

Bodie Hills Upland Vegetation Restoration Project: Proposed Action

Bishop Field Office

Bureau of Land Management

Background:

The Bodie Hills is a largely unfragmented landscape that includes a diversity of Great Basin ecological systems. Major fires and invasive species such as cheatgrass have not yet overtaken and highly altered the area, as they have done elsewhere in the Great Basin. However, there are ecological systems (types of vegetation) that are currently departed from their natural range of variability (NRV)¹ due to a lack of a natural disturbance regime. Many of these ecological systems are at a high risk of conversion to invasive species or to woodlands on sites that previously supported shrublands.

The Bureau of Land Management's (BLM) Bishop Field Office entered into a cooperative agreement in September 2007 with The Nature Conservancy (TNC) to analyze of the current condition of the Bodie Hills ecosystems and their future condition under several different management scenarios developed with public input from stakeholders. The study's purpose was to inform and guide the formulation of future site-specific vegetation management projects to protect and enhance the ecological integrity of the area. The analysis used satellite imagery, remote sensing, predictive ecological models, and cost-benefit assessments. Three workshops were held with a diverse group of stakeholders during 2008 to review and refine ecological models, review findings, and identify potential vegetation management scenarios (Provencher, Low et al. 2009).

The current condition of the Bodie Hills ecological systems varies widely in terms of departure from NRV. The study by the BLM and The Nature Conservancy identified 15 ecological systems in the Bodie Hills. Five are slightly departed from their natural range of variability, five are moderately departed and five are highly departed. The primary cause of high departure is that the sagebrush systems are significantly lacking the earliest successional classes (stages of development after a disturbance). Montane sagebrush steppe comprises almost 120,000 acres, over 63% of the project area. It has very little vegetation in the early succession classes and is dominated by late succession classes. In addition, a portion is depleted of native grasses and forbs, cheatgrass has invaded the existing perennial grasses, and conifers have encroached native sagebrush at middle elevations (Provencher, Low et al. 2009).

¹ The natural range of variability is the variation across the landscape of vegetation states due to the natural biotic or abiotic processes over hundreds of years without intervention from industrial societies. The natural range of variability is estimated using a variety of tools including computer modeling, scientific evidence of vegetation dynamics, and historic records. The sources used for this analysis are documented for each ecosystem type in the appendices of Provencher, L., G. Low, et al. (2009). Bodie Hills Conservation Action Planning. Final Report to the Bureau of Land Management Bishop Field Office. Reno, NV, The Nature Conservancy: 369.

The study also predicted that several ecological systems will become increasingly departed from NRV over the next 20 years in the absence of active management, and several systems will have substantial increases in vegetation classes at high risk of conversion to undesirable unnatural states such as invasive weeds (Provencher, Low et al. 2009).

There is public concern regarding the risk of wildfire threatening communities, structures, and the historic resources in Bodie State Park. Due to the long history of fire suppression, the Bodie Hills have very uniform, continuous, late successional brush and pinyon-juniper ecosystems with relatively high fuel loading. There are opportunities to both improve ecological condition and strategically reduce fuels near communities and sensitive resources to reduce the risk of damage from wildfire.

Stakeholders who participated in the BLM-TNC analysis of the Bodie Hills identified key ecological systems for management action based on their current condition, likely future departure from NRV and/or potential for increased high-risk classes, as well as feasibility of management action. The systems included both upland (arid systems away from water sources) and riparian systems (moist to wet systems that depend on springs and creeks). Riparian systems in the Bodie Hills are often managed by both BLM and private landowners, and ongoing management actions are being taken to improve their condition. The condition of the upland systems will not be improved without concerted action by the BLM, which manages the vast majority of the upland area. In general the strategies for riparian and upland systems vary greatly, but there are a few strategies in common where the main concern is a lack of early seral vegetation stages. This project will focus on the upland systems, but also include some strategies that are common between upland and riparian areas. Examples include prescribed burning which can affect both uplands and some embedded and adjacent riparian systems.

The key upland systems in need of management action from the BLM-TNC analysis and public input are montane sagebrush steppe, Wyoming big sagebrush (both sandy and loamy systems), low sagebrush, and basin wildrye-big sagebrush (Provencher, Low et al. 2009). The key riparian systems in need of management action from the report are montane riparian, stable aspen, and wet meadows.

One other ecosystem, mountain shrub, was found to be not as highly departed from the natural range of variability but could benefit from management to increase the proportion of early seral states due to the lack of recent fire. The likelihood of success in using prescribed burning to introduce early seral stages is very high due to the mesic nature of these sites and the ecology of this system, so it was also included in this proposal.

Purpose and Need:

The ecological systems of the Bodie Hills are exceptional because they are largely intact, but they are outside their natural range of variability and at risk of degradation. This has been recently documented in a study by the BLM and The Nature Conservancy using public workshops, vegetation mapping, and modeling. Since the upland shrubs form the primary matrix of the vegetation in the Bodie Hills, this project focuses on ways to restore those systems and make it possible to reintroduce natural

disturbance regimes. There are several conditions in the upland ecosystems of the Bodie Hills that potentially put them at risk:

1. There are multiple upland ecological systems that are highly departed from their natural range of variability.
2. There are multiple upland ecological systems that are at risk of conversion in the future to undesirable states outside the natural range of variability such as transition to non-native invasive species or shrublands encroached by conifers.
3. The vegetation of the Bodie Hills is dominated by late seral developmental stages resulting in relatively uniform, continuous fuel loads which increases the risk of large scale wildfire with potential negative consequences for wildlife habitat, adjacent communities and historical resources.

Due to these vegetation conditions, management action will have to be taken to prevent one of the best examples of Great Basin upland shrublands from being lost. The purpose of the project is to move the upland and associated riparian ecological systems of the Bodie Hills closer to their natural range of variability to benefit wildlife such as greater sage-grouse, make them more resilient to future disturbances, increase the potential for a natural disturbance regime to be reintroduced, and to reduce the risk of damage to adjacent communities, historic resources, and ecosystems by large scale fires.

Proposed Action:

The BLM, Bishop Field Office is proposing a set of vegetation treatments for the Bodie Hills landscape (see map, Appendix A) to maintain and restore the natural range of variability and reduce the risk to nearby communities and the historic resources in Bodie State Park from severe wildfire. The treatments are based on an analysis of the conditions in the Bodie Hills undertaken cooperatively by the BLM and The Nature Conservancy with input from many public stakeholders. The vegetation types and succession classes used here follow the final report (Provencher, Low et al. 2009).

