Outline

• What is an Ecological Site

• Ecological Site Process

• What is included in an Ecological Site Description

• Ways an ESD can be used for management
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.
Ecological Sites

It is important to remember that ecological sites are a conceptual grouping of characteristic soils, vegetation, and hydrology based on similar climate, landform and disturbance regimes.

And ecological site descriptions are a document that describes and defines the relationships between these ecological characteristics, in order to provide land managers and land users a baseline or guideline for management on the ecological sites they work with.
Ecological sites are a product of all the environmental factors responsible for its development.

This includes:

- Soils
- Topography
- Climate
- Hydrology
- Vegetation
- Disturbance Regime
  - Fire
  - Herbivory
  - Flooding
  - Erosion
  - Drought
- Drought
Ecological Sites have characteristic soils, vegetation and hydrology.

Water flow through the soil on this ecological site is severely limited by these three horizons; all can be water- and root-restricting. This ecological site will likely have distinct vegetation assemblages and lower annual production than another similar ecological site without these restrictive soil horizons.
The Core of the ES Concept: State-and-Transition Models

- A diagram and description of the ecological site community dynamics
  - Discrete community states
  - Transitions indicating change from one community or state to another community or state
  - Thresholds which indicate the difference between states
**State**

A recognizable, resistant and resilient complex of two ecosystem components, the soil base and the vegetation structure.

Several community phases may occur within the same state –if they are relatively discrete and identifiable.

Community pathways represent the natural dynamics that occur in the ecological site. They represent gradients of change in community phases, describing the negative feedbacks that maintain the state.

Redish box is the “State”

Community Pathways shown as 1.1a and 1.2a

<table>
<thead>
<tr>
<th>Community Phase 1.1</th>
<th>Community Phase 1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creosote bush-White bursage/High diversity of other desert shrubs</td>
<td>Creosote bush-White bursage/Low diversity of other shrubs</td>
</tr>
<tr>
<td>Perennial grasses &amp; Annual forbs– High diversity</td>
<td>Perennial grasses &amp; Annual forbs– Low diversity</td>
</tr>
<tr>
<td>Relative composition 65:20:10</td>
<td>Relative composition 80:10:10</td>
</tr>
</tbody>
</table>
Transition

A transition indicates that a change has occurred to move from one state to another. Transitions are the events and drivers that initiate changes to a new state.

Transition is indicated here with the "T1a" and defined with a text description.
Threshold

A threshold is the condition defined by the vegetation and soils and related processes that separate states and preclude recovery of the former state.

Once a threshold is crossed, it is difficult to go back without lots of investments in time and money to recover the lost structure or function in the ecological site.
Threshold here is being represented by the time without fire going long enough that Juniper is too fire-resistant to be removed by the natural fires that occur on this ecological site.
Ecological Site F022BI105CA: Sierra Lodgepole Pine-Quaking aspen Forest

**State 1**

1.1 Sierra lodgepole pine-aspen forest
- Overstory structure: Two story-lodgepole pine canopy higher than the aspen canopy. Aspen begin to decline.
- Tree canopy: 55-85%
- Tree age: 90+ years

1.2 Regeneration
- Overstory structure: aspen sprouts and lodgepole pine seedlings with forbs and grasses.
- Tree canopy: 50 to 90%
- Tree age: up to 10 yrs

1.3 Young aspen and Sierra lodgepole pine
- Overstory structure: Single story aspen with individuals and patches of lodgepole pine.
- Tree canopy: 35-75%
- Tree age: 10-45

1.4 Aspen-Sierra lodgepole pine forest
- Overstory structure: Mosaic of single story aspen and lodgepole pine forests.
- Tree canopy: 45-75%
- Tree age: 45-90

1.1a

1.4a

1.4b

**State 2**

2.1 Sierra lodgepole pine forest
- Overstory structure: Multi-aged irregular structure
- Tree canopy: 45-65%
- Tree age: 125+ years (<125-year age classes in gaps)

2.1a

2.1b

2.2 Open lodgepole pine regeneration
- Overstory structure: lodgepole pine seedlings and saplings
- Tree canopy: up to 56%
- Tree age: up to 40 yrs

