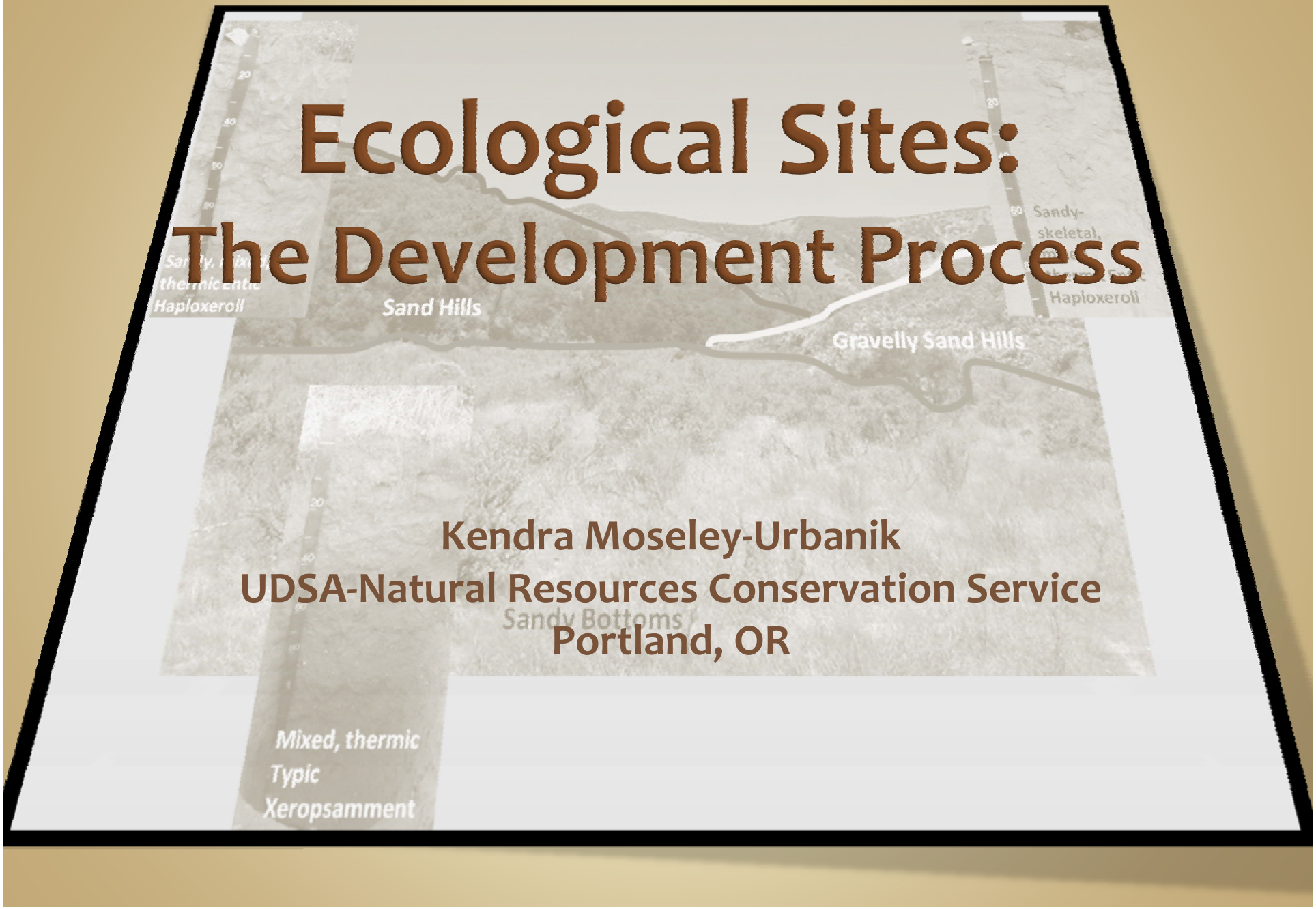
Ecological Sites:
The Development Process



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Portland, OR

Ecological Site Concept

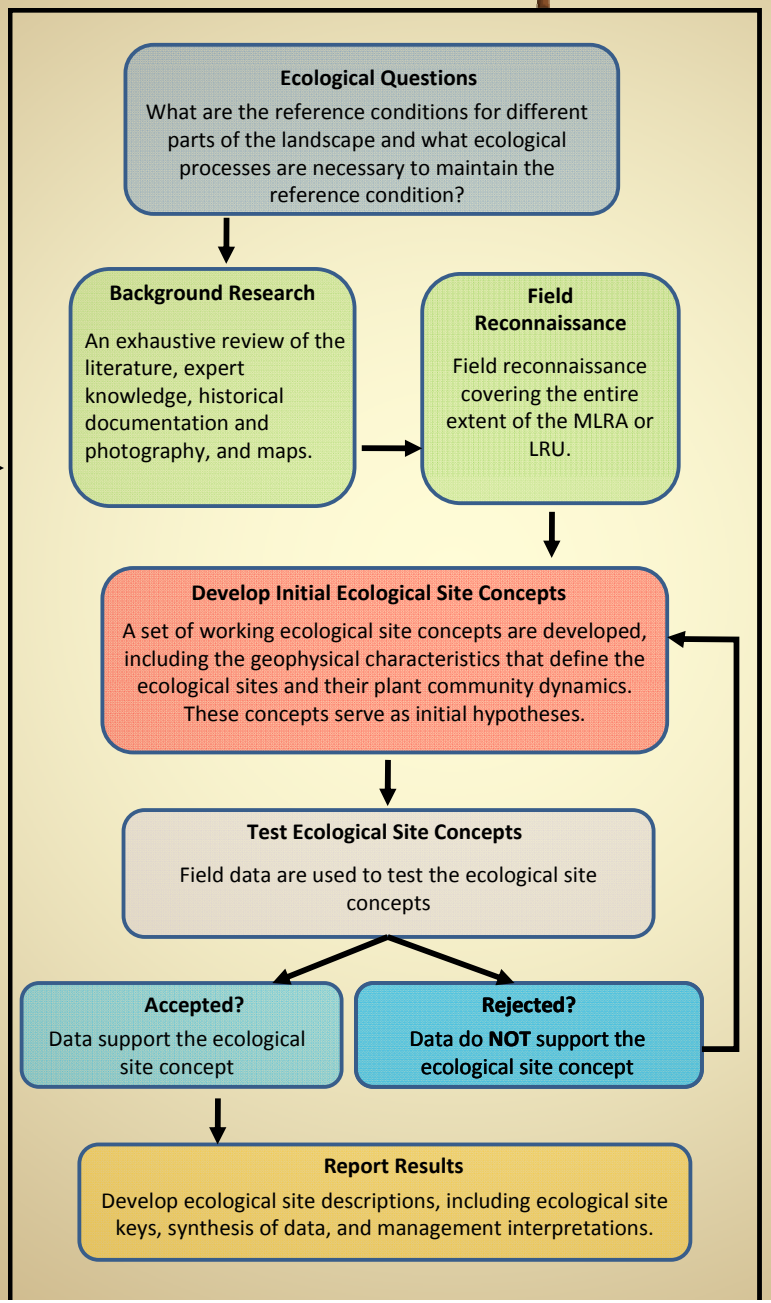
- Like a ‘species concept’

