Ecological Site Descriptions and Forest Service Multi-level Ecosystem Assessments, Planning, & Monitoring Applications

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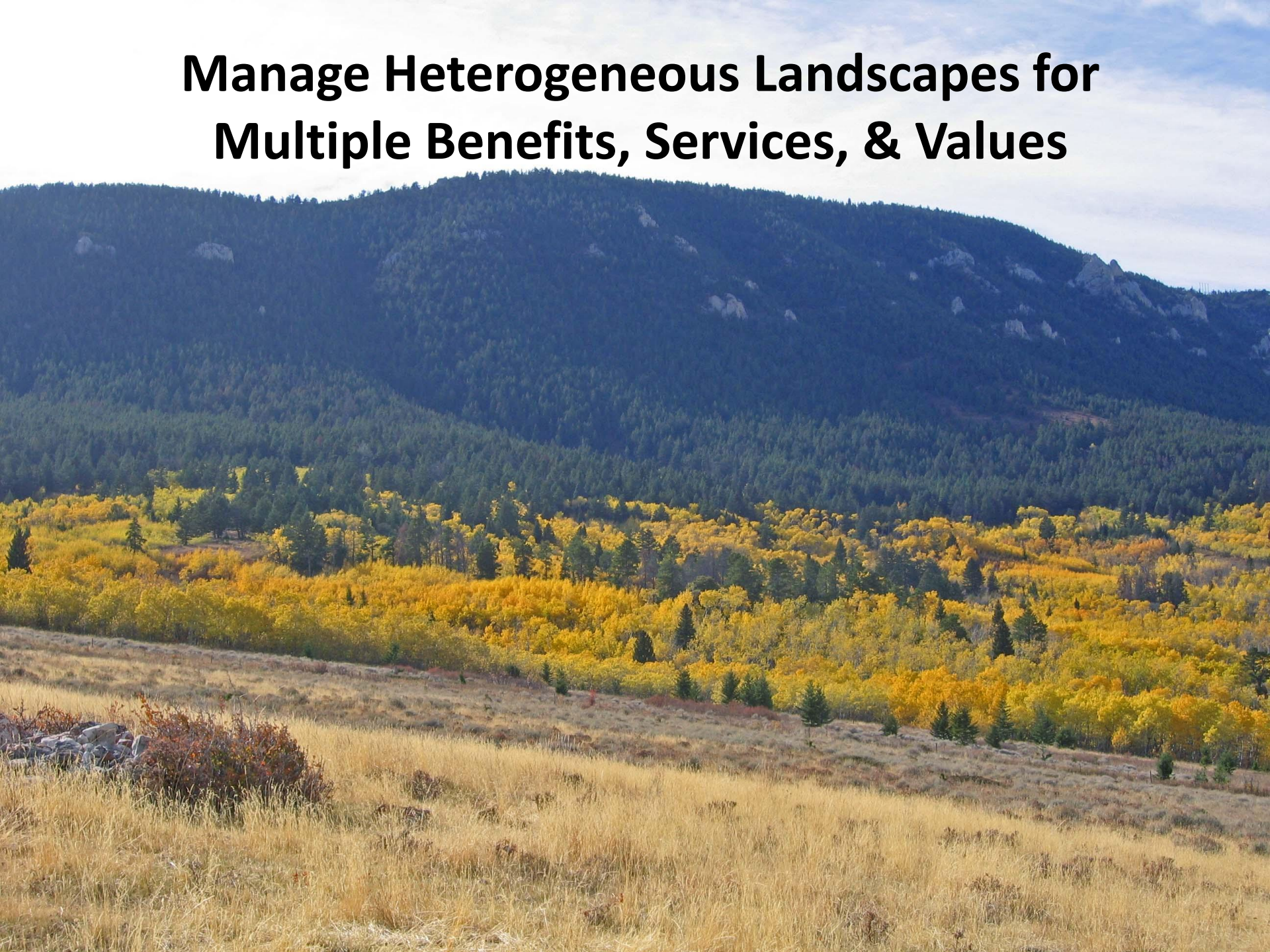
Presentation Topics

Forest Service hierarchical ecological classification, descriptions, and mapping

- Purpose and history
- Information sources for ecological site concept development

Forest Service examples of ESD applications

Manage Heterogeneous Landscapes for Multiple Benefits, Services, & Values



Landscape Matrix

Landscape elements

- **Residual sedimentary mountain slope**
- **Mountain footslope and drainages**
- **Vegetation pattern**
  - **Grassland**
  - **Sagebrush**
  - **Aspen**
  - **Conifer forest**

