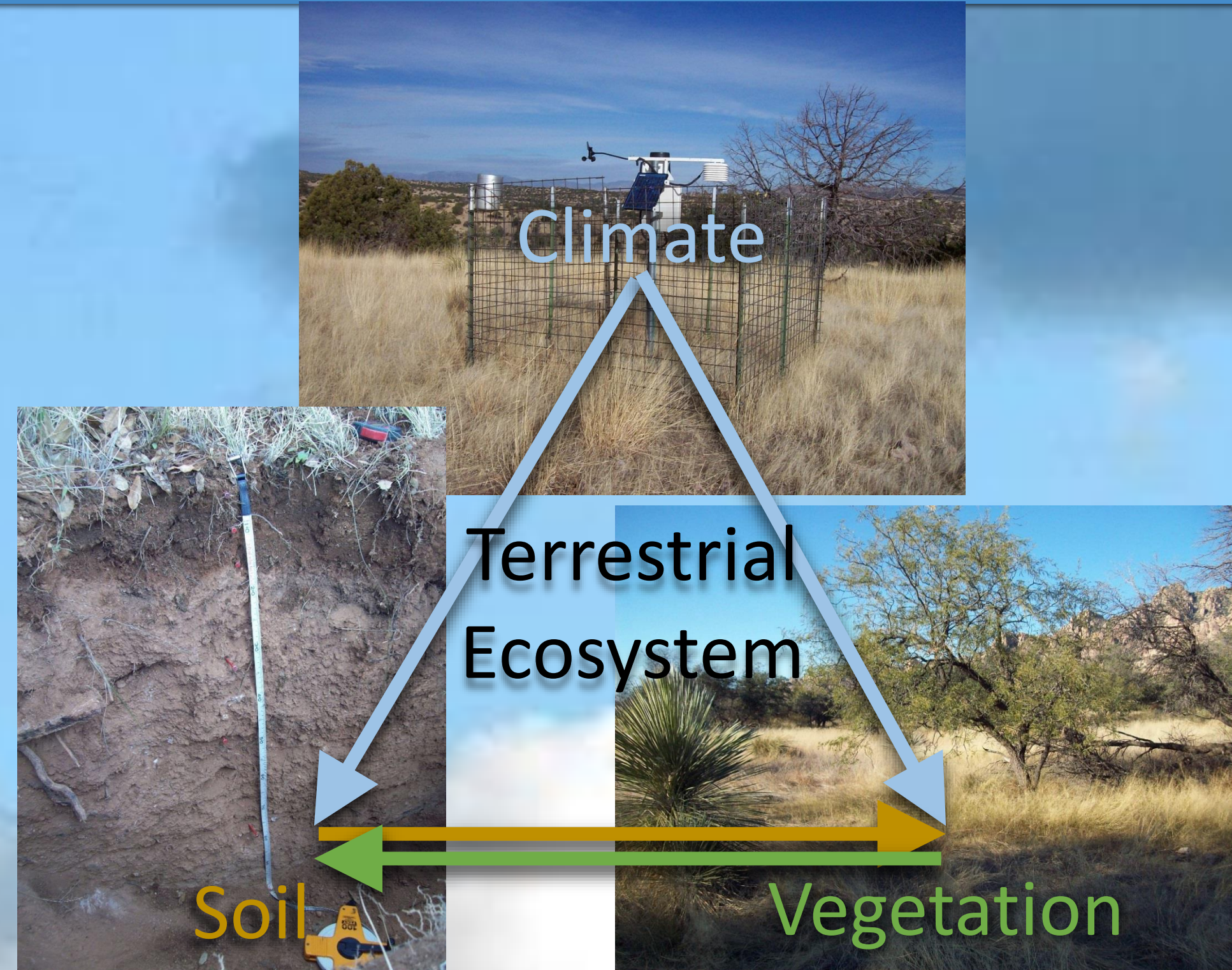
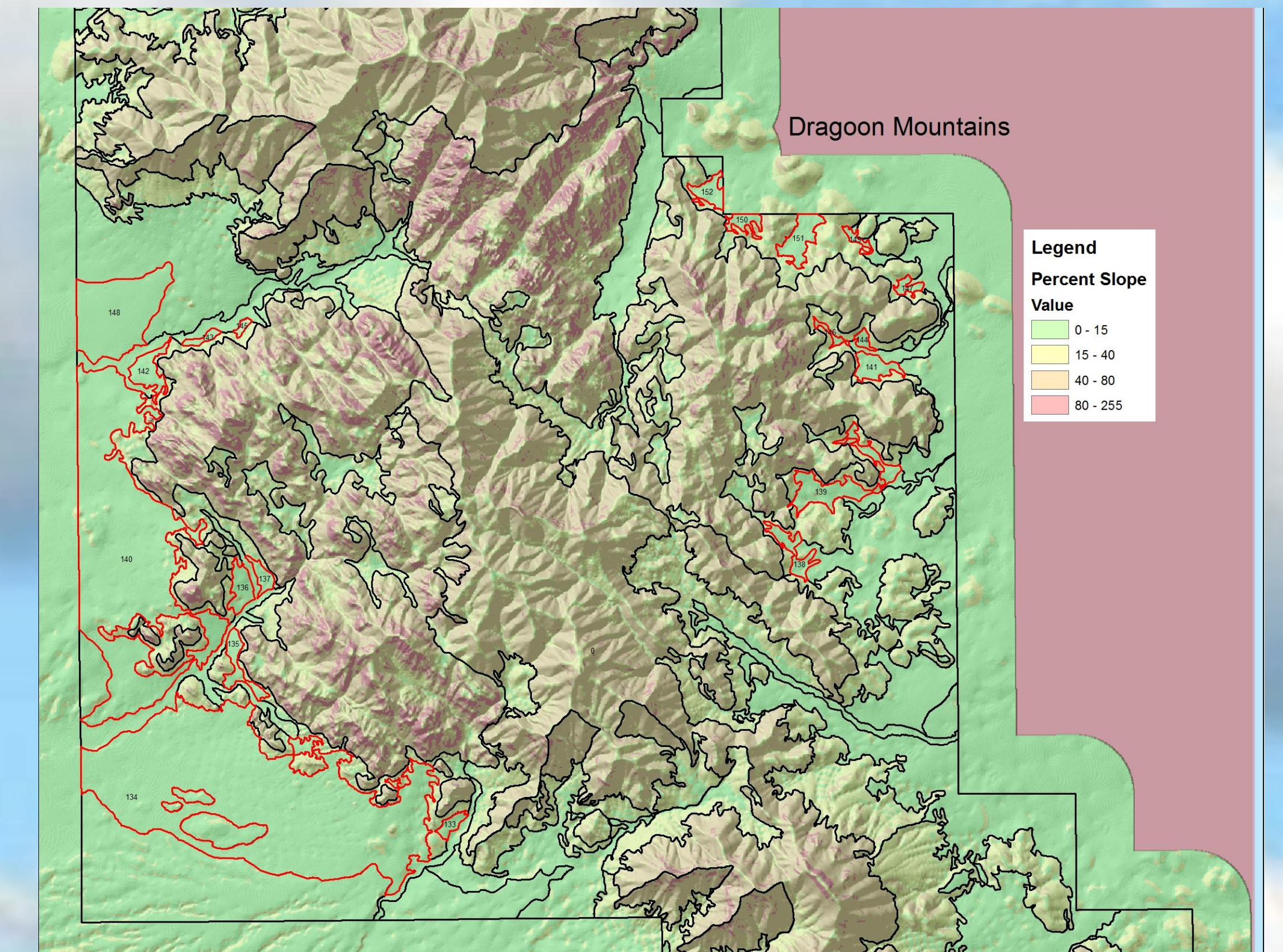
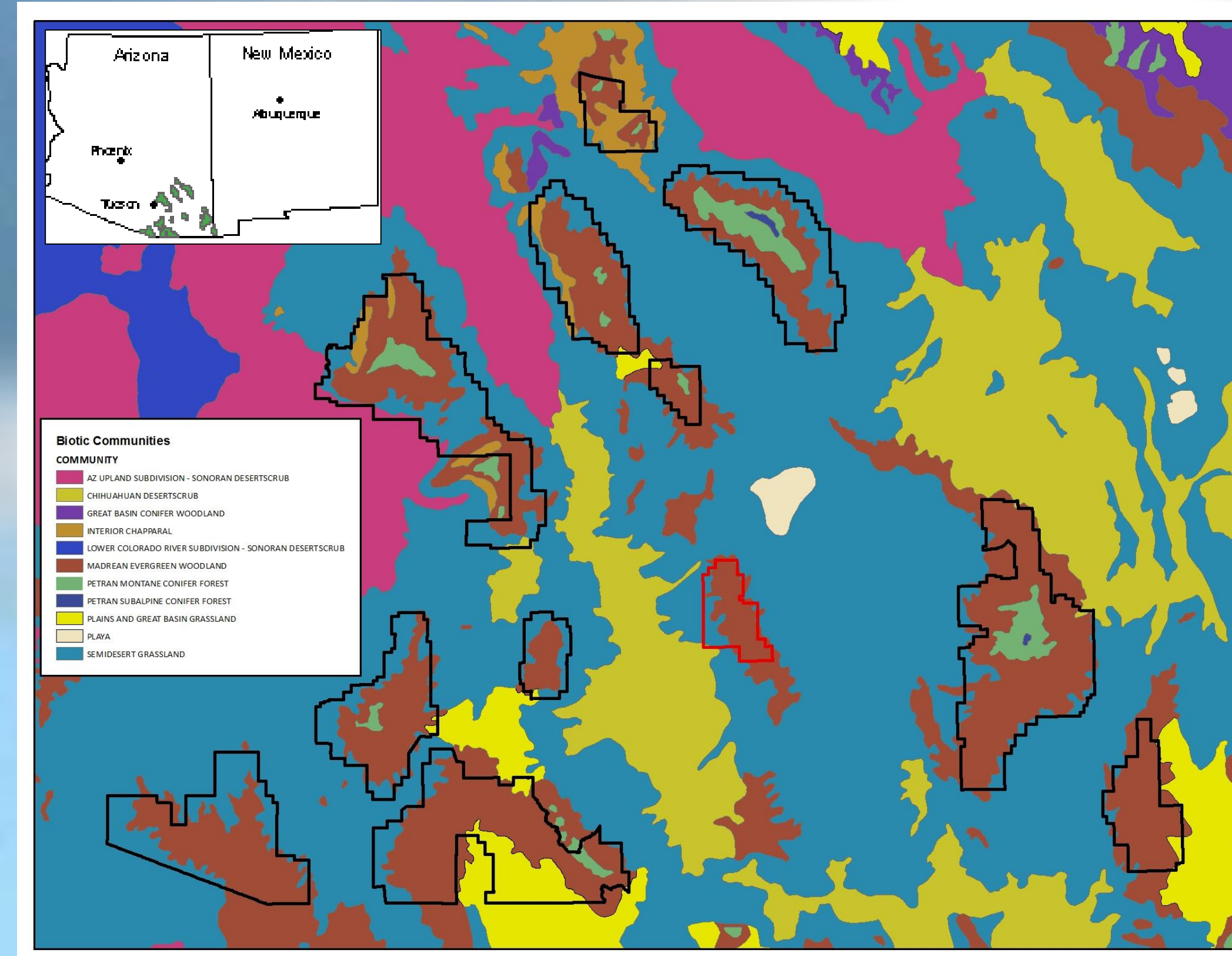
- Description, classification, mapping, and interpretation of ecological units across National Forest System Lands in the Southwestern US
- Ecological Unit – a grouping of ecological types made up of landscape elements: climate, geology, geomorphology, soils, and potential natural vegetation
- Ecological types differ from each other in their ability to produce vegetation and respond to management and natural disturbances
- The goal of TEUI efforts in Region 3 is to provide geospatial and tabular ecosystem unit data and interpretations for site specific projects and landscape level Forest planning.

