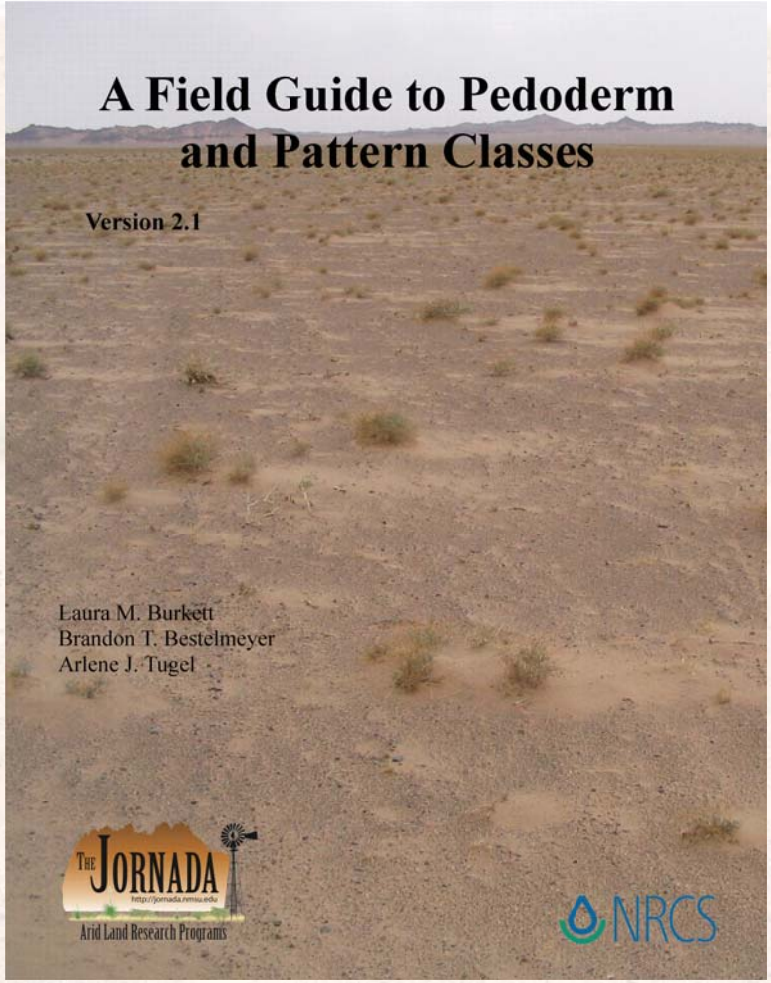
Pedoderm and Pattern Classes



A methodology for rapidly assessing soil surface features and plant patterns that influence ecosystem function.

Pedoderm and Pattern Classes

Three Pedoderm and Pattern Classes:

- Pedoderm Class
- Resource Retention Class
- Soil Redistribution Class

Uses of PPCs:

Extrapolate rangeland health assessments

Alongside soil profile and vegetation data, facilitates the development of ecological site descriptions and state and transition models

Predict responses to management, restoration and natural drivers based on surface soil properties

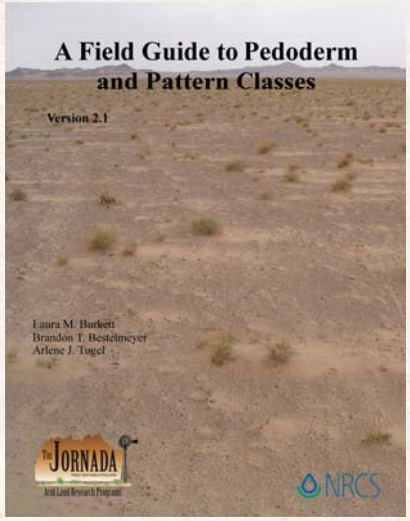
Provide a simple language for describing soil surface features related to ecosystem function

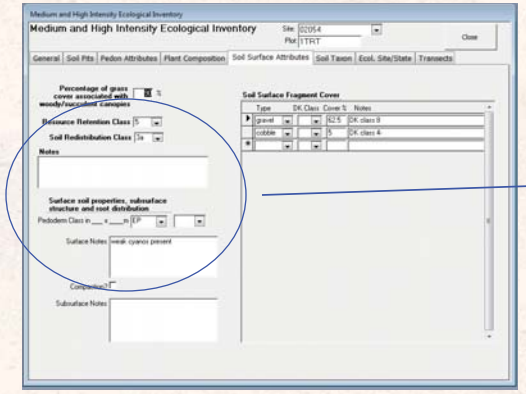
Pedoderm and Pattern Classes

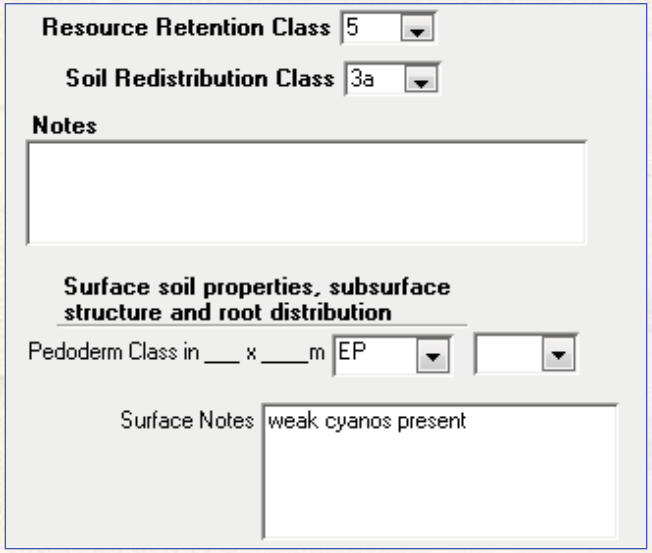
Collaboration between the NRCS and the Jornada Experimental Range

Over a decade of field testing

Currently incorporated in DIMA and NASIS to facilitate use by Soil Survey, BLM and the public







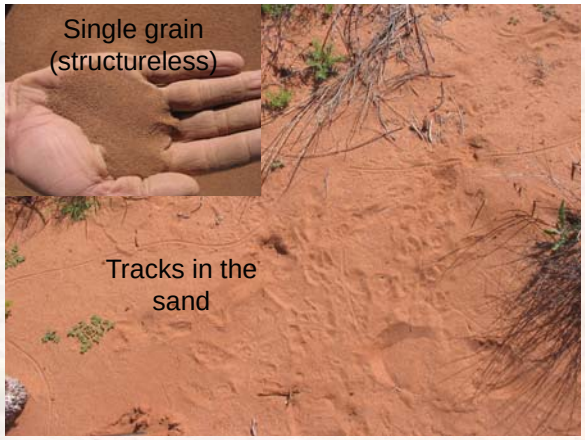
Pedoderm Class (PC)

A description of the air/soil interface (the pedoderm) across a plot.