Vegetation pattern influenced by:

- **Landscape processes**
  - **Distribute water/nutrients**
  - **Differential fire behavior**
  - **Periodic fire – retain aspen**
- **Ecological site abiotic/biotic properties**

Support diverse habitats

- **Elk**
  - **Forage (grassland, shrubland)**
  - **Security cover (aspen, conifer forest)**
- **Ruff grouse - aspen**

Multi-scale Ecological Classification, Descriptions & Mapping Applications

- Understand and communicate ecosystem capability, processes, and response at multiple scales
- Serve multi-level assessments, land & resource planning
  - Regional – Conservation/restoration strategies
  - Forest – Land and resource management plans
  - Landscape/Watershed – Assess resource conditions and landscape processes
  - Project – Grazing allotment management planning

Applications of National Hierarchical Framework of Ecological Units

Planning and Analysis Levels	Ecological Units	Purpose and General Use	General Geographic Extent (map unit size)
Ecoregion Continental Regional	Domain Division Province	• Characterize continental and regional patterns and relationships • Modeling, sampling, national/regional analysis and planning	> thousands of square miles
Subregion	Section Subsection	• Characterize subregional ecosystem patterns and relationships • Strategic, subregional, statewide, assessment and planning, inventory, monitoring	Thousands to tens of square miles
Landscape	Landtype association	• Characterize landscape ecosystem patterns and relationships • National Forest, landscape, & watershed analysis, modeling, planning, inventory, monitoring.	Thousands to hundreds of acres
Land Unit	Landtype Landtype phase	• Characterize land unit ecosystem processes and relationships • Sub-watershed, grazing allotment, modeling, land treatment planning, inventory, monitoring.	Hundreds to less than ten acres

Land System Inventory

(Wertz and Arnold 1972)

- Support land use planning for various products and services within land capabilities on National Forests
- Response to land and resource legislation
- Planning involves several hierarchical levels
- Information scaled to planning level & objectives

Ecological Classification and Mapping, Terrestrial Ecological Unit Inventory, & Ecological Sites

Nested hierarchy:

- Based on relationships among multiple factors:
  - climate
  - geology
  - geomorphology
  - landform
  - topography
  - soils
  - vegetation
- Applied at **appropriate scales** to describe and assess ecosystem processes, response, and condition at multiple levels (site to continental).

Table 1.1a. Relationships of ecological sites with ecological classification and mapping systems across various hierarchical planning and analysis levels.

	Ecological Classification Systems				Ecological Mapping Systems	
Hierarchical Planning and Analysis Levels	**Ecosystem Classification NRCS and BLM**	**Ecosystem Classification FS[1, 2]**	**Potential Natural Vegetation Hierarchy[6]**	**National Vegetation Classification (NVC)[5]**	**National Hierarchical Framework of Ecological Units[1]**	**NRCS Soil Geography Hierarchy[3]**
Continental and Region (Ecoregion)	NA	PNV Series Groups[1]	PNV [1]; Groups, Sub-classes	Formation/Division	Domain, Division, and Province (1:5,000,000-1:30,000,000)	Land Resource Region (LRR)/Common Ecological Region (1:7,500,000)
Subregion	NA	PNC – Series, Formation	Plant Series; Formation	Division/ Macrogroup	Section (1:3,500,000) and Subsection (1:250,000)	Major Land Resource Area (MLRA) (1:3,500,000) Land Resource Unit (LRU)/Common Resource Area (CRA) (1:1,000,000) General Soil Map (1:250,000)
Landscape (watershed—5th unit of Hydrologic Unit Code)	NA	Potential Natural Community (PNC) Series; Habitat Type Group, Ecological type[2]	Plant Series; Habitat Type Group	Group/Alliance; (Dominance Type[4])	Landtype Association (1:60,000)	NA
Land Unit (subwatershed—6th unit of Hydrologic Unit Code), grazing allotment, farm/ranch)	NA	Ecological type[2]	Potential Plant Association; Habitat type	Association/ Alliance	Landtype (1:24,000)	Detailed Soil Map (1:24,000)
	Ecological Site	Ecological type[2]	Potential Plant Association Phase; Habitat type phase	Association	Landtype Phase (< 1:12,000)	Soil series phase (1:12,000)
Individual Sites	Vegetation plot and soil series	Sample site (soil pedon/ vegetation plot)[2]	Vegetation plot	Vegetation plot	NA	Soil Pedon

Ecosystem Hierarchy

The concept:

- Ecosystem processes are driven by factors at higher levels and constrained by factors at lower levels (Allen & Starr 1982, O'Neil et. al. 1980).