2.2a

2.2b

2.4 Sierra lodgepole pine forest
- Overstory structure: Multi-aged irregular structure
- Tree canopy: 35-65%
- Tree age: 40-125 years

2.4a

2.4b

2.5 Dense lodgepole pine forest
- Overstory structure: Dense even-aged
- Tree canopy: 60-90%
- Tree age: 40 to 125 years

2.5a

2.5b

2.5c
State & Transition Model Narratives

**This STM was developed using Limy 5-7, R030XA20CA –**

- **Reference STATE** – This site is dominated by creosotebush-white bursage with a site potential from 200-350-500 lbs/ac of annual production, which includes a high diversity of other desirable shrubs – winterfat, horsebrush, spiny hopsage, ephedras, and shadscale. Also a significant grass component, including ACHY, ACDE, ELELs, and POSE.

- **TRANSITION - 1.1-1.2** – During drought years some of the shrub diversity may be reduced and a lot of the grasses will also be reduced.

- **TRANSITION - 1.2-1.1** – Following years of above average rainfall, the shrub diversity and grass diversity would return...also would see increased annual production of dominant shrubs.

- **THRESHOLD - State 2** – Following years of chronic severe defoliation and invasion of non-native species, LATR and AMDU would persist, but the other shrubs and desirable grasses would be grazed out of the system. After these species are removed, non-native species will invade the site and become the dominant herbaceous component. **THRESHOLD that is crossed, is the introduction of non-native annuals that cannot be removed from the system and will alter disturbance regimes significantly from their natural or historic range of disturbances.**

- **2.1-2.2** – Following either light fires that burn the herbaceous layer and some of the LATR and AMDU or chronic severe defoliation of mostly AMDU, the site will be more heavily dominated by non-native annuals and LATR.

- **2.2-2.1** – AMDU will come back to this site over time.

- **Ref State to State 3** – Following repeated use by OHVs, LATR will become most dominant and possibly only species that still exists given enough time. LATR will not likely be run over, but run around, destroying all other lower growing shrubs and grasses. There will be increased open spaces b/w shrubs, gravels will be pushed below the soil surface, in turn pushing up finer sediments that are more easily erodible, which will increase the chance of wind and water erosion. This will also be a pc that is susceptible to the invasion of exotics.

- **State 2 to State 3** – With OHV use, this community will be pushed to State 3 and will not be able be restored.

- **3.1-3.2** – Poor vigor LATR will be all that’s left, with active erosion and evidence of water gullies. No other plants will likely be found on this site...this is after multiple years of repeated OHV use.

- **State 2 to State 4** – This shift occurs after severe fires that happen following a couple years of good precip that increased annuals herbaceous layer. This would remove all LATR and AMDU and be replaced by a suite of fire-tolerant shrubs that would likely include Ericameria, Buckwheats, and Hymenolea. With an annual herbaceous layer.

- **State 4 to State 2** – Restoration pathway for LATR and AMDU

- **4.1-4.2** – pushed by OHV use to mostly bareground, active erosion and scattered fire/disturbance tolerant shrubs.

- **4.2-4.1** – Can go back to 4.1 if given enough time for shrubs to recover.
Ecological Site Development Process
Ecological Site Concept

- Like a ‘species concept’
- Defines the distinguishing geophysical properties of a site and its STM
- Ecological site and STM development occur together
Ecological Site Development-Approach

**Ecological Questions**
What are the reference conditions for different parts of the landscape and what ecological processes are necessary to maintain the reference condition?

**Background Research**
An exhaustive review of the literature, expert knowledge, historical documentation and photography, and maps.

**Field Reconnaissance**
Field reconnaissance covering the entire extent of the MRRA or LRU.

**Develop Initial Ecological Site Concepts**
A set of working ecological site concepts are developed, including the geophysical characteristics that define the ecological sites and their plant community dynamics. These concepts serve as initial hypotheses.

**Test ecological Site Concepts**
Field data are used to test the ecological site concepts.

**Accepted?**
Data support the ecological site concept.

**Rejected?**
Data do NOT support the ecological site concept.

**Report Results**
Develop ecological site descriptions, including ecological site keys, synthesis of data, and management interpretations.

