Uplift in the CCS

Strategies for consideration

CCS
Version 1.6

Contents:



Introduction

This packet is designed to inform incoming Conservation Credit System participants about some options and strategies for land improvement (uplift) that work well within the credit system. This is not meant to be an exhaustive list of available actions, or a complete summary of available research.

Section one explains how to use a completed habitat quantification tool to determine a credit yield from various actions.

The CCS has certain policy and administrative details that are useful to keep in mind when planning uplift projects, and section two details these considerations.

The appendices are designed to give project planners information, resources, and ideas for uplift on both meadow and upland environments. These ideas are not limited to actions that maximize credit yield, but if implemented will likely result in some sort of credit increase and habitat improvement.

Use these materials to gather ideas and initial plans, then consult with various partners to fully develop an improvement plan.

Section 1: Forecasting

Forecasting uplift in the CCS is done very simply in the Habitat Quantification Tool. Once the initial habitat is quantified by a verifier, the project information is input into an excel spreadsheet which will summarize the vegetation data that is collected. Next to these summaries, there are separate areas for hypothetical numbers to be input in order to observe the change in function for greater sage grouse, and ultimately, credits (see the picture below).

Example:

Decreasing annual grass cover from 19% to 12% increases the score from 23% to 50% (columns 67, 68, and 69)

1	64	65	66	67	68	69	70	71	72	73	74	75
	Cover & Foraging Combined											
Map Unit Name (name)	Current Pre-Modified LBR Site-Scale Score (%)	Projected Pre-Modified LBR Site-Scale Score (%)	Current Average Invasive Annual Grass Cover (%)	Projected Average Invasive Annual Grass Cover (%)	Current Invasive Annual Grass Cover Score (%)	Projected Invasive Annual Grass Cover Score (%)	Current Average Distance to Sagebrush (m)	Projected Average Distance to Sagebrush (m)	Current Distance to Sagebrush Score (%)	Projected Distance to Sagebrush Score (%)	Current LBR Site-Scale Function (%)	Projected LBR Site-Scale Function (%)
First Creek Disturbed Sagebrush	91%	91%	38%		0%	0%	130.0		100%	100%	0%	0%
First Creek Meadow-U	68%	68%	10%		68%	68%	7.5		100%	100%	46%	46%
First Creek Mountain Sage Mix	96%	96%	19%	12%	23%	50%	0.8		100%	100%	22%	48%
NFLH Big Sagebrush	55%	55%	51%		[illegible]	[illegible]	0.0		100%	100%	0%	0%
NFLH Channel-U	84%	84%	29%		[illegible]	[illegible]	3.3		100%	100%	1%	1%
NFLH Disturbed Greasewood Mix	52%	52%	35%		[illegible]	[illegible]	0.0		100%	100%	0%	0%
NFLH Disturbed Sagebrush	46%	46%	50%		0%	0%	0.0		100%	100%	0%	0%
NFLH Greasewood Mix 2	40%	40%	50%		0%	0%	21.7		100%	100%	0%	0%
NFLH Meadow-A												
SFLH Big Sagebrush	37%	37%	38%		0%	0%	0.0		100%	100%	0%	0%
SFLH Disturbed Sagebrush	38%	38%	63%		0%	0%	26.1		100%	100%	0%	0%
SFLH Greasewood Mix 2	44%	44%	16%		36%	36%	0.0		100%	100%	16%	16%
SFLH Meadow-A	79%	79%	0%		100%	100%	287.5		24%	24%	19%	19%
SFLH Meadow-U	93%	93%	0%		100%	100%	140.0		100%	100%	93%	93%
SFLH Sodic Mix 1	49%	49%	6%		100%	100%	15.0		100%	100%	49%	49%
owstorm Mountains Disturbed Sagebru	100%	100%	4%		100%	100%	11.0		100%	100%	100%	100%
Snowstorm Mountains Meadow-U	69%	69%	38%		0%	0%	141.0		100%	100%	0%	0%
wstorm Mountains Mountain Sagebrush	93%	93%	4%		100%	100%	1.0		100%	100%	93%	93%
Spring Creek Big Sagebrush	50%	50%	14%		45%	45%	0.0		100%	100%	22%	22%
Spring Creek Big Sagebrush Bottom	40%	40%	57%		0%	0%	0.0		100%	100%	0%	0%
Spring Creek Disturbed Sagebrush	73%	73%	53%		0%	0%	116.4		100%	100%	0%	0%
Spring Creek Disturbed Sagebrush 2	16%	16%	89%		0%	0%	500.0		100%	100%	0%	0%
Spring Creek Greasewood Mix	49%	49%	34%		0%	0%	134.0		100%	100%	0%	0%
Spring Creek Meadow-U	88%	88%	0%		100%	100%	25.0		100%	100%	88%	88%
Twentyone Creek Big Sagebrush	74%	74%	19%		23%	23%	0.0		100%	100%	17%	17%
Twentyone Creek Disturbed Sagebrush	29%	29%	92%		0%	0%	294.3		100%	100%	0%	0%

4 Enter Forbs & Grass Data | 2.5 Review Transect Data | 2.6 Enter Projected Condition | 3.1 Enter Baseline & Rsrv Acct | 3.2 Review Credit Amount | Scoring Curves | Scoring Weights

Section 1: Forecasting

Numbers which are input into the "Enter Projected Condition" tab should represent a "best guess" of what the response will be to treatments. The resulting forecast of the proposed treatments is summarized in terms of habitat function and credit amount in tab 3.2 "Review Credit Amount."

Example:
The reduction in annual grass cover results in an additional 152 Late Brood Rearing functional acres, which results in 163 additional credits, if the uplift is maintained.

		PROJECTED FUNCTIONAL ACRES			PROJECTED MULTIPLIERS		PROJECTED CREDITS GENERATED							
Map Unit ID (id #)	Map Unit Area (acres)	Projected Breeding Functional Acres Δ Baseline (F-Acres)	Projected LBR Functional Acres Δ Baseline (F-Acres)	Projected Winter Functional Acres Δ Baseline (F-Acres)	Projected Management Importance Multiplier (multiplier)	Projected Wet Meadow Multiplier (multiplier)	Projected Breeding Credit Potential (credits)	Projected LBR Credit Potential (credits)	Projected Winter Credit Potential (credits)	Projected Dominant Habitat Type (type)	Projected Credits Generated (credits)	Projected Reserve Account Contribution (%)	Projected Reserve Account Contribution (credits)	Projected Saleable Credits (credits)
	10,898.75	295.7	152.7	0.0	1.20	0.00	354.8	183.2	0.0		360.4	11%	39.6	320.7
1	514.05	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
2	4.55	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
3	842.33	148.07	152.70	0.00	1.20	0	177.68	183.24	0.00	Late Brood-Rearing	183.24	11%	20.16	163.08
4	285.09	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
5	25.47	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
6	75.53	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
7	439.04	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
8	436.52	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
9	1.45				1.20	8					0.00	11%	0.00	0.00
10	838.26	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
12	563.37	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
13	58.95	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
14	149.69	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
15	30.50	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
16	34.60	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
17	1,004.24	147.59	0.00	0.00	1.20	0	177.11	0.00	0.00	Breeding	177.11	11%	19.48	157.63
18	14.13	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
19	1,525.23	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
28	1,308.04	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
29	125.19	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
31	446.56	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
32	373.93	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
33	204.85	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00

2.4 Enter Forbs & Grass Data | 2.5 Review Transect Data | 2.6 Enter Projected Condition | 3.1 Enter Baseline & Rsrv Acct | 3.2 Review Credit Amount | Scoring Curves | Scoring Weights | Policy Lookup Tables | Va

Section 1: Forecasting

Combinations of treatments may be input into tab 2.6, and the resulting output can be viewed for all map units where treatments are proposed. Credits projected here are contingent on actual verification when the HQT is conducted on the uplift project.

Example:

This screenshot shows credits generated from an annual grass reduction in map unit 3, and a sagebrush cover increase (planting) in map unit 17. Total resulting credits equal 320.

		PROJECTED FUNCTIONAL ACRES			PROJECTED MULTIPLIERS		PROJECTED CREDITS GENERATED							
Map Unit ID (id #)	Map Unit Area (acres)	Projected Breeding Functional Acres Δ Baseline (F-Acres)	Projected LBR Functional Acres Δ Baseline (F-Acres)	Projected Winter Functional Acres Δ Baseline (F-Acres)	Projected Management Importance Multiplier (multiplier)	Projected Wet Meadow Multiplier (multiplier)	Projected Breeding Credit Potential (credits)	Projected LBR Credit Potential (credits)	Projected Winter Credit Potential (credits)	Projected Dominant Habitat Type (type)	Projected Credits Generated (credits)	Projected Reserve Account Contribution (%)	Projected Reserve Account Contribution (credits)	Projected Saleable Credits (credits)
	10,898.75	295.7	152.7	0.0	1.20	0.00	354.8	183.2	0.0		360.4	11%	39.6	320.7
1	514.05	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
2	4.55	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
3	842.33	148.07	152.70	0.00	1.20	0	177.68	183.24	0.00	Late Brood-Rearing	183.24	11%	20.16	163.08
4	285.09	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
5	25.47	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
6	75.53	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
7	439.04	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
8	436.52	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
9	1.45				1.20	8					0.00	11%	0.00	0.00
10	838.26	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
12	563.37	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
13	58.95	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
14	149.69	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
15	30.50	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
16	34.60	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
17	1,004.24	147.59	0.00	0.00	1.20	0	177.11	0.00	0.00	Breeding	177.11	11%	19.48	157.63
18	14.13	0.00	0.00	0.00	1.20	8	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
19	1,525.23	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
28	1,308.04	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
29	125.19	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
31	446.56	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
32	373.93	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00
33	204.85	0.00	0.00	0.00	1.20	0	0.00	0.00	0.00	None	0.00	11%	0.00	0.00

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Section 2:
Specific Recommendations

The important elements to remember can generally be summarized into two main categories, effort and timing:

Effort:

1. ***Increase sampling effort in map units planned for uplift.*** Reducing variation in data collection is a constant challenge when quantifying biological systems. Good sample design, and a large sample size are common ways of minimizing the variability that is inherent in all data collection. Verifiers are responsible for delineating land in a way that will minimize this variation, and the number of transects chosen will affect the accuracy and sensitivity of the HQT outputs. The SETT has guidelines for how many transects should be performed in map units of various acreages. To maximize the detection power, it is recommended that choosing transects at the upper limit will enable better detection of any uplift efforts.

2. ***Focus on available meadow habitats.*** Not only is this more of a limiting habitat for GRSG, meadow areas are generally quicker to respond to inputs than upland habitats and have the benefit of an 8x multiplier to any functional acres generated. This multiplier enables small actions on small acreages to have an outsized impact on credits generation. Scenario 1 illustrates this concept:

3. ***Perennial forbs are important in the calculation of credits.*** Uplift efforts that include an improvement in forb percent cover and species richness will provide a good return on investment. Efforts need to be significant enough that the results can be picked up by random sampling. Make sure that the number of transects established in these map units are on the high side of the guidelines the SETT has established.

Scenario 1: Uplift in the meadow

A 40-acre meadow habitat lacking in perennial grass cover and forb cover yields 0 credits. Several applications of seeding ($200/acre X 4 = $32,000) and careful management may raise the perennial forb cover from 4% to 8%, adding to species richness, and raising perennial grass cover from 22% to 30%. These improvements can yield an additional 115 credits. Maintaining these improvements can be achieved with minimal inputs (well managed grazing, timely irrigation, etc.) through the years, making the investment on small acreages well worthwhile.

Section 2: Specific Recommendations

The important elements to remember can generally be summarized into two main categories, effort and timing:

Effort:

4. <u>Expanding meadow acreage provides a very good return on investment</u>. If meadows are somehow restricted in acreage by external factors (e.g., removal of water, incised channels, inappropriate usage, etc.), removing or better managing those factors and expanding the acreage can be readily accomplished and maintained, and can result in many credits. Scenario 2 illustrates this concept.

Scenario 2: uplift in the meadow
A 4-acre riparian corridor habitat lacking in perennial grass and forb cover yields 14 credits. This riparian area is actively eroding and reducing in size due to a headcut and an actively incising channel. The headcut is not yet deep enough to require an engineered solution, so low-tech beaver dam analogues (BDAs) are used to halt the active erosion and capture sediment. This action stabilizes the erosion and over time reconnects the stream to the floodplain and raises the water table. The BDAs ($10,000), along with additional seeding ($1,600) triples the size of the previously measured riparian area to 12 acres. This yields an additional 33 credits. Maintenance of the improvements may only require careful management, making the initial investment of $11,600 well worth the effort.

5. <u>Perennial forbs are important in the calculation of credits.</u> Uplift efforts that result in an improvement in forb percent cover and species richness will provide a good return on investment. Planned actions need to be significant enough to be picked up by random sampling. Sampling effort also needs to be significant enough to detect the action. Make sure that the number of transects established in these map units are on the high side of the guidelines the SETT has established.

Section 2:
Specific Recommendations

The important elements to remember can generally be summarized into two main categories, effort and timing:

Effort:

6. <u>Invasive annual grass is worth the control effort.</u> Invasive annual grasses are a modifier in the HQT, which means that it reduces the value of the existing habitat. If the existing habitat is good quality, reducing cheatgrass levels over large acreages by 10% can result in many additional credits. If a treatment is repeated and maintained, it can be well worth the effort in terms of credit yield. It will also provide increased forage opportunities, and wildfire mitigation value as well. Scenario 3 illustrates the utility of this effort.

Scenario 3: Uplift in the uplands
A project contains a 270-acre map unit which has no credit value for the preservation of the habitat due to cheatgrass density being too high. Actions available include fencing ($8,000), intense planned grazing, and chemical treatments with plateau (12oz/acre = 3240 oz = 25 gallons = $4,000). Planned correctly, these actions can reduce the cheatgrass density. If these actions reduce cheatgrass density by 10%, and increase perennial grass cover by 4%, the resulting credit may be as high as 44 credits. Maintaining the credits might require 3 additional applications of plateau ($12,000). The total cost for this type of treatment might be $24,000. If credits are sold at $1500 - 2,000 per credit, the value added to a credit producer could be between $42,000 and $64,000.

Section 2: Specific Recommendations

The important elements to remember can generally be summarized into two main categories, effort and timing:

Effort:

7. Upland improvement is a long game. If improvement is possible on upland sites, it is best to approach these efforts with patience and an expectation that quantification of the efforts may be best when the original project expires (30+ years). Generally, areas with at-risk perennial grass and forbs are where upland improvement is a good option. Planned grazing, aerial seedings, and aerial chemical treatments can be well worth the expense if patience is an option. It is important to note that consultation with the SETT may provide options for an up-front award of credits for some efforts. Up to 1/3rd of the total anticipated credits may be issued to assist in defraying the expense of costly treatments that are expected to be successful. Scenario 4 illustrates the utility of this type of treatment.

Scenario 4: uplift in the uplands

An 800-acre map unit has been recently burned, increasing invasive annual grass densities and decreasing brush and perennial grass cover to almost 0. The site is in a moderately resilient site, and it is determined to be a good candidate for restoration actions. Restoration attempts in similar locations have been successful. An application of pre-emergent chemical is applied to reduce invasive grass densities, after which a sagebrush/forb/grass mix is aerially applied. The seeding is successful, and several more applications of pre-emergent are applied to make sure native plants establish well. The project is monitored over a period of 25 years, with control of invasive grasses as needed. If sagebrush cover increases from 0 to 20%, perennial grass from 14% to 25%, forb cover from 0% to 15%, and cheatgrass is reduced from 28% to 18%, the resulting credit yield is 258 credits. A reasonable estimate for the cost of this action might be $250,000. Resulting maintenance of this action might include planned grazing, spot treatment of invasive grasses and annual photo monitoring. Depending on how much the credits are able to be sold for, this investment would likely return a high value to the owner both in cash and recouping lost forage opportunities.

