# *U. S. UPLAND ECOLOGICAL HEALTH ASSESSMENT FOR GRASSLANDS*
# *(Derived by the computer from the U. S. Upland Inventory Form)*
# *USER MANUAL*
# *(Current as of 5/16/2023)*

The user manual is intended to accompany the *U. S. Upland Ecological Health Assessment for Grasslands Form,* which is based on data contained in the *U. S. Upland Inventory Form.*


## ACKNOWLEDGEMENTS

Development of these assessment tools has been a collaborative and reiterative process. Many people have contributed greatly their time, effort, funding, and moral support for the creation of these documents, as well as to the general idea of devising a way for people to look critically at upland sites in a systematic and consistent way. Some individuals and the agencies/organizations they represent who have been instrumental in enabling this work are Dan Hinckley, Tim Bozorth, and Jim Roscoe of the USDI Bureau of Land Management in Montana; Karen Rice and Karl Gebhardt of the USDI Bureau of Land Management in Idaho; Bill Haglan of the USDI Fish and Wildlife Service in Montana; Barry Adams and Gerry Ehlert of Alberta Public Lands Division; Lorne Fitch of Alberta Environmental Protection; Greg Hale and Norine Ambrose of the Alberta Cows and Fish Program, and especially Art Soukkala and Dale Becker of the Confederated and Salish Tribes in northwest Montana.


## BACKGROUND INFORMATION

Upland ecological health assessments evaluate the ability of a site to perform natural functions (such as primary production, maintenance of natural biotic diversity, provision of wildlife habitat, retention of water incident to the site, the development and maintenance of the soil resource). They are designed for use in conjunction with an ecological site classification such as a vegetation-based site classification (habitat type and/or community type) that has been written for the region. The resulting health rating is a measure of departure of a site from full functional capacity that may be attributed to human-caused disturbance. Due to differing site processes and characteristics that are reflected in the dominant vegetation physiognomy, four different ecological health assessment formats are presented. (***NOTE: A project area may include various amounts of any, or all, of the vegetational site types defined below.***) Following are definitions of the terms used to differentiate these forms and a key to assist in determining which one to use on a site.

**Upland Vegetative Lifeform Site Types Defined**

A ***forest/woodland*** is a site dominated by trees that are generally distributed (i.e., not limited to microsites of special hydrologic or edaphic conditions) at a density of at least 10 per acre, and that are reproducing successfully (i.e., there are well established seedlings and/or saplings present in the population). As compared to a forest, a woodland is generally defined as a site with vegetation dominated by a rather open stand of trees of short stature. For example, some woodland stands of *Juniperus scopulorum* (Rocky Mountain juniper) may form an open canopy of stunted trees, especially in xeric sites.

A ***shrubland*** (or shrub steppe) is a form of grassland (steppe) where zonal soils are too dry for trees, and herbaceous perennial grasses are well represented. Shrubs may be aggregated into thickets confined to relatively moist micro-environments or the shrubs may rise above the grasses and form a discontinuous upper layer on the landscape. Therefore, shrublands (shrub steppe) are a grassland (steppe) with a conspicuous shrub element, with the shrubs usually forming an open overstory above the grass layer. ***NOTE:*** Some sites may have varying amounts of low-growing shrubs, such as *Artemisia frigida* (fringed sagewort), *Gutierrezia sarothrae* (broom snakeweed), *Yucca glauca* (soapweed), *Juniperus horizontalis* (creeping juniper), *Opuntia polyacantha* (plains prickly-pear), or *Opuntia fragilis* (fragile cactus). Since these low-growing shrubs are typically shorter than the associated grasses, these sites are considered grassland sites.

A ***grassland*** (or steppe) is also a site where zonal soils are too dry for trees, and where herbaceous perennial grasses are well represented. The dominant grasses of steppe vary greatly in height, but all die back to the ground each year. They may be rhizomatous so that a continuous or interrupted sod is formed, or they may be cespitose, forming bunchgrass or tussock grassland. Forbs are less important in the drier portions of the steppe, but toward the wetter edge they become conspicuous, and may even exceed the graminoids in dry-matter production. Such forb-rich steppe is called meadow steppe. Some shrubs may be present, but these are few and are usually dwarfed and/or shorter than the herbaceous vegetation and interspersed

amongst them. Examples include sites with varying amounts of the low-growing shrubs *Artemisia frigida* (fringed sagewort), *Gutierrezia sarothrae* (broom snakeweed), *Yucca glauca* (soapweed), *Juniperus horizontalis* (creeping juniper), *Opuntia polyacantha* (plains prickly-pear), or *Opuntia fragilis* (fragile cactus). Medium-to-tall shrubs may be present in limited microsites. Trees may also be present, but with less than 10 trees per acre and/or not successfully reproducing.

