A Strategy for Coupled Vegetation and Soil Sampling to Develop Ecological Site Descriptions

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The overall strategy

Point-based sampling: connect hard data to hard data

1) Point data to test map unit concepts and design map units

2) Or…revision of map unit descriptions

3) Data driven ecological site distinctions

4) Data-driven state-and-transition model descriptions

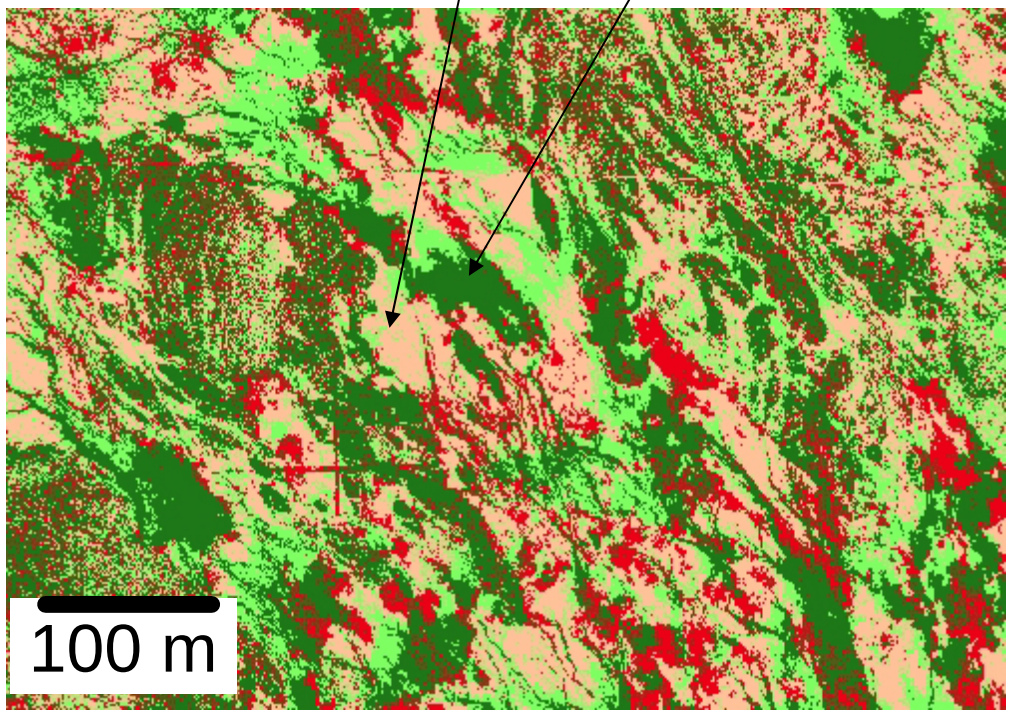
Map unit component sampling: transects of points

5) Representative measurements for diagnostic properties of states within tolerances of site and state concepts

The problem is that soils are patchy and map units are guesses and guides, but not real things

Transition classes

- Persistent bare
- Vegetated to bare
- Bare to vegetated
- Persistent vegetated



Map unit design and ESD and S&T concepts
require climate, vegetation, and soils data related *by location*

Problems:

1) Vegetation data (e.g., NRCS 417 data) nonexistent

2) Vegetation data exists, but not related to soil samples

3) Too few samples to represent LRU -scale variation

4) Neither data type is geolocated

5) Vegetation/cover attributes measured are insufficient

6) No surface soil data, therefore weak connection to rangeland health and state-and-transition models

The solution: coupled vegetation and soil sampling

Elements of a successful approach

1) One or more *range cons* working with soil scientists

2) Range cons that *understand soils*

3) A *vegetation/soil surface sampling protocol* that matches the pace of soil sampling

4) A *coding system* that relates vegetation measurements, soil measurements, and coordinates at points

5) *Many points* with varying levels of detail at a regional scale, rather than a few points with unnecessarily high precision

6) A *database* to house these data and their relationships

A three-level sampling procedure

Based on Presidio County, TX and White Sands, NM Soil Surveys

Low intensity) “Traverse”--low intensity sampling, many points (100s)

- -arbitrary points, often along roads
- -soil to taxon or series or even prelim ecological site
- -vegetation community classes, state class id

Purpose: Initial concept building for map unit design and ESDs, locations for medium intensity samples

A three-level sampling procedure

Low intensity) “Traverse”--low intensity sampling, many points (100s)