## Coronado National Forest Physiography

- 1.78 Million Acres
- Elevation 3000-10720 feet
- The 12 mountain ranges encompassing the Coronado are home to forested life zones separated by a sea of low lying desert and semi-desert grasslands.
- The region is where the Sierra Madre Occidental of Mexico converges with the Rocky Mountains between the Sonoran and Chihuahuan Deserts.

## Map Unit Description of 397

This map unit consists of multitaxa terrestrial ecosystem components. Components .1 - .3 occur in an intricate pattern and are not separable. They occur on gently sloping (0–15 percent), alluvial fan aprons. In addition to map unit components, this map unit includes ephemeral drainages that make up roughly 5 percent composition. Drainage pattern is dendritic in nature. Some areas of this map unit have granite outcrop which constitute less than 5 percent of total map unit composition. Elevation ranges from 1420 - 1560 meters. Approximately 60 percent of the annual precipitation occurs during the period of 01 April to 30 September and winters are mild (HSM).



This diagram indicates that both soil and vegetation are directly influenced by climate; soil supports vegetation; and vegetation acts upon the soil. The product of these complex interactions defines a terrestrial ecosystem. (Whitford, W.G., 2002; USDA 1986)

## Map Unit Validation using the TEUI Geospatial Toolkit

- The toolkit computes tabular statistics and displays information in both chart and table format
- Allows users to assess the variability of an ecological unit (map unit analysis)
- Analyzes sample population to ensure sampling across entire range of variability
- Assesses variability of individual polygons that comprise a map unit

## TEUI Gradient Analysis

Gradient Analysis is a study that seeks to arrange samples in relation to one or more environmental gradients or axis. Ecological data as well as climate data from NOAA Weather Stations is used to define life zones that occur along an elevation continuum ranging from low elevation; hot, dry arid and semi-arid desert to high elevation; cool, wet, upper montane coniferous forests (USDA 1986)

