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Using BIOS Data for Ecological Sites, STMs, & Rangeland Health Data Development

10/02/2020 | Kendra Moseley, Regional Ecologist, SPSP, NRCS

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Ecological Sites vs. Ecological Site Descriptions (ESD)

Ecological Site – A distinctive kind of land with specific physical characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation and in its ability to respond similarly to management actions and natural disturbances.

- In other words, a kind of land with similar potential and response to management.*

ESD – Is the report that characterizes and documents the ecological site concepts synthesizing the existing knowledge, research and associated data of an ecological site (including its climate, soils, hydrology and state-and-transition model) and the interpretation of its characteristics in relation to land use planning and decision-making.



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Ecological site R021X1005CA Gravelly Loam

Accessed: 03/25/2020

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata</i> ssp. <i>vaseyana</i>
Herbaceous	(1) <i>Festuca idahoensis</i> (2) <i>Achnatherum</i>

Physiographic features

This site typically occurs on footslopes and backslopes of hills and mountains throughout Modoc, Lassen, and parts of Shasta counties in Northeastern California.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Elevation	5,300–6,200 ft
Slope	5–30%
Aspect	Aspect is not a significant factor

Climatic features

The climate is semiarid with cold, moist winters and warm, dry summers. The mean annual precipitation is 12 to 16 inches including about 20 to 40 inches of snow. The mean annual temperature is 44 to 47 degrees F., the mean July temperature is about 62 degrees F., and the mean January temperature is about 24 degrees F. The frost-free period is 80 to 85 days.

Mean monthly precipitation is presented in the maximum precipitation row. Monthly precipitation and temperature are 1971–2000 means from the PRISM Group, Oregon Climate Service, Oregon State University, Corvallis, Oregon (Daly 2006). Frost free period and mean annual precipitation

obtained from map unit descriptions (Modoc National Forest Soil Survey).

Table 3. Representative climatic features

Frost-free period (average)	80 days
Freeze-free period (average)	0 days
Precipitation total (average)	16 in

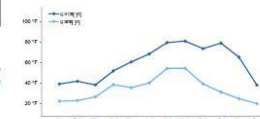


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

Intermittent streams feeding into permanent higher order streams drain this site.

Soil features

This site is characterized by moderately deep loam soils weathered from volcanic rock, particularly andesite. Soils are often gravelly at the surface and sometimes throughout the profile. Depth to bedrock is about 20 to 40 inches. These soils are generally well drained. Available water holding capacity is approximately 3 inches. Permeability is moderate.

With 20 to 40 inches of soil, elevation of 5300 to 6200 feet and rainfall of 12 to 16 inches this site differs from the other sites in MLRA 21 because of its very high herbaceous productivity (average = 2000 lb). Unlike most other sites the soils on this site support *Ceanothus* spp. in the shrub layer.

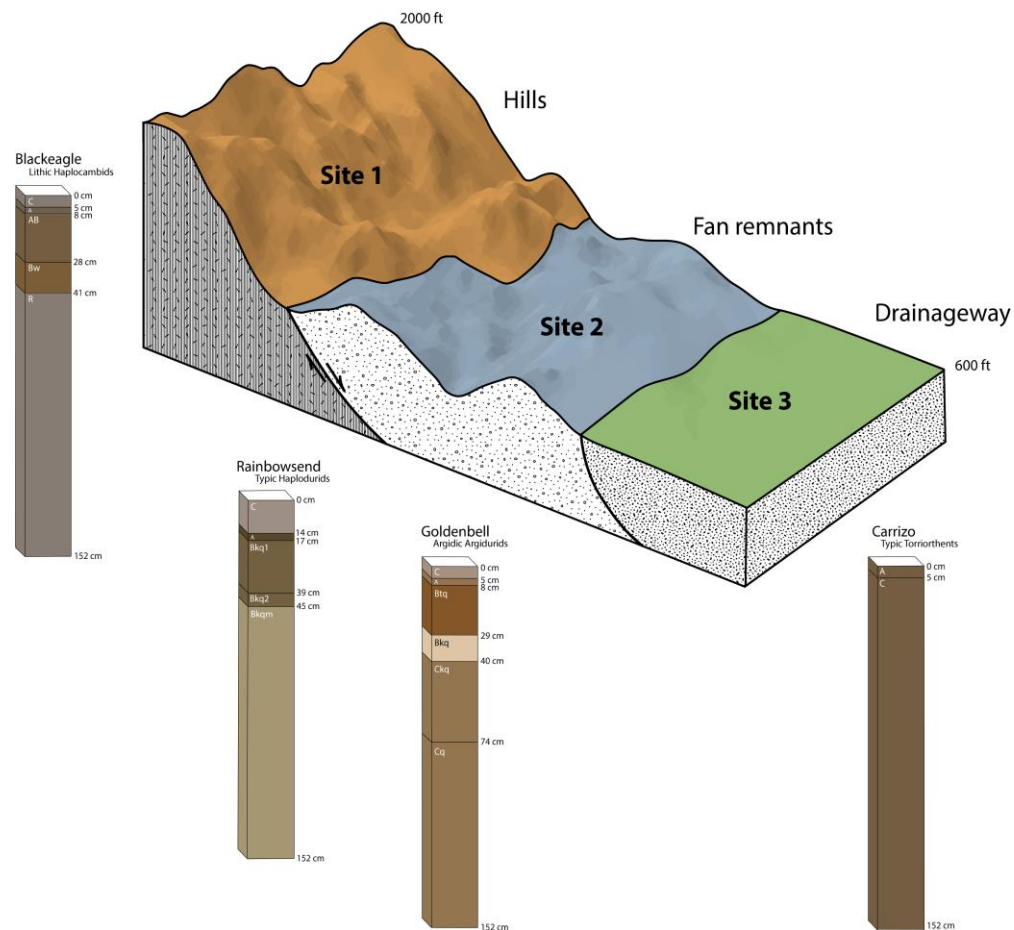


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The Purpose/Function of Ecological Sites and ESDs

1. Stratify the landscape according to varying ecological potential in order to identify management and restoration targets
2. Assess the risk of persistent degradation and take proactive measures to avoid it
3. Specify constraints to, and opportunities for, desired ecosystem change based on a knowledge of ecological processes
4. Identify specific intervention strategies that can promote desired conditions
5. Design and interpret monitoring based on interventions and expected responses.



