Wildlife-Discipline Input
into Proposed Plant Species Composition and Basis of this Input
— K-17 Allotment Management Planning Process —

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Summary

Herbaceous species composition is one of the two most important wildlife-related issues for this project; high species richness and high abundance (i.e., high species diversity) of perennial plant species is a critical component of wildlife habitat. Having a desired condition statement for herbaceous species composition that reflects suitable habitat conditions for wildlife (i.e., stepped down from Objective 2.1(a), 3.3(a), 4.7(a), and 4.7(b), and migratory bird principles and measure) is central to being able to manage livestock grazing in a way that allows Forest Plan direction to be achieved and for migratory bird requirements to be met.

The Proposed Action's original desired condition for plant species composition set a very low bar with respect to habitat suitability for wildlife. Numerous plant communities in the K-17 project area currently dominated by mule ears, Louisiana sagewort, western coneflower, and orange sneeze weed (a consequence mainly of historic sheep grazing) are in less-than-suitable condition for wildlife, but would be deemed to meet desired conditions under the Proposed Action. Reliance on medium and high watershed-value plant species in the proposed desired condition statement for plant species composition is a key reason for the shortcoming. Mule ears, black coneflower, cutleaf balsamroot, and Louisiana sagewort) are of moderate value for watershed protection (R4 Amend. 2209.21-2005-1), but when they dominate plant communities (e.g., as a consequence of historic heavy sheep grazing), they provide very-low-quality wildlife habitat.

Additions made to desired condition statements for several vegetation types (based on an earlier version of this report) more accurately reflects suitable conditions for wildlife, which would prompt adjustments to sheep grazing management to allow upward trends in degraded plant communities in these types. While the adjusted desired conditions for plant species composition in forbland types still sets a relatively low bar from the standpoint of wildlife habitat (especially for mule ears, Louisiana sagewort, and orange sneezeweed types), it would appear to be minimally satisfactory in the short term for wildlife because it would prompt upward trends in plant communities that have low plant species richness. Desired plant species composition is missing from the Adjusted Proposed Action for aspen-forb types, meaning that current conditions in degraded aspen stands can continue and aspen stands currently having suitable plant species composition could decline with the way desired conditions are defined in the Adjusted Proposed Action. This is important given the high importance of aspen habitat to wildlife and the great importance of high forb diversity in these habitats.

Recognition needs to be given to some plant communities dominated by mule ears that may not recover due to the inability for soil to build on these sites, even over many, many decades. Altered sites that have less-than-suitable habitat should never be deemed to be at desired condition.

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Introduction

The purpose of this report is to outline recommended changes to the Proposed Action or addition of a new alternative to build in suitable plant species composition for wildlife (i.e., "long-term" habitat needs, as required for DFC 10 areas, which comprise 51% of the K-17 project area). A separate report addresses short-term habitat needs.

I identified two main shortcomings of the June 22, 2017 Proposed Action for K-17 alternatives, with respect to wildlife, in the January 17, 2018 interdisciplinary meeting: (1) the proposed desired plant species composition would result in less-than-suitable habitat conditions for wildlife (addressed in this report), and (2) the proposed maximum utilization limit of 50% key forage was not designed to meet wildlife needs and would result in less-than-suitable habitat conditions for wildlife (see separate report). I expressed the same concerns for the LaBarge Creek allotment project.

Section 92.31 of WO Amendment 2209.13-2005-10 states that, "When there is a significant issue with the proposed action, an alternative to the proposed action shall be developed and analyzed in detail (FSH 1909.15, sec. 14). <u>In all cases, the rationale and development of alternatives shall be addressed and disclosed</u> in the NEPA analysis for the project." emphasis added. This report outlines the rationale from the standpoint of the wildlife discipline.

I. Wildlife Issue Related to Plant Species Composition

> ***Issue: The desired plant species composition and desired ground cover thresholds in the Proposed Action would allow less-than-suitable habitat conditions for wildlife to persist and would allow habitat currently in suitable conditions to deteriorate to less-than-suitable conditions for wildlife. Less-than-suitable conditions in some situations (e.g., forbland communities and understories now heavily dominated by mule ears, bicolor biscuitroot, Louisiana sagewort, western coneflower, and orange sneezeweed) represent major deviations from suitable conditions for wildlife, meaning the proposed desired condition for plant species composition (1) can have large negative effects on wildlife, which would contribute to negative effects in other parts of the BTNF; and (2) falls short of suitable and adequate habitat as addressed in Objectives 2.1(a) and 3.3(a), Fisheries and Wildlife Prescription, and Rangeland Vegetation Prescription (see also Objectives 4.7(a) and 4.7(b), Forage Improvement Standard, and Allotment Management Plan Standard).***

How desired herbaceous species composition and desired ground cover (especially the former) are defined for forbland, aspen, big sagebrush, moist meadow, silver sagebrush, and moist meadow communities is a very big issue for wildlife in the K-17 allotments (probably the no. 1 issue for this project with respect to wildlife). In their scoping letter, WGFD (2017) expressed concern and asked questions about plant species composition and ground cover, as they pertain to wildlife habitat.

In my May 3, 2017 input into the decision whether to prepare an EA or EIS for K-17 allotments project, I stated that the Proposed Action's desired plant species composition "…is inadequate for wildlife. Using this for desired conditions has high potential for maintaining less-than-suitable habitat conditions for wildlife and allowing currently-suitable habitat conditions to deteriorate."

The benchmarks for herbaceous species composition in the Proposed Action sets a very low bar that allows less-than-suitable conditions for wildlife to persist and for currently-suitable conditions to decline to less-than-suitable conditions for wildlife.

Chapter 90 (R4 Amendment 2209.21-2005-1) calls for an interdisciplinary approach to be used in defining desired conditions. Wildlife-discipline input is critical in defining desired conditions for the K-17 allotments given that 87% of the K-17 allotments are in DFC 10 and 12 areas, and given Objectives 2.1(a) and 3.3(a), and the Fisheries and Wildlife Prescription, as well as the Rangeland Vegetation Prescription, Forage Improvement Standard, and Objectives 4.7(a) and 4.7(b) as they pertain to wildlife.

Making adjustments to the Proposed Action or adding a fourth alternative to address this wildlife issue would respond to Scoping Comments 3-27 (the proposal fails to deal with pollinator issues), 3-45 (use levels must provide necessary seed heads and flowers for various wildlife and pollinators, as well as various snails, frogs, and toads), as well as to scoping comments made by the WGFD and by a member of the public (both expressed concern about using different ground cover thresholds than are in R4 Amendment 2209.21-2005-1 and the multiplier of 0.85).

On the first page of their scoping letter, WGFD stated that, "Because much of this area is recovering from documented historic impacts from the early to mid 1900s, we support a NEPA process that considers alternatives that evaluate management actions that may restore degraded habitat on important wildlife areas," emphasis added (WGFD 2017). The proposed desired condition statement for plant species composition would not allow for and could potentially hinder restoration of degraded habitat on important wildlife areas. The ability to manage sheep to allow recovery of these areas is somewhat questionable in the Adjusted Proposed Action.

WGFD also stated that "The vast scale of the project area elevates the importance of this analysis for the Department, since the resulting management plan could potentially affect a wide variety of wildlife species…" (WGFD 2017).

II. Foundations of Suitable Plant Species Composition for Wildlife

Herbaceous species composition consists of species richness and the relative amount of each species, with the amount of each species typically being measured in terms of canopy cover, weight, density, or basal area. Measures of species composition typically are presented in terms of the composition that is *produced* in a given year (i.e., as measured after plants have matured but before they have been grazed). It is important to recognize that *functional* plant species composition (what is available to wildlife at any given time during the summer) changes over time as the growing season progresses and then as grazing takes place; the latter specific aspect of herbaceous species composition (changes in functional species composition as the grazing season progresses) is addressed in the "Herbaceous Retention" section. The "Herbaceous Species Composition" section only addresses the plant species composition that is produced.

Herbaceous species richness is not just the *number* of herbaceous species. It also takes into account the actual species; i.e., distinction between particular species. For example, it is important to distinguish between native and nonnative species, and between increaser and decreaser species (e.g., Kie et al. 1994). Highlighting the importance of herbaceous species richness is also important on the West Zone of the BTNF because there continues to be a push to rely exclusively on the list of R4 watershed-protection species (those with a medium or high rating in the watershed protection column in Region 4 Range Management Resource Value Rating Guide (Exhibit 01 of R4 Amendment 2209.21-2005-1, section 22.4), and because (1) many species of high importance to wildlife are rated as low in the watershed-protection column, and (2) dominance by some plant species rated as medium or high in the watershed-protection column is harmful to wildlife. See the "Applicability of R4 Watershed-protection Species" section, below, for a detailed discussion of this. For the native species, it is important to keep track of the particular species that naturally grow in a given area since these are the species that are needed by the suite of wildlife species that naturally occurred there.

Percent ground cover, also covered under this section, is applicable to wildlife in several ways, including: (1) it provides a coarse-filter indication of plant species composition, which is highly important to wildlife; (2) ground cover is central to sustaining the capability of the land to produce wildlife habitat, including as related to plant species composition; and (3) ground cover provides a proxy of litter cover, which is an important component of wildlife habitat. Providing a coarse indicator of herbaceous species composition was pointed out in USFS (2009a): "…ground cover below about 60% indicates very low plant species diversity in many rangeland types." If ground cover is near or below 60%, the first order of business is to increase ground cover to the point that plant species richness can begin to increase and for desired plant species to begin increasing in abundance and canopy cover. Restated, as herbaceous species composition on a site approaches desired levels, the utility of percent ground cover as a desired condition or objective declines and, conversely, as herbaceous species composition declines toward 60%, the utility of ground cover as a desired condition or objective increases.

Where individual vegetation types are addressed in this section, the focus is on forbland and aspen types since desired conditions for wet meadow communities; willow communities; moist meadow, silver sagebrush, and shrubby cinquefoil communities; and mountain big sagebrush, snowfield sagebrush, and mountain shrubland communities were defined on page 3 of the June 29, 2016 Proposed Action for the LaBarge Cattle Allotment management planning project. With a few exceptions (see II.A.1.b, above), these conditions generally reflect suitable conditions for wildlife. The basis of suitable plant species composition for these vegetation types was summarized in a report titled, *"Definition of Suitable Conditions for Habitat & Survival Elements for Wildlife — LaBarge Allotment Management Planning Process"* by DeLong (2016b).

The only vegetation types missing from the June 29, 2016 effort that apply to K-17 allotments are forbland and aspen types, and one of the handouts sent in an email on January 18, 2018 define suitable herbaceous species composition for wildlife in forbland communities. These conditions generally apply to the herbaceous understory component of aspen and subalpine big sagebrush communities. Handouts included in the January 18, 2018 email also included a summary of the basis of suitable plant species composition in forbland communities.

A. Management Direction

Together, Forest Plan and migratory bird directives (below) require that riparian areas, rangelands, and forestlands provide suitable habitat for native ungulates, sensitive species, and migratory birds, and an important part of this is providing a composition of herbaceous species — by vegetation type — that meets the needs of these species. This has special application to DFC 10 and 12 parts of the project area.

The general statement of suitable plant species composition (first paragraph of section III.1, page 28) was worded to meet (1) Forest Plan direction calling for sustainable rangelands and riparian areas (including the Objective 4.7(a) and Rangeland Vegetation Prescription) and for providing adequate amounts of suitable habitat for wildlife (Objectives 2.1(a) and 3.3(a)); (2) migratory bird requirements to provide suitable habitat for migratory birds consistent with large-scale migratory bird conservation plans; and (3) direction in the 2012 Planning Rule for wildlife habitat; and to be consistent with Principles A.1 and A.2. Scientific and ecological information was then used to more specifically define the general statement of suitable plant species composition (see part III of this report).

As explained in the 2012 Planning Rule, the coarse-filter / fine-filter approach is the most practical approach to meeting the countless, many times competing, needs of and requirements for the numerous wildlife species the agency is responsible for meeting. The basis may be best summarized as follows:

> "Maintaining or restoring ecological conditions similar to those under which native species have evolved therefore offers the best assurance against losses of biological diversity and maintains habitats for the vast majority of species in an area, subject to factors outside of the Agency's control, such as climate change..." (USDA 2012:21212)
>
> A key underpinning of the 2012 Planning Rule's focus on the coarse-filter / fine-filter approach is "to keep common native species common, contribute to the recovery of threatened and endangered species, conserve candidate and proposed species, and maintain viable populations of species of conservation concern within the plan area." To do this management needs to focus on "Maintaining or restoring ecological conditions similar to those under which native species have evolved." (USDA 2012:21212)
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> As noted in the 2012 Planning Rule, the coarse-filter / fine-filter approach "…is a well-developed concept in the scientific literature and has broad support from the scientific community." Principle A.2,

which includes literature citations, is part-and-parcel with the coarse-filter / fine-filter approach. Iverson (2001), a former Deputy Regional Forester for Region 4, explains the approach in general terms, and Haufler et al. (1999) and Applet et al. (1999) explain the concept in more detail.

Approximating a relatively-natural composition of herbaceous vegetation (or, herbaceous species composition that existed when native wildlife-communities formed in the area) is consistent with guidance in Chapter 20 of FSH 2209. Section 22.1.4 of FSH 2209.21 stated that “the Range Inventory Standardization Committee Report (1983) suggests that a value of 75 percent similar or greater [with respect to potential natural community, or PNC] may be used to differentiate between meeting and not meeting management objectives.” A minimum 75% similarity to potential natural community adopted in a Record of Decision for managing livestock grazing in the Wyoming Range Allotment Complex (USFS 2004b), which consisted of seven sheep allotments on the Big Piney, Jackson, and Greys River Districts of the BTNF. As a comparison, the Fish Habitat Management Guideline states that fish “…habitat should be improved or maintained to at least 90% of its natural potential” and the Streambank Stability Guideline states that “Streambank vegetation should be maintained to 80% of its potential natural condition…” (USFS 1990:126). From this standpoint, it would be difficult to argue that a minimum 75% similarity is too high of a bar to meet.

While forage preferences are known for some wildlife species (see Appendix A), they are poorly understood for most herbivorous species, meaning that it would be impractical to formulate, from scratch, a desired mix of grasses, sedges, forbs, and shrubs to meet the dietary needs of herbivorous wildlife. This is one reason why the only practical way to provide for the needs of native wildlife-communities is to approximate the conditions under which native wildlife-communities formed (i.e., relatively natural conditions). And this is only one aspect of herbaceous vegetation; individual wildlife-species needs for hiding cover, nesting cover, living space, humidity retention, and invertebrate-prey habitat would also need to be built in. This touches on a key reason why the 2012 Planning Rule focuses on the basic principle of approximating conditions under which native wildlife-communities developed as the best strategy for conserving wildlife.

1. Upshot of Management Direction for Suitable Herbaceous Retention for Wildlife

The upshot for suitable plant species composition for wildlife, at the level defined in the Forest Plan and other management direction, is generally as follows:

> A relatively-natural composition of herbaceous vegetation is provided in forbland, aspen, mountain big sagebrush, mountain shrubland, moist meadow, silver sagebrush, and wet meadow communities, as outlined in each of the following subsections. In terms of range condition, this translates to 75-100% similarity to potential natural community in most situations, which is consistent with section 22.1.4 of FSH 2209.21.

This is based on the collective and combined direction outlined in the Forest Plan Objectives 2.1(a), 3.3(a), 4.7(a) and 4.7(b) (for wildlife); Fisheries and Wildlife Prescription; Range Vegetation Prescription; migratory bird requirements; Forest Service policy (e.g., 2202.1.1-3, 2630.3.2-3), and new direction under the 2012 Planning Rule. Migratory bird requirements include requirements to “restore and enhance the habitat of migratory birds, as practicable” and to “Avoid or minimize the alteration of the environment and other adverse impacts on migratory birds” (Executive Order 13186, section 3); migratory bird conservation principles, measures, and practices; applicable Forest Service policy and guidance; and on direction in the 2012 Planning Rule. Forest Plan direction and migratory bird requirements provided the main foundation of the generally-stated suitable condition, but because Forest Plan direction is based on applicable laws (e.g., National Forest Management Act, Multiple-use Sustained Yield Act), regulation, and Forest Service policy, the generally-stated suitable condition statement outlined above supports this higher-level direction as well.

As recognized in the 2012 Planning Rule, the best way and possibly the only way to meet all wildlife-related requirements is to restore or approximate the conditions under which wildlife communities formed, and for herbaceous, aspen-herb, and shrub-herb types addressed in this report, this appears to be best represented by potential natural community (PNC); see introduction to section II.A. “Management Direction” and section II.C.2, “Range Condition”).

This general definition of suitable herbaceous retention was stepped-down to a definition of suitable herbaceous retention having greater specificity, including numbers, using a wealth of scientific information, as summarized in “E. Scientific Basis of Suitable Herbaceous Retention Levels,” below. This greater specificity — especially numeric thresholds — based on scientific information is needed to provide input into prescribing utilization limits, since utilization limits are numeric.

2. Forest Plan

The general framework for defining suitable plant species composition for wildlife in forbland, big sagebrush, mountain shrubland, aspen, silver sagebrush, moist meadow vegetation types is primarily defined by the following goals, objectives, standards, prescriptions, and guidelines:

<u>Provision of Suitable Habitat Conditions</u>

- Objective 2.1(a) — Provide suitable and adequate habitat to support the game and fish population objectives established by the WGFD.
- Objective 3.3(a) — Protect [Region 4] sensitive plant and animal species and provide suitable and adequate amounts of habitat to ensure that activities do not cause: (1) long-term or further decline in population numbers or habitats supporting these populations; and, (2) trends toward federal listing.
- Fisheries and Wildlife Prescription (BTNF-wide) — The BTNF provides habitat adequate to meet the needs of dependent fish and wildlife populations, including those of threatened, endangered, and sensitive species.
- Habitat Diversity Guideline (DFC 2A) — Diverse fish and wildlife habitat types should be maintained in each watershed to provide sufficient habitat to meet WGFD population objectives and distribution of native wildlife including non-game, small game, big game, fish, and threatened and endangered species.

<u>Retention or Improvement of Habitat Conditions</u>

- Objective 4.7(a) — Retain or improve forage and overall range condition.
- Objective 4.7(b) — Retain or enhance riparian vegetation, stream-channel stability, sensitive soils, and water quality where livestock are present.
- Sensitive Species Management Standard (BTNF-wide) — …Crucial habitats of priority I, II, and III species as listed by WGFD and R4’s sensitive species list will be protected and maintained…
- Vegetation: Range Prescription (BTNF-wide) — Forage is provided on a sustained-yield basis that protects rangeland values, wildlife habitat, and meets other resource needs and, for DFC 12 areas, particularly big game.
- Allotment Management Plan Standard (BTNF-wide) — Fisheries; riparian habitats; and threatened, endangered, and sensitive species’ needs will be addressed in allotment management plans. Findings from big-game winter range evaluations will be incorporated into allotment management plans as wildlife habitat objectives and management procedures. Plans will identify the amount and kind of streamside vegetation needed to maintain or improve riparian areas.
- Forage Improvement Standard (BTNF-wide) — Range in less-than-satisfactory condition will be improved. Disturbed areas will be stabilized or regenerated prior to resuming grazing use.
- Streambank Stability Guideline (BTNF-wide) — At least 90 percent of the natural bank stability of streams that support a fishery, particularly threatened, endangered, and sensitive species, and all trout species, should be maintained. Streambank vegetation should be maintained to 80 percent of its potential natural condition or an HCI rating of 85 or greater. Streambank stability vegetation and fish numbers and biomass should be managed by streamtype.

Prescribing Use Limits to Meet Forest Plan Objectives

- Forage Utilization Standard (BTNF-wide) — …During AMP revision, the ID Team and livestock permittees will prescribe site-specific utilization levels needed to meet Forest Plan objectives… Site-specific utilization levels on key wildlife ranges will be established by an ID Team. ID Teams will prescribe other proper-use standards to achieve site-specific objectives for the rangeland being managed… [Pertinent objectives for wildlife are Objectives 2.1(a), 3.3(a), and 4.7(a, b, and d).]

This standard was included because it highlights the need to specify and quantify plant species composition sufficiently to be able to prescribe utilization limits to meet the objectives. Without quantifying desired plant species composition, comparison to existing conditions would not provide useable information to adjust utilization limits.

3. National Direction

Forest Plan direction was based on national-level laws, regulations, and policy (except for migratory bird requirements, which came after the Forest Plan was completed), meaning that suitable conditions for plant species composition is ultimately defined to support this higher-level direction.

a. Laws

- Organic Administration Act of 1897 (16 USC 475) — National forests shall be established "…to improve and protect the forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States…" (emphasis added).
- Multiple-Use Sustained Yield Act of 1960 (16 USC 528) — "…it is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes. The purposes of this Act [e.g., range] are declared to be supplemental to, but not in derogation of, the purposes for which the national forests were established as set forth in the Act of June 4, 1897 (16 USC 475) [e.g., securing favorable conditions of water flows]."

b. FSM (Policy)

- FSM 2202.1 — *National Forest System Objectives* for range management programs on National Forests (those applicable to forbland, aspen-herb, big sagebrush, mountain shrubland, and moist meadow types):
    1. To manage range vegetation to protect basic soil and water resources, provide for ecological diversity, improve or maintain environmental quality, and meet public needs for interrelated resource uses.
    2. To integrate management of range vegetation with other resource programs to achieve multiple objectives contained in Forest land and resource management plans.
    3. To provide for livestock forage, wildlife food and habitat, outdoor recreation, and other resource values dependent on range vegetation.
- FSM 2520.2 — *National Forest System Objectives* for watersheds on National Forest System lands (those applicable to water quality):

  To protect National Forest System watersheds by implementing practices designed to maintain or improve watershed condition, which is the foundation for sustaining ecosystems and the production of renewable natural resources, values, and benefits.
- FSM 2522.02 — *National Forest System Objectives* for watershed improvement on National Forest System lands (those applicable to soils in water quality):
    1. To restore degraded watershed conditions by stabilizing soil, controlling surface runoff and erosion, reducing flood potential, improving long-term soil productivity, and stabilizing drainage network.

