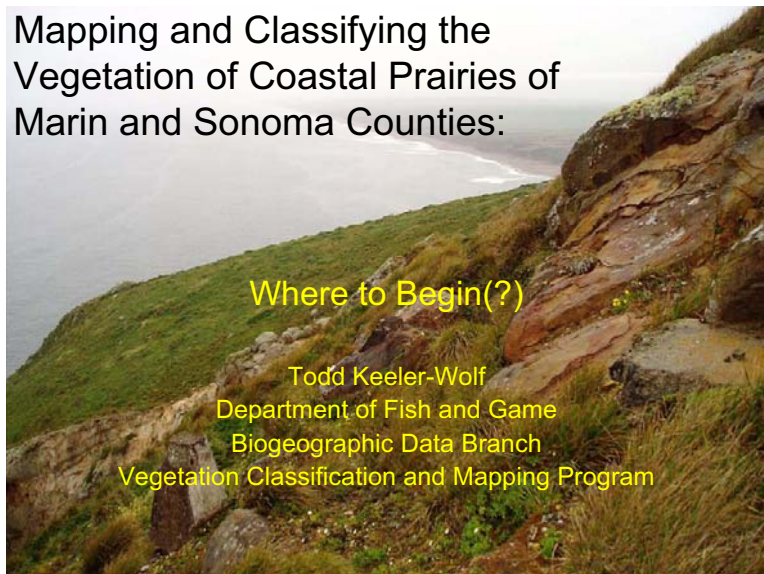


## Mapping and Classifying the Vegetation of Coastal Prairies of Marin and Sonoma Counties:

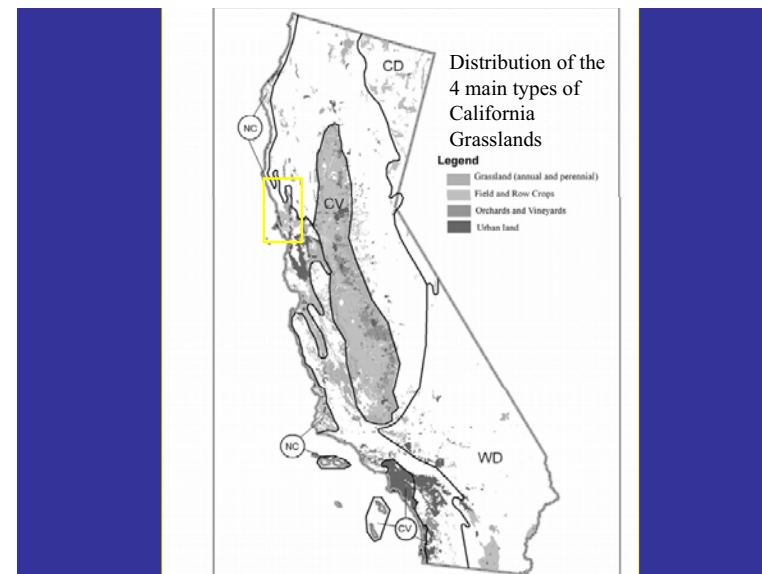


Where to Begin(?)

Todd Keeler-Wolf  
Department of Fish and Game  
Biogeographic Data Branch  
Vegetation Classification and Mapping Program

### What is a Grassland?

- Vegetation averages < 10% uniform cover of woody plants and at least 10% of grass or grass-like plants
- Vegetation dominated by grasses or grass-like plants, may have substantial forb cover
- Species may be annual, and/or perennial
- Vegetation is not permanently wet during the growing season (not a marsh)



### What is the Conventional Coastal Terrace Prairie?

- A.k.a. Fescue-Oatgrass, coastal perennial grassland, bald-hills prairie, part of North Coastal Grassland
- Has strong affinities to the grasslands of central and eastern Oregon and the Palouse Prairie of eastern Washington
- Species richness and the amount of cover still provided by natives are higher along the coast than in the Central Valley
- Ranchers as early as the 1820s also recognized that forage productivity was higher than in the Central Valley

West to East gradient of wet-dry underscores more moisture availability throughout growing season (Pt. Reyes to Petaluma; NAIP June 2005)