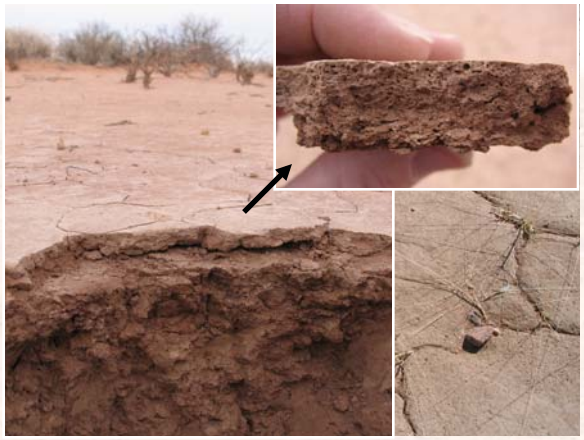
Pedoderm Class (v. 3.0)	select one	[1]Dom Biol Crust	[2]Pedoderm Class Modifier
S = Bare single grain soil; pedoderm is characterized by bare mineral soil and no other class.			
SA = Soil aggregates; well-formed or distinct structural aggregates at the soil surface and no other pedoderm class (well aggregated, but not platy, stable soils).			
RM = Rock mulch with stable soil; surface soil material is trapped and protected by closely spaced and partially embedded rock fragments (mostly cobbles and larger); can be associated with rock outcrops.			
WP = Weak physical or biological crust; none to few cyanobacterial sheaths dangling from ped, no darkening from cyanobacteria.			
SP = Strong physical crust; usually platy or massive, no substantial biological component.			
CEM = Cemented horizon exposed at surface.			
SC = Salt crust of fine to extremely coarse evaporite crystals or visible whitening on the soil surface; may include biological components.			
PDB = Poorly developed biological crust, dense cyanobacterial sheaths form a smooth or dimpled crust of variable darkness; can include other functional/structural groups (algae, lichen, moss).[1]			
SDB = Strongly developed biological crust, typically two or more functional/structural groups (cyanobacteria, algae, moss, lichen) form a rugose, pinnacled or rolling crust.[1]			
CB = Cracking or curling, rubbery algal crust, with or without lichen.[1]			
EP = Erosion pavement; a lag of rock fragments remaining after erosion and removal of finer soil material, forming a dense uniform pavement; individual fragments may be displaced during runoff events.			
DP = Desert pavement; a concentration of closely packed and varnished rock fragments at the soil surface, embedded in a vesicular crust.			
D = Duff; non-decomposed to fully decomposed plant and organic matter located above the A horizon (a patchy or continuous O horizon).			

[1] List 1-2 dominant biological crust functional/structural groups from this list: CY (Cyanobacteria), LC (Lichen Crust), M (Moss), LV (Liverwort), A (Algae).
[2] Pedoderm Class Modifier: So = Loose soil over a pedoderm class.

Pedoderm Classes Common in This Area



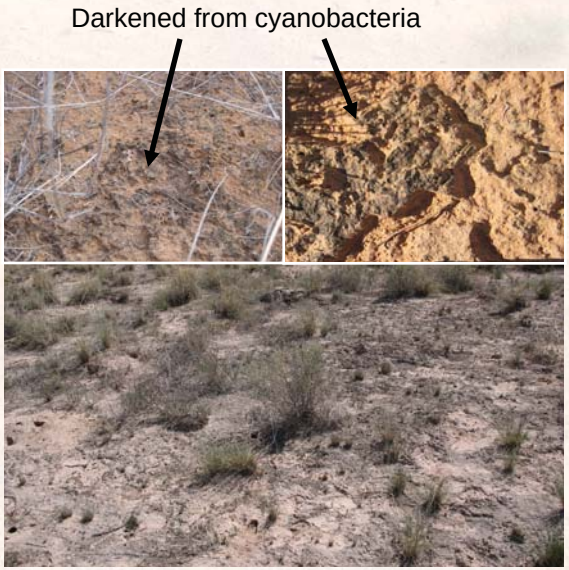
S – Bare single grain soil



SP – Strong physical crust

RM – Rock mulch with stable soil

WP – Weak physical or biological crust



PDB – Poorly developed biological crust

EP – Erosion pavement

Resource Retention Class (RRC)

A description of the spatial patterning of persistent vascular plant patches and interpatches across a plot.

Resource Retention Class (v. 3.0)

	select one	
1. Interconnected persistent plant cover or dense bunchgrasses and surrounding round interpatch areas <30 cm.		**Notes:**
2. Persistent plants interconnected and surrounding round/oval interpatch areas >30 cm.		
3. Persistent plant patches fragmented by elongated interpatch areas that are bounded in the plot.		
4. Persistent plant patches fragmented by elongated interpatch areas that cross through the plot.		
5. Interpatch areas interconnected and crossing the plot in several directions; isolated persistent plant patches.		
6. Interpatch areas interconnected; scattered or no persistent plants.		
Describe persistent plant patch composition:		

Resource Retention Classes

1. Interconnected persistent plant cover or dense bunchgrasses and surrounding round interpatch areas <30 cm.

2. Persistent plants interconnected and surrounding round/oval interpatch areas >30 cm.

3. Persistent plant patches fragmented by elongated interpatch areas that are bounded in the plot.

4. Persistent plant patches fragmented by elongated interpatch areas that cross through the plot.

5. Interpatch areas interconnected and crossing the plot in several directions; isolated persistent plant patches.

6. Interpatch areas interconnected; scattered or no persistent plants.

Soil Redistribution Class (SRC)

A description of the extent and severity of soil redistribution processes (erosion and deposition by wind and water) across a plot.

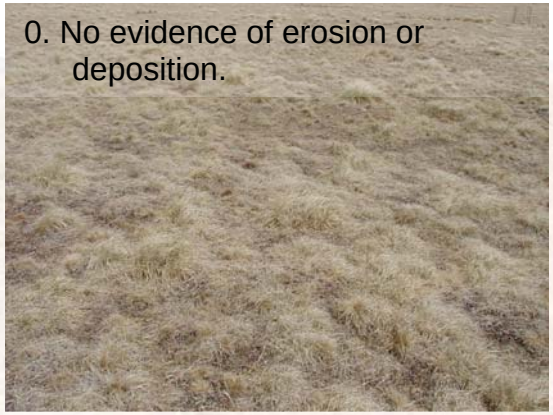
Soil Redistribution Class (v. 3.0)

	select one	
0. No evidence of erosion or deposition.		**Notes:**
1. Very slight soil redistribution.		
2. Patchy, slight (<5 cm) soil loss and deposition[3, 4].		
3a. Extensive, moderate soil loss (<10 cm)[3,4].		
3b. Extensive, moderate soil redistribution (<10 cm)[3,4].		
4a. Extensive, severe erosion (>10 cm); little deposition.		
4b. Extensive, severe erosion (>10 cm) with patchy sediment deposition[3,4].		
4c. Extensive, severe sediment deposition (>10 cm)[3,4].		

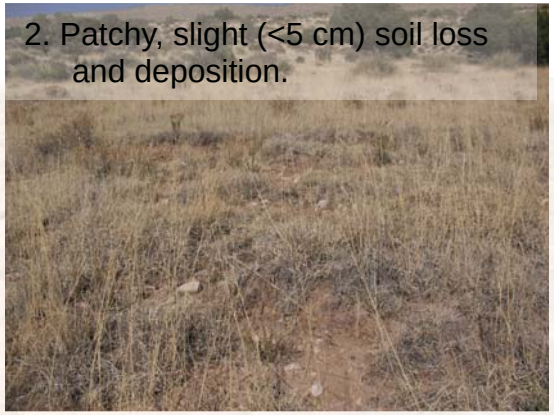
[3] Depositional mounds are formed by the settling of sediment transported by wind and water movement; mounds can occur on or behind obstructions or where wind/water velocity is reduced.

