ESDs/ESI in the USDA Forest Service

Western Regional Soil Survey Conference
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Outline

- History of describing and characterizing ecosystems
- Policy Guidance
- Forest Service involvement with ESD development
- The Forest Service Southwestern Region and ESD development
- Forest Service Southwestern Region TEUI
- Future Collaboration

History of Describing and Characterizing Ecosystems in the Forest Service

- Habitat Types/Plant Associations-Nationwide
- Lands System Inventory-Region 1
- Common Land Units-Region 2
- Terrestrial Ecosystem Survey-Region 3
- Soil Vegetation Survey-Region 5
- Ecological Class System-Region 9
- Soil Survey/Range Sites-Ecological Sites-Regions 4, 6, 8
- Vegetation, Soil, Geology, etc. Overlays

Other Land Classification Systems

- LANDFIRE: BpS-Biophysical Systems; Includes State and Transition models (http://www.landfire.gov/)
- NatureServe: Ecological Systems/Ecological System Units (http://www.natureserve.org/)
- GAP/ReGAP: Landcover, Species Data. (http://gapanalysis.usgs.gov/data/)
- A Classification of North American Biotic Communities- Brown, Reichenbacher and Franson

TEUI Technical Guide-2005

Winthers et. al

Forest Service Involvement in Ecological Site Description Development

National Level

- Co-author Interagency Rangeland Ecological Site Handbook- Dibenedetto, Cleland
- Nation-wide Forest Service review and comment on above

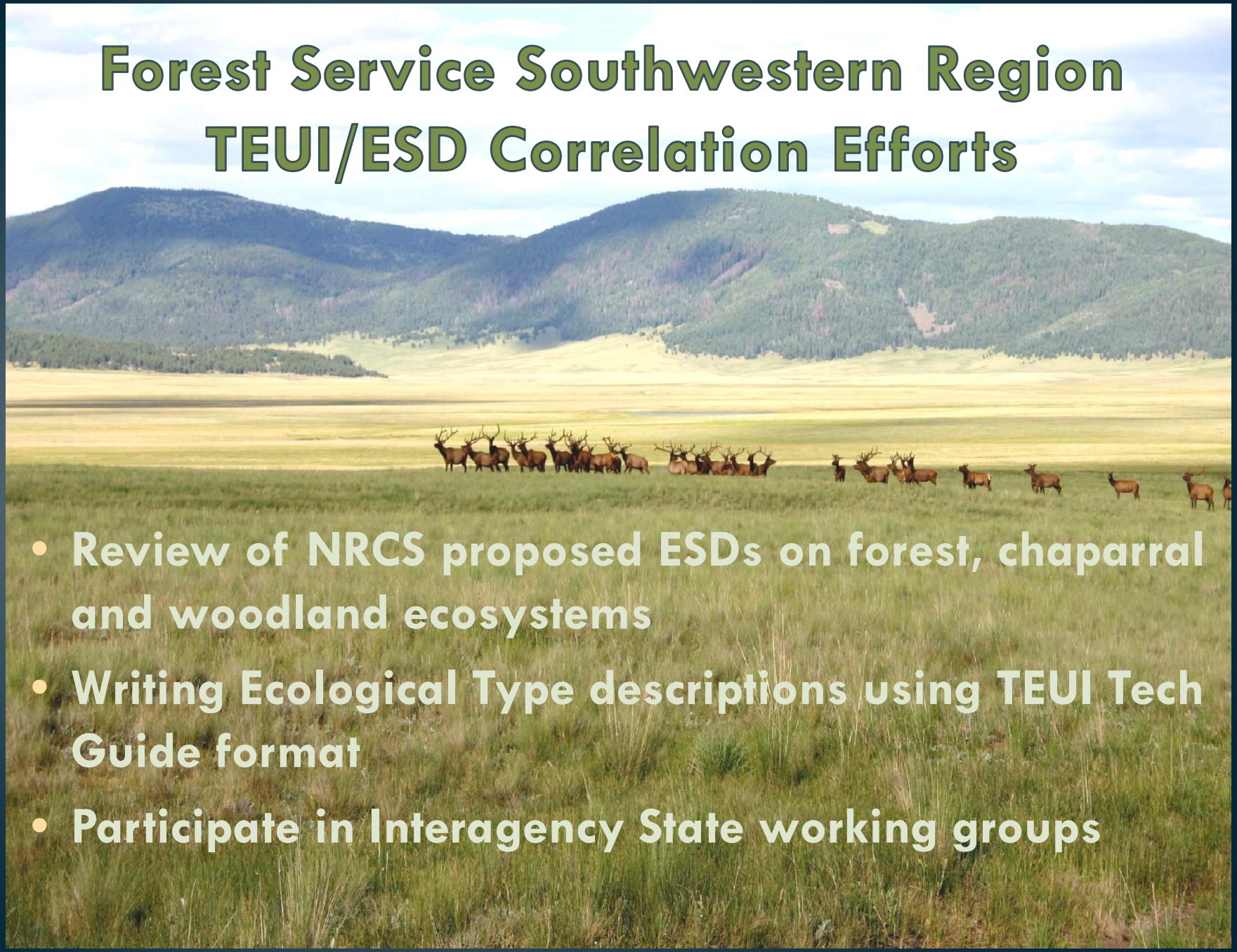
Regional/Local Levels- Varies by MO, MLRA, FS Region, State

- Review NRCS ESDs
- Providing data to NRCS for ESD Development
- Collaborative development of ESDs
- Forest Service developing ESDs on Forest Service administered lands
- Participation in state interagency ESD working groups
- Developing Forest Service Regional Classifications
- NASIS entries as "Other Veg Class"

Forest Service Focus in ESD Handbook

- Interagency ESDs meet all agencies standards and protocols
- Ensure Forest Service TEUI Technical Guide standards and protocols are incorporated in the Handbook
- Consistent Naming Conventions-use of indicator species
- Encourages the formation of Interagency Working Groups at Regional, State (strategic, programmatic) and Local levels (data collection, writing).

