Rangeland Plant Communities

Rebecca Ozeran
May 1, 2019



Overview:
How and why we classify vegetation types

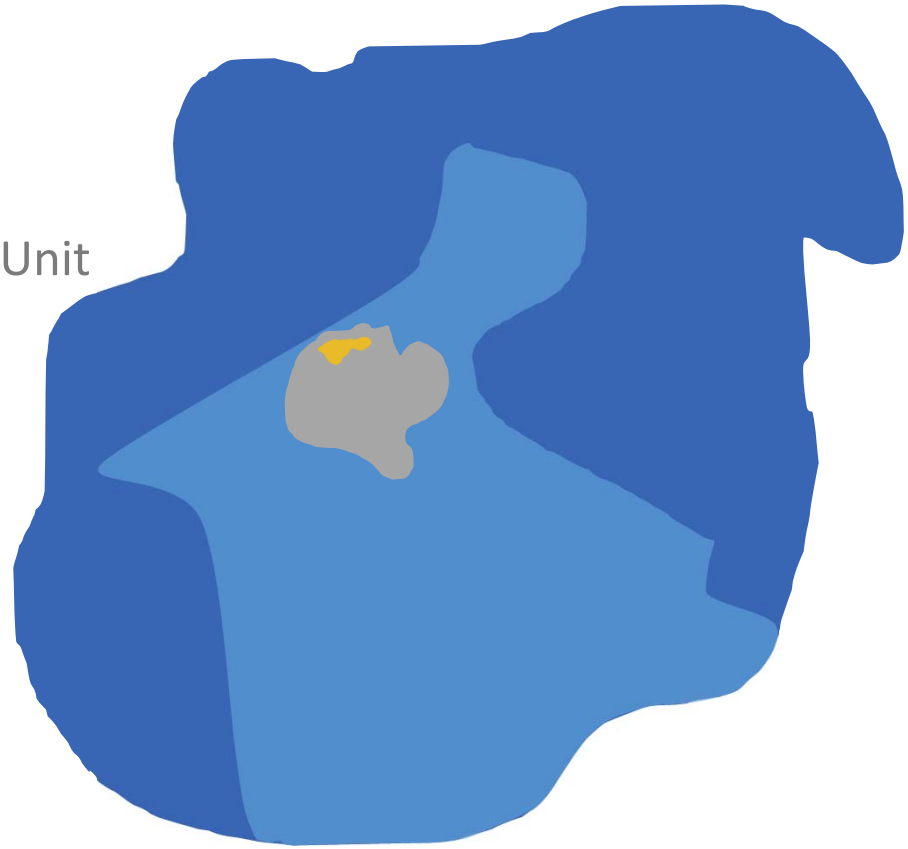
A. Scales of classification
   i. Land Resource Regions
   ii. Major Land Resource Areas
   iii. Common Resource Areas
   iv. Ecological sites

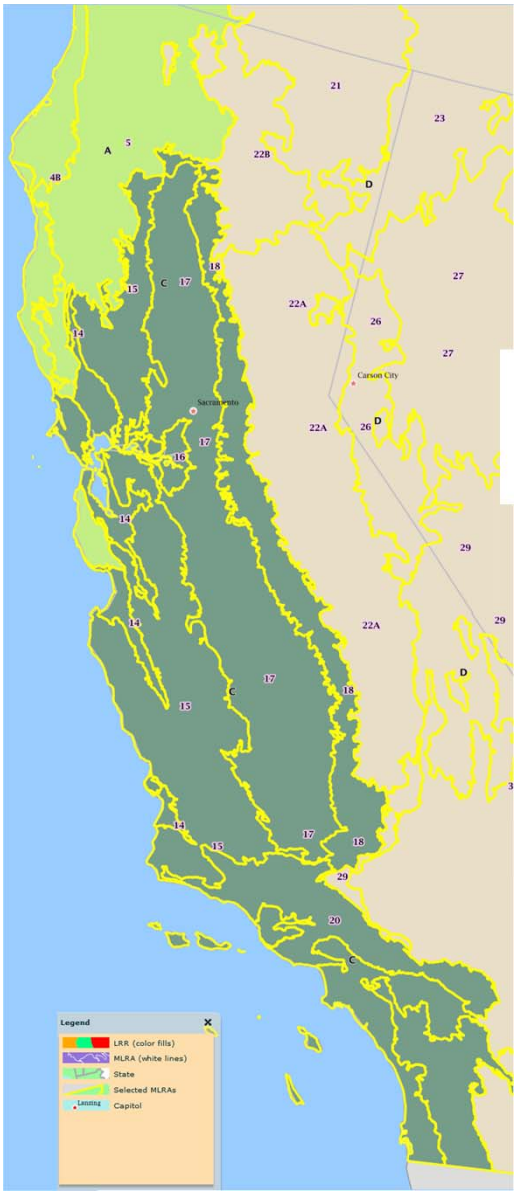
B. Site potential (ESDs, successional and STM models)
   i. Differences between successional and STM paradigms

C. How rangeland management uses classifications
   i. Grazing prescriptions, predicting site response to grazing, fire, etc.