2. To improve watershed conditions.

- FSM 2522.03 — *National Forest System Policy* for watersheds on National Forest System lands (as it applies to lands impacted by historic livestock grazing):

    4. Assign priorities for improving watershed condition in order of decreasing importance as follows:

        a. Those posing menace to life or property because of flood threats or possible mud or debris flows.

        b. Those not meeting, or facing an imminent threat of not meeting, water quality requirements of the Forest Plan.

        c. Those needing action to maintain water quality or achieve other Forest plan goals and objectives.

- FSM 2630.2 — *National Forest System Objective* for wildlife habitat management on National Forest System lands:

    To maintain and improve wildlife and fish habitat as identified in the Forest Plan.

- FSM 2630.3 — *National Forest System Policy* for wildlife habitat management on National Forest System lands (as it applies to livestock grazing management):

    2. Coordinate with other uses and activities to accomplish habitat management objectives and to reduce detrimental effects on wildlife and fisheries.

    3. Mitigate the negative effects of other resource projects upon wildlife and fish habitat.

<u>c. FSH (Guidance)</u>

i. 91.1 - Consistency with Land and Resource Management Plan

Section 91.1 of WO Amendment 2209.13-2005-10 (Chapter 90) states that "Consistency [in allotment management planning] is determined by examining whether the project-level decision implements the goals, objectives, desired conditions, standards and guidelines, and monitoring requirements from the LRMP. Where necessary, grazing permits must be modified to ensure consistency with the LRMP" (see also, Forage Utilization Standard, above).

ii. 92.11 - Identification of Desired Conditions

Section 92.11 of WO Amendment 2209.13-2005-10 provides the following direction for defining desired conditions:

> A team, using an interdisciplinary approach, identifies the desired conditions for rangelands and other related resources within the analysis area. Desired conditions should be specific, quantifiable, and focused. Desired condition statements have two distinct scales.
>
> 1. At the landscape scale, desired conditions are generally taken directly from the LRMP.
>
> 2. At the broad scale, desired conditions are then further described on a site-specific scale for reference areas.
>
> Monitoring can then tie to these reference areas as a means of determining progress toward meeting the desired conditions.

The first scale is addressed in "a. Generally-stated Desired Conditions for Herb Retention for Wildlife in the Forest Plan" under the section, "1. Forest Plan," above.

Desired conditions at the second scale are outlined in "3. Herbaceous Retention for Wildlife" in part II.A near the beginning of the report.

iii. Plant Species Composition and Ground Cover

FSH 2209.22.1 — *Upland Rangeland Health Criteria*. The following criteria provide targets for achieving Objective 1, above.

1. *Non-Native Invasive Species:* If non-native invasives or noxious weeds present, the rangeland is functioning-at-risk at best, and if the non-native invasive plant population is abundant and/ or dense, the rangeland is not functioning, even if adequate ground cover exists.

2. FSH 2209.22.1.2 — *Ground Cover:* If ground cover is greater than a described threshold to prevent adverse soil impacts, the rangeland is functioning from a watershed sustainability standpoint. A minimum of 60 percent ground cover is a general standard for limiting water erosion for the Region, except for certain geologic and soil types that this criterion cannot be achieved; for example, like the Mancos Shale. Ground cover is basal vegetation, litter, moss/lichen, or rock greater than three-fourths inch diameter.

   The minimum ground cover needed for proper functioning sustainable ecosystems for primary vegetation cover types in the Region are (revise these for site-specificity for rangeland project analysis or Forest Plan analysis):

Cover Type	Percent Ground Cover For Functionality
Alpine	90
Aspen	80
Mountain Big Sagebrush	70
Tall Forb	80
Pinyon-Juniper	60
Mountain Mahogany	75
Gamble Oak	75
Mountain Brush	70

3. FSH 2209.22.1.3 — *Shrub Cover:* The desired mix of cover classes for sustainable and functional sagebrush ecosystems for all ecological purposes and needs is:

   10% of the sagebrush area having 0-5% shrub canopy cover.

   50% of the sagebrush area having 6-15% shrub canopy cover.

   40% of the sagebrush area having >15% shrub canopy cover.

4. FSH 2209.22.1.4 — *Species Composition:* A rangeland site is functioning when all the desired plant species (e.g., all species endemic to the site) are present in the desired amount.

<u>d. Executive Order 13186 and MOU (Forest Service and U.S. Fish and Wildlife Service)</u>

In summary, Executive Order 13186 and USFS and USFWS (2008) require the following things — to extent permitted by law, within administrative budgetary limits, and in harmony with agency missions — (letters correspond to those in the “Summary of Requirements, minus qualifiers” column of Table 1):

(a) Design and integrate migratory bird habitat and population conservation principles, measures, and practices into agency planning processes, plans, actions, and activities (there are three individual requirements for this).

(b) Avoid or minimize the alteration of the environment and other adverse impacts on migratory birds.

(c) Restore and enhance migratory bird habitat.

(d) n/a.

Executive Order 13186 (Federal Register, Vol. 66, No. 11, 2001) outlines responsibilities of federal agencies to protect migratory birds under the Migratory Bird Treaty Act. As explained in the "Purpose and Scope of the MOU between the Forest Service and U.S. Fish and Wildlife Service (2008), "The Executive Order directs agencies to take certain actions to further comply with the migratory bird conventions, the Migratory Bird Treaty Act (MBTA), the Bald and Golden Eagle Protection Act (BGEPA), and other pertinent statutes… The

Table 1. Migratory bird requirements outlined in Executive Order 13186 that are applicable to defining suitable conditions on livestock allotments, and summaries of these requirements.

	Executive Order 13186 requires that all federal agencies, in accordance with its MOU and to the extent to which it is permitted by law, within administrative budgetary limits, and in harmony with agency missions:	**Summary of Requirements, minus qualifiers**
1.	support the conservation intent of migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities	a. Design and integrate migratory bird habitat and population conservation principles, measures, and practices into agency planning processes, plans, actions, and activities.
	…and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions;	b. Avoid or minimize the alteration of the environment and other adverse impacts on migratory birds.
2.	restore and enhance the habitat of migratory birds, as practicable;	c. Restore and enhance migratory bird habitat.
3.	prevent or abate the… detrimental alteration of the environment for the benefit of migratory birds, as practicable;	see "b," above.
4.	design migratory bird habitat and population conservation principles, measures, and practices into agency plans and planning processes (…including, but not limited to, forest and rangeland planning, coastal management planning, watershed planning, etc.) as practicable…;	see "a," above.
5.	[several qualifiers]… ensure that agency plans and actions promote programs and recommendations of comprehensive migratory bird planning efforts such as Partners-in-Flight, U.S. National Shorebird Plan, North American Waterfowl Management Plan, North American Colonial Waterbird Plan, and other planning efforts, as well as guidance from other sources…" (e.g., see Objectives and Recommendations in Wyoming Partners in Flight (2003) and Goals and Objectives in Intermountain West Joint Venture (2005:15-20)).	see "a," above.
6.	[addresses NEPA analysis]	n/a
7.	[addresses permits for intentional take]	n/a
8.	[addresses intentional take]	n/a
9.	identify where unintentional take reasonably attributable to agency actions is having, or is likely to have, a measurable negative effect on migratory bird populations, focusing first on species of concern, priority habitats, and key risk factors. With respect to those actions so identified, the agency shall develop and use principles, standards, and practices that will lessen the amount of unintentional take, developing any such conservation efforts in cooperation with the Service. These principles, standards, and practices shall be regularly evaluated and revised to ensure that they are effective in lessening the detrimental effect of agency actions on migratory bird populations. The agency also shall inventory and monitor bird habitat and populations within the agency's capabilities and authorities to the extent feasible to facilitate decisions about the need for, and effectiveness of, conservation efforts;	d. Lesson the amount of identified unintentional take through the application of principles, standards, and practices.
10 - 15.	n/a to identification of suitable conditions.	n/a

purpose of this MOU is to strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and avoid or minimize adverse impacts on migratory birds…"

Many requirements outlined in Executive Order 13186 are incorporated by reference into USFS and USFWS (2008). For example, the MOU requires both agencies to "Protect, restore, and conserve habitat of migratory birds, addressing the responsibilities in Executive Order 13186." The applicable responsibilities identified in E. O. 13186 are outlined in Table 1. Note that the first responsibility starts with "support the conservation intent of migratory bird conventions…," and other responsibilities similarly use terms like "promote." To reduce the amount of text under each habitat/survival element, requirements of Executive Order 13186 are summarized in a-d in Table 1. Summaries do not include qualifiers (e.g., to the extent permitted by law).

Agency plans and planning processes, in Table 1, include "…forest and rangeland planning, coastal management planning, watershed planning, etc." Note the specific reference to rangeland planning.

Principles, measures, and practices identified in bird conservation plans are central to meeting migratory bird requirements. (The requirement to design and integrate migratory bird habitat and population conservation principles, measures, and practices into agency planning processes, plans, actions, and activities is repeated in three of the 15 requirements of Section (e) of Executive Order 13186.) Pertinent principles, measures, and practices identified in pertinent bird conservation plans are listed in the "Management Direction" section of each of the 11 (I – XI) habitat / survival elements.

With respect to requirements items 1-5 (as summarized in a-c) in Table 1, the focus of habitat restoration and conservation is natural habitats and ecosystems (e.g., the Convention for the Conservation of Migratory Birds and Their Environment-Union of Soviet Socialist Republics 1978), which aligns well with the 2012 Planning Rule's focus on the same thing.

As pointed out by the Regional Office (USFS 2012:7), "Importantly, the MOU directs the agencies to, 'focus on habitat restoration and enhancement where actions can benefit specific ecosystems and the migratory birds dependent on them…'"

Paragraph 'f' of Section 3 of Executive Order 13186 states that, "Notwithstanding the requirement to finalize an MOU within 2 years, each agency is encouraged to immediately begin implementing the conservation measures set forth above in subparagraphs (1) through (15) of this section, as appropriate and practicable." This means that the conservation measures in subparagraphs (1) through (15) would need to be carried out even if the MOU expires without replacement.

<u>e. 2012 Planning Rule</u>

In the near future, wildlife on the BTNF will need to be managed consistent with the 2012 Planning Rule (USDA 2012). A key premise of the 2012 Planning Rule is that approximating conditions under which native wildlife-communities formed is fundamental to sustaining all native wildlife species and keeping common native species common:

> "The Department's intent in providing the requirements in this section is to provide for diversity of plant and animal communities, and provide ecological conditions to keep common native species common, contribute to the recovery of threatened and endangered species, conserve candidate and proposed species, and maintain viable populations of species of conservation concern within the plan area.
>
> The premise behind the coarse-filter approach is that native species evolved and adapted within the limits established by natural landforms, vegetation, and disturbance patterns prior to extensive human alteration. Maintaining or restoring ecological conditions similar to those under which native species have evolved therefore offers the best assurance against losses of biological diversity and maintains habitats for the vast majority of species in an area, subject to factors outside of the Agency's control, such as climate change..." (USDA 2012:21212)

As noted in the 2012 Planning Rule (USDA 2012:21212), the coarse-filter/fine-filter approach is a "well-developed concept in the scientific literature and has broad support from the scientific community…" Iverson (2001), including references to published literature, described the concept as it pertains to the Forest Service. Some of the published support for the approach includes Aplet et al. (1999), Haufler et al. (1999), and Hughes et al. (2000).

B. Principles of Wildlife Ecology and Management

A principle of wildlife management, as defined in the *Principles of Wildlife Management* text by Bailey (1984:6), is "a widely accepted generalization based on abundant and diverse research and experience and having wide application for managing wildlife." The principles and measures outlined in the following two sections were considered when formulating suitable plant species composition for wildlife.

1. General Principles of Wildlife Ecology and Management

The following principles apply to determining suitable plant species composition for wildlife. Many of the principles, measures, and practices in subsection '2', below, are encompassed within the following general principles.

Principle A.1. Wildlife need habitat in suitable condition — A long-standing basic principle of wildlife management is that wildlife populations and communities require an adequate amount of suitable habitat to be sustained (Leopold 1933, Dasmann 1981, Burger 1979, Kie et al. 1994, WGFD Staff 1995, Peek 1986, Morrison et al. 1998), and this is recognized in range management (Holechek et al. 2011). Key elements of habitat are food, water, cover from predators and adverse weather, nesting or denning sites, and interspecific competition (Peek 1986, Kie et al. 1994, Morrison et al. 1998). In some cases, insufficient cover may contribute to increased predation and in other cases, behavior of wildlife may inhibit their use of the area with insufficient cover. In discussing basic concepts concerning wildlife habitat, Holechek et al. (2011:283) stated "Wildlife populations are regulated by the availability of food, water, and cover, the basic components of wildlife habitat." If basic habitat elements preferred or required by a particular wildlife species or group of species are absent or of insufficient quality in a given area, this species or group of species will not exist or will exist in lower numbers, depending on the extent of unsuitability. Providing suitable habitat for wildlife is a fundamental underpinning of Forest Plan objectives for wildlife (USFS 1990b)

Principle A.2. Sustaining a full complement of wildlife species requires sustaining habitat that is suitable for native wildlife communities as a whole — The only realistic way to sustain the full complement of native wildlife species on a given landscape over the long term is to approximate, at a landscape scale, habitat conditions within the natural range of variability, which may involve actively managing habitat to mimic key elements of natural systems and allowing natural processes to shape and sustain other habitat elements (Reid and Miller 1989, Keystone 1991, Franklin 1993, Noss and Cooperider 1994, Hunter 1996, Aplet et al. 1999, Haufler et al. 1999, Hughes et al. 2000, Iverson 2001, Cooperrider 2002, Samways 2005). There are far too many unknowns to attempt to manage for the needs of each individual species of group of species if the ultimate goal is to maintain viable populations of all native species. This is a major underlying premise of the 2012 Planning Rule.

Principle A.3. All changes to habitat have positive and negative effects on wildlife — Changes in habitat have positive effects on some wildlife species and negative effects on other species (Bailey 1984, Peek 1986, Severson 1990, Kie et al. 1994, Krausman 1996). This is a consequence in large part of the very wide range of habitat preferences and needs of wildlife. The same change that positively effects on one or more species will negatively affect other species, making it critical to evaluate these effects in the context of sustaining the full complement of wildlife species (see previous principle). Documented positive effects on a given aspect of a wildlife species' natural history does not necessarily mean that the effect is needed or that it translates into population level effects. Given the large number of effects of any change, this principle adds to the importance of Principle A.2 as a general guiding principle.

Principle B.1. Livestock grazing use has positive and negative effects on wildlife — Livestock grazing/browsing has been shown to positively affect some wildlife species during certain life-history stages in particular habitats and more holistically in other species (e.g., at the population level), and it has been shown to negatively affect other wildlife species during certain life-history stages in particular habitats and more holistically in other species (Leopold 1933, University of Idaho 1981, Severson 1990, Kie et al. 1994, Krausman 1996, Peek 1996, Holechek et al. 2011). Positive and negative effects need to be considered in the context of principles A.1, A.2, and A.3, as well as principle B.2. In particular, they need to be considered in the context of the conditions under which native wildlife-communities formed.

Whether livestock grazing/browsing positively or negatively affects a given wildlife species in a given area depends on wildlife habitat requirements, timing of these requirements, and tolerance to shorter/sparser vegetation relative to the forage utilization rate, use of particular features of herbaceous vegetation used by wildlife relative to the parts eaten by livestock, timing and duration of grazing, among other factors. Consistent with Principle A.3, virtually any level, timing, and duration of livestock grazing use will benefit some species and will negatively affect other species.

Whether livestock grazing/browsing positively or negatively affects a native wildlife community as a whole (i.e., wildlife community that formed or evolved in an area prior to Euro-American settlement) depends primarily on the extent to which the community was formed with grazing/browsing pressure, the timing and frequency of this pressure, the extent to which the existing native grazing guild exerts grazing/browsing pressure (relative to pre-Euro-American levels), and the extent to which livestock grazing use can effectively fill-in any of the unfilled gaps of native ungulates (Van Vuren 1981, Mack and Thompson 1982, Burkhardt 1996, Severson 1990, Miller et al. 1994, Noss and Cooperrider 1994, Hunter 1996, Lubinski 2000; see Principle A.2), regardless of positive and negative effects on individual species (see Principle A.3). As with Principle A.3, given the large number of effects of livestock grazing on wildlife and the many unknowns, this principle adds to the importance of Principle A.2 as a general guiding principle.

2. Migratory Bird Conservation Principles, Measures, and Practices

Executive Order 13186 and USFS and USFWS (2008) require that migratory bird conservation principles, measures, and practices be designed and integrated into agency planning processes and plans, specifically including range management plans (Table 1, above). This is a big emphasis of the executive order.

Some of the principles and practices in the Wyoming Partners in Flight Plan (2003) that apply to defining suitable herbaceous retention levels for migratory birds in riparian areas are as follows. The generally-defined desired condition for herbaceous retention is based in part on these principles and practices.

- "…Manage grazing intensity at a level that will maintain the composition, density, and vigor of desired plants…" (pg. 55)
- "Fencing can isolate riparian areas into one or a few pastures; other pastures should be exclusively uplands. This can simplify management intended to protect riparian areas… fencing may be the best alternative for rapid restoration of riparian ecosystems. When fencing riparian areas to exclude livestock, make sure all riparian plant community types are included in the exclosure…" (pg. 55).
- "Manage for a variety of locally native plants. Different plant species host different insect populations, which provide food for a variety of bird species" (pg. 53).
- "Manage grazing intensity at a level that will maintain the composition, density, and vigor of desired plants and will not damage wetland soils, edges, or water quality" (pg. 95).
- "Relatively few bird species breed in meadows, yet they are important foraging areas for members of adjoining avian communities, particularly those in forest and riparian habitats. In the fall, montane meadows become important to both resident and migratory birds because of the abundant populations of insects, which peak late in the season" (pg. 136).

- “Identify and protect those habitats that still have a thriving community of native grasses and forbs. Management should focus on restoring natural disturbance processes, such as fire, and removing invasive nonnative plants” (pg. 137).
- “Maintain small mammal and insect populations as prey for many bird species” (pg. 137).
- “Manage for a variety of locally native plants. Different plant species host different insect populations, which provide food for a variety of bird species” (pg. 137).
- “Prevent the invasion of exotic plants and restore or rehabilitate degraded and disturbed sites to native plant communities…” (pg. 137).
- “Identify and protect those habitats that still have a thriving community of native understory and sagebrush plants” (pg. 277).
- “Where possible, restore or rehabilitate degraded and disturbed sites to native plant communities” (pg. 277).
- “Within extensive areas of sagebrush habitat, manage for a patchwork or mosaic of native plant communities across the local landscape. This may include stands of young and old sagebrush, openings (ranging from bare ground to short vegetation to high grass density), wet meadows, seeps, healthy riparian vegetation, and other interspersed shrub and woodland habitats” (pgs. 277-278).
- “…maintain small mammal populations as prey for many bird and mammal predators” (pg. 278).
- “Manage existing stands of sagebrush steppe for a balance between shrub and perennial grass cover and for open to moderate shrub cover (5 to 25%) and multiple height classes” (pg. 278).
- “Perennial bunchgrasses and native forbs provide food and cover for many sagebrush birds” (pg. 282).
- “Wherever perennial bunchgrasses and native forbs persist, choose practices that stabilize or increase native grass and forb cover in balance with open to moderate (5 to 25%) sagebrush cover” (pg. 282).
- “To maintain bluebunch wheatgrass vigor (its capacity for growth and reproduction), avoid grazing during the growing season until plants begin to cure. Bluebunch wheatgrass, one of the most widespread of native bunchgrasses, is particularly sensitive to heavy grazing during the growing season” (pg. 282).
- “Maintain native forb diversity. Forbs are extremely important to the diets of Greater Sage-Grouse broods, pronghorn antelope, and other wildlife” (pg. 282).
- “Within shrublands where Vesper Sparrows nest, maintain grass height of 6 to 12 inches (15 to 30 cm), 6 to 24% bare ground, 10 to 20% shrub canopy cover, and territory size of about 5 acres (2 ha) per pair” (pg. 475).
- “Maintain vole and other small mammal populations as a food source for Northern Harriers” (pg. 503).
- “Protect undisturbed habitat in which annual vegetation and successional plants can grow and dead vegetation is not removed” (pg. 503).
- “Manage grazing in wet meadows and wetland pastures at low levels, especially during dry years, to maintain nesting cover for Northern Harriers” (pg. 503).
- “Implement wetland and grassland management techniques that provide extensive areas [at least 250 acres (100 ha)] of tall, dense grasses and emergent vegetation in areas where Northern Harriers occur. Nests have been found in areas where the vegetation ranges in height from 1 to 7 feet (30 cm to 2 m)” (pg. 503).

