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Meadow Hydrogeomorphic Types for the Sierra Nevada and Southern Cascade Ranges in California
A FIELD GUIDE

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Depressional Perennial

Setting

Depressional meadows are places where runoff accumulates in a topographic depression. Water either does not flow through the meadow or the flow is essentially imperceptible. Depressional basins are smaller than lakes and are less than 2 meters (6.6 feet) in depth. Depressional features can be natural or manmade. Stock ponds, irrigation ponds, and road impoundments are examples of manmade depressional features.

Hydrology

Depressional perennial meadows have standing water all year or late into the growing season in most years. Dominant sources of water are precipitation, groundwater inputs, and interflow from adjacent uplands. The direction of water movement is normally from the surrounding uplands toward the center of the depression. Depressional perennial meadows are separated from basin peatlands by the absence of a peat layer.

Vegetation

Depressional perennial meadows are characterized by more stable hydroperiods than the depressional seasonal meadow type. These meadows are often dominated at their centers by wetland vegetation (obligate and facultative wetland plant species) that requires saturation near the surface and/or late season moisture. Plant communities may reflect a strong zonation due to changes in flooding depth from center to edge.

Figure 11. Photo of depressional perennial meadow on the Plumas National Forest.
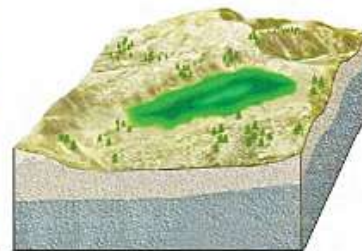
Figure 12. Typical landscape position for the depressional perennial meadow occurring in a topographic depression.

Goal

- Use the Hydrogeomorphic (HGM) classification of Brinson (1994) and expanded by NRCS (2008). We modified for mountain meadows

- Develop a classification of meadows that can be mapped
  - geomorphic position
  - water source
  - water direction (to some extent)
  - presence of organic soil

- Field key
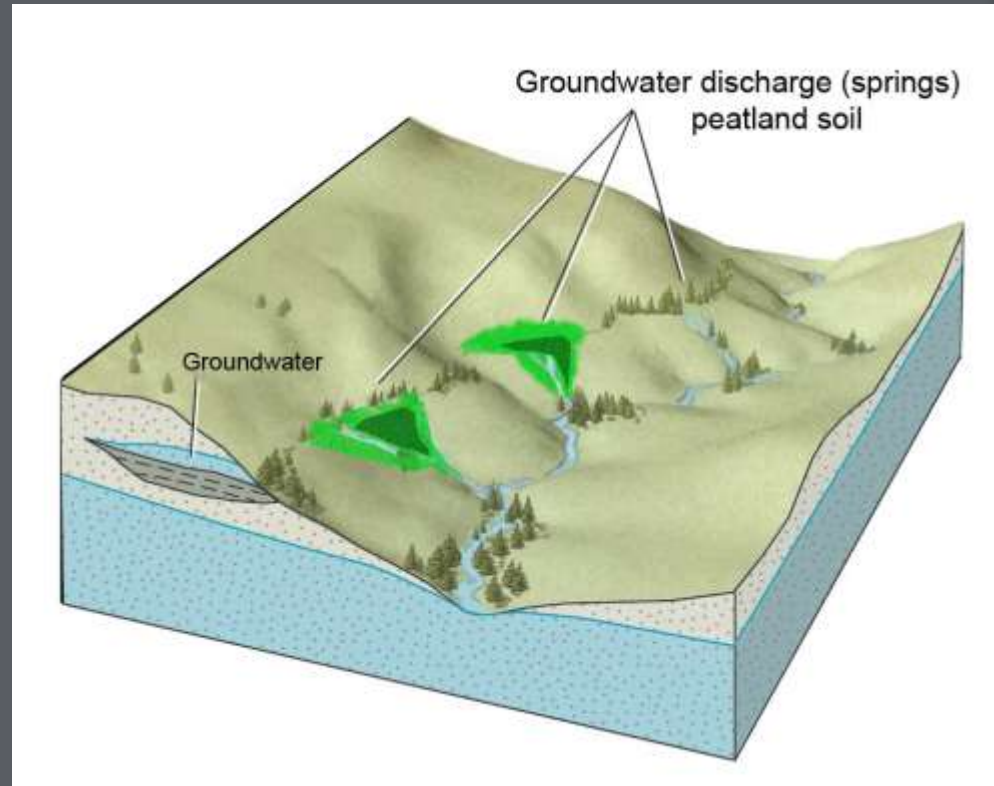
Illustrations in this presentation adapted with permission from Grants Pass Water Laboratory