Medium intensity) “Transect”—medium intensity sampling, fewer points
- -intervals within replicate map unit representatives
- -can be used to examine causes of vegetation differences within and between map units
- -rapid soil profile information (mini-pit, auger holes)
- -vegetation cover estimates by species, soil surface indicators

Purpose: Data used to create and test vegetation-soil relationships, soil-site correlation, and to develop S&T models and model text

A three-level sampling procedure

Low intensity) “Traverse”--low intensity sampling, many points (100s)

Medium intensity) “Transect”—medium intensity sampling, fewer points

High intensity) “Characterization”—high intensity sampling, few points
-replicate, representative pedons and states
-full soil characterization (232) in trench or pits
-line-point intercept, production, soil stability test
augmented by "tier 2" above

Purpose: Create precise data ranges for reference and alternative states of benchmark soils in ESDs

A general strategy for sampling

1. Rapid reconnaissance of potential map units across LRU (**Low**)

↓

2. How do map units differ, how many community types?

↓

3. Use spatial digital data/remote sensing to stratify landscape/preliminary map units

↓

4. Rapid review of map unit delineations (**Low**)

↓

5. “Transect” a subset of proposed map unit delineations with different communities (at least 3 replicates/community/map unit), id map unit component (**Medium**)

↓

6. Evaluate data: important plant community differences are coupled with:

a) no consistent soil differences=different states

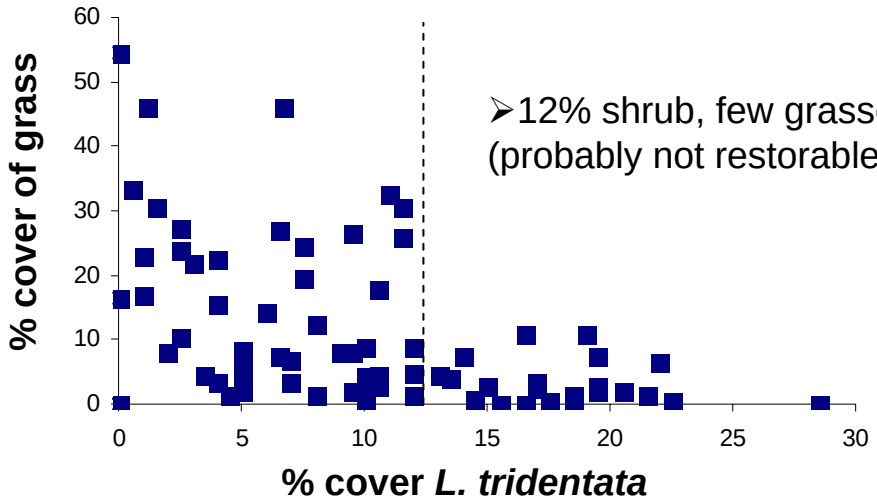
b) distinct soil or climate properties=different LRU and/or ecological sites

↓

7. Select representatives of states within a map unit component for intensive measurement (**High**)

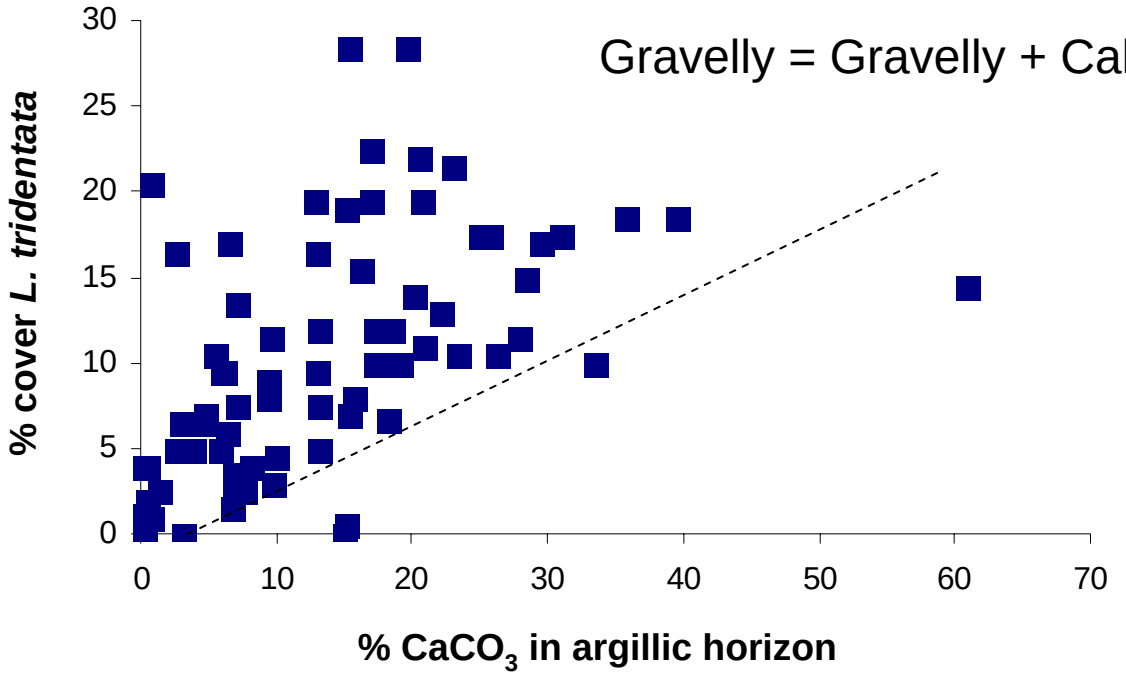
An example: medium/high intensity data used to define states