A. Scales of classification

- From large to small area:
  - Land Resource Region
  - Major Land Resource Area
  - Common Resource Area/Land Resource Unit
  - Ecological Site





Land Resource Regions (LRRs)

- Largest scale, often cross state boundaries
  - "geographically associated MLRAs [with similar characteristics] which approximate broad agricultural market regions." [NRCS]
  - Not used for local management decisions

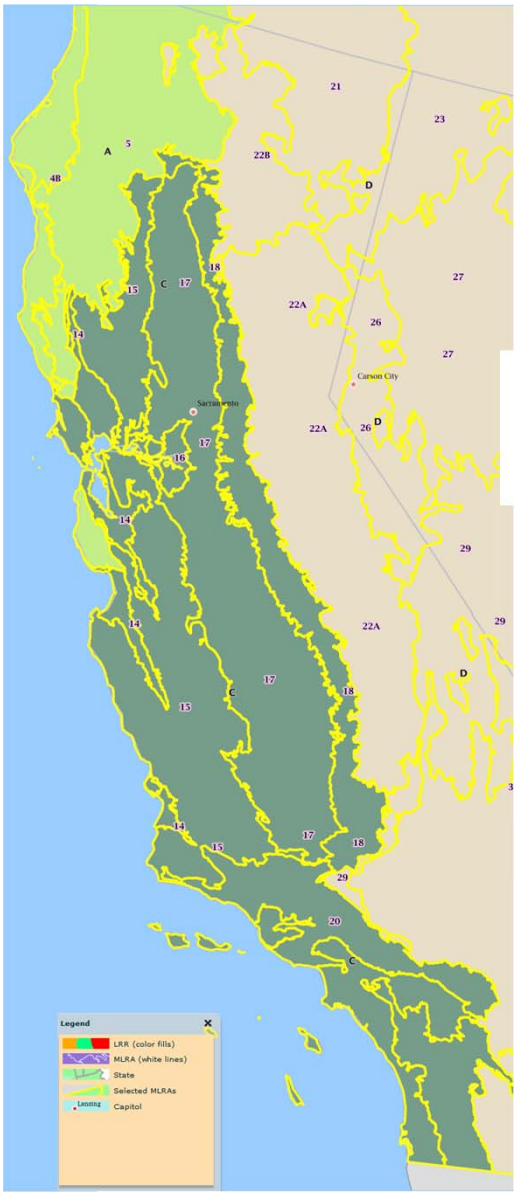
Three LRRs in California

California Subtropical Fruit, Truck, and Specialty Crops*

Northwest Forest, Forage, and Specialty Crops

Western Range and Irrigated

A. Land and vegetation classification



Major Land Resource Areas (MLRAs)

- NRCS definition: “Geographically associated land resource units (LRUs). Identification of these large areas is important in statewide agricultural planning and has value in interstate, regional, and national planning.”

- Large areas; only 278 MLRAs cover US states, Caribbean, and Pacific Basin
- Can cover areas in more than one state

A. Land and vegetation classification

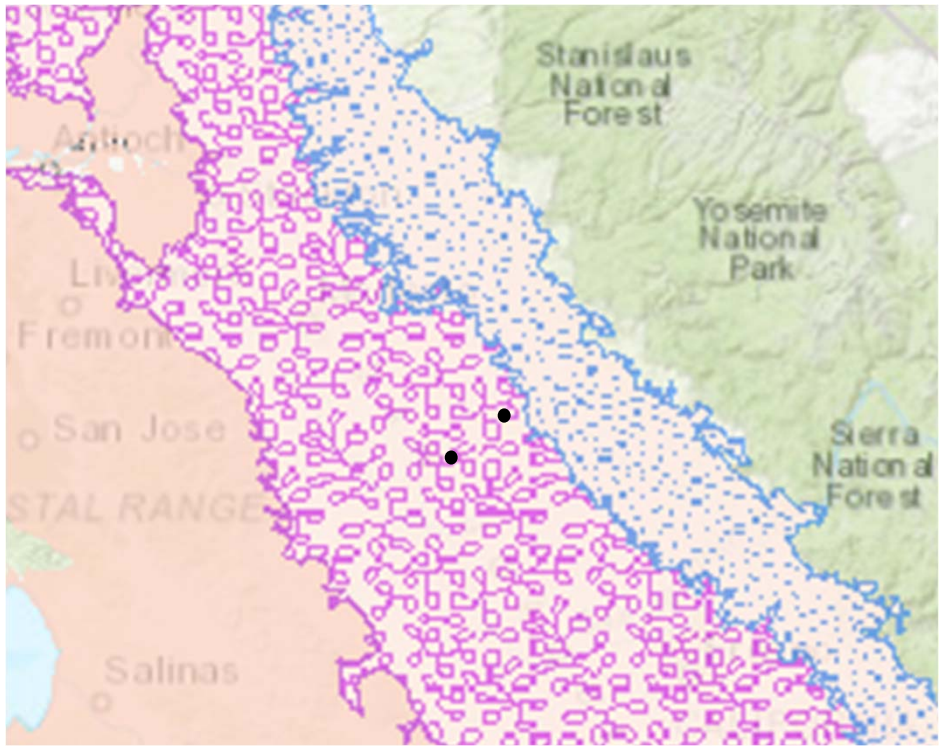
Major Land Resource Areas (MLRAs)

- MLRA description includes
  - physiography (topography, natural and cultural features)
  - geology (bedrock/surface)
  - climate (precip, air temp, frost-free period)
  - water use (surface/ground, quality of water, use allocations)
  - soils (temp/moisture regime, mineralogy, textures, representative soil series)
  - biological resources (plant species supported; key wildlife species, including most common and threatened/endangered spp)
  - land use (key crops, range, forest, industrial, urban, water, and other)

Major Land Resource Areas (MLRAs)