Simple examples:

- Regional climate, modified by landform, topography, and soil properties influence landscape vegetation patterns.
- Drive and modify fire behavior.

Historical Perspective

- Hierarchical ecological classification and ecological unit mapping
  - 1970s Land System Inventory
  - 1960s – 1980s Habitat Type Classifications
  - 1990s – Present, Terrestrial Ecological Unit Inventory
    - Integrate land system inventory abiotic concepts with plant ecology
      - Ecological Type Classification
      - Ecological Unit Mapping
    - Interdisciplinary, medium intensity integrated field data (soils, site, vegetation)

FS - Ecological Classification and Ecological Unit Mapping

Accomplished through:

- **Terrestrial Ecological Unit Inventory (TEUI)**
  - Classify and map ecosystems based on biotic and abiotic factors (regional climate, local climate, geology, geomorphology, landform, topography, soil, PNV)
- **National Hierarchy Framework of Ecological Units**
  - Provides a framework for mapping ecological units from continental to local scales

Present

Ecological site classification and descriptions

- Represent a common, standardized approach to classify, describe, and map land capability and interpret ecosystem processes and response at **local scales**.
- Agreement between BLM, FS, NRCS *(future other)*
  - Adopt, coordinate & participate in ESD development
- Represent evolving concepts
  - Accumulated knowledge & history associated with land and ecosystem classification and mapping among the agencies

What FS can Contribute

- Background, knowledge, & experience in local development and application of ecological classifications
- Ecological land unit mapping, where completed
  - Terrestrial ecological unit inventory (TEUI)
- Legacy data sets
  - Ecological types, habitat types, & existing vegetation classifications

Forest Service Regional Examples: Existing Classifications and Inventory Data

- Westwide
  - 272 published habitat type classifications (as of 1987)
- Southwestern Region
  - Terrestrial Ecological Unit Inventory (TEUI)
- Northern Region
    - 3800 veg. plot/soil pedon data collected concurrently since 1986
    - Land system inventory & TEUI (LTA and land type mapping)
- North Central Region
  - Lake states and Missouri multi-factor classification and modeling
  - LTA mapping completed across all ownerships for 3 states
- Southern Region
  - LTAs mapped across all National Forests

TEUI – Landscape/Land Unit Scale

- **TEUI is conducted following TEUI Tech Guide and National Cooperative Soil Survey Standards (USDA Soil Survey Handbook)**
  - **Provides guidance and standard methods for identifying, classifying, and describing ecological types and mapping ecological units.**

- **Interdisciplinary/multi-factor classification and mapping system:**
  - **Interdisciplinary teams (soil scientist, vegetation ecologists, others)**
  - **Data supported**
  - **Soil pedon, site, and vegetation data collected concurrently**
  - **Identify and describe abiotic/biotic factors that influence plant available water/nutrient and ecosystem processes**

What is an landtype ecological unit?

Mountain Valley – LTA

Landtypes

- **Valley Bottom**
  - **Fluvial processes & landforms**
  - **Riparian/wetlands, forest**

- **Mountain Footslope/lower slope**
  - **Glacial process deposits**
  - **Grassland & sagebrush sites**
  - **Inclusions: aspen, conifer**

- **Upper Mountain slope**
  - **Residual metamorphic rock**
  - **High elevation conifer forest**
    - **Whitebark pine**
    - **Sub alpine-fir/spruce**
    - **Scree**

FS Partnerships in ESD Development

North Central Region

- White Mountain NF – Ecological Unit mapping ESD development

Southwest Region

- Collaborating in ESD development

Northern Region

- Establish interagency work agreement
- Beartooth TEUI/ESD project

Others

Beartooth TEUI – ESD Project

- Beartooth Mountains
  - 510,000 acres
    - 345,000 acres wilderness
    - 165,000 acres non-wilderness

MLRA 43B – Central Rocky Mountains

FS Eco-region

- M331 – Yellowstone Highlands Section
  - Beartooth Mountains Subsection
  - Beartooth Front Subsection