Forest Service Southwestern Region TEUI/ESD Correlation Efforts



- Review of NRCS proposed ESDs on forest, chaparral and woodland ecosystems
- Writing Ecological Type descriptions using TEUI Tech Guide format
- Participate in Interagency State working groups

Joint Forest Service/NRCS TEUI Mapping and Correlation Efforts

Identifying Plant Species for Riparian ESD Characterization

Crosswalk of ESD and TEUI data elements

Descriptive and Interpretative Data Elements of Ecological Unit Inventory

USDA Forest Service - Southwestern Region - Terrestrial Ecoystem Survey

Map Unit Legend:

- **Map Symbol:** two or three digit number
- **Map Unit Component:** decimal number
- **Soil Name/Miscellaneous Area:** Soil Taxonomic Name (family or sugbgroup)/common name
- **Phase:** soil depth, soil surface texture rock modifier, soil surface texture, other unique soil properties
- **Climate Class:** gradient, lifezone (number), sub-step
- **Vegetation Symbol:** Name (plant symbol) of the Potential Natural Vegetation community
- **Slope/Composition/Climax/Kind of Map Unit:** slope - range expressed as a %/composition - expressed as a %/ climax -descriptive term/kind of map unit - descriptive term.

Map Unit Setting and Properties:

- **Map Symbol:** two or three digit number
- **Map Unit Name:** Soil Taxon (family/subgroup)/Climate Class (step/substep)/ Soil Phase (soil depth/surface texture) PNV Taxon (series/subseries)/Climax Class/ Map Unit Kind/Slope Range (expressed in percent).
- **Setting:** narrative form

Describes location of each major ecological type and identifies the landform for each ecological type. MAP (range - expressed in cm). Timing period (range of months) and the amount of precipitation received (expressed as a %). MAAT (range - expressed in degrees Celcius). Mean snowfall and snow accumulation (expressed in cm). Freeze-free period (expressed in days). Elevation (range - expressed in m). Polygons shape and size (range - expressed in hectares). Stream channel type and drainage pattern.

Map Unit Symbol and Component:

- **Landscape Features:** hierarchial
  - **Site Geomorphology:**
  - **Geomorphic Process**
  - **Landscape Term**
  - **Landform**
  - **Element Landform**
  - **Common Landform**
- **Parent Material:**
  - **Kind**
  - **Origin**

USDA Natural Resource Conservation Service - Ecological Site D

Ecological Site Characteristics: small color photograph

- **Site Type:** type of site - rangeland, forest land etc.
- **Site Name:** Name & Precipitation Zone (range - expressed in inches) Identifies plant community by taxonomic name and common name.
- **Site ID:** consists of eleven digits both numerical and alpha characters.
- **Major Land Resource Area:** Three digit number and name

Physiographic Features

A brief description of the location - elevation - landscape position , landform - of the ecological site.

- **Landform:** identifies landform (common name) may include more than one landform.
- **Elevation:** identifies a minimum and a maximum elevation (expressed in feet).
- **Slope:** identifies a minimum and a maximum slope (expressed in %)
- **Water Table Depth:** identifies a minimum and maximum water table depth (expressed in inches)
- **Flooding**
  - **Frequency:** identifies a minimum and maximum flood frequency.
  - **Duration:** identifies a minmum and maximum flood duration.
- **Ponding**
  - **Depth:** identifies a minimum and a maximum ponding depth (expressed in inches).
  - **Frequency:** identifies a minimum and a maximum ponding frequency.
  - **Duration:** identifies a minimum and a maximum ponding duration.
- **Runoff Class:** identifies a minimum and maximum runoff class.
- **Aspect:** descriptive term

Climatic Features: narrative and table form

A narrative discussion on the major climate properties. Range in annual precipitation (expressed in inches), winter/summer ratios, period, precipitation intensity (descriptive term), duration, direction and area from which the storm events originate are discussed. Snowfall amounts and depth (expressed in inches), time periods of snowfall events, humidity are discussed. Average annual air temperatures (range - expressed in degrees Fahrenheit). Time of year is mentioned when daytime air temperatures are the highest and when free temperatures occur.

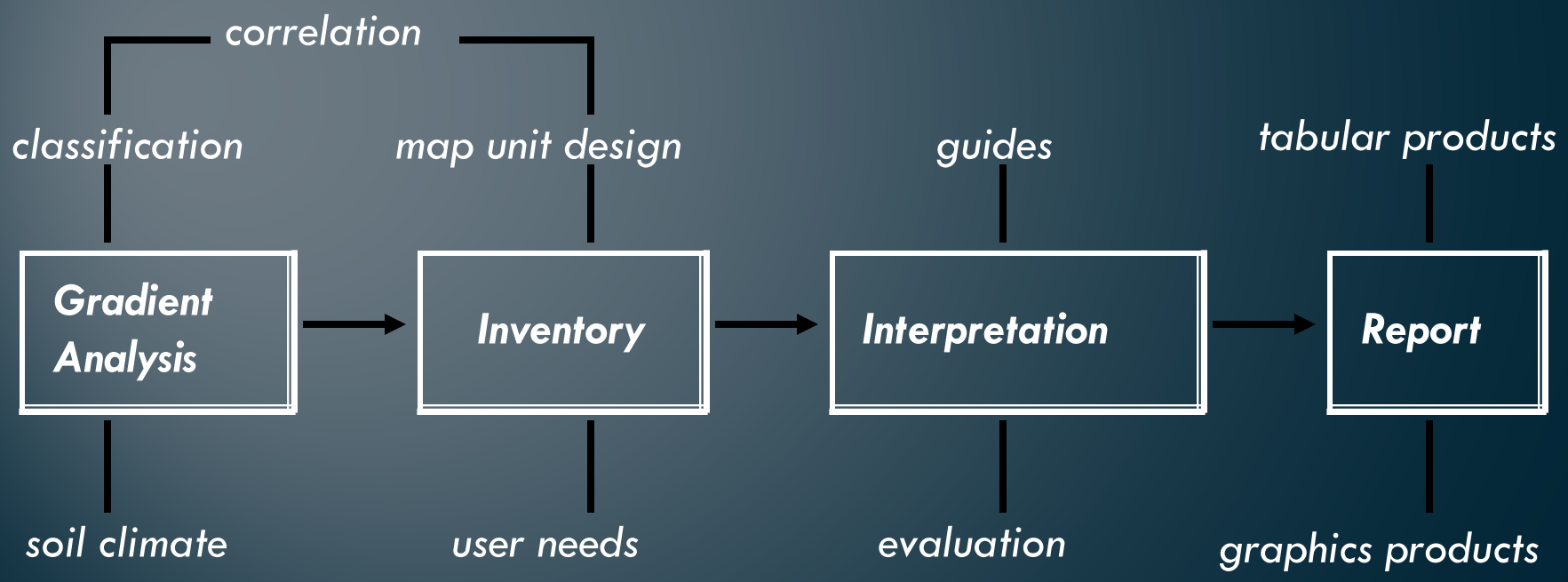
Crosswalk in progress of TEUI Ecological Types with ESDs and other ecological classification systems