Section 2:
Specific Recommendations

The important elements to remember are can generally be summarized into two main categories, effort and timing:

Timing:

In order to avoid complex situations where multiple uplift projects may have multiple expiration dates in different areas with different management expectations, the CCS offers the ability to have uplift credit terms expire with the original project. In a nutshell, uplift credits may have a term of less than 30 years, and the time remaining on the original stewardship project at the time of quantification will set the term of the uplift credits. If the SETT is consulted and notified of implementation of uplift actions, half the time of uplift implementation may be added to the term of the uplift credits. Details may be found in Section 2.4.4 of the CCS manual. Strategies related to this situation are given below.

1. Credits with a longer term are far more flexible and valuable. Have a plan and initiate uplift activities right away. If the credit developer desires for uplift credits to have the same expiration date as the original project, the term assigned will be the time remaining on the original project. This means that the earlier uplift can be measured, the longer the term can be.
Most debit activities require a 30-year minimum term. Exploration debits may be less. Companies will be looking to acquire credits that are available for 30 years. Prorating can match credits and debits with disparate terms, but this may not be appealing to many buyers. A longer-term credit will be more flexible and will appeal to the widest variety of buyers.

2. Notify the SETT right away if uplift projects are initiated. The CCS acknowledges that habitat improvements exist prior to the quantification of the effort, and half the time it takes to implement the improvements may be added to the term *if* the SETT is aware that uplift projects are ongoing. Ideally, uplift plans will be included within the original management plan for the original project, and proof of actions are submitted when the project begins.

3. 30-year uplift credits may have impacts on adjacent lands. If uplift credits are continued beyond the original project timeframe, activities on lands surrounding uplift credits may negatively impact the uplift credits. For example, if a tower is constructed on previous project lands next to current uplift credits, this will be viewed as an intentional reversal and credits will be required to be replaced.

4. Using regularly scheduled HQT events. The HQT is required to be re-run halfway through each stewardship project. This point may be the most natural time to measure uplift efforts and will save money in HQT verification costs. Uplift may be measured however at any time with an independent verification effort in the map unit where the uplift has occurred.

Appendix A

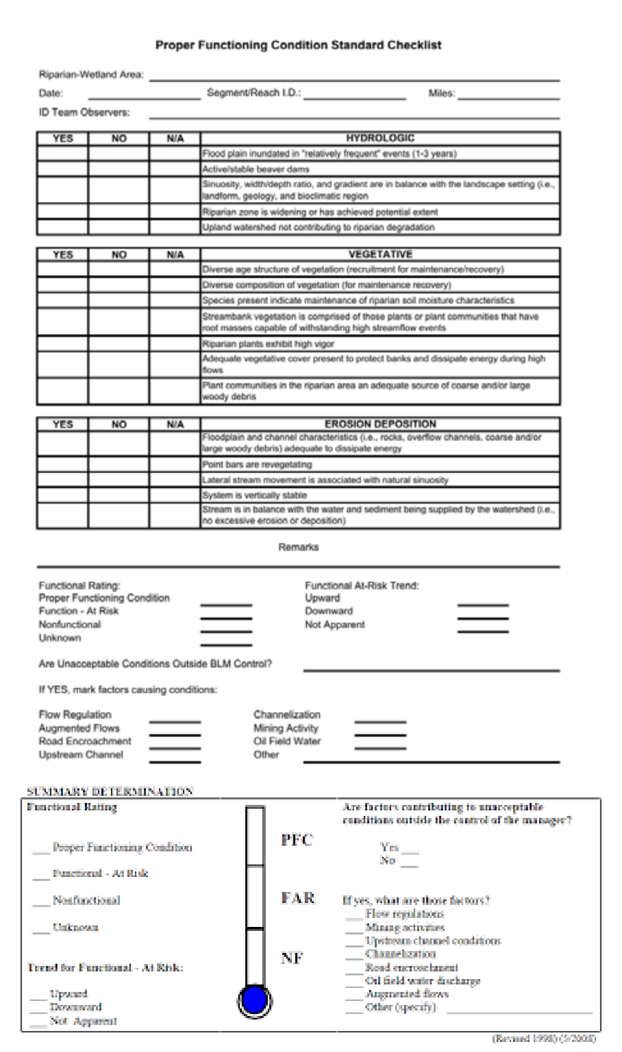
RIPARIAN ENHANCEMENTS

The many benefits of enhancing your riparian areas

Put together by the Sagebrush Ecosystem Technical Team, Updated January 2, 2020

PROPER FUNCTIONING CONDITIONS (PFC)

- PFC Assessments are an important requirement of the credit generation process
- The PFC assessment provides a consistent approach for assessing the health of riparian-wetland areas through the hydrology, vegetation, and soil/landform attributes
- The condition given to the riparian-wetland system "Proper Functioning Condition" refers to a state of resiliency that will allow a riparian-wetland area to hold together during any type of disturbance
- PFC defines a starting point for assessing riparian-wetland areas
  - Other monitoring techniques
    - Multiple Indicators Monitoring (MIM)
    - National Riparian Core Protocol (NRCP)
    - Aquatic Assessment, Inventory, and Monitoring (AIM)



Proper Functioning Condition Standard Checklist

Riparian-Wetland Area: ____

Date: ____ Segment/Reach I.D.: ____ Miles: ____

ID Team Observers: ____

YES	NO	N/A	HYDROLOGIC
			Flood plain inundated in "relatively frequent" events (1-3 years)
			Active/stable beaver dams
			Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region
			Riparian zone is widening or has achieved potential extent
			Upland watershed not contributing to riparian degradation

YES	NO	N/A	VEGETATIVE
			Diverse age structure of vegetation (recruitment for maintenance/recovery)
			Diverse composition of vegetation (for maintenance recovery)
			Species present indicate maintenance of riparian soil moisture characteristics
			Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events
			Riparian plants exhibit high vigor
			Adequate vegetative cover present to protect banks and dissipate energy during high flows
			Plant communities in the riparian area an adequate source of coarse and/or large woody debris

YES	NO	N/A	EROSION DEPOSITION
			Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody debris) adequate to dissipate energy
			Point bars are revegetating
			Lateral stream movement is associated with natural sinuosity
			System is vertically stable
			Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

Remarks

Functional Rating:
Proper Functioning Condition ____
Function - At Risk ____
Nonfunctional ____
Unknown ____

Functional At-Risk Trend:
Upward ____
Downward ____
Not Apparent ____

Are Unacceptable Conditions Outside BLM Control? ____

If YES, mark factors causing conditions:

Flow Regulation ____
Augmented Flows ____
Road Encroachment ____
Upstream Channel ____
Channelization ____
Mining Activity ____
Oil Field Water ____
Other ____

SUMMARY DETERMINATION

Functional Rating
___ Proper Functioning Condition
___ Functional - At Risk
___ Nonfunctional
___ Unknown

Trend for Functional - At Risk:
___ Upward
___ Downward
___ Not Apparent

PFC
FAR
NF

Are factors contributing to unacceptable conditions outside the control of the manager?
Yes ___
No ___

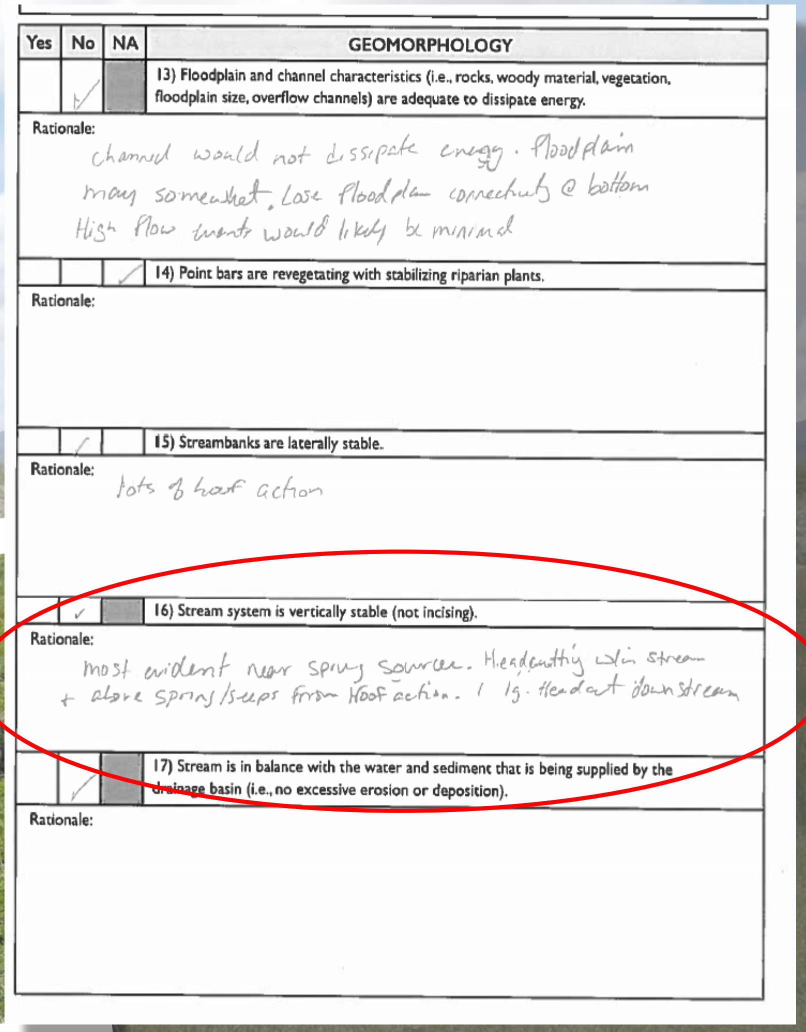
If yes, what are those factors?
___ Flow regulations
___ Mining activities
___ Upstream channel conditions
___ Channelization
___ Road encroachment
___ Oil field water discharge
___ Augmented flows
___ Other (specify) ____

(Revised 1998) (5/2008)

Haven't done PFC Assessments on your riparian-wetland areas, or want to learn more? See http://naes.unr.edu/swanson/Extension/PFCTeam.aspx

PROPER FUNCTIONING CONDITIONS (PFC)

- But now that it has been completed, now what?
- Now you have a description of the needs in the riparian area
- Common problems highlighted during PFC Assessments
  - Channel incision that can shrink or dry out meadows and make them less capable of providing the green forbs for wildlife
  - Overgrazing or overuse of riparian systems
  - Altered flow paths – accelerating water away from the meadow
  - Headcuts



Yes	No	NA	GEOMORPHOLOGY
			13) Floodplain and channel characteristics (i.e., rocks, woody material, vegetation, floodplain size, overflow channels) are adequate to dissipate energy.

Rationale:

Yes	No	NA	
			14) Point bars are revegetating with stabilizing riparian plants.

Rationale:

Yes	No	NA	
			15) Streambanks are laterally stable.

Rationale: lots of hoof action

Yes	No	NA	
			16) Stream system is vertically stable (not incising).

Rationale: most evident near spring source.

Yes	No	NA	
			17) Stream is in balance with the water and sediment that is being supplied by the drainage basin (i.e., no excessive erosion or deposition).

Rationale:

Credit / NRCS

KNOW WHEN TO ACT

- Functionality is important
  - Keeping water on the land longer and slowing it down with vegetation is a part of good riparian management
- Grazing management and vegetation management are usually sufficient solutions, but when problems are severe, then bioengineering may be needed
  - Treat the symptoms that prevent self healing
  - The riparian system probably will heal on its own
  - If bioengineered solutions are needed, start with low-cost and low-impact changes
    - e.g. Beaver Dam Analogs

A process-based approach establishes conditions that will allow the stream channel(s) and floodplains to heal naturally. In contrast, a form-based approach uses structural features (bioengineering) to force healing.

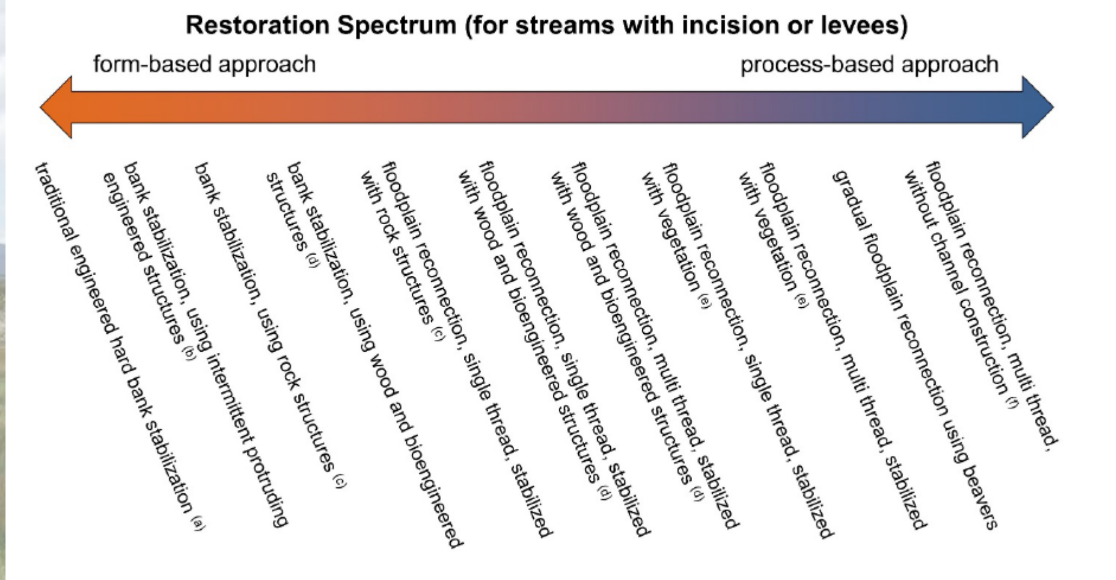


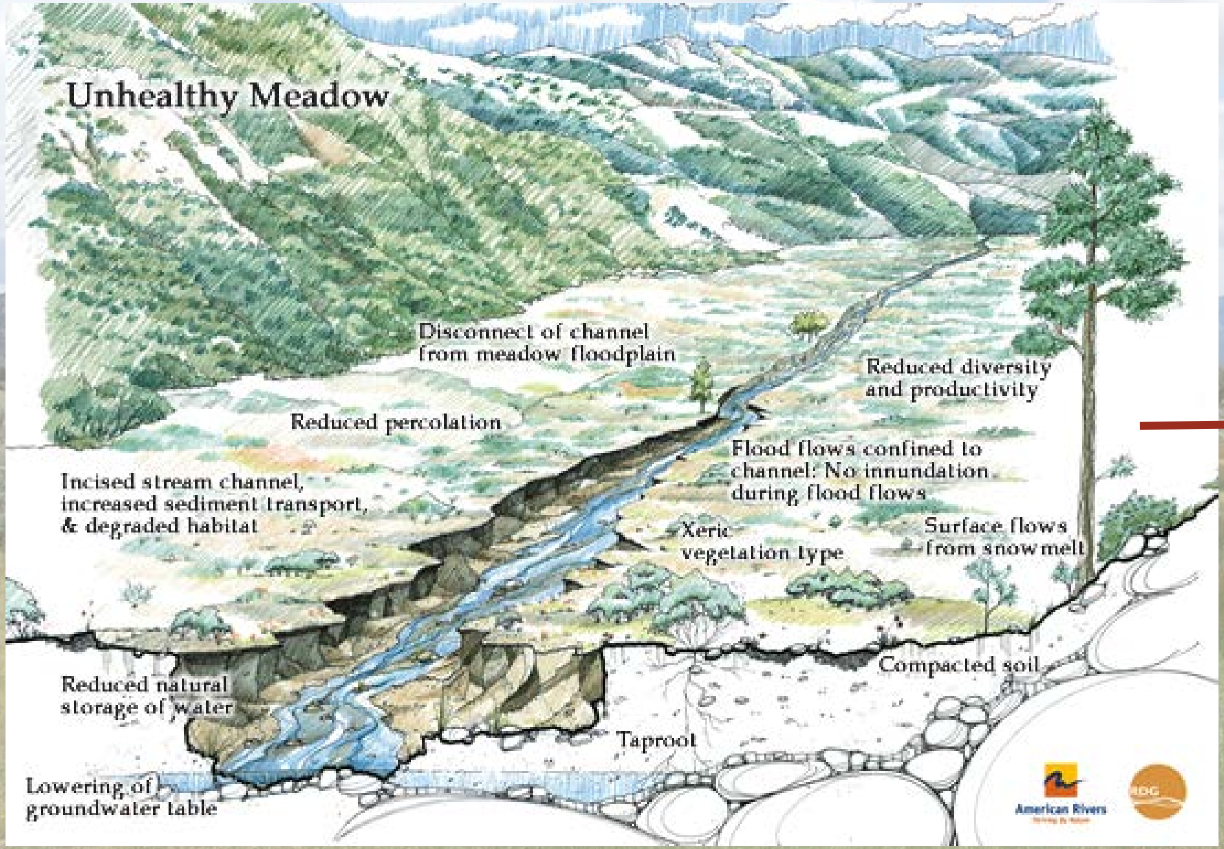
Figure 20: Form- to processed-based restoration approach spectrum for incised or artificially-confined streams. Notes: (a) hard bank stabilization includes concrete revetments, grouted rip rap, and rip rap; (b) intermittent protruding structures includes bendway weirs, spur dikes, and some other bank vanes; (c) rock structures include cross vanes, j-hooks, toe rock, and intermittent rip rap; (d) wood and bioengineered structures includes log vanes, toe wood, root wad revetments, and other bioengineering features; (e) vegetation stabilization refers to the implementation of strong revegetation and management plans that provide for natural bank stabilization; (f) this method is being implemented primarily in the Pacific Northwest and is analogous to an extent with large flood disturbances.

