Retention of Forage, Cover, and other Elements of Wildlife Habitat on Livestock Grazing Allotments of the Greys River Ranger District

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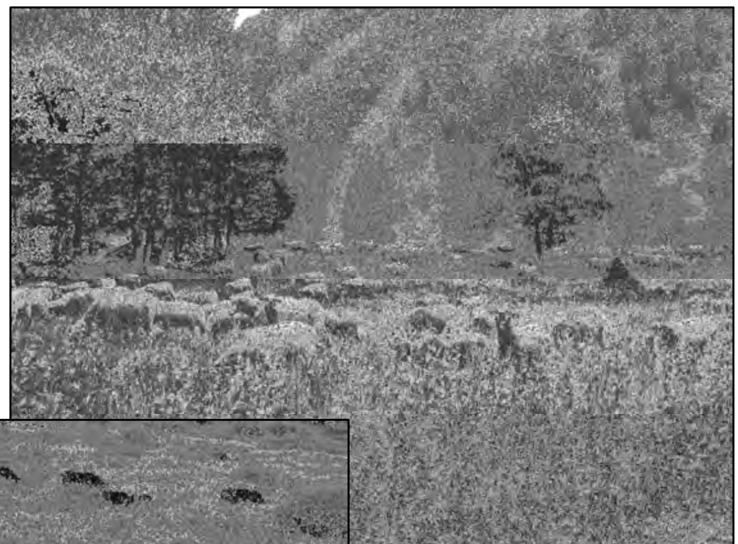

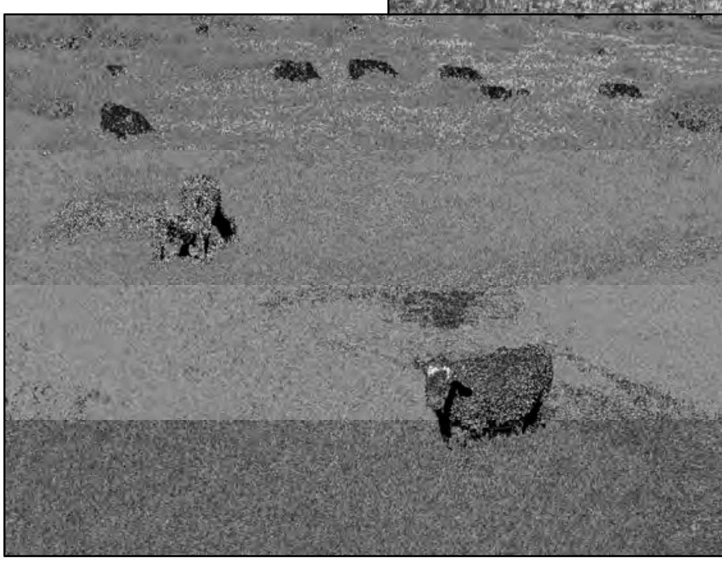

by: Don DeLong, Program Manager (Wildlife, Range, Weeds, & Lands)
Greys River Ranger District, Bridger-Teton National Forest
Afton, Wyoming

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Summary

Recommendations of this effort are consistent with and are well within the range of recommended utilization limits in the range profession. For example, recommended forage utilizatoin standards fall between recommendations of Holechek et al. 2004 (and Vallentine 1990) and Heady and Child (1994). Stubble height recommendations are within the range identified by leading riparian specialists (e.g., Clary and Webster 1990, Hall and Bryant 1995, Clary and Leninger 2000).

While this report focuses almost exclusively on the retention of suitable habitat conditions for wildlife, I made concerted effort to recognize the need and requirement to continue to provide viable livestock grazing opportunities on the Greys River Ranger District. Large parts of the district emphasize wildlife over livestock grazing use, but there are only limited casese where there is a requirement for no adverse impacts of livestock grazing. The Bridger-Teton National Forest Land and Resource Management Plan (Forest Plan) does not require optimum conditions to be provided for wildlife, nor does it require that livestock grazing use be maximized. Balance between these and other uses is required, with the degree of balance shifting among different parts of the district depending on Desired Future Conditions (DFCs) as outlined in the Forest Plan.

The Forest Plan requires wildlife objectives be incorporated into allotment management plans (AMPs) and for the needs of wildlife to be integrated into allotment specific allowable-use standards and livestock grazing practices, and this is reinforced by other directives (e.g., Executive Order 13186). Two fundamental habitat elements must be addressed in direction provided in AMPs: suitable habitat conditions and the amount of this suitable habitat to be retained. I am assuming that both can be built into forage utilization and stubble height standards without having to specify a threshold for the “adequate amount” element. However, if monitoring reveals this is not sufficient to ensure that an adeaquate amount of suitable habitat is being retained, there may be a need to specifically address this element in standards. This report provides the wildlife discipline’s recommendations into the development of these elements of AMPs for allotments on the Greys River Ranger District, and it outlines my thought process in formulating my recommendations.

Wildlife habitat provided by herbaceous vegetation encompasses forage (leafy matter, flowers, seeds, and roots), forage for prey species, and cover (e.g., for nesting, protection from predators, thermal regulation), as well as watershed health elements to sustain habitat quality (e.g., litter, organic content of soil) and fine fuels to facilitate fire which is critical to a large number of wildlife species. Wildlife habitat provided by shrubs includes browse (e.g., leaves, twigs, flowers, berries, roots), forage for prey species, and cover, as well as watershed health elements for sustaining habitat.

Herbaceous vegetation constitutes *the* habitat of many wildlife species and their prey on the district, and it constitutes an important element of habitat and/or key environmental factor (e.g., fine fuel for facilitating fire spread, contribution to limiting sedimentation of wetlands) for most other species. Tall, dense herbaceous vegetation is under-represented and short, sparse herbaceous vegetation is overrepresented in the Greys River/Salt River area of western Wyoming compared to conditions under which wildlife communities developed in this area. There are no

wildlife species that depend on short and/or sparse herbaceous vegetative conditions on the district whose habitat needs are not met by a combination of plant communities having naturally short/sparse herbaceous vegetation, grazing by native herbivores, annual compression of herbaceous vegetation by snow, other natural processes, and, additionally, degraded rangeland and riparian conditions. Therefore, livestock grazing has a direct influence on the amount of suitable habitat that is maintained for wildlife.

Graminoid-Dominated Communities and Understories

Suitable Habitat — For a range of wildlife species, I estimated the amount of herbaceous vegetation that would need to be retained on a given site in order to maintain suitable forage, cover, and other habitat attributes for them (several species are illustrated in Figure S-1). This was done to ensure that my recommendations considered the needs of a full range of wildlife species relative to existing ecological conditions. However, no attempt was made to formulate recommended allowable-use standards for individual species or groups of species.

In general, there is a high level of information supporting the assessment that retaining 80-90% of the annual production of herbaceous vegetation in any given area would provide for the forage, cover, and other habitat needs of most dependent wildlife species. There is a moderate to high level of information supporting the assessment that retaining 70% of the annual production of herbaceous vegetation in any given area would provide for the needs of most dependent wildlife species, but low indication that the needs of species most dependent on tall, dense herbaceous vegetation would be met. There is a low to moderate level of information supporting the assessment that retaining 60% of the annual production of herbaceous vegetation in any given area would provide for the needs of most dependent wildlife species. There is little to no information supporting the assessment that retaining ≤50% of the annual production of herbaceous vegetation in any given area would provide for the needs of most dependent wildlife species. These assessments assume properly functioning conditions; if conditions are below properly functioning condition, higher retention levels would be needed.

The percentages in Figure S-1 are presented in terms of herbaceous vegetation as a whole, which applies well to cover needs of wildlife. However, retention of the annual production of key forage species is more important to herbivores. The relationship between retention of herbaceous vegetation and retention of key forage species depends on the composition of key forage species in plant communities and the difference in utilization rates of key and non-key species. If the composition, by weight, of key forage species for livestock is 25-50% of the total herbaceous community and if the forage utilization rate of non-key species is no higher than ¼ to ½ the utilization rate of key forage species, the following conversions apply:

Table S-1.

To Maintain Minimum Retention Levels for Key Forage Species of:	Retention of Herbaceous Vegetation (overall) would need to be at Least:	
70%	80-85%	(as high as 90% if retention of non-key species is >95%)
60%	70-80%	
50%	60-70%	(as high as 80% if retention of non-key species ≈ 95%)

If the composition of key forage species for livestock is closer to 75% of the plant community, the lower end of the range for retention of herbaceous vegetation (overall) would be 5% lower in

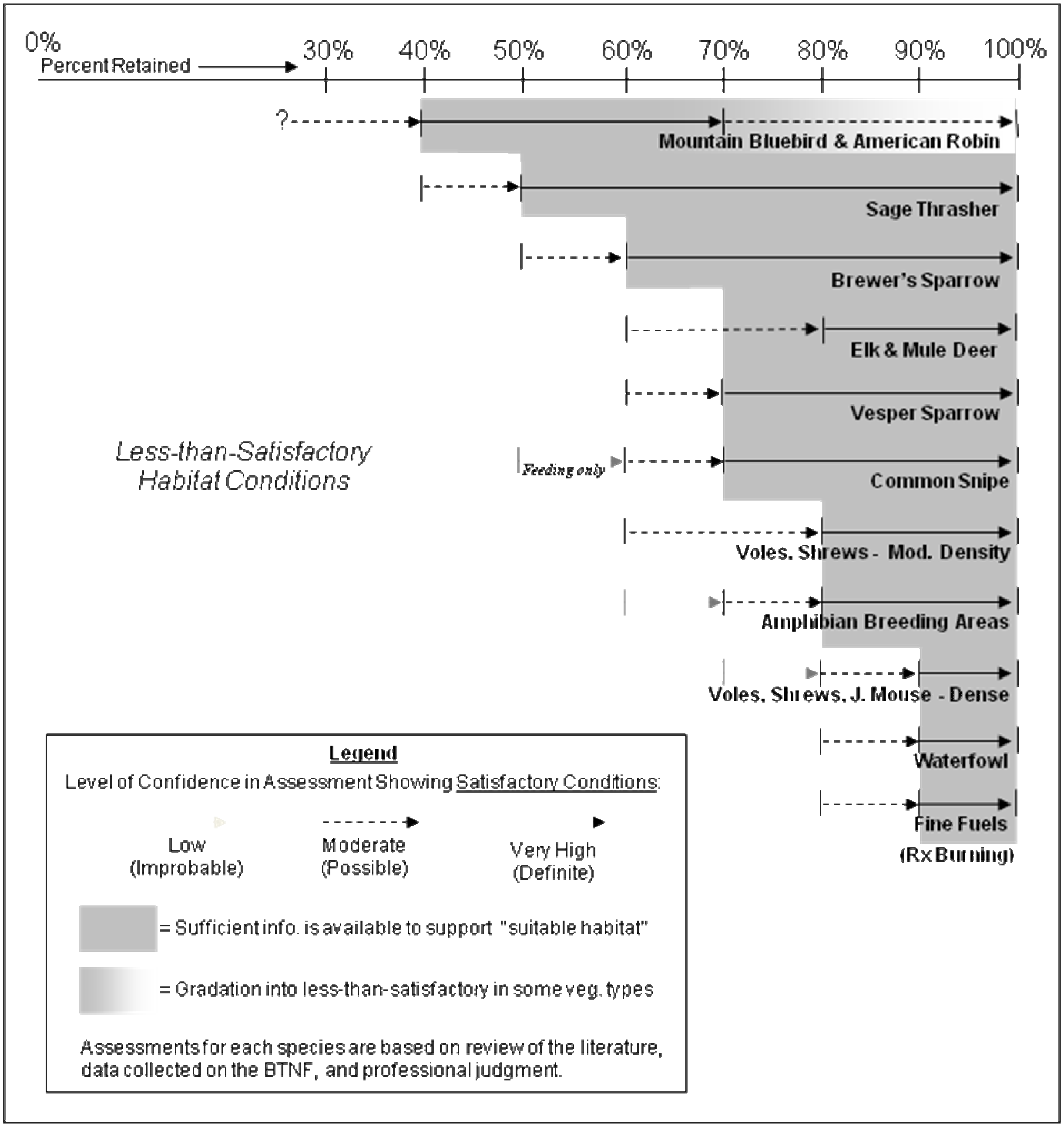

Figure S-1. Suitable habitat conditions as related to different retention levels of total-herbaceous vegetation during the livestock grazing season (assuming healthy, properly functioning conditions). If conditions are less than properly functioning, the amount of herbaceous vegetation retained would need to be higher, proportional to the extent to which conditions deviate from healthy, functioning conditions.

each case (i.e., 75%, 65%, and 55%, respectively). If the composition of key forage species for livestock is <25%, for example in areas that are functioning at risk and in sedge meadows, the retention levels for herbaceous vegetation would be >85%, ≥80-90%, and ≥75-80% respectively.

Establishing stubble height standards on streambanks is done mainly to protect streambank stability and protect willows from excessive browsing, but is not important for retaining suitable forage and cover for wildlife so long as forage utilization limits for the riparian zone retain an adequate amount of suitable forage and cover along streambanks and other parts of the riparian zone. There is little to no indication that contemporary recommendations on minimum average stubble heights on streambanks (e.g., Hall and Bryant 2003, Clary and Leninger 2000) would retain an adequate amount of suitable forage and cover in the vicinity of streambanks. However, minimum stubble heights are critical for the purposes for which they are established (e.g., maintaining streambank stability, reducing browsing on willows), all of which are central to sustaining the capability of riparian zones to produce wildlife habitat. Because average minimum stubble heights would need to be considerably higher than the recommended 3-6 inches and because wildlife forage and cover can be better addressed through forage utilization limits, I only provided a few considerations to consider on the subject of minimum stubble heights.

Adequate Amount of Suitable Habitat — The Forest Plan does not require 100% of allotments to provide suitable habitat for wildlife. Rather, it requires that an "adequate amount" of suitable habitat be retained, with adequacy being dependent on the particular DFCs overlaying a given pasture or allotment. In the DFC areas that emphasize wildlife while providing for livestock grazing to the extent it is compatible with wildlife (DFCs 10 and 12), it is clear that well over half of the habitat should be suitable for dependent wildlife species (Table S-2). Otherwise, it could not be demonstrated that wildlife is being emphasized. Using the same logic, it may be possible to retain less than half of DFC 1B areas, with an emphasizes commodity uses such as livestock grazing, in suitable condition for wildlife, except that (1) the Forest Plan requires DFC 1B areas to contribute to viable populations of MIS, and (2) retaining suitable wildlife forage and cover on less than half the area would conflict with requirements to sustain rangeland and riparian health and functionality (see footnote "D" in Table S-2).

Both from the standpoint of retaining an adequate amount of suitable habitat for wildlife and from the standpoint of sustaining rangelands and riparian areas in healthy condition (and restoring degraded rangelands and riparian areas), the extent of over-use by livestock is an important element that needs to be recognized and managed. As a starting point for developing forage utilization limits that account for the needs of wildlife, I recommend a maximum of 15-30% utilization of the total annual herbaceous production in healthy, functioning uplands and riparian areas of DFC 10 and 12 portions of pastures and a maximum of 30-35% in these parts of DFC 1B areas, so long as a sufficient amount of lightly grazed and ungrazed habitat is retained and so long as there is deferred rotation or rest rotation. A maximum utilization rate of 15% of herbaceous vegetation may be needed to limit utilization of key forage species at 30%.

The recommendation for DFC 10 and 12 areas would allow ⅔ to ¾ or more of each major habitat type within pastures to retain ≥70% of the annual production of herbaceous vegetation (or, ≥60% if ≥70% of the annual production of *key forage species* is found not to be retained on a substantial proportion of each pasture (e.g., if it is <⅓ of a pasture, the recommended forage utilization limit on herbaceous vegetation would need to be reduced.

Table S-2. Forage utilization limits on herbaceous vegetation (**bold**) on grazed portions of riparian & ulands within pastures[C] that would retain suitable wildlife forage and cover at designated proportions, using 70-100% retention of herbaceous vegetation to represent the range of suitable habitat conditions. Forage utilization standards for riparian areas/meadows and upland rangelands need to be kept separate and the largest unit of measure for each of these should be at the pasture level. The recommendation for DFC 1B areas represents an absolute maximum from the standpoint of wildlife habitat, and does not encompass the full range that could be considered; the low end may be as low as 15%, based on published recommendations, but this is an issue for rangeland management specialists.

	Proportion of Each Major Vegetation Type in which 70-100%[A] of the Annual Production is Retained	Utilization Limits on Herbaceous Vegetation that would Allow Suitable Forage and Cover to be Retained at Proportions Shown to Left	*Equivalent Utilization of Key Forage Species*
Rangelands			
DFCs 10 and 12 Areas	2/3-3/4[B]	**≤15-30%**	*≤30-40%*
DFC 1B Areas	1/2-2/3[C]	**≤30-35%**[E]	*≤40-45%*[E]
Riparian Areas & Meadows			
DFCs 10 and 12 Areas	2/3-3/4[B]	**≤15-30%**	*≤30-40%*
DFC 1B Areas	1/2-2/3[C]	**≤30-35%**[E]	*≤40-45%*[E]

[A] This means that retention levels on a site-by-site basis range from 70% to 100%, and it does not allow for an average of 70% across a large area. In other words, no part of the designated proportion (expressed as a fraction) can dip below a retention level of 70%.

[B] DFC 10 and 12 areas — This builds in the "adequate amount" element of wildlife habitat. Proportions are based on ≥10-20% of each major vegetation type being ungrazed (or no more than ≤5% utilization). For grazed portions of pastures, proportions are based on (1) ~25-40% of each major type being grazed at no more than 6-20% utilization of the annual production of herbaceous vegetation and (2) ~30-40% of each major type is grazed at no more than 21-40% utilization (i.e., ≥80% of each type would have 60-100% of annual production of herbaceous vegetation retained). This allows for up to 20% of each type to be grazed at 41-60% utilization of herbaceous vegetation, or approximately 50-75% utilization of key forage species.

[C] DFC 1B areas — This builds in the "adequate amount" element of wildlife habitat. Proportions are based on (1) ~15-25% of each major type being grazed at no more than 6-20% utilization of the annual production of herbaceous vegetation and (2) ~35-60% of each major type is grazed at no more than 21-40% utilization. This allows for up to 33% of each type to be grazed at 41-60% utilization of herbaceous vegetation, or 50-75% utilization of key forage species.

[D] Forage utilization standards for riparian areas/meadows and upland rangelands need to be kept separate within pastures. Ideally, the standards should be monitored in discrete riparian areas / rangelands within pastures.

[E] The upper end of the range (35% utilization of herbaceous vegetation) may be acceptable if the utilization level of key forage species is acceptable from the standpoint of rangeland health and if foraging habitat is marginally or near suitable for native ungulates and other wildlife (i.e., ≤40% utilization of key forage species, possibly ≤45%). Factors to consider regarding rangeland health include: (1) at 35% utilization of herbaceous vegetation, up to an estimated 70% or more of the basal area of key forage species could be grazed to near ground level (allowing up to 50% or more of key forage plants to be grazed at 60-70% utilization), and (2) up to 50% or more of the basal area of herbaceous plants in general could be grazed to near ground level. A utilization level of 35% of herbaceous vegetation is at or near the low end of suitability, meaning that it is likely sufficient in DFC 1B areas. Forage utilization of key forage species could be as high as 50%, but this likely is not acceptable from the standpoint of sustaining properly functioning conditions.

How my recommendations compare with several recommendations by contemporary range management recommendations are illustrated in Figure S-2.

In this report, I provide specific recommendations for native ungulate winter range, amphibian breeding/foraging areas, pika foraging habitat, and other sites.

Although efforts to increase the distribution of livestock use help make greater use of forage by livestock — and, therefore, supportive of the livestock use objective of the Forest Plan — these efforts are generally not consistent with Forest Plan objectives for wildlife (i.e., the lighter an area is grazed by livestock, the more suitable the habitat will be for wildlife). The extent to which attempts are made to increase the distribution of livestock use need to consider the emphasis of the DFC area(s) within which the pasture or allotment exists.

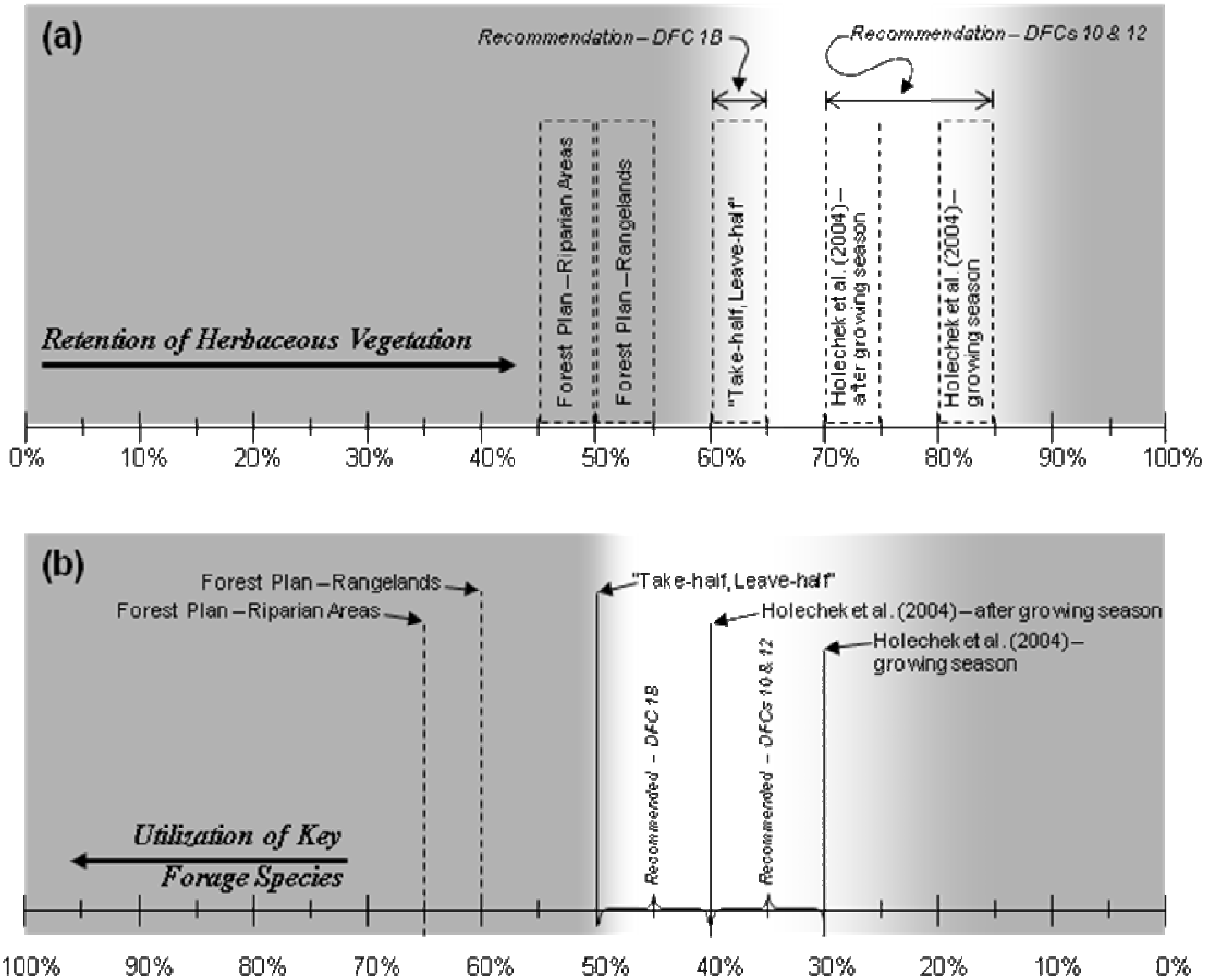

Figure S-2 Illustration of the relationship between recommended limits on forage utilization for retaining suitable forage/cover for wildlife and a range of recommended limitations in the published literature for sustaining healthy rangelands. The white portion generally indicates this range as a "window," with gray areas on each side representing utilization limits that are generally beyond what is acceptable for sustaining healthy rangelands in the Intermountain West. Also shown are maximum forage utilization limits in the Forest Plan.

(a) Illustrates this from the standpoint of retention levels of herbaceous vegetation. Recommendations in the literature (typically utilization levels on key forage species) were converted to retention of herbaceous vegetation.

(b) Illustrates this from the standpoint of forage utilization levels on key forage species. Recommendations from this report (utilization levels on herbaceous vegetation) were converted to utilization levels on key forage species.

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Forb-Dominated Communities and Understories

While many of the same principles apply to forbland, herbland, and big sagebrush-forb communities, there are several key challenges in managing sheep grazing use to retain adequate amounts of suitable forage and cover for wildlife, as compared to managing cattle grazing use. It is necessary to recognize and understand these challenges in order to provide meaning recommendations for managing sheep grazing in ways that retain a sufficient amount of annual production of herbaceous vegetation for wildlife. One of the biggest challenges is the absence of standardized methods for efficiently measuring or estimating percent forage utilization in forb-dominated communities/understories or the amount of herbaceous vegetation remaining in them after being grazing by sheep.

"Once-over" sheep grazing with sheep moving at their own pace is assumed to leave a sufficient percentage of the annual production to sustain rangeland health and to provide for the needs of wildlife. However, the extent to which this is true depends on sheep numbers, terrain features, width and size of rangelands, condition and productivity of rangelands, precipitation levels, distribution of forestland, and other factors. Sustainability and recovery of rangeland health can be tracked over the long-term using standardized methods for measuring percent ground cover, plant species composition, and other attributes. There appear to be no standardized methods for efficiently measuring or estimating the retention of herbaceous vegetation in forbland, herbland, and shrub-forb communities relative to Forest Plan requirements of retaining an adequate amount of suitable forage and cover for wildlife on a year-to-year basis.

There is strong need to develop meaningful wildlife-habitat objectives and to develop meaningful and workable allowable-use standards (e.g., utilization standards) designed to ascertain the extent to which wildlife-habitat objectives in the Forest Plan are being achieved on sheep allotments.

Until then, I recommend designing and implementing sheep grazing practices that (1) maintain functioning rangelands in functioning condition; (2) allow restoration of rangelands that are functioning-at-risk (upward trends in ground cover and plant species composition); (3) rest large areas that are dominated by non-functioning condition until ground cover reaches 60-70% and vegetation cover reaches minimumally-acceptable levels; (4) limit sheep grazing to no more than once-over and adjust sheep numbers to limit grazing intensity at light or conservative levels, recognizing varying topography, size of rangelands and forest openings, etc.; (5) rest functioning rangelands at least once every 4 years, and (6) rest parts of allotments dominated by functioning-at-risk rangelands once every 2-3 years. Regularly scheduled rest would contribute to the mitigation of any short-comings in retaining an adequate amount of suitable forage and cover for wildlife. Light to conservative grazing pressure, from the standpoint of wildlife habitat, means retaining "a large majority" of the annual production of herbaceous vegetation, conceptually equating to >60-70% but without using these percentages since there apparently are no standardized, time-efficient methods for measuring this.

Introduction

This report provides the wildlife discipline's recommendations into the development of wildlife objectives, allowable-use standards, and livestock grazing practices for allotments on the Greys River Ranger District of the Bridger-Teton National Forest (BTNF), as called for in the Forage Utilization Standard and Allotment Management Plan Standard, Forage Utilization Standard, and as also required by Objectives 2.1(a), 3.3(a), 4.7(b), and 4.7(b), and the Sensitive Species Management Standard. The report outlines my thought process in formulating my recommendations. I included a version number in the title to facilitate future updates based on new information, clarifications to be added, and to allow for any errors to be corrected.

The BTNF Land and Resource Management Plan (Forest Plan) requires the needs of wildlife to be integrated into site-specific allowable-use standards and livestock grazing practices. Beyond requiring lands in functioning condition to remain in functioning condition and beyond requiring the restoration of lands in less-than-functioning condition — both central to meeting wildlife objectives of the Forest Plan — the Forest Plan includes the following requirements with respect to the inclusion of wildlife needs into management direction provided in allotment management plans (AMPs):

- Adequate amounts of suitable forage, cover, and other important habitat components must be retained for wildlife in areas grazed by livestock (Objectives 2.1(a), 3.3(a), and 4.7(d)).
- Wildlife habitat provided in riparian areas must be addressed in AMPs (AMP Standard).
- Sensitive animal species must be protected to ensure that activities do not cause long-term or further decline in population numbers, and trends toward federal listing (Objective 3.3(a), and the needs of sensitive species must be addressed in AMPs (AMP Standard).
- Findings from big-game winter range evaluations must be incorporated into AMPs as wildlife habitat objectives (AMP Standard).
- Interdisciplinary teams must prescribe site-specific utilization levels needed to meet Forest Plan objectives, including Objectives 2.1(a), 3.3(a), 4.7(a), 4.7(b), and 4.7(d) (Forage Utilization Standard, Proper-Use Standard).
- Interdisciplinary teams to establish site-specific utilization levels on key wildlife ranges (Forage Utilization Standard, Proper-Use Standard), including crucial winter range, parturition areas, riparian areas, and sage grouse leks and nesting sites (from the Fish; Wildlife; Threatened, Endangered, and Sensitive Species Standard).

Additionally, Executive Order 13186 and USFS and USFWS (2008) require the Forest Service to "Protect, restore, and conserve habitat for migratory birds, addressing the responsibilities of Executive Order 13186," and to "Pursue opportunities to restore or enhance the composition, structure, and juxtaposition of migratory bird habitat…" to the extent practicable. One requirement of Executive Order 13186 is to give serious consideration to migratory bird conservation principles and best management practices in the management of federal lands, including management of livestock grazing. These requirements do not call for anything beyond what is already required by the Forest Plan with respect to the management of livestock grazing (e.g., Objectives 3.3(a), 4.7(a), 4.7(b), 4.7(d); Fisheries and Wildlife Prescription; AMP Standard; Forage Improvement Standard; Aspen Management Guideline; Prescribed Fire Guideline). Within the scope of meeting these objectives, standards, and guidelines, Executive Order 13186 and USFS and USFWS (2008) merely reinforce and stresses the importance of meeting them for migratory birds.

The purpose of this report is to identify the needs of wildlife that need to be taken into account when allowable-use standards and livestock grazing practices are being evaluated and possibly revised for individual allotment management planning efforts on the Greys River Ranger District. The Greys River Ranger District is in the process of reviewing and revising AMPs. Much of this information has been considered in the development of allowable-use standards and livestock grazing practices to date, and earlier draft reports contained some of this information (e.g., a 4-27-08 report co-authored with Geoffory Anderson). The 9-9-08 version of this report was completed for the Little Greys Cattle Allotment.

Part I — Legal/Policy Basis

The relative importance of wildlife in management decisions on the district's livestock allotments and the extent to which forage, cover, and other habitat components are provided for wildlife on livestock allotments are most directly dictated by direction in the Forest Plan, but is also influenced by higher level policy and laws. At the most basic level with respect to livestock and wildlife, the BTNF is required to manage livestock grazing use on allotments to:

- Allow riparian areas, rangelands, and forestlands in properly functioning condition to be sustained and to allow those in less-than-satisfactory condition to be restored (to the extent functionality is affected by livestock grazing use).
- Provide for the grazing of livestock on active allotments by contributing to Objective 1.1(h) of the Forest Plan.
- Provide an adequate amount of suitable forage, cover, and other habitat attributes for wildlife each year in areas grazed by livestock, particularly in riparian areas, crucial winter ranges, parturition areas, and important habitat for threatened and sensitive species, MIS, and migratory birds.

The highest priority requirement is the first bullet. It addresses basic resources that must be sustained and restored, first-and-foremost, before achieving any other Forest Plan objectives. The first bullet provides the building blocks for the second and third bullets, and is needed for their long-term sustainability. Opportunities for livestock grazing on active allotments are provided to the extent they do not materially interfere with direction summarized in the first bullet and to the extent direction in the third bullet can also be met. The latter depends to some degree on the particular DFC in which a particular allotment falls.

The Forest Plan also requires that wildlife habitat requirements be reflected in site-specific objectives and allowable-use standards for each allotment, and that this be documented in AMPs.

Wildlife is emphasized most in DFCs 10 and 12. Where there are conflicts between livestock grazing use and wildlife, conflicts need to be resolved in favor of wildlife while at the same time diligently finding ways to accommodate livestock grazing to the greatest extent possible. In DFCs 2A, 2B, 3, and 4, wildlife and livestock grazing are of roughly equal consideration and, therefore, need to be balanced to the extent possible (recognizing that livestock grazing is slightly less emphasized in DFCs 3 and 4). Livestock grazing use is clearly emphasized in DFC 1B, but even here the needs of wildlife need to be at least minimally provided for.

The basis of this summary is outlined in the following sections.

A. National Direction

Laws

Under the Organic Administration Act of 1897 (16 USC 475), national forests were 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…" The area encompassed by the Greys River Ranger District was added to the forest reserve system by a 1902 presidential proclamation that expanded the Teton Forest Reserve, which itself was an expansion of the Yellowstone Park Timber Land Reserve, originally established in 1891. The purpose of the Yellowstone Park Timber Land Reserve were not agreed upon by Congress until the signing of the Organic Act in 1897 (Steen 1991), and this purpose is quoted above.

The Multiple-Use Sustained Yield Act of 1960 (16 USC 528) declared that "…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, wildlife] 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]."

Policy

Some of the applicable national-level policy includes the following:

- FSM 2202.1 — *National Forest System Objectives* for range management programs on National Forests (those applicable to managing livestock and wildlife):
    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 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.

Other policy is summarized in the subsection, "Riparian and Rangeland Health and Functionality," below.

FOUR THREATS AND LEGACY AREAS

An analysis presented in the Middle Greys River Watershed Assessment (USFS 2005: Figure 3.3.1a, Table 3.3.1c and page 45) reconfirmed the most critical underlying limitations to the long-term conservation of wildlife habitat at the north end of the project area, which also applies to other parts of the project area:

- Reduced fire frequency and extent.
- Increasing amount and extent of motorized vehicle use (and supporting facilities such as roads, trails, and dispersed camping areas).
- Introduction and spread of noxious weeds.
- Unnaturally high levels of herbivory by livestock and native ungulates. By far the largest proportion of impacts stems from historic levels of herbivory, but present-day livestock grazing continues to directly affect ecological conditions, including wildlife habitat.
- Development along borders and in inholdings.

Four of the five underlying limiting factors listed above parallel the most serious threats to the health of the forests and rangelands in the National Forest System: excessive fuel loading (ultimately caused by reduced fire frequency and extent), unmanaged recreation (primarily unmanaged motorized recreation), introduction and spread of nonnative invasive species, and loss of open space (http://fsweb.wo.fs.fed.us/pao/four-threats). The top three objectives for providing basic stewardship and protection on National Forest System lands in Region 4 of the Forest Service directly address the reduced frequency and extent of fire, introduction and spread of noxious weeds, and effects of livestock grazing (USFS 2006).

Achieving desired conditions, Forest Plan goals and objectives pertaining to wildlife habitat on the Greys River Ranger District, and migratory bird requirements (next section) depends in a very large way on how these limiting factors are addressed. The management of livestock grazing use on the Greys River Ranger District will influence the extent to which three of the five limiting factors can successfully be addressed. Therefore, to achiving wildife goals and objectives in the Forest Plan and to meet migratory bird requirements, development of livestock grazing management strategies and controls must address each of these limitations with respect to wildlife habitat.

Water was named by the new Chief of the Forest Service as one of three legacy areas of the National Forest System. Water is one of the building blocks of wildlife habitat in many different ways and because livestock grazing management has a large influence on water cycling (USFS 2006), development of livestock grazing management strategies and controls must address water cycling.

B. Vision and Mission of the Bridger-Teton National Forest

VISION

The BTNF vision statement identifies conditions the forest strives to achieve:

> "The Bridger-Teton National Forest is home to world-class headwaters, wildlife, wilderness and wildlands. Conserving these values, in concert with providing for sustainable uses, is our legacy. We are leaders committed to service, action and excellence."

MISSION

The BTNF mission statement identifies employee attributes the forest aims to meet:

> "The employees of the Bridger-Teton National Forest are dedicated to sound natural resource management. We care for the land by improving and maintaining healthy Forests and rangelands, clean air and water, and diverse habitat for fish and wildlife populations. We serve the people by encouraging responsible use of the resources our Forest provides.
>
> We aim to be progressive leaders in natural resource management. We work effectively as a team, committed to timely completion of projects to meet resource and public needs. We value public comment, we foster partnerships and we are active in our communities. Above all else, Bridger-Teton National Forest employees respect each other and the public we serve."

C. Direction in Forest Plan, Reg. Business Plan, & Forest Service Manual

While this report focuses on retaining sufficient herbaceous vegetation to adequately provide for the needs of wildlife, management direction on restoring and sustaining basic resources (soil and water), and riparian and rangeland functioning is crucial to wildlife conservation. Healthy riparian areas and rangelands are the most fundamental building blocks of wildlife habitat in these areas, and they affect the health and functioning of adjoining forestlands. Pertinent Forest Plan direction is summarized in the first subsection, below.

The second subsection (Livestock Grazing Use) identifies Forest Plan and other direction for providing opportunities for livestock grazing on the Greys River Ranger District. This information is included to provide context.

The third subsection (Wildlife Habitat) outlines direction for meeting the needs of wildlife on the district, including within livestock grazing allotments on the district.

The fourth subsection (Desired Future Condition Management Areas) discusses the implications of management themes and emphasis of Desired Future Conditions (DFCs) in the Forest Plan, and their role in prioritizing among Forest Plan objectives.

RIPARIAN, RANGELAND, AND FORESTLAND HEALTH AND FUNCTIONALITY

The following direction, in combination with the Organic Act and Multiple-Use Sustained Yield Act, requires that livestock grazing use be managed to allow riparian areas and rangelands in properly functioning condition to remain in this condition and to allow those in less-than-satisfactory condition to be restored. This direction is very important to restoring and sustaining suitable habitat conditions for wildlife. Rangeland Specialists, working with interdisciplinary teams and permittees, develop allowable-use standards and livestock grazing practices to meet this requirement. Restoring properly functioning conditions in rangelands and forestlands on the Greys River District will require increased fire (e.g., prescribed burning, wildland fire use) and other vegetation treatments. Fine fuels are important to this aspect of recovery, and they are directly affected by livestock grazing use (i.e., the amount of herbaceous vegetation retained) and indirectly affected by livestock grazing use (by affecting the recovery of rangelands in less-than-satisfactory condition).

The following summarizes direction for each of the main resource areas:

- Soils in unsatisfactory condition must be rehabilitated to satisfactory conditions and allow soils in satisfactory condition to be maintained in a satisfactory, productive condition; activities are managed to protect this basic watershed resource (FSM 2202.1; FSM 2522.02; FSM 2550.3; FSM 2553.02; R4 Business Plan Objective A.3; Forest Plan Objectives 4.7(a) and 4.7(b); Range Vegetation Prescription; Forage Improvement Standard; and the Soil, Water, and Air Preservation Prescription);
- Water Quality must be retained at or above current State water quality standards and National Forest System water quality goals (FSM 2202.1; FSM 2532.02; R4 Business Plan Objective A.3; Forest Plan Objective 1.3(b); Water Quality Standard; and the Soil, Water, and Air Preservation Prescription);
- Riparian Areas, Wetlands, and Floodplains are managed as basic resources for forest management, key to the future productivity of the BTNF (Forest Plan Objective 4.7(b); Riparian Areas, Wetlands, and Floodplains Prescription).
- Streambanks must be protected, and restored where degraded, and bank stability should be retained at 90% of natural (Livestock Grazing of Riparian Areas Standard, Streambank Stability Guideline, Restoring Stream Channel Conditions Guideline).
- Streambank Vegetation that is needed for healthy riparian areas must be restored and sustained; e.g., retained at or restored to 80% of its natural condition (Forest Plan Objective 4.7(b), AMP Standard, Streambank Stability Guideline).
- Range Conditions and Livestock Forage must be improved or retained to healthy conditions; range in less-than-satisfactory condition must be improved; forage must be provided on a sustained yield basis that protects rangeland values, wildlife habitat, and meets other resource needs (FSM 2202.1, FSM 2520.2, FSM 2522.02, Forest Plan Objective 4.7(a), Forest Improvement Standard, Range Vegetation Prescription).
- Aspen sites are managed for the perpetuation aspen for the benefit of wildlife and visual resources, with the loss of aspen stands due to old age, conifer encroachment, and over-browsing being prevented (Aspen Management Guideline (BTNF-wide and DFCs 1B, 2A, 2B, 3, 4, 10, 12); General Vegetation Prescription; Forest Plan Objectives 2.1(a),

3.3(a), and 4.7(d); Fish and Wildlife Prescription; Big Game Habitat Guideline (DFCs 1B, 3, 10, and 12)).

- Noxious Weeds must be addressed in livestock grazing management to minimize the extent to which livestock and livestock grazing contribute to their spread (Four threats, R4 Business Plan Objective A.2, Forest Plan Objective 4.8(b)).
- Vegetation Treatment needs to be addressed in the livestock grazing program to allow for the restoration and sustainability of fire-dependent plant communities (Four Threats, R4 Business Plan Objective A.1, Aspen Management Guideline; Also: FSM 2202.1, FSM 2520.2, FSM 2522.02, FSM 2630.2, FSM 2630.3, Forest Plan Objectives 2.1(a), 3.3(a), and 4.7(a-d)).
- Prescribed Fire Guideline — Prescribed fire may be used to accomplish resource objectives, including producing desired habitat for wildlife, suppressing insects and diseases, improving livestock forage, maintaining fire-dependent animal and plant species, and achieving other desired vegetation conditions.
- The Forest Plan was amended in 2004 to allow wildland fire use management in most of the Greys River Ranger District.

LIVESTOCK GRAZING USE

The main direction pertaining to livestock grazing use is to provide forage for livestock, which contributes to the local economy (Multiple-Use Sustained Yield Act and Forest Plan Goal 1.1 and Objective 1.1(h)). Objective 1.1(h) is to “Provide forage for about 260,000 AUMs of livestock grazing annually.” This is a BTNF-wide objective and does not require every area to provide forage for livestock. The environmental impact statement completed for the Forest Plan recognized that livestock grazing use may decline somewhat on the BTNF as livestock grazing management came into compliance with guidelines and standards.

WILDLIFE AND WILDLIFE HABITAT

The following direction requires that livestock grazing use be managed to allow an adequate amount of suitable forage, cover, and other habitat components be provided to wildlife in areas grazed by livestock. This direction applies to all DFC areas, but the degree of application varies among them. In DFC 1B areas, at least a minimally-adequate amount of at least minimally-suitable habitat must be provided. In DFCs 2A, 2B, 3, and 4, the benchmark is somewhat higher, with habitat provided further within the range of adequacy and suitability. The benchmark is higher still for DFCs 10 and 12 areas, within which the amount and quality of wildlife habitat must clearly be adequate and suitable, respectively.

Suitable habitat does not translate to optimum or ideal habitat conditions for any given wildlife species or group of species. Nor do suitable habitat conditions include habitat conditions that are marginally acceptable such that dependent wildlife inhabit the area, but do poorly. Similarly, an adequate amount does not translate to an optimum amount or total coverage, and nor does it mean providing a token amount of suitable habitat that does not contribute to meeting the needs of dependent wildlife populations. Distribution of suitable habitat is an important consideration. These terms are discussed in more detail in the “Ecological Basis” section.

Threatened, sensitive, and management indicator species of the Greys River Ranger District, and the general category of migratory birds, are listed in Table X. Management indicator species (MIS) are discussed in more detail in USFS (2009). Migratory birds of conservation concern are listed in Appendix A.

Forest Plan Objectives

- Objective 2.1(a) — Provide suitable and adequate habitat to support the game and fish population objectives established by the WGFD.
- Objective 3.2(e) — Provide suitable and adequate amounts of habitat for bald eagles.
- 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.
- Objective 4.7(a) — Retain or improve overall forage and range conditions.
- Objective 4.7(d) — Require that suitable and adequate amounts of forage and cover are retained for wildlife and fish.
- Objective VEG 01 — Manage vegetation to mimic or approximate natural succession and disturbance processes while maintaining habitat components necessary for the conservation of lynx. (Objectives VEG 02, 03, and 04 are within this scope of this objective).

Forest Plan Standards, Prescriptions, and Guidelines

- Sensitive Species Management Standard (BTNF-wide) — Quantifiable objectives will be developed to identify and improve the status of sensitive species and eliminate the need for listing. Crucial habitats of priority I, II, and III species are listed by WGFD and the Intermountain Region Sensitive Species List will be protected and maintained. The Forest Service will cooperate with WGFD on management programs when needed to maintain population objectives of these species, especially with species which have been identified as needing immediate attention and active management to ensure a significant decline in breeding populations do not occur. Information collection and interpretive programs will promote the conservation of these species and their habitats. National Forest managers will participate in species and habitat surveys and monitoring programs needed to gain necessary data to determine population status.
- Fisheries and Wildlife Prescription (for DFCs 1B, 2A, 2B, 3, 4, 10, and 12) — Habitat is managed to help meet objectives for game populations, harvest levels, success, and recreation days.(pgs. 155, 163, 169, 175, 180, 235, 243).
- Big-Game Habitat Guideline (for DFCs 1B, 3, 10, and 12) — Sufficient habitat should be provided to maintain desired populations and distributions of big-game species. *In particular:* Moose winter range — Maintain about 75 percent of the willow/grass type in a willow type. (pgs. 155, 175, 235, 243).
- Diversity of Wildlife Habitat Guideline (for DFCs 2A, 3) — Diverse wildlife habitat types should be maintained within each watershed. Sufficient habitat should be provided to maintain WGFD population objectives and distributions of native wildlife. (pg. 163, 175)

- Allotment Management Plan Standard (forest-wide) — Fisheries, riparian habitats, and TES species' needs will be addressed in AMPs. Findings from big-game winter range [e.g., moose winter habitat in willow bottoms] evaluations will be incorporated into AMPs as wildlife habitat objectives and management procedures. Plans will identify the amount of <u>streamside vegetation</u> needed to maintain or improve riparian areas. (pg. 127)
- Forage Utilization Standard (forest-wide) — This standard did two things: (1) it established absolute maximum utilization limits, and (2) it identified required site-specific allowable-use standards to be developed (pgs. 127-128):
  1. Maintain grazing-use levels in below 65% in riparian areas of satisfactory condition and below 55% in riparian areas of satisfactory conditions.
  2. During AMP revision, the interdisciplinary team and livestock permittees will prescribe site-specific utilization levels needed to meet Forest Plan objectives (e.g., objectives 2.1(a), 3.2(e), 3.3(a), and 4.7(d)).

     The maximum forage utilization guideline will apply to all types of grazing use including wildlife, livestock, and recreational stock.

     During monitoring and evaluation, a utilization guideline may be changed if the prescribed utilization level is not accomplishing planned 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.
- Proper-Use Guideline — Range proper-use standards, including forage utilization standards, should vary depending on site-specific objectives.
- Forage Improvement Standard (forest-wide) — Range in less-than-satisfactory condition will be improved. Disturbed areas will be stabilized or regenerated prior to resuming livestock grazing use. (pg. 128)
- Range Vegetation Prescription (for DFCs 1B, 2A, 2B, 3, 4, 10, and 12) — Range is managed to maintain and enhance range and watershed condition while providing forage for livestock and wildlife. (pgs. 156, 163, 169, 176, 181, 236, 244)
- Protection: Fire Prescription — Fire is managed as a tool to accomplish resource objectives while protecting idenfied values within acceptable levels of risks.
- Prescribed Fire Guideline — Prescribed fire may be used to accomplish resource objectives, including producing desired habitat for threatened, endangered, and sensitive species; developing desired wildlife habitat conditions; and maintaining fire-dependent animal and plant species; among other uses (see guideline for more detail).

<u>Migratory Bird Conservation Requirements</u>

- Migratory Bird Treaty Act — This Act prohibits the “taking” of migratory birds, which is addressed in more detail in Executive Order 13186, and USFS and USFWS (2008).
- Executive Order 13186 — Among other requirements, the executive order requires all federal agencies to (1) design migratory bird habitat conservation principles and practices into agency plans (e.g., AMPs); (2) ensure these agency plans promote programs and recommendations of migratory bird plans such as Partners-in-Flight and North American Waterfowl Management Plan, as well as guidance from other sources (see outline,

below); and (3) guidance in E.O. 13186 encourages federal agencies to use their authorities to conserve migratory birds and minimize unintentional take.

The Forest Service is a partner in the Intermountain West Joint Venture (stepped down from the four major national/North American bird plans) and Wyoming Partners in Flight.

- ▫ Pertinent objectives of the 2005 Intermountain West Joint Venture Coordinated Bird Conservation Plan include:
  - Manage montane riparian zones for stable, non-eroding banks; pristine water quality; stable, year-round flows and sustainable use without abuse over the long-term (this is a priority objective).
- ▫ Pertinent objectives of the Wyoming Steering Committee of the Intermountain West Joint Venture – 2005 include:
  - Permanently protect, maintain, enhance and/or restore 155,000 acres or more of montane riparian habitats.
  - Manage montane riparian zones for stable, non-eroding banks; pristine water quality; stable, year-round flows and sustainable use without abuse over the long-term (this is a priority objective).
  - Manage montane riparian zones from a watershed perspective, and ensure that montane riparian habitats are continuous along the entire drainage and are as wide as the soil and water table will allow riparian vegetation to exist (this is a priority objective).
  - Permanently protect, maintain, enhance and/or restore 27,000 acres or more of wetland and pond complex habitats.
  - Restore or rehabilitate, for wetlands, the hydrology, water quality, and native plant communities of degraded and disturbed wetlands and pond complexes (this is a priority objective).
- ▫ The 2003 Wyoming Partners in Flight Bird Conservation Plan includes similar objectives, and it contains many Best Management Practices pertinent to livestock grazing on the Greys River Ranger District, which need to be considered.

- The purpose of the MOU between the Forest Service and U.S. Fish and Wildlife Service (2008), which was required by Executive Order 13186, is to "…strengthen migratory bird conservation by identifying and implementing strategies that promote conservation and that avoid or minimize adverse impacts on migratory birds…" There are several requirements of the MOU that pertain to livestock grazing management on National Forest System lands. For example, the Forest Service is responsible for:
  - ▫ Protecting, restoring, and conserving habitat for migratory birds, addressing the responsibilities in Executive Order 13186.
  - ▫ Promoting of collaborative inventory, monitoring, management studies, and research related to the conservation of migratory birds and management of their habitats.
  - ▫ Increasing awareness of information contained within comprehensive planning efforts [e.g., Wyoming Partners in Flight (2003), Intermountain West Joint Venture (2005)] for migratory birds in order to facilitate integration of conservation measures into land management and project planning.
  - ▫ Evaluating the effects of agency actions (e.g., implementation of AMPs) on migratory birds, focusing first on species of management concern along with their priority

habitats and key risk factors. To the extent practical in the NEPA process, the following steps must be taken:
- Evaluate and balance long-term benefits of the project against adverse effects.
- Pursue opportunities to restore or enhance the composition, structure, and juxtaposition of migratory bird habitats in the project area.
- Consider approaches, to the extent practicable, for identifying and minimizing take that is incidental to otherwise lawful activities, including (1) altering the season of activities to minimize disturbances during the breeding season, and (2) retaining the integrity of breeding sites, especially those with a long history of use.

▫ Initiating and supporting management studies and research to identify the habitat conditions needed to conserve migratory birds, and to evaluate the effects of management activities on habitats and populations of migratory birds.

DESIRED FUTURE CONDITION (DFC) MANAGEMENT AREAS

The Forest Plan recognizes there are inherent conflicts between some objectives and that not all objectives will be fully met on all areas (pages 93 and 145). Because livestock eat herbaceous vegetation and browse and can cause mechanical damage to vegetation and soil, there are potential conflicts between objectives dealing with livestock grazing use and objectives for wildlife habitat, as recognized in the Forest Plan (USFS 1990a:82, 120, 241-242) and associated EIS (USFS 1990b:283, 298).

The Forest Plan states that any conflicts between objectives must be resolved through the application of Desired Future Conditions (pages 93 and 145). Conflicts among objectives need to be resolved in favor of the objective(s) for resources/uses that are of higher emphasis in a particular DFC, as outlined below in Table 1. Table 2 identifies the management emphasis and management theme of each DFC on the Greys River Ranger District, except for the very small DFCs (9A and 9B).

DFCs influence the extent to which suitable wildlife habitat is restored and provided, including the extent to which suitable forage and cover are retained for wildlife in any given area (see the "Adequate/Suitable versus Marginal and Optimum" subsection in the discussion of background material for the "Ecological Basis" section).

Table 1. Emphasis among resource and use objectives for individual DFC areas (objectives that pertain to or can be affected by livestock grazing and livestock grazing management).

	Ranking (1 = highest emphasis)						
Objectives for:	**DFC 1B Areas**	**DFC 2A Areas**	**DFC 2B Areas**	**DFC 3 Areas**	**DFC 4 Areas**	**DFC 10 Areas**	**DFC 12 Areas**
Rip./Range/Forest Health & Functioning[A]	1	1	1	1	1	1	1
Livestock Grazing Use	2	3	3	3b[B]	2b	3[C]	3
Wildlife Habitat	3	3	3	3a	2b	2	2[D]
Recreation	3	2	2	2	2a	4	2

[A] See basis discussed in text.

[B] lower-case "a" denotes at least a slight emphasis over "b." For example: (1) while DFC 3 calls for protection from activities that can impact certain wildlife values, it does not call for any protection of livestock grazing use; (2) while DFC 4 appears to emphasize semi-primitive recreation to some extent (bottom pg. 179), it places lower emphasis on livestock are wildife; (3) page 149 of the Forest Plan specifies that DFCs 3 and 4 are managed to meet WGFD population objectives, but nowhere is it specified that livestock grazing use is emphasized in these DFCs.

[C] Opportunities for livestock grazing are provided "while having no adverse and some beneficial effects on wildlife."

[D] Emphasis is on big-game species.

Table 2. Management themes and management emphasis' of each of the major DFCs within the Greys River Ranger District.		
DFC	**Management Theme**	**Management Emphasis**
1B	"An area managed for timber harvest, oil and gas, and other commercial activities with many roads and moderate to occasional substantial emphasis on other resources."	"…scheduled wood-fiber production and use, on livestock grazing use, and on other commodity outputs."
2A	"An unroaded area managed to give a quiet, almost primitive recreation experience."	"…Primitive and Semi-Primitive Non-motorized dispersed recreation opportunities."
2B	"An area managed to give a motorized recreation experience."	"…dispersed recreation opportunities including Semi-primitive Motorized and Roaded Natural..."
3	"An area managed to give river- and scenic-recreation experiences."	"…are protected from activities that could diminish or change the free-flowing characteristic, water quality, or the scenic, recreational, fish and wildlife, and other values which make the river eligible for designation."
4	"An area managed to protect municipal water supplies."	"…protect or improve the quality of municipal water supplies."
10	"An area managed to allow for some resource development and roads while having no adverse and some beneficial effects on wildlife."	"…provide long-term and short-term habitat to meet the needs of wildlife managed in balance with timber harvest, grazing, and minerals development. All surface-disturbing activities are designed to have no affect or beneficial effects on wildlife..."
12	"An area managed for high-quality wildlife habitat and escape cover, big-game hunting opportunities, and dispersed recreation activities."	"…providing important habitat for big-game as winter ranges, feedgrounds, calving areas, and security areas..."

Regardless of DFC, restoring and sustaining the health and functionality of riparian areas, wetlands, rangelands, and forestlands must be taken care of first and foremost. The health and functioning of these areas plays a central role in providing adequate amounts of suitable forage and cover for wildlife. Where riparian areas and/or rangelands are less-than-functioning, livestock grazing must be managed to allow restoration to occur. This emphasis is based on several directives. Together, the 1897 Organic Act and Multiple Use Sustained Yield Act of 1960 require that livestock grazing only be accommodated to the extent that it does not derogate the ability of the land to secure favorable conditions of water flow (16 USC 475). However, this does not impose an absolutely-no-adverse-effect standard. National-level range objectives (e.g., FSM 2202.1), Objective A.3 of the Region 4 Business Plan, and Forest Plan prescriptions call for livestock grazing to managed to ensure basic protection of soil and water. The Forage Improvement Standard requires rangeland in less-than-satisfactory condition to be improved and further that disturbed areas will be stabilized or regenerated prior to resuming livestock grazing use. The Rangeland Vegetation Prescription calls for forage to be provided for livestock *on a sustained yield basis* that protects rangeland values, wildlife habitat, and meets other resource needs. The Livestock Grazing in Riparian Area Standard requires "Livestock grazing in riparian areas will be managed to protect streambanks." According to the Watershed Restoration Standard, the importance (in terms of timing) of watershed restoration is proportional to elevation; i.e., higher elevation rangelands have higher priority for restoration. Other Forest Service Policy and Forest Plan direction (e.g., Objectives 4.7(a) and 4.7(b)) provide additional direction for restoring, protecting, and conserving these basic resources.

Thus, site-specific allowable-use standards and livestock grazing practices in all DFC areas must allow ecological conditions in riparian areas and rangelands to be sustained (where they are in healthy and functioning condition) and to be restored (where they are not in healthy and functioning condition), and this is the responsibility of Rangeland Specialists in coordination with interdisciplinary teams and permittees during the allotment management planning process and afterward as adjustments are needed.

After health and functionality are addressed, site-specific allowable-use standards and livestock grazing practices must also meet the needs of resources and uses that are emphasized in particular DFC areas, according to Tables 1 and 2, including the provision of as much forage as possible to livestock on active allotments while still meeting Forest Plan objectives, standards, prescriptions, guidelines, and DFC direction.

Most DFCs (e.g., 2A, 2B, 3, 10, 12) note "You may find some sheep, cattle, and pack animals through the area… You can see evidence of recent livestock grazing in some areas but not in others" (pgs. 162, 168, 174, 234, 242). Some DFCs are somewhat more restrictive. For example, DFC 4 notes that cattle and sheep may be excluded from crucial water supply areas and DFC 12 notes that "Livestock are not permitted on crucial big-game winter ranges closed to grazing. Livestock grazing is permitted on other big-game ranges if it does not conflict with wildlife needs" (pg. 242).

DFC 1B — This DFC clearly emphasizes livestock grazing over wildlife. This is highlighted in the theme and management emphasis statements, and in the series of pictures showing the primary activities in DFC 1B areas. However, the needs of wildlife (e.g., MIS, sensitive species, migratory birds) need to be met to some extent. For example, the Forest Plan requires habitat to be maintained for viable populations of MIS (pg. 149).

DFC 2A, 2B, 3, and 4 — There is no clear prioritization between objectives for wildlife and livestock grazing use (neither are emphasized in theme or management emphasis statements), but additional information provides guidance for striking a balance in terms of allowable-use standards and other livestock grazing management requirements. For example, the picture and caption for DFC 2B (USFS 1990:167) emphasize livestock grazing as a primary activity in this DFC area. Where an allotment is dominated by DFC 3 (e.g., Big Greys cattle allotment), the area must be "protected from activities that could diminish or change the free-flowing characteristic, water quality,… *fish and wildlife*, and other values which make the river eligible for designation," emphasis added. This elevates wildlife and wildlife habitat somewhat and, therefore, the balance falls somewhere between that of DFC 1B and DFC 10/12 areas. Although DFC 4 does not place a higher emphasis on wildlife than livestock grazing use, the bar is raised with respect to watershed functioning and provision of clean and sustainable water supplies. The Forest Plan write-up for DFC 4 areas recognizes the conflicts between livestock grazing use and the protection of municipal water supplies; where the conflict is high enough, the DFC calls for exclusion of livestock. It also de-emphasizes wildlife to some extent.

Objectives and allowable-use standards for DFC 2A, 2B, and 3 areas should be evaluated on a case-by-case basis. If DFC 2A, 2B, 3, and/or 4 areas are relatively small and are surrounded primarily by DFC 10 and 12 areas, recommended objectives and allowable-use standards should be considered for the entire area. If they are surrounded primarily by DFC 1B areas, objectives and standards for DFC 1B should be considered for the entire area. This would reduce complexity of management.

DFC 10 — The theme and emphasis of DFC 10 stresses meeting the needs of the large variety and number of wildlife species in balance with providing opportunities for livestock grazing. Balancing wildlife and livestock grazing does not necessarily mean "equal" provision of wildlife habitat and livestock grazing across the landscape. Clearly, providing opportunities for resource development is one of the highlights of this DFC, but providing opportunities depends on the extent to which the extent to which adverse impacts to wildlife would occur and, ultimately, the extent to which the short-term and long-term needs of wildlife can be met. Therefore, if a given type of resource development has few adverse effects on wildlife, many opportunities can be provided. On the other hand, if a given form of resource development has large adverse impacts on wildlife, few opportunities can be provided if they cannot be adequately mitigated. (Presumably livestock grazing is a type of resource development; otherwise livestock grazing is not part of the theme of this DFC.) Additionally, page 149 of the Forest Plan requires habitat to be maintained for viable populations of MIS.

DFC 12 — Big game is emphasized in this DFC and opportunities for livestock grazing may be provided to the extent they do no not conflict with big game needs. Of all DFCs, constraints on livestock grazing to meet big game needs is highest because (1) big game is clearly emphasized, (2) livestock grazing is not an emphasis or theme of the DFC, and (3) direction is given to only permit livestock grazing if it does not conflict with big game needs, to the extent that livestock grazing can be discontinued. At a minimum (from the standpoint of other wildlife), meeting the needs of the large number of non-game wildlife species and livestock grazing need to be balanced in this DFC, as there is nothing in the DFC that would indicate that livestock grazing is emphasized over non-game wildlife. The most positive language toward livestock grazing in DFC 12 — in the "Experience" section — is that "You *may* find some sheep, cattle, and pack animals throughout the area," emphasis added. On the other hand, there are several indications that wildlife other big game is emphasized at least equally with livestock grazing, if not higher. The theme of DFC 12 states that the area is managed for "high-quality wildlife habitat," and this is repeated at the bottom of the same page (pg. 241) and it is accompanied by a picture of a non-game species. Pictures were selected to illustrate the theme of the DFC, as is the case with all DFC descriptions in the Forest Plan. While it could be argued the authors of the Forest Plan were not careful in their writing and they actually meant big game habitat when they twice used the term "wildlife habitat," it is unlikely they would have mistakenly included a picture of a pine marten accompanied with a caption highlighting wildlife habitat. Additional direction on page 149 (summarized below) requires that habitat is maintained for viable populations of all MIS.

Page 149 of the Forest Plan provides additional information on meeting the needs of MIS in different DFCs:

- Habitat is maintained for viable populations of MIS in all DFCs.
- DFCs 3, 4, 10, and 12 areas are managed to meet WGFD population objectives and to provide habitat for populations, harvest levels, success rates, and recreation days.
- In DFCs 2A and 2B areas, habitat must be managed to help meet WGFD objectives, harvest levels, success rates, and recreation days for wildlife.
- In DFC 1B areas, habitat is provided for existing populations and 50% of harvest levels, success rates, and recreation days.
- DFCs 9A may meet and DFC 9B does not meet WGFD objectives.

Part II — Ecological Information

Within the framework established by the Forest Plan and other management direction outlined above, I compiled and analyzed a range of information to more definitively define — numerically where possible — the forage, cover, and other habitat needs of wildlife on the Greys River Ranger District with respect livestock grazing use. Information included published information on habitat-relationships, results of scientific research, data collected on the district, and professional judgment in light of this information.

The intent of this information is to provide wildlife-related input into the process of developing resource objectives for lands encompassed by allotments, and into the process of reviewing and revising site-specific allowable-use standards and livestock grazing practices.

In compiling and analyzing this information, I recognize that (1) restoring and sustaining riparian and rangeland health and functionality provide is the driving force behind the development of site-specific allowable-use standards and livestock grazing practices; and that (2) site-specific allowable-use standards and livestock grazing practices are typically developed to maintain existing levels of livestock grazing use to the extent possible while meeting Forest Plan objectives, standards, prescriptions, and guidelines for resources, as prescribed in DFCs. In situations where wildlife needs would be sufficiently met — relative to the wildlife-related requirements of the Forest Plan and other direction — by adhering to site-specific allowable-use standards and livestock grazing practices developed to restore and sustain riparian and rangeland functioning, site-specific allowable-use standards and practices would not have to be more restrictive. However, where wildlife needs are not met relative to requirements, site-specific allowable-use standards and practices would need to be further restrictive.

A. Background Information for this Section

OVERALL APPROACH TO DEFINING FORAGE, COVER, AND OTHER NEEDS OF WILDLIFE

Several factors warrant a broad-brush approach to incorporating wildlife forage and cover needs into resource objectives and allowable-use standards: (1) the large number and great variety of MIS species, sensitive species, migratory birds, their prey, and other native wildlife species inhabiting habitats affected by livestock grazing on allotments in the Greys River Ranger District[A]; (2) the diversity and sometimes conflicting nature of habitat preferences/needs of each of these species; and (3) livestock grazing is broad-brush and cannot be expected to be micromanaged to allow specific conditions to be retained in specific areas (e.g., in contrast to prescriptive treatments such as mowing to a certain height in specific areas). Rather, it makes most sense to identify broadly-defined allowable-use standards that would sufficiently retain an adequate amount of forage and cover for wildlife communities across relatively large areas. Exceptions may include important sites for particular wildlife species (e.g., amphibian breeding sites) where strictly relying on a broad-brush approach may result in forage or cover needs not being met.

[A] There are 74 species of mammals, 208 species of birds, 6 species of amphibians and reptiles, and many hundreds of species of invertebrates on the BTNF, and most of these occur on the Greys River Ranger District.

Successfully accounting for the needs of individual wildlife species in a broad-brush approach requires an examination of the details of their needs and, subsequently, synthesizing all these individual needs into a broader strategy. Importantly, very little numeric information exists for most wildlife species. To fill this information gap for these species, several approaches can be used to translate narrative characterizations of forage and cover needs into numeric management recommendations.

Thus, a straightforward way of defining overall forage and cover needs of wildlife for a given area and, ultimately, developing resource objectives and allowable-use standards based on this information is to:

1. Document herbaceous-plant heights in the major native plant communities. When these heights are assessed at the plant community level, it provides an approximation of the conditions under which native wildlife communities were formed and sustained (for one of may factors affecting wildlife diversity).
2. Assess the forage needs of individual wildlife species and groups of species, and how they relate to different grazing intensities.
3. Assess the cover needs of individual wildlife species and groups of species, and how they relate to different grazing intensities.

Each of these are addressed in more detail starting on page 31.

ADEQUATE AMOUNT OF SUITABLE HABITAT

For objectives that call for "suitable and adequate" or "suitable and adequate amounts" of habitat or forage/cover to be provided or retained, I interpreted them requiring that an "adequate amount of suitable" habitat or forage/cover be provided or retained for the following reasons:

- Several Forest Plan objectives call for "adequate amounts" of habitat (for sensitive species and bald eagles; Objective 3.2(e) and 3.3(a)) and forage and cover (for all wildlife in areas grazed by livestock; Objective 4.7(d)) to be provided.
- Another objective calls for "suitable and adequate" habitat be provided (game animals; Objective 2.1(a)).
- Providing a "suitable and adequate amount of habitat" can be interpreted as providing "suitable habitat" and "an adequate amount of it," and this is supported by the following:
    - If suitable and adequate are meant as synonyms, there would have been no need to include both terms in the objectives.
    - At a very basic level, the two parameters of habitat that are most critical to wildlife are quantity and quality of habitat (Bailey 1984, Peek 1986); which corresponds to addressing amount and suitability. For example, if only a small amount of suitable habitat is provided in one location of the BTNF for a particular species, the needs of the species will not be met. A least a certain amount of suitable habitat is needed, with the amount varying among species. Distribution and juxtaposition of different habitat elements for a given species or group of species are also important, but at a broad geographic scale this can be considered within the scope of an "adequate amount of suitable habitat."

- Given these two fundamental parameters of wildlife habitat, a requirement to provide suitable and/or suitable habitat, individually or in combination, infers that quality and quantity are addressed.
- In light of the two of the most fundamental parameters of wildlife habitat and requirements of the Forest Service with respect to wildlife conservation, it would not make sense to require adequate amounts of habitat, regardless of suitability, be provided for wildlife. The term "adequate" would not be needed because every undeveloped acre of the BTNF provides habitat ranging in condition from suitable to unsuitable for wildlife. Moreover, what would an adequate amount of unsuitable habitat be? Therefore, "adequate amounts of habitat" infers adequate amounts of suitable habitat.

HERBACEOUS VEGETATION'S ROLE IN PROVIDING HABITAT

Herbaceous vegetation constitutes *the* habitat for the majority of wildlife species inhabiting non-woody rangeland, riparian, and wetland plant communities (Leopold 1933, Krausman 1996, Wyoming Partners in Flight 2003, Table 3). For most if not all the remaining wildlife species inhabiting these plant communities, herbaceous vegetation is an important part of their habitat. Herbaceous vegetation is also an important part of the habitat for many wildlife species inhabiting woody rangelands and riparian plant communities. Additionally, herbaceous vegetation constitutes the habitat or key habitat element of prey of many wildlife species inhabiting these plant communities (Evans 1984, Krausman 1996).

Beyond directly providing habitat for wildlife and their prey, herbaceous vegetation plays important roles in (1) sustaining (and restoring) the capability of the land to produce wildlife habitat (Dasmann 1964, Kie et al. 1994, Krausman 1996, Holechek et al. 2004); (2) regulating water quality for some species (Keinath and McGee 2005, Patla and Keinath 2005); and (3) providing fine fuels that are important for facilitating fire, which in turn is critical for sustaining fire-dependent plant communities like aspen and mountain shrublands.

ADEQUATE AND SUITABLE VERSUS OPTIMUM AND MARGINAL

The benchmark in the Forest Plan is set at providing "suitable" forage, cover, and other elements of habitat and "adequate amounts" of suitable forage, cover, and other elements of habitat. The Forest Plan does not call for optimum or ideal habitat conditions. For the purposes of this report, *suitable* habitat conditions for a given wildlife species or group of species in a given are encompass a range of conditions, from habitat conditions that are above those that marginally meet their forage, cover, and other needs to optimum habitat conditions. As a whole for a native wildlife community in a given geographic area, suitable habitat conditions range from:

1. near healthy, functioning conditions in riparian areas, wetlands, rangelands, and forestlands, with a mix of early, mid, and late seral communities that is near the natural range of variability, and an amount and distribution of herbaceous vegetation and browse that minimally meets (more than marginally meets) the needs of dependent wildlife relative to the natural potential of the site, to
2. healthy, functioning riparian areas, rangelands, and forestlands with a mix of early, mid, and late seral communities within the range of natural variability, and a sufficient amount and distribution of herbaceous vegetation and browse to meet the needs of dependent wildlife species relative to the natural variability for any given site.

Table 3. Wildlife species that directly or indirectly depend on herbaceous vegetation in rangeland, riparian, wetland, and/or aspen communities for one or more function.

Species	Species Status, Conservation Interest, etc.	Forage/ Cover Needs			Ecosystem Functions		Species	Species Status, Conservation Interest, etc.	Forage/ Cover Needs			Ecosystem Functions	
		Short and/or Sparse Herb. Vegetation	Mod. Height / Density of Herb. Vegetation	Tall, Dense Herb. Veg.	Habitat Req's Periodic Fire (fine fuel)	Herb. Veg. Contrib's to Health, Water Qual., etc			Short and/or Sparse Herb. Vegetation	Mod. Height / Density of Herb. Vegetation	Tall, Dense Herb. Veg.	Habitat Req's Periodic Fire (fine fuel)	Herb. Veg. Contrib's to Health, Water Qual., etc
Wildlife — *Mammals*							Bobcat			— P —			H
Elk	MIS	L	L	L	SAE	H	Canada Lynx	T				EA	H
Mule Deer	MIS	LF	LF	LFh	SAE	H	Black Bear			— P —		E	H
Moose	MIS	L	L	L	SAE	H	Raccoon			— P —		B	H
Bighorn Sheep	MIS	L	L	L	E	H	Short-tailed Weasel			— P —		A	H
Snowshoe Hare					AE	H	Long-tailed Weasel			— P —		AE	H
Mountain Cottontail		Lh	Lh		SAE	H	Least Weasel			— P —		AE	H
Pika		LF	LF	LF	C	H	Mink			— P —		BP	H
Yellow-bellied Marmot		LFS	LFS		EC	H	Wolverine			— P —		P	H
Uinta Ground Squirrel		LS	LS		EC	H	Badger			— P —		P	H
Wyoming Ground Squirrel		LS	LS		EC	H	Striped Skunk			— P —		P	H
Golden-mantled Gr. Squir.		LFS	LFS			H	River Otter			— P —		BP	HW
Yellow-pine Chipmunk		LFS	LFS			H	***Wildlife — Birds***						H
Least Chipmunk		LFS	LFS			H	Canada Goose			PS	PS	BP	H
Uinta Chipmunk		LFS	LFS			H	Mallard			PS	PSn	BP	H
Northern Pocket Gopher		RLF	RLF		EC	H	Gadwall			PS	PSn	BP	H
Beaver					AC	H	Green-winged Teal			PS	PSn	BP	H
Muskrat			L	L		H	Cinnamon Teal			PS	PSn	BP	H
Porcupine		L	L		SAE	H	Ring-necked Duck			PS	PSn	BP	H
Montane Vole			LS	LS	EC	H	Lesser Scaup			PS	PSn	BP	H
Meadow Vole			LSh	LSh	EC	H	Harlequin Duck	S		P	Pn		H
Water Vole				LSh	B	H	Common Goldeneye			P	P		H
Western Heather Vole			LSh	LSh	EC	H	Barrow's Goldeneye			P	P		H
Long-tailed Vole			LSh	LSh	EC	H	Bald Eagle			— P —			H
Western Jumping Mouse				LSh	ECB	H	Golden Eagle			— P —			H
Deer Mouse		LS	LS	LS	EC	H	Osprey			— P —			H
Masked Shrew				Ph	B	H	Northern Harrier			P	Pn		H
Merriam's Shrew			Ph	Ph		H	Swainson's Hawk			— P —		EC	H
Dusky Shrew			Ph	Ph		H	Red-tailed Hawk			— P —		EC	H
Dwarf Shrew			Ph	Ph		H	Northern Goshawk			— P —			H
Water Shrew				Ph	B	HW	Sharp-shinned Hawk			— P —			H
Vagrant Shrew				Ph	B	H	Cooper's Hawk			— P —			H
W. Small-footed Myotis			— P —		EC	H	American Kestrel			— P —		EC	H
Long-eared Myotis			— P —			H	Prairie Falcon			— P —		EC	H
Little Brown Myotis			— P —			H	Peregrine Falcon			— P —			H
Long-legged Myotis			— P —			H	Ruffed Grouse		L	L		AC	H
Hoary Bat			— P —		E	H	Blue Grouse		L	L			H
Big Brown Bat			— P —			H	Sandhill Crane		SP	SPn	SPn	B	H
Townsend's Big-eared Bat			— P —		E	H	Common Snipe		P	Phn	Phn	BC	H
Coyote			— P —		E	H	American Coot			P	P		H
Red Fox			— P —		E	H	Sora				Phn	B	H
Gray Wolf	Exp		— P —		P	H	Great Horned Owl		P	P	P	AEP	H
Mountain Lion			— P —		P	H	Great Gray Owl			P	P	EP	H

Table 3. Wildlife species that directly or indirectly depend on herbaceous vegetation in rangeland, riparian, wetland, and/or aspen communities for one or more function.

Species	Species Status, Conservation Interest, etc.	Forage/ Cover Needs: Short and/or Sparse Herb. Vegetation	Forage/ Cover Needs: Mod. Height / Density of Herb. Vegetation	Forage/ Cover Needs: Tall, Dense Herb. Veg.	Ecosystem Functions: Habitat Req's Periodic Fire (fine fuel)	Ecosystem Functions: Herb. Veg. Contrib's to Health, Water Qual., etc	Species	Species Status, Conservation Interest, etc.	Forage/ Cover Needs: Short and/or Sparse Herb. Vegetation	Forage/ Cover Needs: Mod. Height / Density of Herb. Vegetation	Forage/ Cover Needs: Tall, Dense Herb. Veg.	Ecosystem Functions: Habitat Req's Periodic Fire (fine fuel)	Ecosystem Functions: Herb. Veg. Contrib's to Health, Water Qual., etc
Long-eared Owl			P	P	EP	H	Black-headed Grosbeak		S	S	S	SC	H
Short-eared Owl		P	P	Pn	EP	H	Lazuli Bunting			SP	SP	SAC	H
Northern Saw-whet Owl		p	p	p	A	H	Black Rosy Finch		SP	SP	SP	C	H
Broad-tailed Hummingbird		F	F	F	AE	H	Cassin's Finch		SP	SP	SP		H
Rufous Hummingbird		F	F	F	AE	H	Pine Siskin		S	S	S		H
Bl.-chinned Hummingbird		F	F	F	AE	H	American Goldfinch		SP	SP	SP		H
Calliope Hummingbird		F	F	F	AE	H	Red-winged Blackbird		SP	SP	SPe	B	H
Red-naped Sapsucker					A	H	Brewer's Blackbird		SP	SP	SP		H
Northern Flicker		S	S		A	H	Brown-headed Blackbird		SP	SPn	SPn	A	H
Tree Swallow		P	P	P	A	H	Western Meadowlark		SP	SPn	SPn	C	H
Violet-green Swallow		P	P	P	A	H	***Amphibians & Reptiles***						H
N. Rough-winged Swallow		P	P	P		H	Tiger Salamander			Phe	Phe	B	HW
Black-capped Chickadee					A	H	Columbia Spotted Frog	S		Phet	Phet	B	HW
House Wren					AC	H	Boreal Chorus Frog	MIS		Phet	Phet	B	HW
Mountain Bluebird		P	P		AE	H	Boreal Toad	MIS		Phet	Phet	B	HW
Veery					A	H	Wandering Garter Snake			Ph	Ph	B	H
American Robin		P	P		E	H	***Fish***						
Gray Catbird			P	P		H	Fine-sp. Cutthroat Trout	MIS		Pht	Pht	B	W
Sage Thrasher		P	P		C	H	Rainbow Trout	MIS		Pht	Pht	B	W
American Pipit		Pn	Pn			H	Other Fish			Pht	Pht		W
Cedar Waxwing					SC	H							
Plumbeous Vireo					A	H	***Invertebrate Groupings***						
Orange-crowned Warbler					SC	H	Butterflies		Fe	Fe	Fe	AEC	H
Yellow Warbler					SC	H	Bees & other Pollinators		Fe	Fe	Fe	AEC	H
Black-thr. Blue Warbler					AS	H	Herbivores		—	LFeh	—	AEC	H
American Redstart					A	H	Root Feeders		Re	Re	Re	EC	H
MacGillivray's Warbler				n	AB	H	Predacious Insects & Spiders		Phe	Phe	Phe		
Common Yellowthroat					B	H	Detritus Feeders – Terrestrial		L	L	L	EC	H
Wilson's Warbler					A	H	Detritus Feeders – Aquatic		L	L	L	B	HW
Green-tailed Towhee		SP	SPn	SPn	C	H							
Chipping Sparrow		S	S	S		H	***Watershed Functions***						
Brewer's Sparrow	MIS	SP	SPn	SPn	C	H	Raindrop protection		L	L	L	EC	H
Vesper Sparrow		SP	SP	SPn	EC	H	Litter					EC	H
Sage Sparrow		SP	SP	SP	C	H	Building organic soil		L	L	L	EC	H
Clay-colored Sparrow		SP	SP	SP	C	H	Infiltration/slowed runoff		L	L	L	EC	H
Savannah Sparrow		SP	SP	SPn	C	H	Slowed overland water flow		L	L	L	EC	H
Fox Sparrow		SP	SPh	SPn	B	H	Fine fuel for fire			L	L	(all)	H
Song Sparrow		SP	SP	SP	B	H							
Lincoln's Sparrow		SP	SPh	SPn	B	H							
White-crowned Sparrow		SP	SPn	SPn		H							
Dark-eyed Junco		SP	SP	SP		H							

For codes, see next page.

Codes for Table 3:

Forage & Cover
L = leafy forage
F = flowers (including Nectar)
S = seeds
R = roots
P = prey (small mammals, insects, prey of prey), including aquatic insects that feed on terrestrial vegetation, terrestrial insects that fall into water, etc.
n = nesting cover
h = hiding/other cover
e = substrate for eggs
t = thermal, aridity protection

Fire
S = for reinvigorating shrubs,
A = for restoring aspen
B = fire for sustaining/restoring aspen, which benefits beaver, which in turn produces aquatic habitat, meadows, etc.
E = for producing early-seral habitats
C = Reduction of conifer expansion
P = 'A' and/or 'C' for prey species, and for prey of prey species (e.g., insect-eating fish)

Watershed
H = Watershed health, including benefits to prey species
W = Water quality

In general, the second scenario is the target in DFC 10 and 12 areas, given the emphasis on wildlife, and the first scenario may be minimally acceptable in DFC 1B areas, given the emphasis on commodity production.

An adequate *amount* of suitable forage and cover refers to the amount of suitable habitat that is needed to sustain all native wildlife species at various geographic scales — depending on home range size, migration distances, type of disturbance/human activity being addressed, among other factors — and at relative abundances and distributions within the range of natural variability at these scales. Two examples include:

1. *Mix of successional stages in woody vegetation types* — An adequate amount for this habitat element needs to take into account the range of natural variability of the size and distribution of disturbances that create these mixes (e.g., at the 6th order HUC up to 5th order HUC). An adequate amount for this habitat element is reflected by the mix of successional stages within the natural range of variability.
2. *Height and biomass of herbaceous vegetation (e.g., and effects of livestock utilization)* — An adequate amount for this habitat element depends on home range sizes and distance of migrations. It needs to be provided at small scales within capable habitat for amphibians and small mammals (e.g., several acres up to dozens of acres), and at moderate scales within capable habitat for native ungulates (e.g., across 100s of acres up to several 1,000 acres, depending on seasonal range). At the lower end of adequacy is the amount of suitable habitat that would at least minimally meets (more than marginally meets) the needs of dependent wildlife relative to the natural potential of the site. At the upper end of the adequacy is the amount of suitable habitat that would have been retained with only the grazing of native herbivores (absence of livestock grazing).

As with habitat suitability, an adequate amount that needs to be sustained depends in part on DFC emphasis. Also, absence of a given species or population levels that are lower than the natural range of variability do not necessarily indicate an inadequate amount of suitable habitat, as there are a large number of factors that affect wildlife populations.

RETENTION AS AN OBJECTIVE

Many range management experts have strongly asserted that forage utilization limits and minimum stubble height criteria not be used as objectives (e.g., Heitschmidt et al. 1998, University of Idaho 2004). With respect to sustaining healthy, properly-functioning rangelands and riparian areas, this makes sense. Long-term objectives are established that numerically define desired soil, vegetation, and geomorphic characteristics that directly relate to the health and functionality of these systems. Forage utilization and stubble height standards are then developed to sufficiently constrain livestock grazing to allow objectives to be achieved. The constraints to livestock grazing management can be adjusted over time in order to meet desired conditions on the ground because the important part of the management process is to achieve and sustain rangeland health and functionality, not to meet standards. If utilization and stubble height standards were instead identified as objectives, the "objectives" could very well be met without sustaining rangeland and riparian health. As assessed by Sanders (pg. 6 in Heitschmidt et al. 1998), "Allowable use levels make poor and inconclusive allotment and riparian objectives because they provide no information by themselves on whether desired long-term conditions are being met."