Objectives

- **Demonstrate** :
  - Relationships between TEUI, National Hierarchy Framework of Ecological Units, MLRAs
  - Use of TEUI integrated plot, habitat types, and other information/data to formulate site concepts
  - Explore relationships between soil-geomorphic units and landtype ecological units
  - Generate white papers documenting process

Objectives

- Produce ESDs to meet management needs
  - Idaho fescue habitats
  - Mountain big sagebrush
  - Whitebark pine
  - Aspen

Beartooth Mountain TEUI
Plot Location and Distribution

Project Area References/legacy datasets

Habitat Types

- Mueggler & Stewart
- Pfister et. al.
- Cooper & Steele

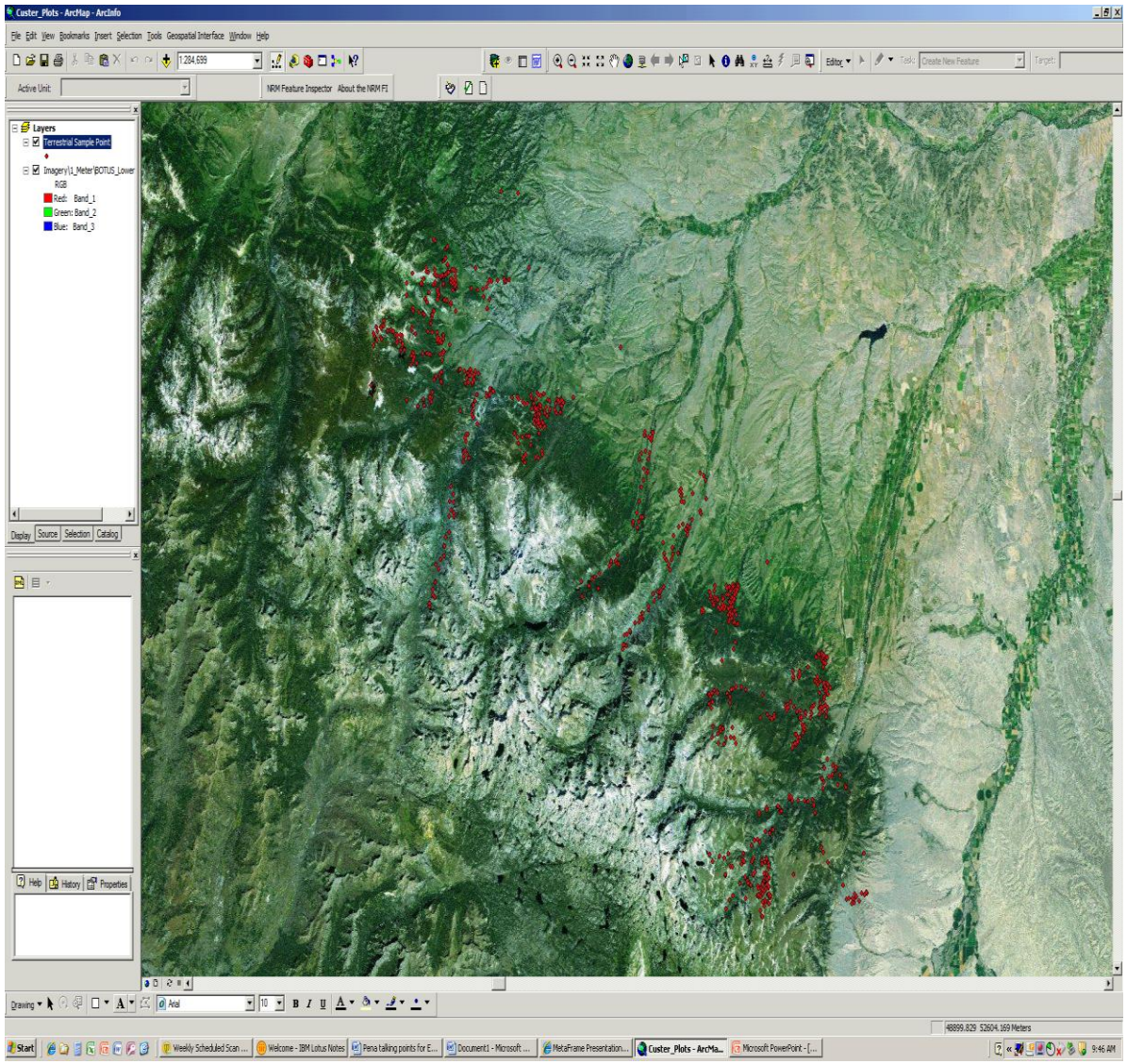
Current ESDs

Subsection/LTA Maps

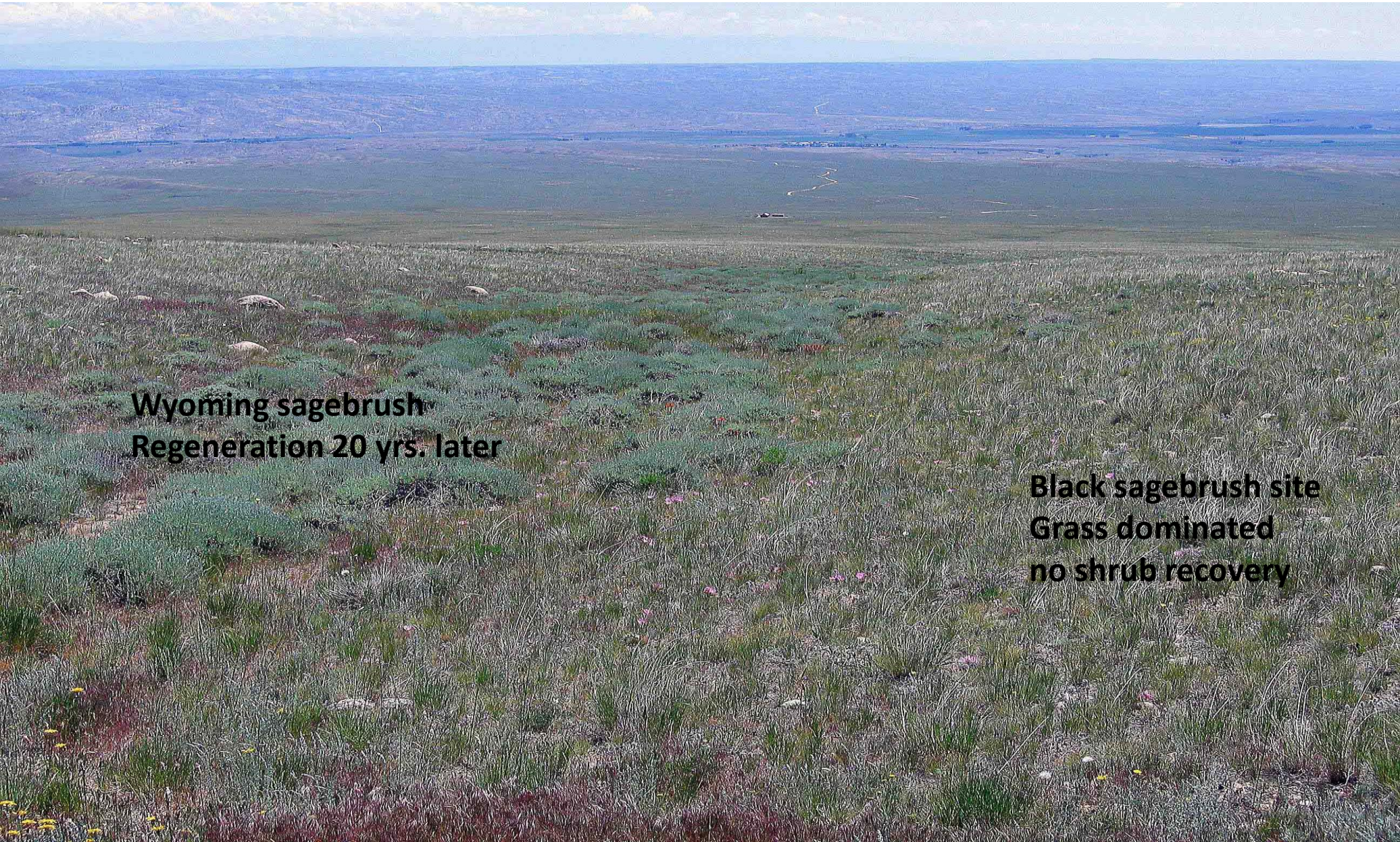
- Climate, geology geomorphology

Vegetation Inventory

- Data sets represent different vegetation development stages, plant communities



Interpret & explain differential site response to disturbance - 1992 Fire



FS Applications

- Plan revision —reference conditions to help inform development of desired conditions, objectives, standards etc.
- Large Landscape conservation/assessments — ESDs are the **common currency** across multiple agencies and countries (Canada, Mexico)—AGO