The vegetation types targeted for treatment are primarily the upland types that were found to be at the greatest departure from their natural range of variability and at the greatest risk of conversion to uncharacteristic classes. Uncharacteristic classes are conditions outside of the historic vegetation states and include invasion by non-native species such as cheat grass and conifer encroached shrublands. Highly departed or at risk riparian vegetation types that are commonly embedded in the upland matrix or adjacent to it are also included in this proposal. The treatments in riparian systems that are included are only those that will also be used in adjacent or surrounding uplands and can be applied continuously across both ecological systems. Because many riparian systems have experienced upland encroachment, it would benefit them to be included in the upland treatments such as prescribed burning or cutting conifers. The report found that there are some other mechanisms in riparian systems causing departure from the natural range of variability (such as meadow incision and lowered water tables) which require very different management techniques to treat them. Those management actions are not included in

this proposed action and are either already covered by NEPA analysis or will be analyzed in separate documents. The upland vegetation types proposed for treatment in this project are the following:

1. Basin Wildrye-Basin Big Sagebrush
2. Low Sagebrush
3. Montane Sagebrush Steppe
4. Mountain Shrub
5. Wyoming Big Sagebrush-loamy
6. Wyoming Big Sagebrush-sandy

Associated riparian systems to be included in some treatments are:

7. Montane riparian
8. Stable aspen
9. Wet meadows

Computer simulations were performed to test the effectiveness of various management strategies suggested by public input at the workshops and to adjust the scale of application. The simulations showed that multiple strategies are required for most ecosystems. Upland sagebrush strategies include: prescribed fire; removing and/or thinning encroaching conifers; establishing fuel breaks along existing roads to prevent wildfire from spreading to human settlements and adjoining ecosystems; and restoration of depleted sagebrush through mowing and in some locations followed by seeding of native herbaceous species (Provencher, Low et al. 2009).

Of the various management scenarios tested in the analysis, the combined ecologically-based and wildfire protection management scenario meets the conservation and restoration objectives for the least cost for the majority of the priority ecological systems. In addition to ecological benefits, this scenario also reduces wildfire risks to Bodie State Historic Park and nearby human settlements (Provencher, Low et al. 2009). The treatments in this proposed action are based on this scenario for an initial 10 year period.

The specific proposals for the vegetation types to be treated are listed in the tables below.

Upland Treatments

1. Basin Wildrye – Big Sagebrush			
Objective: Work towards the long term (20 year) goals of improving ecological condition of Bodie Hills basin wildrye from 73% departure from NRV to 50% departure or less and reducing depleted classes by 50%. Prevent any increase of exotic forbs.			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Treat late seral basin wildrye and classes lacking native herbaceous cover to convert them to early development classes (A and B).	Late seral-open (D), Shrub-Annual grass (U ShAG), Annual grass (U Ag)*	230	-Mowing -hand cutting shrubs with piling and burning or chipping, -broadcast prescribed fire
II. Prevent conversion to conifers by treating early encroachment stages.	Late-open (D), Tree-encroached (U TrEnc), Tree-Annual grass (U TrAG)*	120	-Hand cutting conifers with piling and burning or chipping
III. Early detection – rapid response (EDRR): Continue weed surveys and control exotic forbs when found.	Exotic forbs (U EXF)	200 (if needed)	-Weed surveys -Weed treatment
Maximum acres of vegetation treatment		350	

* Classes with large annual grass components will only be treated if trials of methods such as spring burning are shown to be successful at restoring a greater percentage of natives. See adaptive management strategy.

2. Low Sagebrush			
Objective: Work towards the long term (20 year) goals of maintaining ecological condition of low sagebrush at ~40% departure from NRV or less and limiting increase of high-risk (tree encroached and annual grasses) classes to 10% or less.			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Remove trees from later successional stages.	Late-open (E), Mid-open (B), Tree encroached (U TrEnc)	1250	-Hand cutting conifers with piling and burning or chipping
II. Treat classes with an annual grass component to prevent increase.*	Annual grass (UAG) , Shrub-Annual grass-Perennial grass (U ShAP)	800	-Seeding native species with mowing, hand cutting or spot burning shrubs where necessary for establishment
Maximum acres of vegetation treatment		2050	

*Strategy II was added to the scenario analyzed in the Provencher report because the Field Office does not have the option of using effective herbicides on annual grasses and this is the most effective strategy to minimize annual grasses without the use of chemicals. The area to be treated over 10 years was derived from the acres of annual grass mapped in the analysis. Treatment of those acres should limit the increase of annual grasses, however, the amount in the U ShAP class was likely underestimated because the current sites are small and hard to detect with remote sensing.

3. Montane Sagebrush Steppe			
Objective:			
Work towards the long term (20 year) goals of improving the ecological condition from high departure (72%) from NRV to moderate departure (~55%) and limiting increase in highest risk classes to 20% or less. Establish a fuel break around Bodie State park that will also provide ecological benefits by increasing early successional classes.			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Treat late successional, depleted, and annual grass invaded classes to convert them to early development classes with greater native herbaceous cover.	Mid-closed (C) Late-open (D), Depleted (U DPL), Shrub-Annual grass-Perennial grass (U ShAP)*, Shrub-Annual grass (U ShAG)*	9500	-Broadcast prescribed burning -Mowing -Hand cutting small conifers** -Seeding native species in the most depleted/high risk sites if necessary
II. Remove trees from classes with encroaching conifers to prevent and reduce conversion.	Late-open (D), Late-closed (E), Tree encroached (U TrEnc), Depleted (U DPL), Shrub-Annual grass-Perennial grass (U ShAP), Shrub-Annual grass (U ShAG)	750	-Hand cutting conifers with piling and burning or chipping
III. Construct and maintain a 300 ft. fuel break around structures and values at risk (ex. Bodie State Park) to reduce fire risk and increase early development classes. This may include both BLM and State lands.	Several classes – site selection depends on location, not class.	300***	-Mowing -Hand cutting shrubs with piling and burning or chipping -Broadcast prescribed burning -Seeding native species if necessary
Maximum acres of vegetation treatment		10550	

* Classes with large annual grass components will only be treated if trials of methods such as spring burning are shown to be successful at restoring a greater percentage of natives.

**Early stages of conifer encroachment are difficult to map with aerial photography. Small trees may occur in class C and D.

*** Fuel break acres will be periodically maintained to keep fuel loading low.

4. Mountain Shrub			
Objective: Improve the ecological condition from moderate departure (39%) from NRV to low departure (~25%).*			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Treat late developmental classes to return them to early developmental classes.	C (late-closed) and D (Late-open).	1000	-Broadcast prescribed burning
Maximum acres of vegetation treatment		1000	

*The Mountain shrub ecological system was not identified in the report as one of the highest priorities for treatment so the objectives for managing this system were not explored in detail. The Field Office chose to add this system and create management objectives for it because it has a high probability of success and can be included with adjacent ecosystems in prescribed burns.