Ecological Site Relationships Across the Landscape

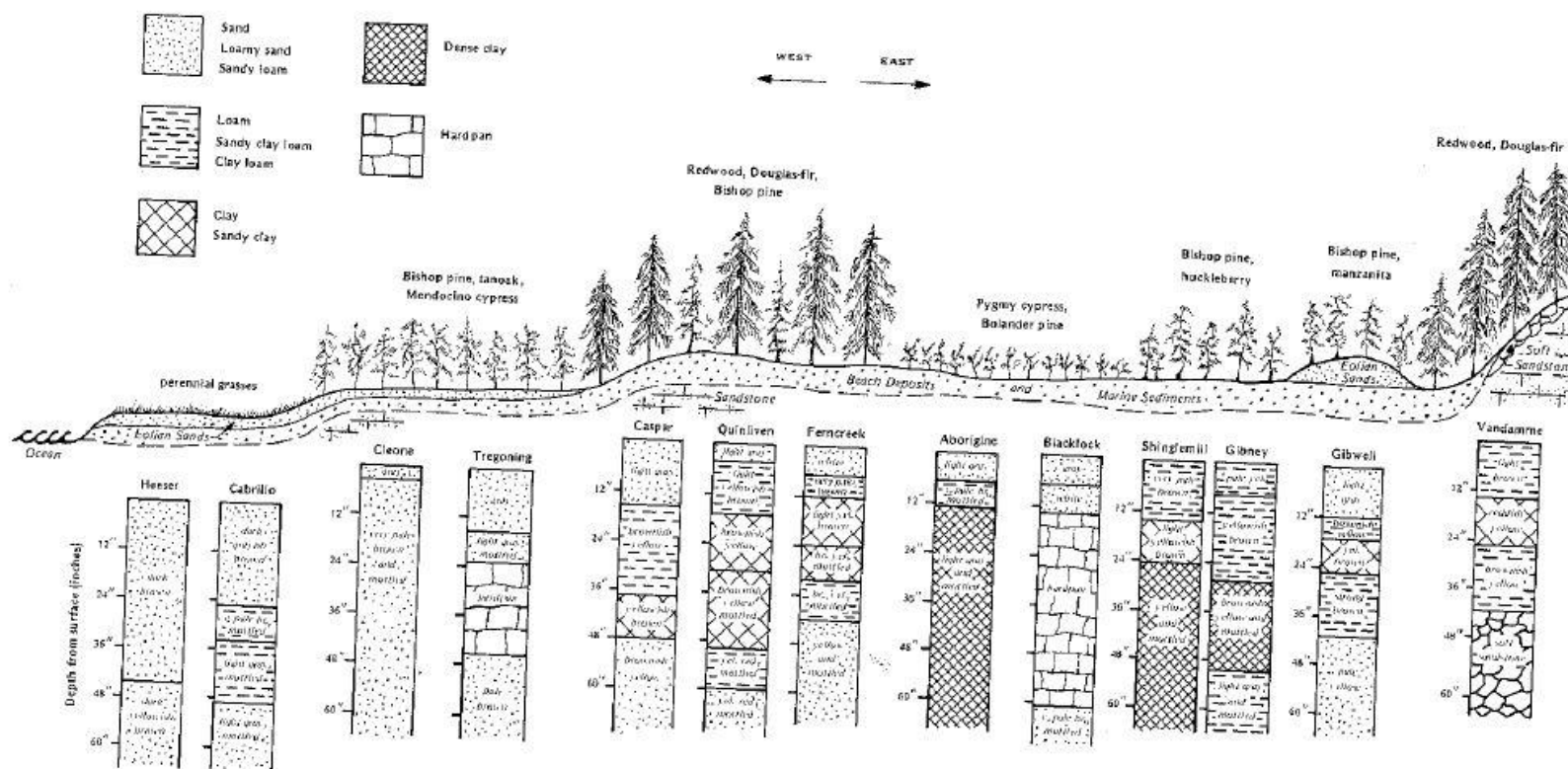
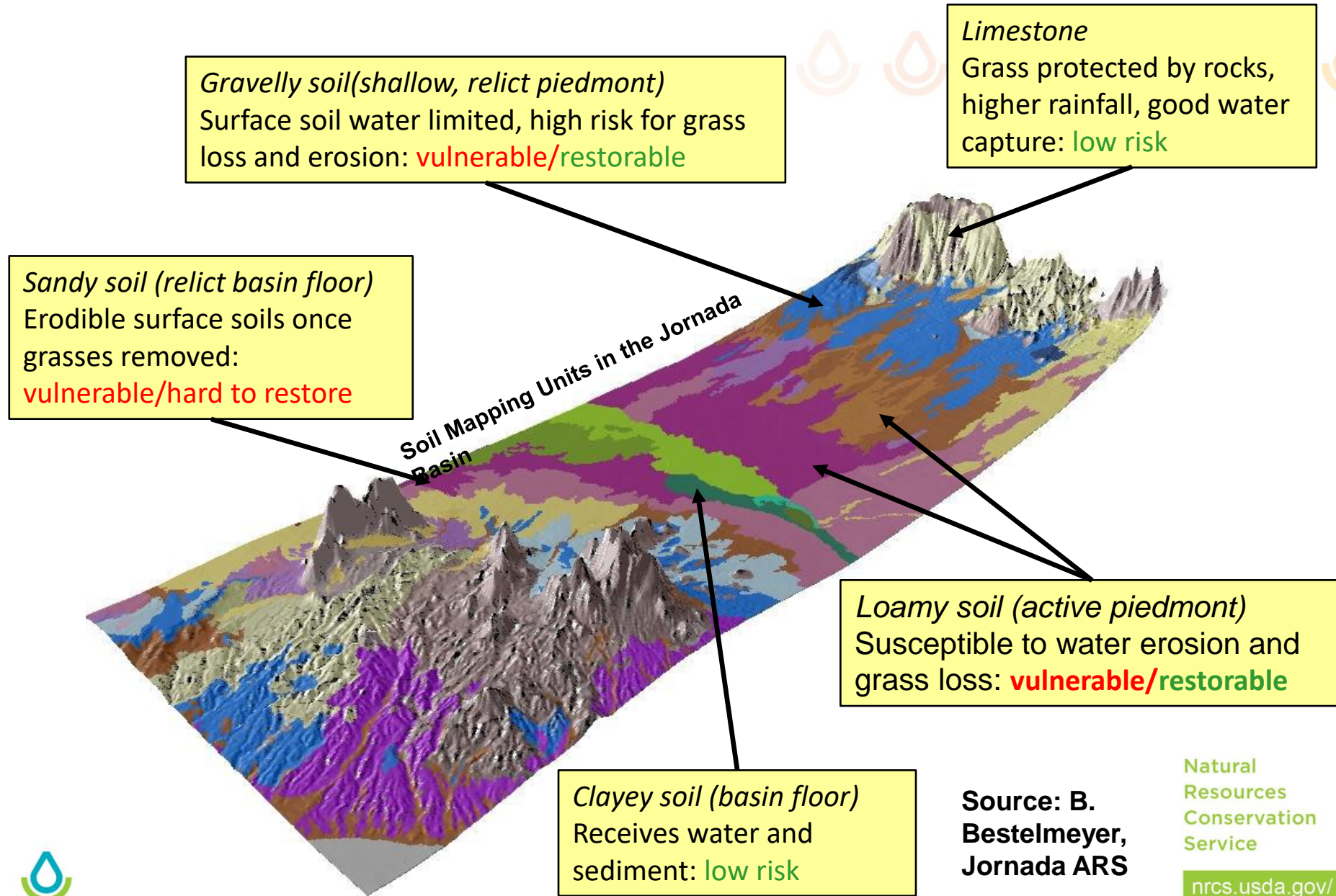


Figure 10.—Idealized illustration of the general relationships among marine terrace soils. This simplified cross-section is typical of the marine terraces near the town of Caspar. The width of the terrace system, from the ocean on the west to the mountainous uplands on the east, is approximately 4 miles at this location. Other cross-sections of the terrace system would reveal different combinations of soils. The upper terrace in this diagram represents perhaps three or more terrace levels. The diagram is not to scale.