< 12% shrub,
high or low grasses (restorable when low)



➢12% shrub, few grasses
(probably not restorable)

An example: medium/high intensity data used to reconsider an ecological site designation!



You probably would not be able to do this with transect data, because transects sum across soil variation in map units and produce too few data

Low: Traverse (ESD Quick data form)

Date:	Observers:
Area :	

Point	State/community	MU	Landform	Soil family/characteristics	Series	Easting	Northing	Elevation

Tobosa-honey mesquite community

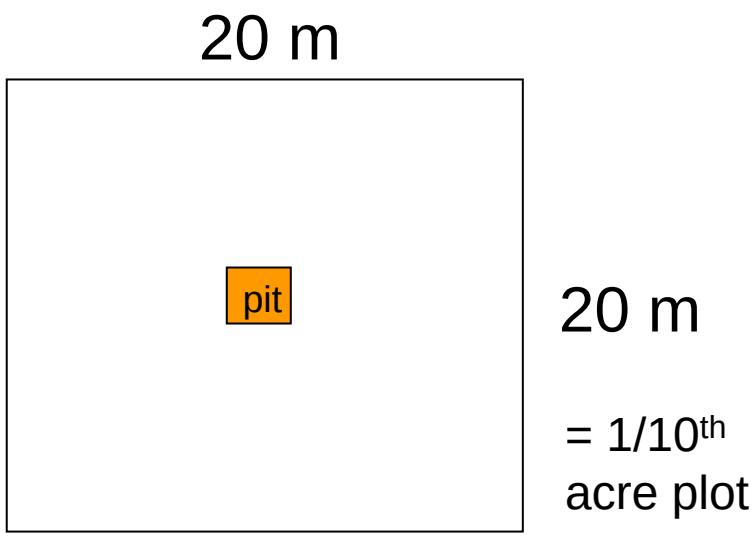
Very rapid identification of plant community from catalog of types generated at S&T workshops or in databases (geolocation also important!)

Medium: Transect (Plant Composition and Pattern form)

Modified Domin-Krajina cover estimate in 20x20 m plot

+--few	1--<0.1%	2--<1%	3--1-4%	4--5-10%	5--10-25%	6--25-33%	7--33-50%	8--50-75%	9--> 75%
+--<0.2m2	1--0.2-0.5m2	2--0.5-4m2	3--4-20m2	4--20-40m2	5--40-100 m2	6--100-132 m2	7--132-200	8-200-300	9--300-380

Woody	Class	**Grass**	Class	**Forb**	Class	**Other**	Class		
						Litter			Percent
						Cryptogram			Scale