***Modified sites*** are dominated by vegetation that has been modified by human manipulation. These sites essentially lack naturally occurring native perennial plants, as the result of human manipulation, such as plowing and seeding (i.e., tame pasture mixes, crops, etc.), hydrologic alteration, irrigation, etc. This designation does not include sites that still have enough native perennial plant components present to key them to a natural habitat type or community type (e.g., a site heavily altered by livestock grazing). Examples of a ***modified upland vegetation site*** include: tame pastures of seeded introduced or cultivar grass species or varieties, Conservation Reserve Program (CRP) lands seeded to species like *Agropyron cristatum* (crested wheatgrass), and improved forest stands (e.g., monoculture stands of trees planted by humans).

**Examples of Possibly Confusing Lifeforms (due to intermediate stature)**

***Trees:*** *Juniperus scopulorum* (Rocky Mountain juniper)
*Juniperus virginiana* (red cedar)
*Quercus macrocarpa* (bur oak)
*Quercus gambelii* (Gambel oak)

***Shrubs:*** *Artemisia frigida* (fringed sagewort)
*Cercocarpus* species (mountain mahogany)
*Coryphantha missouriensis* (pincushion cactus)
*Coryphantha vivipara* (pincushion cactus)
*Crataegus* species (hawthorns)
*Eriogonum microthecum* var. *laxiflorum* (slenderbush buckwheat)
*Gutierrezia sarothrae* (broom snakeweed)
*Opuntia fragilis* (fragile cactus)
*Opuntia polyacantha* (plains prickly-pear)
*Purshia tridentata* (antelope bitterbrush)
*Yucca glauca* (soapweed)

## KEY TO UPLAND LIFEFORM SITE TYPE

At the outset of field data collection for an upland inventory project, it is necessary to understand the distribution and relative abundance of vegetative lifeform site types present. Inventory plot selection and location must be done to reflect this distribution and relative abundance, so that the various types present are correctly represented. Therefore, the project area must be examined using map and aerial imagery, and by walking the site, to become familiar with the vegetation character and distribution. Most upland projects occur on areas with a mosaic of vegetation types. Below, a key is provided for identifying the four vegetative lifeform site types. Reduce the values if the site is highly disturbed.

1. Trees present ***AND*** successfully reproducing (average of 10 or more trees per acre) ***AND NOT*** restricted to microsites ***OR*** to draws/drainages that comprise a limited proportion of the polygon. .....**FOREST/WOODLAND SITE**

1. Trees absent; ***OR*** if present, ***EITHER*** restricted to microsites, or to draws/drainages that comprise a limited proportion of the landscape, ***OR*** not successfully reproducing (less than an average of 10 trees per acre).....**2**

    2. Shrubs (excluding the low-growing shrubs *Artemisia frigida* [fringed sagewort], *Gutierrezia sarothrae* [broom snakeweed], *Yucca glauca* [soapweed], *Juniperus horizontalis* [creeping juniper], *Opuntia polyacantha* [plains prickly-pear], or *Opuntia fragilis* [fragile cactus]) present and generally having greater than 10 percent canopy cover in the polygon. The mature shrubs form either a closed canopy (i.e., thickets) or an open overstory above the herbaceous layer.....**SHRUBLAND SITE**

    2. Shrubs absent; ***OR*** if present, have less than 10 percent canopy cover in the polygon ***OR*** the shrubs are shorter than the herbaceous vegetation and interspersed amongst them, such as sites with varying amounts of the low-growing shrubs *Artemisia frigida* (fringed sagewort), *Gutierrezia sarothrae* (broom snakeweed), *Yucca glauca*

(soapweed), *Juniperus horizontalis* (creeping juniper), *Opuntia polyacantha* (plains prickly-pear), or *Opuntia fragilis* (fragile cactus). .....**3**

3. The site is dominated by native, perennial, herbaceous vegetation; shrubs are either absent ***OR*** when present have less than 10 percent canopy cover in the polygon (do not include the low-growing shrubs *Artemisia frigida* [fringed sagewort], *Gutierrezia sarothrae* [broom snakeweed], *Yucca glauca* [soapweed], *Juniperus horizontalis* [creeping juniper], *Opuntia polyacantha* [plains prickly-pear], or *Opuntia fragilis* [fragile cactus]), ***OR*** the shrubs may be dwarfed and/or shorter than the herbaceous vegetation and interspersed among them. Medium-to-tall shrubs may be present in very limited microsites. (***NOTE:*** *Artemisia cana* [silver sagebrush] may be present on disturbed upland sites that are not considered old alluvial terraces or floodplains.) .....**GRASSLAND SITE**

3. The site has little naturally occurring perennial native vegetation, but has been manipulated purposely to replace the native vegetation with introduced or agronomic species. .....**MODIFIED UPLAND SITE**

## DATA FORM ITEMS

**Record ID No.** This is the unique identifier allocated to each polygon. This number will be assigned in the office when the form is entered into the database.