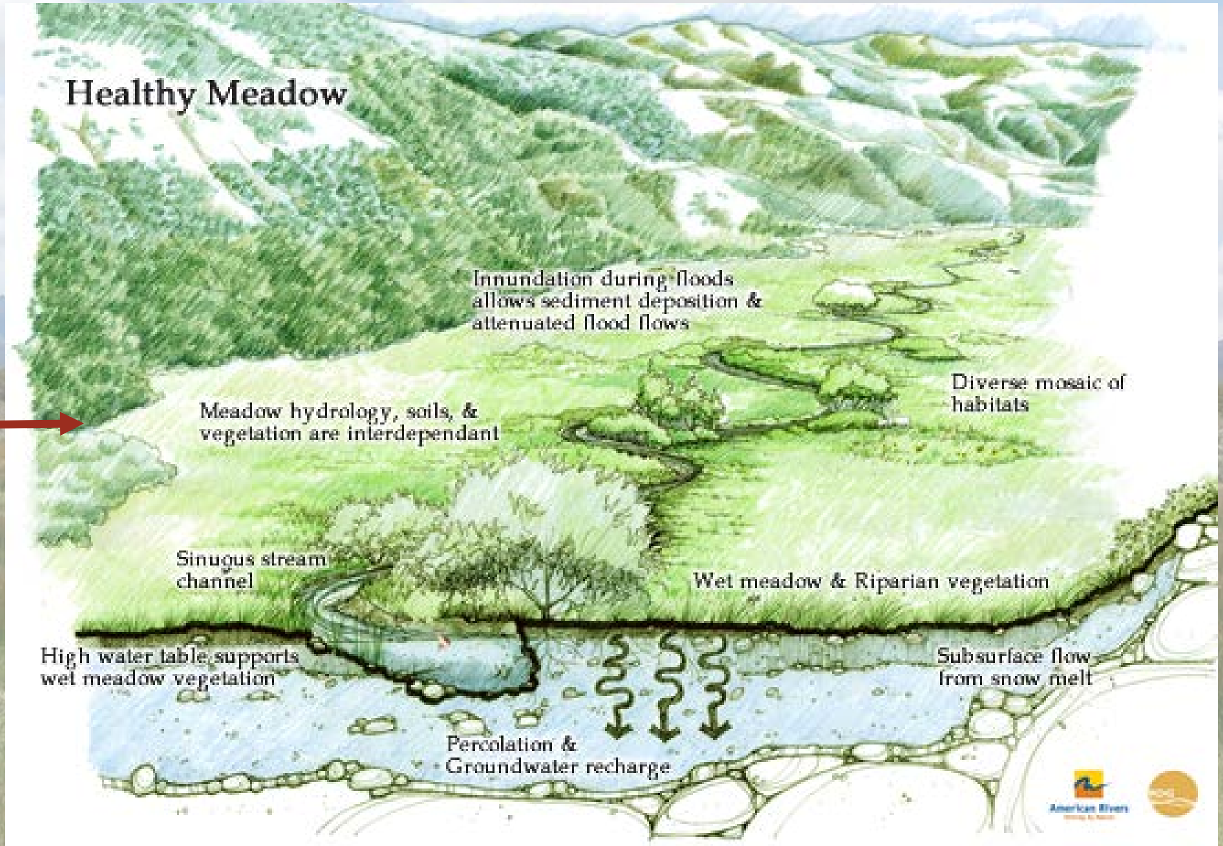
Credit / Yochum, Steven E. 2017. Guidance for Stream Restoration. U.S. Department of Agriculture, Forest Service, National Stream & Aquatic Ecology Center, Technical Note TN-102.3. Fort Collins, CO.

BENEFITS – ECOLOGICAL IMPACTS

- The ultimate goal of riparian enhancements is to create a self-sustaining natural process, to work with the land instead of controlling it. For successful enhancement of the land, all factors must be considered, including climate, soil chemistry, hydrology, plants, wildlife, and land use
- The benefits of a heathy riparian system can be many:
  - Increased forage and have forage available later in the season
  - Increased resistance against disturbances such as poorly managed grazing, floods, and fire
  - Creates a natural fire break
  - Increased resilience to bounce back from impacts such as floods and fire
  - Have water during times of drought when hauling was necessary in the past (better water storage)
  - Better water quality

BENEFITS – ECOLOGICAL IMPACTS





Credit / American Rivers

It is that range of biodiversity that we must care for – the whole thing – rather than just one or two stars. - David Attenborough, *BBC Interview*

BENEFITS – INCREASE STOCKING DENSITY

- Healthy riparian areas can withstand heavier grazing, are protected from water erosion events, prevents loss of forage, watering areas, and soil
- Restored water tables lead to plant communities that increase meadow forage quality and value for livestock production
- One study by Tate et al. (2011) showed that converting a dry site to a moist site or even a wet site can increase the stocking density drastically in the area

Meadow Transition	Old Depth to Water Table (inches)	New Depth to Water Table (inches)	Increased Stocking Density	Increased Weight Gain per Head	Total Increased Production (Stocking Density x Weight Gain)
Dry -> Moist	>36	10-36	379%	32%	532%
Dry -> Wet	>36	0-10	272%	23%	356%
Moist -> Dry	10-36	>36	-22%	-7%	-28%

Tate, K., Roche, L., Merrill, A., Lile, D., Hunt, L., and George, H. 2011. Forage and Cattle Response to Sierra Meadow Restoration. University of California Cooperative Extension, Davis, CA.

- *https://s3.amazonaws.com/american-rivers-website/wp-content/uploads/2016/06/21173418/5-Forage-Model.pdf*
- *https://rangelandwatersheds.ucdavis.edu/Recent%20Outreach/ForageProductionCattlePerformanceSierraMeadowRestoration.pdf*

BENEFITS – INCREASE WATER QUALITY AND CATTLE HEALTH

- Animals with unmanaged access to streams and ponds can degrade water quality by eroding banks, accelerating the loss of riparian vegetation, and by adding excessive nutrients
  - Removal of riparian vegetation can decrease wildlife habitat, increase water temperatures, and will initiate erosion
  - Erosion of water sources can result in conditions leading to the loss of forage, loss of easy access to the water source, and in extreme cases, loss of the water source itself
  - Water contaminated with manure can contain micro-organisms which may reduce weight gains in cattle and nutrient buildup can contribute to nitrate toxicity
  - Excessive nutrients coupled with increased temperatures may result in toxic algal blooms
- Strategies for maintaining water quality include:
  - Stockmanship
  - Limiting access to controlled areas (e.g., exclusion fencing, water gaps, pasture design)
  - Water distribution systems
  - Appropriate timing and duration in rotational strategies

Credit / USEPA

For more information, see

- *https://www.riversedgewest.org/resource-center/documents/grazing-management-processes-and-strategies-riparian-wetland-areas*
- *https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex927*
- *https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex11857*
- *https://www.potomacriverkeepernetwork.org/keeping-cattle-river-healthier-cattle-river/*

BENEFITS– INCREASE CONSERVATION CREDITS

- Meadows are rare in occurrence throughout the sagebrush ecosystem landscape in Nevada
- Meadow habitat is crucial for sage-grouse to fulfill their late brood-rearing life cycle requirements
- In order to more appropriately incorporate the immense value of meadow habitat into the calculation of credits, a multiplier of 8 is applied to all areas made up of meadow habitat

Simplified example: 10 credits of upland habitat converted to meadow turns into 80 credits.

Credit / Sage Grouse Initiative

SCENARIO 1 – INCISED CHANNELS

Example 1

Incised channels lower water table, sometimes prompting undesirable vegetation changes. Filling in incised channels will allow the water to spread out and increase the meadow size, bringing back the nutritious meadow vegetation.

Credit / NPS Photos

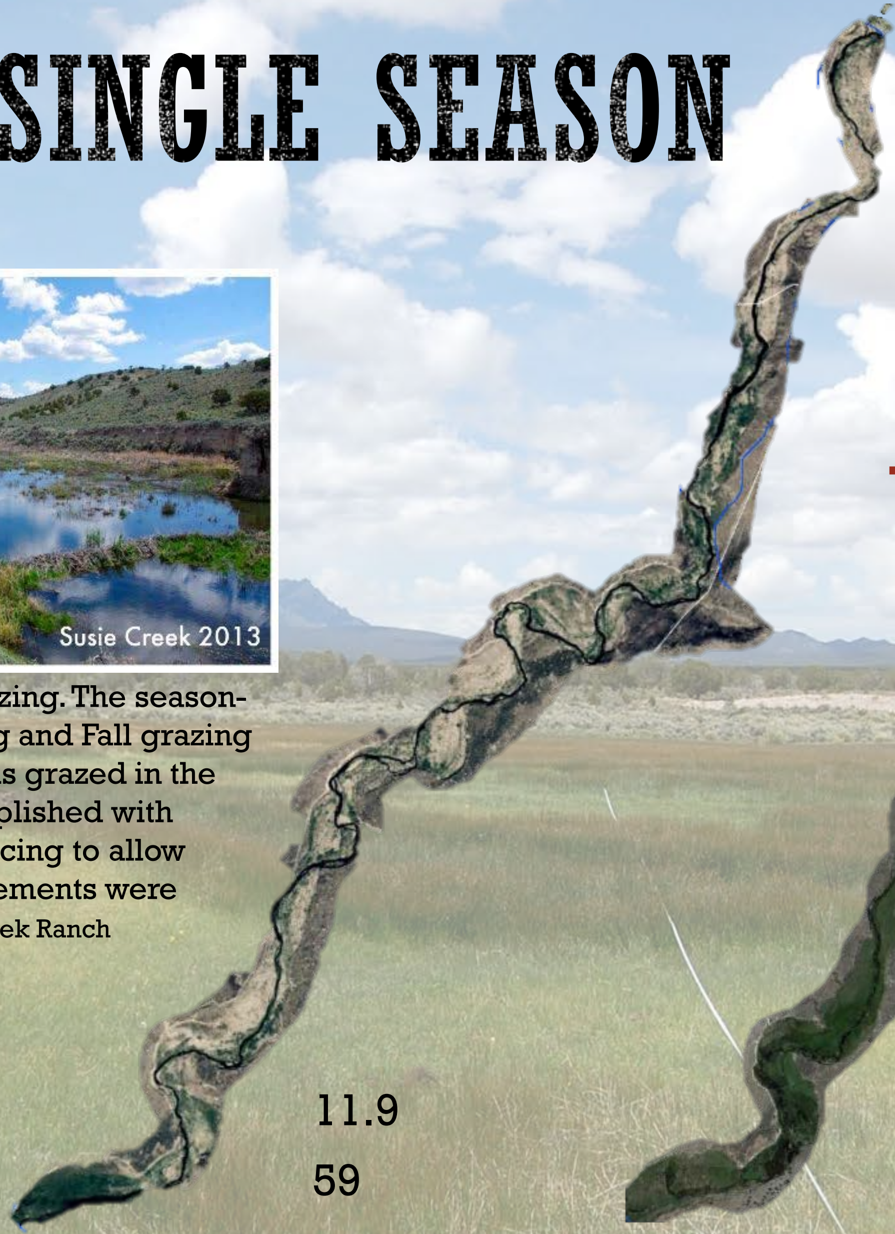
Meadow Acres:	2.51	6.2
Credits:	11	23
Credits/Acre:	1.77	3.71

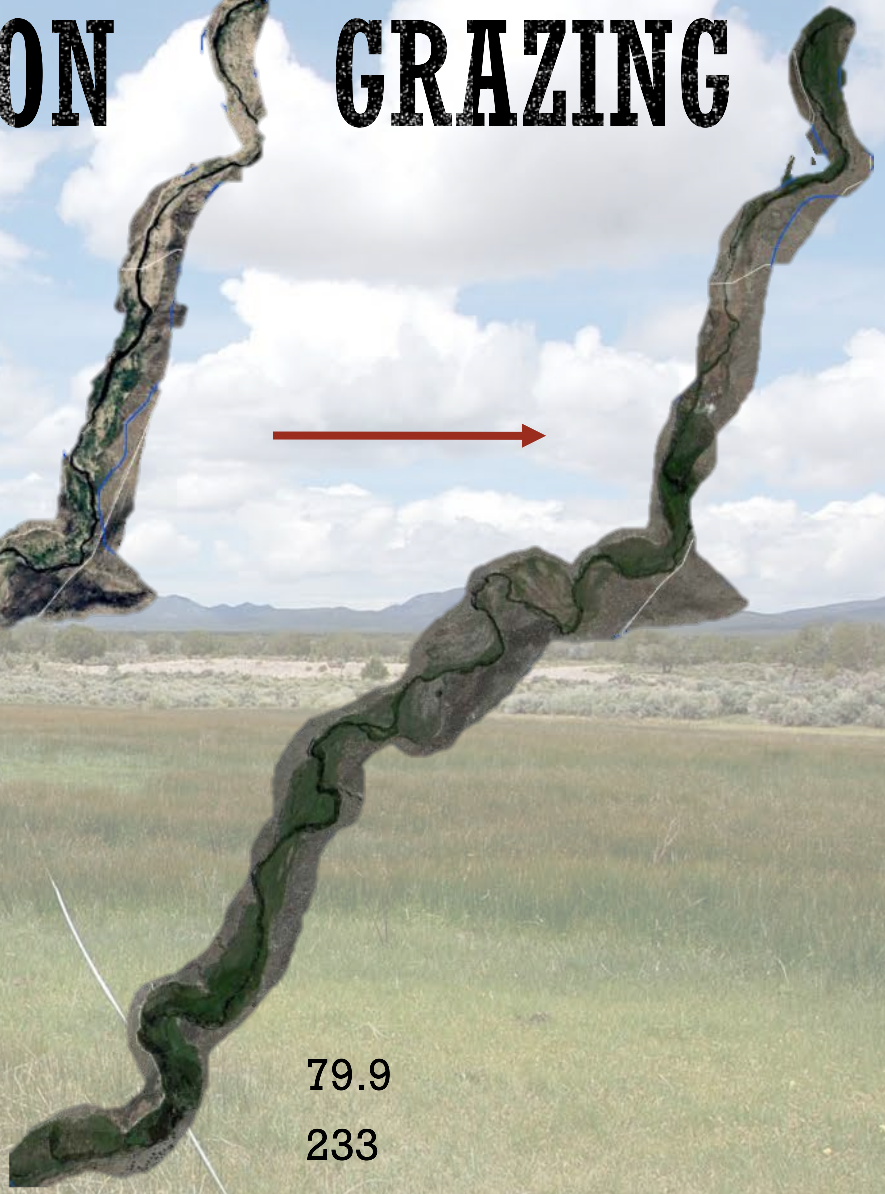
**Example is not spatially correlated with scenarios and just serves to illustrate a point*

SCENARIO 2 – SINGLE SEASON GRAZING

Example 2

Changed the season of use to a deferred rotation for cattle grazing. The season-long hot season grazing was reduced and replaced with Spring and Fall grazing until the riparian system was fully recovered. Now, the system is grazed in the hot season only 1 out of every 3 years. Much of this was accomplished with strategic fencing around the riparian areas, with water gap fencing to allow livestock to drink, but not camp in the area. Significant improvements were noticed within 5 years. Information Credit / Jon Griggs, Maggie Creek Ranch
Photo Credit / Carol Evans





Meadow Acres:	11.9	79.9
Credits:	59	233
Credits/Acre:	0.74	2.92

SCENARIO 3 – EROSION AND DESTABILIZATION

Example 3

Erosion control and using the pond and plug method to allow the channel to fill and plants to reestablish on the banks.