On the other hand, stubble heights and the flip-side of forage utilization limits (i.e., minimum retention levels) are very appriate objectives for wildlife habitat. The amount of herbaceous vegetation retained in a given area during the livestock grazing season is more than an index to how well rangeland and riparian objectives will be achieved in the future, and it more than influences the suitability of habitat that is provided in the area. The retained herbaceous vegetation ***is*** the habitat provided for a large number of wildlife species. The amount retained directly determines whether habitat conditions for these species are suitable or less than satisfactory. Although upward trends in rangeland and riparian condition are important to restoring wildlife habitat conditions over time, wildlife need a place to live and reproduce today and tomorrow — again, retention levels is more than a means to an end. For many wildlife species retention levels are the end. Therefore, Sanders' words from the previous paragraph can be modified somewhat to put it in the context of wildlife habitat management: *retention levels make good and conclusive wildlife habitat objectives because they provide information by themselves on whether desired short-term conditions for wildlife are being provided.*

In grassland, forblands, herblands, and meadows, herbaceous vegetation constitutes the entirety of habitat for wildlife, aside from soil and rocks, and surface water where it is present (Table 3). In big sagebrush, mountain shrubland, and willow communities, herbaceous vegetation herbaceous vegetation is a critical component of habitat for many wildlife species (e.g., for sage grouse, vesper sparrows, voles). The amount of herbaceous vegetation retained in a given area also constitutes the fine fuels available to carry fires, and periodic fire is important to critical for the majority of wildlife species inhabiting the district. There are many other "uses" of herbaceous vegetation that indirectly and cumulatively affect wildlife habitat (Table 3).

A QUALIFIER ON WILDLIFE COVER

Not all wildlife species inhabiting riparian areas, wetlands, and rangelands of the Greys River Ranger District need tall and/or dense herbaceous cover and, in fact, some species prefer short-stature vegetation for feeding and/or nesting (e.g., killdeer, horned larks, American robins, mountain bluebirds). Of all the MIS species, Region 4 Forest Service sensitive species, and migratory bird species of conservation concern (Appendix A) that also are known to inhabit the Greys River Ranger District, the only species to prefer moderately to heavily grazed areas is killdeer. Some species (e.g., sandhill cranes) appear to favor short-grass/sedge areas for some parts of their life history, such as feeding, but not for nesting. None of the MIS species, sensitive species, and migratory bird species of conservation concern would be negatively affected by season-long tall, dense herbaceous vegetation (i.e., no grazing) across the full extent of plant communities currently capable of producing this type of habitat. As discussed elsewhere in this report, short and sparse herbaceous vegetation is over-represented on the district and tall, dense herbaceous vegetation is under-represented for a variety if reasons.

Furthermore, Objective 4.7(d) applies specifically to those species that do require or prefer herbaceous cover for one or more of their life history stages; i.e., adequate amounts of suitable cover must be retained through the livestock grazing season. It is the height and density of herbaceous vegetation on which livestock have the most direct effects. Therefore, measurements of stubble height and forage utilization must recognize that bent-over and matted vegetation only counts toward wildlife cover to the extent it is off the ground — i.e., measurements of stubble height need to be taken from the ground to the "height" of plant matter as it exists (e.g., bent over). Measurements, in the context of wildlife cover, cannot be made of the "length" of outstretched leaves that are not standing erect.

Because livestock grazing and management also has the potential to reduce canopy cover and structural diversity of willow and aspen communities, allowable-use standards must also address retaining forage and cover attributes provided by shrubs and trees in these communities over the long term (and in some places, it requires restoring forage and cover attributes). Allowable-use standards, therefore, need to be established at a level that deters switching from graminoids to browse.

KEY ELEMENTS OF WILDLIFE HABITAT

To adequately manage livestock grazing use to fulfill the above wildlife-related direction, the following elements of wildlife habitat, listed in priority order, need to be addressed in allowable-use standards and other elements of AMPs:

1. *Health and Functionality* — The most fundamental component of wildlife habitat is the health and functioning of riparian areas, wetlands, rangelands, and forestlands (Fagerstone and Ramey 1996, Ohmart 1996, Peek and Kaufman 1996, Wisdom and Thomas 1996, National Research Council 2009, WAFWA 2009). The health and functioning of riparian areas, wetlands, rangelands, and forestlands is the foundation of providing suitable habitat for wildlife. If the capability of the land to produce and sustain healthy vegetation and water sources has been greatly diminished, the potential for producing or sustaining the habitat elements below will be greatly diminished. The most important indicators of health and functionality of streams and riparian areas are stream channel integrity, streambank stability, and composition and distribution of riparian vegetation. The most important indicators of health and functionality of rangelands and forestlands are ground cover, plant species diversity (species richness and abundance of each species), and the mix of early, mid, and late succession. Establishing allowable-use standards to allow for the restoration and sustainability of these parameters are developed by interdisciplinary teams (Forage Utilization Standard) and, therefore, I do not address this element in detail. The mix of seral stages is discussed further in paragraph '4', below.

   Riparian areas and rangelands that are less than healthy, functioning condition sustain fewer herbaceous species and more bare ground, produce less herbaceous vegetation each year, and provide shorter heights and less structural density than riparian areas and rangelands in healthy, functioning condition (Heady and Child 1994, National Research

Council 1994, Holechek et al. 2004). The degree to which these factors are lower is correlated with the level of health and functionality, with highly altered riparian areas and rangelands providing little to no foundation for providing suitable habitat for wildlife species that would normally be associated with them. One implication of this is that allowable-use standards and livestock grazing practices may need to be more restrictive in areas where less-than-functioning conditions prevail in order to provide for the seasonal needs of wildlife (USFS 1990, Wisdom and Thomas 1996, Holechek et al. 2004, WAFWA 2009).

It is assumed, for the purposes of this report, that allowable-use standards developed to allow restoration and sustainability of healthy riparian areas, wetlands, rangelands, and forestlands will result in stream channel integrity, streambank stability, ground cover, and plant species composition being restored and sustained. Livestock grazing practices and allowable-use standards need to recognize and address the pivotal role that beavers can play in the restoration and sustainability of riparian areas and wetlands.

2. *Height and Density of Herbaceous Vegetation* — The height and density of herbaceous vegetation is an important habitat component for many species of wildlife in many types of habitat (Braun et al. 1978, Kie and Loft 1990, Ohmart 1996, Dobkin et al. 1998, Krueper et al. 2003, Wyo. Partners in Flight 2003). The requirement of Objective 4.7(d) of the Forest Plan to *retain* forage and cover for wildlife, it primarily addresses herbaceous vegetation and browse because these are the elements of wildlife forage and cover that are directly reduced by livestock in any given grazing season (see also paragraph '3,' below). Height and density of herbaceous vegetation is primarily affected by (1) the health and functionality of riparian areas, wetlands, rangelands, and forestlands; (2) soil moisture as affected by precipitation, infiltration, and other factors; (3) plant vigor; (4) livestock herbivory and trampling effects; and (5) wildlife herbivory; among other factors.

   The amount of suitable leafy forage available to wildlife on livestock allotments is generally a function of plant species diversity, biomass produced of key forage species, and the biomass of key forage species retained through the livestock grazing season. Of all elements of livestock grazing management, forage utilization limits is the element that most affects the amount and quality of forage available to wildlife on an annual basis. Other elements of forage are addressed in paragraph '3', below.

   The amount of suitable herbaceous wildlife cover on livestock allotment is generally a function of the height and density produced and the height and density retained through the livestock grazing season. In addition to live plant material, accumulations of standing senescent and dead vegetation, bent-over dead plant material, and fallen plant material are important elements of herbaceous wildlife cover. Some ground-nesting bird species require accumulations of residual plant material for nesting. Of all elements of livestock grazing management, forage utilization limits is the element that most affects the amount and quality of herbaceous cover available to wildlife on an annual basis.

   The height of hebaceous vegetation retained through the livestock grazing season also affects the amount of residual vegetation and root mass contributing to watershed functioning (paragraph 1), ground cover and plant species diversity in the long term (paragraph 1), bank stability and riparian functioning (paragraph 1), and amount of fine fuels available for fire spread (paragraph 5); and it is integrally related to the extent of browsing on willows and deciduous trees (paragraph 4) and trampling and defecation in wetlands (paragraphs 6 and 7).

3. *Flowers, Seedheads, Roots, Browse, and Forage/Cover/Substrate for Prey* — In addition to leafy forage (addressed above), herbaceous vegetation provides other forage for wildlife, including flowers (e.g., entire flower heads, nectar, seeds), grass seedheads (entire seedheads, seeds), and roots. As with leafy forage, the species of plant producing flowers, seedheads, and roots is very important — i.e., many wildlife species that feed on flowers, nectar, seeds, and roots selectively feed on those produced by certain plant species. The amount of flowers, grass seedheads, and roots retained through the livestock grazing season is related to the proportion of the overall annual production that is retained.

   Browsing by livestock is typically minor on the Greys River Ranger District and is not addressed to any large degree in this document. By establishing and enforcing conservative allowable-use standards, this should continue.

   Herbaceous vegetation, as well as woody vegetation, provides forage, cover, and substrate for prey species of wildlife, including insects, small mammals, birds, and amphibians. By taking care of the wide range of needs of wildlife addressed in other paragraphs, this element of wildlife habitat should be adequately addressed.

4. *Vegetation Structure in Willow, Cottonwood, and Aspen Communities* — Willow, cottonwood, and aspen communities have by far the largest diversity of migratory birds and wildlife in this part of the Rocky Mountains (Dobkin et al. 2003), and they are among the most important habitats for large ungulates. Wildlife use willows, cottonwood, and aspen for both cover and forage, but this parameter focuses specifically on the cover attributes provided by these shrubs and trees. In most places on the Greys River Ranger District where willow communities exits, they are fairly dense to dense, although the canopy cover is interrupted by trailing in many places on cattle allotments and larger reductions in canopy cover exist in localized areas. Cottonwood and aspen communities on the allotment do not appear to be overly affected (directly) by current cattle and sheep grazing. While it may benefit some bird species, trails and openings in willow communities created by cattle reduces habitat quality for other species. Allowable-use standards established in part to minimize browsing of willows would address this issue to some degree. However, there will always be at least some cattle trails though willow as long as cattle are grazed in willow stands.

5. *Mix of Seral Stages in Vegetation Types* — A mix of seral stages that approximates pre-Euro-American settlement conditions would best meet the needs of native wildlife communities as a whole, as discussed in the Greys River LSA (USFS (2004a; see also Noss and Cooperrider 1994, Hunter 1996). A mix of seral stages is one of several components of paragraph '1', above, but is addressed in more detail here because the most prevalent effect of livestock grazing on this habitat component is its effect on fine fuels, which itself is affected by the height and density of herbaceous vegetation ('2', above). Allowable-use standards sufficient to meet needs in paragraphs 1-4, above, may retain enough plant matter on enough sites to provide fine fuels in anticipation of potential wildland fire use. To prepare for prescribed burns, additional buildup of fine fuels will probably be needed on a case-by-case basis.

6. *Water quality and quantity* — Trampling and defecation by livestock in wetland areas and runoff from degraded rangelands affects water quality, which has the potential to impact amphibians (Keinath and McGee 2005, Patla and Keinath 2005). Trampling and defecation in wetland areas can be managed to some degree through the use of forage utilization standards. In relative terms, high levels of trampling and defecation in a wet marsh many times is related to high utilization levels of surrounding herbaceous vegetation. If the preceding elements are adequately addressed, effects of trampling and defecation on water quality in wetlands should remain within acceptable levels.

   The amount of water in small amphibian breeding pools can be affected by watering livestock, which can be especially critical in mid summer when evaporation is higher, rainfall is less, and tadpoles are metamorphosing. Patla and Keinath (2005) expressed concern about dewatering small pools where tadpoles had not yet completed metamorphosis, and this likely is a factor in some areas on the Greys River Ranger District.

7. *Habitat Effectiveness and Security of Habitats* — The presence of livestock and accompanying activity (e.g., herding) has been shown to reduce the extent to which some wildlife species use otherwise suitable habitat (Robinette et al. 1977, Beck et al. 1996, Wisdom and Thomas 1996). Livestock also reduces the security of habitat by such things as disturbing and trampling low nests (Gjersing 1975, Koerth et al 1983, Holmes and Johnson 2005); attracting cowbirds (Holmes and Johnson 2005); disrupting and trampling amphibian eggs, larva, and juveniles (Patla and Keinath 2005, Keinath and McGee); possibly introducing or spreading disease organisms to the environment (Patla 2000); as well as disease transmission (Jessup and Boyce 1996, Williams and Barker 2001). Some of these factors will likely remain effects that cannot be effectively mitigated and that will remain byproducts of the requirement to provide for livestock grazing use. In other cases, livestock grazing management and/or allowable-use standards need to be adjusted to mitigate effects.

ECOLOGICAL AND RESOURCE MANAGEMENT PRINCIPLES

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." Bailey provides the following example to illustrate the meaning of a principle. Experience with many species of wildlife has demonstrated that wildlife populations can be managed on a sustained yield basis. This does not mean that they *should* be, but rather only that they *can* be. For this reason, he explained that "Principles of wildlife management are concepts to consider in formulating management objectives and in reaching management decisions. Principles do not tell the wildlife manager what to do..." Management principles help managers determine whether goals and objectives being considered can be reasonably achieved; they provide one measure for determining whether strategies being considered can realistically be used to accomplish the goals and objectives; and they help in assessing potential consequences of taking action.

Bailey (1984) goes on to note that "Principles are neither unchallengeable nor unchanging. They may be widely accepted today and become expanded, modified, or discarded and replaced, as new knowledge provides new insight." Wildlife management planning provides an ideal time to re-evaluate the principles upon which existing management is based and to examine newer principles and concepts.

To be clear, I am not recommending that these principles provide management direction.

A. Basic Wildlife Conservation 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 suitable habitat to be sustained (Leopold 1933, Dasmann 1964, 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. 2004). 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. (2004) stated "Wildlife populations are regulated by the availability of food, water, and cover, the basic components of wildlife habitat" (Holechek et al. 2004:458). 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 1990).

Principle A.2 — Sustaining a full compliment of wildlife species requires sustaining habitat that is suitable for native wildlife communities as a whole

The only realistic way to sustain the full compliment 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 (Diamond 1981, Reid and Miller 1989, Keystone 1991, Noss and Cooperider 1994, Hunter 1996, Cooperrider 2002). 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. Given introduction of noxious weeds, the impracticality of allowing all lightning-strike fires to burn unabated, existence of roads and other facilities that greatly alter ecological processes, requirements allowing harvest of renewable resources, and many other factors necessitate the active management of at least some processes to approximate natural conditions. When this is a goal of management, changes in habitat due to disturbances (next principle) must be evaluated in this context.

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 affects on one or more species will negatively affect other species, making it critical to evaluate these effects in the context of sustaining the full compliment 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. People at a county fair can be used as an analogy.

Two different food courts, one offering typical fair food (hamburgers, fries, soda, ice cream) and the other only offering salads and juices, one could conceivably observe far more people at the former. While this is not directly transferable to wildlife, it shows that increased use of a given area after habitat changes does not necessarily mean the effect is needed or that is beneficial at the population level. Similarly, an observed negative effect does not necessarily mean the effect will detrimentally affect a given wildlife population.

B. Principles of Wildlife-Livestock Grazing Relationships

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. 2004). Positive and negative effects need to be considered in the context of principles A.1, A.2, and A.3, as well as principles B.2, B.3, and B.5.

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, Severson 1990, Miller et al. 1994, Noss and Cooperrider 1994, Hunter 1996; see Principle A.2), regardless of positive and negative effects on individual species (see Principle A.3).

Principle B.2 — The amount and quality of forage and cover for most wildlife species inhabiting riparian, wetland, and rangeland habitats [in the Greys River Ranger District] is inversely related to the level of forage utilization by livestock

This principle involves one aspect of Principle B.1, above, and it addresses one specific element of Forest Plan direction:

> <u>Context</u>: Objective 4.7(d), applicable only to livestock allotments, focuses on the amount and quality of wildlife forage and cover retained during the livestock grazing season, and the Forest Plan focuses on addressing resource problems, including inconsistencies between livestock grazing use and achieving wildlife objectives. The opening sentence of the Forest Plan is to "solve or prevent serious problems associated with existing natural resources and people's continuing use of them," thereby emphasizing the resolution of resource problems while continuing sustainable use of resources. Under one of the four major problem

categories, one of the "Forest Challenges" is to avoid unacceptable effects of livestock grazing use (USFS 1990:82). "Overuse of the range by livestock, including pack and saddle stock, can cause unacceptable loss of other resources. The challenge is to manage the levels and locations of grazing livestock to maintain or enhance resource values… Livestock grazing is managed to limit effects on other resources." While most effects of livestock grazing use on habitat conditions on the Greys River Ranger District are the result of historic livestock grazing practices, current and future livestock grazing use has the potential to affect wildlife habitat on the district.

A large number and variety of wildlife species depend on different parts of herbaceous plants for forage (directly or indirectly, e.g., some wildlife depend on insects, some of which rely on particular plant parts), and an equally large number and variety of wildlife species depend on tall, dense herbaceous vegetation or moderately dense herbaceous vegetation. This is based on a large volume of published literature, some of which is cited in this report. For many species that depend on plant parts preferred by livestock and for those that depend on tall, dense herbaceous vegetation, forage/cover begins to decline with the first bites and steps taken by livestock in a given area, although the effects are negligible and immeasurable at the early stage of grazing in a given area. As assessed by Holechek et al. (2004:458), "Livestock affect wildlife habitat directly by removing and/or trampling vegetation that could otherwise be used for food and cover." However, in the early stages of livestock grazing in tall, dense herbaceous vegetation, small microsite openings are created, which may benefit some wildlife species (e.g., spotted frogs, white-crowned sparrow) until the tall, dense characteristics of the vegetation begins to decline (Kie and Loft 1990, Severson 1990, Chilton et al. 1995, Watson et al. 2003, Holechek et al. 2004). At some point along the continuum of grazing utilization, which spans from 0% to 100% utilization, the amount of forage and cover begins to decline more rapidly as grazing progresses. The rate of decline then slows at some point along the continuum as insufficient forage and cover are left.

In considering this principle, one must also consider Principles A.3 and B.1, specifically that some wildlife species and groups of species benefit from higher levels of grazing up to and including heavy and severe grazing pressure. These species, however, are not addressed in Objective 4.7(d) with its emphasis on *retaining* forage and cover for wildlife during the livestock grazing process.

Principle B.3 — Wildlife conservation and livestock grazing use can co-exist, but this does not mean there is an absence of conflict.

This principle involves a fundamental doctrine of National Forest System lands:

Context: 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…" Nowhere in the Act does it allude to there being an absence of conflict between livestock grazing and wildlife conservation. Given the realities of livestock grazing, the Act essentially builds in and allows for a certain level of adverse impacts of livestock grazing use on wildlife and visa versa. The Forest Plan carries forward the direction in the Multiple-Use Sustained Yield Act and the realities of conflicts among uses (e.g., see Principle B.2, above). In part, this is the basis for the range of DFC areas on the Bridger-Teton National Forest. Striking a balance between livestock grazing and wildlife, according to direction for particular DFC areas, is one of the aims of the allotment management planning process. In short, co-existence of

> wildlife conservation and livestock grazing use in no way means the absence of conflicts or adverse impacts. Absence of adverse impacts, in either direction, is not a requirement, nor is it realistic.
>
> Wildlife habitat conservation is a responsibility of both wildlife and range programs. Two of the overriding National Forest System objectives for range management are "To integrate management of range vegetation with other resource programs to achieve multiple objectives contained in Forest land and resource management plans," and "To provide for livestock forage, wildlife food and habitat, outdoor recreation, and other resource values dependent on range vegetation" (FSM 2202.1.2). Chapter 90 of FSM 2209.13 states "Under the National Forest Management Act (NFMA) of 1976 (16 U.S.C. 1600 et seq.), project-level decisions, which authorize the use of specific National Forest System lands for a particular purpose like livestock grazing must be consistent with the broad programmatic direction established in the [Forest Plan]. Consistency is determined by examining whether the project-level decision implements the goals, objectives, desired conditions, standards and guidelines, and monitoring requirements from the [Forest Plan]. Where necessary, grazing permits must be modified to ensure consistency with the [Forest Plan]."

While the law, regulation, policy, and the Forest Plan require that both livestock grazing opportunities and wildlife conservation be provided, major texts that address the subject demonstrate that it is possible to concurrently sustain a native diversity (species richness and relative abundance) of wildlife while also providing opportunities for livestock grazing (Univ. of Idaho 1981, Peek 1986, Kie et al. 1994, Krausman 1996, The Wildlife Society 2009, Holechek et al. 2004). In other words, not only is it a legal requirement, it is also possible. Holechek et al. (2004:458) stated that "Livestock grazing, if carefully controlled, is often compatible and sometimes beneficial to the habitat needs of desirable wildlife."

Multiple-use does not mean that opportunities for every use are provided on every acre. There are places where the level of adverse impacts of any level of livestock grazing on wildlife is too high to allow livestock grazing use to occur, as recognized in the Forest Plan. Conversely, meeting the needs of wildlife is less important on some lands (e.g. DFC 1B areas).

Principle B.3 — Livestock stocking rate is a key variable in managing effects on wildlife

"Livestock management practices that can affect wildlife habitats and populations include livestock numbers, timing, and duration of grazing, animal distribution, livestock types, and specialized grazing systems" (Kie et al. 1994). More than any other livestock grazing variable, stocking rate of livestock directly influences the amount and quality of forage and cover available to native ungulates (Wisdom and Thomas 1996, WAFWA 2009) and other wildlife (Braun et al. 1978, Fagerstone and Ramey 1996, Wyo. Partners in Flight 2003), primarily by affecting the amount (e.g., biomass, height) of key plant species and herbaceous vegetation in general that is retained through the summer and fall. Quality of forage is primarily a function of plant species richness and relative abundance (addressed in previous paragraph) and the amount of the annual production of key forage species retained through the livestock grazing season. For some wildlife, specific parts of plants remaining (e.g., flowers, seed heads) is important, not just the overall amount remaining, and this needs to be accounted for when establishing allowable-use standards.

However, if stocking rate is too high to retain suitable forage and cover for wildlife, timing and duration become key factors. Knopf (1996) argued that the season of livestock grazing is a more important consideration for sustaining migratory bird habitat than intensity of livestock grazing, but this assumed that intensity of the grazing during the livestock grazing season is high enough to reduce the suitability of herbaceous cover (year-to-year) or the suitability of woody vegetation (long-term).

Principle B.4 — Competition between livestock and native ungulates for forage is minimal on rangelands in healthy, functioning condition that are conservatively grazed by livestock

Competition between livestock and native ungulates for forage is typically minimal on rangelands that are in healthy, functioning condition and that are conservatively grazed by livestock (Kie et al. 1994, Fagerstone and Ramey 1996, Wisdom and Thomas 1996, Peek and Krausman 1996, Yoakum et al.1996, Holechek et al. 2004, WAFWA 2009). The opening line of The Wildlife Society's (2009) position on livestock grazing on western rangelands is "Properly functioning rangeland ecosystems, supporting a wide diversity of native plant species, are critically important to sustaining wildlife diversity and productivity in the American West…" On rangelands and riparian areas in less-than-satisfactory condition, particularly where wildlife is an emphasis, livestock utilization levels need to be commensurate with the functionality of the particular area, including no livestock grazing on rangelands in non-functioning condition. This principle is built into the existing Forage Utilization Standard. A higher percentages of the annual production of key forage species on less-than-satisfactory rangeland is based on (1) the need to retain a higher percent of vegetation for recovery (Holechek et al. 2004); (2) lower composition of desired species and propensity for higher utilization rates of these species; (3) overall lowered annual production; (4) the tendency of sheep to forage on young (e.g., establishing) plants (Karsli 1994, Olson and Lacey 1994), which can be more easily killed; and (5) the increased potential for competition to occur between livestock and mule deer (Peek and Krausman 1996, WAFWA 2009), especially during drought (Lomas and Bender 2007). To retain amounts of key forage species on functioning-at-risk rangelands that are comparable to the amount retained on functioning rangelands when they are conservatively grazed (e.g., 60-70% of the annual production of key forage species retained), the percentage of the annual production of key forage species needs to be higher. I did not come across any published support that would indicate that the needs of native herbivores can be met when livestock graze non-functioning rangeland and rangeland at the lower end of functioning-at-risk.

Principle B.5 — Managing livestock and wildlife on public lands is challenging

In his preface, Krausman (1996:vii) put it well: "Managing livestock and wildlife on public lands in the western United States is one of the most challenging issues for managers of rangelands and answers do not come easily…" This statement followed the recognition that western rangelands provide habitat for >3,000 species of mammals, birds, reptiles, amphibians, and fish. Most of the Bridger-Teton National Forest's 300 species of mammals, birds, reptiles, and amphibians inhabit the Greys River Ranger District, with many of them dependent on or influenced by the condition and management of rangelands, riparian areas, and wetlands. Add to this the hundreds of insect species that provide food for many species of mammals, birds, reptiles, and amphibians, and the role they play in sustaining (and restoring) functioning rangelands. Many of these insects are highly specialized with narrow habitat requirements. Seasonal habitat requirements of this large number of wildlife species are highly diverse. Added to this are requirements for such things as sustaining fine fuels for spreading fires (e.g., for fire-dependent communities such as aspen and the large number of species dependent on aspen habitat), not to mention all of the rangeland and watershed elements that need to remain functional in order to sustain wildlife habitat. Further complicating management are the interactions between livestock and wildlife, such as displacement effects, attractant effects (e.g., nest parasitism by cowbirds), trampling effects (e.g., tadpoles, bird nests), direct effects on water quality in small water bodies, effects of fences and water developments, and potential for disease transmission.

John Hall, former Director of Arizona Game and Fish Department, stated "The problem of livestock versus wildlife has plagued us since the turn of the century… Instead of decreasing the intensity, this battle has become broader and more bitter as the years go by. It would seem tha as we learn more about the proper management of both livestock and wildlife on our ranges, some progress would be made towards solving the problem of conflicting use" (1955, as cited in Severson 1990:2). Severson added that "A conflict that was once primarily centered on deer/elk/sheep/cattle and confined to the West has expanded to include all forms of wildlife and has become a national concern, despite an increasing knowledge base."

DESIRED CONDITIONS — GENERAL CONCEPTS

Approach

Desired conditions of wildlife habitat, for the purposes of this report, encompass the natural range of variability, properly functioning condition, and functioning conditions (USFS 1990, USFS 2004a, USFS 2005). In addition to encompassing the long-term health and mix of seral stages in riparian areas, wetlands, rangelands, and forestlands, the intent is for these concepts to encompass the natural (pre-Euor-American settlement) range of variability of herbaceous vegetation and browse retained in any given year. Characterizing desired conditions for wildlife habitat is needed for ascertaining "suitable" and an "adequate amount" of habitat.

This view of desired conditions for wildlife habitat is consistent with and supports the recognition that the only feasible way to restore and sustain all wildlife species native to a given landscape is to approximate the habitat conditions (including range of variability) under which the wildlife community evolved (Diamond 1981, Reid and Miller 1989, Keystone 1991, Noss and Cooperrider 1994, Wagner et al. 1995, Hunter 1996, Cooperrider 2002; see Principle A.2). There are far too many wildlife species with far too many unique habitat preferences and needs to (1) manage habitat to attempt to individually provide for each of their needs, or (2) rely on providing habitat for MIS, sensitive species, and threatened and endangered species as a means of providing sufficient habitat for all other wildlife species. There are too many of these special-status species to individually provide for their needs. Furthermore and more importantly, in combination, they do not represent the habitat needs of the larger wildlife community.

The "approximation" of habitat conditions under which wildlife communities evolved on a given landscape is not an exacting science and it recognizes that many conditions have changed (e.g., introduction of noxious weeds), that some habitat alterations will remain (e.g., major roads in riparian areas), some processes will not be permitted to operate unabated and will continue to be managed (e.g., fire) or approximated (e.g., through logging), and that human activities and uses of the land will continue (e.g., recreation, livestock grazing, logging).

This approach does not discount the requirement to emphasize certain groups of wildlife in particular DFC areas (e.g., native ungulates in DFC 12). However, restoring some semblance of the conditions under which wildlife communities evolved in this area (e.g., a larger mix of early and mid seral communities and a greater number, abundance, and biomass of grasses and forbs available as forage) would benefit native ungulates. The emphasis on native ungulates in DFC 12 areas has more to do with managing other uses (e.g., recreation, timber harvest, livestock grazing) to minimize adverse impacts on native ungulates. Thus, approximating conditions under which wildlife communities evolved in this area is consistent with the emphasis on native ungulates in DFC 12 areas.

From the standpoint of managing the effects of livestock herbivory on wildlife habitat, approximating the conditions under which wildlife communities evolved is supported by the needs of individual wildlife species (see "Forage Needs of Individual Species," "Cover Needs of Individual Species," and "Other Habitat-Related Needs").

Herbivory: Natural Range of Variability

Of particular relevance to this report is the process of herbivory, and the extent to which native herbivores are either grazing/browsing at similar levels and distributions as occurred prior to Euro-American settlement, or are grazing/browsing at levels and distributions that are less than occurred prior to Euro-American settlement. This is important for assessing the extent to which any given livestock grazing effect is neutral, beneficial, or adverse. It needs to be evaluated in light of the amount of land dominated by herbaceous vegetation and/or shrubs (including range of variability over time) and the amount of this land in healthy, productive condition.

Overall Role that Herbivory Played in Shaping Vegetative Habitat

Plant communities throughout much of the intermountain west evolved with relatively light grazing pressure (Mack and Thompson 1982, Miller et al. 1994) — e.g., graminoids and forbs attained heights and mass dictated by precipitation levels throughout *most* of the intermountain west's rangeland and riparian communities, and only a small portion of the mass was removed by native ungulates each year. The prevalence of bluebunch wheatgrass, Idaho fescue, and other bunchgrasses supports the contention that grazing pressure by native ungulates was not very high, as these species are not very resistant to all but light or conservative grazing pressure (Heady 1950, Mack and Thompson 1982). This is not to say that herbivores did not have any influence on vegetation composition and structure. Miller et al. (1994) assessed that, while climatic conditions and frequency of fire probably played the largest role in influencing change in plant communities prior to Euro-American settlement, native ungulates, rodents, lagamorphs, birds, insects, mites, and plant-parasitic nematodes — combined — were important influences on vegetation composition and structure in the region (see also Archer and Smeins 1991).

Miller et al. (1994) recognized that heavy grazing by large herbivores likely occurred prior to Euro-American settlement, but that it would have been localized. In some areas, moderate to heavy grazing pressure may have been fairly extensive, for example, in areas where large numbers of ungulates wintered. Large numbers of native ungulates were known to concentrate in the Green River basin (Allred 1950, Craighead 1952) and the Snake River plains of eastern Idaho, according to fur-trapper Osborn Russell during the late 1830s (Haines 1965). This grazing pressure was during the dormant season, but substantial grazing pressure probably also occurred on winter ranges and adjoining areas during the early growing season as animals dispersed.

Moderate to heavy grazing pressure by elk, mule deer, bison, and other herbivores in what is now the Greys River Ranger District likely occurred, but (1) these effects were likely localized and not widespread; (2) nearly the full compliment of native herbivores still inhabit and are currently exerting an influence on vegetation in the watershed; and (3) while some species may now be less abundant or absent (e.g., bison), some species may be more abundant and certainly are at consistently higher numbers than historically occurred (e.g., elk). Furthermore, other present-day factors may offset some of the changes, as discussed in the "Comparative Level of Historic and Current Herbivory by Native Ungulates" subsection, below.

> *Perhaps it is not even proper to speak of 'elk management' by itself. It needs to be integrated with management of other species.*
> Olaus Murie (1951:348, as cited by Cooperrider 2002)

Relative Abundance of Native Ungulates

Elk numbers apparently were relatively high, although it is unclear how elk numbers prior to Euro-American settlement compare to existing numbers except that it is likely they fluctuated more than they do now. "Historically, Wyoming probably was more densely populated with elk than any other state… (Murie 1951)" (O'Gara and Dundas 2002:112). They continued by stating that mountain ranges in northwestern Wyoming, including the Salt River Range (and presumably Wyoming Range), "were a center of abundance for elk and have remained so." Elk in these mountains had access to large winter ranges, including the Green River basin and Snake River plain in Idaho (Murie 1951, O'Gara and Dundas 2002). Few likely wintered on the Greys River Ranger District. O'Gara and Dundas also reported on accounts of elk being difficult to find in some areas during some periods of the latter half of the 1800s.

Kie and Czeck (2000:639) stated that "…firsthand accounts of the explorers invariably indicated a scarcity of deer in the west relative to bison, elk, and pronghorn (Julander and Low 1976, Rue 1978)." While habitat conditions should have been highly suitable for mule deer given the prevalence of early and mid seral communities, high elk numbers many times correlate with lower mule deer numbers or differences in distributions (Wisdom et al. 2005). It is likely that mule deer numbers fluctuated over time and were not always low as accounts would suggest.

Houston (1968, as cited by Wigglesworth 2004) argued that moose were not present in Wyoming prior to the late 1800s when they moved into the area from Montana and Idaho. He said they became established in Jackson Hole, and this timeframe likely applies as well to the Wyoming and Salt River Ranges by the early 1900s. From 1960, numbers in Wyoming appeared to steadily increase from less than 4,000 to an estimated 8,700 in the early 1980s, and then to an estimated 13,500 by 1990 (Karns 1997). Even if moose were present and low in abundance in western Wyoming prior to the late 1800s, it appears that browsing and grazing pressure by moose is currently higher than what it was prior to Euro-American settlement.

Now absent or rare on the district, grazing by bison, pronghorn, and bighorn sheep likely was more prevalent prior to Euro-American settlement. However, the distribution of grazing effects by these species would have been much less than that of elk and mule deer:

- Bison were known to inhabit Star Valley possibly at relatively high numbers, as observed by trapper Osborn Russell during the late 1830s (Haines 1965), but there is little evidence to show they congregated at higher densities above or beyond the valley floor of Star Valley. For example, while Russell reported seeing bison and other large herbivores in Star Valley when he traveled through the valley, he did not record any observations of bison in the Greys River or Little Greys River on his travels through there (Haines 1965). Access to most of the major drainages of the Greys River Ranger District that empty into Star Valley is limited by steep, rugged terrain and conifer forestland. However, some of the south-facing slopes and, after fires, north-facing slopes would have allowed access to some of these watersheds (e.g., Greys River, Little Greys River). Several bison skulls have been found along the Greys River. The lower portion of the Spring Creek watershed and Big Ridge would have been readily accessible, as would have been the Salt Pass area.

It is possible that bison, combined with the effects of other herbivores, may have grazed some parts of watersheds moderately to heavily. However, to the extent it occurred, it was likely periodic and irregular. Miller et al. (1994) discussed the likely cyclic nature of localized heavier grazing pressure. To the extent bison grazed in some of the district's watersheds, this use probably occurred in valley bottoms and lower side slopes.

- Bighorn sheep likely occupied a much wider distribution on the Greys River Ranger District than they currently do. 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 (Krausman and Shackleton 2000, WAFWA 2007b). Therefore, they likely exerted a heavier influence on plant communities than they currently do, although moderate to heavy grazing pressure would likely have been limited in extent.
- Pronghorn may have been more common to the extent that fires created and sustained larger openings for pronghorn to readily access the Greys River and Little Greys River watersheds and other watersheds emptying into Star Valley. I observed 5-6 pronghorn in McCain Meadow in the summer of 2001, 5 along the Greys River Road near Marten Creek in 2007, and have heard of other similar observations along the Greys River Road. They probably summered in Star Valley prior to Euro-American settlement and may have seasonally inhabited accessible watersheds along the Star Valley Front and Spring Creek/Big Ridge area. However, pronghorn likely exerted little if any influence on herbaceous plant communities and understories.
- I am not aware of any other herbivores endemic to the area encompassed by the Greys River (e.g., rodents, lagamorphs, birds, insects, mites, and plant-parasitic nematodes) that have lower population levels than they did prior to Euro-American settlement, at least relative to existing production levels of herbaceous vegetation. Where herbaceous vegetation on rangelands and in riparian areas is depleted or altered, there necessarily must be lower densities of rodents, insects, etc. compared to pre-Euro-American settlement. On rangelands and riparian areas in healthy, functioning condition, however, there is no reason to believe that populations are lower than what they were prior to Euro-American settlement. These other herbivores can consume relatively large quantities of herbaceous vegetation and root material (Archer and Smeins 1991, Miller et al. 1994).

Comparative Level of Historic and Current Herbivory by Native Ungulates

Conclusions about the extent to which historic and current levels of native herbivory compare cannot be made, but some generalizations are possible.

Valley Bottom Meadows and Toe Slopes — There appears to be less grazing by native ungulates in some of the larger valley bottoms and toe slopes (e.g., lower Greys River, Little Greys River, Spring Creek/Big Ridge area) shallow passes with fairly ready access to Star Valley, Green River basin, or Bear River basin (e.g., Salt Pass, Tri-basin Divide/Poison Meadows, and possibly lower portions of the.

Bison may have periodically grazed these areas, and they no longer exert this pressure. They probably used valley bottoms, particularly on terraces, benches, and moist to dry meadows above the influences of water tables, they probably grazed on toe slopes and possibly higher slopes. Van Vuren (1981) found that, while bison used a wide range of topographic areas in northern Utah — driven by the availability of preferred forage and included slopes up to 40° areas well away from water — cattle distribution was limited by slope, distance to water, and vertical distance to water. The well-known preference of cattle to remain in riparian areas unless pushed out probably ties back to habitat use patterns of their ancestors thousands of years ago in Europe and Asia (Clutton-Brock 1981, as cited by Noss and Cooperrider 1994). Therefore, while general forage preferences of bison and cattle are similar from the standpoint of grasses vs. forbs and shrubs, their habitat use is substantially different (Van Vuren 1981). There is no clear indication that bison used riparian zones heavily influenced by water tables to any large extent, although they would have at least watered in these areas. When they used riparian zones, they probably only stayed for short periods (Noss and Cooperrider 1994).

Elk likely grazed lower-elevation valley bottoms and toe slopes more than they do now. While elk numbers are higher now than they were prior to Euro-American settlement, the proportion of elk use of large valley bottoms is likely considerably lower than what it was historically due to concentrated human activity in large valley bottoms of the district. It has been well established that vehicle traffic on roads reduces elk use of adjoining habitat, sometimes up to nearly 2 miles As the density of open roads increases in an area, elk use of the area declines (Lyons 1983, Canfield 1999, Wisdom and Cook 2000), and many of these valley-bottom roads also have an abundance of other human activities associated with them that further reduces use by elk. Use of these areas by mule deer may not be reduced to the same degree as elk since they do not appear to be affected as much by human activity (Wisdom et al. 2005a), but any possible increases in grazing by mule deer (due to fewer elk; Wisdom et al. 2005b) would likely not make up for the reductions in grazing pressure by elk.

Small pools, springs, beaver ponds, and other wetlands in valley bottoms received some level of grazing, hoof action (trampling), defecation, and urination. In most cases, grazing pressure was likely not very high since many of these wetlands likely supported sedges, but use may have been high in some situations. It is not clear how much native ungulates used these small pools and ponds for watering and for other purposes, but at a minimum, trampling, defecation, and urination occurred to a limited extent in some of them and likely to a large extent in a minority of them. There may currently be less use by elk in valley bottoms now having roads, but higher moose use (which concentrate more in valley-bottom habitats) may make up some of the difference. It is also plausible that bands of bison and large groups of elk more heavily impacted wetland vegetation and water quality in localized areas — i.e., it is likely that at least some level of impact occurred, but the extent of impact to small valley-bottom wetlands across the landscape may have been limited.

Beyond differences in grazing pressure by native ungulates in valley bottoms and on toe slopes, other factors affect the amount of short vegetation that is provided in these areas. The extensive road system in large valley bottoms facilitates access for public use. Dispersed camping, gazing by horse stack, parking (e.g., for fishing, firewood collection), picnicking, off-road/trail motorized use (e.g., ATVs), and intensive foot traffic in some areas, combined with changes in herbaceous plant communities and understories, have combined to sustain shorter and sparser herbaceous vegetation in localized areas along valley bottoms. For example, Kentucky bluegrass and smooth brome communities tend to be sparser, shorter, and/or more readily shortened than the communities they replaced. Lowered water tables also contribute to sparser vegetation, and noxious weeds may contribute to this in localized areas. These factors offset, to some extent, the reduced grazing pressure by native ungulates in valley bottoms. The high level of human activity likely affects use of valley bottoms by some species that use short herbaceous vegetation, but may not impact other species that use short herbaceous vegetation (e.g., American robins, mountain bluebirds).

Herbivory by other herbivores likely is similar to what it was prior to Euro-American settlement, except where riparian vegetation has been altered due to roads, dispersed camping areas, dominance by Kentucky bluegrass, lowered water tables, etc. In these areas, I am not clear whether these other herbivores — namely small mammals and insects — would have greater or lesser pressure on the herbaceous communities. It likely depends on the situation. Grasshoppers, for example, are know to exert disproportionately more grazing pressure on herbaceous vegetation when herbaceous communities are depleted and less vigorous. On the other hand, voles and other species are less common on these sites.

Livestock grazing use further contributes to shorter and sparser herbaceous vegetation where it occurs in valley bottoms.

Rangelands — At a minimum, utilization rates by native ungulates in big sagebrush, grassland, and forbland communities would appear to be no less at present compared to grazing pressure prior to Euro-American settlement, and it is likely they are currently grazed by native ungulates at higher utilization levels. However, these higher levels of grazing do not appear to result in readily noticeable reductions in the amount of herbaceous vegetation retained through the spring, summer, and fall, except in limited locations. Reasons for the likely higher levels of grazing by native ungulates across the landscape include the following:

- Bison likely used other rangelands on the district, other than toe slopes and terraces. Their use patterns were discussed under the heading "Valley-bottom Meadows and Toe Slopes," above. In summary, bison use of some of the more accessible big sagebrush-grass and grassland communities on the district were probably inhabited by roaming bands of bison. The current rate of herbivory by native ungulates on these limited areas on the district is likely lower than what it was historically. However, the light to heavy use these areas may have received would likely not have occurred every year and may have only occasionally occurred. There is no indication that any of the district's rangelands were grazed moderately or heavily on an annual basis.
- It appears that numbers of elk, mule deer, and moose numbers are consistently higher than what naturally occurred, although bighorn sheep numbers are lower and distribution more limited. This may have more effects at higher elevations (tall forb, big sagebrush-forb communities) than lower elevations because elk tend to use higher elevations more than they did prior to Euro-American settlement due to motorized and other human activities at lower elevations, and likely remain at higher elevations further into the fall (due to hunting; Bailey 1999, Irwin 2002), which may contribute to higher grazing on forbland communities. Bighorn sheep also remain higher for longer periods of time than they did historically (Krausman and Shackleton 2000, Beecham et al. 2007), but there are few bighorn sheep remaining in the Wyoming Range and none in the Salt River Range.

  It is generally recognized that elk grazing in some parts of their summer range can be fairly heavy, including in forbland communities (USFS 1997, USFS 2004a). While several biologists in the 1950s through the mid 1970s contended that some areas within the Jackson elk herd unit had been ‘overgrazed’ by elk, others insisted there is no evidence of this (Boyce 1989). Levels of grazing by native ungulates and effects of high grazing levels on rangelands have not been documented in the Greys River Ranger District, except possibly in a limited number of situations, although it references to this have been made in USFS (2004a) and other documents.

- The acreage of land in early and mid succession on the district is considerably less than what it had been when fire played a more prominent role on the landscape, and the expansion of conifers into former rangelands continues mostly unabated (Gruell 1975; Gruell 1980a,b; USFS 1997, USFS 2004a; USFS 2005). This results in grazing being somewhat more concentrated on a smaller acreage, and may contribute to higher use of rangelands.
- The rate of herbivory by rodents, insects, and other small herbivores may be similar to what it was prior to Euro-American settlement, except on rangelands where vegetation has been substantially altered. On these lands, I am not clear whether the rate of herbivory is lesser (e.g., due to reduced numbers of rodents and insects and absence of some species) or greater (e.g., due to disproportionately higher pressure on the remaining vegetation) than it was prior to Euro-American settlement.
- A large proportion of the district’s big sagebrush and most of the district’s tall forb and other forbland communities are functioning-at-risk or non-functioning (USFS 1997, USFS 2009), meaning that the biomass of grasses and forbs produced is lower, which in turn means that utilization rates (% of annual production removed) are higher than would occur in a health, functioning rangelands given the same biomass of forage removed. Consistently larger numbers of native ungulates may compound this effect in places.

Aspen and Willow Stands — Grazing and browsing by native ungulates in aspen and willow stands is likely somewhat higher now than what had occurred prior to Euro-American settlement as a consequence of consistently higher elk and mule deer numbers, higher moose numbers (particularly if moose did not exist in this area prior to the late 1800s), considerably lower acreage of aspen stands having a larger density of suckers and saplings, and lower acreage of other communities in a productive state. All of these factors tend to concentrate more use on fewer twigs available for browsing. It is likely that elk and mule deer densities in any particular area or watershed prior to Euro-American settlement reached densities that occur today, but relatively high densities likely did not recur year after year except on winter ranges and spring transition ranges. Even in these locations, periodic reductions in animal numbers would have given resulted in less grazing and browsing pressure.

Other Factors — Other factors may also affect forage utilization rates in several plant communities, including spread of noxious weeds which further reduces land base of suitable forage (only a localized problem at present) and predator control activities to the extent they are successful in reducing coyote numbers which could result in larger populations of small mammals.

Landscape Perspective

The amount of suitable rangeland, riparian, and associated wetland habitat conditions in the larger geographic area (e.g., west-central Wyoming) are reduced compared to pre-Euro-American conditions due to historic activities (e.g., livestock grazing, beaver trapping, terracing), diminished role of fire, and the preponderance of farming, livestock grazing, and development (e.g., towns, housing developments, oil and gas compounds, roads, campgrounds) and the current rapid growth in this development (see USFS 2009 for effects on the BTNF). The combined effects of these activities are most prominent in the area's wide valley bottoms. Where herbaceous and shrubland communities persist on private lands (mostly valley-bottom habitats), herbaceous vegetation height is typically shorter than what had occurred prior to Euro-American settlement.

The result of these cumulative effects is under-representation of tall, dense herbaceous vegetation and over-representation of short and/or sparse herbaceous vegetation, relative to conditions that existed prior to Euro-American settlement, i.e., the conditions under which native wildlife communities were formed and sustained

This is not to say that federal lands should make up all of the difference, but it does indicate the importance of providing tall, dense herbaceous vegetation particularly in valley bottom and toe-slope plant communities.

Relationship to Needs of Individual Wildlife Species

Characterizing the needs of individual wildlife species (in "Forage Needs of Individual Species," "Cover Needs of Individual Species," and "Other Habitat-Related Needs") was done independent of the concept of approximating conditions under which wildlife communities evolved in this area. In retrospect, however, these characterizations when taken as a whole lend support to the overall approach of this report to assessing forage and cover needs of wildlife.

YEARS OF BELOW-AVERAGE PRECIPITATION

Wildlife need forage, cover, and other habitat attributes every day throughout the year every year, and years when precipitation levels are well below average greatly reduce the availability of these resources to wildlife. In assessing the effects of dry years on forage availability for elk, Hobbs et al. (2003) assumed a reduction of 55% compared to years of average precipitation levels. Production may be even lower in extremely dry years (e.g., 2007). Effects of dry years on forage and cover for wildlife has not been studied extensively, but where it has been studied, results support the basic principles of reduced supply under an unchanged (constant) demand. For example, Lomas and Bender (2007) found that drought in north-central New Mexico was a major factor contributing to low fawn survival. Livestock grazing compounds these effects by reducing an already lowered supply. If the production of herbaceous vegetation is reduced by 55% due to lower-than-average precipitation and livestock remove an additional 30%, this leaves about 32% of the herbaceous vegetation produced in an average year. In addition to less leaf matter being produced, lower production levels also mean fewer flowers and seeds (and reductions in flower and seed production may be disproportionately lower). If forage utilization levels are at 60%, the amount of retained herbaceous vegetation — compared to that produced in an average year — is 18% (and this may overestimate the situation in 2007 since this was an exceptionally dry year). Impacts to wildlife are straightforward.

One viewpoint is that it is acceptable for allowable-use standards to be exceeded periodically in years of below-average precipitation because rangeland vegetation will recover in forthcoming years. However, this is not the view of all range practitioners (e.g., Thurow and Taylor 1999, Holechek et al. 2004), and it is inconsistent with the Forest Plan. Thurow and Taylor (1999), for example, recommended more conservative grazing pratices in drought years. Implications of livestock grazing in dry years include the following:

- Adverse effects of livestock grazing on wildlife in years of below average precipitation (even when allowable-use standards are met) are compounded by lowered plant production in years of below-average precipitation.
- If percent utilization by livestock is higher in dry years, adverse impacts are further compounded.
- Additionally, long-term impacts may result from exceeding allowable-use standards. Some examples include:
  - Adherence to allowable-use standards should minimize the extent to which cattle expand trailing in willow communities and cause other mechanical damage. However, if allowable-use standards are exceeded in dry years, this could result in an incremental increase in trails through willow stands and expansion of openings, which may continue to be used during preceding years, thereby expanding traditional use patterns.
  - One year of excessive grazing of streambank vegetation, which, if followed by large peak flows could result in considerable, long-lasting damage to stream channel integrity.
  - Impacts to key forage species may last more than one year, which could result in further changes to plant species composition. For example, Heady (1950) found that that clipping bluebunch wheatgrass to 6 inches (i.e., roughly about 50% utilization, with a range of about 40-60% utilization) during the growing season is too severe for the plants to maintain themselves; and Mueggler (1975, as cited by Peek 1986:182) "reported that Idaho fescue and bluebunch wheatgrass required 3 and 6 years respectively to fully recover after one heavy clipping."
  - It may be possible for Kentucky bluegrass and other "increaser" species to make gains in distribution and abundance as a consequence of excessive grazing in dry years, which further diminishes the capability of the land to produce wildlife forage and cover. This could happen to the extent that vigor of native species is reduced at the fringes of bluegrass distribution or where bluegrass is present, but has not yet exerted dominance. Kentucky bluegrass is rhizomatous, is more resistant to heavy grazing pressure than most of our native species due to growing points that are below the ground surface, and plant species composition in areas overused by livestock readily shift toward Kentucky bluegrass where this species has been introduced (Youngblood et al. 1985, Uchytil 1993). It is highly palatable and readily eaten by elk and other wildlife, especially during the early growing season, and can provide fair to good wildlife cover where soil remains moist through the growing season and where vigor is not compromised. However, Kentucky bluegrass is of lower value to wildlife using the riparian areas where Kentucky bluegrass is most abundant, as compared to the native plant communities it replaced.
  - For wildlife populations that are declining or near the threshold of declining, seemingly small effects can contribute to large cumulative impacts.

At worst, forage utilization standards should remain unchanged in years of below-average precipitation. At least in DFC 10 and 12 areas, an argument could be made that they should be more restrictive in dry years. WAFWA (2008) and WAFWA (2009) recommended the preparation of contingency plans for years in an average of less than 75% of the average precipitation falls. This concept is already generally built into stubble heights to some extent because a lower percent utilization would be permitted in dry years compared to years of average and above-average precipitation.

More restrictive allowable-use standards in dry years would not result in “more” herbaceous vegetation being retained for wildlife. More accurately, increasingly restrictive allowable-use standards in dry years would merely result in herbaceous forage and cover being reduced by a lesser amount.

Therefore, from the standpoint of wildlife, particularly in DFC 10 and 12 areas, it is clear that exceeding allowable-use standards in dry years would conflict with Forest Plan direction.

One final note. I try not to use the term “drought” when discussing years of below-average precipitation because (1) this term implies that dry years are unusual and only occasionally occur, (2) use of this term builds in a false impression that we don’t need to plan for these years as a matter year-to-year management, and (3) the term is value-laden. By definition, years of below-average precipitation occur nearly 50% of the time and, therefore, are not unusual. Drought years should be reserved for those years when the level of dryness is well below the regularly occurring dry years. A 1 in 10 year event is regular, but a 1 in 50 year event can be considered outside of the norm. For example, 2007 was among the driest years on record (if not the driest), and can be considered a drought. Unless of course, climate change is truly happening and this level of dryness becomes a regular occurrence.

INFORMATION GAPS

Where there is some question about such things as the minimum amount of herbaceous vegetation that needs to be retained for a given species to meet their needs, the following information is provided in this report: (1) optimum conditions, (2) amount of vegetation that clearly does not meet their needs, and (3) a range of possible minimum amounts that would need to be retained to at least minimally meet the needs of the species. In DFC 10 and 12 areas, deference is given to the upper end of the range, whereas in DFC 1B areas, deference could be given to the lower end of the range (to represent the lower end of what can be considered satisfactory). Professional judgment is used in these situations.

There are non-functioning areas where it is clear to soils and range management specialists that recover would not occur for many centuries. When there are questions about the existing potential to improve to at-risk-conditions or better within 50-100 years, deference needs to be given to restoration in DFC 10 and 12 areas from the standpoint of meeting the needs of wildlife in these areas.

B. Suitable Wildlife Forage

In this section, the forage needs of wildlife and implications of livestock grazing are described for each of several species and groups of wildlife.

The issue of retaining wildlife forage in areas grazed by livestock grazing traditionally has been limited to native ungulates (Kie et al. 1994, Kaufman 1996) and this is applicable to DFC 12 areas given the emphasis on big game. However, there is potential for competition between livestock and numerous species of wildlife and, therefore, applicable to DFC 10 areas, as well as other DFC areas to a lesser degree. Even for DFC 12 areas, the Forest Service is required to retain forage for non-ungulate wildlife species.

Given the wide range of forage needs and the difficulties involved with estimating/measuring utilization of key forage species, we have not attempted, for the district, to estimate the biomass of annual production of key forage species that should be allocated to livestock, wild herbivores (numerous species requiring many different plant species and plant parts), wildlife cover, and watershed values for each of the major vegetation types. Standardized methods exist for determine the biomass of annual production per acre for each plant community type, estimate the amount that could be removed on an annual basis, and to allocate specific proportions to livestock and wildlife (e.g., Wisdom and Thomas 1996, Holechek et al. 2004). However, this approach would entail a major time commitment and an increase in funding, may not result in any better information on the amount of vegetation to retain for wildlife and other resources than produced by focusing on percent retention/utilization (this report), and it may infer a much greater level of accuracy than actually would exist. Difficulties in using such an approach include:

- Biomass of key forage species and other prominent herbaceous species is not available for the district's major plant communities under a range of growing-season precipitation levels, and a large amount of staff time would be required to obtain this.
- Not only would "forage" need to be allocated to livestock and native ungulates, it would also need to be allocated to:
    - All other native herbivores, as well as to seed-eaters and nectar sippers. The latter two greatly complicate allocation methods that are based on biomass.
    - Cover and substrated for hiding and thermal protection (birds, small mammals, amphibians), nests (birds), eggs (amphibians), and prey (e.g., insects, small mammals) are also important elements of herbaceous vegetation to wildlife. Cover and substrate needs vary considerably from species to species and would be very difficult to model, particularly when the standard of measure is biomass.
    - Sustaining healthy and properly-functioning riparian areas, wetlands, rangelands, and forestlands — including the provision of fine fuels for fire spread — which in turn are critical for sustaining suitable wildlife habitat.
- The accuracy and precision of methods to estimate/measure utilization of key forage species are generally not very high for the following reasons cited by Laycock (1997), as referenced by G. Anderson, former Rangeland Management Specialist:
    - Patterns of utilization are highly variable in both space and time. Herbivory, by nature, is not uniform across the landscape nor is it uniform from year to year.
    - Different methods of determining utilization will yield different results.
    - Different observers get different results using the same method to estimate utilization.

While information on key forage species of elk and mule deer is helpful in designing allowable-use standards, it is not practical to base allowable-use standards on key forage species for them. This is because (1) there is insufficient data on the district and it would take a major effort to obtain the information; (2) composition of key forage species for elk and mule deer varies considerably from area to area on the district, making a one-size fits all key-forage-based standard not possible; (3) herbaceous vegetation is likely not going to be managed for key forage species for a small handful of wildlife species; (4) it would be impractical and not very meaningful to attempt to limit livestock grazing use based only on allowable-use standards for key forages for elk and mule deer because at some point allowable-use standards need to address a much wider range of habitat needs.

The Greys River Ranger District is going in the direction of using the landscape appearance method (BLM et al. 2008) in combination with utilization mapping (BLM et al. 2008) to estimate forage utilization levels at the end of the livestock grazing season. Estimating utilization of key forage species would require an additional effort, and most methods are considerably more time intensive than the landscape scale method.

Therefore, at this point, it is most reasonable to take a general approach to addressing the forage needs of wildlife. This involves recognizing the range of forage needs of wildlife, and building these needs into allowable-use standards, possibly including both large-scale standards and small-scale standards for specific situations.

UTILIZATION OF KEY FORAGE SPECIES VS. HERBACEOUS VEGETATION IN GENERAL

Most forage utilization recommendations in the literature are expressed in terms of key forage species, but the landscape appearance method (BLM et al. 1999:120, BLM et al. 2008:27), which is being considered for use on the Greys River Ranger District at least on cattle allotments, assesses overall utilization of herbaceous vegetation. The landscape appearance method does not distinguish between key and other herbaceous species. Conversion between the two methods is straightforward; a matter of simple mathematical principles so long as species composition (by weight) is known. Unfortunately, I do not have a good handle on the composition of key forage species and non-key forage species. Furthermore, the composition of key and non-key species depends on wildlife species being assessed and it is different in different plant communities across allotments and the district as a whole. Composition of key forage species of elk is likely high in some big sagebrush communities where Idaho fescue, bluebunch wheatgrass, and other preferred species are common. It is low in tall sedge communities. Therefore, Table 4 presents a wide range of compositions.

Use of the landscape appearance method requires lower overall utilization levels to limit utilization levels on key forage species. Zobell (2007), for example, felt that utilization of the total herbaceous vegetation on a site may needed to be limited to 20% in order to limit the utilization of key forage species to 35-40%, but this depends on plant species composition and other factors. Also, WAFWA (2007a:24) implied that, to limit utilization of key forage species to 35-45%, utilization of all forage on a landscape would need to be limited to 25-35% due to some forage being unavailable to livestock. Table 4 supports these assessments, assuming that the key forage species in the areas he observed comprised approximately 25-50% of the total composition of the plant communities and assuming there was ≤20% utilization of non-key species. If, on the other hand, composition of key forage species is considerably higher than 50%, a higher utilization limit than 20% of herbaceous vegetation could be accommodated while still retaining utilization of key forage species at no more than 35-40%.

Table 4. Retention rate of herbaceous vegetation (overall) at different rates of retention of key forage species and non-key forage species relative to the composition of key forage species in the plant community.

Retention Rate of Key Forage Species	Retention Rate of Non-Key Species	Composition of Key Forage Species in Plant Community				
		10%	**25%**	**50%**	**75%**	**90%**
90%	**~100%**	99	97.5	95	92.5	91
80%	**~100%**	98	95	90	85	82
	90%	89	87.5	85	82.5	81
70%	**~100%**	97	92.5	85	77.5	73
	90%	88	85	80	75	72
	80%	79	77.5	75	72.5	71
60%	**~100%**	96	90	80	70	64
	90%	87	82.5	75	67.5	63
	80%	78	75	70	65	62
	70%	69	67.5	65	62.5	61
50%	**90%**	86	80	70	60	54
	80%	77	72.5	65	57.5	53
	70%	68	65	60	55	52
	60%	59	57.5	55	52.5	51
40%	**80%**	76	70	60	50	44
	70%	67	62.5	55	47.5	43
	60%	58	55	50	45	42
	50%	49	47.5	45	42.5	41
30%	**70%**	66	60	50	40	34
	60%	57	52.5	45	37.5	33
	50%	48	45	40	35	32
	40%	39	37.5	35	32.5	31
20%	**50%**	47	42.5	35	27.5	23
	40%	38	35	30	25	22

≥90% retained, or ≤10% of annual production of herbaceous vegetation utilized

= 80-89% retained, or 11-20% of annual production of herbaceous vegetation utilized

= 70-79% retained, or 21-30% of annual production of herbaceous vegetation utilized

= 60-69% retained, or 31-40% of annual production of herbaceous vegetation utilized

<60% retained, or >40% of annual production of herbaceous vegetation utilized

If the composition, by weight, of key forage species for livestock is 25-50% of the total herbaceous community and if the forage utilization rate of non-key species is no higher than ¼ to ½ the utilization rate of key forage species, the following conversions would apply.

To Maintain Minimum Retention Levels for <u>Key Forage Species of</u>:	Retention of Herbaceous Vegetation (overall) <u>would need to be at Least</u>:	
70%	80-85%	(as high as 90% if retention of non-key species >95%)
60%	70-75%	
50%	60-65%	(as high as 80% if retention of non-key species ≈90%)

If the composition of key forage species for livestock is closer to 75% of the plant community, the lower end of the range for retention of herbaceous vegetation (overall) would be 5% lower in each case (i.e., 75%, 65%, and 55%, respectively).

If the composition of key forage species for livestock is <25%, for example in areas that are functioning at risk, the following conversions would apply.

To Maintain Minimum Retention Levels for Key Forage Species of:	Retention of Herbaceous Vegetation (overall) would need to be at Least:
70%	>85%
60%	≥80-90%
50%	≥75-80%

For rangelands that are non-functioning, overall forage utilization may have to be less than what is shown above due to the very low proportion of key forage plants and the overall low density of plants.

FORAGE NEEDS OF INDIVIDUAL WILDLIFE SPECIES

In this section, I focus on large ungulates given the large amount of information available on forage needs of large ungulates and on the relationship between large ungulates and livestock grazing. I include a small number of other species, and generally address other species.

Most of the specific (e.g., numeric) information on wildlife-livestock grazing relationships in this section pertains to graminoid-dominated plant communities and understories. I generally address wildlife-livestock grazing relationships in forb-dominated communities and understories, including both forage and cover and including herbaceous leaf matter and flowers of forbs, in the subsection "Forb-Dominated Communities and Understories" of the "Wildlife Cover" section (beginning on page 144).

Herbaceous Leaf Matter

Herbivores that forage on leaves and stalks of grasses, forbs, sedges, forbs, and rushes include native ungulates, lagamorphs, rodents, birds, insects, mites, and plant-parasitic nematodes (Miller et al. 1994). Elk, mule deer, moose, and bighorn sheep are MIS species. Diets of individual native ungulate species are summarized in USFS (2009). There is considerable overlap in diets of cattle and elk, between sheep and mule deer, and between sheep and moose where and when moose are foraging on forbs. There can also be seasonal overlap in diets of sheep and elk and between cattle and mule deer. USFS (2009) discusses this is more detail. See also Wisdom and Thomas (1996) and Peek and Krausman (1996).

Elk

Habitat requirements and population status of elk on the Bridger-Teton National Forest are summarized in USFS (2009). Competition for herbaceous forage probably has the largest potential conflict of any potential conflicts between Forest Plan objectives for livestock use and those for elk. On cattle allotments, the greatest potential for competition exists on elk winter and spring ranges, and autumn ranges (Wisdom and Thomas 1996, Miller 2002). On most sheep allotments, the greatest potential for competition exists on elk summer and autumn ranges (Miller 2002), although some elk winter range exists at the lower elevations of some sheep allotments. While the potential for competition between sheep and elk is lower than it is between cattle and elk, since cattle and elk are both primarily grass eaters, Pickford and Reid (1943, as cited by Miller 2002) found that elk consumed 13% grasses, 81% forbs, and 6% shrubs on a summer range in northeast Oregon, compared with 33% grasses, 66% forbs, and less than 1% shrubs during the same period. Therefore, in areas dominated by forblands and herblands, elk may consume large quantities of forbs when they are succulent, which puts them in competition with sheep on sheep allotments.

FSH 2209.22.1 (amendment for Region 4) list plant species that are favored forage for elk and mule deer, as well as those that are valuable for erosion control (watershed value). This list should be evaluated and customized for the district.

Livestock herbivory has potential, on a year-to-year basis, to affect the amount and quality of forage available to elk, particularly where dietary overlap occurs on transition, calving, and winter ranges (Wisdom and Thomas 1996). As recognized by Wisdom and Thomas (1996), cattle tend to use the drainage bottoms and lower slopes below those used by elk during summer months, although some elk use these areas during summer. Also, elk congregate in some of the district's meadow/forest complexes during early summer (during calving) and late summer/fall (during the rut). Sheep use many of the same rangelands used by elk above drainage bottoms.

For elk that winter on native winter range and not on winter feedgrounds (e.g., Deadman-Moose Creek, Star Valley Front, and Big Ridge-Spring Creek winter ranges), availability of nutritious forage during summer, fall, and winter is critical. Availability of a sufficient amount of forage during winter on winter range is clear. Just as important is the nutritional status of elk going into winter (see discussion under Mule Deer, below), making the availability of nutritious forage during summer and fall all the more important for these elk. The implications of chronic wasting disease on elk in the area is yet unknown, but there is at least a possibility that it may result in more elk wintering on native winter range, which may increase the importance of both the condition of elk winter ranges and summer/fall ranges.

Retention on Spring, Summer, and Fall Range

Available information strongly indicates that retaining 80% to ~100% of the annual production of herbaceous vegetation in healthy, functioning rangelands and riparian areas would be sufficient to meet the needs of elk; there is a moderately high indication that retaining as little as 30% of annual production of herbaceous vegetation would be sufficient; and there is little to no indication that retaining as little as 60% would be sufficient to meet their needs. An absolute 100% is not a realistic high-end figure due to the many natural factors that reduce the biomass of herbaceous vegetation during spring and summer months and, therefore, "~100%" is used to represent near or approximately 100%. It reinforces that retaining 60-70% of the annual production does not represent satisfactory forage conditions for elk *per se*; it represents the lower end of a range of satisfactory conditions.

The following two paragraphs present utilization limits in terms of key forage species, which is different than the above paragraph which discussed utilization in terms of all herbaceous vegetation. Table 4 and accompanying tables in the previous section present cross-walks between the two.

Holechek et al. (2004), recommended retaining 70% of the annual production of key forage species through the livestock grazing season in sagebrush grassland, mountain shrubland, and conifer forestland to sustain healthy rangeland conditions, provide for watershed functioning, and meet the needs of wildlife in general — when livestock grazing takes place during the growing season; Vallentine (1990) had concurred with earlier editions of Holechek et als' text with respect to this. Holechek et al. (2004) assessed that retaining as little as 60% of the annual production of key forage species would provide for sustainability of rangeland vegetation and generally provide for the needs of wildlife when healthy, functioning rangelands are grazed during the dormant season. The beginning of the dormant season ranges from early or mid July in dry years in low-elevation uplands to late September in permanently moist parts of riparian zones. In alpine areas, Holechek et al. (2004) recommended retaining 70-80% of the annual production of key forage species, meaning that utilization of herbaceous vegetation in general would need to be lower than this (e.g., 10-20%).

Wisdom and Thomas (1996) summarized the effects of three cattle stocking levels on forage conditions for elk. They assessed that light stocking rates can be neutral or positive; moderate stocking rates (25-60% utilization of key forage species) can be positive, neutral, or negative, depending on many variables; and high stocking rates "invariably heighten the potential for competition with elk for limited forage." They suggested that season-end utilization levels of key forage species of ≤40% should maintain desirable composition of forage for elk, and they did not provide any indication that utilization levels of >40% would result in neutral or positive effects.

There is little support for the assessment that retaining <40-50% of the annual production of key forage species would retain suitable foraging habitat for elk. The take-half-leave-half approach only addresses the health of individual plants and does not take into account other uses of herbaceous vegetation. Considering cattle grazing behavior as described by McKinney (1997), only about 20% of the available key forage would remain available to elk in the fall if 50% were removed; this is because 30% would be comprise the vegetation within 1-3 inches of the soil surface (Figure 1), and this level of grazing could have impacts to rangelands. Several rangeland textbooks recommend retaining higher levels of annual production of key forage species (Vallentine 1990, Holechek et al. 2004). Peek (2008), an authority on large ungulates in the intermountain west, said the old rule-of-thumb for bunchgrasses of taking half and leaving half should be reduced to ensure that other values are not adversely affected. Holechek et al. (2004:217) assessed that, while this guideline applies well in some parts of the United States, it results in rangeland deterioration in coniferous forest rangelands, among other zones. They cited nine studies showing that a maximum of 35-45% utilization of key forage species was needed, which translates into an estimated retention of 65-80% (Table 4). Figure 1 illustrates one reason why these studies showed downward trends in range conditions when retention levels are below about 60-65%; half or more of the plants are grazed below the "take-half, leave-half" level.

Converting the recommendations in the previous three paragraphs (i.e., retention of ≥60-70% of the annual production of key forage species) for use under the landscape appearance method requires retaining a minimum of 70-80% of the annual production of herbaceous vegetation on functioning rangelands, assuming that key forage species comprise 25-50% of the plant community and that retention of non-key species ≈80-90% (Table 4). This provides a target in DFC 10 and 12 areas (where any conflicts between Forest Plan objectives must be resolved in favor of wildlife), while at the same time contributing to the livestock use objective. Retaining a

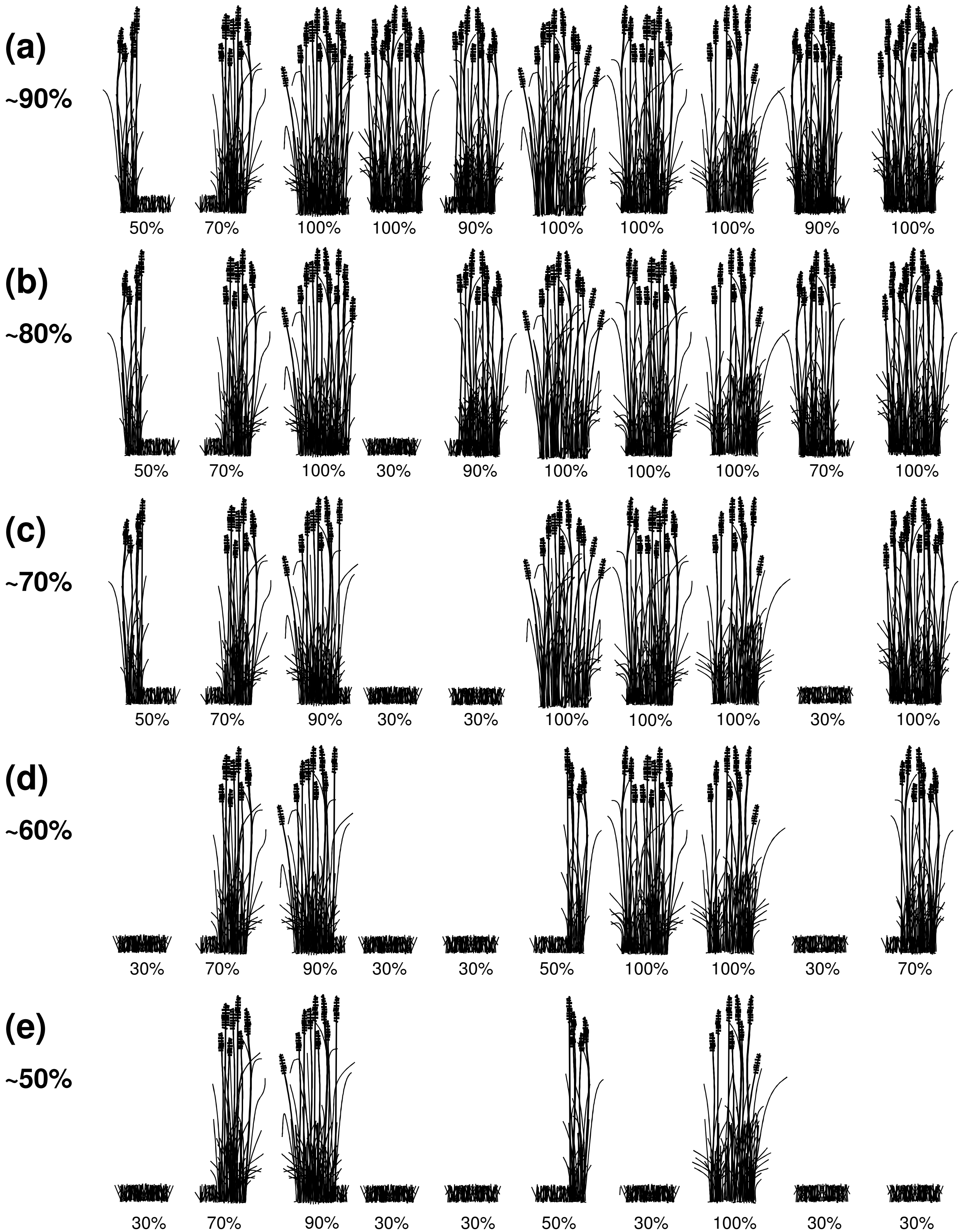

Figure 1. Representation of five different retention levels (shown to left). Retention levels of individual plant are shown under each plant; “(e)” is based on McKinney (1997), and others were based on the same concept (see Table 9). 40% retention could result from 7 plants at 30% and 3 plants at 70% retention, and 30% retention results from all plants at 30%. Assumes no skimming, grazing from the top, or trampling effects. (Also: Kinney & Glary (1994), BLM et al. (1999))

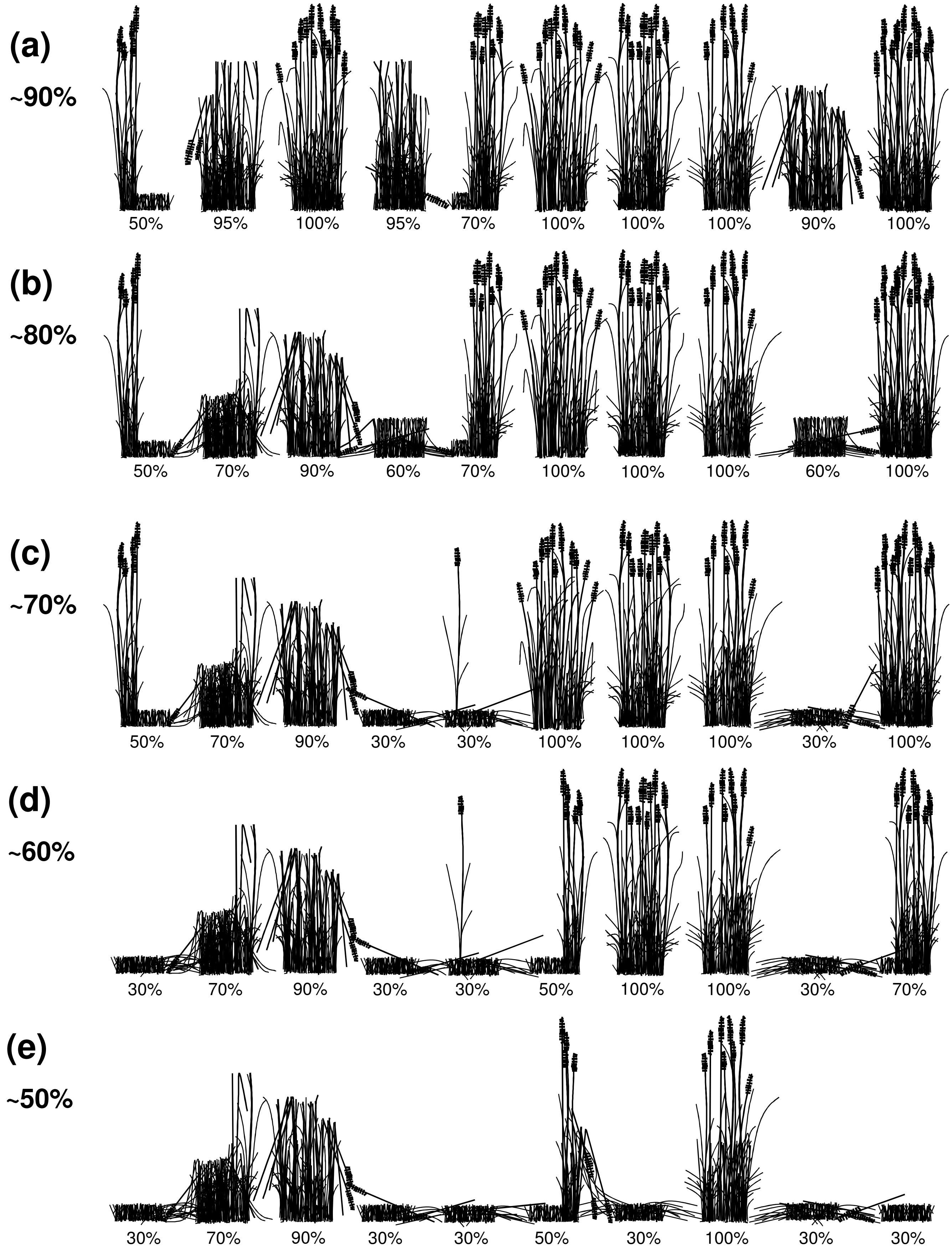

Figure 2. Representation of five different retention levels (shown to left), assuming (1) some skimming and grazing from the top of each plant downward and (2) increasing levels of trampling effects with lower retention levels.

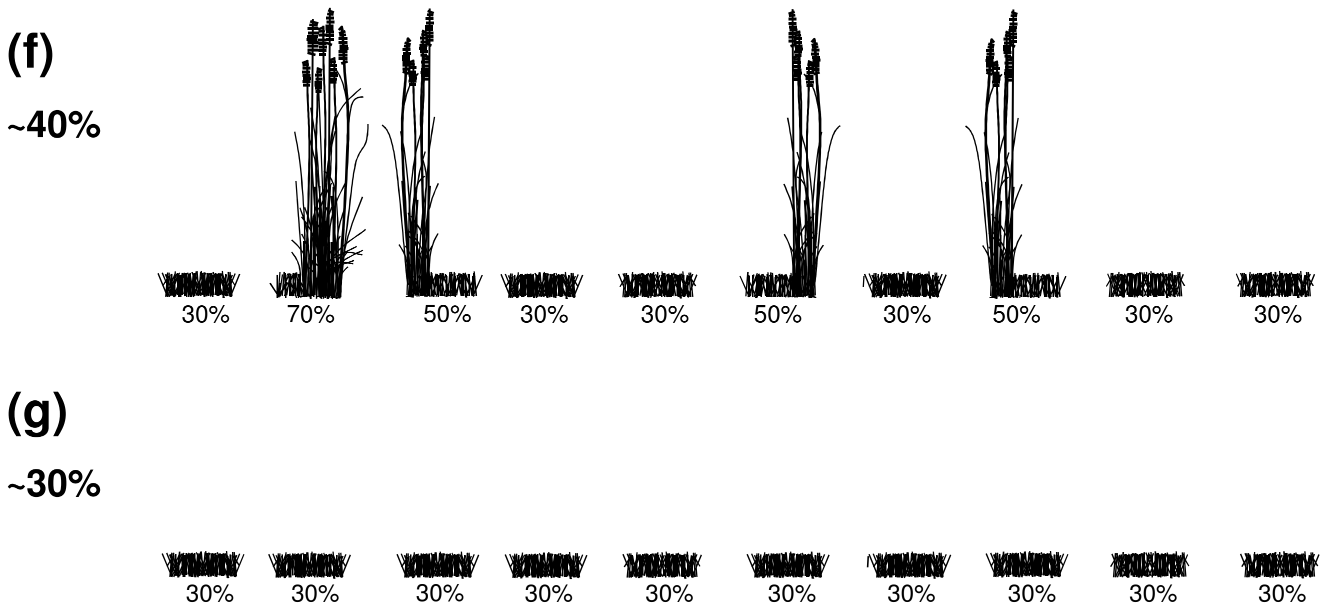

Figure 1 (continued).

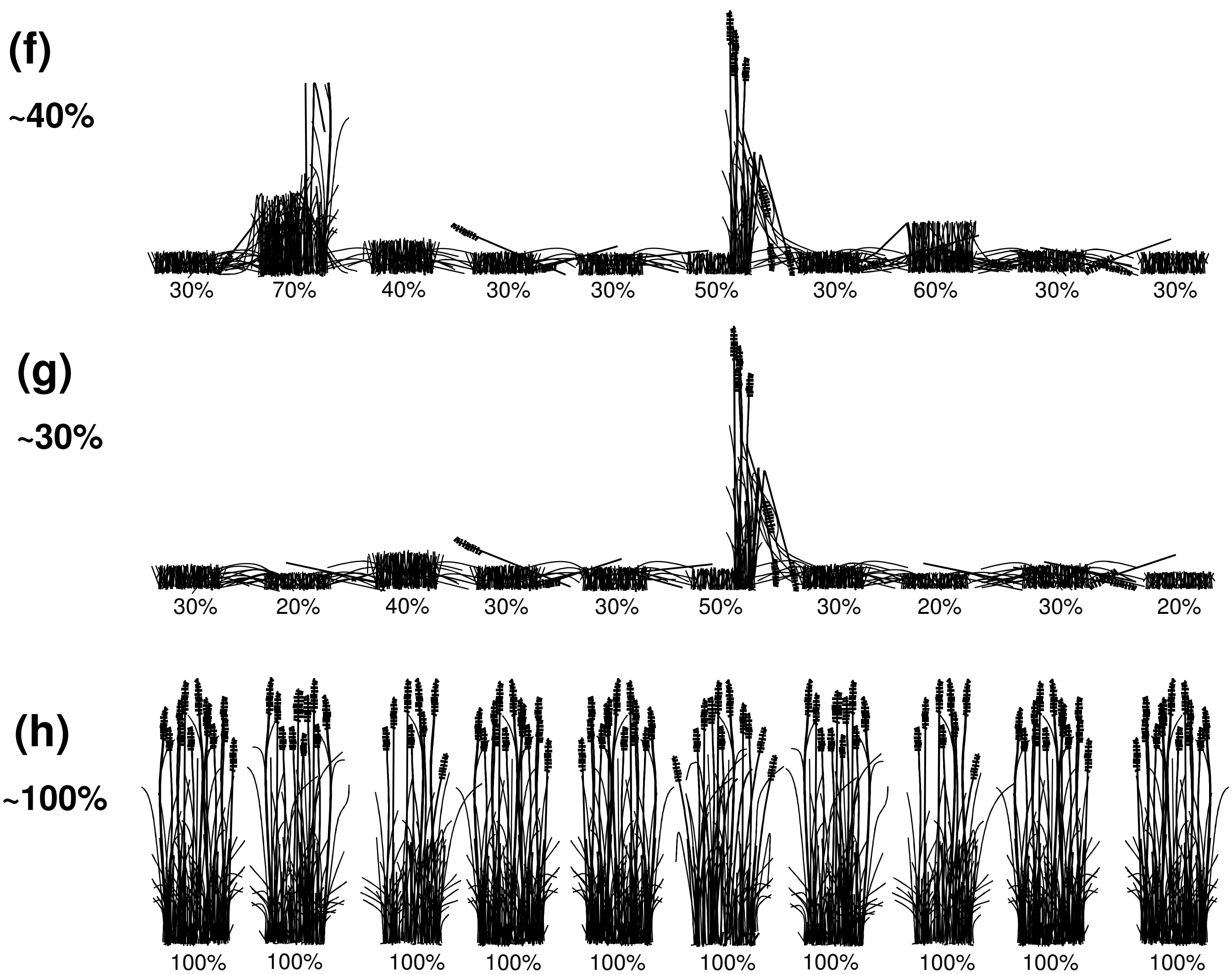

Figure 2 (continue). Also includes 100% retention.