**Administrative Data**
**A1.** Agency or organization collecting the data.

**A2.** Funding Agency/Organization.

**A3a.** BLM (Bureau of Land Management) State Office.

**A3b.** BLM Field Office/Field Station.

**A3c.** BLM Office Code (recorded in the office).

**A3d.** Is the polygon in an active BLM grazing allotment (recorded in the office)?

**A3e, f.** For BLM polygons, the BLM Office Code, whether the polygon is in an active BLM grazing allotment, and the Allotment Number is supplied by the BLM. These items are entered into the computer in the office; the computer then references a master list of Allotment ID's to complete the remaining Allotment information. Because some polygons incorporate more than one Allotment, space is provided to enter two sets of Allotment information. The master Allotment list is periodically updated by the BLM National Applied Resource Sciences Center to make needed corrections.

**A4.** USDI Fish and Wildlife Service Refuge name.

**A5.** Indian Reservation name.

**A6.** USDI National Park Service Park/National Historical Site name.

**A7.** USFS (Forest Service) National Forest name.

**A8.** Other location.

**A9.** Year the field work was done.

**A10.** Date of field work by day, month, and year.

**A11.** Names of all field data observers.

***NOTE:*** Information for items **A12a-h** is found in the office; field evaluators need not complete these items.

**A12.** The several parts of these items identify various ways in which a data record may represent a resampling of a polygon that may have been inventoried again at some other time. The data in this record may have been collected on an area that coincides precisely with an area inventoried at another time and recorded as another record in the database. It may also represent the resampling of only a part of an area previously sampled. This would include the case where this polygon overlaps, but does not precisely and entirely coincide with one inventoried at another time. One other case is where more than one polygon inventoried one year coincides with a single polygon inventoried another year. All of these cases are represented in the database, and all have some value for monitoring purposes, in that they give some information on how the status on a site changes over time. ***This is done in the office with access to the database; field evaluators need not complete these items.***

**A12a.** Has any part of the area within this polygon been inventoried previously, or subsequently, as represented by any other data record in the database? Such other records would logically carry different dates.

**A12b.** Does the areal extent of this polygon exactly coincide with that of any other inventory represented in the database? In many cases, subsequent inventories only partially overlap spatially. The purpose of this question is to identify those records that can be compared as representing exactly the same ground area.

**A12c.** Does this record represent the latest data recorded for this site (polygon)?

**A12d.** If A12b is answered Yes, then enter the record ID number(s) of any other previous or subsequent re-inventories (resampling) of this exact polygon for purposes of cross-reference.

**A12e.** Enter the years of any records recorded in item A12d as representing other inventories of this exact polygon.

**A12f.** Even though this polygon is not a re-inventory of the exact same area as any other polygon, does it share at least some common area with one or more polygons inventoried at another time?

**A12g.** Enter the years of any other inventories of polygons sharing common ground area with this one.

**A12h.** If A12f is answered Yes, then enter the record ID number(s) of any other polygon(s) sharing common ground area with this one.

**A13a.** Has a management change been implemented on this polygon?

**A13b.** If A13a is answered Yes, in what year was the management change implemented?

**A13c.** If A13a is answered Yes, describe the management change implemented.

**Location Data**

**B1.** State in which the field work was done (recorded in the office).

**B2.** County or municipal district in which the field work was done (recorded in the office).

**B3.** This field for allotment, range, or management unit is intended for entities other than the BLM to use for grouping polygons by management unit. The BLM management units are grouped using the grazing allotment information in A3 above.

**B4a.** Give a name or local designation that identifies the area where the upland inventory is conducted. If possible, use a name that is shown on the 7.5 minute topographic map.

**B4b, c.** Polygons are grouped together for management purposes. For example, all polygons around Henry's Lake in the Idaho Falls Field Office could be identified as Group Name: Idaho Falls Field Office; Group Number: 1 (recorded in the office).

**B5.** Polygon number is a sequential identifier of the portion of the area assessed. This is referenced to the map delineations. Sequences normally progress clockwise.

**B6.** Elevation (feet or meters) of the polygon midpoint. Elevation is interpolated from the topographic map(s).

**B7a.** Record the latitude and longitude of the polygon, along with the GPS projection and accuracy. Record the degrees, minutes, and seconds, along with decimal degrees. ***NOTE: All of North America is latitude = North, and longitude = West.***

**B7b.** Record any comments pertaining to the "other" location.

**Selected Summary Data**

**C1a.** Vegetation type is a categorical description of predominant polygon character, based on kind of vegetative cover and/or land use. Use the key below to determine the site vegetation category that best characterizes the majority of the polygon. Observers will ***select only one category*** as representative of the entire polygon.