- Defines the distinguishing geophysical properties of a site and its STM

- Ecological site and STM development occur together

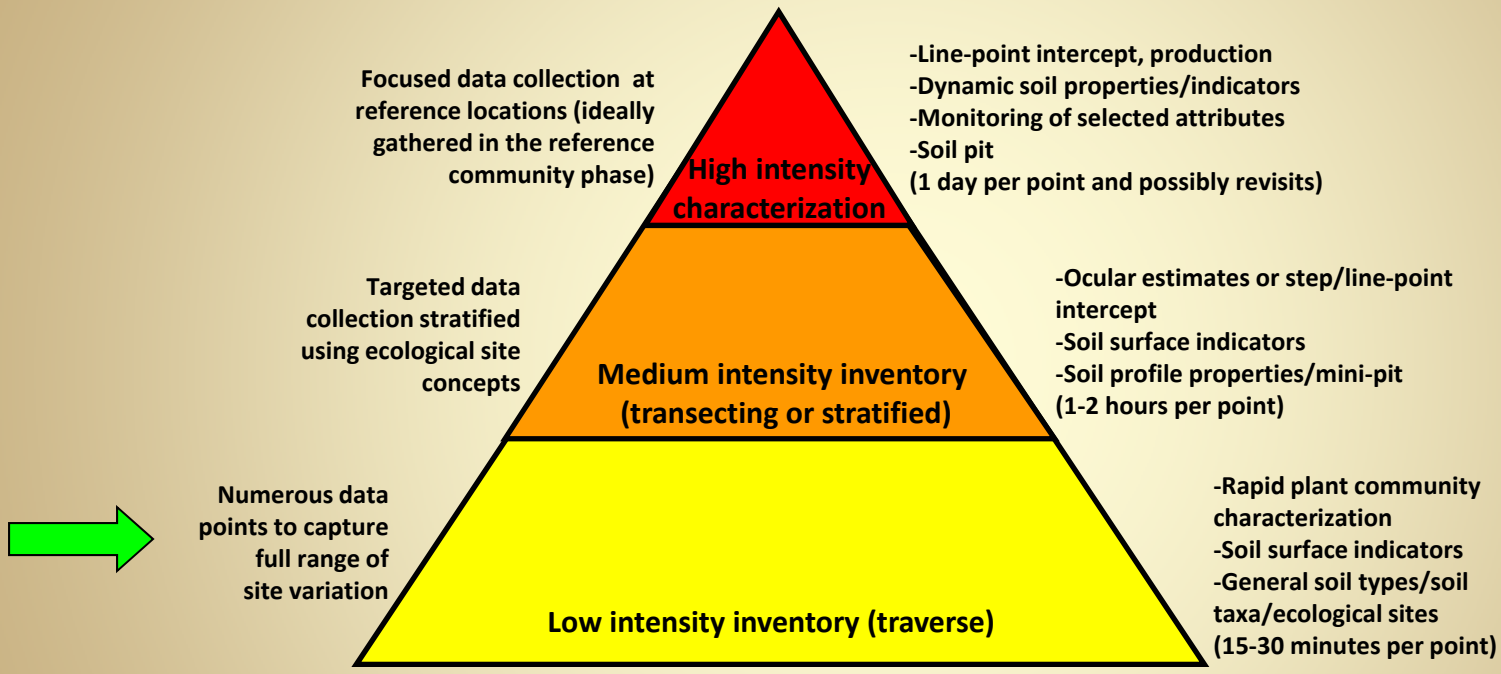
Ecological Site Development-Approach

MLRA or LRU



Moseley et al., 2010

Ecological Site Development-Data support



Moseley et al., 2010

Developing Concepts

- Background research
  - How should ecological potential vary across the landscape?
  - Existing mapping of soils, geology, weather & climate, vegetation, hydrology etc.
  - Interview with “local knowledge” experts
  - Historical documentation (survey records, journals and diaries, photos, etc)
  - Science literature, published studies in the area

Developing Concepts

Background research should result in rudimentary groupings of climate zones/elevation zones, parent materials, soil properties, and vegetation and wildlife communities, and provide information on common land uses and management concerns.