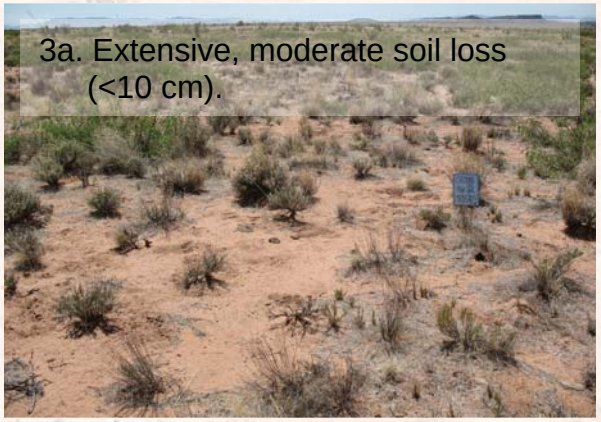
[4] Confirm deposition within a soil pit. Recently deposited material is usually seen as a thinly or finely stratified soil surface with alternating thin layers of varying textures; lacks structure.

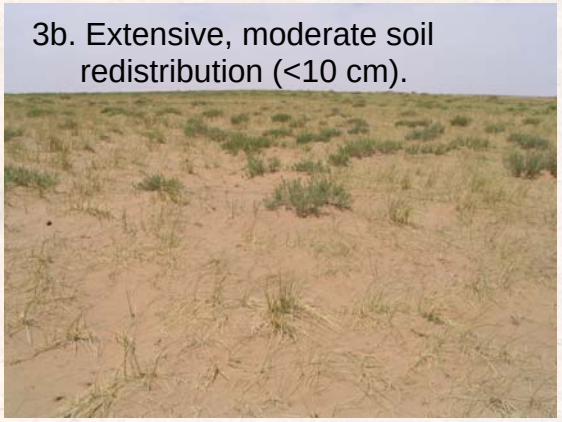
Soil Redistribution Classes

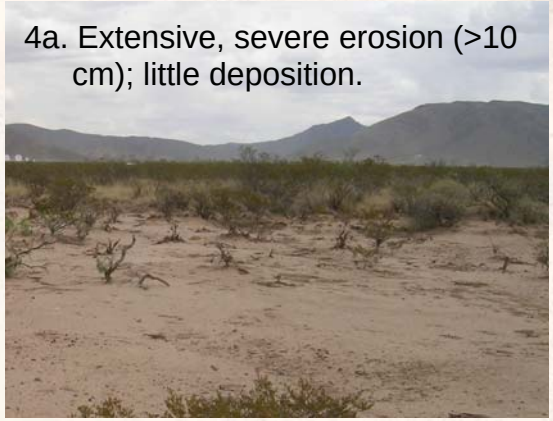

0. No evidence of erosion or deposition.

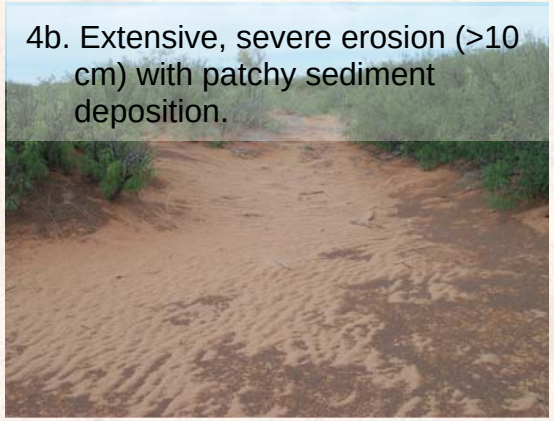

1. Very slight soil redistribution.


2. Patchy, slight (<5 cm) soil loss and deposition.


3a. Extensive, moderate soil loss (<10 cm).

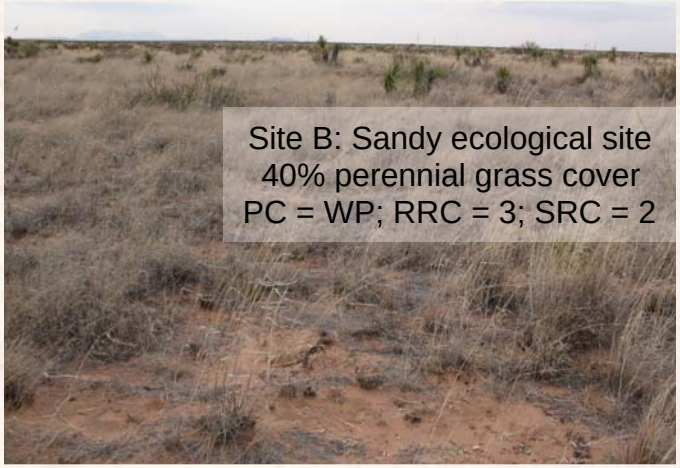

3b. Extensive, moderate soil redistribution (<10 cm).


4a. Extensive, severe erosion (>10 cm); little deposition.


4b. Extensive, severe erosion (>10 cm) with patchy sediment deposition.


4c. Extensive, severe sediment deposition (>10 cm).

Distinguishing Community Phases within Ecological States: PPCs + Soil and Plant Data



Conclusion: Site B is at a greater risk of erosion and subsequent grass loss.

Soil profile data: Sandy ecological sites.
Vegetation data: Grassland state.
Site A has more perennial grass cover than Site B
PC: Site A's poorly developed biological crust (PC = PDB) connotes a higher potential for plant establishment, soil and nutrient retention and water infiltration compared to Site B's WP pedoderm (weak physical/biological crust).
RRC: The larger, elongated interpatches of Site B (RRC = 3) infer a lower resistance to wind and water erosion compared to that of Site A (RRC = 1).
SRC: Site B's SRC (2) indicates reduced soil stability compared to that of Site A (SRC = 0).

