Appendix 1. Evaluation Worksheet for Rangeland Health

Rev. 12/15/02

Evaluation Worksheet for Rangeland Health

Aerial Photo:_____.

Management Unit_____ (Allotment or pasture) **State** __TX___ **Office** _____ **Range/Ecol. Site Code**: ___R081CY355TX__

Ecological Site Name:__Adobe_____ **Soil Map Unit/Component Name**:___Brackett Association, undulating__

Observers: ___Moseley_____ **Date**: _____

Location (description):_____

T. ____ **R**. _____ **or** _____**N. Lat. Or UTM E**_____**m Position by GPS? Y / N**
UTM Zone____, **Datum**_____
Sec. _____, _____ _____**W. Long. N**_____**m Photos taken? Y / N**

Size of evaluation area _____

Soil / site verification:
Range/Ecol. Site Descr., Soil Surv., and/or Ecol. Ref. Area:
Surface texture _____Loam_____
Depth: very shallow __, shallow X, **moderate __, deep __**
Type and depth of diagnostic horizons:
1. __Limestone Bedrock w/in 20 " _ **3.** _____
2. _____ **4.** _____
Surf. Efferv.: none__, v. slight__, slight__, strong__ violent__

Evaluation Area:
Surface texture _____
Depth: very shallow __, shallow __, moderate __, deep __
Type and depth of diagnostic horizons:
1. _____ **3.** _____
2. _____ **4.** _____
Surf. Efferv.: none__, v. slight__, slight__, strong__, violent__

Parent material _Limestone__ **Slope** *1-8***% Elevation** 500-1600 **ft. Topographic position** _____ **Aspect** __

Average annual precipitation *_28-34____inches* **Seasonal distribution** _____

Recent weather (last 2 years) (1) drought ___, (2) normal ____, or (3) wet _____.

Wildlife use, livestock use (intensity and season of allotted use), and recent disturbances:
_____
_____
_____
_____

Off-site influences on evaluation area: _____
_____
_____
_____

Criteria used to select this particular evaluation area as REPRESENTATIVE (specific info. And factors considered; degree of "representativeness")
_____
_____
_____
_____

Other remarks (continue on back if necessary)
_____
_____
_____
_____

Reference: **(1) Ecological Reference Worksheet**:_____**; Author**: _____; **Creation Date**: _____
or (2) Other (e.g. name and date of ecological site description, locations of ecological reference area(s))_____

Appendix 2.

Ecological Reference Worksheet

Author(s)/participant(s): ____Moseley_____

Contact for lead author: ___San Angelo Zone Office 325.944.0147_____ **Reference site used? Yes/No**

Date: _____ **MLRA:** __81C_____ **Ecological Site:** __Adobe_____ This *must* be verified based on soils and climate (see Ecological Site Description). Current plant community *cannot* be used to identify the ecological site.

Indicators. For each indicator, describe the potential for the site. Where possible, (1) use numbers, (2) include expected range of values for above- and below-average years for **each** community within the reference state, when appropriate & (3) cite data. Continue descriptions on separate sheet.

1. Number and extent of rills:
None

2. Presence of water flow patterns:
None, except following extremely high intensity storms when short flow patterns may appear

3. Number and height of erosional pedestals or terracettes:
None

4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are *not* bare ground): 0 to 10 percent bare ground. Small and non-connected areas.

5. Number of gullies and erosion associated with gullies:
None

6. Extent of wind scoured, blowouts and/or depositional areas:
None

7. Amount of litter movement (describe size and distance expected to travel):
Minimal and short

8. Soil surface (top few mm) resistance to erosion (stability values are averages – most sites will show a range of values for both plant canopy and interspaces, if different):
Soil Stability rating 5-6.

9. Soil surface structure and SOM content (include type and strength of structure, and A-horizon color and thickness for both plant canopy and interspaces, if different): Soil surface is light brownish gray gravelly clay loam; moderately fine subangular blocky structure parting to moderate fine granular; hard, firm, sticky; common fine roots; 15% volume of limestone fragments; 51% calcium carbonate equivalent; calcareous; moderately alkaline; Soil Organic Matter is 1- 3%.