FS Applications

- Rangeland Health Assessments—IIRH
  - Reference conditions to develop reference worksheet
  - Necessary to assess levels of departures from reference conditions
  - "Yard stick" for monitoring to achieve desired conditions
- Soils- new FS Soil Manual (2010) soil functions = NRCS soil functions

Soil Functions:

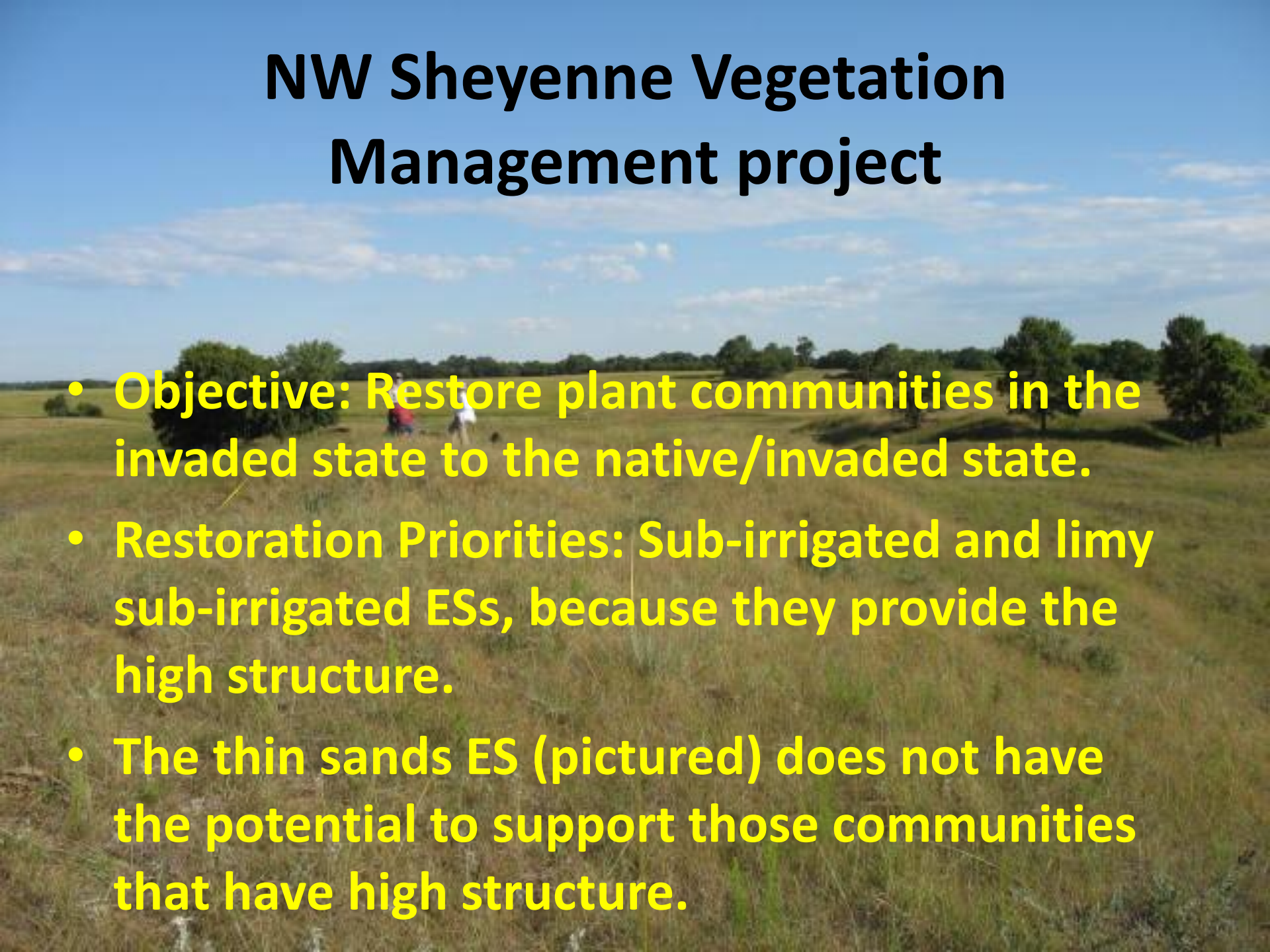
-soil biology
-soil hydrology
(the ability of the soil to absorb, store, and transmit water),
-nutrient cycling,
-stability and support,
-filtering and buffering

By assessing, analyzing, managing, and monitoring soil characteristics that affect **soil functions,** we will effectively manage vegetative growth and function.