Site 1



Site 2



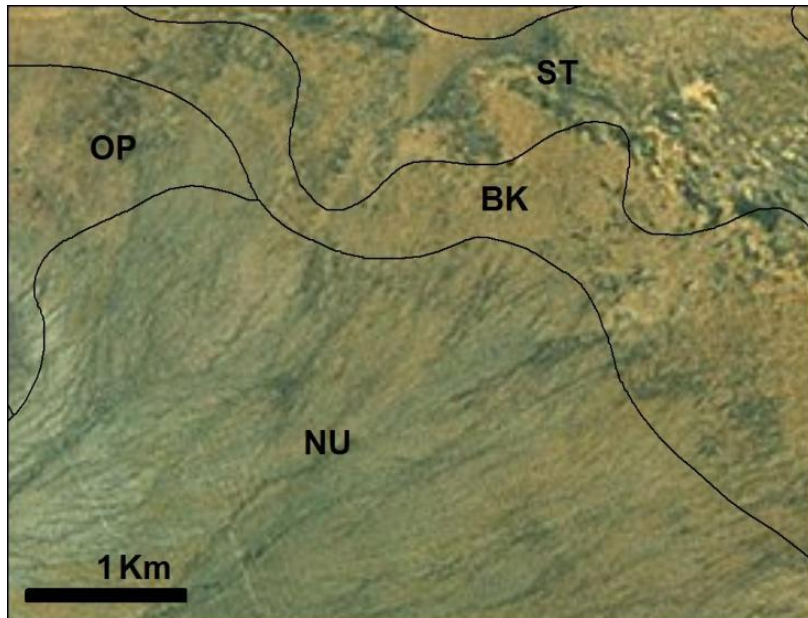
Site 3

Ecological sites concepts developed based on relationship of soil profiles to soil processes and vegetation pattern



Ecological Sites are Correlated to Soil Components

Ecological sites classify soil map unit components (soil series phases) of the US National Cooperative Soil Survey



Map unit/components = Ecological site

ST: Stellar association

40% Stellar clay loam, 0-3% slopes = *Clayey*
 40% Stellar clay loam, 0-3% slopes, flooded = *Bottomland*
 20% other inclusions

BK: Berino-Dona Ana association

50% Berino fine sandy loam, 1-5 % slopes = *Sandy*
 30% Dona Ana fine sandy loam, 1-5% slopes = *Sandy*
 20% other inclusions

OP: Onite-Pajarito association

40% Onite loamy sand, 1-4% slopes = *Sandy*
 30% Pajarito fine sandy loam, 0-5% slopes = *Sandy*
 15% Pintura fine sand, 0-5% slopes = *Deep sandy*
 15% other inclusions

A soil map unit can contain more than one ecological site

An ecological site groups several similar soil map unit components

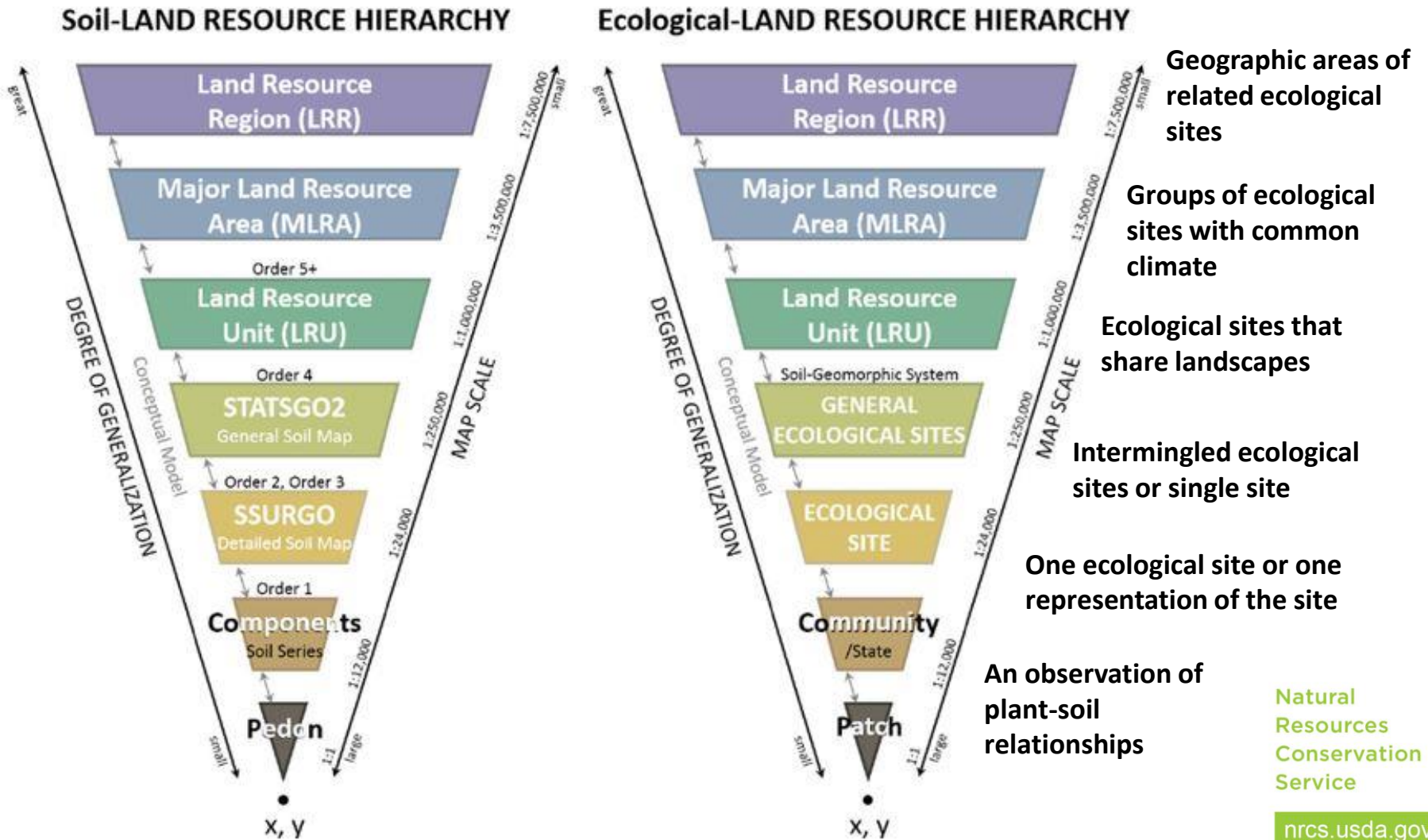


Source: B. Bestelmeyer, Jornada ARS

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Nesting Ecological Sites into Landscape Framework

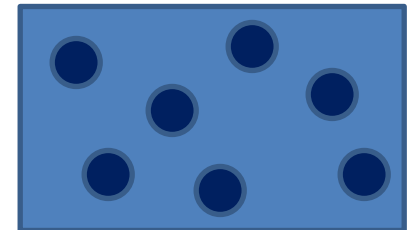
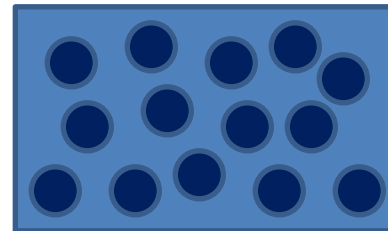
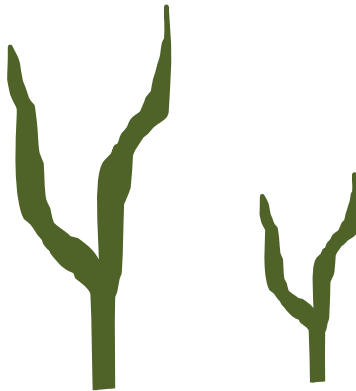


How Ecological Sites are Differentiated

- Significant differences in the species that are in the characteristic community phase



- Significant differences in the relative proportion of species in the characteristic community phase



- Significant differences in the total annual production of the characteristic community phase

State-and-Transition Models (STMs)

A diagram and description of the ecological site community dynamics

- ✓ Discrete community states and phases
- ✓ Transitions indicating change from one community phase or state to another community phase or state
- ✓ Thresholds which indicate the difference between states