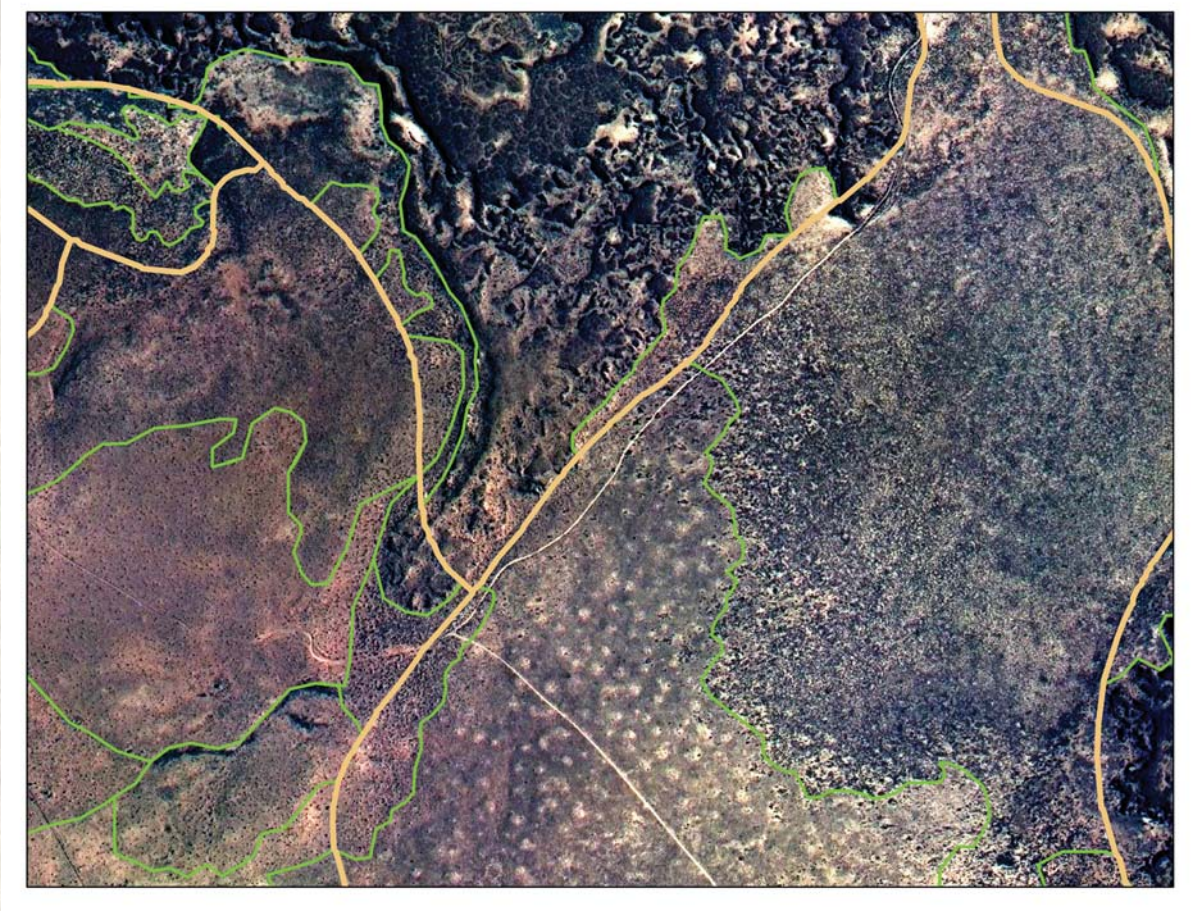
PPCs and Ecological States: State Mapping Traverse Data

Hills ecological site
Altered savanna (270)
1% cover perennial grasses
PC: EP with CEM
RRC: 6
SRC: 4a

Hills ecological site
Savanna with PRGL2 (350)
40% cover perennial grasses
PC: EP
RRC: 3
SRC: 3a

What is ‘state mapping’?

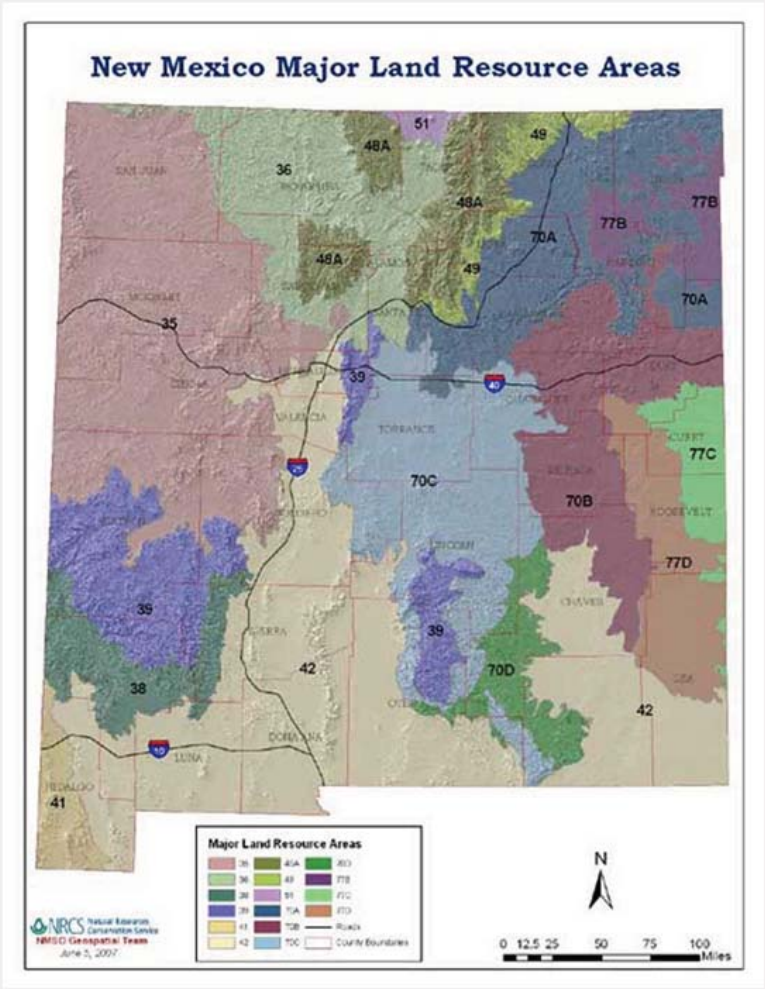
- A spatial representation of vegetation states by ecological site



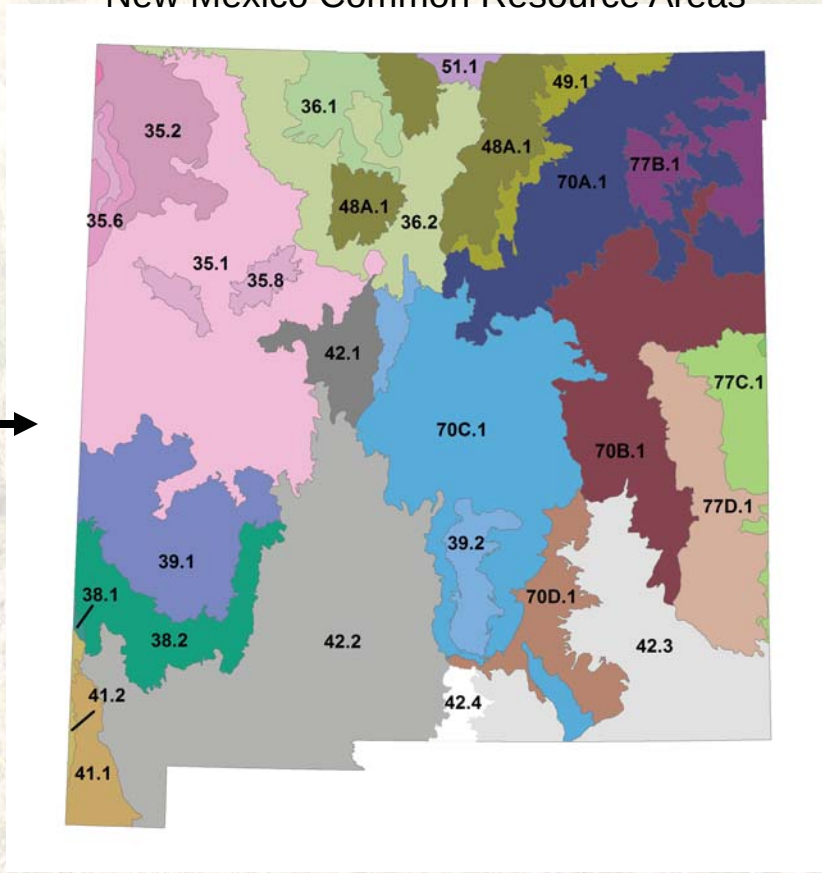
Soil Map Units / Ecological Site Associations

