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Service**

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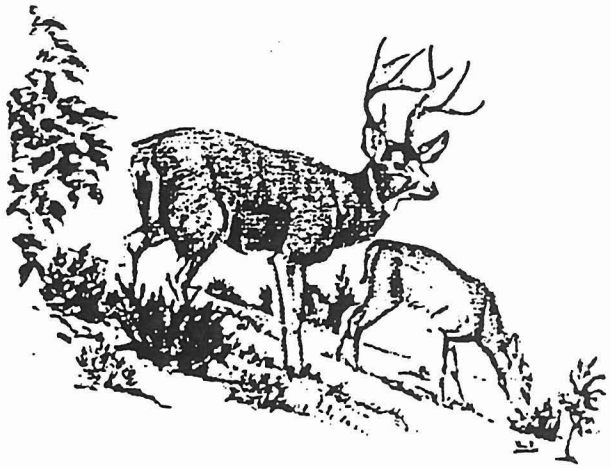
Sierra National Forest Land and Resource Management Plan Amendment

An Environmental Assessment of Utilization Standards for Determining Proper Use of Available Forage for Commercial Livestock



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CHAPTER I. PURPOSE & NEED

1.1 BACKGROUND

The Sierra National Forest Land and Resource Management Plan (Forest Plan) currently requires the Forest to:

> Limit herbaceous vegetation utilization by livestock in accordance with allowable use factor tables developed for R5 FSH 2209.21, Range Environmental Analysis Handbook. Develop and implement utilization standards to fit desired site-specific range conditions in riparian areas. Give priority to Allotment Management Plan development for allotments that have riparian areas in less than satisfactory condition (ref: Range Standard and Guideline 85b, Forest Plan Record of Decision, September 24, 1992, Errata, page 2).

The allowable use tables for the Handbook were developed in 1969. Since then, allowable use factor tables have been developed for the draft Region 5 Rangeland Analysis Field Guide (1993) (R5 Field Guide). In accordance with Standard and Guideline (S&G) 85b, the Forest has been implementing these new factor tables in the draft Field Guide on an annual basis by including them in each annual operating plan. Because S&G 85b contains a cross-reference only, the allowable use standards have been unintentionally obscure to the public and Forest Service employees alike, and this has resulted in implementation and compliance problems.

After the Sierra National Forest Land and Resource Management Plan (Forest Plan) was adopted in 1992, there was confusion on how to interpret standards and guidelines related to allowable use of rangelands. As a result, there were problems in implementing and obtaining compliance of the standards. Based on this and other resource management concerns, California Trout, et al. (Litigants) sued the Sierra National Forest (Forest) to correct what they considered to be problems associated with the rangeland management program. The Litigants agreed to dismiss the suit with certain stipulations. One of the stipulations was to propose a Forest Plan amendment to incorporate grazing utilization standards and guidelines.

During preliminary development of the amendment, three alternatives were identified and considered in detail. After review by the Forest specialists, livestock permittees, litigants and other public groups, the Forest decided to introduce a fourth alternative, which is primarily based upon the valuable public input we received on the January 6, 1995 Environmental Assessment. This Environmental Assessment (Assessment) discusses and analyzes the four alternatives.

1.2 PURPOSE AND NEED FOR PROPOSED ACTION

The **purpose** of this Assessment is to analyze whether the Sierra National Forest should: (1) incorporate current allowable use guidelines referenced in the draft Regional Field Guide (1993) as maximum allowable use standards into the Forest Plan (No Action); or (2) consider other alternatives for amending of the Forest Plan. The standards and guidelines would be incorporated as Level II Forest-wide Standards and Guidelines (ref. LRMP, 1-5). They would supersede existing Standard #85b and identify minimum amounts of forage that will be held from commercial livestock operators to protect other resource values.

The **need** for these standards and guidelines is to provide Forest officers and Forest users a clear description of what is proper allowable use of available forage for livestock, while protecting other resource values such as productive soils, desired vegetation, high quality water, wildlife, and fisheries habitats.

1.3 LEGAL AUTHORITY AND MANAGEMENT DIRECTION

National Forest management is guided by various laws, regulations, and polices that provide the framework for all levels of planning--including national and regional guides, forest plans, and site-specific environmental documents. Livestock grazing is a specifically authorized use of National Forest System lands; forests are directed to provide for grazing opportunities, where appropriate, to eligible livestock operators. Forest Service planning regulations found in 36 CFR 219 state that forest plans define overall management direction, including standards and guidelines, for managing National Forest System resources, including rangeland resources. Applicable laws and regulations that are pertinent to the proposed action include:

Organic Administration Act of 1897
Bankhead-Jones Farm Tenant Act of 1937
Granger-Thye Act of 1950
Multiple Use-Sustained Yield Act of 1960
National Forest Management Act of 1976
Public Rangelands Improvement Act of 1978

This Assessment was prepared using direction provided in Forest Service Manual 2200, Range Management, effective April 21, 1991. Under Policy Direction 2211.6, Standards and Guidelines:

> Standards and guidelines for rangelands must be quantifiable, have time frames, and be based on ecologically defined units. They must address the current vegetative and other rangeland resource situations along with indicating the management strategies that will be utilized to move vegetation and other resources toward a desired condition.
> The Sierra's Forest Plan was approved by Regional Forester Stewart in the Record of Decision dated September 24, 1992 as amended January 13, 1993. The Forest Plan provides the following narrative for management direction on the Sierra National Forest under 4.3.10, FUTURE CONDITION--Range:
>
> Permitted livestock use will increase to about 40,600 AUMs annually. Most of the increase will be accomplished by taking advantage of intensified grazing on annual grassland, treatment of chaparral, transitory range, construction of water developments, and additional

drift fences. Limited areas of primary range, presently in poor condition, will be managed to improve range condition. Increased production will be partially offset by reducing or discontinuing use of poor condition range at higher elevations and by grazing adjustments on some ranges to maintain amenity values, such as dispersed recreation and wildlife resources.