10. Effect of plant community composition (relative proportion of different functional groups) & spatial distribution on infiltration & runoff: High canopy, basal cover and density with small interspaces should make rainfall impact negligible. This site has well drained soils, moderately slow permeability, very low available water capacity, rapid surface runoff, hazard of water erosion is severe, fertility is low, and shallow root zone. Seeps can occur after wet periods.

11. Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site): None

12. Functional/Structural Groups (list in order of descending dominance by above-ground weight using symbols: >>, >, = to indicate much greater than, greater than, and equal to): Warm Season Midgrasses (S) > Warm Season Tallgrasses (S) > Trees (S) > Forbs (S) > Warm Season Shortgrasses (M) > Shrubs (M).

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):
Grasses will almost always show some mortality and decadence.

14. Average percent litter cover (__90 -100_____%) and depth (½ -3_____ inches). 90 -100 % litter cover and ½ to 3 inches depth.

15. Expected annual production (this is TOTAL above-ground production, not just forage production):
___1100_____ - ___4700_____ #/acre

16. Potential invasive (including noxious) species (native and non-native). List species which characterize degraded states and which, after a threshold is crossed, "can, and often do, continue to increase regardless of the management of the site and may eventually dominate the site": Ashe juniper is the primary invader.

17. Perennial plant reproductive capability:
All species should be capable of reproducing on the Adobe ecological site, except during periods of prolonged drought.

Appendix 4. Functional/Structural Groups Worksheet

State__TX_____ Office_____ Ecological Site___ADOBE__ Site ID_R081CY355TX_

Observers_____ Date_____

Functional/Structural Groups			Species List for Functional/Structural Groups
Name	Potential[1]	Actual[2]	Plant Names
Warm Season Tallgrass	S		Little bluestem
Warm Season Tallgrass	M		Indiangrass
Warm Season Midgrasses	S		Sideoats grama, Tall grama
Secondary Warm Season Midgrasses	M		Texas wintergrass, Sideoats grama, Tall grama, Low panicums, Green sprangletop, Reverchon's bristlegrass
Warm Season Shortgrasses	M		Muhly, Dropseeds, Threeawns, Tridens, Cedar Sedge, Hairy Grama
Forbs	S		Annual and perennial forbs
Shrubs	S		Sumac, Kidneywood, Elbowbush, Bumelia, algerita, Greenbrier, Persimmon, Buckeye, sotol
Trees	S		Liveoak, Texas oak, Ashe juniper
Additional species groups of interest			
Noxious Weeds			
Invasive Native Plants			Ashe juniper
Invasive Exotic Plants			Old world bluestem.
Biological Crust[3]			

Indicate whether each "structural/functional group" is a Dominant (D) (roughly 40-100 % composition), **a Sub-dominant (S)** (roughly 10-40% composition) **a Minor Component (M)** (roughly 2-5% composition), or a Trace Component **(T)** (<2% composition) based on weight or cover composition in the area of interest (e.g., "Actual[2]" column) relative to the "Potential[2] " column derived from information found in the ecological site/description and/or at the ecological reference area.

Biological Crust [3] dominance is evaluated solely on **cover** not composition by weight.

Appendix 5.