Ecological States

NRCS Major Land Resource Areas and Common Resource Areas

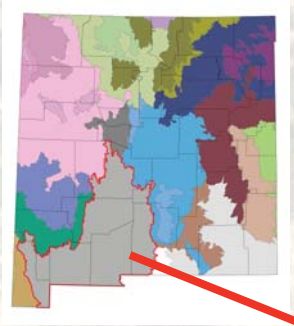


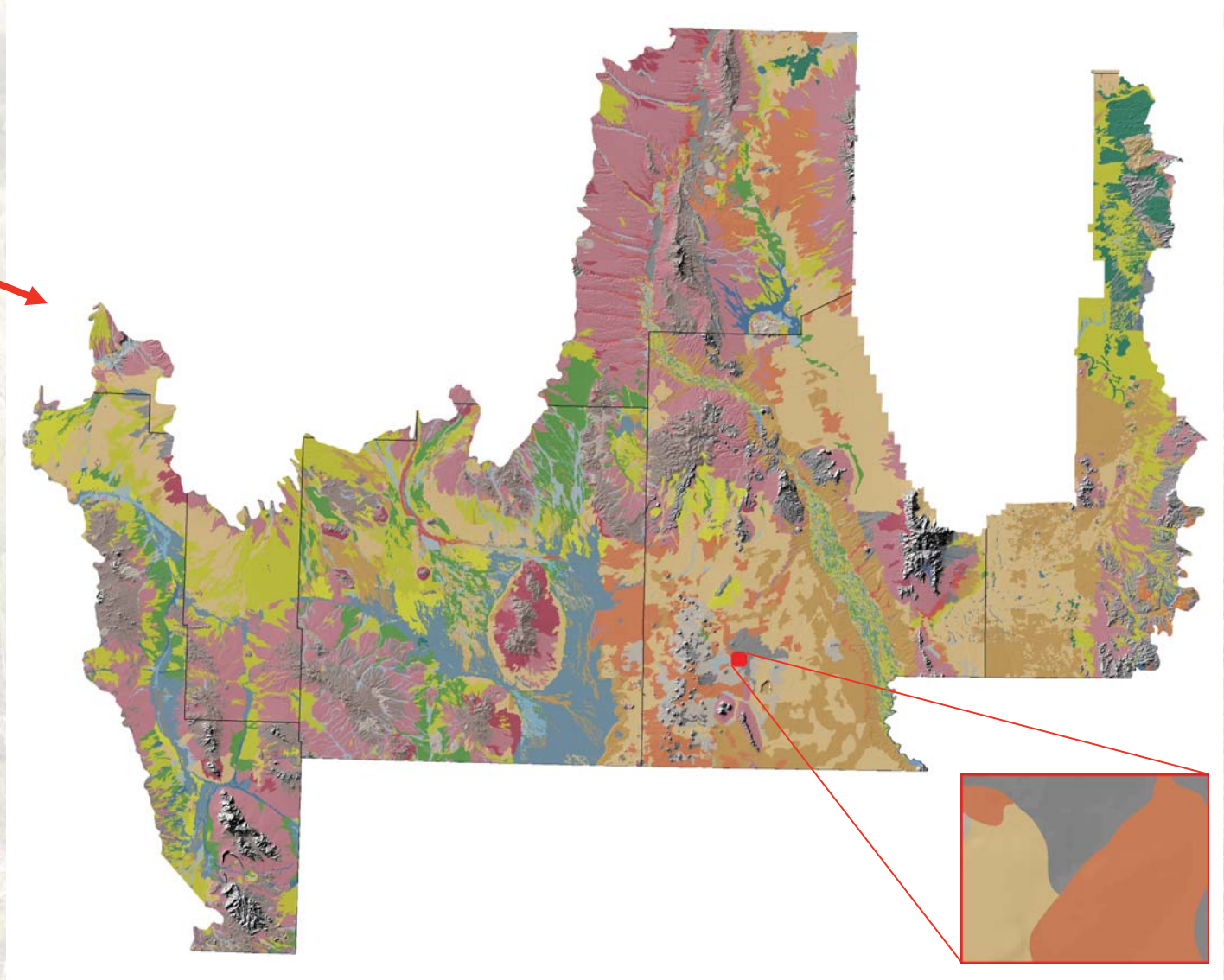
New Mexico Common Resource Areas



NRCS SSURGO Detailed Soil Map

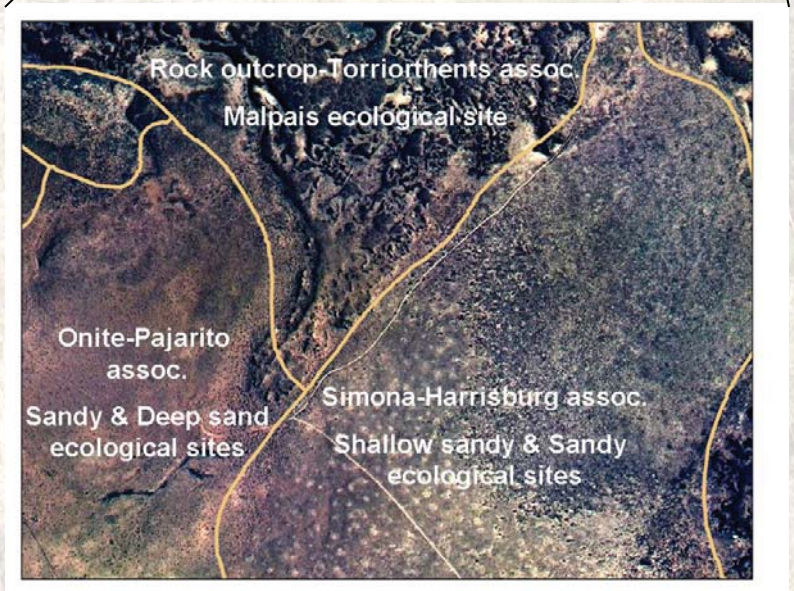
(Intermingled ecological sites or a single site)