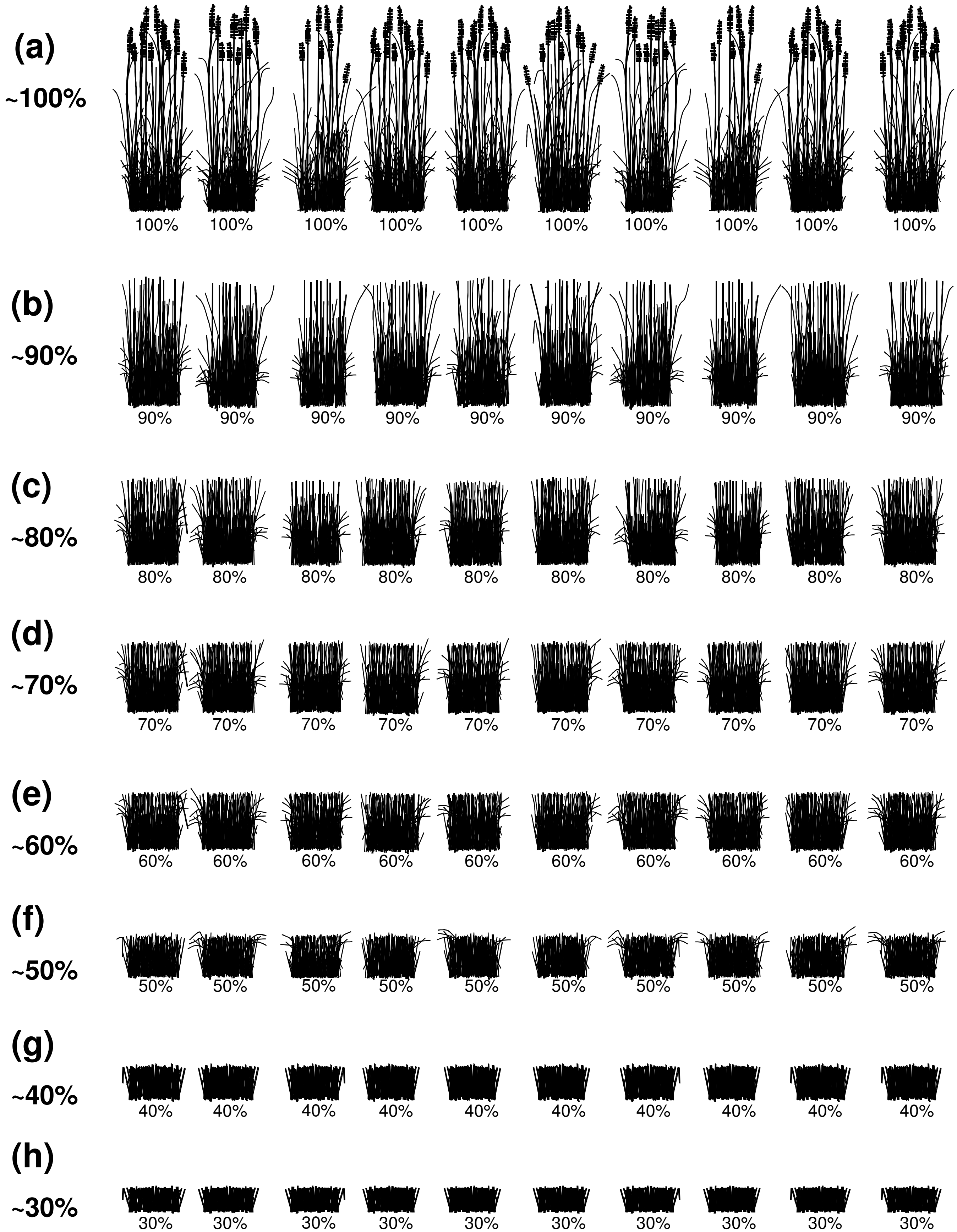

Figure 3. Representation of eight different retention levels (shown to left), assuming grazing from the top of plants downward, resulting in homogenous heights (based on information in Kinney and Glary (1994) and BLM et al. (1999).

minimum of 60% of the annual production of key forage species could be accomplished by retaining 65% of the annual production of herbaceous vegetation if composition of key forage species is high (e.g., 75%). There is little support for the assessment that retaining as little as 60% of annual production of herbaceous vegetation would be sufficient to provide for the forage needs of elk, as this would result in an estimated 45-50% of the annual production of key forage species being retained. This conflicts with direction in DFC 10 and 12 areas. Furthermore, it needs to be remembered that utilization is measured/estimated in September through mid October, and utilization by elk continues after this time (i.e., the absolute minimum of 65% does not account for this and would need to be raised somewhat on elk fall-transition areas).

While the percentages outlined in previous paragraphs do not translate as easily to meaningful allowable-use standards for sheep, the basic concepts holds. This is discussed in more detail in the “Forb-Dominated Communities and Understories” section (beginning on page 144).

Compared to healthy, functioning rangelands, a higher percentage of the annual production of key forage species on functioning-at-risk rangelands needs to be retained through the livestock grazing season, particularly in DFC 10 and 12 areas. Minimum retention levels should be >80-85% in order to retain forage for elk and to allow recovery of the rangelands. Areas with large amounts of non-functioning rangeland should not be grazed by livestock. (See “B. Principles of Wildlife-Livestock Grazing Relationships” and “Utilization of Key Forage Species vs. Herbaceous Vegetation in General” sections for explanation).

Retention on Winter Range

The potential for competition between cattle and elk is typically highest on elk winter range and spring-fall ranges, and forage quality is at its lowest point during winter months which compounds the effect (Wisdom and Thomas 1996). Summertime sheep grazing can also result in competition with elk for forage on winter range. While there is some indication that livestock grazing can in some situations enhance the nutritional quality of winter forage for elk, there appears to be little realistic potential on the Greys River Ranger District for this (see next subsection, below). Within areas designated as crucial elk winter range, conflicts have the potential for occurring on south- and west-facing slopes, and these slopes exist in three locations: Spring Creek-Big Ridge area, Star Valley Front, and south end of Middle Ridge. While most of the district’s elk winter on feedgrounds, winter range continues to support several hundred elk every winter. Also, there is an increasing emphasis on having elk spend more time on native winter range and less time on winter feedgrounds as one of several methods to reduce the prevalence of brucellosis (Clause et al. 2002, USFS 2004, WGFD 2006a) and this has the potential to increase further with chronic wasting disease moving toward this part of the state.

Because cattle and sheep directly compete with elk for forage on elk winter ranges grazed by livestock during summer months, livestock is required to be managed to minimize conflicts where winter ranges fall within DFC 10 and 12 areas. For example, in DFC 12 areas, it states that “Livestock are not permitted on crucial big-game winter ranges closed to grazing. Livestock grazing is permitted on other big-game ranges if it does not conflict with wildlife needs” (USFS 1990:242). This does not require closing of crucial winter ranges to livestock grazing, but it does emphasize the importance of managing livestock grazing use to minimize potential conflict. In DFC 10 areas, the management emphasis is to provide for the habitat needs of wildlife, including on winter range, in balance with commercial uses such as livestock grazing (USFS 1990:235).

In many situations, the best possible scenario solely from the standpoint of elk is the absence of livestock grazing on winter ranges, but the Forest Plan does not require that optimum conditions be provided, particularly in crucial winter ranges within DFC 3 and 10 areas. The potential for conflict is influenced by the number of elk relative to the amount of available forage. Where it can be shown that elk only require a small amount of the available herbaceous vegetation during winter and early spring, retention levels described for spring, summer, and fall ranges may suffice. Where it is shown that elk only require a moderate amount of the available herbaceous vegetation, retention of the annual production of herbaceous vegetation should probably be limited to 80% (e.g., in order to retain a minimum 70% of the annual production of key forage species), depending on plant species composition. Where elk require a large proportion of the available herbaceous vegetation during winter, it may still be possible to provide for a small amount of livestock grazing, but there would be little support for retention levels of <90% of the annual production of herbaceous vegetation (in order to retain 80-90% of key forage species), assuming ≤50% composition of key forage species in plant communities. It is possible that even this level of livestock grazing is excessive on elk winter ranges. An exception to all of the above assessments would be if it could be demonstrated that livestock grazing enhanced forage for wintering elk.

Several other important factors need to be considered. For example, an estimated 25-50% of herbaceous vegetation on a winter range may be unavailable to wintering elk due to being unpalatable, obstructed by inedible plant tissue (e.g., under shrubs), and trampling effects (Hobbs et al. 2003). Unavailable plant tissue also includes the lower 10-20% of bunchgrasses. Compounding this effect is snow depth and snow qualities (typically expressed as snow water equivalent). As snow water equivalent increases above 2 inches, forage availability drops (Hobbs et al. 2003). Therefore, where elk require a large proportion of the "available" herbaceous vegetation, there may be little or no flexibility for providing forage for livestock during summer months.

Assessment of Possible Benefits of Livestock Grazing

Several possible benefits of livestock grazing on elk forage conditions have been described in the literature, but there are few realistic applications on the Greys River Ranger District:

1. <u>Reduced accumulations of residual vegetative material to improve access to forage</u> — One reported benefit of livestock grazing is to improve access to current-year's growth of bunchgrasses on elk winter and/or spring range through the use of livestock grazing. Livestock are used to reduce residual vegetation early enough in the season to allow sufficient growth of bunchgrasses in order to provide winter forage for elk (Anderson and Scherzinger 1975, Peek 1986).

   The concept is straightforward. If current year's growth is within clumps of residual, standing grass cover, elk either have to pick through residual, standing grass cover (which slows forage intake and results in some of the current year's growth being missed by elk), or they have to eat residual, standing grass with the new growth (which reduces overall nutritional content of forage). Biologists and wildlife researchers that provided input into Hobbs et al. (2003), estimated that 25-50% of herbaceous vegetation produced on a site is unavailable to wintering ungulates because it is unpalatable *or is obstructed* by inedible plant tissue (i.e., accumulations of residual plant material). Conversely, if current year's growth of bunchgrasses is completely or nearly free of residual plant material from previous years, the net energy gained from each bite is higher. This is a simple matter of previous year's plant material (of low nutritive value) being mixed with current year's plant material (comparatively higher nutritive value), thereby reducing the overall nutritive value as compared to bites without any previous year's material.

Relatively low quality of forage on an elk winter range in northeastern Oregon was attributed to the depleted nutritional value of the accumulation of past year's growth intermixed with and limiting access to current year's growth (Anderson and Scherzinger 1975). Cattle were grazed on the Bridge Creek Management Area during May through mid-June, after Idaho fescue and bluebunch wheatgrass had matured to the "boot"stage. They presented it as a case of pre-conditioning forage (bullet number 3, below), but as pointed out by the two authors, the physiological responses of perennial grasses to cattle grazing on the Bridge Creek area were conjectural. They did not measure nutrient contents of regrowth and ungrazed plants in the autumn or winter. However, it is possible that the increased overall nutritional quality of available forage, due to reductions in the accumulations of residual grass cover by cattle, contributed to increased numbers of elk[B].

While there may be situations on the Greys River Ranger District where grazing by livestock benefits elk by maintaining lower levels of residual build-up, there are several limitations for the intentional use of this application of grazing based on methods described in the published literature:

- This potential benefit of cattle grazing to wintering elk relies on sufficient regrowth of grasses after being grazed during the first half of the growing season. Hedrick et al. (1969) found that regrowth of vegetation following cattle grazing only occurred during two of five years in one location in southeastern Oregon. Grazing took place about May 10 - May 31 each year, but annual precipitation only averaged about 10 inches (which is considerably less than precipitation levels on the Greys River Ranger District). Apparently, a sufficient amount of regrowth occurred on the Bridge Creek Management Area in Northeastern Oregon to provide for the winter forage needs of the relatively low numbers of elk on this winter range.
- Grazing of cattle from May through mid June — the first half of the growing season — particularly at the levels required for preventing accumulations of residual grass cover, has been shown to be detrimental to the plants grazed at this time (Laycock 1967, Mueggler 1975, Rickard et al. 1975, Pitt 1986) and the long-term productivity and health of rangelands (Heady and Child 1994, Holechek et at. 2004). "Range readiness guidelines are generally based on delay of grazing until primary forage grasses have reached a certain height or have a certain number of leaves and the soil is dry enough that large animals will not make deep tracks…" (Holechek et al. 2004:237).

  Grazing at this season at the levels required to limit accumulations of residual plant material could be considered heavy grazing, and this may be why Anderson et al. (1990b) recommended that early grazing only be allowed in any unit once out of every

[B] Although it is certainly plausible that overall nutritional quality of winter-time forage for elk increased due to the reduction in residual plant material: (1) none of the conclusions reached by authors were verified with any measurements, (2) elk in other management units increased during the same time period, including one that increased at the same rate as the management unit with the introduction of cattle grazing (annual reports and big game statistics from 1960 through 1993, Oregon Division of Wildlife; and data provided in Anderson and Scherzinger 1975), (3) elk densities on winter range were low, which needs to be considered in applying their results to more typical elk winter range where elk densities are relatively high (and where accumulations of residual plant material is not an issue). Their report presented a hypothesis.

two or three years. Mueggler (1975, as cited by Peek 1986:182) "reported that Idaho fescue and bluebunch wheatgrass required 3 and 6 years respectively to fully recover after one heavy clipping." In his study on preconditioning forage (see below), Pitt (1986) found that clipping bluebunch wheatgrass to 6 inches was inversely related to plant survival, density of seedhead stems, and density of seedheads. This is similar to Heady's (1950) finding that clipping bluebunch wheatgrass to 6 inches (roughly 50% utilization, or a range of about 40-60% utilization) was too severe for plants to maintain themselves, and this is when plant material was removed later in the growing season. Idaho fescue and bluebunch wheatgrass are two of the key forage species on the Greys River Ranger District, both for elk and for cattle.

- Density of elk must be considered. Where elk densities are high on winter ranges, they likely prevent accumulations of residual plant material from accumulating, and attempts to improve forage quality through the use of cattle grazing may be counter productive. The major publications on elk that address livestock grazing recognize that the greatest potential for cattle grazing to impact elk, as a consequence of competition for forage between cattle and elk occurs on elk winter range (e.g., Murie 1951, Boyce 1989, Miller 2002, Toweill and Thomas 2002; see also Peek 1986). These publications also recognize that elk winter range is typically limited relative to the number of elk, which creates concentrations of elk. Therefore, consideration of the benefits reported by Anderson and Scherzinger (1975) must also recognize that, because elk densities were too low to prevent the accumulation of residual plant material (a considerable amount of grass appeared to be unused prior to the onset of cattle grazing), competition with cattle was also relatively low when cattle began grazing the area.
- In many parts of the Greys River Ranger District, heavy snows generally push much of the residual vegetation down and, where this occurs, accumulations of residual vegetation generally does not occur, even on low-elevation south-facing slope where snow accumulations are the least (e.g., lower Cottonwood Creek, as shown to right). While shrub canopies greatly reduce the influence of the compression effects of snow (residual grass tends to remain standing under shrub canopies), cattle tend to avoid grazing grasses under these canopies when grazing occurs at moderate levels. Another consideration is that the species with the highest nutritional value in winter generally have the lowest capability to stand up under the snow, while the characteristics that enable other species to stand up well under snow (sturdy, highly lignified stems) also make them less palatable to elk (Cole 2009). Cole said that "Just about every grass species or growing condition that elk find palatable (low, leafy and green) do not stand up well in snow."

On slopes where snow does not compress sturdy grass species between shrub canopies, periodic heavy grazing of bunchgrasses by livestock may have at least some potential to benefit elk on winter range (i.e., 'b' from the first paragraph, above) where it is determined that elk numbers are too low to maintain low levels of residual accumulations themselves. I did not find any applications of this in the published literature, but this would avoid pitfalls of cattle grazing in the early growing season. However, cattle grazing that takes place in the latter half of the growing season and after the growing season greatly increases the potential for direct competition for forage on elk winter range (Dragt and Havstad 1989, Wisdom and Thomas 1996). This is because summer-season livestock grazing on elk winter range that is heavy enough to reduce residual plant material would substantially reduce the amount of forage retained for wintering elk. In other words, every mouthful that is eaten by livestock in summer is one less mouthful available to elk during the forthcoming winter. Thus, any application of this technique should only be done no more than once every several years (e.g., once every 5-7 years or more). Dragt and Havstad (1989) concluded that, "under the current, deferred rotation grazing system [June 10 – October 15 on an allotment in western Montana], the primary consideration for winter forage allocation would be the quantity of available forage rather than its quality."

Information would need to demonstrate that residual plant material is having a detrimental effect on elk before this is instituted. Before any attempts to improve forage quality on elk winter ranges in this way, potential improvements in overall forage quality must be weighed against reductions in forage quantity. With all of these constraints and no more than limited benefits, this application would appear to be questionable.

2. Reduced accumulations of residual vegetative material to increase vigor and growth of grass species — According to this concept, accumulations of past year's growth blocks sunlight and inhibits photosynthesis (Savory 1988, Urness 1990, Anderson 1993). These authors contend that, if a particular grass plant is not grazed within a 2-3 year period, the accumulation of old plant material weakens a grass plant and may actually kill it. Conversely, other range researchers (e.g., Sauer 1978, Sneva 1980, Briske 1991) contend that standing dead plant material is beneficial to plant health. The merits of both sides of this argument continue to publish papers in support of their opinions, and I am not going to attempt to sort out the intricacies here.

   Rather, I offer a few considerations that pertain to the potential benefits of this application to elk and other wildlife on the Greys River Ranger District:

   - The weight of snow, particularly during the late winter and spring, compresses plant material not protected by shrubs to a point where it does not block sunlight to growing plants. This was discussed above. Among other things, this hastens decomposition.
   - The Forest Plan does not call for optimum conditions to be produced for any wildlife species or group of species, as discussed earlier.
   - Residual plant material, to the extent it accumulates on the Greys River Ranger District (in lieu of herbivory by native ungulates and other herbivores, snow compaction, and decomposition processes), is part of the natural ecology of this area. To the extent that residual herbaceous vegetation actually happens and to the extent this causes reductions in plant vigor, this effect is offset by the contributions that accumulations of plant material makes to cover for numerous wildlife species, forage

and cover or countless prey species, reductions in evaporation from the soil, litter cover, and eventually organic material in the soil. Because residual herbaceous vegetation does not accumulate like it does in areas with lesser snowpack, accumulations are all the more important where they do occur on the district.

- The full compliment of large grazers currently exist on the district and, with the exception of bison, bighorn sheep (which have a much reduced distribution), and possibly pronghorn, and numbers of elk, mule deer, and moose are likely within the range of natural variability or higher (e.g., elk). Therefore, grazing pressure by native ungulates that affects the amount of residual build-up likely is no less, on balance, than it was prior to Euro-American settlement. An exception may be the bottom-lands of major drainages where less grazing by native ungulates may occur due to extirpation of bison and roads/human activity that reduces use by elk. This is discussed further in the “Herbivory: Natural Range of Variability” section (starting on page 32).
- While it may be possible to favor one wildlife species or a group of species (e.g., herbivores that graze on grass leaves) by altering natural processes, this would have adverse impacts to other wildlife species as discussed in following section of this report. Needs of each species must be balanced, and this balance is best attained by approximating natural conditions. Accumulations of dead plant material, to the extent this occurs on the district, is a natural process and provides for the needs of numerous wildlife species and the prey of many other wildlife species, fine fuels that facilitates fire spread which benefits many dozens of wildlife species, not to mention watershed functions such as protection from raindrops, litter that slows overland flow and facilitates infiltration, and soil building.
- The emphasis of particular DFCs can help determine which side of this long-standing argument to “err” on. For example, the bulk of the acreage of rangelands and riparian areas on the Greys River Ranger District were grazed relatively lightly prior to the onset of livestock grazing in the late 1800s, bunchgrasses in general did not evolve to withstand much grazing pressure, and accumulations of dead plant material is a natural and important part of wildlife habitat and watersheds, as discussed earlier in this report.
- Furthermore, most of the district will continue to be grazed by livestock and, therefore, there will be large areas where residual plant material will not accumulate to any large degree (not to mention the effects of snowpack and natural withering of forbs). This will result in much larger areas where season-end height and weight of herbaceous is reduced, compared to pre-Euro-American settlement conditions. In other words, no additional attempts need to be undertaken to reduce accumulations of residual plant material.

3. <u>Preconditioning of winter forage for elk</u> — Another potential use of cattle grazing use is increasing the nutritional value of current year’s growth for later use by wintering native ungulates. This concept is described by Anderson et al. (1990a,b). The goal of preconditioning is to improve the nutritional quality of autumn/winter forage through the grazing of plants, usually bunchgrasses, during the growing season. To improve the quality of autumn/winter forage, according to the concept, livestock must be moved off of treatment areas by mid-growing season to allow regrowth of grazed plants. Sufficient moisture to provide for partial regrowth after livestock are removed is imperative. Early season grazing causes a delay in phenology of grazed plants. The regrowth, as explained by Anderson et al. (1990b), is cured by heat and lack of moisture when the plants are at

maximum forage value. As such, a higher level of nutrients are fixed in the regrowth, resulting in fall/winter forage that has higher nutritional value than otherwise would have been available. This assumes that sufficient moisture is available for regrowth to occur, but not enough for the plants to complete their natural physiological cycle. By terminating physiological processes in regrowing plants (by heat and drought), translocation of nutrients to roots is stopped. Anderson et al. (1990b), therefore, recommends that forage in any particular unit only be preconditioned once out of every two or three years. If a plant completes its annual growth cycle, it will cure the same nutritionally as if it had not been grazed.

Empirical support for preconditioning was ascertained in part by Pitt (1986) for bluebunch wheatgrass, a native bunchgrass of the intermountain region and a key forage species for elk and cattle on the Greys River Ranger District. He found that growth was delayed in experimentally-raised plants that were subject to moderate defoliation (i.e., plants clipped to 6 inch height) for 2 consecutive years during spring. Following two years of clipping, re-growth (measured on 26 October) had higher protein, digestibility, calcium, and phosphorus contents compared to that of unclipped plants. Clippings that occurred later during critical growth stages (i.e., emergence-seed formation) maintained the highest level of nutrients. However, early season clipping in the first year of the study did not increase the nutritional quality of regrowth. This suggests that early season defoliation of bluebunch wheatgrass may not consistently enhance nutritional quality of autumn/winter forage, even when the timing of reduced soil moisture relative to plant phenology is highly controlled, or that it may take two consecutive spring grazings to precondition autumn/winter forage.

Implications of the use of preconditioning forage for wintering elk on the Greys River Ranger District include the following:

- Cattle would need to graze elk winter range from near the beginning of the growing season until about the first or second week of June, assuming a growing season of April 15 through August 1 on south- and west-facing slopes. This conflicts with the principle of range readiness, as discussed below.
- Removal of cattle about the first week of June or mid June requires that sufficient soil moisture exists to allow plants to put on a substantial amount of growth, but insufficient soil moisture to allow plants to set seed and transport nutrients to their roots. This provides a very narrow window for successfully preconditioning forage, which brings to question the practicality of implementing this concept, especially given the large variability in the timing and amount of precipitation during May, June, and July. For example, to successfully precondition forage in a dry spring, cattle would need to be removed earlier than midway through growing season, but if rains come afterward, the effort would have been wasted. In many cases, bunchgrasses would be able to complete their life cycle and set seed after being grazed the first half of the growing season. As yet, successful preconditioning of forage by cattle in an actual livestock management situation has not been documented. The often-cited paper, Anderson and Scherzinger (1975), did not provide any evidence that pre-conditioning occurred, and the authors themselves pointed out that physiological responses of perennial grasses to cattle grazing on the Bridge Creek area were conjectural. However, it is possible that reductions in residual plant material resulting from cattle grazing increased the overall nutritional value of bunchgrasses, rather than these grasses being preconditioned (see bullet number 1, above). Dragt and Havstad (1987)

measured chemical constituents of several important bunchgrasses in October following a cattle grazing season of June 10 – October 15 in western Montana. They found no significant differences in forage quality between plant material from grazed plants and ungrazed plants.

Unintended consequences of this technique include reduced seed production, reduced vigor in subsequent years, and increased mortality of plants, as discussed under "1. Reduced accumulations of residual vegetative material to improve access to forage," above).

If preconditioning of forage is only attempted once every 2-3 years, as recommended by Anderson (1990b) to mitigate impacts to plant vigor and survival, and recognizing that successful preconditioning would likely only occur occasionally, there is little indication that successful preconditioning of forage would actually take place more than 3 out of every 10 years, and this may be an overestimate.

Miller (2002) assessed that sheep grazing practices on high elevation ranges on sheep allotments may extend the availability of high-quality grass well into late summer and autumn, based on Rhodes and Sharrow (1990). Rhodes and Sharrow (1983, 1990) found that forage (6 plant species primarily used by big game) in areas grazed by sheep in the spring had higher levels of crude protein and dry matter digestibility in October than forage collected in October from ungrazed areas. There study was conducted in coastal clearcuts that receive about 100 inches of precipitation as rain, and sheep grazing occurred during spring.

4. <u>Reduce the canopy cover of big sagebrush to allow herbaceous understories to recover</u> — The reduction in shrub canopy cover would be accomplished by very high stocking rates of cattle in relatively small areas and for short durations. This was put forth by the Little Greys Allotment permittees. While Heady and Child (1994), Krausman (1996), and Holechek et al. (2004) did not identify the use of cattle to reduce shrub canopy cover in their discussions of methods to treat shrubs and shrublands, I observed the results of this firsthand on a ranch in central Oregon. Reduced canopy cover of big sagebrush allows herbaceous vegetation to increase in canopy cover and productivity (Miller et al. 1994, Riggs 1996). This possible use of high stocking rates to reduce shrub cover involves trade-offs between the benefits of reducing sagebrush canopy cover and the short-term impacts to soils and herbaceous vegetation, possible long-term effects, and cost/acre (in terms of money and personnel time for environmental analyses, etc.) compared to other means of reducing shrub canopy cover such as other forms of mechanical treatment and prescribed burning. This would need to be assessed on a case-by-case basis by range specialists, biologists, and others.

Mule Deer

While the distribution of cattle and mule deer overlap during summer months on the district, direct competition for forage between these ungulates likely is low where the overlapping distributions are in healthy, functioning condition and grazing pressure is conservative (Peek and Krausman 1996, WAFWA 2009). Cattle primarily forage on grasses during summer, in contrast to summer diets of mule deer which is mostly split between shrubs and forbs. Several factors can result in higher competition between cattle and mule deer. In some areas, cattle can consume a considerable amount of forbs, but the tendency of cattle to eat forbs usually occurs early in the season (i.e., spring), and cattle are not turned onto allotments until mid June. Also, if cattle grazing became heavy and if forbs have not yet withered, cattle may switch to consuming more forbs and browse (Peek and Krausman 1996). In spring when mule deer are eating more grass, there is potential for competition, but at least two studies cited by Holechek et al. (2004) found that deer and cattle selected different grass species when cattle grazing was light to moderate, implying that competition may exist when grazing pressure was higher. This may be particularly true in dry years. Lomas and Bender (2007) found that drought in north-central New Mexico was a major factor contributing to low fawn survival, which can be compounded if livestock grazing pressure is greater than light or conservative. In most years, forb production is likely sufficient for mule deer by June 15 in cattle allotments.

Direct competition between mule deer and domestic sheep for forage has the potential to occur during the entire sheep grazing season because this is when sheep are feeding heavily on forbs and when forb intake by mule deer is high (Peek and Krausman 1996). WAFWA (2008:11) reported that "Domestic sheep and goats have diets very similar to deer (forbs and browse) and have the potential to seriously reduce forage available to deer (Smith and Julander 1953)." On rangelands in healthy, functioning condition, however, sheep grazing that is maintained at once-over low-intensity grazing, competition would likely be kept to negligible/minor levels including negligible to no competition for browse.

Retention on Spring, Summer, and Fall Range

The long-standing low numbers of mule deer in the Wyoming Range mule deer herd, compared to the WGFD herd objective (they are now about 66% below the objective) and low doe:fawn ratios for the largest part of this herd during the last eight years (WGFD Job Completion Report for the Jackson/Pinedale Region), depleted and reduced winter range (Blair 1967, Scribner 2006, WGFD 2007), and the impaired condition of much of the summer and transition range in the Wyoming Range, Salt River Range, and Gannett Hills (USFS 1997, USFS 2009) makes the condition on summer and transition range and livestock grazing levels on these areas important issues for mule deer management (e.g., Objective 2.1(a) of the Forest Plan). Summer and fall nutrition has important consequences to reproductive performance, growth, and subsequent survival of several species of native ungulates (Boyce 1989:93, Spalinger 2000, Cook et al. 2004, Lomas and Bender 2007). Nutritional status of native ungulates during summer-fall normally does not impair the physiology or survival of these species during summer and fall, but rather influences subsequent winter survival, calf/fawn production, and calf/fawn survival, and this can be particularly important when winter range is in substandard conditions.

Availability of an adequate amount of suitable forage is especially important during years of below-average precipitation (Lomas and Bender 2007). Among other effects, dry years can cause mule deer to shift their diet to a higher composition of grasses. If more than conservative grazing pressure continues year after year, reduced species diversity may set the stage for increased competition between livestock and deer. In a California study, home range size was smallest in the absence of cattle grazing and centered on creek-bottom, meadow-riparian habitat (Kie and Czeck 2000). Under heavy cattle grazing in the same study, centers of activity did not shift, but home range size became large and included areas with steeper slopes. Peek and Krausman (1996:186) asserted that "While the range manager cannot anticipate the weather, the implications are obviously to keep rangelands productive with a diversity of forage so animals have opportunities to exercise free choice and minimize potential competition." Kie and Czeck (2000) also assessed that carefully designed rest-rotation systems have potential for providing similar benefits to mule deer of ungrazed meadows. Holechek et al. (2004) also recognized the potential for accommodating both mule deer and cattle on rangeland that is maintained in healthy conditions. No information was found in the literature on specific amounts (e.g., stubble heights, % of plant remaining) to retain for ungulates or other species. The district's only mule deer winter range exists along most of the length of the Star Valley Front and in the Spring Creek/Big Ridge area. The Star Valley Front winter range supports a large majority of the mule deer that summer in the Salt River Range (pers. comm., G. Fralick, WGFD, 2009).

Fourteen habitat biologists from seven state wildlife agencies recommended retaining 60-70% of the annual production of key forage species through the livestock grazing season to provide for the needs of mule deer in big sagebrush, mountain shrubland, and mixed conifer communities in healthy, functioning condition habitat (WAFWA 2009). They recommended the lower figure when livestock are grazed during the dormant (non-growing) season and the higher figure when livestock are grazed during the growing season or when rangelands are in less-than-satisfactory condition. At least half of the cattle grazing season on the Greys River Ranger District occurs during the dormant season, but nearly half occurs during the growing season. On riparian areas, the growing season extends through much of the livestock grazing season. For the Colorado Plateau, WAFWA (2007:24) recommended that "all herbivores in aggregate should not exceed ~35-45% of the forage commonly available to all species…"

To convert WAFWA's (2009) recommendations to percent retained of the total herbaceous production (vs. only key species), a minimum of 70-85% of the total annual production of herbaceous vegetation would be neede, as discussed in the "Elk" subsection, above. I did not come across any support for the assessment that retaining ≤60% of the annual production of herbaceous vegetation would allow for the needs of mule deer to be met.

Therefore, available information strongly indicates that retaining 80% or 85% to ~100% of the annual production of herbaceous vegetation in healthy, functioning rangelands and riparian areas would be sufficient to meet the needs of mule deer. There is moderate support for the assessment that that retaining as little as 70% of annual production of herbaceous vegetation would be sufficient to meet the forage needs of mule deer so long as a minimum of about 60% of the annual production of key forage species is maintained and most of the livestock grazing season occurs after the growing season. For livestock grazing that occurs during the growing season, retaining a minimum of 70% of the annual production of *key forage species* could be accomplished by retaining 75% of the annual production of herbaceous vegetation if composition of key forage species is high (e.g., 75%). There is little to no indication that retaining as little as 60% of the annual production of herbaceous vegetation would be sufficient to meet their needs and, therefore, would conflict with direction provided for DFC 10 and 12 areas. If any adjustments are made to minimum retention levels in dry years, they should be increased.

A higher percentages of the annual production of key forage species (and, thus, overall herbaceous vegetation) needs to be retained on rangelands that are functioning-at-risk, and there is no support for allowing livestock on non-functioning rangelands, particularly where wildlife is emphasized. Minimum retention levels should be >80-85% in order to retain forage for mule deer and to allow recovery of the rangelands. Areas with large amounts of non-functioning rangeland should not be grazed by livestock. (See "B. Principles of Wildlife-Livestock Grazing Relationships" and "Utilization of Key Forage Species vs. Herbaceous Vegetation in General" sections for explanation). See the "Elk" subsection above for more detail.

Retention on Winter Range

There currently is little livestock grazing that occurs on crucial mule deer winter range on the Greys River Ranger District due to (1) closures for watershed and recreational purposes, (2) cattle not making use of the steeper slopes on cattle allotments, (3) few sheep allotments extending far enough to the west, (4) forage reserve allotments not currently being used, and (5) sheep not using westerly portions of active sheep allotments.

Because of the difficulty in controlling retention levels with sheep bands approaching or exceeding 1,000 and given the large number of cumulative impacts affecting mule deer on their winter ranges, the best possible scenario would be to avoid grazing of mule deer winter range by sheep. Since there is no established sheep grazing use on mule deer winter range, this would not require any changes. Similarly, while cattle can be encouraged to make greater use of slopes, this is not occurring at present and should continue.

Therefore, minimum retention levels on mule deer winter range are not needed at present.

For any action that would result in grazing of mule deer winter range by sheep or cattle (including trailing), retention levels would need to be evaluated and incorporated into objectives and allowable-use standards. They would obviously need to be more restrictive than retention levels identified for spring, summer, and fall ranges.

Assessment of Possible Benefits of Livestock Grazing

Several possible benefits of livestock grazing on forage conditions for mule deer have been described in the literature, but there are few realistic applications on the Greys River Ranger District:

1. Reduced accumulations of residual vegetative material to improve access to forage — Improved access to nutritive early-season bunchgrasses has the potential to benefit mule deer (Urness 1990; Willms et al. 1981 and Leckenby 1968, as cited by Holechek et al. 2004:467). These studies provide two examples of "…light to moderate summer grazing of bunchgrass range by cattle improved the attractiveness of these ranges to mule deer in the spring and fall because nutritious new growth was more available than on ungrazed range."

   On mule deer spring range where residual plant material would otherwise accumulate, this is likely one beneficial effect of livestock grazing. However, the extent to which this actually occurs on the Greys River Ranger District is likely fairly limited due to the compacting effects of snow (see "Elk" subsection, above, for more details). Outside the early growing season, there is likely no potential for benefits to mule deer because their use of grasses is limited during the remainder of the year and residual matter does not build-up for most forbs grazed by livestock. While there may be beneficial effects on mule deer in some parts of the district, and while these benefits would continue with continued livestock grazing on allotments, there is no need to attempt to intentionally produce these conditions.

2. Reduced accumulations of residual vegetative material to increase vigor and growth of grass species — See write-up for "Elk," above. While Leckenby et al. (1982) implied that spring and summer grazing of coarse-leaved bunchgrasses may stimulate increased production, quality, and accessibility of grass growth available to mule deer on fall and

winter ranges, Austin et al. (1983) found that ungrazed crested wheatgrass had more re-growth than spring-grazed areas and deer preferred ungrazed areas for winter foraging.

3. Increased access to forbs in graminoid-dominated communities — This potential benefit of livestock grazing has been identified for pronghorn and sage grouse (see the "Sage Grouse" subsection, below), but because forbs are an important component of the diet of mule deer, there is a potential application for this species as well.
4. Facilitation of shrub growth — This is addressed in the subsection on "Browse," below.

Moose

While direct competition between livestock and moose is typically low (so long as browsing by cattle and sheep is minimal), competition can occur when moose are foraging on forbs. Forbs may comprise the bulk of moose diets when they are available and succulent (Renecker and Schwartz 1997). Therefore, potential competition would be highest on sheep allotments where moose seasonally feed on forbs or could potentially feed on forbs if it were not for deteriorated range conditions.

The principle related to functionality of rangelands described mule deer would similarly apply to moose. On rangelands in healthy, functioning condition, competition for forbs would likely be low when forage utilization by livestock is no more than conservative. On rangelands in less-than-satisfactory condition, proportionally more forage would need to be retained to reduce the level of competition.

Bighorn Sheep

The only two places where domestic sheep currently have the potential to compete with bighorn sheep for forage. One is at the southeastern end of the Mink Creek Allotment (an active allotment) and the Marten and North Sheep Creek allotments (now in the Triple Peak Forage Reserve). Given their similar diets, domestic sheep have the potential to compete with bighorn sheep for forage, especially on rangelands in less-than-satisfactory condition (Krausman and Shackleton 2000, Beechman et al. 2007). Beechman et al. (2007) assessed that reduced carrying capacity due to historic overgrazing by livestock is biggest habitat related issue. They also pointed out 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.

To the extent that separation is maintained between domestic and bighorn sheep — for the purpose of reducing the potential for disease transmission (as outlined in Wyoming Statewide Bighorn/Domestic Sheep Interaction Working Group 2004) — direct competition for forage would not occur. Because of the high probability of disease transmission when domestic sheep and bighorn sheep share the same range, even incidentally, and the magnitude of adverse effects associated with disease transmission, even 5% utilization by domestic sheep within occupied bighorn sheep habitat has the potential to result in major impacts. There is no information indicating that any more than 0% utilization by domestic sheep on occupied bighorn sheep range can be accommodated without threatening bighorn sheep. Competition for forage is a minor issue compared to disease transmission.

Pika

Pikas occur throughout the Greys River Ranger District where suitable habitat exists. In the southern part of their range, it is uncommon to find pikas below about 7,700 feet in elevation, but further north — e.g., in the middle of their range — they may be found at somewhat lower elevations (Smith and Weston 1990). One of the main limiting factors appears to be high temperatures. The typical habitat of pikas is talus slopes and adjoining and intermixed herbaceous communities, preferring parts of talus slopes with rock 10-40 inches in diameter, which provide gaps large enough for movement by pikas (Smith and Weston 1990, Fisher et al. 2000). They occasionally use similar accumulations of rock, and they typically are found near the edges of talus slopes close to where herbaceous vegetation is growing. Pikas feed on a large variety of herbaceous plants that occur along the fringes of talus slopes, including different species forbs, grasses, and sedges that are clipped and consumed or stored in haystacks for winter use (Fisher et al. 2000, Smith and Weston). They appear to be fairly flexible in their diets, but in any given area they select plants sequentially according to phenology and nutritional value. Smith and Weston (1990) cited several studies showing that pikas select for plants with significantly higher caloric, protein, lipid, and water content.

Pikas collect as much herbaceous vegetation as possible during summer and fall months, with amounts collected depending on factors such as forage availability in plant communities adjacent to talus slopes (e.g., plant communities with higher levels of herbaceous production yield larger haypiles) and distance to suitable vegetation (Smith and Weston 1990). The amount of forage stored in haypiles appears to be insufficient to fully provide for their winter forage needs. Smith and Weston (1990) assessed that haypiles serve as potential (surplus) winter food sources, especially when the winter season is unusually prolonged or harsh. Pikas tunnel out to adjoining herbaceous plant communities to forage during winter months.

While few studies have been conducted on the potential effects of livestock grazing on pikas, the one study that I found addressing this issue presented results indicating that livestock grazing has the potential to affect pika populations (Beever et al. 2003). Beever et al. (2003) concluded that cattle and horse grazing within about 20-50 yards of talus slopes used by pikas many negatively affect them. They provided two reasons for possible conflicts between livestock grazing near talus slopes and pika conservation: (1) intensity of pika foraging decreases and costs associated with foraging increase with increasing distance from talus slopes, and (2) risk of predation increases as distance from talus slopes increase. Their study areas did not include areas grazed by sheep.

While cattle allotments on the district do not encompass much in the way of pika habitat, pika habitat exists throughout sheep allotments and there is a greater likelihood for sheep to feed on herbaceous plants used by pikas and for sheep to graze in the rough terrain adjoining talus slopes. The high degree of competition between plateau pikas and livestock (sheep, yak, and horses) in the Tibetan plateau of China (Hsun and Smith 2003) provides some support to this assessment. Beever et al. (2003) also identified trampling of soil and vegetation by livestock as a possible indirect impact to pika foraging habitat.

Current and future livestock grazing in the immediate vicinity of talus slopes has the potential to compound the effects of several environmental factors. Beever et al. (2003) discussed possible implications of summer temperatures and overwinter survival. They assessed that high summer temperatures, which cause pikas to spend more time in shaded microsites, could result in less time foraging and storing hay during the summer, which may prevent pikas from gaining sufficient body mass and collecting sufficient hay to overwinter successfully. Having a lower-end elevation of 5,600 feet, the Greys River Ranger District encompasses the lower end of the elevational range of pikas in this part of the Rocky Mountains. And, given the warmer temperatures during the last 10 years compared to long-term temperatures, the district encompasses an elevational zone where pikas may be affected by these warmer temperatures. Furthermore, the amount of available herbaceous vegetation in the immediate vicinity of talus slopes is limited in some locations on the district due to geomorphology, as well as historic sheep grazing in some locations. The additional influence of present-day moderate to heavy livestock grazing use in the immediate vicinity of talus slopes has the potential to contribute to the extirpation of pika colonies adversely affected by one or more of these factors but that would otherwise persist.

Where herbaceous vegetation is abundant and in healthy condition along the fringes of talus slopes, retaining ≥60% would probably retain suitable foraging habitat for pikas given their low densities and small biomass requirements. However, where forage availability is limited, it is possible that any herbaceous vegetation removed by sheep may threaten the survival of pikas in that location. There is little to no information indicating that retention of <95-100% (with respect to sheep grazing) in these situations would retain suitable foraging habitat for pikas. Given the very restricted and isolated habitats of pika, the apparent high potential for competition, and current concern about pikas (e.g., the U.S. Fish and Wildlife Service is in the process of evaluating pika for threatened or endangered species status), a conservative approach to addressing this issue is warranted.

Greater Sage Grouse

The distribution of sage grouse appears to be limited to the western side of the Gannett Hills. There are no known leks, but there is at least a reasonable chance that hens from two known leks just over the border in Idaho nest in the Spring Creek/Big Ridge area, which is within a cattle allotment.

Cattle grazing has the potential to affect the amount and quality of forage available to sage grouse as a consequence of effects on plant species diversity over the long term, and forage utilization rate and timing in any given season. Big sagebrush and adjoining rangelands and meadows that are in healthy, productive condition and that provide high plant species richness and an abundance of forbs are important for nutritional status of egg-laying hens (Barnett and Crawford 1994, Connelly et al. 2000) and for brood-rearing (Dunn and Braun 1986, Klott and Lindzey 1990, Drut et al. 1994*a*). Therefore, restoring big sagebrush and adjoining communities to healthy, functioning conditions and sustaining them in this condition are important for sage grouse. Allowable-use standards need to be set accordingly from the standpoint of sage grouse.

The potential for competition between cattle and sage grouse is likely low on health, functioning rangelands where utilization levels are no higher than moderate (e.g., no higher than about 40% utilization of key forage species). This is because cattle in big sagebrush habitat and adjoining grasslands and meadows usually feed on graminoids while sage grouse typically forage on forbs (and insects) in these habitats (Connelly et al. 2000). Use of forbs by cattle is discussed in the Mule Deer section, above, and is likely not a major issue with respect to sage grouse.

Grazing of graminoids by cattle in meadows in any given year has been shown to increase the availability of forbs to adult and young sage grouse (Oakleaf 1971, Klebenow and Burkhardt 1982, Evans 1986). Relatively high utilization levels (e.g., moderate, heavy, and severe) in a patchy mosaic with lighter utilization levels appear to favor use of meadows by foraging sage grouse, with patches of vegetation of 2-6 inches tall apparently being preferred in one study (Oakleaf 1971, Klebenow and Burkhardt 1982, Evans 1986). Evans (1986) found that grazing of meadows during the growing season interrupted the normal processes of maturation and resulted in continued growth of new leaves throughout a longer period during summer. This appeared to prolong the availability of succulent forage for sage grouse, as compared to forage in ungrazed meadows. Evans observed that forbs in ungrazed portions of meadows matured and weathered soon after seed set. She found that crude protein generally was higher and crude fiber generally lower in the forbs collected from the severely grazed portions of one meadow in comparison to forbs collected from an ungrazed portion of the same meadow. Lowered water tables in Evan's study compounded some of the effects she observed.

Although it is well-documented that sage grouse make greater use of parts of meadow that have been moderately to severely grazed, several other factors need to be considered. First, I do not know of any studies demonstrating that improved availability of succulent forbs is needed in conserving sage grouse. Second, at least some parts of meadows within cattle allotments will continue to be grazed to a moderate to severe level so long as large numbers of cattle spend any amount of time in the allotment, meaning that intentional efforts to create these conditions will likely not be necessary. Third, heavy to severe grazing of meadows on a consistent basis has well-documented impacts and cannot be justified on the basis of increasing the availability of forbs for sage grouse.

I do not know of any studies showing similar results in big sagebrush or grassland communities. The vegetation structure in these communities is much more patchy at fine scales (e.g., bunchgrasses, shrubs, with short or no vegetation in the interspaces), which already facilitates access to forbs in these communities.

Retention levels discussed in the mule deer section would likely provide for the needs of sage grouse foraging.

Seeds

Grass, forb, and sedge seeds are important to many species of migratory birds, including Brewer's sparrow (MIS species), and small mammals — as many as 55 species or more on the Greys River Ranger District. At least 34 species of breeding birds (e.g., many sparrows and finches, blackbirds, mourning doves, horned larks, northern flickers, waterfowl, sandhill cranes, ruffed grouse) feed on forb and grass seeds in non-forested habitats in the Greys River Ranger District. During staging and migration, these and at least an additional 12-15 bird species feed on seeds (for a total of more than 46 species), with some of these species depending on seeds. At least 9 species of small mammals also eat grass and forb seeds (e.g., chipmunks, ground squirrels, mice, voles). This general assessment was based on known species occurrences and Cerovski et al. (2004).

Therefore, it is important to manage livestock to retain enough forb and grass seeds to provide for the needs of migratory birds and small mammals (Wyoming Partners in Flight 2003, Holmes and Johnson 2005), on top of providing seeds for restoring and sustaining forbs and grasses over the long term. Forb seeds are retained to the extent that flowers are retained, which is addressed in the subsection on flowers, below. Similar principles apply.

BLM et al. (1999:120) and BLM et al. (2008:27) provide estimates of the proportion of grass seedheads that remain at different forage utilization levels. I express their estimates relative to the percent of annual production remaining on a given site. The following assessments apply to rangeland sites that are in functioning condition.

- At ≥80% of the annual production retained on a given site (≤20% utilization), BLM et al. (2008:27) states that "few seedstalks… are grazed." Table 11 (in the section "Amount of Wildlife Cover Retained in Rangeland Habitats," later in this report) suggests that as few as an estimated 72% of seedstalks would remain at 20% utilization (see the row labeled "Basal A AGL"), which is supported by Figures 1a-b and 2a-b in the "Elk" subsection, above (an estimated 70-75% of seedstalks remain at 80% retention). This assumes that cattle all grazed plants and parts of plants are grazed to near-ground level and that seedstalks are removed when this occurs, and it assumes that no skimming or topping occurs. It is, however, possible for cattle to work their way around and avoid seedstalks while foraging on leaf matter, which would leave more than the estimated 72% retained.

  On the other hand, BLM et al. (2008:27) also recognizes that livestock may "top" herbaceous vegetation in the 6-20% utilization category, which can include preferential foraging of seedstalks. Information in Heady (1950) and Kinney and Glary (1994) indicate that removing the top 10% of the dry-weight of plants (which could be easily be construed as topping) is enough to remove most or all seedstalks. If grazing on a particular site was limited to topping plants, 100% of the seedstalks could be removed (0% of seedstalks remaining). Obviously this does not happen, but it serves to illustrate that more than "a few" seedstalks would be grazed in situations where livestock grazing includes the topping of plants. Figure 2 illustrates what could happen with some grazing of plants from the bottom as described by McKinney (1997) and from the top (skimming/topping), as well as trampling.

  Whether livestock preferentially forage on seedstalks, avoid them, or eat some of them as a consequence of foraging on other parts of plants depends on many factors, including species of grass, phenological stage of plant, and other available forage. Another variable to consider from the standpoint of seed-eating wildlife, is that seedstalks may be attached to plant material bitten off by cattle, but the seedstalk themselves may intentionally fall to the ground during the chewing process. If phenology is advanced enough, many of these seeds would be available to seed eaters.

  Given all the variability at this level of grazing, it is difficult to estimate the proportion of seedstalks remaining after the grazing season. Except when extensive topping occurs (which would be rare), a sufficient amount of seeds would likely be retained to provide for the needs of seed-eating wildlife.

- At ≥60-79% of the annual production retained (21-40% utilization), BLM et al. (2008:27) states that "60-80% of the number of current seedstalks of herbaceous plants remain intact." This does not appear to be accurate for the upper half of this utilization category (31-40% utilization). First, the minimum amount of grazed basal area is about 45-56%, leaving only 44-55% of ungrazed basal area (Table 11). Roughly translated, and assuming no avoidance of seedstalks during grazing, this means that only 44-55% of seedstalks would remain intact (see Figures 1c-d and 2c-d; an estimated 40-45% of seedstalks remain at 60% retention). Second, considering variability in the amounts of plant material removed and if at least some plants were grazed from the top-down, it may be possible for as few as 35% of seedheads remaining intact (Table 8, later in this report).

Third, BLM et al. (2008:27) also states that rangelands may be topped or skimmed, meaning that a portion of the 21-40% utilization would consist of grazing seedstalks, and Figure 2 illustrates that it may be possible for 30% or less of the seedstalks to remain intact. Combined with grazing of plants near ground level and other bite sizes (e.g., Table 8), topping and skimming could potentially result in few remaining intact seedstalks. However, as discussed previously, livestock can avoid seedstalks as they graze leaf material, which would lessen the proportion of seedstalks removed.

Therefore, a more realistic range of seedstalks remaining intact for 21-40% utilization would appear to be 35-80%, but it may be even lower if there is extensive topping or trampling.

At this level of grazing, key forage species are disproportionately grazed (i.e., at a higher utilization level than 21-40%), meaning their seedheads are disproportionately less available than other seedheads of other plant species. Thus, fewer than 35-80% of seedheads of key forage species would remain available. This would mean that wildlife species favoring or needing seeds of key forage species may be disproportionately affected.

Thus, there is low to moderate indication that retaining 60-69% of the annual production on a given site would retain suitable seed-forage habitat in general, and there is moderate indication that retaining 70-79% of the annual production on a given site condition would retain suitable seed-forage habitat. For the entire range of 60-79% retention, there is moderate indication.

- At ≥40-59% of the annual production retained (41-60% utilization), BLM et al. (2008:27) states that only "15-25% of the number of current seedstalks of herbaceous species remain intact." This generally appears to represent the lower end of possibilities, and the upper end would not be much higher. A maximum of about 9-40% of the basal area would remain intact at this level of grazing (Table 11), assuming all grazed parts of plants are near-ground level in height. Figures 1e-f and 2e-f show that the upper end may be between 30% and 40%, although Figure 2 shows that it could be as low as 10-15%. If some plants are grazed from the top but not grazed to near-ground level, a lower proportion would remain intact.

  A more realistic range of seedstalks remaining intact for 41-60% utilization would appear to be 15-40%.

  If this is an accurate assessment of the proportion of seedstalks remaining, there is little to no indication — without additional information showing otherwise — that this is sufficient to retain suitable seed-forage habitat.

- At ≥20-39% of the annual production retained (61-80% utilization), BLM et al. (2008:27) states that "less than 10% of the current seedstalks remain[]." This is consistent with Tables 4 and 6, and Figures 1g and 2g. There is no indication this would be sufficient to even minimally provide for the needs of seed-eating wildlife.
- BLM et al. (2008:27) states that, at <20% of the annual production retained, "There is no evidence of reproduction or current seedstalks of herbaceous species," which is consistent with information in Tables 4 and 5. There is no indication this would be sufficient to even minimally provide for the needs of seed-eating wildlife.

The above assessments do not apply to sites that are either in functioning-at-risk or non-functioning condition, except possibly those that are at the high end of functioning-at-risk. Larger percentages of seeds would need to be retained within declining ecological condition. On non-functioning rangelands, for example, 100% of seedheads should be retained in order to contribute to restoration and providing for the needs of wildlife. I say 'contribute' because the amount of seedheads produced on non-functioning rangeland — even without any grazing — would not be sufficient to 'provide for' these needs.

It is possible that the relationships between utilization levels and percentages of grass seedheads remaining, identified above, also generally apply to flower seedheads retained on sheep allotments. While there obviously are differences between the behavior of cattle foraging on grasses and sheep foraging on forbs, this may provide a start to addressing this issue on sheep allotments. Topping of grass seedheads by cattle, for example, roughly equates to preferential foraging of flowers by sheep when this occurs.

Flowers

A large number and variety of wildlife species, including native ungulates, lagamorphs, and many species of rodents and birds (as well as numerous species of insects and mites), either eat flowers as part of the plant material they consume, or they sip nectar, or feed on seeds. Many species of birds also feed on insects that inhabit flowers (see "Insects" subsection, below). For wildlife species that feed on flowerheads, most of these species likely forage on developing and mature flowerheads on an opportunistic basis and do not require flowers, although developing and mature flowers are highly nutritious forage. Nectar eating species (e.g., hummingbirds, butterflies, bees) depend on flowers for their food to the point that, if there are no nectar-producing flowers favorable to or required by these species in a given area or there is an insufficient density, use of the area by these species will be impacted (Debinski and Prichard 2002, Wyo. Partners in Flight 2003, National Research Council 2009). This has the potential to limit recovery of degraded forblands and herblands. Many species of migratory birds depend on seeds of forbs and grasses during some seasons, and seeds supplement their diet during other seasons (Wyo. Partners in Flight 2003). Seeds also supplement the diet of many small mammal species (see the "Seeds" subsection, above).

Broad-tailed and calliope hummingbirds inhabit a range of vegetation types and plant communities, but willow, meadow, forbland, big sagebrush, and early-seral conifer communities are important, especially when intermixed with forested habitats (Calder and Calder 1992, Calder and Calder 1994, Wyo. Partners in Flight 2003). They use areas with a mix of forested and non-forested habitat because flowers typically are more prevalent in non-forest plant communities. Flowers are a critical requirement of their habitat. In addition to feeding on nectar, they also feed on tiny insects found on flowers. They typically nest in conifer forestland and aspen stands, but also will nest in willow and cottonwood stands. Once they begin nesting, an adequate amount of suitable flowers is needed within their home range. Wyoming Partners in Flight (2003) identified the loss of flowering plants due to incompatible livestock grazing as a concern for broad-tailed and calliope hummingbirds in the mountainous areas of Wyoming. They recommended implementation of Best Management Practices that emphasize retaining patches of flowering plants within otherwise suitable habitat and reducing impacts of livestock grazing and other factors on flowering plants.

Insects play a crucial role in sustaining healthy plant communities in riparian areas, wetlands, and rangelands (Evan 1984). Pollination is a critical role that insects play in communities where forbs and mountain shrubs are prevalent (Evan 1984, National Research Council 2009). Without sufficient pollination, forb communities and understories cannot be sustained, and degraded communities cannot be restored. Fragmentation of healthy flower habitat has been shown to lead to reduced populations of pollinators, which can reduce pollination of flowers in remaining habitat patches, in turn resulting in reduced seed production per plant, which in turn can limit recovery (Harris and Johnson 2004, National Research Council 2009). Compounding this effect is that some species of flowers are only pollinated by particular insect species or group of species, populations of which may have been impacted by depleted forbland, herbland, and shrub-forb communities. These factors have the potential to limit recovery of the district's forblands and herblands that are currently in non-functioning condition and possibly some that are functioning at risk. Grazing of flowers in such areas further reduces the number and density of desired species of flowers, further compounding fragmentation effects. This may also affect forblands and herblands that are at the lower end of functioning-at-risk condition. Another possible effect of livestock grazing is that it can affect the timing of flowering, which has the potential to affect pollination of some species given the sometimes close synchronization between the timing of flowering and timing of insect life history stages.

In discussing conservation of butterflies, Opler (1999:25) stated that "some seriously declining habitats include many wetlands, old-growth forests, streamside vegetation, spring-fed meadows and seeps…" He continued by stating that "Aggressive introduced exotic weeds are competing with and replacing native plants throughout the west. Among the more serious are leafy spurge, Canada thistle, white-top, wild oats, smooth brome, knapweeds, and seet clovers." Livestock grazing use has the potential to contribute to the introduction and spread of noxious weeds (see the "Noxious Weed" section of this report). The Greys River Ranger District has 5 of the 7 species listed by Opler as "among the more serious."

The Chief of the Forest Service recently recognized the importance of pollinators: "We know that by managing for pollinators and their habitats on our national forests and grasslands we help ensure conservation of our Nation's biodiversity and create a healthier environment for both wildlife and people" (Kimbell 2009). This aspect of insect-flower relationships goes beyond DFC 10 and 12 areas and involves all DFCs because this is an issue that involves the restoration of degraded forblands, herblands, and shrub-forb communities.

Because of their high visibility, distinct markings compared to other insects, and affinity of particular butterfly species to specific flowering species/groups, butterflies are being used to represent insect communities and to indicate the health of vegetation communities (Hammond 1995, Maes and Dyck 2005). A large number of butterflies exist in the southern Greater Yellowstone ecosystem and, similar to hummingbirds, most of them require flowers — and for some butterflies, specific species of flowering plants — for their survival (Debinski and Pritchard 2002). USFS (1997:17) stated that "Because flower production is adversely affected when these tall forb communities area lost, some sensitive, disjunct or isolated colonies of butterflies are also at risk of disappearing."

An MOU between the Forest Service and the North American Butterfly Association identifies several possible cooperative projects, including (1) further development and implementation of best management practices for butterflies, their host plants, and the ecosystems upon which they depend; (2) monitoring forest and grassland (rangeland) status, health and productivity; (3) completion of inventories, assessments/mapping, and monitoring to support the management, recovery, and restoration of biological resources of concern; and (4) development of standard methods and protocols to support the implementation of conservation and resource management initiatives (NABA and USFS 2009). These and other projects identified in the MOU align with the need on the Greys River Ranger District for standardized methods for monitoring forage utilization of sheep grazing (see the "Forb-Dominated Communities and Understories" section, starting on page 144).

The "Forb-Dominated Communities and Understories" section outlines seven variables that influence whether an adequate amount of suitable forage is retained on given areas within sheep allotments, and this includes variables that affect the extent to which an adequate amount of suitable flowers are retained. This includes discussions of grazing intensity that retain different densities of flowers and the influence of rangeland condition, as well as different levels of rest for mitigating the potential for overuse, given the many unknowns with managing utilization levels. The condition of rangelands is the main variable that currently affects the density of favorable species of flowers. I did not come across any information to show that grazing intensities on key forage species higher than light or conservative (i.e., light grazing of herbaceous vegetation) would be sufficient to meet the needs of species that depend on flowers, especially those that depend on flowers of particular forb species. This is for forbland, herbland, and big sagebrush-forb communities in functioning condition and at the upper end of those that are functioning at risk. Whether once-over grazing by sheep moving at their own pace retains an acceptable density of favored flowers depends on the number of sheep, size/width of the rangeland being grazed, among other factors.

In forbland, herbland, and big sagebrush-forb communities that are at the lower end of functioning-at-risk and those in non-functioning condition where a diversity of native plant species persists, even "light" grazing by sheep has the potential to reduce an already greatly reduced number and density of flowers. As sheep pass through areas where the density of herbaceous plants is markedly lower than would exist in healthy conditions and where the composition is skewed toward increaser species, sheep likely disproportionately feed on favored forb species and their flowers. Developing flowers and mature flowers are among the most nutritious part of forbs, and sheep selectively feed on them (Rawlins 1996; observations of permittees). In addition to the density of flowers favored by hummingbirds and butterflies being reduced even further, sheep grazing in these areas reduces survival of young increaser forbs and reduces the numbers of seeds of these species being produced. In these areas, once-over light grazing during the flower-development and flowering period would appear to be too high of grazing pressure to provide for the needs of hummingbirds, butterflies, bees, and other pollinators. Impacted populations of pollinators further limit the ability of forblands, herblands, and big sagebrush-forb communities to recover.

Periodic rest and/or providing rested sites along sheep grazing routes can play an important role in both providing an adequate amount of flower forage for wildlife and allowing recovery of rangelands currently functioning at risk. This is particularly important given the lack of a standardized method for monitoring forb retention and/or forb utilization by sheep. The frequency should be inversely related to the functionality of the rangeland and understanding of effects on wildlife forage, and positively correlated with sheep-band size.

Browse

The main native browsers of deciduous shrubs and trees in the Little Greys allotment include native ungulates (moose, mule deer, and elk), snowshoe hares, several vole species, porcupines, and beavers. In particular, moose, mule deer, snowshoe hare, and beavers depend on deciduous browse in the area encompassed by the allotment. Intact, healthy willow, willow-mixed, mountain shrubland, aspen, and cottonwood communities are important to native browsers.

The vigor of shrubs in some upland shrub communities is reduced (Gruell 1975, USFS 1997) and likely continues to decline. However, despite the extent that livestock contributed to this situation, Peek and Kaufman (1996) recognized that removal of livestock would not increase shrub production. Fire or mechanical treatment is needed to do this.

Given the apparently low extent to which cattle and sheep browse on the district, I do not address this issue in any great detail. Preliminary results of a two-year aspen assessment indicate that browsing pressure on aspen suckers and saplings on the Greys River Ranger District is high (Loosen 2008), but most of this is likely native herbivores. If browsing by livestock is found to be an issue on a particular allotment or part of an allotment, this topic will need to be addressed in greater detail.

Relationship between Livestock Use and the Retention of Browse for Wildlife

WGFD (2006b) recommended that livestock utilization of shrubs not exceed 20% of the current annual growth, and that combined utilization of livesock and mule deer not exceed 40%. However, WAFWA (2009) assessed that there would be a sufficient amount of browse available for mule deer when browsing by cattle does not exceed 50% of the annual leader growth. It is not clear why this recommendation is so high. WAFWA's (2008) recommendation was based on recommendations for common winterfat, fourwing saltbush, and mountain mahogany. I was not clear whether these recommendations applied to winter range or whether WAFWA's relatively high recommendation was for ranges managed primarily for livestock. Browse is critical on winter ranges of these species, and the annual production of browse on some winter ranges does not appear to be sufficient to maintain mule deer in winters following a season of below-average growing-season precipitation.

Trailing ("tunneling") and other mechanical damage to willow stands can also have an effect on the availability of browse if damage is extensive enough and if combined with browsing of young shoots by cattle. However, if cattle are moved before stubble height of graminoids reaches 4-8 inches, cattle likely will have browsed no more than a negligible amount (Hall and Bryant 1995, Clary and Leininger 2000).

Assessment of Possible Benefits of Livestock Grazing

Livestock grazing at relatively high stocking rates has been shown to favor woody vegetation by restricting or inhibiting competing herbaceous vegetation (Urness 1990, Peek and Krausman 1996, Holechek et al. 2004, Gruell 1986). This applies primarily to early- and mid-seral communities where shrub canopy cover has not yet moved communities into late succession. Stocking rates would need to be high enough to impact herbaceous vegetation, but low enough that shrubs are not impacted.

Growth of bitterbrush, for example, has been shown to be enhanced by intensively grazing herbaceous plants by livestock during spring (Smith and Doell 1968, as cited by Urness 1981;

Reiner and Urness 1982). Reduction of herbaceous plants by heavy livestock use in spring (e.g., >60% utilization) subsequently increases survival and growth of seedling and mature bitterbrush (McConnell and Smith 1970, Neal 1981, Reiner and Urness 1982). Prescription of periodic, heavy grazing of herbaceous plants in spring and early summer has, therefore, been suggested as one of several techniques to improve long-term survival and growth of seedlings and leader production in mature bitterbrush (McConnell and Smith 1977, Neal 1981, Leckenby et al. 1982, Reiner and Urness 1982). Rest from livestock grazing during the summer (following early season grazing) is important because summer is the critical growing period of shrubs.

The basis of this approach is partly founded in factors that led to the high mule deer numbers that peaked in the 1960s and 1970s. Historic increases in western populations of mule deer were attributed mainly to changes in plant succession that resulted from the combined influence of heavy livestock grazing, fire suppression, and regulation of deer harvest (Gruell 1986, Kie and Czeck 2000). Apparently, heavy livestock grazing between 1880-1930 reduced survival of herbaceous plants, reduced spread of fire, advanced vegetative succession, and increased survival and cover of shrubs important to deer, especially on winter ranges.

Because herbaceous communities and understories are already impacted to the degree they are, this method for restoring conditions in mountain shrubland communities would likely not be acceptable on the district, except possibly in highly controlled situations in limited areas (e.g., as part of a larger strategy if we were to have difficulty reestablishing shrubs following a fire on mule deer winter range). Given the long time since the vast majority of shrubland communities have burned on the district and the old-age of shrubs in these communities, intensive grazing pressure on herbaceous communities would likely do little if anything to improve browse conditions.

Roots

Gophers and a variety of insects, nematodes, and other invertebrates feed on plant roots. Northern pocket gophers primarily feed on roots and other succulent underground plant parts, although they leave their burrows at night during summer months to eat succulent forbs (Fisher et al 2000). Their burrow systems may span across 150 to 500 square feet and they range in depth from 2 inches to 10 feet. While no investigations have been done on the Greys River Ranger District, gopher abundance appears to be relatively high in a wide range of habitats. Gophers (along with voles) is the primary prey species of great gray owls (a Region 4 sensitive species) and is a prey species of Swainson's hawks, which is a species of conservation by the U.S. Fish and Wildlife Service and several organizations.

Keinath and Beauvais (2006) related the effects of reduced root mass caused by reduced biomass of above-ground vegetation (due to livestock grazing) on gophers. While differing results have been obtained in studies on the effects of livestock grazing on pocket gophers, it appears that reductions in the biomass of forbs causes reductions in densities of pocket gophers (Fagerstone and Ramey 1996). Keinath and Beauvais (2006) also cited several studies from the 1960s through the 1990s concluding that livestock grazing reduced abundance of pocket gophers. Despite the possible appearance that gophers are more abundant in areas grazed by livestock — e.g., due to the perception of more gopher activity — it has been shown that gopher activity (burrowing) increases with lower biomass of forbs (Fagerstone and Ramey 1996) and, furthermore, depletion of herbaceous cover increases the visibility of gopher activity. Kie et al.

(1994) cited a 1970s study in Colorado that found gopher density to be twice as high on ungrazed ranges as in grazed ranges.

While most indications are that livestock grazing reduce densities of gophers, Kie et al. (1994) cited three reports of heavy livestock grazing in the 1940s and 1950s resulting in increased numbers of pocket gophers due to the abundance of deep-rooted bulbous forbs. Keinath and Beauvais (2006) also cited a study from 1936 and 1965 concluding that livestock grazing increases gopher abundance. At least one study was based on the assumption that livestock grazing can increase forb diversity (or composition?), which is similar to the three studies cited in Kie et al. (1994). To the extent that forb composition and production is increased (i.e., at the detriment of graminoids), it would stand to reason that gopher abundance could increase. Youngblood et al. (1985) described riparian plant communities in which forb composition may have increased as a consequence of livestock grazing pressure. One of the studies cited by Keinath and Beauvais (2006) concluding that livestock grazing could increase gopher abundance also asserted that this would reverse when grazing pressure became heavy, whereupon gophers virtually disappeared.

Not only does reduced vigor and excessive livestock grazing likely sustain lower densities of gophers, they could also indirectly affect predators of

Effects of livestock grazing discussed in the previous paragraphs focus on long-term effects (e.g., density and productivity of forbs), and do not appear to address year-to-year effects of livestock grazing. It is likely that, on a year-to-year basis, gophers would likely not be affected until grazing pressure increased to the point that root mass declined in any given year.

Invertebrates

Insects and other invertebrates provide forage for numerous wildlife species, including Brewer's sparrows (MIS), chorus frogs and boreal toads (MIS), spotted frogs (sensitive species), and willow flycatchers, sage thrashers, and black rosy finches (species of concern), as well as cutthroat trout (MIS; not addressed in any detail in this report). Most insects are either primary or secondary consumers and, therefore, are critical links in food webs (Krebs 1978, Brewer 1979, Evans 1984). The importance of understanding food webs in the conservation of wildlife and other resources was recognized as far back as the 1930s, including the role insects play (e.g., Leopold 1939). Food webs demonstrate the pivitol role that invertebrates play in sustaining wildlife communities (Krebs 1978, Brewer 1979, Ricklefs 1979, Evans 1984). Ricklefs (1979) presented the following simple food chain (one series of links in a food web), starting with energy provided by the sun: sun → grass → grasshopper → meadowlark → snake → owl. Food webs make it easy to see that reductions in invertebrate species richness and abundance of particular groups of insects would have major adverse impacts on numerous wildlife species and wildlife communities. In addition to providing food for wildlife, they also play crucial roles in pollination (see the "Flowers" subsection, above), decomposition, regulating plant species composition, and other functions.

In general, healthy and diverse insect communities contribute to supporting healthy communities of migratory birds, grouse, small mammals, reptiles, and amphibians that feed on insects as all or part or all of their diet (Kantrud 1990, Drut et al. 1994b, Connelly 2000, Wyo. Partners in Flight 2003, Holmes and Johnson 2005, Patla and Keinath 2005). Another general principle is that healthy insect communities, as any biotic community, depend on healthy, functioning rangeland, riparian, and wetland communities (Evans 1984, Noss and Cooperrider 1994, National Research Council 2009). Healthy, functioning riparian areas and rangelands that are not grazed or only lightly grazed by livestock provides the framework for a large number and variety of niches that are occupied by an even larger number of insect species. In comparison, degraded riparian areas/rangelands and those that are heavily grazed have far fewer niches, which means far fewer insect species.

Because livestock grazing directly affects the height, biomass, and structure of herbaceous vegetation, and the availability of different plant parts as forage, cover, and substrate for insects, forage utilization by livestock affects the composition of insect communities. In discussing the conservation of insects, Evans (2008:43) stated that livestock grazing, mowing, and herbicide use can — depending on the level — "drastically modify habitats by reducing the amount of food available to arthropod herbivores and destroying their egg-laying and pupation sites." Forage utilization by livestock can also affect species richness if livestock affect plant communities in the same way every year at the same time in a given area, and/or if livestock grazing limits recovery of degraded riparian areas and rangelands.

As with wildlife communities, maintaining a native diversity (species richness and relative abundance of each species) of insects depends on maintaining or approximating the composition, structure, and patterns of plant communities and the processes under which these communities developed (see Principle A.2). These conditions and processes do not need to be exact, and they do not need to be provided on all acres of riparian areas and rangelands, as was discussed in the "Adequate and Suitable versus Optimum and Marginal" section (beginning on page 17). Furthermore, it needs to be recognized that riparian and rangeland communities in this area developed with grazing by large ungulates (see the "Desired Conditions — General Concepts" section (starting on page 31).

Because grazing intensity by native ungulates is currently at least comparable to what it was prior to Euro-American settlement in most parts of the district, livestock grazing is not necessary to produce or approximate habitat conditions to sustain insect populations. However, many insect communities likely can tolerate some level of livestock grazing, and the diversity in some plant communities may increase with light grazing pressure, such as in marshes (Kantrud 1990). However, to ascertain whether an increase in diversity is beneficial to wildlife, one would need to determine which species increased in presence and abundance and which decreased. In some cases, it is surmised that light to moderate livestock grazing can increase insect populations used by some species of wildlife (e.g., waterfowl broods, Kantrud 1990), while in other cases, it is possible that livestock grazing can diminish favored insects (e.g., spotted frogs and boreal toads, Keinath and McGee 2005, Patla and Keinath 2005). The situation addressed by Kantrud involved dense emergent vegetation in marshes.

The range in effects of livestock grazing on individual species and guilds of insects is likely comparable to the range in effects on individual species and guilds of wildlife, which are discussed in other sections of this report. In other words, some insects likely can tolerate no more than a light grazing pressure (e.g., ≤10-20% utilization of herbaceous vegetation) while others may favor heavy livestock grazing (e.g., >50% utilization of herbaceous vegetation). Therefore, as a general rule, there is (1) strong support for the assessment that retention of ≥80% of the annual production would retain suitable cover would provide for the needs of insects as a whole, so long as key plant parts are not disproportionately removed; (2) moderate to strong support for the assessment that retention of ≥70% of the annual production would retain suitable cover would provide for the needs of insects as a whole, (3) low to moderate support for the assessment that retention of ≥60% of the annual production would retain suitable cover would provide for the needs of insects as a whole; and (4) low to no support for the assessment that retention of <60% of the annual production would retain suitable cover would provide for the needs of insects as a whole. Addressing the needs of migratory birds, small mammals, and pollinators (see "Flowers" section, above) should adequately take into account the needs of insects as a whole.

Small Mammals, Lagamorphs, and Migratory Birds

Small mammals, lagomorphs, birds provide forage for a variety of hawks, owls, and small to medium size mammalian predators, including three sensitive species (great gray owls, northern goshawks, peregrine falcons, wolverines), threatned species (e.g., Canada lynx), and other species of conservation concern (e.g., Swainson's hawk, golden eagles, short-eared owls). Pine marten and boreal owls (MIS and sensitive species, respectively) also prey on small mammals, but these small mammals likely are not influenced by livestock grazing.

Maintaining (and restoring where conditions are degraded) an adequate amount of suitable habitat for native small mammal and bird communities is central to providing for the needs of species that feed on them. Forage and cover needs of a range of small mammal and bird species are addressed elsewhere in this report.

C. Suitable Wildlife Cover — Graminoids

The focus of this section is on habitat needs of wildlife that require at least some level of cover provided by herbaceous vegetation, for several reasons: (1) most wildlife species that use herbaceous communities and many species that use shrubland communities rely on cover provided by herbaceous vegetation (and the majority of the remainder that don't depend on herbaceous vegetation for forage), (2) there are no wildlife species that depend on conditions created by livestock grazing use (e.g., short and/or sparse herbaceous vegetation) that are not otherwise created or sustained (e.g., by native ungulates, herbaceous vegetation that is naturally short/sparse, degraded rangeland and riparian conditions), (3) livestock grazing use reduces herbaceous wildlife cover, and (4) Objective 4.7(d) focus on *retention* of wildlife cover in areas grazed by livestock in order to minimize unacceptable effects of livestock grazing (i.e., the concern outlined in the Forest Plan did not involve too little short, sparse herbaceous vegetation being produced).

Wildlife cover is made up of above-ground parts of plants and geo-physical features (e.g., rocks, cliffs), as well as the soil itself where some wildlife species burrow to meet some of their cover needs (Leopold 1933, Peek 1986, Kie et al. 1994, Krausman 1996). Livestock grazing use has the potential to affect wildlife cover provided by herbaceous vegetation, upland shrubs, willows, aspen, and conifer trees. Cover provided by herbaceous vegetation can be reduced on an annual basis and, if riparian/rangeland health and functionality is less-than-satisfactory, cover provided by herbaceous vegetation may be reduced over the long term. Many species of wildlife, from several taxonomic groups require or otherwise use herbaceous vegetation for cover: large and small mammals, birds, amphibians, as well as numerous species of invertebrates. The prey of some bird and mammal species needs herbaceous cover as well, making herbaceous cover important for these predatory and insectivorous species as well. Tables 3 and 12, and Figure 10 summarizes information on migratory bird and small mammal species known to occur or likely occur in the Little Greys River watershed. Appendix A lists bird species that are known to occur or likely occur on the Greys River Ranger District the last several years.

Herbaceous vegetation contributes to cover for wildlife in a variety of ways, including protection from predators while they feed, protection of eggs and young from predators, and thermal and moisture regulation, including protection from the sun. Tall, dense herbaceous cover not only makes it harder to see small animals and nests on the ground, it also helps to retain moisture and lower temperatures within a few inches of the ground on hot days (particularly when the wind is blowing) and to retain heat on cold days and nights. Accumulations of dead plant material — both standing and bent over — can contribute substantially to these cover qualities and oftentimes is important. Some wildlife species have an innate sense about cover such that they tend not to leave areas where they have a "sense of security;" I refer to this cover need generally as overhead cover. Therefore, some species of wildlife will not exist in favored habitat types if suitable herbaceous cover does not exist and will disappear from an favored habitat types if herbaceous cover declines below a certain threshold. Other wildlife species may continue to attempt to reproduce, forage, and roost in cover at the lower end of suitability, but may experience higher levels of mortality, whether from predators, desiccation (drying) from the sun, or other causes.

Effects of livestock grazing use on cover provided by upland shrubs, willows, aspen, and conifer trees occurs over the long term through direct effects (e.g., browsing, mechanical damage) and indirect and cumulative effects (e.g., effects on water tables, effects on herbaceous vegetation). Effects on herbaceous vegetation have the potential to reduce streambank stability, allow woody vegetation to increase in abundance and canopy cover, and reduce the amount and distribution of fine fuels.

GRAMINOID-DOMINATED COMMMUNITIES & UNDERSTORIES — BROAD-LEVEL ASSESSMENT

In this section, I take a broad-level approach to estimating minimum levels of herbaceous vegetation that need to be retained in graminoid-dominated communities and understories. Information in this section was used in estimating cover requirements of some wildlife species in forthcoming sections on individual cover needs, and also it contributed directly to recommended forage utilization standards and minimum stubble height standards.

Plant Communities

The first step was to determine the most prominent graminoid species in plant communities native to the area now encompassed within the Little Greys cattle allotment. The herbaceous plant species listed in willow community types also occur in interspaces between willows (e.g., small meadow like communities) within the type.

> *Wet and Moist Meadow Communities* — Youngblood et al. (1985) described several graminoid community types that occur within the project area (Table 5). Sedge communities are characterized by dense stands of one or more species of sedges and grasses. While plant amphibians, and some species of birds (Youngblood et al. 1985, Ohmart 1996). Marshes typically are small and they transition in and out of wet meadow and willow communities.

Table 5. Dominant and other graminoids occurring in the most prevalent riparian plant communities in the Little Greys River C&H Allotment, based on Youngblood et al. (1985).

	Grasses										**Sedges/Rushes**						**Forbs**		
Plant Community Type	Idaho Fescue	Kentucky Bluegrass	Timothy	Tufted Hairgrass	Fringed Brome	Nodding Brome	Fowl Bluegrass	Redtop	Bluejoint Reedgrass	Smooth Wildrye	Nebraska Sedge	Beaked Sedge	Water Sedge	Small-wing Sedge	Analogue Sedge	Baltic Rush	Common Horsetail	Short/Med-size Forbs	Tall Mesic Forbs
Conifer/Bluejoint Reedgrass									X										
Conifer/Small Bedstraw																		X	
Narrow-leaved Cottonwood/ Kentucky Bluegrass		X								X									
Red-osier Dogwood/Small Bedstraw		X								X							x	X	
Alder-leaved Buckthorn									X	X								X	
Silver Sagebr./Idaho Fescue (may occur)	X	x												x				x	
Silver Sagebrush/Kentucky Bluegrass		X																X	
Boothe's Willow/Beaked Sedge*									X			X	X				X	x	
Boothe's Willow/Bluejoint Reedgrass									X			x							
Boothe's Willow/Common Horsetail*																	X	X	
Boothe's Willow/False Solomon's Seal*		x		x	x		x					x						X	X
Boothe's Willow/Kentucky Bluegrass*		X	X		X	X		X										x	
Wolf's Willow/Water Sedge*												X	X						
Wolf's Willow/Beaked Sedge*												X	X						
Wolf's Willow/Nebraska Sedge				x							X				X				
Wolf's Willow/Tufted Hairgrass				X														X	?
Wolf's Willow/Fowl Bluegrass							X						x	x		x		x	
Wolf's Willow/Mesic Forbs*		x		x										x				X	?
Coyote Willow/Common Horsetail*		x					x		X			x					X		x
Coyote Willow/Kentucky Bluegrass*		X	X			X		X											
Small-wing Sedge		x		x								x	x	X					
Analogue Sedge												x	x		X			x	
Beaked Sedge*		x		x								X	x	x				x	
Water Sedge		x		x								X	X	x		x			
Miscellaneous Sedge				x							x	x	x	x	x				

Baltic Rush		x		x								x	x			X		x	?
Tufted Hairgrass*		x		X								x	x	x				x	
Tufted Hairgrass –declining condition		X		x								x	x	x				X	
Kentucky Bluegrass		X	x															x	?
False Hellebore (may not occur)				x			x											x	X
Mesic Forb (may occur)			x															X	X

* = Common/prevalent community types
X = Prevalent plant species in community (typically dominant in the plant community)
x = Plant species is present in community, but not prevalent or dominant

Native sedge communities appear to occupy fewer acres than what existed prior to Euro-American settlement and the onset of livestock grazing, seeding of nonnative species, beaver trapping, and road building, meaning that the current capability of some sites to produce herbaceous wildlife cover is reduced. Hermann (1970) and Youngblood et al. (1985) described several sedge species that are moderately to highly palatable to cattle at least during the growing season (e.g., Small-wing sedge, analogue sedge, and beaked sedge), and it is possible these species were among those most heavily impacted during historic period of livestock grazing and subsequently converted to community types dominated by Kentucky bluegrass, other grasses, and/or forbs — but at least in some cases this must have been facilitated by a lowering of the water table (e.g., where wet meadows existed and Kentucky bluegrass communities now exist). In some plant communities, high composition species richness is naturally low in sedge communities, including inclusions of small marshes, and therefore of low value to some wildlife species, herbaceous cover is typically fairly tall and very dense thereby provides high-quality habitat for small mammals, reptiles, of forbs (particularly graceful cinquefoil, wild strawberry, sneezeweed (*Helenium hoopesii*), western valerian, and aster species) indicates elevated disturbance levels. Changes in beaver activity due to over-trapping and reduction in aspen stands, and road building may also have contributed to changes in sedge communities.

Grass-dominated communities in riparian and other moist meadow situations (e.g., meadows) are also common on the Greys River Ranger District. The tufted hairgrass community type "…usually creates a noticeably dense sward of individual tussocks" (Youngblood et al. 1985). Other moist meadows are dominated or co-dominated by species such as redtop, beaked sedge, small-winged sedge, and bluejoint reedgrass. I have seen a few places where bluejoint reedgrass forms extensive stands.

Some moist meadow situations — and mostly restricted to cattle allotments — are dominated by nonnative species. The Kentucky bluegrass community type "…apparently represents disturbed conditions of other more common [community types]. Grazing pressure from livestock probably are responsible for some of our stands" (Youngblood et al. 1985), although they identified one site in Idaho that had been treated with herbicide and seeded. Uchytil (1993) also described Kentucky bluegrass as a dominant of many riparian meadow communities and other moist meadow situations throughout the West, as well as of other sites beyond the riparian zone. Communities dominated by Kentucky bluegrass are very common in the lower Greys River and in Spring Creek. Two other types, not described by Youngblood et al. (1985) are smooth brome communities and timothy communities. Some of these are the result of seedings that were carried out in the 1940s and 1960s (e.g., McCain

Meadow). Several nonnative species were seeded and most of these have declined in composition since being seeded, but smooth continues to flourish in places. Smooth brome and timothy communities are distributed throughout the district, but communities dominated by timothy typically area small. There are large gradations in the composition of nonnative species, from minor representation to domination of plant communities.

Silver Sagebrush Communities — While Youngblood et al. (1985) did not sample any silver sagebrush communities on the Greys River Ranger District, they described two related communities. One of these, the silver sagebrush/Kentucky bluegrass community type, appears to be fairly common on the Greys River Ranger District. Youngblood et al. (1985) assessed that the dominance of Kentucky bluegrass in this type is a consequence of extended grazing pressure. Smooth brome is another common grass species that dominates or co-dominates understories of silver sagebrush communities. At least some of this is a consequence of seedings in the 1940s and 1960s. The silver sagebrush/Idaho fescue community type is one possible type that was replaced by today's silversagebrush/ Kentucky bluegrass, silver sagebrush/smooth brome and other altered silver sagebrush types (Youngblood et al. 1985). Uchytil (1993) also discussed the conversion of sagebrush spp./Idaho fescue communities to sagebrush spp./Kentucky bluegrass. Silver sagebrush/Idaho fescue community type is common in the Wyoming Range on gently sloping alluvial benches, toeslopes, and seeps between 6,500 and 8,400 feet in elevation. Some sites should have small-wing sedge as an understory species (Youngblood et al. 1985). Padgett et al. (1989) described a silver sagebrush/tufted hairgrass type, which contained a dense understory of this species, one or more species of sedge, and baltic rush. It is possible that the understories of many of the silver sagebrush/Kentucky bluegrasss and silver sagebrush/smooth brome communities on the Greys River Ranger District had been comprised of tufted hairgrass and sedges.