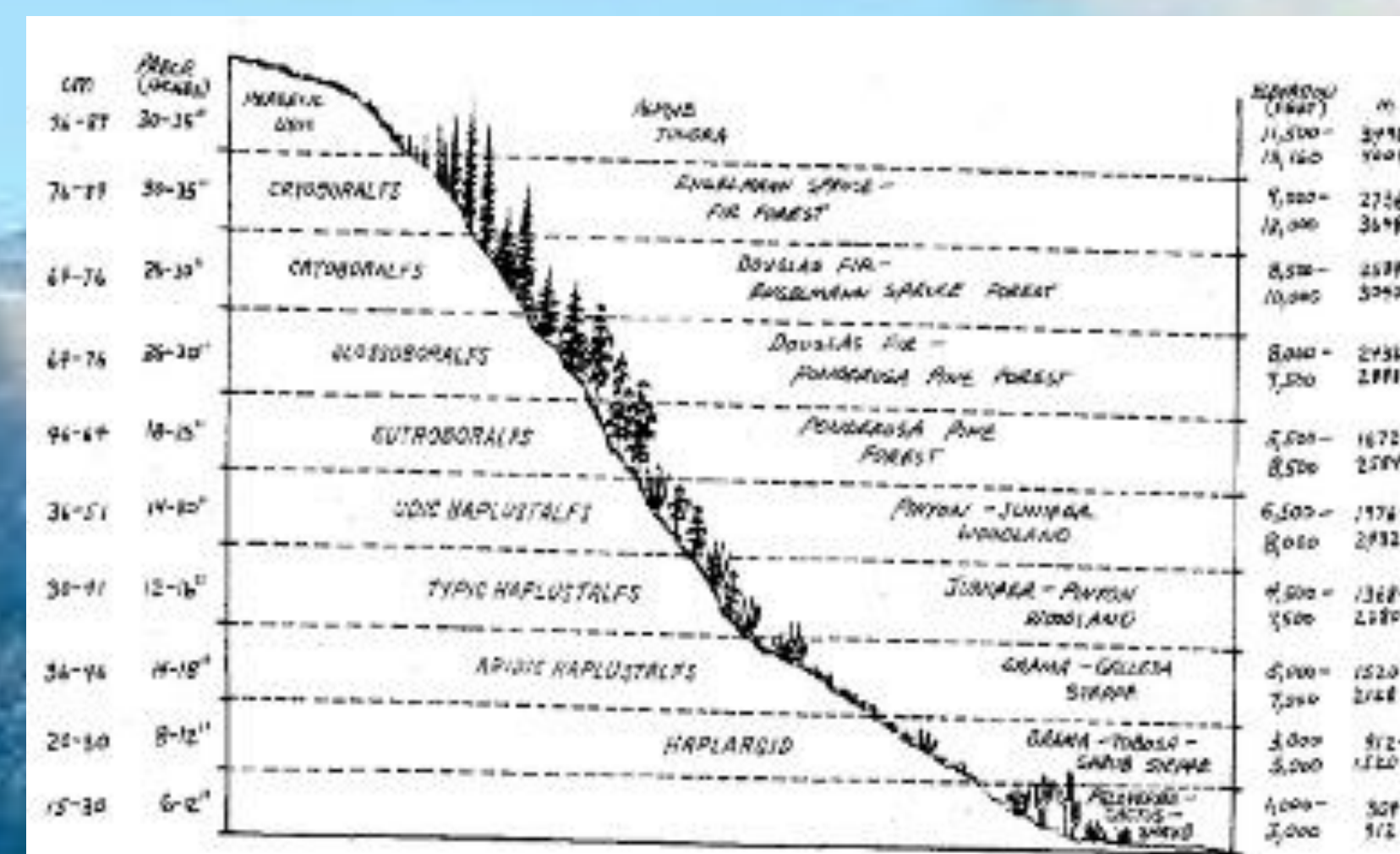


Fig. 12.9. Altitude sequence of soils and vegetation in New Mexico. After Carleton et al (9), U.S.D.A. Forest Service