- Currently in… MLRA 17

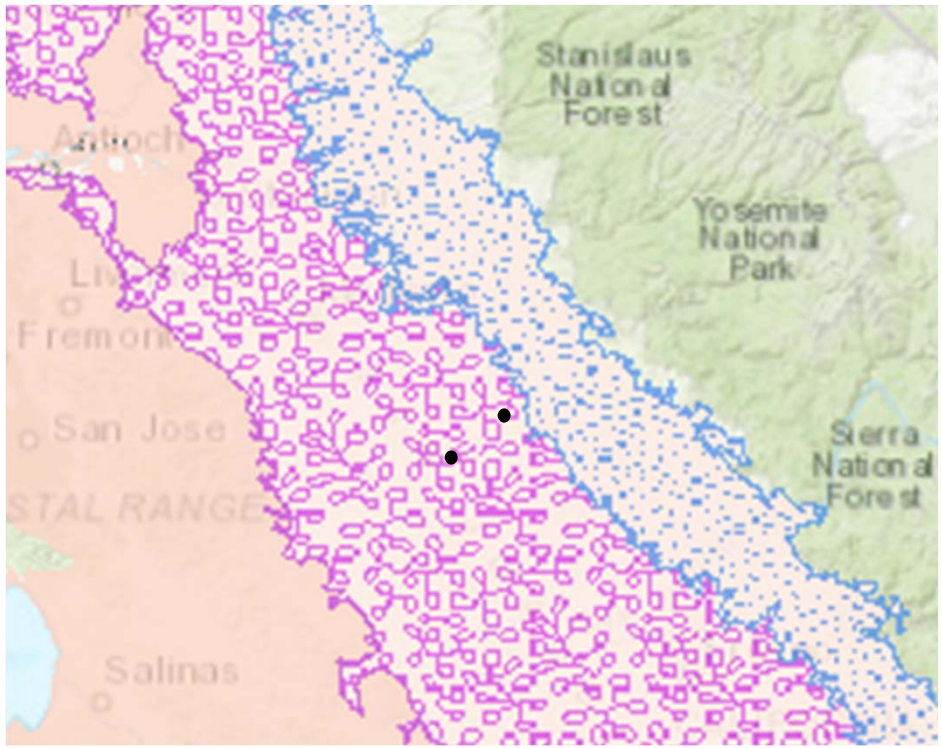
- Physiography
  - basins, fans, floodplains, terraces and foothills
  - elevation 0-660ft
  - large river systems and two major canals



A. Land and vegetation classification

Major Land Resource Areas - MLRA 17

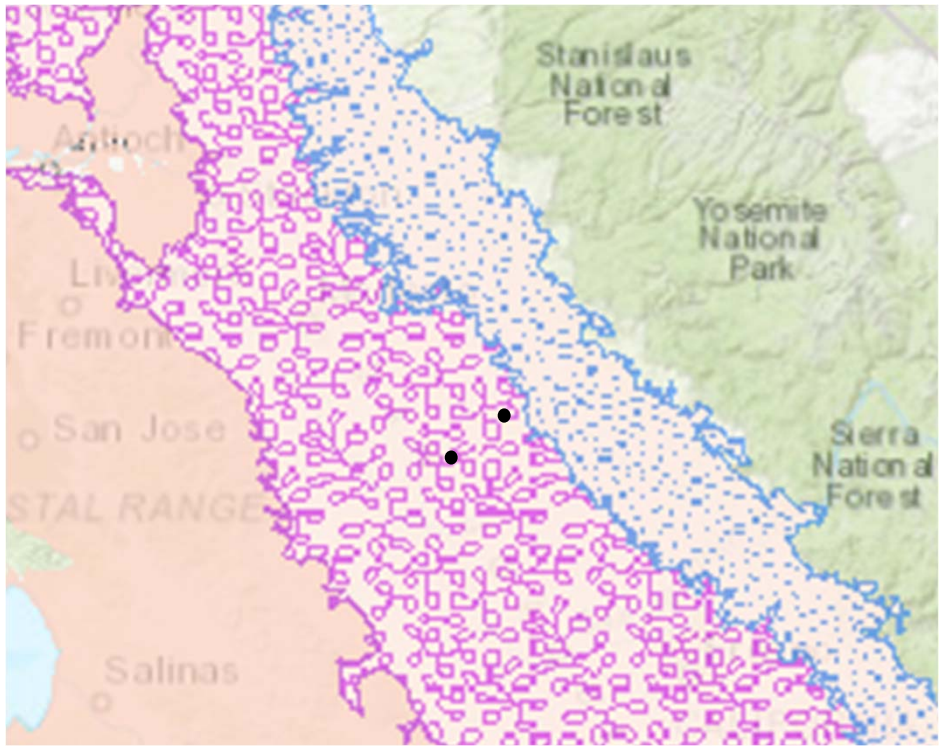
- Geology
  - sediment-derived, ≤9mi deep
  - volcanic in origin, atop Sierra granite
  - valley soils contain oil and gas reserves
- Climate
  - Sac Valley: 12-30in
  - San Joaquin Valley: 5-12in
  - Tulare Basin: <6in
  - Long hot summer/cool wet winter
  - Freeze-free period ± 325 d