Developing Concepts

- Reconnaissance (refining initial concepts)
  - Correlations among soil properties and vegetation
  - Variability in plant community-soil relationships
  - Local knowledge: historical events, vegetation-soil relationships, and the origins of landscape patterns
  - Reference sites (exclosures, airports)
  - Observations across MLRA or LRU
  - Systematic, low intensity records

Developing Concepts

- After research and reconnaissance, develop initial sites concepts
- Initial site concepts represent a hypothesis that can be tested
- Clearly specify the climatic, topographic, and soil properties that distinguish the site from others

Developing Concepts

- Climate
  - Precipitation amounts (averages and extremes)
  - Precipitation timing
  - Temperature (averages and extremes)
  - Growing season (length and relationship to precipitation)
  - Wind speeds

Developing Concepts

- Topographic properties
  - Elevation
  - Aspect
  - Slope
  - Landscape Position
  - Contributing or accepting resources

Developing Concepts

- Soil Properties
  - Surface texture (importance for water infiltration, retention, soil erodibility)
  - Surface modifiers (gravels, stones, boulders, hummocks, etc)
  - Subsoil horizons (texture, type)
  - Depth to root restrictive horizons, water table, or bedrock (type)
  - Chemistry (Sodium, Calcium, Gypsum, etc)

Developing Concepts

- Specify a range in characteristics that vary at different spatial scales
  - Relatively fine scales of soil properties
  - Broader scale elevation and climatic variations

Developing Concepts

- Existing vegetation can not be a primary ecological site criterion because it is easily manipulated therefore highly variable.
- Nonetheless, certain species can be used to assist in ecological site definition and identification because they provide clues to soil and climatic conditions.
- The ecological site concept should be developed, using geophysical attributes that enable identification of the ecological site without vegetation on the site.

Developing Concepts

- Where changes in soils, aspect, topography, or moisture conditions are abrupt, boundaries of the ecological site will be obvious
- Where these factors change gradually along broad environmental gradients, ecological site distinctions are more difficult identify and may require data collection before solid ecological site concepts can be developed

Developing Concepts

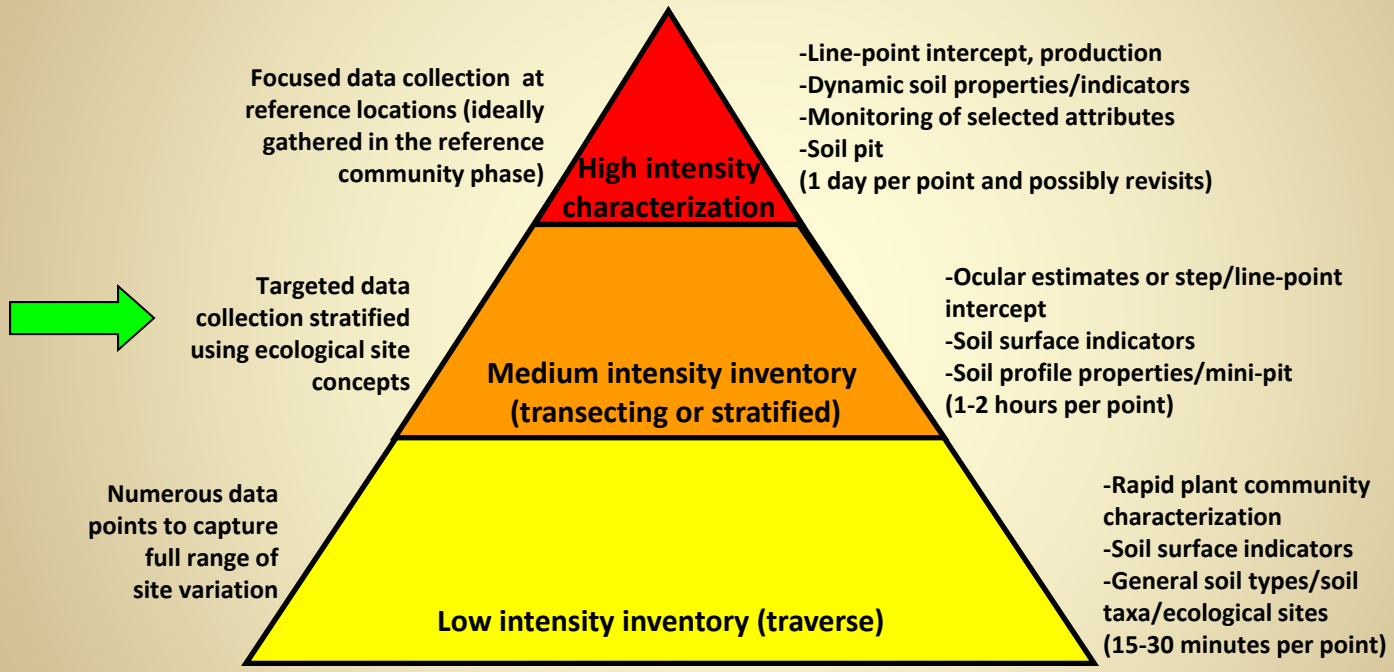
Developing Concepts

- Ecological site concepts are multivariate constructs. They are built from the relationships of several, interacting attributes that collectively produce similar environments for plant communities, similar ecological dynamics, and similar response to disturbances.

Example ecological site concepts

Preliminary Ecological Site	Elevation (ft)	Landform	Geology	Aspects	Slopes	Soil Texture	Soil Depth	Dominant Reference Vegetation	Data Collection Needs?
1	1500 – 3500	Mountains	Granite	South West	Steep	Sandy	Deep	Chamise-Buckbrush	High variation – extensive data needs
2	1200 – 3800	Mountains	Granite	North East	Steep	Loamy Sand	Moderately Deep	Bigberry manzanita-Scrub oak	High variation – extensive data needs
3	500 – 1000	Upper Stream Terraces	Rhyolite	Neutral	Flat	Sandy Clay Loam	Deep	Valley oak-Sedge	Low variation – minimum data needs
4	1500 – 3500	Footslopes	Volcanic Breccia	North East	Steep	Sandy Loam	Shallow to bedrock	Hollyleaf cherry-Toyon	High variation – extensive data needs

Testing ecological site concepts



How do we decide the ecological sites to be recognized?

Ability to **produce** kinds, amounts and proportions and in **response** to disturbance:

- Abiotic factors that influence plant production, composition, ecological processes.
- Significant differences in presence of species or species groups.
- Significant differences in relative proportion of species or species groups.
- Significant differences in total annual production.
- Significant differences in responses to management actions or disturbance processes.