**KEY TO UPLAND LIFEFORM SITE TYPE**

1. Trees present ***AND*** successfully reproducing (average of 10 or more trees per acre) ***AND NOT*** restricted to microsites ***OR*** to draws/drainages that comprise a limited proportion of the polygon. .....**FOREST/WOODLAND SITE**

1. Trees absent; ***OR*** if present, ***EITHER*** restricted to microsites, or to draws/drainages that comprise a limited proportion of the landscape, ***OR*** not successfully reproducing (less than an average of 10 trees per acre).....**2**

    2. Shrubs (excluding the low-growing shrubs *Artemisia frigida* [fringed sagewort], *Gutierrezia sarothrae* [broom snakeweed], *Yucca glauca* [soapweed], *Juniperus horizontalis* [creeping juniper], *Opuntia polyacantha* [plains prickly-pear], or *Opuntia fragilis* [fragile cactus]) present and generally having greater than 10 percent canopy cover in the polygon. The mature shrubs form either a closed canopy (i.e., thickets) or an open overstory above the herbaceous layer.....**SHRUBLAND SITE**

    2. Shrubs absent; ***OR*** if present, have less than 10 percent canopy cover in the polygon ***OR*** the shrubs are shorter than the herbaceous vegetation and interspersed amongst them, such as sites with varying amounts of the low-growing shrubs *Artemisia frigida* (fringed sagewort), *Gutierrezia sarothrae* (broom snakeweed), *Yucca glauca* (soapweed), *Juniperus horizontalis* (creeping juniper), *Opuntia polyacantha* (plains prickly-pear), or *Opuntia fragilis* (fragile cactus). .....**3**

3. The site is dominated by native, perennial, herbaceous vegetation; shrubs are either absent ***OR*** when present have less than 10 percent canopy cover in the polygon (do not include the low-growing shrubs *Artemisia frigida* [fringed sagewort], *Gutierrezia sarothrae* [broom snakeweed], *Yucca glauca* [soapweed], *Juniperus horizontalis* [creeping juniper], *Opuntia polyacantha* [plains prickly-pear], or *Opuntia fragilis* [fragile cactus]), ***OR*** the shrubs may be dwarfed and/or shorter than the herbaceous vegetation and interspersed among them. Medium-to-tall shrubs may be present in very limited microsites. (***NOTE:*** *Artemisia cana* [silver sagebrush] may be present on disturbed upland sites that are not considered old alluvial terraces or floodplains.) .....**GRASSLAND SITE**

3. The site has little naturally occurring perennial native vegetation, but has been manipulated purposely to replace the native vegetation with introduced or agronomic species. .....**MODIFIED UPLAND SITE**

**C1b.** Identify the vegetation subtype, if appropriate. May include types such as all needle-and-thread stands, all western wheatgrass stands, etc.

**C2.** The size (acres/hectares) of the polygon or sampling plot (microplot of usually a portion of an acre or up to 15 to 25 acres in size) is recorded in this field. The size of a polygon can be determined using a GIS, Google Earth Pro, planimeter, or dot grid.

**C3.** In some cases, the sampling plot data is used to characterize, or represent, a larger area. Give the acreage of the area actually represented by this polygon. For example, a sample plot of 15 acre is used to represent a 200 acre field. The observer would then enter 200 acres in this field.

## *FACTORS FOR ASSESSING GRASSLAND UPLAND SITE HEALTH*
## *(Derived by the computer from the U. S. Upland Inventory Form)*

A ***grassland*** (or steppe) is also a site where zonal soils are too dry for trees and herbaceous perennial grasses are well represented. The dominant grasses of steppe vary greatly in height, but all die back to the ground each year. They may be rhizomatous so that a continuous or interrupted sod is formed, or they may be cespitose, forming bunchgrass or tussock grassland. Forbs are less important in the drier portions of the steppe, but toward the wetter edge they become conspicuous, and may even exceed the graminoids in dry-matter production. Such forb-rich steppe is called meadow steppe. When present, shrubs may be dwarfed and/or shorter than the herbaceous vegetation and interspersed amongst them, such as sites with varying amounts of the low-growing shrubs *Artemisia frigida* (fringed sagewort), *Gutierrezia sarothrae* (broom snakeweed), or *Juniperus horizontalis* (creeping juniper). Medium-to-tall shrubs may be present in limited microsites. These sites are referred to as grasslands. Trees may be present, but with less than 10 trees per acre and not successfully reproducing.

**1. Native Plant Species Canopy Cover.** The fraction of live plant canopy cover on the polygon by species that are not native to western North America is a strong measure of the degree of alteration to the natural vegetation on a site.

**Scoring:**
**15 =** Over 90% of all live plant canopy cover on the polygon is by native species.
**10 =** 70% to 90% of all live plant canopy cover on the polygon is by native species.
**5 =** 40% to 70% of all live plant canopy cover on the polygon is by native species.
**0 =** Less than 40% of all live plant canopy cover on the polygon is by native species.

**2. Native Perennial Forb Canopy Cover.** Consider only native perennial forbs, and ignore annuals and all non native species. Estimate the total combined canopy cover of all the native perennial forbs on the polygon and select the appropriate scoring category.

**Scoring:**
**6 =** More than 15% of the plant canopy cover on the polygon is by native perennial forbs.
**4** = 10% to 15% of the plant canopy cover on the polygon is by native perennial forbs.
**2** = 5% to 10% of the plant canopy cover on the polygon is by native perennial forbs.
**0** = Less than 5% of the plant canopy cover on the polygon is by native perennial forbs.