Definition of a meadow

* An ecosystem type composed of one or more plant communities dominated by herbaceous species

* Supports plants that use surface water and/or shallow groudwater (generally at depths < 1 m)

* Woody vegetation (trees, shrubs) may occur and be locally dense, but are not dominant

HGM types derived from combinations of soil, water source, and geomorphic setting
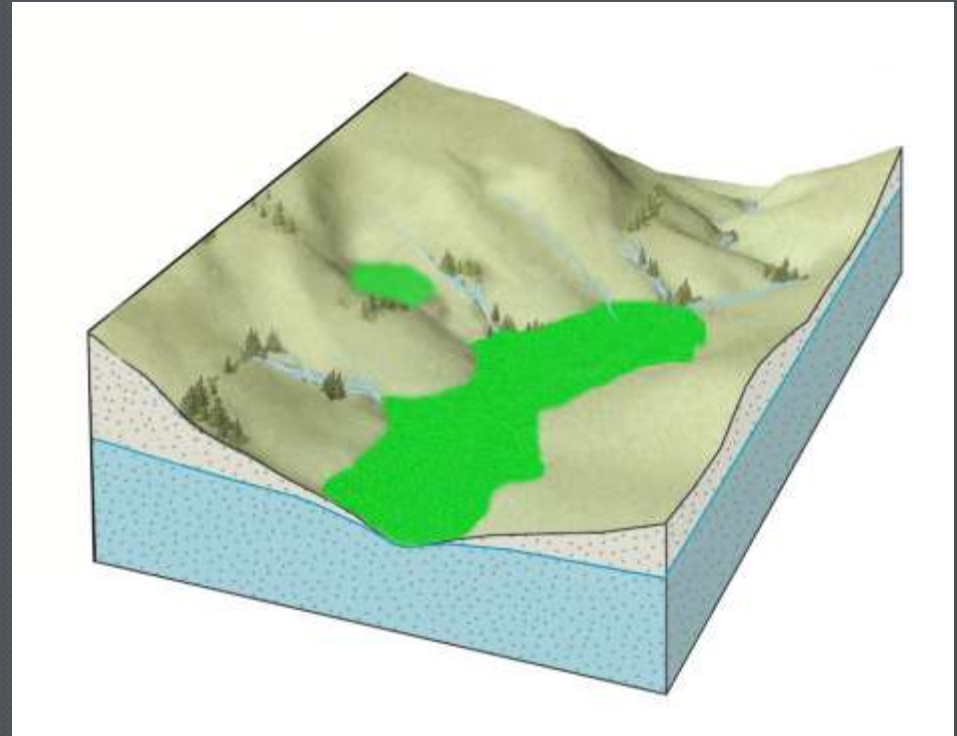
(the name says a lot)