USDA-NRCS NRPH (2007); IESHR (Draft)

Testing ecological site concepts

- Systematic inventories of two types:
  - Stratified random based on repeated samples of different ecological site delineations, especially those for which data are needed
  - Areas deliberately selected due to information contained in them (e.g., reference areas, degraded areas, areas with known management histories connected to local knowledge)

Testing ecological site concepts

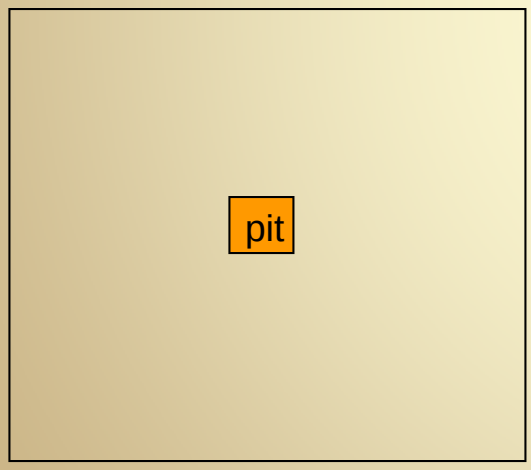
- Stratified random inventory:
  - GIS layers (DEM, geology, soils, imagery) used to estimate locations of ecological sites and random points are selected
  - Google Earth and NASA WorldWind
  - Replication sufficient to build statistical models
  - Samples can be clustered (transecting or groups)
  - Samples can be stratified by landscapes

Testing ecological site concepts

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

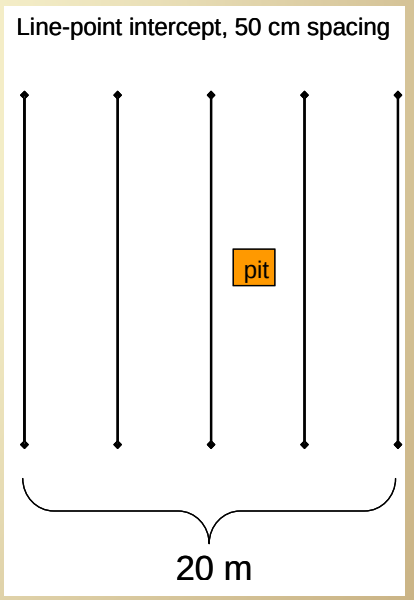
Woody	Class	**Grass**	Class	**Forb**	Class	**Other**	Class		
						Litter			Percent
						Cryptogram			Scale