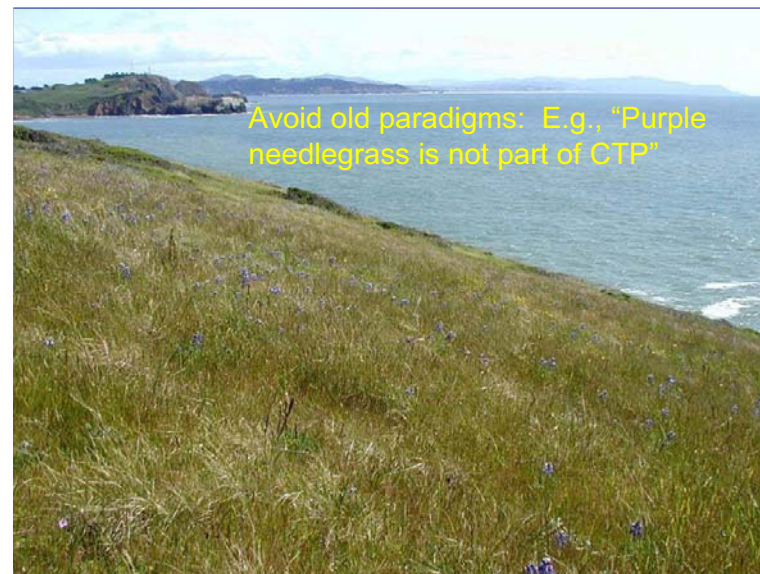


## What is Coastal Terrace Prairie? (2)

- Influenced by cool maritime climate
- An assortment of grasslands with a number of different combinations of species
- Plant community patterns influenced by soil depth, moisture, fertility, texture
- Influenced by natural and non-natural historical patterns of disturbance (default vegetation is not usually grass in many areas)
- Stands are not usually large

## Issues of Clarification

- How do we individuate it from other native CA grasslands?
- How do we individuate it from non-native coastal grassland (annual and perennial)?
- How do we tease out seral relationships with woody vegetation such as coastal scrub and coniferous forest?



Bald-hills grassland (*Festuca roemerii*) inner Mendocino Co. is not CTP



"Native coastal grasslands have high biodiversity"



Pure *Nassella pulchra* stand Coyote Hills, Alameda Co.

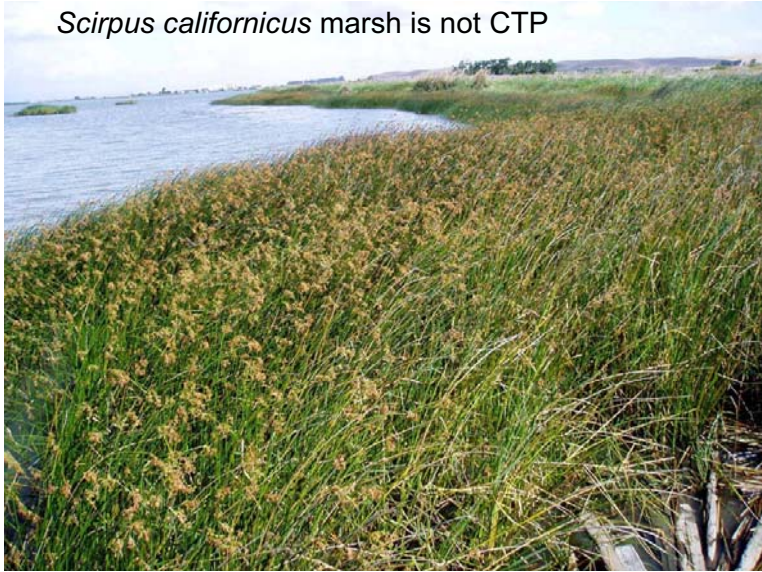
*Festuca roemerii* central Marin Co. Is it CTP?



Saltgrass meadows: are they part of the CTP matrix?