Big Sagebrush Communities — Big sagebrush community composition is highly variable in the watershed, primarily dependent on soils, aspect, slope, and other environmental conditions. Shrub canopies range from almost exclusively mountain big sagebrush to big sagebrush/mixed shrub (e.g., snowberry, bitterbrush, chokecherry, serviceberry). Understories range from domination by low-stature species (e.g., Sandberg's bluegrass, buckwheat, phlox), to mid-height species (e.g., Idaho fescue, junegrass, sticky geranium, lupine, yarrow), to taller species (e.g., bluebunch wheatgrass). Bunchgrasses dominate understories on some sites while forbs dominate understories on other sites.

Willow Communities — Youngblood et al. (1985) described several riparian willow community types that occur within the project area (Table 5.). Conditions are diverse, ranging from low-stature, fairly open shrub canopy cover to tall, impenetrable shrub canopies. Most willow communities include more than one willow species and typically include other shrub species. While one or more of several species of sedges, grasses, and forbs may dominate the understory (Table 5), depending on site conditions, understories are typically moderately to highly productive and dense (Youngblood et al. 1985).

Aspen — In the first year of a two-year aspen assessment of the Greys River Ranger District, 31 aspen and aspen-mix communities were observed (Loosen 2008). Community types are based on Mueggler (1988). Preliminary results indicate that browsing pressure on aspen suckers and saplings is high, conifer expansion is high, and that 84% of aspen stands are currently moderately-high to high priority for treatment, meaning the vast majority of stands are at risk of loss due to conversion to conifer.

Graminoid Height Contributing to Cover

The next step was to estimate the height of graminoid plant material that contributes most to wildlife cover in the plant communities outlined above. The intent of the following information was to inform and provide context to the process of adjusting base-level stubble heights to provide for suitable herbaceous wildlife cover. It does not provide definitive information for adjusting or establishing stubble height standards to address wildlife cover needs. Plant height varies by geographic and many other factors. Plant heights in Table 6 are presented as ranges and it is likely that heights of plants in healthy condition in the Little Greys River watershed would fall within these ranges.

Information in Table 6 was derived from plant identification texts, other published literature, and measured plants in 2008 (Appendices B and C). The height of plant material contributing most to herbaceous wildlife cover refers to the parts of individual plants (grasses, sedges, and rushes) in which plant material is most densely concentrated and that is above about 2 inches. For bunch grasses and some other grass species, this is primarily the "bunch" or leaf tuft. For other grasses (e.g., those having leaves on culms), effective cover is also provided by plant material further up the culms; I include this part of the plant in the category of leaf tufts. Even though this plant material is not as tightly concentrated as it is in the bunches of bunch grasses, turf grasses typically are spaced closer together. Effective cover provided by sedges and rushes typically is close to the total height of the plants, an exception being small-winged sedge which has the structure of a bunchgrass. For all species, the lowest 2 inches of plants contribute little if any to cover for most wildlife species using herbaceous cover. For some species (e.g., waterfowl, for nesting), this lower threshold is higher.

Effects of Snow on Accumulations of Residual Plant Material

Snow accumulations during winter reduce herbaceous wildlife cover that would otherwise be available for nesting cover, hiding and overhead cover for small mammals and birds, and for other species. This applies primarily to grasses and fine-leaved sedges because forbs normally shrink, break apart, and fall to the ground (i.e., little residual standing plant material accumulates in forb plants, and compression by snow has little additional effect), and some of the stouter sedges hold up relatively well under the weight of snow. Also, residual standing plant material under the protection of shrubs (e.g., big sagebrush, other upland shrubs, and willows) offsets the effects of snow to some degree. This provides nesting cover for several ground-nesting birds that require herbaceous cover, but not all ground-nesting birds will nest under shrubs. It also provides at least some cover for small mammals in shrub communities.

Large, stout sedges (e.g., beaked, water, and Nebraska sedge) tend to retain more standing plant material through the winter into spring than most grasses, although some grasses (e.g., Great Basin wildrye) also retain standing plant material through the winter as well. Where historic livestock grazing pressure converted sedge communities to plant communities dominated by Kentucky bluegrass and other grasses, residual cover in spring is now compromised.

Estimates of Graminoid Height in Herbaceous Communities and Understories

Based on information in the "Plant Communities" subsection and information in Table 6, graminoids would, under ungrazed/lightly grazed conditions (and assuming healthy,

Table 6. Total heights and height of plant material that most contributes to herbaceous wildlife cover for gramminoid species that occur in several vegetation types in the Little Greys River watershed, Bridger-Teton National Forest. Heights are based on published literature[A] and measured heights[B] in the Little Greys River watershed.

Graminoid Species	Big Sagebush	Aspen (or Conifer)	Silver Sagebrush	Dry & Moist Meadows	Wet Meadows, Willow & Rip. Shrub	Total Plant Height (w/ Seed Stalk; Culm Height)	Height of Plant Material Contributing Most to Wildlife Cover ("Leaf Tuft")
Bluebunch wheatgrass	X		x	x		12-40"	4-20"
Idaho fescue[B]	X		x	x		12-30"	4-15"
Prairie junegrass	X			x		10-24"	4-12"
Letterman needlegrass	X					10-24"	3-8"
Subalpine needlegrass	X		X	X		12-40"	4-12"
Mountain brome	X					10-40"	5-20"
Sandberg bluegrass	X					8-25"	2-8"
Winter bent	X					12-24"	2-6"
Pinegrass		C				28-40"	14-26"
Intermed. wheatgrass	X					18-40"	15-40"
Orchard grass[B]	X	X	X	X		12-58"	6-40"
Smooth brome[B]	X	X	X	X		16-42"	8-18"
Timothy (domestic) [B]	X	X	X	X		12-40"	9-20"
Kentucky bluegrass[B]	X	X	X	X		10-36"	7-22"
Bulbous bluegrass			X	X		12-24"	3-14"
Tufted hairgrass[B]				X	X	16-44" rarely down to 8"	6-20" rarely down to 3"
Redtop[B]				X	X	24-40" rarely down to 8"	16-36" rarely down to 5"
Fowl bluegrass				X	X	10-60"	—
Fowl mannagrass					X	8-40"	4-28"
Bluejoint reedgrass[B]					X	24-44"	14-36"
Fringed brome				X	X	20-48"	—
Meadowbarley[B]					X	12-30" rarely down to 8"	6-16" rarely down to 2"
Nebraska sedge					X	8-40"	6-40"
Beaked sedge[B]					X	12-48"	12-40"
Water sedge					X	8-40" rarely down to 4"	8-40" rarely down to 4"
Analogue sedge					X	8-35"	6-28"
Small-wing sedge[B]			X	X	X	14-30" rarely down to 8"	6-16" rarely down to 3"
Baltic rush[B]					X	12-36"	12-30"

[A] Cronquist et al. (1977), Esser (1993), Gucker (2007), Harrison (unknown year), Heady (1950), Hermann (1970), Hitchcock (1971), Kershaw et al. (1998), Kinney and Clary (1994), Padgett et al. (1989), Skinner et al. (1999), Sullivan (1992), Uchytil (1993), Zlatnik, E. (1999).

[B] A sampling of designated plant species were measured in 2008 (none of the plants had been grazed this season).

vigorous plants), contributed to herbaceous community/understory heights as follows. The focus is on leaf tufts since they are the part of graminoids that primarily contributes to wildlife cover, but also recognizing the contribution that seed stalks above leaf tufts make toward cover. Estimates of heights in Table 6 are for individual plants in a plant community; for example, leaf-tuft heights of bluebunch wheatgrass on a given site may range from 6 to 18 inches, but the height across the site characterizing its cover value may be about 14 inches. The following are gross-level estimates to provide rough approximations of plant-community potential (e.g., 3 inches vs. 12 inches vs. 36 inches). The following information is not meant to provide exacting estimates.

Wet Meadow Communities — Sedges under these conditions would attain heights greater than in moist meadow situations. Ungrazed or lightly grazed height of vegetation (focusing mostly on leaf-tuft height) in wet meadows in healthy condition and dominated by beaked and water sedge range from situations where heights are roughly 10-15" to where they are 20-30". Sedge meadows having heights of 10-15 inches was fairly common along Blind Trail Creek and South Fork of the Little Greys River in 2007 (with no more than light grazing), and sedge meadows at 20-30 inches tall were less common (DeLong 2007a, and additional observations in 2008). Shorter-stature wet meadows dominated by small-winged sedge, less prevalent than tall-sedge meadows, would typically have ungrazed/lightly grazed heights of considerably taller than the minimum 3 inches shown in Table 6 (5-6 inches as a minimum may be reasonable), and heights up to 10 inches or more is possible.

Moist Meadow Communities and Silver Sagebrush — A range of heights would exist under ungrazed/lightly grazed situations, assuming vegetation is in healthy condition. Where tufted hairgrass and/or small-winged sedge are the dominant graminoid species, plant height providing the most effective herbaceous wildlife cover ranges from 6-10 inches to 10-15 inches or more. On drier sites, heights may be as low as 3-6 inches and plants spaced further apart. In places where Kentucky bluegrass and/or smooth brome now dominate the herbaceous plant community (e.g., moist meadow) or understory (e.g., silver sagebrush), the structure of graminoid communities and understories is sparser and possibly shorter than the original community. However, Uchytil (1993) referenced information showing that Kentucky bluegrass can provide at least moderate quality nesting cover for some ground nesting birds as large as teal. Where taller grasses and sedges predominate (e.g., redtop, beaked sedge), plant height providing the most effective herbaceous wildlife cover typically is 10-24 inches or taller, with contributions to cover provided by sedges being somewhat shorter. Heights observed in many moist meadow communities in the Little Greys River watershed prior to livestock grazing in 2007 and 2008 was 10-24 inches (DeLong 2007a, 2007b, 2007c, and additional observations in 2008). This corresponded to ungrazed grass leaves under silver sagebrush plants at the end of the livestock grazing season, which were generally 10-24 inches compared to the typical 1-3 inch heights between shrubs where grazing occurred in 2007.

On sites where bluejoint reedgrass is a prevalent representative species and where redtop is productive, plant height providing the most effective herbaceous wildlife cover can be as high as 30 inches or more.

Willow Communities — A range of herbaceous understory heights exist under healthy, ungrazed/lightly grazed conditions, depending on dominant species in the understory (e.g., see Table 5). In understories dominated by tall sedges, heights would be similar to heights discussed for "Wet Meadow Communities" (e.g., 10-24 inches or taller). Where bluejoint reedgrass, smooth wildrye, and other tall riparian grasses dominate undestories, heights of the understory community (again, focusing mainly on plant material contributing most to wildlife cover) is 15 inches at a minimum, at least 24 inches in many communities, and can be as tall as 30 inches or taller. Grass heights under willows observed in 2007 ranged from 10-15 inches to 10-24 inches, in contrast to 1-4 inches between willows and in openings (DeLong 2007a, 2007b).

On somewhat drier sites (where short-stature grasses typically dominate), understory heights would approximate those described above for tufted hairgrass and small-winged sedge communities in the "Moist Meadow Communities," above.

Big sagebrush Communities — Ungrazed/lightly grazed heights of native herbaceous understories in healthy conditions are variable from site to site, with native bunchgrass leaf-tufts ranging from 3 to 12 inches tall, depending on the site and native species comprising the understory and with total stalk heights up to 12-36 inches. Furthermore, because vegetation (e.g., shrubs, bunchgrasses, and forbs) in sagebrush communities have highly variable heights and are spaced apart, wildlife cover is more broken and variable than in riparian and meadow communities. On some big sagebrush sites, graminoids naturally contribute only minimally to wildlife cover (e.g., ungrazed leaf-tuft heights of Sandberg's bluegrass of of 3-5 inches or taller, with total stalk heights up to as high as 12 inches or more). On other big sagebrush sites, ungrazed leaf-tuft heights are mid-range, roughly 5-10 inches with stalk heights up to 24 inches or more (e.g., Idaho fescue, junegrasses, needlegrasses). Taller/mixed graminoids contributions to understory cover include ungrazed leaf-tuft heights of 6-18 inches, with stalk heights as high as 24-30 (e.g., bluebunch wheatgrass, Idaho fescue, junegrass, needlegrasses).

On big sagebrush sites with understories now dominated by Kentucky bluegrass and smooth brome, the native grass species that formerly dominated the understories is unclear. However, Youngblood et al. (1985) described a silver sagebrush/Idaho fescue community type, and they observed that this type had shifted to silver sagebrush/Kentucky bluegrass in places (they did not describe big sagebrush types). Given the proximity of some of these big sagebrush communities (i.e., those now dominated by Kentucky bluegrass and/or smooth brome) to these silver sagebrush sites and the inherent productivity of the sites, they may formerly have had understories dominated by Idaho fescue, among other grass species.

Several species of non-native wheatgrasses, bluegrasses, orchard grass, smooth brome, and domestic timothy are now prominent in the understories of big sagebrush communities.

Amount of Wildlife Cover Retained in Wet and Moist Graminoid Habitats

Two approaches were used to translate height of graminoids to wildlife-cover qualities and to characterize the amount of cover remaining after different levels of vegetation removal.

Relative Suitability of Wildlife Cover at Different Heights for 9 Wet and Moist Meadow Species

As part of the process of assessing the relationship between retention levels of herbaceous vegetation and livestock grazing use was to estimate the heights of graminoids in relation to intensity of grazing pressure and to assess the relative effects on wildlife cover qualities. This was done for nine riparian/wetland species, all of which are native to the Greys River watershed except Kentucky bluegrass. Thus, all species except Kentucky bluegrass were used to help assess suitability of wildlife cover in plant communities in which they occur. Kentucky bluegrass can provide cover (Uchytil 1993), but the quality of cover on sites dominated by Kentucky bluegrass and other non-native species should be assessed relative to the quality of cover provided by native species that naturally had occupied those sites.

Heights of each species for several different intensities of clipping (i.e., percent dry-weight removed) in Table 7 were calculated based on results of Kinney and Glary (1994). Kinney and Glary (1994) provided pictures of each species at several clipping intensities (0%, 10%, 30%, 50%, 70%, and 90% dry-weight removed). Several pictures are included in this report as examples (Figures 4a, 4b, 4c, and 4d), and the patterns they show are similar to photo guides in BLM et al. (1999). These pictures and stubble heights of plants shown in Table 7 were used to judge the relative quality of wildlife cover that would remain after different degrees of clipping intensities if this were done across an entire patch of homogenous vegetation. In making judgments, I also considered the relative contributions of seed stalks to cover as well as the increasing amount of vegetation that would be bent over and matted (due to hoof action) as utilization levels rose. However, assessments were mostly based on height.

Table 7. Range in heights and average heights of plants used in Kinney and Glary's (1994) study for each of several different amounts of plant material removed, and relative assessments of the suitability of remaining wildlife cover (color coded). Included species are those that are prevalent in plant communities of the Greys River Ranger District. Heights of some species (e.g., beaked sedge, water sedge) are commonly somewhat less than those in Kinney and Glary's study, meaning that percent dry-weight retained for particular stubble heights would be somewhat higher than those shown below; also, some color categories may shift to the right for some stubble heights (but a shift of no more than one column).

	Percent Dry-Weight Retained															
	100%		**90%**		**80%**		**70%**		**60%**		**50%**		**30%**		**10%**	
	Range	**Av.**	Range	**Av.**	Range	**Av.**	Range	**Av.**	Range	Av.	Range	**Av.**	Range	**Av.**	Range	**Ave.**
Tufted hairgrass	11-17	**14**	7-11	**9**	3-8	**5**	*2.5-3.8*	***3.2***	1.9-2.9	**2.4**	1.3-2.0	**1.7**	0.75-1.2	**1**	0.25-0.4	**0.35**
Bluejoint reedgr.	24-38	**29**	*15-24*	***19***	12-19	**15**	10-16	**12**	8-13	**10**	6.2-10	**7.5**	3.5-5.5	**4.2**	1.0-1.5	**1.2**
Redtop	23-33	**29**	15-21	**18**	*11-15*	***13***	8-12	**10**	6-9	**8**	5-7	**6**	2.9-4.1	**3.6**	0.9-1.3	**1.2**
Kent. bluegrass	9-31	**17**	*6-22*	***12***	*4-14*	**8**	2.9-10	**5.5**	2.1-7	**4.0**	1.6-5.5	**3**	0.8-2.8	**1.5**	0.25-0.9	**0.5**
Smallwing sedge	12-16	**14**	*8-11*	***9***	5.5-7	**6**	4.0-5.4	**4.7**	3.2-4.3	**3.8**	2.4-3.2	**2.8**	1.2-1.6	**1.4**	0.3-0.4	**0.35**
Nebraska sedge	19-25	**21**	*15-19*	***16***	12-16	**13**	10-13	**11**	7.5-10	**8**	6-8	**7**	3.3-4.4	**3.7**	1.0-1.25	**1.0**
Beaked sedge	*19-28*	***24***	13-20	**17**	11-16	**14**	9-13	**11**	7-10	**9**	5.5-8	**7**	2.8-4.2	**3.6**	0.75-1.1	**1.0**
Water sedge	14-26	**22**	*11-21*	***18***	9-17	**15**	8-14	**12**	6-11	**9**	5-9	**8**	2.7-5	**4**	0.85-1.6	**1.3**
Baltic rush	20-38	**29**	*15-29*	***22***	12-24	**18**	10-20	**15**	8.5-16	**12**	7-13	**10**	4-8	**5.8**	1.3-2.5	**1.9**
	The shaded cells, as coded below, assume homogenous height across portions of wet or moist meadows.															
	italix	= approximate height of the grass/sedge 'leaf-tuft' (e.g., basal leaves, or height without seed-head).														
	A	= wildlife cover at optimum or near optimum levels for native, dependent wildlife species.														
	B	= wildlife cover reduced somewhat to a moderate amount; vegetation still provides at least some cover.														
	C	= wildlife cover attributes are nearly gone relative to ungrazed conditions (less-than-satisfactory).														
	D	= wildlife cover attributes do not exist.														

Based on this assessment, cells in the table were color-coded according to the legend at the bottom of the table, based primarily on visual estimates of wildlife cover qualities (using photographs provided in Kinney and Glary 1994) that would remain if an entire site were at the heights shown in the cells of Table 7. 'B' depicts heights of plants when they still provide some wildlife cover, but where the quality of cover is noticeably reduced. Heights in 'A' and 'B' cells appear to provide suitable herbaceous cover for native wildlife communities associated with wet and moist meadow communities dominated by these and similar graminoid species. They would likewise appear to provide suitable herbaceous cover in willow communities where the understories are dominated by graminoids. These assessments appear to be consistent with

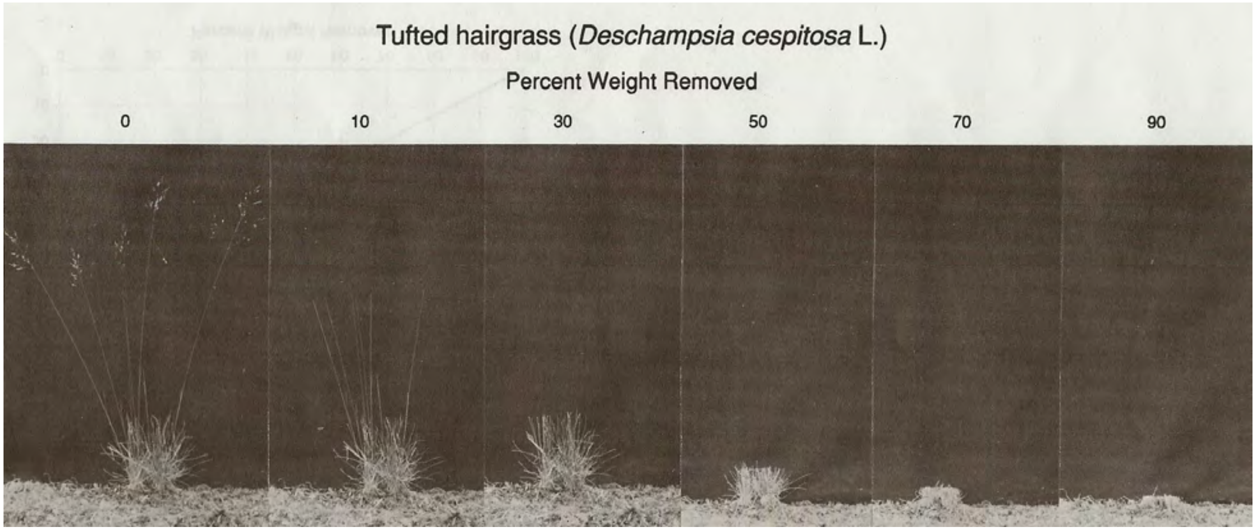

Figure 4a. Tufted hairgrass at potential height and at five ‘grazing’ intensities (from Kinney and Glary 1994).

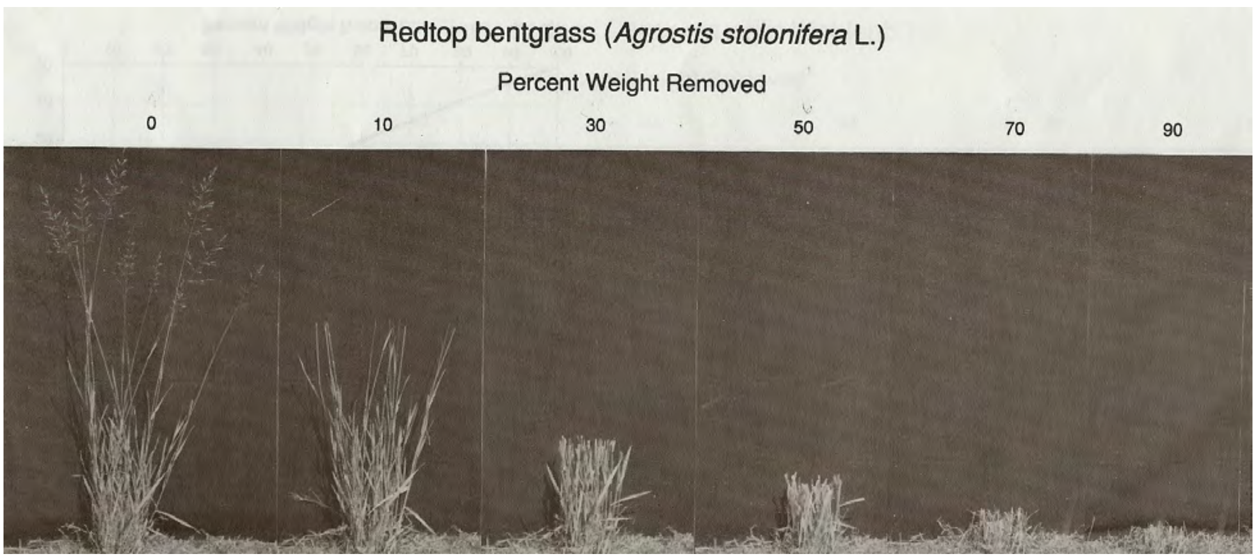

Figure 4b. Redtop at potential height and at five ‘grazing’ intensities (from Kinney and Glary 1994).

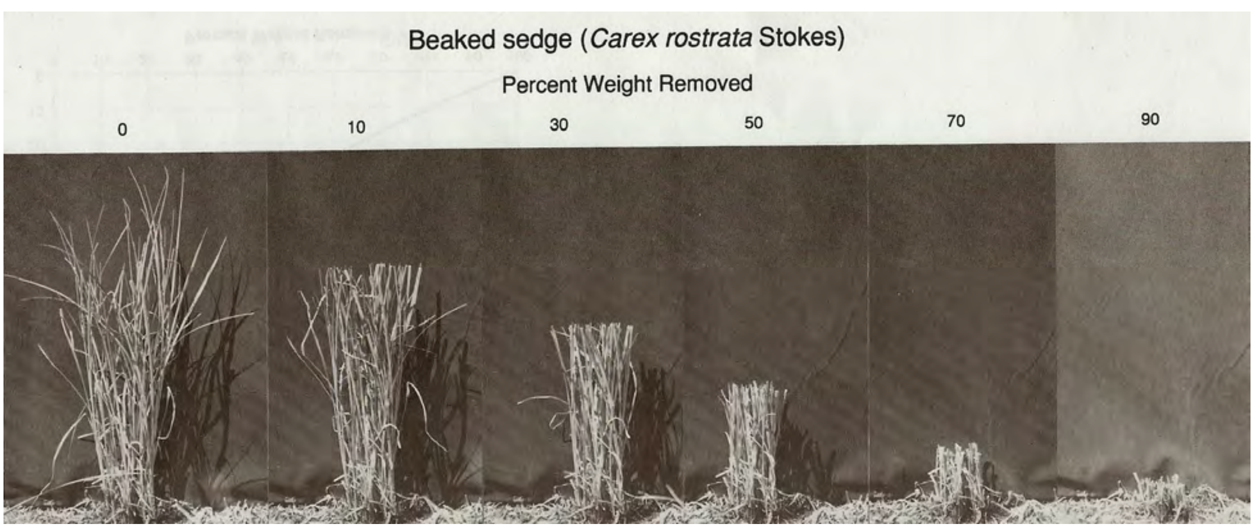

Figure 4c. Beaked sedge at potential height and at five ‘grazing’ intensities (from Kinney and Glary 1994).

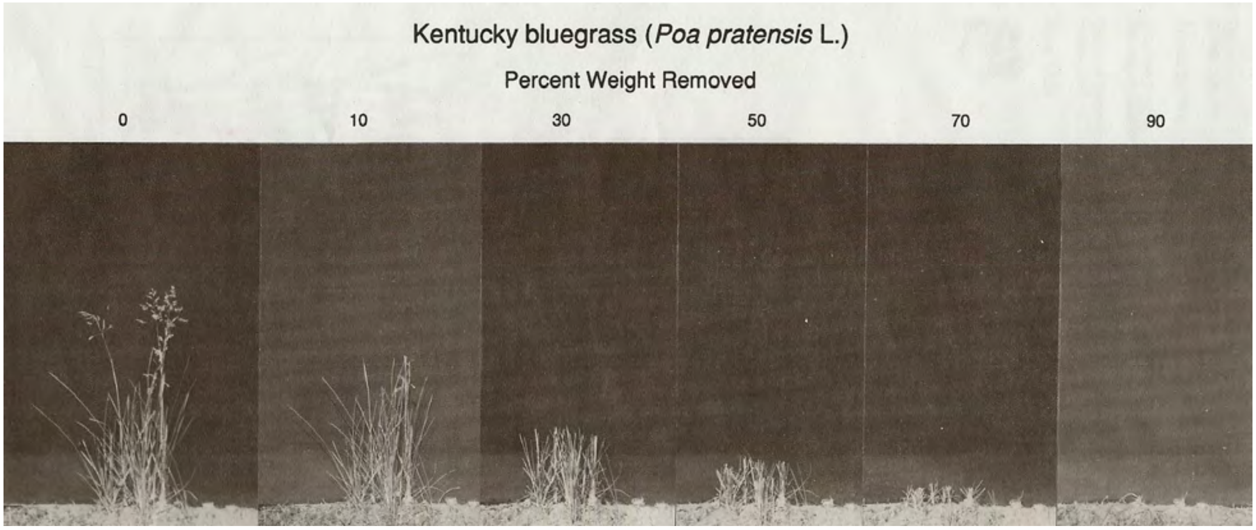

Figure 4d. Kentucky bluegrass at potential height and at five 'grazing' intensities (from Kinney and Glary 1994).

general descriptions of vegetation appearance at different utilization levels described in the *Wyoming Rangeland Monitoring Guide* (page 25) and Holechek et al. (2004:248), although their descriptions were for upland communities. Herbaceous heights suitable for individual species and groups of species (section "Cover Needs of Individual Wildlife Species and Groups of Species," above) also support these general assessments.

Cover attributes of different plant species vary, meaning that while 8-inch stubble of one species may provide marginally suitable wildlife cover, 8-inch stubble of another species may provide less than suitable cover. Cover attributes of individual plant species vary according to a variety of factors, including height of ungrazed leaf tufts, density of leaf structure at different height levels, added height and structural attributes of seedheads, and distance between plants. Stubble height of 3-4 inches would provide virtually no cover with respect to all the tall sedges, but it would provide some cover when considering tufted hairgrass on drier sites (Table 7). Therefore, on drier sites where tufted hairgrass-dominated communities/understories are now dominated by Kentucky bluegrass, a minimum 3-4 inch stubble height of Kentucky bluegrass may be within the range of suitable wildlife cover for this particular plant community/understory.

Relationships between Amount of Annual Production Retained and Wildlife Cover

Two of the most common ways of assessing herbage removed and herbage remaining after the livestock grazing season are estimates of the percent herbage removed/retained and measures of stubble heights. Stubble heights are most commonly evaluated along streambanks (Hall and Bryant 1995, Clary and Leininger 2000, Univ. of Idaho 2004). While the categorization of wildlife cover attributes in Table 7 assumes a consistent height across a given site or within a small area, cattle grazing and trampling is patchy on any given site and across the landscape, creating short to tall heights where multiple species and soil conditions exist (Forbes 1988, Stuth 1991, McKinney 1991), including where there are shrubs that protect grasses and sedges from grazing. That cattle grazing creates patchiness is recognized in the landscape appearance approach to estimating forage utilization levels; degree of patchiness is an important criterion in this approach (BLM et al. 1999:120, BLM 2008:27&52).

Assessments of the level of confidence for given levels of herbaceous vegetation retained for dependent wildlife were based on cover attributes of vegetation at different levels of retained herbaceous vegetation and they considered the cover needs of dependent wildlife addressed elsewhere in this report. Assessments assume that communities are in healthy, functioning condition or nearly so. For at-risk and non-functioning communities and those not in properly functioning condition, percent of herbaceous vegetation retained would need to be higher to have comparable cover qualities. They apply on a site-by-site basis, and do not include average retention across large areas.

95-100% of Annual Production Retained

At 0-5% utilization (95-100% of annual production retained), wildlife cover is at or near ungrazed conditions, with a very high probability of providing satisfactory cover for all dependent wildlife species, relative to site potential and where the site is at potential (vegetation is in healthy, functioning condition). Where moderate to tall, dense herbaceous vegetation was or is produced, these characteristics would be retained, thereby continuing to provide for the needs of wildlife species that require or favor tall, dense herbaceous vegetation (the same would be true of herbaceous vegetation that begins as moderately-tall, moderately-dense vegetation).

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Very High
Large majority of dependant species	Very High
Species most dependent on tall, dense herb. vegetation	Very High

80-94% of Annual Production Retained

At 6-20% utilization (80-94% of annual production retained), wildlife cover is reduced to a fairly small degree, and vegetation still provides satisfactory cover for large majority of dependent wildlife species. Herbaceous vegetation at this retention level would continue to provide for many of needs of wildlife that depend on or favor tall, dense herbaceous vegetation (the same pattern would be true where moderately-tall, moderately-dense vegetation is produced). The basis for this is outlined in the following paragraphs.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Very High
Large majority of dependant species	High
Species most dependent on tall, dense herb. vegetation	Moderate

BLM et al. (2008:27) characterized 6-20% utilization as “The rangeland has the appearance of very light grazing. The herbaceous forage plants may be topped or slightly used.” If livestock progressively reduced the height of all vegetation consistently, starting with skimming and working down from there on each plant (i.e., no plant receiving any more use than any other), 20% utilization would result in a 40-65% reduction in herbaceous height, based species assessed by Kinney and Glary (1994) or a 43-75% (average of 60%) reduction based on BLM et al. (1999:118) (Figures 3b-c of the “Elk” section, Figures 4a-d). Most of the height reduction in grasses occurs at the upper stalk and seedhead (which contributes less to cover than the leaf tuft). In sedges, even initial reductions in height begin to reduce effective wildlife cover. When 80% of the annual production is retained in tall sedge communities, wildlife cover qualities are reduced by a small to moderate extent, but cover is likely still satisfactory for most species (Table 7, Figure 4c). At comparable utilization levels, sedges retain greater relativel heights than grasses.

It is possible that the very initial phases of patchiness begins between about 10 and 20% utilization on some sites (Figures 1a-b and 2a-b in the “Elk” section) and, therefore, where moderate to tall, dense herbaceous vegetation was or is produced, these characteristics begin to be reduced at 20% utilization (but most characteristics of moderate-tall, dense vegetation are retained). For example, at this level of grazing, it is possible for 20% or more of the basal area of plants to be grazed at >60% utilization (Table 8, Figure 1b). The potential exists for small patches to begin forming at this level of grazing, but patches would in most cases be very small. Microsite patches produced at utilization levels of ~5-10 and possibly as high as 20% may benefit some wildlife species inhabiting some tall, dense herbaceous communities, and this may mimick conditions produced by native herbivores in these communities.

Table 8. A sampling of potential average forage utilization levels at a small scale (e.g., along a transect), based on cattle grazing behavior outlined in McKinney (1997). Shaded columns are examples provided by McKinney. One of the purposes of this table is to illustrate the percent of the basal area on a given site that can potentially be heavily grazed in each category (i.e., the “Cat.” row).

Util.[A]	**Percent of Plants in a Small Area that are Grazed at Each Utilization Category**																			
0-5%	50	50	40	40	35	60	35	40	25	40	20	25	15	10	20	10	0	0	0	0
6-20%	40	30	30	20	15	0	20	10	15	10	20	10	15	15	10	10	10	0	0	0
21-40%	10	5	10	15	10	0	10	10	15	0	10	10	15	15	10	10	10	10	0	0
41-60%	0	5	10	10	10	0	10	10	15	0	10	20	20	20	10	10	10	10	10	0
61-80%	0	10	10	15	20	40	25	30	30	50	40	35	35	40	50	60	70	80	80	80
81-95%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	20
AFU[B]	**8**	**16**	**20**	**24**	**25**	**29**	**29**	**31**	**36**	**38**	**39**	**40**	**42**	**45**	**45**	**52**	**54**	**60**	**70**	**74**
APR[C]	**92**	**84**	**80**	**76**	**75**	**71**	**68**	**65**	**64**	**62**	**61**	**60**	**58**	**55**	**55**	**48**	**46**	**40**	**30**	**26**
Crit.[D]	Skimmed, slightly used.			Topped, skimmed, or grazed in patches, 60-80% of seedstalks remain intact									Grazed fairly uniformly (patches of standing grass may remain), 15-25% of seedheads remain						Complete search, <10% seedstalks	
Cat.[E]	**6-20%**			**21-40%**									**41-60%**						**61-80%**	

[A] Mid-points of forage utilization, on a plant-by-plant basis (same categories as used in Landscape Appearance method).
[B] Average Forage Utilization, based on averaging mid-points within each column.
[C] Average Percent of the annual production Retained.
[D] Relevant criteria for assigning forage utilization categories under the Landscape Appearance method.
[E] Forage utilization categories at small scales (e.g., transect), based on the Landscape Appearance method (BLM et al. 1999, BLM et al. 2008).

Plant material below a certain height does not contribute to wildlife cover, depending on the wildlife species and use of the cover. Assuming that herbaceous vegetation height below 1 inch does not contribute to cover for any wildlife species, even small mammals, the 1-inch mark (height above ground) can be recalibrated to 0 for the purpose of assessing reductions in vegetation that actually contributes to cover. The same can be done for ground-nesting birds the size of ducks, for which the 3-inch mark can be recalibrating to 0 (i.e., plant material below 3 inches provides virtually no cover for their nests). Figure 5 illustrates height-weight graphs for five common graminoid species of the Greys River Ranger District and horizontal dashed lines showing 1-inch, 2-inch, and 3-inch heights above the ground. The following assessments are based on average heights of individual plants.

- Assuming recalibration at the 1-inch mark, retention of 80% of total herbaceous vegetation retains an estimated 22-56% (average of 38%) of the plant height that contributes to cover, based on the height-weight curves of BLM et al. (1999:118). Similarly, an estimated 31-67% of plant height contributing to cover would be retained by retaining 80% of the dry weight of plants assessed by Kinney and Glary (1994).

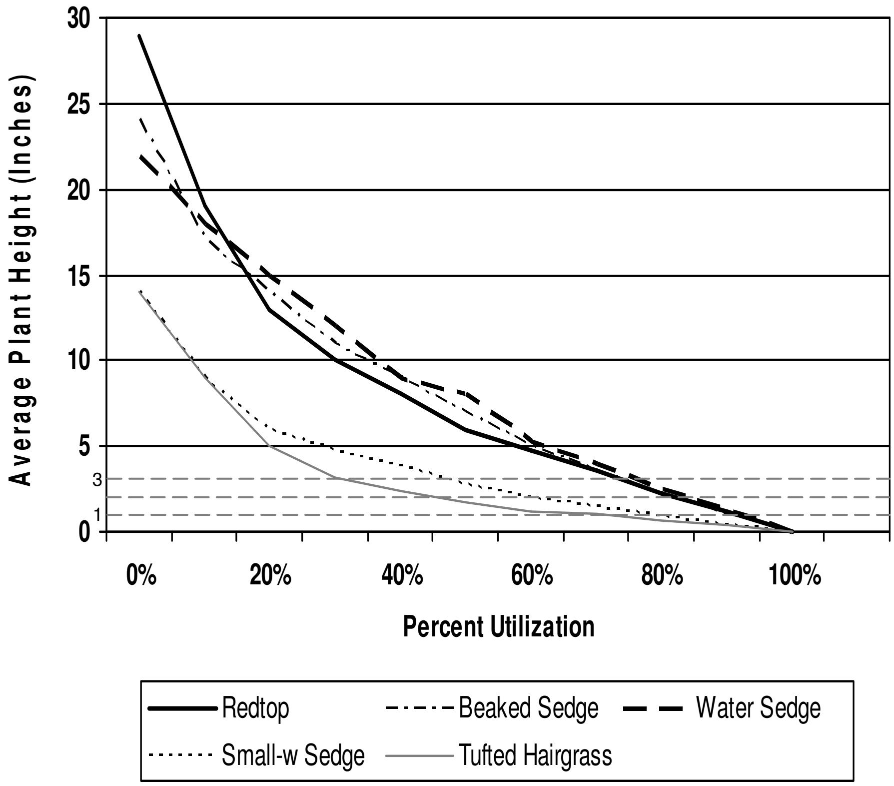

Figure 5. Changes in plant height at as the percent of plant weight remaining decreases, based on clipping data provided in Kinney and Glary (1994). The five plant species shown are common on the Greys River Ranger District.

- Assuming recalibration at the 1-inch mark, retention of 80% of total herbaceous vegetation retains an estimated 40-70% of the biomass of the plant material that contributes to cover (Table 9). There may be small mammals and ground-nesting passerines for which the lowest 1½-2 inches of plants do not contribute any meaningful cover. For these species, less than 40-70% of the cover would remain when 80% of the total biomass herbaceous vegetation is retained.
- Assuming recalibration at the 3-inch mark, retention of 80% of total herbaceous vegetation only retains an estimated 10-55% of the biomass of the plant material that contributes to cover (Table 9). The lower end of this range is unrealistic because it is for plant species with tall seedstalks and relatively short leaf tufts (e.g., tufted hairgrass), which may not be used by ducks even when ungrazed (thus, a more pertinent range may be 40-55% for grasses with taller leaf tufts).

Table 9. Adjusted retention levels of herbaceous vegetation to reflect the percent of biomass of herbaceous vegetation that contributes to wildlife cover, based on the percent of total herbaceous vegetation biomass as adjusted to discount the biomass in the lowest 1 inch, 1½-2 inches, and 3 inches of plants. The lowest 1 inch of plants contribute virtually no to no cover for small mammals and ground nests of passerine birds, and the lowest 3 inches of plants contribute virtually no cover to no cover for duck nests and ground-foraging passerine birds. As an example, retention of a total of 70% of the biomass of herbaceous vegetation would retain an estimated 30-60% of the biomass contributing to cover for small mammals and ground nests of passerine birds, depending on plant species composition and pre-grazing plant heights.

Adjusted New Baseline			**Adjustment of Total Retention to New Baseline**	**Percent of Total Herbaceous Vegetation Retained (Total Retention)**								
1”	**1½ -2”**	**3”**		**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**	**100%**
			-5%	15	25	35	45	55	65	75	85	95
TG			-10%	10	20	30	40	50	60	70	80	90
	TG		-15%	5	15	25	35	45	55	65	75	85
sws	TG		-20%	0	10	20	30	40	50	60	70	80
sws		TG	-25%	0	5	15	25	35	45	55	65	75
th	sws		-30%	0	0	10	20	30	40	50	60	70
th	sws		-35%	0	0	5	15	25	35	45	55	65
	sws		-40%	0	0	0	10	20	30	40	50	60
	th		-45%	0	0	0	5	15	25	35	45	55
	th	sws	-50%	0	0	0	0	10	20	30	40	50
	th	sws	-55%	0	0	0	0	5	15	25	35	45
			-60%	0	0	0	0	0	10	20	30	40
		th	-65%	0	0	0	0	0	5	15	25	35
		th	-70%	0	0	0	0	0	0	10	20	30

Legend:

TG = Tall graminoids (redtop, beaked sedge, water sedge), based on data in Kinney and Glary (1994)

sws = Small-winged sedge, based on data in Kinney and Glary (1994)

th = tufted hairgrass, based on data in Kinney and Glary (1994)

(light grey) = range of several bunchgrass species, based on weight-height curves in BLM et al. (1999:118)

(dark grey) = average for several bunchgrass species, based on weight-height curves in BLM et al. (1999:118)

In a pilot study in which I assessed wildlife cover attributes relative to estimated forage utilization levels (based on the landscape appearance method) in the Little Greys River drainage, 6-20% utilization (80-94% retained) did not markedly reduce wildlife cover qualities (DeLong 2008). On most sample sites, there was less than a 20% reduction in Robel pole readings at 4-meters, less than a 20% reduction in the number of dots obscured in the cover disk, and less than a 40% reduction in Robel Pole readings at 1-meter compared to pre-grazing readings (Figures 6 and 7). Reductions were larger on three sites grazed to an estimated 6-20% utilization, but they had been fairly heavily matted by cattle laying on the site which typically is a low percentage of the landscape.

70-79% of Annual Production Retained

At 21-30% utilization (70-79% of annual production retained), wildlife cover is reduced somewhat to a moderate amount, and vegetation still provides satisfactory cover for many wildlife species. Herbaceous vegetation at this retention level would continue to provide for some to many of needs of wildlife that depend on or favor tall, dense herbaceous vegetation, but tall, dense characteristics are being depleted as retention declines to 70% (the same pattern would be true where moderately-tall, moderately-dense vegetation is produced). The basis for this is outlined in the following paragraphs.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Very High
Large majority of dependant species	Moderate to High
Species most dependent on tall, dense herb. vegetation	Low

If livestock progressively reduced the height of all vegetation consistently, 30% utilization (70% of annual production retained) would result in a 45-75% reduction in herbaceous height, based grass and sedge species assessed by Kinney and Glary (1994) or a 60-86% (average of 74%) reduction based on grasses assessed in BLM et al. (1999:118) (Figure 3d and Figures 4a-d). A fairly considerable amount of the leaf-tuft remains, particularly for tall sedge species, and sites at a homogenous height would still provide many attributes of wildlife cover for most species (Figures 4a-d, Table 7), more so than in communities dominated by grasses (Figure 3d).

Recognizing the patchiness of grazing, McKinney (1997) provided a hypothetical example of an average of 29% utilization, which he estimated could result in about 40% of the plants (or basal area) on a given site being grazed to >600% utilization (Table 8; Figure 1c). Table 8 and Figures 1b-c and 2b-c illustrate that herbaceous wildlife cover likely begins to be substantively affected by 30% utilization (AFU), or 70% retained (APR); i.e., somewhere between 80% and 70% retention, but closer to 70%. Where moderate-tall, dense herbaceous vegetation is produced, 30% utilization would be sufficient for vegetation to no longer be characterized as "dense," although patches of dense vegetation and a considerable amount of moderate-tall vegetation would persist in many cases (McKinney 1997, DeLong 2009, and characterization in this sub-section). These conditions are likely still somewhat suitable for species that depend on herbaceous understory vegetation for nest concealment, hiding cover, overhead cover, etc. This is because open patches created by grazing are still relatively small and not connected to any large extent: (1) more than 50% of plants still have ≥80% of their annual production retained, and (2) less than 40% of plants only have ≤50% of their annual production retained (Table 8).

The assessment that wildlife cover begins to be substantially affected at approximately 30% utilization is supported by BLM et al. (2008) and DeLong (2008). Sites grazed at 20-40% utilization typically are typically becoming patchy (BLM et al. 1999:120, BLM et al. 2008:27) as illustrated for McKinney (1997). Restated, the cover qualities of tall, dense and moderately-tall, moderatey-dense herbaceous cover is well on its way to declining between 20% and 40% utilization. My pilot study on the relationship between wildlife cover and cattle forage utilization adds credence to this assessment because 20-40% utilization resulted in some fairly marked changes in wildlife cover qualities, compared to ungrazed conditions (DeLong 2008). There was a 50-90% reduction in Robel pole readings at 4-meters a 50% to nearly 100% reduction in Robel pole readins at 1-meter, and in a limited sample, there was a 20-85% reduction in the number of dots obscured in the cover disk, compared to pre-grazing (Figures 6 and 7).

To account for plant material near ground level that does not contribute to wildlife cover, the following "recalibrations" provide additional information to consider (see explanation in the "*80-94% of Annual Production Retained*" discussion, above):

- Assuming recalibration at the 1-inch mark, retention of 70% of total herbaceous vegetation retains an estimated 11-38% (average of 24%) of the plant height that contributes to cover, based on the height-weight curves of BLM et al. (1999:118).

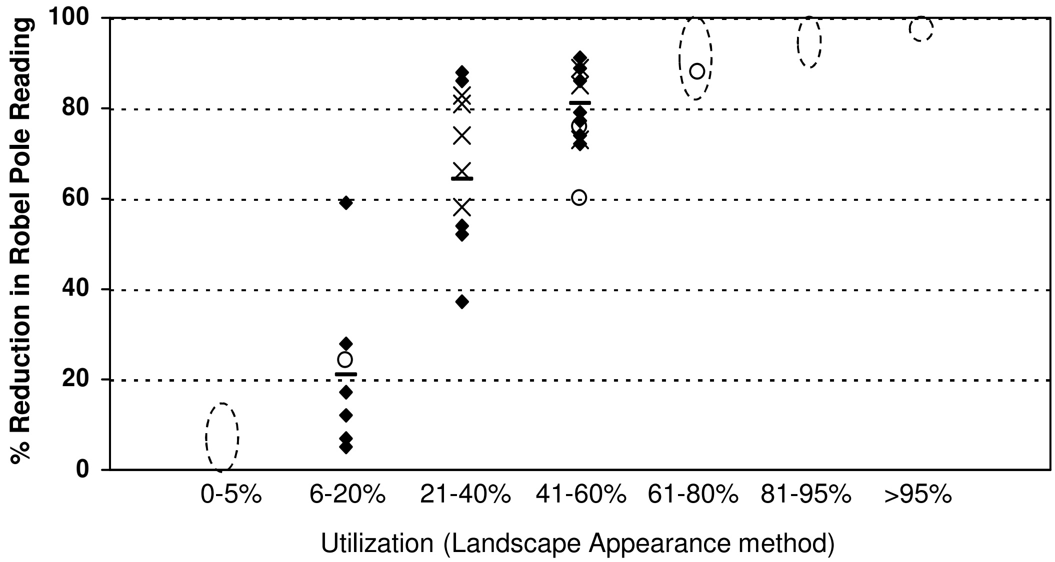

Figure 6. Percent reduction in 4m Robel pole readings in smooth brome (x's), mixed-species moist-meadow communities, including redtop sites (diamonds), and sedge (o's). Dashes = averages for moist meadow sites. Dashed ovals and circles show where data points would be expected. (From DeLong 2008)

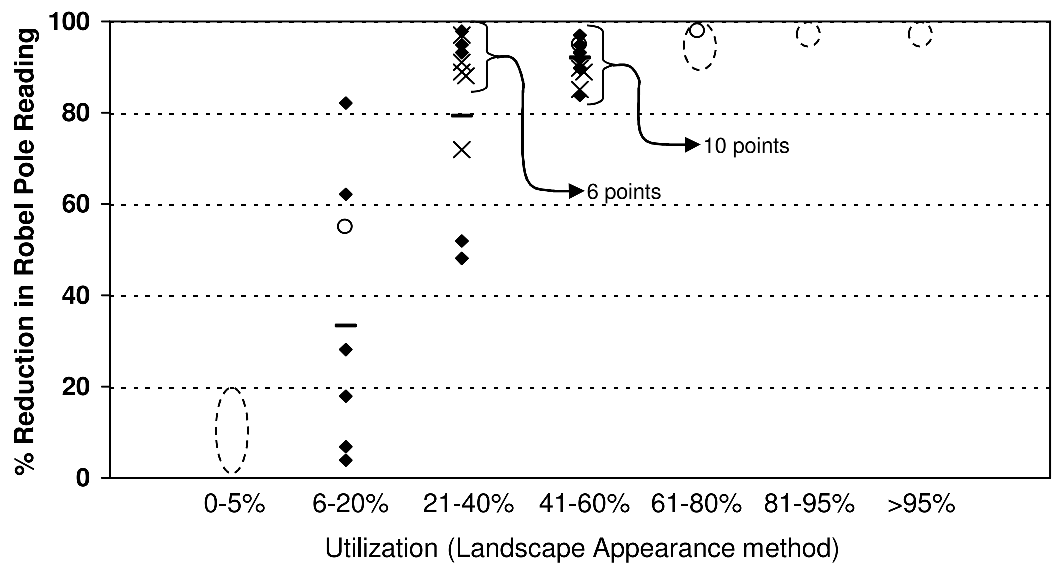

Figure 7. Percent reduction in 1m Robel pole readings in smooth brome (x's), mixed-species moist-meadow communities, including redtop sites (diamonds), and sedge (o's). Dashes = averages for moist meadow sites. Dashed ovals and circles show where data points would be expected. (From DeLong 2008)

Similarly, an estimated 17-52% of plant height contributing to cover would be retained by retaining 70% of the dry weight of plants assessed by Kinney and Glary (1994).

- Assuming recalibration at the 1-inch mark, retention of 70% of total herbaceous vegetation retains an estimated 30-60% of the biomass of the plant material that contributes to cover (Table 9). For wildlife species for which the lowest 1½-2 inches of plants do not contribute any meaningful cover, a lesser amount of cover would remain at this retention level.
- Assuming recalibration at the 3-inch mark, retention of 70% of total herbaceous vegetation only retains an estimated 0-45% of the biomass of the plant material that contributes to cover (Table 9). The lower end of this range may not be applicable because it is for plant species with tall seedstalks and relatively short leaf tufts (e.g., tufted hairgrass), which may not be used by ducks even when ungrazed (thus, a more pertinent range may be 30-45% for grasses with taller leaf tufts).

60-69% of Annual Production Retained

At 31-40% utilization (60-69% of annual production retained), wildlife cover likely is reduced by a moderate amount to nearly gone for most wildlife species, relative to ungrazed conditions. Characteristics of tall, dense herbaceous vegetation are noticeably reduced and are disappearing at the lower end of the range (closer to 60% retention) and, therefore, cover attributes may no longer be suitable for most wildlife that depend on or favor tall, dense herbaceous vegetation (the same pattern would be true where moderately-tall, moderately-dense vegetation is produced). Note, however, that some of the characteristics of tall, dense vegetation are retained to some extent at the upper end of the range (closer to 70% retention). The basis for this assessment is outlined in the following paragraphs.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Moderate to Moderately High
Large majority of dependant species	Low to Moderate
Species most dependent on tall, dense herb. vegetation	Low

If livestock progressively reduced the height of all vegetation consistently and if grazing did not result in trampling effects, 40% utilization (60% of annual production retained) would result in a 60-85% reduction in herbaceous height, based grass and sedge species assessed by Kinney and Glary (1994) or a 75-91% (average of 84%) reduction based on grasses assessed in BLM et al. (1999:118) (Figure 3e, Figures 4a-d). For tall sedge species (closer to a 60% reduction in height, rather than 85%), height and structure remain at this level of grazing, albeit reduced considerably, except that bent-over and matted sedges at this level of grazing would contribute to lesser cover qualities. This may be sufficient to provide cover for some species using sedge habitats, but it is not sufficient for other species (Figures 4a-d, Table 7). For redtop and other tall grasses, height and structure appear to be at or near the margin of not providing wildlife cover, especially when considering the effects of bent-over and matted vegetation at this level of grazing pressure. In many cases, cover would not appear to be suitable for many wildlife species.

This paragraph and the following paragraph recognize the patchiness of grazing. According to BLM et al. (2008:27), grazing has become definitively patchy when utilization reaches 30-40%

(see Figures 1c-d and 2c-d). At an average of 40% utilization on a given site (60% of annual production retained), it is possible that sufficient cover is still within the range of suitability for some species. However, it is likely there is enough basal area of plants near ground level and enough plants bent over and matted to move the site outside the realms of providing suitable herbaceous cover for most other species. Up to about 35-40% utilization, openings created by grazing appear to represent <50% of the site; i.e., ≤50% of a site consists of heavily grazed patches and ≥50% of the site consists of herbaceous vegetation with at least some height to it, much of these less-grazed patches having >80% of annual production retained (Table 8). Trampling effects (e.g., bent-over, broken, and matted vegetation) would reduce wildlife cover further. Where moderate-tall, dense herbaceous vegetation was or is produced, 40% utilization would be sufficient for vegetation to no longer provide moderate to tall, dense cover (McKinney 1997, DeLong 2009, and characterization in this sub-section).

Applicable results of my pilot study on the relationship between wildlife cover and forage utilization were presented in the last paragraph of the "70% of Annual Production Retained" subsection, above. Utilization levels approaching 40% likely approach the upper ends of the identified ranges of 50-100% reduction in Robel Pole readings and 30-90% reduction in the number of dots obscured in the cover disk, compared to pre-grazing readings (Figures 6, 7, and 8a). As compared to percentages presented in previous paragraphs, these reductions factor in trampling effects, which can have substantial effects on wildlife cover attributes.

To account for plant material near ground level that does not contribute to wildlife cover, the following "recalibrations" provide additional information to consider (see explanation in the "*80-94% of Annual Production Retained*" discussion, above):

- Assuming recalibration at the 1-inch mark, retention of 60% of total herbaceous vegetation retains an estimated 5-23% (average of 14%) of the plant height that contributes to cover, based on the height-weight curves of BLM et al. (1999:118). Similarly, an estimated 11-38% of plant height contributing to cover would be retained by retaining 60% of the dry weight of plants assessed by Kinney and Glary (1994).
- Assuming recalibration at the 1-inch mark, retention of 60% of total herbaceous vegetation retains an estimated 20-50% of the biomass of the plant material that contributes to cover (Table 9). For wildlife species for which the lowest 1½-2 inches of plants do not contribute any meaningful cover, a lesser amount of cover would remain at this retention level.
- Assuming recalibration at the 3-inch mark, retention of 60% of total herbaceous vegetation only retains an estimated 0-35% of the biomass of the plant material that contributes to cover (Table 9). The lower end of this range may not be applicable because it is for plant species with tall seedstalks and relatively short leaf tufts (e.g., tufted hairgrass), which may not be used by ducks even when ungrazed (thus, a more pertinent range may be 20-35% for grasses with taller leaf tufts).

Patches created by grazing is a natural part of the landscape, but in deciding whether additional patches created by livestock grazing is beneficial to wildlife consideration needs to be given to the factors discussed in Principles A.2 and B.2, and the "Herbivory: Natural Range of Variability" section after the discussion of principles. Where bison occasionally grazed in the area now encompassed by the Greys River Ranger District, a larger number of grazed patches

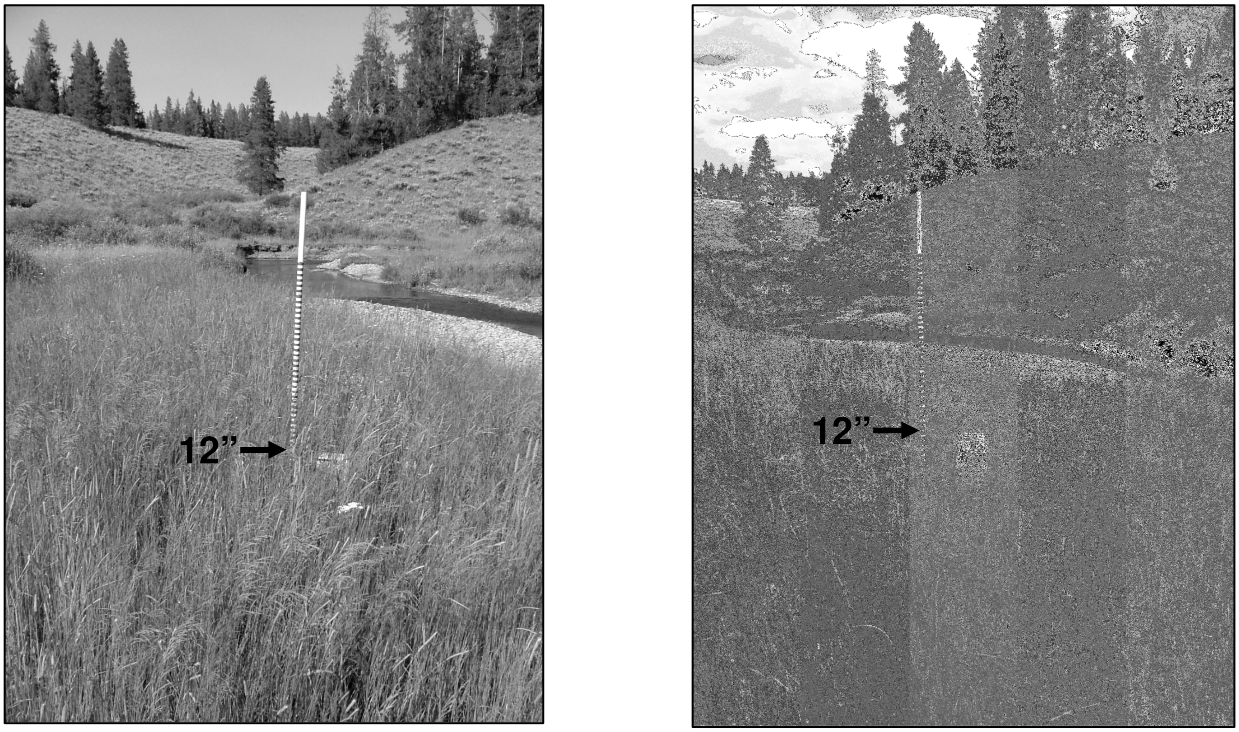

Figure 8a. Example of a change in vegetation height and density (pre- and post-grazing) when grazed at an estimated 21-40% utilization of herbaceous vegetation using the landscape appearance method. Dominant vegetation is redtop and timothy, South Fork of Little Greys River, Greys River Ranger District, 2008.

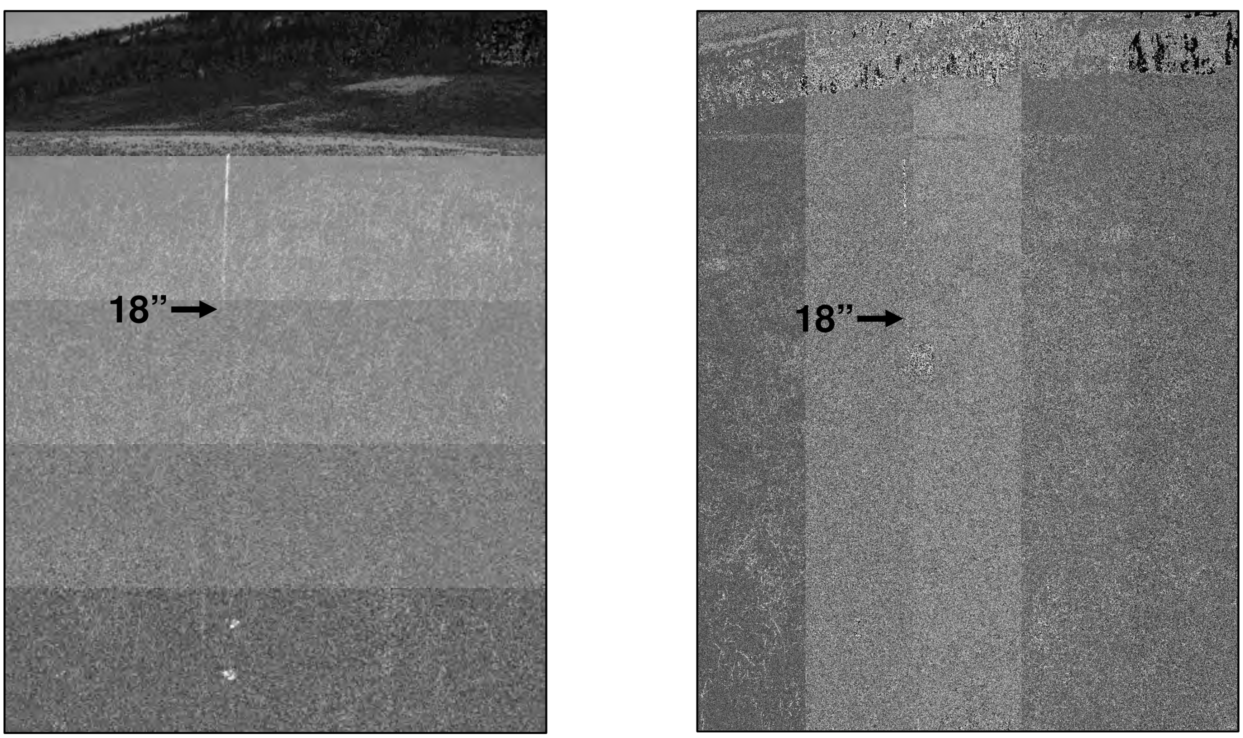

Figure 8b. Example of a change in vegetation height and density (pre- and post-grazing) when grazed at an estimated 41-60% utilization of herbaceous vegetation using the landscape appearance method. A moist meadow community dominanted by sedges and tufted hairgrass, McCain Meadow, Greys River Ranger District, 2008.

were undoubtedly created than are being created by the native compliment of native herbivores, but the extent of this was probably fairly limited across the district.

50-59% of Annual Production Retained

At 41-50% utilization, wildlife cover likely is nearly gone for most wildlife species, relative to ungrazed conditions, wildlife cover may no longer exist for some species (i.e., cover is either at the low end of suitability or it is no longer suitable for most dependent species). Characteristics of tall, dense herbaceous vegetation are gone or nearly gone at the low end of the range (50% retention) and, therefore, cover attributes are not suitable for wildlife that depend on or favor tall, dense herbaceous vegetation (the same pattern would be true where moderately-tall, moderately-dense vegetation is produced). The basis for this assessment is outlined below.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Moderate
Large majority of dependant species	Low
Species most dependent on tall, dense herb. vegetation	None

If livestock progressively reduced the height of all vegetation consistently and if grazing did not result in trampling effects, 50% utilization (50% of annual production retained) would result in an estimated 65-90% reduction in herbaceous height, based on grass and sedge species assessed by Kinney and Glary (1994) or a 84-95% (average of 89%) reduction based on grasses assessed in BLM et al. (1999:118) (Figure 3f, Figures 4a-d). For tall sedge species (closer to a 65-70% reduction in height, rather than 90%), height and structure remain at this level of grazing (similar to the 60%-retained category), except that bent-over and matted sedges at this level of grazing would contribute to lesser cover qualities — moreso than at the 60%-retained category. These conditions may be sufficient to provide cover for some species using sedge habitats, but there is little indication that it would be sufficient for most species (Figures 4a-d, Table 7). For redtop and other tall grasses, height and structure appear to be at the margin of not providing wildlife cover, especially when considering the effects of bent-over and matted vegetation at this level of grazing pressure. In many cases, cover would not appear to be suitable for many wildlife species.

This paragraph and the following two paragraphs recognize the patchiness of grazing. Beyond approximately 40% utilization, patches of grazed plants shifts to patches of ungrazed/lightly grazed plants, which is illustrated in Figures 1d-e and 2d-e and is consistent with BLM et al. (1999:120) and BLM et al. (2008:27). At 40-60% utilization, BLM (2008:27) states that "The rangeland appears entirely covered as uniformly as natural features and facilitaties allow." At least at the lower end of this range (e.g., 40-50% utilization), microsites of taller herbaceous vegetation remain, but they may be small, especially when considering the amount of bent over, broken, and matted herbaceous vegetation that occurs at this level of grazing (Table 8; Figure 2). Where dense shrubs protect underlying herbaceous vegetation, these may provide microsites of wildlife cover for some species, but at the density of shrub cover required to protect enough herbaceous vegetation to retain effective cover, the shrub itself likely provides sufficient cover for those wildlife species that would use this type of microsite.

McKinney (1991) assessed that 50% utilization on a given site would result in a large proportion of the basal area of plants on the site being grazed down to near-ground level (comparable to 70% utilization on an individual plant). He presented the following as one possible scenario:

70% utilization of 6 of 10 plants and 50%, 30%, 10%, and 0% utilization each of the remaining 4 plants, for an average of 52% utilization (right shaded column in Table 8). This scenario resulted in about 70% of the basal area being grazed to near-ground level and about 30% of the basal area being grazed to less than 10% utilization.

In my pilot study on the relationship between wildlife cover and forage utilization, 40-60% utilization (40-60% retained) resulted in major changes in wildlife cover qualities, compared to ungrazed conditions (Figures 6, 7, and 8b) (DeLong 2008). There was a 70-90% reduction in Robel pole readings at 4-meters and a 80-100% reduction in Robel pole readins at 1-meter, and in a limited sample, there was a 50-90% reduction in the number of dots obscured in the cover disk, compared to pre-grazing readings.

To account for plant material near ground level that does not contribute to wildlife cover, the following "recalibrations" provide additional information to consider (see explanation in the "*80-94% of Annual Production Retained*" discussion, above):

- Assuming recalibration at the 1-inch mark, retention of 50% of total herbaceous vegetation retains an estimated 2-13% (average of 7%) of the plant height that contributes to cover, based on the height-weight curves of BLM et al. (1999:118). Similarly, an estimated 5-33% of plant height contributing to cover would be retained by retaining 60% of the dry weight of plants assessed by Kinney and Glary (1994).
- Assuming recalibration at the 1-inch mark, retention of 50% of total herbaceous vegetation retains an estimated 10-40% of the biomass of the plant material that contributes to cover (Table 9). For wildlife species for which the lowest 1½-2 inches of plants do not contribute any meaningful cover, a lesser amount of cover would remain at this retention level. For both the 1-inch and 1½ -2 inch marks, cover qualities would be reduced by a major amount (i.e., very little if any meaningful cover would remain).
- Assuming recalibration at the 3-inch mark, retention of 50% of total herbaceous vegetation only retains an estimated 0-25% of the biomass of the plant material that contributes to cover (Table 9), or roughly 10-25% retention for grasses with taller leaf tufts (i.e., virtually no meaningful cover remains).

Patches created by grazing is a natural part of the landscape (see "*60-69% of Annual Production Retained*," above).

40-49% of Annual Production Retained

At 51-60% utilization, suitable wildlife no longer exist for most if not all dependent wildlife species (Figures 1f, 2f, and 8b). Characteristics of tall, dense herbaceous vegetation are gone at this level of retention and, therefore, cover attributes are not suitable for wildlife that depend on or favor tall, dense or moderately-tall, moderately-dense herbaceous vegetation.

<u>Suitable Wildlife Cover Provided for</u>:	<u>Level of Confidence</u>
At least some dependent species	Low
Large majority of dependant species	None
Species most dependent on tall, dense herb. vegetation	None

The basis for these assessments is an extension of the previous subsection, as well as information provided in the next section.

To account for plant material near ground level that does not contribute to wildlife cover, the following "recalibrations" provide additional information to consider (see explanation in the "*80-94% of Annual Production Retained*" discussion, above):

- Assuming recalibration at the 1-inch mark, retention of 40% of total herbaceous vegetation retains an estimated 0-8% of the plant height that contributes to cover, based on the height-weight curves of BLM et al. (1999:118). Similarly, an estimated 2-20% of plant height contributing to cover would be retained by retaining 40% of the dry weight of plants assessed by Kinney and Glary (1994).
- Assuming recalibration at the 1-inch mark, retention of 40% of total herbaceous vegetation retains an estimated 0-30% of the biomass of the plant material that contributes to cover (Table 9); for many plant communities, no to virtually no cover remains if grazed to a homogenous height. There is no indication any plant communities would provide suitable cover for any wildlife species (Figures 4a-d, Table 7).
- Assuming recalibration at the 3-inch mark, retention of 40% of total herbaceous vegetation only retains an estimated 0-15% of the biomass of the plant material that contributes to cover; i.e., virtually no meaningful cover remains (Table 9).

The existing maximum forage utilization standard (Forest Plan) for satisfactory riparian areas is 65% of key forage species, or an estimated 45-55% retention of herbaceous vegetation (Table 4).

Heavily grazed areas created by grazing is a natural part of the landscape, but in deciding whether additional patches created by livestock grazing is beneficial to wildlife consideration needs to be given to the factors discussed in Principles A.2 and B.2, and the "Herbivory: Natural Range of Variability" section after the discussion of principles. Where bison occasionally grazed in the area now encompassed by the Greys River Ranger District, a larger number of heavily grazed areas were undoubtedly created than are being created by the native compliment of native herbivores today, but the extent of this was probably fairly limited across the district and they likely were not created every year in the same place.

<40% of Annual Production Retained

At >61% utilization, few if any microsites of herbaceous cover remain and herbaceous wildlife cover has been eliminated for most wildlife species that depend on or favor tall, dense or moderately-tall, moderately-dense herbaceous vegetation, relative to ungrazed conditions (Figures 1f-g and 2f-g). The basis for the following assessment is outlined below.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Low to None
Large majority of dependant species	None
Species most dependent on tall, dense herb. vegetation	None

If livestock progressively reduced the height of all vegetation consistently and if grazing did not result in trampling effects, 61-70% utilization (30-39% of annual production retained) would result in an estimated 76-93% reduction in herbaceous height, based grass and sedge species assessed by Kinney and Glary (1994) (Figures 4a-d and Figure 5) or a 89-97% (average of 93% for 61% utilization and average of 96% for 70% utilization) reduction based on grasses assessed in BLM et al. (1999:118).

To account for plant material near ground level that does not contribute to wildlife cover, the following "recalibrations" provide additional information to consider (see explanation in the "*80-94% of Annual Production Retained*" discussion, above):

- Assuming recalibration at the 1-inch mark, retention of 30% of total herbaceous vegetation retains an estimated 0-4% of the plant height that contributes to cover, based on the height-weight curves of BLM et al. (1999:118). Similarly, an estimated 0-14% of plant height contributing to cover would be retained by retaining 30% of the dry weight of plants assessed by Kinney and Glary (1994).
- Assuming recalibration at the 1-inch mark, retention of 30% of total herbaceous vegetation retains an estimated 0-20% of the biomass of the plant material that contributes to cover (Table 9); for most plant communities, no cover would remain if grazed to a homogenous height. There is no indication any plant communities would provide suitable cover for any wildlife species (Figures 4a-d, Table 7).
- Assuming recalibration at the 3-inch mark, retention of 30% of total herbaceous vegetation would not retain any cover (Table 9).

At 61-80% utilization, BLM (2008:27) states "The rangeland has the appearance of complete search. Herbaceous species are almost completely utilized." If any microsites remain, they would not provide effective wildlife cover for most, if not all, species. Where dense shrubs protect underlying herbaceous vegetation, these may provide microsites of wildlife cover for some species, but at the density of shrub cover required to protect enough herbaceous vegetation to retain effective cover, the shrub itself likely provides sufficient cover for those wildlife species that would use this type of microsite.

Only one of the sample sites in my pilot study was grazed at 61-80% utilization, grazing resulted in an approximate 90-98% reduction in Robel pole readings at 4-meters and 1-meter and in the number of dots obscured in the cover disk, compared to pre-grazing readings (Figures 6 and 7) (DeLong 2008). It is anticipated that a larger sample size would yield similar results at this grazing intensity.

Small areas of heavily to severely grazed areas created by grazing is a natural part of the landscape (see "*40-49% of Annual Production Retained*," above).

Minimum Stubble Height along the Green-line

The main purpose of this assessment of stubble heights is to evaluate the range of minimum stubble height standards recommended in the published literature (4-6 inches) with respect to retaining forage and cover for wildlife. While herbaceous vegetation along streambanks is important to a variety of wildlife species, habitat on streambanks is two-dimensional even though it is linear and narrow. In contrast, stubble height standards typically are applied to the green-line, which is one-dimensional.

I chose not to evaluate a range of stubble heights in detail because forage utilization standards for riparian areas would apply along water courses outside of the narrow green-line and these standards, if they incorporate wildlife habitat needs, would be more restrictive than the most conservative recommended minimum stubble height in the literature. As revealed in the following assessmen, application of these stubble height recommendations would not be sufficient to retain an adequate amount of suitable forage and cover for wildlife in many cases on the district. Again, this is not a big issue because stubble heights along the green-line would safe-guard the streambank and forage utilization standards applied to all other parts of the riparian zone would retain suitable forage and cover for wildlife.

One limitation of stubble heights is that it does not account for the large variability of starting, pre-grazing heights of sedges and grasses. To adequately account for wildlife habitat needs, minimum stubble height standards would need to be developed for the upper height class, but this could result in major restrictions on livestock grazing use in areas where sedges and grasses are shorter.

In the following assessment, I focus mostly on 6-inch and 4-inch stubble heights, but also assess other stubble heights to a limited degree.

6-Inch Stubble Height on Streambanks – Sedges

Suitability of wildlife cover provided by a minimum 6-inch stubble height on streambanks depends on ungrazed heights of sedge communities, location and size/shape of communities, among other factors. It also depends on whether the minimum stubble height is a minimum average or an absolute minimum. Protocol for measuring stubble height (e.g., whether the length of flattened, but attached and live sedge leaves are measured as height).

Two scenarios are provided below.

The first scenario is of a sedge community that is either grazed down to a homogeneous height of 6 inches, or heights are somewhat variable but average 6 inches. This is the “minimum average” scenario. The basis for the following assessment, which assumes that most ungrazed streamside sedges on the district are closer in height to 10-15 inches than 20-24, is outlined below. For the communities at or near 20-24 inches tall, the assessment would be Moderate, Low, and None, respectively.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Low to Moderately High
Large majority of dependant species	Low to Moderate
Species most dependent on tall, dense herb. vegetation	None to Low

Wildlife cover would be reduced somewhat (where ungrazed heights are 10-15 inches), but would still provide some cover for a range of wildlife species that use these communities. In one study in Idaho, a 6-inch stubble height of sedges and grasses was comparable to retaining approximately 68-76% of the annual production (Clary 1988 (unpublished data), as cited in Clary and Webster 1989), but information on the proportion of sedges and grasses, species composition, and initial plant heights were not provided. Information in Kinney and Glary (1994) suggest that pre-grazed heights were about 10 inches or less. Based on information provided in Kinney and Glary (1994), retaining a homogenous or average 6-inch stubble height in a sedge community that was 10-15 inches prior to grazing would be comparable to retaining 55-70% of the annual production (or, 30-45% utilization). Overall height of the community would be reduced by an estimated 40-60% (Table 7, Figure 5).

A patch of sedges with an average ungrazed height of 20-24 that is grazed down to an average of 6 inches would retain little if any of its wildlife-cover attributes (Table 7, Figure 4c) because (1) the height of the community would be reduced by roughly 70-75%; (2) only about 40-50% of the annual production would be retained (50-60% utilization); and (3) a considerable amount of bent-over, broken, and matted vegetation would result at this level of utilization, especially in wet environments, which would reduce cover attributes further than what is assessed in Table 7.

The second scenario is of a sedge community in which grazing results in some sedge plants remaining ungrazed or nearly as tall as ungrazed heights, some plants being being or just over 6 inches, and some plants with intermediate heights, but in which no more than a small proportion (e.g., <5-10%) of sedges are grazed to less than 6 inches tall. This is the "absolute minimum" scenario. The basis for the following assessment is outlined below. The assessment assumes that most ungrazed streamside sedges on the district are closer in height to 10-15 inches than 20-24.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	High
Large majority of dependant species	Moderate to Moderately High
Species most dependent on tall, dense herb. vegetation	Moderate

This scenario would result in 15-30% utilization or less, assuming ungrazed heights of 10-15 inches. An allowance for a small percentage of plants grazed below 6 inches is justified because it would not be possible to graze a sedge community without at least some sedge plants being grazed below 6 inches, and there would need to be some accommodation for this level of utilization.

A minimum average 6-inch stubble height is at the upper end of the range of "proper use" recommendations of Clary and Webster (1990) and Clary and Leninger (2000) for graminoids on streambanks. Holechek et al. (2004) recommended a range of 3-5 inches. These recommendations only deal with stream channel and riparian functioning, and do not address wildlife cover needs.

4-Inch Stubble Height on Streambanks – Sedges

A patch of sedges grazed down to a homogenous height of 4 inches would not provide any cover for most species of wildlife that use sedge communities, assuming heights on the Greys River Ranger District of 10-15 inches, and up to as tall as 20-24 inches. An average 4-inch stubble height would not be considerably different, since any micro-sites of greater than 4 inches would be offset by microsites less than 4 inches. Vegetation very much taller than 4 inches would be scant because the shortest plants couldn't be very much shorter than 1 inch and it only takes a 7-inch tall plant to average out a 1-inch plant. The assumptions identified for the 6-inch stubble height similarly apply for following assessment (level of confidence).

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Low to Moderate
Large majority of dependant species	Low
Species most dependent on tall, dense herb. vegetation	None

A 4-inch stubble height would be comparable to retaining an estimated 30-63% of the annual production of sedges. In the Idaho study, a 4-inch stubble height of sedges and grasses was comparable to retaining approximately 56-63% of the annual production (Clary 1988 (unpublished data), as cited in Clary and Webster 1989). Based on ungrazed heights of sedges commonly found on streambanks on the Little Greys cattle allotment (e.g., 10-15 inches), information in Kinney and Glary (1994) suggest that a homogeneous 4-inch stubble height on sedges would result in about 40-50% of the annual production of sedges being retained (Table 7). Figures 3e-f would be comparable illustrations, given differences between bunchgrasses and sedges (sedges tend to retain somewhat more height relative to utilization; see Figure 4c). Where sedges grow to 20-24 inches, as little as 30% of the annual production would be retained (comparable to Figure 3g). Overall height would decline an estimated 60-83% (Table 7).

A minimum average 4-inch stubble height is above the recommendation by Hall and Bryant (1995) and is within the range recommended by Clary and Leninger (2000) and Holechek et al. (2004) for sedges and riparian grasses on streambanks. These recommendations only deal with stream channel and riparian functioning, and do not address wildlife cover needs.

4-Inch Stubble Height on Streambanks - Grasses

Based on typical heights of redtop found on moist, productive sites on the Greys River Ranger District (e.g., 24-36 inches), information in Kinney and Glary (1994) suggests that a 4-inch stubble height would be comparable to retaining only 30-40% of its annual production (Table 7). The percent of the annual production of all grasses combined would be higher than this at a minimum 4-inch stubble height because (1) redtop is one of the taller grass species that occurs on streambanks — and the only one studied in Kinney and Glary (1994), and (2) there would be a range of heights from 4 inches (at the low end) possibly up to ungrazed heights (at the high end). Clary (1995) suggested that a 2-inch stubble height for redtop would be sufficient to sustain plant health, but this clearly would not provide for the cover needs of wildlife using meadow habitat dominated by redtop. A 2-inch stubble height of redtop would retain only 10-55% of annual production (i.e., total utilization rate of 45-95%), assuming total plant height of 24-36 (Table 7).

Other Stubble Heights on Streambanks

Based on ungrazed heights of sedges commonly found on streambanks on cattle allotments of the Greys River Ranger District (e.g., commonly 10-15 inches in some places, but as tall as 20-24 inches in many areas that are properly functioning), information in Kinney and Glary (1994) the following retention levels are estimated for a range of average stubble heights.

Pre-grazing Height of Community	**3-inch**	**4-inch**	**6-inch**	**8-inch**	**10-inch**	**12-inch**
10-15 inches	35-45%	40-50%	55-70%	65-90%	75-100%	90-100%
20-24 inches	25-35%	30-40%	40-50%	50-65%	60-75%	70-85%
Those in Kinney & Glary 1994	25-35%	30-45%	35-60%	45-70%	55-80%	65-90%

There is no information to support the assessment that an average stubble height of 3 inches would retain suitable forage and cover for wildlife. A minimum average 3-inch stubble height was recommended by Hall and Bryant (1995) as a minimum stubble height for graminoids on streambanks. It is at the lower end of the range of recommendations of Clary and Leninger (2000) and Holechek et al. (2004) for graminoids on streambanks. These recommendations only deal with stream channel and riparian functioning, and do not address wildlife cover needs.

A minimum average 8-inch stubble height, if applied across wet meadow and moist meadow communities, would retain cover for a range of wildlife species where the ungrazed height of sedges is 10-15 inches, but it would not be sufficient in communities as tall as 20-24 inches. At pre-grazing heights of 20-24 inches, height would be reduced by about 60-67% and only about 50-65% of the annual production would be retained (Table 7). A minimum average 8-inch stubble height is higher than the range recommended by Hall and Bryant (1995), Clary and Leninger (2000), and Holechek et al. (2004) for sedges and riparian grasses on streambanks. However, Fraser (2003) recommended as high as a minimum average 8-inch stubble height on streambank sedges. All of these recommendations only deal with stream channel and riparian functioning, and do not address wildlife cover needs.

At minimum average stubble heights of 10-12 inches, only minimal grazing would occur in sedge communities of 10-15 inches, leaving considerable cover qualities. In communties of 20-24 inches, average stubble heights of 10-12 inch would retain some cover qualities for many species, but possibly not enough for species most dependent on tall, dense sedge vegetation.

Temporal Perspectives and Possible Use of Livestock Grazing to Manage Wildlife Cover

A related issue is deferred-rotation livestock grazing. While the previous paragraphs discussed herbaceous height in spatial terms, deferred-rotation livestock grazing addresses herbaceous height in temporal terms. For example, herbaceous vegetation on a particular site early in one season may not contribute to suitable wildlife cover, but herbaceous vegetation on the same site may provide suitable wildlife cover early in the season for the next year or two as a consequence of deferring cattle grazing.

A combination of deferred-rotation livestock grazing and patchiness of herbaceous vegetation height within pastures may allow an adequate amount of suitable herbaceous cover to be retained for native wildlife communities even if the average stubble height is somewhat less than suitable. With this in mind, Table 7 provides another source of information in formulating stubble height standards in riparian and moist meadow communities.

Amount of Wildlife Cover Retained in Rangeland Habitats

The principles and habitat-livestock relationships described above for moist and wet meadows, apply as well to rangeland habitats, except that herbaceous communities and understories dominated by bunchgrasses have inherent patchiness at small scales prior to the onset of livestock grazing. The discussion in the "Big Sagebrush-Grass and Mountain Shrubland-Grass Habitats" subsection was divided according to utilization categories of the landscape appearance method. A different approach was used for the "Forb-Dominated Communities and Understories" subsection, in recognition of the way in which utilization by domestic sheep is monitored and recognizing the greater variability in health and functionality of rangelands on sheep allotments.