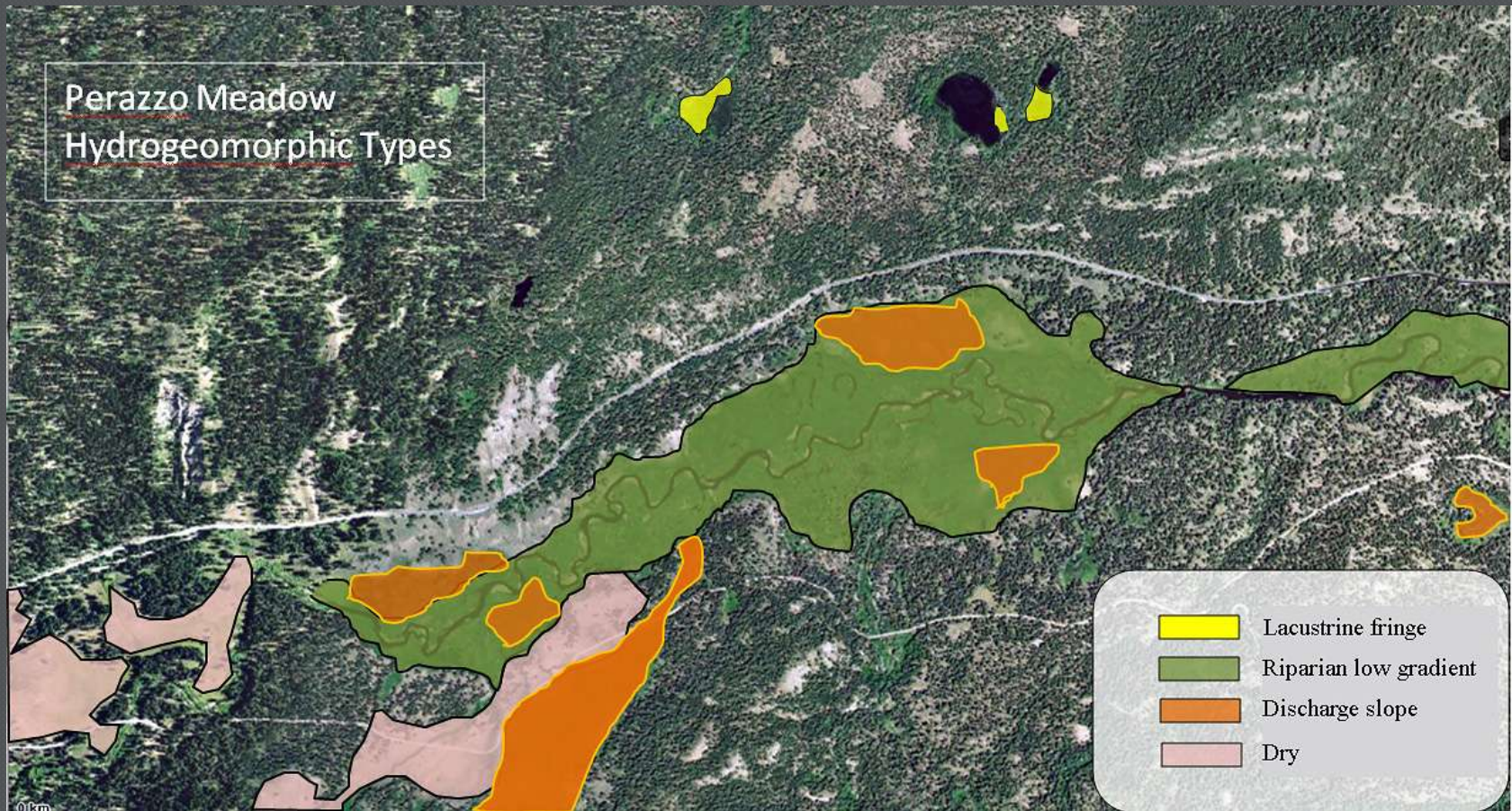| Soil	Water source	Geomorphic settings
- Organic - Mineral	- Precipitation (and interflow) - Groundwater - Surface water (overbank, sheet flow, or impounded)	- Riverine (in valley with stream channel) - Drainageway (in valley with no stream channel) - Depression - Slope (hillslope or toeslope) - Lake fringe (lacustrine)

Why develop HGM classification for mountain meadows?

- Need a classification of mountain meadows useful for management that indicates how a meadow looks, and how a meadow works

- Need a classification that can be used in the field to determine a meadow type fairly quickly

- Need a classification that is useful for:
  - restoration (hydrograph, timing of release)
  - range assessment (condition and trend of meadows)
  - wildlife habitat (willow flycatcher)
  - climate change (shrinking peatlands)

What the HGM classification is not

- Not a substitute for riparian ecological site descriptions (ESD's) being developed . Likely related in a hierarchical manner.

- Not an ecological site classification, HGM types may contain a complex of ecological sites

Typical meadow mapping exercise using HGM classification

Perazzo Meadow
Hydrogeomorphic Types

Legend:
- Lacustrine fringe
- Riparian low gradient
- Discharge slope
- Dry

Data collection and analysis

- 670 meadow plots were sampled from 1999 to 2011 as part of the USFS R5 meadow monitoring project
  - Landscape position
  - Plant community
  - Depth to water table
  - Primary water source

- Meadow sites were compared with the Brinson (1994) HGM model

- New types were added that did not fit the model

# Seven HGM classes and fourteen HGM subtypes identified

- Peatland (3 subtypes)
- Depressional (2 subtypes)
- Lacustrine fringe (1 subtype)
- Dry (1 subtype)
- Discharge slope (springs)(1 subtype)
- Riparian channelized (3 sbutypes
- Subsurface nonchannelized (3 subtypes)