5. Wyoming big sagebrush - loamy			
Objective: Work towards the long term (20 year) goals of improving ecological condition from highly departed (~74%) to moderately departed (<66%) and reducing the risk of wildfire spreading to adjoining ecosystems and properties or structures.			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Treat late development classes in fuel breaks mostly arranged along roads to return them to early development classes and reduce the fuel load and continuity.	Late-closed (C), Late2-open (D), Late2-closed (E), Depleted (U DPL) , other classes as necessary to complete fuel break.	250**	-Mowing -Seeding native species
II. Remove trees from classes with encroaching conifers.*	Late-closed (C), Late2-open (D), Late2-closed (E), Tree encroached 9U TrEnc)	600*	-Hand cutting conifers with piling and burning or chipping
Maximum acres of vegetation treatment		850	

*Tree removal was not included in the management scenario for this ecological system in the Provencher report, but it was included in this proposed action because tree encroachment into this system was under represented in the mapping based on field review. In addition, the analysis also predicts that there would be 600 acres of tree encroachment by the end of the scenario without active management. No true juniper or pinyon woodlands will be treated.

** Fuel break acres will be periodically maintained to keep fuel loading low.

6. Wyoming big sagebrush – sandy			
Objective: Work towards the long term (20 year) goal of improving ecological condition by a small percentage (5%) while reducing risk of wildfire spreading into adjoining ecosystems and properties or structures.			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Create fuel breaks mostly arranged along roads to convert to early developmental classes and reduce fuel load and continuity.	Many; site selection depends on location rather than class but majority of area will be in Depleted (U DPL), Late-closed (C), Late2-open (D), Late2-closed (E).	500**	-Mowing -Hand cutting shrubs with piling and burning or chipping -Seeding native species if necessary
II. Remove trees from classes with encroaching conifers.*	Late-closed (C), Late2-open (D), Late2-closed (E), Tree encroached 9U TrEnc)	1000*	-Hand cutting conifers with piling and burning or chipping
Maximum acres of vegetation treatment		1500	

*Tree removal was not included in the management scenario for this ecological system in the Provencher report, but it was included in this proposed action because tree encroachment into this system was under represented in the mapping based on field review. In addition, the analysis also predicts that there would be 5670 acres of tree encroachment by the end of the scenario without active management. No true juniper or pinyon woodlands will be treated.

** Fuel break acres will be periodically maintained to keep fuel loading low.

Associated Riparian Treatments

7. Montane riparian			
Objective: Contribute to the long term (20 year) goal of maintaining the riparian habitat at less than ~33% departure from the natural range of variability.			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Treat late successional classes to move them to early successional stages and reverse or prevent conversion to upland woody species.	Late-closed (E), Shrub-Forb-Encroached (U SFEnc)	30	-Broadcast prescribed burning
III. Early detection – rapid response (EDRR): Continue weed surveys and control exotic forbs when found.	Exotic forbs (U EXF)	50 (if needed)	-Weed surveys -Weed treatment
Maximum acres of vegetation treatment		30	

8. Stable aspen			
Objective: Contribute to the long term (20 year) goal of improving the ecological condition from 41% departure from the natural range of variability to ~33% departure and reduce “no aspen” classes by ~50%.			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Treat late successional classes to move them to early succesional stages, reverse or prevent conversion to upland species, and promote healthy aspen regeneration.	Late1-closed (E), Late1-open (D), Depleted-open (U DPL), No aspen (U NAS)	500	-Broadcast prescribed burning -Hand cutting conifers
Maximum acres of vegetation treatment		500	

9. Wet meadows			
Objective: Contribute to the long term (20 year) goal of maintaining the ecological condition of wet meadow at less than 33% departure from the natural range of variability, preventing any increase in exotic forbs, ensuring no additional desertification, and reducing iris/silver sage by 50%.			
Strategy	Classes to be treated (See Appendix B for class descriptions)	Acres over 10 years	Management tools to be used
I. Treat areas of iris or sagebrush to convert them to early seral classes.	Shrub-Forb encroached (U SFEnc), Desertification (U DES), Tree encroached (U TrEnc)	100	-Broadcast prescribed burning*
Maximum acres of vegetation treatment		100	

* Other methods were recommended in the report in addition to broadcast burning. Those methods are outside the scope of this analysis because they are not among the tools also being used in the uplands.

Sum of All Ecological Systems:

Total maximum acres of vegetation treatment across all ecological systems*	16930
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* Does not include maintenance of established fuel breaks or weed treatments.

Methods:

Broadcast prescribed burning:

The controlled application of fire broadcast across a predetermined unit to consume vegetation. Resource management objectives are achieved by applying fire during specific environmental conditions and by some preparation of the site to control spread or protect islands within the burned area for protection of cultural or natural resources. Prescribed burning will be used to consume shrubs in a mosaic pattern and small trees and ladder fuels. The conditions under which burning will take place to achieve the ecological and resource protection goals and to provide for safety will be specified in a prescribed burn plan written by a qualified burn boss. Unit boundaries will be designed to follow natural and existing features as much as possible to reduce the visual impacts and the need for line construction. Some preparation of the site may be necessary before burning including wetlining, blacklining, hand cutting or mowing, or handline construction with hand tools. Tools such as drip torches

and fusees and other firing devices will be used to ignite the fire. Fire will be controlled with blacklining, water (engines where there are existing roads or bladder bags) and hand tools. The specific tools and methods will be determined by the qualified burn boss to allow for effective implementation and safety. Using adaptive management, the season of burning may be adjusted and the results monitored for cheatgrass response to test the possibility of using timing of burning to reduce risk of cheatgrass spread.

Mowing shrubs:

The use of a Bobcat™, ASV™ (a compact track loader), or similar-sized machine with low ground pressure (less than 10 psi) equipped with a mower or other appropriate attachment to mow and mulch shrubs and small trees. Chips remain on the ground. The height of mowing can be controlled to leave a percentage of existing shrub cover. Mosaic patterns and unit boundaries that follow natural features will be used wherever possible.

Hand cutting shrubs:

The use of chainsaws to hand-cut shrubs, usually in a mosaic pattern so that small patches are left uncut. The resulting slash would be piled and burned or chipped depending on the access and resource concerns (See piling and burning and chipping method descriptions and selection criteria below).

Hand cutting conifers:

The use of chainsaws to remove or thin conifers encroaching into shrubland sites (primarily pinyon and some juniper). Young (post European contact) conifers would be removed, but older conifers will be maintained. This will result in a mosaic on some sites. No true pinyon-juniper woodlands would be treated. Where access allows and outside of Wilderness Study Areas, larger-sized material could be made available for firewood. Any remaining slash (tree limbs and boles) will be treated with one of two methods depending on access and resource concerns (See Piling and burning and chipping method descriptions and selection criteria below) or could be removed off site for disposal.

Piling and burning:

Slash will be piled by hand and burned under favorable conditions once the slash has cured. The locations of piles will be carefully selected. Where possible, piles will be constructed in natural openings, on top of cut conifer stumps where trees have been removed, and outside areas with high annual grass density. A prescribed burn plan written by a qualified burn boss will be followed.

Chipping:

Slash will be chipped with a mechanical chipper. The chips will either be blown back onto the site at a depth no greater than 2 inches or hauled off the site.