**3. Vegetation Community Structure.** This question assesses the present vegetation structure on the site as it compares to the potential vegetation structure. Vegetation community structure is the vertical layering of various height plant growth forms created by the species composition as indicated by the appropriate ecological site or habitat type/community type. This is important for ecological function, i.e., primary biomass productivity, for habitat values, and for maintenance of soil and hydrologic resources.

It is important to key the site to a type using a vegetation-based classification appropriate to the region in which you are working. Ecological site descriptions are available from the USDA Natural Resource Conservation Service (2013). For habitat types/community types, in western Montana use the *Grassland and shrubland habitat types of Western Montana* (Mueggler and Stewart 1980), and for eastern Montana use *Classification and Management of Upland, Riparian, and Wetland Sites in the USDI Bureau of Land Management's Miles City Field Office, Northern Great Plains, Eastern Montana* (Hansen and others 2008). When the name of the habitat type(s) or successional community type(s) on the site are known, then one can compare the vegetation on the site to that described in the document for late seral to climax, or relatively undisturbed, stands of that type. Using the broad categories below, choose a best fit to indicate how structurally intact the site vegetation is, as compared to the habitat type description. To judge the standard of comparison for vegetation structure, refer to stand data summaries in the classification documents, such as named above, that show species average canopy cover and constancy of occurrence in each habitat type.

Without a locally appropriate vegetation-based classification to use, the observer must use judgement in making the call of what the potential vegetative structure is on the site. Figure 1 is a conceptual illustration to assist in visualizing the categories of disturbance-caused alteration on grassland sites. Photos 1a-h depict grassland examples of the four scoring categories.

**Scoring:**

**9 =** Good—The vegetative community structure is fully intact and provides full ecological function appropriate to the ecological site(s) or habitat type(s)/community type(s).

**6 =** Slight Reduction—There is noticeable, but not severe, alteration of the vegetative community structure, and ecological function is intact but slightly impaired.

**3 =** Moderate—There is moderate alteration of the vegetative community structure and ecological function is moderately impaired.

**0 =** Severe—The vegetative community structure has been severely altered, and provides greatly diminished ecological function.

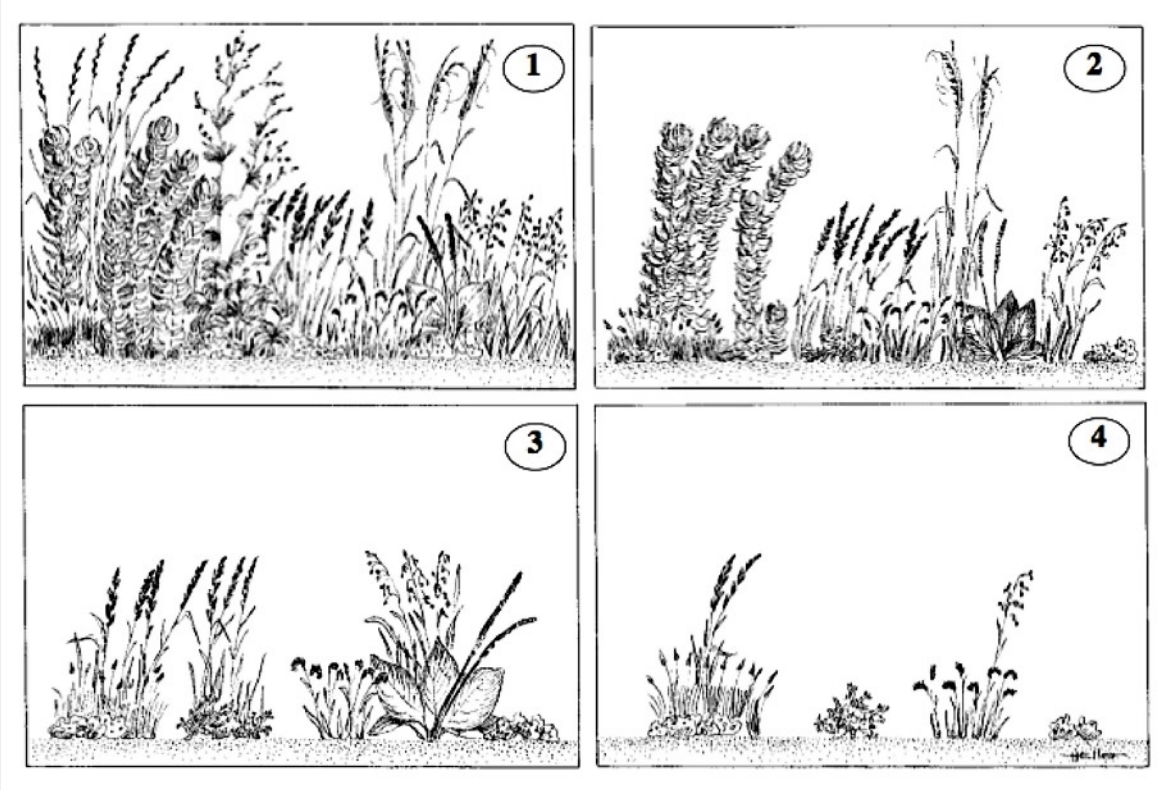


**Figure 1.** Example illustration of structural change to grassland plant community as disturbance level increases. 1) All expected structural layers well represented; 2) Tall grasses and forbs significantly reduced; 3) Tall grasses and forbs layer absent, and mid height layer reduced; 4) Community reduced to only low grasses and forbs. ***NOTE:*** *Not all grassland sites will look like this figure or have the same site potential. The user needs to refer to the appropriate ecological site or habitat type/community type description for information about successional stages.* (figure adapted from Adams and others [2003])