20 m

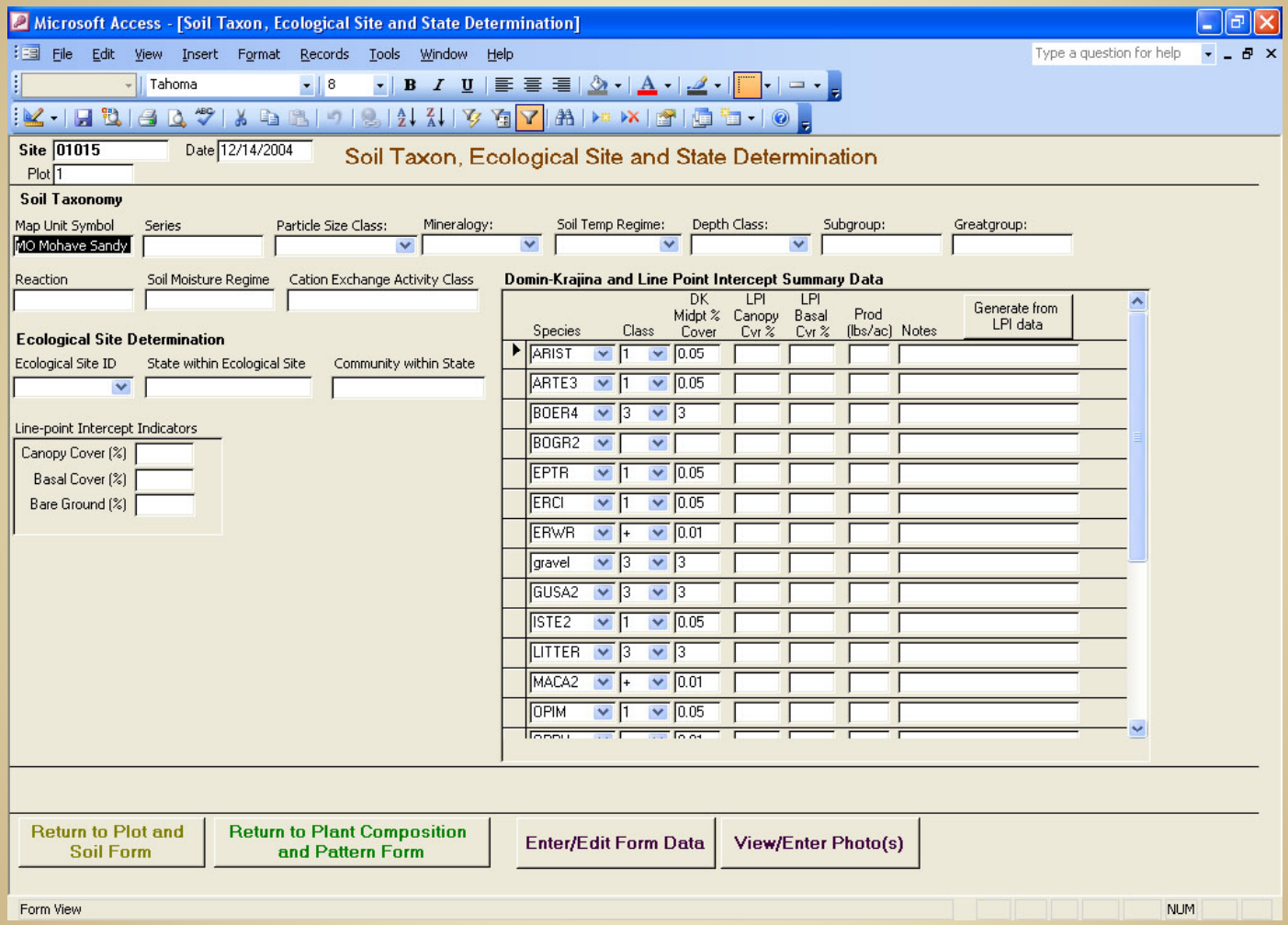
= 1/10th acre plot

or



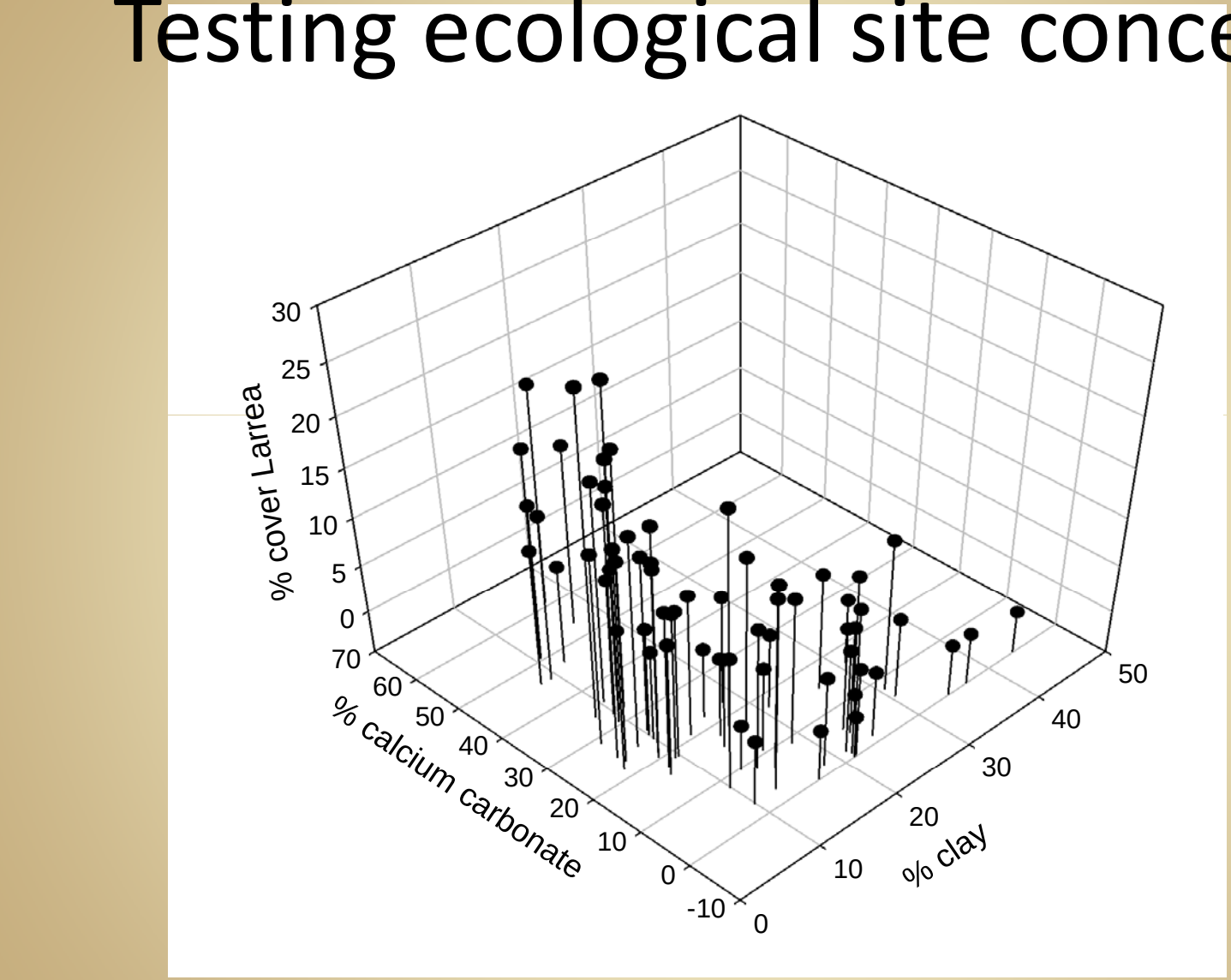
Link observations of vegetation and soils: cover estimated ocularly or using LPI, but must be quick enough to get replication