Big Sagebrush-Grass and Mountain Shrubland-Grass Habitats

To translate height of graminoids to wildlife-cover qualities and to characterize the amount of cover remaining after different levels of herbaceous vegetation removal, I primarily relied on information provided in the clipping studies conducted by Heady (1950). He provided detailed information on height-weight relationships of five bunchgrasses, which I summarized in Table 10 and used to estimate amount of herbaceous wildlife cover retained at different levels of grazing. After discussing results of clipping studies, I incorporate the realities of grazing behavior of livestock, which creates different herbaceous structure than clipping, as discussed and illustrated by McKinney (1997). Assessing cover qualities of understory vegetation in big sagebrush and other shrubland communities is further complicated by the clumpiness of vegetation (e.g., bunchgrasses and bushes vs. relatively more even distribution and density of plants in meadow situations). Nonetheless, at least a general assessment is needed to meet Forest Plan direction on retaining an adequate amount of suitable cover in areas grazed by livestock.

Table 10. Height of 5 bunchgrasses and Kentucky bluegrass (in inches) at different percentages of biomass of plants retained, based on information in Heady (1950; bunchgrasses) and Kinney and Glary (1994; Kentucky bluegrass), two clipping studies. 100% retained equates to ungrazed plants, 90% retained equates to 10% of biomass (by dry weight) removed. Shaded indicate approximate leaf-tuft heights when ungrazed based on proportions in Appendix B.

	Ungrazed Height		**Percent Retained (by Dry Weight)**						
Plant Species	**Total**	***Leaf Tuft***	**90%**	**80%**	**70%**	**60%**	**50%**	**40%**	**30%**
Bluebunch wheatgrass	16-28	*8-18*	9½-17	8-13½	7-11	6-9	5-7½	4-6	3-5
Needle-and-thread grass	21-31	*7-10*	11-18	8-14	6½-10	5-8	4-6½	3-5	2-3½
Green needlegrass	11-23	*3½-8*	6-11	5½-8	4½-6½	3-5	2-4	1½-3	1-2½
Idaho fescue	13-19	*5-10*	6-11	4-6	2½-4½	2-3½	1½-2½	1-2	1-1½
Prairie junegrass	7-18	*2½-9*	4-9	3-6	2½-4	2-3	1½-2½	1-2	1-1½
Kentucky bluegrass	9-31	*3-12*	6-22	4-14	3-10	2-7	1½-5½	—	<1-3
	(dark shading)	= plant height for many plants is likely at or near the leaft tuft height							
	(light shading)	= plant height is at or near the leaft tuft height for a small number of plants							

Using illustrations developed by McKinney (1997), BLM et al. (2008:52) illustrated forage utilization on a plant-by-plant basis in two ways: "even" utilization and "uneven" utilization[C]. In even utilization, a cow takes one or multiple bites from the top of the plant, evenly working their way down the plant. Uneven utilization involves grazing of different parts of a plant to different degrees, typically a major reduction in height of part of a plant while part of the plant remains at or near the ungrazed height. McKinney (1997:4) put it well: "when Bossy visits a tasty bunchgrass plant she puts her mouth down next to the ground, gives the head a little tilt, and ropes the whole plant in with her tongue at about *Heavy Munch* on the old chart" (in his paper, heavy munch is 60-80% utilization of a given plant; i.e., a mid-point of 70% utilization). Uneven utilization based on this reality of grazing behavior involves a cow wrapping its tongue around a part of a plant and grazing this part of the basal area of the plant at ~70%, resulting in an average utilization level for the plant that is <70%, depending on how much of the basal area remains ungrazed (Table 11).

[C] BLM et al. (2008:52) did not define utilization on a site-by-site or area-by-area basis even though this is how utilization is managed. They defined it on a plant-by-plant basis, yet utilization is measured and estimated elsewhere in the document on a site-by-site basis.

I begin with assessments of how different retention levels for individual plants (assuming even utilization) affects the ability of these plants to contribute to wildlife cover. Afterward, I assess wildlife cover provided at several categories of retention recognizing uneven utilization.

In each of the following paragraphs (bullets), I characterize the contributions that each of several bunchgrass species make to wildlife cover at each of several even retention levels, based on information in Heady (1950). I used his weight-height information in tables and graphs to develop Table 10, and I estimated leaf tuft heights based on proportions in Appendix B. Thus assessments pertaining to leaf tufts are approximations. In the following assessments, I focus on relative changes in structural attributes and in visual obstruction, and did not attempt to differentiate among effects on different wildlife species because this is covered in "Cover Requirements of Individual Species," later in the report. Height of plants declines quickly during the initial removal of 10-15% of their dry weight (Table 10), and, for most species, contributions to visual obstruction decline most between about 20% and 40% utilization.

Table 11. A sampling of percent basal area that is grazed to near ground level at a range of average utilization levels (AFUs calculated in Table 8) at the site level. All figures are based on mid-points in the left-most column (Util.), and they assume that all bites taken by cattle are near ground level (no skimming, topping), as discussed and illustrated in McKinney (1997) and as illustrated in BLM et al. (2008:52). Therefore, the percent basal area with herbaceous vegetation height near ground level (Basal A NGL) equates to the maximum basal area of vegetation height near ground level that can possibly result from each average utilization level (AFU). Shaded columns are the same as those in Table 8.

Util.[A]	**Percent of Basal Area of Plants in a Small Area that is Near Ground Level (comparable to ~70% utilization)**																			
0-5%	≤2	≤2	≤1	≤1	≤1	≤2	≤1	≤1	<1	≤1	<1	<1	<1	<1	<1	<1	0	0	0	0
6-20%	8	6	6	4	3	0	4	3	3	2	4	2	3	3	2	2	2	0	0	0
21-40%	4	2	4	7	4	0	4	4	7	0	4	4	7	7	4	4	4	4	0	0
41-60%	0	4	7	7	7	0	7	11	11	0	7	14	14	14	7	7	7	7	7	0
61-80%	0	10	10	15	20	40	30	30	30	50	40	35	35	40	50	60	70	80	80	80
81-95%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	20
Basal A NGL[B]	*14*	*24*	*28*	*34*	*35*	*42*	*46*	*49*	*52*	*53*	*56*	*56*	*60*	*65*	*64*	*74*	*83*	*91*	*97*	*100*
Basal A AGL[C]	*86*	*76*	*72*	*66*	*65*	*58*	*54*	*51*	*48*	*47*	*44*	*44*	*40*	*35*	*36*	*26*	*17*	*9*	*3*	*0*
AFU[D]	**8**	**16**	**20**	**24**	**25**	**29**	**32**	**35**	**36**	**38**	**39**	**40**	**42**	**45**	**45**	**52**	**54**	**60**	**70**	**74**
APR[E]	**92**	**84**	**80**	**76**	**75**	**71**	**68**	**65**	**64**	**62**	**61**	**60**	**58**	**55**	**55**	**48**	**46**	**40**	**30**	**26**
Crit.[F]	Skimmed, slightly used.			Topped, skimmed, or grazed in patches, 60-80% of seedstalks remain intact									Grazed fairly uniformly (patches of standing grass may remain), 15-25% of seedheads remain						Complete search, <10% seedstalks	
Cat.[G]	**6-20%**			**21-40%**									**41-60%**						**61-80%**	

[A] Mid-points of forage utilization, on a plant-by-plant basis (same categories as used in Landscape Appearance method).
[B] Basal Area Near Ground Level (see McKinney 1997, i.e., "nubbed off close"). This refers to the basal area of plants that are grazed to near ground level. For many grazed plants on a given site that has been grazed by cattle, the entire basal area is at "near ground level," which equates to 60-80% utilization. For other plants, only part of the basal area of the plant is grazed near ground level, meaning that utilization of the plant is something less than 60-80%, depending how large the bite is.
[C] Basal Area Above Ground Level. This equates to retained vegetation above the lowest possible bite mark. It can vary in height from a few inches above ground to the full height of the ungrazed plant.
[D] Average Forage Utilization, based on averaging mid-points within each column of Table 8.
[E] Average Percent of the annual production Retained, from Table 8.
[F] Relevant criteria for assigning forage utilization categories under the Landscape Appearance method.
[G] Forage utilization categories at small scales (e.g., transect), based on the Landscape Appearance method (BLM et al. 1999, BLM et al. 2008).

Herbaceous vegetation that is within approximately 1.5-2 inches of the ground contributes little to wildlife cover (e.g., for ground-nesting passerines, small mammals, frogs) and, therefore, changes that have the most effects on wildlife cover are those that happen above about 2 inches.

- At 95-100% of the annual production retained, there is no measurable reduction in the contribution to wildlife cover.
- With 80-94% of the annual production retained, most mature plants would continue to contribute substantively to wildlife cover. Clipping the uppermost 10% of the dry-weight of each of several bunchgrass species in Heady's (1950) study reduced plant height by about 40-55%, but it did not appear to eat into the leaf tuft height (it mostly involved the removal of seedheads and associated stalks, which is consistent with McKinney 1997). At this level of clipping, plants would clearly continue to contribute to wildlife cover, although removal of seedheads and much of the associated stalk reduces visual obstruction to a small extent.

  Clipping the uppermost 20% of the dry-weight of each plant in Heady's (1950) study reduced plant height by about 50-70% (Table 10), and began to reduce leaf tuft heights in some species (e.g., by as much as an estimated 25-40%). In some species, clipping the uppermost 20% of the dry-weight did not appear to begin to affect leaf tuft height (e.g., Green needlegrass). At this level of clipping, plants would continue to contribute to wildlife cover, although removal of seedheads and associated stalks and removal of the very top portion of leaf tufts reduces visual obstruction by a small extent.
- With 60-79% of the annual production retained, contributions of individual plants to cover would range from a small contribution to a large contribution, relative to their contribution when ungrazed. The previous paragraph summarizes the effects of a 20% reduction in dry-weight (approximating 79% retained).

  Clipping the uppermost 30% of the dry-weight of each plant in Heady's (1950) study reduced plant height by about 55-80% (Table 10), and likely reduced the leaf tuft heights in most species (e.g., by as much as an estimated 25-50%). For some individual plants of some species, clipping the uppermost 30% of the dry-weight appeared to only affect seedheads and associated stalks. Removing the uppermost 30% of the dry-weight of Idaho fescue appears to have reduced height of leaf tufts by as much as 50% or more and it reduced leaf tuft height to a point where cover provided by plants is nearly gone in many Idaho fescue plants. This is because stubble heights of 2 inches do not contribute to cover more than a negligible amount. At this level of clipping, most plants would continue to contribute to wildlife cover, but at a somewhat reduced level. The removal of seedheads and associated stalks and removal of the top portion of leaf tufts reduces visual obstruction by a small to moderate extent for most species.

  Clipping the uppermost 40% of the dry-weight of each plant in Heady's (1950) study reduced plant height by about 60-80% (Table 10), and reduced the leaf tuft heights possibly by as little as 10-15% (e.g., bluebunch wheatgrass) up to as much as 60-70% (e.g., for Idaho fescue, junegrass). At this level of clipping, some plant species (e.g., bluebunch wheatgrass, needle-and-threat grass) would continue to contribute to wildlife cover, albeit it at a moderately to considerably reduced level relative to ungrazed heights. The actual extent of reduction depends on plant species, ungrazed height of an individual plant, and the wildlife species of interest. There are virtually no contributions of Idaho fescue and junegrass plants to wildlife cover at this level of grazing.

- With 40-59% of the annual production retained, contributions of individual plants to cover would range from none to moderate contributions, relative to their contribution when ungrazed. The previous paragraph summarizes the effects of a 40% reduction in dry-weight (approximating 59% retained).

  Clipping the uppermost 50% of the dry-weight of each plant in Heady's (1950) study reduced plant height by about 70-85% (Table 10), and reduced the leaf tuft heights by an estimated 40-75%. Some plants (e.g., bluebunch wheatgrass, needle-and-threat grass) would continue to marginally contribute to wildlife cover. At this level of grazing, Idaho fescue and junegrass would not contribute to wildlife cover. Heady (1950) concluded that clipping bluebunch wheatgrass to 6 inches is too severe for the plants to maintain themselves.

  Clipping the uppermost 60% of the dry-weight of each plant in Heady's (1950) study reduced plant height by about 75-90% (Table 10), and reduced the leaf tuft heights by an estimated 50-80%. Some plants (e.g., bluebunch wheatgrass, needle-and-threat grass) would continue to marginally contribute to wildlife cover. At this level of grazing, Idaho fescue and junegrass would not contribute to wildlife cover. At this level of grazing, Idaho fescue and junegrass would not contribute to wildlife cover.

- With 20-39% of the annual production retained, there would be no contributions of individual plants to wildlife cover. The previous paragraph summarizes the effects of a 60% reduction in dry-weight (approximating 39% retained).

  Clipping the uppermost 70% of the dry-weight of each plant in Heady's (1950) study reduced plant height by about 80-90% or more (Table 10), and reduced the leaf tuft heights by an estimated 60-85%. At this level of grazing, stubble heights do not contribute to wildlife cover, except that stubble heights of bluebunch wheatgrass may contribute by a negligible amount for a small number of wildlife species for specific natural history needs.

  I did not assess cover contributions below 30% of annual production retained because it is readily apparent that no cover is provided at this level.

Kentucky bluegrass can provide cover, but the quality of cover on sites dominated by Kentucky bluegrass and other non-native species should be assessed relative to the quality of cover provided by native species that naturally had occupied those sites.

In the remainder of this subsection, I assess the extent to which wildlife cover is retained at different levels of livestock grazing in recognition of the patchiness of grazing (e.g., as recognized by Anderson and Currier 1973, Forbes 1988, Stuth 1991, Laycock 1997, and McKinney 1997).

95-100% of Annual Production Retained

At 0-5% utilization (95-100% of annual production retained), wildlife cover is at or near ungrazed conditions, providing satisfactory cover for all dependent wildlife species.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Very High
Large majority of dependant species	Very High
Species most dependent on tall, dense herb. vegetation	Very High

80-94% of Annual Production Retained

At 6-20% utilization (80-94% of annual production retained), wildlife cover is reduced to a fairly small degree, and vegetation still provides satisfactory cover for large majority of dependent wildlife species. The basis for the following assessment is outlined in the forthcoming paragraphs.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Very High
Large majority of dependant species	High
Species most dependent on tall, dense herb. vegetation	Moderately High

BLM et al. (2008:27) characterized 6-20% utilization as "The rangeland has the appearance of very light grazing. The herbaceous forage plants may be topped or slightly used." If livestock progressively reduced the height of all vegetation consistently, starting with skimming and working down from their on each plant (i.e., no plant receiving any more use than any other), 20% utilization may result in an estimated 50-70% reduction in herbaceous height on the site for species assessed by Heady (1950) (Table 10, Figure 3c), but most of the height reduction in grasses occurs at the upper stalk and seedhead (which contributes less to cover than the leaf tuft). When 80% of the annual production is retained, wildlife cover qualities would be slightly reduced to moderately reduced, depending on grass species, but cover is likely still satisfactory for most species.

The initial phase of patchiness has the potential to begin near 20% utilization on any given site (Figures 1b and 2b). For example, it is possible for as much as 25-28% of the basal area of herbaceous vegetation to be grazed near ground level (Table 11), but this may not be enough to form discernable patches. Furthermore, if more plants are topped or grazed down from the top somewhat than are grazed from the bottom, the basal area grazed to near ground level would be less than 25-28% (Figure 2b). For example, if 15% of plants on a site are topped (e.g., mid-point of 13.5% utilization) and 15% are conservatively grazed from the top (mid-point of 30.5% utilization), 10% of the basal area could be grazed near ground level (stubble height comparable to utilization of about 70%), which would leave about 60% of the basal area ungrazed.

60-79% of Annual Production Retained

At 21-40% utilization (60-79% of annual production retained), wildlife cover is reduced somewhat to a moderate amount, and vegetation still provides satisfactory cover for many wildlife species, except at the lower end of this range (i.e., when retention declines to near 60%). The basis for this is outlined in the following paragraphs.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	High
Large majority of dependant species	Moderate
Species most dependent on tall, dense herb. vegetation	Low to Moderate

There is a high probability that adequate cover is being retained for most if not all dependent wildlife species when the amount of annual production retained is closer to 79% (see previous discussion for 80% retained). As the amount retained declines to closer to 60%, there is less information supporting the assessment that suitable cover is retained for dependent species.

According to BLM et al. (2008:27), grazing has become very definitively patchy in the 21-40% utilization category, and this can be seen in Figures 1b-d and 2b-d. A given site grazed to 35-40% utilization could result in as much as 50-56% of the basal area of bunchgrasses being grazed to near ground level (Table 11), but Table 8 indicates that moderately to heavily grazed plants may constitute as little as 45-50% of the basal area at this level of grazing. If 10% of plants are topped (mid-point of 13.5% utilization), 10% are grazed conservatively from the top (mid-point of 30.5% utilization), and 20% are moderately to heavily from the top (mid-point of 50.5%), leaving about 35% of the basal area being grazed near ground level (Table 8). This in turn would translate into about 55% of the basal area being short enough to constitute grazed patches. Broken and bent vegetation would contribute to a higher percentage. Therefore, a utilization of about 35% is about the point on the continuum where "patches" on a given site shift from being "patches of heavily grazed vegetation" to "patches of remaining cover."

Microsite openings (e.g., that create "patchiness" discussed by BLM et al. 2008:27) grazed close to the ground still have some tall plant material, but not enough to effectively contribute to wildlife cover. Microsite cover patches consist of ungrazed to lightly or moderately grazed plants and include various amounts of bent over and broken plants (caused by livestock walking through these patches), and many times include a small number of plants or parts of plants that have been grazed close to the ground (Figure 2b-d). Grazed, bent-over, and broken plants within remaining cover patches and the size of cover patches and their juxtaposition to other cover patches affects the suitability of cover to varying degrees for different wildlife species. Shrubs protect herbaceous vegetation from grazing to varying degrees, thereby providing centers of microsite cover patches where at least some wildlife species (e.g., ground-nesting migratory birds) use the cover.

Grazed microsite patches where nearly 100% of the basal area is grazed to 50-70% utilization would provide little if any cover and would increase visibility into patches of taller vegetation adjacent to these grazed patches. It is likely that enough cover would be available in mosaics of these small (microsite) grazed and ungrazed patches on sites grazed to 31-40% utilization to provide for the cover needs of many dependent wildlife species. It is also likely there is enough basal area of plants grazed near ground level and enough plants bent over and matted to move a given site outside the realms of providing suitable herbaceous cover for most other species (at the 31-40% utilization level).

Larger areas (e.g., dozens to hundreds of acres) grazed within this category (60-79% of annual production retained) have the potential to provide a range of conditions from ungrazed/lightly grazed sites to sites that are grazed at about 40% utilization.

Patches created by grazing is a natural part of the landscape, but in deciding whether additional patches created by livestock grazing is beneficial to wildlife consideration needs to be given to the factors discussed in Principles A.2 and B.2, and the "Herbivory: Natural Range of Variability" section after the discussion of principles. Where bison occasionally grazed in the area now encompassed by the Greys River Ranger District, a larger number of grazed patches were undoubtedly created than are being created by the native compliment of native herbivores, but the extent of this was probably fairly limited across the district.

40-59% of Annual Production Retained

At 41-60% utilization, wildlife cover is reduced by a moderate (when as much as 59% of annual production is retained) to major amount (when as little as 40% is retained). When only 40% of annual production is retained, the only standing grass with potential to provide cover is found under impenetrable portions of shrubs, leaving very little cover. For many wildlife species using this habitat in ungrazed condition, cover attributes may no longer be suitable. The basis for this assessment is outlined below.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Low to Moderate
Large majority of dependant species	None to Low
Species most dependent on tall, dense herb. vegetation	None

At 41-60% utilization, "The rangeland appears entirely covered as uniformly as natural features and facilitaties allow" (BLM et al. 2008:27). A given site grazed to 41-60% utilization has the potential to result in approximately 60-90% of the basal area of bunchgrasses being grazed to near ground level (Table 11, Figures 1d-f and 2d-f). The proportion of individual plants grazed at 41-60% and 61-80% utilization levels (Table 8) may similarly range from 55% to 60%. The previous sub-section outlined characterization of wildlife cover when about 59% (about 40% utilization) of herbaceous vegetation is retained. This section focuses on cover that is provided when grazing levels are closer to 50% up through about 60%.

The quote from BLM et al. (2008) in the previous paragraph is consistent with the hypothetical situation outlined by McKinney (1997) for a site grazed at 52% utilization: about 60% of the basal area of plants were grazed to about 70% utilization, about 20% of the basal area was grazed at ≤20% utilization, and the remaining 20% was split between 21-40% and 41-60% (Figure 1e). In this situation, an estimated 74% of the basal area would be grazed to near ground level (Table 11). Assuming heights provided in Table 10, McKinney's scenario of 52% utilization would result in about 60% of the basal area having 1-5 inch stubble heights, 20% having stubble heights of 1-11 inches, and 20% of the basal area having stubble heights ranging from 3 to possibly as high as 31 inches. As discussed previously, some of the taller heights would be mixed in with the 1-5 inch stubble heights and some of the shorter heights would be mixed in with the taller heights. Furthermore, some of the taller stubble heights would not be as tall as shown in Table 10 due to hoof action. Also, isolated tall plants and very small patches (e.g., 2-3 tall plants right next to each other) would not contribute more than negligibly to cover. Thus, it would not be possible to have more than a small amount of erbaceous vegetation on a site (e.g., no more than an estimated 10-25%) that is tall enough and in large enough patches to provide even minimally suitable cover. In big sagebrush communities, much of the remaining taller herbaceous vegetation at 50% utilization typically occurs under shrubs.

This category would allow for utilization to approach 60%. A given site grazed at 55-60% utilization could result in as much as 70-90% of the basal area of buchgrasses being grazed to near-ground level (Table 11, Figures 1f and 2f), with nearly all of this being grazed at the >60% utilization level (Table 8). At the lower end of this range (e.g., 70-80% of the basal area), additional basal area may be grazed at 41-60% utilization, which moves the basal area of short vegetation to 80-90%. Taller plant material would remain on less than 20% of the basal area of the site (likely as low as 10% or less), but much of this would likely be bent over, broken, or matted. At this level of grazing, patches of lightly grazed plants that are still standing (if they exist) would not be large enough to provide suitable cover for any dependent species (Figures 1f and 2f). Most standing plant material would be under the protection of shrubs.

Heavily grazed areas created by grazing is a natural part of the landscape, but in deciding whether additional patches created by livestock grazing is beneficial to wildlife consideration needs to be given to the factors discussed in Principles A.2 and B.2, and the “Herbivory: Natural Range of Variability” section after the discussion of principles. Where bison occasionally grazed in the area now encompassed by the Greys River Ranger District, a larger number of heavily grazed areas were undoubtedly created than are being created by the native compliment of native herbivores today, but the extent of this was probably fairly limited across the district and they likely were not created every year in the same place.

The existing maximum forage utilization standard (Forest Plan) for satisfactory rangelands is 60% of key forage species, or an estimated 50-60% retention of herbaceous vegetation (Table 4).

<40% of Annual Production Retained

At >60% utilization, the only microsite cover patches remaining would be in inaccessible places under large, dense shrubs (Figures 1f-g and 2f-g). Wildlife cover provided by herbaceous vegetation would have been eliminated in most community types for most wildlife species, relative to ungrazed conditions. The basis for this assessment is outlined below.

Suitable Wildlife Cover Provided for:	Level of Confidence
At least some dependent species	Low to None
Large majority of dependant species	None
Species most dependent on tall, dense herb. vegetation	None

At 61-80% utilization, BLM (2008:27) states “The rangeland has the appearance of complete search. Herbaceous species are almost completely utilized.” An estimated 90-100% of the basal area would be grazed to near-ground level (Tables 4 and 6), which is consistent with BLM et al’s. characterization. This can be seen in Figures 1g and 2g. If any microsites remain, there is no indication they would provide effective wildlife cover for any wildlife species. Where dense shrubs protect underlying herbaceous vegetation, these may provide microsites of wildlife cover for some species, but at the density of shrub cover required to protect enough herbaceous vegetation to retain effective cover, the shrub itself likely provides sufficient cover for those wildlife species that would use this type of microsite.

Small areas of heavily to severely grazed areas created by grazing is a natural part of the landscape (see "*40-49% of Annual Production Retained*," above).

COVER REQUIREMENTS OF INDIVIDUAL SPECIES

All assessments of the effects of livestock grazing on retention of wildlife cover in this section are for habitats that are in healthy, functioning condition unless otherwise noted.

This section summarizes the cover requirements of a range of wildlife species (Table 3) with an emphasis on those that require or favor tall, dense or moderately-tall, moderately-dense herbaceous cover. I also summarize the habitat requirements of a few species not requiring this level of cover or that require sparse and/or low-stature vegetation in order to show the ends of the spectrum of habitat needs with respect to the height and density of herbaceous vegetation. However, I did not attempt to summarize the cover needs of all wildlife species, nor did I attempt to equally treat each category of cover needs along the gradient from 'no cover needed' to 'dense cover needed.' I do address in any detail the habitat requirements of wildlife species preferring sparse, short, or no herbaceous vegetation for the following reasons:

1. With respect to livestock grazing effects on wildlife, the Forest Plan objective for providing wildlife habitat calls for the retention of an adequate amount of suitable forage and cover for wildlife, which specifically focuses on *retaining* vegetation that provides cover for wildlife. This objective addresses problems identified in the Forest Plan pertaining to too little herbaceous vegetation being retained. The objective does not call for livestock to produce suitable wildlife forage and cover, nor are any problems identified in the Forest Plan pertaining to too little herbaceous vegetation being removed by livestock.
2. None of the MIS, sensitive species, threatened species, or their prey that inhabit the Greys River Ranger District would benefit from either (a) herbaceous cover that is shorter or sparser than what would be provided in an ungrazed or lightly grazed system, or (b) willow and aspen stands with reduced canopy cover, particularly given the existing condition of rangelands, riparian areas, and willow communities.
3. Native migratory bird communities and native wildlife communities as a whole evolved in what is now the Greys River Ranger District with generally very light to light grazing pressure, with localized areas being more heavily grazed.
4. While some species (e.g., mountain bluebirds, American robins, killdeer) may benefit from additional reductions in herbaceous cover in rangelands and riparian areas, above-and-beyond what already exists due to natural conditions and historic livestock grazing and other factors: (a) this would be outside the natural range of variability, (b) these species would be favored to the detriment of other native species, and (c) these types of habitat conditions are currently overrepresented in the surrounding area and intermountain west. As an example, large expanses of forbland, herbland, shrub-forb, shrub-grass, and meadows on the district currently have reduced ground cover and reduced overall herbaceous vegetation height. Another example is that graminoid communities with short grass height are abundant in Star Valley and other nearby large

valley bottoms. There is no shortage of habitat for birds and other wildlife that require sparse or short herbaceous vegetation.

5. Furthermore, because livestock grazing will continue on the Greys River Ranger District, there will continue to be large areas where herbaceous vegetation is reduced in height and density on a year-to-year basis.
6. None of the species that would benefit from reduced or depleted herbaceous cover require that additional areas of reduced height and/or density be provided on the Greys River Ranger District. For example, while mountain bluebirds would benefit from moderate to heavy grazing in the vicinity of their nest cavity, they would likely be able to find sufficient forage to feed their young in the absence of grazing. Killdeer, on the other hand, will not use areas with more than sparse herbaceous vegetation, but their historical occurrence on the district was likely limited to rock and gravelly bars in streams/rivers in wide, open valley bottoms and possibly limited areas where meadows were heavily grazed. I do not know of any wildlife species on the district that depends on moderate or heavy grazing pressure for sustaining their population.

The purpose of this section is not to incorporate specific cover requirements for individual wildlife species into allowable-use standards, but rather to provide specific information on individual wildlife species that exist as parts of native wildlife communities in order to (1) better assess the cover requirements of wildlife dependent on herbaceous and other cover, as a whole; and (2) supplement and support information provided in the sections entitle "Amount of Wildlife Cover Retained in Wet and Moist Graminoid Habitats" and "Amount of Cover Retained in Rangeland Habitats," above.

The figures on percent of annual production retained in the individual species accounts, below, assume that riparian areas, wetlands, and rangelands are in healthy, functioning condition. To the extent they are in less-than-functioning condition, percentages would be higher.

Meadow, Riparian, and Wetland Wildlife that Need Herbaceous Cover

In general, aside from long-term alterations to habitat caused by livestock grazing, one of the biggest effects of livestock grazing on migratory birds and other wildlife is the temporary (annual) removal of cover required by species for reproduction and concealment (Kirsch et al. 1978, Medin and Clary 1990, Kantrud 1990, Kie et al. 1994, Ohmart 1996, Krueper et al. 2003). The removal of cattle, and subsequent increase in herbaceous and other riparian vegetation has been shown to result in increases in number of bird species and abundance (Dobkin et al. 1998, Krueper et al. 2003). Thus, the annual removal of plant material by grazing influences the amount of cover that is available for migratory birds dependent on this cover, which addresses Objective 4.7(d), other habitat-related objectives, and E.O. 13186.

In addition to live and standing dead herbaceous vegetation, another important component of herbaceous cover for many wildlife species is accumulations of dead plant material that is not necessarily "standing," and this may in part explain the sometimes statistically-significant relationship between the occurrence of some cover-dependent species and percent litter cover.

Columbia spotted Frog

A Region 4 sensitive species, spotted frogs are well distributed across the district, but are less common than chorus frogs. They breed in shallow waters of ponds, marshes, slow streams, river backwater channels, and along lake edges (Hammerson 1982, Patla 2000, Patla and Keinath 2005). Breeding sites typically contain emergent vegetation (e.g., sedges). Nearly all breeding sites surveyed on the district by Patla (2000), McEachern et al. (2006), McEachern (2007), McEachern and Brick (2008), and myself contained dense graminoid cover. Spotted frogs typically lay eggs just after snowmelt (Patla and Keinath 2005), which varies considerably from low to high elevations. In general, the breeding season typically begins in late April or early May (low elevations) to late June (high elevations), and metamorphosis occurs between mid July and late September, depending on elevation and other factors.

After breeding and for the remainder of the summer and fall, adult spotted frogs move to seasonally moist meadows, ephemeral and permanent pools in meadows and forests, beaver ponds, lake margins, riparian zones, streams, and marshes (Polliod et al. 2002, Patla and Keinath 2005). Wetland habitat is preferred as summer habitat, but they can travel relatively long distances between breeding sites and summer habitat, with these migrations typically beginning in May and June (Turner 1960) to early July (Polliod et al. 2002). As surface water evaporates from ephemerally moist and wet areas used by spotted frogs after breeding, they frogs move to more permanently wet areas. While some populations of spotted frogs (e.g., those in the Great Basin) typically do no venture far from water after breeding (Engle and Munger 2000), other populations have a fairly high proportion of individuals that travel as far as several hundred yards to 2/3 mile or more between breeding sites and summer foraging habitat (Turner 1960, Polliod et al. 2002, Patla and Keinath 2005). Some individuals follow riparian zones when available, but others migrate along linear routes across meadows and upland habitats such as big sagebrush communities and forestland (Pilliod et al. 2002). These distances appear to be consistent with populations on the Greys River Ranger District; for example, in the Little Greys River drainage (e.g., McCain Meadow and Blind Trail Creek area), I found that some of the ephemeral pools in which spotted frogs were observed during the breeding season are about 1/4 to 1/3 mile from the nearest permanent body of water (the only place where I took a cursory look at this). Depending on conditions of summer habitat, many individuals leave summer habitat and move to winter habitat, usually August/September (Polliod et al. 2002, Patla and Keinath 2005).

Movements by juvenile spotted frogs have been shown to be considerably shorter than adults (Polliod et al. 2002). However, because some of the breeding sites used by spotted frogs go dry, they must move to more permanent wetlands and streams which can be as far as 1/4 to 1/3 mile away. This necessitates overland travel. Polliod et al (2002) reported migrations of juveniles to winter habitat occurring in September and October. However, if breeding pools dry shortly after metamorphosis (e.g., mid-July or August), survival would depend on overland movement to more permanent water prior to September. If breeding pools dry before metamorphosis is completed, the young frogs will die, which likely happens on the Greys River District.

Polliod et al. (2002) and Patla and Keinath (2005) reported that spotted frog migrations variably occur at night, during the day, during rain events, and when it is not raining. Published accounts of movement rates during migration have ranged from less than 110 yards/day (Patla 1997), to about 55-205 yards/day (Turner 1960), up to 760 yards/day of one individual in Idaho (Polliod et al. 2002). Migrations from summer to wintering sites were completed in 1-2 days in central Idaho, but they did not report on rates for summer migrations.

Migrations across dry land pose particular problems for frogs. Bodies of frogs have only limited ability to regulate the loss of water through their skin and, therefore, their skin must remain moist. They regulate skin moisture through the microsites they inhabit. Dumas (1964, as cited in Patla and Keinath 2005) reported that relative humidity of 65% at about 80 °F is lethal to adult spotted frogs in approximately two hours. Therefore, for those that migrate from their breeding site when humidity is low and/or temperatures are high, survival may depend on migration habitat that retains higher humidity/moisture at ground level and protection from the sun and predators (e.g., herbaceous and shrub cover) or that provides microsites with these qualities. This may be particularly important for adults that migrate between mid June and early July and juveniles that migrate away from the temporary waters of some breeding sites during late July through mid September (when temperatures are highest, relative humidity is lowest, and rain events may be widely spaced). However, Polliod et al. (2002) found that some frogs migrated through subalpine fir and lodgepole pine with sparse whortleberry and bear grass, but seeps, springs, and other water sources were available along the way (8,000-8,500 ft. elevation with an easterly aspect). Polliod et al. (2002) recommended protecting groups of diverse water bodies and surrounding uplands within about 2/3-mile of breeding ponds; Patla and Keinath (2005) also recommended protecting migration habitat.

Effects of livestock grazing on suitability of spotted frog habitat has not been studied to any large extent, but Patla and Keinath (2005:47-48) assessed that "All the available summaries of threats faced by spotted frogs list livestock grazing as a major concern (Gomez 1994; Perkins and Lentsch 1998; Maxell 2000; USFWS 2002; Munger et al. 2002)." Negative effects of livestock grazing on cover used by spotted frogs include reduction or loss of cover at breeding sites and foraging sites and along migration routes (including the reduction or loss of microsites), soil compaction (which can prevent frogs from burrowing underground to prevent desiccation or freezing), and trampling of streambanks (under which frogs could otherwise hibernate). Availability of an adequate amount of suitable cover may be especially important for frogs during mid summer at times when they are not directly associated with aquatic habitat.

Low intensity livestock grazing may be neutral or beneficial to spotted frogs, especially where sedge cover in aquatic habitat is tall and dense by creating small openings for basking and by facilitating eutrophication which can benefit larva. Shovlain et al. (In Prep.) found that, under low grazing pressure, Oregon spotted frogs did not show a preference for grazed areas or exclosures, but they increased their use of exclosures as cattle grazing pressure increased beyond this level. Watson et al. (2003) found that grazing by cattle created openings in reed canary-grass (which can become very tall and dense, and was mostly unused by Oregon spotted frogs). Bull (2005) similarly assessed that some level of livestock grazing may benefit Columbia spotted frogs by creating openings in otherwise marsh habitat, thereby providing basking sites and increasing solar radiation of water. Bull (2005) recognized that livestock grazing also has negative effects on spotted frogs. Whereas creation of openings in otherwise dense marsh habitat can be beneficial (Figures 1a-b and 2a-b), it is not necessary and, more importantly, a large amount of emergent vegetation is prominent component of spotted frog habitat. Livestock grazing that results in the reduction in the height of streambank vegetation to the point it begins reducing cover for frogs and emergent vegetation beyond creating small openings is detrimental.

Winter habitat of spotted frogs include ponds, streams, undercut stream banks, springs, beaver dams, and underground areas (associated with water bodies), but all such sites must have above-freezing temperatures, be moist or wet, and be well-oxygenated (Patla and Keinath 2005).

Patla and Keinath (2005) forwarded recommendations of five other reports for fencing critical breeding, foraging, over-wintering, and migration habitat and, where fencing is not feasible they recommended enforcing utilization levels that maintain or improve habitat conditions for spotted frogs. They also recommended managing livestock grazing along streams that avoids soil compaction, late-season reductions in vegetation, and damage to willows and the stream channel. Based on habitat requirements of spotted frogs, there is strong evidence showing that retaining >90% of the annual production of herbaceous vegetation in breeding, foraging, and migration habitat would meet their needs. Available information (including information in the "Broad-level Assessment of Wildlife Cover" section, above) also indicates that retaining 80-90% of the annual production of herbaceous vegetation would be sufficient to meet the needs of spotted frogs in these habitats. For example, small openings created by livestock may be used by foraging and basking frogs, meaning that 10-20% utilization of herbaceous vegetation would not adversely impact their habitat.

When the amount of retained vegetation begins to decline below 70% in sedge communities, cover attributes begin to decline considerably (see "Broad-level Assessment of Wildlife Cover" section, above), but this information indicates there is sufficient cover remaining at roughly 70% retained to provide for the cover needs of spotted frogs in breeding and foraging habitat (e.g., Figures 1a-c and 2a-c). While cover remains when the amount of herbaceous vegetation has dropped to 60% (Figures 1d and 2d), it is not clear whether it remains "suitable." Furthermore, lower levels of grazing intensity would reduce the chance that eggs are disrupted, tadpoles and metamorphosing frogs are crushed, and water quality is reduced. Conservatively, the threshold between suitable habitat and less-than-satisfactory habitat (e.g., in DFC 10 areas and possibly DFC 3 and 12 areas) should be drawn at about 70%. I do not know of any information demonstrating that retaining less than 60% of the annual production of sedges would be sufficient to provide for the needs of spotted frogs in these habitats, recognizing that some wetland areas naturally are grazed/trampled below this level by native ungulates, including bison prior to their extirpation. In migration habitat, available information suggests that retaining 50-60% of annual production would be sufficient to meet their needs for thermal protection during migration. At this level, microsites comprised of small groups of ungrazed or lightly grazed bunchgrasses would be regularly distributed in most cases.

See the "Boreal Toad" section for discussion of stubble heights.

Boreal Chorus Frog

Chorus frogs (MIS) are most common amphibians on the district. I have seen or heard them from some of the lowest elevations on the district near Alpine to the top of the Wyoming Range above Blind Bull Lake. chorus frogs breed in shallow, ephemeral pools, marshes, and sometimes more permanent waters. They typically do not breed in pools kept cool by large influxes of water (Hammerson 1982), which has been observed on the BTNF. Although ephemeral pools and marshes are preferred for breeding, these sometimes dry up before tadpoles have metamorphosed (Hammerson 1982). At higher elevations in Colorado (e.g., above 9,000 feet), breeding begins immediately after the spring thaw in late May or early June, and breeding extends into June, which is comparable to timing on the BTNF. Spencer (1971, as cited by Hammerson 1982) observed breeding chorus frogs in July at elevations above 11,800 feet.

Breeding sites usually have emergent and sometimes submergent vegetation, and eggs are usually deposited on submerged portions of vegetation (Hammerson 1982). On the Greys River

Ranger District, most breeding sites have emergent vegetation (McEachern 2006, 2007, 2008). They metamorphose during July and August in the mountains of Colorado, which is likely comparable to the situation on the Greys River Ranger District.

In the mountains of Colorado, chorus frogs spend most of the summer in wet meadows, sometimes as far as 1/3 mile from breeding pools, although some remain in or near pools of water (Hammerson 1982). Other authors have reported they usually remain within about 100 yards of wetlands. For example, WGFD (2005) stated they are rarely found away from permanent water. However, some of the ephemeral pools in which they breed on the Greys River RD are 1/4 to 1/3 mile from the nearest permanent body of water. Except during the breeding season, chorus frogs were found to be most active between 10:00 a.m. and 3:00 p.m. at about 9,700 feet in Colorado. When inactive, they hide in water, thick vegetation, under objects on the ground, and in rodent burrows. They usually remain active until September-October, depending on elevation and temperatures.

As with spotted frogs, some of the breeding sites observed so far on the Greys River Ranger District are up to 1/4 – 1/3 mile from permanent aquatic habitat, necessitating overland travel by adults and juveniles. Some of these sites area also used by spotted frogs. Thus, characterizations of migration habitat for spotted frogs, above, likely apply to chorus frogs as well.

Effects of livestock grazing on spotted frogs also likely apply to chorus frogs as well. See the "Boreal Toad" section for discussion of stubble heights.

Boreal Toad

The only observations of boreal toads (MIS) are in the upper Greys River watershed above Corral Creek, but they may exist in other high elevation areas. Breeding occurs in ponds, lakes, slow streams, river backwater channels and oxbow ponds, beaver ponds, flooded meadows, ephemeral pools, and manmade impoundments (Hammerson 1982, Keinath and McGee 2005). Pierce (2006) added that these sites are normally associated with lodgepole pine and spruce-fir forests. Breeding sites are in shallow portions of these types of water bodies (typically <4-8 inches deep). Eggs are deposited in the water, usually in open areas where thermal effects of the sun are optimized. Breeding typically begins when snow melts or ice thaws at breeding sites and, therefore, the timing of breeding is variable from year to year and is dependent on elevation (Keinath and McGee 2005). In most areas, breeding occurs between mid-May and mid-July. Hatching occurs 10-14 days after eggs are laid. Metamorphosis typically happens from late July to late September, but the time to metamorphosis is highly variable and depends on water temperature and site conditions.

After metamorphosing, young toads move away from aquatic habitat and use moist terrestrial habitats where part of their time is spent under the shelter of moist woody debris and underground cavities, and they spend part of their time basking in the sunlight to thermregulate (Keinath and McGee 2005). Adults are primarily terrestrial and inhabit a great variety of habitats, from non-forested to forested and from dry to wet. They can travel large distances, traversing through different types of habitats as they move. Hammerson (1982) reported on a study where toads sometimes stayed in the same spot for several days but occasionally moved as far as 165 feet per day. Some biologists and researchers believe they tend to spend more time in areas such as willows and sedges where the soil is wet or moist (Hammerson 1982, Keith and McGee 2005). Pierce (2006) stated that adult toads move into high grasses and surrounding forests after breeding. Particularly when they inhabit drier habitats, they spend a disproportionate amount of time in relatively moist microsites such as under shrubs, woody debris, and in underground burrows, and they tend to remain near moister habitats. Moist microsites in drier habitats provide protection from evaporative water loss and are used to thermoregulate. Adult boreal toads also thermoregulate by basking in the sun.

Male boreal toads tend to remain close to breeding sites (e.g., within about 1,000 feet), while females may range as far as 1.5-2.4 miles (Pierce 2006).

Keinath and McGee (2005) identified several ways that livestock grazing can negatively affect boreal toads as a consequence of reduced cover, including increased predation, increased desiccation (and mortality) when vegetation on banks of breeding sites is reduced, as well as reduced availability of moist microsites in non-breeding habitat. Effects of livestock grazing at breeding sites may be similar to those described for spotted frogs, including possible benefits since boreal toads typically lay their eggs in openings in emergent vegetation. Boreal toads may be able to deal with somewhat higher levels of grazing in non-breeding habitat since they can regulate their skin is less permeable to water, so long as sufficient microsites remain and so long as insect abundance is not adversely affected. The known breeding sites of boreal toads are within sheep allotments, but an adult toad was found in the Mink Creek drainage in an area used by cattle from the cattle allotment encompassing the far upper portion of the Greys River. It is also possible that toads inhabit upper portions of some of the cattle allotments.

Effects of livestock grazing on spotted frogs also likely apply to boreal toads as well, and these findings are consistent with the following discussion of stubble heights.

Keinath and McGee (2005) recommended retaining stubble heights on streambanks of at least 4-6 inches, based on recommended stubble heights for sustaining streambank stability. They did not cite any studies assessing the needs of toads relative to stubble height. If stubble height recommendations are implemented as minimum averages, as discussed in BLM et al. (1999, 2008) and Univ. of Idaho (2004), cover qualities would be nearly gone, as discussed in the "Amount of Wildlife Cover Retained in Wet and Moist Graminoid Habitats" section (starting on page 83); see Figures 3e-g and 4c, and Table 7. A 4-inch stubble height would provide little protection from the sun and from predators, especially when considering the amount of trampling and bent sedges that exist at the level of grazing that would lead to a 4-inch stubble height. In areas where an average of 6 inches is retained, cover qualities would be reduced by a moderate amount in sedge communities of 10-15 inches and considerably in 20-24 inch communities, but sedges would still provide some cover.

Therefore, there is moderate evidence that a minimum average 6-inch stubble height across a sedge community would sustain cover qualities suitable for amphibians the size of boreal toads. The potential for trampling of vegetation, eggs, tadpoles, and metamorphosing toads and impacts to water quality would be elevated at this level of grazing in communities taller than 15 inches (e.g., utilization as high as 50-60%). There is little evidence that average stubble heights of 4 inches across a sedge community would provide suitable cover and maintain minimal levels of trampling on vegetation, eggs, tadpoles, and metamorphosing toads. Below 4 inches, it is clear that cover would not be provided and the potential for trampling effects would be elevated.

Mallards, Green-winged Teal, and Cinnamon Teal

Mallards are the most common waterfowl species that nest in the Greys River watershed. While nest densities are far below that of the prairie pothole region, the Rocky Mountains have similar numbers of nesting mallards as the prairie pothole region (Bellrose 1976), meaning that, while the Rocky Mountains contribute substantively to mallard production, small numbers of breeding mallards in countless small valleys are critical. Hence — in part — objectives of the 2005 Intermountain West Joint Venture Coordinated Bird Conservation Plan to protect, maintain, and enhance/restore at least 155,000 acres of montane riparian habitats and 27,000 acres or more of wetland and pond complex habitats in the intermountain west.

Based on Bellrose (1976), nesting by mallards in many parts of the Greys River probably is initiated between late April and mid May, depending on sufficient snowmelt. Nesting habitat in some areas may not have sufficient snowmelt until late May. Green-winged and Cinnamon teal likely initiate nesting on the district between early and mid May, possibly later in May depending on timing of snowmelt (Bellrose 1976, Baicich and Harrison 1997). Nest building, egg-laying, and incubation of mallards and teal last 5-6 weeks, which extends the nesting period into mid to late June, possibly into early July. Renesting, which is not uncommon, would further extend the nesting period well into July.

While mallards typically nest within 100 yards of water, a small proportion nest as far away as 1 mile (Bellrose 1976). Thus, much of the riparian meadow and willow, moist meadow, silver sagebrush, and portions of big sagebrush and other rangeland types in the Greys River Ranger District have the potential to provide nesting habitat for mallards. Nests typically are on the ground in tall, thick vegetation (Baicich and Harrison 1997). Bellrose (1976) stated "Dense vegetation about 24 inches high appears to be the primary requirement, regardless of other cover qualities.

The quality of riparian and moist meadow habitat for nesting mallards may provide an indication of habitat quality for other wildlife species dependent on tall, dense herbaceous vegetation in these areas given the large volume of information on habitat relationships and effects of uses and management activities on nest success, compared to the scarcity of information on most other species.

Green-winged teal inhabit many of the districts wider riparian zones where sedges and willows occur, and particularly where beaver ponds are common. Cinnamon teal are less common, but frequent the same habitat. While dense cover appears to be a more important prerequisite for the cinnamon teal nest sites than the type of vegetation (Bellrose 1976), cinnamon teal nests generally are located in low (<24 inch tall), perennial vegetation such as baltic rush, saltgrass, sedges, and tufted hairgrass, and less often under willows (Gammonley 1996). Green-winged teal nests are commonly sedge meadows, grasslands, and brush thickets near ponds (Johnson 1995). Most nests are within about 220 yards of water (Bellrose 1976, Johnson 1995, Gammonley 1996) and, on average, cinnamon teal nest closer to water than green-winged teal, with cinnamon teal nests typically placed within 30 feet of water (Gammonley 1996). Teal nests are typically located in dense vegetation, with cinnamon teal nests are often placed underneath matted, dead stems of vegetation so the nest is completely concealed on all sides (Gammonley 1996). Female cinnamon teal commonly select nest sites whereby they can approach nests through tunnels in the vegetation. Nests of green-winged teal are placed under heavy (50-80%) vegetation cover and are very well concealed (Johnson 1995).

Effects of Livestock Grazing

Another way to assess the importance of tall, thick vegetation to mallards and teal is to evaluate effects of reducing its height, for which many studies have shown detrimental effects. Kirsch (1969) and Braun et al. (1978) reviewed more than 50 studies on the effects of cattle grazing on waterfowl and Straussman (1987) reviewed livestock grazing and haying programs on 123 national wildlife refuges, and they all concluded that livestock grazing is generally detrimental to waterfowl nesting. Kirsch (1969) was unable to find any examples of where livestock grazing increased waterfowl production, and Braun et al. (1978) knew of only one study that reported higher nest success in areas moderately grazed by livestock compared to idle lands. After reviewing the literature on the effects of livestock grazing on breeding waterfowl, Kirby et al. (1992) found no evidence from appropriately designed studies to indicate that livestock grazing benefits upland nesting ducks. In a study of 26 years of mallard nesting information in a mountain valley of southern Colorado, nest density and nest success declined with increasing cattle grazing intensity and nest density increased with length of time since the last grazing season (Gilbert et al. 1996). A recent study in Arizona indicated that mallard numbers were trending upward during a 5-year period after cattle were removed from a riparian system, although it is possible that other factors may have contributed to the upward trend. Holechek et al. (2004) noted that livestock grazing, even at light intensities, appears to be harmful to nesting waterfowl.

In areas where waterfowl production is a major goal (i.e., where optimum habitat conditions are desired), Gilbert et al. (1996) recommended that livestock graze in waterfowl nesting areas no more than once every 6-7 years, and Kirsch (1969) recommended complete removal of livestock grazing. Gilbert et al. (1996) estimated that accumulations of residual vegetation would not impede annual production and affect nesting cover until after about 6-7 years in San Luis Valley of Colorado. While information in this paragraph and the previous paragraph are not fully applicable to the Greys River Ranger District, since the Forest Plan does not call for optimum wildlife cover, it reinforces the great importance of tall, dense herbaceous vegetation to some groups of wildlife species and that, to provide for the needs of some wildlife species, at least some amount of ungrazed or no-more-than lightly grazed vegetation needs to be retained. Waterfowl represent the needs of other wildlife species that depend on tall, dense herbaceous vegetation, but for which a large volume of information does not exist.

Livestock grazing pressure that led to negative effects on nest densities and nest success in the studies and literature reviews cited above was more than light grazing pressure (i.e., >0-20% utilization) and in many cases may have been greater than 21-40% utilization. Based on the general assessments of cover attributes of retained herbaceous vegetation (beginning on page 83; see, for example, Figures 1 and 2), there is strong support for the assessment that retention of ≥90% of annual production of herbaceous vegetation would retain sufficiently tall, dense herbaceous vegetation to provide suitable waterfowl nesting cover. Information summarized in the "Broad-level Assessment of Wildlife Cover" section, above, indicates that retaining 80-89% of annual production on any given site should also be sufficient to provide for waterfowl nesting needs on that site. However, available information provides little support for the assessment that retaining 70-79% of annual production would retain tall, dense characteristics for waterfowl nesting. There is no support for the assessment that retention of <70% would retain tall, dense characteristics of herbaceous vegetation for suitable waterfowl nesting cover. While the chance of eggs being crushed by livestock would increase within increasing levels of livestock, density of active nests (i.e., renesting attempts) is likely reduced by June 15 when cattle are turned out.

Given the low density of nesting waterfowl in capable habitat on the Greys River Ranger District compared to places where above-cited studies were conducted, there is not a need to retain ≥80% annual production across riparian areas and meadows. Furthermore, the weight of snow reduces the cover qualities of residual grass material, which negates benefits to waterfowl nesting. Sedges tend to hold up better under the snow and build-up of residual sedge material over a few years may help even more. Also, low-stature willow (e.g., Wolf willow) and silver sagebrush canopy cover helps to keep residual sedge and grass material upright. Retaining ≥80% of the annual production of herbaceous vegetation in small patches scattered across riparian areas and adjoining meadows would likely provide for the needs of waterfowl nesting. Also, and particularly for teal, tall, dense herbaceous vegetation within 30 feet of streams and beaver ponds should be retained. There is little to no indication that minimum average stubble heights of 4-6 inches, alone, would retain suitable nesting cover along streambanks.

Sandhill Crane

Sandhill cranes occur on the Greys River Ranger District in low densities during spring and summer months, but they appear to be fairly well distributed across the district in suitable habitat. During the breeding season, sandhill cranes inhabit riparian areas (e.g., moist meadow, wet meadow, open willow communities, beaver pond complexes), marshes, forest openings with similar habitat, and forested ponds and pools. In the Rocky Mountains, sandhill cranes typically nest in wet meadow-shallow marsh zones along marsh edges (Tacha et al. 1994). Where tall emergent vegetation such as cattails and hardstem bulrush are not available, they will nest in areas dominated by sedges and rushes (Armbruster 1987). They will also nest in areas willows and conifers are present, so long as canopy cover of these species is not high. Standing water or close proximity to water appears to be a nest placement requirement. In northern Colorado, nests were located within about 3 feet of slow moving, willow-lined streams (Bieniasz 1979, as cited in Armbruster 1987); the one nest I found on Blind Trail Creek is consistent with this. Trampling of colts has been reported in California and Idaho. Nesting likely begins in early to mid May on the district, based on Baicich and Harrison (1997). Nest building, egg-laying, and incubation of cranes lasts 5-6 weeks, which extends the nesting period into mid to late June.

On Malheur National Wildlife Refuge in eastern Oregon, mean height of vegetation at 727 nest sites was 14.5 inches, and ranged from 0 to 80 inches (Littlefield 2001). Littlefield (1995) found that the level of nest concealment affected depredation rates of sandhill crane nests. Livestock can also cause problems for nesting sandhill cranes. Livestock grazing reduces vegetative cover, which can increase the rate of nest depredation (Braun et al. 1975, Littlefield and Paullin 1990, Littlefield 1995). USFS and PRBO (2008) reported that sandhill crane nesting was rare in several meadows in the Sierra Nevadas of California when they were heavily grazed and, after cessation of livestock grazing, the meadows support a breeding population.

Given similarities in nesting habitat needs, implications of livestock grazing on sandhill cranes is similar to those described for mallards and teal. However, sandhill cranes will nest more in the open and tall, dense nesting cover may not be as important where beaver pond complexes and shallow marshes exist. Cranes are building floating nests in some of these situations, and are taking advantage of beaver lodges in some cases (pers. observation 2007, and observations of P.

McEachern, Wildlife Crew Leader, Greys River-Kemmerer Districts, USFS, 2009). Published studies suggest that depredation of eggs in these situations will be higher. In areas where cranes nest in tall, dense vegetation, even retention levels as low as 70%, in areas where shrubs exist or where sturdy, robust graminoids exist, would retain at least some level of visual obstruction for nests. As with mallards and teal, this does not require retaining ≥70-80% of the annual production across riparian areas, but providing for the nesting needs of sandhill cranes does require, at a minimum, small areas of this level of retention scattered across riparian areas, particularly near water. Also, lighter grazing intensities would reduce the chance that eggs are crushed by livestock (until eggs hatch in mid to late June).

Sandhill cranes feed on a variety of food items including roots, bulbs, grains, berries, snails, earthworms, insects, amphibians, lizards, snakes, small mammals, and greens (Armbruster 1987, Tacha et al. 1994), and will forage in upland plant communities (e.g., big sagebrush, aspen) in addition to wetland and riparian areas. In contrast to effects of livestock grazing on nesting habitat, sandhill cranes will use areas grazed by livestock and in some situations they appeared to prefer meadows grazed by livestock (Armbruster 1987).

The amount of herbaceous vegetation that is needed to meet the foraging needs of sandhill cranes is much more variable. There is sufficient information to show that retaining >90% of annual production would meet the needs of feeding sandhill cranes, as sandhill cranes do not depend on grazed areas for feeding and this is particularly true for most riparian and meadow habitats on the Greys River Ranger District which support relatively short herbaceous herbaceous vegetation (e.g., <2-3 feet tall). There is also sufficient information to demonstrate that retaining 60-69% of annual production would be sufficient to meet the needs of feeding sandhill cranes, as they have been shown to favor areas grazed by livestock. In some of this information, livestock grazing use was characterized as "heavy," meaning there is at least some information indicating that retaining as little as 40-49% of the annual production (e.g., utilization of 51-60%) would be sufficient to meet their feeding needs, at least on a year-to-year basis. This level of grazing, if done regularly on any given site, could have adverse impacts on vegetative forage and animal prey species.

Common Snipe

Snipe are common in riparian wet meadow and willow communities on the district, from low to higher elevations where suitable habitat exits. During the breeding season in this part of the Rocky Mountains, they inhabit shallow wetlands, wet meadow/willow habitat (Arnold 1994). In a study in Colorado, sedge species dominated 7 of 12 sites occupied by common snipe. In a study in California, wet zones with analogue sedge and beaked sedge (common on the allotment) were of greatest importance. Nests are typically concealed in grasses and sedges on moist, but unflooded ground near water (Arnold 1994, Baicich and Harrison 1997). In one study cited in Arnold (1994), authors concluded that snipe favored areas with low and sparse vegetation, often grazed or mowed, with moist to saturated soils. Douglas et al. (1992) also found that snipe—in eastern Idaho—favored "low" graminoid vegetation in wet meadow habitat, compared to "high" graminoid vegetation, but they classified low graminoids as 12 inches tall and high graminoids as 36 inches tall. The wet meadow habitat in their study corresponded to beaked sedge, water sedge, and Nebraska sedge community types of Youngblood et al. (1985). Many of the sedge communities on the Greys River Ranger District, without being grazed, would be classified as "low" in their study. Nest initiation and egg-laying on the district likely begins in early to mid May, possibly later in May (Arnold 1984, Baicich and Harrison 1997). Nest building, egg-laying, and incubation of snipe lasts about 4 weeks, which extends the nesting period into early to mid June. I am unclear whether renesting occurs if the first clutch is lost. If they renest, the nesting period would extend into July. Young snipe need hiding cover after leaving the nest, particularly before they can fly which takes nearly 3 weeks.

While snipe inhabit and flourish in areas not grazed by livestock (i.e., ≥90% of herbaceous vegetation retained), available information demonstrates they also do well in areas where livestock grazing pressure is conservative (60-79% of annual production retained), based on information provided in Douglas et al. 1992 and Arnold 1994, previous sections of this report, and personal observations. When the amount of retained vegetation begins to decline below 60-69% in sedge communities, cover attributes decline considerably (see "Broad-level Assessment of Wildlife Cover" section, above), but snipe use the patchy habitat provided in this "transition" phase. I did not, however, locate information to show that retaining as little as 50% of the annual production of sedges would be sufficient to meet the needs of snipe. Ungrazed or lightly grazed patches are needed for nesting. However, nesting is initiated prior to the onset of livestock grazing; light to conservative grazing pressure would reduce the chance that eggs are crushed by livestock.

Sora

Soras are uncommon on the Greys River Ranger District. There are at least a few breeding pairs in the sedge marsh southwest of Waterdog Lake, and I also flushed one next to lower Blind Trail Creek. They may also exist in large beaver pond complexes with large sedge marshes. They need extensive areas of cattails or tall, dense sedge communities in shallow water, especially where dead, floating vegetation provides substrate for invertebrates (Melvin and Gibbs 1996). Nesting probably doesn't begin until late May on the district. Nest building, egg-laying, and incubation of soras lasts 3-5 weeks, which extends the nesting period into late June to early July. I am unclear whether renesting occurs if the first clutch is lost. If they renest, then nesting period would extend further into July and possibly early August. Young need cover for at least another 5 weeks, as it typically takes them this amount of time to be able to fly.

Based on habitat requirements of snipe, there is strong evidence showing that retaining >90% of the annual production of sedges would meet the needs of nesting soras. Available information (including information in the "Broad-level Assessment of Wildlife Cover" section, above) also indicates that retaining 80-89% of the annual production of sedges may be sufficient to meet the needs of soras. However, I do not know of any information demonstrating that retaining less than 80% of the annual production of sedges would be sufficient to provide for the nesting of soras.

Killdeer

Of all wildlife species using riparian meadows and other moist meadows on the Greys River Ranger District, killdeer are the only species that I am aware of require short vegetation. (Note: species such as sandhill cranes will preferentially use areas of short vegetation for feeding, but require taller vegetation for nesting and do not require short grass for feeding.) Killdeer nest in a wide variety of places, including bare sandy or gravelly areas and areas of short turf, typically around lakes ponds, and rivers, but may also nest in meadows, pastures, golf courses, airports, and similar areas of open turf, as well as on bare cultivated land and along gravel roads and in gravel parking lots (Baicich and Harrison 1997).

Nesting usually begins by early April in the northern parts of their range, but it is unlikely they would begin nesting until later in April or early May on the district, given the timing of snowmelt. Nest building, egg-laying, and incubation of killdeer lasts 4-5 weeks, which extends the nesting period into early June. Renesting likely occurs if the first clutch is lost, which would extend the nest period later into June or early July. Killdeer are sometimes double-brooded, but it is not known whether they do so on the district; if so, this could extend the nest period into July or early August. Young typically fly at about 40 days.

Killdeer are rare to uncommon on the district. It is very possible that they nest on the district, but the few that nest probably do not select meadows for their nest sites, except where there are areas of prominent bare ground and/or gravelly areas with sparse vegetation. Even though many meadows are dominated by very low-stature vegetation, due to compression by snow as well as other effects such as grazing, the timing of killdeer nesting would not provide them with enough cues to anticipate whether grass cover would be too tall by the time eggs hatch 4-5 weeks after a nest site is selected. This is probably why they do not typically nest in meadows on the district, except where herbaceous vegetation is obviously absent or sparse.

If killdeer were to nest in or near a riparian meadow, there is strong support for the assessment that retaining less than 30% of herbaceous vegetation on sites would benefit this species. Likewise, there is strong support for the assessment that retaining more than 40-50% of the annual production of herbaceous vegetation would result in less-than-suitable habitat for this species, assuming a healthy, functioning meadow community.

Northern Harrier

They are uncommon on the Greys River Ranger District. During the breeding season, northern harriers inhabit marshy meadows, lightly grazed wet pastures, old fields, marshes, and dry uplands such as grasslands and shrub-steppe (MacWhirter and Bildstein 1996, Slater 2005). Nesting likely begins early to mid May on the district based on Baicich and Harrison (1997). Nest building, egg-laying, incubation, and nestling period of norther harriers lasts about 2½ months, which extends the nesting period into mid to late July. Renesting may occur if the first clutch of eggs is lost, which could extend the nesting period into August. Young leave the nest before they can fly and require hiding cover.

They tend to favor large tracts of undisturbed habitats dominated by thick vegetation growth. Northern harriers nest in a large variety of open (treeless) habitats, so long as the vegetation is dense (MacWhirter and Bildstein 1996, Baicich and Harrison 1997) and 1-7 ft. tall (WPIF 2003, Slater 2005). In studies conducted in Wyoming and several states surrounding Wyoming, harriers used habitat with herbaceous height averaging 9 to 12 inches (but this did not appear to be limited to nesting habitat). They appear to favor dense graminoid cover >21 inches for nesting (Slater 2005). Vegetation from the previous growing season is an important component of the nest site, and most nests are located near water. Another characteristic of their habitat is high percent litter cover (e.g., >40% residual litter cover). Therefore, the assessments I made for waterfowl with respect to acceptable levels of livestock grazing, above, would apply to this species as well.

Savannah Sparrows

This species inhabits some of the large, open meadows on the district. During the breeding season, savannah sparrows inhabit grassy meadows, lightly grazed pastures, sedge marshes, and other open (treeless) areas with graminoid vegetation (Wheelwright and Rising 1993, Baicich and Harrison 1997). While they nest in open areas, nests may be close to the edge of conifer forests. They favor dense herbaceous vegetation, especially moist microhabitats in grassy areas. Nests are placed on the ground and are well hidden, with nests hidden by a canopy of dead grasses and herbs, or tucked under a tussock with a vegetation tunnel leading to the nest (Wheelwright and Rising 1993). Nesting on the district is initiated in May and nest-building and nest-occupancy generally is about 5 weeks, extending the nest-occupancy period into June for the first brood (Baicich and Harrison 1997). After feeding fledglings for several days or more, the process is commonly repeated for a second brood, which extends the nesting season well into July. Re-nesting may further extend this period (e.g., early August).

Livestock grazing levels that allow tall, dense herbaceous vegetation to persist in large graminoid-dominated meadows through early August would provide for the nesting needs of Savannah sparrows. Where the weight of snow does not completely mat residual vegetation, residual cover extending into early May likely is important for nesting. However, even where nests are built where there is not an abundance of dense herbaceous cover, rapidly growing vegetation at the nest site would soon provide cover for the nest and nestlings. Therefore, acceptable levels of livestock grazing with respect to retaining suitable cover would be similar to that of waterfowl, above. However, Savannah sparrows appear to be somewhat more tolerant of livestock grazing than waterfowl and there is some indication that retaining at least 70-79% of annual production should maintain enough tall, dense characteristics to provide suitable habitat. At 60-69% retention, however, there is little information supporting the assessment that tall, dense characteristics are maintained. (See also the discussion for "Voles and Western Jumping Mice," below.)

Western Meadowlarks

Meadowlarks inhabit some of the larger open meadows and grasslands on the district. They are most common in native grasslands and pastures, and they show a preference for areas with good grass and litter cover (Lanyon 1994). Nest sites are placed on the ground and are well concealed in dense vegetation. While Krueper et al. (2003) suggested that the removal of cattle contributed to a decline in eastern meadowlark numbers over a five year period after the removal of cattle, their data showed variability in numbers year to year, including the highest number of meadowlarks observed three years after cattle were removed (i.e., their study does not support beneficial effects of cattle grazing on eastern meadowlarks). Nesting on the district is initiated in May and nest occupation generally is about 5-6 weeks, extending the nest-building and nest-occupancy period into late June or early July for the first brood (Baicich and Harrison 1997). They then feed their young for two weeks or more. They commonly replace lost clutches, which can extend the nest-occupancy period into mid July or early August. It is not clear whether they are double brooded, but there would not appear to be sufficient time for this.

Livestock grazing levels that allow tall, dense herbaceous vegetation to be retained in large graminoid-dominated meadows through early August would provide for the nesting needs of meadowlarks. Where the weight of snow does not completely mat residual vegetation, residual cover extending into early May likely is important for nesting. Therefore, acceptable levels of livestock grazing with respect to retaining suitable cover would be similar to that of Savannah sparrows.

Voles and Western Jumping Mice

Voles and jumping mice, as a group, are widely distributed on the district, but the distribution of individual species (e.g., montane, meadow, and water voles) is not known. Montane, meadow, water voles, and western jumping mice prefer areas with tall, dense and "rank" herbaceous cover (Burt and Grossenheider 1976, MacCracken et al. 1985a, Fagerstone and Ramey 1996, Fisher et al. 2000). Kie and Loft (1990) assessed that reductions in height below 12 inches in mountain meadows would adversely affect montane voles. In an Idaho study, montane voles were more common in an ungrazed exclosure than in grazed sites (Medin and Clary 1990). In areas with dense vegetation in the western U.S., meadow voles cycle, but they do not cycle where grasses are kept low by burning or grazing (Fagerstone and Ramey 1996). Voles are important prey species of many predators, including several Region 4 sensitive species and predatory migratory birds of conservation interest.

Livestock grazing typically reduces abundance of voles (Fagerstone and Ramey 1996), which is consistent with habitat needs of voles and the fact that livestock grazing removes the vegetation that constitutes their habitat. Based on their habitat needs and the effect of livestock grazing on herbaceous cover, acceptable levels of livestock grazing would be similar to that of waterfowl, except that voles and jumping mice may be somewhat more tolerant of livestock grazing. There is some indication that retaining at least 70-79% of annual production should maintain enough tall, dense characteristics to provide suitable habitat for these species. This is based on the habitat needs of voles, their small size, and my judgment about the amount and structure of herbaceous vegetation that is retained when 21-30% has been removed by livestock, which includes some level of broken and matted vegetation (earlier sections of this report). At 60-69% retention, the amount and structure of remaining vegetation has changed considerably from ungrazed vegetation, but there are still numerous patches of tall, dense vegetation. However, grazed microsites are also abundant. Therefore, there is low to moderate indication that retaining 60-69% of the annual production would be on the suitable side of the threshold between suitable and unsuitable cover. Information contained in this report does not support the assessment that retaining 50-59% of the annual production would maintain suitable cover for these species.

Shrews

Shrews likely are widely distributed in riparian and moist meadow communities on the district, but the distribution of particular species is unknown. At least a few of the following species likely occur on the district: masked shrew, dusky shrew, dwarf shrew, water shrew, and vagrant shrew (Cerovski et al. 2004). Masked, water, and vagrant shrews prefer moist conditions (Burt and Grossenheider 1976), including lush herbaceous vegetation where moist conditions are not maintained by water near or at the ground surface and not maintained by dense canopies of trees or shrubs. Dusky and dwarf shrews also use riparian and other moist habitats, but they also may be found on drier slopes. MacCracken et al. (1985b) found that percent litter cover was an important indicator of the quality of masked and dwarf shrew habitat.

For the species that prefer moist habitats, relationships between habitat suitability and livestock grazing may be similar to those described for voles and shrews, above. Dusky and dwarf shrews may accommodate livestock grazing to a somewhat greater extent, but I am not clear on this.

Deer Mice

Deer mice inhabit a wide range of habitats, from meadows to shrublands to forestlands. As noted by Burt and Grossenheider (1976:159), "Nearly every dry-land habitat within its range is occupied by this species; forests in some areas, grasslands in others, a mixture in still others." They occur coast to coast and from Alaska and Canada south to Mexico, excluding much of the southeastern United States.

Because they inhabit such a wide range of habitats, they can tolerate a wide range of livestock grazing intensities.

In Utah, deer mice "…preferred pastures from which the least amount of grass cover had been removed by livestock" (Frischknecht 1965, as cited by Kie et al. 1994:668), but they were almost twice as abundant in grazed sites as compared to ungrazed sites (Medin and Clary 1990).

Possible Benefits of Livestock Grazing in Meadow and Open Willow Communities

Creating Structural Diversity in Herbaceous Plant Communities

The potential for using cattle to increase structural diversity of vegetation has been discussed by Kie and Loft (1990), Severson (1990), USFWS (1990), and Holechek et al. (2004:458). This is supported by the grazing behavior of cattle, i.e., that it is patchy (Forbes 1988, Stuth 1991, McKinney 1991). It is also supported by BLM et al. (1999) and BLM et al. (2008), which describe patchiness relative to grazing intensity. According to BLM et al. (2008:27), grazing has become very definitively patchy when grazing intensity has increased to about 21-40% utilization. Based on information in this report, a given site grazed to 35-40% utilization could result in as much as 35-56% of the basal area of bunchgrasses being grazed to near ground level (Tables 4 and 6). In meadows where graminoid communities would otherwise be relatively tall and dense, this changes habitat structure considerably. It also changes vegetation structure in big sagebrush and mountain shrubland communities, but not nearly as dramatically because herbaceous communities many times are already fairly open. Discussions of the use of cattle to increase structural diversity of herbaceous vegetation generally apply to meadows and marshes.

Holechek et al. (2004:458) tied the potential benefits of increased structural diversity to two things:

- *Benefits of edge effect at various scales* — They explained edge effect and went on to state that "Diversity in both plant species and plant communities over short distances is the key to healthy wildlife populations…" While it has long been recognized that higher levels of habitat diversity at small to large geographic scales increases wildlife diversity (species richness and relative abundance of each species), it has been increasingly recognized that increasing habitat diversity and wildlife diversity is not necessarily a defensible goal. If a goal of wildlife management is to retain the full compliment of native species, approximating or mimicking native or natural habitat diversity is the most straightforward way to accomplish it (see Principle A.3). Meadows with relatively tall, dense herbaceous vegetation is a natural and important part of wildlife habitat in this area, particularly since so much of this habitat at low elevations has been converted to farmland and residential developments in this part of the intermountain west and much of what remains is grazed by livestock.

- *Negative effects of accumulations of residual herbaceous vegetation* — Holechek et al. also assessed that benefits of "controlled grazing" to increase structural diversity in grasslands and meadows "…are more likely to occur in the more humid, wet rangeland types (over... [20 in.] annual precipitation), where tall grasses without periodic defoliation shade out nutritious forbs and impede the mobility of small mammals and birds. Positive benefits to wildlife from grazing influences become questionable… where shading of desirable forbs and excessive accumulation of vegetation are seldom a problem."

  As discussed previously, residual herbaceous plant material does not accumulate in meadows — due to compaction by snow — except in the few places where sturdier grasses exist and where grasses are protected under the canopies of shrubs. Where residual herbaceous plant material does accumulate, it is an important contribution to wildlife habitat. Furthermore, meadow vegetation in many places is shorter and sparser than would exist if plant vigor was normal and if plant communities were in healthy, functioning condition (USFS 1997, USFS 2004, USFS 2009). In many areas, the height and density of herbaceous vegetation in meadows is less than satisfactory for species that require tall, dense herbaceous vegetation, prior to recreation or grazing effects. The addition of recreational activities (e.g., dispersed camping, parking, motorized use, horse grazing, foot traffic) in some places compound this effect. And further compounding this effect is grazing by cattle and working horses.

While grazing pressure that creates patchiness in healthy meadow communities (e.g., 20-40% utilization of herbaceous vegetation) would benefit some species (e.g., mountain bluebirds, American robins, northern flickers), it would negatively affect other species (e.g., green-winged teal, savannah sparrows, meadow voles). As discussed for individual species, there is little support for the assessment that patchiness in meadows is *needed* for any species that may benefit from it (e.g., spotted frogs; Watson et al. 2003, Bull 2005), and there is little to no support for the assessment that creation of patches in healthy meadow vegetation would retain suitable cover for species dependent on tall, dense herbaceous vegetation. Creating more patches in meadows that are in less-than-satisfactory condition would compound the adverse effects.

An important consideration with respect to this subject is that cattle grazing will continue to graze many of the low-elevation meadows on the district, in support of Objective 1.1(h) of the Forest Plan, and will create patchy networks in these meadows (assuming grazing intensity does not rise above 21-40%). There is no need to attempt to intentionally create patchiness in meadow communities.

Sustaining Meadow Communities

The potential use of cattle to improve or sustain long-term productivity of meadows for wildlife habitat has been discussed by several authors, including Kie and Loft (1990) and Wyoming Partners in Flight (2003). This typically involves period heavy grazing to reduce the accumulations of residual herbaceous vegetation. Obviously, if an objective of periodic heavy grazing by livestock is to help sustain wildlife cover in meadows, this would need to be done as infrequently as possible because, otherwise, depleted or low amounts of cover would be maintained. Gilbert et al. (1996) recommended grazing or haying no more than once out of every 6-7 years to remove accumulations of residual vegetation in the San Luis Valley of Colorado. In many riparian and meadow graminoid communities on the Greys River Ranger District, snow cover is sufficient to mat most of the herbaceous vegetation, thereby limiting accumulations of residual vegetation. By matting the vegetation close to the ground, this also facilitates the decomposition process, which further limits build-up of residual vegetation. Furthermore, because the level of herbivory by native herbivores was likely fairly low in most parts of the district prior to Euro-American settlement (see the "Desired Conditions — General Concepts," section), there likely were accumulations of herbaceous vegetation that were not impacted by snow. This may have limited annual production on these sites, but this is not undesirable. If heavy grazing were to occur, dry years should be avoided.

Wildlife Inhabiting Willow and Aspen Stands that Use Herbaceous Cover

Mule Deer

While the effects of livestock grazing on mule deer (MIS species) has been well studied and while it is recognized that cover in general is important to mule deer, effects of reduced herbaceous cover has received little attention. Loft et a. (1987) found that moderate and heavy cattle grazing pressure in aspen stands and heavy grazing in willow stands reduced hiding cover for mule deer fawns when cattle grazing occurred during the fawning season. Fawning in the Greys River drainage generally occurs during the month of June, and the cattle grazing season begins about June 15, meaning there is a potential for cattle grazing to affect hiding cover for mule deer fawns. The effects this may have on fawn predation and the deer population is unknown.

Amphibians

Willow communities near water bodies, and particularly willow communities with wet conditions and standing water, provide habitat for spotted frogs, chorus frogs, boreal toads, and tiger salamanders on the district. Habitat needs of spotted frogs, chorus frogs, and boreal toads were addressed previously (and apply to willow stands). While sedges is a common component of spotted frog and boreal toad habitat, willows and aquatic vegetation also can be important; willows may be important for thermal cover (Keinath and McGee 2005, Patla and Keinath 2005). Willows mitigate the effects of cattle grazing by providing cover and by protecting graminoids from grazing, thereby further retaining cover.

Waterfowl

Willow communities near water bodies provide potential nesting habitat for mallards and teal. Nesting-cover needs of mallards, green-winged teal, and cinnamon teal were addressed previously, and they apply to willow stands. Herbaceous vegetation is still important, but with the added component of willow plants contributing to nesting cover. Willows mitigate the effects of cattle grazing by providing nesting cover and by protecting graminoids from grazing, thereby further retaining nesting cover.

Fox Sparrow

Fox sparrows appear to be fairly common in large stands of tall, dense willows. It typically nests on the ground or just above the ground. Dense shrub cover appears to be main requirement for nesting, but tall, dense herbaceous cover also appears to contribute to nest concealment (Johnson and Anderson 2004). Nesting on the district likely is initiated in early to mid May and nest-building and nest-occupancy generally lasts 4-5 weeks, extending the nest-occupancy period into early to mid June for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period (e.g., early July). Young are fed by the parents for 2 weeks or more. Double-brooding is possible, which would extend the nest-occupancy period to late July or early August.

Based on several studies, Johnson and Anderson (2004) assessed that cattle grazing in riparian willow communities has the potential to negatively affect fox sparrows, but most impacts are those that develop over time (e.g., reductions in the canopy cover of willows and other riparian shrubs). Based on the habitat needs of fox sparrows and the effects of livestock grazing on herbaceous cover (earlier sections of this report), there is strong support for the assessment that retaining ≥90% of the annual production of herbaceous vegetation in dense willow communities is sufficient to meet the needs of fox sparrows, and it is likely that 80-89% retention would also be sufficient to meet their needs. It is likely that the structure of willow communities used by fox sparrows would prevent much higher grazing use than 11-20% utilization.

I am not clear whether it is even possible to attain utilization levels of >20% in the willow communities used by fox sparrows since the vast majority of a given dense willow community is inaccessible to cattle and other gazers. Even if production of herbaceous forage in willow stands is 1/6 of the production along established cattle trails through the willow community, and assuming a trail density of about 625 ft. per acre (comparable to 3 miles per square mile) and a width of 1.5 feet, 70% utilization along these trails and no utilization in the interior of willow stands translates to an overall retention of just over 90% of the annual production. However, the production differential is likely not this high and cattle can graze more than this 2% of a willow stand. I have seen fox sparrows in relatively dense stands of willow that contained openings with dense stands of sedges (15% of the area?). If 15% of an area accessible to cattle supports graminoids, if production within the interior of the willow stand is 1/6 of the open (accessible) graminoid communities, and if 70% of graminoids is retained in these open communities (and 100% retention in the interior), overall retention for the entire area would be 84%. If, in this hypothetical example, retention was 60% in the open sedge communities, overall retention for the entire area would be 78%. Again a multiplier of 1/6 is probably too low for parts of willow stands that are inaccessible to cattle, meaning that retention levels would be higher.

Because of the large number of interacting variables and because a high overall retention levels in willow stands can result in heavy cattle grazing in limited areas accessible to cattle, it is important to limit assessments of utilization to areas accessible to cattle (see the recommendations section for more detail).

The level of herbaceous vegetation that is retained has the potential to affect fox sparrows on a year-to-year basis, but the main issue related to livestock grazing use is sustaining healthy, relatively-dense stands of willow (long-developing attributes). The most important issue for fox sparrows is limiting livestock grazing use to light enough levels to allow willow stands to remain in healthy, dense condition (where they become naturally dense) and to allow less-than-satisfactory stands to recover. Beyond this, there is strong support for the assessment that retaining 80% to ~100% of the annual production of herbacesous vegetation in graminoid communities accessible to cattle would retain suitable herbaceous wildlife cover for fox sparrows, primarily for foraging, on these sites. This is because fox sparrows, even when foraging, prefer to remain in or very close to dense vegetation (Johnson and Anderson 2004). Also, this low level of utilization in open areas and along trails would result in very light to no use of herbaceous vegetation throughout the vast majority of willow communities. There is moderately strong support for the assessment that retaining a minimum of 70-79% on these sites because patches of relatively tall, dense herbaceous wildlife cover would remain and small open microsites may be used for foraging, although these are not necessary. There is less support for the assessment that 60-79% retention would be sufficient, as sedge and other graminoid communities are opening considerably at this level. There is no support for the assessment that retaining a minimum of 50-59% or less would provide for the cover needs of secretive species like fox sparrows in openings in willow communities. This does not apply to trails, so long as utilization levels are not high enough to result in further mechanical damage and expansion of trails. In relatively dense to dense stands of willows with fairly limited trailing, heavy grazing along trails likely has little impact on fox sparrows. (See the section, "Wildlife Inhabiting Willow & Aspen Stands that Use Shrub and Tree Cover" for more information.)

White-crowned Sparrow

This species is one of the most common species associated with tall, dense stands of willows on the district, and they also inhabit other moist shrubby communities and, at higher elevations, krumholtz communities. White-crowned sparrows in this area (subspecies *Zonotrichia leucophrys oriantha*) typically breed in subalpine willow-graminoid meadows (Chilton et al. 1995), and Douglas et al. (1992) found they favored tall willow communities with either sedge/grass understories or forb-dominated understories (e.g., Boothe's willow/beaked sedge and Boothe's willow/false Solomon's seal community types described by Youngblood et al. 1985; see Table 5, previously in this report). White-crowned sparrows of this subspecies usually nest on the ground, and Chilton et al. (1995) stated that grass is a necessary habitat feature. Chilton et al. (1985) cited one study that found 84% of nests were on the ground "in low grass or sedges" or beneath sagebrush. Unfortunately "low" was not defined in the source paper (King and Mewaldt 1987). Some authors have defined low herbaceous vegetation as <12 inches (e.g., Kie and Loft 1990, Douglas et al. 1992). Nests are typically either placed in grass cover (many times in dense grass cover), at the base of willow bushes, or under sagebrush plants. Vegetation usually overhangs their nests. Nesting on the district likely is initiated in May and nest-building and nest-occupancy generally lasts 4-5 weeks, extending the nest-occupancy period into mid or late June for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period (e.g., early July). Young are fed by the parents for 3-4 weeks or more. Double-brooding is possible, which would extend the nest-occupancy period well into August.

In addition to dense shrubs or conifer thickets (e.g., krumholtz) and grass being important to white-crowned sparrows, Chilton et al. (1995) identified small patches of bare ground as being important for foraging (e.g., Figures 1c-d and 2c-d). They assessed that sites are "most suitable if bare ground / grass and shrubs are distributed patchily," citing another source for this.

Relationships between the suitability of white-crowned sparrow habitat and livestock grazing use is similar to what I described in the fox sparrow section, above, except that (1) white-crowned sparrows are not as secretive and do not need the same level of dense herbaceous cover as fox sparrows and, related to this, (2) bare ground is an important feature of foraging habitat for white-crowned sparrows. Therefore, there is strong support for the assessment that retaining as little as 60-69% of the annual production of herbacesous vegetation in graminoid communities accessible to cattle in and around willow stands would retain suitable herbaceous wildlife cover for white-crowned sparrows, primarily for foraging. At this level, herbaceous vegetation would be very patchy in many situations with alternating patches of heavily grazed microsites and moderate to tall patches of relatively dense microsites. Even at 50-59% retention, there may be sufficient patches of remaining graminoid cover to provide for their cover needs, assuming that shrub cover is nearby and that higher retention levels are associated with willows (for nesting).