**Photo 1a.** A stand of *Agropyron spicatum* (bluebunch wheatgrass), the tallest late seral species on this productive site (Score = 9 points)

**Photo 1b.** A healthy bunchgrass stand on a xeric site with sparse vegetation potential (Score = 9 points)

**Photo 1c.** A healthy stand of *Andropogon scoparius/Carex filifolia* (little bluestem/threadleaf sedge) habitat type (Score = 9 points)

**Photo 1d.** A bunchgrass stand with much of the tallest layer replaced by shorter species (Note the scattering of the low shrub *Artemisia cana* [silver sagebrush]) (Score = 6 points)

**Photo 1e.** A stand of *Agropyron spicatum* (bluebunch wheatgrass) with taller grasses reduced and the understory converted to disturbance induced *Artemisia frigida* (fringed sagewort) and increased *Carex filifolia* (threadleaf sedge) (Score = 3 points)

**Photo 1f.** A stand of *Agropyron spicatum* (bluebunch wheatgrass) with taller bunchgrasses reduced and the understory converted to disturbance induced forbs and lower, and sod-forming graminoids (Score = 3 points)

**Photo 1g.** A severely overgrazed bunchgrass stand where most all tall grasses and mid height grasses are replaced by low, sod-forming, graminoid species and bare ground (Score = 0 points)

**Photo 1h.** A close view of a severely disturbed grassland site converted to the low, sod-forming, *Bouteloua gracilis* (blue grama), *Opuntia polyacantha* (plains prickly-pear), and *Carex filifolia* (threadleaf sedge) (Score = 0 points)

**4. Invasive Plant Species (Weeds).** Invasive plants (noxious weeds) are alien species whose introduction does or is likely to cause economic and *environmental* harm. Use a weed list that is standard for the region, or use the list that is printed on the field form. Noxious weed presence indicates a degrading ecosystem. Although some of these species may contribute to some ecological functions, their negative impacts reduce overall site health. This item assesses the extent to which the site is impacted by noxious weeds. Severity of the problem is a function of density/distribution (pattern of occurrence), as well as abundance of the weeds.

Record the combined percent canopy cover and the overall density distribution class of all invasive plants (from the standard list) that occur on the polygon. Invasive plant species in Montana, Idaho, North Dakota, and South Dakota are listed on the form, and space is allowed for recording others. ***Leave no listed species field blank, however;*** enter to indicate absence of a species. (A blank field means the observer forgot to collect the data; a value means the observer looked.) For each weed species observed record canopy cover as a percentage of the polygon (area being evaluated) and density/distribution class. Choose a density/distribution class from the chart below that best represents each species' pattern of presence on the site.

**4a. Total Canopy Cover of Invasive Plant Species (Weeds).** The observer must evaluate the total percentage of the polygon area that is covered by the combined canopy of all plants of all species of invasive plants. Invasive plant species to count for this assessment item are generally those listed by the state or county noxious weed control agency where the site is located. It is important to list the species found and counted at the site being assessed. Determine which rating applies in the scoring scale below.

**Scoring:**
**3 =** No invasive plant species (weeds) on the site.
**2 =** Invasive plants present with total canopy cover less than 1% of the polygon area.
**1 =** Invasive plants present with total canopy cover between 1% and 15% of the polygon area.
**0 =** Invasive plants present with total canopy cover more than 15% of the polygon area.

**4b. Density/Distribution Pattern of Invasive Plant Species (Weeds).** The observer must pick a category of pattern and extent of invasive plant distribution from the chart (Figure 2) below that best fits what is observed on the polygon, while realizing that the real situation may be only roughly approximated at best by any of these diagrams. Choose the category that most closely matches the weed distribution on the polygon.

**Scoring:**
**3 =** No invasive plant species (weeds) on the site.
**2 =** Invasive plants present with density/distribution in categories 1, 2, or 3.
**1 =** Invasive plants present with density/distribution in categories 4, 5, 6, or 7.
**0 =** Invasive plants present with density/distribution in categories 8, or higher.

| CLASS | DESCRIPTION OF ABUNDANCE | DISTRIBUTION PATTERN |
|---|---|---|
| 0 | No invasive plants on the polygon | |
| 1 | Rare occurrence | |
| 2 | A few sporadically occurring individual plants | |
| 3 | A single patch | |
| 4 | A single patch plus a few sporadically occurring plants | |
| 5 | Several sporadically occurring plants | |
| 6 | A single patch plus several sporadically occurring plants | |
| 7 | A few patches | |
| 8 | A few patches plus several sporadically occurring plants | |
| 9 | Several well spaced patches | |
| 10 | Continuous uniform occurrence of well spaced plants | |
| 11 | Continuous occurrence of plants with a few gaps in the distribution | |
| 12 | Continuous dense occurrence of plants | |
| 13 | Continuous occurrence of plants associated with a wetter or drier zone within the polygon. | |