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Reference State



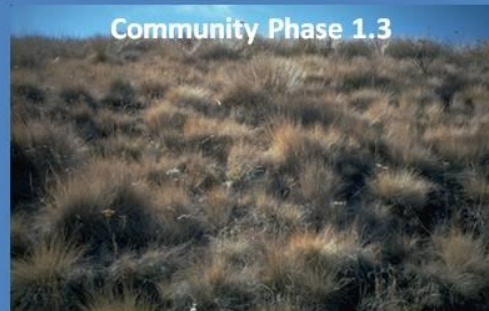
Community Phase 1.1

Time without fire



Community Phase 1.2

Time without fire



Community Phase 1.3



Juniper control

No fire

State 2



Community Phase 2.1

State 3



Community Phase 3.1

Transitions

Cheatgrass Invasion

Reference state

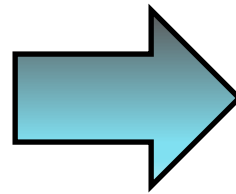
Illustrates management and restoration potentials

Ecological Site Descriptions help describe the changes from the reference state to alternative states, based on biotic and abiotic structure and function changes

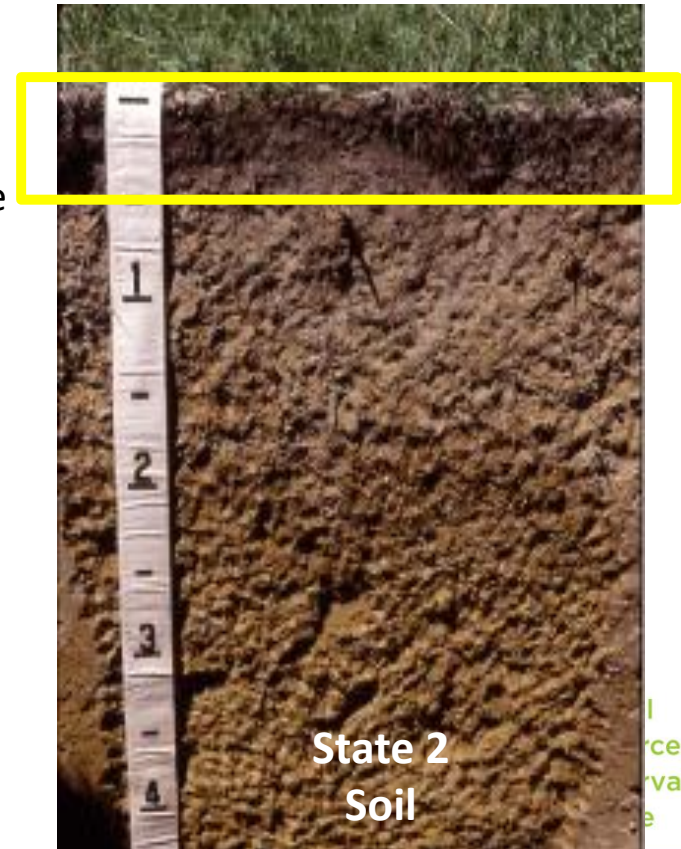


State-and-Transition Models (STMs)

Ecological sites and their STMs describe the soils properties typical of the reference communities, as well as the soil changes possible due to disturbance/management



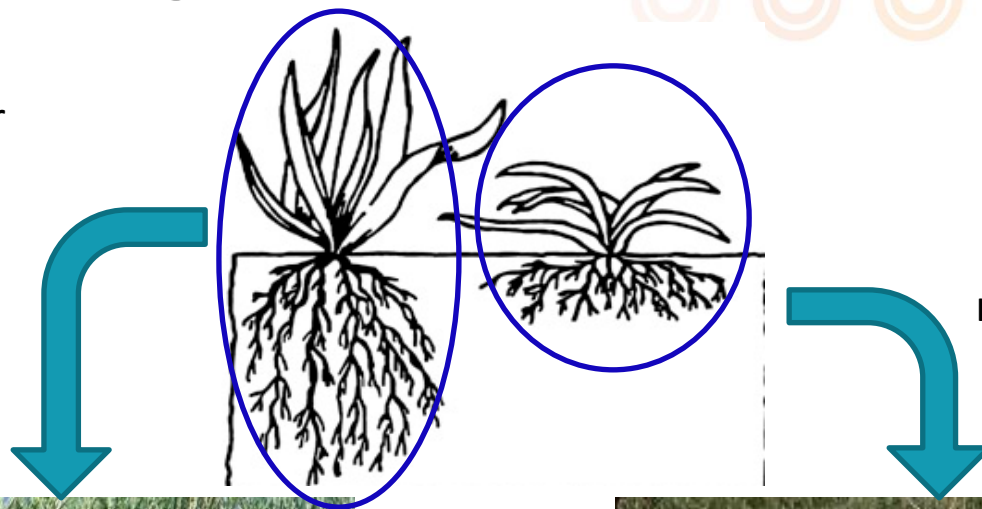
Decreased surface
soil stability
Increased soil
erosion potential
Loss of Organic
Matter
Decreased
infiltration
Increased bulk
density
Decreased
porosity



Ecological Site Vegetation Information

Ecological sites and their STMs describe the vegetation structure & cover typical of the reference communities

As well as changes possible due to disturbance/management in the alternative states



Perennial grass dominant
Deep, fibrous roots
No bareground
1500 lbs/acre



Transition



Annual grass dominant
Shallow, fibrous roots
1.5 ft bareground patches
500 lbs/acre