Intentional creation of bare ground, however, is not needed for white-crowned sparrows because (1) microsites with short herbaceous vegetation and bare ground is naturally distributed in habitats used by white-crowned sparrows, which includes adjoining big sagebrush and mountain shrublands; (2) grazing and hoof action by native ungulates contribute to patches of short herbaceous vegetation and bare ground, and their abundance generally is at or above pre-settlement levels; (3) one of the features of riparian areas in less-than-satisfactory condition is drier conditions, which sustains higher levels of bare ground; (4) some of the introduced graminoid species that dominate parts of riparian areas tend to have a more open structure (e.g., smooth brome); (5) recreational and other uses (e.g., dispersed camping, designated open trails, user-created trails, horse grazing) contribute to short herbaceous vegetation and bare ground; and (6) microsites with short herbaceous vegetation and bare ground will be created wherever cattle are grazed, regardless of the level of grazing. I have seen an abundance of white-crowned sparrows in many willow communities that receive no more than very light grazing pressure on the district.

MacGillvray's Warbler

I have observed and heard MacGillvray's warblers in a variety of habitats on the district, including dense willow stands, aspen stands, and conifer/mixed-deciduous tree/shrub communities, which is consistent with Pitocchelli (1995) and Baicich and Harrison (1997). They are among the more common warblers on the district. They are "Common in riparian habitats and wet thickets in southern portion of breeding range. Requires dense undergrowth and moderate cover…" (Pitocchelli 1995:5). Wyoming is in the southern portion of their breeding range. Undergrowth favorable to MacGillvray's warblers in Wyoming consists of dense mixes of rushes, horsetails, grasses, and sedges. According to Pitocchelli (1995) and Baicich and Harrison (1997), they nest at the base of shrubs and sometimes on the ground or in clumps of grasses under or near shrubs. The nest is always concealed by shrubs and dense undergrowth. They typically forage within 6 feet of the ground and commonly forage within 2 feet of the ground, including on the ground, at some times of the summer (Pitocchelli 1995, Wyo. Partners in Flight 2003).

Nesting on the district likely is initiated in May and nest-building and nest-occupancy generally lasts 4-5 weeks, extending the nest-occupancy period into mid or late June for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period (e.g., early July). Young are fed by the parents for an unknown period of time. Double-brooding is possible, which would extend the nest-occupancy period into early August. They are an uncommon cowbird host (Pitocchelli 1995, Wyo. Partners in Flight 2003).

Relationships between the suitability of MacGillvray's warbler habitat in riparian areas and livestock grazing use are similar to what I described in the fox sparrow section.

Lincoln's Sparrow

In the montane zone, Lincoln's sparrows are found mainly in boggy, willow-, sedge-, and moss-dominated habitats, particularly where shrub cover is dense (Ammon 1995). They appear to be fairly common in these types of habitats on the district. Their nests are "…on the ground, most often inside a low willow shrub or mountain birch (*Betula glandulosa*) that also contains fairly dense sedge cover" and they are usually well concealed with distinct nest-entrance tunnel through herbaceous vegetation (Ammon 1995:9). In the Centennial Mountains of eastern Idaho (5,300-5,600 ft. elevation), Douglas et al. (1992) found that Lincoln's sparrows favored short willow communities with dense sedge understories (e.g., the Wolf willow/beaked sedge and Wolf willow/water sedge communities described by Youngblood et al. 1985; see Table 5, above). Nesting on the district likely is initiated in early June and nest-building and nest-occupancy generally is about 5-6 weeks, extending the nest-occupancy period into early or mid July for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period (e.g., late July possibly to mid August). Young are fed by adults for another 2-3 weeks. It is unclear whether they are double-brooded, but this would seem unlikely in this area.

Livestock grazing levels that allow tall, dense herbaceous vegetation to be retained in low-stature willow communities through early to mid August (and then residual cover for the following spring) would provide for the nesting needs of Lincoln's sparrows. Retention of herbaceous vegetation between willow plants may be less important, but because of the short height and small width of willows in these communities (compared to tall willow communities), graminoids between willow plants contribute to hiding cover of nests under willows. Furthermore, low-stature willow plants do not protect graminoids to the extent that tall willows protect them. It is easier for cattle to access these communities and trail systems can be extensive.

Based on the habitat needs of Lincoln's sparrows and the effects of livestock grazing on herbaceous cover (earlier sections of this report), while recognizing the influence of willows on the pattern of grazing utilization, there is strong indication that retaining 90% to ~100% of the annual production of herbaceous vegetation in low-stature willow communities is sufficient to meet the needs of Lincoln's sparrows. There also is at least a moderately-high level of support for the assessment that retention of 80-89% of the annual production of herbaceous vegetation in dense, low-stature willow communities would retain suitable cover for Lincoln's sparrows. Graminoids would remain relatively tall and dense at this level of grazing. Graminoids growing under the canopy of willow plants would remain ungrazed or no more than lightly grazed (in dense willow stands, this would constitute most of the graminoid plants). In dense willow stands with a fairly limited trail system, grazing pressure may be fairly heavy in the trails and in some of the small openings. This likely has no more than limited effects on Lincoln's sparrows, including no more than slight potential for nest trampling, but does not account for other potential impacts (e.g., effects of cattle on cowbird parasitism, increased access by predators due to trails; see the section, "Wildlife Inhabiting Willow & Aspen Stands that Use Shrub and Tree Cover" for more information).

There is less support for the assessment that retention of 70-79% of the annual production of herbaceous vegetation would retain suitable cover for Lincoln's sparrow, given the higher level of grazing pressure along trails and in openings and the likelihood that this level of grazing would include grazing of graminoids around willow plants. However, the density of willow plants is probably high enough and utilization of graminoids low enough to retain a fairly high density of ungrazed to lighly grazed graminoids growing under the canopies of willow plants. Tall, dense graminoid characteristics would be retained to a large extent. There is no more than moderate support (and possibly low support) for the assessment that retention of 60-69% of the annual production would retain suitable cover for Lincoln's sparrows. By virtue of Lincoln's sparrows inhabiting dense willow stands, a 31-40% utilization level (60-69% retention) would indicate that trailing is extensive enough and openings large enough to accommodate an overall utilization level of 31-40%, which would indicate less-than-satisfactory conditions for Lincoln's sparrows. However, it is possible that reduced canopy cover of willows could in part be offset by tall, dense graminoid cover — if this is the case, lower levels of grazing pressure would be needed. There is very little to no support for the assessment that retention of <60% would retain suitable habitat conditions for Lincoln's sparrows. This level of grazing (≥40% utilization) would indicate that a fairly extensive trail network and openings exists, given that graminoids under willow plants would still be protected. At the density of willows required by Lincoln's sparrows, it likely is not possible to reach utilization levels of ≥40% without considerable mechanical damage to willow communities. (See the section, "Wildlife Inhabiting Willow & Aspen Stands that Use Shrub and Tree Cover" for more information.)

Common Yellowthroat

In general, common yellowthroats breed in low undergrowth near water, including along streams (Baicich and Harrison 1997). I have only observed common yellowthroats on one site on the Greys River Ranger District so far — in a stand of low-stature willow in lower Blind Trail Creek — but I have not spent much time in this community elsewhere on the district, and they likely exist in many other locations (they are listed as "fairly common" on a bird checklist for Jackson Hole). (I was originally surprised to see them in this situation, as I associated them with dense cattail stands… which is where I found them to be plentiful in eastern North Dakota.) Their nest is usually placed just above the ground (usually no higher than 3 ft.) or over water in dense forbs, cattails, reeds, grass tussocks, and similar situations, commonly at the base of shrubs or saplings (Baicich and Harrison 1997). Wetmore et al. (1964:286) characterized the nest microsite as follows: "She hides the nest so well in grass, shrubs, or reeds that you probably won't find a yellowthroat's cup-shaped nest unless you come close enough to flush a bird from one."

Nesting on the district likely is initiated in May on the district, and nest-building and nest-occupancy generally lasts 5 weeks, extending the nest-occupancy period into mid or late June for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period (e.g., early July). Young are fed by the parents for an unknown period of time, but young remain dependent on adults for longer than for other warblers. Double-brooding is possible, which would extend the nest-occupancy period into early August. They are a cowbird host (Wetmore et al. 1964).

Based on similarity in habitat needs in low-stature willow communities, the relationships between the suitability of common yellowthroat habitat in riparian areas and livestock grazing use are similar to what I described in the Lincoln's sparrow section. Common yellowthroats were identified by Dobkin et al. (2002) as a species most closely associated with willow communities that are grazed no more than lightly by ungulates and a moderate fire-return interval.

Red-winged Blackbird

This species is uncommon on the district and inhabits wet meadow and willow habitat associated with riparian areas, lakes, and other wetlands. It is included as representative of a species that builds nests above the ground in tall graminoids [e.g., cattails, reeds, bluejoint reedgrass, and tall sedges], although they also place their nests in willow plants (Yasukawa and Searcy 1995, Baicich and Harrison 1997). They nest mostly in cattail marshes and similar situations, but these conditions are rare on the Greys River Ranger District. Nests in moderate-height emergent marsh vegetation are typically 8-32 inches above the water, requiring graminoids at least 10-12 tall. When attached to stalks, no attempt appears to be made to hide the nest in foliage. Nests in upland areas are typically on or near the ground and concealed by herbaceous vegetation and shrubs. Nesting on the district likely is initiated in early to mid May and nest-building and nest-occupancy generally lasts 5-6 weeks, extending the nest-occupancy period into mid to late June for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period (e.g., mid July). Young are fed by the parents for 2 weeks or more. Double-brooding is possible, which would extend the nest-occupancy period to early August.

Where cattle graze in tall-graminoid communities (e.g., where bluejoint reedgrass and tall sedges are extensive enough to provide nesting habitat near water), they may disrupt or damage nests since nests in these plant communities are supported by graminoid stalks, which are vulnerable to being damaged or destroyed by walking and running cattle and other large animals.

It is difficult to place a lower threshold on retention in graminoid communities for red-winged blackbirds because, aside from impacts to nests when they are attached to graminoid stalks, this species is relatively tolerant of cattle grazing and most nests on the district are probably placed in willow or other riparian deciduous shrubs and not in graminoid communities. Most tall-graminoid communities typically adjoin or are near willow/mixed deciduous shrub communities, and most red-winged blackbirds likely select these shrub communities for nesting.

Voles, Western Jumping Mice, and Shrews

Cover requirements of montane voles, meadow voles, water voles, western jumping mice, and shrews are discussed in the previous section entitled "Meadow, Riparian, and Wetland Wildlife that Need Herbaceous Cover," above.

Of the three most common species of voles, water voles have the narrowest set of habitat requirements. They prefer linear strips within about 60 feet of alpine and subalpine spring-fed and glacial streams with gravel bottoms, about 5° slopes, and bordered by deep soils (Klaus and Beauvais 2004). While they occur at lower elevations, they may be more common above 8,000 feet. They are most common in willow/wet sedge community types and livestock grazing has been identified as the "likely greatest anthropogenic threat to water voles in [the Rocky Mountain Region] of the Forest Service (Klaus and Beauvais 2004).

Of the habitat elements that can be affected by human activity and management, Klaus and Beauvais (2004) identified structural integrity of stream banks as one of the most critical elements of water vole habitat. Successful reproduction depends in part on security of nests underground burrows, which can also be impacted by soil compaction. They identified late June and early July as the period when the potential is highest for impacts to reproductive success.

Livestock grazing has the potential to shift small mammal communities in riparian areas, which include specialists like water voles, toward communities dominated by habitat generalists, which do not include species like water voles.

Rangeland Wildlife that Need Herbaceous Cover

Greater Sage Grouse

Sage grouse distribution is limited to the Spring Creek/Big Ridge area. They are sagebrush-obligates from the standpoint of nesting. They commonly nest in sagebrush that is 11-30 inches tall (Connelly et al. 2000). Sage grouse hens typically place their nests under tall sagebrush plants with relatively large canopies and, within a particular area, select patches with relatively high canopy cover. Herbaceous vegetation is an important component of nesting habitat (Wakkinen 1990, Gregg et al 1994,Connelly et al. 2000). The amount and height of herbaceous vegetation has been shown to affect nest success (Gregg et al. 1994, DeLong et al. 1995). Gregg et al. (1994) found that sage grouse nests on sites with grass heights of >7 inches (and sagebrush height of 16-30 inches) were more successful than nests with shorter grass and sagebrush heights. Sage grouse will nest on sites where grass height and density provide little protection to nests, but nest success has been shown to be lower. Because sage grouse nest early in the season, residual herbaceous cover from previous years is important and, because sagebrush canopies provide protection from being matted down by the weight of snow, much of this residual grass cover persists.

Based on Baicich and Harrison (1997) and snowmelt, nesting by sage grouse likely begins in late April to early May. Nest building, egg-laying, and incubation of sage grouse lasts 5-6 weeks, which extends the nesting period into mid June. Renesting, which is not uncommon if the first clutch of eggs is lost, could extend the nesting period into July.

Wyoming Partners in Flight (2003:284) recommended retaining minimum residual grass/forb heights of 7-8 inches, measured in May and early June, to provide adequate herbaceous cover for nesting sage grouse and sharp-tailed grouse (to account for renesting in this area, this should extend at least until the end of June). Grass heights of 7-8 inches roughly corresponds to 70-80% of annual production retained on individual plants evaluated in Table 10 (i.e., assuming grazing from the top of plants working downward); where initial grass heights are shorter, the percent retention would need to be higher. While sharp-tailed grouse no longer inhabit the Greys River Ranger District, they nest in similar situations as sage grouse (albeit in mountain shrubland areas) and provide additional information on ground nesting species that require herbaceous cover for successful nesting (data on sharp-tailed grouse reinforce and lend greater confidence to the 7-inch threshold for sage grouse).

Estimating the utilization limits that it would take to retain stubble heights of 7-8 inches can be assessed in two ways:

- If it is assumed that cattle graze plants from the top down and that they exert relatively equal grazing pressure on each plant, retention of a minimum of 90% of the annual production of herbaceous vegetation would be needed to retain stubble heights of 7-8 inches on *all* species assessed in Table 10 (see Figure 3b). For the tall and moderately tall bunchgrasses assessed in Table 10, retention would need to be ≥70% (Figures 3a-d).
- If it is assumed that cattle many times take bites from lower down on the plant (i.e., “heavy munch” as characterized by McKinney 1997) and that patchy grazing results as characterized in BLM et al. (1999) and BLM et al. (2008), retention of about 80% of the annual production in a given area would be needed to retain most (i.e., greater than about 60%) of the basal area of grasses at ≥7-8 inches tall (for the amount of basal area that would grow taller than 7 inches if it were not grazed). At a utilization level of 20%, up to an estimated 30% of the basal area of plants could potentially be grazed to near-ground level (Table 11, Figures 1b and 2b). If this were to happen, a small portion of the basal area *not* grazed to near-ground level would retain heights mid-way between near-ground level and ungrazed heights, and much of the remainder of the basal area would retain ungrazed heights or near ungrazed heights. This assumes that most of the basal area of short to moderate height species (e.g., Idaho fescue, Sandberg’s bluegrass) remain ungrazed. At this level of grazing, the vast majority of grasses under the protection of shrubs would remain ungrazed or only lightly grazed, thereby retaining heights of ≥7-8

inches in association with shrub canopies. (see "Amount of Wildlife Cover Retained in Rangeland Habitats" section, beginning on page 103, for more information).

Under this scenario, many plants are either grazed at the "heavy munch" level or either not grazed or lightly grazed (Figure 1b). In other words, in many cases a plant or a large part of a plant is either grazed down to near-ground level (e.g., ≤2-4 inches) or it retains ungrazed or near-ungrazed heights, or part of the plant is grazed to near ground level and the remainder is left untouched or only lightly grazed. Figures 1b-d and 2b-d illustrate the reduction in cover that occurs between 20% and 40% utilization.

This scenario recognizes that the important issue for wildlife cover is the proportion of plants or basal area of plants that are *not* grazed to near-ground height and, conversely, the proportion of plants or basal area that retains >50-75% of their height (which is most of what is not grazed to near-ground level).

Therefore, there is strong support for the assessment that retention of ≥80% of the annual production of herbaceous vegetation in big sagebrush communities would retain suitable nesting cover for sage grouse, assuming adequate sagebrush canopy cover and height and assuming healthy understories.

There is moderate support for the assessment that retention of 70-79% of the annual production of herbaceous vegetation in big sagebrush communities through the end of June would retain suitable cover for sage grouse during the nesting season. I gave it a "moderate" rather than high because it is possible (likely?) for only 50% or less of the basal area to retain heights of ≥7-8 inches. However, because most grasses under the protection of sagebrush would remain ungrazed or only lightly grazed at this level of utilization and because residual grass between sagebrush plants would be compressed under the weight of snow during winter, it would stand to reason that this level of grazing would retain suitable residual cover beyond the livestock grazing season (for the following nesting season). This would only apply to grazing that occurs after June, and it is possible this relationship also applies when only 60-69% of residual cover is retained beyond the livestock grazing season. Because so little of the basal area of grasses would be retained at ≥7-8 inches when only 50-59% of the annual production of herbaceous vegetation is retained (Table 11), there is no more than low support for this level of grazing retaining suitable cover for sage grouse.

Vesper Sparrow

This species inhabits grassland, meadow, forest clearings, and sagebrush habitat with herbaceous vegetation, typically where there is at least some shrub cover (but this is not always the case). Characteristics of habitat includes bunchgrasses that are spaced apart, but where they are 6-12 inches tall and where bare ground is approximately 6-24% (Wyo. Partners in Flight 2003:473). They feed on the ground, eating insects and grass and forb seeds. Nests are often placed under herbaceous vegetation. Nesting on the district likely is initiated in mid May and nest-building and nest-occupancy generally lasts 4-5 weeks, extending the nest-occupancy period into mid or late June for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period (e.g., early July). Young are fed by the parents for as long as 3 weeks or more. Double-brooding is possible, which would extend the nesting period well into August.

Wyoming Partners in Flight (2003) provides conflicting objectives and recommendations. One of the habitat objectives for vesper sparrows is to maintain "good bunchgrass cover" of 6-12 inches high, but to help achieve this objective, they recommend limiting forage utilization by livestock and other ungulates to 50%. Limiting forage utilization to 50% would not maintain grass height of 6-12 inches. However, I address the merits of both in the following discussion.

Vesper sparrows prefer areas where grass cover is relatively sparse (Wyo. Partners in Flight 2003, Baicich and Harrison 1997). This is indicated by their preference for areas where the proportion of bare ground is 6-24% (Wyo. Partners in Flight 2003), which is typical for big sagebrush and grassland communities in healthy, functioning condition (O'Brien et al. 2003), depending on soil, aspect, and other factors. In other words, vesper sparrows do not require big sagebrush and grassland communities to be in less-than-functioning condition, but they will typically not nest in meadows where grass cover is dense.

Stubble Height of 6-12 Inches

Retaining stubble heights of at least 6-12 inches does not conflict with the above description of habitat needs, and it supports Wyoming Partners in Flight's (2003) assessment that good bunchgrass cover is needed for nest concealment. Estimating the utilization limits that it would take to retain stubble heights of 6-12 inches can be assessed in two ways:

- If it is assumed that cattle graze plants from the top down and that they exert relatively equal grazing pressure on each plant, the relationships would be similar to those described for sage grouse. This is because the analysis was based primarily on the minimum stubble height for vesper sparrows (≥6 inches) and sage grouse (≥7 inches). If only the tallest bunchgrasses in Table 10 (bluebunch wheatgrass) are considered, stubble heights of 6 inches could be retained when retention of annual production is ≥60% (Figures 3a-e). A minimum of 12 inches would require lower utilization levels (e.g., ≥90% retention of herbaceous vegetation).
- If it is assumed that cattle many times take bites from lower down on the plant (i.e., "heavy munch") and that patchy grazing results, the relationships would be similar to those described in the second bullet for sage grouse. The relationships are similar because minimum stubble heights are similar (see previous bullet) and because many plants are either grazed at the "heavy munch" level or either not grazed or lightly grazed as described in the sage grouse section. A minimum average 12-inch stubble height would require lower utilization levels than those presented in the sage grouse discussion, and could not reasonably be maintained in areas grazed by livestock for any reasonable amount of time.

Maximum 50% Utilization

Wyoming Partners in Flight (2003:475) recommended protecting current year's herbaceous growth through the nesting season by managing for at least 50% of annual vegetation growth to remain through the following nesting season. Taking the same approach for assessing the relationship between percent utilization and habitat needs as was done for stubble height, above, the effects of limiting utilization to 50% can be assessed in two ways:

- If it is assumed that cattle graze plants from the top down and that they exert relatively equal grazing pressure on each plant, limiting utilization to 50% of the annual production of herbaceous vegetation would retain heights of roughly 1½-2½ inches for the shorter grasses assessed in Table 10 (with ungrazed heights of 7-19 inches) and heights of roughly 4-7½ inches for the taller grasses (with ungrazed heights of 16-31 inches). This is illustrated in Figure 3f.

- If it is assumed that cattle many times take bites from lower down on the plant (i.e., “heavy munch”) and that patchy grazing results, retention of 50% of the annual production in a given area would result in only about 25% of the plants or basal area of plants retaining heights greater than about 1½-4 inches (Figure 1e). Thus, up to 75% of the basal area of plants would not provide any more than marginal hiding cover for nests. Heights of <2 inches likely do not provide effective cover for hiding nests. Most of the remaining basal area (≤25%) — the portion that would retain ≥50-75% of the ungrazed heights — would contribute to cover.

  Retaining only 50% utilization of the annual production of herbaceous vegetation would conflict with Wyoming Partners in Flight’s (2003) assessment that good bunchgrass cover for nest concealment is needed (e.g., compare Figures 1e and 2e with Figure 2h). However, Baicich and Harrison (1997:300) assessed that “Nest on the ground, often near patches of scanty or absent herbage. In a small hollow against the base of a weed or grass tuft, concealed or exposed” and Wetmore et al’s (1964:358) assessment that “The pair build their nest in a grassy hollow, sometimes in the shelter of a leafy bush or surrounding tussocks.” What is not clear in this characterization is whether the plant community consists of “scanty” vegetation or whether they were attempting to explain that Vesper sparrows many times select microsites of “scanty” within an area of relatively dense herbage.

Upshot

Based on the information in the last two sub-sections and considering benefits and potential risk level associated with the two scenarios, as well as the listing of vesper sparrows as a Level II species in Wyoming Partners in Flight (2003): (1) there are positive effects and no negative effects of retaining stubble heights of ≥6-12 inches, compared to limiting utilization to 50%; and (2) there are possible negative effects and no positive effects of limiting utilization to 50%, compared to retaining stubble heights of ≥6-12 inches. An exception to the latter is that 50% utilization in an area with tall, dense grass in big sagebrush and grassland communities cover where bare ground is <6% may result in habitat suitability being improved for vesper sparrows.

Where vesper sparrows have the opportunity to place their nests under the protection of bunchgrasses that are ≥6-12 inches tall, nest success would likely be higher, as shown by numerous studies on a range of ground nesting bird species.

In DFC 10 and 12 areas, it is clear that the Forest Plan calls for erring on the side of retaining stubble heights of ≥6-12 inches for this species. These are not optimum conditions because ungrazed grasses in big sagebrush communities and grasslands would provide the most protection to vesper sparrow nests, and bunchgrass density is typically low enough to accommodate this species. There is strong support for the assessment that retention of ≥80% of the annual production of herbaceous vegetation in big sagebrush communities would retain suitable nesting cover for vesper sparrows. There is also strong support for the assessment that retention of 70-79% of the annual production of herbaceous vegetation in big sagebrush communities would retain suitable cover for vesper sparrows, assuming healthy, functioning conditions in the sagebrush and grassland community (otherwise, there would be lower support). There is moderate support for the assessment that retention of 60-69% of the annual production would retain suitable cover for this species. At this level of grazing, an estimated 45-60% of the basal area could be expected to retain grass cover that is taller than 1½-4 inches, much of which would be >6 inches. However, there is low support for the assessment that retaining 50-59% would retain suitable cover, as discussed previously.

Green-tailed Towhee

This species breeds in a range of mixed-species shrub communities, typically having at least some sagebrush (Baicich and Harrison 1997, Dobbs 2006). Vigor of shrub patches, based on percentage of live branches and herbaceous biomass, appears to be a good indicator of microhabitat quality for green-tailed towhees (Dodds 2006). Green-tailed towhees nest on or near the ground (e.g., low in a shrub) and are usually well concealed by shrubs, grasses, and small trees (Baicich and Harrison 1997, Dodds 2006). Nesting on the district likely is initiated in mid to late May and nest-building and nest-occupancy generally lasts 5-6 weeks, extending the nest-occupancy period into late June for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period into July. Young are fed by the parents after leaving the nest for an unknown length of time. Double-brooding is possible, which could extend the nesting period well into August.

Brewers Sparrow

This is an ecological indicator species for big sagebrush — primarily for indicating changes in the acreage of big sagebrush habitat and not necessarily changes in the herbaceous understory. I have observed or heard them in many of the larger big sagebrush stands on the district, and other efforts have documented them as well. Changes in herbaceous understories of sagebrush caused by livestock grazing (e.g., reduced height of herbaceous understory in a given year) do not appear to affect the quality of the habitat for Brewer's sparrows as much as it affects habitat quality for other birds inhabiting sagebrush communities (Holmes and Johnson 2005). The height and density of herbaceous vegetation does not appear to measurably affect the use of big sagebrush habitat by Brewer's sparrows so long as at least some herbaceous concealment cover exists and so long as there is sufficient herbaceous vegetation to support adequate forage, such as seeds and insects (Holmes and Johnson 2005). However, there is no indication that healthy, vigorous understories deter use of sagebrush habitat by Brewer's sparrows so long as sagebrush height and canopy cover are high enough. Plant species diversity is an important attribute for sustaining sufficient seed crops and insects.

Nest building and egg laying in this area typically begins in early May to early June, depending on snow melt (Baicich and Harrison 1997, Holmes and Johnson 2005). They build cup nests of grass, rootlets, and forbs low in the branches of live sagebrush shrub or on the ground at the base of a live sagebrush plant. Brewer's sparrows are frequently double-brooded, and they commonly re-nest after nest failure, meaning that the egg-laying period extends into early to late July depending on elevation. The nesting period for this area ends in late July to mid August, depending on elevation. Brewer's sparrows are a common cowbird host and parasitized nests are occasionally to commonly abandoned (Wyo. Partners in Flight 2003, Holmes and Johnson 2005).

There is no indication that ungrazed conditions in big sagebrush communities would adversely impact this species. From the standpoint of herbaceous wildlife cover, there is strong support for the assessment that retention of ≥60% of the annual production would retain suitable cover for Brewer's sparrows. There is moderate support for the assessment that retention of 50-59% of the annual production would retain suitable cover for Brewer's sparrows because, although this species does not require dense or moderately-dense herbaceous cover, they require some herbaceous cover in sagebrush communities. Retention of 50-59% of the annual production of herbaceous vegetation would retain a minimal amount, primarily under the canopies of sagebrush. Therefore, there is little support for the assessment that retaining <50% of the annual production would retain suitable herbaceous cover for Brewer's sparrows.

Two other considerations pertaining to retention of herbaceous vegetation for this species are forage resources (seeds and insects; see the "Forage Needs of Individual Species" section) and trampling effects (see the "Other Habitat-Related Needs" section). For example, there is little support for the assessment that retaining <60% of herbaceous vegetation retains suitable seed-forage, and moderate support for 60-79% of herbaceous vegetation. As forage utilization levels increase (lower retention levels), the chances of nests being disturbed, damaged, or destroyed by livestock increases.

Sage Thrasher

Sage thrashers are another sagebrush obligate. The only area where I have observed them so far on the district is in the Spring Creek/Big Ridge area, but I suspect they also exist in the Salt Pass area and possibly Tri-basin Divide. They appear to require herbaceous vegetation for cover to an even lesser degree than Brewer's sparrows, so long as enough herbaceous vegetation is being maintained to sustain an adequate abundance of suitable insect species. Sage thrashers build their nest in a low fork of shrubs, and sometimes on the ground in the stems of a bush (Baicich and Harrison 1997).

Nest building and egg laying in this area probably begins in early May (Baicich and Harrison 1997). Nest-building and nest-occupancy generally lasts 5-6 weeks, extending the nest-occupancy period into mid June for the first brood (Baicich and Harrison 1997). Re-nesting may further extend this period (e.g., late June or early July). Young are fed by the parents for an unknown period of time. Double-brooding is possible, which would extend the nesting period into August.

The relationship between suitable herbaceous-cover conditions and livestock grazing are likely similar to Brewer's sparrows, except that lower levels of retention may be acceptable so long as an adequate amount of suitable insects are maintained. It is possible that retention levels as low as 40-49% may be acceptable. However, it may not be possible to allow for lesser retention levels than identified for Brewer's sparrows since insect abundance would likely be impacted at lower levels (see "Wildlife Forage" section). Furthermore, there is no indication that ungrazed conditions would adversely impact this species, particularly where rangeland conditions are less-than-satisfactory (e.g., reduced density and composition of herbaceous species).

Mountain Bluebird and American Robins

The foraging habitat needs of these two species represent the foraging habitat needs of wildlife that nest in wooded areas and feed in open forestland, forest openings, and adjoining rangelands and meadows with short and/or sparse herbaceous vegetation. Before and after the breeding season, they can venture extensively across rangelands. Because bluebirds are cavity nesters, they are tied to forested areas to a greater extent than robins, which can nest in isolated trees and on rock outcrops and buildings well away from forests. Mountain bluebirds are fairly common on the district and robins are abundant.

For foraging, both species favor areas of short herbaceous vegetation and, where vegetation is relatively tall, they favor microsites between plants (Wetmore 1964, Power and Lomardo 1996, Wiggins 2006). For example, in a literature review conducted by Power and Lombardo (1996), they found that mountain bluebirds prefer to hunt in short vegetation or bare areas where vegetation is less than or equal to mountain bluebird's tarsal height (e.g., about 1 inch) since foraging in such locations involves less energy and less risk. I have put up and monitored hundreds of nest boxes for mountain bluebirds, and I found that nest boxes in extensive areas of tall, dense grass cover were occupied much less often. The extensive use of mowed lawns by robins across the United States demonstrates that this species is geared toward foraging in areas of short vegetation.

Therefore, there is strong support for the assessment that retention levels as low as 30% would provide suitable "cover" for mountain bluebirds and robins in foraging areas. This includes strong support for the assessment that moderate to heavy livestock grazing in healthy tall forb communities would facilitate foraging by mountain bluebirds and robins. Where ungrazed conditions limit ready access to the ground by mountain bluebirds and robins, retention of only 30-50% of the annual production of herbaceous vegetation may constitute optimum conditions.

At the other end of the scale, there is strong support for the assessment that retention of 70 to ~100% of the annual production of herbaceous vegetation would currently provide suitable "cover" for these two species in most big sagebrush, mountain shrubland, grassland, and many forbland, herbland, and meadow communities. For example, big sagebrush communities in healthy, functioning condition, typically have sufficient spacing between plants for bluebirds and robins to forage, although conditions are not optimum. In some community types that normally are too tall and dense (e.g., tall forb, meadow) suitable foraging habitat is currently being provided due to degraded rangeland/riparian conditions. For example, many forbland communities on the district are functioning-at-risk or non-functioning, which greatly facilitate foraging by bluebirds and robins, except that insect populations are depleted on these sites. Similarly, meadows where water tables are lowered and/or where plant species composition has been altered many times have sparser and shorter vegetation than should exist on these sites, but this is conducive to feeding by mountain bluebirds and robins.

Consideration also needs to be given to the long-term impacts of only retaining 30-50% of the annual production of herbaceous vegetation, which ultimately impacts insect diversity and productivity on affected sites. Furthermore, areas of ≤40-50% retention will continue to be provided on allotments where livestock grazing use continues, regardless of how it is managed (i.e., there is no need to attempt to intentionally produce areas where retention is ≤40-50%.

Dark-eyed Junco

This species nests and forages on the ground in open forests, forest openings, and adjoining rangelands and meadows along forest edges (Baicich and Harrison 1997). The place their nest in a variety of situations, ranging from open to hidden microsites. They nest on the ground in tree roots, under shrubs, next to stumps and rocks, in herbage on banks and rocky slopes, and in the open against (or partially hidden by) a plant tuft, stump, or rock (Baicich and Harrison 1997). On the Greys River Ranger District, I found one nest under a branch in an open forest with very little material covering the nest, and I found another at the base of a coneflower. I cannot think of any open forest or edge type habitat where I have not seen dark-eyed juncos here and in Colorado, Nevada, and Oregon.

Cover is not affected to any large degree by livestock grazing. The relationship between habitat suitability and livestock grazing is probably similar to those described for mountain bluebirds and robins, above.

Voles and Shrews

Heather, long-tailed, and sagebrush voles, and Merriam's, dusky shrews, and dwarf shrews may exist on the district, and they inhabit a range of rangeland habitats, including big sagebrush, mountain shrubland, grassland, rocky slopes. Cover requirements of dusky and dwarf shrews also discussed in the previous section entitled "Meadow, Riparian, and Wetland Wildlife that Need Herbaceous Cover," above.

Because the density of herbaceous vegetation in big sagebrush, mountain shrubland, and grassland communities is lower than what it naturally is in riparian areas and moist meadows, and because of the wide variety of herbaceous density in these communities, it is likely that voles and shrews inhabiting these communities can tolerate lower densities of herbaceous vegetation resulting from livestock grazing.

Density of moderate to tall herbaceous vegetation in big sagebrush, mountain shrubland, and grassland communities would be reduced by only a small amount when retention levels are ≥80% (i.e., ≤20% utilization); i.e., a reduction of up to 30% (as indicated by information in Table 11). Density would be reduced by a moderate amount when 70-79% of the annual production of herbaceous vegetation is retained; i.e., a reduction of 30-40%. At this level of livestock grazing, most of the basal area of plants would retain much of its height, but beyond this level the amount of cover provided by herbaceous vegetation would decline considerably. At a retention level of 60-69% retention, density of herbaceous plant material would be reduced by as much as an estimated 40-55%. Therefore, there is only moderate (or low?) support for the assessment that retaining 60-69% of the annual production would retain suitable habitat for voles inhabiting big sagebrush, mountain shrubland, and grassland communities. There would be low to no support for lower levels of retention.

Chipmunks

Least, Uinta, and yellow-pine chipmunks likely exist on the district, and they inhabit a large variety of plant communities, including big sagebrush, mountain shrubland, rocky slopes, open coniferous forests, and aspen stands (Burt and Grossenheider 1976, Cerovski et al. 2004). They typically do not inhabit areas with tall, dense herbaceous vegetation.

Changes in herbaceous cover do not appear to a factor in habitat use by chipmunks, but because chipmunks rely on plant material for food livestock grazing has the potential to affect them (see "Wildlife Forage" section). There currently is no need to intentionally reduce the height and density of herbaceous vegetation on rangelands to produce or sustain habitat for chipmunks, given the natural extent of bare ground in many rangeland types and the extent of less-than-satisfactory conditions.

Sagebrush Lizard

Sagebrush lizards appear to be uncommon on the district, but they likely occur in more areas than currently reported. I have only found them in two locations (lower Swift Creek and lower Little Greys River), both of which were relatively steep, rocky south-facing slopes. In this area, they inhabit dry sagebrush slopes, open forestlands, and in the vicinity of rock outcrops (Stebbins 1966, Hammerson 1982). Required habitat features include open ground, good illumination, and scattered low bushes. Rocks are a common feature in some places.

If the distribution of sagebrush lizards is limited on the Greys River Ranger District due to changes since Euro-American settlement, it is not due to an insufficient amount of rangelands with short and or sparse herbaceous cover since more of this habitat exists now than it did historically. There currently is no need to intentionally reduce the height and density of herbaceous vegetation on rangelands to produce or sustain habitat for sagebrush lizards.

D. Suitable Wildlife Forage and Cover — Other

This section addresses suitable forage and cover for wildlife dependent on herbaceous vegetation in forbland communities and in deciduous woody habitats.

FORB-DOMINATED COMMUNITIES & UNDERSTORIES — BROAD-LEVEL ASSESSMENT

This subsection incorporates by reference information summarized in above in the “Suitable Wildlife Forage — Graminoids” and “Suitable Wildlife Cover — Graminoids,” and builds on the principles outlined therein. There is a considerable amount of information on livestock grazing effects on graminoid-dominated communities and understories and on wildlife-livestock grazing relationships in these communities/understories. Less information exists on these subjects in forb-dominated communities and understories. Considerable information also exists on livestock grazing effects on willow and aspen communities, but livestock have had and continue to have more effects on graminoid-dominated and forb-dominated communities and understories.

This sub-section delves more into livestock grazing practices than previous discussions. On cattle allotments, biologists typically provide input on allowable-use standards, rest, and possibly basic elements of cattle management (e.g., grazing initiation date), but do not delve into numbers and season of use (unless certain times need to be avoided). In contrast, biologists need to provide input on livestock grazing management on sheep allotments until it is possible to establish allowable-use standards that address wildlife habitat needs.

The Challenge

> Possibly the biggest challenges in managing sheep grazing retain an adequate amount of suitable forage and cover for wildlife, under current management, are (1) the lack of forage utilization or stubble height standards, or comparable allowable-use standards; and (2) lack of measurable wildlife habitat objectives for sheep allotments.

There are several challenges in managing sheep grazing use to retain adequate amounts of suitable forage and cover for wildlife, as compared to managing cattle grazing use. It is necessary to recognize and understand these challenges in order to provide meaning recommendations for managing sheep grazing in ways that retain a sufficient amount of annual production of herbaceous vegetation for wildlife (i.e., to achieve Objectives 2.1(a), 3.3(a), and 4.7(d)).

Figure 9 summarizes the challenge. The figure compares the relationship between grazing-management factors that are directly controllable and different levels of checks on the effectiveness of management controls.

A key difference between cattle and sheep management that heavily influences retention of herbaceous vegetation on any given area within any given season is the level at which the management feedback loop can realistically take place. For cattle, there is a feedback loop between "Forage Utilization and Stubble Height Standards" and "Livestock Numbers, Duration, Frequency," which provides the capability to manage cattle grazing use at relatively fine scales (herding and fencing are options within this loop to further control grazing intensity in particular areas). Reaction times can be relatively short, possibly within a given season, but definitely from one season to the next.

For sheep, on the other hand, the management feedback loop currently is between "Forest Plan Objectives for Retaining Forage and Cover" and "Livestock Numbers, Duration, Frequency." This only allows grazing use to be managed at a course scale because Forest Plan objectives for wildlife habitat are broadly stated, not quantified, and apply to the entire BTNF. Reaction time may be slow, with management adjustments being made over the course of many years as trend data is compiled and analyzed. Several of the reasons for limitations of the management feedback loop on sheep allotments are as follows:

- At present, there are no specific wildlife habitat objectives for sheep allotments and there are limitations to developing numeric habitat objectives, and this is the reason for the "Allotment-Specific Habitat Objectives" textbox being lighter than other textboxes in Figure 9. Reasons for limitations include the following:
    - There currently are no standardized, time-efficient methods for measuring or estimating the amount of forbs retained after sheep grazing (see first bullet, above); standardized methods exist, but they are very time intensive and not practical. Reductions in the height, biomass, and other attributes of herbaceous vegetation in forbland, herbland, and shrub-forb communities are not as readily measured and estimated as reductions in height, biomass, and other attributes of grass-dominated communities and understories. In contrast to grass-dominated communities and understories, in which forage utilization and stubble height standards are meaningful and relatively standardized, no meaningful and standardized methods are yet available for measuring or estimated either the amount of forbs removed or the amount retained.
    - Relatively little quantitative information is available on the forage and cover needs of individual wildlife species in forblands, herblands, and shrub-forb communities, and on the proportion or amount of annual production that needs to be retained in order to meet wildlife needs. However, sufficient information exists, along with basic principles, to formulate general targets to aim for (which is one of the purposes of this report).

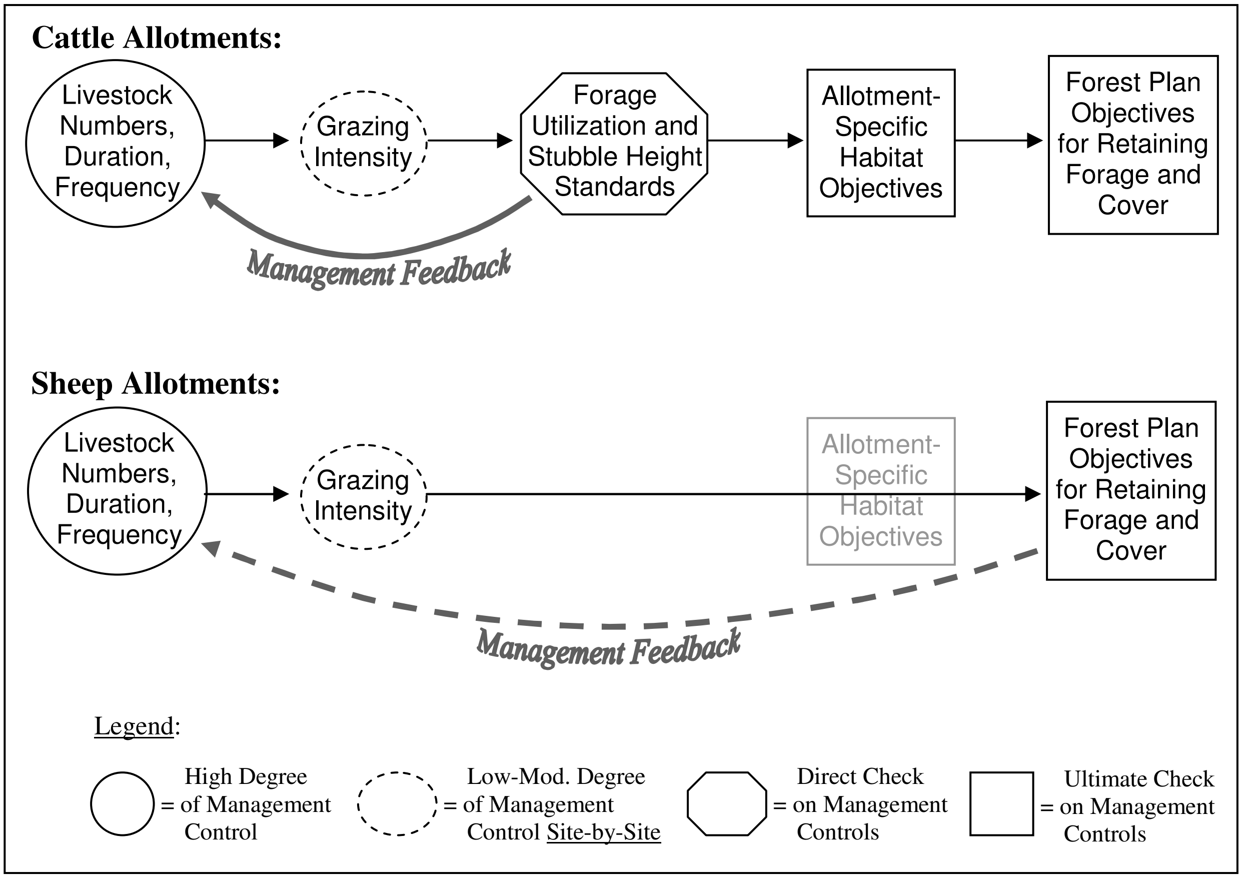

Figure 9. Simplified illustration of the current relationship between livestock grazing management factors that are directly controlled and different levels of checks on management controls on cattle and sheep allotments on the Greys River Ranger District. Also shown is the management feedback loop for making changes based on monitoring results.

Explanation of the format of the figure — Arrows pointing to the right indicate cause-and-effect relationships, from the cause (left-side of each arrow) to the effect (right side of each arrow). The arrow between the two circles/ovals indicates that livestock numbers and the duration and frequency of grazing *affects* grazing intensity. All other arrows indicate that the factor on the left side of the arrow *affects the ability* to meet the factor on the right side of the arrow (e.g., grazing intensity does affect or lead to standards, but it does affect the ability to meet standards). In this way, livestock grazing is not managed to achieve wildlife-habitat objectives (i.e., livestock grazing is not used to achieve objectives). Rather, livestock grazing is managed in ways that *allow* wildlife-habitat objectives to be achieved. Resource objectives, including wildlife objectives, are achieved primarily through the operation of natural processes; livestock grazing use needs to be limited enough to *allow* processes to operate sufficiently in order to either sustain ecological conditions or to restore them.

Livestock numbers and the duration and frequency of grazing are key elements of controllable livestock management elements that affect grazing intensity. Grazing intensity, which is not directly controllable, directly affects the amount and proportion of the annual production that is retained, which directly affects the amount of suitable forage and cover retained for wildlife. Therefore, by establishing a "check" on livestock management at this level (through the application of allowable-use standards such as forage utilization and stubble height standards), livestock numbers, duration, and frequency and other management elements (e.g., herding, fencing to more closely manage grazing intensity) can be adjusted to retain an adequate amount of forage and cover for wildlife. Therefore, management feedback forms a fairly solid feedback loop. On the other hand, where allowable-use standards currently do not exist and where wildlife-habitat objectives are no more detailed than Forest Plan objectives, as is the case in sheep grazing management on the district, management feedback can only take the form of general assessments (thus, the dashed "management feedback" arrow). This makes it difficult to make changes to livestock grazing management that may be needed to allow wildlife-related Forest Plan objectives to be achieved.

- There currently are no forage utilization or stubble height standards, or comparable standards on the district's sheep allotments and, therefore, the "Forage Utilization and Stubble Height Standards" textbox is absent for sheep allotments in Figure 9. Reasons for this limitation include the following:
  - The amount of herbaceous vegetation in forb-dominated communities/ understories needing to be retained for wildlife has not been quantified or otherwise specifically defined (as discussed above) in the published literature.
  - There currently are no standardized, time-efficient methods for measuring or estimating percent forage utilization in forb-dominated communities/understories or the amount of herbaceous vegetation remaining in them after being grazing and, therefore, this box is absent for sheep allotments in Figure 9. The Forage Utilization Standard of the Forest Plan recognizes this limitation. Several problems exist, including the large amount of shrinkage that occurs in forbs immediately following the growing season (considerably more than with grasses), many forbs break apart easily after they dry, and sheep grazing use can result in considerably more damage (e.g., bending, breaking) to forbs compared to cattle grazing.

  Note: Compiling information to define workable allowable-use standards is one of the purposes of this report.

The lack of meaningful allowable-use standards and wildlife-habitat objectives makes it difficult to adjust sheep numbers, frequency of within-season grazing, frequency of rest among seasons, and other management variables. Regardless, however, the Forest Plan requires that an adequate amount of suitable forage, cover, and other habitat attributes be retained for wildlife in areas grazed by sheep, particularly in DFC 10 and 12 areas, and we must find a way to achieve these objectives.

Sheep Grazing Management Variables

The following seven variables, which I gleaned from discussions we have had on the district over the course of the last three years, have a major influence on whether an adequate amount of suitable forage, cover, and other habitat attributes are retained for wildlife on any forb-dominated community after sheep have grazed the community.

The Variables

A. Environmental Variables

1. *Community Type and its Ecological Condition* — This may be the most important variable. Different community types produce different amounts and compositions of herbaceous vegetation when in healthy, functioning condition. Plant communities produce different amounts of herbaceous vegetation depending on the ecological condition they are in (Heady and Child 1994, National Research Council, 1994, Holecheck et al. 2004). Functionality determinations for ground cover are based on information provided in Region 4 amendment to FSH 2209.21-22.1 and O'Brien et al. (2003). Criteria for each of the three functionality categories were defined by G. Anderson (Range Management Specialist for Greys River District, 1999-2008) based on Region 4 amendment to FSH 2209.21-22.1 and O'Brien et al. (2003). I added criteria for the mix of succession stages and canopy cover for late-seral communities.

- Functioning Condition — When in functioning condition, ground cover is 80-100% in moist forblands, 70-90% in dry forbland, 70-90% in dry big sagebrush, 85-100% in moist big sagebrush, 90-100% in alpine communities, and 80-100% in aspen stands. Ground cover is a percent measure of litter, vegetation within 1-inch of the soil surface, moss, and rocks greater than ¾ inch diameter. Signs of active soil movement are low, and, if gullies are present, they are healed or mostly healed. Soil surface conditions and vegetation have potential of recovering quickly from trampling displacement effects. The number and abundance of desired herbaceous species are high, relative to site potential: (1) at least 80% of the species in a given area are desirable species, (2) at least 80% of the number of plants in the area are desirable species, and (3) none of the species are noxious weeds.

  Desirable plant species depend the purposes for which an area is managed (FSH 2209.22.1.4), which depends on Forest Plan goals and objectives and direction in DFCs. Example purposes listed in FSH 2209.22.1.4 include watershed sustainability, forage production, sage grouse habitat, low risk wildfire community, and a pleasing wildflower setting. For wildlife communities on the Greys River Ranger District, the most desirable plant species composition for a given site is diversity (species richness and relative abundance of each species) that naturally would exist on the site if it were not for human influences and relative to the current stage of ecological succession following a disturbance like fire (Principle A.2, USFS 2005). On sites where the A and or B soil horizons have been lost, this would not be possible, and the "fall-back" species composition would be as many native species represented as possible, especially those that are effective in holding soil in place and building soil, while also providing forage and cover for wildlife.

  When a landscape is in functioning condition, approximately 20-30% of the acreage of big sagebrush types is in early succession, 60-70% is in mid succession, and 10-20% is in late succession (Havlina 2003, USFS 2004a, and Barrett 2003). F. Ryan (Range Management Program Specialist for the BTNF) assessed that a minimum of 50% of the acreage of the big sagebrush type on a landscape should have ≤15% canopy cover. Some stands may be as dense as 45% canopy cover, but should comprise a small minority of a landscape.

  Thus, annual production of forbs and grasses is at or near site potential, relative to growing season precipitation.
- Functioning-at-Risk Condition — Ground cover for all community types is greater than 60%, but less than the percent identified for functioning condition. Signs of active soil movement and the potential for active soil movement are generally moderate, but may be high in a some places. Soil surface and vegetation conditions are susceptible to long-lasting effects of trampling displacement, which also contribute to higher levels of soil movement. The number of herbaceous plant species is moderate in most places and the abundance of individual desired plant species is low to moderate: (1) less than 80% of the species in a given area are desirable species and (2) at least 80% of the number of plants in the area are desirable species. However, plant communities are not dominated by a small number of aggressive species or noxious weeds as described below for non-functioning conditions).

  The mix of seral stages is intermediate between functioning and non-functioning conditions, but must be considered in the context of other criteria. If ground cover and plant species richness indicate functioning conditions, but close to 100% of the acreage of big sagebrush types in a given landscape is in late succession, big sagebrush in this landscape is functioning-at-risk. With this proportion of the big sagebrush type in late succession, plant species composition and productivity of herbaceous vegetation are lower than they would be in functioning condition.

Annual production of forbs and grasses may be near site potential (where ground cover and plant species composition are near site potential), but may be considerably lower than site potential (where ground cover and plant spcies composition are nearer non-functioning conditions), especially for key forage species. In some areas, an increase in rock content, due to major soil loss decades ago, has offset diminished vegetation cover — i.e., if it were not for the high rock content, some areas classified as functioning-at-risk would be classified as non-functioning. (See "Non-Functioning Conditions, below.) However, this would be picked up in assessments of plant species composition.

- Non-Functioning Condition — Any site with less than 60% ground cover is considered to be non-functioning. Signs of active soil movement and the potential for active soil movement are typically high. The number of herbaceous plant species in most cases is low and herbaceous plants typically are widely spaced (low to moderate abundance of individual species). Sites dominated by noxious weeds are non-functioning. Areas dominated by Wyethia (Wyethia amplexicaulis), tarweed (Madia glomerata), and/or Artemesia michauxiana) are considered non-functioning due to species composition; however, observations indicate that these areas usually have less than 60% basal ground cover and would be given a non-functioning rating on that basis alone.

  Close to 100% or 100% of the acreage of big sagebrush types in a landscape would contribute to non-functioning conditions, but this is not a sole indicator of non-functioning conditions.

  In non-functioning areas, annual production of desirable species is reduced by a major extent compared to the same site if it were in functioning condition.

G. Anderson, Range Management Specialist on the Greys River Ranger District from 1999 through 2008 estimated that less than 5% of the district's forbland/herbland communities are currently in functioning condition, roughly 40% are in functioning-at-risk condition, and that more than half are non-functioning (MIS Capability/Suitability meeting notes, Nov. 11-12, 2008). BTNF-wide, USFS (1997) estimated that 25% of tall forb communities had been "lost," which either equates to those in non-functioning condition and those in non-functioning condition with no potential for recovery. They also assessed that there is a high risk of losing key elements of this type and an "extreme risk if current grazing practices hold the community in degraded condition." Forbland communities in the Wyoming Range and Salt River Range appear to be in worse condition than in other parts of the BTNF (i.e., proportionally more are non-functioning). G. Anderson also roughly estimated that approximately one-third of big sagebrush communities are currently in functioning condition on the district, approximately half are functioning-at-risk, and about one-fifth are non-functioning. USFS (1997) assessed that there is a high risk of losing key elements of this type on the BTNF. The understory of most of these are dominated by graminioids, but a considerable acreage has understories dominated by forbs.

2. *Growing-Season Soil Moisture* — The amount of moister available to plants through the growing season plays a large role in determining the level of annual production of forbs

on a given site. The amount of soil moisture depends in part on snow pack, but is largely dependent on the amount of precipitation that falls during the growing season and the proportion of this precipitation that percolates into the soil (Thurow 1991, Satturlund and Adams 1992, National Research Council 1994). The amount that percolates into the soil, rather than flowing downhill (overland flow), is heavily influenced by the amount of litter cover, organic material in the soil surface, and extensiveness of root systems near the soil surface. Percent litter cover and vegetation cover are good indicators of this. Water infiltration and percolation on rangelands in healthy, functioning condition generally is high. Conversely, water infiltration and percolation on rangelands in non-functioning condition (e.g., ground cover <60% and/or depleted plant species composition) generally is poor; i.e., considerably less than if the same rangelands were in functioning condition. Holechek et al. (2004) cited studies showing that a minimum of 65% ground cover is needed to prevent excessive erosion in mountainous areas (erosion is a sign that overland flow, rather than infiltration, is occurring). Water infiltration rates on functioning-at-risk rangelands have infiltration rates that are somewhat less to considerably less than functioning rangeland. Rangelands that are close to healthy, functioning condition have infiltration rates that approximate those on healthy, functioning rangelands.

Therefore, growing season precipitation and ecological conditions combine to affect soil moisture.

3. *Terrain Characteristics* — Terrain on sheep allotments of the Greys River Ranger Districts are highly variable, ranging from gently rolling hills, to steep hillsides, to long, narrow ridgelines. Some of the rangelands associated with these are wide with few places where dense timber, riparian willow, cliff bands change the width of rangelands along sheep grazing routes. More typical, however, is that rangelands along routes alternate between wide rangelands and narrow corridors that are constrained by terrain features and/or dense timber. Along some routes, most rangelands exist as narrow to moderately narrow strips. The size and width of rangelands can have a large bearing on density of sheep as they move through an area, which can alter the effects of sheep numbers (below).

B. Management Variables

1. *Number of Times that Sheep Graze an Area* — Limiting sheep grazing to "once-over grazing" is a very course-scale means of controlling the intensity of grazing pressure. A requirement of once-over grazing is that sheep are not allowed to graze a given site more than one time each grazing season (i.e., no area can be grazed twice in a given summer). Once sheep have move on, they are not allowed to graze or move across this same site until the following summer. It prohibits sheep moving through the same area later in the same day or the next day.
2. *Number of Sheep in a Band* — The number of sheep in a given band can have a major effect on the proportion of the annual production retained, as this is a major determinant of grazing intensity (Heady and Child 1994, Holechek et al. 2004). All other factors being equal (e.g., width of area, rate of movement by sheep, biomass and composition of herbaceous vegetation), 500 sheep moving through a given area would remove far less herbaceous material and would result in considerably less vegetation being bent over and matted than 1,000 sheep moving through the same area. In Region 4, changes in numbers of sheep are not allowed to be considered during the allotment management

review/revision process, but this can be done administratively outside the allotment management planning process.

3. *Rate of Movement* — At a given number of sheep in a band, the only way to control the level of forage utilization and soil disturbance is to manage their rate of movement through an area. The aim is to allow sheep to move through areas at their own pace. Zobell (2007) measured utilization levels on graminoids in sheep allotments in the Uinta Mountains, and found that utilization rarely exceeded 30% when sheep were kept on the move, but not pushed. He surmised that utilization was similar on forbs. If herders slow the movement of sheep in a given area, grazing pressure increases. It is possible for moderate to heavy grazing to ensue. If herders push sheep through an area (i.e., faster than their natural rate of movement), soil disturbance can become excessive and, although grazing pressure would be lower, this may be offset by broken and trampled plants.

<u>C. Wildlife Habitat Needs</u>

1. The amount and type of forage and cover needed by wildlife depends on the species of wildlife and time of year. Many forbland, herbland, and shrub-forb communities, when in functioning condition, provide an abundance of forage for a wide variety of wildlife species (see the "Forage Needs of Individual Wildlife Species" section). Plant species composition, including the abundance of plant species important to individual wildlife species, is paramount. The proportion, by dry-weight, of the annual production that needs to be retained depends on the species of wildlife in question. For some species, the amount remaining available to them is directly related to the proportion of the dry-weight retained. For wildlife species dependent on flowers (e.g., for nectar, seeds), the amount remaining available may be proportionally less than the total amount of herbaceous vegetation retained. For wildlife species dependent on roots and leaves near the base of plants, there may not be any reduction in the amount available to them, so long as a sufficient amount of plant material remains to prevent reductions in root mass.

   The amount of forage (leaves, nectar, seeds, roots, etc.) that would adequately provide for the needs of individual wildlife species in a given area is highly variable, dependent on many factors. Forblands, herblands, and shrub-forb communities in healthy, functioning typically produce an abundance of these types of forage, and a reduction in amount — to a point — would have no more than minor effects on wildlife. However, this threshold is unknown for most species and it may vary greatly from site to site for any given wildlife species. For example, where small patches of nectar-producing flowering plants are intermingled with aspen and conifer communities, light or conservative grazing by sheep may result in a considerable reduction in forage for nesting hummingbirds. Where nectar-producing flowers are abundant on large hillsides with scattered patches of aspen and conifer, light to conservative grazing would likely retain sufficient forage for these birds.

   Availability of succulent leafy matter and flowers are available, depending on forb species and elevation, from May through September. Leaves and stalks of some species provide forage after senescence and under the snow for some species of wildlife. Current-year seeds are available starting in July-August until snow accumulates. Roots are available year-round.

   Forbs likely are less important in providing cover than graminoids because the period of time when forbs erect and "full-bodied" is limited to the time after they have grown to near full height and before they have senesced (e.g., June through August or September, depending on elevation). Forbs shrink considerably during senescence compared to graminoids where shrinkage and reduction in height are fairly limited. Nonetheless, cover provided by forbs in forblands, herblands, and shrub-forb communities is important to a variety of wildlife, including small mammals, mule deer (e.g., fawning), passerine birds (e.g., nesting, cover during foraging), insects, and predatory/insectivorous wildlife that feed on them.

Sheep grazing use can influence other attributes of wildlife habitat, including water quality and sedimentation of pools, ponds, and streams, by affecting the rate of recovery of upslope rangelands, as discussed earlier.

Related Considerations

Limiting sheep grazing to "once over" in a given area does not necessarily mean that utilization will be low enough to retain an adequate amount of suitable forage, cover, and other habitat attributes for wildlife. Whether an adequate amount is retained depends on a variety of factors, including the number and movement rate of sheep relative to environmental variables. Several examples of once-over grazing not retaining sufficient forage, cover, and other habitat attributes for wildlife include the following:

- *Areas that are in non-functioning condition* — Even before sheep graze a non-functioning area, forage and cover for wildlife is already less-than-satisfactory for wildlife. Any level of sheep grazing in such an area would reduce forage and cover for wildlife even further, including depletion of forage and cover where small patches of higher levels of ground cover and plant species composition may occur. The less-than-satisfactory ground cover also can result in excessive sedimentation and reduced water quality in wetlands and streams used by wildlife. Compounding these effects is below-average precipitation. Furthermore, even "light" grazing has the potential to slow or hinder recovery over the long term, as discussed Principle B.4. In short, I am not aware of any evidence to show that sheep can graze non-functioning areas while ensuring that even marginally adequate amounts of suitable forage and cover are retained for wildlife.
- *Areas that are at the low end of functioning-at-risk with sheep numbers too high* — The number of sheep and rate of movement that would retain an adequate amount of suitable herbaceous vegetation for wildlife on a functioning rangeland area may not retain an adequate amount of suitable vegetation on the same rangeland if it were at the low end of functioning-at-risk. This is because plant density is lower, plant species composition many times is skewed toward undesirable or less-desirable species, litter/vegetation cover is reduced (possibly meaning reduced plant vigor).

  If the annual production of key herbaceous vegetation is considerably less on these rangelands than occurs on functioning rangelands (e.g., if it is ≥1/3 less), it is likely that a range assessment would find them to be in less-than-satisfactory condition. This is based on (1) plant species composition is considerably lower in areas that are functioning at risk, and (2) the assessments that removing 1/3 or more of the annual production in graminoid communities would move them into less-than-satisfactory condition for many dependent wildlife species (other parts of this report).

  Grazing by sheep in these areas compounds this effect. If annual production on a site is already lowered by ≥1/3 due to degraded conditions and if composition of key forage species is disproportionately reduced, even light grazing could have fairly major effects.

Add to this, dry years where annual production can be reduced by as much as 50% or more.

On the other hand, just as the Forest Plan allows less-than-healthy rangelands to be grazed so long as trends in rangeland conditions are upward, three situations should also be acceptable so long as trends in rangeland condition are upward: (1) wildlife habitat is less-than-satisfactory due to reduced rangeland conditions, and even light or conservative sheep grazing compounds this to some extent; (2) land productivity is sufficient to produce marginally satisfactory wildlife habitat, but light to conservative sheep grazing reduces this to unsatisfactory levels; and (3) wildlife habitat is either marginally unsatisfactory or marginally satisfactory, and the effects of reducing herbaceous vegetation due to light or conservative sheep grazing are not well understood. These effects can be mitigated to some extent by regularly scheduled rest. (See "Rest from Livestock Grazing," below.)

- *Areas that are in functioning condition with sheep numbers too high, given terrain characteristics* — The number of sheep and rate of movement that would retain an adequate amount of herbaceous vegetation for wildlife on a wide, functioning rangeland area may not do so on the same rangeland if it were narrow. Given the same number of sheep, narrower rangelands increase the density of sheep and, therefore, the number of times that each plant is grazed by different sheep. This increases grazing intensity. Sheep would naturally move through narrower areas at a faster rate, but not enough to prevent an increase in the number of times each plant is grazed. Also, the higher density of sheep, particularly with a faster rate of movement, would result in more plants that are bent or broken. Less than average precipitation would compound these effects.

  While it is obvious that sheep numbers cannot be changed every time that rangeland narrows or widens along a grazing route, numbers on a given allotment need to consider the characteristic mosaics and patterns of rangelands on the allotment and care needs to be given when grazing parts of the allotment where narrower/smaller rangelands exist.

  These relationships likely hold true for rangelands that are at the upper end of functioning-at-risk, particularly those near functioning condition.

Upshot

In order to retain an adequate amount of suitable forage and cover forage for wildlife in forbland, herbland, and shrub-forb communities within sheep allotments, and recognizing the factors described in the previous eight pages, management in the short term needs to address grazing intensity by managing sheep numbers, frequency of grazing per season, movement rate of sheep, and rest. There are two possible options to address the first three: (1) preliminarily determine the number of sheep that can be grazed, once-over grazing and moving at their own pace while retaining an adequate amount of suitable forage and cover, relative to DFC emphasis, and adjust numbers as necessary; or (2) develop appropriate wildlife-habitat objectives and develop allowable-use standards (e.g., utilization standards) designed to allow rangeland objectives, wildlife-habitat objectives, and objectives for other resources to be achieved, and adjust sheep numbers over time as needed. The first option, which would necessarily rely on grazing pressure being limited to light or conservative, is not available at this time because the Regional Office has decided not to allow changes in livestock numbers during the allotment management planning process. This makes it imperative that resource objectives and allowable-use standards be developed and implemented. (Realistically, preliminary determination of appropriate numbers for each allotment — the first option — would require the equivalent of objectives and allowable-use standards to be developed to guide any changes in numbers.)

It may be necessary to define wildlife-habitat objectives and allowable-use standards somewhat broadly at first, but attempts should be made to begin *quantifying* the amount or proportion of annual production that needs to be retained to meet the needs of wildlife.

It is very likely that once-over light to conservative grazing in most forbland, herbland, and shrub-forb communities in functioning condition will be shown to retain an adequate amount of forage and cover for wildlife. Many forbland, herbland, and shrub-forb communities are very productive, and the removal of a small proportion of the annual production would retain a large amount of forage and cover for wildlife (see Principle B.3 and information presented in related discussions of graminoid communities). This would also be true of these communities that are near functioning condition, although increased frequency of rest may be needed in questionable areas. In the mid range and lower end of functioning-at-risk, once-over light grazing at different intensities of grazing (e.g., a function of sheep numbers, ecological conditions, size of area, etc.) will need to be evaluated to ascertain what levels of sheep grazing retain adequate amounts of suitable forage and cover for wildlife. In general, increasing the frequency of rest can be used to offset reductions in the level of certainty of effects and lower levels of ecological condition. As pointed out earlier, I do not know of any evidence to show that once-over light grazing of forblands, herblands, and shrub-forb communities in non-functioning condition would retain even marginally-satisfactory levels of forage and cover for wildlife, mostly because annual production is not high enough to reach this threshold.

For forblands, herblands, and shrub-forb communities in functioning condition, there is a high likelihood that retaining ≥90% of the annual production of herbaceous vegetation would allow an adequate amount of suitable forage and cover to be retained. Because flowers and other plant parts are removed disproportionate to their weight and because sheep grazing use results in considerable amounts of bent and broken plants (compared to cattle grazing at the same grazing intensity), it is possible that wildlife forage and cover begin to be affected as retention declines below 80% or 90% (on the Little Greys cattle allotment in 2008, cover began to noticeably decline between 80% and 70% retention in graminoid-dominated communities). A retention level of 80-90% of herbaceous vegetation equates to an estimated 70-80% retention of key forage species (Table 4). There is a low likelihood that retaining ≤60% of the annual production of herbaceous vegetation would allow an adequate amount of suitable forage and cover to be retained, particularly for wildlife that rely on plant parts that may be removed by sheep disproportionate to their availability. Holecheck et al. (2004) recommended a maximum of 20-30% utilization of key forage species (i.e., retention of 70-80% of key forage species) in alpine communities. Retaining 60% of herbaceous vegetation would only retain an estimated 45-55% of key forage species and cover would likely be substantially reduced, especially considering trampling effects.

A minimum, as yet immeasurable, retention level of 70-90% of herbaceous vegetation (including 60-80% retention of key forage species) provides a starting point.

Trends

Trends in ecological condition are an important consideration for wildlife habitat. It is important that functioning rangelands stay in functioning condition and that rangelands in functioning-at-risk and non-functioning condition have upward trends. Not only is this a requirement to meet Forest Plan direction for soils, water, and vegetation, it also is a requirement in DFC 10 and 12 areas with respect to achieving wildlife objectives in the Forest Plan.

Even if sheep grazing on rangeland in a given area is adversely affecting wildlife habitat on a year-to-year basis due in part to the area being in functioning-at-risk condition, an upward trend in ecological condition may allow for continued sheep grazing although rest, reduced sheep numbers, and other adjustments may be needed to mitigate effects. However, this likely applies only to areas that are at the upper half of functioning-at-risk (i.e., near functioning conditions).

Where trends are static or downward, changes in sheep grazing management would be needed regardless of the amount of forage and cover retained for wildlife.

Rest from Livestock Grazing

"Rest" in this report generally refers to rest from livestock grazing and, unless otherwise qualified, the minimum unit of time is one livestock grazing season.

Periodic rest and longer-term rest can play integral roles in retaining adequate amounts of suitable forage, cover, and other habitat attributes for wildlife on sheep allotments. Rest from livestock is particularly applicable to forblands, herblands, and shrub-forb communities in sheep allotments because they typically are higher elevation and (1) native populations of large herbivores are currently exerting the same level of grazing pressure or higher level of grazing pressure than they did prior to Euro-American settlement, meaning that wildlife communities in these communities generally evolved with relatively low levels of grazing pressure; (2) it is not uncommon for large portions of allotments to be functioning-at-risk and non-functioning due to historic sheep grazing, which results in higher grazing intensities of native large herbivores than what occurred prior to Euor-American settlement; (3) additional grazing pressure imposed by sheep bands further compounds the effects; and (4) grazing intensities and retention levels are currently managed by controlling the number of times sheep pass through any given area and by managing the rate of movement of sheep, which is a very coarse-scale approach and provides no more than moderate assurance that an adequate amount of forage and cover are being retained for wildlife in any given year.

A few general examples of the role of rest include the following.

- Relatively frequent regularly-scheduled rest can play an integral role in mitigating possibly insufficient levels of herbaceous vegetation that may be retained in once-over sheep grazing, until a workable and meaningful forage utilization standard is developed.
- Relatively frequent regularly-scheduled rest can play an integral role in mitigating insufficient levels of herbaceous vegetation that may be retained in once-over sheep grazing in areas where (1) rangeland condition is variable across the landscape, (2) the size and width of rangelands and forest openings are highly variable. These factors result in varying grazing intensities on different parts of the landscape at a given band size, and assuming sheep are moving at their own pace.
- Relatively frequent regularly-scheduled rest can play an important role in mitigating effects of once-over sheep grazing on functioning-at-risk rangelands, depending on band size and variables identified in the previous bullet.

- Long-term rest can play an important role in allowing non-functioning rangelands to recover.

Frequency of Rest

Frequency of rest is an important variable for retaining an adequate amount of suitable forage and cover for wildlife. Retaining forage and cover for wildlife is an annual issue and, therefore, has different implications than managing for long-developing attributes such as ground cover and plant species diversity. While resting areas 1 in 5 years or less frequently may be sufficient for sustaining and restoring long-developing attributes, rest at this these frequencies would be insufficient for mitigating situations in which once-over sheep grazing is not or may not be retaining an adequate amount of suitable forage and cover for wildlife. If an insufficient amount of suitable forage and cover are being retained each year that sheep are grazed, providing an adequate amount every fifth year (through rest) would only mitigate the effect to a minor extent.

To be meaningful in situations where an insufficient amount of suitable forage and cover are being retained in years when sheep are grazed, rest would need to be at least as frequent as 1 in 4 years. If rest is provided 1 in 4 years, the forage and cover in the intervening 3 years would need to be close to being suitable because 3 years of unsatisfactory forage and cover is too long for many wildlife populations to persist. The DFC within which an area exists may affect frequency of rest since different resources and opportunities are emphasized in different DFCs. Examples of frequency of rest under different circumstances include the following:

- On healthy, functioning rangelands where it is demonstrated that an adequate amount of suitable forage and cover are annually being retained for wildlife, there may not be a need for regularly scheduled rest. This does not include periodic rest to sustain healthy, functioning conditions, which is needed to sustain the capacity to provide wildlife forage and cover.
- A minimum of 1 year of rest every 4 years may be sufficient (1) where it has not been demonstrated that once-over sheep grazing is retaining adequate amounts of suitable forage and cover for wildlife on functioning rangelands and rangelands at the high end of functioning-at-risk; and (2) where it has been demonstrated that once-over sheep grazing is not retaining an adequate amount of suitable forage and cover on functioning rangelands and rangelands at the high end of functioning-at-risk, but where it is close.
- A minimum of 1 year of rest every 3 years, or possibly as low as 1 in 2 years, may be sufficient (1) where it has not been demonstrated that once-over sheep grazing is retaining adequate amounts of suitable forage and cover for wildlife on rangelands that are at the middle or low end of functioning-at-risk; and (2) where it has been demonstrated that once-over sheep grazing is not retaining an adequate amount of suitable forage and cover on rangelands that are at the middle or low end of functioning-at-risk. The frequency of rest would depend on actual conditions. Annual production on rangelands at the middle or low end of functioning-at-risk may or may not produce suitable wildlife forage and cover. Even light grazing (e.g., ≤10-20% overall utilization) may result in fairly high use of key forage species, given their low abundance/density in this situation. A high frequency of rest would be needed to offset this affect. It may be possible to rest these areas as infrequently as 1 in 3 years if upward trends are documented and, on balance, retain an adequate amount of sufficient forage and cover for wildlife.

Just as sheep grazing can continue in areas where ground cover and plant species composition objectives are not being met (due to historic sheep grazing impacts) so long as progress is being made toward the objectives, sheep can continue to graze in areas where retention levels for wildlife are insufficient so long as (1) progress is being made toward achieving vegetation objectives and (2) insufficient retention levels are being mitigated as much as possible while still providing for sheep grazing.

- If frequency of rest needs to be more than 2 years in 3, this points in the direction of long-term rest.

Particularly in DFC 10 and 12 areas, it is particularly important for livestock grazing use to be managed in ways that allow ground cover to progress toward desired conditions outlined in FSH 2209.22.1.2 and O'Brien et al. (2003). Providing suitable wildlife habitat depends on ground cover being at or above the levels identified in these documents (see Principle B.4). If there are conflicts between current livestock grazing use in these areas and the ability to achieve these ground cover levels, livestock grazing use would need adjusted — including more frequent rest or long-term rest — to ensure continued upward trends toward these levels. This also applies to DFC 4 areas, except the focus is on retaining and restoring watershed values and water quantity/quality, and it also applies to some extent to DFC 3.

Long-Term Rest

Long-term rest may be needed in some situations. For example, parts of allotments predominated by non-functioning rangelands should be rested to allow rangeland functionality and wildlife habitat to recover. Furthermore, the availability of suitable forage and cover for wildlife is well below satisfactory levels on non-functioning rangelands and it would be difficult to justify continued sheep grazing on these lands until habitat conditions are no longer designated as non-functioning, as discussed in the "Sheep Grazing Management Variables" section, above. Several of the sheep allotments on the Big Piney Ranger District provide examples of extended rest of entire allotments being used to allow recovery to a pre-defined point before sheep grazing can resume (USFS 2004b). Management of the North Piney, Bare Mountain, and Triple Peak sheep allotments on the Big Piney Ranger District and Marten Creek and South Fork Sheep Creek sheep allotments on the Greys River Ranger District provide an example of large portions of sheep allotments being rested until pre-defined recovery criteria are met (USFS 2008).

At a minimum, long-term rest of non-functioning areas should resume until ground cover reaches a minimum of 60% across the rested area and plant species diversity reaches a minimum threshold (which needs to be better defined). On forbland and herbland communities, it would be beneficial to continue rest until ground cover reaches a minimum of 70% across the rested area.

Another option is to rest several areas that are in functioning or near-functioning condition along grazing routes in DFC 10 and 12 areas where it has not been determined that suitable forage and cover are being provided or retained. This would be to livestock grazing management as the Snag Habitat Guideline is to timber harvest management, except that rested patches may need to be larger than 5 acres depending on the ecological conditions along the route, retention of herbaceous forage, and habitat patterns, among other factors.

Geographic Scales of Rest

Rest can be applied at several geographic scales:

- Entire allotments (e.g., rest-rotation among allotments, long-term rest).
- Entire pastures or large portions of allotments (e.g., rest-rotation within allotments, long-term rest).

• Areas within allotments/pastures. This can take the form of (1) regularly schedule rest, which can be accomplished by alternating grazing routes within an allotment (another form of rest-rotation); and long-term rest of particular areas along grazing routes.

Forage and Cover Needs of Individual Wildlife Species

For the forage and cover needs of individual wildlife species using forblands, herblands, and shrub-forb communities, see the discussion of forage needs of individual wildlife species in the "Suitable Wildlife Forage — Graminoids" section and discussion of cover requirements of individual wildlife species in the "Suitable Wildlife Cover — Graminoids" section.

COVER PROVIDED BY DECIDUOUS SHRUBS AND TREES

Sagebrush, mountain shrubs, willows and other riparian deciduous shrubs, aspen, and cottonwood provide important cover and other habitat attributes to a large variety of species. There are several sagebrush obligate wildlife species that depend on sagebrush plant, and mountain shrublands provide cover and substrate for a large variety of species (Bock et al. 1993, Baicich and Harrison 1997, Wyoming Partners in Flight 2003). Of any types of habitat in this area, aspen and riparian willow communities provide for the largest diversity of wildife species, including aspen and willow obligates (DeByle 1985a, Dobkin et al. 2002).

Mid- and late-seral shrubland and deciduous forestland communities in without a large conifer component and without substantial direct effects by livestock (e.g. browsing, mechanical damage) provide cover and forage for dependent wildlife species. Disclimax shrubland communities with lowered vigor of shrubs, but without a large conifer component, still provide cover for these species. Some level of conifer canopy cover in aspen, mountain shrubland, and big sagebrush communities does not impact wildlife use of these communities, but at some point, conifer trees out-compete aspen and shrubs to a degree that wildlife species associated with aspen and mountain shrubland, respectively, disappear from the communities. Furthermore, conifer expansion within aspen and shrub communities eventually overtop and shade out aspen (Loope and Gruell 1973, Bartos and Campbell 1998), as well as shrubs, thereby converting the community into a conifer stand and possibly permanently eliminating potential for aspen to respond after a fire. These effects are prevalent and widespread on the Greys River Ranger District due to the greatly reduced frequency of fire in areas supporting these communities. The proportion of mountain shrubland and aspen types in late succession is far above desired conditions on the Greys River Ranger District, and conifer expansion is common in many late-seral shrubland communities and most late-seral aspen stands (Gruell 1975, USFS 1985, USFS 2004a, USFS 2009). There also is a large acreage of aspen and mountain shrubland communities that have already converted to conifer forestland (i.e., no longer counted toward acreage of these communities).

Livestock grazing use on the Greys River Ranger District plays no more than a minor role in the effects described above, but because of the great importance of this issue, the need address it, and the many interconnected factors that affect fire ecology and management on the district, the issue must be addressed comprehensively. Such an approach, therefore, needs to recognize the role that livestock grazing use play.

Livestock grazing use can influence habitat provided by shrubs and trees in several ways:

- Browsing and mechanical damage can reduce height, canopy cover, and/or structural diversity of willow, aspen, cottonwood, and mixed-deciduous riparian shrub communities, including the creation of "tunnels" and trails in willow stands (DeByle 1985a, Brock 1988, Platts 1989, Chaney et al. 1993, Elmore and Kaufman 1994, Ohmart 1996). These types of effects in willow communities on the Greys River Ranger District typically only occur in cattle allotments and, while widespread in cattle allotments, occur at low levels in most situations. The most common effect is the creation and maintenance of trails through willow stands, with reductions in the canopy cover of willows being much less common. Browsing may hinder the growth of young willow communities in some places, but this appears to be limited. I have not looked closely at seedling and sapling cottonwood trees.

  Browsing of aspen is widespread across sheep and cattle allotments on the district, but most of this appears to be from native ungulates. There likely are places where livestock exert pressure on aspen suckers. For example, a wide-spread release of aspen suckers on the Squaw Creek-Weiner Creek sheep allotment appears to correspond to the last permittee discontinuing his operation on the allotment. Cause-and-effect has not been substantiated in this case.

- Reduction in the health and functionality of riparian areas and rangelands due to historic livestock grazing use, which in turn may limit the production of shrubs and trees in some areas. For example, lowered water tables and altered stream channels in riparian areas contributes to lower canopy cover of willows (Chaney et al. 1993, Elmore and Kauffman 1994). Depending on how present-day livestock grazing is managed, it can contribute further to reductions, maintain degraded conditions, or it can allow for recover to occur. Reduced health and functionality in some communities (e.g., big sagebrush communities) can include excessive shrub canopy cover, which may or may not adversely affect species dependent on sagebrush cover.

- Herbaceous basal cover, plant species composition, and plant vigor were reduced to varying extents on many rangelands of the district, from minor to major degrees compared to pre-Euro-American settlement conditions, which affects the amount and distribution of fine fuels. Where herbaceous vegetation cover has been moderately to greatly reduced compared to conditions that existed prior to the onset of historic livestock grazing, this may have been a contributing factor to the altered fire ecology during the last half of the 20th Century. This in turn may have contributed to the current mostly unabated increases in conifer density and canopy cover in mountain shrubland, big sagebrush, and aspen communities and otherwise reduced conditions in aspen communities. For the same reasons, reduced herbaceous basal cover, plant composition, and plant vigor may limit the future restoration and sustainability of mountain shrubland and aspen communities, and present-day livestock grazing has the potential to limit recovery depending on how it is managed.

Depleted herbaceous vegetation likely only plays a minor role in limiting the recovery and sustainability of aspen and mountain shrubland communities, but a fire that doesn't ignite on a given site due to depleted herbaceous vegetation or one that ignites near the edge of a large forest opening or large forbland slope but dies before reaching trees or shrubs on the other side are possibilities. If there is insufficient herbaceous vegetation in a shrubland community to carry a fire, this also affects the ability of these communities to burn.

- Grazing of herbaceous vegetation on a year-to-year basis reduces the amount and distribution of fine fuels, thereby compounding the effects of depleted herbaceous vegetation (described above) and also reduces fine fuels in healthy, functioning rangelands. Reduction in fine fuels in any given year is directly proportional to forage utilization rates. Therefore, forage utilization by livestock has the potential to directly affect fire spread, particularly on grasslands, herblands, forblands, and shrublands with low densities of shrubs (Riggs et al. 1996, Launchbaugh et al. 2008, Miller and Heyerdahl 2008), which in turn has the potential to affect mountain shrubland, open conifer forestland, and aspen communities as described above.
- Possibly a larger effect of livestock grazing on the recovery and sustainability of aspen and mountain shrubland communities is the effects of the "active allotment" status and presence of livestock on the potential for carrying out prescribed burns and managing lightning-strike fires as wildland fire use. This is discussed in more detail in USFS (2009).

To address these effects on deciduous shrubland and forestland communities, direction would need to be provided in AMPs and AOIs, for example:

- Minimum stubble height requirements of 4-6 inches along the green-line has been shown to minimize browsing of willow and other riparian shrubs (Hall and Bryant 1995, Clary et al. 1996, and Clary and Leininger 2000, University of Idaho 2004). As stubble height of key herbaceous forage declines below 4-6 inches, cattle are more likely to begin using other forage and browse. If a stubble height standard is initially established at 4 inches, monitoring would be needed to assess whether it may need to be increased to 5 or 6 inches to minimize browsing of riparian shrubs. If it is originally established at a minimum of 6 inches, a track record showing that 6 inches definitively minimizes browsing of riparian shrubs could be used to reduce it to 5 inches, and possibly 4 inches. However, because monitoring of willows likely will not be undertaken, and given direction in DFCs 3, 4, 10, and 12 to emphasize watershed functioning and/or wildlife, a conservative starting point of 6 inches would be warranted. If monitoring of willow browsing were to be undertaken, stubble height standards could potentially be adjusted downward. The point at which cattle begin shifting their foraging behavior is somewhat dependent on season.

  Minimum stubble height standards would also — in combination with either stubble height standards in other parts of the riparian zone (e.g., wetlands, wet meadows), conservative utilization limits, and seasonal restrictions — help to minimize establishment of trails through willows, widening of trails and openings due to mechanical damage, and possibly allowing the existing trail systems to decline.

- Implementing a minimum stubble height standard of 6 inches on streamside sedges and grasses would also facilitate the recovery of stream channel integrity and the functioning of riparian zones (Clary and Leininger 2000, Clary and Webster 2000, University of Idaho 2004), thereby allowing recovery of willow and other riparian shrub species. Six inches is at the upper end of the generally recommended 4-6 inch range, but the recommendations specify that the upper end of the range should be applied to riparian zones in need of recovery. Some authors have included 3 inches at the lower end of the range, but there is no indication this would facilitate recovery.
- On rangelands where the basal area and production levels (biomass) of herbaceous vegetation are below functioning condition, allowable-use standards and other restrictions on livestock grazing use would need to be implemented to allow for their recovery. This is being addressed by Rangeland Management Specialists.
- Several options exist for recognizing the important role that fine fuels play in fire ecology and management and for accommodating prescribed burning and wildland fire use. The "Fine Fuels / Fire Ecology" discussion in the "Other Habitat-Related Needs" section describes forage utilization levels that would retain suitable amounts of fine fuels.