MLRA or LRU

Moseley et al., 2010
Ecological Site Development - Data support

- **Focused data collection** at reference locations (ideally gathered in the reference community phase)
- **Targeted data collection** stratified using ecological site concepts
- **Numerous data points** to capture full range of site variation

**High intensity characterization**
- Line-point intercept, production
- Dynamic soil properties/indicators
- Monitoring of selected attributes
- Soil pit
  (1 day per point and possibly revisits)

**Medium intensity inventory**
- Ocular estimates or step/line-point intercept
- Soil surface indicators
- Soil profile properties/mini-pit
  (1-2 hours per point)

**Low intensity inventory (traverse)**
- Rapid plant community characterization
- Soil surface indicators
- General soil types/soil taxa/ecological sites
  (15-30 minutes per point)

Moseley et al., 2010
Developing Concepts

- Background research
  - How should ecological potential vary across the landscape?
  - Existing mapping of soils, geology, weather & climate, vegetation, hydrology etc.
  - Interview with “local knowledge” experts
  - Historical documentation (survey records, journals and diaries, photos, etc)
  - Science literature, published studies in the area
Developing Concepts

Background research should result in rudimentary groupings of climate zones/elevation zones, parent materials, soil properties, and vegetation and wildlife communities, and provide information on common land uses and management concerns.
Developing Concepts

• Reconnaissance (refining initial concepts)
  - Correlations among soil properties and vegetation
  - Variability in plant community-soil relationships
  - Local knowledge: historical events, vegetation-soil relationships, and the origins of landscape patterns
  - Reference sites (exclosures, airports)
  - Observations across MLRA or LRU
  - Systematic, low intensity records
Developing Concepts

- After research and reconnaissance, develop initial sites concepts
- Initial site concepts represent a hypothesis that can be tested
- Clearly specify the climatic, topographic, and soil properties that distinguish the site from others
Developing Concepts

- Climate
  - Precipitation amounts (averages and extremes)
  - Precipitation timing
  - Temperature (averages and extremes)
  - Growing season (length and relationship to precipitation)
  - Wind speeds
Developing Concepts

- Topographic properties
  - Elevation
  - Aspect
  - Slope
  - Landscape Position
  - Contributing or accepting resources
Developing Concepts

- Soil Properties
  - Surface texture (importance for water infiltration, retention, soil erodibility)
  - Surface modifiers (gravel, stones, boulders, hummocks, etc)
  - Subsoil horizons (texture, type)
  - Depth to root restrictive horizons, water table, or bedrock (type)
  - Chemistry (Sodium, Calcium, Gypsum, etc)
Developing Concepts

• Specify a range in characteristics that vary at different spatial scales
  ▪ Relatively fine scales of soil properties
  ▪ Broader scale elevation and climatic variations
Developing Concepts

• Existing vegetation can not be a primary ecological site criterion because it is easily manipulated therefore highly variable.
• Nonetheless, certain species can be used to assist in ecological site definition and identification because they provide clues to soil and climatic conditions.
• The ecological site concept should be developed, using geophysical attributes that enable identification of the ecological site without vegetation on the site.
Developing Concepts

- Where changes in soils, aspect, topography, or moisture conditions are abrupt, boundaries of the ecological site will be obvious.
- Where these factors change gradually along broad environmental gradients, ecological site distinctions are more difficult to identify and may require data collection before solid ecological site concepts can be developed.
Developing Concepts

Sandy Bottoms (~ Sandy-skeletal, mixed, thermic Entic Haploxeroll)

Sand Hills

Gravelly Sand Hills

Sandy Bottoms

Mixed, thermic Typic Xeropsamment
Developing Concepts

- Ecological site concepts are multivariate constructs. They are built from the relationships of several, interacting attributes that collectively produce similar environments for plant communities, similar ecological dynamics, and similar response to disturbances.
Example ecological site concepts