Evaluation Matrix for Rangeland Health

State_____ Office_____ Ecological Site_____ Site ID_____

Authors:_____ Revision Date_____

	Departure from Ecological Site Description/Ecological Reference Worksheet				
Indicator	**Extreme**	**Moderate to Extreme**	**Moderate**	**Slight to Moderate**	**None to Slight**
1. Rills*					Ecological Reference Worksheet: None
Generic Descriptor	Rill formation is severe and well defined throughout most of the site.	Rill formation is moderately active and well defined throughout most of the site.	Active rill formation is slight at infrequent intervals; mostly in exposed areas.	No recent formation of rills; old rills have blunted or muted features**.**	Current or past formation of rills as expected for the site.
2. Water Flow Patterns *					Ecological Reference Worksheet: None, except following extremely high intensity storms when short flow patterns may appear
Generic Descriptor	Water flow patterns extensive and numerous; unstable with active erosion; usually connected.	Water flow patterns more numerous and extensive than expected; deposition and cut areas common; occasionally connected.	Number and length of water flow patterns nearly match what is expected for the site; erosion is minor with some instability and deposition.	Number and length of water flow patterns match what is expected for the site; some evidence of minor erosion. Flow patterns are stable and short.	Matches what is expected for the site; minimal evidence of past or current soil deposition or erosion.
3. Pedestals and/or Terracettes					Ecological Reference Worksheet: None
3. Pedestals and/or Terracettes Generic Descriptor	Abundant active pedestalling and numerous terracettes. Many rocks and plants are pedestaled; exposed plant roots are common.	Moderate active pedestalling; terracettes common. Some rocks and plants are pedestaled with occasional exposed roots.	Slight active pedestalling; most pedestals are in flow paths and interspaces and/or on exposed slopes. Occasional terracettes present.	Active pedestalling or terracette formation is rare; some evidence of past pedestal formation, especially in water flow patterns on exposed slopes.	Current or past evidence of pedestaled plants or rocks as expected for the site. Terracettes absent or uncommon.

* Descriptions should be more specific than those listed in the General Example, if possible, and refer to the criteria included in the None to Slight description, which is based on the Ecological Reference Worksheet. See page __ for an Ecological Reference Worksheet example.

	Departure from Ecological Site Description/Ecological Reference Worksheet				
Indicator	**Extreme**	**Moderate to Extreme**	**Moderate**	**Slight to Moderate**	**None to Slight**
4. Bare Ground					Ecological Reference Worksheet: 0 to 10 percent bare ground. Small and non-connected areas.
4. Bare Ground Generic Descriptor	Much higher than expected for the site. Bare areas are large and generally connected.	Moderate to much higher than expected for the site. Bare areas are large and occasionally connected.	Moderately higher than expected for the site. Bare areas are of moderate size and sporadically connected.	Slightly to moderately higher than expected for the site. Bare areas are small and rarely connected.	Amount and size of bare areas match that expected for the site.
5. Gullies					Ecological Reference Worksheet: None
5. Gullies Generic Descriptor	Common with indications of active erosion and downcutting; vegetation is infrequent on slopes and/or bed. Nickpoints and headcuts are numerous and active**.**	Moderate in number to common with indications of active erosion; vegetation is intermittent on slopes and/or bed. Headcuts are active; down-cutting is not apparent.	Moderate in number with indications of active erosion; vegetation is intermittent on slopes and/or bed. Occasional headcuts may be present.	Uncommon, vegetation is stabilizing the bed and slopes; no signs of active headcuts, nickpoints, or bed erosion**.**	Match what is expected for the site; drainages are represented as natural stable channels; vegetation common and no signs of erosion.
6. Wind Scoured, Blowout and/or Depositional Areas					Ecological Reference Worksheet: None
6. Wind Scoured, Blowout and/or Depositional Areas Generic Descriptor	Extensive.	Common.	Occasionally present.	Infrequent and few.	Match what is expected for the site .

* Descriptions should be more specific than those listed in the General Example, if possible, and refer to the criteria included in the None to Slight description, which is based on the Ecological Reference Worksheet. See page __ for an Ecological Reference Worksheet example.