Credit / Plumas Corporation

Meadow Acres:	1,149.94	2,980.9
Credits:	4,549	9,320
Credits/Acre:	1.53	3.13

*Example is not spatially correlated with scenarios and just serves to illustrate a point

MEADOW/STREAM DEGRADATION SOLUTIONS

Issue	Meadow/Stream Enhancement Methods*
Streambank Erosion  Credit / Santa Clara Valley Water District	Clearing Overgrowth/Debris Fencing Seeding/Revegetating Soil Bioengineering Large Woody Debris and Whole Tree Jams Grade Stabilization Pond and Plug Bank stabilization Zeedyk Rock Structures Stream Crossing Stabilization
Channelization/ Incised Channels  Credit / USFS	Beaver Dam Analogues Bedload/Sediment Management Large Woody Debris and Whole Tree Jams Riffle Augmentation Pond and Plug Bank stabilization- Cross Vanes/W-Weirs/J-Hooks Zeedyk Rock Structures
Trampled or Compacted Streams or Meadows (Pictured Right)	Planned Grazing (e.g., Rest/Rotation) Fencing Seeding/Revegetating

Issue	Meadow/Stream Enhancement Methods*
Lack of Vegetation+  Credit / NPS	Planned Grazing (e.g., Deferred Rotation) Remove Modifications Fencing Seeding/Revegetating Bank stabilization- Live Staking Soil Bioengineering
No Fish Habitat  Credit / H. M. Neville	Seeding/Revegetating Large Woody Debris and Whole Tree Jams Riffle Augmentation Stream Crossing Stabilization Geomorphic Fish Passage

Credit / Central Sierra Environmental Resource Center

Credit / Wildlands Defense

*Sorted in order from process-based to form-based approaches as described on page 4

+ Establishing stabilizing riparian vegetation first may naturally correct other issues in the riparian system. All other methods are supplementary when the riparian system has degraded past the help of the plants.

MEADOW/STREAM ENHANCEMENT METHODS

- Beaver Dam Analogues
  - A man-made structure designed to mimic the form and function of a natural beaver dam, to restore streams and floodplain habitat and increase water storage

Credit / Goldfarb, B., *Beavers, rebooted*, *Science,* 08 Jun 2018: Vol. 360, Issue 6393, pp. 1058-1061

Credit / Utah State University

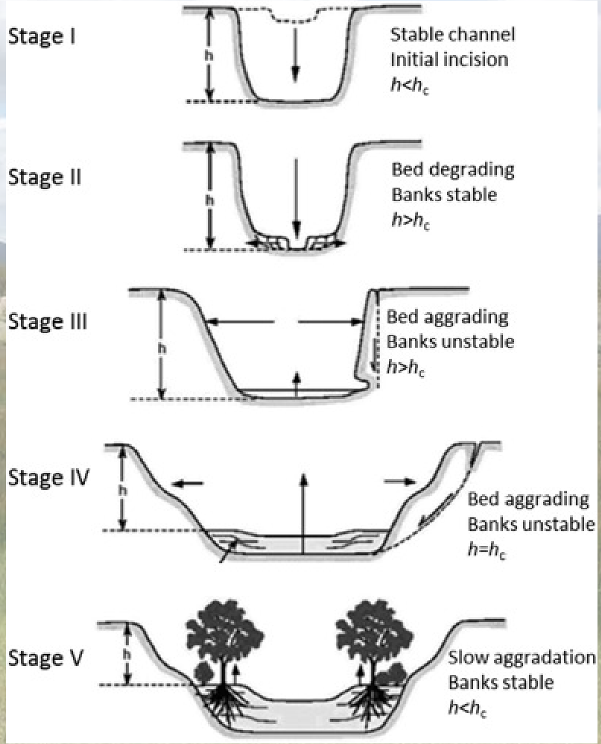
For more information, see

- *https://www.researchgate.net/publication/319507450_Chapter_6_-_Beaver_Dam_Analogs*

- Bedload/Sediment Management
  - Restoring sediment in a stream or meadow can be necessary to reconnecting the floodplain and widen the meadow
    - Many of the techniques throughout this document that specifically slow down the water and help prevent erosion will increase sediment accumulation
    - Appropriate sediment accumulation in deeper and incised channels will allow for increased vegetation establishment on the new stream banks, eventually accumulating sediment and raising the water table

For more information, see

- *http://www.aces.edu/natural-resources/water-resources/documents/13ALUrbanStreamMORPH.pdf*



Credit / Thompson, C.J., et al., *A channel evolution model for subtropical macrochannel systems, Catena,* Volume 139, April 2016, Pages 199-213

MEADOW/STREAM ENHANCEMENT METHODS

- Clearing Overgrowth/Debris
  - Woody debris is an important part of natural and healthy stream systems.
    - It increases channel roughness, dissipates energy, slows floodwaters and reducing potential for flood damage downstream
    - Woody debris that poses little risk to infrastructure is best left in place
  - In some instances, however, significant debris can impact flows by blocking bridge and culvert openings, diverting streams and causing erosion of banks and should be removed

Credit / Bidgee

For more information, see

- *https://www.dec.ny.gov/lands/92418.html*

- Fencing
  - Excessive hoof action erodes stream banks and bottoms, dislodges soil, and removes stabilizing plants. Erosional processes can result in degraded habitat for both macroinvertebrates and fish
  - Fencing and planned grazing can be combined for the establishment and growth of stabilizing vegetation
  - Fencing well beyond the green line is most effective

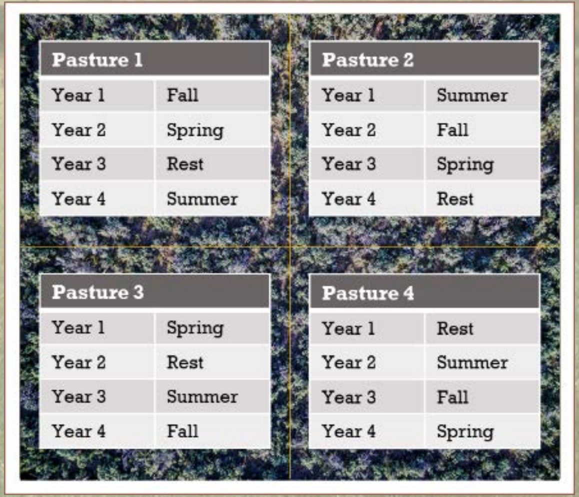
For more information, see

- *https://www.blm.gov/or/programs/nrst/files/Final%20TR%201737-14.pdf*

Credit / Jeremy Roberts

MEADOW/STREAM ENHANCEMENT METHODS

- Planned Grazing (e.g. Deferred Rotation, Rest/Rotation)
  - Repeated and prolonged use in the same growing season each year weakens plants' ability to recover in the short term and eventually, long term
  - Grazing practices that control and vary the timing and duration of grazing in a certain location and the intensity of use can be applied to create conditions for plant communities to recover from disturbance
  - Times of rest are very important for riparian recovery



Pasture 1	
Year 1	Fall
Year 2	Spring
Year 3	Rest
Year 4	Summer

Pasture 2	
Year 1	Summer
Year 2	Fall
Year 3	Spring
Year 4	Rest

Pasture 3	
Year 1	Spring
Year 2	Rest
Year 3	Summer
Year 4	Fall

Pasture 4	
Year 1	Rest
Year 2	Summer
Year 3	Fall
Year 4	Spring

For more information, see

- *https://www.blm.gov/sites/blm.gov/files/documents/files/TR_1737-20_0.pdf*
- *http://naes.unr.edu/swanson/Extension/NV%20CCT/Swanson%20et%20al%202015%20%20%20%2016-225-2-PB.pdf*

- Pond and Plug
  - Blocking the channel to divert the stream to previously abandoned channels; create a system of ponds
    - Reduces streambank erosion
    - Improves forage and riparian vegetation
    - Improves water-holding capabilities
    - Lessens the effects of major flood events
    - Connects the channel with the natural floodplain

For more information, see

- *https://www.wetlandrestorationandtraining.com/wp-content/uploads/2014/07/Pond-Plug-Treatment-for-Stream-Meadow-Restoration.pdf*
- *https://www.env.nm.gov/wp-content/uploads/2018/01/Valle_Seco_Plug_and_Pond.pdf*

MEADOW/STREAM ENHANCEMENT METHODS

- Grade Stabilization
  - Used to control the grade of a riparian channel (e.g. headcuts) in order to reduce erosion and improve water quality
    - Check Dams/Gabion Structures
    - Weirs
    - Drop Structures
    - Rock/Sod Chutes

- Large Woody Debris and Whole Tree Jams
  - Adding and trapping wood in stream channels and floodplains
    - Adds habitat for fish and wildlife
    - Maintains connectivity between the channel and floodplain by raising the water table
    - Lowers the gradient of the stream
    - Creates pool habitat for fish by concentrating flows and creating scour areas

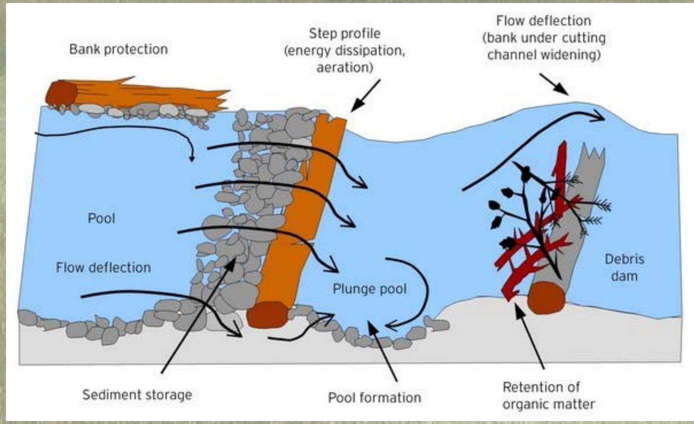

a) Credit / NRCS

Examples of a gabion structure (a) and a weir (b).


b) Credit / BLM

For more information, see

- *https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1263175.pdf*
- *http://socwisconsin.org/wp-content/uploads/2016/06/410_WI_CPS-2016-06_ForBroadReview.pdf*
- *https://www.wou.edu/las/physci/taylor/g407/restoration/WA_Dept_Forestory_2004_Drop_Structures.pdf*



Credit / Scion

For more information, see

- *https://www.wou.edu/las/physci/taylor/g407/restoration/WA_Dept_Forestory_2004_Large_Wood_Structures.pdf*
- *https://www.fs.fed.us/psw/publications/documents/gtr-181/005_Naiman.pdf*

MEADOW/STREAM ENHANCEMENT METHODS

- Bank Stabilization
  - Live Staking – Stem cuttings taken from trees during their dormant season, inserted directly Into stream banks to eventually grow into new trees. (see "Soil Bioengineering")

Credit / Dakota County Soil and Water Conservation District

For more information, see *https://www.unce.unr.edu/publications/files/ho/other/fs9709.pdf*

  - Erosion/Coir Wattles/Fiber Rolls – Cylinders of compressed, weed free straw to protect stream-bank from erosion

Credit / RoLanka International

  - Cross Vanes/W-Weir/J-Hooks – Rocks or logs placed in the stream to dissipate energy, catch sediment, and reduce erosion, use with caution, can cause a worse issue if not careful

Credit / USFWS

Credit / NRCS

  - Rip-Rap – Armoring banks with larger material that will not move with water flow, use sparingly. Contact Technical Service Providers for more information.

Credit / NRCS

For more information, see

- *https://ndep.nv.gov/uploads/water-nonpoint-docs/NVBMPHandbook1994.pdf*
- *http://altarvalleyconservation.org/wp-content/uploads/pdf/75-Induced_Meandering_Field_Guide.pdf*
- *https://www.waterboards.ca.gov/rwqcb2/water_issues/programs/TMDLs/guadalupe_river_mercury/GuidanceManualStream-bankRepair.pdf*

MEADOW/STREAM ENHANCEMENT METHODS

- Remove Modifications
  - Stream/spring modifications such as diversions, culverts, dams, weirs, channelization, etc., can reduce downstream flow, disconnect the stream from its natural floodplain, or lessen the ability of the stream to withstand large flood events
    - Modifications should only occur when absolutely necessary
    - If the modification is no longer providing the expected benefit, is unnecessary, or the natural state would provide greater benefit, and if removal will not cause a worse issue, consider removing the modification to allow the riparian areas to return to their natural state

Credit / USFWS

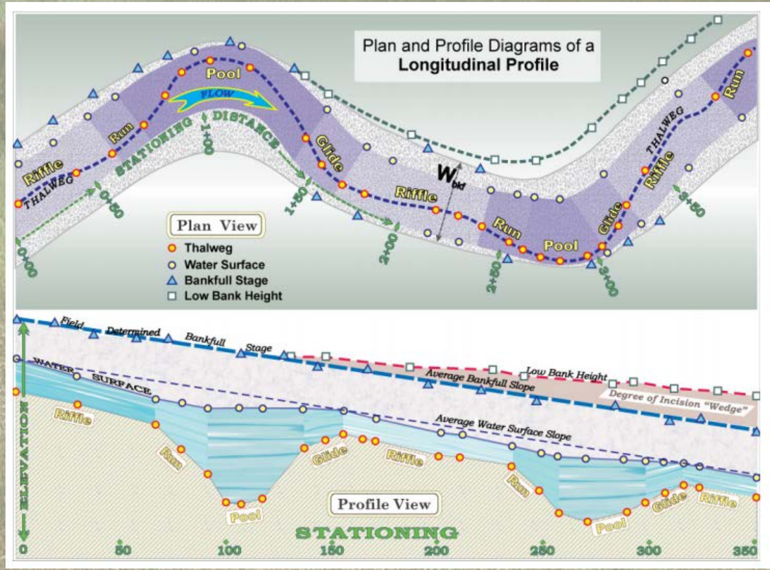
For more information, see

- *https://www.nap.edu/read/10327/chapter/5*

- Riffle Augmentation
  - Raises the level of the channel through the construction of raised riffles (gravel piles) within the channel to near the meadow surface. This raises groundwater levels, increases vegetative cover, spreads flows over the meadow floodplain, and increases bedload
    - Also creates habitat for fish and aquatic invertebrates.