7 HGM classes, 14 HGM subtypes

HGM class	Water Source dominant	Landform	Types in classification
Peatland	Groundwater, water input from lake	Hillslope, toeslope, basin	3 types: *Discharge slope peatland; mound peatland; basin peatland*
Depressional	groundwater, interflow, precip.	Depressional basin	2 types: *perennial, seasonal*
Discharge slope (springs)	Groundwater	Hillslope, toeslope	1 type: *discharge slope*
Dry	Not fed by groundwater	Stream terrace, bench, hillslope	1 type; *Dry*
Lacustrine fringe	Overbank flow from lake, groundwater inputs from lake	Lake fringe	1 type; *Lacustrine fringe*
Riparian channelized	Overbank flow, groundwater	Floodplain, terrace	3 types; *low gradient riparian; middle gradient riparian; high gradient riparian*
Non channelized drainways	Groundwater, interflow	drainway	3 types; *low gradient subsurface; middle gradient subsurface; high gradient subsurface*

Class: Peatland - 3 subtypes

- If a site has at least 20 cm of peat (organic soil) in the top 40 cm, falls in the peatland HGM meadow type

- Peat contains 12 – 18% organic carbon by dry weight (depends on the clay fraction in soil)

40 cm
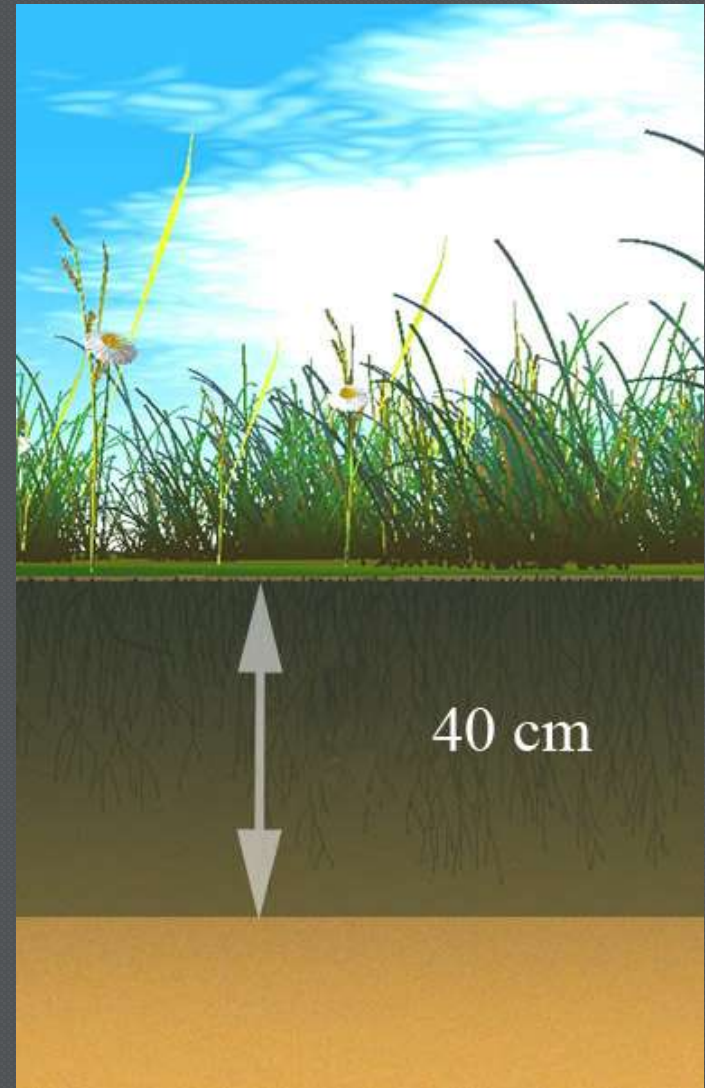
Basin peatland subtype

If the site occurs in a basin (typically with no inlets or outlets) or at the margins of lakes or ponds

Peat:	Yes
Water source:	Inputs from lake, groundwater and/or surface water
Landform:	Lake fringe

Mound peatland subtype

If the site occurs at the base of a slope, on a toeslope, or valley bottom where peat has accumulated creating a mound due to strong upwelling of groundwater

|	
Peat:	Yes
Water source:	Groundwater
Landform:	Hillslope, toeslope, base of alluvial fan

Discharge slope peatland subtype

If a site occurs on a hillslope, toeslope, or at the base of an alluvial fan where groundwater discharges to the surface

Peat:	Yes
Water source:	Groundwater discharge
Landform:	Hillslope, toeslope, base of alluvial fan

Class: depressional - 2 types

- < 20 cm of peat on the top 40 cm of soil.

- Occurs in a topographic depression that allows accumulation of surface water or precipitation.