A. Land and vegetation classification

Major Land Resource Areas - MLRA 17

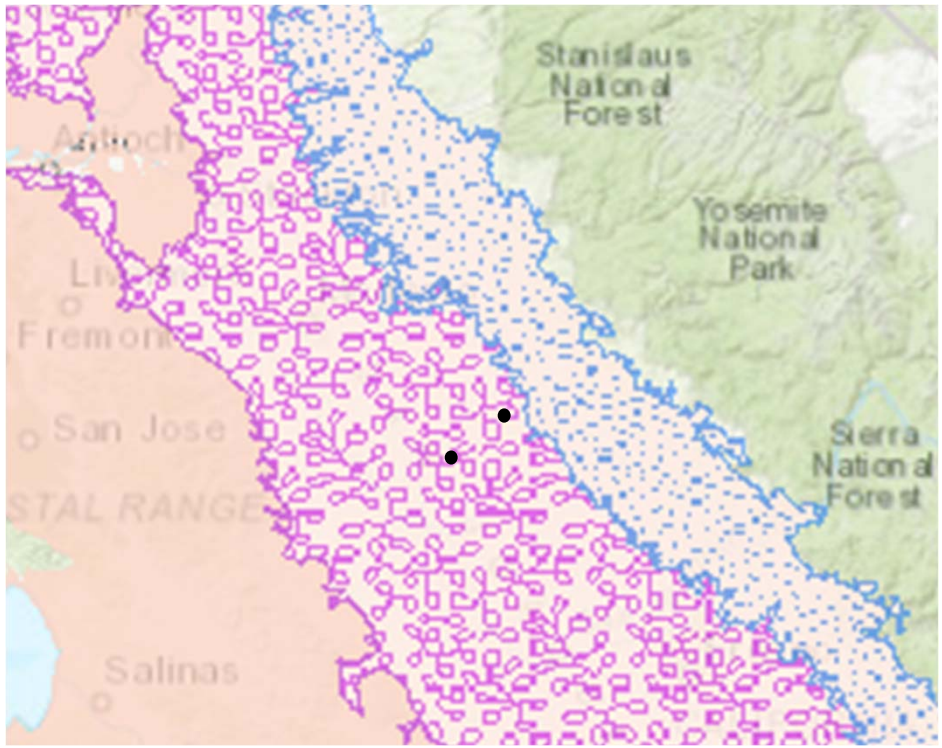
- Water use - total withdrawal averages 22,755 million gal/day
  - Public supply
    - surface water, 0.5%; ground water, 6.5%
  - Livestock
    - surface water, 0.4%; ground water, 0.7%
  - Irrigation
    - surface water, 51.5%; ground water, 38.1%
  - Other
    - surface water, 0.7%; ground water, 1.5%
- 47% groundwater, 53% surface



A. Land and vegetation classification

Major Land Resource Areas - MLRA 17

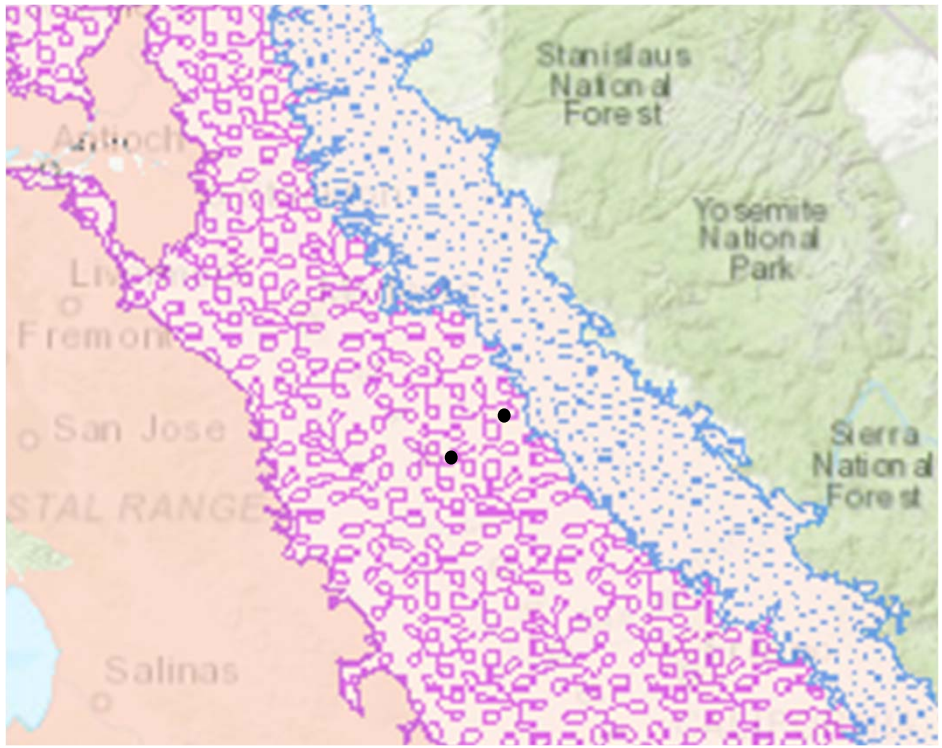
- Soils
  - alfisols, aridisols, entisols, mollisols, vertisols
  - hot/dry soil temperature and moisture
  - mixed or smectitic mineralogy
  - deep, well drained, and loamy or clayey
  - some shallow duripan
- Biological resources
  - annual grasses and forbs, scattered trees (oak, willow, cottonwood)
  - jackrabbit, coyote, fox, ground squirrel, pocket gopher, song- and water-birds
  - salmon, striped bass, steelhead, shad, sturgeon, bass, bluegill, catfish



A. Land and vegetation classification

Major Land Resource Areas - MLRA 17

- Land use -
  - Cropland—private, 58%
    - = 1/3 of total CA cropland
    - 75% is irrigated
  - Grassland—private, 25%; Federal, 2%
  - Forest—private, 2%
  - Urban development—private, 8%
  - Water—private, 1%
  - Other—private, 4%



A. Land and vegetation classification

Common Resource Areas (CRAs)/ Land Resource Units (LRUs)

