Ecological Sites and Conservation Decision Making

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Use of Ecological Sites and STMs

Nine Steps of Planning (three phases)
- Phase 1: Inventory; Phase 2: Alternative Systems/Practices;
  Phase 3: Monitoring/Feedback

Suitability/Limitations for Land Uses and Practices
Response to Management and Disturbance
Resilience and Sustainability
Spatial Relevancy

State and Transition Models (STMs)
- Range of Conditions (soil health indicators)
- Transitions (Practices, Adaptive Management, Common Mistakes)
- Land use decision tree
- Nested STMs (i.e. orchards/vineyards vs. row crop)
- Decision-making
- FOTG Standards (i.e. seeding/planting practices)
**Major Land Resource Area (MLRA) 75**

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**Ecological Site Description Selection**

ESD Reports

<table>
<thead>
<tr>
<th>Report Link</th>
<th>Site Stage</th>
<th>Type</th>
<th>MLRA</th>
<th>Name</th>
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<td>Loamy Lowland</td>
<td>/Andropogon gerardii-Schizachyrium scoparium</td>
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<td>Shallow Limy</td>
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* Click a column header to sort on the respective field

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**Site Concepts (aggregate for cropland or pastureland)**
Section I: Ecological Site Characteristics
Ecological Site Identification and Concept

**Site stage:** Provisional

**Provisional:** An ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

**Site name:** Loamy Upland

/ Andropogon gerardii - Schizachyrium scoparium

(/ big bluestem - little bluestem)

**Site type:** Rangeland

**Site ID:** R075XY08NE

**Major land resource area (MLRA):** 075-Central Loess Plains

[Image of Loamy Uplands Distribution Map]
Physiographic Image.—Loamy Upland Geographic Diagram
Management Adaptations Account for Site, Soil, and Climate Variables
Sites Have Similar Climate and Climate Variability

Average Annual Precipitation

Nebraska

Average Annual Precipitation

Kansas

Legend (in inches)
- Under 16
- 16 to 26
- 18 to 22
- 22 to 24
- Above 24

Legend (in inches)
- Under 24
- 24 to 32
- 32 to 40
- Above 40

This is a map of annual precipitation averaged over the period 1981-2000. Station observations were collected from the NOAA Cooperative and USDA-NRCS SNOTEL network, plus other state and local networks. The PRISM modeling system was used to create the gridded estimates from which this map was made. The size of each grid cell is approximately 1.04 km. Support was provided by the NCDC Water and Climate Center.

For information on the PRISM modeling system, visit the SCAS web site at http://www.scas.oregonstate.edu/prism

The latest PRISM digital data sets created by the SCAS can be obtained from the Climate Source at http://www.climatesource.com

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Ecological Sites (Conservation Planning on all Land Uses)

Spatial

Basis for aggregating soil map unit components across state and county boundaries

Similar ecological/management response, climate, soils, hydrology, physiography, and other factors

Consider all land uses common to the site

Similar native plant communities

Similar productivity

Similar Soil/Site Limitations (i.e. shallow soils, wetness, salinity)
State and Transition Models (STMs) For Conservation Planning on all Land Uses

*Blueprint for conservation planning for common landuses* (from local planners, farmers, and others as knowledge is gained)

*Support local priorities and programs* (invasive species, restoration, wildlife, water quality, soil health, hydrology impacts, etc.)

*Local expertise/knowledge used to establish common States* (land use condition)

*Transitions and Pathways describe how changes in states occur* (conservation practices, management, climate, & time)

*Separate STMs for each land use* (focus on landuses that are most applicable for planning and programs)

*Restoration pathways* (i.e. wetland restorations, Declining Habitat Restorations)

*Indicators for Common States* (Soil Health, Pasture Condition)
**LANDUSE CONVERSIONS AND RESTORATION PATHWAYS (general more detailed options/information will be developed)**

- **T1, T9** Cultivation/chemical kill, Irrigation Well and Irrigation Application System if irrigated
- **T2** Cultivation and reseeding, abandoned or combination of fertilizer, seeding, heavy summer grazing
- **T3, T7** Encroachment by Red cedar, Siberian elm and/or Locust and lack of fire or brush management; Cultivation Tree planting and Forest Stand Management
- **T4** Clearing and cultivation
- **T5** Abandonment and tree encroachment; Tree planting and Forest Stand Management
- **T6** Site preparation and Pasture Seeding
- **T8, T11** Clearing, and pasture seeding or range seeding
- **T10** Site Preparation and Range seeding

**LANDUSE INTERPRETATIONS (general information for each major land use)**

- **Range:** Refer to rangeland ESD, STM and other major range interpretations
- **Crop:** Cropping limitations, equipment limitations, crop yields, crop adaptability, management limitations, other general cropland interpretations for site.
- **Pasture:** Forage suitability group information, land use limitations, equipment limitations, productivity, grass/legume adaptability, management limitations, other general pasture interpretations for site.
- **Forest:** Tree and shrub group information, land use limitations, equipment limitations, wildlife, production timber indexes, tree/shrub adaptability, management limitations, other general forest interpretations for site.
Land Use Interpretations/Limitations/Suitability

**Crop:** Conservation practice limitations, Cropping limitations, equipment limitations, crop yields, crop adaptability, management limitations, other general cropland interpretations for site.