<table>
<thead>
<tr>
<th>Preliminary Ecological Site</th>
<th>Elevation (ft)</th>
<th>Landform</th>
<th>Geology</th>
<th>Aspects</th>
<th>Slopes</th>
<th>Soil Texture</th>
<th>Soil Depth</th>
<th>Dominant Reference Vegetation</th>
<th>Data Collection Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1500 – 3500</td>
<td>Mountains</td>
<td>Granite</td>
<td>South West</td>
<td>Steep</td>
<td>Sandy</td>
<td>Deep</td>
<td>Chamise-Buckbrush</td>
<td>High variation – extensive data needs</td>
</tr>
<tr>
<td>2</td>
<td>1200 – 3800</td>
<td>Mountains</td>
<td>Granite</td>
<td>North East</td>
<td>Steep</td>
<td>Loamy Sand</td>
<td>Moderately Deep</td>
<td>Bigberry manzanita-Scrub oak</td>
<td>High variation – extensive data needs</td>
</tr>
<tr>
<td>3</td>
<td>500 – 1000</td>
<td>Upper Stream Terraces</td>
<td>Rhyolite</td>
<td>Neutral</td>
<td>Flat</td>
<td>Sandy Clay Loam</td>
<td>Deep</td>
<td>Valley oak-Sedge</td>
<td>Low variation – minimum data needs</td>
</tr>
<tr>
<td>4</td>
<td>1500 – 3500</td>
<td>Footslopes</td>
<td>Volcanic Breccia</td>
<td>North East</td>
<td>Steep</td>
<td>Sandy Loam</td>
<td>Shallow to bedrock</td>
<td>Hollyleaf cherry-Toyon</td>
<td>High variation – extensive data needs</td>
</tr>
</tbody>
</table>


Testing ecological site concepts

- **Focused data collection** at reference locations (ideally gathered in the reference community phase)
  - Line-point intercept, production
  - Dynamic soil properties/indicators
  - Monitoring of selected attributes
  - Soil pit
  (1 day per point and possibly revisits)

- **Targeted data collection stratified using ecological site concepts**
  - Ocular estimates or step/line-point intercept
  - Soil surface indicators
  - Soil profile properties/mini-pit
  (1-2 hours per point)

- **Numerous data points to capture full range of site variation**
  - Rapid plant community characterization
  - Soil surface indicators
  - General soil types/soil taxa/ecological sites
  (15-30 minutes per point)

- **High intensity characterization**

- **Medium intensity inventory (transecting or stratified)**
  - Soil surface indicators
  - General soil types/soil taxa/ecological sites
  (15-30 minutes per point)

- **Low intensity inventory (traverse)**
  - General soil types/soil taxa/ecological sites
  (15-30 minutes per point)
How do we decide the ecological sites to be recognized?

Ability to **produce** kinds, amounts and proportions and in **response** to disturbance:

- Abiotic factors that influence plant production, composition, ecological processes.
- Significant differences in presence of species or species groups.
- Significant differences in relative proportion of species or species groups.
- Significant differences in total annual production.
- Significant differences in responses to management actions or disturbance processes.

USDA-NRCS NRPH (2007); IESHR (Draft)
Testing ecological site concepts

• Systematic inventories of two types:
  – Stratified random based on repeated samples of different ecological site delineations, especially those for which data are needed
  – Areas deliberately selected due to information contained in them (e.g., reference areas, degraded areas, areas with known management histories connected to local knowledge)
Testing ecological site concepts

- Stratified random inventory:
  - GIS layers (DEM, geology, soils, imagery) used to estimate locations of ecological sites and random points are selected
  - Google Earth and NASA WorldWind
  - Replication sufficient to build statistical models
  - Samples can be clustered (transecting or groups)
  - Samples can be stratified by landscapes
Testing ecological site concepts