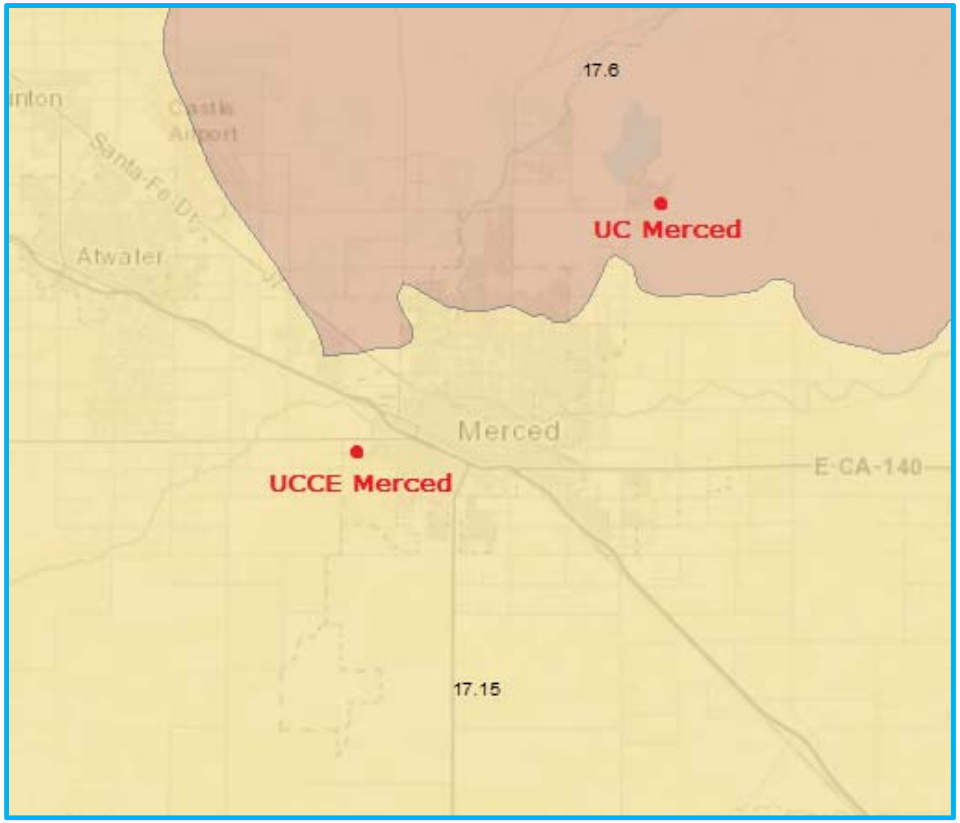
- Subdivisions of MLRAs

- LRUs often have the same extent as soil map units
  - soils may include smaller LRUs if different climate, water, land use, etc.

- CRAs a newer name - Beyond soils, created by subdividing MLRAs by:
  - resource concerns, hydrology, resource use, topography, or human uses
  - CRAs are named as “MLRA.X”, e.g., CRA 72.6 is CRA 6 in MLRA 72

Common Resource Areas (CRAs)

- CRA 17.6 tends to have cobbles and gravel (skeletal structure) in the topsoil
  - gravelly loam dominates near UCM
- CRA 17.15 tends to lack skeletal structure in the topsoil



A. Land and vegetation classification

Ecological Sites

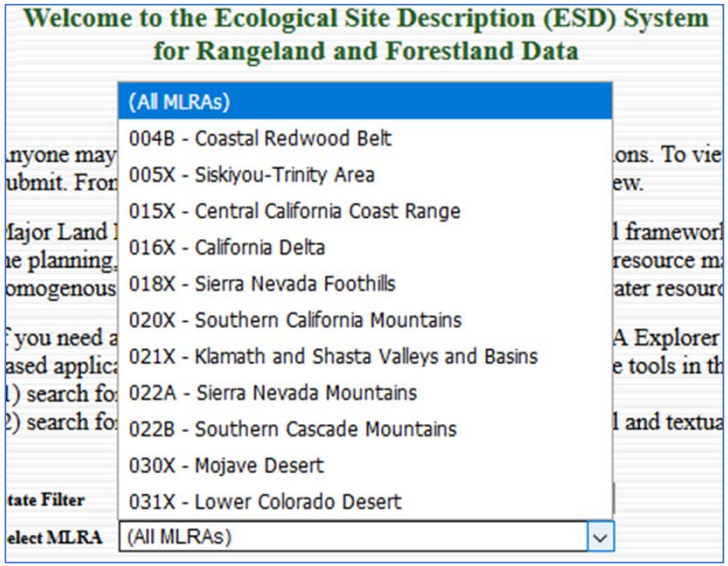
- "Framework for classifying and describing rangeland and forestland soils and vegetation... delineating land units that share similar capabilities **to respond to management activities or disturbance**." (NRCS)

- Defined by:
  - vegetation, including "natural" and weedy/invasive
  - possible land uses, and their suitability on site
  - wildlife using the site
  - soil properties
  - possible responses to events/management (fire, grazing, drought)

A. Land and vegetation classification

Ecological Site Descriptions (ESDs)

- Document and standardize defining characteristics of ecological sites
- Still being written for many areas of the US (e.g., none available in MLRA 17)



- Access ESDs through ESIS: https://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx

Ecological Sites

- We will look at example ESD reports (both in MLRA 18)
  - ***Site name:*** **Sandy Loam**
    Quercus douglasii - Quercus wislizeni / Bromus - Avena fatua
    (blue oak - interior live oak / brome - wild oat)
    Site type: Rangeland
    Site ID: R018XI006CA

  - ***Site name***: **Gravelly Loam Foothills**
    Quercus douglasii - Quercus wislizeni / Ceanothus cuneatus - Arctostaphylos viscida / Bromus - Avena fatua
    (blue oak - interior live oak / buckbrush - sticky whiteleaf manzanita / brome - wild oat)
    Site type: Rangeland
    Site ID: R018XI001CA

Review – land classification

1. What land classification level has the biggest units?
2. What classification level has units that are relevant to managers?
3. List three characteristics that help define an MLRA.
4. Name a land classification (at any level) that covers where we are.