Seeding native species:

A native species mix appropriate for the site and collected locally when possible would be used in situations where recruitment of natives is not occurring indicating a depleted native seed bank or where strong competition from natives is necessary to limit annual grass abundance. Seeds will be certified “weed free.” Seeding will be done by any accepted method including hand, aerial, or rangeland drill (see method selection criteria below).

Weed surveys:

The first component of an early detection, rapid response (EDRR) strategy for preventing new invasions of weeds into a landscape. Target ecological systems will be regularly surveyed for occurrences of currently uncommon weeds including but not limited to: muskthistle (*Cardus nutans*), knapweed (*Centarea* spp.), Canadian thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), perennial

pepperweed/whitetop (*Lepidium latifolium/Cardaria* spp.), salt cedar (*Tamarix ramossissima*), woolly mullein (*Verbascum thapsus*). Only woolly mullein is known to occur on BLM lands in the Bodie Hills. The other species are included in surveys because there are known populations in other parts of California and Nevada and early detection of any infestation is key to preventing its establishment and spread throughout the area. Any occurrences will be immediately recorded and reported so that they can be evaluated, contained, and controlled.

Weed treatment:

The second component of an EDRR strategy for preventing new invasions of weeds into a landscape. If new occurrences of weeds are detected, appropriate eradication measures will be implemented, as determined by interdisciplinary effort (Bishop Fire Management Plan pg. 53). Where possible they will be hand pulled, often over several years to achieve complete control. Some weeds can only effectively be treated by spot application of herbicides. Application of herbicides is not included in this proposed action, but will be used where necessary if approved in a separate NEPA analysis.

Method Selection Criteria:

The methods used will depend on the current vegetation state and the action necessary to move to the desired vegetation as described in the treatment tables above. Where there is a choice of treatment methods, the treatment most likely to achieve the desired vegetation state and cause the least disturbance to other resources or risk of adverse outcomes (i.e. cheatgrass) will be used. The following criteria describe some of the situations where one treatment will be favored over another:

Prescribed burning:

- The preferred method where the goal is to return the site to an early seral state (with low shrub cover) especially in WSAs or areas with inventoried wilderness characteristics.
- Would not be the preferred treatment method where the risk of annual grass increase is high (sites with existing annual grasses, south facing slopes and loamy soils) or other high risk classes.
- Would not be used where there is not enough surface fuel to carry a broadcast fire (i.e. late stages of conifer encroachment where understory is depleted or in habitats such as low sagebrush with very little surface fuel).
- Could be used on any terrain.
- Would not generally be used in close proximity to structures and communities. Will be used where the Fire Management Officer determines that it can be done without undue risk.

Mowing:

- Would be used where the goal is to reduce but not entirely remove shrub cover, remove small trees from the early stages of conifer encroachment, and not disturb the herbaceous understory. The resulting vegetation state would typically be class B-C.
- Used only on gently sloping (<15%), non-rocky areas.
- Would be one of the preferred methods (see also hand cutting) in areas of sage grouse nesting or wintering habitat where maintaining some sagebrush cover is important.
- Would be one of the preferred methods (see also hand cutting) instead of broadcast prescribed burning where the risk of increasing annual grasses is high.
- Would be one of the preferred methods (see also hand cutting) instead of broadcast prescribed burning where there are fire control concerns especially near structures.

Hand cutting shrubs:

- Would be used where the goal is to reduce or eliminate shrub cover and not disturb the herbaceous understory.
- Will be the preferred method where variable shrub cover and mosaic patterns are important especially in sage grouse habitat, areas with complex vegetation patterns or high visual concerns.
- Could be used on any type of ground including areas with poor access, steep topography, and rocky uneven surfaces.
- More labor intensive than broadcast prescribed burning or mowing.
- Preferred over broadcast burning where there are fire control risks.
- Preferred over broadcast burning where the risk of annual grass increase is high.

Hand cutting conifers:

- Would be used where larger encroaching trees need to be removed that would not be likely to be consumed during prescribed broadcast burning.
- Would be used where there are encroaching conifers and the goal is to maintain shrub cover, for example in sage grouse habitat.
- Could be used on any type of ground including areas with poor access, steep topography, and rocky uneven surfaces.

Piling and burning:

- Would be the preferred method of slash disposal after hand cutting of shrubs or trees.
- Could be used on any terrain.
- Would not be used where there is a high risk of increasing annual grasses in the burn pile footprint and chipping is a viable alternative (close to roads).
- Would not be the preferred method where visual impacts from key observation points would be undesirable.

Chipping:

- Would be preferred method of slash disposal close to roads where visual impacts of piles would be high, or where the risk of increasing annual grasses is high.
- Could only be used where road allow access for the chipper.

Seeding methods:

- Seeding would only be done if local native seedbank does not respond after treatment.
- Hand seeding will be preferred.
- A rangeland drill will not be used in WSAs or areas with inventoried Wilderness Characteristics.
- Fuel breaks in areas with annual grass may be seeded using a rangeland drill.

Design Features:

The following design features will be used to minimize negative effects of the treatments on other resources. Some design features are required by existing plans and BLM direction including the Bishop Resource Management Plan (Bishop RMP) (US Department of the Interior 1993), the Amendment to the Bishop Resource Management Plan to Incorporate Fire Management Plan Strategies and Objectives (Fire Management Plan) (US Department of the Interior 2004), and the Interim Management Policy for Lands Under Wilderness Review (H-8550-1)(US Department of the Interior 1995).

Air quality:

- Prior to prescribed fire operations, appropriate permits would be obtained from Great Basin Unified Air Pollution Control Board (GBUAPCB).
- “Burn” or “No Burn” day conditions would be adhered to, as determined by the California Air Resources Board (CARB).
- Degradation of air quality in Class I Airsheds would be minimized by conducting prescribed fire operations when meteorological conditions favor smoke dispersal away from these areas.
- Prescribed fire operations would be conducted when meteorological conditions favor minimal nuisance smoke in communities.

Botany:

- All endangered, threatened, candidate and sensitive plant populations will be protected (Bishop RMP pg. 17).
- Units will be analyzed for potential special status plant species habitat. Any potential habitat will be surveyed before treatment. If a population of a sensitive species is found that analysis by the BLM shows could be adversely affected, the treatment will be moved or modified to prevent adverse effects. Special status plant species with suitable habitat in the Bodie Hills include the list below. Design features to protect occurrences of these species are listed. If other species are found to be sensitive and occur in the project area, they will be added and design features will be determined by interdisciplinary effort with input from the Field Office botanist.