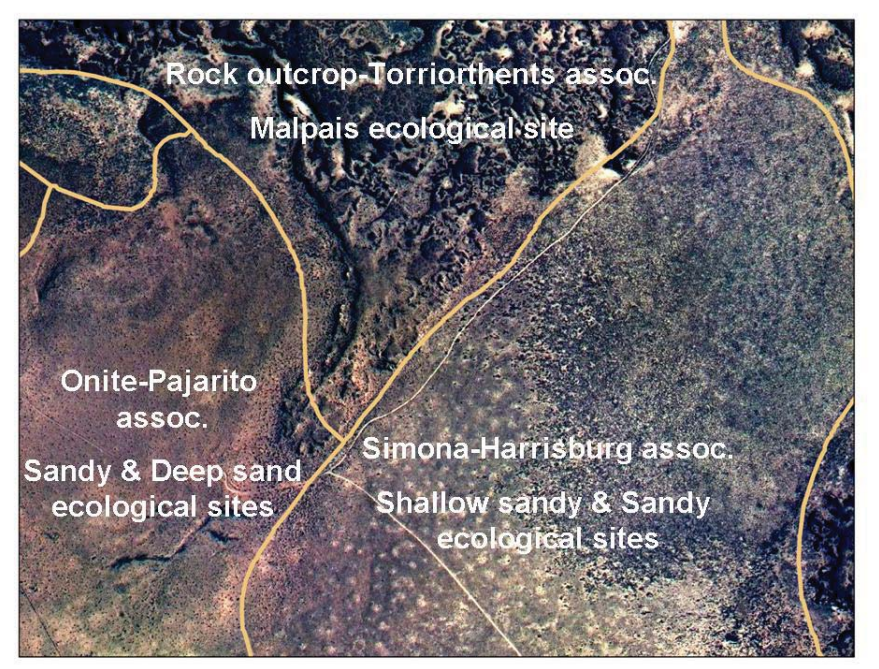


Obtain or Create Spatial Data Linking Each Soil Component within an NRCS SSURGO Soil Map Unit (SMU) to its Correlated Ecological Site

Soil Series/Phase	Correlated Ecological Site
Simona sandy loam	Shallow Sandy
Harrisburg loamy sand	Sandy
Wink	Sandy
Pajarito	Sandy
Onite	Sandy
Cruces	Shallow Sandy



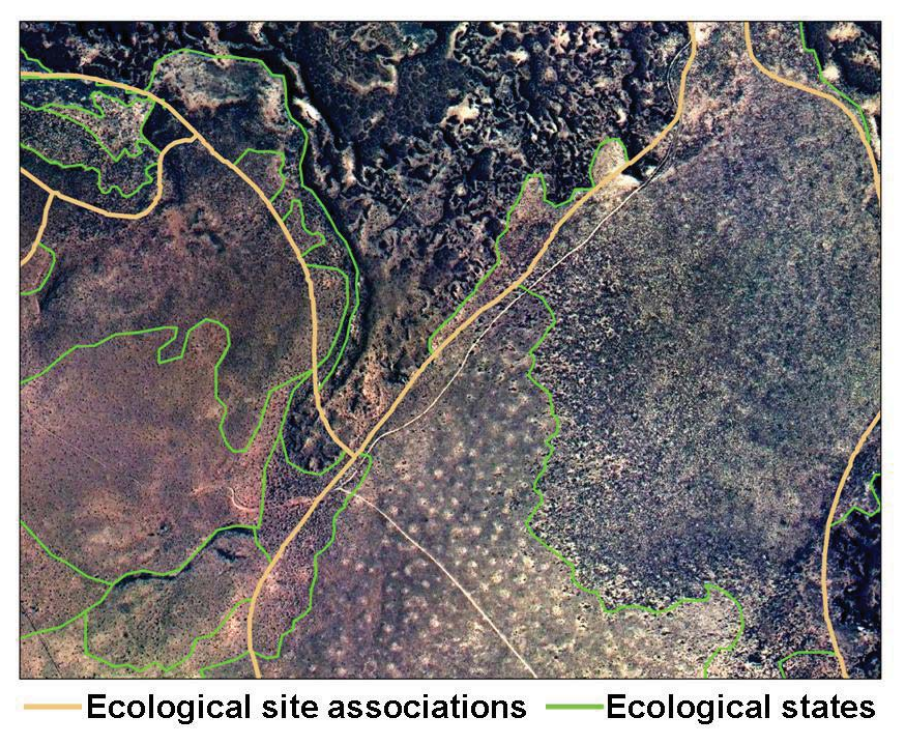
SSURGO Soil Survey + ESDs + STMs + DOQQs



Original SSURGO soil survey lines are preserved during delineation (soil survey polygon = parent polygon)

'State' polygons are delineated within the SSURGO soil survey polygons (state polygons = child polygons)

Delineate State Polygons

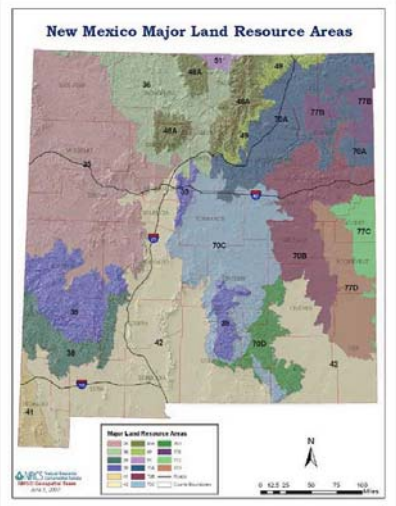


State Codes via Generalized Ecological Sites: MRLA 42 Example

- by Reference State (cover and distribution of plant functional groups)
- by Dominant Processes

Type 1: little woody cover in reference state

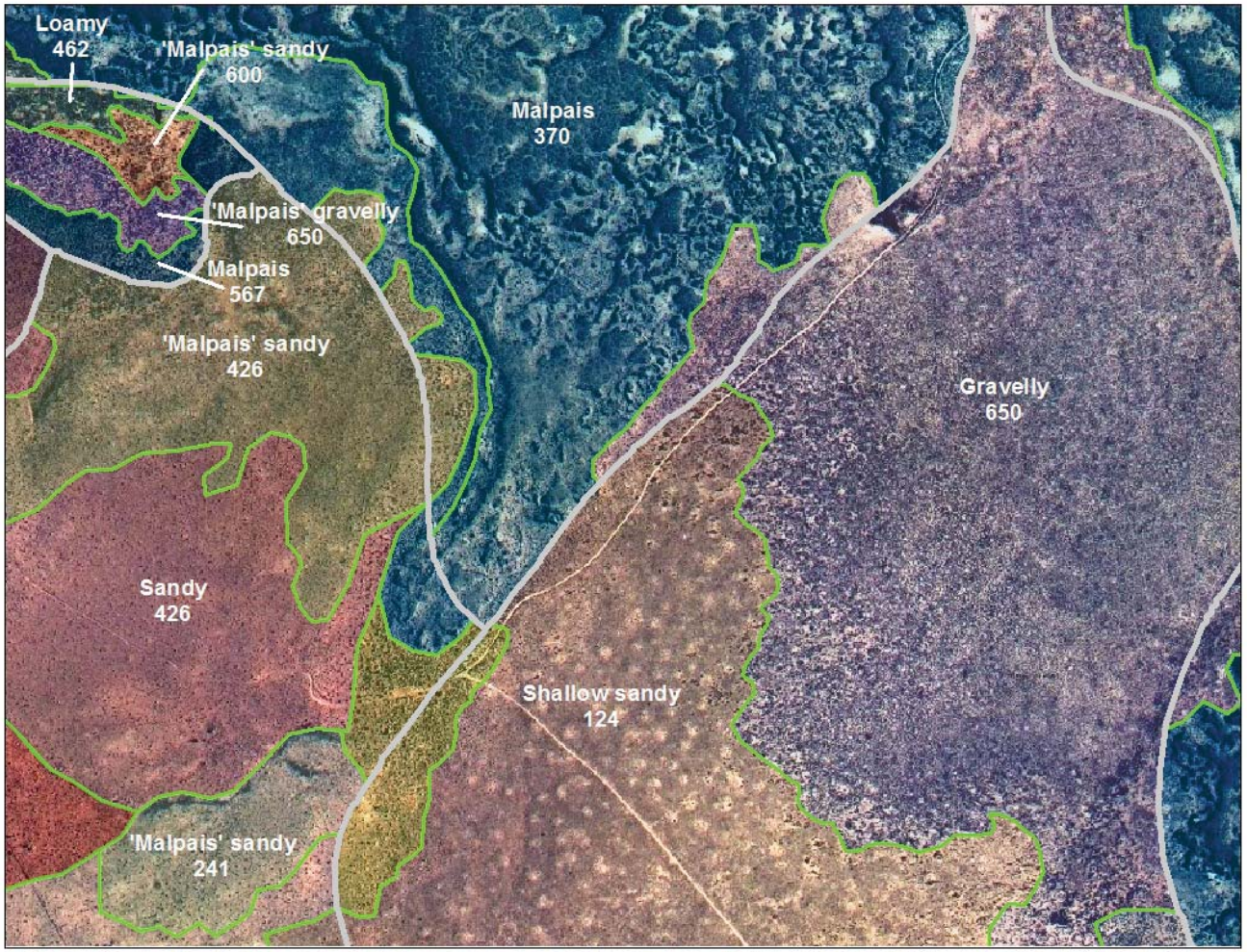
State Code	State Class
1	Grassland
2	Altered Grassland
4	Shrub / Tree- invaded Grassland
6	Shrubland / Woodland
7	Bare / Annuals
8	Exotic-invaded
9	Exotic-dominated