Modified Domin-Krajina cover estimate in 20x20 m plot

<table>
<thead>
<tr>
<th>Cover Estimate</th>
<th>1 -- &lt;0.1%</th>
<th>2 -- &lt;1%</th>
<th>3 -- 1-4%</th>
<th>4 -- 5-10%</th>
<th>5 -- 10-25%</th>
<th>6 -- 25-33%</th>
<th>7 -- 33-50%</th>
<th>8 -- 50-75%</th>
<th>9 -- &gt; 75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>+--few</td>
<td>1 -- &lt;0.1%</td>
<td>2 -- &lt;1%</td>
<td>3 -- 1-4%</td>
<td>4 -- 5-10%</td>
<td>5 -- 10-25%</td>
<td>6 -- 25-33%</td>
<td>7 -- 33-50%</td>
<td>8 -- 50-75%</td>
<td>9 -- &gt; 75%</td>
</tr>
<tr>
<td>+--&lt;0.2 m²</td>
<td>1 -- 0.2-0.5 m²</td>
<td>2 -- 0.5-4 m²</td>
<td>3 -- 4-20 m²</td>
<td>4 -- 20-40 m²</td>
<td>5 -- 40-100 m²</td>
<td>6 -- 100-132 m²</td>
<td>7 -- 132-200</td>
<td>8 -- 200-300</td>
<td>9 -- 300-380</td>
</tr>
</tbody>
</table>

Woody Class | Grass Class | Forb Class | Other Class |

| Percent Scale |

Link observations of vegetation and soils: cover estimated ocularly or using LPI, but must be quick enough to get replication.
Testing ecological site concepts

<table>
<thead>
<tr>
<th>Species</th>
<th>Class</th>
<th>M%</th>
<th>LPI</th>
<th>LPI</th>
<th>Prod</th>
<th>Notes</th>
<th>Generate from LPI data</th>
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<tbody>
<tr>
<td>AR1</td>
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</tr>
</tbody>
</table>

Vegetation and soils data must be databased together (JER and others have used the DIMA database)
Testing ecological site concepts

Larrea cover has complex relationships to clay and carbonate in argillic horizon.
Testing ecological site concepts

Three ecological sites potentially represented in this sample
Testing ecological site concepts

Inventory data support existence of alternative states (12% creosotebush canopy cover is a good break)
Testing ecological site concepts

Historical evidence tied to inventory: in the 1850s, evidence of grass-dominated and *Larrea*-dominated patches in area: which soil?
## Soil-site correlation

Nickel-Tencee-Delnorte complex, moderately sloping, soil map unit

<table>
<thead>
<tr>
<th>Soil map unit component</th>
<th>MLRA</th>
<th>LRU</th>
<th>Ecological Site</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel very fine gravelly sandy loam</td>
<td>042X</td>
<td>B</td>
<td>Gravelly</td>
<td>NM</td>
</tr>
<tr>
<td>Del Norte gravelly loam</td>
<td>042X</td>
<td>B</td>
<td>Gravelly</td>
<td>NM</td>
</tr>
<tr>
<td>Tencee very gravelly sandy loam</td>
<td>042X</td>
<td>B</td>
<td>*Limy gravelly</td>
<td>NM</td>
</tr>
<tr>
<td>*proposed new site</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Soil-site correlation “rules”

An *ecological site* can include more than one soil series, provided that the soils are similar.

A *soil map unit* can include more than one ecological site. Soil map units often include many different soils, with different potentials to support plant communities.

Even a *soil series* can include more than one ecological site. Soil surface texture often varies within a soil series. Soil surface texture is very important in distinguishing ecological sites.
High intensity Samples

Focused data collection at reference locations (ideally gathered in the reference community phase)

Targeted data collection stratified using ecological site concepts

Numerous data points to capture full range of site variation

High intensity characterization

- Line-point intercept, production
- Dynamic soil properties/indicators
- Monitoring of selected attributes
- Soil pit
  (1 day per point and possibly revisits)

Medium intensity inventory (transecting or stratified)

- Ocular estimates or step/line-point intercept
- Soil surface indicators
- Soil profile properties/mini-pit
  (1-2 hours per point)

Low intensity inventory (traverse)

- Rapid plant community characterization
- Soil surface indicators
- General soil types/soil taxa/ecological sites
  (15-30 minutes per point)
High intensity Samples

20m x 20m plot, one stratum, four soil subsamples

- Baseline, 20 m long
- Transect, 20 m long
- Herbaceous production subplot, 1 msq
- Woody production subplot, 100 msq
- Soil subsample
- Soil subsample full pedon description
- Soil stability sample