C. IMPORTANCE TO WILDLIFE

1. Driver of Wildlife Habitat Conditions and Wildlife Species Richness and Abundance

Plant species composition, including the composition of noxious weeds, is a key driver of wildlife habitat conditions. First, plant species composition is a key component of range condition (section 22.1 of FSH 2209.21, National Research Council 1994, Holechek et al. 2011:129-134). The range condition concept has long been recognized as central to being able to sustain suitable wildlife habitat over the long term on areas routinely grazed by livestock (Leopold 1923, Leopold 1924, Peek 1986:180-184, Robinson and Bolen 1989:297-302, Kie et al. 1994). Range condition drives the capability of the land to annually produce suitable wildlife habitat over the long term, which means this aspect of plant species composition has an indirect, albeit very important, influence on wildlife habitat. As one example, where range condition has declined to a mid-seral state (e.g., conversion of a diverse forbland community to domination by mule ears due to heavy or severe livestock grazing in the early to mid 1900s), the plant species composition that is annually produced is already depleted, even before the onset of livestock grazing in any given year. This is aspect of plant species composition generally falls under the auspices of the Rangeland Management Specialist.

Second, plant species composition also directly dictates the quality of habitat conditions for wildlife at any given time. At a coarse scale, it dictates vegetation structure (e.g., conifer forestland, big sagebrush community, willow community, tall forb community). Vegetation structure at this scale is a major factor influencing wildlife species occurrence and the species composition of wildlife communities.

2. Importance of Species Diversity to Meeting Wildlife Needs

Plant species diversity (species richness and abundance/cover of individual species) is paramount in herbaceous communities and herbaceous understories, as this dictates what is seasonally available to particular vertebrate and invertebrate wildlife species.

At a finer scale, the particular suite of plant species comprising a particular structural class of vegetation also influences wildlife species occurrence, and plant species composition has a very large influence on the abundance of wildlife species that depend on specific plant species or taxa. A large majority of the nearly 200 species of birds, mammals, amphibians, and reptiles, and a majority of the many hundreds to thousands of invertebrate species that occur on the Kemmerer Ranger District depend on herbaceous vegetation in some way. Herbaceous species composition is very important to invertebrate and vertebrate wildlife because it determines the variety, abundance, and amount of vegetative food (leaves, seeds, flowers, nectar, roots) and prey (invertebrates, small mammals, lagomorphs, native ungulates, and birds) that are available, the type of cover and living space that is available, and the microclimate. Figure 1 highlights habitat attributes of a naturally-diverse herbaceous community with naturally high percent canopy cover (e.g., moist meadow and forbland communities; see also Figure 2). As one example, USFS (1997:17) assessed that “Because flower production is adversely affected when these tall forb communities are lost, some sensitive, disjunct or isolated colonies of butterflies are also at risk of disappearing.” There is a growing body of scientific literature demonstrating this.

Given the large number and variety of wildlife that directly and indirectly depend at least to some degree on herbaceous vegetation (e.g., from western bumblebees to calliope hummingbirds, to montane voles, to olive-sided flycatchers, to long-tailed weasels, to Cassin’s finches and savannah sparrows, to mountain cottontails, to short-eared owls, to golden eagles, to elk, to mountain lions), a large variety of herbaceous species is needed to support their needs — depending on the natural capacity of the land (i.e., conditions under which native wildlife-communities formed; USDA 2012). Native herbivores, granivores, and nectar-feeders, including invertebrates, have forage preferences and some of invertebrate and vertebrate species only forage on a narrow range of plant taxa. See Appendix A for further information on the range of herbaceous forage needs of wildlife.

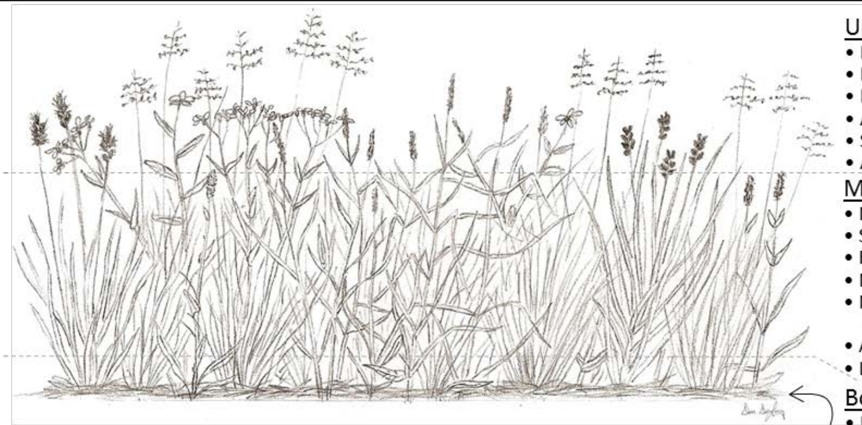

Figure 1. Habitat attributes important to vertebrate and invertebrate wildlife in a moist meadow community, by biophysical layer. The layers and descriptions are comparable to forbland communities, except forbs comprise a larger proportion of plant species.

A central upshot of this report is that a natural or relatively-natural herbaceous species composition is crucial to providing suitable foraging habitat, cover, living space, and microclimate for native ungulates, sensitive species, migratory birds, and other wildlife and it assumes a relatively-natural mix of succession age classes is maintained[A]. There are many reasons why it is crucial to define suitable herbaceous species composition for wildlife as a relatively-natural herbaceous species composition, including the following:

a. Plant species composition dictates the vegetation structure that is produced during the growing season, and vegetation structure is highly important to wildlife (see '1', above).

b. Plant species composition dictates forage availability for numerous wildlife species. Also:

   i. Known forage preferences and dietary needs of the many dozens of species of mammals and birds in the project area —with respect to leafy forage, seeds, and flowers — encompass a very large number and variety of grass, forb, and sedge species (see Appendix A for a small sampling).

      An important note is that only a small proportion of plant species in an area are used by a particular herbivore and that this small proportion of plant species is different for each herbivore, making plant species diversity highly important. As abundance or cover of favored plant species declines for a given herbivore, energy expenditure increases as they spend more time and energy searching.

   ii. While forage preferences and diets of elk and mule deer are fairly well understood (Appendix A), preferred herbaceous forage species (for leafy forage, seedheads, and flowers) of many mammal and bird species are not very well understood*.

c. Conserving invertebrate communities is highly dependent on maintaining an approximation of the plant species composition under which these communities formed (see DeLong 206 for some of the supporting science related to this). Numerous studies have shown that even small reductions in plant species composition can have relatively large effects on invertebrate communities. Also:

   i. There is limited understanding, at best, of the occurrence of individual invertebrate species in the project area, seasonality, dependence of individual invertebrate species on or preferences for specific herbaceous species, and other habitat relationships*.

[A] The assumption of a relatively-natural mix of is important because the mix of succession age classes defines the distribution, size, and juxtaposition of plant communities across the landscape, and plant species composition is typically addressed within plant communities.

   ii. There is limited understanding of the invertebrate prey species of many bird, bat, shrew, reptile, and amphibian species, and less understanding of the seasonal needs for particular invertebrate species*.

d. Conserving vertebrate prey (e.g., ungulates, lagomorphs, small mammals, birds, amphibians) is highly dependent on maintaining an approximation of the plant species composition under which these communities formed. Also:

   i. While the vertebrate-prey preferences of many predatory mammal and bird species are well understood, they are not fully known for all predatory mammal and bird species*.

   ii. Dietary needs and forage preferences and other habitat needs of many small mammal, bird, reptile, and amphibian (prey) species are not fully understood (see 2.b and 3.b, above)*.

e. There are far too many species of birds, mammals, reptiles, amphibians, and invertebrates that depend on the leaves, seeds, and flowers of specific herbaceous species to attempt to determine and manage for compositions of individual grass, sedge, and forb taxa for particular wildlife species or groups of species.

f. Even if sufficient information were to be available on specific forage/prey needs of all mammal, bird, reptile, and amphibian species in the project area*, it would be virtually impossible to formulate (starting from scratch) a composition of herbaceous plant species that balances these needs, by plant community type, and to attempt to manage for this.

g. Even if it were possible to formulate a composition of herbaceous plant species that balances the herbaceous needs of all vertebrate and invertebrate species, by plant community type, it is almost certain that a relatively-natural herbaceous species composition by plant community type would be identified through this process. This is because the wildlife community that developed in this part of the Rocky Mountains did so under the habitat conditions — including plant species composition — that existed here.

The importance of approximating the herbaceous conditions under which native wildlife-communities formed increases inversely with the amount of information available on plant species composition requirements of dependent vertebrate and invertebrate wildlife (*, above). In other words, where little information exists to determine suitable plant species composition for particular groups of wildlife species, the best approach to conserving them is to provide the habitat we know they can persist in (i.e., the conditions under which wildlife communities formed; USDA 2012:21212).

The reasons listed above likely are some of the very reasons the architects of the 2012 Planning Rule came to the conclusion that "…native species evolved and adapted within the limits established by natural landforms, vegetation, and disturbance patterns prior to extensive human alteration. Maintaining or restoring ecological conditions similar to those under which native species have evolved therefore offers the best assurance against losses of biological diversity and maintains habitats for the vast majority of species in an area, subject to factors outside of the Agency's control, such as climate change…" (USDA 2012:21212). Also, "The Department's intent in providing the requirements in this section [e.g., coarse-filter/fine-filter approach] is to provide for diversity of plant and animal communities, and provide ecological conditions to keep common native species common, contribute to the recovery of threatened and endangered species, conserve candidate and proposed species, and maintain viable populations of species of conservation concern within the plan area" (USFS 2012:21212).

Given direction in the 2012 Planning Rule, the large number and variety of herbaceous species needed by vertebrate wildlife and their prey, and the many unknowns, the watershed/erosion-control potential ratings outlined in Exhibit 01 of R4 AMENDMENT 2209.21-2005-1 make a poor indicator of wildlife habitat quality with respect to herbaceous species composition. It being a poor indicator of wildlife habitat quality is further outlined in the "Applicability of R4 Watershed Species" section.

3. Implications of Geographic Scale and Multiple Stressors on Assessments Effects and Forest Plan Compliance

It would be very difficult to support conclusions that altered herbaceous species composition perpetuated by a given proposed action or alternative (1) has no more than minor effects on wildlife at the BTNF scale, and (2) would meet suitable-habitat and other requirements of the Forest Plan (Objective 2.1(a), 3.3(a), 4.7(a), and 4.7(b); Fisheries and Wildlife Prescription; Range Vegetation Prescription; and Forage Improvement Standard). There are several reasons for this, with the first two bullets being the main reasons:

- While altered plant species composition in a given series of allotments, due to historic livestock grazing, probably does not independently have more than minor impacts on any wildlife population at the BTNF scale, the combined effects of altered species composition in each affected area across the BTNF has high potential for substantively impacting wildlife populations at the BTNF scale, particularly given the large magnitude to which plant species composition has been altered in a range of vegetation types at the BTNF scale. Herbaceous species composition has been substantively reduced on large proportions of several vegetation types, including forbland, aspen, big sagebrush, silver sagebrush, and moist meadow types (USFS 1997, USFS 2003, USFS 2004a, USFS 2004b, USFS 2005b, USFS 2008, Loosen et al. 2009, USFS 2009a), and herbaceous species composition was reduced sufficiently in the tall forb type across an estimated 25% of the tall forb type such that it is now considered lost (USFS 1997).

  Restated, if it were not for the altered herbaceous species composition on each of the relatively small areas across the BTNF — which together comprise a large area and a large proportion of forbland, aspen, silver sagebrush, moist meadow, and other vegetation types on the BTNF — altered herbaceous species composition at the BTNF scale would not have the large impacts on wildlife that it currently probably does. Consistently high numbers of native ungulates (especially elk) likely contributes to limiting recovery of herbaceous species composition in localized areas; prior to Euro-American settlement, elk and mule deer number likely fluctuated year-to-year much more than they do today.

- Altered herbaceous species composition is only one of several herbaceous-related factors that impact wildlife that directly or indirectly depend on herbaceous communities and understories across the BTNF, and this occurs as a result of factors operating at localized and allotment scales. This means that impacts to wildlife at the scale of the BTNF are a consequence of similar effects occurring at localized scales across the BTNF.

  Other factors include reduced acreage of herbaceous communities and productive herbaceous understories in aspen, big sagebrush, silver sagebrush, moist meadow, and other vegetation types due to advancing succession and conifer encroachment as a consequence of reduced prevalence and spread of fire (Gruell et al. 1980a,b; USFS 1997, USFS 2009; Loosen et al. 2009); increased prevalence and spread of noxious weeds in these vegetation types; habitat loss due to roads and other facilities; reduced water-table elevations due to altered hydrology stemming from livestock grazing and road construction. These alterations to herbaceous communities and understories appears to be having large effects on the availability and productivity of herbaceous vegetation at the BTNF scale, which in turn is likely impacting wildlife.

- Additionally, herbaceous, shrub-herb, and aspen-herb vegetation types on the K-17 allotments have been impacted off the BTNF in nearby, surrounding landscapes (e.g., private lands and BLM lands), which contributes to negative effects on wildlife species that occur in the K-17 allotments, thereby affecting wildlife populations generally at the scale of the BTNF. Some impacts to herbaceous vegetation in these vegetation types are more pronounced on private and BLM lands. While these effects do not influence the degree to which Forest Plan objectives, standards, prescriptions, and guidelines are met, they affect the importance of meeting them. For example, if off-BTNF conditions were satisfactory for wildlife, meeting Forest Plan direction for suitable habitat may not be as important as meeting this direction when off-BTNF conditions are far from satisfactory.

In a similar vein as the last bullet, effects on herbaceous vegetation is just one of a range of factors affecting wildlife species that occur in the K-17 project area, and cumulative assessments of these factors — in combination with the effects of the proposed and alternatives on herbaceous species composition — can add to the importance of meeting the herbaceous-related needs of wildlife in the project area according to Forest Plan direction, migratory bird requirements, and other management direction (e.g., Forest Service policy, 2012 Planning Rule). Mule deer numbers in the project area, for example, are affected by winter range conditions on BLM lands that are below suitable conditions. This increases the importance of providing suitable forage conditions for mule deer in the project area (particularly suitable herbaceous species composition combined with suitable herbaceous retention) since mule deer (as well as elk and moose) because mule deer in higher fitness going into the winter have been shown to be more able to survive the winter, even with reduced winter range conditions (Scwartz and Renecker 1997, Cook et al. 2004, Lomas and Bender 2007, WAFWA 2009). As another example, migratory birds that nest and summer in the project area and winter in the southeastern U.S., Central America, or South America are affected by less-than-suitable conditions in these areas. Suitable habitat conditions, including suitable herbaceous species composition, can help offset impacts along migration routes and in wintering areas.

4. Range Condition

The importance of herbaceous species composition to wildlife is highlighted by the application of range condition to wildlife conservation (e.g., Robinson and Bolen 1989:297-300, Kie et al. 1994:663-664). These and other wildlife professionals emphasized that different wildlife species and groups of wildlife species favor different range condition classes, and range condition is predominantly driven by plant species composition. Smith (1978), Robinson and Bolen (1989), and Kie et al. (1994) discussed the need to define wildlife habitat objectives in terms of range condition classes favorable to the wildlife species or groups of wildlife species that are emphasized in a given area. For any given geographic area, the range condition class that occurred when the native wildlife-community formed is the range condition class that is needed to meet the seasonal needs of all vertebrate and invertebrate wildlife species (e.g., USDA 2012:21212). As such, wildlife species diversity (species richness and relative abundance) declines to the degree that range condition in a particular area departs from potential natural community or climax, except when this occurs temporarily after a fire or other natural disturbance. Individual species have been shown to be affected by range condition class. Robinson and Bolen (1989:297-299), for example, cited several studies demonstrating that lower range condition classes coincided with lower nutritional quality of white-tailed deer diets and lower percentages of yearlings with spikes (instead of branched antlers), and experimental studies demonstrating that white-tailed deer on diets of lower nutritional quality produced fewer fawns. Again, given the large ramifications of plant species composition on wildlife diversity, plant species composition is of utmost importance and range condition classes provide a useful way to address this.

Range condition is assessed based on a comparison between the existing plant species composition and the potential natural community (PNC) or climax community (Holechek et al. 2011:129-134) (Table 2). Range condition originally had four categories: excellent, good, fair, and poor. This later was changed to climax, late seral, mid seral, and early seral (Holechek et al. 2011:133), but even though “seral” implies stages of succession, the stages of vegetation succession are assessed in relation to the disturbance of long-term grazing use and not in relation to single-event disturbances like fire or clearcutting. Succession after fire on a rangeland proceeds through a different successional pathways than it does after years of heavy or severe grazing on a rangeland, and this is the reason the term range “condition” is used instead of range succession. Post-fire succession can be classified in terms of plant-community age classes (e.g., number of years post fire) whereas range condition classes cannot are based on plant species composition.

Figure 2 (from the Sierra National Forests) illustrates how habitat conditions change with declining range condition (i.e., declining plant species composition) in a mountain meadow.

Table 2. Degree of departure from potential natural community (PNC), expressed as percent similarity to PNC, for each range condition class.

Range Condition	Percent of PNC	Summary of Figure 3
Climax	76-100%	Dominated by decreaser species, with low number of increaser species. At the low end of this category, increasers are gaining in cover and possibly some invaders.
Late Seral	51-75%	Still dominated by decreasers, but increasers increasing in prevalence, and some invaders beginning to establish.
Mid Seral	26-50%	Dominated by increasers and, while decreasers may still comprise relatively-high proportion of cover at the high end of the category, the cover of increasers is higher. Invaders comprise a substantive proportion of the total cover, and may dominate in some cases (Figure 3.A).
Early Seral	0-25%	Dominated by invaders (Figures 2.A and 2.B) and, in some cases increasers (Figure 3.C). Decreasers comprise a minority of the total cover or are absent.

Many or most forbland and sagebrush-forbland sites in early-seral or mid-seral range condition (i.e., where the herbaceous layer is dominated by mule ears, bicolor biscuitroot, Louisiana sagewort, and other aggressive increaser species) provide habitat that is considerably below suitable habitat conditions for wildlife because they typically have a far lower plant species richness and far lower abundance of increaser species than occurred prior to historic sheep grazing. This has major negative effects on wildlife in the areas occupied by these sites, including mule deer, seed-eating birds and small mammals, numerous invertebrates and the insectivorous wildlife that feed on them, nectar-eaters (e.g., hummingbirds, butterflies, bees), among others. While sites dominated by mule ears, bicolor biscuitroot, Louisiana sagewort, and other aggressive increaser species are naturally-occurring in some situations (e.g., landslides and where deep snow persists through much of the growing season), they typically represent altered conditions due to historic grazing by domestic sheep (Mueggler and Campbell 1982, Mueggler 1988, Murray and Mayland 1994, USFS 1997, Winward 2003, Winward 2004, USFS 2009, Kachergis et al. 2014, Stringham et al. 2015).

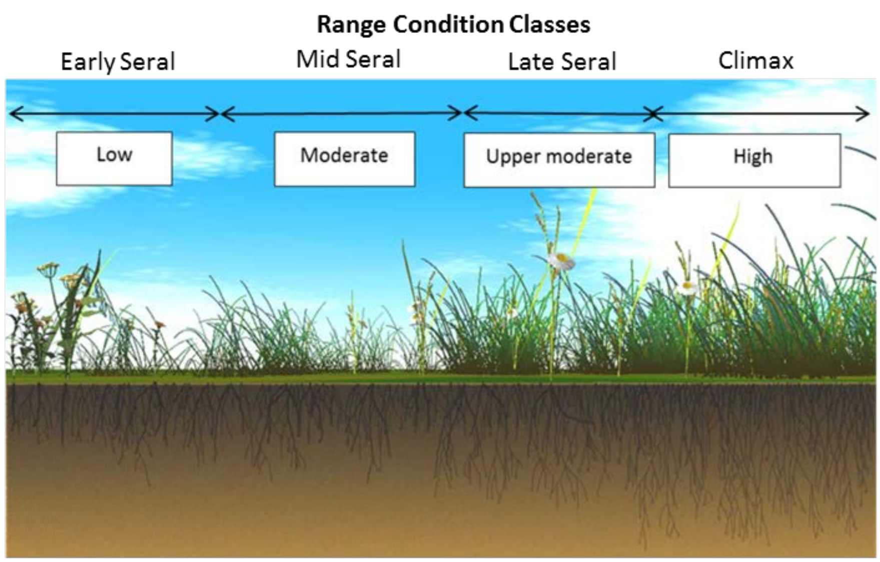

Figure 1. Ecological condition (low, moderate, upper moderate, and high) in a mountain meadow. Each condition class represents the rating derived from Region 5 meadow scorecards. The crosswalk to range condition classes is shown above of the illustration.

Purely from the standpoint of determining range "condition," the range condition classes can only be applied to rangelands that are in late succession — relative to post fire — and likely in mid succession relative to fire. In early succession, soon after a fire or mechanical treatment that eliminates or greatly reduces woody vegetation, the species associated this succession stage overlap with species associated with early-seral and mid-seral range condition classes. In no way does this mean the area is in poor or fair condition. However, if an area in late succession (e.g., 40-50 years after the most recent fire), classifies to an early- or mid-seral range condition, the area is in poor or fair condition.

Ground cover is important to wildlife in several ways, including as a coarse-filter indicator of the functionality of a given area. If, for example, ground cover is less than 60% on a given tall forb or mountain big sagebrush site (as measured according to R4 Amendment 2209.21-2005-1), we know the site is non-functioning from the range standpoint and that plant species composition is highly altered and well below suitable conditions for wildlife… without even having to spend the time measuring plant species composition. If ground cover is, for example, 70% on a tall forb site, we know plant species composition is below suitable conditions for wildlife, but that some habitat elements are provided by the plant community. Ground cover is import to long-term range condition and the capability to annually produce wildlife habitat. In discussing the conservation of wildlife on rangelands, Kie et al. (1994:664) stated that "First, a determination is made as to whether soil stability goals are being met. If not overall condition is unsatisfactory."