Muldavin Mapped Veg Class	TEUI Subseries Veg Class	NRCS ESD	Muldavin Primary Plant Associations
Upper Montane Grassland	Dapa2/Fear2	Subalpine Grassland	Dapa2/Fear2
	Feth/Dapa2/Fear2	Subalpine Grassland	Feth/Dapa2
	Feth/Dapa2	Subalpine Grassland	Dapa2/Feid
	Feth/Dapa2/Feid/Popr	Subalpine Grassland	Dapa2/Popr
			Feth/Popr
Lower Montane Grassland	Fear2/Mumo/Bltr/Bogr2	Mountain Loam Dry	Fear2/Bltr
	Fear2/Mumo	Mountain Loam Dry	Fear2/Popr
	Fear2/Pasm/Muwr	Mountain Loam Dry	Fear2/Feid
	Feid/Muwr/Bltr/Popr	Mountain Valley Dry	Fear2/Mumo
			Bltr/Mumo

Forest Service Southwestern Region TEUI

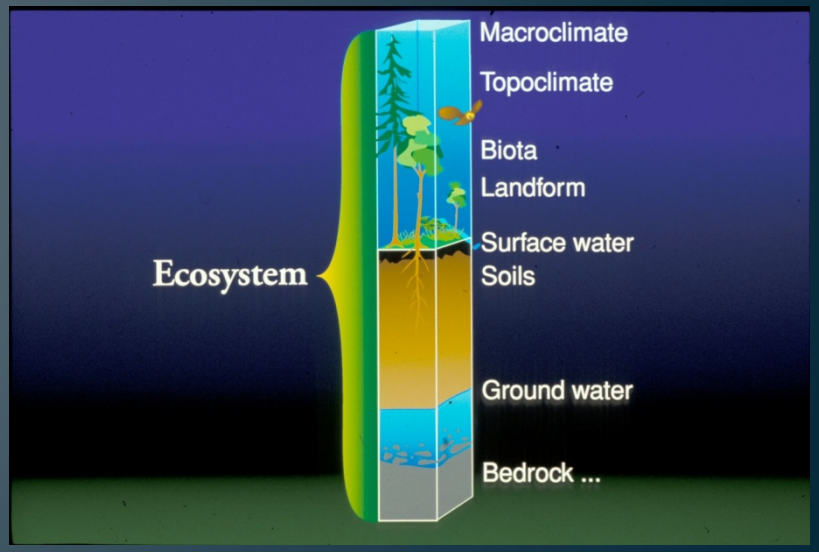
Terrestrial Ecosystem Survey

Simplified flow chart of the sequence to Terrestrial Ecosystem Survey



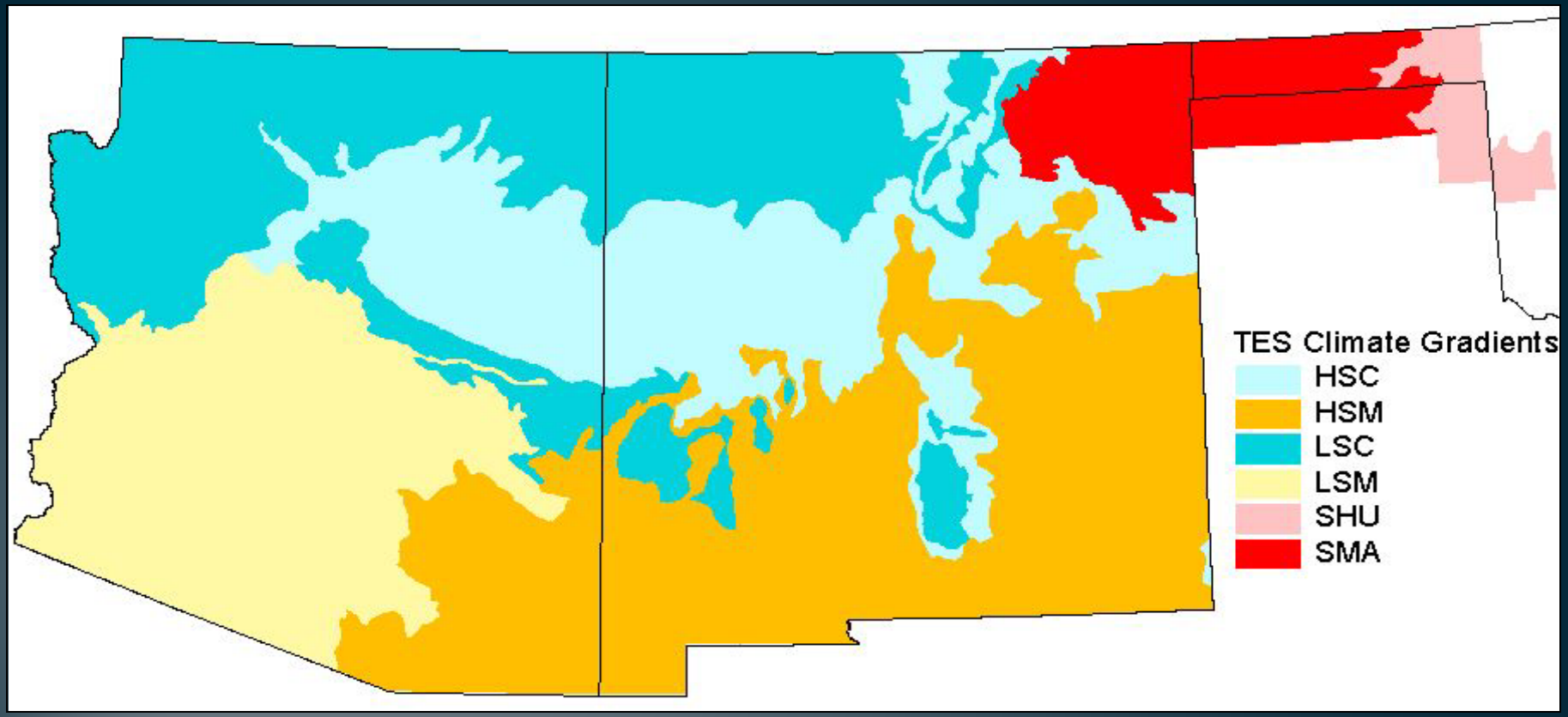
Integrated approach to soil, vegetation and climate data collection, mapping and interpretation