*Scirpus californicus* marsh is not CTP



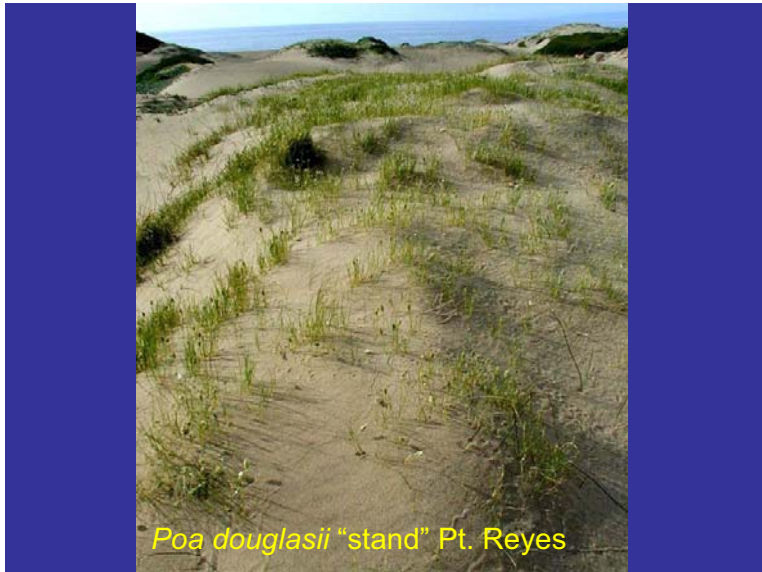
Is this *Juncus balticus*-*Argentina anserina* stand a CTP grassland?



But *Deschampsia caespitosa*, a classic CTP type, occurs on the outer edge of marsh in the Delta and other areas

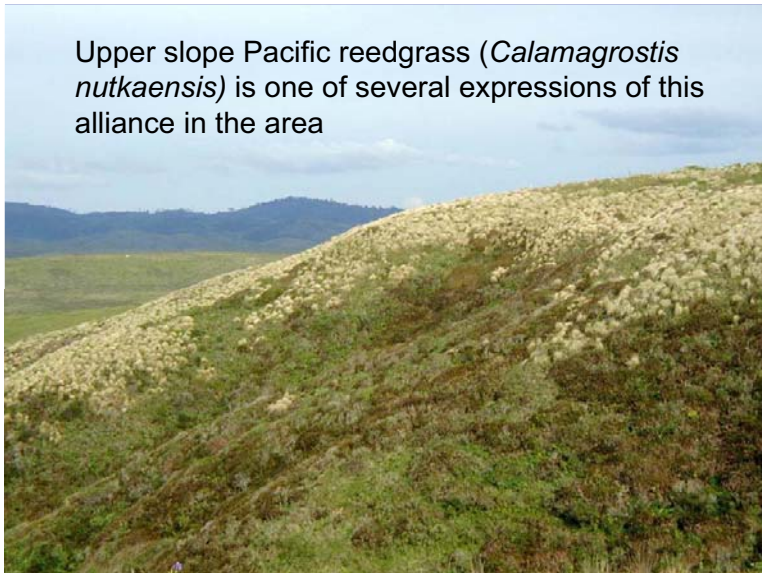
Dune vegetation includes several native grass-dominated types (*Leymus mollis*). Should they be considered?



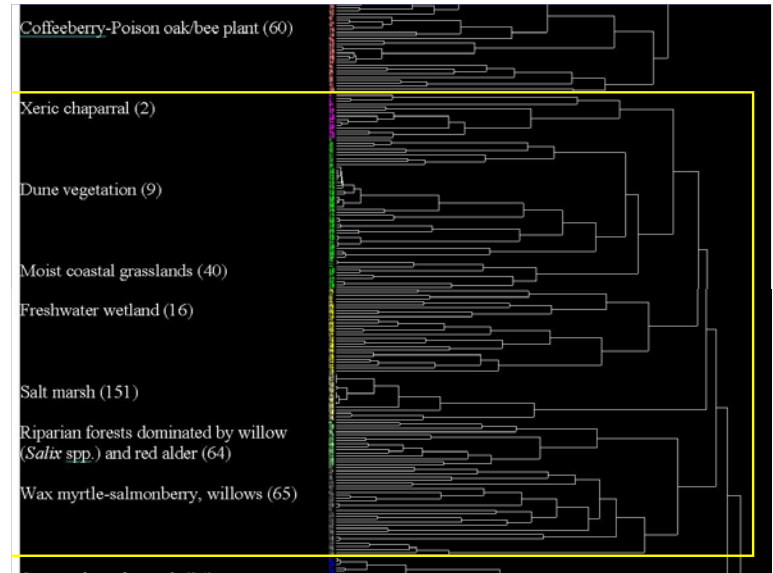


*Poa douglasii* "stand" Pt. Reyes

Vegetation sampling and analysis is the only way to discover natural variation, show relationships, and define the correlation between stand composition and environment.