For more information, see

- *https://www.fs.fed.us/biology/nsaec/assets/gravelaugmentationreport.pdf*



Credit / 2013 Wildland Hydrology

MEADOW/STREAM ENHANCEMENT METHODS

- Seeding/Revegetating
  - Although riparian areas and meadows have high resiliency and will most likely recover vegetation on their own with the removal of the disturbance, sometimes seeding can be used to speed up the process or to protect barren soil from being lost.
    - Heavily disturbed or long disturbed areas may require seeding in order to recover
    - Invasive weeds should be addressed prior to any plantings
    - If overgrown with tall grasses or the ground is thick with litter, grazing or mowing may need to occur before planting
    - Stabilizing sedges and rushes and other plants are very important to recovery

- Soil Bioengineering
  - Planting stabilizing vegetation, either alone or with other structures on banks and slopes for stabilization and erosion reduction, as well as initial vegetation establishment
    - Depending on riparian type, plants used can be grasses, forbs, shrubs, or trees and can be used in conjunction with other bank stabilization methods (e.g., willow plantings).
    - Planting thick stands of shrubs or trees can also be used as live fences to reduce access to riparian areas

Credit / NRCS

For more information, see

- *https://www.slideshare.net/KalyanThapa1/bioengineering-power-point-presentation-57303605*
- *http://naes.unr.edu/swanson/Extension/NV%20CCT/NV%20PL%20useful%20for%20Rip%20Cond%20Assessment%20and%20Monitoring%20UNCE%20SP%2016-15.pdf*
- *https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/idpmctn7064.pdf*
- *https://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/nv/plantsanimals/?cid=stelprdb1166941*
- *See the CCS seeding list for preferred plant species for replanting.*

MEADOW/STREAM ENHANCEMENT METHODS

- Stream Crossing Stabilization
  - Stream and meadow crossings can cause significant erosion which can lead to incised channels and loss of floodplain connectivity
  - If necessary to provide permanent access for people, livestock, equipment, or vehicles, a stabilized structure should be constructed
    - Does not have to be large complex structures – an armored crossing can be enough
    - To improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream and reducing erosion
    - Do not place crossings where channel grade or alignment changes abruptly, excessive instability is evident, where large tributaries enter the stream, or within 300 feet of known spawning areas of listed species. Avoid wetland areas
  - Bridge Crossings
    - Ensure that the capacity of the structure is sufficient to maintain a sustainable channel during high flow events. The streambed may be mobile, and the design should not adversely affect sediment transport. Adequately protect bridges so that out-of-bank flows safely bypass without damaging the bridge or eroding the banks

For more information, see

- *https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1046932.pdf*
- *https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1167481.pdf*
- *https://ncforestservice.gov/water_quality/wq_presentations/2017-NCFS-WQrefresher-3xings.pdf*

- Culvert Crossings
  - Design culverts in a manner that is adequate for the use, type of road, class of vehicle, and size and flow of stream
  - Design culverts to mimic natural conditions, minimize habitat fragmentation, and minimize barriers to fish movement. (See "Geomorphic Fish Passage")
- Ford Crossings/Low Water Crossings
  - Concrete Fords/ Hog Panel Fords – Use concrete ford crossings only where the foundation of the stream crossing is determined to have adequate bearing strength, and include an integrated apron to avoid erosion
  - Rock Fords – Geotextile material with crushed rock over it to stabilize the crossing

a) Concrete Ford and Bridge Crossings Credit / John Walton
b) Culvert Crossing Credit / NC Dept. of Agriculture
c) Rock Ford Crossing Credit / USFS

MEADOW/STREAM ENHANCEMENT METHODS

- Zeedyk Rock Structures
  - Rock structures that slow and disperse water, capture sediment, and increase surrounding soil moisture to promote meadow growth
  - Zuni Bowl
    - Rock lines step falls with plunge pools used to stabilize a headcut
  - Rock Rundown
    - Cutting back a steep headcut and armoring it with rocks to slow down the water and protect the soil
  - Rock Layback
    - Cutting back a shallow headcut and armoring it with rocks to slow down the water and protect the soil
  - Log and Fabric
    - Zuni bowl when logs are easier to obtain than rocks, but logs will rot fast in Nevada weather. Ensure the logs do not float away
  - One Rock Dam
    - A single layer of rocks that slows the flow of water, increases bank and floodplain infiltration, and captures sediment, allowing the bed to raise over time and correct channelization, similar to riffles

- Filter Dam
  - Structure with similar results to a One Rock Dam, but for a deep channel or a gully. Consists of three layers of different sizes of rock – large boulders on the downstream edge, small boulders in the middle, and cobble on the upstream side. It is more effective than the One Rock Dam
- Media Luna
  - A layer of rocks formed in a half-circle on a slope, used to spread sheet flows across the landscape

For more information, see

- *https://www.sagegrouseinitiative.com/wp-content/uploads/2018/05/CO-NRCS_Range_Technical_Note_40_Gunnison_Zeedyk-Structures_5-18.pdf*
- *https://streamdynamics.us/sites/default/files/resource-docs/nrcs-approved-erosion-control.pdf*

a) Credit / Nathan Seward
b) Credit / Nathan Seward
c) Credit / Renee Rondeau
d) Credit / Shawn Conner
e) Credit / Nathan Seward
f) Credit / Betsy Neely
g) Credit /Shawn Conner

OTHER ENHANCEMENTS TO BENEFIT FISH

- Geomorphic Fish Passage
  - The creation of water crossings or grade decrease for fish that mimic natural conditions (preferred over normal culverts)
    - e.g., Bottomless culverts and fish ladders

Credit / USDA

For more information, see

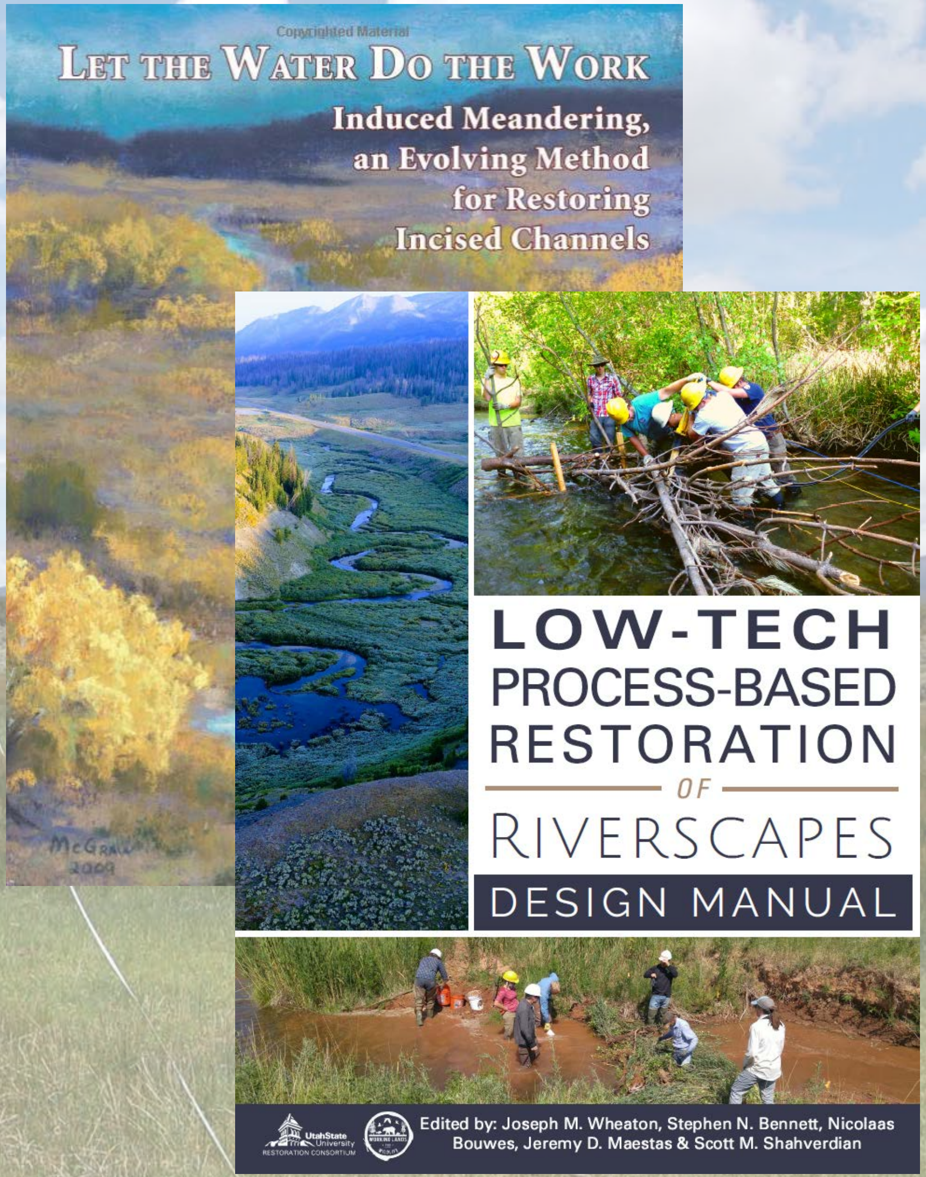
- *https://www.fhwa.dot.gov/engineering/hydraulics/pubs/07033/07033.pdf*
- *https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_025953.doc*

RESOURCES

For more information, see

- *NRCS Stream Restoration Design (National Engineering Handbook 654)*
- *Proper Functioning Conditions*
- *"Let the Water Do the Work: Induced Meandering, and Evolving Method for Restoring Incised Channels" by Zeedyk and Clothier (Book)*
- *Low-Tech Process-Based Restoration of Riverscapes: Design Manual by Wheaton et al.*

All other resources mentioned in this document can be found online through technical references, scientific or educational documents, or presentations.



"Unless we practice conservation, those who come after us will have to pay the price of misery, degradation, and failure for the progress and prosperity of our day."
\- Gifford Pinchot, *The Fight for Conservation*

Appendix B

UPLAND ENHANCEMENTS

The many options for enhancing your upland areas

Put together by the Sagebrush Ecosystem Technical Team, Updated January 2, 2020

UPLIFT POTENTIAL

- Sagebrush ecosystem health issues are often apparent (bare ground, active erosion, invasive species), but sometimes issues may not be visually impactful (over/under dominance of shrubs, no forb cover, invasive species, etc.).

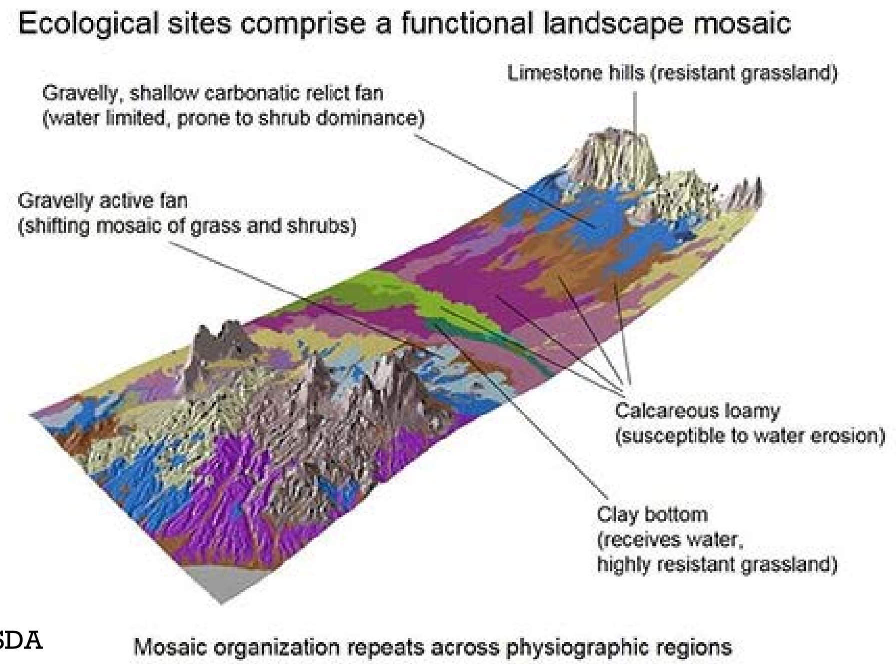
- Many resources exist to identify, address, and monitor potential problems.[1]

- Any uplift actions must be realistic and based in the potential of each site. An extreme example of unrealistic expectations may be an expectation to establish palm trees at a site near Jarbidge (or the Ruby Mtns). *Ecological site descriptions* may assist in setting good objectives.

[1] Interpreting Indicators of Rangeland Health
Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems
The Nevada Rangeland Monitoring Handbook

ECOLOGICAL SITE DESCRIPTIONS

- Vegetation communities vary across landscapes, depending on a variety of factors including soil type, climate, and hydrography.
- These varying geographical units are called "ecological sites."
- Each ecological site will have unique conditions that dictate how vegetation will be naturally structured. This is called "ecological potential."
- Success of uplift actions are based on the ecological potential of each area.



Credit: USDA

ECOLOGICAL SITE POTENTIAL

APPLICATION

- USDA Websoil Survey[1] will return information on ecological site description and potential, generally what is "supposed" to be there.

Map unit 670:

Dominant vegetation

Bluebunch wheatgrass, Thurber's needlegrass, Squirreltail, Low Sagebrush.

Approximate ground cover percentage

60% grass, 10% forbs, 30% shrub

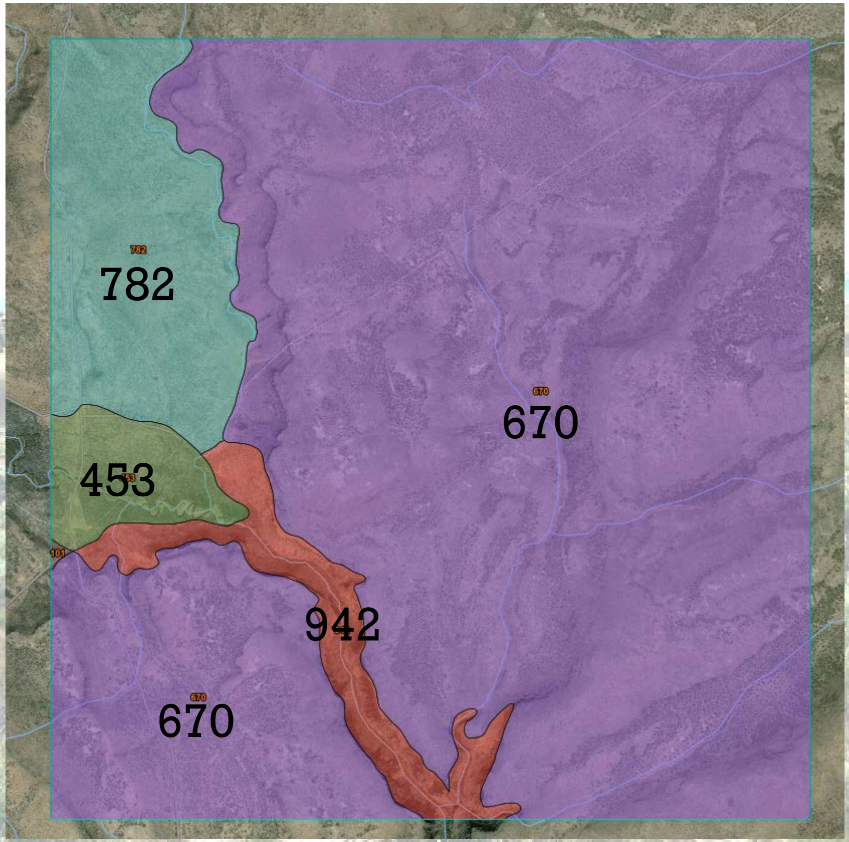
Annual Production (lbs/acre):

Grass – 360

Forb- 60

Shrub – 180

Dominant vegetation may move between shrubs or grasses being dominant or co-dominant and forbs may increase or decrease



If map unit 670 is dominated by sandbergs bluegrass and green rabbitbrush there is room for improvement. This uplift effort however should not expect to include success of basin wildrye, Idaho fescue and mountain big sagbrush. Those species are not in the potential of the site!