Overview:
How and why we classify vegetation types

A. Scales of classification
   i. Land Resource Regions
   ii. Major Land Resource Areas
   iii. Common Resource Areas
   iv. Ecological sites

B. Site potential (ESDs, successional and STM models)
   i. Differences between successional and STM paradigms

C. How rangeland management uses classifications
   i. Grazing prescriptions, predicting site response to grazing, fire, etc.

B. Site Potential

- Under various circumstances, what *could* the site look like?
  - Often, site potential refers to “historical” or “pristine” condition
  - “Pristine” often unrealistic
  - Commonly potential describes best-case scenario

- Knowing existing community characteristics helps describe site potential

- Two paradigms to view community changes...

Succession Model (1)

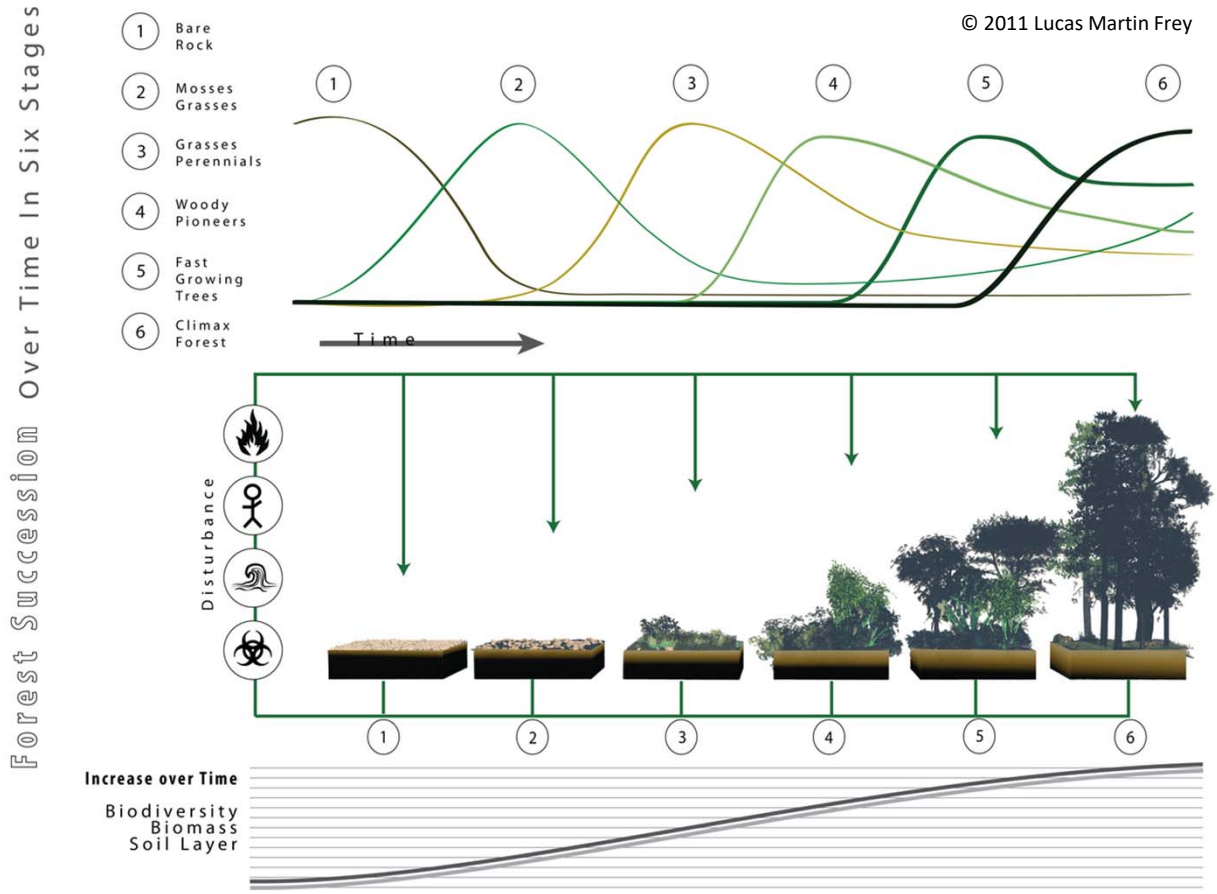
- Clementsian Succession, AKA relay floristics
  - Namesake, Frederic Clements; first published in the 1910s

- Assumptions…
  - Community progresses linearly toward a predetermined climax community
  - Change over time is due to differing plant needs and ongoing competition
  - Often correlated to soil development over time
  - Disturbance (fire, human activity, grazing…) simply restarts linear succession
  - Thus, proper grazing can create an equilibrium state

Succession Model (1)

- Assumptions…
  - Climax community = stable end point

- Textbook example: bare ground ► mosses ► grasses and forbs ► shrubs ► trees



B. Site potential

Succession Model (1)

- Limitations of Clementsian/deterministic succession:

  - Removal of grazing does not always cause vegetation to change in the predicted way (if at all)
  - Some community/vegetation type conversions appear irreversible - debunking the assumption of a single climax community on a site
  - Relative abundance of competing plants early in succession can result in different “final” community composition - again debunking deterministic assumption
  - Fire as disturbance does not impact all species equally
  - Irreversible changes to soil conditions may ► different site potential

State and Transition Model (2)