BLM Special Status Plants with potential habitat or populations in the Bodie Hills:

- *Astragalus johannis-howellii* (Long valley milkvetch):
Mostly occurs in Great Basin xeric mixed sage which is not a target ecosystem for treatment. If occurrences are found in a proposed treatment area, a treatment exclusion area will be established with no piling, burning, or mowing.
- *Astragalus oophorus var. lavinii* (Lavin’s milk vetch):
Occurs in Pinyon-juniper and could be within the treatment areas. If an occurrence of this species is found, a treatment exclusion area will be established with no piling, burning or mowing.
- *Astragalus pseudiodanthus* (Tonopah milk-vetch):
Occurs along the edges of stabilizing sand dunes associated with historic Mono Lake shorelines and is not likely to be included in the treatment areas. If it is encountered, a treatment exclusion area will be established with no piling, burning, or mowing.
- *Boechea bodiensis* (Bodie Hills rock-cress):
Confined to rocky, steep slopes and mountain summits and ridgelines and unlikely to be included in treatment areas. If it is encountered, exclusion areas will be established with no piling, burning, or mowing.
- *Cusickiella quadricostata* (Bodie Hills cusickiella [draba]):
This species is common on rocky low sage sites throughout the area. Where populations are found exclusion areas will be established with no piling or mowing (broadcast burning is not proposed for low sagebrush habitats).
- *Phacelia monoensis* (Mono phacelia):
Occurs on friable rhyolitic clay sites that are susceptible to frequent frost heaving and other natural as well as anthropogenic disturbances, e.g. activities associated with roadsides. This species may respond positively to some forms of disturbance; however in populations of the species, equipment will not be staged and a treatment exclusion area will be established with no piling or mowing. If fire is applied to areas where the

species occurs, burning will happen prior to the plant emerging or after seed has dispersed.

- *Polyctenium williamsiae* (William's combleaf):
Occurs along the margins seasonal lake shores. Unlikely to occur in a treatment unit, but if it is encountered, a treatment exclusion area will be established with no piling, burning or mowing.
- *Streptanthus oliganthus* (Masonic Mountain jewel flower):
Restricted to granitic rock outcrops in parts of the Bodie Hills. If it is encountered, a treatment exclusion area would be established with no piling, burning or mowing.

California Native Plant Society (CNPS) List 2 species – Plants rare or threatened in California but more common elsewhere

If CNPS List 2 species are found in a treatment unit, an exclusion area will be established with no piling, burning or mowing. The CNPS List 2 species that may occur in the project area are:

- *Allium atrorubens* – Great Basin onion
Occurs within low sage flats.
 - *Arabis cobrensis* – Masonic rock cress
Occurs in sagebrush-steppe communities commonly underneath or in close proximity to mountain sagebrush (*Artemisia tridentata* ssp. *vaseyana*) plants.
 - *Crepis runcinata* ssp. *hallii* – meadow hawksbeard
Occurs in alkali meadows with Aquic Torriorthent soils.
 - *Menzelia torreyi* – little blazing star
Commonly associated with Travertine or volcanic substrates that are often devoid of other plant species. Unlikely to be in treatment units.
 - *Tetradymia tetramers* – dune horsebrush
Confined to the sand dune systems. Unlikely to be in treatment units.
- Using adaptive management, if evidence is found during the project implementation period of a positive relationship of any special status plant species with fire or other disturbances, then the practice of excluding them from the treatment activities will no longer be implemented. For example, if a wildfire burns through populations and there is a positive response, then populations will no longer be excluded from prescribed burn treatments.

Cultural Resources:

- A complete survey for unrecorded Resources of interest and determination of treatment methods, within the proposed project area will be applied on a site specific basis prior to project implementation, as per the State Protocol Agreement (SPA) between The California State Director of the Bureau of Land Management and The California State Historic Preservation Officer regarding the manner in which the Bureau of Land Management will meet its Responsibilities under the National Historic Preservation Act and the National Programmatic Agreement among the BLM, Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (SPA, 2007).
- California Bureau of Land Management Supplemental Procedures for Protection of Cultural Resources from Prescribed Fire Effects, a Cultural Resource Amendment to The State Protocol between California Bureau of Land Management and The California State Historic Preservation Officer and the Nevada State Historic Preservation Officer, will be applied on a site specific basis (SPA, 2007).

- Standard procedures for protecting cultural resources will be followed for activities that are located immediately adjacent to cultural resources (CA BLM, SPA, 2007, Protocol Supplemental Procedures for Prescribed Fire, Standard Protection Measures for Cultural Resources in Prescribed Fire Areas, Attachment 1, E) including such techniques as flagging and avoiding, directional felling and non-mechanized fuels reduction treatments.
- Post fire survey needs will be determined prior to prescribe fire operations, and will be based on projected site sensitivity.
- All access routes will be clearly flagged and identified in order to avoid Cultural sites.
- Tribal concerns regarding fuels treatment within the pinyon will be addressed prior to, and during planning phases of proposed project activity.

Range:

- The BLM will consult and coordinate with range permittees in the design, layout and timing of the treatments.
- Prescribed burn and seeding treatments will be rested from grazing for at least two growing seasons following treatment (Bishop RMP pg. 11). The extent of the rest, if different from 2 years, will be determined by the BLM Bishop Field Office Manager based on an interdisciplinary process. The BLM will work with permittees so that rest from livestock can be accommodated with as little impact to their grazing operation as possible.
- Any subsequent infrastructure and/or projects (e.g. fencing) to aid in resting treatment areas will be analyzed in a separate NEPA document.

Recreation:

- Fire control lines will be rehabbed and barriers will be installed where necessary near roads and trails so that they are not used as OHV trails.

Soils/Hydrology:

- Mechanical equipment and vehicles will not be used off existing roads or routes on wet or poorly drained or erosive soils (Bishop RMP pg. 13).

Visual resources:

- The project area includes mostly Visual Resource Management (VRM) Classes 2 and 3 and a small portion of VRM1 in the Conway Summit Area of Critical Environmental Concern. A visual contrast rating will be conducted for each treatment unit to ensure conformance with VRM.
- Units will use irregular patterns to create more edge and islands of vegetation will be left for cover (Bishop RMP pg. 11). These design features also benefit wildlife and wilderness character (See wildlife and WSAs).
- Cut trees will be piled and burned unless they are less than 10 feet in height and less than 6 inches in diameter (no large dead trees will be left scattered across the site).
- In pile burning treatments piles will be created on top of cut stumps where possible to consume the stump (see the pile burning method description).
- In VRM 1 areas, prescribed burning will be the preferred method where it can accomplish the desired vegetation condition.

Weeds:

- A survey for weeds will be done before any area is treated. If weeds are found the units and methods will be modified as necessary based on a risk assessment conducted by the BLM botanist.
- If cheatgrass is common throughout the unit, fall prescribed broadcast burning will be avoided.
- Any equipment moved from an infested area to an uninfested area will be cleaned. If a unit has documented weeds in one portion, that portion will be treated last to avoid spreading weeds throughout the treatment area.
- Post-treatment surveys will be conducted to detect increases in non-native plant species. If non-native species cover exceeds 5% in treated areas, appropriate eradication measures will be implemented, as determined by interdisciplinary effort (Bishop Fire Management Plan pg. 53).
- Using adaptive management, if elevated levels of non-native species are detected in post-treatment surveys, future treatments will be modified to help prevent increases in non-native species due to treatment methods or locations.