Upper slope Pacific reedgrass (*Calamagrostis nutkaensis*) is one of several expressions of this alliance in the area



## What to Study

- Natural variation
  - Correlation between species composition and environment
- What is a “natural pattern” in coastal prairie?
  - The balance between disturbance and succession (grazing, fire, clearing)
- How is native biodiversity represented?
  - Within stands
  - Beta diversity (not always high within, but also between stands)

Much of the native within-stand diversity is maintained by a balance of disturbance regimes



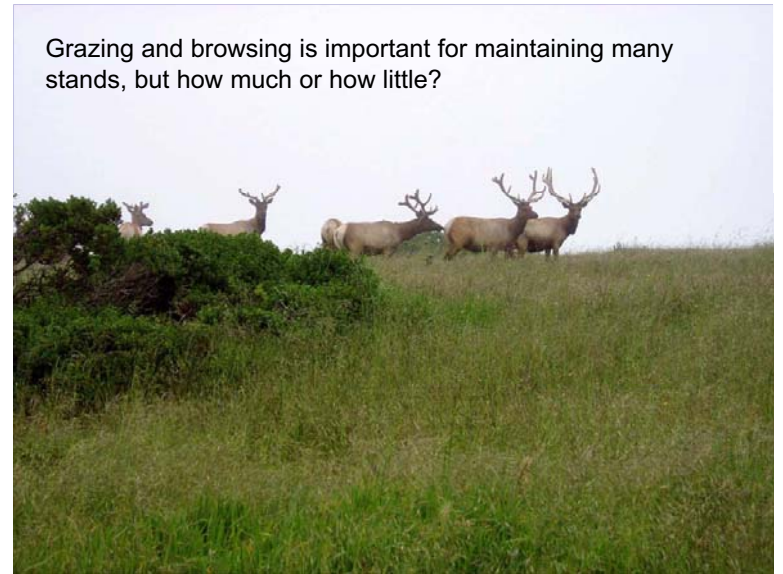
## Seral Relationships: Role of Fire, Grazing, etc.

- Grass to tree types
  - Bishop pine
  - Douglas-fir
  - Sitka spruce (further north)
- Grass to scrub
  - Yellow bush lupine turnover
  - Coyotebrush increase





Grazing and browsing is important for maintaining many stands, but how much or how little?



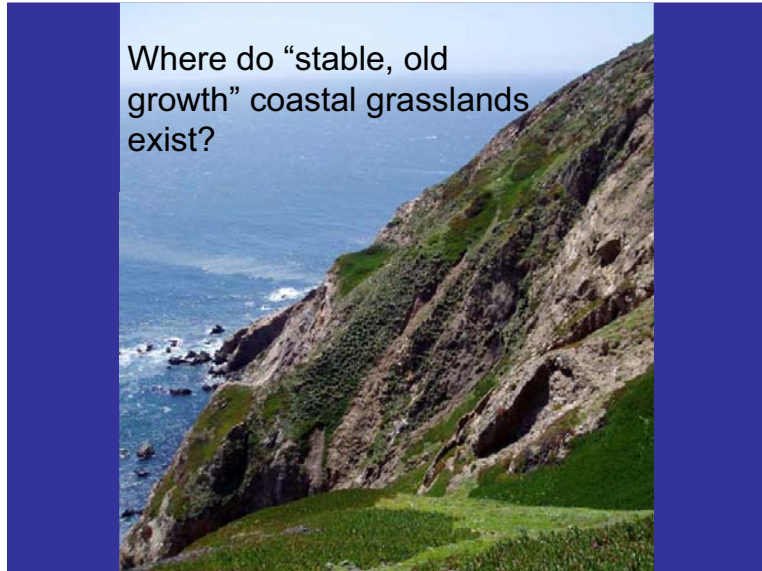
*Lupinus arboreus* cyclic wax and wane



However, these too have their own forms of dynamism



Where do “stable, old growth” coastal grasslands exist?