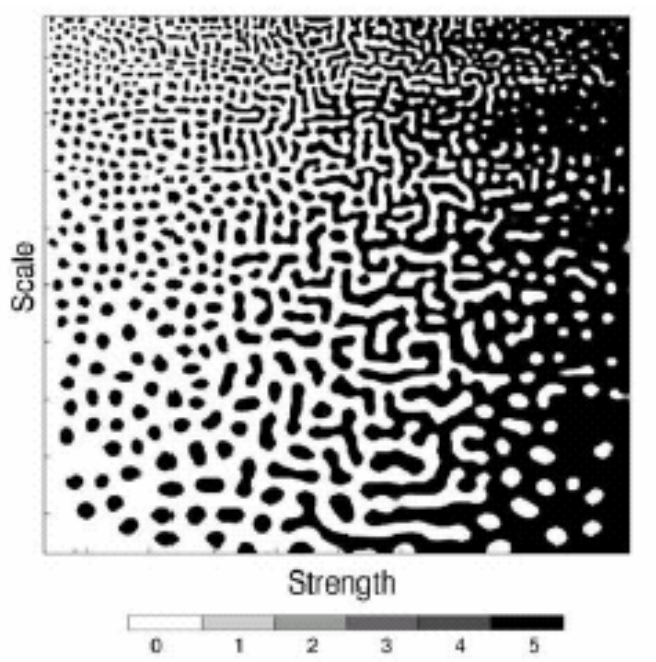
= 1/10th acre plot

Cover estimated ocularly using cover scale within a 20x20 m area around pit, can be performed rapidly during soil survey transecting (15 minutes)

Medium : Transect (Plant Composition and Pattern form)

Resource retention class in 20 x 20 m

Interconnected grass cover or dense bunchgrasses; and surrounding ellipsoid bare patches < 30 cm	
Grass cover interconnected and surrounding ellipsoid bare ground patches from 30-__cm	cm
Grass cover fragmented by elongate bare ground areas to __ cm wide but bounded in plot	cm
Grass cover fragmented by elongate bare ground areas to __ cm wide that across entire width of plot	cm
Bare ground interconnected in several directions and isolated grass patches up to __ cm	cm
Bare ground interconnected with scattered or no grass plants	



from Reitkerk et al., 2004, Science 305: 1926

A simple measure of patch structure that relates to the *potential for erosion*

Relates to Rangeland Health Indicators, but does not compare to a standard (because it is not defined yet)

Used in S&T model text to describe states

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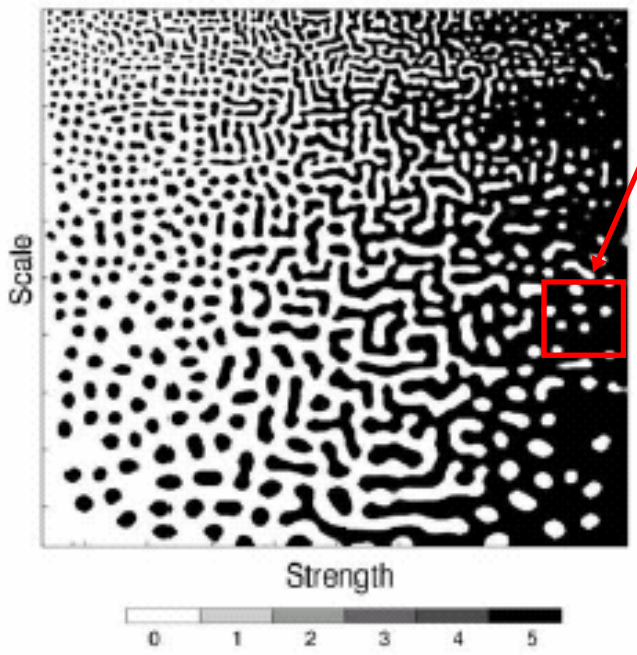

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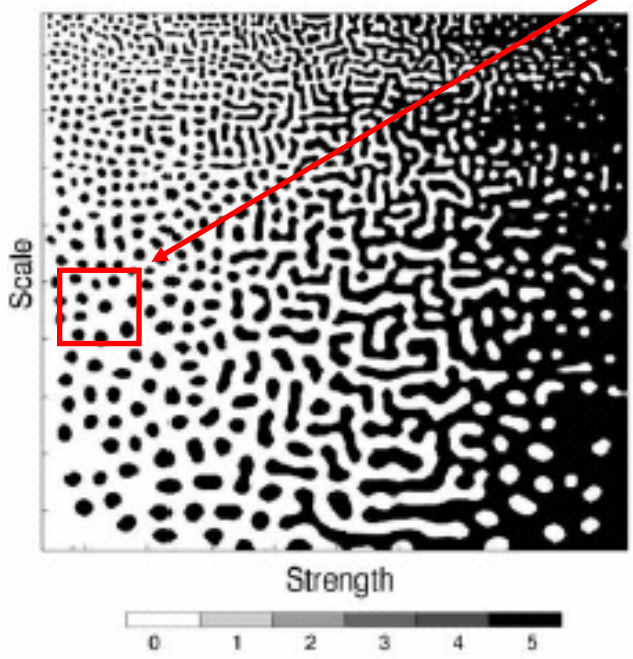