Soil, Vegetation, slope morphometry, geomorphology, geology, disturbance data are recorded at the same place at the same time at every point visited on the ground



Gradient Analysis

- A climatic gradient and climate classification is based upon NOAA weather station data
- Correlates soil moisture and temperature regimes to climate classes from established studies
- Correlates indicator plant species and plant communities to climate classes and diagnostic soil properties within those climate classes



Ecological Gradient Descriptions

LSC -- Low sun cold has >50% of annual precipitation occurs in low sun period, October-March. Soil temperature regime is frigid.

HSC -- high sun cold has >50% of annual precipitation occurs in high sun period, April-September. Soil temperature regime is frigid.

HSM -- High sun mild has >50% of annual precipitation occurs in high sun period, April-September. Soil temperature regime is mesic.

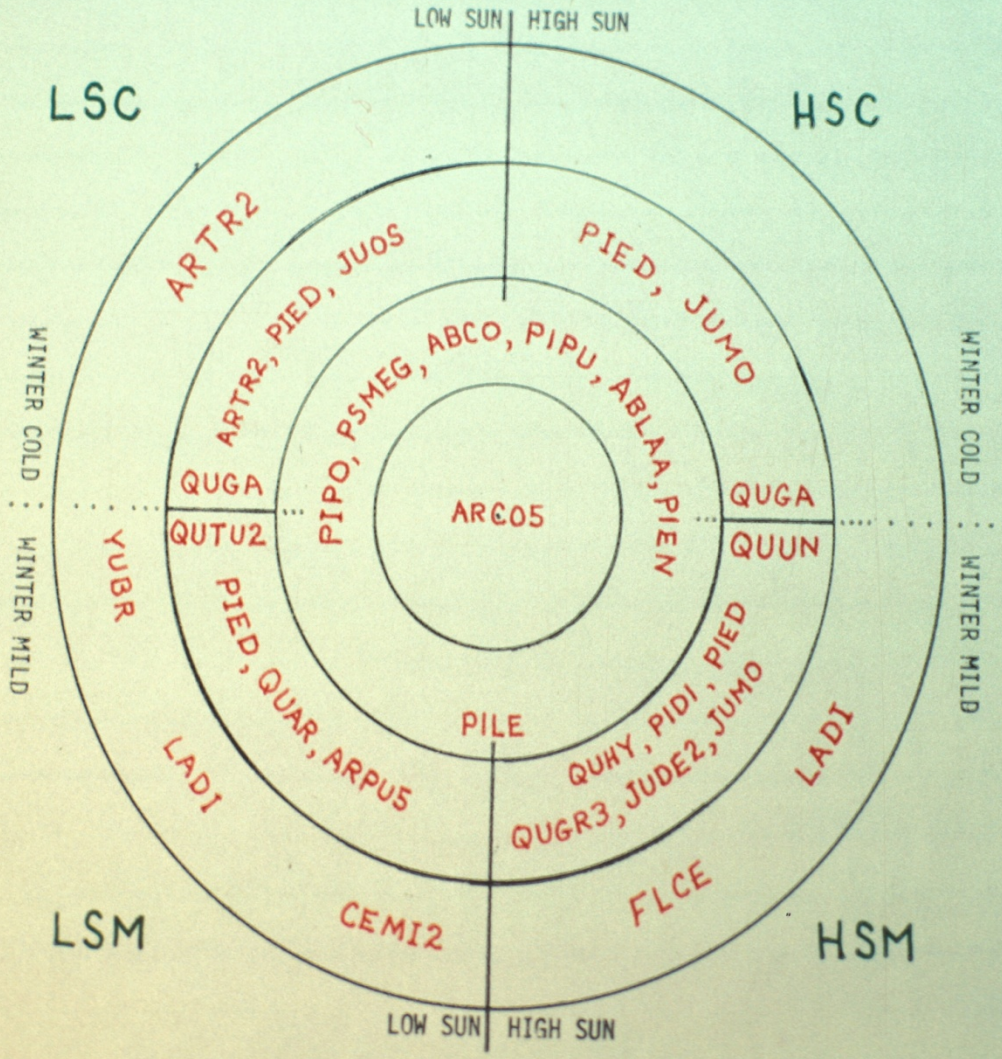
LSM -- Low sun mild has >50% of annual precipitation occurs in low sun period, October-March. Soil temperature regime is mesic.