  Sufficient herbaceous vegetation will not be retained across each allotments in all years to facilitate fire spread in the unlikely event that lightning ignites a fire that has potential to be managed as a wildland fire use. However, the importance of fire to the majority of wildlife species on the district, combined with herbaceous forage and cover needs of wildlife and the important role that standing herbaceous vegetation and litter play in restoring and sustaining watershed functioning and wildlife habitat, strongly points in the direction of developing and implementing conservative allowable-use standards.

  To accommodate prescribed burning, and because allowable-use standards will not retain an optimum level of fine fuels, pre-treatment rest will likely be needed. Post-treatment rest (e.g., 1-2 years) would also be needed following prescribed burns, as well as wildand fire use and wild fires.

A note on fire in shrub communities: The canopy of big sagebrush and other shrubs is an important to critical element of wildlife cover for sagebrush and the many species that inhabit mountain shrubland communities, respectively. However, it needs to be recognized that late-seral big sagebrush and mountain shrubland communities are over-represented on the district and that canopy cover within some of late-seral big sagebrush stands is unnaturally high (USFS 1997, USFS 2009). High canopy cover of bit sagebrush has been shown to limit herbaceous production (Winward 1991, Miller et al. 1994, Knight 1994, Riggs et al. 1996).

Cover Needs of Individual Wildlife Inhabiting Willow & Aspen Stands that Use Shrub and Tree Cover

While shrub and tree canopy is relatively free from the effects of cattle on a short term (e.g., annual) basis, cattle use has the potential to affect shrub and tree canopies over several years through browsing of young stems, stem and trunk damage, trampling, and soil compaction. Thus, the process of defining allowable-use standards must consider the requirement to retain this element of wildlife cover.

Native Ungulates (MIS species)

Loft et al. (1987), Barnes et al. (1991), and Peek and Krausman (1996) recognized the influence of livestock grazing on cover used by mule deer, including both herbaceous and shrub/tree cover. Willow and aspen communities, when in healthy condition, provide important habitat for moose and mule deer on the Little Greys allotment, and aspen provides important habitat for elk. Cattle herbivory has the potential to markedly impact riparian willow communities (Chaney et al. 1993, Elmore and Kaufman 1994, Kie et al. 1994, Ohmart 1996), which reduces cover qualities provided by willow communities. Calving moose and those with calves seek out dense cover such as closed-canopy shrub habitat (Peek 1997). While current cattle herbivory in the Little Greys allotment appears to be having no more than negligible adverse impacts on willows in willow communities, it has reduced the canopy cover in a few willow communities. While cattle browsing of aspen and deciduous shrubs in aspen stands was not observed to be excessive on the allotment, it has the potential (if not managed adequately) to impact aspen stands (DeByle et al 1985), which in turn could reduce cover qualities provided by deciduous shrubs and trees in these stands.

Migratory Birds

Of all types of habitats in the southern Greater Yellowstone ecosystem, ecologically intact and healthy riparian areas and aspen stands sustain the most biologically diverse wildlife communities (Dobkin et al. 2002, Wyoming Partners in Flight 2003). There are 76 species of birds that are closely associated with willow, cottonwood, and aspen communities in this area (Dobkin et al. 2002). A disproportionate number of migratory bird species are associated with these deciduous woody communities, as compared to other types of habitat. Several bird species associated with willow, cottonwood, and aspen habitat and that were identified by Intermountain West Joint Venture (2005:Appendix A) as priority bird species of Wyoming occur in the Little Greys. Many of these species do best in healthy stands of willow, cottonwood, and/or aspen (WPIF 2003).

It is well documented that long-term degradation of willow, cottonwood, and aspen communities can adversely impact bird communities (Mosconi and Hutto 1981, Bock 1993, Knopf 1996, Sanders and Edge 1998, Dobkin et al. 2003, WPIF 2003). Sanders and Edge (1998) counted 2.2 times more birds in continuous willow communities than in discontinuous willow associations. In one of the two years, species richness was significantly higher in continuous willow communities. Abundance of willow flycatchers, yellow warblers, song sparrows, American robin, and common snipe increased with increasing canopy cover of willows. However, Fritz et al. (1988) found little difference between abundance of song sparrows and yellow warblers between continuous and discontinuous willow communities, and found robins to be associated with discontinuous willow communities. They found willow flycatchers, Lincoln's sparrows, and white-crowned sparrows to be most closely associated with continuous willow communities. While cattle browsing and mechanical damage in any given year would not noticeably deplete cover provided by willows, cottonwood, or aspen, livestock herbivory needs to be managed in a ways that retain cover qualities of deciduous shrubs and trees.

The species listed in the subsection "Wildlife Inhabiting Willow and Aspen Communities that Use Herbaceous Cover" typically require dense shrubby vegetation, with dense herbaceous vegetation being a secondary (albeit important) factor — i.e., if dense herbaceous vegetation exists without dense shrubby vegetation, the birds would be absent. It is likely that a minor amount of trailing in otherwise dense stands of willow would continue to support Lincoln's sparrows, fox sparrows, gray catbirds, and other species needing dense willow/mixed deciduous shrub communities, but as trailing increases, the density of these communities declines and it is possible that disturbance, predation, and cowbird parasitism would increasingly impact these species.

Dobkin et al. (2002) highlighted two characteristics important for sustaining riparian and aspen habitat for bird communities: light ungulate grazing (as opposed to heavy grazing pressure) and a moderate fire-return interval (e.g., 50-100 years).

Strong indication that retaining a minimum 6-inch stubble height on sedges and grasses would help minimize impacts to willow communities (Hall and Bryan 1995, Clary and Leininger 2000). It is possible that a minimum stubble height of 4 inches would be adequate where pre-grazed grass height is relatively short. Utilization limits would also help to minimize impacts to willow communities, to allow dense willow communities to remain dense, and to allow areas of extensive trailing to recover. It would seem very likely that retaining ≥90% of the annual production of graminoids in dense willow communities would allow these conditions to be achieved. At 11-20% utilization (80-89% retention), however, it is possible that the structure of willow communities may be affected. This is because the great majority of graminoid plants would remain ungrazed or very lightly grazed due to willow canopy cover and inaccessibility by cattle, leaving only trails to be grazed. At this level of grazing, these trails would need to be heavily grazed to achieve 11-20% utilization in the willow community as a whole, which could affect the structure of the willow community (e.g., by the creation of more/wider trails).

In moderately dense willow stands, higher levels of grazing could be accommodated, but I hesitate to estimate appropriate levels in terms of percent utilization for the entire community. It stands to reason that, if utilization levels are >50-60% on trails, the possibility exists for impacts to willow community structure (e.g., through the creation of more trails, wider trails, pushing into other small openings and creating trails to them).

If willow communities are burned, extra care needs to be taken to ensure that extensive livestock trails do not become established. If not managed, it would be easy for livestock to establish trails as willow communities grow, but prior to canopies being big enough to exclude cattle. Then as willow grow taller, it may be possible for cattle to maintain these trail networks when willows have attained their full height.

Species that are dependent on aspen are being impacted by the ongoing loss of aspen habitat on the district and throughout the Bridger-Teton National Forest and many other parts of the Intermountain West. Restoring and maintaining aspen habitat is dependent fire — which currently is at a much reduced frequency — and adequate fire spread is dependent in part on the distribution of fine fuels. The next section "Other Habitat-Related Needs" addresses this critical need in more detail.

E. Other Habitat-Related Needs

The focus of this report is providing recommendations on retention levels for herbaceous vegetation in livestock allotments in order to retain suitable habitat for wildlife through the livestock grazing season, but livestock grazing use affects other elements of wildlife habitat and many of these are, coincidentally, related to retention levels of herbaceous vegetation.

Individually, each of the impacts of livestock grazing use in this section may be negligible or minor, but when combined with other indirect and indirect effects of livestock grazing, they have the potential to affect population levels, especially when combined with other cumulative factors affecting wildlife populations.

WATER QUALITY AND QUANTITY

Water quality is an important habitat parameter for a number of wildlife species, including Harlequin ducks (sensitive species), American dippers, and amphibians (sensitive species and MIS) (Wyo. Partners in Flight 2003, Keinath and McGee 2005, Patla and Keinath 2005). The main livestock-related effects on water quality and quantity that can reduce habitat suitability are as follows:

- *Direct Effects on Water Quality* — Water quality in amphibian breeding pools is reduced by livestock churning-up of mud and other material due to trampling, and by defecation and urination by livestock (Keinath and McGee 2005). Use of breeding pools by livestock for watering on the district ranges from low level, occassional use to a high level of use where effects are readily observable. The most critical period is the larval stage (Keinath and McGee 2005), which spans from the egg-laying period through the metamorphosis of frogs and toads, which is from late April through mid July at low elevations, and from June through early September at high elevations (mid elevations fall between these two ranges). Therefore, on cattle allotments, the highest potential for adverse effects is from the onset of the grazing season through mid July, typically about 1 month. This period is missed on lower elevation portions of sheep allotments. At high elevations, the highest potential for adverse effects is from the onset of sheep grazing through early September, typically about 1½-2 months. Although much larger numbers of sheep use any given water source compared to cattle allotments, the duration of use is considerably shorter (e.g., a much shorter period in any given day, and far fewer days) and sheep do not venture as far into the water as cattle.
- *Indirect Effects of Historic Livestock Grazing* — Rangelands that have reduced ground cover are more prone to have elevated levels of erosion, which translates into elevated levels of sedimentation in down-gradient waters (Thurow 1991, Satturlund and Adams 1992, National Research Council 1994). This is particularly true when ground cover is below 60-65% — Holechek et al. (2004) cited studies showing that a minimum of 65% ground cover is needed to prevent excessive erosion in mountainous areas. Keinath and McGee (2005), Patla and Keinath (2005), and other authors have discussed the implications of soil erosion and sedimentation to amphibian conservation.
- *Indirect Effects of Present-day Livestock Grazing* — Related to this is the extent to which recovery of damaged rangelands is slowed due to present-day livestock grazing. Depending on utilization levels, timing, and frequency of livestock grazing, recovery

rates can be slowed, stalled, or reversed (Prevedel 2003, Holechek et al. 2004). Care needs to be given to make sure that utilization levels and other aspects of livestock grazing use are managed to allow for a reasonable rate of recovery. Livestock grazing use can also temporarily increase erosion rates and sedimentation, such as when a sheep band grazes on a slope during or immediately after a large rain event, particularly if the slope has a high amount of bare ground to begin with.

- *Direct Effects on Water Quantity* — Cattle and sheep drinking water from drying amphibian breeding pools has the potential to prevent the completion of the metamorphose process (Patla and Keinath 2005). This is only an issue where breeding pools are small and where evaporation has already substantially reduced the amount of water in larger breeding pools (but where sufficient water would otherwise be retained through the completion of metamorphosis). The main variables are the amount of water in a given pool and the evaporation rate relative to timing of metamorphosis, and the number of livestock and frequency of use. The larger the number of livestock and the smaller the pool, the greater the chane of depleting the water before tadpoles have a chance to successfully metamorphose. Direct effects of livestock on water quality (discussed at the beginning of this section) compound the effects of a shrinking water supply due to higher concentrations of the contaminants.

  The most critical period for retaining water in breeding pools would be the same as described in the direct effects on water quality, above. After adult frogs have left breeding pools and after young frogs and toads have metamorphosed, they typically gravitate and migrate to more permanent water bodies, streams, and springs (Polliod et al. 2002, Keinath and McGee 2005, Patla and Keinath 2005, Pierce 2006).

Recommended minimum retention levels in the published literature to sustain rangeland vegetation in functioning condition — expressed as utilization limits in this literature — range from 50% to 70% retention of the annual production of key forage species (which translates into an estimated 60-85% retention of herbaceous vegetation). Given the emphasis on a range of wildlife species in DFC 10 areas, on top of the more important requirements for restoring and sustaining functioning rangelands and riparian areas, and given the questions about whether a minimum of 50% retention of the annual production of key forage species is sufficient to maintain watershed functioning on rangeland types in this area (e.g., Holechek et al. 2004), a more conservative retention level is warranted. For many years, take-half leave-half was a widely accepted utilization limit, but during the last 25 years, many range experts have adjusted this recommendation, especially on rangelands that are not meeting resource objectives. Holechek et al. (2004), for example, summarized studies showing that 50% utilization of key forage species results in the deterioration of rangelands in this geographic area, and that retention levels of 55-65% allow palatable species to retain themselves. They recommended a minimum of 70% retention of the annual production of key forage species (which translates to an estimated 80-85% retention of herbaceous vegetation) during the growing season on healthy, functioning rangelands or during the growing season on degraded rangelands, and 60% (which translates to an estimated 70-80% retention of herbaceous vegetation) during the dormant season on healthy, functioning rangelands. These recommendations may primarily apply to graminoid-dominated communities and understories, but they appear to be consistent with the once-over "light" grazing recommendations by range management specialists on the BTNF for sheep allotments (but see the "Challenge" subsection of the "Forb-dominated Communities and Understories" section). The Forest Plan (Forage Utilization Standard) requires higher retention levels on rangelands in less-than-satisfactory condition, and this is supported by Heady and Child (1994) and Holecheck et al. (2004).

A similar case can be made for DFC 4 areas, given their emphasize watershed functioning and water supplies, and this conservative approach would benefit wildlife species affected by water quality.

In general, higher retention levels of herbaceous vegetation in the vicinity of wetlands and streams (e.g., ≥80% retention of herbaceous vegetation and minimum 6-8 inch stubble heights on sedges and riparian grasses) would indirectly result in comparatively lesser direct adverse effects on water quality and quantity compared to lower retention levels, particularly on cattle allotments. However, this is only a general relationship and other factors influence the degree of use of any particular wetland or section of stream (e.g., topography, density and distribution of water, number of cattle relative to duration of use, fencing), and other mitigation measures may be needed. (See also the "Soil Compaction and Trampling Effects," below.)

FINE FUELS / FIRE ECOLOGY

A large majority of wildlife species on the district depend on or favors habitats that are maintained or produced by fire. Habitats include:

- <u>Aspen Communities</u> — Aspen are out-competed over time by conifers (Gruell 1975, Gruell 1980a,b, USFS 1984, USFS 1997, USFS 2004).
- <u>Late-seral Big Sagebrush and Mountain Shrubland Communities</u> — These communities have been declining in acreage over time due to advancing conifer forestland and increased density of conifer trees (Gruell 1975, USFS 1997, USFS 2004, USFS 2005).
- <u>Early-seral Big Sagebrush and Mountain Shrubland Communities</u> — These communities are greatly under-represented on the district due to the reduction in fire frequency and spread (Gruell 1975, USFS 1997, USFS 2004, USFS 2005).
- <u>Early-seral and Mid-seral Forestland Communities</u> — These communities are greatly under-represented on the district due to the reduction in fire frequency and spread (Gruell 1975, Gruell 1980a,b, USFS 1997, USFS 2004, USFS 2005).
- <u>Open, Mature Stands of Douglas-fir and Mixed Conifer</u> — Open stands of Douglas-fir were historically maintained by low-intensity surface fires (USFS 2003, USFS 2004a; see also Gruell et al. 1986 and Noss et al. 2006).
- <u>Willow Communities</u> — are also being lost due to unabated increases in the density and canopy cover of conifer trees in many drainages. While the unabated increase in conifer density and canopy cover is related to water tables and cyclical or periodic beaver activity, the increase in conifer density and canopy cover is widespread and does not appear to be limited to these two factors.

The main cause of this aspect of less-than-satisfactory habitat conditions is reduced frequency and extent of fires on the landscape, which in turn is due mainly to fire suppression activities, but livestock grazing and road construction have also contributed (Gruell 1980a,b, Miller et al. 1994, USFS 1997, Miller and Heyerdahl 2008, USFS 2009). Historic over use by livestock contributed in two ways. First, it greatly reduced the biomass of herbaceous vegetation on an annual in many parts of the district, which depleted fine fuels prior to the fire season. Second, it reduced the density and species richness of herbaceous vegetation over time, which resulted in long-lasting reductions in the amount of fine fuels produced on many rangelands of the district and corresponding increases in bare ground. On some sites, reduced plant density and species richness were fairly minor, but on other sites, reductions were severe enough to produce fairly effective fire breaks. This is discussed in more detail in USFS (2009).

While present-day livestock grazing use plays a relatively small role, it does contributes to the many factors that limit the return of fire onto the landscape, particularly in parts of the Greys River Ranger District with extensive rangelands and with extensive rangelands intermixed with forestland pockets and stringers. One way that present-day livestock grazing contributes is that it slows the recovery of herbaceous communities and understories; even properly managed livestock grazing slows recovery to some extent. Another way that it contributes to limitations on the return of fire to the landscape is that forage utilization reduces the amount, height, and distribution of fine fuels available to carry a fire (Gruell et al. 1986, McAdoo et al. 2007, Strand 2009), minimally in areas where utilization is <20% and by a major amount where utilization is >40-50%. Strand (2009:1) stated that "grazing has the highest potential to affect fire spread and intensity in areas that are dominated by herbaceous fuels with low sagebrush cover and under low to moderate conditions in weather severity." Possibly the biggest effects are the influence of active allotments on locating prescribed burns and the influence of active allotments and the presence of livestock on an allotment on decisions whether to manage lightning-strike fires as wildland fire use or as a wildfire. These are discussed further in USFS (2009).

The effects of present-day livestock grazing use on fine fuels is easy to envision for rangelands, but effects on fine fuels also has the potential to affect fire spread in some forested communities where rangelands and large forest openings are prevalent. If herbaceous production is depleted and/or if forage utilization had reduced the amount of fine fuels sufficiently to stop fire spread across a given rangeland, this can reduce the potential for fire burning forestland (e.g., conifer and/or aspen) on the other side. Given the major backlog of disturbances such as fire, this in turn would forego benefits to many wildlife species. On the other hand, depleted rangelands and rangelands with recent forage utilization by livestock can provide fire breaks when fighting wildfires (McAdoo et al. 2007, Strand 2008), thereby providing benefits to resources and/or structures being protected from fire, but not necessarily wildlife as a whole. (Use of livestock grazing to intentionally create fire breaks in anticipation of possible wildfire needs to be targeted to specific areas without impacting resources in the larger area, as noted by McAdoo et al. 2007.)

To implement a prescribed burn, regardless of objectives, at least one season of rest prior to prescribed burning is a common recommendation in order for fine fuels to build sufficiently (Gruel et al. 1986). Gruell et al. (1986:7) stated that "Exclusion of livestock for one season is frequently necessary to develop adequate grass fuel. Where coverage of sagebrush is less than about 15 percent, a grass loading of about 600 lb/acre is needed to support fire (Britton and Ralphs 1979). For sagebrush coverage greater than about 20 percent, 300 lb/acre of grass may be adequate." Given the emphasis on completely resting areas from livestock grazing prior to a prescribed burn, there is strong support for the assessment that retention of ≥90% of herbaceous vegetation would be sufficient to meet the needs of a prescribed burn. There may be moderate support for the assessment that retention of 80-89% of herbaceous vegetation would be sufficient. However, there likely is little to no support for any lower levels of retention.

While it is not possible to rest large areas in anticipation of the possibility of a lightning strike (and wildland fire use), retention levels of herbaceous vegetation need to be considered in light of the district's overall strategy for managing lightning-strike fires as a wildland fire use. Wildland fire use may be the most promising approach to restoring and sustaining the habitats listed at the beginning of this section. While prescribed burning and mechanical treatments will continue to play a role they are costly, only affect small areas, constraints are increasing (e.g., absolute protectiong of multistory forestland for lynx), burn windows are unpredictable, 86% of the district is off-limits to mechanical treatment in forestlands, prescribed burns in forested areas greatly increases complexity and risks, among othe reasons.

Managing herbaceous retention levels for wildland fire use is different than for prescribed burns because there is a very low chance of (1) lightning sparking a fire in any particular area and (2) a large number of other factors that would need to addressed and coordinated in order to manage a fire as wildland fire use. However, if no consideration is given to this management element, we consciously reduce the chances of meeting resource objectives. The parts of the district where fire-return intervals were relatively short are areas where fine fuels played a comparatively larger role, and these are the areas where livestock are grazed. A few of the many other considerations include adjoining land ownership and structures, recreation objectives, commercial-harvest objectives (e.g., timber, livestock grazing), and wildlife objectives.

The ecological and fire management principles are the same as for prescribed burns (e.g., characteristics of fine fuels heavily influence surface fires), but given the other considerations, here is a modified discussion of the relationships between the retention of fine fuels and livestock grazing (although this needs to be reviewed by fire management specialists):

- There is strong support for the assessment that retention of ≥90% of herbaceous vegetation would be sufficient to meet the needs of a prescribed burn.
- There is moderate support for the assessment that retention of 70-89% of herbaceous vegetation would minimally provide for adequate fire spread. While the risk of inadequate fire spread may be too high for a prescribed fire, this level of retention would at least provide some possibility of reasonable fire spread in a wildland fire use situation.
- There is low to moderate support for the assessment that retention of 60-69% of herbaceous vegetation would minimally provide for adequate fire spread in most rangeland situations.
- There is no support for the assessment that retention of <60% of herbaceous vegetation would minimally provide for adequate fire spread in most rangeland situations.

Burned areas should either be rested or no more than lightly/moderately grazed in late season (Gruell et al. 1986).

SOIL COMPACTION AND TRAMPLING EFFECTS

Walking and running livestock can directly and indirectly injure and kill some wildlife and their eggs. Direct injury and death can result from livestock stepping on eggs and young birds and small mammals in ground nests, disrupting or jarring nests in shrubs and low trees, stepping on or disrupting amphibian egg masses in shallow water, stepping on tadpoles and metamorphosing amphibians in shallow water and on banks, and killing amphibians and small mammals by crushing burrows near the ground surface and in banks (Gjersing 1975, Wyo. Partners in Flight

2003, Holmes and Johnson 2005, Keinath and McGee 2005, Patla and Keinath 2005). Wyoming Partners in Flight (2003) identified several migratory bird species that can be affected by trampling. Injured animals are predisposed to dying of other causes and surviving injured animals may have lower reproductive potential (an indirect effect).

Other indirect effect include (1) increased soil compaction, which can prevent frogs and toads from burrowing underground which they do to prevent desiccation or freezing; and (2) trampling of streambanks under which frogs hibernate, which can affect winter survival (Keinath and McGee 2005, Patla and Keinath 2005). Reduced litter cover and reduced organic content of soils can compound the first effect. Both of these factors can also limit the burrowing capability of some small mammals (Klaus and Beauvais 2004). Effects of soil compaction on amphibians and small mammals can be compounded by drying of the ground due to large reductions in herbaceous vegetation.

Direct and indirect effects of walking and running livestock (i.e., trampling effects) are directly related to the intensity of grazing (utilization rates) and, therefore, are inversely related to the amount of herbaceous vegetation retained, as well as the amount of herding that is used to manage livestock distribution. Retention of herbaceous vegetation in a given area is mostly a function of the number of livestock and the amount of time they spend in the area. A high density of livestock in a given area for a short amount of time can result in trampling effects on wildlife, just as a lower density of livestock in the same area for a longer period of time. It is a function of the total amount of walking/running that is done within a given area (e.g., total miles walked by all animals within a given area). The total amount of walking/running that is done is directly related to the grazing intensity, or level of forage utilization. An exception to this is herding cattle. Frequent herding of cattle, for example to maintain lower utilization levels in riparian areas and increasing use of adjoining uplands, increases the trampling effects beyond what would be expected at a given utilization level in the riparian zone due to higher levels of animal movement back and forth through the riparian zone and faster movement (trotting/running vs.walking). This could be mitigated by the addition of a fence, which would also have other benefits to the management of wetland and riparian areas (although these benefits must be weighed against negative effects to native ungulates and some migratory birds).

Therefore, trampling effects are managed concurrent with forage utilization limits and minimum-allowable stubble heights. Allowable-use standards on herbaceous vegetation that retain suitable forage and cover are in the neighborhood of ≤20-30% utilization (or, ≤30-40% utilization of key forage species) and a minimum stubble height of 6 inches on streambanks, which allow for conservative levels of grazing. Areas that receive higher levels of grazing pressure (e.g., 40-60% or higher utilization of herbaceous vegetation, <4 inch stubble heights on streambanks) would have a higher propability of trampling effects both in general and on specific sites (e.g., amphibian breeding pools, streambanks). If this is a small portion of any given pasture, adverse effects would be fairly limited except that major impacts to amphibians can occur on very small areas, such as where livestock water. This means that adherence to conservative utilization standards does not necessarily mean these impacts will be avoided without implementing other control measures. While some studies did not detect trampling effects of livestock on amphibians (Bull and Hayes 2000), the published literature is clear that this is a potential effect of livestock grazing wherever there is overlap in livestock grazing and amphibian breeding sites. Additional requirements for livestock grazing management may help to alleviate such impacts, but some of these impacts will be unavoidable.

While higher utilization levels generally correspond to higher probabilities of trampling effects — whether this involves larger numbers of livestock with no change in season of use or a longer season of use with no change in livestock numbers — it stands to reason that larger numbers of livestock are more apt to result in detrimental trampling effects than smaller numbers spread over a longer period of time. At amphibian breeding sites, a small number of animals periodically visiting a water source has potential to trample or otherwise affect eggs, tadpoles, and metamorphosing frogs, especially since this is spread over a period of time. But large concentration of animals, especially if this occurs at a time when amphibians are prone to trampling effects, can result in larger impacts. This is because more animals would be in the water and at the waters edge at any given time, which probably pushes more animals further into the water, causes more commotion and movement, and increases the chance of any individual amphibian being impacted. For example, in one instance on the Targhee National Forest, thousands of metamorphosed toads were killed when sheep were herded through a drying pond (Bartlelt 1998, 2000, as cited by Keinath and McGee 2005). Apparently, hundreds of toads were directly killed by trampling and hundreds more died shortly afterward from desiccation due to trampling of the vegetative cover.

On many allotments, less-than-satisfactory conditions caused by the impacts of trampling are averted to some extent by the timing of turning livestock onto allotments, deferred rotation among pastures or allotments, seasonal progression of grazing use within allotment/pasture, and regularly-scheduled and periodic rest.

NOXIOUS WEEDS

Noxious weeds on the Greys River Ranger District have the potential to have major adverse effects on wildlife habitat, as they have in other parts of the intermountain west (see USFS 2009). Although the distribution and extent of noxious weed infestations is currently not high enough to reduce habitat suitability by a major amount, except in localized areas, the potential exists for a major increase in spotted knapweed, leafy spurge, yellow toadflax, and other noxious weeds. A wide range of habitats can be impacted, including riparian areas, ungulate winter ranges, big sagebrush and mountain shrub communities, aspen stands, forbland, and herbland communities.

The potential for noxious weed introduction and spread increases as the retention level in a given area declines (i.e., as utilization levels increase). Over-use of individual plants and disturbance of the soil will occur at any level of livestock grazing and, therefore, the potential for the introduction and spread of noxious weeds is generally inversely related to retention levels. The ecological condition of rangelands and riparian areas influences this to some degree. At relatively high retention levels in an area that is in healthy, functioning condition, there are fewer opportunities for weeds to successfully establish, as compared to relatively high retention levels in an area that is at the low end of functioning-at-risk.

Livestock grazing use contributes to the introduction and spread of noxious weeds in two main ways: (1) dispersal of noxious-weed seeds, and (2) site preparation and reduced inter-plant competition (see USFS 2009). The number of livestock influences the first factor and, so long as livestock are out for several days to a few weeks, the potential to introduce new seeds (from outside the district) exists. Forage utilization levels have little influence on this. On the other hand, dispersal of seeds that already exist in a given allotment is influenced by forage utilization because the longer livestock are in a given area and the larger number of livestock in the area, the greater the chance of weed seeds being picked up and distributed to new sites within the area. Also, with higher utilization levels, more micro-sites and sites will be created that are favorable for germination and establishment of noxious weeds, particularly in functioning-at-risk and non-functioning rangelands and riparian areas. Some exceptions to this occur, including pushing sheep through an area at a faster rate than they normally would go (i.e., the utilization level may be low, but soil disturbance can be high), and herding cattle away from a riparian zone on a daily basis may result in low utilizatoin rates relative to the amount of hoof action.

A few general rules are as follows:

- Parts of pastures/allotments that are ungrazed and unused by livestock in any given year have a lesser potential for noxious weed introduction and spread than grazed portions.
- Parts of pastures/allotments where retention levels are ≥80% have a lesser potential for noxious weed introduction and spread than parts where retention levels are <80%.
- By minimizing the proportion of allotments and pastures in the 40-59% retention level, the potential for noxious weed introduction and spread would be lowered, as compared to higher proportions of allotments and pastures in the 40-59% retention level.
- By minimizing the proportion of allotments and pastures in the 20-39% retention level, the potential for noxious weed introduction and spread would be lowered, as compared to higher proportions of allotments and pastures in the 20-39% retention level.

DISEASE

Livestock can transmit or spread disease in several ways, including by being carriers of the disease and by conveying disease organisms on their body. Jessup and Boyce (1996) and Williams and Barker (2001) listed several diseases that can be transmitted from cattle to native ungulates, either through direct contact or by livestock introducing disease organisms to habitat used by host species of wildlife. Patla (2000) identified the potential for livestock to carry disease organisms from water body to water body, thereby reducing habitat quality for affected wildlife species. This issue is addressed in more detail in USFS (2009) with respect to MIS.

In many cases, it is the mere presence/absence of livestock that carry particular disease organisms. Depending on the disease and host species, if livestock transport disease organisms to a particular area, the number of livestock, duration of use, and season of use may only be minor variables. Therefore, in contrast to previous habitat factors (e.g., trampling effects, water quality effects), attempting to manage the potential of disease transmission by managing retention levels of herbaceous vegetation is much less useful and may have no practical utility. This is because the first bite taken by a cow or sheep signifies their presence in an area, which provides the mechanism for either direct transmission of disease or deposition of disease organisms into the environment. Livestock numbers and duration of use in a given area influence the distribution and density of disease organisms, thereby generally corresponding to retention levels of herbaceous vegetation.

But again, depending on the severity of the disease and potential for successful direct transmission of the disease or introduction of disease organisms into the environment, the number of livestock and the amount of time spent in a given area may be immaterial. An example is the potential transmission of disease from domestic sheep to bighorn sheep. The consequences are severe enough and the potential for successful transmission is high enough that even one infected domestic sheep for one day in an area used by bighorn sheep is of major concern (Jessup and Boyce 1996, Krausman et al. 1996, Krausman and Shackleton 2000, Schommer and Woolever 2008). A large number of recommendations to address this issue, according to the importance of any given bighorn sheep herd, are provided in the Wyoming Bighorn/ Domestic Sheep Interaction Working Group (2004) and WAFWA (2007b). On the other hand, the potential for elk or mule deer contracting a new, highly infectious disease from cattle or sheep on the district is relatively low (Jessup and Boyce 1996, Williams and Barker 2001) and, therefore, is not of big enough concern to address at this point, but not to say this is not an issue that needs to be revisited periodically. Also, there is suspicion that livestock can transnsport disease organisms that adverse impact amphibians (Patla 2000), but this has not been confirmed and the threat level needs to be evaluated further. If this were to be identified as an issue needing to be addressed, livestock grazing intensity would likely be immaterial. Mitigation options may include decontamination prior to livestock being transported onto the district and exclusion (e.g., fencing of amphibian breeding sites).

NEST PARASITISM

Cattle grazing in and near (e.g., within 4 miles) migratory bird nesting habitat during the nesting season and fragmentation of large willow stands increase the potential for cowbird nest parasitism because the presence of cattle and horses (e.g., herder's horses) attracts brown-headed cowbirds to breeding sites (Wetmore et al. 1964, Baicich and Harrison 1997, Wyo. Partners in Flight 2003, Holmes and Johnson 2005). Although Holmes and Johnson (2005) stated there is no reported information on cowbird brood parasitism in the Rocky Mountain Region of the Forest Service, the extent to which this was studied was not clear and the potential still exists since Brewer's sparrows are susceptible to this. Nest parasitism often leads to nest abandonmenty, thereby reducing reproductive success. Although brown-headed cowbirds are native to this area, unnaturally higher levels of cowird nest parasitism caused by cattle grazing use — to the extent this occurs — have the potential to contribute to decines in migratory bird populations and is of concern throughout the distribution of brown-headed cowbirds. What is an unnaturally high level of cowbird nest parasitism is unclear because brown-headed cowbirds are endemic to this area and bison use of small parts of the area now within the Greys River Ranger District may have attracted cowbirds into some of the areas now grazed by cattle. However, it is not clear when bison would have used the valley bottoms and toe slopes of the district and whether any use occurred during the egg-laying or and re-nesting periods. Given the abundance of new growth in the larger valley bottoms (e.g., Star Valley, Swan Valley) from May into late June or July, it is possible that bison didn't move to higher elevation areas until grasses began to dry at lower elevations.

The main management strategies for reducing potential effects of cowbird parasitism are delaying the onset of cattle grazing until after the egg-laying period in any given pasture or allotment and alternating years of early-season use (e.g., deferred rotation, rest-rotation (Wyo. Partners in Flight 2003). It is very likely that turnout dates of mid June through late June are late enough to avoid or at least heavily mitigate effects of cattle attracting cowbirds since most birds susceptible to cowbird parasitism begin egg-laying in early to late May, and at least some re-nesting has been initiated prior to mid June. Cattle on the Big Greys and Little Greys allotments are managed on a deferred rotation system and cattle grazing in the first rotation is not initiated until the third week of June (although cattle trail through the lower Greys River and Little Greys River every year for a period of 1 week or more in the third week of June). Turnout dates closer to June 1 and allotments in which cattle use the same areas early in the season every year (i.e., no rotation) would have a higher potential for nest parasitism.

Livestock grazing intensity may not influence cowbird parasitism rate to any extent, except that lower forage utilization standards would tend to reduce the time spent in a given pasture — assuming no change in cattle numbers — which may slightly reduce the potential for cowbird parasitism.

Cowbird nest parasitism in the interiors of large, dense, unfragmented willow stands tends to be lower than in fragmented stands (Wyo. Partners in Flight 2003). Present-day cattle grazing that contributes to increases in fragmentation or that reduces the process of filling-in (e.g., where historic cattle grazing created openings and trails through otherwise impenetrable stands) has the potential to contribute to elevated levels of cowbird parasitism in affected willow stands. Although impacts to willow stands are relatively low on the Greys River Ranger District, trails through willow stands are not uncommon and cattle grazing use likely maintains openings that otherwise would not exist. The extent to which this influences cowbird parasitism is unclear, but the potential exists for elevated levels.

FENCES

In this section, I do not address the topic of fences in any great detail and only address one specific fencing considerations pertaining to managing forage utilization by livestock. The purpose for installing and maintaining fences needs to be weighed against direction for providing wildlife habitat, among other considerations. For example, if the purpose of a fence in a DFC 10 or 12 area (and possibly DFC 3 and 4 areas) is to increase the distribution of livestock into an area currently unused by livestock, may not be appropriate if unused/lightly-use areas comprise a small portion of a given pasture or allotment. It would be inappropriate if addition of the fence would result in a less-than-adequate amount of forage, cover, and other habitat attributes being retained for wildlife. On the other hand, a fence that is used to supplement herding in order to reduce impacts to a riparian area or other sensitive area is one example of an appriate use of fencing if this cannot be done through herding.

F. Summary of "Suitable" Habitat

In this section, I identify the range of retention levels that would allow suitable forage, cover, and other habitat attributes to be retained for most dependent wildlife species on a given site, and I summarize the basis of the minimum thresholds. This section does not address the issue of retaining an adequate amount of suitable habitat, as this is addressed in a later section.

As general rules for graminoid-dominated communities and understories, the information outlined in this report support the following assessments:

- Higher minimim retention levels of herbaceous vegetation retain higher quality wildlife habitat on the Greys River Ranger District. Higher retention levels also facilitate a faster recovery rate of wildlife habitat than lower levels of retention.

- Retaining 70-80% to ~100% of the annual production of herbaceous vegetation (including 60-70% to ~100% of the annual production of key forage species) in healthy, functioning rangelands and riparian areas would provide for the forage, cover, and other habitat needs (e.g., low levels of sedimentation, low levels of trampling, facilitation of fire) of dependent wildlife species on a site-by-site basis. If less than 60% of the annual production of key forage species is retained, the lower limit of 70% would need to be increased as a lower threshold of suitability.
- There is no more than limited support for the assessment that retaining as little as 60% of the annual production of herbaceous vegetation in healthy, functioning rangelands and riparian areas would provide for the forage, cover, and other habitat needs of dependent wildlife species on a site-by-site basis. At this level, utilization of key forage species would be 50% or higher (which is unacceptable for native herbivores), cover qualities are substantially reduced, and it is questionable whether wildlife habitat can be sustainable at this level of grazing.
- Retaining stubble heights of 6 inches to ungrazed heights on streambanks in properly functioning condition would provide for the cover and other habitat needs (e.g., retention of willows, low levels of trampling/ defecation) of dependent wildlife species.
- Retention levels would need to be higher for functioning-at-risk rangelands and riparian areas that are in less-than-properly functioning condition. An exception may be rangelands and riparian areas that are near functioning/properly functioning condition.

As a general rule for forb-dominated communities and understories, the information outlined in this report supports the following assessment, recognizing that there currently are no readily-usable standardized methods for measuring or estimating percent retention in these communities:

- The general rules for graminoid-dominated communities and understories apply to forb-dominated communities and understories (except stubble heights). For example, to retain suitable forage and cover for dependent wildlife species, "most to all" of the annual production of herbaceous plant material in healthy, functioning forblands, herblands, and shrub-forb communities would need to be retained, and the extent of broken and bent-over plants would need to be minimized. "Most to all" recognizes the central role that herbaceous vegetation plays in providing suitable forage (leaf matter, flowers, seeds, and roots) and cover for many species of wildlife inhabiting or using these communities, while also recognizing the reality that it may be premature to quantify retention levels needed for wildlife habitat. "All" recognizes that healthy, functioning forblands, herblands, and shrub-forb communities not grazed by livestock are at the upper end of suitability for dependent wildlife species.

  "Most" provides a broadly-defined, qualitative minimum level of annual production of herbaceous vegetation that needs to be retained through the sheep grazing season. As discussed previously for forb-dominated communities and understories, an appropriate minimum threshold likely falls somewhere between 70% and 90% for healthy, functioning communities (i.e., 60-80% retention of key forage species). Also, the extent of bent-over and broken plant material would also need to be kept to a minimum, while recognizing that bent-over and broken plant material is part-and-parcel with sheep grazing use (i.e., some level needs to be accommodated). Although there are no readily usable standardized methods for measuring or estimating retention levels in forb-dominated communities and understories, percentages help to visualize what is needed.

The basis of these assessments is outlined below.

BY WILDLIFE SPECIES

Retention of Herbaceous Vegetation

Table 12 and Figure 10 summarize the degree of retention of herbaceous vegetation that is needed to provide for the seasonal forage and cover needs of several species and groups of wildlife, based on information outlined in the “Forage Needs of Individual Wildlife Needs,” “Cover Requirements of Individual Species,” and other sections of the report. Figures 1 and 2 provide a visual representation of the different retention levels.

Table 12. Level of confidence that each of several herbaceous vegetation retention levels would provide suitable forage and/or cover in healthy, functioning rangelands, riparian areas, and wetlands for each of several wildlife species and groups of species, starting at the ≥95 retention level and working downward. For each species, the level of confidence applies primarily to the main habitats they inhabit, except for species that do not use plant communities that naturally provide moderate to high levels of wildlife cover (e.g., killdeer). Retention levels in this table refer to herbaceous vegetation in general, and are not specific to key forage species.

	Elk and Mule Deer	Elk & Deer (winter)	Bighorn Sheep	Sage Grouse	Sage Thrasher	Brewer’s Sparrow	Vesper Sparrow	Voles (rangeland)	Deer Mice	Hummingbirds, Butterflies	Killdeer	Meadowlark, Savannah Sparrow	Northern Harrier	Sandhill Crane (feeding)	Sandhill Crane (nesting)	Common Snipe	Waterfowl (nesting)	Voles & Western Jumping Mice (rip.)	Amphibians – riparian & wetland	Amphibian – rangeland / forestland
Use:	f	f	f	n,f	n,*f*	f,n	n,f,*f*	n,f	n,f	f,*f*	n,*f*	n,f,*f*	n,*f*	f,*f*	n	n,*f*	n	n,f	n,*f*	n,*f*
Setting:	r,w,f	r	r	r	r	r	r	w,r	w,r,f	w,r,f	w	w	w	w	w	w	w,r	w,r	r	z,f
Percent Retained																				
≥95%	VH	VH	VH[A]	VH	VH	VH	VH	VH	H	VH	L	H	VH	H	VH	VH	VH	VH	VH	VH
90-94%	VH	H	N[A]	H	VH	VH	VH	VH	H	H	L	H	H	H	VH	VH	H	VH	VH	VH
80-89%	H	M	N	H	H	VH	H	H	H	M	L	H	M	H	M	H	M	H	H	H
70-79%	M	L	N	M	H	H	H	M	H	?	L	M	N	H	L-M	H	N	M	M	M
60-69%	L	N	N	L	H	H	M	M	H	?	L	ML	N	H	L	MH	N	ML	L	M
50-59%	N	N	N	N	MH	M	N	N	H	N	M	N	N	M	N	ML	N	N	N	M
40-49%	N	N	N	N	M	N	N	N	M	N	M	N	N	M	N	N	N	N	N	N
30-39%	N	N	N	N	N	N	N	N	M	N	H	N	N	N	N	N	N	N	N	N
20-29%	N	N	N	N	N	N	N	N	N	N	H	N	N	N	N	N	N	N	N	N
10-19%	N	N	N	N	N	N	N	N	N	N	H	N	N	N	N	N	N	N	N	N
0-9%	N	N	N	N	N	N	N	N	N	N	H	N	N	N	N	N	N	N	N	N

f = foraging, n = nesting/reproduction (*f* = vegetation/habitat provides for needs of prey, e.g., insects, small mammals)
r = rangeland, w = wetland and riparian, f = forestland
Level of confidence: VH = very high, H = high, MH = moderately high, M = moderate, ML = moderately low, L = low, U = Unsure do to N = none.

In addition to forage and cover for wildlife, several other habitat and wildlife related attributes were addressed in identifying retention levels for individual wildlife species and groups of species:

- Restoring and Sustaining Healthy Wildlife Habitat on Rangelands and Riparian Areas — The ability of damaged rangelands and riparian areas to recover and the ability of healthy rangelands and riparian areas to sustain themselves is directly related to retention levels

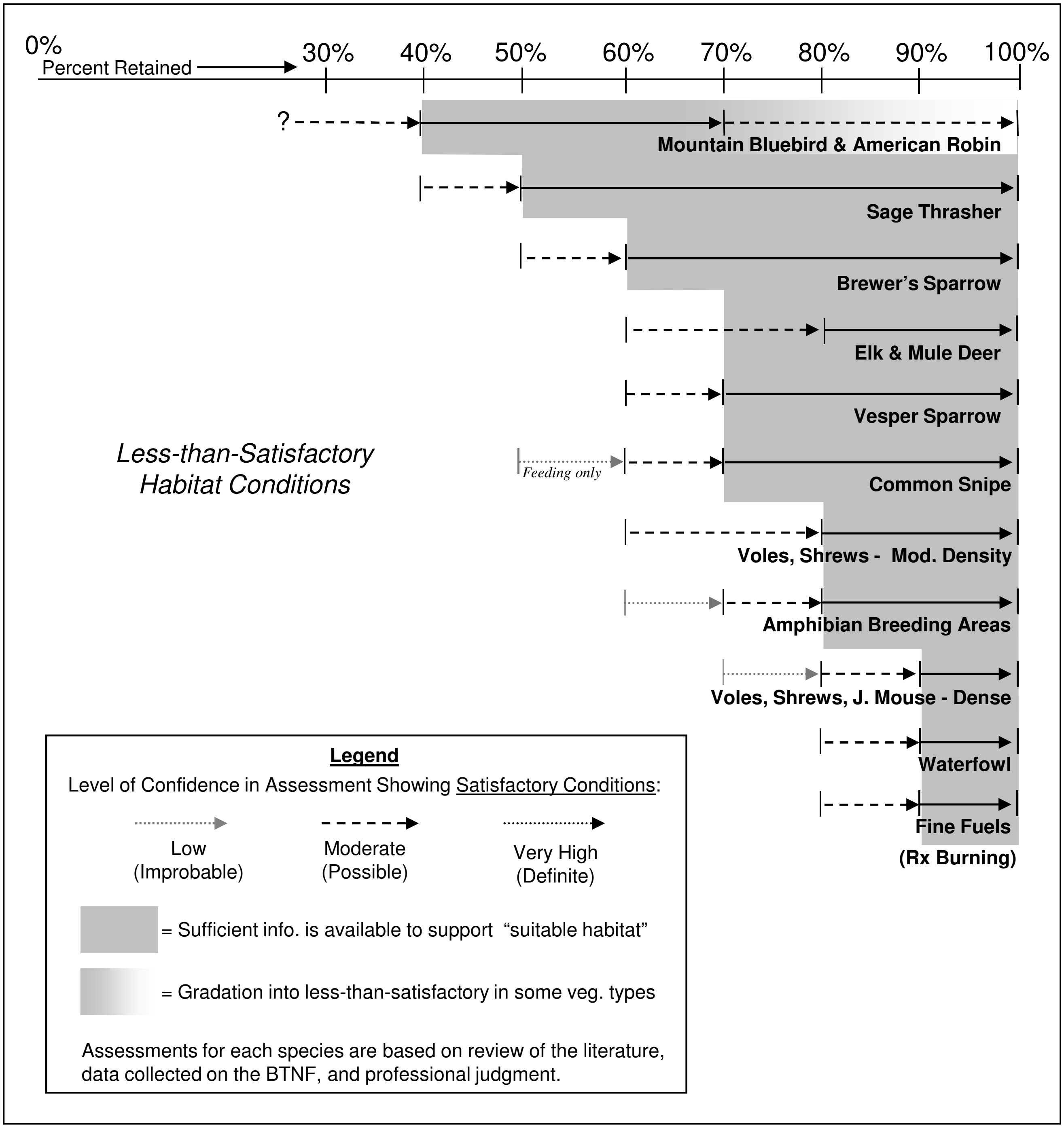

Figure 10. Suitable habitat conditions as related to different retention levels of total-herbaceous vegetation during the livestock grazing season (assuming healthy, properly functioning conditions). If conditions are less than properly functioning, the amount of herbaceous vegetation retained would need to be higher, proportional to the extent to which conditions deviate from healthy, functioning conditions.

of herbaceous vegetation. Healthy, functioning rangelands and riparian areas are cornerstones of providing adequate amounts of suitable habitat for wildlife. Specific examples include:

  - Retention of herbaceous vegetation to contribute to (1) roots holding soil in place, (2) minimizing impacts of raindrops (standing vegetation and litter), (3) reducing evaporation near the ground surface, (4) increased infiltration of water (roots, litter, organic content of soil), (5) slowing movement of overland flow (standing vegetation and litter), and (6) plant health and vigor (organic content of soil, retention level).
  - Retention of streambank herbaceous vegetation contributes to stable streambanks, which in turn contributes to high stream channel integrity and properly functioning riparian areas.
  - Retention of streambank herbaceous vegetation minimizes the browsing of willows, which in turn helps to sustain streambanks and productive wildlife habitat.
  - Retention of herbaceous vegetation to reduce the potential for infestation by noxious weeds. Over-use of herbaceous vegetation can increase bare ground and disturb soils, which can facilitate successful establishment of noxious weeds.

- Soil compaction, trampling of streambanks, and organic content of soils — Soil compaction has the potential to affect the ability of frogs, toads, and small mammals to burrow into moist riparian and meadow soils. The organic content and amount of litter cover can compound this effect, making it more difficult for these wildlife species to burrow into the ground or under litter accumulations. Trampling of streambanks can impact amphibians and small mammals by crushing individuals in burrows and by reducing the ability of these species to use streambanks for burrowing. The level of soil compaction, reduced organic/litter content, and other impacts are inversely related to retention levels.

- Fine fuels for fire spread — The majority of wildlife on the district depends on or benefit from habitats that are sustained or produced by periodic fire. The extent of fire spread in many areas of the district depends in part on the amount and distribution of fine fuels, which in turn is determined by natural potential of sites, ecological condition (i.e., extent of deviation from natural potential), and the proportion of the annual production of herbaceous vegetation that is retained in any given year.

- Water quality in amphibian breeding pools and in streams — The extent to which water quality is affected by defecation, urination, and churning the bottom of pools by livestock is directly related to the intensity of grazing, which in turn is inversely related to retention levels of herbaceous vegetation. Also, the extent to which erosion in rangelands affects water quality is directly related to the condition of rangelands, which in turn is directly related to retention levels of herbaceous vegetation.

- Trampling of tadpoles/metamorphosing amphibians and bird nests — High concentrations of livestock in and around frog and toad breeding pools have the potential to result in the trampling of substantial numbers of tadpoles and/or metamorphosing amphibians, depending on timing. Bird nests on the ground and in low bushes can also be impacted by livestock. In many situations, trampling effects are inversely related to retention levels. Also, changes in season of use, restrictions in the vicinity of breeding pools, and fencing can reduce or eliminate this threat.

- Nest parasitism by brown-headed cowbirds is addressed in this report. The potential for nest parasitism cannot be addressed through the application of allowable-use standards. Restrictions on the onset of cattle grazing, deferment, and rest are viable options.
- Disease transmission from livestock to wildlife — The potential for livestock to transmit disease to wildlife is another consideration in adjusting and establishing allowable-use standards and rest. There are three general categories of management response: (1) no need to adjust livestock management at this time, which applies to most diseases and most wildlife species given the low level of effects or low probability of occurrence; (2) some level of consideration should be given to adjusting livestock management; and (3) livestock grazing should be discontinued on particular areas where potential for transmission is high and wildlife values are high. Most potential for transmissions on the Greys River Ranger District fall into the first category, and none fall into the third category at this time. An example of the second category is the consideration of disease transmission in the management of domestic sheep within allotments within the current range of bighorn sheep (Wyoming Bighorn/Domestic Sheep Interaction Working Group 2004, WAFWA 2007b, USFS 2009). Given the magnitude of the potential consequences of disease transmission from domestic sheep to bighorn sheep, less-than-satisfactory conditions result when forage utilization by domestic sheep is >0%.

Seasonality of Herbaceous Vegetation Needs

Many of the forage and cover needs of wildlife described in this report are seasonal. Seasonal differences in forage, cover, and other habitat requirements of wildlife should be considered in establishing allowable-use standards, although in most plant communities there are at least some wildlife needs to be met by herbaceous vegetation during every month of the year.

Figure 11 summarizes the approximate (and simplified) seasonal needs of forage and cover of wildlife. The illustration assumes that (1) considerable snowmelt occurs in April and herbaceous vegetation is exposed May 1, (2) passerine birds migrate by October 1, and (3) herbaceous cover is again overtopped by snow beginning in mid-November. Actual dates vary by as much as a month from year to year and they depend on elevation, aspect, slope, precipitation patterns, temperatures, individual species (migration), and many other factors. Snow melt at high elevations occurs more than one month after that of low elevations.

Examples of forage and cover needs of wildlife are as follows. Winter forage needs of elk and mule deer influence the location, amount of winter range, winter-time mobility, timing at which forage is needed, and timing of measures/estimates of forage utilization (October). These and other factors combine to make it necessary to retain a high proportion of the annual production, as measured/estimated in October, for use by elk and mule deer later in the year. Some species (e.g., waterfowl) only need tall, dense herbaceous vegetation for a short period of time in late spring/early summer (e.g., May-June), but they use accumulations of residual herbaceous cover from previous years. Voles, jumping mice, savannah sparrows, and many other small wildlife species need overhead cover throughout the summer, especially small mammals.

Depending on plant community type, snow accumulation during the winter is heavy enough to compress a large majority of herbaceous vegetation, except where herbaceous vegetation is protected by shrub cover and excluding sturdier grasses (e.g., Great Basin wildrye) and sedges (e.g., beaked sedge, Nebraska sedge). Thus, residual herbaceous vegetation has little opportunity

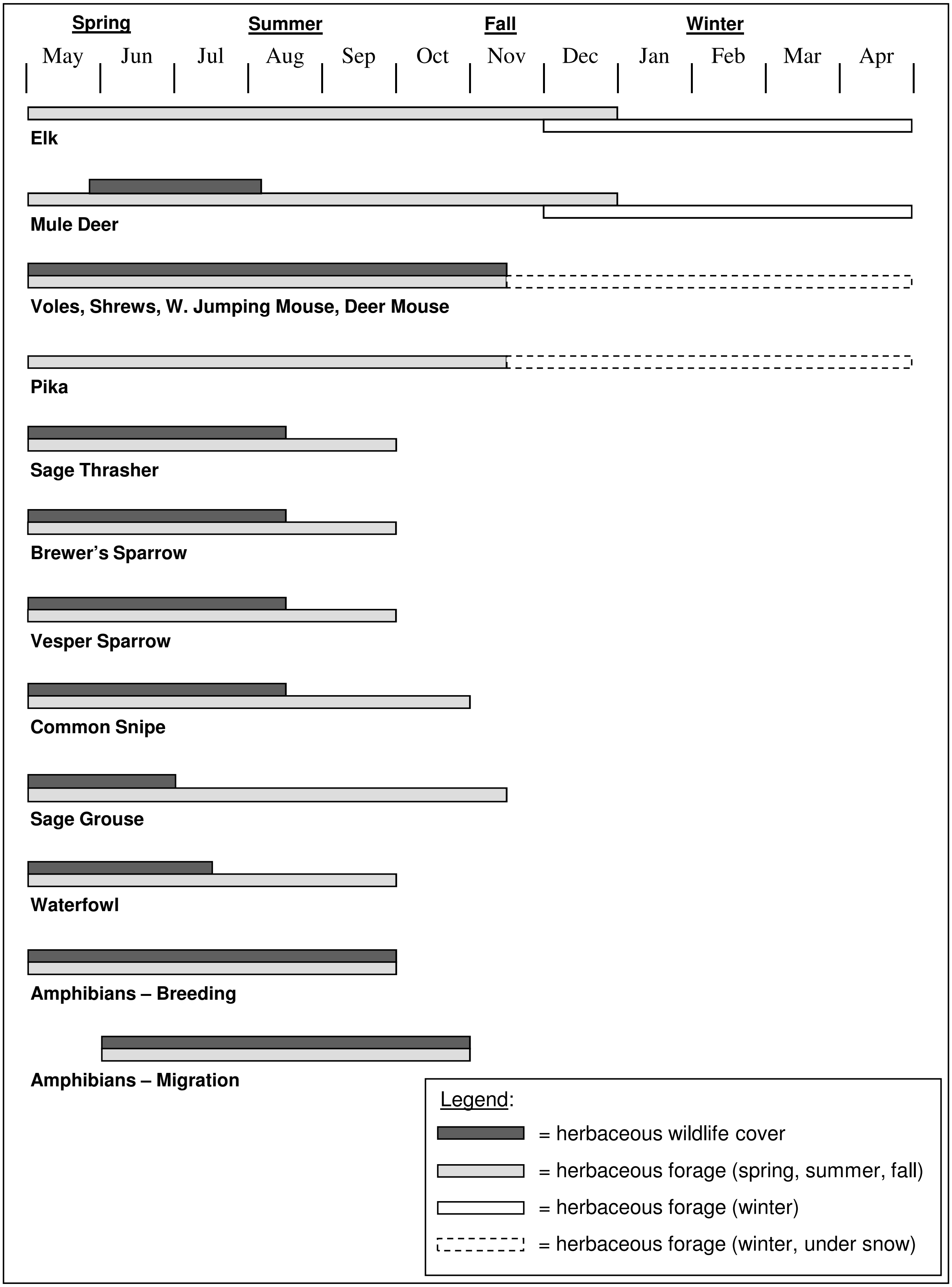

Figure 11. Approximate seasons when a range of wildlife species uses herbaceous vegetation for a variety of purposes, Greys River Ranger District, Wyoming. This figure assumes that most snowmelt occurs by May 1. At higher elevations, bars shift to the right. (See text for supporting references.)

to accumulate, which has three notable effects: (1) high accessibility of nutritious new growth in early spring; (2) low amount of residual cover that would otherwise be available for voles, ground-nesting birds, etc. after snowmelt; and (3) no more than limited effects on photosynthesis in the new growth each spring.

There are several related factors that need to be considered. The potential for trampling effects (e.g., bird nests, amphibian egg masses and tadpoles) is greatest in the early livestock grazing season, but are also high through much of the summer (e.g., metamorphosing amphibians). Fine fuels, which facilitate fire spread — which in turn is critical to a large number of wildlife species — are most important during late summer.

In most, if not all, plant communities that have potential to be grazed by livestock, herbaceous vegetation is used or required by dependent wildlife throughout summer months. More species require herbaceous cover early in the summer due to reproductive needs (e.g., nesting, egg-laying by amphibians, fawning), but cover needs extend into the summer (e.g., re-nesting, overhead cover for voles and other small wildlife, cover for young amphibians, cover for insects that provide food for other wildlife species), not to mention season-long and winter forage needs.

Therefore, less restrictive allowable-use standards earlier in the summer conflict with wildlife needs and post-livestock-grazing-season needs also need to be considered. Given available information, there is no reason to have different levels of allowable-use standards for different times of the livestock grazing season.

Another seasonality consideration is the timing of measuring/estimating allowable-use standards. There is some thought that it is permissible to graze vegetation shorter than what allowable-use standards call for, so long as it grows back and meets standards by the end of the livestock grazing season. For reasons discussed throughout this report, this is not consistent with meeting the needs of wildlife. Nor is it consistent with principles of sustaining plant health. In other words, even though allowable-use standards are typically monitored at the end of the livestock grazing season, they should be met at any time during the livestock grazing season.

Use of Livestock to Achieve Habitat Objectives

Earlier in this report, I evaluated several potential applications of livestock grazing to improve wildlife habitat. While it is clear that the range of conditions created by livestock grazing benefit some species of wildlife — as any change in habitat does this — the potential for using livestock grazing to achieve wildlife habitat objectives on the Greys River Ranger District is very limited at best. This is consistent with Severson's (1990:3) assessment in the text he edited, titled *Can Livestock Be Used as a Tool to Enhance Wildlife Habitat?*; in summary, he concluded that "…Indeed, it's applications may be very limited."

It would be possible to identify conditions produced by livestock that are beneficial to a number of wildlife species, and then to design a livestock grazing program around this as a way to engage livestock grazing management in resource management. However, this is not sound resource management and it does not further the conservation of wildlife that need conservation attention.

Furthermore, there is a big difference between managing livestock grazing use to achieve specific habitat objectives and managing livestock as part of a commercially viable operation.

While there are some benefits to wildlife that are inadvertently produced as a consequence of about any livestock grazing program — again, since any change in habitat benefits some wildlife species — intentionally producing pre-defined conditions outlined in objectives requires a large amount of control over the timing, duration, distribution, and intensity of grazing. As part of this, the program must be flexible enough to move or remove livestock at any point in time. Given the very limited application of using livestock grazing to achieve objectives, herd size would need to be fairly small and either a large amount of moveable fence or intensive herding would be needed. All in all, this likely is not a framework within which permittees can realistically manage livestock on the district and still achieve their business goals.

I do not recommend attempting to use livestock grazing to achieve specific habitat objectives on the Greys River Ranger District at this time for the following reasons:

1. There currently are no objectives for which livestock grazing can be used, except on a very limited basis and not without environmental effects that would need to be analyzed (e.g., highly concentrating cattle for short periods can reduce canopy cover of big sagebrush).
2. While some wildlife species favor habitat conditions produced by livestock grazing, there is little or no support for the assessment that these conditions need to be produced on the district since (a) many of these wildlife species are habitat generalists (i.e., they can use other types of habitat); (b) many of these wildlife species are fairly common to abundant (e.g., robin, dark-eyed junco, deer mice), (c) habitat for many of these species is also provided by rangelands and riparian areas that are in less-than-satisfactory condition; and (d) a small number of beneficiaries (e.g., cowbirds, black-billed magpies) adversely impact other wildlife when they become more common.
3. There already is an abundance of conditions produced by livestock grazing use, both short-term and long-term effects.
4. Developing and implementing a part of a livestock grazing program to attempt to benefit wildlife would take a considerable amount of time, which would take valuable time away from programs where attention is actually needed, for example, addressing threats imposed by motorized use, restoring aspen stands, increasing the amount of early-seral shrub/forest communities, noxious weed control. At best, spending time and resources on attempting to develop and implement beneficial uses of livestock would fall into the category of treating symptoms rather than treating the cause.
5. So long as livestock grazing continues on any given allotment, there will continue to be areas that are grazed at light to moderate to heavy levels, thereby producing a range of conditions on a year-to-year basis. Therefore, there is no reason to intentionally attempt to do this. Also, if we attempt to intentionally graze areas at >50% utilization, we could easily run the risk of grazing more than what is acceptable at this level. Regardless of how livestock grazing is managed, there will always be difficulty in limiting heavy grazing to acceptable levels.

BY PLANT COMMUNITY TYPE

Each plant community is inhabited and used by a large variety of wildlife species. Therefore, the forage, cover, and other habitat preferences and needs of individual wildlife species need to be distilled to broad categories of plant communities Table 13. The summaries outlined below are based on information contained in various parts of this report.

The following are several basic, fairly universal findings regarding the retention of herbaceous vegetation on the Greys River Ranger District. They apply to rangelands and riparian areas in healthy, functioning condition and near healthy, functioning condition. For areas that are at the low end of fuctioning-at-risk (or comparable characterization for riparian areas), retention levels to provide roughly equivalent forage and cover need to be higher. In some cases, vegetation cover and plant species composition may not be high enough to allow any livestock grazing if the aim is to retain "roughly equivalent" levels of herbaceous vegetation, and sharing/balancing of impacts to livestock use (in terms of less forage being made available) and wildlife (in terms of less-than-satisfactory forage and cover being retained) may be warranted. Livestock grazing in non-functioning areas with potential to recover is not supportable from the standpoint of wildlife (e.g., in DFC 10 and 12 areas).

Table 13. Level of confidence that each category of retention levels would retain a combination of suitable forage and suitable cover for most wildlife species inhabiting or using each of several major groupings of habitat, assuming healthy, functioning conditions (the level of confidence in areas in functioning-at-risk and non-functioning conditions would be lower in each row). The table starts with assessments at the ≥95 retention level and works downward. Utilization in this table refers to utilization levels of herbaceous vegetation in general, and is not specific to key forage species.

Percent Retained	Big Sagebrush, Mountain Shrubland, & Grassland	Elk & Deer Crucial Winter Range	Forbland & Herbland[A]	Alpine Communities	Moist Meadow & Silver Sagebrush	Wet Meadow	Willow & Cottonwood	Wetlands & Streambanks	*To facilitate Fire Spread (Prescribed Burning & Fire Use)*
≥95%	VH	H	VH	H	VH	VH	VH	VH	H
90-94%	VH	M	H	H	VH	H	VH	H	M
80-89%	H	L	M	M	H	H	H	H	L
70-79%	M	N	L	L	M-H	M	H	M	L
60-69%	L	N	N	N	L	L	L-M	L-M	N
50-59%	N	N	N	N	N	N	N	N	N
40-49%	N	N	N	N	N	N	N	N	N
30-39%	N	N	N	N	N	N	N	N	N
20-29%	N	N	N	N	N	N	N	N	N
10-19%	N	N	N	N	N	N	N	N	N
0-9%	N	N	N	N	N	N	N	N	N

f = foraging, n = nesting/reproduction (*f* = vegetation/habitat provides for needs of prey, e.g., insects, small mammals)
r = rangeland, w = wetland and riparian, f = forestland
Level of confidence: VH = very high, H = high, MH = moderately high, M = moderate, ML = moderately low, L = low, U = Unsure do to N = none.
[D] Stubble heights are expressed in general terms of graminoids along the green-line of streams and within and immediately around wetlands and heights in this table assume a homogenous height across a community; because stubble height standards are typically expressed as minimum thresholds, graminoids on a given site are as tall or taller than the minimum height (e.g., if the minimum height on a given site is 4 inches, heights would range from 4 inches to ungrazed heights). Use of any given plant community by wildlife species listed in this table depends on the potential of the community to produce desired height and density. If for example, an ungrazed sedge community is typically about 5-6 inches tall, species associated with taller vegetation would not use this community.

Percent of Annual Production Retained

- *≥90% Retained* — There is a considerable amount of information demonstrating that retaining ≥90% of the annual production of herbaceous vegetation (an estimated ≥75-80% retention of key forage species) would retain suitable forage, cover, and other habitat attributes for dependent wildlife species in rangelands, riparian areas, and wetlands. And I am unaware of any information demonstrating that any wildlife species endemic to the Greys River area would be adversely affected by this level of retention relative to natural population levels (range of natural variability) and population objectives established by WGFD. This is due to (1) grazing pressure by wildlife currently being at or above levels that historically produced conditions under which native wildlife communities in the area evolved — except bison in limited areas of the Greys River Ranger District; (2) reduced density of herbaceous plants, altered species composition (e.g., Kentucky bluegrass, Wyethia), and/or reduced vigor in many areas due to less-than-functioning rangeland and riparian conditions; (3) natural variability in plant community height/sparseness stemming from natural soil and geomorphological conditions, and (4) effects of dispersed camping and other human activities (e.g., short vegetation). Commercial livestock grazing operations add to the distribution and extent of short vegetation conditions, without any deliberate attempts to do so.
- *70-79% Retention* — There is a moderate to moderately-large amount of information showing that retaining 70-89% of annual production of herbaceous vegetation (including an estimated 55-70% retention of key forage species) generally is sufficient to provide suitable forage and cover for most wildlife species using rangelands, riparian areas, and wetlands, although suitability for any wildlife species depends on the type of habitat and amount retained (Tables HHH and ZZZ). Available information shows that the upper end of the range for key forage species (e.g., ~65-70% retention) is sufficient to retain suitable forage for native ungulates, but the lower end of the range (e.g., ~55-60% retention) is at the low end of suitable forage conditions. It appears that the full range is sufficient for elk (except on winter range), but mule deer experts recommended this level of livestock grazing only be allowed if the grazing occurred after the growing season. This was based on recommended forage utilization limits designed primarily to sustain rangeland health and functionality.
- *60-69% Retention* — There is a low to moderate amount of information showing that retaining 60-69% of annual production of herbaceous vegetation (including an estimated 45-60% retention of key forage species) is sufficient to minimally meet the forage and cover needs of most dependent wildlife in most types of habitats (Tables HHH and ZZZ). There is no more than low support for the assessment that 60-65% retention of herbaceous vegetation (i.e., 45-55% retention of key forage species) is sufficient to retain suitable forage for native ungulates; this equates to 45-55% utilization of key forage species.
- *50-59% Retention* — I am not aware of any information to demonstrate that retention of 50-59% of annual production of herbaceous vegetation (including an estimated 35-50% retention of key forage species) would retain suitable forage, cover, and other habitat needs of most wildlife species relying on herbaceous forage and/or cover in rangelands, meadows, and riparian areas. Retention of 50-59 percent of overall herbaceous annual production equates to retaining less than 50% of the annual production of key forage species. Information is available indicating that cover for some species (e.g., those

requiring only a minimal amount of herbaceous cover and those that do not require any level of herbaceous cover) may be suitable where only 50-59% of the annual production of herbaceous vegetation is retained, but there is little to no need to manipulate habitat to provide for their needs for the reasons listed in the next paragraph.

- *≤50% Retention* — I am not aware of any information to demonstrate that retention of ≤50% of annual production of herbaceous vegetation (including an estimated ≤40% retention of key forage species) would provide suitable forage, cover, and other habitat needs of most wildlife species using any given habitat type. There are no wildlife species that depend on sites that have ≤50% of the annual production of herbaceous vegetation retained in rangelands, meadows, or riparian areas (i.e., commensual relationship between bison (and, now, cattle) grazing and mountain plovers in the Great Plains). While some species (e.g., deer mice, mountain bluebirds) may use heavily grazed sites or appear to prefer these sites, maintaining viable populations of these species on the district does not depend on manipulating habitat to increase the prevalenc of these conditions. Other species (e.g., killdeer) may take advantage of conditions produced by heavy grazing pressure, but typically inhabit other habitats with naturally sparse or no vegetation.

  Also, while there are general recommendations in the literature about wildlife-related benefits associated with periodic removal of accumulations of residual grass cover, there are no outstanding needs on the district for this. This is already being accomplished through the compression effects of snow, and the frequency of livestock grazing for this purposes, if needed, should be limited to no more than once out of every 7 or more years in this environment. Furthermore, areas of short and/or sparse herbaceous vegetation are overrepresented on the Greys River Ranger District, compared to pre-Euro-American settlement conditions, due to (1) a wide natural variability in plant community height/sparsness stemming from natural soil and geomorpholocial conditions, (2) historic livestock grazing (e.g., sparse vegetation), (3) current livestock grazing operations (short vegetation conditions), and (4) dispersed camping and other human activities (e.g., short vegetation). Therefore, to the extent there are wildlife needs for short herbaceous vegetation, there is no need to attempt to deliberately produce these conditions.

<u>Stubble Heights on Streambanks</u>

- *≥8 inches* — There is a high level of support for the assessment that retaining stubble heights of ≥8 inches would retain suitable forage and cover for most dependent wildlife species, assuming that a large majority of plants are taller than 8 inches. In most situations, a minimum stubble height of 8 inches would result in retention levels of ≥70-80%. Trampling effects would be minimized.

- *≥6 inches* — There is a moderate to high support for the assessment that retaining stubble heights of ≥6 inches would retain suitable forage and cover for most dependent wildlife species, assuming that a large majority of plants are taller than 6 inches. Where ungrazed sedges typically are 10-15 inches tall, a minimum average of 6 inches (i.e., retention of ≥60-80% of the annual production) would be sufficient to provide for the cover needs of most species. If a minimum *average* stubble height of 6 inches were implemented, this would result in <60% of the annual production being maintained. Where ungrazed sedges typically are >18 inches tall, a reduction in height to a minimum of 6 inches would reduce cover qualities considerably (40-50% retention), and if a minimum *average* of 6 inches were implemented, <40% of the annual production would be retained on these sites. Therefore, retaining an *average* of ≥6 inches would not be sufficient from the standpoint of retaining suitable cover for wildlife. Trampling effects would likely remain at an acceptable level. If a minimum 6-inch stubble height were applied to wetlands, water quality impacts would also remain relatively low.

- *≥ 4 inches* — There is low to moderate support for the assessment that a minimum 4-inch stubble height on grasses would retain suitable forage and cover for most dependent wildlife species. For grass communities, a minimum 4-inch stubble height would result in >50% of the annual production retained, except where redtop and other tall grasses dominate streambanks (a minimum 4-inch stubble height in this case could result in only 30-40% of the annual production retained, depending on ungrazed heights). Grass heights would range from 4 inches to ungrazed heights.

  On higher banks dominated by species such as tufted hairgrass and small-winged sedge communities having total heights of 12-18 inches, a minimum stubble height of 4 inches would retain an estimated 70% of the annual production. Some of these communities are now dominated by bluegrasses, and the relationship is similar.

  There is low or no support for only retaining a minimum of 4-inch stubble height on sedges, from the standpoint of wildlife. This would only retain 40-50% of the annual production of sedges in most situations (50-60% utilization. The full range of possibilities would be 30-65% retention of the annual production of sedges.

- *<4 inches* — I am not aware of any information to demonstrate that stubble heights of less than 4 inches along the banks of streams and wetlands would retain suitable forage, cover, and other habitat needs of most wildlife species using herbaceous forage and cover in these areas.

G. "Amount" of Suitable Habitat

Wildlife do not require 100% of the habitat within their range to provide suitable forage and cover, the Forest Plan does not require this, nor is it possible to retain 100% of habitat in suitable condition in a commercial livestock grazing program. Therefore, an important part of establishing allowable-use standards in part to meet wildlife needs according to Forest Plan direction is to ascertain the minimum proportion of each vegetation type and/or parts of allotments that needs to provide suitable forage and cover, and then to establish allowable-use standards that will allow these needs to be met. The proportion depends on many factors, including the range of seasonal forage needs of wildlife species that normally would use a particular vegetation type, home range sizes of dependant wildlife, and seasonal cover needs (including minimum patch size of cover needs) of individual within their home range. In recognizing that uneven livestock distribution and over-use of some areas are inherent elements of livestock grazing, a central issue is to determine an acceptable level of over-use by livestock relative to the needs of wildlife.

The process of determining the *adequate amount* of suitable habitat, for the purpose of feeding into the process of formulating allowable-use standards, must recognize the major limitations imposed by (1) the course scale at which allowable-use standards established and implemented; (2) the impracticality of determining and then synthesizing information on the home range sizes, minimum number of home ranges needed in any given area, and other distributional needs of every dependent wildlife species; and (3) many other factors. Even if it were practical to synthesize information on the home range sizes, number of home ranges needed, and other distributional requirements of every wildlife species — or even a range of representative species — livestock cannot be managed at a fine enough scale to implement standards developed in this way. Furthermore, even if a minimum amount of habitat could be accurately determined based on a synthesis of relevant information and even if livestock could be managed accordingly, these figures would (1) change from area to area depending on the size and juxtaposition of plant communities and their ecological condition, and (2) would need to be adjusted for individual DFC areas based on qualitative assessments of management emphasis.

I used the following approach to generally address the "adequate amount" element of Forest Plan objectives, each of which is addressed in the forthcoming discussion:

1. Evaluation of two aspects of geographic scale, one from the standpoint of herbaceous vegetation and geographic scales of assessment and the other from the standpoint of different wildlife species and their habitat needs.
2. Assessment of the prevalences of tall, dense and moderately-tall/moderately-dense herbaceous communities and understories relative to the conditions under which wildlife communities in this area developed or evolved, taking into account (1) pre-Euro-American grazing pressure and the existing grazing pressure exerted by native herbivores combined with human-related activities, and (2) a larger geographic context.
3. Estimation of the percent of each ecological zone within each pasture that would be in each retention category at each of several pasture-wide retention levels.
4. Ascertain a minimally-acceptable propoportion of a pasture that constitutes the lower end of the range of an "adequate amount" of suitable wildlife habitat relative to direction for DFCs.

GEOGRAPHIC SCALES — FOR EVALUATING ADEQUATE AMOUNT

An important part of determining the amount of habitat to be retained for wildlife in areas encompassed by livestock allotments is to evaluate the geographic scales (1) at which retention levels can be assessed and monitored with respect to wildlife needs and (2) that are meaningful to wildlife in terms of their forage, cover, and other habitat needs associated with herbaceous vegetation.

Herbaceous Vegetation

Plant Scale

A long-standing principle of livestock grazing has been the concept of take-half leave-half, and it originated at the scale of individual plants. Although some range management practitioners have been recommending lower levels of maximum utilization levels, a maximum of 50% utilization of plants provides a good example to carry through the various geographic scales discussed below. Research has demonstrated that root systems of many bunchgrasses can withstand up to about 50% utilization of the dry weight of the above-ground portion of the plant during the growing season. So long as a plant's root mass is maintained, it can recover from herbage removal without apparent lasting effects on vigor and plant health (Dietz 1989). After about 50% utilization, root mass begins to shrink, which leads to reduced vigor and productivity (Dietz

1989, Heady and Childs 1994). Other species may require a lower maximum utilization level. Based on Heady's (1950) study, vigor and health of bluebunch wheatgrass declined when plants were grazed at utilization levels higher than approximately 40% during the growing season (I converted stubble heights to utilization levels based on data presented in his paper). Fifty percent utilization corresponded to an average of about 6 inches and Heady (1950) concluded that a minimum stubble height of 6 inches was not sufficient to prevent deterioration of plants.

Sample-Site (Plot) Scale

This is the scale at which each estimate is taken when using the landscape appearance method, which is the "immediate area visible to examiners when standing at a particular location along the transect" (BLM et al. 1999:120). This method involves averaging utilization of plants within the area viewed by examiners. The examiners do not do the averaging, as this is already built into the utilization categories. In 2008, we concentrated our view to a 20-foot radius. This provides a good fine-scale for introducing an important issue in addressing "adequate amount."

McKinney (1997) highlighted a problem in the way the utilization concept has been applied to livestock grazing management: utilization limits developed for individual plants are applied on a larger geographic scale, which allows for greater utilization of individual plants than identified in utilization standards. As observed by McKinney (1997:4), "when Bossy visits a tasty bunchgrass plant she puts her mouth down next to the ground, gives the head a little tilt, and ropes the whole plant in with her tongue at about *Heavy Munch* on the old chart" (in his paper, heavy munch is 60-80% utilization of a given plant; i.e., a mid-point of 70% utilization). In a hypothetical example he presented, an average of 52% utilization in a given area resulted from an estimated 65-75% of the basal area of bunchgrasses being grazed down to near-ground level (comparable to an individual plant being grazed at 61-80% utilization, or an average of about 70%) and 60% of individual plants being grazed at about 70% utilization. This means that a large portion of plants were grazed beyond a utilization level of 50% (i.e., over-utilized). Regardless of how cattle are managed, they will continue to graze individual plants as characterized by McKinney (1997) and other authors (e.g., Anderson and Currier 1973, Forbes 1988, Stuth 1991). And, because livestock grazing is a legitimate use of one National Forest System lands on the Bridger-Teton National Forest (Multiple Use Sustained Yield Act, USFS 1990), some level of over-utilization of individual plants is acceptable. This is no different than other uses of National Forest System lands that have impacts on resources (e.g., many forms of recreation, mining, timber harvest).

Site

The smallest scale at which allowable-use standards can be applied is what I'm generally referring to as a "site," for lack of a more descriptive word. This would include the geographic scale at which a forage utilization limits are applied when the standard applies an absolute maximum utilization level (e.g., no area on a pasture/allotment can exceed x-level of utilization. As discussed previously, the size of this geographic scale is likely larger than 1 acre and may be less than 50 acres.

From the standpoint of a slightly modified concept of utilization limits — i.e., limiting utilization on enough individual key plants at a level that allows plant species composition to be sustainable — this is the most meaningful level at which to apply utilization limits. A downside of applying forage utilization standards at this small of a scale, however, is that anything below 60-70% utilization would be exceeded in many (most? all?) years due to the grazing behavior of cattle, as discussed previously. There will always be areas where a majority of plants are grazed to the level that cattle naturally graze them. Applying utilization limits at this level appears to be one reason why Burkhardt (1997) expressed such disdain for forage utilization limits.

For implementing stubble heights, stream reach will likely be used, based on established criteria.

Vegetation Type and Ecological Unit

The next highest meaningful geographic scale is that of an ecological "unit," but this is comprised of one to several vegetation types. Vegetation types *per se* would not provide a workable scale to monitor forage utilization because there would be too many in any given pasture and their distributions can be complex.

The way I am viewing an ecological unit is that it can be a large contiguous area dominated by a single vegetation type, but more typically it would be a discrete set of vegetation types or a large area dominated by one or several similar vegetation types with relatively small inclustions of other types. One example is large riparian area or riparian area/meadow complex comprised of moist meadow, wet meadow, and willow types. Another example is a large big sagebrush matrix with inclusions of mountain shrubland, meadow, conifer, and aspen patches.

Applying utilization limits designed for smaller scales (e.g., individual plant or site level) to this scale can create problems. For example, applying a 50% utilization limit on key forage species — based on the adverse effects of <50% use of an individual plant — at the ecological unit level allows (1) half the key plants to be grazed at >50% utilization (or, 60% of the basal area being grazed to near-ground level; Table 11), and (2) large expanses where far greater than half the key plants are grazed at >50% utilization.

If maximum average forage utilization standards appropriately take into account grazing patchiness at various scales, they can be applied at the ecological unit scale from the standpoint of retaining forage, cover, and other habitat attributes for wildlife. This entails using forage utilization limits as indices that address the realities of grazing patchiness, for instance, addressing the question of how much over-use is acceptable? Continuing on the example in the previous paragraph, a forage utilization limit of 30% as applied across an ecological unit would limit >50% utilization to 1/3 or less of the unit (Table 8). A forage utilization limit of 20% as applied across an ecological unit would limit >50% utilization to an estimated 10-20% of the unit. These are rough estimates, but the point is that it should be possible to decide on an acceptable level of over-use and formulate a utilization level that accounts for this. Assumptions and intents of any given standard should be identified since applying utilization limits at this scale involves a number of assumptions.

Holechek et al. (2004) and WAFWA (2009) recognized that over-use of vegetation is an inherent part of livestock grazing on public lands. On rangelands in general, Holechek et al. (2004:248) felt that it would be reasonable for public land ranchers to over-use as much as 30% of key areas. Similarly, WAFWA (2009) suggested there may be some tolerance of heavy use on as much as 30% of grazable lands. Neither of these publications specified whether this applied to lands emphasizing livestock use or other uses/resources and, therefore, is taken to apply to all lands in general regardless of emphasis. Holechek and Galt (2000, as cited by WAFWA 2009) recommended the avoidance of heavy use of the same areas year after year.

Pasture/Allotment Scale

This is too large of a geographic scale to apply forage utilization limits, unless limits are set low enough that an over-use is kept to an acceptable level in the most heavily grazed vegetation types that are also important to wildlife. Also, applying allowable-use standards at this scale compounds the effects in different vegetation types. For example, it would allow low lying grasslands to be over-used to a greater extent than big sagebrush areas are over-used, and it would allow riparian meadows to be over-used to a greater extent than adjoining rangelands. As a general rule, to retain an adequate amount of suitable forage, cover, and other attributes of wildlife habitat, maximum forage utilization standards need to be set at increasingly lower percentages as the size of areas for assessing utilization increase and, even more so, as they take in a greater variability in types of habitats.

Wildlife

Table 14 identifies the order of magnitude of the geographic scale at which habitat needs of representative wildlife need to be addressed. The purpose of these rough estimates is to ascertain whether forage utilization limits and other livestock grazing controls need to be applied over large geographic areas (i.e., hundreds to thousands of acres) or at site-specific locations (e.g., several acres to dozens of acres). Many of the wildlife species in Table 14 are also addressed in Table 3 and Figures 10 and 11.

GEOGRAPHIC AND HISTORIC CONTEXT

An important geographic-scale consideration is recognizing the extent of changes in different types of habitats across large geographic areas (e.g., western Wyoming, Intermountain West) relative to the needs of different species. As a general rule with respect to herbaceous vegetation and its composition and structure in valley bottoms and rangelands in this part of the Intermountain West, there currently is a large overrepresentation of lands providing short and/or sparse herbaceous vegetation for longer durations (e.g., irrigated farmland, hayfields, lawns, livestock pastures, livestock allotments, rangeland affected by historic over-use by livestock) compared to what existed prior to Euro-American settlement. Furthermore, most species associated with short and/or sparse herbaceous vegetation and those that can readily adjust to these conditions are generalist species and many are common to abundant (e.g., American robin, dark-eyed junco, chipmunks, deer mice). Mountain bluebirds are more restrictive, but they are dependent on cavities in trees, for which there can be considerable competition. Elk and mule deer can also flourish under these conditions so long as an adequate amount of suitable forage is retained. Wildlife species that depend on tall, dense herbaceous vegetation for cover have considerably less habitat in this part of the Intermountain West than they did prior to Euro-American settlement. Many of these species tolerate some level of grazing, as this was part of the pre-Euro-American-settlement landscape, but existing conditions restrict the distribution of many of these species. Therefore, and in consideration of the proportion of valley-bottom and rangeland habitats in less-than-satisfactory condition on the district (i.e., areas with sparser and shorter herbaceous vegetation than should occur) and existing population levels of native ungulates, little if any consideration needs to be given to intentionally producing short, sparse vegetative conditions. Conversely, there is a need to place enough controls on livestock grazing to retain areas of sufficiently tall and dense herbaceous vegetation — i.e., Objective 4.7(d).