## Small Stands are the Norm

- Narrow strips based on sharp gradients (e.g., moisture, salinity)
- Stands limited by natural landscape (e.g., terraces, soil lenses, bluffs)
- Stands based on small patch dynamics (e.g., clearing, fire, browsing/grazing intensity)





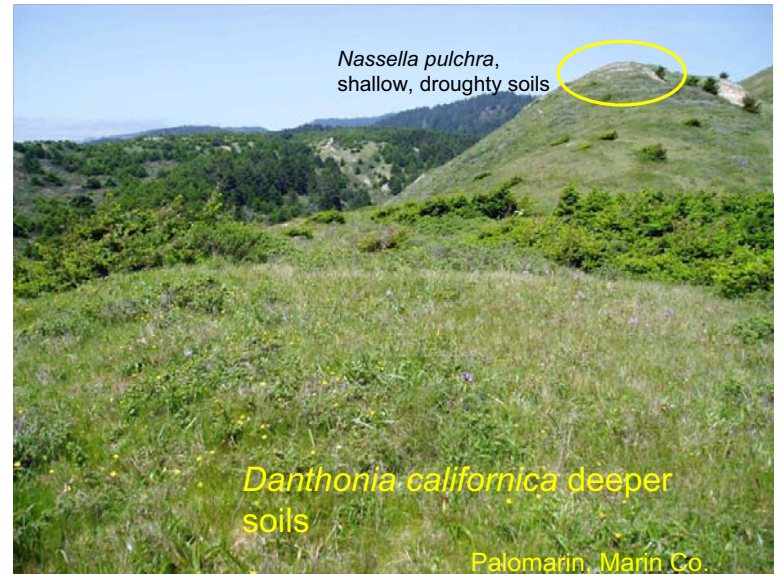
*Leymus triticoides* belt, salt marsh margin



*Deschampsia caespitosa* belt, brackish marsh margin



*Nassella lepida* upper slope clay lenses, Santa Monica Mtns., Ventura Co.



*Nassella pulchra*, shallow, droughty soils

*Danthonia californica* deeper soils

Palomarin, Marin Co.

We only partially understand the  
vegetation of the coastal  
grasslands

No sampling and analysis of natural variation  
along the coast or middle North Coast  
Ranges north of Point Reyes



Some of the rarest  
native CTP types are  
among the least  
understood

*Festuca rubra* grassland, Pt.  
Tom



*Festuca rubra*, stabilized sand stand, Humboldt Co.



*Festuca californica* stand Limantour, Pt. Reyes



*Elymus glaucus*, Ocean Song Farm,  
Sonoma Co.



Sweet vernal grass (*Anthoxanthum odoratum*)  
Pt. Reyes NSS

## Non-native Grasslands

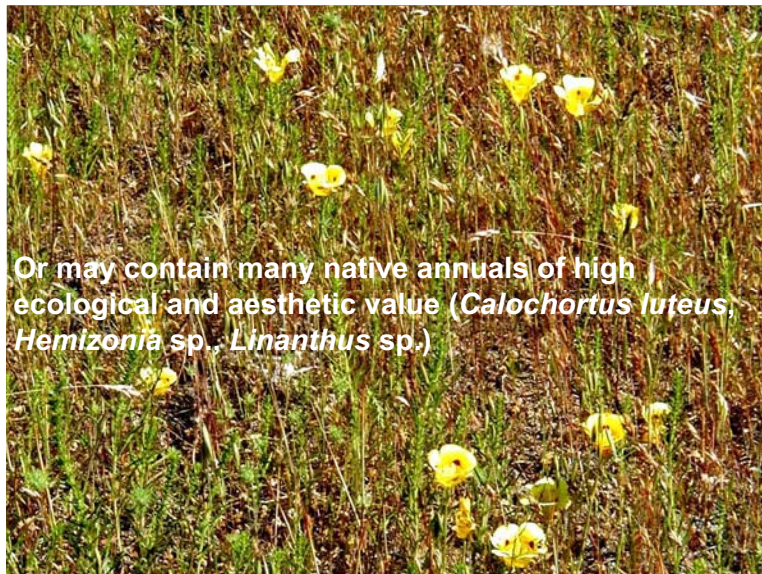
- Perennial (planted for pasture, sustained by higher average moisture than interior CA; diverse and pugnacious)
- Annual (some shared with the interior of the state, but some are more directly related to the coastal moist environment)
- Variable as threats to native biodiversity (some may be reservoirs of nativity)
- Need to understand them and know their ecologies