SMA -- Semi-arid; higher elevation plains that are drier (ustic soil moisture regime) and colder (mesic soil temperature regime).

SHU -- Subhumid; lower elevation plains that are wetter (Udic ustic soil moisture regime) and warmer (thermic soil temperature regime).

CLIMATES OF THE SOUTHWEST

Mean Annual Precipitation
>50%



Climatic Gradient Steps

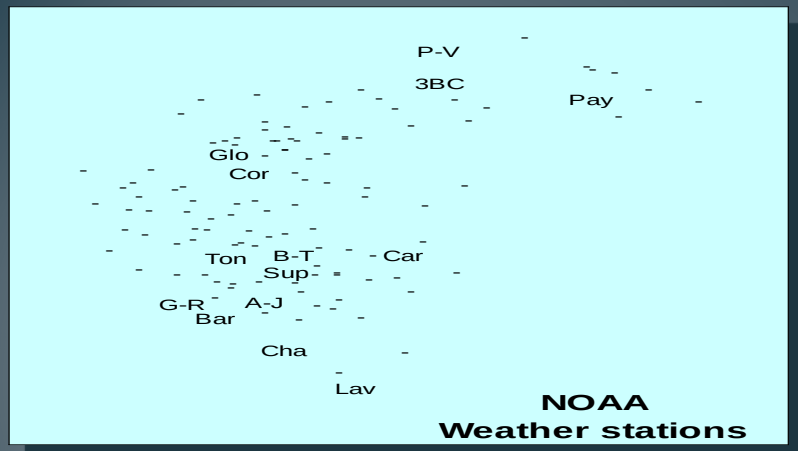
```
                                Climate
Dry                          |         |                                Wet
<----------------------      |   TE    |  ------------------------------->
Hot                          V         V                               Cold
                          Soil <-----> Vegetation

1       2       3          4        5        6        7        8          COLUMN NUMBER

                Herbaceous Woods    Forest   Forest   Forest   Herbaceous CLASS
                    1800      2100     2400     2700     3200     3800    ELEVATION (m)
                      13        10        6        5        2       -2    MAST (deg C)
                      30        40       56       66       76       86    MAP (cm)
                Ustic      Ustic    Ustic    Udic     Udic     Udic       SMR
                Mesic      Mesic    Frigid   Frigid   Cryic    Pergelic   STR
                Bogr2-------->                                            INDICATOR PLANT
                           Jumo------>      Psmeg------>
                                      Pipos-------->            Kobe--->
                                                        Pien---->
```

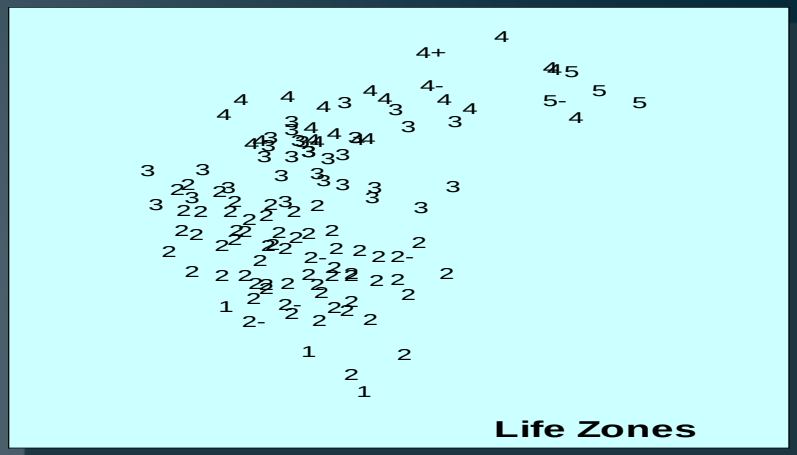
Climatic Gradient Sub Steps

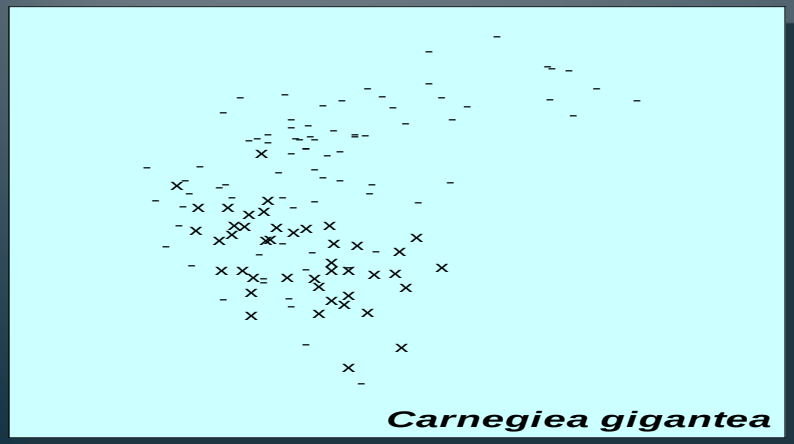
Climatic Gradient Analysis
Cibola Forested Districts