- Three replicates per state per site
- Consider monitoring to document temporal variations due to climate
Develop interpretations

- High intensity data and other data:
  - Domestic animal uses/forage
  - Wildlife habitat (by state or community)
    (see Holmes and Miller, JWM, 2010)
  - Hydrologic functions
  - Recreation
  - Future options (carbon sequestration, dust control, more detail on wildlife habitat)
After vegetation data has been compiled and analyzed and placed with the proper ecological site, all data should be entered into the ESD section of ESIS.

The ESD section of ESIS is also where the ecological dynamics, photos, and STM are kept. This is also where ecological interpretations and range health reference sheets are housed. It is the primary database to store all Ecological Site Descriptions.
**ECOLOGICAL SITE CHARACTERISTICS**

**Site Type:** Rangeland  
**Site Name:** Loamy upland  
( *Artemisia tridentata* ssp. *vaseyana* / *Festuca idahoensis* (mountain big sagebrush / Idaho fescue)  
**Site ID:** R021X007CA  
**Major Land Resource Area:** 021-Klamath and Shasta Valleys and Basins

**Physiographic Features:**  
This site typically occurs at elevations of 2,000 to 6,600 feet on mountains and foothills. Slopes are 0 to 70 percent.

<table>
<thead>
<tr>
<th>Landform</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Mountain slope</td>
<td>5300</td>
<td>6200</td>
</tr>
<tr>
<td>Elevation (feet)</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>Slope (percent)</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Water Table Depth (inches)</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Flooding</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Frequency</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Duration</td>
<td>No Influence on this site</td>
<td></td>
</tr>
</tbody>
</table>
Ecological Site Descriptions & Web Soil Survey
Using Ecological Sites for Ecosystem Services

Major Land Resource Area: 018 - Sierra Nevada Foothills
Ecological Site: Gravelly loam foothill
Site ID: R018XI001CA

<table>
<thead>
<tr>
<th>STATE/ECOSYSTEM SERVICE</th>
<th>Water Supply Infiltration (cm/hr)</th>
<th>Nutrient Cycling N, C/kg</th>
<th>Biotic Integrity (diversity H')</th>
<th>Agricultural Production (ANPP kg/ha)</th>
<th>Bulk Density (g/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undisturbed Woodland</td>
<td>218</td>
<td>3.6, 52</td>
<td>2.05</td>
<td>1030</td>
<td>1.2</td>
</tr>
<tr>
<td>Annual Grassland</td>
<td>21</td>
<td>2.5, 28</td>
<td>1.84</td>
<td>3343</td>
<td>1.4</td>
</tr>
<tr>
<td>Invasive Annuals</td>
<td>20</td>
<td>2.4, 27</td>
<td>1.03</td>
<td>3672</td>
<td>1.4</td>
</tr>
<tr>
<td>Blue Oak Savanna</td>
<td>72</td>
<td>2.9, 37</td>
<td>1.71</td>
<td>1670</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Dr. Ken Tate
UC Davis
Using Ecological Sites to Predict Effects of Climate Change

Vegetation change on a landscape in Central Oregon

A current
B +30 y
C + 100 y

Approaches to incorporating climate change effects in state and transition simulation models of vegetation
B.K. Kerns et al
Spatially-explicit management prescriptions and monitoring

Site ID: R042XA051NM
MLRA: 42
Site: Sandy
Dona Ana County, NM

Ecological state
- Black grama grassland
- Altered grassland type
- Shrub-invaded type
- Shrubland

Management priority
- Manage stocking rates
- Maintain cover
- Shrub removal
- Rest or alternative uses

Dr. Brandon Bestelmeyer ARS
Restoring Gulf Coast Wetlands

Site ID: 150AY013
Name: Clayey Terrace Prairie
Summary

By providing all of this information about a piece of land, ecological sites offer a land manager the critical information on the ecological functions and processes that characterize the site.

This information allows land users and land managers to make informed decisions about the management they choose to apply to their land.
Thank you!