Type 2: reference state includes significant woody and perennial grass cover

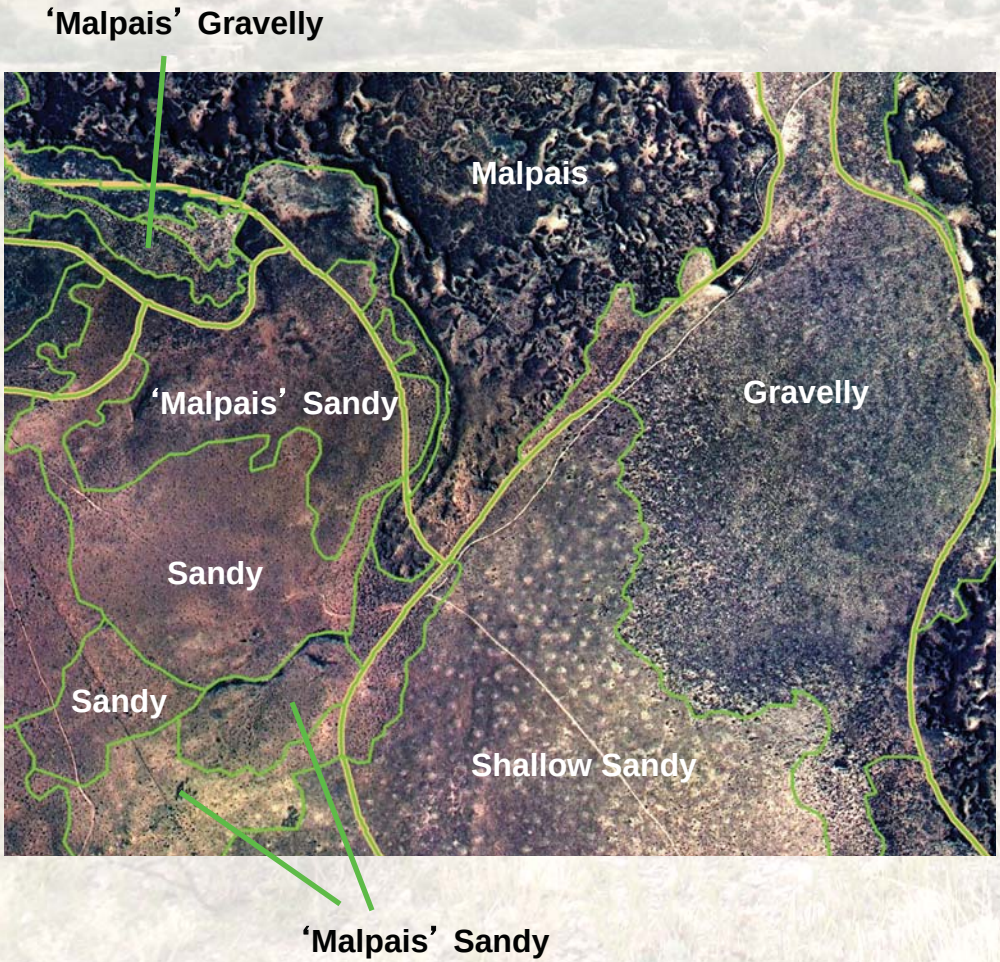
State Code	State Class
3	Shrub / Tree Savanna
2	Altered Savanna
5	Shrub / Tree- Dominated
6	Shrubland / Woodland
7	Bare / Annuals

Products: Spatial data with ecological site name & state code (1:13,000 – 1:16,000)

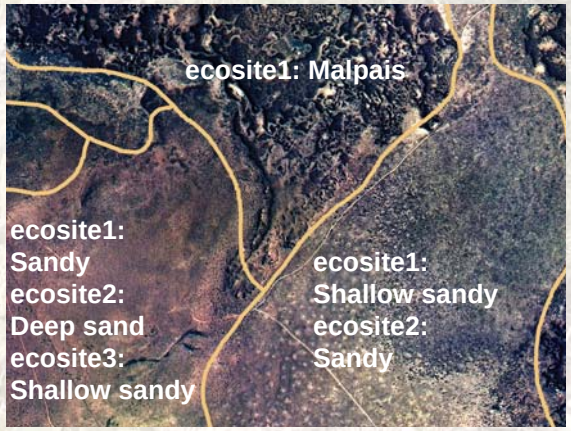


State map preserves original SSURGO soil survey lines (soil survey = parent)
'State' polygons are delineated within the SSURGO soil survey polygons
(state polygons = child polygons)