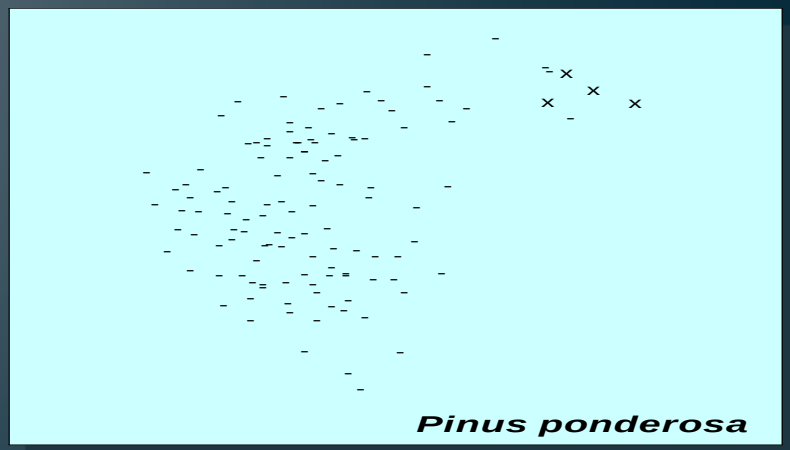
Climate Class	Climate Station	MAP cm	# Wet Days	MLSP %	MAS cm	MASA cm (C or P)	SP	**FFP	MAAT deg C	MMXAAT deg C	MMNAAT deg C	MMXSAT deg C	MMNWAT deg C	MSST deg C	MWST deg C	MAST deg C	*ME m	SMR	STR
HSC4-1	TESH Appnd B	36		40	70			160	10.0						6	11.0	2000 (1950)	ustic	mesic
	Grants Airport NOAA	26.4	60	37	31.0		11/15 to 3/31	137	10.2	20.0	0.6	30.6	-9.0						
	Placitas soil temp/moist													25.2	2.7	13.9		ustic	mesic
HSC40	TESH Appnd B	40		40	80			150	9.0						5.0	10.0	2100 (2200)	ustic	mesic
	Mntair NOAA	36.1	54	34	62.2		11/1 to 4/30	144	10.9	19.8	2.0	30.3	-6.6						
HSC4+1	TESH Appnd B	46		40	90			140	8.0						4.0	9.0	2200 (2200)	ustic	mesic
	Lookout soil remp site													17.0	2.0	9.5			mesic
HSC5-1	TESH Appnd B	50		45	100	15P	12/1 to 3/1	130	6.0					13.0	3.0	7.0	2300 (2275)	ustic	frigid
	Oak Flats soil temp site													14.2	0.4	7.3			

Ordination Analysis for Weather Stations, life zones and species for the Low Sun Mild Climatic Gradient



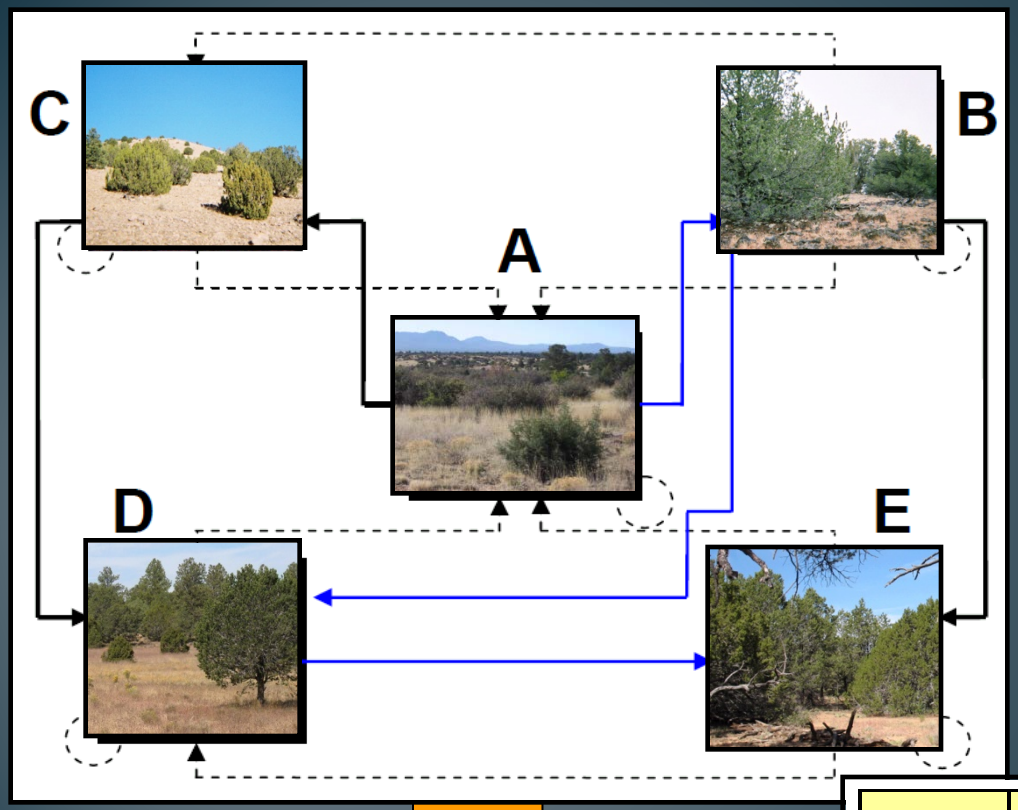






Pinyon-Juniper Grass Reference Condition

State-and-Transition Modeling



VDDT model outputs

State	Historic Mean*	Description
A	5	Post replacement
C	25	Mid-open
D	50	Late-open
B	10	Mid development closed
E	10	Late-closed

Primary Climax

- **Edaphic Climax**

  Typic Haplustalf, LSM 4, 0, loamy-skeletal, mixed, mesic,

  Pifa/Juos/Qutu2/Aprpu2

Disclimax Class

- **Edaphic-zootic disclimax**
  The community derived from which the dominant herbivore and the modified vegetation form a dynamic and interlocking system.