Table 14. Geographic scope (order of magnitude) of the forage, cover, and other habitat needs associated with herbaceous vegetation for a range of wildlife species.

	DFC 10 and 12 Areas							**DFC 1B areas**						
	≥70-90% of:			**≥70% of:**				**≥50-75% of:**			**≥50% of:**			
Wildlife Species / Group of Species	**several acres**	**dozens of acres**	**100s of acres**	**several acres**	**dozens of acres**	**100s of acres[A]**	**1000's of acres[A]**	**several acres**	**dozens of acres**	**100s of acres**	**several acres**	**dozens of acres**	**100s of acres[A]**	**1000's of acres[A]**
Elk and Mule Deer		w	w			F	F		w	w			F	F
Bighorn Sheep		w	w			F[B]	F[B]							
Sage Grouse						BF	BF							
Sage Thrasher						BF	BF						BF	BF
Brewer's Sparrow						BF	BF						BF	BF
Vesper Sparrow						BFH	BFH						BFH	BFH
Voles – Rangelands						BFH	BFH						BFH	BFH
Deer Mice						F	F						F	F
Pika	F	F						F	F					
Hummingbirds/Butterflies/Pollin.					F	F	F					F	F	F
Killdeer	S				S			S				S		
Mountain Bluebird	s				s	s		s					s	s
Meadowlarks/Savannah Sparrow					BFH	BFH						BFH	BFH	
Northern Harrier					BF	BF						BF	BF	
Sandhill Crane		B			BF	F			B			BF	F	
Common Snipe					BFH	BFH						BFH	BFH	
Waterfowl	B	B			B	B		B	B			B	B	
Voles – riparian/meadow (gen.)	BFH	BFH			BFH	BFH	BFH	BFH	BFH			BFH	BFH	BFH
Voles/Jump. Mice – dense veg.	BFH	BFH						BFH	BFH					
Amphibians	BFH	BFH			M	M	M	BFH	BFH			M	M	M
Water quality					X	X	X					X	X	X
Fine fuels			X			X	X			X			X	X

[A] This refers to forage and cover that is fairly evenly distributed to patchy but regular distribution of suitable forage across large areas (e.g., forage for elk/deer) to a scattering of numerous patches of suitable cover (e.g., ground-nest sites for birds) across large acreages

[B] 100% of 100s to 1,000s of acres needs to remain ungrazed/unused by domestic sheep.

Codes:

F = Forage needs with respect to herbaceous vegetation and associated prey (e.g., insects, small mammals) are met or not met across the specified geographic scale.

B = Nesting cover needs for birds and some small mammals are met or not met at the micro-site level where nest-site selection occurs (e.g., several square yards to dozens of square yards) and, for many species, nest site selection is influenced by herbaceous cover at larger scales (e.g., <1 to several acres). Because livestock grazing cannot be managed to retain high percentages of annual production at numerous micro-sites across 100s to 1000s of acres, meeting cover needs at numerous micro-site scales would need to be accomplished as a by-product of managing for conservative grazing levels that leave numerous small patches of suitable cover scattered throughout large geographic scales.

Herbaceous vegetation needs for species that breed in relatively small or limited habitats (e.g., small sedge pools) are met or not met at these small scales. Thus, livestock grazing may need to be managed differently in localized areas.

M = Cover needs of migrating amphibians are met or not met across small to large areas depending on the density of micro-site with suitable cover. In areas where the density and distribution of shrubs, course woody debris, and other non-herbaceous cover do not provide suitable cover, the amount of herbaceous vegetation retained can heavily influence the suitability of migration habitat.

H = Hiding and overhead cover needs (e.g., for species that spend most or all of their time in tall, dense herbaceous cover) are met or not met across the specified geographic scale. Some small mammals need blocks of contiguous areas of tall, dense vegetation, but these typically are smaller areas (e.g., meadows, narrow corridors along stream banks).

S = Sparse, short vegetation (minimal to no herbaceous cover). Species inhabiting the Greys River Ranger District using this type of habitat are typically associated with gravel bars and similar areas along river systems.

s = Areas of short herbaceous vegetation is used for foraging at small scales (e.g., parts of forest openings) up to larger scales (scattered patches of shorter vegetation across 100s where a scattering of trees exist). There are no species inhabiting the Greys River Ranger District that require extensive areas of short herbaceous vegetation.

w = Winter range for native ungulates where they feed on herbaceous vegetation (e.g., as opposed to willow bottoms), which typically are on southerly and westerly facing slopes.

Recognition also needs to be given to the reality that native ungulates exert heavy grazing pressure in localized areas. Periodic use by bison is missing today, and elk may have exerted more pressure at lower elevations than they do today. Thus, some allowance needs to be given — just from the standpoing of natural conditions — to over-use by cattle in lower elevations of the district. Comparisons of grazing pressure exerted by native ungulates prior to Euro-American settlement and currently were discussed in the "Desired Conditions — General Concepts" section near the beginning of this report.

BREAKDOWN OF RETENTION LEVELS ACROSS PASTURES AND ECOLOGICAL ZONES

In the process of determining the "amount" of suitable wildlife habitat that needs to be retained within each pasture, the range of retention levels within each pasture[D] (and the percent retention in each of these categories) must be addressed. I did this by calculating the percentage of each pasture that would need to be in each of the five retention categories (RC in Table 15) at each of several pasture-wide average retention levels (ARL in Table 15). This was done in recognition that livestock grazing pressure across any given pasture is not even and that it results in mosaic of utilization levels (Anderson and Currier 1973, Forbes 1988, Stuth 1991), especially where there is rugged and highly variable topography and high variability in vegetation (Holechek et al. (2004); else actual use mapping would not be needed as described in Anderson and Currier (1973), BLM et al. (1999), and BLM et al. (2008). For example, Anderson and Currier (1973:89) illustrated "a typical pattern of utilization," which included a large area with no utilization, other areas at 20% utilization, and large areas (more than half the pasture) at 60% and 80% utilization of key forage species for a pasture-wide average of 52% utilization. Addressing this issue is a critical component of retaining an "adequate amount" of suitable habitat for wildlife.

Table 15. Retention of herbaceous vegetation averaged within a given pasture (ARL) based on possible combinations of retention levels (shown as the percent of area in each of 5 retention categories (RC)). The dark line depicts the threshold between the 60-79% (mid-point of 69.5%) and 40-59% (midpoint of 49.5%) retention categories. This table presents hypothetical situations and, while percentages within a column and associated ARL figures, are driven by mathematical principles (e.g., as the percent in 29.5% category rises, the percent in the 97.5% category must go up or the percent in the 87% category must go up to a larger extent in order to remain at the same ARL), the chance of any given situation happening on the ground depends on the number of cattle, season of use, and behavior of grazing cattle as influenced by topography, distribution of rangeland types, herding, fences, water availability, and other factors.

RC[A]	**Percent of a Given Pasture in Each Utilization Category**																												
97.5%	25	20	10	0	10	15	20	15	10	15	15	10	15	10	0	15	10	5	10	10	10	5	0	10	10	5	0	5	5
87%	25	20	15	15	20	20	20	20	15	15	15	10	20	15	10	15	15	15	15	10	10	10	15	10	10	5	0	10	5
69.5%	25	30	50	70	35	30	20	30	35	30	30	40	40	50	70	25	30	35	25	30	25	30	35	20	15	20	20	15	5
49.5%	25	25	25	15	30	25	20	20	35	30	30	35	25	20	15	30	35	35	40	35	40	45	30	40	35	40	60	25	35
29.5%	0	5	0	0	5	10	20	15	5	10	10	5	10	10	5	15	10	5	10	15	15	10	20	20	30	30	20	45	50
ARL[B]	**76**	**72**	**70**	**69**	**68**	**68**	**67**	**67**	**66**	**66**	**66**	**65**	**65**	**65**	**65**	**64**	**64**	**64**	**63**	**61**	**60**	**60**	**60**	**58**	**55**	**52**	**50**	**50**	**45**
AFU[C]	**24**	**28**	**30**	**30**	**32**	**32**	**33**	**33**	**34**	**34**	**34**	**35**	**35**	**35**	**35**	**36**	**36**	**36**	**37**	**39**	**40**	**40**	**40**	**42**	**45**	**48**	**50**	**50**	**55**
Cat.[D]	**21-40%**																							**41-60%**					

[A] Retention categories (mid-points), based on the landscape appearance method. Retention levels are the flip-side of the utilization levels in the landscape appearance method.

[B] Average Retention Level, based on averaging mid-points.

[C] Average Forage Utilization, based on averaging mid-points.

[D] At a minimum, this needs to be addressed for rangelands and riparian areas/meadows separately, but this can be broken down further if needed, recognizing this would get more complicated. I referred to "pasture" only to get the idea across, but if retention levels are averaged across rangelands and riparian areas/meadows, this could easily result in over use of riparian areas being hidden in the overall average. The objective is to retain an adequate amount of suitable habitat within each of the major vegetation types, but this would be too cumbersome to implement.

[D] Forage utilization categories based on the Landscape Appearance method (only two are represented by hypothetical numbers).

Basic mathematical principles were used, along with recognizing basic livestock grazing behavior, to produce Table 15. If livestock were managed in a way that resulted in grazing intensity being evenly distributed throughout a pasture, a retention level of just below 65% could be attained if a maximum of 35% utilization were the standard (i.e., 100% would be in the 60-79% category, or 69.5% RC of Table 15). However, it is likely that livestock will continue to heavily use some areas and some areas will continue to be ungrazed or lightly used, meaning there will continue to be a wide range of retention levels on any given pasture, as shown in the table. Also, to retain an average retention level (e.g., 65%) on a given pasture in light of heavy grazing pressure (e.g., <50% retention) in some parts of the pasture requires that a roughly equivalent amount of the pasture be grazed at ligher levels (e.g., >80% retention). This can also be illustrated using an off-shoot of McKinney 1997). Just as "29% utilization" of a give site by livestock does not mean that all individual plants are actually grazed at 29% (McKinney 1997), "29% utilization" across a pasture does not mean that all sites grazed by livestock are limited to 29% utilization. Just as many plants are grazed at higher levels than 29% on a site where utilization averages 29% (e.g., many are grazed at 70% utilization in McKinney's example), there are many parts of a large riparian area/meadow complex that receive more than 29% utilization when the meadow complex is grazed an average of 29%; for example, Table 15 indicates that 25% of this meadow complex may be grazed at the 41-60% utilization level (retention level of 40-59%, or RC of 49.5%) when the average utilization for the complex is 29% (AFU of 28-30 in the table).

The law of averages also dictates that, to maintain an average retention level of 65% with a low percentage of a pasture in a heavier utilization category (RC of 49.5%), a proportionally lower percentage would need to be more lightly grazed (RC of 87%), which takes us toward an even distribution of livestock. Because an even distribution of grazing pressure is undesirable from the standpoint of wildlife (and not realistic anyhow), either (1) average retention levels for each pasture need to be considerably higher (e.g., 80%) or (2) we need to recognize that some parts of pastures will continue to be over used and to build this into the program, including efforts to shift this around from year to year.

The breakdown of retention levels in the example provided in Anderson and Currier (1973:89) is somewhat different than the breakdown for 50-55% (AFU) in Table 15 (or, ARL of 45-50%) because the example in Anderson and Currier had 55% of the pasture grazed at 60-80%, which is far greater than what should occur on the Greys River Ranger District and, therefore, Table 15 did not address this level of heavy to severe grazing pressure.

BLM et al. (2001:29) presented a considerably different example. They provide an example of an allotment where average utilization was 35% (65% retention), which included retention of 60-79% (RC of 69.5%) on about 40% of the allotment, retention of 40-59% (RC of 49.5%) on about 53% of the allotment, and retention of 20-39% (RC of 29.5%) on about 7% of the allotment, which is within the realms of what is presented in Table 16. The example from BLM (2001:29) appears to be for a relatively flat area with fairly homogenous vegetation, where relatively uniform grazing pressure may be expected. For example, there were no ungrazed (<5% utilization) and no areas of ≤20% utilization, and only a minor amount grazed at >60% utilization. The rugged and highly variably topography, high variability in vegetation and plant production, and patchiness of water availability on the district are major factors working against an even distribution of livestock. Not only is the example in BLM et al. (2008) unrealistic for the district, this level of distribution would make it more difficult to meet wildlife objectives of the Forest Plan unless retention levels were higher.

Because it is grazing that affects retention levels, and because allowable-use standards are designed specifically to control the level of livestock grazing, I repeated the calculations done for Table 15 without the 95-100% retention category (Table 16). With respect to grazing effects, we are concerned about grazing effects where grazing occurs. This adjustment allows averages for a pasture to be based only on those portions of the pasture that were actually grazed.

Particularly in DFC 10 and 12 portions of allotments, even distribution of livestock is not a viable livestock management strategy given direction provided in the Forest Plan for wildlife and recognizing the wide variety of wildlife habitat needs and the many species that need tall, dense herbaceous vegetation (Table 3). With respect to wildlife, an objective of even distribution of livestock grazing would presume that the hundreds of wildlife species in a given area all have very similar habitat needs. If >30% utilization of herbaceous vegetation is exerted evenly across a pasture or allotment, it would also presume that herbaceous vegetation is not all that important to wildlife. Unless overall retention levels are high, an even distribution would conflict with wildlife objectives because some wildlife species require tall, dense herbaceous vegetation throughout summer months, while other species requiring herbaceous vegetation can suffice with somewhat lesser amounts, while still others only have seasonal needs for herbaceous vegetation.

Table 16. Retention of herbaceous vegetation averaged within grazed portions of a given pasture (ARL) based on possible combinations of retention levels (shown as the percent of grazed portions of a pasture at each of 5 retention categories (RCs)). The dark line depicts the threshold between the 60-79% (mid-point of 69.5%) and 40-59% (midpoint of 49.5%) retention categories. This table presents hypothetical situations and, while percentages within a column and associated ARL figures, are driven by mathematical principles (e.g., as the percent in 29.5% category rises, the percent in the 97.5% category must go up or the percent in the 87% category must go up to a larger extent in order to remain at the same ARL), the chance of any given situation happening on the ground depends on the number of cattle, season of use, and behavior of grazing cattle as influenced by topography, distribution of rangeland types, herding, fences, water availability, and other factors.

RC[A]	**Percent of a Given Pasture in Each Utilization Category**																											
97.5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
87%	40	40	35	17	33	25	30	25	15	15	20	20	25	20	20	20	10		15	15		25	20	10	10	10	5	5	5
69.5%	40	30	40	70	33	50	35	35	60	55	45	40	35	40	35	30	50	60	40	35	50	25	30	35	30	25	15	10	5
49.5%	20	30	20	13	33	25	35	30	20	25	30	40	35	30	35	40	30	30	40	40	50	25	30	40	45	40	55	70	50
29.5%			5					5	5	5	5		5	10	10	10	10	10	5	10		25	20	15	15	25	25	15	40
ARL[A]	**72**	**70**	**70**	**70**	**69**	**69**	**68**	**67**	**66**	**65**	**65**	**65**	**65**	**63**	**62**	**61**	**61**	**60**	**60**	**60**	**60**	**59**	**59**	**57**	**56**	**53**	**50**	**50**	**44**
AFU[B]	**28**	**30**	**30**	**30**	**31**	**31**	**32**	**33**	**34**	**35**	**35**	**35**	**35**	**37**	**38**	**39**	**39**	**40**	**40**	**40**	**40**	**41**	**41**	**43**	**44**	**47**	**50**	**50**	**56**
Cat.[C]	**21-40%**																					**41-60%**							

(See previous table for footnotes)

MINIMALLY ACCEPTABLE AMOUNTS

In general, with increasing size of habitat patches and home range size of associated wildlife, the need to maintain all or nearly all of the habitat in suitable conditions declines. Conversely, wildlife that inhabit habitat that exists in small patches or in narrow corridors (e.g., amphibians, water voles, pika) typically need all or nearly all of the habitat at these fine scales to provide suitable conditions, particularly where small habitat patches are isolated.

A considerable amount time and funding could be expended to attempt to model habitat needs of a full range of wildlife species in relation to the effects of livestock grazing in order to ascertain the minimum amount of habitat that needs to be retained in suitable condition. However, there are too many variables and assumptions to make any answer meaningful, and this would need to be done for a range of different types of allotments given the variability in conditions from allotment to allotment. Application of the results then needs to be adjusted to fit the emphasis of particular DFC areas, and there are no scientific principles involved with this.

A more meaningful approach, which does not extend beyond our level of understanding, is to apply some very basic principles and Forest Plan direction to the situation as is outlined below.

Large Habitat Patches

For large and mobile wildlife, and for wildlife that inhabit large habitat patches (e.g., hundreds to thousands of acres), there is not a need to provide suitable forage and cover in all parts of their capable habitat.

DFC 10 and 12 Areas

I identified 2/3 to 3/4 (or, 70%) as a reasonable lower end target for retaining a suitable level of herbaceous vegetation within each major ecological zone (rangeland and riparian areas) in DFC 10 and 12 areas for the following reasons:

- For all practical purposes, big game and other wildlife inhabit all of the rangeland and riparian habitat within the boundaries of allotments.
- Activities such as livestock grazing in DFC 10 and 12 areas areas must be managed to avoid adverse effects on wildlife and big game, respectively. Wildlife is emphasized in DFC 10 areas and big game is emphasized in DFC 12 areas.
- A starting point for considering a minimum amount of suitable level of herbaceous vegetation is to look within the range of 55% to 90% of rangelands and riparian areas:
    - A bare minimum of 55% is needed to constitute an emphasis. If a suitable level of herbaceous vegetation is retained on 50% or less of the rangeland and riparian habitat within an allotment, it would be difficult to justify that wildlife is being emphasized, particularly given the requirement to provide for the needs of the many dozens of wildlife species (not to mention many other resource values dependent on herbaceous vegetation) versus one species of livestock in a given allotment (Table 3).
    - A suitable level of herbaceous vegetation needs to be retained on something less than 100%. The Forest Plan does not require that 100% of rangeland and riparian habitat be retained in suitable condition, nor is this possible on an active livestock allotment. The Multiple-Use Sustained Yield Act and other directives build livestock grazing into the management and operation of National Forest System lands and, given the grazing behavior of livestock, they build in a certain level of over-use.
- At the high end, 90% is close to 100% (within 10%) and, therefore, would not be a reasonable minimum figure.
- At the low end, 55% is not much of an emphasis and, therefore, would not be a reasonable minimum figure, especially when considering the following:
    - The habitat needs of the many dozens of wildlife species dependent on herbaceous vegetation are highly variable (i.e., one size *does not* fit all). Retaining 55% of the rangeland in a given pasture in suitable condition for one group of species does not mean that 55% is retained in suitable condition for all other groups of wildlife.
    - Not all wildlife species that typically exist within a particular habitat will actually occupy each and every site that contains what we perceive as suitable habitat for them,

just as cattle do not utilize all available capable grazing land within a pasture (i.e., considerably more “suitable” habitat typically needs to be provided than what is actually occupied by any given species).

- ▫ A range of vegetation types and plant communities exist within the broad category of rangelands within a pasture/allotment, and a range of vegetation types exist within the broad category of riparian areas within a pasture/allotment. Although fences and herding help to even the distribution of cattle out, different vegetation types/pant communities will be grazed at different intensities. If for example, dense willow and a beaver pond complex occupy 40% of a riparian habitat in a pasture, and if this area is mostly ungrazed by cattle (e.g., herbaceous vegetation is retained at a suitable level throughout 90% of this area), 85% the remaining acreage of the riparian area (e.g. moist/wet meadow habitat) could be left in less-than-satisfactory condition while still meeting an overall 55% target for riparian areas. This is somewhat of an extreme example, but it serves to show that setting the lower threshold at 55% will not result in a suitable level of herbaceous vegetation being retained on >50% in each vegetation type, meaning that wildlife will not be emphasized in more heavily grazed vegetation types.

  The Forest Plan and other direction requires that an adequate amount of suitable forage and cover be retained for all wildlife species, although the degree to which this is carried out depends on DFC direction.

  To retain a suitable level of herbaceous vegetation on ≥55% of each major riparian vegetation type in each pasture may require retaining a suitable level of herbaceous vegetation on considerably more than 55% of the riparian area as a whole. And 55% within each vegetation type is an absolute minimum figure.

- ▫ Retaining an ideal level of herbaceous vegetation on ≥90% of the riparian acreage and ≥90% of the rangeland acreage would be optimum in the context of wildlife habitat needs in light of the conditions under which wildlife communities developed in this area, existing status of wildlife populations, loss and degredation of the major vegetation types in western Wyoming, ecological conditions on the Greys River Ranger District, existing grazing pressure by native ungulates relative to grazing pressure prior to Euro-American settlement, the cumulative impacts of all activities on National Forest System lands, and the factors outlined above. Habitat needs for wildlife using relatively short and sparse herbaceous vegetation, in general, are currently well provided for.
- ▫ The above statements reemphasize the point that retaining a suitable level of herbaceous vegetation for wildlife on 50% or less of the acreage of rangelands and of riparian areas would not be adequate.

• On the other hand, the Greys River Ranger District is required to provide opportunities for livestock grazing, and it very well may not be possible to retaining a suitable level of herbaceous vegetation for wildlife on ≥90% of riparian and rangeland acreage. Consider also that:

  - ▫ Retaining optimum or near-optimum conditions for wildlife is not required by the Forest Plan.
  - ▫ Grazing behavior of livestock dictates that at least some level of over-use will occur regardless of how their distribution is managed (within reason).

- Bison periodically reduced the amount of herbaceous vegetation to an unknown level on some parts of what is now the Greys River Ranger District and likely created areas of what we would not consider over-use (e.g., valley bottoms and side slopes in the Greys River drainage, Star Valley Front area, Spring Creek/Big Ridge area, Salt Pass area). However, bison likely did not graze in large numbers on the district and the elk population was not maintained at the high level it is now.

- Another consideration is that conservative recommendations for forage utilization for rangeland types in this geographic region are in the range of a maximum of 30 to 40% of key forage species (i.e., minimum retention of an estimated 70-85% of herbaceous vegetation, depending on species composition; Table 4) in sagebrush, mountain shrubland, and conifer forests (Holechek et al. 2004, with Vallentine 1990 agreeing with the same recommendations in an earlier version of Holechek's text). These retention levels, when applied at the pasture level, could allow for as much as 10-50% of a given pasture retaining less than 70% of herbaceous vegetation (Table 17); this would include ≤10-30% of a pasture having retention levels of <60% (i.e., 45-50% utilization of key forage species). The point is to minimize the amount of rangeland that is grazed at >30-40% utilization of key forage species.

  In alpine areas, Holechek et al. (2004) recommended a maximum of 20-30% utilization of key forage species (i.e., a minimum retention of an estimated 80-95% of herbaceous vegetation, depending on species composition).

  DFC 10 and 12 areas warrant a conservative approach to sustaining rangeland health as crucial cornerstone for sustaining wildlife habitat. If retention levels are set too high, there are no threats of impacting wildlife habitat. On the other hand, if they are set too low, there are definite threats to both sustaining wildlife habitat and retaining an adequate amount of forage and cover for wildlife.

DFC 1B Areas

I identified 1/2 (50%) as a reasonable lower end target for retaining a suitable level of herbaceous vegetation within each major ecological zone (rangeland and riparian areas) in DFC 1B areas for the following reasons:

- Wildlife is not emphasized in DFC 1B areas and, therefore, the proportion of rangelands and riparian areas in a pasture does not need to be as high as in DFC 10 and 12 areas.
- However, viable populations of MIS are required to be maintained in DFC 1B areas, and Objectives 2.1(a), 3.3(a), and 4.7(d) and requirements of Executive Order 13186 and USFS and USFWS (2008) must be achieved to the extent possible, recognizing that livestock grazing use is emphasized in DFC 1B areas.
- Retaining a suitable level of herbaceous vegetation on 50% of rangelands and riparian areas would result in less than 50% of some major vegetation types having a suitable level of herbaceous vegetation (see discussion for DFC 10 and 12 areas, above).
- Allowable-use standards to sustain the health and functioning of rangelands and riparian areas would result in some level of habitat being retained for wildlife.

Upshot for Large Habitat Patches

An overall (average) retention level of ≥75% of herbaceous vegetation would be the most appropriate retention level for DFCs 10 and 12, given the large proportion of each pasture that would retain ≥70% of herbaceous vegetation and corresponding ≥60% retention of key forage species (Table 17). Retaining an average of 75% of herbaceous vegetation across each ecological unit would allow 70% of herbaceous vegetation to be retained across an estimated 70% or more of each ecological unit, while also allowing an average of 35-40% utilization of key forage species by livestock across grazed portions of the pasture. However, attaining an average of 75% retention of herbaceous vegetation on grazed portions of pastures would require that less than an estimated 5-10% of each pasture is over-used (e.g., >40% utilization of herbaceous vegetation, or ≥50% utilization of key forage species). This would require a very high level of herding and, therefore, this option may not be realistic. Limiting the acreage grazed at >40% utilization of herbaceous vegetation to <5-10% would likely mean that the overall retention level would be higher than 75%. This is because livestock would need to be removed fairly soon after arriving in a given pasture unless herding was very intensive.

Table 17. Proportion of each ecological zone within each pasture in each of each of five categories of retention. The bottom of the table identifies targeted proportions that are reasonable for each of the overall retention levels for the ecological zones (e.g., 70-75% for DFC 10 and 12 areas) relative to Forest Plan direction. Proportions were based on information in Tables 14 and 15.

<table>
<tr><th>Retention of Herbaceous Vegetation:</th><th>20-39%</th><th>40-59%</th><th>60-79%</th><th>80-94%</th><th>≥95%</th></tr>
<tr><td>Utilization of Herbaceous Vegetation:</td><td>61-80%</td><td>41-60%</td><td>21-40%</td><td>6-20%</td><td>≤5%</td></tr>
<tr><td>Utilization of Key Forage Species:</td><td>70-85%</td><td>50-75%</td><td>30-55%</td><td>10-35%</td><td>≤20%</td></tr>
<tr><td>Proportion of Pasture in each Category (livestock-grazed areas only)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>If average retention is 80%</td><td>0%</td><td>0%</td><td>30-50%</td><td>50-70%</td><td>n/a</td></tr>
<tr><td>If average retention is 75%</td><td>0%</td><td>0-10%</td><td>50-55%</td><td>40-45%</td><td>n/a</td></tr>
<tr><td>If average retention is 70%</td><td>0-5%</td><td>15-35%</td><td>30-70%</td><td>15-40%</td><td>n/a</td></tr>
<tr><td>If average retention is 65%</td><td>0-5%</td><td>20-40%</td><td>30-60%</td><td>15-25%</td><td>n/a</td></tr>
<tr><td>If average retention is 60%</td><td>0-10%</td><td>30-50%</td><td>30-60%</td><td>10-25%</td><td>n/a</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Proportion of Pasture in each Category (adjusted for grazed and ungrazed areas)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>If average retention in grazed areas is 80%</td><td>0%</td><td>0%</td><td>20-40%</td><td>35-55%</td><td>20-30%</td></tr>
<tr><td>If average retention in grazed areas is 75%</td><td>0%</td><td>0-10%</td><td>40-45%</td><td>30-40%</td><td>10-25%</td></tr>
<tr><td>If average retention in grazed areas is 70%</td><td>0-5%</td><td>10-30%</td><td>25-55%</td><td>10-35%</td><td>10-20%</td></tr>
<tr><td>If average retention in grazed areas is 65%</td><td>0-5%</td><td>20-35%</td><td>25-55%</td><td>15-25%</td><td>≤10%</td></tr>
<tr><td>If average retention in grazed areas is 60%</td><td>0-10%</td><td>25-45%</td><td>25-55%</td><td>10-25%</td><td>≤10%</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Targeted Levels (≥) and Limits (≤) (for grazed and ungrazed areas)</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">If average retention in grazed areas is 80%</td><td rowspan="2" colspan="2"><5%</td><td>—</td><td>≥40%</td><td>≥20%</td></tr>
<tr><td colspan="3">>95% (incl. ≥80% at ≥70% retention)</td></tr>
<tr><td rowspan="2">If average retention in grazed areas is 75%</td><td rowspan="2" colspan="2">≤10%</td><td>—</td><td>≥30%</td><td>≥15%</td></tr>
<tr><td colspan="3">≥90% (incl. ≥70% at ≥70% retention)</td></tr>
<tr><td rowspan="2">If average retention in grazed areas is 70%</td><td rowspan="2" colspan="2">≤20%</td><td>—</td><td>≥25%</td><td>≥10%</td></tr>
<tr><td colspan="3">≥80% (incl. ≥60% at ≥70% retention)</td></tr>
<tr><td rowspan="2">If average retention in grazed areas is 65%</td><td rowspan="2" colspan="2">≤33%</td><td>—</td><td>≥15%</td><td>≥5%</td></tr>
<tr><td colspan="3">≥67% (incl. ≥50% at ≥70% retention)</td></tr>
<tr><td rowspan="2">If average retention in grazed areas is 60%</td><td rowspan="2" colspan="2">≤45</td><td>—</td><td>≥10%</td><td>≥5%</td></tr>
<tr><td colspan="3">≥55 (incl. ≥40% at ≥70% retention)</td></tr>
</table>

I feel that the most workable average retention level within grazed portions of DFCs 10 and 12 may be 70% retention of herbaceous vegetation (Table 17). This would allow 70% of herbaceous vegetation to be retained across an estimated 60% or more of each ecological unit, while also allowing up to an average of 40% utilization of key forage species by livestock across grazed portions of the pasture. (If it is found that 70% retention would result in >40% utilization of key forage species, the overall retention level should be increased incrementally until a maximum of 40% utilization of key forage species can be maintained.) This option would allow over-use to occur on as much as 20% of each pasture (Table 17), which seems like a reasonable compromise.

An average retention of 70% herbaceous vegetation is at the very lower end of what can be considered workable from the standpoing of wildlife.

An average of 65% retention of herbaceous vegetation in grazed portions of each ecological unit would allow 70% of herbaceous vegetation to be retained on about half the acreage within each ecological unit. This would result in utilization of key forage species exceeding 50% utilization on as much as one-third or more of the grazed portion of each pasture (Table 17). While this may be acceptable in areas with an emphasis on livestock grazing use, it is not acceptable in areas with an emphasis on wildlife (and in areas where no-net adverse impacts on wildlife are permitted).

It is important to remember that producing variability in retention levels is merely a by product of livestock grazing. The variability in retention levels is not needed for wildlife.

Small Habitat Patches

For small and relatively immobile wildlife, and for wildlife that inhabit small habitat patches (e.g., less than 1 acre up 10 acres), there is a considerably higher need to provide suitable forage and cover in all parts of their capable habitat. For example, wildlife that require tall, dense herbaceous vegetation in small habitats and narrow linear habitats (e.g., amphibians, water voles) typically need all or nearly all of the habitat to provide suitable conditions, particularly where small habitat patches are isolated.

Therefore, allowable-use standards and management practices in DFC 10 and 12 areas should be established that retain ≥70% of herbaceous vegetation throughout ≥70% of the acreage of ≥70% these small habitat patches. This does not mean these patches must remain ungrazed, only that suitable habitat conditions should be maintained on at least 70% of the area. It likely is not possible to maintain all small habitat patches at the identified retention levels and, therefore, I specified that a minimum of 70% of the patches need to be maintained at these levels.

Because wildlife is not emphasized in DFC 1B areas — although requirements to sustain viable populations of wildlife still exist — it may be possible to only retain ≥60% of herbaceous vegetation throughout ≥70% of the acreage of ≥70% these small habitat patches. Rather than reducing the the acceptable amount of suitable habitat in this case, I reduced the threshold for the level of herbaceous vegetation retained (from 70% retention to 60% retention) in order to maintain a higher level of somewhat suitable habitat/suitable habitat.

These specifications apply to amphibian breeding and feeding area and habitat used by water voles and pika. Maintaining suitable habitat for water voles would likely be provided by implementing a minimum 6-inch stubble height on streambanks.

Part III — Recommendations

This report outlines information that I used to identify maximum utilization levels, minimum stubble heights, and other livestock management controls that would retain a minimally-adequate amount of minimally-suitable forage, cover, and other habitat attributes for dependent wildlife on the Greys River Ranger District. The utilization levels and stubble heights in my recommendations would not result in the mid-range or upper range of "an adequate amount of suitable forage, cover, and other habitat attributes" being retained for wildlife.

The following sections summarize information contained in this report. The last section identifies my recommendations.

Considerations in Setting Allowable-Use Standards

From the standpoint of wildlife, two key elements must be addressed in allowable-use standards: (1) *suitability* of wildlife habitat on any given site, which is inversely related to the amount of herbaceous vegetation and browse that are removed from any given site; and (2) *amount* of suitable habitat retained through the livestock grazing season, which is addressed by taking into consideration the proportions of ecological units in different utilization categories. The second element recognizes that over-use occurs and uses this information to establish allowable-use standards that maintain over-used acreage at acceptable levels, based on the proportion of each ecological unit that needs to be retained in suitable condition for wildlife.

Providing suitable habitat for the wide range of wildlife species using rangelands and riparian areas on the district requires, among many factors, restoring and sustaining a native composition of herbaceous plants. This needs to be considered in the development of objectives. On a related matter, vegetation cover is the most important element of ground cover. It is possible to achieve minimum ground cover without attaining desired conditions for wildlife. For example, a minimum of 80% ground cover in forbland communities can be attained with a high composition of surface rock despite depleted vegetation. More emphasis needs to be given to percent vegetation cover.

I do not address browse in any detail because browsing by livestock at this time does not appear to be an issue in most parts of the allotment, and because I address browsing of riparian shrubs in forage utilization and stubble height recommendations.

Recommendations

I provide recommendations on objectives and standards that I believe would limit livestock sufficiently to at least minimally provide for the needs of dependent wildlife. Assumptions provide greater clarity to the intent of the objectives and standards. If time and funding are periodically available to field verify some of the assumptions, this would be a valuable contribution to managing livestock grazing in a way that sustains wildlife resources. However, the assumptions are not objectives and nor are they standards. Therefore, there is no requirement that they be field verified. In most cases, assumptions behind recommendations are not documented and there is no question as to whether they need to be field verified.

I provide recommendations for three different categories of DFC areas:

<u>DFC 10 and 12 Areas</u>

DFC 10 Areas — This DFC emphasizes all wildlife species, and it is clear these areas are to provide opportunities for commercial activities such as livestock grazing so long as they have "no adverse and some beneficial effects on wildlife" and to "provide long-term and short-term habitat to meet the needs of wildlife, managed in balance with… livestock grazing…" A standard of "no effect" is not realistic and, instead, I focused on a retaining enough herbaceous vegetation to do more than minimally provide for wildlife needs, but less than optimally providing for their needs. I set the bar at the low end of being able to provide an adequate amount of suitable forage, cover, and other habitat attributes for wildlife in order to provide opportunities for commercial livestock grazing operations (if the bar was set in the middle of an adequate amount of suitable habitat (i.e., midway between 70% retention and ~100% retention), recommended forage utilization standards would be nearer a maximum average of about 15% utilization across ≥70% of each pasture. A minimum retention of 70% of herbaceous vegetation across 70% of rangelands and riparian areas in each pasture includes areas where ≤15% utilization would occur.

DFC 12 Areas — This DFC emphasizes big game species over other wildlife species and over livestock grazing, while also providing opportunities for livestock grazing to the extent it does not conflict with big game habitat needs. If it is not possible to graze livestock while also providing suitable forage on winter range, direction is given in the Forest Plan to cease livestock grazing use on winter range. The bar is not set quite as high for wildlife in general — recommendations for wildlife in general are similar to those of DFC 10 areas.

<u>DFC 1B Areas</u>

It is clear that livestock grazing use is emphasized over wildlife and wildlife habitat in DFC 1B areas, while also at least minimally providing for the viability of populations of management indicator species and meeting wildlife objectives to the extent possible. I set the bar just below what I believed would provide an adequate amount of suitable forage, cover, and other habitat attributes for wildlife, given the emphasis of this alternative on livestock grazing use. Given patchiness of grazing and uneven distribution of livestock, suitable habitat would be retained for most dependent wildlife in most areas.

<u>DFC 2A, 2B, 3, and 4 Areas</u>

In these DFCs, objectives for wildlife and livestock grazing use are generally at equal priority, except that DFC 2B areas emphasize livestock grazing to extent (see picture and caption, USFS 1990:167) and livestock grazing is deemphasized. I recommended objectives and standards for DFC 2A, 2B, and 3 areas be evaluated on a case-by-case basis. In large part, if these areas are surrounded primarily by DFC 10 and 12 areas, recommended objectives and standards should be considered for the entire area. If they are surrounded primarily by DFC 1B areas, they objectives and standards for this DFC should be considered for the entire area. This would reduce complexity of management.

DFC 3 areas — Where an allotment is dominated by DFC 3 (e.g., Big Greys cattle allotment), the area must be "protected from activities that could diminish or change the free-flowing characteristic, water quality,… fish and wildlife, and other values which make the river eligible for designation." This elevates wildlife and wildlife habitat somewhat and, therefore, recommendations would fall somewhere between those for DFC 1B areas and DFC 10 and 12 areas, with a pull toward recommendations for DFC 10 and 12 areas.

DFC 4 areas — Although this DFC does not place a higher emphasis on wildlife than livestock grazing use, the bar is raised with respect to watershed functioning and provision of clean and sustainable water supplies. The Forest Plan write-up for DFC 4 areas recognizes the conflicts between livestock grazing use and the protection of municipal water supplies; where the conflict is high enough, the DFC calls for exclusion of livestock. Therefore, recommended objectives and standards for DFC 10 and 12 areas would support the emphasis of DFC 4 areas more so than those recommended for DFC 1B areas. For these reasons, recommendations for DFC 4 areas would be similar to those for DFC 10 and 12 areas.

TERMINOLOGY AND CHARACTERIZATION OF UTILIZATION CATEGORIES

Terms for Characterizing Grazing Intensity

Terms used to characterize levels of livestock grazing intensity, based on effects on individual plants, can be adjusted to apply to effects on wildlife. I am not proposing to rename forage utilization categories for use on the Greys River Ranger District. I am only highlighting that heavy grazing from the standpoint of the plant is different than heavy grazing from the standpoint of wildlife.

Klipple and Bement (1961) (as cited by Holechek et al.2004:217) defined heavy grazing as "a degree of herbage utilization that does not permit desirable forage species to maintain themselves." Moderate grazing was defined as a degree of herbage utilization that allows the palatable species to maintain themselves but usually does not permit them to improve in herbage-producing ability (presumably where range conditions are less-than-satisfactory). Light grazing means a degree of herbage utilization that allows palatable species to improve their herbage-producing ability (presumably where range conditions are less-than-satisfactory.

In the following characterizations of utilization categories for *overall use of herbaceous vegetation* (<u>not</u> for key forage species), I started with Holechek and Galt's (2000) characterizations livestock grazing intensity, and modified them to (1) fit categories in the landscape appearance method (BLM et al. 1999, BLM et al. 2008), (2) recognize the lower percentages associated with assessments of overall herbaceous use compared to assessments of use of key forage species, and (3) to generally correspond with wildlife effects based on this report.

Table 18 provides a characterization of the categories of the landscape appearance method from the standpoint of retaining suitable forage and cover for wildlife (percent use of the annual production of herbaceous vegetation removed).

Table 18. Crosswalk between utilization levels of the landscape appearance method (BLM et al. 2008) and utilization of key forage species (see Table 4 for basis of estimates), and characterization of the use level from the standpoint of retaining forage and cover for wildlife.

Utilization Categories (Herbaceous Veg.)	Characterization	Comparable Use of Key Forage Species[A]
<5%	negligible to light use	<15%
6-20%	conservative use	15-35%
21-40%	moderate to heavy use	30-55%
41-60%	heavy to severe use	50-75%
>60%	severe use	>70%

[A] Assuming composition of key forage species of 25-50% and assuming that utilization levels on non-key forage species is somewhat to moderately less than utilization of key forage species.

Holechek and Galt (2000) characterized light use to non-use of *key forage species* as 0-30%, conservative use as 31-40%, moderate use as 41-50%, heavy use as 51-60%, and severe use as >60%, but this was for utilization of key forage species. To retain use of key forage species at these levels, percent use of herbaceous vegetation in general would need to be considerably lower (Table 4). Based on the findings in this report, there are measurable effects on wildlife forage and cover by 20% utilization of herbaceous vegetation and by 30% and 40% utilization of herbaceous vegetation, suitability of forage and cover has been affected considerably for most depended wildlife species. Above about 40% utilization, forage and cover is generally being affected by a considerable degree.

The highest reference to a maximum utilization level that I was able to find for retaining forage for native ungulates was 50%, and this was for utilization of key forage species. Contemporary figures are at 30-40% as a maximum utilization of key forage plant species (see “Elk” and “Mule Deer” discussions). This may be too high for some wildlife species, depending the part of the plant they use for foraging and selection of plant parts by livestock. Maximum figures for herbaceous vegetation in general (as opposed to use of key forage species), therefore, are lower than 30-50%. Assuming 40% utilization of herbaceous vegetation as an absolute maximum figure for retaining suitable forage for dependent wildlife in functioning rangelands, the extreme ends of the scale for wildlife forage availability, therefore, ranges from 0% utilization to 40% utilization, meaning that 40% (the high end of the scale) cannot be considered “moderate” use from this standpoint. However, this does not mean that I believe 40% utilization would retain suitable forage for dependent wildlife in the range of habitats addressed in this report. I only identify this as the extremity of forage utilizations that have potential to retain suitable forage. The information in this report indicates that 30% utilization of herbaceous vegetation (40-45% utilizatoin of key forage species) is at the upper end of what can still retain suitable forage conditions for wildlife.

By about 40% utilization of herbaceous vegetation, cover for most dependent wildlife species is no longer suitable or is at the very low end of suitability. In moist and wet meadow types, it is probably no longer suitable for most dependent species, and in big sagebrush and mountain shrubland types, it is probably at the low end of suitability for most dependent species. By 50% utilization, wildlife cover is nearly gone and is no longer suitable for most species, and by 60%

utilization, wildlife cover is gone for all dependent species (therefore, 50-60% utilization is outside the range of suitability). Using 40% utilization as the absolute low end of retaining wildlife cover, the scale for wildlife cover availability, therefore, ranges from 0% utilization to 40% utilization, meaning that 40% (low end of cover suitability) cannot be considered "moderate" use from this standpoint. Having 40% included within the range of suitable wildlife cover in no way means that considerable portions of an allotment could be grazed at 40% utilization and still maintain suitable wildlife cover. The purpose here is only to identify the extremities of the range and to demonstrate that 40% cannot be considered moderate grazing from the standpoint of wildlife cover.

Adjustments to Landscape Assessment Characterizations

The percent of seedstalks remaining in the 21-40% and 41-60% categories were (1) inconsistent with available information, some of which was cited in BLM et al. (2008); and (2) had a large, unexplained gap between the two categories. Remaining seedstalks in the 21-40% category was identified as 60-80%, and for the 41-60% category remaining seedstalks was identified as 15-25%, which is a gap of nearly 50%! Resolving this is especially important because grazing intensity commonly falls into these two categories, being able to readily distinguish between these two categories is of paramount importance, and because percent of seedstalks remaining is a key characteristic.

Based on the information I reviewed, more realistic ranges of seedstalks remaining intact are as follows:

For 21-40% utilization, remaining seedstalks should be 35-80%.

For 41-60% utilization, remaining seedstalks should be 15-40%.

"Maximum" and "Maximum Average" Utilization

Stating a utilization standard in terms of a maximum utilization limit — without any reference to geographic scale of assessment — can be interpreted in a variety of ways, both of which have important implications to the ability to retain suitable forage and cover for wildlife.

There are two possible interpretations of a maximum of 50% utilization of key forage species (50% is used only for illustrative purposes):

1) Of the total tonnage (dry weight) of key forage species produced on a given area in a given year, up to 50% can be removed each year. If the annual production of key forage plants on a given allotment is 5 tons, this interpretation would allow up to 2.5 tons be removed. While even distribution of livestock is attempted, this interpretation would allow over-use of plants in some areas and no use of plants in other areas, so long as the total tonnage does not exceed 2.5 tons. This has several problems. A maximum of 50% utilization stems from the take-half leave half principle for individual plants (e.g., Dietz 1989, Heady and Child 1994), and the probability of being consistent with this principle is low when assessing utilization at the pasture or allotment level. This is because removing up to 50% of the dry weight of key forage species at such large scales would allow (1) half a pasture or allotment to be grazed at ≤50% utilization and the other half being grazed at >50% utilization, (2) up to half or more of the key forage plants to be grazed at >50% utilization in parts of the pasture/allotment where total utilization is ≤50%, and (3) more than half of the key forage plants to be grazed at >50% utilization in

parts of the pasture/allotment where total utilization is >50% (Tables 4 and 6, as applied to key forage species). McKinney (1997) provides a good explanation of this. In short, a maximum of 50% utilization of the dry weight of key forage species across a pasture or allotment allows more than half of the individual key forage plants to be grazed at >50% utilization. Maximizing distribution of cattle would address numbers 1 and 3, but maximum distribution would not alleviate the fact that the standard allows for up to half or more of key forage plants to be grazed at >50% utilization. Even at a maximum of 40% utilization of the dry weight of key forage species across a pasture or allotment, the proportion of individual key forage plants being utilized at >50% can approach half. This can have major implications to wildlife.

2) If, on the other hand, the intent of a "maximum of 50% utilization of key forage species" is to cease grazing before any part of a pasture or allotment reaches 50% utilization, a much finer geographic scale of assessment needs to be applied. Anything less than one acre is likely too small because it would not be possible to meet a maximum 50% utilization standard on each and every acre of an allotment. Fifty acres may be too large of an area to determine whether a maximum utilization standard has been met or exceeded for a pasture or allotment. If 50 acres is used, this would mean that it would be acceptable for patches as large as 49 acres to be grazed at >50% utilization in this example. Because there is such a large difference in wildlife-habitat effects relative to the size at which a given maximum utilization standard is assessed, I recommend clearly defining the geographic scope at which it is to be assessed.

   This interpretation would result in the majority of the grazable land within pastures and allotments being grazed at levels far less than 50% utilization.

Utilization limits applied across entire pastures or allotments is probably why studies have shown that a maximum 50% utilization of key forage species is insufficient to maintain healthy, functioning condition in many vegetation types. Holechek et al. (2004:217) found that, outside of southern pine forests, humid grasslands, and annual grasslands, "research has been remarkably consistent" in showing that maximum utilization rates of 35-45% allows palatable species to maintain themselves, although this level does not necessarily allow conditions to improve. According to them, the preponderance of research shows that 50% utilization results in rangeland deterioration in semiarid grasslands, desert, and coniferous forest rangelands. This could very well be due to the large proportion of individual plants that are grazed at >50% utilization on a regular basis.

To clarify the first interpretation, I recommend incorporating the term "maximum average" (vs. just "maximum") in the wording of utilization standards. The end result is the same. In the example provided, a maximum average of 50% utilization would result in the same amount of forage being removed as an absolute maximum of 50% utilization of the total tonnage produced. Adding "average" would clarify that the second interpretation is not meant.

The second interpretation better supports the ultimate intent of limiting utilization, which is to to limit the utilization of enough individual plants across a landscape in order to sustain healthy, functioning conditions or, on rangelands that are less-than-functioning, to allow recovery to occur. Add to this the intent of retaining an adequate amount of suitable forage and cover for wildlife. Placing limits on the the total tonnage removed from a pasture/allotment, without realistic considerations of patchiness of grazing and inability to achieve even distribution of livestock, has little application to the ultimate intent of limiting utilization of forage by livestock.

This entire discussion also applies to "minimum" stubble heights, except that instead of maximum utilization levels, limits are expressed in terms of minimum stubble heights. As with utilization limits, minimum "average" stubble heights have limited application to the ultimate intent of limiting utilization along streambanks when grazing of streambanks is patchy. Because stubble heights are assessed at finer scales — when used along streambanks — it is more straightforward to address individual plants in monitoring.

GRAMMINOID COMMUNITIES & UNDERSTORIES

Upland Rangelands

DFC 10 and 12 Areas

Recommended Objective for Wildlife Habitat (general) — Annually retain ≥70-85% of the annual production of herbaceous vegetation throughout at least ⅔ of each major type of habitat (e.g., grassland, big sagebrush, mountain shrubland, and adjoining aspen and open conifer forestland), including retention of ≥95% of herbaceous vegetation across ≥15-20% of each type, within each pasture/grazing through the livestock grazing season in order to provide for the forage, cover, and other habitat needs of wildlife, assuming that most plant communities are in healthy, functioning condition. This does not include communities and understories heavily dominated by smooth brome, bluegrasses, and other aggressive nonnative graminoids.

Recommended Utilization Standard — A maximum average of 15-30% utilization of the annual production of herbaceous vegetation within the grazed portions of upland rangelands within each pasture or other unit of an allotment, assuming that most plant communities are in healthy, functioning condition.

In years when growing season precipitation is less than 75% of average, reduce maximum utilization by at least 5-10%. On rangelands that are in the mid-range and low end of functioning at risk, reduce maximum utilization by at least 5-10%, depending on the extent of reduced conditions. Areas where non-functioning conditions are common — and where potential exists for substantive recover to occur within 50-100 years — should be rested from livestock grazing until lands improve to "functioning at risk."

Summary of the Assumptions of the Objective and Standard —

- They would annually result in a range of 70-85% to ~100% of the annual production being maintained across at least ⅔ of each major habitat type (identified in objective) within each pasture/grazing unit during and after the livestock grazing season. Retention of 70% of herbaceous vegetation would include retention of 80% to ~100% of the annual production of herbaceous vegetation across at least ⅓ to ½ of each of the major habitat types with a substantial portion of this area remaining ungrazed by livestock. Retention of 85% would retain 80% to ~100% of the annual production of herbaceous vegetation would be retained across at least ⅔ of each major type.
- No more than about 20% of any of the major habitat types (listed in objective) would receive heavy enough grazing pressure to retain less that 60% of the annual production of herbaceous vegetation within these over-used areas. These more heavily grazed areas

may include areas dominated by smooth brome, Kentucky bluegrass, and other aggressive nonnative graminoids. Impacts to these areas are of lesser concern from the wildlife standpoint, particularly along roads since a variety of factors already reduce habitat quality and habitat effectiveness. Allowing for heavier use in some parts of pastures in part recognizes that this likely occurred prior to Euro-American settlement.

- Areas where ≥80% and ≥90% of the annual production is retained would be well distributed across each pasture/grazing unit.
- >60-70% of the annual production of *key forage* species for wildlife would be annually retained throughout at least ⅔ of each of the major habitat types within each pasture/grazing unit during and after the livestock grazing season, and this would be well distributed. (The range generally corresponds to ≥70-80% retention of herbaceous vegetation, respectively.) At a minimum of 70% retention of herbaceous vegetation (corresponding to a minimum of about 60% retention of key forage species), a substantial portion of this would have >70% of the annual production of key forage species for wildlife retained. It is assumed that:
  - A minimum of 80% of the annual production of herbaceous vegetation is needed to retain a minimum of 70% (i.e., ≤30% utilization) of the annual production of key forage species.
  - A minimum 70% of the annual production of herbaceous vegetation is needed to retain a minimum of 55-60% (i.e., ≤40-45% utilization) of the annual production of key forage species, assuming key forage species comprise 25-50% of the plant community. If 30% utilization of herbaceous vegetation results in greater than 40% utilization of key forage species (i.e., if key forage species comprise much less than 50% of the composition of plant communities), the forage recommended forage utilization limit should be reduced in DFC 10 and 12 areas.

    I originally developed the 70% retention recommendation based primarily on herbaceous cover needs of wildlife, assuming this would be more than adequate for meeting the forage needs of big game and other herbivores. However, further assessment of forage needs and preparation of the cross-walk between retention levels of herbaceous vegetation and key forage species indicates that retention based on wildlife forage needs may be higher than retention based on overall wildlife cover needs. For example, retention of 70% of herbaceous vegetation may only equate to a retention of 55-60% for key forage species (Table 4), which is lower than retention levels needed for elk and mule deer (minimum of 60-70% for mule deer and elk). If composition of key forage species falls between 50% and 75%, a retention level of 70% of herbaceous vegetation translates into a retention level of approximately 65%. If on the other hand, rangelands are less-than-functioning (e.g., reduced overall density of plant species and/or reduced composition of key species), a retention level of 70% for herbaceous vegetation translates into retention rates as low as 50% for key forage species. Therefore, a minimum retention of 70% of the annual production of herbaceous vegetation is the lowest defensible retention level for DFC 12 areas at or near functioning condition, given the emphasis on big game. A minimum retention level of 80% of herbaceous vegetation (i.e., 60-70% retention of key forage species) has a stronger basis.

The recommended objective and utilization standard are generally consistent with and generally support forage utilization limits recommended by leading range management authorities (e.g., Vallentine 1990, Holechek et al. 2004), recognizing there are others that are more conservative. I say "generally" because the recommendations are somewhat higher than recommended by these experts. They recommend no higher than 30% utilization of key forage species (an estimated 15-20% utilization of herbaceous vegetation) for rangelands in this area when livestock are grazed during the growing season, and as high as 40% utilization of key forage species (an estimated 25-30% utilization of herbaceous vegetation) when grazing occurs after the growing season. These authors are referenced not so much to provide support for the above recommendations, but rather to show that the recommendations are well within the range of recommended utilization limits in the range profession.

<u>DFC 1B Areas</u>

Recommended Objective for Wildlife Habitat (general) — Annually retain a minimum of 60% of the annual production of herbaceous vegetation throughout at least ⅔ of each major habitat types (e.g., grassland, big sagebrush, mountain shrubland, and adjoining aspen and open conifer forestland) within each pasture/grazing unit during and after the livestock grazing season in order to provide for the forage, cover, and other habitat needs of wildlife, assuming that most plant communities are in healthy, functioning condition. This does not include communities and understories heavily dominated by smooth brome, bluegrasses, and other aggressive nonnative graminoids.

Recommended Utilization Standard — A maximum average of 35% utilization of the annual production of herbaceous vegetation within the grazed portions of upland rangelands within each pasture or other unit of an allotment, assuming that most plant communities are in healthy, functioning condition.

Summary of the Assumptions of the Objective and Standard —

- They would annually result in a range of 60% to ~100% of the annual production being maintained across at least ⅔ of each broad category of habitat types (listed in objective) within each pasture/grazing unit during and after the livestock grazing season, including retention of a range of 80% to ~100% of the annual production of herbaceous vegetation across at least 20% of each of the major habitat types with a substantial portion of this remaining ungrazed by livestock.
- No more than about ⅓ of any of the major habitat types (listed above) would receive heavy enough grazing pressure to retain less <60% of the annual production of herbaceous vegetation within these over-used areas. This is consistent with Holechek et al. (2004:248). These more heavily grazed areas would include areas dominated by smooth brome, Kentucky bluegrass, and other aggressive nonnative graminoids). Allowing for heavier use in some parts of pastures also recognizes that this likely occurred in localized situations prior to Euro-American settlement.
- Areas where ≥80% and ≥90% of the annual production is retained would be well distributed across each pasture/grazing unit.
- >60% of the annual production of key forage species for wildlife would be annually retained throughout at least ⅓ of each broad category of the habitat types within each pasture/grazing unit during and after the livestock grazing season, and this would be well distributed.

Recommendations for DFC 1B areas represent absolute maximums from the standpoint of wildlife habitat in this DFC area, and they do not encompass the full range that should be considered. The low end may be as low as 15%, based on published recommendations (e.g., Holechek et al. 2004), but this is an issue for rangeland management specialists. The recommended objective and utilization standard for DFC 1B areas are somewhat higher than forage utilization limits recommended by some leading range management authorities (e.g., Vallentine 1990, Holechek et al. 2004), and are just below recommendations by other authorities (e.g., Heady and Child 1994). Heady and Child (1994) supported the "take-half, leave half" approach. See discussion for DFC 10 and 12 areas for recommendations of Holechek et al. (2004). The upper end of the recommended objective and utilization standard for DFC 1B areas (35% utilization of herbaceous vegetation) equates to an estimated 40-50% utilization of key forage species. Whether a maximum 45-50% utilization of key forage species is acceptable from the standpoint of sustaining rangeland health and restoring rangeland health in areas of less-than-satisfactory condition needs to be decided by rangeland management specialists. Holechek et al. (2004) brings to question the validity of a maximum 50% utilization of key forage species. Depending on the composition of key forage species, a maximum 35% utilizatoin limit may not be acceptable even in DFC 1B areas. In the summary of this document, I referenced ≤45% utilization of key forage species for a maximum 35% utilization of herbaceous vegetation (Table S-2).

Riparian/Meadow

DFC 10 and 12 Areas

Recommended Objective for Wildlife Habitat (general) — Annually retain ≥70-85% of the annual production of herbaceous vegetation throughout at least ⅔ of each major type of habitat (e.g., wet meadow, moist meadow, silver sagebrush, willow, and cottonwood communities), including retention of ≥95% of herbaceous vegetation across ≥15-20% of each type, within each pasture/grazing through the livestock grazing season in order to provide for the forage, cover, and other habitat needs of wildlife, assuming that most plant communities are in healthy, functioning condition. This does not include communities and understories heavily dominated by smooth brome, bluegrasses, and other aggressive nonnative graminoids.

Recommended Utilization Standard — A maximum average of 15-30% utilization of the annual production of herbaceous vegetation within the grazed portions of riparian areas and meadows within each pasture or other unit of an allotment, assuming that most plant communities are in healthy, functioning condition.

In years when growing season precipitation is less than 75% of average, reduce maximum utilization by at least 5-10%. In riparian areas that are below properly functioning condition, reduce maximum utilization by at least 5-10%, depending on the extent of reduced conditions. Poorly functioning riparian areas should not be grazed until they have recovered.

Summary of the Assumptions of the Objective and Standard —

See the summary for DFC 10 and 12 areas in the "Upland Rangelands" subsection, above.

DFC 1B Areas

Recommended Objective for Wildlife Habitat (general) — Annually retain a minimum of 60% of the annual production of herbaceous vegetation throughout at least ⅔ of each major habitat types (e.g., wet meadow, moist meadow, silver sagebrush, willow, and cottonwood communities, but not including communities and understories heavily dominated by smooth brome, bluegrasses, and other aggressive nonnative graminoids) within each pasture/grazing unit during and after the livestock grazing season in order to provide for the forage, cover, and other habitat needs of wildlife.

Recommended Utilization Standard — A maximum average of 35% utilization of the annual production of herbaceous vegetation within the grazed portions of riparian areas and meadows within each pasture or other unit of an allotment, assuming that most plant communities are in healthy, functioning condition.

Summary of the Assumptions of the Objective and Standard —

See the summary for DFC 1B areas in the "Upland Rangelands" subsection, above.

Streambanks and Wetlands

There is little to no indication that contemporary recommendations on minimum average stubble heights on streambanks (e.g., Hall and Bryant 2003, Clary and Leninger 2000) would retain an adequate amount of suitable forage and cover in the vicinity of streambanks. However, minimum stubble heights along the green-line are not important for retaining suitable forage and cover for wildlife so long as forage utilization limits for the riparian zone result in sufficient forage and cover being retained. This by no means diminishes the importance of minimum stubble heights on streambanks. They are critical for the purposes for which they are established (e.g., maintaining streambank stability, reducing browsing on willows), all of which are central to sustaining the capability of riparian zones to produce wildlife habitat.

This said, I include a few recommendations for consideration where an overall utilization standard for riparian areas may not be sufficient to ensure an adequate amount of wildlife cover is being retained along streambanks.

<u>All DFCs</u>

Recommended Objective for Wildlife Habitat —Within 10 feet of streambanks and wetlands, annually retain ≥70-80% of the annual production of herbaceous vegetation along each stream reach and wetland shoreline in order to provide for the forage, cover, and other habitat needs of dependent wildlife, assuming that stream channels are properly functioning. If stream channels are not properly functioning, higher retention levels may be needed.

Recommended Utilization Standards

The following are presented as options to consider, but as discussed earlier in this report,

- A minimum average of 8-10 inch stubble height on sedges along grazed portions of each stream reach, to be measured along the green-line.
- A minimum 6-inch stubble height on sedges along the green-line; that is, >90% of sedge plants along any given stream reach must have a height of ≥6 inches.

Summary of the Assumptions of this Standard —

- Use of sedges by cattle on the Greys River Ranger District typically is not very high until surrounding lands have been grazed more heavily, and grazing along streambanks is patchy, which contributes to a wide range of stubble heights.

- A minimum average 6-inch stubble height may be adequate in a small number some places, but it may result in as little as 55% of herbaceous vegetation being retained (assuming ungrazed heights of 10-15 inches), or as little as 40% retention (assuming ungrazed heights of 20-24 inches). An average 6-inch stubble height along a stream reach can result in portions being grazed down to 2-3 inches (e.g., 70-80% utilization) and portions not grazed at all. If the portions grazed to 2-3 inches are on the outside of a curve in the stream, this could result in major adverse impacts to the channel. Limiting the percent of heavily grazed sedge sedge plants could be accomplished, for example, as was done in the second recommended standard, above (minimum 6-inch stubble height).
- However, a minimum 6-inch stubble height (not minimum average) would be adequate to retain suitable forage and cover for wildlife in most situations because a range of heights would be provided, from 6 inches up to ungrazed heights. A considerable amount of sedge vegetation would be well above 6 inches.
- Most wildlife that use or depend on cover along streambanks need this cover throughout the summer months, with more species requiring cover early in the summer (e.g., for nesting). Therefore, less restrictive stubble height standards earlier in the season (e.g., 4 inches early in season, 6 inches later in the season) are inconsistent with wildlife needs.
- There is moderate to high indication that retaining 70-80% of the annual production of herbaceous vegetation and a minimum average 8-10 inch stubble height or an absolute minimum 6-inch stubble height would be sufficiently restrictive to minimize trampling of tadpoles and metamorphising frogs and toads, streambank trampling and soil compaction that can impact burrowing wildlife along stream channels and near wetlands.
- The recommended objective and standards apply to stream systems that are at properly functioning condition as well as those that are below properly functioning condition. The standard was primarily designed for systems in properly functioning condition, but it would also allow streams in degraded condition to recover while continuing to provide livestock grazing opportunities and while retaining wildlife cover in areas supporting sedges. It recognizes that vigor of graminoids may be reduced along these streams.

Management Studies and Research

BLM et al. (1999) and BLM et al. (2008) describe accepted methods and protocol for monitoring forage utilization (which can be converted directly to percent retention) and stubble heights. Several pieces of information would make results obtained from forage utilization estimates and stubble height measurements more applicable for use in determining the extent to which Forest Plan objectives for wildlife are being achieved:

- <u>Testing the Landscape Appearance Methods</u> — The only supporting documents listed for the landscape appearance method in BLM et al. (1999) are Heady (1949), Anderson and Currier (1973), and BLM (1984). None of these documents included any empirical verification that estimates of percent utilization obtained from using this method accurately reflect actual utilization levels. BLM et al. (2001, 2008) did not cite any supporting documentation.

  There are many merits to using the landscape appearance method, and testing to determine the accuracy of this method would strengthen the approach and would lend greater support to future use of this method, both from the standpoint of achieving wildlife objectives and meeting range forage utilization standards. Management studies and/or research would not need to be completed in one year. It could be staged over a period of five or more years, with preliminary results periodically being analyzed and assessed.

- Relationship Between Retention of Herbaceous Vegetation and Key Forage Species — There is a need to more closely estimate the relationship between results obtained from the landscape appearance method (expressed in terms of percent utilization of herbaceous vegetation) and percent utilization of key forage species. Most recommendations for forage utilization limits are expressed in terms of percent utilization of key species, which cannot be directly applied to results of the landscape appearance method. Complicating this further is the change in focus of methodology from the "key forage plant method" (BLM 1984) to the "landscape appearance method" (BLM et al. 1999 and BLM et al. 2001/2008). The descriptions of the different utilization categories are virtually identical, the only difference being that the term "key" was dropped in "key herbaceous forage plants" and "key herbaceous species" in the 1999 and 2001/2008 versions, unfortunately without any explanation as to how this effects interpretation of the results. This may be the source of some of the consternation in ongoing allotment management planning on the district.

  Here is a quick summary of each of the current reports describing the landscape appearance method and publications cited therein:

  - Heady (1949) identified 9 categories of utilization of key forage species: unused, slight, light, moderate, proper, close, severe, extreme, and destructive. The degree of use of each category was characteristized in one sentence.
  - Anderson and Currier (1973) identified 5 categories of utilization of key forage species: none (0-15% use), light (16-35% use), safe (36-65% use), heavy (66-88% use), and severe (>80% use). The degree of use of each of these categories was described in 1-3 sentences.
  - BLM (1984) identified and described 6 categories of utilization of key forage species, seemingly a combination between Heady (1949) and Anderson and Currier (1973).
  - BLM et al. (1999) and BLM et al. (2008) identified and described 7 categories of utilization of herbaceous vegetation, not key forage species. The descriptions are very similar to the 6 categories in BLM (1984), with one major and two minor differences. The major change is that the two newer publications dropped "key" from "key herbaceous forage plants" and "key herbaceous species." While the BLM (1984) and the BLM et al. (1999, 2008) descriptions may both produce valid results in their own right, they do not provide comparable results. For example, 21-40% utilization of key forage species obtained using the criteria in BLM et al. (1999, 2008) would be comparable to an estimated 30-55% using the criteria in BLM et al. (1984) (Table 4, note that the table is expressed in terms of retention). The two minor differences are that (1) BLM et al. (1999) and BLM et al. (2001/2008) split the "severe" category of BLM (1984) into two categories (81-94% use and 95-100% use), and (2) the two newer publications (BLM et al. 1999 and BLM et al. 2001/2008) dropped use of the names of classes.

- Relationship Between Percent Retention and Visual Obscurity — To gain a better understanding of the relationship between forage utilization levels and wildlife cover, I recommend collecting visual obstruction data using a Robel pole in conjunction with estimates of forage utilization using the landscape appearance method (see DeLong

2008). Collecting visual obstruction data would not substantially add to the amount of time required in testing the landscape appearance method (above), and this would further strengthen the tie between percent forage utilization and amount of wildlife cover retained. The use of Robel poles to estimate visual obstruction and effective cover is common in the field of wildlife conservation and using it to measure standing crop on rangelands is increasing (Benkobi et al. 2000, Uresk and Benzon 2007). Use of the Robel pole has several advantages because of its simplicity and dual measurements obtained from its use (estimates of utilization or stubble heights for range monitoring and estimates of effective cover for wildlife habitat monitoring).

FORB COMMUNITIES & UNDERSTORIES

All concepts related to forage utilization summarized in the previous pages ("Gramminoid Communities & Understories" and "Unique/Specific Habitat" sections) apply to communities and understories dominated by forbs.

Allowable-Use Standards and Management Practices

For now — given no readily usable standardized methods for measuring/estimating the amount of forbs retained after sheep grazing, and relatively little information available on the forage and cover needs of individual wildlife species in forb-dominated communities/understories — we need to rely more heavily on direct management of sheep grazing practices (see Figure 9).

<u>All DFCs</u>

The following practices were developed by the interdisciplinary team working on allotment management planning on the Greys River Ranger District. Although they would not fully ensure that an adequate amount of forage, cover, and other habitat attributes are retained for wildlife, they would contribute to this end.

- Limit sheep grazing to once-over on all sites within allotments.
- Allow sheep to move at their own pace along grazing routes, while making sure they keep on the move.
- At a minimum, adjust sheep numbers (band size) and frequency of rest as needed to ensure that (1) functioning conditions are maintained where functioning conditions currently exist, and (2) upward trends in ecological conditions are sustained where conditions currently are less than functioning.
- Provide rest until ground cover is ≥60% across areas that currently are predominated by non-functioning (e.g., <60% ground cover). "Across areas" means that ≥60% ground cover needs to be attained on the vast majority of sites within the area needing rest.
- Other standard practices such as bedding no more than once on any given site, shading no more than once on any given site, and range readiness prior to onset of sheep grazing season would also contribute to retaining forage and cover for wildlife.
- Provide a minimum of 1 season of rest for every 4 years in areas predominated by functioning conditions where stable are being sustained. This would contribute to sustaining healthy, functioning rangelands. This frequency of rest also applies to rangelands that are near functioning condition and that have an upward trend.

DFC 10 and 12 Areas

Given uncertainties about whether existing sheep numbers on allotments, the following practices should be implemented — above-and-beyond providing for rangeland functioning and recovery of rangeland functioning (previous bullets, above). They would *better ensure* that an adequate amount of suitable forage, cover, and other habitat attributes are provided each year.

- Minimum of 1 year of rest every 2-3 years on areas that are at the lower end of functioning-at-risk (assuming upward trends). A higher frequency of rest or lower sheep numbers would be needed if upward trends are not sustained. A lower frequency of rest for a given allotment (e.g., 1 year in 4) may be justified if enough of several of the following elements of management are adjusted sufficiently to mitigate the effects:
  - Alternate routes each year so that each route is grazed only once every other year. This would result in the allotment not needing any allotment-wide rest.
  - Alternate portions of routes year-to-year so that each part of the alternate routes are grazed every other year.
  - Reduce sheep numbers (band size).
  - Designate patches of wildlife forage/cover patches — like the wildlife snag patch concept in the Snag Habitat Guideline — and rest these every year. The minimum size and number per mile of route or section, and the maximum distance from the route would need to be determined. These patches would need to be in functioning condition or near-functioning condition.
  - Move sheep through degraded areas quicker if this can be done without increased soil disturbance. This likely would offset adverse effects only to a small degree (at most) and risk of added adverse impacts may be too high.
  - Deferred rotation of grazing routes. At most, this would offset adverse effects to a small degree.
- At a minimum, develop and incorporate qualitative retention objectives and qualitative allowable-use standards — that reflect principles identified in this report — into allotment management plans.

A missing element of sheep grazing management currently is a meaningful and practical forage utilizatoin standard that would retain an adequate amount of suitable forage, cover, and other habitat elements for wildlife on a year-to-year basis.

Management Studies and Research

Suitability of wildlife forage and cover in any given year is inversely related to the amount of herbaceous vegetation that is removed by sheep and trampled by their hooves. Also, the forage of some wildlife species may be disproportionately reduced. For example, 20% utilization of herbaceous vegetation in many situations will result in >20% reduction in the number of flowers and it may result in considerably more than 20% reduction in some species of flowers. This differential is of particular concern, even at overall light levels of grazing, in forblands and herblands that are at the lower end of functioning at risk and non-functioning condition.

While long term monitoring of ground cover and plant species composition are important for restoring and sustaining wildlife habitat — as these parameters indicate the capability of the land to produce suitable wildlife habitat — this is only part of the equation. Retention of herbaceous vegetation through the livestock grazing season (previous paragraph) is also critical. If a given area produces a sufficient amount of herbaceous vegetation to provide suitable wildlife habitat, this becomes meaningless if livestock remove enough herbage to create less-than-satisfactory conditions for wildlife.

Therefore, it is imperative that methodology be identified or developed for evaluating the retention level of herbaceous vegetation in forbland, herbland, and shrub-forb communities relative to requirements of wildlife objectives.

There apparently are no standardardized, time-efficient methods for measuring or estimating forage utilization in forb-dominated communities and understories of differing range conditions. However, there are several options for addressing this issue. I recommend that a workable, practical, and ecologically meaningful numeric or explicitely-worded qualitative objectives and allowable-use standards be developed that would assure that an adequate amount of suitable forage and cover are being retained in years when sheep graze an allotment. The following are two options, but others should be explored.

- A descriptive, "landscape appearance" method could be developed similar to what was done for graminoid communities, and as described by Heady (1949), Anderson and Currier (1973), and BLM et al. (2008). Objectives and standards could be readily developed to coincide with this method. This may require the use of cages or small exclosure in different soil types and plant community in different condition classes.
- Another option would be a decision-tree approach.

UNIQUE/SPECIFIC HABITATS

Elk and Mule Deer Winter Range — Particularly in DFC 10 and 12 areas, care needs to be taken to ensure that an adequate amount of suitable forage is retained for elk and mule deer on winter ranges, especially on crucial winter ranges. The Forest Plan requires that habitat objectives and management strategies be developed for winter ranges where livestock grazing occurs.

Objectives need to be developed on a case-by-case basis, considering site-specific conditions, and standards need to be developed based on these objectives. The Forest Plan provides for the complete cessation of livestock grazing on some crucial winter ranges in DFC 12 areas (USFS 1990:242). Where it can be demonstrated that livestock grazing can be managed to minimize conflict with the forage needs of elk and mule deer on winter and early spring ranges, objectives for retention, as measured in September or October, cannot be any lower than 70% of the annual production of key forage species, which may mean retention as high as 80-85% of the annual production of herbaceous vegetation in general. There is little information to demonstrate that retaining less than 70% of key forage species would provide suitable winter forage conditions. Depending on plant species composition, retention of graminoids in general may need to be higher.

Objectives, allowable-use standards, and incorporation of rest also must consider the need for restoring fire on the landscape (both prescribed burning and wildland fire use) in winter range of elk, mule deer, and moose. Periodic fire is critical to restoring and maintaining winter ranges of these species. Retaining a minimum of 70% of the annual production of graminoids would help retain a satisfactory amount of fine fuels to carry fire, but pre-treatment rest likely will be needed for prescribed burning and post-treatment rest will be needed in most cases to prevent over-use of recovering plants after being burned.

Additionally, Objectives need to be developed for browse on these winter ranges. Where it can be demonstrated that livestock herbivory can be managed to minimize conflict with the browse needs of elk and mule deer on winter and early spring ranges, objectives for retention, as measured in September or October, may be as low as 50% of the annual production of key forage species, based on WAFWA 2009; however, this seems to be much too low for elk and mule deer winter range. This issue needs to be assessed in more detail.

Bighorn Sheep Range — Ideally, separation should be maintained between domestic sheep and bighorn sheep, which includes a wide buffer area to account for wandering individuals of either species. However, the Darby Mountain bighorn sheep herd is designated as a non-emphasis herd, which means that removal of domestic sheep from areas of current overlap should not be an immediate unilateral objective (Wyoming Statewide Bighorn/Domestic Sheep Interaction Working Group 2004). According to the working group, use of separation, if possible and desirable, should be achieved through negotiation between affected parties.

The distribution of the Jackson bighorn sheep herd, as mapped by WGFD, does not extend onto the Greys River Ranger District, but animals from this herd have gotten close to the Elk Wallow and Bailey Creek sheep allotments of the district. Efforts should be made to keep separation between this core bighorn sheep herd and domestic sheep in these allotments.

I hesitate to identify any acceptable minimum level of forage retention because, by the time grazing levels approach a forage utilization standards (e.g., on high elevation grasslands and big sagebrush-grass communities used by bighorn sheep), the potential for disease transmission would have long since exceeded serious levels of disease transmission potential. Also, there currently is little if any grazing by domestic sheep within the present distribution of bighorn sheep. The Mink Creek sheep allotment is the only active allotment that overlaps with the distribution of the Darby Mountain bighorn sheep herd, and (1) the area inhabited by bighorn sheep is not within the area designated as capable land for domestic sheep grazing, (2) domestic sheep currently do not graze the portion of the allotment inhabited by bighorn sheep, and (3) bighorn sheep likely do not descend in elevation enough to overlap with the current range of domestic sheep. However, at present there is nothing to prevent herders from taking domestic sheep upward in elevation and it is possible for bighorn sheep to descend in elevation.

I recommend the following, in priority order and consistent with the Wyoming Statewide Bighorn/Domestic Sheep Interaction Working Group (2004) and WAFWA (2007b):

1. Maintain/establish non-use by domestic sheep above 9,700 feet in elevation from Sheep Creek south to the south end of the district (south of Wyoming Peak).
2. Map the known current distribution and potential distribution of the Darby herd on the district and the current distribution pattern of domestic sheep in the Mink Creek Allotment and potential grazing routes in the Triple Peak Forage Reserve Allotments on the district, and identify areas of potential overlap in distribution. Alter grazing routes in the forage reserve allotments to avoid distributional overlaps.

3. Formulate and implement a strategy consistent with the Wyoming Statewide Bighorn/Domestic Sheep Interaction Working Group (2004) and WAFWA (2007b) to (a) minimize the potential for overlap in distribution, and (b) respond in a timely manner to bighorn sheep or domestic sheep outside of their mapped distribution.
4. Evaluate the potential for overlap in distribution in the Bailey Lake Allotment, and formulate and implement a strategy consistent with the working group and WAFWA (2007b) to (a) minimize the potential for overlap in distribution, and (b) respond in a timely manner to any observations of bighorn sheep within the distribution of domestic sheep.

Pika Habitat — Specifically addressing the foraging needs of pika on sheep allotments should be considered in developing allowable-use standards and required sheep management practices. Several factors would make it possible to manage sheep grazing to limit or avoid grazing in the vicinity of talus slopes occupied by pika: (1) talus slopes are readily recognizable; (2) grazing locations of sheep can be controlled fairly effectively through herding, meaning that plant communities adjoining talus slopes can be avoided if needed; (3) bedding of sheep in pika habitat can be readily avoided; (4) other measures are possible, for example, having one of the herders keep sheep away from talus slopes as sheep pass through down-slope herbaceous communities; and (5) determination of whether given talus slopes are occupied by pikas is straightforward, although it would require a large time commitment. This needs to be explored in more detail.

Amphibian Breeding Areas — Where potential exists for livestock to impact known key ranges of spotted frogs, chorus frogs, or boreal toads, site-specific objectives and allowable-use standards should be established. The Forest Plan requires that the needs of sensitive species be addressed in AMPs (AMP Standard) and that objectives be developed for sensitive species (Sensitive Species Management Standard). In these paragraphs, I define key ranges as areas containing several to numerous breeding ponds, foraging water bodies, and the likely migration routes. They typically do not include single, isolated ponds, unless they are breeding sites for boreal toads or there is indication they are important for sustaining a localized populations of frogs. The concept of key amphibian ranges needs to be further refined.

Objectives need to be developed on a case-by-case basis, considering site-specific conditions and class of livestock, and standards need to be developed based on these objectives. Objectives for key ranges should call for ≥70% of the annual production of herbaceous vegetation being retained across ≥70% of this range during early summer through September. There is a moderate to high level of information indicating that retaining ≥70% of the annual production of herbaceous vegetation across ≥70% of amphibian ranges are sufficient to (1) maintain an adequate amount of suitable cover for frogs and toads, (2) minimize trampling of tadpoles and metamorphising frogs and toads, (3) minimize streambank trampling and soil compaction that can impact burrowing frogs and toads. Consideration should also be given to minimum stubble heights that would retain suitable cover for amphibians and that would minimize streambank trampling and soil compaction.

There is little information to demonstrate that ranges used by amphibians would be in suitable condition if the retention level is less than 70% of annual production. One option that may need to be considered in some areas is riparian fencing or exclosures. Expansive willow communities would mitigate effects of livestock grazing since healthy willow canopies would both protect herbaceous vegetation from grazing and provide cover for amphibians. Impacted willow plants may or may not serve these functions.

On an allotment-by-allotment basis, key amphibian ranges need to be identified, and objectives and livestock management practices to retain a satisfactory level of cover in these areas need to be identified.

Sage Grouse Nesting Areas — Nesting requirements of sage grouse need to be considered in reviewing and revising allowable-use standards. The Forest Plan requires that the needs of sensitive species be addressed in AMPs (AMP Standard) and that objectives be developed for sensitive species (Sensitive Species Management Standard). Limiting cattle grazing to a maximum of 20-30% utilization of herbaceous vegetation — depending on plant species composition — should retain enough herbaceous vegetation to sustain minimum stubble heights of 7-8 inches in order to provide for the nesting needs of sage grouse.

Other options that should be considered include deferred rotation and rest rotation systems.

Waterfowl and Crane Nesting Areas — In DFC 10 and 12 areas, there may be some areas where site-specific allowable-use standards, rest-rotation, and/or long-term rest may be warranted. I do not know of any areas where this may be warranted, but this should be considered on an allotment-by-allotment basis. More restrictive allowable-use standards for waterfowl and crane nesting areas may not be needed where dense willow stands protect underlying graminoids from grazing and provide waterfowl nesting cover. Deferred rotation and rest rotation systems, especially rest, would benefit these species.

BROWSE

On allotments in which browsing by livestock is an issue, I recommend this issue be explored further. A general guideline until then would be to limit browsing by livestock to 50% of the annual leader growth, except on winter ranges of mule deer, elk, and moose in DFC 10 and 12 areas, where maximum browsing of annual leader growth should be no more than negligigle to minor amount (i.e., retention of ≥90-95%).

REST AND DEFERMENT

Full-season rest from livestock grazing plays an important role in retaining an adequate amount of forage, cover, and other habitat attributes for wildlife both on sheep and cattle allotments.

Several recommendations for sheep allotments are as follows:

- A minimum of 1 year of rest every 4 years may be sufficient (1) where it has not been demonstrated that once-over sheep grazing is retaining adequate amounts of suitable forage and cover for wildlife on functioning rangelands and rangelands at the high end of functioning-at-risk; and (2) where it has been demonstrated that once-over sheep grazing is not retaining an adequate amount of suitable forage and cover on functioning rangelands and rangelands at the high end of functioning-at-risk, but where it is close.
- A minimum of 1 year of rest every 3 years, or possibly as low as 1 in 2 years, may be sufficient (1) where it has not been demonstrated that once-over sheep grazing is retaining adequate amounts of suitable forage and cover for wildlife on rangelands that

are at the middle or low end of functioning-at-risk; and (2) where it has been demonstrated that once-over sheep grazing is not retaining an adequate amount of suitable forage and cover on rangelands that are at the middle or low end of functioning-at-risk.

- Parts of allotments predominated by non-functioning rangelands should be rested to allow rangeland functionality and wildlife habitat to recover. At a minimum, long-term rest of non-functioning areas should resume until ground cover reaches a minimum of 60% across the rested area and plant species diversity reaches a minimum threshold (which needs to be better defined). On forbland and herbland communities, it would be beneficial to continue rest until ground cover reaches a minimum of 70% across the rested area.
- Include provisions in AMPs for accommodating prescribed burning and wildland fire use, including pre-treatment rest (a minimum of one growing season prior to prescribed burn) and post-fire rest (a minimum of 1 year and as many as 2-3 years, as needed).

Rest can also play a role in retaining suitable wildlife habitat conditions on cattle allotments. Rest can mitigate, to some extent, failure to retain an adequate amount of suitable forage and cover for wildlife so retention levels are relatively close to those providing an adequate amount of suitable habitat. Given the limitations of prescribed burning and wildland fires use on cattle allotments, including provisions in AMPs for accommodating prescribed burning and wildland fire use are important (see bullet, above, for details). Ideally, each pasture should be rested once every 3-4 years, but this may not be necessary if allowable-use standards are conservative enough to retain an adequate amount of suitable forage, cover, and other habitat elements for wildlife.

There is no indication that full-season rest would adversely affect any wildlife species on the district, given the over-representation of short and/or sparse herbaceous vegetation in a range of vegetation types.

YEARS OF BELOW-AVERAGE PRECIPITIATION

At a minimum, permittees need to adhere to allowable-use standards and other livestock grazing requirements related to wildlife habitat. Wildlife are under more stress during these years due to reduced herbaceous and shrub productivity and livestock grazing compounds this effect, not to mention that there is a greater chance of livestock grazing causing long-term adverse impacts to the productivity of the land. If any leeway is provided in dry years, the Forest Plan points in the direction of ensuring that basic resources are protected (all DFCs) and that deference is given to wildlife in DFCs 10 and 12.

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