**Figure 2.** Invasive plant species class guidelines (figure adapted from Adams and others [2003])

**5. Disturbance-Increaser Undesirable Species.** A large cover of disturbance-increaser undesirable species, whether native or exotic, indicates displacement from the potential natural community (PNC) and a reduction in functional health. These species generally are less productive and poorly perform most ecological functions. They usually result from some disturbance, which removes more desirable species. Invasive plant species considered in the previous item are not counted here again. A list of disturbance-increaser undesirable species that are counted is presented below. Other disturbance-increaser undesirable species may be present on a site, but consistency and comparability will be maintained by always counting the same set of species.

*Antennaria* species (everlasting; pussytoes)
*Artemisia frigida* (fringed sagewort)
*Filago arvensis* (field filago)
*Gutierrezia sarothrae* (broom snakeweed)
*Lepidium densiflorum* (prairie pepperweed)
*Medicago lupulina* (black medick)
*Opuntia* species (prickly-pear; cactus)
*Phleum pratense* (timothy)
*Plantago lanceolata* (English plantain)
*Poa compressa* (Canada bluegrass)
*Poa pratensis* (Kentucky bluegrass)
*Sisymbrium altissimum* (tall tumblemustard)
*Sisymbrium loeselii* (Loeselii tumblemustard)
*Taraxacum laevigatum* (red-seeded dandelion)
*Taraxacum officinale* (common dandelion)
*Trifolium pratense* (red clover)
*Trifolium repens* (white clover)

**Scoring:**
**3** = Less than 5% of the site covered by disturbance-increaser undesirable species.
**2** = 5% to 25% of the site covered by disturbance-increaser undesirable species.
**1** = 25% to 50% of the site covered by disturbance-increaser undesirable species.
**0** = More than 50% of the site covered by disturbance-increaser undesirable species.

**6. Human-Caused Bare Ground.** Bare ground is soil not covered by plants, litter or duff, downed wood, or rocks larger than 2.5 inches (6 cm). The amount of an upland site that lacks plant canopy cover can vary greatly, depending of site type; however bare ground caused by human activity on any site indicates a deterioration of site health. Human land uses commonly causing bare ground include livestock grazing, recreational activities, vehicle traffic, industrial activities, etc. The evaluator should consider the causes of all bare ground observed and estimate what fraction of it is human-caused. ***NOTE:***

*On sites having a large amount of natural bare ground (e.g., on badland topography or saline soils) carefully evaluate evidence of human-caused bare-ground vs. normal amounts of bare-ground for this setting.*

**Scoring:**
**9** = Less than 1% of the polygon is human-caused bare ground.
**6** = 1% to 5% of the polygon is human-caused bare ground.
**3** = 5% to 15% of the polygon is human-caused bare ground.
**0** = More than 15% of the polygon is human-caused bare ground.

**7. Evidence of Accelerated Soil Erosion by Water and/or Wind.** Look for signs of soil or litter movement (e.g., deposition of sediment or litter by surface water flow, rills, pedastalling, gully formation, and blow-outs) as evidence of accelerated soil erosion. Answer this question by assessing how much of the entire polygon area exhibits these kinds of evidence of soil movement. ***NOTE:*** *On badland topography, carefully evaluate evidence of accelerated soil erosion by water and/or wind vs. normal rates of soil erosion for this setting.*

**Scoring:**
**12** = Less than 1% of the polygon shows evidence of accelerated soil erosion.
**8** = 1% to 15% of the polygon shows evidence of accelerated soil erosion.
**4** = 15% to 25% of the polygon shows evidence of accelerated soil erosion.
**0** = More than 25% of the polygon shows evidence of accelerated soil erosion.

**8. Plant Material Litter and Duff.** Functional benefits of a layer of plant material residue (litter and duff) at the soil surface include: 1) the conservation of soil moisture by enhancing moisture retention and infiltration; 2) mitigation of soil temperature extremes; and 3) recycling of nutrients on the site. Although the amount of litter and duff expected on a healthy natural site varies greatly by site type, all stages of decomposition should be present, and the litter and duff distribution within a given stand of one type should be relatively even across the stand in a pattern that generally mimics the pattern of plant species distribution. Look for areas of thinner or absent litter and duff associated with evidence of animal use patterns (i.e., near trails or easily grazed areas, versus areas of more restricted access). Information about litter and duff amount and distribution can sometimes be gained by examining conditions across fences separating different management regimes.

Expected litter and duff amounts are usually developed from monitoring of long-term benchmark sites under light to moderate grazing. The reference site should be a light to moderately grazed site with enough litter and duff to retain moisture. Litter and duff includes residual plant material from previous years growth including standing stems, fallen stems and leaf material, and partially decomposed material. Estimate litter and duff across the entire polygon. Look at the distribution, evenness, and patchiness of litter and duff across the polygon. Photos 2a-f provide illustrations of a range of site litter conditions.