Harding Grass (*Phalaris aquatica*) Potato Harbor, Santa Cruz Is.



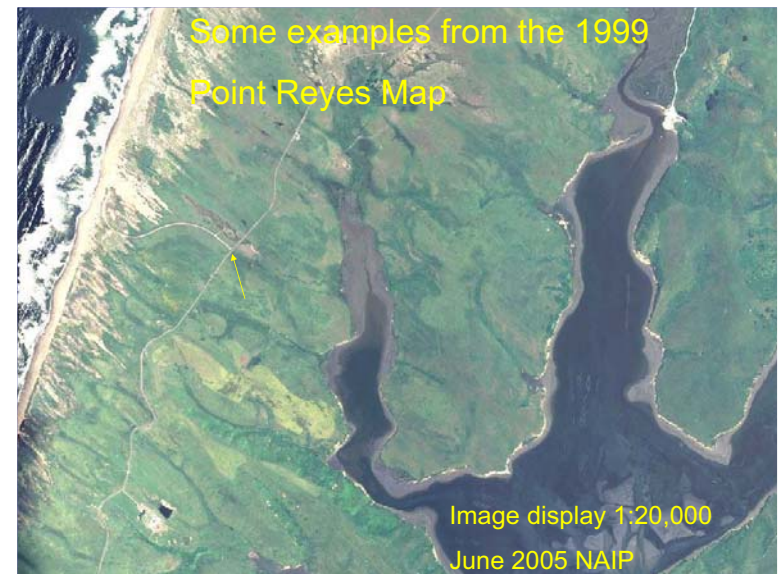
Annual grassland may be largely non-native (*Cynosurus echinatus*-*Gastridium ventricosum*; Mendocino Co.)



Or may contain many native annuals of high ecological and aesthetic value (*Calochortus luteus*, *Hemizonia* sp., *Linanthus* sp.)

## Mapping Issues of Coastal Terrace Prairie:

- Herbaceous vegetation is very hard to map using traditional or high tech remote-sensing methods
  - Small patch size
  - Subtle photo signatures
  - Phenological and inter-annual variability
  - A wide variety of types with distinctive species combinations
  - Can't throw out the annual grassland baby with the bathwater (nativity)
  - Can't assume "perennial" is good (or bad)