	Departure from Ecological Site Description/Ecological Reference Worksheet				
Indicator	**Extreme**	**Moderate to Extreme**	**Moderate**	**Slight to Moderate**	**None to Slight**
7. Litter Movement (wind or water)					Ecological Reference Worksheet: Minimal and short
7. Litter Movement (wind or water) Generic Descriptor	Extreme; concentrated around obstructions. Most size classes of litter have been displaced**.**	Moderate to extreme; loosely concentrated near obstructions. Moderate to small size classes of litter have been displaced.	Moderate movement of smaller size classes in scattered concentrations around obstructions and in depressions**.**	Slightly to moderately more than expected for the site with only small size classes of litter being displaced.	Matches that expected for the site with a fairly uniform distribution of litter ..
8. Soil Surface Resistance to Erosion					Ecological Reference Worksheet: Soil Stability rating 5-6.
8. Soil Surface Resistance to Erosion Generic Descriptor	Extremely reduced throughout the site. Biological stabilization agents including organic matter and biological crusts virtually absent.	Significantly reduced in most plant canopy interspaces and moderately reduced beneath plant canopies. Stabilizing agents present only in isolated patches.	Significantly reduced in at least half of the plant canopy interspaces, or moderately reduced throughout the site.	Some reduction in soil surface stability in plant interspaces or slight reduction throughout the site. Stabilizing agents reduced below expected.	Matches that expected for the site. Surface soil is stabilized by organic matter decomposition products and/or a biological crust .

9. Soil Surface Loss or Degradation					Ecological Reference Worksheet: Soil surface is light brownish gray gravelly clay loam; moderately fine subangular blocky structure parting to moderate fine granular; hard, firm, sticky; common fine roots; 15% volume of limestone fragments; 51% calcium carbonate equivalent; calcareous; moderately alkaline; Soil Organic Matter is 1- 3%.
9. Soil Surface Loss (especially in plant interspaces Generic Descriptor	Soil surface horizon absent. Soil structure near surface is similar to, or more degraded, than that in subsurface horizons. No distinguishable difference in subsurface organic matter content.	Soil loss or degradation severe throughout site. Minimal differences in soil organic matter content and structure of surface and subsurface layers.	Moderate soil loss or degradation in plant interspaces with some degradation beneath plant canopies. Soil structure is degraded and soil organic matter content is significantly reduced.	Some soil loss has occurred and/or soil structure shows signs of degradation, especially in plant interspaces.	Soil surface horizon intact. Soil structure and organic matter content match that expected for site .

* Descriptions should be more specific than those listed in the General Example, if possible, and refer to the criteria included in the None to Slight description, which is based on the Ecological Reference Worksheet. See page __ for an Ecological Reference Worksheet example.

	Departure from Ecological Site Description/Ecological Reference Worksheet				
Indicator	**Extreme**	**Moderate to Extreme**	**Moderate**	**Slight to Moderate**	**None to Slight**
10. Plant Community Composition & Distribution Relative to Infiltration & Runoff					Ecological Reference Worksheet: High canopy, basal cover and density with small interspaces should make rainfall impact negligible. This site has well drained soils, moderately slow permeability, very low available water capacity, rapid surface runoff, hazard of water erosion is severe, fertility is low, and shallow root zone. Seeps can occur after wet periods.
10. Plant Community Composition & Distribution Relative to Infiltration & Runoff Generic Descriptor	Infiltration is severely decreased due to adverse changes in plant community composition and/or distribution. Adverse plant cover changes have occurred.	Infiltration is greatly decreased due to adverse changes in plant community composition and/or distribution. Detrimental plant cover changes have occurred.	Infiltration is moderately reduced due to adverse changes in plant community composition and/or distribution. Plant cover changes negatively affect infiltration.	Infiltration is slightly to moderately affected by minor changes in plant community composition and/or distribution. Plant cover changes have only a minor effect on infiltration.	Infiltration and runoff are not affected by any changes in plant community composition and distribution. Any changes in infiltration and runoff can be attributed to other factors (e.g. compaction).
11. Compaction Layer (below soil surface)					Ecological Reference Worksheet: None
11. Compaction Layer (below soil surface) Generic Descriptor	Extensive; severely restricts water movement and root penetration.	Widespread; greatly restricts water movement and root penetration.	Moderately wide-spread, moderately restricts water movement and root penetration.	Rarely present or is thin and weakly restrictive to water movement and root penetration.	Matches that expected for the site; none to minimal, not restrictive to water movement and root penetration.

* Descriptions should be more specific than those listed in the General Example, if possible, and refer to the criteria included in the None to Slight description, which is based on the Ecological Reference Worksheet. See page __ for an Ecological Reference Worksheet example.