**Scoring:**
**9** = Litter and duff amounts are more or less uniform across the polygon and includes last year's growth (standing dead plant material), fallen dead plant material and variably decomposed material on the soil surface. Litter and duff (lb/acre) is more than 90% of expected levels under a light to moderate grazing intensity.
**6** = Litter and duff amounts appear to be slightly to moderately reduced and are somewhat patchy across the polygon. Last year's growth (standing dead plant material) is less abundant with fallen dead plant material and variably decomposed material on the soil surface being more or less equal in amount. Litter and duff (lb/acre) is between 60% to 90% of expected levels under a light to moderate grazing intensity.
**3** = Litter and duff amounts appear to be moderately reduced and are very patchy across the polygon. Last year's growth (standing dead plant material) is greatly reduced, with fallen dead plant material and variably decomposed material on the soil surface being the dominant form of litter and duff. Litter and duff (lb/acre) is between 30% to 60% of expected levels under a light to moderate grazing intensity.
**0** = Litter and duff amounts appear greatly reduce or absent in the polygon. The extent and distribution of exposed soil has increased. There is little or no standing or fallen litter. Decomposing material on the oils surface is the main type of litter. Litter and duff (lb/acre) is less than 30% of expected levels under a light to moderate grazing intensity.

**Photo 2a.** A grassland stand with normal accumulation of litter evenly distributed (Score = 9 points)

**Photo 2b.** A grassland stand now dominated by the invasive *Bromus japonicus* (field brome) that makes a large amount of litter (Score = 9 points)

**Photo 2c.** A grassland stand with slightly reduced accumulation of litter, with bare spots (Score = 6 points)

**Photo 2d.** A grassland stand, with moderately reduced litter accumulation, but lower vegetative potential as well, (Score = 3 points)

**Photo 2e.** A grassland stand with a moderately to greatly reduced litter accumulation (Score = 3 points)

**Photo 2f.** A severely overgrazed grassland stand, dominated by *Bouteloua gracilis* (blue grama), with almost no litter cover (Score = 0 points)

**9. Human-Caused Physical Site Alteration.** Many human activities can alter the physical integrity and/or natural topography of the site in other ways that disrupt its functional capacity, especially the natural movement of water. Such alterations may be caused by farming practices (plowing), terracing, contour ditching (either to spread water across the site, or to convey water to some other site), soil compaction (by vehicle, machinery, or livestock), industrial activities (mining, timber harvest, etc.), construction, etc. Examples of such alteration include roads, animal trails, fields converted to hay production or tame pasture species, plowed crop fields, compaction by industrial or recreational equipment, over-grazed rangeland, etc. Look for visible physical evidence of the human-caused alterations. Use none to describe when there is no physical alterations to the site by human activity. If there are human-caused physical alterations to the site and there is either no visible evidence of functional effect or only limited effect, the answer to the question would be slight.

**9a.** The percentage of the whole polygon area that is altered by human activities.

**Scoring:**
**9** = Less than 5% of the polygon is physically altered by human activity.
**6** = 5% to 15% of the polygon is physically altered by human activity.
**3** = 15% to 35% of the polygon is physically altered by human activity.
**0** = More than 35% of the polygon is physically altered by human activity.

**9b.** Severity of the human-caused alteration.

**Scoring:**
**6** = ***No physical alterations*** to the site by human activity.
**4** = Human alterations to the physical site are ***slight*** in effect.
**2** = Human alterations to the physical site are ***moderate*** in effect.
**0** = Human alterations to the physical site are ***severe*** in effect.

## LITERATURE CITED


Adams, B. W., G. Ehlert, C. Stone, M. Alexander, D. Lawrence, M. Willoughby, D. Moisey, C. Hincz, and A. Burkinshaw. 2003. Range health assessment for grassland, forest and tame pasture. Public Lands and Forests Division, Alberta Sustainable Resource Development. Publication. No. T/044.

Daubenmire, R. D. 1959. A canopy-coverage method of vegetation analysis. Northwest Science 33:43-66.

Hansen, Paul L., William H. Thompson, J. Gant Massey, and Max Thompson. 2008. Classification and management of upland, riparian, and wetland sites of USDI Bureau of Land Management's Miles City Field Office, eastern Montana USA. Prepared for the USDI Bureau of Land Management Miles City Field Office, Miles City, Montana, USA. 640 p. plus 91 p. of Appendix B (Indicator Species).

Mueggler, Walter F., and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service General Technical Report INT-66. Intermountain Forest and Range Experiment Station, Ogden, Utah, USA. 154 p.

USDA Natural Resource Conservation Service. 2013. Ecological Site Description (ESD) System for Rangeland and Forestland Data. http://esis.sc.egov.usda.gov/Welcome/pgReportLocation.aspx?type=ESD. February 4, 2013.