- May have any combination of inlets, outlets, or lack them completely
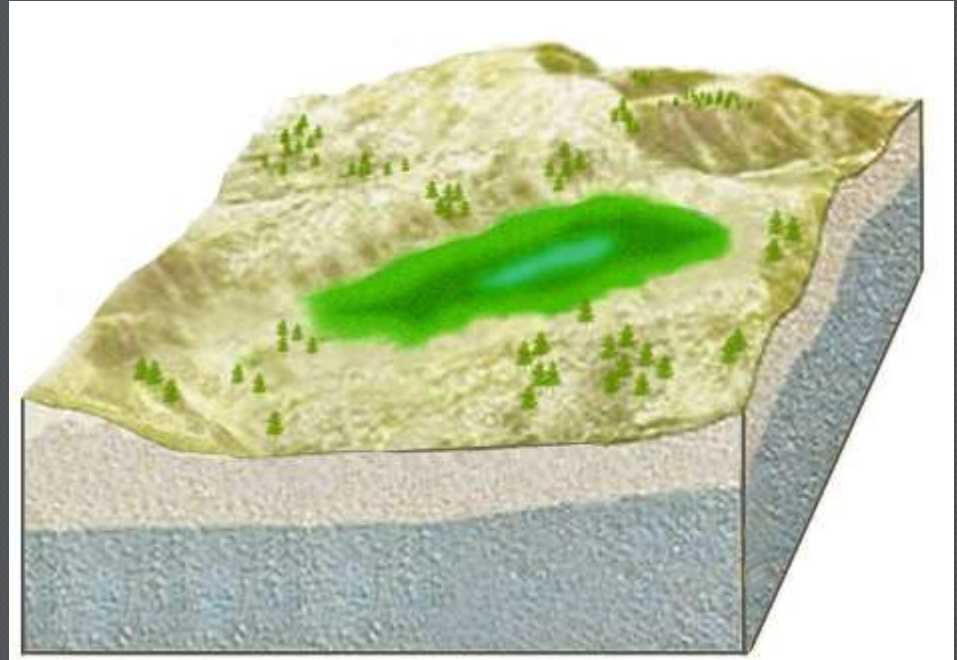
Depressional seasonal subtype

Has no standing water after late July during most years, also includes vernal pools

Peat:	No
Water source:	Precipitation, interflow
Landform:	depressional

Depressional perennial subtype

Has some amount of standing water after late July during most years

Peat:	No
Water source:	Groundwater, precipitation
Landform:	depressional

Class: Lacustrine fringe -1 type
occurs on fringe of lake or reservior (lake > 2 m deep)

Peat:	No
Water source:	Inputs from lake - groundwater and/or surface water
Landform:	Lake fringe

Class: Dry meadow - 1 type

Peat:	No
Water source:	precipitation
Landform:	Stream terrace, hillslope, bench

Class: Discharge slope - 1 type
springs and seeps

Peat:	No
Water source:	Groundwater discharge
Landform:	Hilllsope, toeslope, base of alluvial fan

Class: Riparian channelized - 3 types

- Occurs in a valley adjacent to a stream channel. Dominant water sources are surface water and/or groundwater

- Subtypes based on stream gradient (Rosgen gradients)

Riparian (channelized) low gradient subtype (slope <2%)

Peat:	No
Water source:	Surface water overbank flow and/or groundwater
Landform:	Floodplain, terrace

Riparian (channelized) middle gradient subtype (slope 2 – 4%)

Peat:	No
Water source:	Surface water overbank flow and/or groundwater
Landform:	Floodplain, terrace

Riparian (channelized) high gradient subtype (slope > 4%)

Peat:	No
Water source:	Surface water overbank flow and/or groundwater
Landform:	Floodplain, terrace

Class: Subsurface (nonchannelized) - 3 types

- Occurs in a valley bottom, channel length < 50% of the valley length.