There are two key implications of the definition of ground cover to wildlife, as it is defined in the scoping letters / proposed action of June 22, 2017 for K-17 sheep allotments:

1. Reducing the low-end ground cover level by 15% would set the stage for downward trends in ecosystem functionality, which would negatively impact wildlife associated with the affected communities. The proposed definition of desired conditions for ground cover includes the phrase, "no less than 85% of potential ground cover for each vegetation cover type." Because the low-end thresholds in section 22.1 of R4 Amendment 2209.21-2005-1 represent the "…<u>minimum ground cover needed for proper functioning sustainable ecosystems</u>," establishing desired low-end ground cover thresholds 15% lower than this essentially builds-in non-sustainability into desired condition statements. When ground cover

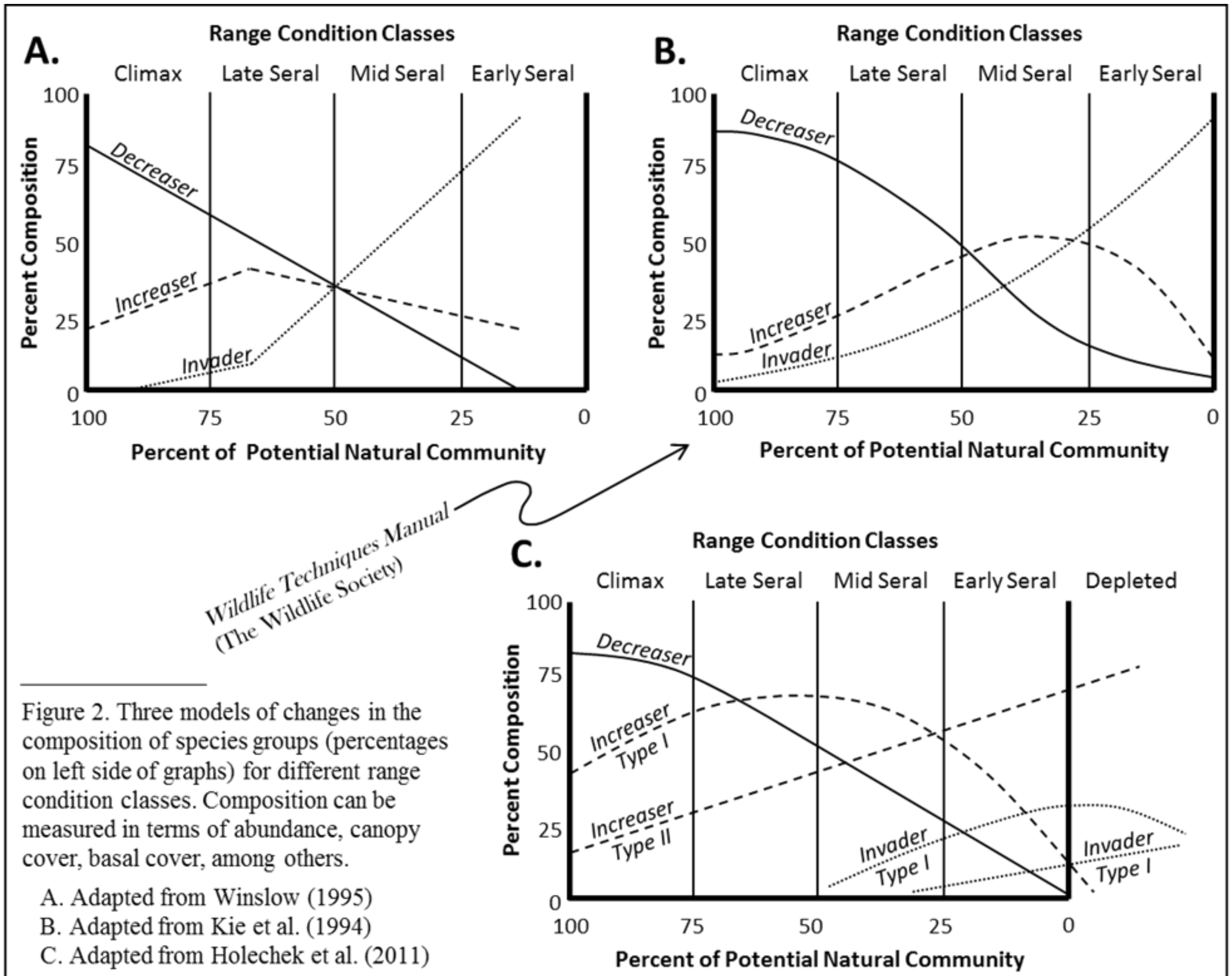

Figure 2. Three models of changes in the composition of species groups (percentages on left side of graphs) for different range condition classes. Composition can be measured in terms of abundance, canopy cover, basal cover, among others.

A. Adapted from Winslow (1995)
B. Adapted from Kie et al. (1994)
C. Adapted from Holechek et al. (2011)

levels drop below levels identified in O'Brien et al. (2003:2), they noted that sites "…would begin to lose basic functionality defined by increased soil erosion and loss of site sustainability," and more specifically assessed that "ground cover levels below these minimum thresholds were determined to be functioning at risk for basic watershed protection." (Many of the base thresholds for ground cover in the June 22, 2017 proposed action appear to be derived from R4 Amendment 2209.21-2005-1, but this is not clearly stated in the proposed action; O'Brien et al. 2003 was not cited, nor were any other sources for the desired ground cover thresholds.)

Minimum ground cover thresholds in R4 Amendment 2209.21-2005-1 and O'Brien et al. (2003) were not written to characterize pristine conditions or conditions reflecting non-use by livestock and other uses. They are not "potential ground cover" as characterized in the June 29, 2016 and June 22, 2017 proposed actions. As clearly stated in R4 Amendment 2209.21-2005-1 and O'Brien et al. (2003), low-end ground cover thresholds specifically were written to define a threshold below which ecosystem and watershed conditions would begin deteriorating. If it were not for uses, such as livestock grazing, that can impact watershed health and ecosystem functioning through reductions in ground cover, there would be no need to define low-end thresholds for ground cover.

In adding "range" as a use of National Forest System lands, the Multiple-Use Sustained Yield Act of 1960 declared that "The purposes of this Act are declared to be supplemental to, but not in derogation of, the purposes for which the national forests were established as set forth in the Act of June 4, 1897 (16 U.S.C. 475)," emphasis added. The "the purposes for which the national forests were established," as outlined in the 1897 Organic Act were "to improve and protect the forest within the reservation, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States," emphasis added. (Impacts of sheep grazing on watershed conditions and implications to irrigation farmers and drinking water played were key issues when forest reserves were first establish and their management was being discussed (Ellison 1954, Rowley 1985, Lewis 2005).)

As such, livestock grazing is not permitted to reduce ground cover to the point that it begins derogating the "purpose of securing favorable conditions of water flows." The Soil, Water, and Air Prescription (USFS 1990:136) requires that "Activities are planned to protect the quality of the basic watershed resources of soil, water, and air. The Vegetation: General Prescription, Vegetation: Range Prescription, and Forage Improvement Standard require vegetation diversity to be protected, enhanced, and improved. Nowhere in the Forest Plan does there appear to be room to lower the low-end ground cover thresholds in R4 Amendment 2209.21-2005-1.

Minimum ground cover thresholds outlined in Table 1 have been identified in a large number and wide range of assessments, planning/NEPA documents, decision documents, and allotment management plans on the BTNF, including the following. The decision documents and allotment management plans listed below cover 22 sheep allotments on 3 districts, and this is only a partial list:

- Greys River Landscape Scale Assessment (USFS 2004a)
- Final environmental impact statement for Wyoming Range allotment complex (USFS 2004b) (*7 sheep allotments on the Big Piney, Jackson, and Greys River Districts*)
- Middle Greys River watershed assessment (USFS 2005a)
- Decision memo for continuation of forage reserve allotment status on three forage reserve allotments: Squaw Creek/Weiner Creek, Birch Creek/Star Peaks, and White Creek sheep allotments (USFS 2005b)
- Decision memo to authorize continued livestock grazing on the Three Forks, Corral Creek, and Mink Creek Sheep Allotments (USFS 2007)
- Allotment management plan for the Triple Peak forage reserve, Big Piney and Greys River Ranger Districts (USFS 2008) (*5 sheep allotments*)

- ○ Updated assessment of the condition of management indicator species habitat with respect to livestock grazing use on the Bridger-Teton National Forest: land and resource management plan assessment (USFS 2009a)
- ○ Decision notice and finding of no significant impact for reauthorization of livestock grazing and allotment management plan review and revision: Bear Creek, Virginia Peak, North Salt, and South Salt Sheep Allotments (USFS 2009b)

The proposed shift for the tall forb type highlights the implications. A minimum 80% ground cover is needed to maintain proper functioning sustainable ecosystems for this type (R4 Amendment 2209.21-2005-1; also: Winward 1998, O'Brien et al 2003). O'Brien et al. (2003:2) similarly identified 80% as "The minimum ground cover needed for proper functioning sustainable watersheds…" in the tall forb type on the BTNF. Winward (1998:1) stated "…ground cover values with greater than 15-20 percent bare soil will usually result in excessive soil losses…" (i.e., a minimum threshold for ground cover of 80-85%).

Reducing the low-end threshold for desired conditions in tall forb types from 80% to 68% represents a major shift not supported by Forest Service guidance and published literature, and that would have substantive impacts on wildlife (<u>note</u>: the June 22, 2017 proposed action would set the low-end threshold at 64-68%). When ground cover on a tall forb site is between 80% (Table 3) and 60%, the site is "at risk," as characterized in several BTNF documents (e.g., USFS 2005b, USFS 2007, USFS 2008). When ground cover drops below 60%, sites are considered to be non-functioning (e.g., USFS 2004b, USFS 2005b, USFS 2007, USFS 2008, USFS 2009b) and the potential for reduced water infiltration and excessive soil erosion is greatly increased (Thurow 1991, Satturlund and Adams 1992, National Research Council 1994, USFS 1997, Holechek et al. 2011). This similarly applies to other vegetation types in Table 3.

As such, reducing the low-end of desired conditions in tall forb communities to 68% would allow site conditions to deteriorate considerably, and would provide little buffer between functioning and non-functioning conditions. The designation of "at-risk" conditions provides such a buffer, but if the low-end of desired ground cover is set at 64-68% for the tall forb type (as one example), a given site can go from "desired" to "non-functioning" within a span of 5% ground cover.

2. The way in which ground cover is measured can greatly affect they degree to which desired ground cover levels are determined to be met or not met. As used in the proposed action of June 22, 2017, ground cover includes canopy cover of vegetation instead of limiting the vegetation component of ground cover to basal vegetation. In some plant communities, such as those dominated by mule ears, the ground layer below herbaceous canopies can be dominated by bare ground, which can result in ground cover being overestimated with respect to the way ground cover thresholds were defined in R4 Amendment 2209.21-2005-1 and O'Brien et al. (2003). Restated, data collected in this way has high potential of showing that ground cover on a given site meets desired conditions when it actually is below (potentially well below) desired conditions, which can cause excessive erosion and deterioration of watershed conditions (see previous bullet).

Both of these factors would result in a 'double hit' to wildlife because no. 1 (desired conditions) lowers the bar and no. 2 (monitoring) would make it easier for sites to appear as though they are over the bar when they aren't.

Because the above issues pertain to the functioning of watersheds and ecosystem health, they apply to all DFC areas. With respect to wildlife, the above discussion has particular importance to DFC 3, 10, and 12, given the elevated emphasis on wildlife resource.

D. How Livestock can Affect Conditions

Cattle and sheep grazing has been shown, in a large number and variety of studies, to affect plant species composition in riparian, upland rangeland, and aspen communities. Livestock grazing affects plant species composition depending on the level of use, timing, duration, and distribution of livestock. Effects have been described since at least as far back as Leopold (1923, 1924) and Ellison (1954) and there is a large volume of science on this, some of which has been summarized in range management textbooks and chapters (e.g., Briske 1991, Miller et al. 1994, Holechek et al. 2011), and the effects are widely accepted. This involves fundamental principles of riparian, rangeland, and aspen ecology and management. As such, there is little reason to outline the ways in which livestock alter plant species composition.

1. Forbland Communities

One specific issue, however, that warrants additional consideration is the degree to which historic sheep grazing affected forbland communities in the West Zone, and whether and to what degree plant communities within the footprint of the historic forbland type reflect natural conditions (i.e., the conditions under which native wildlife-communities formed).

This has very important ramifications to wildlife.

There appear to be two prevailing views on whether many of today's forbland communities are in an altered state due to historic livestock grazing:

a. A relatively-large proportion of the acreage of forbland types in the West Zone are altered, with a substantial proportion being highly altered (e.g., dominated by mule ears, bicolor biscuitroot, Louisiana sagewort, tarweed), compared to conditions that existed prior to the period of heavy grazing by domestic sheep. This is the characterization in many Forest Service documents for the West Zone or that encompass the West Zone (USFS 2001, USFS 2004a, USFS 2009b) and other parts of the BTNF and BTNF as a whole (USFS 1997, USFS 2004b, USFS 2009a), and by Alma Winward (e.g., Winward 1998), a retired Region 4 vegetation ecologist who probably is most familiar with this vegetation type.

b. Most of the acreage of the forbland types in the West Zone generally reflect the potential natural community. The draft, proposed desired conditions outlined for the scoping letter for K-17 sheep allotment management defines desired conditions in a way that forb communities dominated by mule ears, western coneflower, bicolor biscuitroot, and orange sneezeweed would qualify as meeting desired conditions. I am not aware of any documents that characterize the situation on the BTNF or nearby areas in this way, although Aaron Zobell likely has other supportive documentation for this viewpoint.

Part of this issue is whether the extensive areas of mule ears is naturally occurring or if much of this is a consequence of heavy sheep grazing when more than 200,000 sheep annually grazed the Wyoming Range, Salt River Range, and Commissary Ridge. As recognized by WGFD (2017:3), "According to the 1997 BTNF Properly Functioning Condition Assessment, 25% of the tall forb communities that historically occupied the BTNF have been lost, and this community type has been identified to be at high risk on the BTNF." USFS (1997) attributed most of the impacts to historic sheep grazing.

How this is addressed in upcoming allotment management planning efforts will have major implications to wildlife.

Several factors need to be considered in addressing this issue, including the following. It is difficult to understand how grazing and trampling by hundreds of thousands of sheep — oftentimes twice or more each year (northward movement, then southward movement) for several decades — did not negatively affect soil and vegetation where they grazed in forbland communities.

a. Tall forb communities appear to have evolved with little grazing by mule deer, moose, elk, and bighorn sheep during summer and autumn. As such, tall forb communities and prominent forb species in these communities do not appear to be resistant to grazing.

b. These communities were heavily to severely grazed by more than 200,000 sheep every summer from about 1900 to the mid 1900s (USFS 2001, USFS 2004a, USFS 2005a), and they appeared to be grazed by different bands of sheep at different times and they appeared to be grazed again when sheep were herded back in late summer; for example:

> *Greys River Landscape Scale Assessment* — "Old timers in Star Valley recall being able to count the bands of sheep on the driveways by the clouds of dust on the skyline. No one knows the exact number of sheep trailed around the turn of the century but estimates are on the order of a half million sheep. By 1915, there were 175 permittees grazing 216,500 sheep, and 10,000 cattle and horses on the Wyoming National Forest…" (USFS 2004a:28). "As much as five feet of soil was eroded from vulnerable areas like Sheep Pass; such areas are permanently altered (USFS 2004a:28).

c. Sheep grazing during this period caused considerable soil loss and alteration of vegetation in high-elevation forbland communities, especially along sheep driveways and on steep slopes (USFS 1997, Winward 1998, USFS 2001, USFS 2004a, USFS 2004b). For example:

> Winward (1998), who may very well know the tall forb type better than anyone else, stated that "During the early settlement of the western United States, grazing by domestic animals, especially sheep, substantially reduced and altered plant composition and cover on [areas supporting the tall forb type]. In many cases, the luxuriant plant species were lost and replaced by rhizomatous or lower statured, more xeric species…"
>
> …Without the early protective cover provided by the taller, native species, much soil loss continues to occur throughout this type. Over half of the area that once supported the tall forb type has lost enough of the soil mantle that these areas are no longer suited for growing the original tall forb species…"
>
> *Commissary Ridge / Tunp Range Landscape Scale Assessment* — "The range condition within most of the upland sagebrush and grass community types is poor to fair. These conditions are a result of fire suppression, grazing pressure, and climatic factors… Today, with livestock numbers remaining static overtime and forage production declining, the condition and trend for this community type will continue to decline" (USFS 2001:3-38).

d. After cessation of sheep grazing in different parts of the Wyoming and Salt River Ranges, most nested frequency plots are showing upward trends in ground cover and plant species composition. If ground cover and plant species composition *during* the period of sheep grazing generally reflects plant species composition of plant communities that existed *prior to* the period of sheep grazing, a generally stable trend would be expected after sheep grazing is stopped.

e. A large proportion of the gullies that now exist in and below many high-elevation forbland communities are still "active," and if they had been active for more than several decades, they would be considerably larger than they are today. Given the current size of gullies, they are a fairly recent phenomenon.

f. Altered soil and vegetation conditions on the West Zone due to historic sheep grazing are parallel to what has happened throughout the Intermountain West (Ellison 1954, Rowley 1985, Bowns and Bagley 1986, Prevedel et al. 2005).

It is immensely important to wildlife to carefully (e.g., conservatively) manage sheep grazing on the few areas that may remain relatively intact and those that have reduced plant species composition and ground cover, given: (1) the highly-altered condition of a large proportion of the tall forb type; (2) continued excessive soil loss from areas with ≤60-65% ground cover (Thurow 1991, Satturlund and Adams 1992, National Research Council 1994, USFS 1997, Holechek et al. 2011) and possibly as high as ≤80-85% ground cover (Winward 1998); (3) many of these altered sites may not recover for many, many decades (if ever); combined with (4) the lowered plant species composition and ground cover on a substantive portion of the tall forb type, and (5) ongoing declining conditions in some places (Winward 1998). Where the tall forb community has been "lost," but where at least some species of tall forb communities exist and where they are germinating and "attempting" to reestablish, sheep should be grazed conservatively enough to allow recovery to occur.

E. Low Applicability of R4 Watershed-protection Species to Wildlife

Two recent proposed actions (Project Initiation Letter of July 20, 2015 for the LaBarge cattle allotment and scoping letter / proposed action of June 22, 2017 for K-17 sheep allotments) outlined the following desired condition for plant species composition (quoted paragraph below). The first proposal was modified for the June 29, 2016 scoping letter / proposed action for the LaBarge cattle allotment based on the February 21, 2016 version of this report; the proposed desired plant species composition was modified to reflect wildlife needs. However, this was not carried through into the June 22, 2017 proposed action for K-17 sheep allotments.

The proposed desired conditions for plant species composition being put forward is as follows:

> "Native and selected non-native species of moderate to high value for watershed protection (1993 Region 4 Range Management Resource Value Rating Guide, FSH 2209.21.27.4, Ex. 02,) will be equal to or greater than 60% of the relative cover in all vegetation types grazed by livestock. Selected non-native species are those including in plantings in the past based on their erosion control and other desired values. Includes both woody and herbaceous species."

This has been put forth with little if any support from the standpoint of adequately providing for the needs of wildlife in DFC 10 and 12 areas (87% of project area), and it conflicts with guidance in Chapter 20 of FSH 2209. Section 22.1.4 of FSH 2209.21, which states that "the Range Inventory Standardization Committee Report (1983) suggests that a value of 75 percent similar or greater [with respect to potential natural community, or PNC] may be used to differentiate between meeting and not meeting management objectives." This guidance aligns with direction in the 2012 Planning Rule with respect to wildlife conservation, including a conservation approach that is in part based on the recognition that "Maintaining or restoring ecological conditions similar to those under which native species have evolved therefore offers the best assurance against losses of biological diversity and maintains habitats for the vast majority of species in an area" (USDA 2012:21212). A minimum 75% similarity to potential natural community was adopted in a Record of Decision for managing livestock grazing in the Wyoming Range Allotment Complex (USFS 2004b).

Also, the proposed desired conditions for plant species composition would allow deteriorated wildlife-habitat conditions to perpetuate and currently suitable habitat conditions to deteriorate. Many of the rangelands, riparian, and aspen understories that currently provide unsuitable habitat for wildlife due to highly-altered herbaceous species composition (e.g., herbaceous layers dominated by mule ears, bicolor biscuitroot, Louisiana sagewort, coneflower, orange sneezeweed, Kentucky bluegrass, or smooth brome[B]) would be allowed to persist in deteriorated condition. Rangelands, riparian areas, and aspen understories that currently provide suitable habitat for wildlife would be permitted to deteriorate. Therefore, the desired condition quoted in the indented paragraph, above, is in no way appropriate for the wildlife resource, especially in DFC 3, 10, and 12 areas, but also in DFC 1B, 2A, and 3B areas.

In short, habitat conditions for wildlife dependent on the herbaceous layer (in the K-17 project area) has the potential to be far different than conditions identified for tall forb communities in Murray and Mayland (1994), USFS (1997), Winward (1998), O'Brien et al. (2003), Winward (2003), Williams (2007), USFS (2009), and Winward (2009); identified for mountain big sagebrush communities in Williams et al. (2007), LANDFIRE (2007), and NRCS (2008a,b); and identified for moist meadow and silver sagebrush communities in Norton et al. (1981), Youngblood et al. (1985), Kovalchik (1987), Padgett et al. (1989), Taylor (1994a,b).