Wilderness Study Areas/Wilderness characteristics:

- All actions within designated WSAs will follow the intent of H-8550-1: Interim Management Policy for Lands Under Wilderness Review. The purpose of this proposal is to protect and manage the Bodie Hills “to preserve its natural conditions” (H-8550-1 pg 19) including the natural disturbance/fire regime and distribution of vegetation classes. Restoring natural disturbance regimes is consistent with preservation of wilderness character and the intent of the IMP which allows for prescribed burning where necessary to maintain fire-dependent natural ecosystems (H-8550-1 pg. 39).
- Methods that are least disturbing to the site (H-8550-1 pg. 10) will be chosen where they will achieve the goals for the ecological system and vegetation class as described in the methods section. Prescribed burning will be used where it can accomplish the desired ecological state. If prescribed burning will not accomplish the ecological restoration necessary, the other methods described will be used as described in the methods section.
- A minimum tool analysis will be conducted using the accepted agency standard guide (Minimum Requirements Decision Guide) as each unit within WSAs is laid out to ensure that the methods chosen and the location of the unit are consistent with preserving the area’s suitability for preservation as wilderness. While the minimum tool analysis is intended for use in designated wilderness, it “can be useful as guide when applied to the interim management of WSAs” (H-8550-1 pg. 18).
- Surface disturbance as defined in H-8550-1 (pg. 9) will be prevented or minimized in WSAs and any area with inventoried wilderness characteristics. No new roads or routes will be created. Low ground pressure equipment will be used for mowing, the only treatment method where motorized equipment must be used off existing roads and routes. Broadcast prescribed burning units will use natural and existing features for control as much as possible and utilize Minimum Impact Strategies and Techniques (MIST) as much as possible to limit ground disturbance.
- Units will be designed to have a natural appearance with uneven boundaries that follow natural features where possible and with irregular islands of untreated vegetation. These features will be used throughout the project and also have a positive benefit for wildlife habitat (see wildlife below).
- No material cut within a WSA will be offered for use as fuel wood (H-8550-1 pg. 43).

- Trees will be low cut (less than 4") to minimize visual impacts in the WSAs and any area with inventoried wilderness characteristics.
- Rangeland drills will not be used for seeding in WSAs or areas with inventoried wilderness characteristics.
- See Visual Resources for additional design features that maintain the natural appearance of the landscape both inside and outside the WSAs or areas with inventoried wilderness characteristics.

Wildlife:

- Treatment units will use irregular patterns to create more edge and islands of vegetation will be left for cover (Bishop RMP pg. 11). Units will be designed to be small enough to provide good edge and cover habitat nearby for wildlife species such as sage grouse and to provide nearby seed sources for native vegetation recruitment. Prescribed burn and mowing units in sage grouse habitat will not exceed 124 acres where possible². These features will also benefit visual and botanical resources.
- Treatments removing tree cover within 2 miles of active sage grouse leks will be prioritized to create habitat with optimum characteristics for sage grouse (Bishop RMP pg. 17). Treatment methods least disturbing to the stand of sagebrush will be used if the sagebrush stand meets sage grouse habitat needs.
- Alteration of Wyoming sagebrush habitats involving removal of sagebrush cover (both treatments and other disturbances such as wildfire) will not exceed the guideline to alter no more than 6% of Wyoming sagebrush in a decade³. The proposed action will treat only 2.4% of currently mapped Wyoming big sagebrush, and if other disturbances such as wildfire alter the habitat type the total treatment acres will be adjusted to stay below the 6% guideline or eliminate treatment alterations in the case of natural disturbances above the threshold.
- Alteration of mountain big sagebrush habitats involving removal of sagebrush cover (both treatments and other disturbances such as wildfire) will not exceed the guideline to alter no more than 10% in a decade⁴. The proposed action will treat a maximum of 8.2% of currently mapped mountain big sagebrush, and if other disturbances such as wildfire alter the habitat type the total treatment acres will be adjusted to stay below the 6% guideline or eliminate treatment alterations in the case of natural disturbances above the threshold.
- In sage grouse winter habitat, treatments involving removal of sagebrush cover will not exceed 10% of the area in a decade⁵. Treatment areas will be adjusted if other disturbances such as wildfire remove sagebrush cover during the time period.

² Adapted from Connolly, J. W., M. A. Schroeder, et al. (2000). "Guidelines to manage sage grouse populations and their habitats." *Wildlife Society Bulletin* **28**(4): 967-985. "Discourage prescribed burns > 50 ha".

³ Adapted from the guidelines to manage sage grouse populations and their habitats (Connelly et al 2000). "When restoring habitats dominated by Wyoming big sagebrush, regardless of techniques used (e.g. prescribed fire, herbicides), do not treat >20% of the breeding habitat (including areas burned by wildfire) within a 30 year period."

⁴ Adapted from the guidelines to manage sage grouse populations and their habitats (Connelly et al 2000). "When restoring habitats dominated by mountain big sagebrush, regardless of techniques used (e.g. fire, herbicides), treat ≤20% of the breeding habitat (including areas burned by wildfire) within a 20 year period."

⁵ Adapted from the guidelines to manage sage grouse populations and their habitats (Connelly et al 2000). "[D]o not burn >20% of an area used by sage grouse during winter within any 20-30 year period (depending on the estimated recovery time for the sagebrush habitat)."

- The proposed total treatment area of 16,930 acres in all vegetation and habitat types is well within the maximum of 23,899 acres (15% of the Bridgeport Valley and Bodie Hills Management areas) to be treated over 10 years (Bishop Fire Management Plan, pg. 24, 53). If wildfire acres exceed the fire management plan goal of 3182 acres during the 10 year period, the acreages of treatments will be adjusted to account for those burned in wildfire (Bishop Fire Management Plan pg. 51). Acres in the target ecological systems that have been burned by wildfire will be considered treated and subtracted from the treatment targets.
- To reduce impacts to migratory birds, the project analysis and implementation will follow the guidance in the April 12th, 2010 MOU between the BLM and the US Fish and Wildlife Service (BLM MOU WO-230-2010-04) to promote the conservation of migratory birds.
- Treatments in sage grouse habitat will conform with direction in the Bishop RMP and incorporate recommendations from the Greater Sage Grouse Conservation Plan for the Bi-state Plan Area, Nevada and Eastern California (Nevada Department of Wildlife 2004).
- In areas of potential pygmy rabbit habitat, burrow surveys will be conducted before project implementation. To protect and improve habitat for pygmy rabbits, exclusion areas would be identified where surveys have identified extant pygmy rabbit populations and/or burrow systems that may be adversely affected by proposed treatment activities. No broadcast burning or piling and/or pile burning would be allowed in areas identified for exclusion.