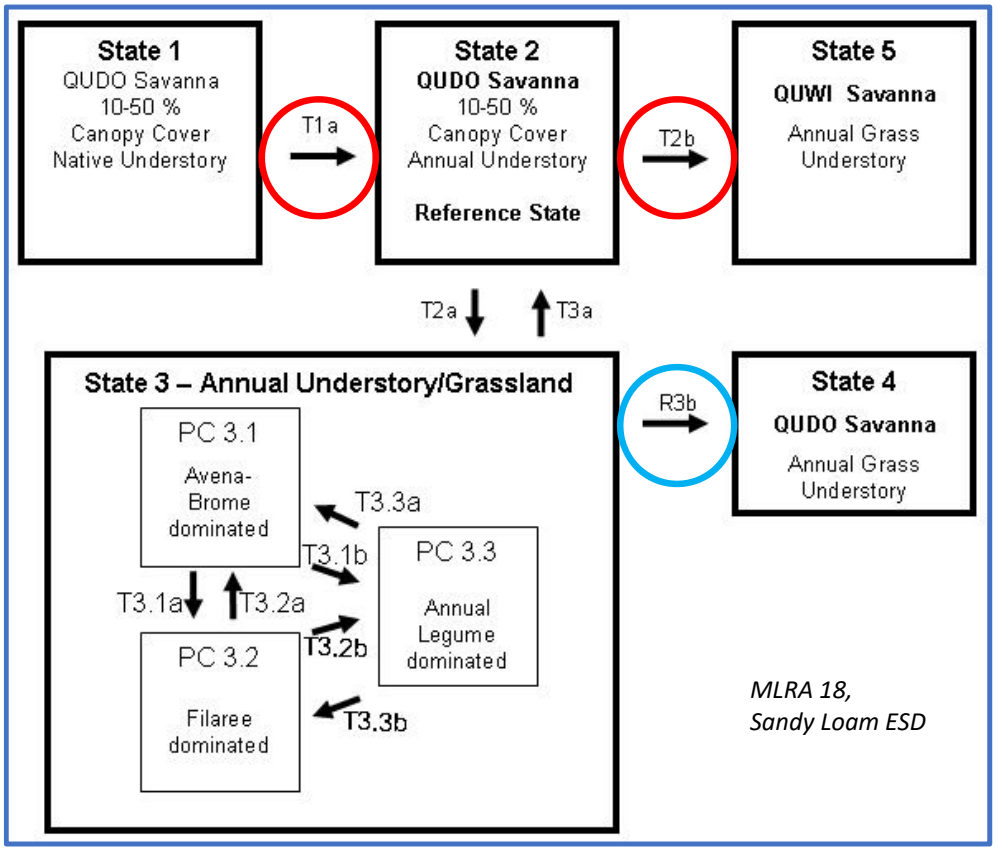
- Also called “non-equilibrium” model
- Developed in 1960s/1970s
- Assumption that community can exist in any of several stable states, with transitions between states
  - “Stable” = resilient, where some variation exists within the state
  - Transitions often defined by management and/or abiotic site characteristics
- States can be temporary or long-lasting
- Transitions can be reversible or irreversible

State and Transition Model (2)

- T1a and T2b assumed irreversible
- R3b is from artificial reveg. (high input)

- Rate of transition varies
  - plant lifespan, climatic conditions, human involvement, etc.

- "Thresholds" are major, generally irreversible transitions (not always included)



B. Site potential

Ecological Site Descriptions and Site Potential

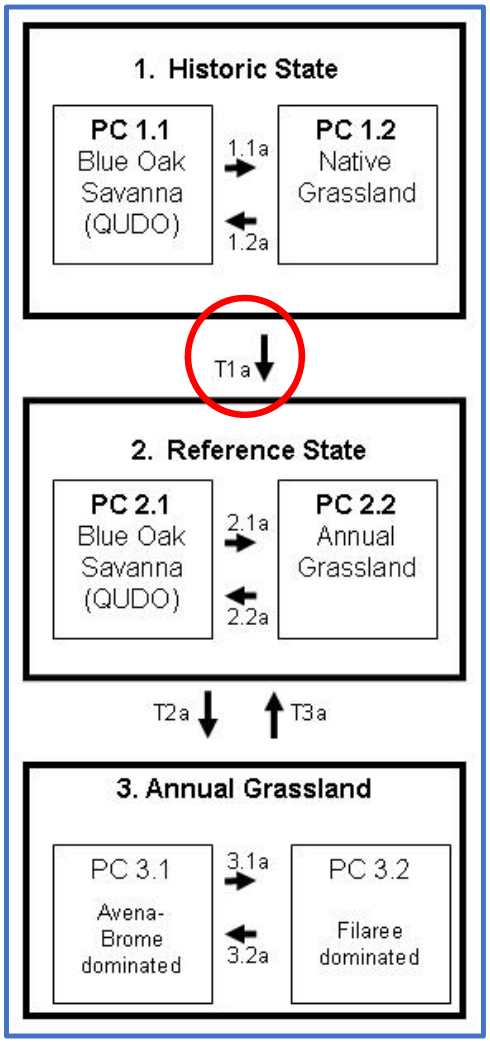
- ESDs include STMs, not linear succession
  - Competition not the only driver of community change
  - Soils, slope/aspect, fire frequency ►different possible states within a Site

- ESDs describe past, present, and possible future community on site
  - Reference state = site potential
  - Reference state may be similar to present conditions or reflective of known historical conditions

B. Site potential

Ecological Site Descriptions and Site Potential

- e.g. for MLRA 18's **Very Stony Shallow Loam**:
- "**The reference state for this ecological site is similar to its pre-European state;** however, density of shrubs and foothill pine (Pinus sabiniana) may be different due to fire suppression and annual grasses and forbs now dominate the understory."
- **"The reference state for this ecological site is a blue oak savanna mixed in a mosaic with annual dominated grassland patches."**



B. Site potential

Review – site potential

1. Which model better applies to your land?

2. Does the idea of “site potential” fit better under succession or state-and-transition models? Why?

3. Can you describe a situation where site potential cannot be reached?

Overview:
How and why we classify vegetation types

A. Scales of classification
   i. Land Resource Regions
   ii. Major Land Resource Areas
   iii. Common Resource Areas
   iv. Ecological sites

B. Site potential (ESDs, successional and STM models)
   i. Differences between successional and STM paradigms

C. How rangeland management uses classifications
   i. Grazing prescriptions, predicting site response to grazing, fire, etc.