	Departure from Ecological Site Description/Ecological Reference Worksheet				
Indicator	**Extreme**	**Moderate to Extreme**	**Moderate**	**Slight to Moderate**	**None to Slight**
12. Functional/ Structural Groups (F/S Groups) See Functional/ Structural Groups Worksheet					Ecological Reference Worksheet: Warm Season Midgrasses (S) > Warm Season Tallgrasses (S) > Trees (S) > Forbs (S) > Warm Season Shortgrasses (M) > Shrubs (M).
12. Functional/ Structural Groups (F/SGroups) Generic Descriptor	Number of F/S groups greatly reduced AND/OR Relative dominance of F/S groups has been dramatically altered AND/OR Number of species within F/S groups dramatically reduced.	Number of F/S groups reduced AND/OR One dominant group and/or one or more sub-dominate group replaced by F/S groups not expected for the site AND/OR Number of species within F/S groups significantly reduced.	Number of F/S groups moderately reduced AND/OR One or more sub-dominant F/S groups replaced by F/S groups not expected for the site AND/OR Number of species within F/S groups moderately reduced.	Number of F/S groups slightly reduced AND/OR Relative dominance of F/S groups has been modified from that expected for the site AND/OR number of species within F/S slightly reduced.	F/S groups and number of species in each group closely match that expected for the site.
13. Plant Mortality/ Decadence					Ecological Reference Worksheet: Grasses will almost always show some mortality and decadence.
13. Plant Mortality/ Decadence Generic Descriptor	Dead and/or decadent plants are common.	Dead plants and/or decadent plants are somewhat common.	Some dead and/or decadent plants are present.	Slight plant mortality and/or decadence.	Plant mortality and decadence match that expected for the site.
14. Litter Amount					Ecological Reference Worksheet: 90 -100 % litter cover and ½ to 3 inches depth.
14. Litter Amount Generic Descriptor	Largely absent or dominant relative to site potential and weather.	Greatly reduced or increased relative to site potential and weather**.**	Moderately more or less relative to site potential and weather.	Slightly more or less relative to site potential and weather.	Amount is what is expected for the site potential and weather.

* Descriptions should be more specific than those listed in the General Example, if possible, and refer to the criteria included in the None to Slight description, which is based on the Ecological Reference Worksheet. See page __ for an Ecological Reference Worksheet example.

	Departure from Ecological Site Description/Ecological Reference Worksheet				
Indicator	**Extreme**	**Moderate to Extreme**	**Moderate**	**Slight to Moderate**	**None to Slight**
15. Annual Production					Ecological Reference Worksheet: 1100 - 4700 #/acre
15. Annual Production Generic Descriptor	Less than 20% of potential production for the site based on recent weather.	20-40% of potential production for the site based on recent weather.	40-60% of potential production for the site based on recent weather.	60-80% of potential production for the site based on recent weather.	Exceeds 80% of potential production for the site based on recent weather.
16. Invasive Plants					Ecological Reference Worksheet: Ashe juniper is the primary invader.
16. Invasive Plants Generic Descriptor	Dominate the site.	Common throughout the site.	Scattered throughout the site.	Present primarily in disturbed areas within the site.	If present, composition of invasive species, matches that expected for the site.
17.Reproductivc Capability of Perennial Plants (native or seeded)					Ecological Reference Worksheet: All species should be capable of reproducing on the Adobe ecological site, except during periods of prolonged drought.
17.Reproductivc Capability of Perennial Plants (native or seeded) Generic Descriptor	Capability to produce seed or vegetative tillers is severely reduced relative to recent climatic conditions	Capability to produce seed or vegetative tillers is greatly reduced relative to recent climatic conditions	Capability to produce seed or vegetative tillers is moderately reduced relative to recent climatic conditions.	Capability to produce seed or vegetative tillers is slightly reduced relative to recent climatic conditions.	Capability to produce seed or vegetative tillers is not reduced relative to recent climatic conditions

* Descriptions should be more specific than those listed in the General Example, if possible, and refer to the criteria included in the None to Slight description, which is based on the Ecological Reference Worksheet. See page __ for an Ecological Reference Worksheet example.