Testing ecological site concepts



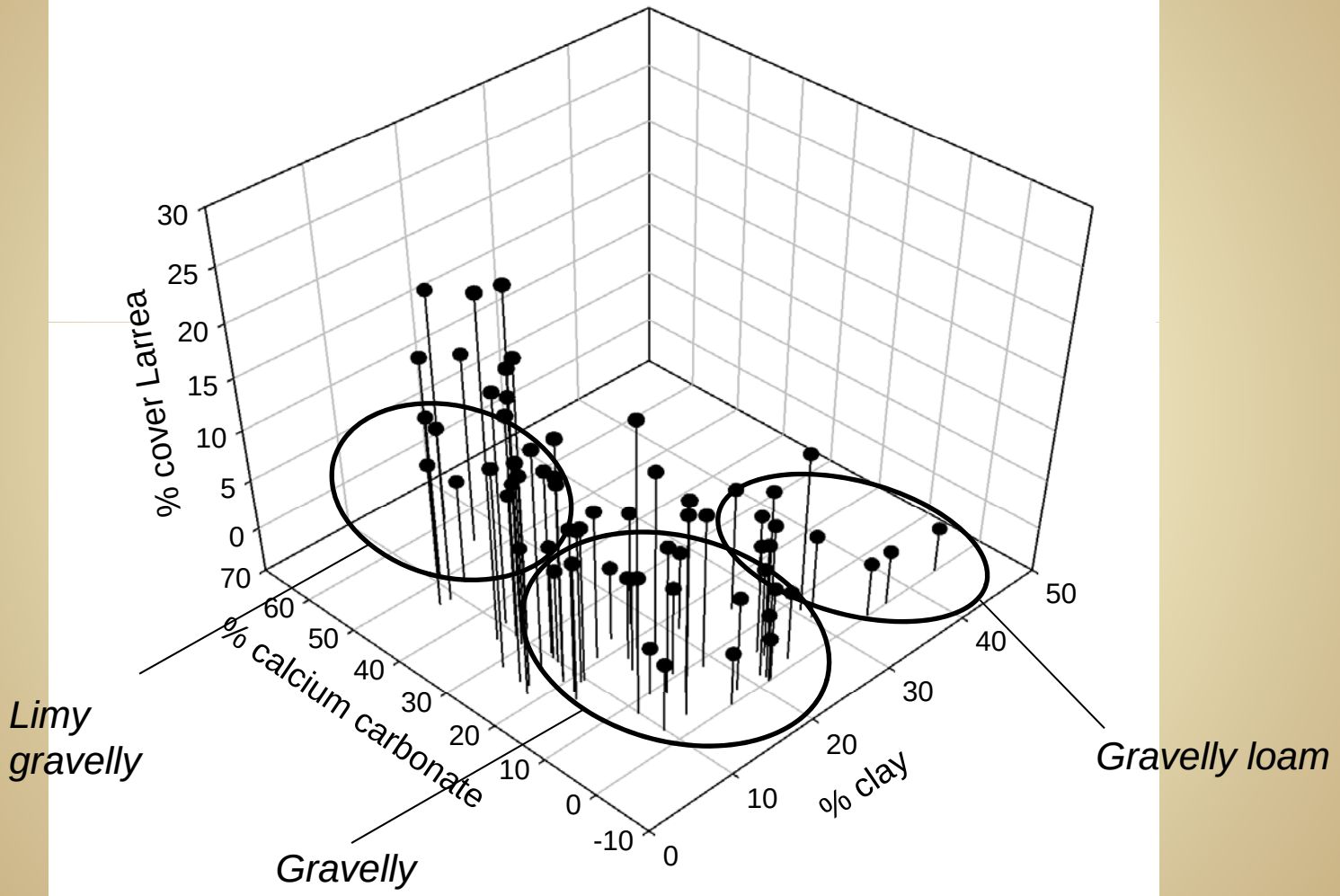
Vegetation and soils data must be databased together (JER and others have used the DIMA database)

Testing ecological site concepts



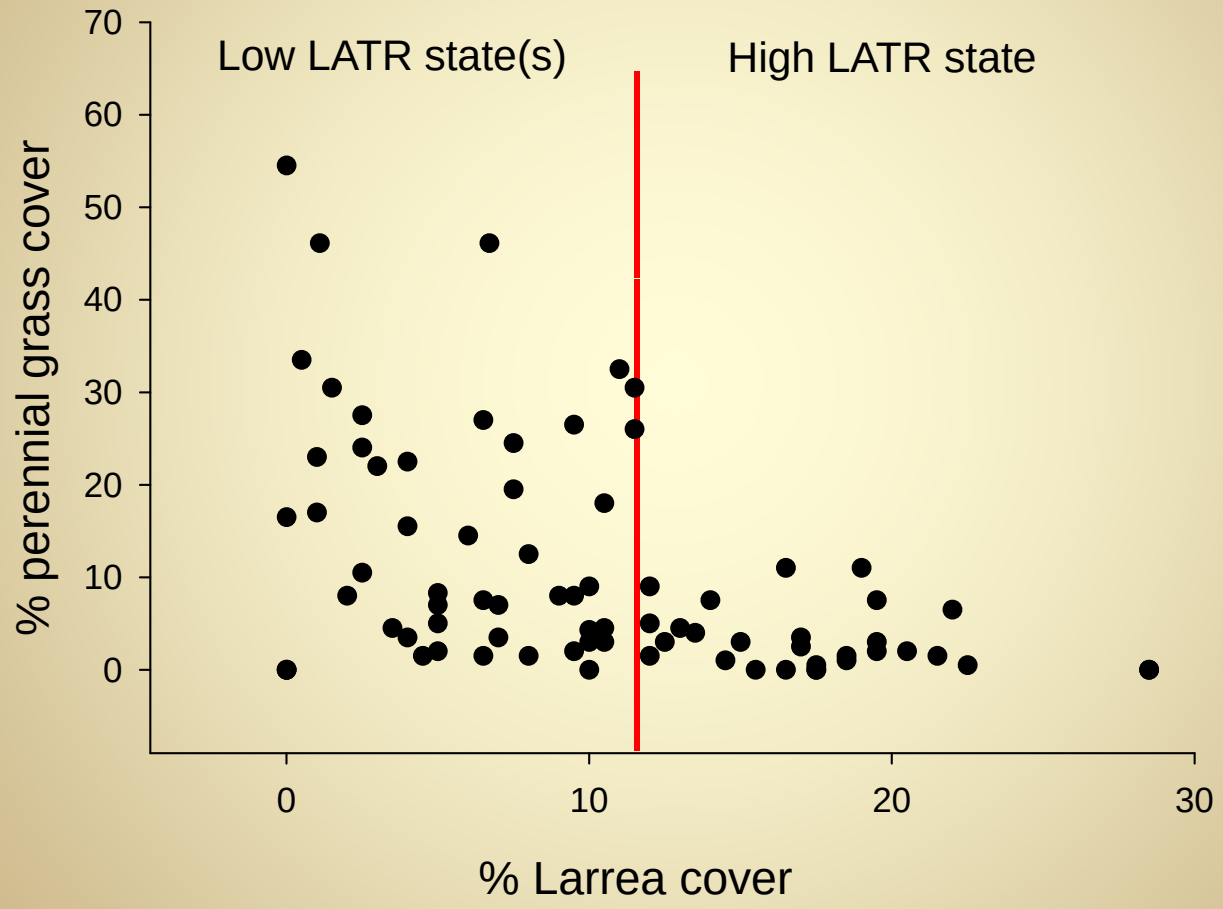
Larrea cover has complex relationships to clay and carbonate in argillic horizon