**Pasture:** Land use limitations, equipment limitations, productivity, grass/legume adaptability, management limitations, and other general pasture interpretations for site.

**Forest:** Tree and shrub group information, land use limitations, equipment limitations, wildlife, production timber indexes, tree/shrub adaptability, management limitations, other general forest interpretations for site.
STM Using Structured Decision Making Model

(1) define clients decision context;
(2) identify measurable objectives;
(3) formulate alternative management strategies;
(4) explore the consequences of alternatives in relation to objectives;
(5) select alternative but make trade-offs among objectives.
(Loamy Upland) Range STM

1. Loess Mixed Grass Prairie
   - 1.1 Big bluestem, Indiangrass
   - 1.2 Big bluestem, Little bluestem

2. Native/Invaded Grass State
   - 2.1 Tall dropseed/ Blue grama/Kentucky bluegrass

3. Invaded Grass State
   - 3.1 Smooth bromegrass/ Kentucky bluegrass
   - 3.2 Smooth bromegrass/ Kentucky bluegrass/western ragweed/weedy forbs

4. Invaded Woody State
   - 4.1 Eastern redcedar, Locust / Siberian elm

R2A – Prescribed grazing with adequate recovery period.
R3A – Range seeding with native species; if significant native remnants exist – prescribed fire, chemical treatments, animal impact with targeted prescribed grazing and adequate recovery periods.
R4A – Wildlife, prescribed fire, brush management.
3.1A Continuous season long grazing, inadequate recovery periods.
3.2A Chemical spraying or sheep/goat grazing targeting weedy forbs.
R3B – Prescribed burn, Early and Late Season targeted prescribed grazing.

1.1A & 1.2B – Continuous season long grazing, inadequate recovery periods;
1.2A & 1.3A – Return to adequate recovery periods.
T1A – Introduction/encroachment of non-native species.
T1B & T2A – Outside energy inputs such as haying, fertilizer, seeding.
T2B – Continuous season long grazing, inadequate recovery periods, lack of fire.
T3A – Lack of brush management and/or

2.1A – Prescribed grazing with adequate recovery period.
2.2A – Return to adequate recovery periods.
T1B – Introduction/encroachment of non-native species.
T2B – Outside energy inputs such as haying, fertilizer, seeding.
T3B – Lack of brush management and/or
1.1 Big bluestem, Indiangrass
1.2 Big bluestem, Little bluestem
1.3 Sideoats grama, Little bluestem, Western wheatgrass with remnant tall WS grasses

2.1 Tall dropseed/ Blue grama/Kentucky bluegrass

3.1 Smooth bromegrass/ Kentucky bluegrass

4.1 Eastern redcedar, Locust / Siberian elm
Dryland Crop (Loamy Upland)

1. High

1.1 Short Term High level SHMS following range, pasture

1.2 High Managed Perennial Hayland (long term)

1.3 High Level Soil Health Management System (long term)

2. Medium

2.1 Mulch Tillage/Short term no-till

2.2 Medium Managed/Per. Hayland

3. Low

3.1 Corn Soybean Conventional Tillage

3.2 Silage/Stover Harvested, Overgrazed CT

3.3 Low condition Hayland
On-site Soil Health Indicators
Degraded Cropland State: Management (Highly Erodible)
Conventional Tillage (fall chisel spring disk)
328: Corn-Soybean Rotation
No Cover Crops
No Field Borders
Standard Nutrient Management
Pest Resistance

1. What are the onsite indicators of this state/condition?
2. What are the limitations for this land use?
3. What practices and management will address erosion and other resource concerns when severe storms occur?
**Enhanced Cropland**

**State:**

**Conservation Practices**

- 329: Continuous No-till
- 328: Diverse crop rotation
- C-SB-W/CC rotated from perennial hayland
- 330: Contour Farming
- 340: Cover Crops
- 528: Prescribed Grazing
- 386: Field Borders
- 600: Terraces
- 412: Grassed Waterway
- 620: Underground Outlets
- 590: Nutrient Management (soil testing, zone mgt liming, 4Rs)
- 595: Pest Mgt (Scouting, Thresholds, Herbicide Resistance Management)

Perennial Hayland (2000-2009 same field)
Adaptive Management On the Kucera Farm

- Continuous No-till, crop rotation
- CRP, CSP, EQIP, Local Programs
- Perennial crops
- High carbon cover crops
**June, 13th 2018**

**Soil Health Management System**
(IPM, Nutrient Mgt, Rotation, Continuous No-Till, Cover Crops)
(High drought resilience)