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Medium : Transect (Plant Composition and Pattern form)

Erosion pattern class in 20 x 20 m

	Check one
No evidence of erosion or deposition	
Erosion limited to small (< 50 cm) blowouts or rills, few pedestals	
Erosion across large (> 50 cm) bare patches, gullies, flow patterns, but low soil loss	
Erosion across large areas with minor deflation, coppicing, flow patterns, pedestals	
Erosion across large areas with deflation, coppicing, and truncation of horizons	
Deposition across large areas, may have rills, flow patterns.	

A simple measure of erosion pattern that describes the *consequences of erosion processes for soils*

Relates to Rangeland Health Indicators, but does not compare to a standard (because it is not defined yet)

Used in S&T model text to describe states

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Another simple measure related to rangeland health indicators and used in text

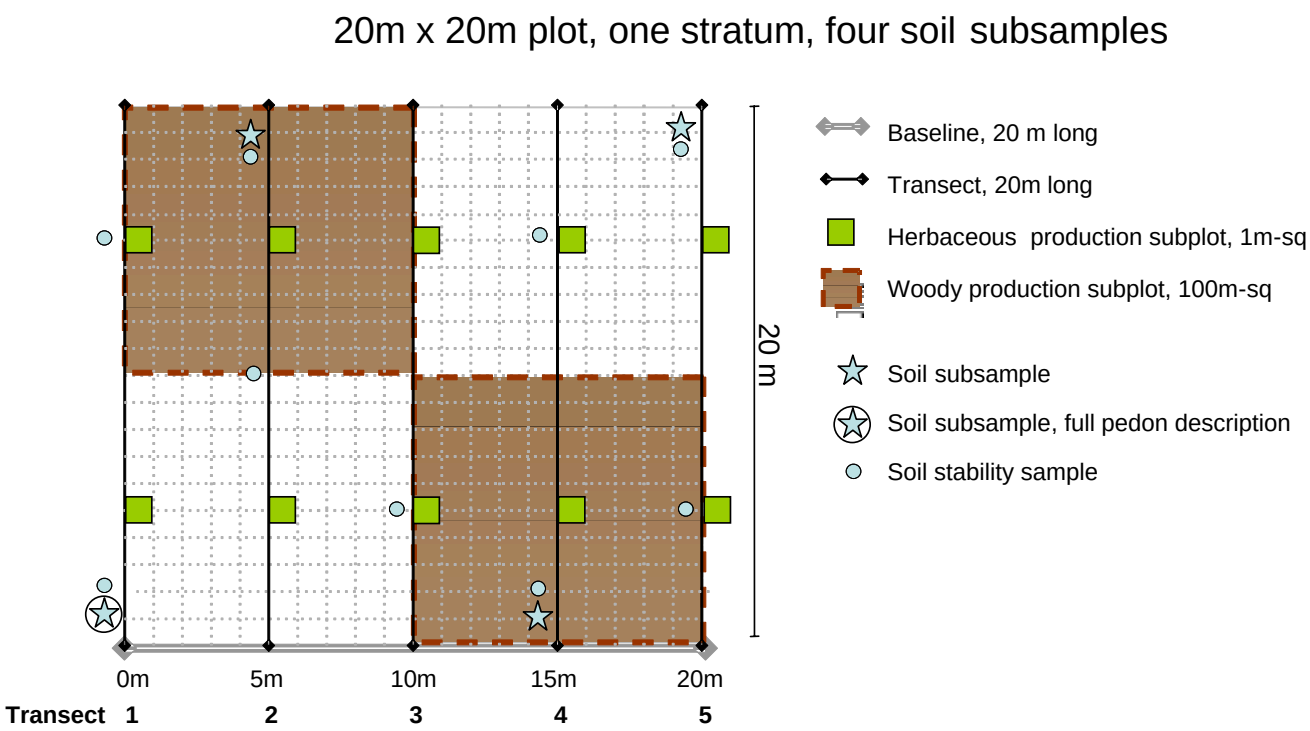
Medium : Transect (Soil form)