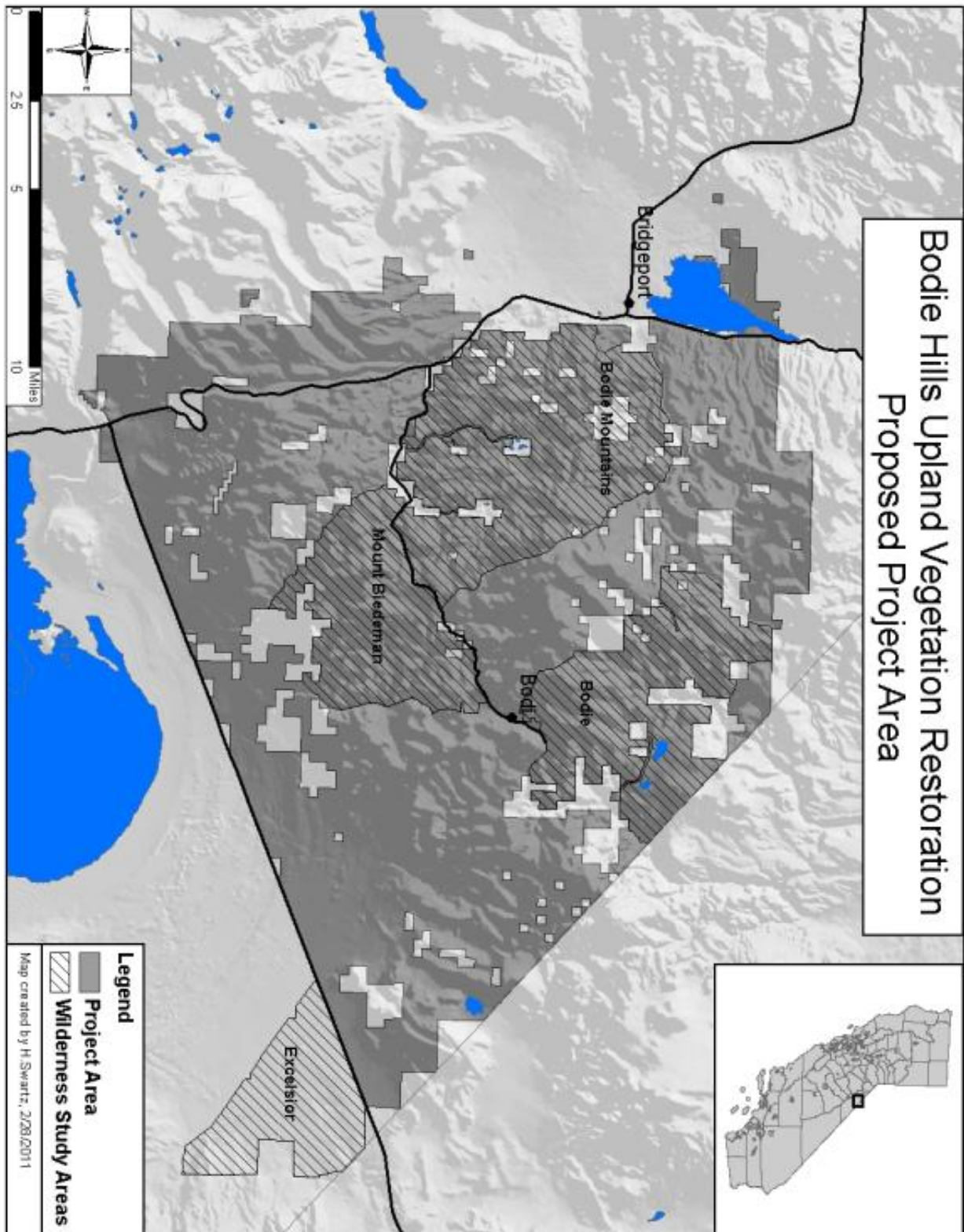
Monitoring Plan:

- A subset of the treatment units will be selected in the Bishop BLM-Inyo National Forest Interagency vegetation treatment monitoring program to be monitored for effectiveness (fuel load, vegetation structure and composition). (Bishop Fire Management Plan pg. 147-151).
- Treatment units will be surveyed after implementation for non-native species (see weeds).
- Any post prescribed burn cultural surveys will be done if they were identified during unit layout as needed based on site sensitivity (see cultural resources).

References:

- Connolly, J. W., M. A. Schroeder, et al. (2000). "Guidelines to manage sage grouse populations and their habitats." *Wildlife Society Bulletin* **28**(4): 967-985.
- Nevada Department of Wildlife (2004). Greater Sage-Grouse Conservation Plan for the Bi-State Plan Area of Nevada and Eastern California: 193.
- Provencher, L., G. Low, et al. (2009). Bodie Hills Conservation Action Planning. Final Report to the Bureau of Land Management Bishop Field Office. Reno, NV, The Nature Conservancy: 369.
- US Department of the Interior, Bureau of Land Management, (1995). H-8550-1 Interim management policy for lands under wilderness review.
- US Department of the Interior, Bureau of Land Management, Bishop Field Office (1993). Bishop Resource Management Plan and Record of Decision. Bishop, CA: 63.
- US Department of the Interior, Bureau of Land Management, Bishop Field Office (2004). Amendment to the Bishop Resource Management Plan to Incorporate Fire Management Plan Strategies and Objectives. Bishop, CA.

Appendix A: Project Area Map



Appendix B: Vegetation Classes

Definitions of the vegetation classes for the target ecological systems in the Bodie Hills as described in Provencher et al, 2009.

1. Basin Wildrye-Basin Big Sagebrush

A *Early*: 0-20% cover of basin wildrye

B *Mid--Closed*: 21-80% cover of basin wildrye

C na

D *Late-open*: 11-20% cover of big sagebrush; <75% cover of basin wildrye

E na

U *ShAG*: Shrub-Annual-Grass; 11-20% cover of big sage; 11-30% basin wildrye; <30% cover of cheatgrass

U *AG*: Annual-Grass; 10-40% cover of cheatgrass

U *TrEnc*: Tree-Encroached; 10-40% cover of conifers; <10% herbaceous cover

U *TrAG*: Tree-Annual-Grass; 10-40% cover of conifers; 5-20% cover annual grasses

U *EXF*: Exotic-Forbs; 20-100% exotic forbs (knapweed, tall whitetop, purple loosetrife)

U *ESH*: *Early*-Shrub; 0-40% cover of rabbitbrush species

2. Low Sagebrush

A *Early*: 0-10% herbaceous cover; 0-10% cover of rabbitbrush

B *Mid1-open*: 11-20% cover of low sage <0.5m; 10-20% herbaceous cover

C na

D na

E *Late1-open*: cover of trees 0-10% <5m; 15-25% cover of low sage; 5-20% herbaceous cover

U *ShAP*: Shrub-Annual-Grass-Perennial-Grass; 5-20% cover of low sage <0.5m; 5-20% native herbaceous cover; 5-15% cheatgrass cover