The proposed desired condition, as quoted above, is not an appropriate desired condition for wildlife on cattle and sheep allotments of the Greys River and Kemmerer Ranger Districts for the following reasons:

[B] It is recognized that domination by these species, except smooth brome (and probably Kentucky bluegrass), occurred in some situations naturally, but much of the acreage today is a consequence of historic livestock grazing.

1. Desired plant species composition is defined within the general framework of Forest Plan objectives, standards, prescriptions, and guidelines in light of the DFCs in a given set of the allotments (a-c, below).
   a. "The interpretation of desired species and amounts will change when goals change for specific purposes, like watershed sustainability, forage production, sage grouse habitat, low risk wildfire community, or a pleasing wildflower setting in a sagebrush community" (section 22.1.4 of FSH 2209.13.21-2005-1).
   b. The Forest Plan acknowledges conflict between some of the objectives in the plan, and explains that, where conflicts between objectives arise, "The conflicts are resolved by application of Desired Future Conditions to different areas of the National Forest" (pg. 93).
   c. A majority of acres of most allotments are in DFC 10 and 12 areas. The management theme of DFC 10 areas is "An area managed to allow for some resource development and roads while having no adverse and some beneficial effects on wildlife," and the management emphasis is "…to provide long-term and short-term habitat <u>to meet the needs of wildlife</u> managed <u>in balance</u> with… grazing…" The management theme of DFC 12 areas is "An area managed for high-quality wildlife habitat and escape cover, big-game hunting opportunities, and dispersed recreation activities." The management emphasis is on big game.

      Large portions of some allotments are in DFC 3 areas, a management emphasis of which is the ensure these areas "…are protected from activities that could diminish or change the free-flowing characteristic, water quality, or the scenic, recreational, <u>fish and wildlife</u>, and other values which make the river eligible for designation."

      Given the emphasis on wildlife in DFC 10 and 12 areas, the following objectives, standards, and prescriptions must receive a high degree of emphasis in defining desired conditions:

      - Objective 2.1(a) — Provide suitable and adequate habitat to support the game and fish population objectives established by the WGFD.
      - Objective 3.3(a) — Protect [Region 4] sensitive plant and animal species and provide suitable and adequate amounts of habitat to ensure that activities do not cause: (1) long-term or further decline in population numbers or habitats supporting these populations; and, (2) trends toward federal listing.
      - Fisheries and Wildlife Prescription (BTNF-wide) — The BTNF provides habitat adequate to meet the needs of dependent fish and wildlife populations, including those of threatened, endangered, and sensitive species.
      - Sensitive Species Management Standard (BTNF-wide) — …Crucial habitats of priority I, II, and III species as listed by WGFD and R4's sensitive species list will be protected and maintained…
      - Vegetation: Range Prescription (BTNF-wide) — Forage is provided on a sustained-yield basis that protects rangeland values, wildlife habitat, and meets other resource needs and, for DFC 12 areas, particularly big game.

   As such, by allowing for such major deviations from suitable conditions for wildlife, relying on R4 watershed-protection species in the desired-condition statement for plant species composition would play a large role in suitable and adequate habitat not being provided, which has implications to meeting Forest Plan direction.
2. Watershed value ratings in Exhibit 02 of FSH 2209.21.27.4, as a whole, provide a poor indicator of the suitability of plant species composition for wildlife. As examples:
   a. Of a total of 323 grasses, sedges, rushes, and forbs that were rated as moderate or high for watershed value, an average of 96 (30%) were rated as low for mule deer and elk. For forbs, 101 of 323 (41%) were rated as low for elk.

b. Of a total of 235 grasses, sedges, rushes, and forbs that were rated as low for watershed value, 90 were rated low for mule deer (38%) and 145 (62%) were rated moderate or high for mule deer.

c. Of a total of 233 grasses, sedges, rushes, and forbs that were rated as low for watershed value, 117 were rated low for elk (50%) and 116 (50%) were rated moderate or high for elk.

d. Several non-native species are designated as having high value for watershed protection (e.g., Kentucky bluegrass, smooth brome) or moderate value for watershed protection (e.g., Canada bluegrass, redtop, meadow foxtail), and dominance of plant communities by these species signal deteriorated habitat conditions for wildlife communities. Where these species comprise a large proportion of the canopy cover, herbaceous species composition is typically reduced, height is reduced (e.g., Kentucky bluegrass), and herbaceous vegetation density and biomass (Kentucky bluegrass, smooth brome) are reduced, meaning that habitat conditions are poor for wildlife despite meeting the draft benchmark.

e. Several native species having moderate value for watershed protection (e.g., mule ears, black coneflower, cutleaf balsamroot, woodland strawberry, Louisiana sagewort) typically indicate, when at a high percent canopy cover, altered species composition due to elevated grazing use. Therefore, the draft benchmark could be met while providing far less-than-suitable habitat for native wildlife.

f. Numerous native herbaceous species important to vertebrate and invertebrate wildlife are not designated as moderate to high value for watershed protection in the table. Presence or prominence of these species, according to Exhibit 02 of FSH 2209.21.27.4, would contribute to a conclusion that a site is below desired conditions. See Appendix A for more detail.)

- Numerous forb species and a portion of grass species with low watershed values provide seeds for many migratory bird and small mammal species.
- Roughly half the plant species used by broad-tailed hummingbirds as a nectar source have low watershed value and the other half have moderate watershed value.
- Numerous forb species and a portion of grass species with low watershed values provide leafy forage for insects which in turn are important to many migratory bird, bat, and shrew species.
- A high proportion of forb species with low watershed value are important for pollinators (e.g., butterflies, moths, bees, flies).

3. The draft benchmark only addresses plant species composition to a small degree (it’s reference to 60% of vegetation cover), and the handbook (FSH 2209.21.22.1) specifies that desired plant species composition has two parts: desired plant species richness and desired plant species being “…present in the desired amount.” Plant species composition is one of four rangeland health criteria that need to be considered in determining the functionality of upland rangelands. The functionality of rangelands is cornerstone to providing suitable wildlife habitat.

   According to the draft benchmark (desired condition for plant species composition), a site can have only one species having a moderate or high rating and still be deemed to meet this desired condition so long as this one species comprises 60% of the vegetation cover. This obviously is in conflict with providing a “desired amount” of a range of desired plant species.

   Also, the draft benchmark not having any measure of the ‘amount’ of each species, the other half of species composition, or the ‘amount’ of herbaceous vegetation as a whole. According to the draft benchmark, a site can have a total herbaceous canopy cover of, say, 5% and still be deemed to meet this desired condition.

   These factors compound the problems for dependent wildlife identified in no. 2, above.

III. Suitable Conditions and Scientific Basis

This part of the report outlines suitable plant species composition for wildlife[C], which is being submitted as wildlife-discipline input into the process of defining desired conditions for plant species composition for the K-17 sheep allotments. This input can be incorporated by adjusting the Proposed Action and/or developing a new alternative (Alternative 4). The foundations of suitable conditions are outlined in Part II and the scientific and ecological basis is integrated throughout the subsections that follow.

1. Plant Species Composition

In general terms, suitable plant species composition for wildlife is as follows, based on Forest Plan direction, migratory bird requirements, other management direction, and principles of wildlife ecology and management:

> A relatively-natural composition of herbaceous vegetation is provided in forbland, aspen, mountain big sagebrush, mountain shrubland, moist meadow, silver sagebrush, and wet meadow communities, as outlined in each of the following subsections. In terms of range condition, this translates to 75-100% similarity to potential natural community in most situations, which is consistent with section 22.1.4 of FSH 2209.21.

Several of desired condition statements below (for vegetation type groupings b, c, and d) were included in the June 29, 2016 Proposed Action for the LaBarge Creek allotment-management planning project (sent to the public with a scoping letter). The original source of these desired conditions was a February 21, 2016 report providing wildlife input into the process, and Aaron Zobell subsequently made adjustments to some of the species lists in the vegetation type groupings (b, c, and d, below), and these adjustments are included below.

Forbland communities were not addressed in the original report for the LaBarge Creek allotment-management planning project, nor were they addressed in the Proposed Action for the LaBarge Creek allotment-management planning project.

As better or more detailed information becomes available on natural species compositions in forbland and other plant community types (e.g., NRCS's ecological site description effort), the following numeric descriptions of plant species composition will need to be adjusted.

<u>a. Forbland Communities and Aspen Understories where Dominated by Forbs</u>

A minimum of 25 herbaceous species (not including noxious weeds species) provides a reasonable — albeit conservative — starting point for a minimum threshold for suitable conditions in forb-dominated communities and understories. In 15 forb community types on the BTNF described by Gregory (1983), the average number of plant species ranged from 17 to 28, with 13 of the 15 types averaging 20 or more species. She sampled 200 sites on the BTNF. Based on Appendix 4 of Gregory (1983), 98% of sites had 10 or more species, 91% of sites had 15 or more species, 75% of sites had 20 or more species, 48% of sites had 25 or more species, and 22% of sites had 30 or more species (information on 186 sites (15 communities) was included in Appendix 4). Some of the communities sampled by Gregory (1983) appeared to be in a reduced ecological condition, and it is likely that lower species richness in many situations corresponded to lowered ecological conditions. The extent of reduced conditions in her study is unknown since she did not assess the ecological condition of the sites she sampled. It is quite possible that a minimum of 20 herbaceous species sets a low bar, but additional work in this arena, for example the newly initiated ecological-site-description effort by NRCS on the BTNF, will add to our understanding of this subject. Naturalized non-native species are satisfactory if they are species that fill roles or functions of native species.

[C] This input technically is from the wildlife discipline, but it aligns with the prevailing viewpoint of the range discipline on the BTNF and Regional Office as reflected in assessments, reports, and published documents.

Suitable herbaceous plant species composition in forbland communities consists of the following for native wildlife-communities. If these criteria are met, there would be a reasonable chance that conditions would be suitable for native wildlife-communities and individual wildlife species.

a. Canopy cover of herbaceous vegetation is at 50-100% — when in suitable conditions for native wildlife-communities — with drier sites closer to the lower end of the range and moister sites closer to the higher end of the range (Ellison 1954, Gregory 1983, O'Brien et al. 2003, Williams 2007). Canopy cover of herbaceous vegetation is considerably greater than 50% in tall forb communities, which occur in mesic situations (note: this suitable condition applies where sites naturally were mesic but have become drier due to historic sheep grazing).

b. To be in suitable condition, at least 60% of the total vegetation canopy cover must be comprised of species representative of forbland communities (Ellison 1954, Winward 1998), including the following species, with none of the species individually comprising more than 25% of the total vegetation canopy cover, and with grasses typically comprising no more than 10% of the total herbaceous canopy cover (based primarily on Gregory 1983; as supplemented by Ellison 1954, Murray and Mayland 1994, Winward 1998, O'Brien et al. 2003, Williams 2007, Kusbach 2010):

Forb species representative of forb community types or are widespread across types[A]

fernleaf ligusticum[B,C,D,E,F,H]	nettle leaf gianthyssop[B,D,E]	thickleaf groundsel[B,D,E]
tall larkspur[B,C,D,E,F]	western coneflower[B,D,E,J]	peregrine fleabane[B]
silvery lupine[B,D,E,F]	blue stickseed[B,D,E]	leafbract aster[B,D,E,F]
western sweetroot[B,D,E,F]	meadow rue[B,D,E,F]	thickstem aster[B]
western valerian[B,D,E,F,H,I]	fernleaf lousewort[B,D]	Englemann aster[B,D]
sticky geranium[B,C,D,E,F,H,I]		

Forbs representative of small number of forb comm. types & not widespread across types [G] *although some can occur in communities with high diversity (represented by above species)*

edible valerian[B,C,D,F,I]	elkslip marsh marigold[B]	cow parsnip[B,D,E, F]
one-flower helianthella[B,C,D,E,F]	mountain bluebells[B,D,E,F]	California false hellebore[B,E]
arrowleaf balsamroot[B,E]	Canada goldenrod[B,D]	long-leaf arnica[B,E]
cutleaf balsamroot[B]		

Grasses representative of forb communities

mountain brome[B,C,D,H]	slender wheatgrass[D,H]	hood sedge[E,F,H]
purple oniongrass[D]	Raynold's sedge[D,E,F,H]	small-winged sedge

[A] These species may comprise a majority of the vegetation canopy cover, up to nearly the total vegetation canopy cover in some cases (Gregory 1983:Appendix 3). This may be natural for these plant communities.

[B] The main source for the three lists is Gregory (1983), a study on the BTNF (see Appendix C). Other sources are supplementary to this.

[C] Listed as representative of the tall forb type on the BTNF by O'Brien et al. (2003:Appendix C).

[D] Prominent forb species (or comparable species) in the tall forb type listed in Murray and Mayland (1994) within the range of tall forb communities in the West.

[E] Winward (1998). Species in in the first list, above, that were in the top two-thirds of Winward's (1998) "Indicator" list are designated. Species in the second list, above, that were either in the bottom one-third of his "Indicator" list (indicating drier or disturbed conditions) or were listed in his "Species from (a) Adjacent Meadow Settings."

[F] Ellison (1954); species (or comparable species) listed as conspicuous and representative of tall forb communities in the Wasatch Plateau area of northern Utah. He listed other species. The ones noted above also had high constancies in Gregory (1985).

[G] Dominant or "constant" forb species listed for three forb types classified by Kusbach (2010) for northern Utah.

[H] Listed in Williams (2007:19) as being dominant in tall forb communities in Region 4.

[I] Identified in Winward (2003) as key indicators of tall forb communities or that are selectively eaten by domestic sheep and should be key species for monitoring.

[J] Other species that occur in a wide range of forb community types, but that do not represent or contribute to representing forb community types, include western yarrow, northwest cinquefoil, western coneflower.

Additional information supporting forb species listed above:

Forb species in the first group, above, (1) had constancies of ≥25% in at least 3 of 4 forb community types in Gregory (1983) that were characterized as having high plant species richness and on productive soils (the four forb communities listed below); or (2) were identified by Gregory (1983) as being a co-dominant of a forb community type, but were not listed in "c," below.

Fernleaf ligusticum – tall larkspur	Nettle leaf gianthyssop – snowy goldeneye
Silvery lupine – Virginia strawberry	Cow parsnip – western coneflower

The following species also met this criteria, but were not included in the first list because they were not identified in other sources or because they occur in a wide range of other plant communities: western yarrow, northwest cinquefoil, orange agoseris, five-nerve helianthella, and Drummond rockcress; their removal was also suggested by Jill Miller, WGFD.

Also, most species in the first group had constancies of at least 20% in 10 or more community types (relative to the 15 forb community types of Gregory 1983), but some had constancies of 20% in as few as 6 forb community types (see Appendix C). Exceptions are cow parsnip, arrowleaf balsamroot, one-flower helianthella, and showy goldeneye, which had low constancies, but were identified by Gregory (1983) as co-dominants in forb community type.

Of the 23 genera listed as representative of tall forb communities by Murry and Mayland (1994), 13 overlap with the 16 genera listed in the first group, above. Another 4 of the genera listed by Murray and Mayland (1994) are listed in the second group, above, and 2 others (western coneflower and northwestern cinquefoil) are addressed below since they are a major-increaser species with respect to sheep grazing, as recognized by Murry and Mayland (1994:49) for coneflower. Only 4 of genera listed as representative of tall forb communities by Murry and Mayland (1994) are not included in first and second groups, above; they are monkshood, columbine, goldeneye, and violet.

The only species / genera listed by Kusbach (2010) that are not included in the first and second groups, above, or in "c," below, are sulphur buckwheat, alpine buttercup, and three species of annual forbs (thinleaf bedstraw, blue-eyed Mary, and chickweed); annual species are not included in the first two groups, above. Western coneflower, listed by Kusbach as major components of tall forb communities, is represented in "c," below, as is king biscuitroot, which is related to bicolor biscuitroot (see "c," below).

c. To be in suitable condition for native wildlife-communities, canopy cover of mule ears, western coneflower, Louisiana sagewort, cutleaf balsamroot, orange sneezeweed, bicolor biscuitroot, and northwest cinquefoil must be each be less than 5-10%, except for a small proportion of the total forbland acreage. Where a threshold has been crossed (e.g., where mule ears, western coneflower, cudweed sagewort, or tarweed dominates a forbland community, or a subalpine big sagebrush or aspen understory), this in no way indicates acceptable conditions for wildlife; rather, it indicates highly unsuitable conditions for wildlife (this is irrespective of whether the threshold can ever realistically be crossed back to suitable conditions).

Information upon which this based:

While domination of a site by mule ears can occur naturally, it oftentimes is a consequence of a history of heavy to severe sheep grazing (Mueggler and Campbell 1982, Mueggler 1988, Murray and Mayland 1994, USFS 1997, Winward 2003, Winward 2004, USFS 2009, Winward 2009 as noted in DeLong 2009, Kachergis et al. 2014, Stringham et al. 2015). Erosion of the A horizon can be a contributing factor. Winward (2003:4) noted that "Yellow flowered species such as mules ears (*Wyethia*), butterweeds (*Senecio* ssp.), showy goldeneye (*Viguiera mulfiflora*) and splitleaved balsamroot (*Balsamorhiza macrophylla*) tend to increase with grazing pressure." In the head of North Horse Creek in the Wyoming Range, Winward (2004:1) noted that "…Wyethia has become the almost sole dominant species due to excessive livestock grazing during the previous century."

Similarly, a high percent canopy cover of western coneflower likely occurs naturally, but it also has been found to be a consequence of heavy to severe livestock grazing use (Mueggler and Campbell 1982, Mueggler 1988, Murray and Mayland 1994, Williams 2007, USFS 2009, Winward 2009 as noted in DeLong 2009).

Orange sneezeweed, bicolor biscuitroot, northwest cinquefoil, and cutleaf balsamroot also occur in forb communities that have high total canopy cover and that have a naturally diverse composition, but they tend to increase with sheep grazing (Ellison 1954, Winward 1998; Winward 2003; USFS 2009, Winward 2009, as recorded by DeLong 2009). On a site in the head of LaBarge Creek, Winward (2003:2) noted that "Herbaceous sage or Louisiana wormwood (*Artemisia ludoviciana*) is a native rhizomatous species and is currently dominating this site. Its presence is an indication of past grazing abuse. It has low palatability to grazing animals and because of its rhizomatous nature has filled in voids left by the loss of plants that are highly selected by grazers. In a more

> healthy state herbaceous sage, on this site, should be less than 3 percent composition. It currently is approaching 80 – 90 percent composition." He went on to note: "Other species on this site are Blue-eyed Mary (*Collinsia parviflora*) and Douglas knotweed (*Polygonum douglassii*) both native annuals, and Orange sneezeweed (*Heleniuna hoopesii*) a native perennial, all known to be indicators of a low condition class when in high amounts."
>
> Ellison (1954) identified *Artemisia discolor* as a species that becomes abundant through overgrazing, and it is part of the *Artemesia ludoviciana* (Louisiana sagewort or wormwood) complex. Although they are valuable parts of the native forb plant community (Winward 2009) when they comprise relatively small parts of the community, the reduction in plant species composition represented by high percent canopy cover of any of these species produces negative impacts on wildlife. Lousiana sagewort also has value, but large areas dominated by this species many times represents depleted herbaceous species composition.

d. Canopy cover of tarweed, Douglas knotweed, common dandelion, shrubs, and conifer trees — when in suitable condition for native wildlife-communities — are each less than 5%.

Information upon which this based:

> Ellison (1954) identified tarweed, Douglas knotweed, common dandelion, and a host of other species (e.g., lamb's quarters, collomia) that can become abundant with overgrazing, including several identified in "c," above. Winward (1998) also identified dominance by tarweed as a sign of past overgrazing. Winward (2003) also identified Douglas knotweed as an indicator of low condition when in high amounts.

e. To be in suitable condition, noxious weeds must be absent or constitute no more than a negligible part of the plant community.

<u>b. Mountain Big Sagebrush and Mountain Shrubland Communities (with graminoid understories)</u>

In mature and old mountain big sagebrush and mountain shrubland communities where shrub canopy cover is ≤20-30%, total herbaceous canopy cover is approximately 40-85% (Williams et al. 2007:45, LANDFIRE 2007); bluebunch wheatgrass (*Elymus spicatus*) is present in most mountain big sagebrush stands; and canopy cover of bluebunch wheatgrass, Idaho fescue, slender wheatgrass, western wheatgrass (*Pascopyroum smithii*), spike fescue (*Leucopoa kingii*), and other perennial bunchgrasses should comprise another 23-75% of the total annual vegetation production, by weight (NRCS 2008). This also applies to grassland types, except shrub canopy cover. Aaron Zobell (Range Program Manager, West Zone) also identified mutton grass (Poa fendleriana), thickspike wheatgrass (*Elymus lanceolatus*), Columbia needlegrass (*Stipa nelsonii*), onion grass (*Melica bulbosa*), purple onion grass (*Melica spectabilis*), Liddon-sedge (*Carex petasata*), and valley sedge (*Carex vallicola*) as desirable species, and marsh bluegrass (*Poa leptocoma*; in snowfield areas), Letterman's needlegrass (*Stipa lettermanii*) and Junegrass (*Koeleria macrantha*) as present (it's not clear whether there are supporting references for these species). Specific citations for canopy cover include the following:

i. "Herbaceous canopy cover should typically exceed 50 percent, except on shallow or rocky soils" (Williams et al. 2007:45).

ii. "Herbaceous cover is moderate to abundant ranging from 40-85%" in the Inter-Mountain Basins Montane Sagebrush Steppe (LANDFIRE 2007:142). Modelers were Dave Tart and Stanley Kitchen. Mountain big sagebrush is the dominant shrub, and "…this type ranges from 6000ft and can occur up to 9900ft (Bridger-Teton National Forest) in the southern portion of the zone."

iii. "Other uncharacteristic conditions in this type include herbaceous canopy cover less than 40%..." (Evers et al. 2005). This is an earlier version of LANDFIRE (2007), but with different modelers.