[1]https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

ECOLOGICAL TRANSITIONS

- Rangeland condition thresholds exist that prevent movement between vegetation communities (states) when thresholds are crossed.
- When thresholds are crossed (e.g., moving from perennial grass dominated to annual grass dominated), land will not move back to original state without outside management.
- Ecological site descriptions can explain what types of states exist and what options exist to move between states (active vs. passive restoration methods).

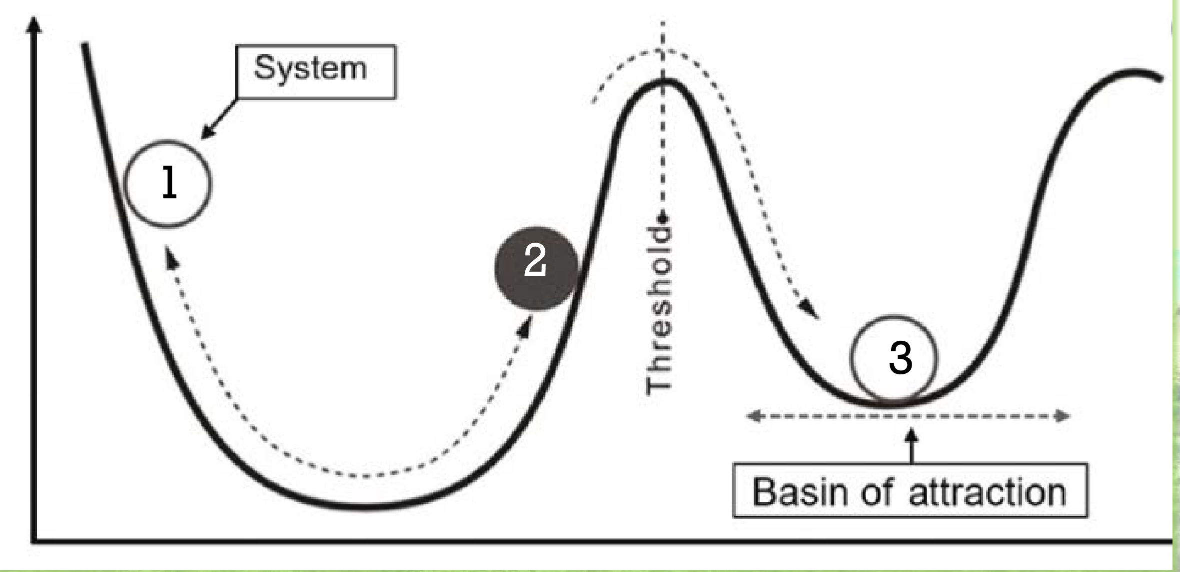


Figure 1. The original system moves between shrub (1) and perennial grass (2) dominance. When the system moves to an annual grass dominated site (3), it becomes necessary for outside energy to be used to move out of its basin to a previous state (uplift).

See Ecological Site Description Factsheet for more information

Figure 1 adapted from Keane et al. 2018, Use of landscape simulation modeling to quantify resilience for ecological applications.

UPLIFT OPTIONS:

Passive Options:	Active Options:
Livestock Grazing	Invasive Grass Treatments
Rest	Perennial Grass Seeding
	Woody Species Manipulation

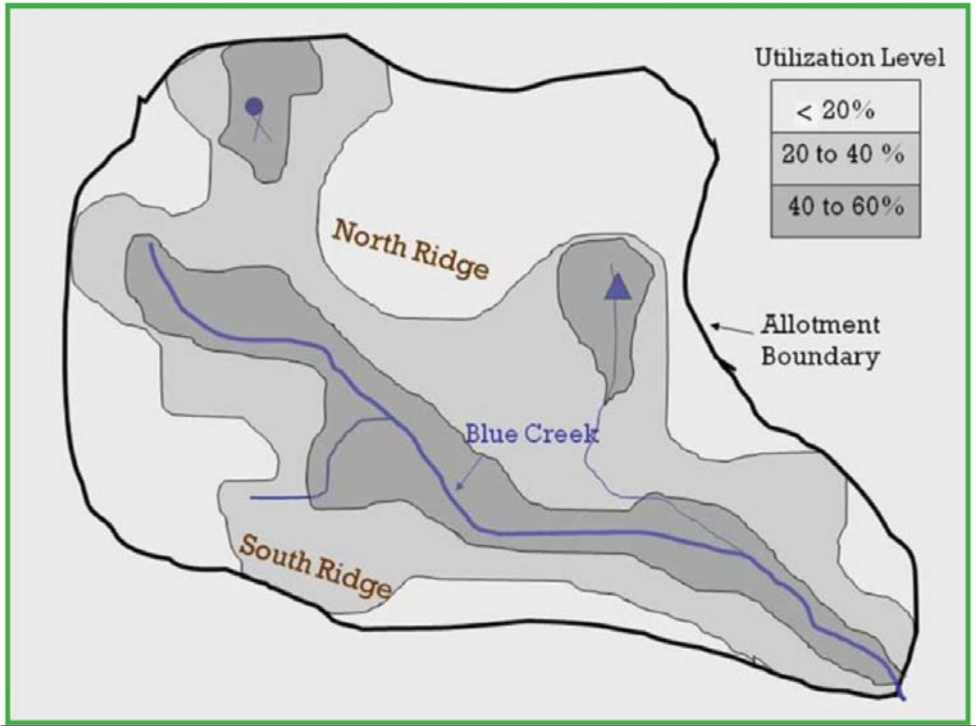
These are some of the most well-known options in the great basin, however the science and state of research surrounding these options are enormous. This is not intended to be an exhaustive review. This is meant to provide ideas and possibilities for further development.

PASSIVE UPLIFT OPTIONS:

LIVESTOCK GRAZING

Effecting changes in perennial grass, forb, or shrub density and cover with livestock can generally be separated into several options:

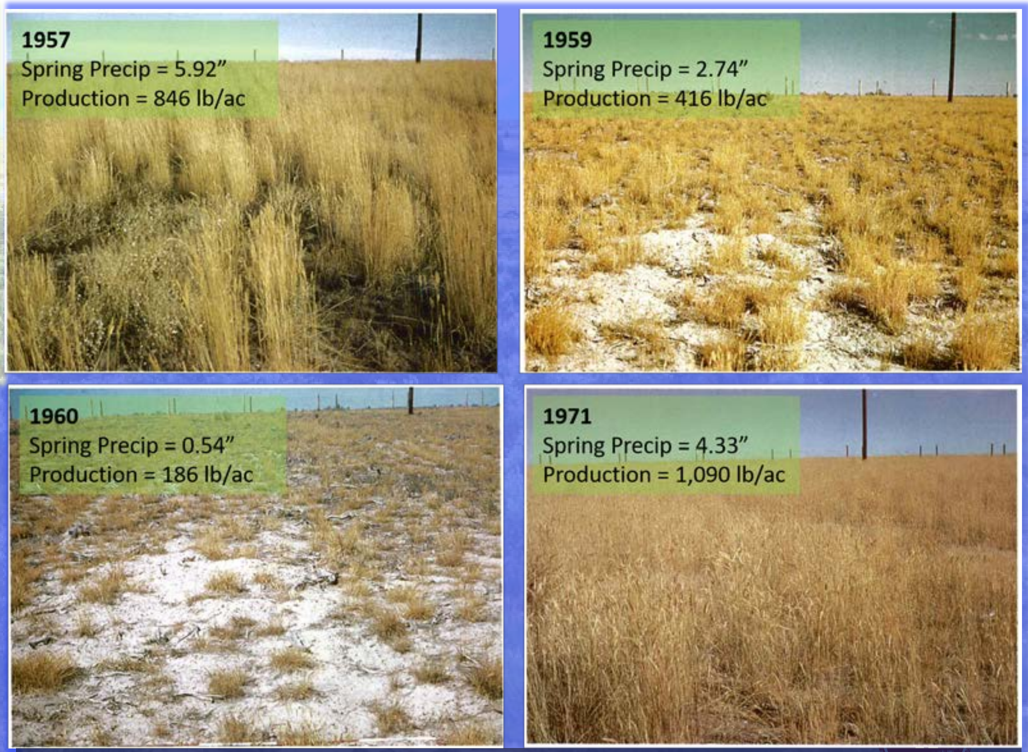
1. Increase or decrease grazing intensity.



From "Grazing Influence, Objective Development, and Management in Wyoming's Greater Sage-Grouse Habitat"

Certain areas may be overutilized, under utilized, or a combination of the two.

Grazing intensity should attempt to adapt to environmental conditions.



From "Sharp et al. 1992, "variability of crested wheatgrass production over 35 years"

UPLIFT OPTIONS:

LIVESTOCK GRAZING

Sometimes, utilization is less important than adjusting frequency, duration, or altering locations.

2. Change livestock spatial or temporal distribution.
   - Implementing strategies that allow for grass recovery and reproduction is important.

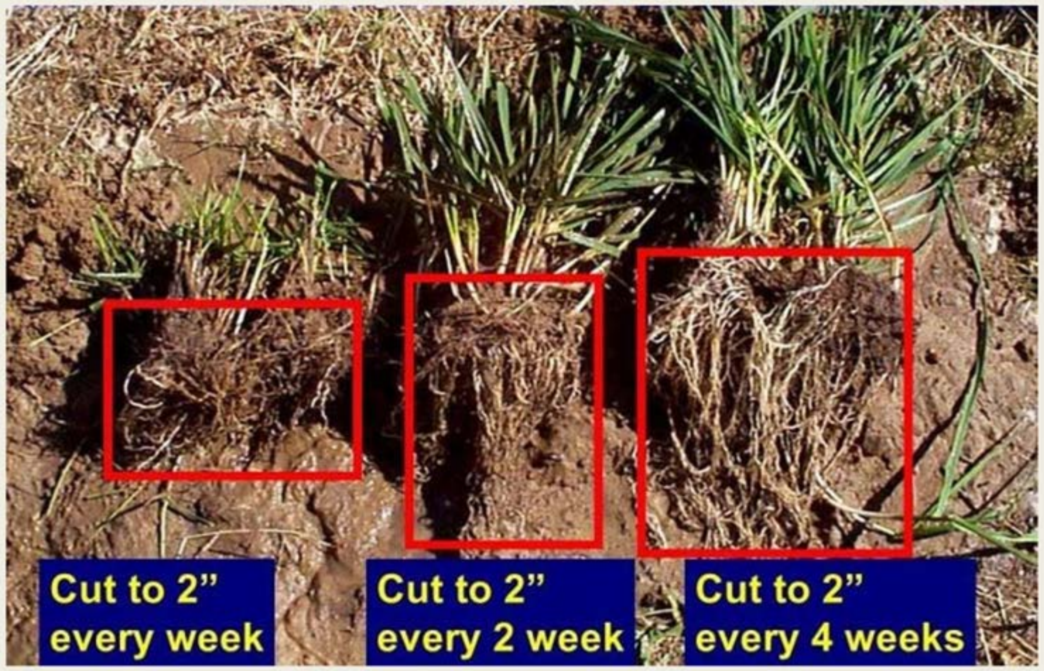
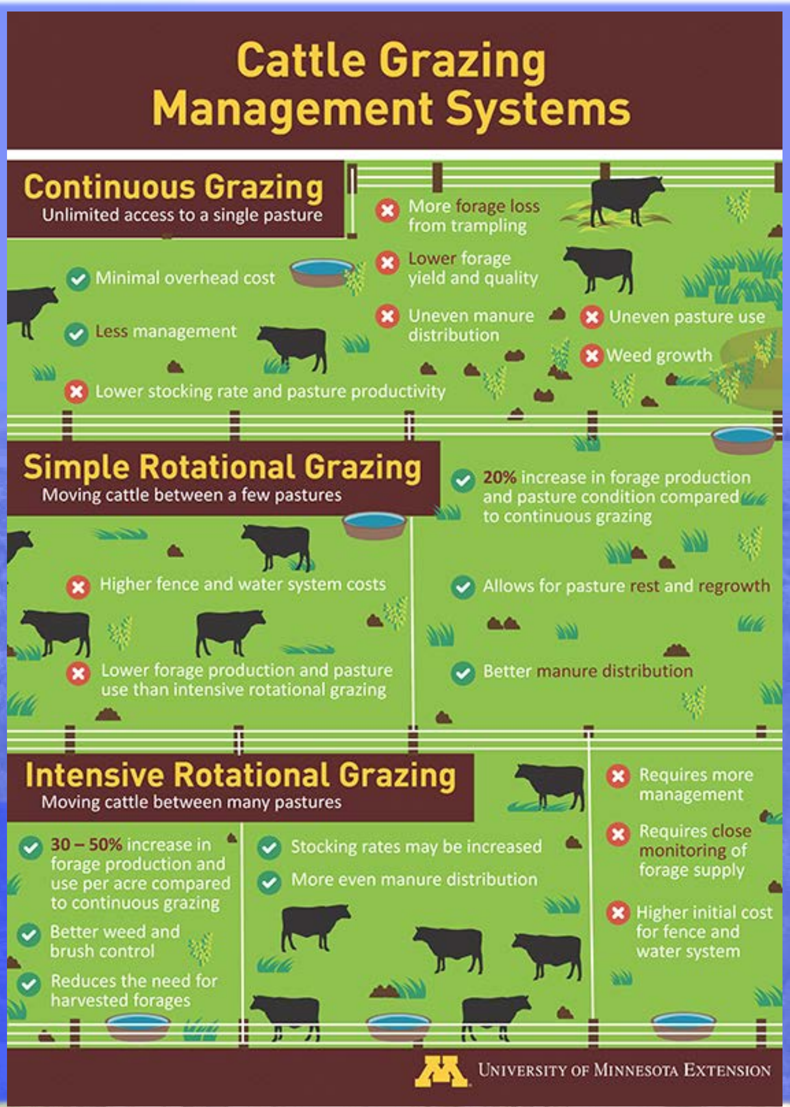


Photo credit: http://onpasture.com/2013/04/30/collect-more-sunshine-to-grow-more-grass/

Grazing that repeats in the same place and time or happens too often is detrimental to native bunchgrasses in the great basin.

Strategies that mix up the duration, time and frequency of grazing can provide needed variation for plants



UPLIFT OPTIONS:
LIVESTOCK GRAZING

Available tools:

The *Grazing Response Index (GRI)* may illuminate options for changing how livestock are distributed within seasons. Rest-rotation is not the only answer.