Linework from 1994  
1:24,000 contact prints

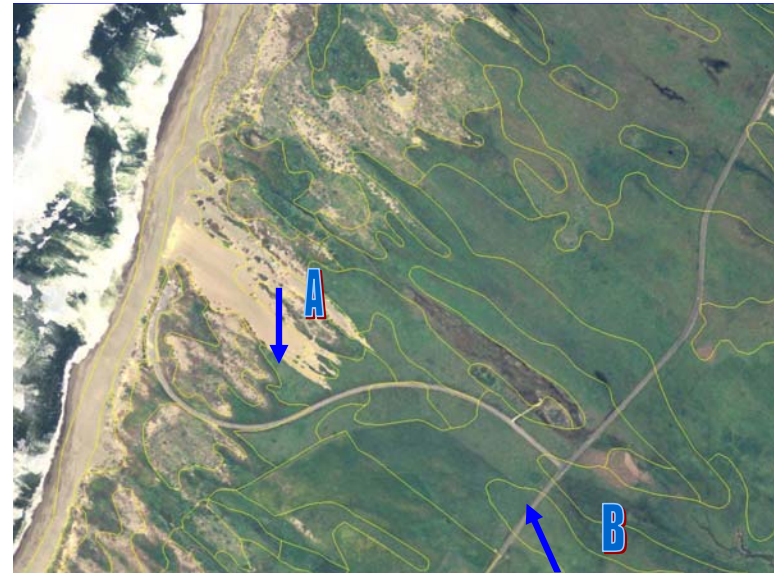


Image display 1:3,000



*Calamagrostis nutkaensis* - *Carex* spp. - *Juncus* spp. Association

B



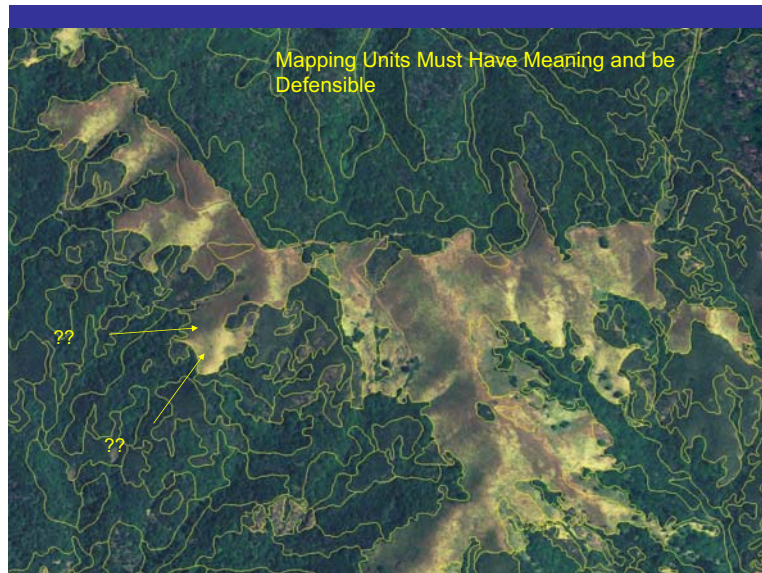
*Deschampsia cespitosa* - *Horkelia marinensis* Association



## Map using the proper parameters:

- Small patches = high resolution imagery = small MMU
- Similar signatures with fine-scale environmental differences =
  - lots of field data to define differences
  - and good supporting GIS information to help derive the information (1-5 m DEMs, digital soils data, well-georeferenced field samples, etc.)





## General Recommendations

- The most efficient approach will be a single integrated sampling and mapping project that has sufficient funding and time to address all of your needs (consider uses and final products carefully)
- Think broadly about definitions
  - What was native grassland historically?
  - Are there non-traditional “grasslands” that you also believe should be addressed?
  - Research the variety of existing grasslands and related types
  - Sample them and classify them
- Mask-out forest, true pasture (planted, highly modified), and other non-related or exogenous types.
- Rely heavily on field work
- Mapping should be done by ecologists who know the local vegetation
- Map stands as much as possible, not consolidated mapping units

## Initial Information Gathering

- Obtain existing classification information and field plot data (it will not be enough)
- Develop a sample allocation process based on your vision of full representation
- Solicit all possible help from private landowners (access, historical use of land, involvement in data collection and attributing)

## Field Data Recommendations

- Field crews should be expert botanists/ecologists
- Use relevés and sample at peak phenology
- Sample full range of variability of all grassland types and grassland-to-woody transitions
- Collect rigorous geographic information from the field (e.g., GPS stands that are difficult to photo-interpret),
- Collect general information about size, shape and adjacent stand types
- Use an array of techniques based on phase of project (detailed samples, reconnaissance level observations, accuracy assessment samples, depending on phase of the project)



## Mapping Recommendations

- Use true color or CIR high resolution aerial photography (no smaller than 1:12,000)
- Chose optimal phenology (or multiple dates from late spring to mid summer if possible)
- Use photo-interpreters who have a strong background in vegetation mapping, and have been involved with the field data collection and classification of the local grasslands
  - Consider GPS or ArcPad of some stands in field, stand inventory (similar to meadow assessments done by RAP)
  - Require as many field-verified samples as possible



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