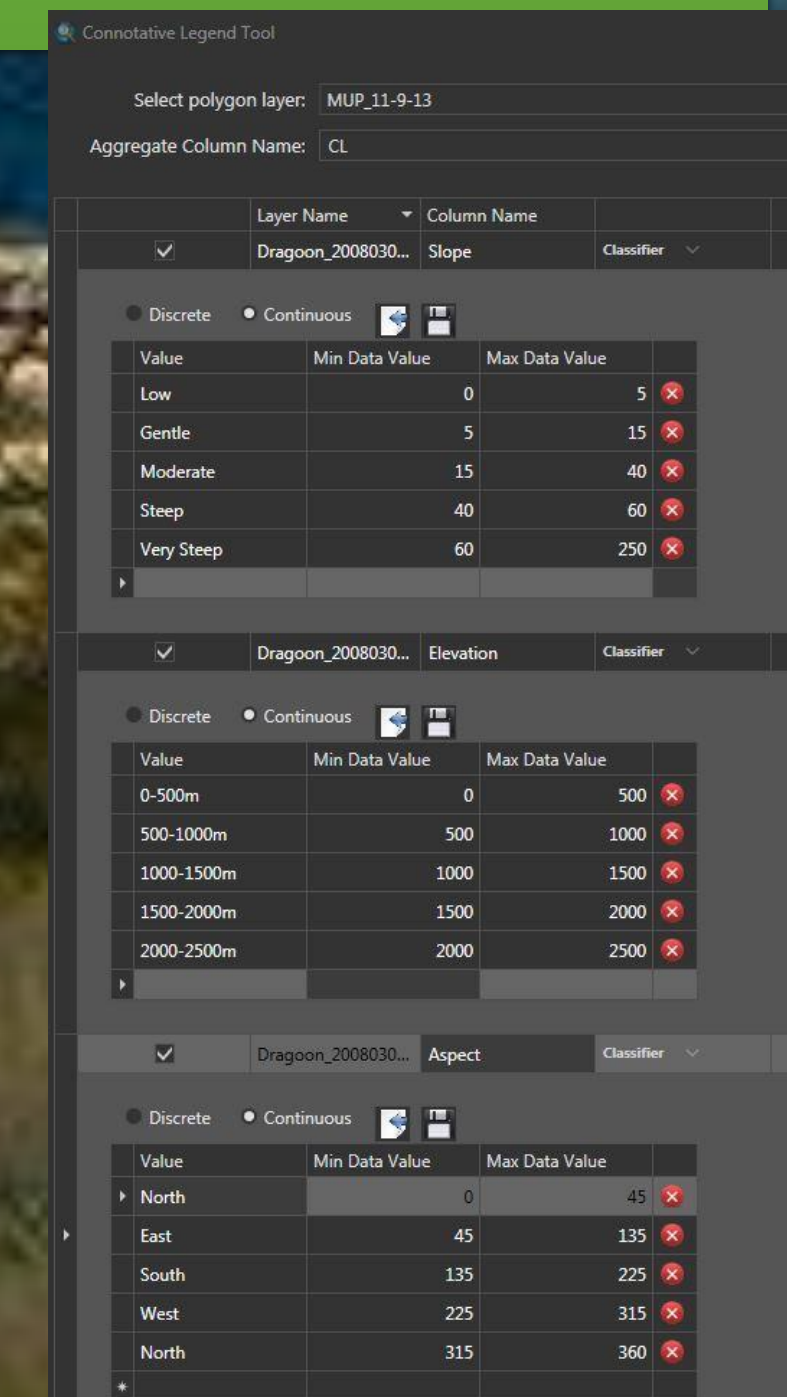
## MU 397 Statistical Analysis

Coronado NF HSM Gradient				HSM Descriptors	
3	4	5	6		
---	---	---	---	+1	NOAA / RAWS Weather Station
Douglas FAA Airport	Chiricahua Natl. Monument	Gila NF Temp. Site Rincon	Gila NF Temp. Site	0	
---	---	---	---	-1	
7/2/1948 - 12/31/2010	1/1/1909 - 12/28/2010	02/1999 - 01/2012	---	0	Period of Record
---	1/1/1910 - 12/31/2010	06/1994 - 06/2013	02/1999 - 01/2012	-1	
1300	1900	---	2700	+1	ME
1220	1637	2257	2700	0	
1000	1490	2511	2500	-1	
40	52	62	72	+1	MAP
32	49	58	68	0	
30	46	53	64	-1	
---	---	---	---	+1	MLSP
29%	41%	34%	50%	0	
---	37%	---	---	-1	
17	14	---	---	0	MAAT
---	14	11	---	-1	
---	---	---	---	+1	MAST
---	---	11	---	0	
---	---	---	9	-1	
---	---	---	---	+1	MSST
---	---	18	---	0	
---	---	---	14	-1	
---	---	---	---	+1	
---	---	5	---	0	MWST
---	---	---	4	-1	
Ustic	Ustic	Ustic	Udic	---	SMR
Thermic	Mesic	Mesic	Frigid	---	STR
Aridic	Typic	Udic	Typic	---	Soil Subgroup
Haplustalfs	Haplustalfs	Haplustalfs	Haplustalfs	---	Soil Great Group
BOCU	DU2E2	PIPO5	PSMEG	---	Veg. Series