Grazing Response Index (R2-2200-GRI)

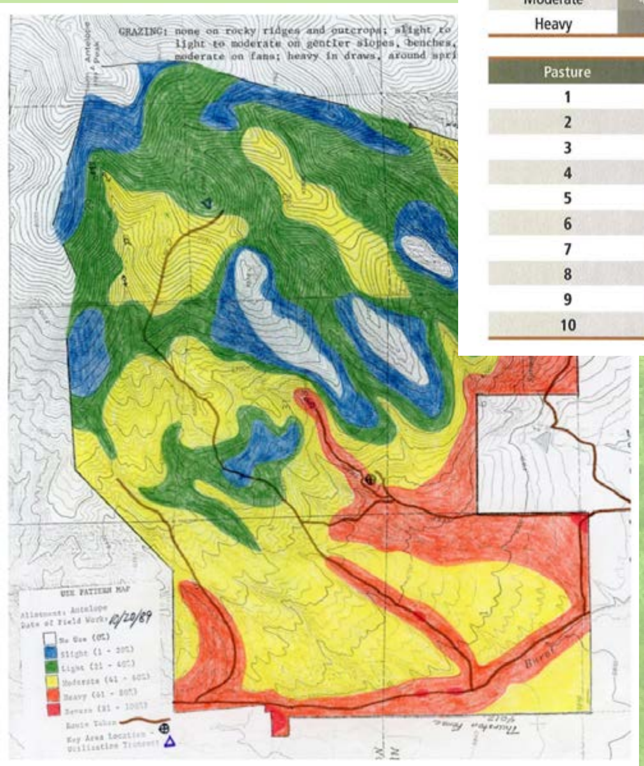
Forest Bighorn NF	**District** Buffalo Rd	**Spatial ID** FS 02 12 10 373010830 0045 94
Allotment Name and Number Table Mountain	**Pasture** Pat Park	
Kind/Class & Number of Animals 825 C/C	**Period of Use** 6/1 - 7/15	**Actual Use** 1238 Animal Months
Date 07/21/94	**Examiner(s)** J. Dawkins	

# of Defoliations	Value
1	+1
2	0
3	-1

Amount of Use	Percent	Value
Light	<40 percent	+1
Moderate	40-55 percent	0
Heavy	>55 percent	-1

Opportunity to Grow or Regrow	Value
Full season	+2
Most of season	+1
Some chance	0
Little chance	-1
No chance	-2

Pasture	Frequency	Intensity	Opportunity	Total GRI
1	+1	-1	+1	+1
2	0	0	-1	-1
3	0	0	+1	+1
4	-1	-1	-2	-4
5	+1	0	+2	+3
6	0	0	+1	+1
7	+1	+1	-1	+1
8	-1	0	-1	-2
9	0	+1	0	+1
10	0	-1	+1	0



If uplift can be achieved with simple livestock management, defined use areas and implementing the GRI can help determine what changes are needed. For more information on the GRI please see:

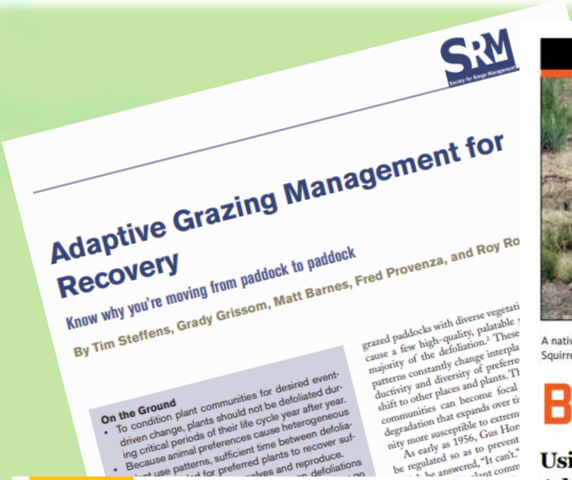
The Nevada Rangeland Monitoring Handbook
Colorado Grazing Lands Coalition
Bureau of Land Management Guide

UPLIFT OPTIONS:
LIVESTOCK GRAZING

Available tools:

Adaptive Grazing Management

- Having a plan but using yearly conditions to change operations will generally result in positive outcomes. Every scenario is impossible to detail, but some of the information on the right will assist in planning.



OREGON STATE UNIVERSITY EXTENSION SERVICE

Photo: Lori Ziegenhagen

A native bunchgrass landscape composed of bottlebrush squirreltail, Idaho fescue and the smaller Sandberg's bluegrass during June. Squirreltail and fescue are in the seed development stage.

Bunchgrass Phenology

Using Growth Stages of Grasses as Adaptive Grazing Management Tools

Vanessa Schroeder and Dustin Johnson

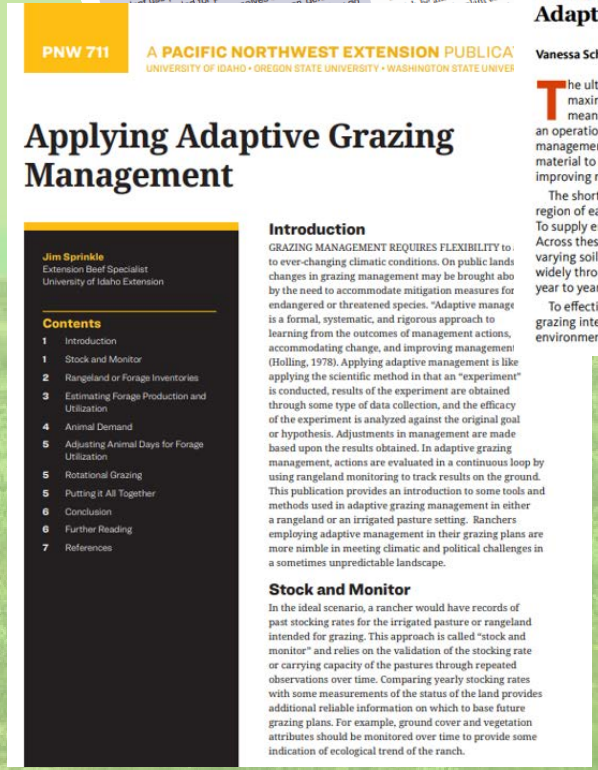
The ultimate goal of a successful rangeland cattle operation is to maximize the conversion of forage into beef, year after year. That means producers must sustainably manage vegetation to maintain an operation's resource base and long-term profitability. Effective grazing management of rangelands relies upon removing only enough plant material to meet the nutritional needs of livestock, while maintaining or improving rangeland health.

The short growing seasons and low precipitation of the high desert region of eastern Oregon limit plant growth, resulting in low productivity. To supply enough forage, grazing operations depend on vast areas of land. Across these large pastures, plant communities differ widely based on varying soils, elevations and aspects. Rangeland vegetation can also vary widely through time in the high desert, where precipitation fluctuates from year to year — from less than 50% to over 200% of the long-term average.

To effectively manage grazing, managers must understand how livestock grazing interacts with plant growth and production in a highly variable environment.

Photo © Oregon State University

Vanessa Schroeder, Extension faculty research assistant, and Dustin Johnson, Extension livestock and rangeland field faculty and associate professor, both of the Eastern Oregon Agricultural Research Center, Oregon State University.



PNW 711 A PACIFIC NORTHWEST EXTENSION PUBLICA
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Applying Adaptive Grazing Management

Jim Sprinkle
Extension Beef Specialist
University of Idaho Extension

Contents

Introduction

GRAZING MANAGEMENT REQUIRES FLEXIBILITY to adapt to ever-changing climatic conditions. On public lands changes in grazing management may be brought abo by the need to accommodate mitigation measures for endangered or threatened species. "Adaptive manage is a formal, systematic, and rigorous approach to learning from the outcomes of management actions, accommodating change, and improving management (Holling, 1978). Applying adaptive management is like applying the scientific method in that an "experiment" is conducted, results of the experiment are obtained through some type of data collection, and the efficacy of the experiment is analyzed against the original goal or hypothesis. Adjustments in management are made based upon the results obtained. In adaptive grazing management, actions are evaluated in a continuous loop by using rangeland monitoring to track results on the ground. This publication provides an introduction to some tools and methods used in adaptive grazing management in either a rangeland or an irrigated pasture setting. Ranchers employing adaptive management in their grazing plans are more nimble in meeting climatic and political challenges in a sometimes unpredictable landscape.

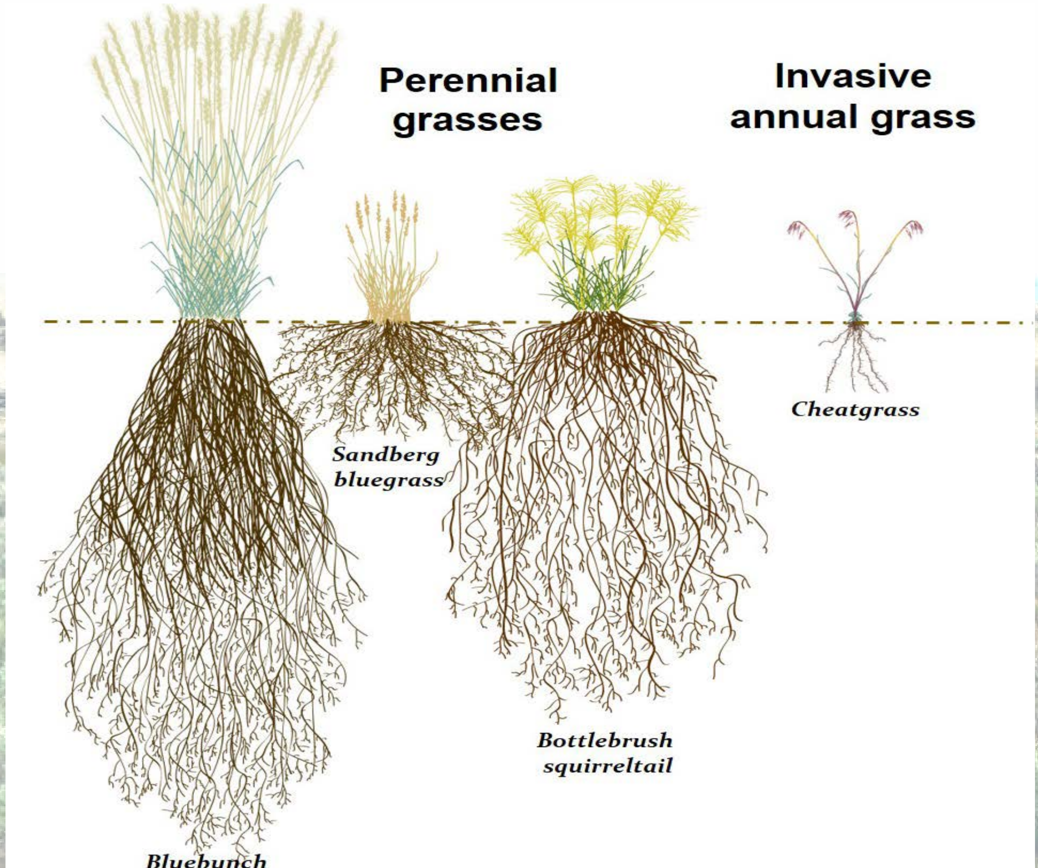
Stock and Monitor

In the ideal scenario, a rancher would have records of past stocking rates for the irrigated pasture or rangeland intended for grazing. This approach is called "stock and monitor" and relies on the validation of the stocking rate or carrying capacity of the pastures through repeated observations over time. Comparing yearly stocking rates with some measurements of the status of the land provides additional reliable information on which to base future grazing plans. For example, ground cover and vegetation attributes should be monitored over time to provide some indication of ecological trend of the ranch.

"Switching things up" is a natural and intuitive instinct for many producers, but knowing when and where is difficult, especially in the great basin. The following resources have good general information; use the local NRCS office for more local and specific information.

[Applying Adaptive Grazing Management](#)
[Bunchgrass Phenology As A Grazing Tool](#)
[Adaptive Grazing Management For Recovery](#)

UPLIFT METHODS:
INVASIVE ANNUAL GRASS TREATMENTS



Credit: Jeremy Maestas and Maja Smith

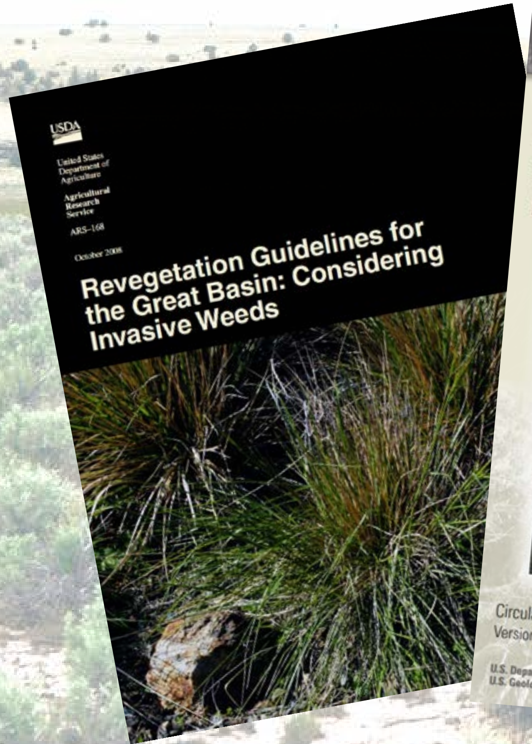
- Invasive annual grass dominance represents an ecological threshold difficult to reverse.
- Research over the years indicate the most effective defense against invasive annual grasses are healthy native perennial grass communities.
- Attempted treatments need to have an integrated management strategy for re-establishing or strengthening existing perennials.

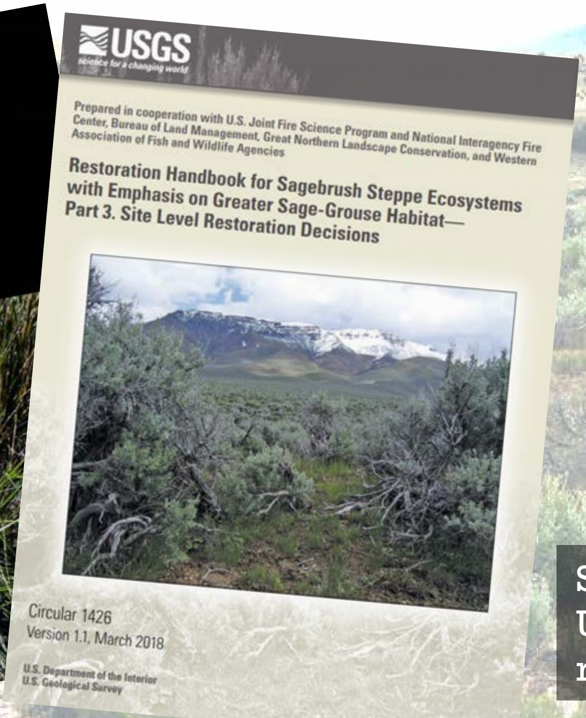
Top Photo: Crested Wheatgrass vs. Cheatgrass invasion.

Bottom Photo: Bunchgrass suppressing Cheatgrass

UPLIFT METHODS:
INVASIVE ANNUAL GRASS TREATMENTS

- Where landscapes are in a cheatgrass dominated state, annual grass suppression efforts should be followed by a perennial grass establishment strategy. This may require seeding efforts.