Ecological Site Data Collection Strategy

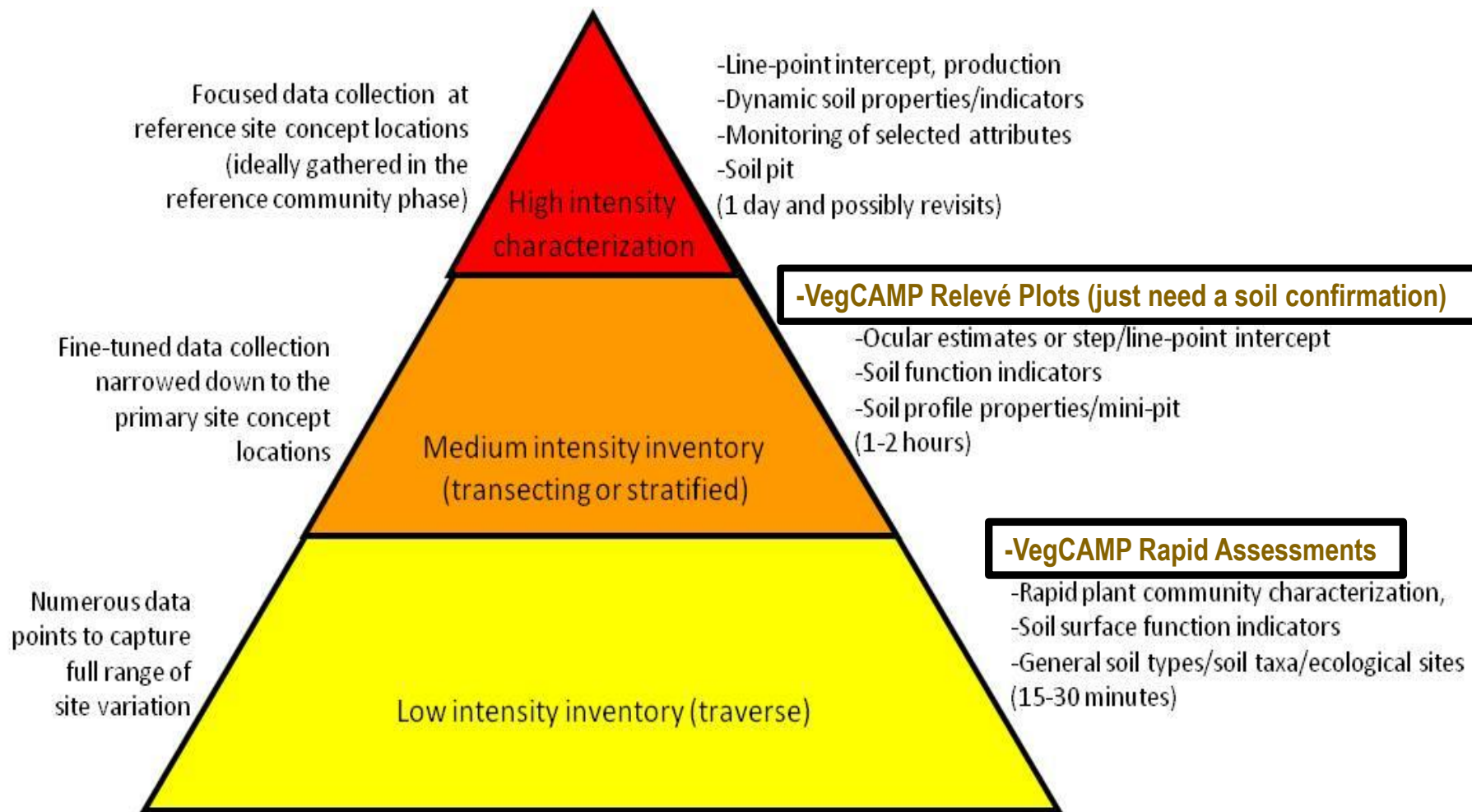


Table 6. Ground cover

Tree foliar cover	0-75%
Shrub/vine/liana foliar cover	0-20%
Grass/grasslike foliar cover	10-40%
Forb foliar cover	0-20%
Non-vascular plants	0%
Biological crusts	0%
Litter	0-20%
Surface fragments >0.25" and <=3"	0%

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				1949–2508	
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	189–308	–
2				409–748	
	pullup muhly	MUF12	<i>Muhlenbergia filiformis</i>	220–440	–
	meadow barley	HOBR2	<i>Hordeum brachyantherum</i>	189–308	–
3				818–1496	
	Nebraska sedge	CANE2	<i>Carex nebrascensis</i>	220–440	–
				220–440	–
				189–308	–

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Elevation	5,300–6,200 ft
Slope	5–30%
Aspect	Aspect is not a significant factor

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	10-40%	0-20%
>1 <= 2	–	–	–	–
>2 <= 4.5	–	0-20%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	0-75%	–	–	–

- ✓ Site Characteristics
- ✓ Stand structure and age classes
- ✓ Cover % and species lists

Combined Vegetation Rapid Assessment and Relevé Field Form

(Revised April 27, 2017 for the Lassen-Medoc project)

For Office Use:	Final database #:	Final vegetation type:	Alliance
			Association
I. LOCATIONAL/ENVIRONMENTAL DESCRIPTION			
Database #:	Date:	Name of recorder:	circle: Relevé or RA
Allocation UID:		Location Name:	
GPS name:		For Relevé only: Bearing°, left axis at ID point ____ of Long / Short side	
UTME ____		UTMN ____	
Zone: 10		NAD83 GPS error: ft./ m./ PDOP ____	
Decimal degrees: LAT ____		LONG ____	
GPS within stand? Yes / No If No, cite from GPS to stand: distance (m) ____ bearing ° ____ inclination ° ____			
and record: Base point ID ____ Projected UTM: UTME ____ UTMN ____			
Camera Name:		Cardinal photos at ID point:	
Other photos:			

- ✓ Site Characteristics
- ✓ Stand structure and age classes
- ✓ Cover % and species lists

Stand Size (acres): <1, 1-5, >5	Plot Size (m²): 100 / ____	1
Exposure, Actual %:	NE NW SE SW Flat Variable	Ste
Topography: Macro: top upper mid lower bottom	Mi	
Geology code:	Soil Texture code:	
Restoration code: 1=None obvious 2=Juniper removal 3=Grass/forbs seeding		
% Surface cover:	(Incl. outcrops) (>60cm diam) (>25cm diam)	
% C		
Fire:		
Site		

Combined V

Database #:

IV. VEGETATION DESCRIPTION

% Cover - Conifer tree / Hardwood tree

Height Class - Conifer tree / Hardwood tree: ____ / ____

Regenerating Tree: ____ Shrub: ____ Herbaceous: ____

Height classes: 1=<1/2m, 2=1/2-1m, 3=1-2m, 4=2-5m, 5=5-10m, 6=10-15m, 7=15-20m, 8=20-35m, 9=35-50m, 10=>50m

Stratum categories: T=Tree, A=SApling, E=SEedling, S=Shrub, H=Herb, N=Non-vascular

% Cover Intervals for reference: r=trace, +=<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%

Stratum	Species	% cover	C	Final species determination

Disturbance code / intensity (L,M,H): ____ / ____ / ____ "Other" ____

II. HABITAT DESCRIPTION

Tree DBH: T1 (<1" dbh), T2 (1-6" dbh), T3 (6-11" dbh), T4 (11-24" dbh), T5 (>24" dbh), T6 multi-layered (T3 or T4 layer under T5, >60% cover)

Shrub: S1 seedling (<3 yr. old), S2 young (<1% dead), S3 mature (1-25% dead), S4 decadent (>25% dead)

Herbaceous: H1 (<12" plant ht.), H2 (>12" ht.)

III. INTERPRETATION OF STAND

Field-assessed vegetation Alliance name:

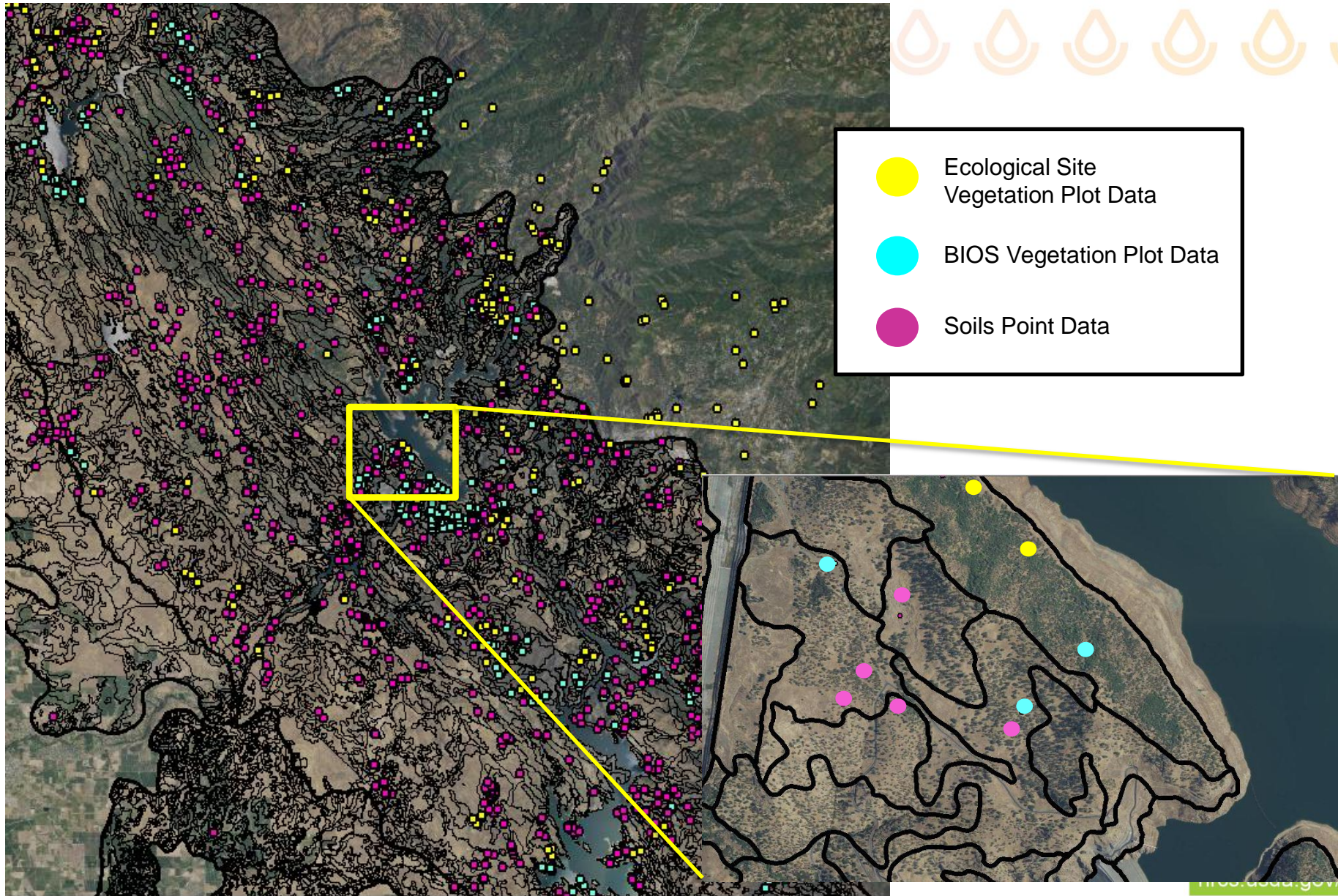
Field-assessed Association name (optional):