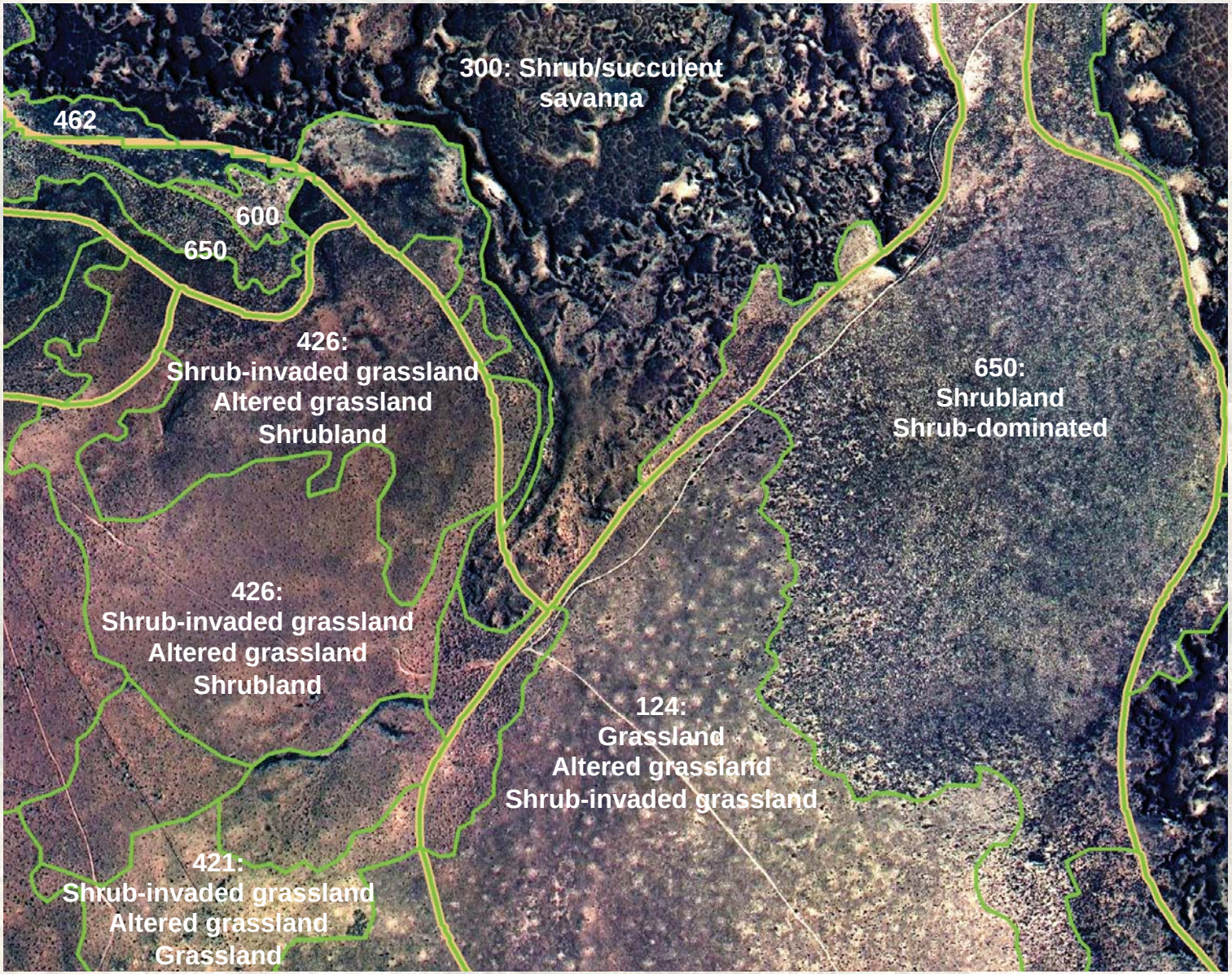
Products: Spatially explicit ecological sites



VS.

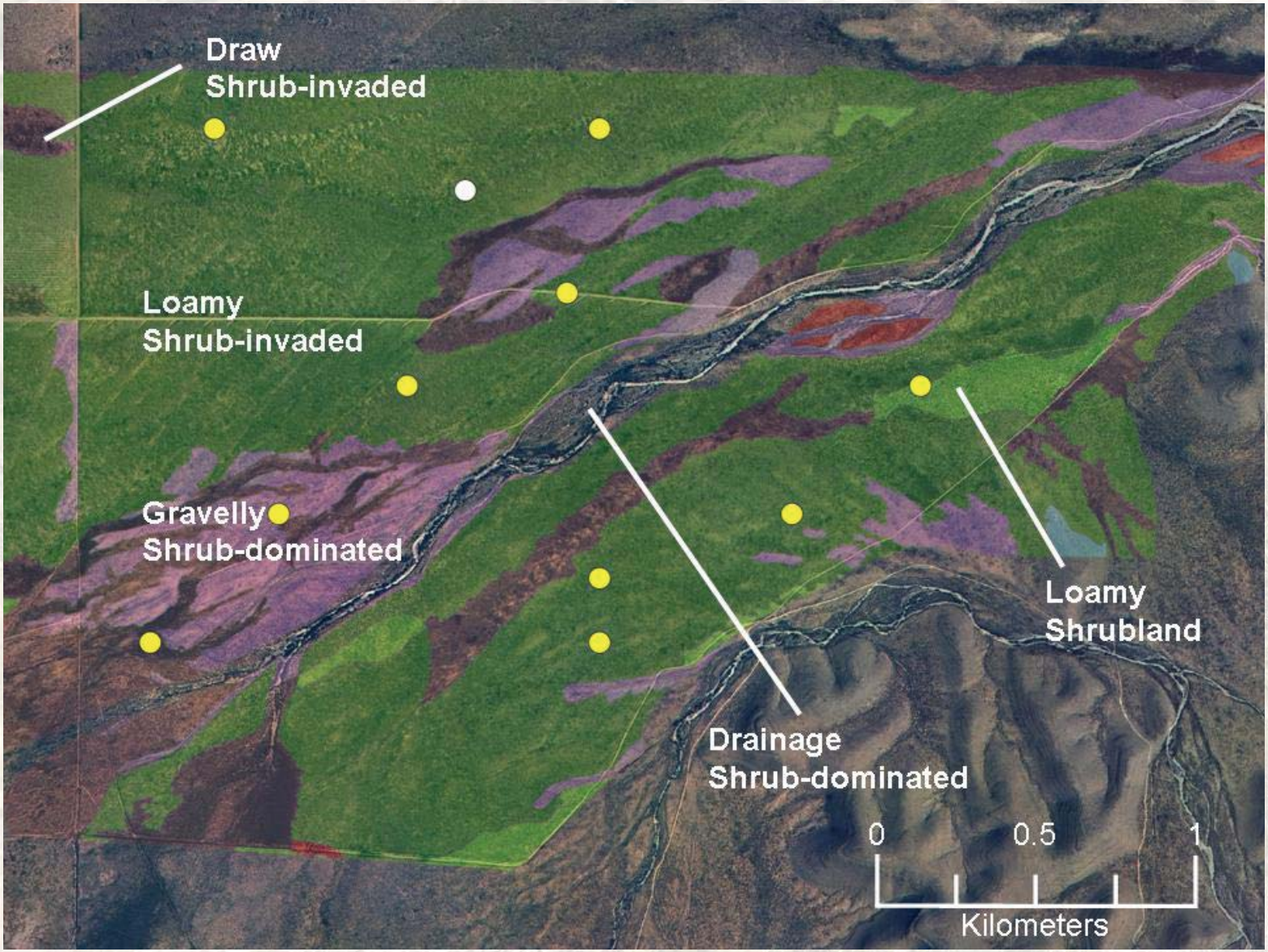


Products: Spatially explicit ecological states



State Map Uses

Management planning: Shrub Removal Treatments



State Map Uses

Spatial Extrapolation of Qualitative Assessments