**Corn-Soybean**
Partial No-Till, Lack of IPM, Weed resistance, low infiltration rates

**June, 18th 2018**

**Conventional Tillage**
Lack of IPM, low drought resilience (low)

**Onsite Indicators**
- Physical?
- Chemical?
- Biological?
- Dynamic Soil Property Ranges?

**Transitions**
- Conservation Practices?
- Time?
- Management?
- Site/Soil Resilience?

**Resource Impacts**
- Soil?
- Water?
- Air?
- Plants?
- Wildlife/Livestock?
- Human?
Degradation / Resilience Threshold

Resource Concern Threshold

Soil Functions / Ecosystem Services

Ecological Potential (example graph)

Disturbance
within one Agricultural Production Group

Continuous no-till perennial crops in rotation, w/ cover crops

Continuous no-till rotation, w/ cover crops

Organic system w/ cover crops

Diverse rotation, tillage

Monocrop, Residue removal tillage

Grain Rotations

Attainable for Grain Rotations Production Group

Continuous no-till, no cover crops

Rotation, short term no-till, no cover crops

Monocrop, Residue removal tillage

Grain Rotations

Natural Resources Conservation Service

nrcs.usda.gov/
Water Erosion Prediction Model Outputs (States)

- Soil Loss tons/ac/yr
- Runoff Inches per season
- SCI

High Management | Medium Management | Low Management

- Soil Loss: High Management (5), Medium Management (4), Low Management (1)
- Runoff Inches: High Management (2), Medium Management (4), Low Management (0)
- SCI: High Management (1), Medium Management (1), Low Management (0)
Drought and Heavy Rainfall Resilience

- Wheat
- Soybeans
- Corn

County Avg

Bushels/Acre

Precipitation (in)

May 1 to Aug 31 Rainfall

Rest of Year

Two Hail Storms (June and Sept)
Dryland Pasture (Loamy Upland)

1. High
   1.1 Diverse forage system providing extended season grazing - highly managed

2. Medium
   2.1 Cool season dominated – average mgmt
   2.2 Warm season dominated – average mgmt

3. Low
   3.1 Overgrazed, weed infested, low level of management; most hardy forage survives

Resource Concerns in Degraded State:
SOIL EROSION: Sheet and rill erosion, ephemeral erosion, concentrated flow erosion
SOIL QUALITY DEGRADATION: SOM degradation, compaction
WATER QUALITY DEGRADATION: sediments, nutrients, pathogens
DEGRADED PLANT CONDITION: weed infestation, overgrazed, reduced yield
LIVESTOCK: inadequate feed/orage, inadequate water supply
WILDLIFE HABITAT: cover

Transition Descriptions
T1: Prescribed grazing with short rotations, residue management specific to each forage species, strategically located fence, water, shade, minerals, etc.; forage and biomass planting; nutrient management – strategic timing of N applications to extend grazing season; IPM – weed control sensitive to desirable broadleaves
T2: lengthen grazing rotation, residue management not specific to species; adequate fence and water but not ideally located; timing of fertilizer not aligned with extended production goals; broad application of herbicides
T3: overstock & overgraze; no fertilizer; no weed control
T4: Prescribed grazing of some kind; nutrient management – apply fertilizers; forage and biomass planting;

Information from FSGs (growth curves, production, species etc.)

Adapted Cool-Season Grasses
- Creeping meadow foxtail
- Meadow brome
- Smooth brome
- Orchardgrass
- Canada wildrye
- Tall fescue
- Western wheatgrass
- Intermediate wheatgrass
- Tall wheatgrass

Adapted Warm-Season Grasses
- Big bluestem
- Sideoats grama
- Switchgrass
- Little bluestem
- Indiangrass

Adapted Legumes
- Cicer milkvetch
- Illinois ticktrefoil
- Birdsfoot deervetch
- Alfalfa
- Red clover

Description of resource conditions for each state
1. Pasture Condition Scorecard 4 or 5 in every category
2. Pasture Condition Scorecard 3 or 4 in every category
3. Pasture Condition Scorecard < 3
Continuous Grazed

Rotationally grazed for 3 days or less, mowed twice annually with nutrient management

"Very High"

Continuous Grazed with herbicide, mowing and nutrient management

Appropriate Stocking Rate, Rotationally Grazed

Cool Season Broadleaf herbicide

“Medium”

Overstocked

Brush control and appropriate stocking rate

“High”

Rotationally grazed with nutrient mgmt

Appropriate stocking rate

“Medium”

Without herbicide

Cool Season Broadleaf herbicide

“Low”

Low Stocking Rate Continuous Grazed

“Low”

Reduced stocking rate and no mowing or herbicide

“Medium”

Appropriate Stocking Rate, Rotationally Grazed

“High”

Brush control and appropriate stocking rate

“Low”

Herbicide and appropriately stocked

“Low”
Conclusions
(Ecological Site uses for conservation decision-making)

Spatial Relevancy
Common conditions (States) within each land use
Conservation Practice Recommendations (blue print)
Ecosystem Services
Practice and Management Response (resiliency)
Site limitations and sustainable land uses
Common Transitions (negative & positive)
Restoration Pathways (i.e. wetland, prairie, forest)
Monitoring conditions and trends (site indicator, range of conditions)
Questions?
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June 10, 2017

June 13, 2017