See USDA guidelines and USGS Circular 1426 for re-vegetation strategies

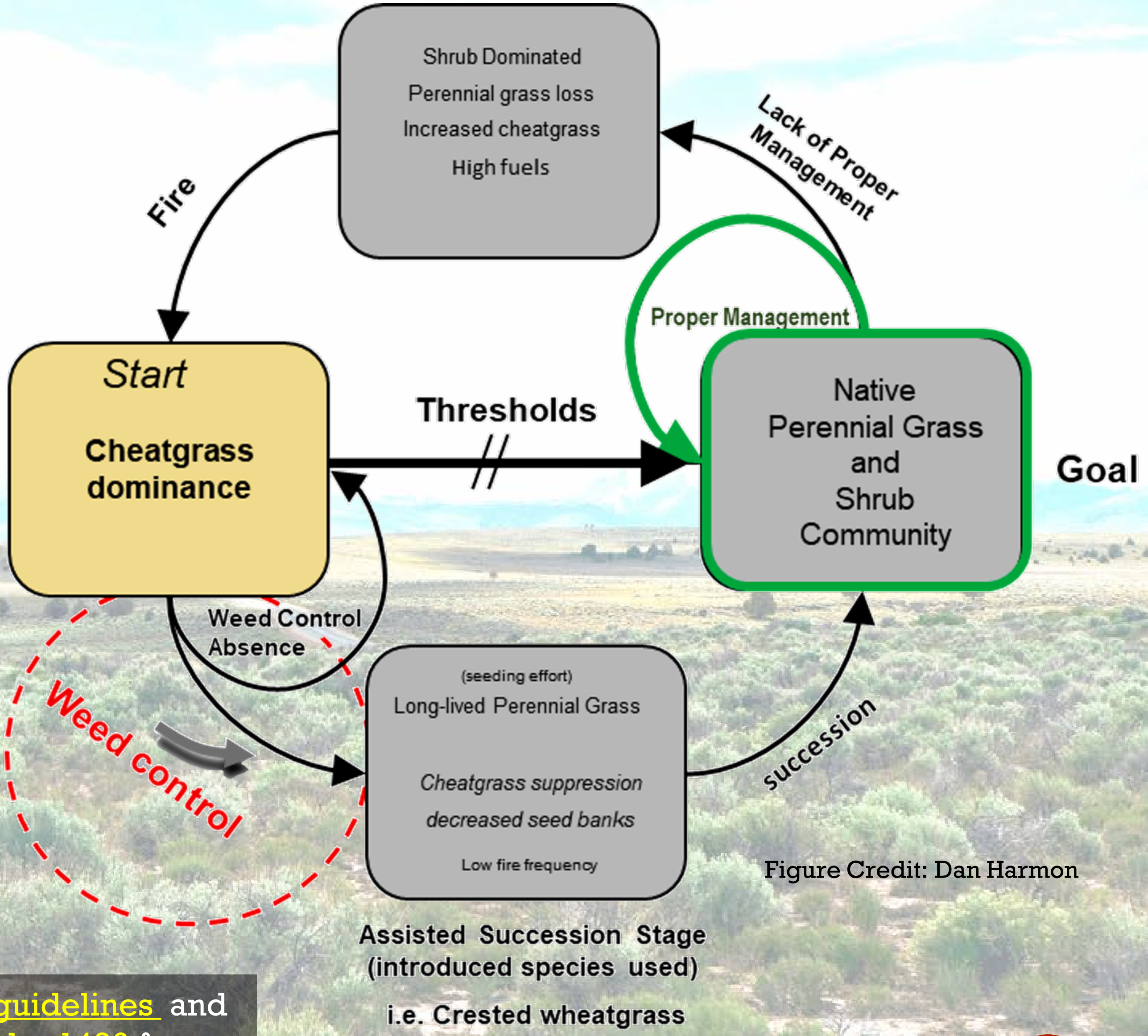
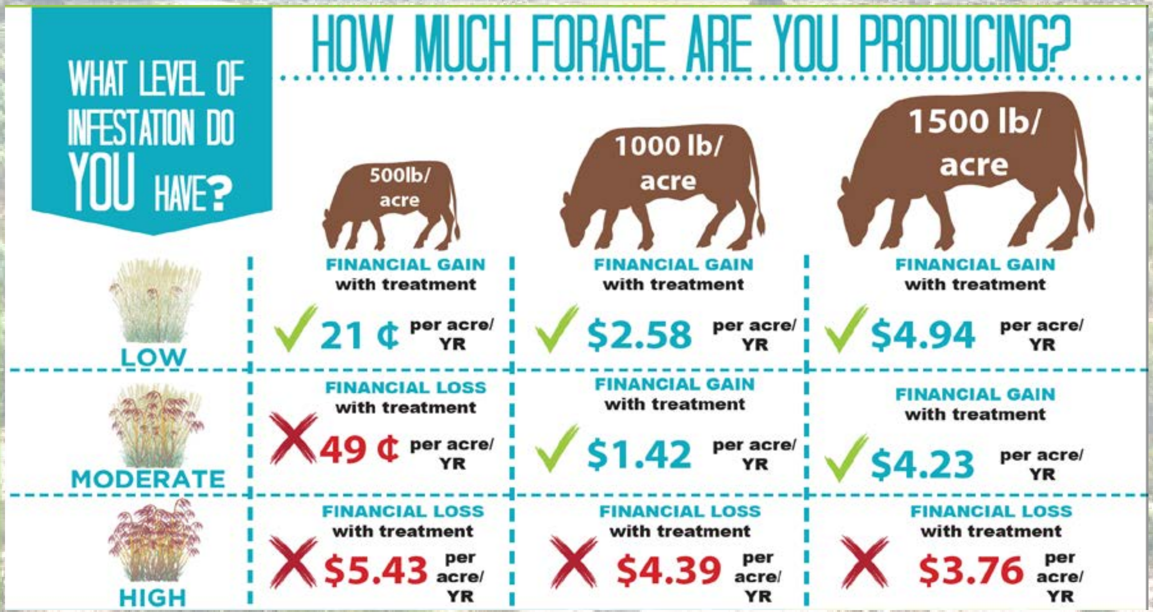


Figure Credit: Dan Harmon

UPLIFT METHODS:
INVASIVE ANNUAL GRASS TREATMENTS

The most effective time to treat annual grass invasions is when infestations are at low/moderate levels. High infestation rates may still be worth the effort, but surrounding infestation levels matter even more in high infestation, monoculture situations.



Integrated Pest Management (IPM) involves incorporating multiple elements in a strategy to treat weeds. This type of effort will generally be most effective, strategies involving annual grass treatments should have chemical treatments and reseeding as the focus of the overall strategy.

UPLIFT METHODS:

INVASIVE ANNUAL GRASS TREATMENTS

Herbicide options:

- Pre-emergent treatment options are applied in fall and prevent germination. This provides significant annual control depending on application rates and soil composition.
- Growth Regulator treatments are applied during seed formation and can interrupt seed development and prevent reproduction.

Preemergent Chemical	**Notes**
Imazapic (*Plateau*)	Most well-known, successful at reducing cover, may persist longer than 1 season.
Rimsulfuron (*Matrix*)	Provides good control when applied in fall or early spring
Sulfometuron (*Landmark*)	
Growth Regulator Chemical	**Notes**
Aminopyralid (Milestone)	Highly effective and relatively cheap if applied at early flowering stage.
Non-Selective	**Notes**
Glyphosate (*Round-up*)	The right rate and timing can control immature annuals while preserving perennial grasses.

For more specific information on chemical strategies see:
Cheatgrass management handbook
Medusahead management guide

UPLIFT METHODS:
PERENNIAL GRASS SEEDING PROJECTS

- Seeding perennial grass will give quickest site stabilization, and quickest return on investment. Seeding sagebrush or other woody species is a long-term project.

Seeding Strategies:
- Broadcast
  - Aerial
  - Terrestrial
- Drill
- Hydro-seeding (small area)
- Mulch Seeding

Native vs. Non-native?

Priority is site stabilization and preventing invasive annual grasses. Non-native species may be appropriate depending on site conditions

UPLIFT METHODS:

PERENNIAL GRASS SEEDING PROJECTS

- Some plant seeds are most successful with specific methods. The Great Basin Factsheet #14 has information on what methods to use with which seeds, and factsheet #10 which has sagebrush planting suggestions:

Number 14 • 2016

Great Basin Factsheet Series

Information and tools to conserve and restore Great Basin ecosystems

Seeding Techniques for Sagebrush Community Restoration After Fire

Table 1. Common species suitable for seeding at low-elevation sagebrush sites (derived from Monsen et al. 2004, Lambert 2005a, Ogle et al. 2012, USDA PLANTS 2015). This list is not exhaustive, and not all species are suitable for all sites. Species and seed sources should be selected based on adaptation to planting site conditions.

Common Name	Latin Name	Community[1]	Seed Box[2]	Depth[3]	Group[4]
Grasses					
Bluegrass, Sandberg	*Poa secunda*	BA, BL, WY	SS, LS	≤ ¼-¾"	ABJK
Dropseed, sand	*Sporobolus cryptandrus*	BA, WY	SS	≤ ¼"	AK

Number 10 • 2015

Great Basin Factsheet Series

Information and tools to conserve and restore Great Basin ecosystems

Seeding Big Sagebrush Successfully on Intermountain Rangelands

Purpose: To provide land managers with state-of-the-art information on the establishment of big sagebrush through direct seeding.

In Brief:

- Big sagebrush can be seeded successfully on climatically suitable sites in the Great Basin using the proper seeding guidelines.

UPLIFT METHODS:

PERENNIAL GRASS SEEDING PROJECTS

Resources can be found here, here, here, and here for more information on planting suggestions.

Native and Non-native species are available. Site characteristics will determine which are most appropriate. *Ecological site descriptions* will help determine the site characteristics!

Use the intermountain planting guide to determine suggested seed mixes or contact the NRCS for assistance.

RANGELAND PLANTINGS

HIGH MOUNTAIN ECOSYSTEM

ABLE R-1. SUBALPINE (35" + ANN. PRECIP.) (LBS.PLS/ACRE)

	No Soil Limitation			
	Seed-Mix Options			
Species	A	B	C	D
Grasses				
Mountain brome (N) [1]	5		6	
Smooth brome (I)				8
Big bluegrass (N)		2	2	2
Meadow brome (I)		8	2	
Slender wheatgrass (N)	5			
Legume				
White clover (I)		1	1	1

Other Adapted Species:

Grasses: blue wildrye (N) and Garrison meadow foxtail (I).

Forbs and Legumes: mountain lupine (N), sweetanise (N), Wasatch and Rocky Mountain penstemon (N), cow parsnip (N), and porter ligusticum (N).

[1](N)=Native and (I)=Introduced

TABLE R-7. WYOMING BIG SAGEBRUSH (8"-12" ANN. PRECIP.) (LBS.PLS/ACRE)

	Moderate to Deep Soils			Clay Soils		Shallow, Sandy Soils		
	Seed-Mix Options			Seed-Mix Options		Seed-Mix Options		Single
Species	A	B	C	A	B	A	B	Species
Grasses								
Crested wheatgrass (I) [2]		3	6	4	5			
Siberian wheatgrass (I)							6	10
Russian wildrye (I)		3	4	3	5			
Thickspike wheatgrass (N)	3	2		3		7	4	
Snake River wheatgrass(N)	3	2						
Bottlebrush squirreltail (N)	1							
Indian ricegrass (N)	2					3		
Shrub or Forb								
Blue flax (N)	1	1	1	1	1	1	1	
Forage kochia (I)[1]		0.5-1	0.5-1	0.5-1	0.5-1		0.5-1	0.5-1

Other Adapted Species:

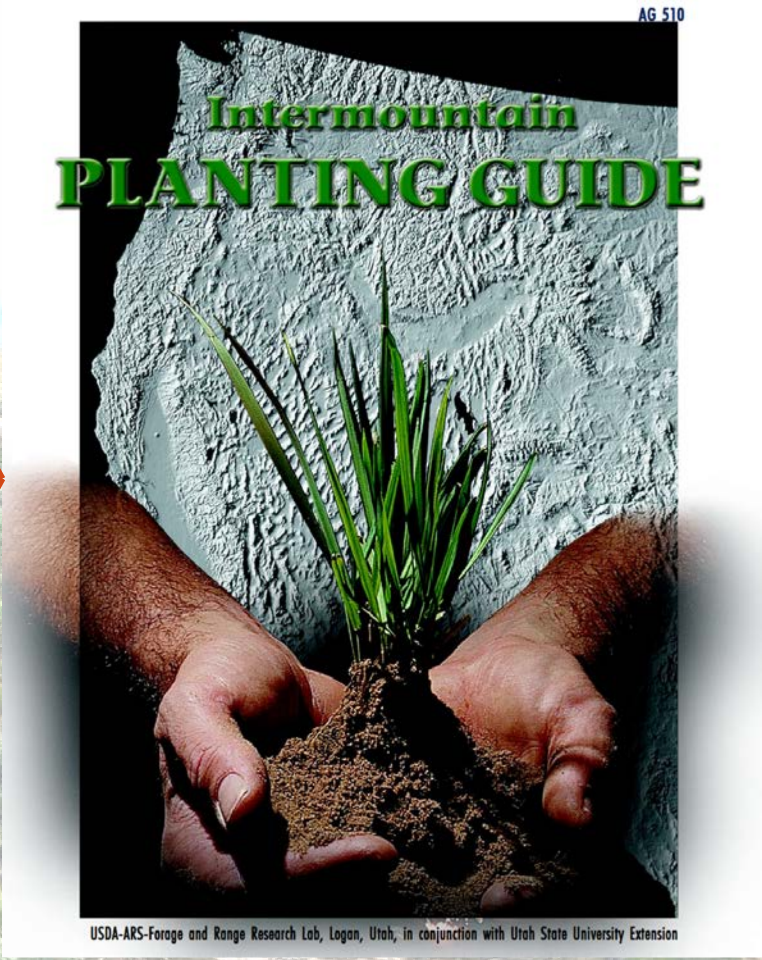
Grasses: galleta grass (N), Snake River wheatgrass (N) 'Secar' as an alternative to bluebunch wheatgrass (N), needle and threadgrass (N), and Salina wildrye (N).

Forbs and Legumes: Palmer penstemon (N), globemallow (N), alfalfa (I) (at higher percipitation).

Shrubs: fourwing saltbush (N), winterfat (N), Wyoming big sagebrush (N), and shadscale (N).

[1] Forage kochia has been successfully seeded in areas receiving 6" of precipitation.

[2] (N)=Native and (I)=Introduced

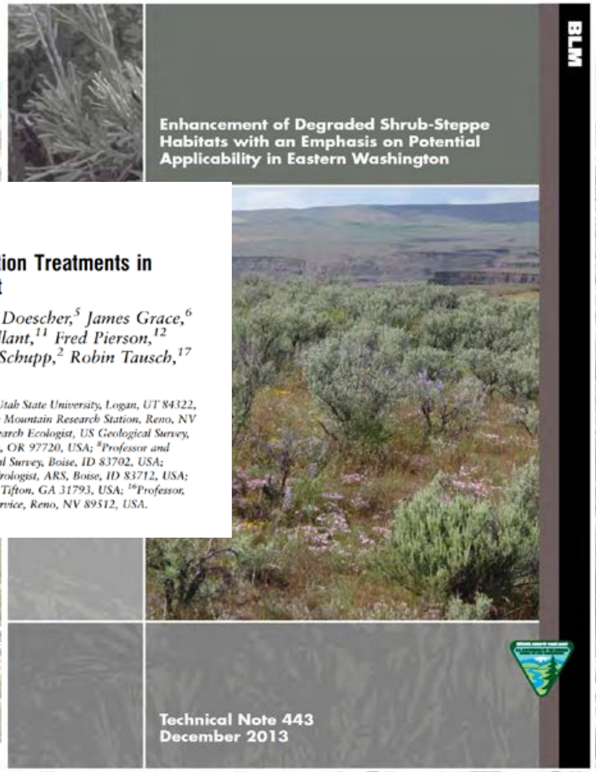


UPLIFT METHODS:
WOODY SPECIES MANIPULATION

- Phase one Pinyon-Juniper is a well-established and valuable conservation practice and is generally required of all CCS projects.
- Dynamism between grass dominance, shrub dominance, and co-dominance is common in the sagebrush ecosystem.
- An overly dominant shrub component can result in a suppressed grass understory and high risk of very hot wildfires.

- Shrub treatment options to restore natural variability include:
  - Prescribed wildfire
  - Mechanical (mowing)
  - Chemical

Shrub treatments should only be contemplated where an understory is non-existent, shrub component is decadent and unhealthy, and the risk of invasive species being made worse is low. Consult with the SETT and other partners to determine the appropriateness of shrub treatments due to the importance of shrubs to the lifecycle of the sage grouse.



Rangeland Ecol Manage 67:584–598 | September 2014 | DOI: 10.2111/REM-D-14-00084.1

A Synopsis of Short-Term Response to Alternative Restoration Treatments in Sagebrush-Steppe: The SageSTEP Project

James McIver,[1] Mark Brunson,[2] Steve Bunting,[3] Jeanne Chambers,[4] Paul Doescher,[5] James Grace,[6] April Hulet,[7] Dale Johnson,[8] Steve Knick,[9] Richard Miller,[10] Mike Pellant,[11] Fred Pierson,[12] David Pyke,[13] Benjamin Rau,[14] Kim Rollins,[15] Bruce Roundy,[16] Eugene Schupp,[2] Robin Tausch,[17] and Jason Williams[18]

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See BLM technical note 443 and SageSTEP synopsis for information on potential treatments

Credit: Oregon State University

DECISION TIME:

- Active vs. Passive restoration decisions depend on ecological states, and whether transitions have been crossed.
- State and Transition models are available for most of Nevada. Contact the NRCS or the SETT for more information.
- Deploying the appropriate method will depend on resource issues.
- Generally, focusing on the shrub, grass, forb dominance dynamic and addressing imbalances will provide what is good for both the herd, and the bird in the Sagebrush Ecosystem.