Surface soil properties

S = No crust; may be plant base or soil without any other surface feature	
WP = Weak physical or bilogical crust, may have few cyanobacterial sheaths dangling from ped, no darkening from cyanobacteria.	
SP = Strong physical crust	
PDB = Poorly developed biological crust assemblage, few to many cyanobacterial sheaths, may be slightly dark, can include some other morphological group (algal crust, lichen, moss	
SDB = Strongly developed biological crust assemblage, obvious dark cyanobacteria, rubbery algal moss or lichen crust.	
CB = Cracking or curling, rubbery algal crusts, with or without lichen	
RA = Uniform rock armor	
CEM = Cemented	
D = Duff	
EL = Embedded litter	

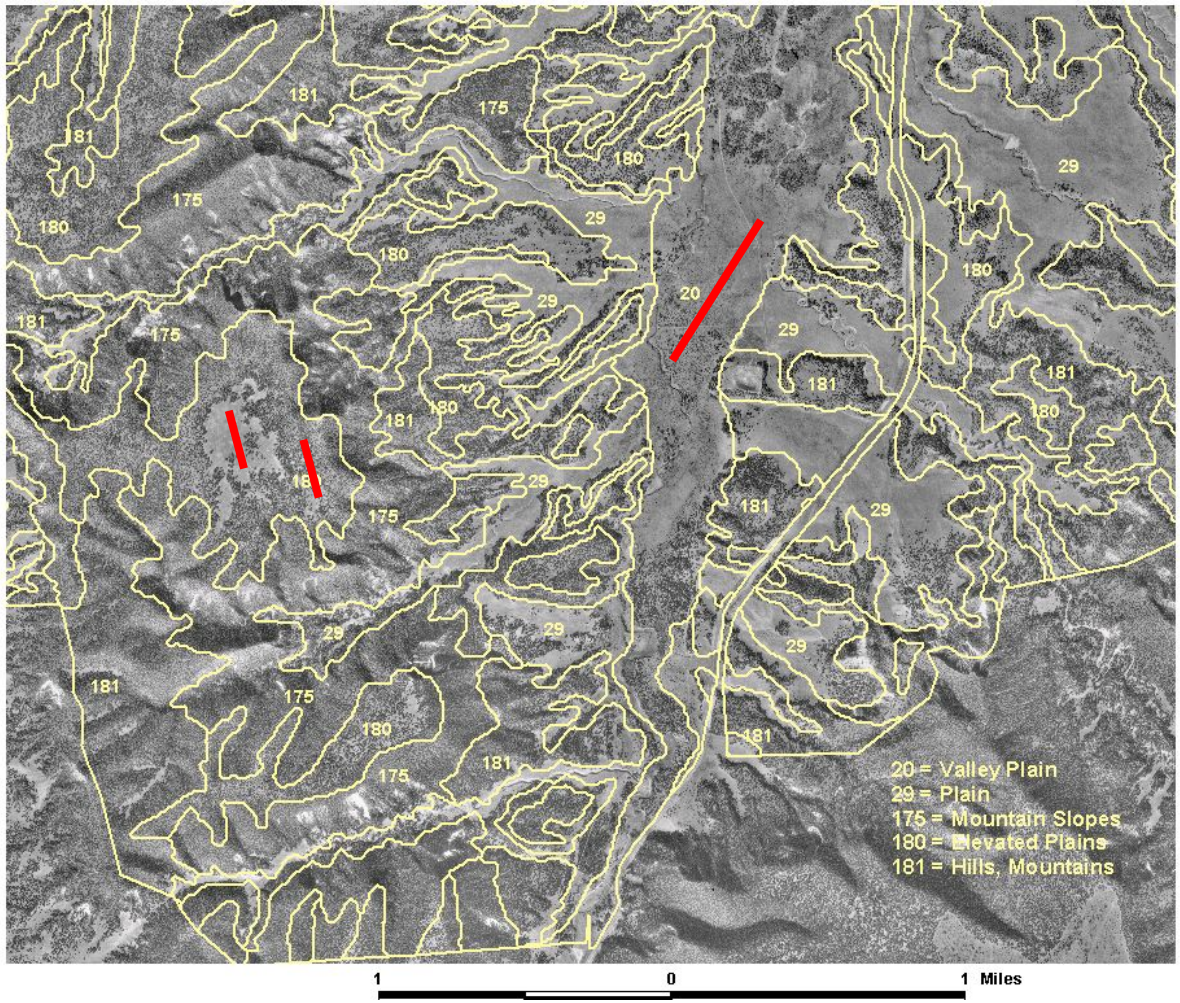
These classes are estimated visually in Tier 2 plots or can be used with more intensive techniques