Disclimax Class

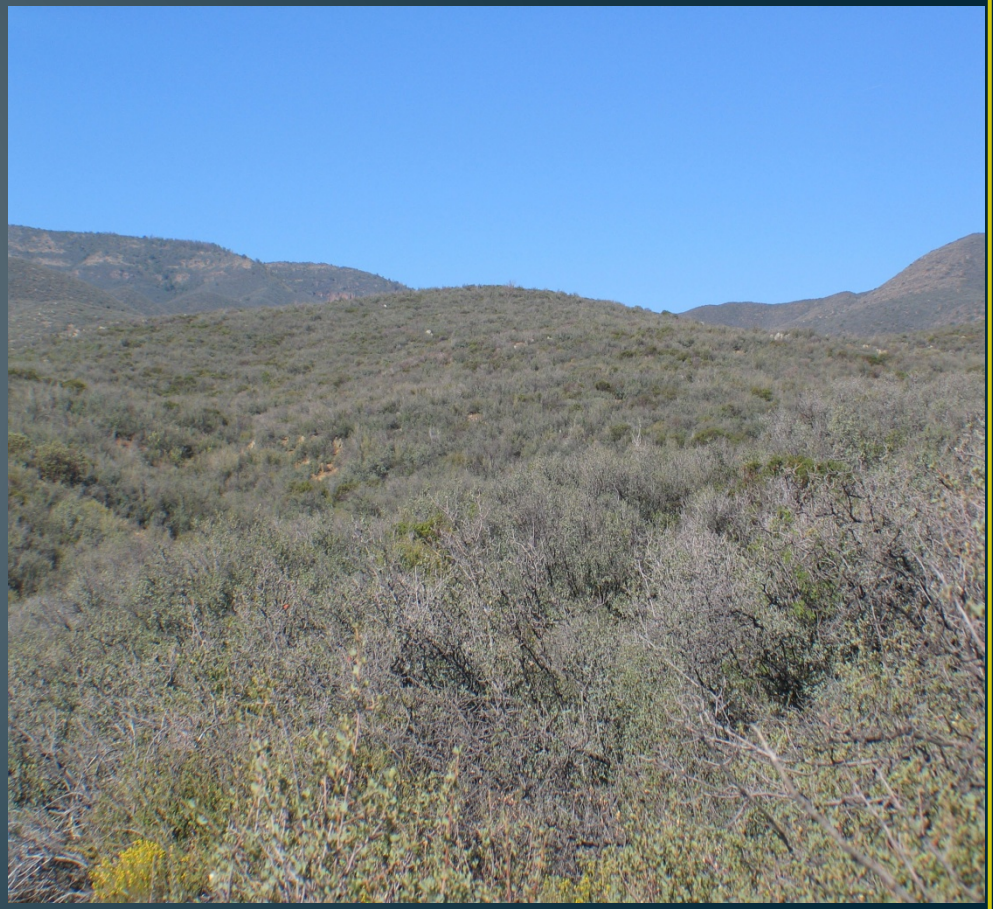
- **Edaphic-fire disclimax**

  A community that exhibits vegetative composition and structure only as a consequence of episodic burning.

Fire Climax

- **Fire Climax**

  A community that maintains its composition and structure only as a consequence of periodic or recurrent burning.



OBSERVATION FORM

USDA Forest Service	**Map Unit Observations**	R3-FS-2500-9 (1/09/03)
Map Unit Symbol: 148	**Terrestrial Ecosystem Survey Area:** Carson National Forest	

1	Flight/Aerial Photo/Stop: 152/199-27/1	**By:** SHS	**Date:** 04/05/03	**NRIS Data Entry:**
Soil Taxon: Typic Argiustolls, fine, mixed, superactive, mesic HSC 4, 0	Phase: loam, mod. deep		**GPS File:** R041514	**By:** -- **Date:** --
			UTM (N)**:** 4013118.26	
			UTM (E)**:** 673703.58	

GD (%): 22	Vegetation Taxon: Pied/Jumo/Qupa4		Climax Class: edaphic	BA(%) 5
AS (deg): 96	LsT: --	Diagnostic Soil Properties:	Notes: Pedestals up to 2 cm tall, some tree roots exposed. Mistletoe infestation.	LT(%) 20
SL (m): 25	Lf: TIBL	A – 0-6, CL (30), GR, 10 YR 3/2 NE		RF(%) 20
EL(m): 1820	ELf: --	Bt1 – 6-20, SC (38), 10 YR 3/3 NE		RO(%) --
GP: TE	CLf: MOSL	Bt2 – 20-56, SC (42), 10 YR 4/3 NE		BS(%) 58
SP: BS	PM: UP	R-56, hard sandstone bedrock		CR(%) 2
PM (k/o): RESI/SANS				OS(%) 35

Pied	20	Cemo	2					Erja	2	ASTRA	T			Bogr2	10						
Jumo	8	Rhtr	1					Hyfi	.3	Peba	T			Lyph	2						
Jude2	2	Qupa4	10					Chgr	.1					Pifi	1						
		Oppo	.2					Badi	.2												

Ecological Type Reference Location Criteria

- ❑ Site is stable
- ❑ Site is functioning
- ❑ Site is diverse in species composition and structure

SITE FORM FRONT TOP

USDA Forest Service	ECOLOGICAL SITE DESCRIPTION	R3-FS-2500-6 (March 2003)
Map Symbol: 148 **Component:** 0.1	**Representative for Map Unit:** X **Taxon:** X	**Soil Taxon:** Typic Argiustolls, fine, mixed, superactive, mesic HSC 4, 0
By: SHS	**Date:** 4/05/03	**Phase:** CL MD
NRIS Terra Data Entry - Date: -- By: --		**Vegetation Taxon:** Pied/Jumo/Qupa4
Plot - Shape: circular		**Climax Class:** edaphic; **MAP** (cm): 42
Dimension: 375 sq m		**Plant Association:** Pied/Qupa4
Flight/Photo/Stop: 154/199-45/2		**Stone Boulder Class:** - - ; **Surface Morphometry** - Gradient (%): 26
GPS File Name: R041513	**DC:** x **AVG:** x	**Erosion Kind:** S ; Aspect (deg.): 96 Length (m): 25
UTM: N3990396.88, E580386.37		**Erosion Degree Class:** 2 ; Elevation (m): 1876 Complexity: S
Township: 21N **Range:** 27E	**Section:** 18	**Drainage Class:** WD ; Slope Shape - Horizontal: LI
State: N.M.		**Surface Runoff Class:** VH ; Slope Shape - Vertical: LI
County: Rio Arriba	x	**Formation:** Kdp,Dakota sans ; Slope Position: BS Position Modifier: UP
Forest: Carson N.F.		**Parent Material** - Kind-Origin: RESI-SANS
District: Tres Piedras		**Site Geomorphology** - GP: TE LsT: --
********** *******		Lf: TIBL ELf: -- CLf: MOSL