Testing ecological site concepts



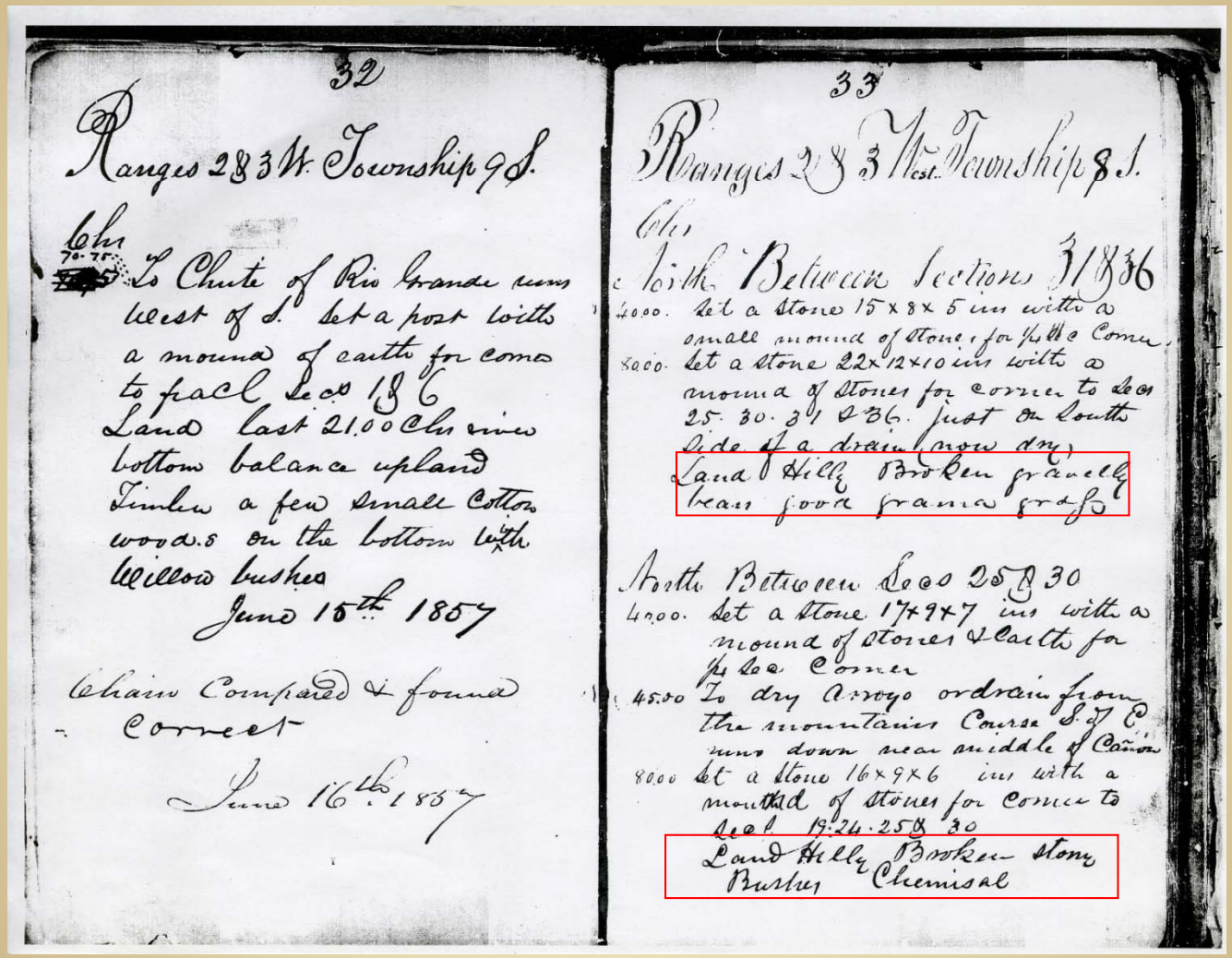
Three ecological sites potentially represented in this sample

Testing ecological site concepts



Inventory data support existence of alternative states (12% creosotebush canopy cover is a good break)

Testing ecological site concepts



32

Ranges 28 & W. Township 9 S.

Chs
70. 75.
Lo Chute of Rio Grande runs West of S. Set a post with a mound of earth for corner to sec 19 & 24 Land last 21.00 Chs river bottom balance upland Timber a few small Cotton woods on the bottom with Willow bushes
June 16th 1857

Chain Compared & found Correct
June 16th 1857

33

Ranges 28 & West Township 8 S.

Chs
With Between Sections 31 & 36
40.00. Set a stone 15 x 8 x 5 ins with a small mound of stones for ¼ Sec Corner
80.00. Set a stone 22 x 12 x 10 ins with a mound of stones for corner to Secs 25. 30. 31 & 36. Just on South side of a drain (now dry)
Land Hilly Broken gravelly bean good grama grass

North Between Secs 25 & 30
40.00. Set a stone 17 x 9 x 7 ins with a mound of stones & earth for ¼ Sec Corner
45.00 To dry Arroyo ordrain from the mountains Course S. 27 E runs down near middle of Cañon
80.00 Set a stone 16 x 9 x 6 ins with a mound of stones for corner to Secs 19. 24. 25 & 30
Land Hilly Broken stone Bushes Chemisal

Historical evidence tied to inventory: in the 1850s, evidence of grass-dominated and *Larrea*-dominated patches in area: which soil?

Soil-site correlation

Nickel-Tencee-Delnorte complex, moderately sloping, soil map unit

		Ecological Site			
Soil map unit component		**MLRA**	**LRU**	**Ecological Site**	**State**
Nickel very fine gravelly sandy loam		042X	B	Gravelly	NM
Del Norte gravelly loam		042X	B	Gravelly	NM
Tencee very gravelly sandy loam		042X	B	*Limy gravelly	NM
*proposed new site					