High: Intensive characterization: line point intercept vegetation, quantitative soil surface properties, production



LPI design yields 200 points for basal and canopy cover but maintains observations within 10-20 m of the soil pit

Characterization of soil map unit components



Variable length line-point intercept

500 m, 2 m spacing
200 m, 1 m spacing
100 m, .5 m spacing
=200 points

Double sampling

10 1m^2 plots spread along transect

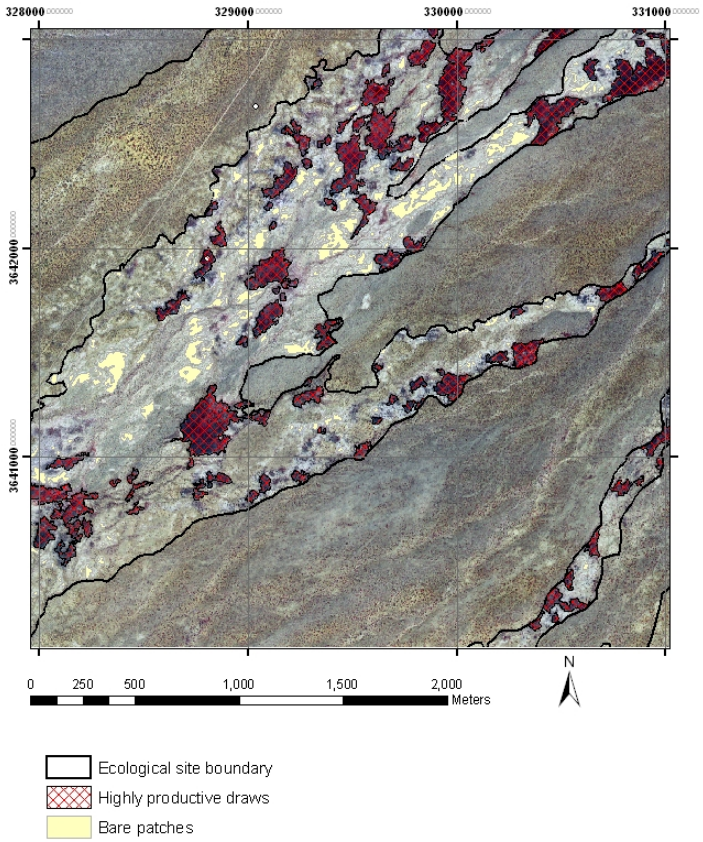
Soil surface classes

Diagnostic pits

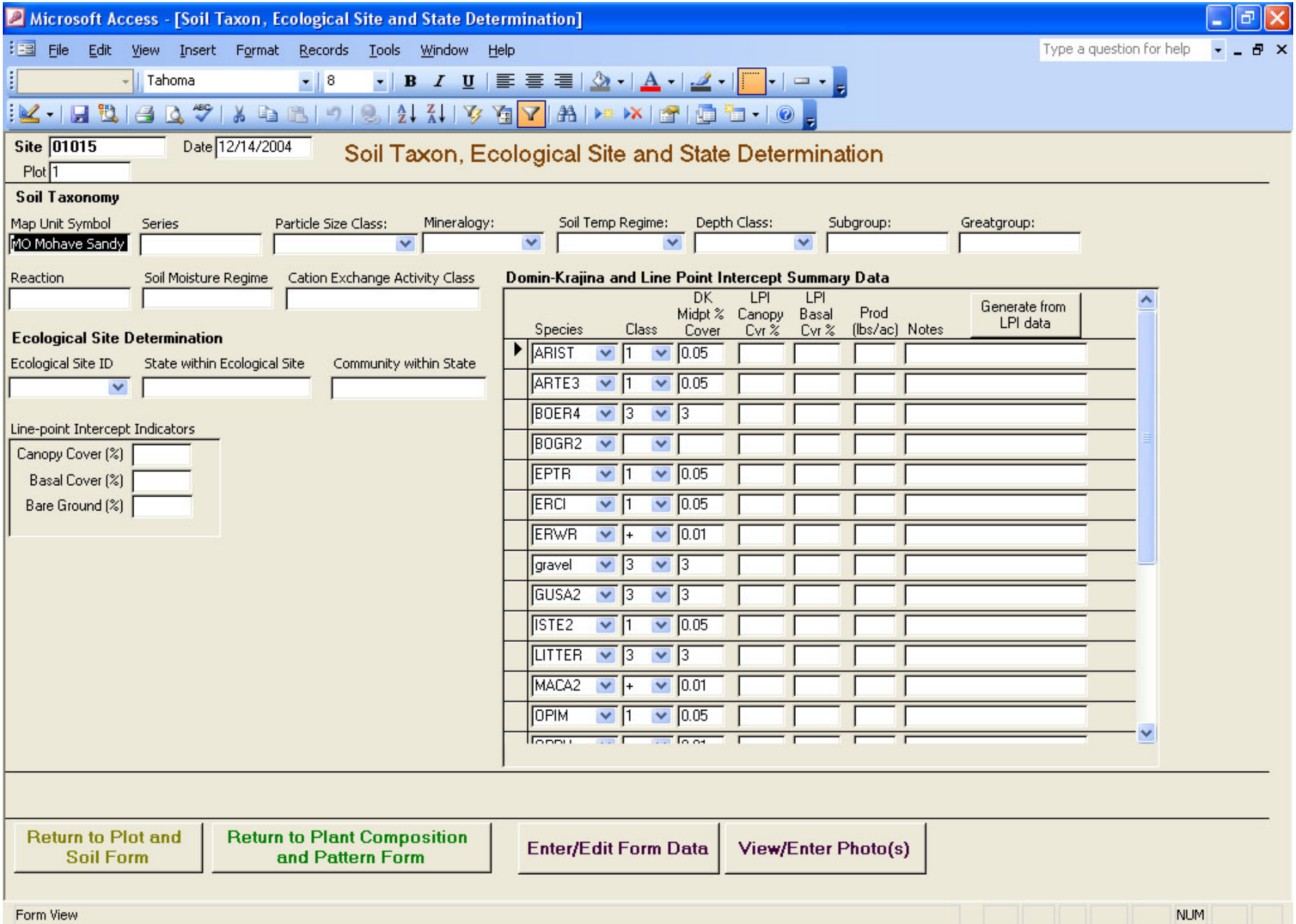
Spread along transect

Objective is to adequately capture variation within and between map unit components

Landscape pattern: DOQQs and satellite imagery can add to descriptions of states



Within a site, we describe the *pattern* of highly vegetated and bare areas to help define states expressed at larger scales than a 400m^2 plot


Microsoft Access - [Soil Taxon, Ecological Site and State Determination]
File Edit View Insert Format Records Tools Window Help
Type a question for help
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8
Site 01015
Date 12/14/2004
Plot 1
Soil Taxon, Ecological Site and State Determination
Soil Taxonomy
Map Unit Symbol