To be in suitable condition, noxious weeds and cheatgrass must be absent or constitute no more than a negligible part of the plant community.

c. Moist Meadow, Silver Sagebrush, Shrubby Cinquefoil, and Meadow-Willow Communities

In moist meadow, moist silver sagebrush[D], shrubby cinquefoil, and meadow-willow[E] communities, total herbaceous canopy cover — when in suitable condition — is approximately 80-100%[3]; ≥25% of the total herbaceous canopy cover is comprised of tufted hairgrass (*Deschampsia caespitosa*) (except possibly where small-winged sedge is the dominant graminoid); and, in combination, ≥60% of the total canopy cover is comprised of tufted hairgrass, alpine timothy (*Phleum alpinum*); timber danthonia (*Danthonia intermedia*), small-winged sedge (*Carex microptera*), Nebraska sedge, wooly sedge, Raynold's sedge (*Carex raynoldsii*), silver sedge, and slender-beak sedge, and, in small-winged sedge communities only, additional species are beaked sedge, aquatic sedge, and bluejoint reedgrass) or ≥60% canopy cover of tufted hairgrass, Columbia needlegrass (*Stipa nelsonii*), slender wheatgrass (*Elymus trachycaulus*), basin wildrye (*Elymus cinereus*), mountain brome (*Bromus marginatus*), Cusick's bluegrass (*Poa epilis*) and various sedges, combined, or equivalent native or nonnative species in each case (Mueggler and Stewart 1980, Norton et al. 1981:57, Youngblood et al. 1985:App. B, Kovalchik 1987, Padgett et al. 1989:App. B, Taylor 1994a, Taylor 1994b, Manning and Padgett 1995, NRCS 2008a:Reference Sheets, NRCS 2008b:Reference Sheets). Equivalent means similar functions, including similar height, vegetative density, and provision of forage, cover, and substrate for invertebrates. Aaron Zobell (Range Program Manager, West Zone) also identified Sierra rush (*Juncus nevadensis*); woolly sedge (*Carex pellita*), different-nerved sedge (*Carex heteroneura*), Raynold's sedge, Ebony sedge (*Carex ebenea*), Hood's sedge, Colorado rush (*Juncus confusus*), Letterman's needlesgrass (*Stipa lettermanii*), and meadow barely (*Hordeum brachyantherum*) as desirable species in moist meadow communities (it's not clear whether there are supporting references for these species).

Total herbaceous canopy cover may be lower in silver sagebrush and shrubby cinquefoil communities where total shrub cover is at a point that it limits herbaceous production, provided that only a small proportion of these types have "excessive" shrub cover.

Herbaceous species composition in the understories of shrubby cinquefoil and silver sagebrush communities is similar to that of moist meadow communities, with a caveat that increasing percent canopy cover of shrubs, above a certain threshold, likely incrementally reduces overall herbaceous canopy cover, as occurs in big sagebrush communities (Winward 1991, Riggs et al. 1996). Also, while some silver sagebrush communities naturally are dominated by Idaho fescue (*Festuca idahoensis*) or other somewhat drier-site grass species, many silver sagebrush-Idaho fescue communities today are a product of a history of high levels of livestock grazing and/or drying of sites and represent diminished herbaceous species composition (Mueggler and Stewart 1980, Youngblood et al. 1985). High percent canopy cover of silver sagebrush is naturally occurring on some proportion of the silver sagebrush type.

For suitable conditions to exist there must be an absence of nonnative bluegrasses (e.g., *Poa pratensis, Poa bulbosa, Poa compressa*), redtop (*Agrostis stolonifera*), smooth brome (*Bromus inermis*), or a low combined canopy cover of these species (e.g., <20%, in combination, of the total herbaceous canopy cover); a relatively low combined canopy cover of Virginia strawberry (*Frageria virginiana*), orange sneeze weed (*Helenium hoopsii*), alpine leafbract aster (*Symphyotrichum foliaceum*), northwest cinquefoil (*Potentilla gracilis*), and introduced clover species (e.g., <10%); and an absence of noxious weeds (Mueggler and Stewart 1980, Youngblood et al. 1985, Padgett et al. 1989). Where a threshold has been crossed (e.g., where nonnative bluegrass, redtop, or smooth brome dominates a meadow community or silver sagebrush understory), this in no way indicates acceptable conditions for wildlife; rather, it indicates highly unsuitable conditions for wildlife (this is irrespective of whether the threshold can ever be crossed back to suitable conditions).

[D] Silver sagebrush communities on moist, productive sites are distinguished from those on relatively dry sites (those at the drier end of the range of sites occupied by silver sagebrush communities) and/or porous sites (e.g., silver sagebrush communities on gravely, well-drained soils). However, this needs to be assessed in the context of natural conditions because livestock grazing use and other activity likely have contributed to altered herbaceous understories in silver sagebrush communities (e.g., Youngblood et al. 1985).

[E] "Meadow" portion of willow communities (e.g., gaps or open patches in willow communities that produce meadow-like habitat).

Where tufted hairgrass and/or small-winged sedge are the dominant graminoid species, the predominant height of communities (i.e., minus seed stalks) ranges from the upper end of 6-11.9 inches to 12-23.9 inches, and where the herbaceous layer is dominated by basin wildrye, the predominant height of communities is 24-35.9 inches (Herman 1970, Cronquist et al. 1977, Padgett et al. 1989, Kinney and Clary 1994, Skinner 2010).

d. Wet Meadow Communities

Wet meadow communities and vegetated portions of wetlands — when in suitable condition — have total herbaceous canopy cover of approximately 80-100%[F,G] and a minimum of 75% of the total herbaceous canopy cover is comprised of beaked sedge (*Carex utriculata*), water sedge (*Carex aquatilis*), and Nebraska sedge (*Carex nebrascensis*), analogue sedge (*Carex simulata*), slender-beak sedge (*Carex lasiocarpa*), Hood's sedge (Carex hoodii), silver sedge (*Carex praegracilis*), wooly sedge (*Carex pellita*), or sedges with similar hydrologic needs, singly or in combination (Mueggler and Stewart 1980, Youngblood et al. 1985:App. B, Padgett et al. 1989:App. B, Winward 1989, Manning and Padgett 1995, NRCS 2008a:Reference Sheets, NRCS 2008b:Reference Sheets). Marshland habitat is similar, but overall canopy cover may be lower due to natural hydrologic and soil conditions that maintain open water conditions. Bluejoint reedgrass (*Calamagrostis canadensis*) and Baltic rush (*Juncus balticus*) dominate some wet meadow and marsh sites, but it must be recognized that domination by Baltic rush in some cases is a result of disturbances that reduced the abundance of sedges and, in these situations, domination by Baltic rush is outside the range of suitable conditions.

The predominant height of leaf tufts (i.e., plant height minus seed stalks) in sedge-dominated wet meadow and marsh communities under natural or relatively natural conditions is variable depending on natural site conditions, ranging from approximately 6-11.9 inches (short height-class), to 12-23.9 inches (moderate height-class), to 24-35.9 inches (tall height-class) (Herman 1970, Norton et al. 1981, Padgett et al. 1989, Kinney and Clary 1994). When in healthy condition, most wet meadow and marsh communities likely are in a moderate or tall height category.

e. Adjustments to Desired Conditions in June 22, 2017 Proposed Action

The following adjustments should be made:

i. If "selected non-native species" remains in the desired condition statement for plant species composition, several species need to be specifically excluded, including the following, regardless of whether they were included in plantings:

Kentucky bluegrass[H] (*Poa pratensis*), although there is some indication of it being native

Bulbous bluegrass (*Poa bulbosa*)

Meadow foxtail (*Alopecurus pratensis*)

Redtop (*Agrostis stolonifera*)

Smooth brome (*Bromus inermis*)

[F] A minimum threshold of 80% appears to represent somewhat altered conditions because communities sampled by Norton et al. (1981), Youngblood et al. (1985), Padgett et al. (1989), and Manning and Padgett (1995) were sampled after a century of livestock grazing and other activities, but it is being interpreted as being "relatively" natural. Winward (1989) identified — in examples of the potential natural community of several wet meadow communities — sedge composition and canopy cover of 85% or higher; dominant sedges in these communities were variously Nebraska sedge, beaked sedge, and water sedge, which are the dominants in most wet meadow communities on the BTNF.

[G] This level of canopy cover depends on natural site potential. Some sites naturally were/are not sufficient to produce this level of canopy cover. If historic or recent-past livestock grazing reduced site potential, the aim would be to restore the natural potential, as this is important in providing suitable wildlife habitat.

[H] It is recognized that some experts designate Kentucky bluegrass as either a both a nonnative and native species, and some designate it as a native species. Even if when it is designated as a native species, recognition is given to an increase in distribution and abundance since Euro-American settlement.

ii. Make it clear that altered states are not within the scope of desired conditions. For example, where the A horizon and possibly B horizon have been lost across large areas and where mule ears dominates the plant community, conditions are well below suitable conditions for wildlife and will remain so until the community transitions back, if this is even possible. Many areas that are now dominated by mule ears will likely remain as near-monocultures of mule ears for many decades or longer. If it is not possible for the community to transition back, it will remain in less-than-suitable conditions for wildlife. The same holds true for meadow communities dominated by Kentucky bluegrass and other nonnative bluegrasses. Even if it will not be possible to convert nonnative bluegrass communities to a more natural mix of species and even if the reality is that these communities will remain dominated by nonnative bluegrasses, conditions will remain less-than-suitable for wildlife, meaning they should be identified as less-than-desired conditions.

iii. Do not add a statement that standing, dead vegetation is counted toward percent canopy cover. Only live vegetation is counted toward percent canopy cover. Standing dead vegetation is not counted as canopy cover from the standpoint of measuring or estimating plant species composition. Otherwise, herbaceous canopy cover will be overestimated, with an obvious consequence of less-than-suitable habitat being perpetuated.

iv. Do not add a statement that willow and other woody vegetation is counted toward herbaceous canopy cover (when measuring or estimating herbaceous species composition). Willow and other woody vegetation is not counted toward herbaceous canopy cover when measuring or estimating herbaceous species composition. Otherwise, herbaceous canopy cover will be overestimated, with an obvious consequence of less-than-suitable habitat being perpetuated.

2. Ground Cover

First, the following sentence needs to be removed from the desired condition statement for ground cover at the top of Table 2, page v of the June 22, 2017 Proposed Action. If it stays in the Proposed Action, it needs to be removed from Alternative 4.

> "Do not allow grazing management activities that will result in >85% of potential effective ground cover for each plant community type grazed by livestock."

Second, the established low-end thresholds for ground cover (R4 Amendment 2209.21-2005-1, section 22.1) need to somehow be cited and addressed in the desired condition statement for ground cover, either in the Proposed Action or a new alternative. Two options here:

a. The most supportable and appropriate change would be to replace ground cover thresholds in Table 3 of the June 22, 2017 Proposed Action with thresholds in R4 Amendment 2209.21-2005-1, section 22.1 (Table 3, below), which would require a shift in the way ground cover would be measured under the Proposed Action. A clean way to do this would be, in Alternative 4, to replace Table 3 of the Proposed Action with Table 3.

b. At a minimum (if option 1 is not followed), the Proposed Action or Alternative 4 will need to calibrate groundcover thresholds in Table 3 of the Proposed Action with groundcover thresholds in R4 Amendment 2209.21-2005-1, section 22.1, as supplemented by O'Brien et al. (2003) (Table 3, below) since this is the "gold standard" on the BTNF. To the extent minimum thresholds in Table 3 of the Proposed Action are met in the future, but minimum ground cover thresholds in R4 Amendment 2209.21-2005-1 and O'Brien et al. (2003) are not met, minimum ground cover thresholds in Table 3 of the Proposed Action will need to be adjusted upward accordingly.

   Regardless of how this is done, we need to be confident that desired conditions for ground cover, as defined in R4 Amendment 2209.21-2005-1 and O'Brien et al. (2003), are being met.

Table 3. Minimum ground cover levels "…needed for proper functioning sustainable ecosystems" (22.1 of R4 Amendment 2209.21-2005-1), below which ecosystems would be "…functioning at risk for basic watershed protection" (O'Brien et al. 2003:2).

Vegetation Type	**Ground Cover**[A]
Alpine	90%[B,C]
Tall Forb	80%[B,C]
Aspen	80-95%[B,C]
Mountain Big Sagebrush	70-85%[B,C,D]
Mountain Shrubland	70%[B]

[A] "Ground cover is basal vegetation, litter, moss/lichen, or rock greater than three-fourths inch diameter" (section 22.1 of R4 Amendment 2209.21-2005-1 and O'Brien et al. 2003).

[B] R4 Amendment 2209.21-2005-1, section 22.1.

[C] O'Brien et al. (2003).

[D] For mountain big sagebrush, the 70% of R4 Amendment 2209.21-2005-1 can be applied to well-drained sites and the 85% of O'Brien et al. (2003) can be applied to mesic sites. This can also be done for the aspen type, as well as mesic mountain shrubland sites.

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Appendix A: Why Herb Species Composition is an Important Element of Wildlife Habitat

— Wildlife Forage —

Table of Contents

INTRODUCTION

This appendix presents lists of herbaceous species eaten by a few representative species and groups of vertebrate and invertebrate species, which supports the approximation of a relatively-natural plant species composition.

ROCKY MOUNTAIN ELK AND MULE DEER

Grasses and Sedges

There is considerable overlap in the graminoid species consistently selected by native ungulates and the graminoid species identified by NRCS (2008) and Youngblood et al. (1985) as being representative of or consistently found in mountain big sagebrush, mountain shrubland, grassland, silver sagebrush, and meadow plant communities that are in relatively-natural condition (i.e., potential natural plant community, historic climax plant community). Given this large overlap, the plant species compositions generally described in NRCS (2008) for historic climax plant communities would provide suitable conditions for native ungulates. Furthermore, early-successional plant communities resulting from fire or mechanical treatments would produce similar plant species compositions, except at higher abundances/canopy cover.

In graminoid-dominated plant communities and understories, a substantive composition of bluebunch wheatgrass, Idaho fescue, needlegrasses (spp.), blue wildrye, blue wildrye, mountain brome, bluejoint reedgrass, elk sedge, riparian sedges, and other native graminoids — as exists in a natural species composition — would contribute substantively toward meeting seasonal needs of elk (Table 1) and, to a lesser extent, mule deer (Tables 5.a and 6). Bluebunch wheatgrass and Idaho fescue as a herbaceous forage favored by elk and mule deer is well documented (Tables 1, 2, and 3; see also Anderson and Scherzinger 1975, Dietz and Nagy 1976, Miller et al. 1981, Dragt and Havstad 1989). Elk use a wide range of grass species (Table 2a only shows a relatively small portion of species) and, while elk show preference for some grass species throughout the year, they show preference for some species only seasonally. Mule deer also use a wide range of grass species (Tables 5.a), but the composition of grass in mule deer diets is lower than it is for elk. A larger variety of grasses appear to be used by mule deer during summer months, but grasses comprise a larger component of their diet during spring and fall. In northeastern Oregon, Miller et al. (1981) found Sandberg's bluegrass — the earliest to initiate growth — to be the most grazed grass species by deer and elk in March, with bluebunch wheatgrass, Idaho fescue, Kentucky bluegrass, and timothy also being favored at this time; this is consistent with Tables 1 and 2. These grasses comprised a large part of the diet through mid-May and forbs comprised nearly half of deer and elk diets at this time. Sandberg's bluegrass may be the species found on wind-blown ridges used by mule deer and elk on the district during winter and early spring.

Elk and mule deer show preference for several nonnative species, including orchardgrass, timothy, Kentucky bluegrass, smooth brome, and cheatgrass. So long as naturalized non-native plant species fill roles or functions of native species and so long as they are species that do no tend to dominate communities, they would be considered satisfactory from the standpoint of elk and mule deer. There area at least two reasons why Kentucky bluegrass, smooth brome, and cheatgrass are not satisfactory, despite elk and mule deer showing preference for

Table 1. Relative seasonal values of graminoids eaten by Rocky Mountain elk, compiled by Cook (2002:286-288). Of the 79 grass and sedge species and genera listed by Cook, the following are some of the commonly found species and genera in major plant communities on the Greys River Ranger District, as indicated in the left column. The right-hand column indicates the number of references listed by Cook; see his paper for literature cited.

Plant Community[A]	Species	Consumption Ranking[B] by Season Spring	Summer	Fall	Winter	No. of Refs.

	Natives	[C]				
sb,ms,a,g,ss,m	Bluebunch wheatgrass	+	+	+	++	20
sb,ms,a,g,ss,m	Slender wheatgrass		–	+	++	1
sb,ms,g,ss,m	Idaho fescue	++	+	++	+	22
sb,ms,g	Spike fescue		+			2
sb,ms,a,g[D]	Needlegrass spp.	++	+	+	++	5
sb,ms,g,m	Nelsons / Columbia needlegrass[E]		–		++	2
sb,ms,g	Needle-and-thread	+	–	+	+	3
?	Canada wildrye		+			1
sb,ms,g,ss,m	Blue wildrye	+	++	++	–	4
sb,ms,a,g,m	Prairie junegrass	+	+	++	+	10
ss,m	Alpine timothy	+	+			3
sb,ms,g	Sandberg's bluegrass	+	–	+	+	5
sb,g	Indian ricegrass			++	+	2
c	Pinegrass	+	+	–	+	4
f,a,ss	Mountain brome	+	++	+	++	6
f,a,m	Showy (purple) oniongrass		+			2
ss,m	Tufted hairgrass		0			2
ss,m,wm	Bluejoint reedgrass	–	+	–	++	4
m,ss,wm[C]	Sedge spp.	–	+	+	+	16
sb,ms,g,m	Elk sedge	+	+	++	++	11
wm	Baltic rush		++			1
	Nonnatives					
sb,ms,g,m	Intermediate wheatgrass		–		+	2
sb,ms,a,g,ss,m	Smooth brome	+	+	+	++	3
sb,ms,g	Cheatgrass	–			+	4
sb,ms,a,g,m	Orchardgrass	+	+			3
sb,ms,a,g,ss,m	Timothy	++	–	++	+	6
sb,ms,a,g,ss,m	Bluegrass spp.[F]	++	+	++	+	13
m	Bulbous bluegrass				+	1
sb,ms,a,g,ss,m	Kentucky bluegrass	+	++	++	++	3

[A] Species that are representative of or common in particular plant communities, as identified in NRCS (2008) for big sagebrush (bs), mountain shrubland (ms), grassland (g), silver sagebrush (ss) and meadow (m) communities; Youngblood et al. (1985; e.g., Appendix B) and Padgett et al. (1989; e.g., Appendix B) for silver sagebrush and meadow communities; and Gregory (1983) and O'Brien et al. (2003) for forbland (f) and aspen (a) communities. Conifer communities (c).

[B] Based on average amounts reported, with – = light, + = moderate, and ++ = high use.

[C] Blanks mean that information was not presented in the source document for this cell, which could potentially mean no more than a trace during the respective season.

[D] One or more species from the identified taxa are representative species.

[E] Also known as subalpine needlegrass.

[F] Appears to include native and nonnative species of bluegrass.

them. First, they tend to dominate plant communities at the exclusion of other plant species, which greatly reduces the ability of plant communities to provide a wide range of grass and forb species. Plant species richness is one of the most important attributes of plant communities for ungulate foraging, including providing for seasonal needs (Tables 1, 2, 4, and 5). Second, some species like Kentucky bluegrass and orchard grass are grazed down fairly quickly in many areas upon the initiation of cattle grazing that they effectively become unavailable as forage for native ungulates.

Table 2. Relative seasonal values of grasses eaten by mule deer, compiled by Kufeld et al. (1973). Of the 67 species and 17 genera of grasses and sedges listed by Kufeld et al. (1973:Table 4) (a total of 84 rows of information), the following are some of the commonly found species and genera in forbland, big sagebrush, meadow, and aspen communities on the Greys River Ranger District. The right-hand column indicates the number of references listed by Kufeld et al. (1973). Table 4 of their paper lists the actual literature

references, and the table also identifies the number of references for each season. Increaser species are also included for comparison.

Plant Communities	Grass/Sedge Species	Consumption Ranking[B] by Season Spring	Summer	Fall	Winter	No. of Refs.
	Representative Species					
sb,ms,a,m	Bluebunch wheatgrass	–	*t*	*t* –	+	8
sb,ms,m	Idaho fescue	+			+	5
sb,ms,m	Letterman needlegrass		*t* –			2
sb,ms,m	Columbia needlegrass		*t* –	+		1
sb,ms,m	Spikefescue		*t*		*t* –	2
sb,ms,a,m	Slender wheatgrass					*
f,sb,ms,a	Mountain brome					*
sb,ms,a,m	Prairie junegrass	+	*t* +	*t*	*t*	7
ss,m	Foxtail barley		*t*			1
f,sb,ms	Sandberg's bluegrass	++	*t*	*t* +	+	4
	Spike trisetum		*t*			1
m	Tufted hairgrass		*t*			1
sb,ms,g,ss,m	Wheatgrass spp. (old Agropyron)	+	*t*	++	+	9
sb,ms,a,g,ss,m	Bluegrass spp.	*t* +	*t*	*t*	*t* –	13
m,wm	Carex spp.	*t* –	*t* +	*t* +	*t* –	15
	Nonnative Species					
sb,ms,a,ss,m	Kentucky bluegrass	*t*	–			6
sb,ms,a,ss,m	Smooth brome		+			1
sb,ms,a,ss,m	Timothy	+	*t*	*t*	+	4
sb,ms,a,m	Orchardgrass	+	+			2
sb,ms	Cheatgrass	+	*t*	+	+	13

[B] Based on average amounts reported, with *t* = trace, – = light, + = moderate, and ++ heavy use relative to other species eaten. Two symbols means a range from the first to the second.