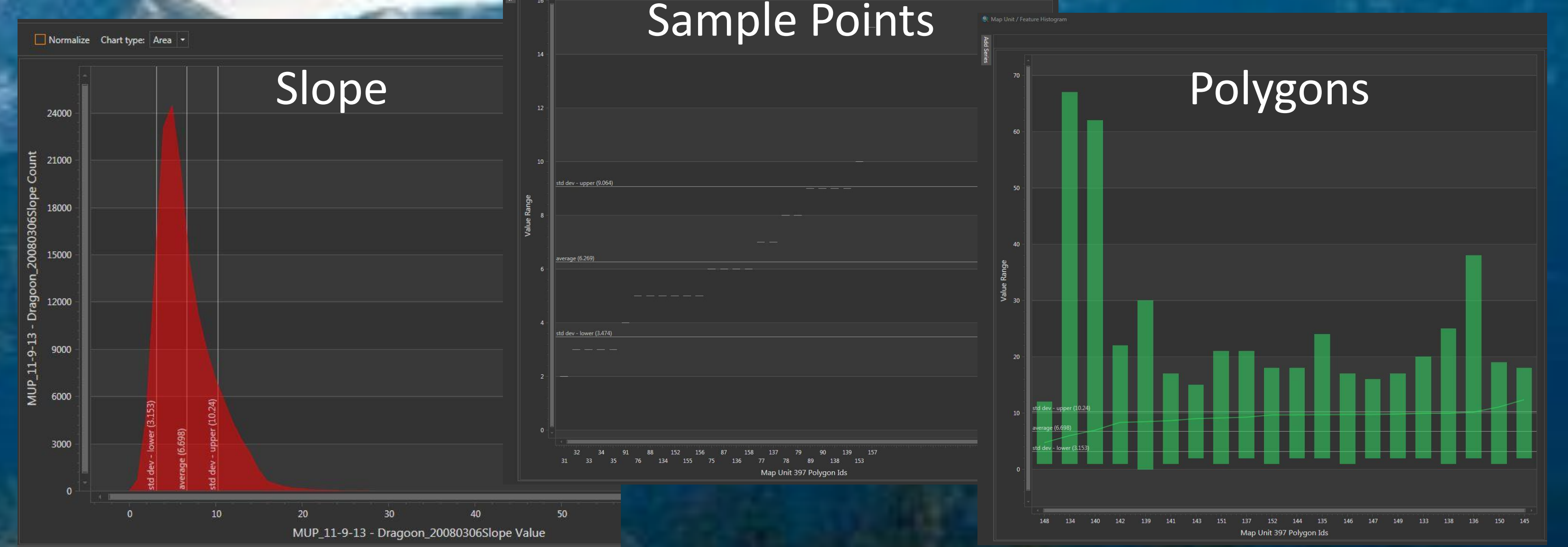
Life Zone Ecotones - Within each life zone, climate variability (hot/dry, cool/moist) influence plant species composition and soil.

## Connotative Legend tool

- Calculates statistics using existing polygon layers and a defined raster layer
- User defines the range of values and assigns group names to each range
- Calculates a zonal majority for each polygon, and labels the polygon based on the user defined group
- New classifications are added to the polygon layer's attribute table
- Can be used to assign map unit numbers to similar polygons
- Additional research necessary for use as digital mapping tool