Adjacent Alliances/direction: ____ / ____ / ____

Confidence in Alliance identification: L M H Explain:

Phenology (E,P,L): Herb Shrub Tree Other identification or mapping information:





Identify

Identify from:

<Top-most layer>

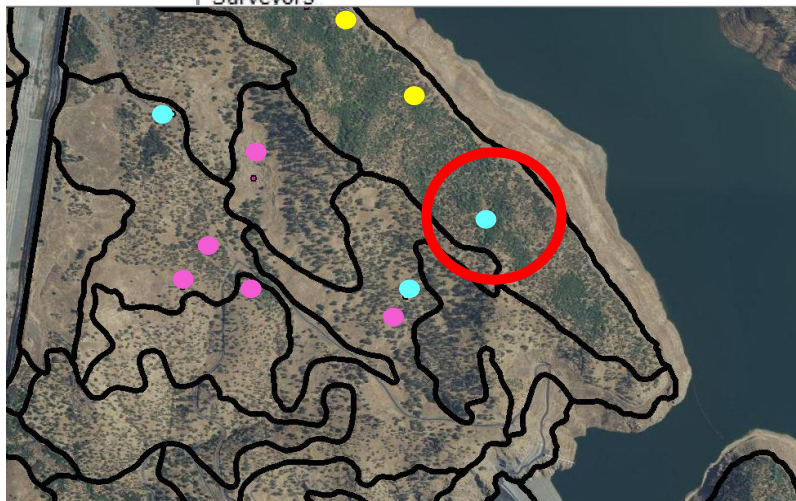
☐ MLRA18_VegeClip_wMUpoly_ALL

Loafercreek-Gopheridge complex, 15 to 30 percent slopes

Location:

-46,547.107 -6,573.434 Meters

Field	Value
MUSYM	7086
MUKEY	2440240
Mapunit Name	Loafercreek-Gopheridge complex, 15 to 30 percent slopes
National MU Symbol	2mx8f
FID_MLRA18_CNPSVegePtsClip_MLRA18_Vege_PedonPlots_pointdistance1500ft_MLRA18_PedonClip	2852
WyptID	SNFN0215
SurveyType	Releve
SurveyDate	5/24/2005
Surveyors	*JT, AM
	177
	SNFN0215
	Quercus douglasii / Bromus spp. – Daucus pusillus
	Association



NASIS (National Soils Information System) – NRCS ES Database

Component Ecological Site

Component

Local Database

Data Mapunit

Lineage

DMU Description

DMU Rec ID

Seq

Low

RV

High

Component Name

789113

525636

35

Terracelake

Component Existing Plants

Component Forest Productivity

Component Geomorphic Description

Component Hydric Criteria

Component Month

Component Other Vegeta

Local Plant

Seq

Plant Symbol

Scientific Name

National Vernacular Name

Common Name

1

ARNE

Arctostaphylos nevadensis

pinemat manzanita

pinemat manzanita

2

CHSE11

Chrysolepis sempervirens

bush chinquapin

bush chinquapin

3

ABMA

Abies magnifica

California red fir

California red fir

4

PICOM

Pinus contorta var. murrayana

Murray lodgepole pine

Sierra lodgepole pine

5

CAREX

Carex

sedge

sedge

5

ERMA4

Eriogonum marifolium

marumleaf buckwheat

marumleaf buckwheat

5

ERNJ3

Eriogonum nudum

naked buckwheat

naked buckwheat

5

PENE3

Penstemon newberryi

mountain pride

mountain pride

Tables

GDB_SpatialRefs

GPSname

MapUnitsName

PhotoApp

RAClassification

RAClassification_TestData

RAImpacts

RAImpacts_TestData

RAPlants

RAPlants_TestData

RAPlots

RAPlots_TestData

RAProjects

RAProjects_TestData

SelectedObjects

Selections

SurveyPlants

SurveyPlants_TestData

SurveyPoints

SurveyPoints_SHAPE_Ind...

SurveyPoints_TestData

SurveyPlants

WaypointID

Stratum

CodeSpecies

Species_nam

SpeciesName

Species_cove

Char

0901011610171

Herb

BRTE

Bromus tectoru

Bromus tectoru

28

0901011610171

Herb

POSE

Poa secunda J. f

Poa secunda

16

0901011610171

Shrub

ARTRW8

Artemisia triden

Artemisia triden

8

0901011610171

Herb

ELEL5

Elymus elymoid

Elymus elymoid

7

0901011610171

Shrub

ARARL

Artemisia arbus

Artemisia arbus

5

0901011610171

Herb

DRVE2

Draba verna L.

Draba verna

3

0901011610171

Herb

EPBR3

Epilobium brach

Epilobium brach

2

0901011610171

Herb

FRPU2

Fritillaria pudica

Fritillaria pudica

1

0901011610171

Herb

VUMI

Vulpia microsta

Vulpia microsta

1

0901011610171

Shrub

TECA2

Tetradymia can

Tetradymia can

1

0901011610171

Herb

MIGR

Microsteris grac

Microsteris grac

1

0901011610171

Herb

COPA3

Collinsia parvifl

Collinsia parvifl

1

0901011610171

Herb

BLSC

Blepharipappus

Blepharipappus

1

0901011610171

Herb

ACTH7

Achnatherum th

Achnatherum th

1

0901011610171

Herb

CRAC2

Crepis acuminat

Crepis acuminat

0.01

0901011610171

Herb

ZIPA2

Zigadenus panic

Zigadenus panic

0.01

0901011610171

Shrub

ERMI4

Eriogonum micr

Eriogonum micr

0.01

0901011610171

Shrub

ERSP7

Eriogonum spha

Eriogonum spha

0.01

0901011610171

Herb

ASPU9

Astragalus pursl

Astragalus pursl

0.01

0901011610171

Herb

FRAT

Fritillaria atropu

Fritillaria atropu

0.01

0901011610171

Herb

ERST4

Eriogonum stric

Eriogonum stric

0.01

0901011610171

Herb

COGR4

Collomia grandi

Collomia grandi

0.01

0901011610171

Herb

IOAL

Ionactis alpina

Ionactis alpina

0.01

0901011610171

Herb

IOAL

Ionactis alpina


Ionactis alpina

0.01

Record: 1 of 86446

No Filter

Search



All individual plot data should be entered into a database that can be queried.