- Subtypes based on stream gradient (Rosgen gradients)

Subsurface (nonchannelized) low gradient subtype (slope < 2 %)

Peat:	No
Water source:	Groundwater, surface water during storm events, precipitation
Landform:	Drainageway, swale

Subsurface (nonchannelized) middle gradient subtype (slope 2 - 4 %)

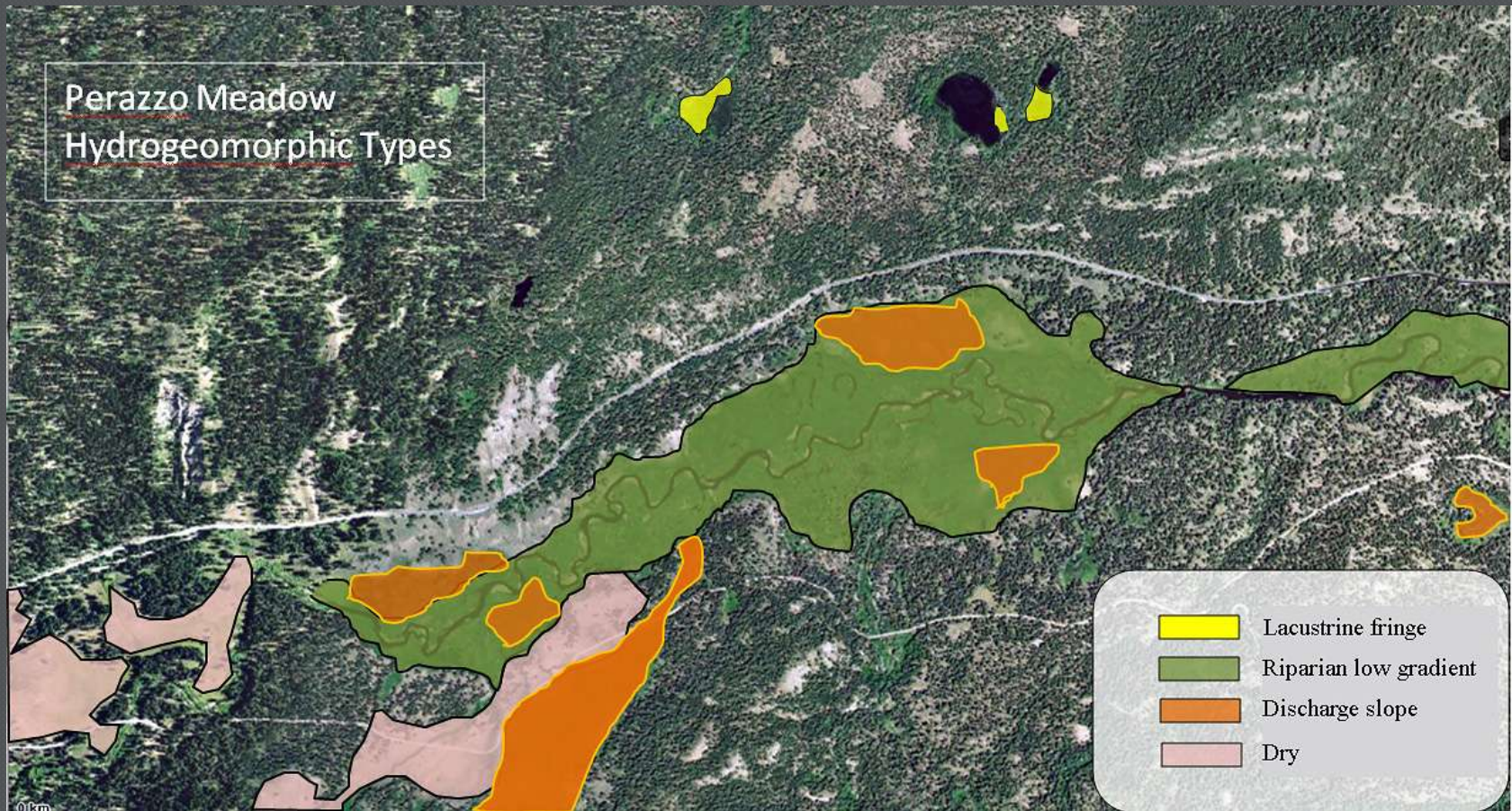| Peat:	No
Water source:	Groundwater, surface water during storm events, precipitation
Landform:	Drainageway, swale

Subsurface (nonchannelized) high gradient subtype (slope > 4 %)

Peat:	No
Water source:	Groundwater, surface water during storm events, precipitation
Landform:	Drainageway, swale

Meadows may have > 1 HGM type in the meadow area

Perazzo Meadow
Hydrogeomorphic Types

Legend:
- Lacustrine fringe
- Riparian low gradient
- Discharge slope
- Dry

Summary

- 7 HGM classes identified with 14 subtypes
- Field key allows HGM to be determined in the field with some training
- Knowing common wetland plants and their wetland rating helps a lot
- Some work has begun on field mapping by FS and NPS in CA

For copies of the HGM
meadow key and guide

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