SITE FORM FRONT MIDDLE

Horizon/Layer			USDA Texture	Rock Frag	Color	Struc	Surface Features	Consist	Pores	Roots	Reaction	Accessory Properties
Symbol	Depth Thick cm	Bdy	Tex Mod Texture % Clay	Gr Cb St By % Vol	p/d p/m c/d r/m	Gr Si Ty	Ki Am Dis Loc	Dr Mo St Pl Ce CA	Qu Si Sh VC	Qu Si Lo	pH CaCO3 Effervesce	Mottles, RMF Stress Features Concentrations
A	0-5 5	AS	GR CL 30%	18 -- -- --	10YR 5/2 3/2 5/2 3/2	2 VF GR	----------	S VFR MS MP	-------	3 VF T	7.8 NE	----------
Bt1	5-25 20	CW	GR SC 36%	20 – -- --	10YR 5/3 3/3 5/3 3/3	2CO PR 2M SBK	CLF, M, D, PF	HA, VFI, VS, VP	2, VF TU, L	2 VF 1 F 1 M, CO	8.0 NE	----------
Bt2	25-56 31	AW	GR SC 42%	30 – --- ---	10YR 6/6 4/6 6/6 4/6	2CO PR 2M SBK	CLF, M, D, PF	HA, VFI, VS, VP	2, VF TU, L	2 VF 1 F 1 M, CO	8.4 SL	CAM, f, 1, P, S, MAT
R	56+	--	Hard Sndst bedrock									

SITE FORM FRONT BOTTOM

Diagnostic Surface Epipedon: Mollic			Thickness:	0	to	25	cm
Diagnostic Subsurface Horizon: Argillic			Thickness:	5	to	56	cm
			Thickness:		to		cm
Control Section: 50 cm	Av. Clay (%) 41	Av. Rock Frag. (%) 26	Thickness:	5	to	55	cm

Notes: Depth to bedrock varies from 52 to 63 cm in the pit.
Pedestals from .5 to 2 cm in height are common. Rills are present.

Bt2: OSF, F, D, PF

SITE FORM BACK TOP

VEGETATION

Vegetation Cross Reference:

Trees		Shrubs						Forbs						Graminoids		
Species	%CC	Species	%CC	Ht	Species	%CC	Ht	Species	%CC	Ht	Species	%CC	Ht	Species	%CC	Ht
Pied	20	Cemo	3	74				Erja	.3	2				Bogr2	15	22
Jumo	6	Qupa4	10	52				Hyri	.5	18				Lyph	2	17
Jude2	1							Badi	.2	26				Pifi	3	26
								Chgr	T	10						
								ASTRA	P	6						
Totals	27	**********				13		**********				1.0		**********	20	***

Disturbance		Treatment	
Category	Agent	Category	Type
42 70	42000 7000	43 71	43000 71002

Notes: Some forbs just emerging, not able to identify.
Some mistletoe present on Pied outside of plot.
Pifi occurs under tree canopy.

SITE FORM BACK BOTTOM

Surface Components	Ocular
Graminoids (BA)	6
Forb (BA)	T
Shrub (BA)	.5
Tree (BA)	1
Litter (>1.25 cm)	20
Gravel (0.2 – 0.5 cm)	5
Gravel (0.5 – 2.0 cm)	5
Gravel (2.0 - 7.5 cm)	2
Cobble (7.5 - 25.0 cm)	3
Stone (25.0 - 60.0 cm)	--
Boulder (> 60.0 cm)	--
Rock Outcrop	--
Bare Soil	58
Cryptogams	.1
Total	100.6
Overstory Cover	30

Woodland Species Size Class – DRC						
Species	Pied	Jumo	Jude2			****
≤ 0.9"						****
1.0" - 2.9"						****
3.0" - 4.9"						****
5.0" - 8.9"						****
9.0" - 11.9"						****
12.0"- 17.9"						****
18.0"- 23.9"						****
> 24.0"						****
Cords/Acre	8	1	T			****

Forest Productivity – Site Index									
Species	--	--							
Height	--	--							
Age	--	--							
SI	--	--							
Avg SI	--	**********			**********			**********	

Microbiotic Organisms	Ocular
Mosses	
Lichens	.1
Liverworts	
Algae/Cyanobacteria	

Woody Material Size Class			
< 3"	10	9"-11"	
3"-5"	2	11"-13"	
5"-7"	3	13"-15"	
7"-9"	1	> 15"	

Cacti Species Height Class			
Species			
≤ .1m			
.1m - 1m			
1m -2m			
2m -4m			
4m -6m			
≥ 6m			
Total			
**********			

Forest Species Size Class – DBH												
Species												
≤ 0.9"												
1.0" – 4.9"												
5.0" – 8.9"												
9.0" – 11.9"												
12.0" – 17.9"												
18.0" – 23.9"												
≥ 24.0"												
Basal Area												

Future Collaboration

- Standardization of reference site selection criteria, protocols, definitions for data collection-New ESD Manual
- Better understanding of the purpose of ESDs and assumptions made in ESD development
- ESD models and interpretations more data driven not solely conceptual
- ESDs comprised of hierarchical classifications at the same levels
- Establish stronger indicators of an ESD-Gradient analysis, common vegetation classification system
- Build on and refine what has already been done. Don't reinvent the wheel.

The End