U *AG*: Annual-Grasses; 5-20% cheatgrass cover

U *TrEnc*: Tree-Encroached; 10-30% cover of trees; <5% herbaceous cover

3. Montane Sagebrush Steppe

A *Early*: 0-10% canopy of mountain sage/mountain brush; >50% grass/forb cover

B *Mid--open*: 11-30% cover of mountain sage/mountain shrub; >50% herbaceous cover

C *Mid--closed*; 31-50% cover of mountain sage/mountain brush; 25-50% herbaceous cover, <10% conifer sapling cover

D *Late-open*: 10-30% cover conifer <10m; 25-40% cover of mountain sage/mountain brush; <30% herbaceous cover

E *Late-closed*: 31-80% conifer cover 10-25m; 6-20% shrub cover; <20% herbaceous cover

U *ESH*: *Early*-Shrub; 0-40% cover rabbitbrush species

U *TrEnc*: Tree-Encroached; 31-80% conifer cover 10-25m; <5% shrub cover; <5% herbaceous cover

U *DPL*: Depleted; 31-50% cover of mountain sage/mountain brush; <5% herbaceous cover; <10% conifer sapling cover

U *ShAG*: Shrub-Annual-Grass; 31-50% cover of mountain sage/mountain brush; 5-40% cheatgrass cover; <10% conifer sapling cover

U *ShAP*: Shrub-Annual-Grass-Perennial-Grass; 31-50% cover of mountain sage/mountain brush; 5-30% cover of native grass; 5-10% cheatgrass cover; <10% conifer sapling cover

U *AG*: Annual-Grass; 10-30% cover of cheatgrass

4. Mountain Shrub

A *Early*: 0-40% shrubs <0.5m tall

B *Mid1 –closed*: 10-30% cover shrubs 0.5-2.9m tall

C *Late1 –closed*: 30-60% cover shrubs 0.5-2.9m tall

D *Late1 –open*: 5-15% cover conifers 5-24m tall

U *TrEnc*: Tree-Encroached; 31-80% conifer cover 10-25m, <5% shrub cover, <5% herbaceous cover

U *ESH*: *Early*-Shrub; 0-40% cover rabbitbrush species

5. Wyoming Big Sagebrush: loamy

A *Early*: 20-40% herbaceous cover, <10% cover of rabbitbrush species and Wyoming big sage

B *Mid1-open*: 11-20% cover Wyoming big sagebrush; 10-40% herbaceous cover

C *Late1-closed*: 20-40% cover of Wyoming big sage; <20% native herbaceous cover

D *Late2-open*: 0-10% pinyon or juniper <5m tall, 20-30% cover of Wyoming big sage; <10% native herbaceous cover

E *Late2-closed*: 11-60% pinyon or juniper <10m tall, 10% cover of Wyoming big sage; <10% native herbaceous cover

U *ShAP*: Shrub-Annual-Grass-Perennial Grass; 10-30% Wyoming big sage <0.5m, 5-20% native grass cover; 5-20% cover cheatgrass

U *ShAG*: Shrub-Annual-Grass; 10-30% Wyoming big sage <0.5m; 10-30% cover cheatgrass

U *DPL*: Depleted; 10-40% Wyoming big sage <1.0m; herbaceous cover <5%

U *AG*: Annual-Grass; 10-40% cover of cheatgrass

U *ESH*: *Early*-Shrub; >10% cover of rabbitbrush; native grass cover variable

U *TrEnc*: Tree-Encroached; 11-60% cover of trees 5-9m; <5% cover of cheatgrass; <5% cover of native grass

U *TrAG*: Tree-Annual-Grass; 11-60% cover of trees 5-9m; 5-20% cheatgrass cover

6. Wyoming Big Sagebrush: sandy

A *Early*: 10-25% herbaceous cover, <10% cover of rabbitbrush species and Wyoming big sage

B *Mid--open*: 11-20% cover Wyoming big sagebrush; 10-25% herbaceous cover

C *Late-closed*: 20-40% cover of Wyoming big sage; <15% native herbaceous cover

D *Late2-open*: 0-10% pinyon or juniper <5m tall, 20-30% cover of Wyoming big sage; <10% native herbaceous cover

E *Late2-closed*: 11-60% pinyon or juniper <10m tall, 10% cover of Wyoming big sage; <10% native herbaceous cover

U *DPL*: Depleted; 10-40% Wyoming big sage <1.0m; herbaceous cover <5%

U *DPL*: Depleted; 10-40% Wyoming big sage <1.0m; herbaceous cover <5%

U *TrEnc*: Tree-Encroached; 10-40% cover of pinyon or juniper

7. Montane-Subalpine Riparian

A *Early*; 0-50% cover of riparian shrubs (willow, cottonwood, buffaloberry); <3m

B na

C *Mid1-open*; 31-100% cover of riparian trees <10m

D na

E *Late1-closed*; 31-100% cover of riparian trees 10-24m

U *SFEnc*: Shrub-Forb-Encroached; 0-30% cover of shrubs and trees >3m

U *EXF*: Exotic-Forbs; 20-100% cover of exotic forbs (knapweed, tall whitetop, purple loosertrife), salt cedar, or Russian olive

U *DES*: Desertification; Entrenched river/creek with 10-50% cover of upland shrubs (e.g., big sage)

8. Stable Aspen

A *Early*; 0-100% cover of aspen <5m tall

B *Mid1-closed*; 40-99% cover of aspen <5-10m

C Na

D *Late1-open*; 0-39% cover of aspen 10-25 m; 0-25% conifer cover 10-25 m

E *Late1-closed*; 40-99% cover of aspen 10-25m; few conifers in mid-story

U *DPL-Open*: 10-50% cover of older aspen 10-25m; no or little aspen regeneration; few conifers in mid-story

U *NAS-all*: No Aspen; dead clone of aspen; 5-50% cover of mountain sagebrush/mountain shrub; <50% herbaceous cover

U *Uncharacteristic*: includes several uncharacteristic NAS classes as observed in montane sagebrush steppe biophysical setting

9. Wet Meadow

A *Early-open*: 0-60% herbaceous cover

B *Mid--closed*: 61-100% herbaceous cover

C Na

D *Late-open*: 0-10% tree-shrub cover; 60-80% herbaceous cover

E Na

U *SFEnc-All*: Shrub-Forb-Encroached; 0-10% cover of less palatable grasses and forbs; bareground cover 10-30% cover

U *EXF*: Exotic-Forbs; 20-100% exotic forbs (knapweed, tall whitetop, purple loosertrife)

U *DES*: Desertification; Entrenched water table with 10-50% cover of sagebrush

U *AG*: Annual-Grass; 10-30% cover of cheatgrass; < 10% shrub cover

U *TrEnc*: Tree-Encroached; 31-80% conifer cover 10-25m; <5% shrub cover; <5% herbaceous cover