Dakota Prairie Grasslands

- Sheyenne National Grassland: Plan management area prescription: restoration—seral stage and structure objectives.
- 30-40% high structure for prairie chickens (sensitive) and sharptail grouse, both of which have declined.
- They're doing restoration to improve habitat for the birds.
- 28 sensitive plants, 1 threatened plant – prairie fringed orchid

NW Sheyenne Vegetation Management project



- Objective: Restore plant communities in the invaded state to the native/invaded state.
- Restoration Priorities: Sub-irrigated and limy sub-irrigated ESs, because they provide the high structure.
- The thin sands ES (pictured) does not have the potential to support those communities that have high structure.

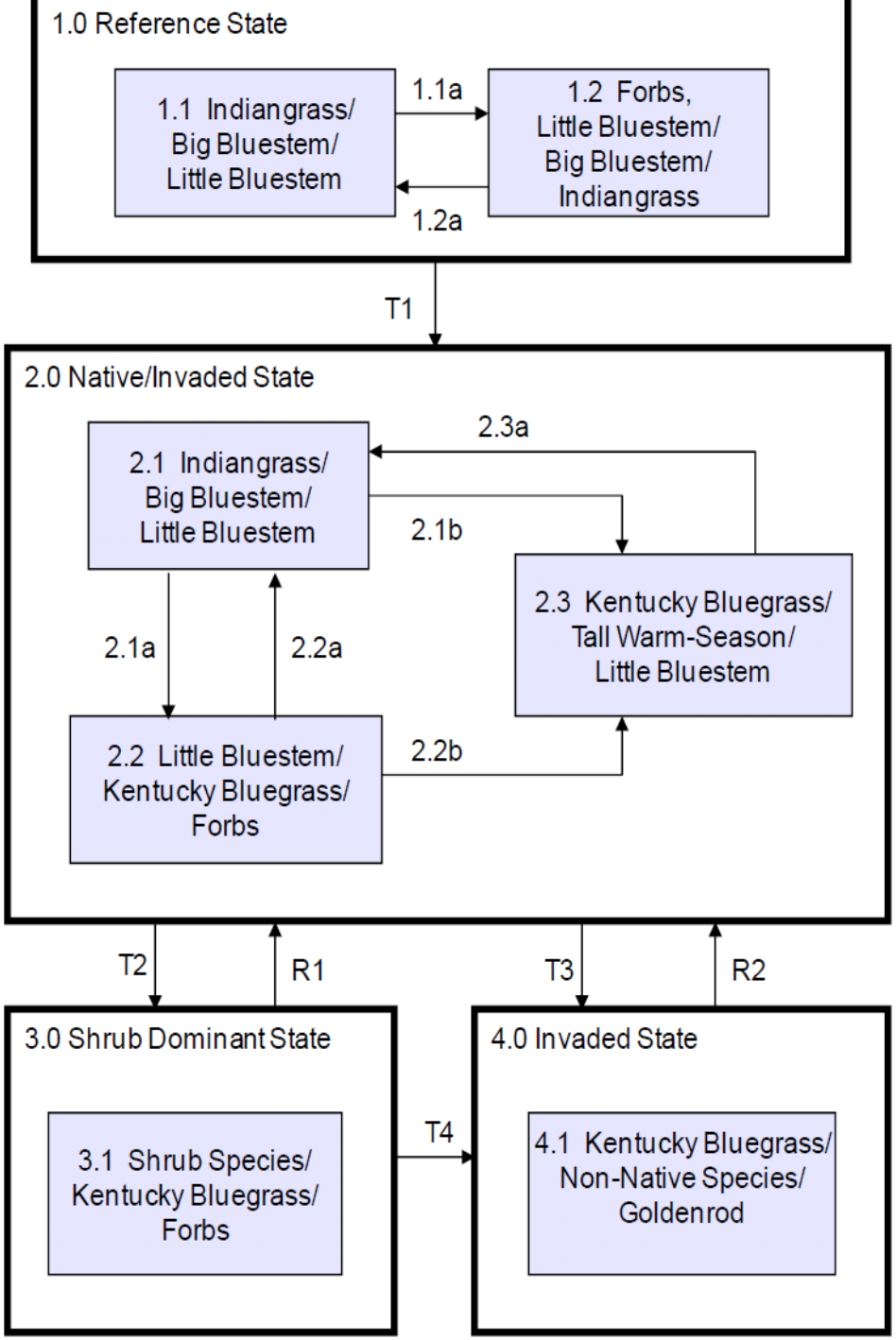
ID Team Process—NRCS, FS and TNC

ESDs help frame the discussion for restoration options based on reference conditions.