MO Mohave Sandy
Series
Particle Size Class:
Mineralogy:
Soil Temp Regime:
Depth Class:
Subgroup:
Greatgroup:
Reaction
Soil Moisture Regime
Cation Exchange Activity Class
Ecological Site Determination
Ecological Site ID
State within Ecological Site
Community within State
Line-point Intercept Indicators
Canopy Cover (%)
Basal Cover (%)
Bare Ground (%)
Domin-Krajina and Line Point Intercept Summary Data
Species
Class
DK Midpt % Cover
LPI Canopy Cvr %
LPI Basal Cvr %
Prod (lbs/ac)
Notes
Generate from LPI data
ARIST 1 0.05
ARTE3 1 0.05
BOER4 3 3
BOGR2
EPTR 1 0.05
ERCI 1 0.05
ERWR + 0.01
gravel 3 3
GUSA2 3 3
ISTE2 1 0.05
LITTER 3 3
MACA2 + 0.01
OPIM 1 0.05
Return to Plot and Soil Form
Return to Plant Composition and Pattern Form
Enter/Edit Form Data
View/Enter Photo(s)
Form View
NUM

Conclusions

- The protocol has successfully matched the pace of soil survey in the White Sands Missile Range survey
- Without additional range cons to participate in soil survey teams, valuable data are not being gathered
- **Numerous** samples of **coupled plant, soil surface, and subsoil data** at MLRA scales are essential to develop and improve ESDs and S&T models
- ESDs need to be data driven, there is increased scrutiny