VegCAMP Access Database



Information in ESD

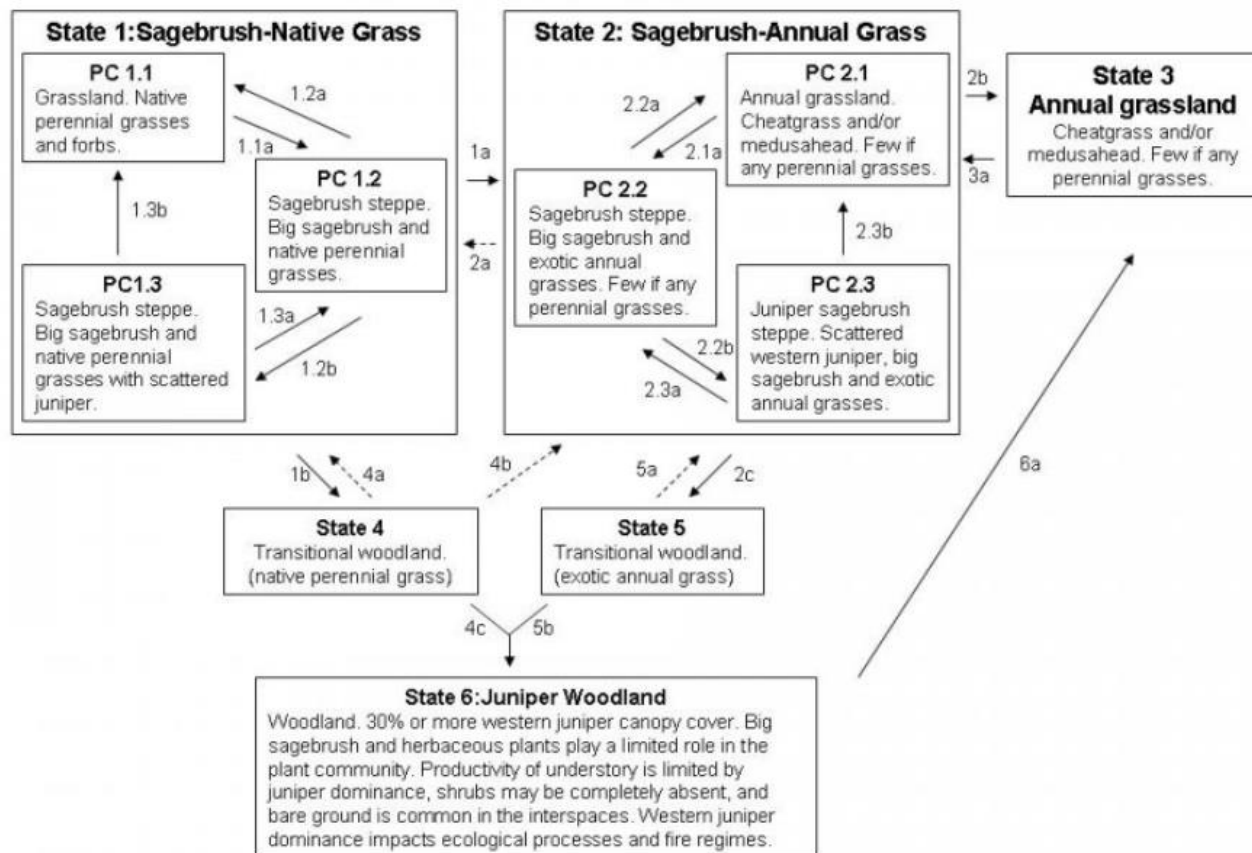
Ecological dynamics

The historic natural plant community is dominated mountain big sagebrush (*Artemisia tridentata* ssp. *vasey*) and perennial grasses. The vegetation states for ecological site range from open grassland to sagebrush steppe with a few, scattered western junipers (*Juniper occidentalis* ssp. *occidentalis*). The distribution of vegetation states is influenced by soils, topography, and fire history. Grassland and sagebrush steppe patches occur together in a mosaic. The reference state for this ecological site is similar to its pre-European state; however, expansion of western juniper and invasion of exotic annual grasses since the late 1800s has resulted in transitions to current states.

The shrub layer of this ecological site is typically dominated by mountain big sagebrush intermixed with perennial bunchgrasses, and often contains a rich variety of forbs. Antelope bitterbrush (*Purshia tridentata*) and occasional other shrubs such as a variety of ceanothus (*Ceanothus* spp.) and rabbitbrush (*Chrysothamnus* spp.) may be present. Historically herbaceous vegetation and grassland patches were dominated by Idaho fescue (*Festuca idahoensis*) and needlegrass (*Achnatherum* spp.) but grazing and other disturbances have led to the expansion of bluegrass (*Poa* spp.) and Western Juniper Expansion.

Prior to European settlement, western juniper was found primarily in places where fire was restricted - on rock outcrops, rocky ridges, and shallow, rocky or heavy clay soils with very low productivity. As a result of fire suppression and early grazing practices that began in the late 1800s, western juniper has been increasing in density and expanding its range into adjacent sagebrush steppe.

Conversion to western juniper woodland threatens to degrade sagebrush steppe ecosystems because it can reduce the quantity and quality of forage, accelerate soil



Invasion by Exotic Grasses

An estimated 3 million acres in the Western United States have become dominated by invasive grasses such as cheatgrass (*Bromus tectorum*) or medusahead (*Taeniatherum caput-medusae*) (West, 1999). Unfortunately these grasses are capable of invading disturbed and undisturbed rangelands. Warmer and drier sites, sites at lower elevations (below 5000 ft) that have south-facing or west-facing aspects, have experienced disturbance such as fire or heavy grazing, or are in close proximity to roads may be more susceptible to invasion by exotic annual grasses.

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Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association*Common Name:** Mountain Sagebrush / Blue Fescue**NVC Association Code:** CEGL001533, *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Shrub Grassland**Alliance:** *Artemisia tridentata* ssp. *vaseyana* Alliance**Association Concept**

The *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* Association forms open to inter and herbaceous layers. The emergent tree layer is typically sparse to open. The association primarily from midslopes to ridge summits at all aspects. Soils are derived from a variety of primarily general volcanic extrusives, andesite, or igneous, and textures are widely variable range from approximately 1292 to 2384 meters. *Artemisia tridentata* ssp. *vaseyana* is the cl shrub. Characteristic herbs include *Festuca idahoensis* and *Poa secunda*, and those often *Bromus tectorum* and *Elymus elymoides*.

Diagnostic Criteria: This association is characterized by an open to intermittent shrub layer *tridentata* ssp. *vaseyana* with an open to intermittent herbaceous layer of *Festuca idahoensis* shrub cover ranges from 8 to 49 percent.

Vegetation Description

Vegetation Structure: The Alliance forms a sparse to intermittent shrub layer, and the overall shrub cover ranges from 2 to 60 percent. The tree layer is typically sparse, and the herbaceous layer is sparse to intermittent.

Vegetation Floristics: *Artemisia tridentata* is the dominant and characteristic shrub. Stands sometimes have sparse, emergent *Juniperus occidentalis* in the tree layer. *Bromus tectorum* and *Elymus elymoides*, and often include

Dynamics: *Artemisia tridentata*

Species of Interest: *Astragalus agrestis*, *Balsamorhiza elegantulus*, *Lupinus nevadensis*, and *Polygala subsp.*

Information in VegCAMP

Reports

Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association*Common Name:** Big Sagebrush – (Rabbitbrush) / Cheatgrass**NVC Association Code:** CEGL002699, *Artemisia tridentata* - (*Ericameria nauseosa*) / *Bromus tectorum* Ruderal Shrubland**Alliance:** *Artemisia tridentata* Alliance**Association Concept**

The *Artemisia tridentata* – (*Ericameria nauseosa*) / *Bromus tectorum* Association forms an open to intermittent shrub layer. The emergent tree layer is typically sparse, and the herbaceous layer is sparse to intermittent. The association is found primarily on bottoms, slopes, and ridgetops at all aspects. Soils are derived from a variety of substrates but primarily basalt, general volcanic extrusives, or igneous and textures are widely variable. Elevations range from approximately 1225 to 1751 meters. Dominant and characteristic shrubs include *Artemisia tridentata* and *Ericameria nauseosa*. The dominant and characteristic herb is *Bromus tectorum*, and *Elymus elymoides* is often present.