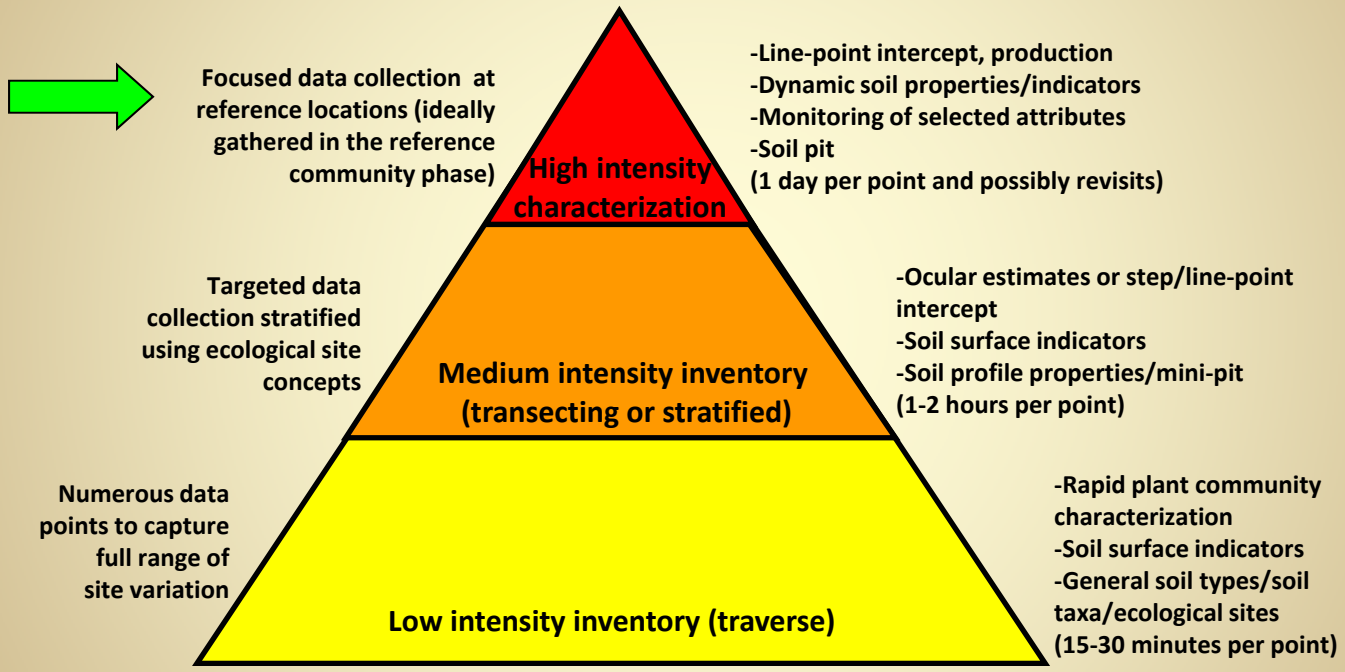
Soil-site correlation “rules”

An ***ecological site*** can include more than one soil series, provided that the soils are similar

A ***soil map unit*** can include more than one ecological site. Soil map units often include many different soils, with different potentials to support plant communities

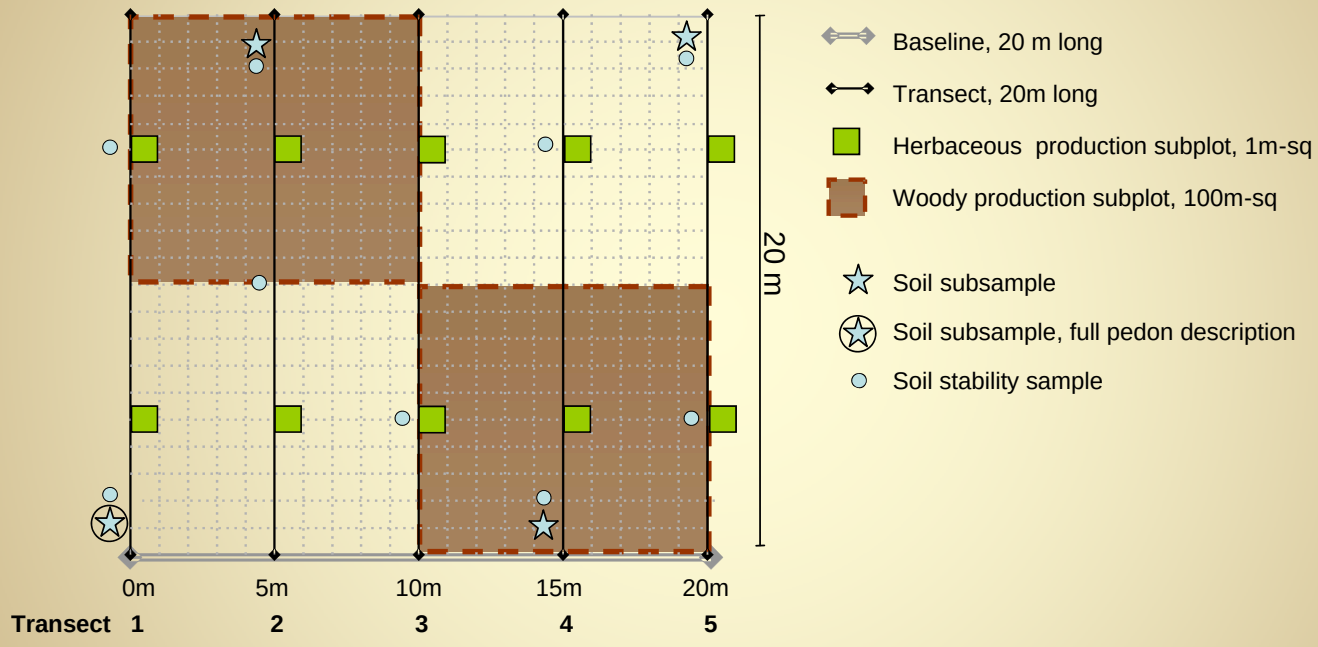
Even a ***soil series*** can include more than one ecological site. Soil surface texture often varies within a soil series. Soil surface texture is very important in distinguishing ecological sites.

High intensity Samples



High intensity Samples

20m x 20m plot, one stratum, four soil subsamples



- Three replicates per state per site
- Consider monitoring to document temporal variations due to climate

Develop interpretations

- High intensity data and other data:
  - Domestic animal uses/forage
  - Wildlife habitat (by state or community)

    (see Holmes and Miller, JWM, 2010)
  - Hydrologic functions
  - Recreation
  - Future options (carbon sequestration, dust control, more detail on wildlife habitat)


Thank you!