C. Using land classifications

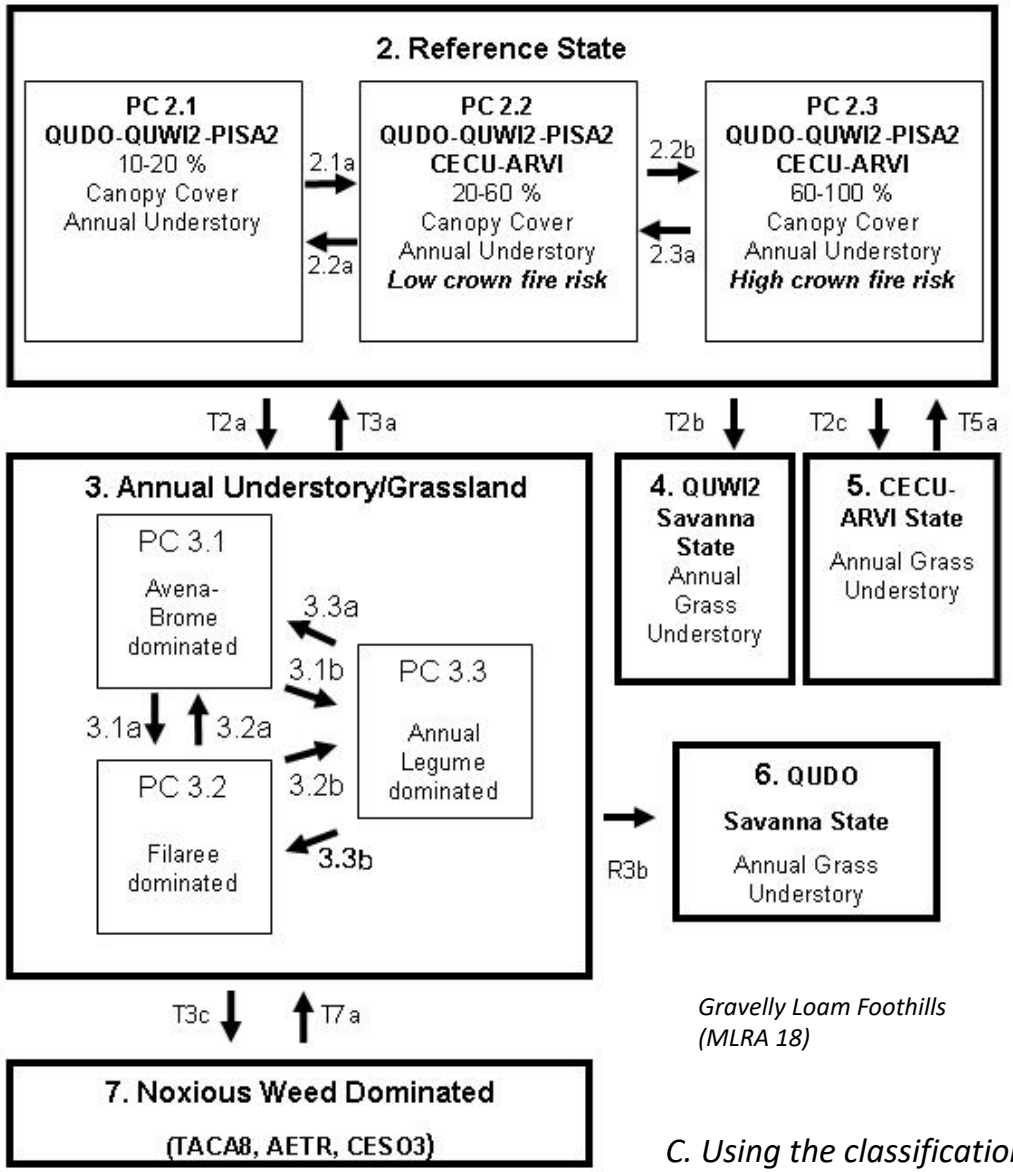
- Why bother?
  - Describe characteristics of regions beyond/within political boundaries
  - Communicability/consistency across agencies and managers
  - Helpful for new landowners

- Management decision support tool
  - Better predict response to management decisions, e.g. grazing or Rx fire
  - Understand investment needed to shift community toward preferred states
  - Confirm or explain patterns already observed on a site

Management scenario

- To maintain Annual Grassland (State 3), how would you get there from the Reference State?
- To get to the Reference State from State 5, what would you do?

- Now look at the ESD narrative. Did we describe the same transitions as the ESD?



Gravelly Loam Foothills (MLRA 18)

C. Using the classification

Review – management

1. Do you plan to incorporate land classification into your management?
2. If so, in what way? If not, why not?

Thank you!

References/further reading

- Westoby, M., Walker, B., and Noy-Meir, I. 1989. Opportunistic management for rangelands not at equilibrium. Journal of Range Management 42:266-274. Available here.
- Bestelmeyer et al. 2016. Improving the effectiveness of ecological site descriptions: general state-and-transition models and the Ecosystem Dynamics Interpretive Tool (EDIT). Rangelands 38:329-335. Available here.

- ESIS for ESD reports: https://esis.sc.egov.usda.gov/Welcome/pgReportLocation.aspx?type=ESD
- PLANTS database (learn about the plants in an ESD): https://plants.sc.egov.usda.gov/java/
- Soil Web (can relate to ESDs): https://casoilresource.lawr.ucdavis.edu/gmap/