Diagnostic Criteria: This association is characterized by an open to intermittent shrub layer of *Artemisia tridentata* and *Ericameria nauseosa*. The overall shrub cover ranges from 5 to 41 percent.

Local Alliance Distribution

Modoc Plateau: Adin Mountains and Valleys (M261Gf), Bald Mountain - Dixie Valley (M261Gj), Crowder Flat (M261Gc), Devil's Garden (M261Gb), Eagle Lake - Observation Peak (M261Gm), Horsehead Mountain (M261Gk), Likely Mountain (M261Gi), Likely Tableland (M261Gh), Lower Klamath - Tule Lake Basins (M261Ga), Pit River Valley (M261Gg)

Northwestern Basin and Range: Medicine Lake Lava Flows (M261Dh)

Southern Cascades: Medicine Lake Lava Flows (M261Dh)

Associations

Artemisia tridentata Association

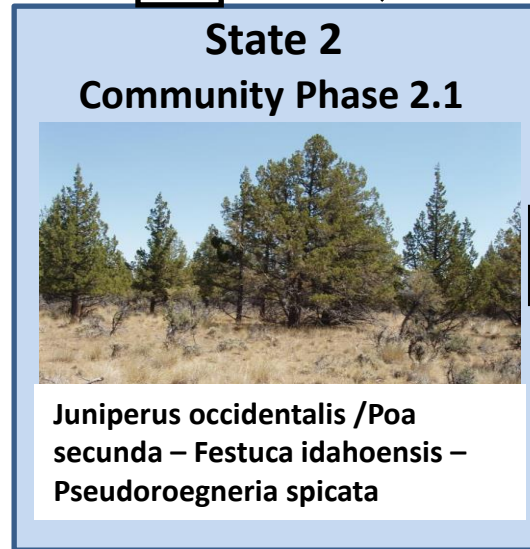
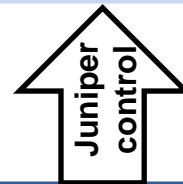
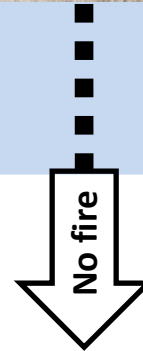
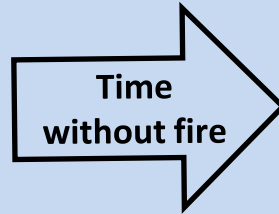
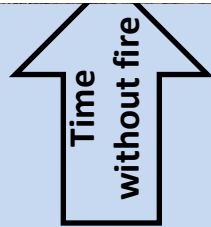
Artemisia tridentata – (*Ericameria nauseosa*) / *Bromus tectorum* Association

Artemisia tridentata – *Ephedra viridis* / *Pseudoroegneria spicata* Provisional Association

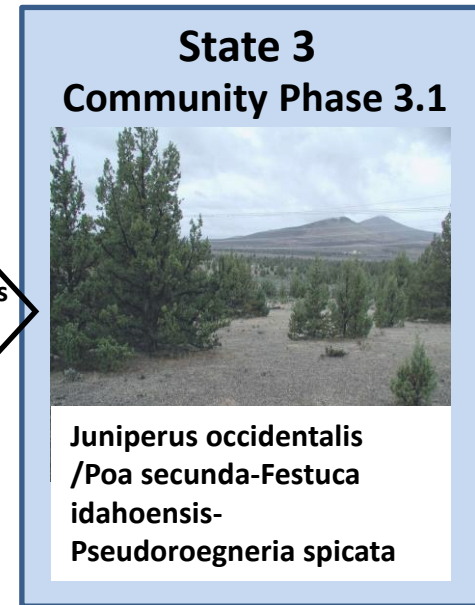
Artemisia tridentata / *Distichlis spicata* Provisional Association



Reference State



Transitions



Reference State – Community Phase 1.1 and 1.2

- (1) *Artemisia tridentata* ssp. *vaseyana* is strongly dominant to co-dominant in the shrub layer with *Purshia tridentata*, *Tetradymia canescens*, and/or *Chrysothamnus viscidiflorus*. Emergent *Pinus jeffreyi* and *Juniperus occidentalis* are often present although at low cover. *Festuca idahoensis* is dominant to co-dominant in the herb layer with *Poa secunda*, *Achnatherum thurberianum*, *Pseudoroegneria spicata* and/or *Achillea millefolium*.

Artemisia tridentata ssp. *vaseyana* / *Festuca idahoensis* Association (n=33)

VegCAMP
plot data
informing
association

Alternative States – Community Phase 2.1

- iv) *Juniperus occidentalis* stands with minimal shrub component (typically <4% absolute cover). Juniper cover is usually greater than 10% and trees are of mixed age classes. Herb layer is sparse to moderate, sometimes with significant cover of non-native grasses such as *Bromus tectorum*. However, native grasses including *Poa secunda*, *Pseudoroegneria spicata*, *Festuca idahoensis*, and/or *Achnatherum thurberianum* are characteristic in the herb layer. If shrubs are present, they are patchy and insignificant.

Juniperus occidentalis / (*Poa secunda* – *Festuca idahoensis* – *Pseudoroegneria spicata*) Association (n=30)



INTERPRETING INDICATORS OF RANGELAND HEALTH, Version 5, REFERENCE SHEET

Ecological site name: _____ Ecological site code: _____

Author(s)/participant(s): _____

Contact for lead author: _____

Date: _____ MLRA: _____ LRU: _____

Composition based on (check one): ☐ Cover ☐ Annual Production

Metadata storage location: _____

Indicators. For each indicator, describe the potential for the site using the reference sheet checklist. Where possible, (1) use quantitative measurements; (2) include expected range of values for above- and below-average years and natural disturbance regimes for each community phase within the reference state; and (3) cite data sources used. Continue descriptions on separate sheet.

1. Rills:**2. Water flow patterns:****3. Pedestals and/or terracettes:****4. Bare ground:****5. Gullies:****6. Wind-scoured and/or depositional areas:****7. Litter movement:****8. Soil surface resistance to erosion:****9. Soil surface loss and degradation:****10. Effects of plant community composition and distribution on infiltration:****11. Compaction layer:****12. Functional/structural groups:**

Dominance Category ¹	Relative Dominance of F/S Groups for Community Phases in the Reference State <i>Minimum expected number of species for dominant and subdominant groups is included in parentheses.</i>		
	Dominance based on ¹ : Annual Production ____ or Foliar Cover ____		
	Phase 1. ____	Phase 1. ____	Phase 1. ____
Dominant			
Subdominant			
Minor			
Trace			

¹ Biological soil crust dominance is determined based on cover, rather than production. If biological soil crusts are an expected dominant or subdominant group, the number of expected life forms (e.g., lichen, moss) is listed, rather than number of individual species.

13. Dead or dying plants or plant parts:**14. Litter cover and depth:****15. Annual production:****16. Invasive plants:****17. Vigor with an emphasis on reproductive capability of perennial plants:**

Rangeland Health Reference Sheets and Matrices



Questions??