ESD Process-FS/NRCS/TNC Partnership

- Range specialist located vegetation communities within MLRA 56.
- NRCS soil scientist dug pits to determine ES, working with FS specialists.
- Jeff Dibenedetto's data were used; his ecological types were refined using soils data.

Field Verification—ID Team


1.0 Reference State
1.1 Indiangrass/ Big Bluestem/ Little Bluestem
1.1a
1.2 Forbs, Little Bluestem/ Big Bluestem/ Indiangrass
1.2a
T1
2.0 Native/Invaded State
2.1 Indiangrass/ Big Bluestem/ Little Bluestem
2.3a
2.1b
2.3 Kentucky Bluegrass/ Tall Warm-Season/ Little Bluestem
2.1a
2.2a
2.2 Little Bluestem/ Kentucky Bluegrass/ Forbs
2.2b
T2
R1
T3
R2
3.0 Shrub Dominant State
3.1 Shrub Species/ Kentucky Bluegrass/ Forbs
T4
4.0 Invaded State
4.1 Kentucky Bluegrass/ Non-Native Species/ Goldenrod

Invaded/Native State—Indiangrass-Big and Little Bluestem

- Some Kentucky Bluegrass present
- Prescribed grazing and prescribed burning to restore native plant communities

Invaded State-Spurge

- More aggressive tools may be necessary to move from invaded to native/invaded state
- Options:
  - Early Round Up treatment to reduce bluegrass and inter-seed on sites that still had a some native species present.
  - Plow completely and reseed if the site is dominated by (e.g, 90%) bluegrass

Planning Matrix			
Allotment:			
Designated Area:			
1A) Potential			
1B) Desired Condition			
1C) Existing Condition			
1D)What			
1D)Where			
1D)When			
1D)Why			

Plan-to-Project Matrix			
Allotment: Grassy Flats			
Designated Area: Volcanic Hills 16-20 Inch p.z. Clayey Ecological Site (VHCES) in Silver, Gold, Copper Pastures and Tin Trap			
	Vegetative Resource	Wildlife Resource	Soil Resource
1A) Potential	Mixed grassland, warm and cool season grasses, forbs, lesser shrubs and trees.	Habitat diversity for variety of mountain and grassland wildlife species.	Bare ground of 3-15% with a rock component of 35-80% with vegetative ground cover of 21-75%.
1B) Desired Condition	Vegetative communities reflective of the VHCES.	Forage and nesting cover of 6 inches is provided for ground nesting birds in the XYZ nesting habitat.	Soil surfaces are protected by vegetative ground cover, which includes vegetation basal area, and litter.
1C) Existing Condition	The VHCES lacks perennial cool season grasses in the Gold and Silver Pastures. The Tin Trap also lacks cool season grasses due to consistent fall use for weaning. Copper Pasture has appropriate species composition based on ESD.	Forage is provided by forb and grass component as well as insect component. Cover for nesting is not adequate during nesting season, as average cover height in the Copper pasture, which is utilized prior to or during nesting averages 4 inches.	Bare ground averages > 30% in Silver and Gold Pastures. Bare ground averages 10% which is appropriate in the Copper Pasture and the Tin Trap.
1D)What	Increase perennial cool season grasses	6 Inch cover height	Demonstrate increase in vegetative ground cover towards High Similarity to ESD potential.
1D)Where	VHCES in Silver and Gold Pastures	XYZ Nesting Habitat, which is in the Copper Pasture	VHCES in Silver and Gold Pastures
1D)When	Within 1 decade (2016)	Nesting Season June 30 – August 15	Within one decade (2016)
1D)Why	CS grasses are important for spring forage for wildlife, livestock and general diversity.	Per District Wildlife Management Plan and research reference, Reed et al. 1999	Soil stability during monsoon season as well as general soil condition.

Montana's Interagency ESD effort

Meetings with NRCS, BLM, ARS, to evaluate existing ESDs.

Determine which existing ESDs apply to federal lands.

Determine enhancements to meet additonal needs.

Determine what new ESDs need to be developed.

Work together using existing data, classifications, expertise etc.