* No data provided in Kufeld et al. (1973). This may be a result of the species not being present on any of the study areas or of very low availability, or it could mean that the species was present, but just not selected.

Table 3. Relative values of several grasses as forage for mule deer, from Peek (1996:185). Peek's valuation of these grass species as forage for cattle is also included below. Only plant species occurring on the Greys River Ranger District are included, and those that are representative of certain plant species are indicated in the left column.

Rep. Species[A]? (by community)	Species / Genera	Rating for Mule Deer	Rating for Cattle
	Representative Species		
sb,ms,a,g,ss,m	Bluebunch wheatgrass	Good	Excellent
sb,ms,g,ss,m	Idaho fescue	Excellent	Excellent
sb,ms,g	Needleandthread	Moderate	Fair-Good
f,a,ss,m	Mountain brome	Good	Excellent
ss,m	Tufted hairgrass	Fair-good	Excellent
	Nonnatives		
sb,ms,a,g,ss,m	Kentucky bluegrass	Light use	Good
sb,ms,a,g,m	Orchardgrass	Moderate	Excellent
sb,ms,a,g,ss,m	Timothy	Good-Excellent	Excellent
sb,ms,g	Cheatgrass	Moderate	Good

[A] Species that are representative of or common in particular plant communities; see previous tables for codes.

Forbs

Probably the most important attribute of ungulate foraging habitat with respect to forbs is plant species composition, both in terms of high species richness and abundance of forage species. There is no set small group of forb species that contribute proportionally more than other forbs in general (e.g., Tables 4 and 5 for elk and mule deer). For mule deer, Kufeld et al. (1973:4) noted that "Relatively few individual forb species were reported heavily eaten in a large number of references, although many forbs were frequently reported to be consumed in moderate quantities. In studies reporting forbs, a large variety of species were usually involved.

Table 4. Relative seasonal values of forbs eaten by Rocky Mountain elk, compiled by Cook (2002:286-288). Of the 145 forb species and genera listed by Cook, the following are some of the commonly found species and genera in major communities on the Greys River Ranger District. The right-hand column indicates the number of references listed by Cook; see his paper for literature cited.

Plant Community[A]	**Species**	**Seasons** Spring	Summer	Fall	Winter	**No. of Refs.**
	Representative Species					
f,sb,ms,a,m	Sticky geranium	+	++	+	[B]	10
f,sb,ms,a,m	Mountain bluebells		++	++		1
f,a,m	Cow parsnip	–	–			2
f,a,m,wm	California false hellebore		–			1
f,a,m	Goldenrod spp.	–				1
f,sb,ms,a	Groundsel spp.	+	–		+	5
f,sb,ms,a	Arrowleaf groundsel		++	++		2
—	(Columbian groundsel[C])		++			
wm	Avens spp.		+			1
wm	Elephanthead pedicularis		+			1
wm	Jacob's ladder		+	-		1
	Closely-Related Species					
f,a,m	Yampa[D]		+			1
f,sb,ms,a,m	Larkspur spp.[E]		+			1
f,sb,ms,a,m	Lupine spp.[F]	+	–	+		14
f,sb,ms,a,m	Velvet Lupine[F]		++			1
	Increaser Species					
m,ss	Canada thistle (nonnative)	–				1
f,sb,a,m,ss	Northwest cinquefoil		–			1
f,sb,a,m,ss	(Cinquefoil ssp.)	–	–	+		8
f,sb,ms,a	Wyethia spp.		++	++		3

[A] Species that are representative of or common in particular plant communities, as identified in Gregory (1983) and O'Brien et al. (2003) for forbland (f) and aspen (a) communities; NRCS (2008) for big sagebrush (bs), mountain shrubland (ms), grassland (g), silver sagebrush (ss), and riparian and other meadow (m) communities; and Youngblood et al. (1985; e.g., Appendix B) and Padgett et al. (1989; e.g., Appendix B) for wet meadow communities (wm).

[B] Blanks mean that information does not exist.

[C] Columbian groundsel does not exist on Greys River RD, but is provided as another example of groundsels, of which 13 occur on the district.

[D] Fernleaf ligusticum — also in the carrot family — is representative of forbland communities on the Greys River RD. Additionally, yampa also is common in forbland communities on the district.

[E] Tall larkspur is representative of forbland communities on the Greys River RD.

[F] Silvery lupine is representative of forbland communities on the Greys River RD. Additionally, velvet lupine also is common in big sagebrush communities, meadows, and forest openings on the district.

Table 5. Relative seasonal values of forbs eaten by mule deer, compiled by Kufeld et al. (1973). Of the 394 species and 120 genera listed by Kufeld et al. (1973:Table 3) (a total of 514 rows of information), the following are some of the commonly found species and genera in forbland, big sagebrush, meadow, and aspen communities on the Greys River Ranger District. The right-hand column indicates the number of references listed by Kufeld et al. (1973). Table 4 of their paper lists the actual literature references, and the table also identifies the number of references for each season. Increaser species are also included for comparison.

Plant Communities	Forb Species	Consumption Ranking[B] by Season Spring	Summer	Fall	Winter	No. of Refs.
	Representative Species					
f,sb,ms,a	Sticky geranium	+	+			4
f,a	Ferneaf ligusticum					*
f,sb,ms,a	Tall larkspur		t –	t		2
f,sb,ms,a	Silvery lupine	–	+	++	t –	5
f,sb,ms,a	Needleleaf gianthyssop		+			3
f,a	Blue stickseed					*
f,a	Western valerian		t			1
f,a	Edible valerian					*
f,a,m	Meadowrue	t	+	t		8
f,sb,ms,a	Thickleaf groundsel		+	t		2
f,a	Peregrine fleabane		t	t		2
f,a	Leafbract aster	t	+		t	2
f,a	Thickstem aster					*
f,a	Engelmann aster		+	+		1
f,sb,a	Single-flower sunflower		+		t	3
f,sb,a	Arrowleaf balsamroot	t +	t +	+	+	33
f,a,m	Elkslip marsh marigold		t –	t		2
f,sb,ms,a,m	Western yarrow	t –	t –	t –	t –	27
f,a	Mountain bluebells		t	t		1
f,a	Canada goldenrod					*
f,a	Cow parsnip					*
f,m	California false hellebore					*
f	Long-leaf arnica					*
f,sb,ms,g	Sulphur buckwheat	t ++	t –	t +	t –	6
sb,ms,g	Hood’s phlox	t +		t +	–	11
sb,ms	Pale agoseris			+	t	4
sb,ms	Tapertip hawksbeard	–	t		–	4
sb,ms	Slender locoweed		+			1
f,a	Rocky Mountain goldenrod					*
f,sb,ms,a	Arrowleaf groundsel		t	t		1
f,sb,ms,a	Wyoming Indian paintbrush		++	+	–	2
f,sb,ms,a	Wasatch penstemon	t			t	1
f,sb,ms,a,ss,m	Wild strawberry (Virginia)	t	t –	t +	–	6
a	Woodland strawberry		+			1
f,a	Wild licorice (Glycyrrhiza)	–	++	+	–	5
	Prairie smoke (Geum)	–	t –		t	8
f,sb,ms,g	American bistort (Polygonum)		t –			2
f,sb,ms,g	Yellow salsify	t –	+	+	t –	12
f,sb,ms,g	Blue-eyed Mary (Collinsia)				t	1
f,sb,ms,g	Narrow-leaved collomia	t	–			2

Table 5. Continued.

Plant Communities	Forb Species	Consumption Ranking[B] by Season Spring	Summer	Fall	Winter	No. of Refs.
	Increaser Species					
f,sb,ms	Mule ears	–	++	–	–	5
f,sb,ms,a,ss,m	Northwestern cinquefoil			t	t	4
f,sb	Cutleaf balsamroot					*
f,sb	Cudweed sagewort	t –	t	t –	t –	18
m,ss	Canada thistle (nonnative)	t			t	1
roadsides	Yellow sweetclover (nonnative)	+	++	t ++	t +	6
sb,ms,a,ss,m	Common dandelion (nonnative)	t +	+	t –	t	14
	Common Genera					
f,sb,ms,a,g,m	Lomatium	t ++	–	t	t	8
f,sb,ms,a,g	Lupine spp.	+	–	+	+	35
f,sb,ms,a,g	Daisy spp. (Erigeron)	t +	t –	t –	t –	16
f,sb,ms,a,g	Aster spp.	t +	+	+	+	19
f,sb,ms,a	Goldenrod spp.	t	t +		t –	6
f,sb,ms	Arnica spp.		+			3
f,sb,ms,a	Paintbrush spp.	t	+	t –	t	8
f,sb,ms,g	Milkvetch spp.	t	+	t –	t	12
f,sb,ms	Locoweed	–	t –	t	–	5
f,sb,ms	Pussytoes spp.	+	t	–	t –	14
f,sb,ms,g	Agoseris spp.	–	t –	t	t	9
f,sb,ms,a	Penstemon	t +	t –	t –	t +	25
f,sb,ms,a,ss,m	Thistle (native/nonnative)	t	t +	+	t +	21
f,sb,ms,g	Buckwheat	t –	t +	t –	t +	43
sb,ms	Phlox	t –	t –	t +	t +	25
f,sb,ms	Gilia	t		t –	–	3
f,sb,ms,a,ss,m	Clover	–	t ++	t +	t	15
f,sb,ms,a	Voilet		t –			3

[B] Based on average amounts reported, with t = trace, – = light, + = moderate, and ++ heavy use relative to other species eaten. Two symbols means a range from the first to the second.

* No data provided in Kufeld et al. (1973). This may be a result of the species not being present on any of the study areas or of very low availability, or it could mean that the species was present, but just not selected.

Given the importance of species richness to native ungulates and the naturally high herbaceous-species richness in native forb, shrub-forb, and aspen-forb communities, suitable conditions for native ungulates in forb communities and understories consist of the richness and relative abundance of each species that occurred naturally; see the "Key Habitat Elements" subsection of "Native Wildlife Communities as a Whole," above.

Kufeld et al. (1973) found the composition of forbs in the diets of mule deer rising from an average of 15% in winter to 25% in spring, and rising again to an average of 46% in the summer, and down to an average of 30% during fall. Dietz and Nagy (1976) identified "a great many species of forbs" as being moderately used by mule deer during spring, and .

Elk forage on forbs to a much lesser degree than mule deer, but show a similar pattern. Elk eat few if any forbs during winter and gradually increase their consumption of forbs later in the spring through summer when forbs are succulent (Cook et al. 2002).

MOOSE

Little information exists on the use of forbs by moose, but Table 6 identifies some of the local forbs that were reported used in studies in other parts of the western United States. Moose forage on forbs when they are succulent on the district, and may be an important part of the diet at this time.

Table 6. Graminoids and forbs consumed by moose throughout North America, compiled by Renecker and Schwartz (1997:417-418), but limited to those that occur on the Greys River Ranger District.

Plant Community[A]	Species / Genera	Locations of Studies	No. of Refs.
sb,ms,a,g,m	Wheatgrass spp.	WY, MT	1
sb,ms,g,f,m	Brome spp.	WY	1
sb,ms,a,g,m	Bluegrass spp.	WY	2
all	Grass spp.	NF, IR, BC, AK, MB	11
wm,m	Sedge spp.	AB, NF, IR, BC, AK, MB, NWT, SK	8
f,sb,ms,a,m	Western yarrow	ON, AB	1
f,sb,ms,a	Sticky geranium	MT	1
f,sb,ms,a	Lupine spp.[F]	MT	1
	Fleabane	AB	1
	Willow-herb spp.	WY	1
c	Fireweed	AK,BC	3
sb,ms	Elk thistle	MT	1
	Increaser Species		
f,sb,ms,a,m	Western coneflower	MT	1
ss,m,w	Canada thistle	AB	1

[A] Species that are representative of or common in particular plant communities. Plant communities include mountain big sagebrush (sb), mountain shrubland (ms), forbland (f), silver sagebrush (ss), meadow (m), aspen (a), and wet meadow (wm).

BIGHORN SHEEP

The historical distribution of bighorn sheep in western Wyoming was much larger than it is today, they had much larger seasonal movements, and they historically used a much larger range of habitat types. Their current distribution in western Wyoming is restricted (Krausman and Shackleton 2000, WAFWA 2007). Even though the bighorn sheep distribution in western Wyoming was considerably larger than it is today, bighorn sheep habitat in western North America is naturally fragmented within a much larger landscape (Beecham et al 2007).

Although diets vary among populations and winter diets are dominated by grasses, Krausman and Shackleton (2000) and Beechman et al. (2007) assessed that the diet of bighorn sheep in the Rocky Mountains is dominated by forbs when they are succulent and palatable, followed by grasses, and lastly browse. Shrubs, including sagebrush and bitterbrush, may be used in fall and winter. For bighorn sheep in the Teton Range, Courtemanch (2014:20) assessed that "Bighorn sheep diets were comprised of shrubs, grasses, and sedges during the spring and early summer, and shifted to forbs and grasses later in the summer… Forbs comprised nearly 60% of the August diet. Summer diets were diverse, including 40 plant genera identified from fecal samples… However, only 5 genera were present above 5% in the diet: Bromus (8%), Poa (22%), Carex (20%), Astragalus (8%), and Geranium (6%). Bighorn sheep exhibited significant selection for Bromus, Poa, Carex, and Astragalus throughout the summer…" Two noteworthy items regarding this quoted material: (1) forbs comprised 60% of the August diet, (2) diets consisted of 40 plant species, and (3) nearly all forage species comprise small percentages of their diet. In combination, high plant species diversity appears to be important.

Historically, bighorn sheep wintered on lower-elevation winter ranges, but migration to these low-elevation ranges is much more restricted today, which means they need to now find sufficient winter forage at high elevations.

SAGE GROUSE

Suitability of a big sagebrush site for pre-laying sage grouse hens and sage grouse chicks increases as more of the following species are present and as the canopy cover of individual species increases:

Hawksbeard	Clover	Curlyleaf gumweed
Mountain dandelion	Broomrape	Western salsify
Common dandelion	Long-leaf phlox	Western yarrow
Milkvetch	Parsley	Prickly lettuce
Microseris	Everlasting	Fleabane

This list is based on the following information:

- In a study in southeastern Oregon, pre-laying hens consistently selected for hawksbeard, mountain dandelion, long-leaf phlox, milkvetch, clover, desert parsley, and everlasting (Barnett and Crawford 1994), and these are all well represented on the Greys River Ranger District.
- The Upper Snake River Sage-Grouse Working Group (2008) identified the following forb species as commonly identified as important forb species used by sage grouse in early spring (only those occurring on the Greys River Ranger District are listed): common dandelion, curlycup gumweed, western salsify, western yarrow, prickly lettuce, fleabane, sweetclover, milkvetch, and fringed sagewort, although they noted that most native forb species are eaten by sage grouse when the plants are young and succulent. This group of species may be more representative of Wyoming big sagebrush habitat than mountain big sagebrush habitat.
- Forbs eaten by sage grouse chicks in a study in southeastern Oregon, in order of preference, included hawksbeard, milkvetch, common dandelion, mountain dandelion, broomrape, microseris, and clover (Drut et al. 1994). All of these genera are well represented on the Greys River Ranger District. Sage grouse chicks in the southeast Oregon study foraged on a total of 34 genera of forbs.

MIGRATORY BIRDS AND GROUSE

Many migratory bird species and three species of grouse depend on a relatively natural herbaceous species composition to provide the "right foods" in the "right seasons." There are four main groups of food that have their foundations in herbaceous vegetation and that are highly dependent on herbaceous species composition:

- ***Seeds*** — A large number and wide variety of bird species feed on seeds of grasses, sedges, and forbs, and this includes birds that typically inhabit riparian areas (e.g., mallards, black-headed grosbeaks, white-crowned sparrows, Lincoln's sparrows, savannah sparrows) and rangelands (e.g., Brewer's sparrows, vesper sparrows), as well as species that spend most of their time in forests (e.g., Pine grosbeaks, Cassin's finches). (See "Food Habits" sections for individual species of sparrows, finches, grosbeaks, blackbirds, and ducks in The American Ornithologist's Union's *Birds of North America* reports; the list of herbaceous plant taxa is long.) In part, use of different seed sizes by different bird species stems from different beak sizes. Herbaceous species richness and relative abundance of seedstalks and flowers of particular species is important at least to some degree because different granivorous bird species have different preferences and species richness and relative abundance of seedstalks and flowers can influence the availability of seeds under different situations.

  While the most practical way to provide for the foraging needs of birds with respect to seeds is to restore and maintain a relatively-natural composition of herbaceous species, this likely is not as important as it is for invertebrates.

- ***Flowers*** — Hummingbirds are the only group of bird species dependent on nectar for food, although a few other species will opportunistically feed on nectar (e.g., northern oriole). They use a fairly limited number of forb species as nectar sources.

- ***Leafy Material*** — a small number of bird species eat leaves in meadows (e.g., Canada geese, mallards, sage grouse) and mountain big sagebrush communities (sage grouse). Canada geese and mallards likely will eat most any grass species that is available, sage grouse have distinct preferences for several forb species (see "Sage Grouse" section).

- ***Invertebrate Prey*** — The only practical way to provide for the full range of foraging needs of birds (as well as for bats, small mammals, reptiles, and amphibians) with respect to invertebrates is to restore and maintain a relatively-natural composition of herbaceous species for at least three reasons. First, there is a large number of bird species having known different preferences for invertebrate taxa. Second, there is limited understanding of the prey species of many bird species, the seasonal importance of different invertebrate species, the distribution and abundance of these invertebrate species in the central Rocky Mountains, and the habitat needs of the species inhabiting riparian and rangeland habitat. The most practical approach to provide for a wide range of habitat needs of wildlife species native to an area, when little is known of their species composition or their habitat needs, is to approximate the conditions under which the wildlife community formed (Principle A.2).

  Third, even if sufficient information was available on specific habitat needs of prey species, it would be impractical to attempt to manage for specific habitat needs of individual invertebrate species eaten by a select group of migratory birds, especially given other management objectives and priorities.

  Also critical to providing for a suitable invertebrate prey base is retaining a sufficient amount of herbaceous vegetation to provide for the cover, microclimate, shading, egg-laying-substrate (specific locations on plants), pupation sites, and litter/mulch needs of invertebrates.

- ***Vertebrate Prey (small mammals, birds, reptiles, and amphibians)*** — Approximating a natural composition of herbaceous species and herbaceous retention levels is important to sustaining the range of vertebrate species in riparian areas and rangelands that seasonally provide for the foraging needs of predatory bird species for at least two reasons. First, there is a range of predatory bird species that have known different preferences for vertebrate taxa, and some of these are seasonal. Second, it would be impractical to attempt to manage for specific habitat needs of individual small mammal, bird, amphibian, and reptile species eaten by predatory bird species, especially given the other wide range of habitat needs of migratory birds and other wildlife species, as well as management objectives for other resource areas, recreational use, and commercial uses.

  Likely more important than a relatively-natural composition of herbaceous species is approximating natural vegetation structure, especially for species like meadow voles, montane voles, and long-tailed voles, which provide the bulk of the biomass of small mammal prey in moist meadow complexes. Also critical to providing for a suitable invertebrate prey base is retaining a sufficient amount of herbaceous vegetation to provide for the cover, microclimate, shading, egg-laying-substrate (specific locations on plants), pupation sites, and litter/mulch needs of invertebrates.

BATS

As noted in the Conservation Plan for Bats in Wyoming (Hester and Grenier 2005:11), "In general, nocturnal flying insects are the most common prey, including moths (Lepidoptera), beetles (Coleoptera), flies (Diptera), midges (Chironomidae), mosquitoes (Culicidae), termites (Isoptera), and ants (Formicidae). Some bat species also take non-flying insects, which they glean off of foliage or the ground (Kurta 2000; Hinman and Snow 2003). Although some bats may specialize to some extent, most are opportunistic foragers, concentrating on whatever insects of the correct size are within their habitat and the limits of their morphology and echolocation abilities (Brigham and others 1992)." Although many bat species are opportunistic, flying insects must be of the "correct size," as noted above.

Given unknowns about prey species preferences of many bats and about the occurrence, distribution, and habitat relationships of prey species, the most practical approach to maintaining a suitable prey base for bats is to approximate the conditions under which native insect communities developed, which is consistent with a key premise of the 2012 Planning Rule. An important part of this for insects is approximating a relatively natural composition of herbaceous plant species.

Small Mammals

Herbaceous species composition is important, at least at a broad level, for small mammals. Herbaceous species composition is a key driver of vegetation structure, which is important to many small mammals species. Also, even though the main utility of herbaceous vegetation to microtine voles appears to be hiding and escape cover, Batzli (1985) provided evidence that low amounts of preferred forage, and the subsequent effects on nutrition may play an important role in the population size of voles. Fagerstone and Ramey (1996) cited two studies indicating that sagebrush voles are restricted to areas where bluebunch wheatgrass occurs with big sagebrush.

Several species of shrews exist within the Greys River and Kemmerer Ranger Districts, and they feed on invertebrates. As part of a large group of wildlife species that feed on invertebrates (many species of migratory birds, grouse, bats, small mammals, reptiles, and amphibians), the types and distribution of invertebrates available to shrews depend on habitat conditions, and an important habitat condition that affects invertebrates is herbaceous species composition.