FID	Acres	Elevation	Aspect	Slope	Connotative Legend
2	289	1000-1500m	West	Low	1000-1500m West Low
6	1690	1000-1500m	West	Low	1000-1500m West Low
21	32	1000-1500m	North	Gentle	1000-1500m North Gentle
35	49	1000-1500m	West	Gentle	1000-1500m West Gentle
36	1176	1500-2000m	West	Gentle	1500-2000m West Gentle
38	40	1000-1500m	South	Gentle	1000-1500m South Gentle
40	41	1000-1500m	West	Gentle	1000-1500m West Gentle
42	18	1500-2000m	South	Gentle	1500-2000m South Gentle
62	22	1000-1500m	East	Gentle	1000-1500m East Gentle
63	57	1000-1500m	North	Gentle	1000-1500m North Gentle
107	21	1500-2000m	West	Gentle	1500-2000m West Gentle
109	7	1500-2000m	West	Gentle	1500-2000m West Gentle
110	12	1000-1500m	North	Gentle	1000-1500m North Gentle
136	10	1000-1500m	South	Gentle	1000-1500m South Gentle
139	112	1000-1500m	South	Gentle	1000-1500m South Gentle
140	10	1000-1500m	East	Gentle	1000-1500m East Gentle
141	40	1000-1500m	North	Gentle	1000-1500m North Gentle
142	40	1500-2000m	East	Gentle	1500-2000m East Gentle
151	15	1000-1500m	East	Gentle	1000-1500m East Gentle
152	11	1000-1500m	East	Gentle	1000-1500m East Gentle



Feature	MapUnit	Raster	Mean	Majority	Maximum	Minimum	Minority	Range	Std	Sum	Median	Variety	Count	NoDataCount
MUP_11-9-13	43	Dragoon_20080306Slope	8.16558694	5	74	0	53	74	6.046511	189066	7	60	23154	0
MUP_11-9-13	45	Dragoon_20080306Slope	9.127476314	4	101	0	51	101	7.258553	222537	7	75	24381	0
MUP_11-9-13	351	Dragoon_20080306Slope	7.318503351	4	75	0	0	75	4.659205	432465	6	51	59092	0
MUP_11-9-13	361	Dragoon_20080306Slope	53.35800511	49	174	1	128	173	15.425942	7266720	53	146	136188	0
MUP_11-9-13	362	Dragoon_20080306Slope	8.202055393	7	43	0	38	43	3.82183	751013	8	42	91564	0
MUP_11-9-13	363	Dragoon_20080306Slope	23.65428594	17	69	1	65	68	9.562971	916438	23	66	38743	0
MUP_11-9-13	364	Dragoon_20080306Slope	8.821707921	5	50	0	50	50	5.155745	795127	8	51	90133	0
MUP_11-9-13	369	Dragoon_20080306Slope	24.01393859	16	77	1	72	76	9.025018	4543125	23	75	189187	0
MUP_11-9-13	374	Dragoon_20080306Slope	8.254406352	7	122	1	63	121	4.060137	997999	7	80	120905	0
MUP_11-9-13	388	Dragoon_20080306Slope	9.688829041	8	61	1	47	60	4.432826	863420	9	58	89115	0
MUP_11-9-13	397	Dragoon_20080306Slope	6.698375513	5	67	0	43	67	3.549699	1000744	6	63	149401	0
MUP_11-9-13	435	Dragoon_20080306Slope	58.11066617	48	250	1	237	249	27.262904	23615989	54	250	406401	0
MUP_11-9-13	436	Dragoon_20080306Slope	22.44650271	16	127	0	87	127	10.182537	2270778	21	102	101164	0
MUP_11-9-13	444	Dragoon_20080306Slope	53.61947158	52	204	1	138	203	15.785203	29968298	54	154	558907	0
MUP_11-9-13	449	Dragoon_20080306Slope	24.58942322	16	76	1	66	75	10.145895	2851660	24	75	115971	0

## Conclusion

- The TEUI toolkit provides easily repeatable methods of assessing the variability of landscape elements that comprise ecological units.
- Scientists working on the initial survey of the Coronado National Forest are using the toolkit to develop and strengthen ecological units.
- The result is a quantitative scientific analysis of TEUI mapping efforts on the Coronado National Forest.

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