Invertebrates — General

Although invertebrates are treated as one group of wildlife with other groups including amphibians, small mammals, and migratory birds, the number and variety of species represented in the invertebrate grouping far exceeds that of any other grouping. It encompasses thousands of species across numerous classes, orders, families, and genera in riparian areas and rangelands across the central Rocky Mountains. In general, invertebrates include insects, spiders, mites, terrestrial worms, nematodes, centipedes, millipedes, and mollusks. Major orders include dragonflies and damselflies (*Odanata*); grasshoppers, crickets, and katydids (*Orthopera*); stick insects (*Phasmida*); stoneflies (*Plecoptera*); true bugs, cicadas, and kin (*Hemiptera*); beetles (*Coleoptera*); flies (*Diptera*); caddisflies (*Trichoptera*); butterflies and moths (*Lepidoptera*); ants, bees, and wasps (*Hymenoptera*); spiders (*Aranea*); ticks and mites (*Acari*); centipedes (*Chilopoda*); and millipedes (*Diplopoda*). While invertebrate species likely comprise more than 95% of the animal species in riparian areas and rangelands, habitat relationships of these species are much less understood than those of vertebrate species.

Invertebrates are of fundamental importance to a wide range of ecological functions (e.g., pollination, decomposition and soil aeration, herbivory, a major food source) in riparian and rangeland systems. Most insects are either primary or secondary consumers and, therefore, are critical links in food webs (Krebs 1978, Brewer 1979, Ricklefs 1979, Evans 1984). Food-web and energy-pyramid illustrations demonstrate the pivotal role that invertebrates play in sustaining wildlife communities. Pollinators (e.g., moths, butterflies, bees, and some fly and beetle species) play a crucial role in sustaining healthy forbland, meadow, and other plant communities (Samways 2005, National Research Council 2009) and can very well be looked upon as keystone species, especially where forbs are a naturally predominant component of plant communities. Healthy and diverse invertebrate communities are central to sustaining numerous species of birds, bats, small mammals (e.g., shrews), reptiles, and amphibians.

In areas where plant species richness was naturally high, plant species composition is paramount to restoring and sustaining invertebrate communities. Given the large proportion of herbaceous communities and shrub-herbaceous communities that have reduced plant species richness, it is especially important for remaining plant communities in good health (e.g., at potential natural community, potential functioning condition, approximation of natural community) to remain as such. Allowing plant species composition to recover also is important.

Many invertebrate species depend on particular parts of plants (e.g., flowers, seedheads, stalks, leaves, roots), and some even need the correct plant parts at certain positions or heights relative to the ground or top of canopies; as one example, some butterfly species only lay their eggs on leaves of certain plant taxa near the canopy surface (Scott 1986, Samways 2005, National Research Council 2007, New 2009). Some larva attach themselves to particular plant parts of certain plant taxa. Providing for the egg-laying and pupation sites of the full range of invertebrate species, along with providing for the forage needs of these invertebrates, relies heavily upon a relatively-natural composition of herbaceous plant species, relatively-tall herbaceous vegetation, and high percent canopy cover.

A relatively natural species composition of invertebrates is central to maintaining ecosystem functioning conducted by invertebrates and to providing for the seasonal invertebrate-forage needs of more than 100 species of birds, bats, small mammals, reptiles, and amphibians (Wyo. Partners in Flight 2003). And key to this is maintaining (or, restoring and then maintaining) a relatively natural plant species composition in the major vegetation types (Samways 2005, New 2009). Samways (2005:103-104) stressed that "insect diversity conservation depends heavily on plant diversity conservation." Specialization in insects may be a contributing factor to this as well as related findings of Hughes et al. (2000) and Siemann et al. (1998) that higher plant species composition facilitates higher insect diversity.

BUTTERFLIES, MOTHS, AND BEES

While many insect species are generalists, there are also many species that are specialists, with some species of insects depending on one or small number of plant species or species within a small number of genera, and some populations within a given insect species may have different host plant species (Evans 1984:328-331, Scott 1993; and see Tables 7 and 8). There are many examples of this in butterfly, moth, and bee species, although the plant hosts of many butterflies, moths, and bees remain unknown (Scott 1986, Debinski and Pritchard 2002, Poole 2009, Cane In Press).

The information on host plants and on forage-plant species favored by pollinators provided in this section represents a very small fraction of plant-invertebrate relationships and needs. The main point of presenting this information is to illustrate the major importance of plant species richness and relative abundance / canopy cover of individual plant species. As discussed in the main body of the report, "functional plant species composition" is of utmost importance. If herbaceous species composition is measured prior to the livestock grazing season and is ascertained to be "suitable" for pollinators and other invertebrates, but then is grazed to the point that functional plant species composition (e.g., in this case, the abundance of flowers of each particular species that remains, and the amount of forage of particular plant species that remains) is considerably lower than what was measured, pollinators and other invertebrates that depend on the needed plant parts of particular plant taxa — that are no longer available or available at too low of frequency — the pollinator species or other invertebrate species would likely decline in abundance.

Table 7. Plant associations, location of egg-laying, and timing of flights of 15 butterfly subfamilies (representing 138 species), based on information in Scott (1993), Debinski and Pritchard (2002), Pool (2009).

Butterfly Subfamily **Common Name**	**Scientific Name**	**No. Spp. in GYA**	**Timing of Flights**	**Host Plants** (and nectar plants where info. was available)	**Loc. of Eggs On/Near Host Plant**
Parnassians	Parnassiinae	2	Jn-Au	Herb: Stonecrops	on HP
Swallowtails	Papilioninae	6	Ap-Jy, My-Jy, My-Au, Jn-Jy	Herb: carrot family (e.g., cow parsnip, angelica) Woody: Ceonothus, cherry, cottonwood, birches, willows, aspen	leaves & flowers; near HP
Whites	Pierinae	11	Ap-My, My-Jn, My-Jy, My-Au, Au-Se	Herb: Mustard family, Rocky Mtn. bee plant, alpine bladderpod, common tansy Woody: Conifers	leaves, flower buds, flowers; near top of plants
Sulphers	Coliadinae	8	My-Se, My-Oc, Jn-Au, Jy-Au, Jn-Oc	Herb: Pea family (e.g., vetches, locoweeds, clovers, lupines) Woody: Huckleberry, alpine false-wintergreen	leaves; near top of plants
Blues	Polyommatinae	12	Ap-Jn, Ap-Jy, Ap-Oc (3x), My-Au	Herb: buckwheats, asters/sunflowers, herb. primrose, Pea family (e.g., locoweeds, vetches, lupines, clovers, legumes), alpine rock jasmine, saxifrages. Woody: roses, heaths	flowers, flower buds, seed pods, near HP
Hairstreaks	Theclinae	14	Ap-Jn, My-Jn, My-Au, Jn-Jy, Jn-Au	Herb: lupines, buckwheats Woody: bitterbrush, mtn. mahogany, cherry, serviceberry, huckleberry, bearberry, willows, juniper, lodgepole pine Nectar: buckwheats, ceonothus, Rocky Mtn. bee plant, pussytoes, lupines, roses	flowers, leaves, twigs/stems, litter at HP base, near HP
Coppers	Lyaeninae	10	My-Au, Jn-Jy, Jn-Au, Jy-Au	Herb: pondweeds, buckwheats (incl. mtn. knotweed, sorrels, docks) Nectar: buckwheats (as above), rabbitbrush, shrubby cinquefoil, milkweed	leaves, litter at HP base, near HP
Fritillaries–Greater	Heliconinae	10	My-Au, Jn-Au, Jn-Se	Herb: violets	litter at base of HP, on HP
Lesser	" "	8	My-Jn, My-Jy, Jn-Jy, Jn-Au	Herb: violets, bistorts, buckwheats Woody: heath family, willows	near HP, on HP
True Brushfoots	Nymphalinae	10	Ap-Se (2x), My-Jn, My-Au, Jn-Jy, Jn-Au, Jy-Au	Herb: thistles, asters/sunflowers, fleabanes, groundsels, figwort family (e.g., paintbrushes, elephanthead), penstemon, valarians, plantains, honeysuckles, broomrapes Woody: common rabbitbrush	leaves and flowers
Tortoiseshells, Anglewings, Ladies		12	Ap-Se, June, Jn-Jy, Jn-Se	Herb: nettles, thistles, mallows Woody: gooseberries, currents, alders, willows, cottonwoods, birches, ceonothus	leaves and twigs
Admirals	Limenitidinae	2	Jn-Au, Jn-Se	Woody: willows, cottonwood, aspen, rose family (e.g., chokecherry, serviceberry)	leaves
Satyrs	Satyrinae	15	Ap-Se, My-Au, My-Se, Jn-Jy, Jn-Au, Jy-Au, Jy-Se	Herb: grasses (e.g., needle-and-thread, reed canary grass, blue gramma, Kentucky bluegrass), sedges Woody: willows	leaves, stems, rocks near HP
Milkweed Butterfy	Danainae	1	variable	Milkweeds	leaves
Dusky Wings		3	Ap-Jy, Ap-Au	Herb: legumes (e.g., lupines, vetches) Woody: willows, aspen	leaves
Skippers		14*	Ap-Se, My-Jy, My-Au, My-Se, Jn-Jy, Ju-Au, Jy-Oc	Herb: grasses (e.g., Idaho fescue, timothy, wheat-grasses, bluegrasses, wildrye), sedges, horkelias, cinquefoils, mallows (incl. hollyhock), and amaranthaceae and chenopodiaceae families	stalks, seed-heads, leaves, near HP
Total No. Species		138			

Table 8. Plant associations of several bee genera, based on input from Jim Cane, Agricultural Research Service, Logan, Utah (Cane 2011). J. Cane was asked what types of bees are associated with the following forb species.

Forb Species	**Bee Associations**
Sticky geranium	Few sweat bees, Andrena
Fernleaf ligusticum	Unknown
Single-flowered sunflower	Likely large number of bees
Tobacco root	Unknown
Silvery lupine	Moderate to large numbers of Osmia and bumblebees; few Eucera
Fendler meadow rue	Low number of bees
Tall larkspur	Long-tongued bumblebees, possibly Eucera
Showy goldeneye	Moderate to large number of bees, generalists and those liking composites
Mountain bluebells	Bumblebees
Western sweetroot	Unknown
Blue stickseed	Moderate to large number of Osmia, bumblebees, and Andrena
Thickleaf groundsel	Rarely identified with bees
Needleleaf gianthyssop	Bumblebees
Canada goldenrod	Many kinds of bees in good numbers
Leafbract aster	Small generalist bees
Thickstem aster	Small generalist bees
Arrowleaf balsamroot	Select bee species in the Osmia, Halictus, Eucera, Andrena families
Long-leaf arnica	Small number of Osmia, Andrena, and bumblebees
Elkslip marsh marigold	Likely no bees (and likely few insects)
Cow parsnip	Few if any bees (mostly flies)
California false hellebore	Few if any bees (mostly flies)
Western yarrow	Small to moderate number of small bees; not very attractive
Common Genera	
Groundsels	Varies; S. serra abundantly visited
Goldenrods	Many kinds of bees in good numbers
Milkvetches	Abundant Osmia, bumblebees, Eucera
Hawksbeards	Small number of species in the Osmia, Halictus, Eucera, and Andrena families
Fleabanes	Depends on speciesl small generalist bees
Parsley/wild carrots	Small number of species in the Andrena family; abundance of these bees
Lupines	Small number of species in the Osmia, Eucera, and Andrena families
Penstemons	Small number of species in the Osmia (Pseudomasaris on many)
Indian paintbrushes	Bombus use some paintbrush species (red paintbrushes used by hummingbirds)
Cinquefoils	Attracts some bees
Buttercups	Few bees

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Appendix B: Plant Species Common & Scientific Names

GRASSES

Common Name	Scientific Name	Common Name	Scientific Name
Barley, meadow	*Hordeum brachyantherum*	Rush, Baltic	*Juncus balticus*
Bluegrass, bulbous*	*Poa bulbosa*	Rush, Colorado	*Juncus confuses*
Bluegrass, Cusick's	*Poa epilis*	Rush, Sierra	*Juncus nevadensis*
Bluegrass, Kentucky*	*Poa pratensis*	Sedge, analogue	*Carex simulate*
Bluegrass, marsh	*Poa leptocoma*	Sedge, beaked	*Carex utriculata*
Bluegrass, Canada*	*Poa compressa*	Sedge, different-nerved	*Carex heteroneura*
Brome, Smooth	*Bromus inermis*	Sedge, ebony	*Carex ebenea*
Brome, mountain	*Bromus marginatus*	Sedge, Hood's	*Carex hoodia*
Danthonia, timber	*Danthonia intermedia*	Sedge, Liddon	*Carex petasata*
Hairgrass, tufted	*Deschampsia caespitosa*	Sedge, Nebraska	*Carex nebrascensis*
Fescue, Idaho	*Fescu idahoensis*	Sedge, Raynold's	*Carex raynoldsii*
Fescue, spike	*Leucopoa kingii*	Sedge, silver	*Carex praegracilis*
Foxtail, meadow*	*Alopecurus pratensis*	Sedge, slender-beak	*Carex lasiocarpa*
Junegrass	*Koeleria macrantha*	Sedge, small-winged	*Carex microptera*
Mutton grass	*Poa fendleriana*	Sedge, valley	*Carex vallicola*
Needlegrass, Columbia	*Stipa nelsonii*	Sedge, water	*Carex aquatilis*
Needlegrass, Letterman's	*Stipa lettermanii*	Sedge, wooly	*Carex pellita*
Oniongrass	*Melica bulbosa*	Timothy, alpine	*Phleum alpinum*
Oniongrass, purple	*Melica spectabilis*	Wheatgrass, bluebunch	*Elymus spicatus*
Redtop*	*Agrostis stolonifera*	Wheatgrass, slender	*Elymus trachycaulus*
Reedgrass, bluejoint	*Calamagrostis canadensis*	Wheatgrass, thickspike	*Elymus lanceolatus*
		Wheatgrass, western	*Pascopyroum smithii*
		Wildrye, basin	*Elymus cinereus*

FORBS

Common Name	Scientific Name	Common Name	Scientific Name
Arnica, long-leaf	*Arnica longifolia*	Helianthella, one-flower (Sunflower, single-flower)	*Helianthella uniflora*
Aster, Englemann	*Eucephalus engelmannii (Aster engelmannii)*	Knotweed, Douglas’	*Polygonum douglasii*
Aster, leafbract	*Symphyotrichum foliaceum (Aster foliaceus)*	Larkspur, tall	*Delphinium occidentale*
Aster, thickstem	*Eurybia intergrifolia (Aster intergrifolia)*	Ligusticum, fernleaf (Licorice-root)	*Ligusticum filicinum*
Balsamroot, arrowleaf	*Balsamorhiza sagittata*	Lousewort, fernleaf	*Pedicularis bracteosa*
Balsamroot, cutleaf	*Balsamorhiza macrophylla*	Lupine, silvery	*Lupinus argenteus*
Biscuitroot, bicolor (Desertparsley, Wasatch)	*Lomatium bicolor*	Marsh marigold, elkslip	*Caltha leptosepala*
Bluebells, mountain	*Mertensia ciliate*	Mary, blue-eyed	*Collinsia parviflora*
Cinquefoil, gland	*Potentilla glandulosa*	Meadow-rue, Fendler’s	*Thalictrum fendleri*
Cinquefoil, northwest	*Potentilla gracillis*	Mule-ears	*Wyethia amplexicaulis*
Cinquefoil, verileaf	*Potentilla, diversifolia*	Parsnip, cow	*Heracleum maximum*
Coneflower, western	*Rudbeckia occidentalis*	Sneezeweed, orange	*Hymenoxy hoopesii*
Daisy, showy (Fleabane, alpine)	*Erigeron speciosus*	Solomonseal, false	*Maianthemum stellatum*
False hellebore, California	*Veratrum californicum*	Sorrel, mountain	*Rumex paucifolius*
Fleabane, peregrine	*Erigeron peregrinus*	Stickseed, blue (Stickseed, western)	*Hackelia floribunda*
Gianthyssop, nettle leaf (Horsemint)	*Agastache urticifolia*	Strawberry, blueleaf	*Fragaria virginiana*
Geranium, sticky	*Geranium viscosissimum*	Strawberry, woodland	*Fragaria vesca*
Goldeneye, showy	*Viguiera multiflora*	Sweetroot, western (Sweetcicely, western)	*Osmorhiza occidentalis*
Goldenrod, Canada	*Solidago Canadensis*	Tarweed, mountain	*Madia glomerata*
Groundsel, butterweed	*Senecio serra*	Valerian, edible (Tobacco root)	*Valeriana edulis*
Groundsel, thickleaf	*Senecio crassulus*	Valerian, western	*Valeriana occidentalis*
		Yarrow, western	*Achillea millefolium*

Appendix C: Analysis of Gregory (1983)

Don DeLong
10-16-2017

This appendix describes methods I used (1) in "ForbSpeciesRankingsGregory1983_byDeLongDec2012.xlsx," and (2) to identify plant species that are most representative of forbland communities, based on Gregory (1983). I initially relied heavily on Gregory (1983) because it provided the most detailed information on species composition in forb communities on the BTNF. She identified 15 distinct forb community types on the BTNF.

Using Appendix 3-1 of Gregory (1983), I took the following steps.

1. For each species (i.e., each row in Appendix 3-1), I tallied or counted the following:

   a. Columns D-H in Excel Spreadsheet[9]

      I counted the number of community types (columns in Appendix 3-1) for which the plant species had a constancy of at least 20%, and then I did the same for constancies of ≥25%, ≥33%, ≥40%, and ≥50%.

      For example, there were four community types in which arrowleaf balsamroot (BASA) had constancies of at least 20% (BASA-HEUN, AGUR-VEMU, EPAN, and LUAR-FRVI), and there was only one community type in which BASA had a constancy of at least 40% (BASA-HEUN).

      I only did this for species that had relatively-high constancy for at least one community type.

   b. Columns I in Excel Spreadsheet

      I counted the number of plant communities for which there was at least one occurrence of the species.

   c. Columns K-M in Excel Spreadsheet

      The number of plant communities (of the 4 in each group) in which the given plant species had a constancy of ≥25%. An example is that arrowleaf balsamroot (BASA) had constancies of ≥25% in 2 of the 4 plant community types in Group 1 (AGUR-VEMU and LUAR-FRVI, but not LIFI-DEOC and HELA-RUOC).

      To begin with, three groupings of community types were delineated based on whether community types generally encompassed a large number of species (Group 1) or a low number of species (Groups 2 and 3); whether moist/wet and productive soils generally supports a high species richness (Group 1) or where the canopy is dominated by one species (Group 3, except HEHO); where (Group 2).

      Group 1 (4 types): Fernleaf ligusticum – tall larkspur (LIFI-DEOC), silvery lupine – Virginia strawberry (LUAR-FRVI), nettle leaf gianthyssop – showy goldeneye (AGUR-VIMU), cow parsnip – black coneflower (HELA-RUOC)

      Soils typically are still productive and moist, typically with high ground cover. Plant species typically is high.

[9] ForbSpeciesRankingsGregory1983_byDeLongDec2012.xlsx

Group 2 (4 types): Cutleaf balsamroot (BAMA), Arrowleaf balsamroot – single-flower sunflower (BASA-HEUN), cudweed sagewort – edible valerian (ARLU-VAED), mule ears (WYAM)

Soils are relatively dry or well drained, or a portion or all of the A horizon has been lost (and sometimes some of the B horizon). Plant species richness generally is low and it is not uncommon for one species to dominate the canopy.

Note that the constancy of VAED in the ARLU-VAED type is only 32%. Many ARLU-VAED sites are dominated by ARLU with few other species.

Group 3: Mountain bluebells (MECI), California false hellebore (VECA), long-leaf arnica (ARLO), orange sneezeweed (HEHO)

Soils typically are moist or wet, typically are productive. However, compared to Group 1, the canopy typically is dominated by one species. An exception is orange sneezeweed; although plant species richness typically is low, the canopy usually is not dominated by orange sneezeweed. HEHO may fit better in Group 2.

2. Plant species were ranked according to their constancies and representation across plant communities (1.a-c, above), and then plants species were ordered according to this ranking. Constancies in columns D-H were most important in ranking the species, followed by the number of plant communities with at least one occurrence of the species, and followed by the number of plant communities (of the 4 in each group) in which the given plant species had a constancy of ≥25%.
3. Plant species were divided into three categories (see column A of the Excel spreadsheet):
   a. Perennial species that commonly are part of mixed communities (rank 1-33)

      Plant species richness of associated communities tends to decline with incrementally lower rank, especially at the bottom end of this category (i.e., as 33rd rank is approached), due to increasing dryness or wetness. As examples, cow parsnip, mountain bluebells, and one-flower sunflower (especially mountain bluebells) can comprise nearly 100% of the canopy cover of communities, situations which would place them in "b," below.
   b. Perennial Species that dominate communities, many times nearly singularly (rank 34-43)

      Exceptions (species that do not tend to dominate canopies) included edible velarian and elkslip marshmarigold.
   c. Annual species (these species were not ranked, and were placed at the bottom of the table)

   Note how this aligns with the blue, purple, and pink highlights of plant species in the Excel spreadsheet (see legend at the bottom of the spreadsheet).
4. The plant species "…that commonly are part of mixed communities" were ranked according to their constancies and representation across plant communities (1.a-c, above). Constancies in columns D-H were most important, followed by the number of plant communities with at least one occurrence of the species, and followed by the number of plant communities (of the 4 in each group) in which the given plant species had a constancy of ≥25%.
5. This information was used to help build lists in the second bullet at the bottom of page 1 and top of page two of the "Wildlife Input on Desired Conditions for Forbland Communities" document, in the following two categories:

   Forbs representative of forb community types or are widespread across types

   Forbs representative of small number of forb comm. types, and not widespread across types