Site-specific management decisions will be made in individual Allotment Management Plans (AMPs) through an interdisciplinary planning process. Continued utilization of positive measures, such as salting, herding, water developments, fencing and riding, will be used whenever the opportunities exist to improve livestock distribution and minimize impacts to riparian areas. If mitigation is unsuccessful in preventing unacceptable resources damage to riparian habitat, measures will be taken to reduce or eliminate livestock use in the affected areas.

The Forest Plan was amended in the Record of Decision to include the following guideline:

(85b) Limit herbaceous vegetation utilization by livestock in accordance with allowable use factor tables developed for R5 FSH 2209.21, Range Environmental Analysis Handbook. Develop and implement utilization standards to fit desired site specific range conditions in riparian areas. Give priority to Allotment Management Plan development for allotments that have riparian in less than satisfactory condition.

1.4 PROJECT SCOPING AND PUBLIC PARTICIPATION

The Interdisciplinary (ID) Team, consisting of a supervisory wildlife biologist and a forest resource officer, met on almost a daily basis from October 17 until December 30 to discuss the environmental analysis process and document preparation. Input was requested and received from forest specialists in archaeology, botany, fisheries, fuels, hydrology, range, soils, and wildlife. The ID team met with the Forest Botanist, Forest Fisheries Biologist, and Assistant Land Management Planner on December 22 to discuss public input and document review.

A public scoping letter was mailed October 28, 1994, and an additional clarification letter was mailed November 3. A third letter describing a new alternative was mailed November 14. A public scoping meeting was held at the Clovis Veterans Memorial Building on November 15. Notes from the forty attendees (approximate) were recorded on flip charts, typed, and mailed on November 18 to those who attended. The mailing list and names and addresses of the attendees are on file at the Sierra National Forest Supervisor's Office located at 1600 Tollhouse Road, Clovis, California. A total of sixteen written responses were received from the public, and twenty individuals made presentations at the public meeting.

1.5 MANAGEMENT ISSUES AND CONCERNS

The following significant issues and concerns were raised regarding the proposed actions:

1. What is the impact on riparian resources?

2. What is the impact on Willow Flycatcher habitat?

3. What is the impact on Rawson's flaming trumpet?

4. What is the impact on deer hiding cover?

5. What kind of monitoring will be required for each alternative, and can that monitoring be made uniform and readily applicable?

6. Will any of the alternatives provide information concerning the accuracy of meadow range condition ratings?

7. Is the use of increaser/decreaser species to determine meadow range condition valid?

1.6 PUBLIC INPUT

As part of the public scoping process, the Forest requested input to an initial environmental assessment released on January 6, 1995, titled, Sierra National Forest Land and Resource Management Plan Amendment--Utilization Standards for Cattle. As a result of this public input, a fourth alternative was developed for this analysis. A full summary of that input, and the original letters received, can be found in the planning record at the Sierra National Forest Supervisor's Office. The following statements are a summary of public input received:

1. **Forest Service Direction and Forest Planning.** The Assessment conflicts with the proposals in the Draft Region 5 Field Guide and does not appear to have been developed with full interdisciplinary participation.

2. **Level of Analysis and Significance of Decision.** The Assessment is unclear and confusing. The document does not adequately discuss or evaluate impacts to fish, aquatic and riparian resources, reptiles, soil stability, meadow stability, and sedimentation.

3. **Utilization Standards and Guidelines.** The Assessment did not give due consideration to a number of resource values nor did it address streambank disturbance or allowable use levels by other grazers.

4. **Utilization Monitoring Methods.** For herbaceous riparian vegetation, use of the Residual Dry Matter standards by Double Plot method is over complex and susceptible to challenges.

5. **Economic and Social Effects.** The Assessment's economic and social analysis incorrectly compares the cost of public versus private rangelands.

6. **Soil and Water Effects.** The potential effects of cattle grazing on aquatic and riparian resources need to be recognized and understood for each relevant landform in order to develop meaningful grazing standards.

7. **Rangeland Condition & Ecological Health.** None of the alternatives considers ecosystem management as a viable approach to rangeland management.

8. **Wildlife Effects.** None of the alternatives incorporates management plans that address sustainability of wildlife populations.

1.7 PROPOSED ADMINISTRATIVE ACTION

Through this analysis process, the Forest Service has developed a fourth alternative that is the new proposed action. This alternative is most responsive to the public input received, as well as proactive in establishing new direction for the range management program on this forest. The management objective under Alternative 4 would be to adopt commercial livestock forage utilization standards and guides that:

(1) are easily applicable with a minimum knowledge of current resource conditions;

(2) allow for a well-balanced range program which is both efficient and effective in achieving the desired condition;

(3) give direction for more complex analysis or application of ecological concepts;

(4) are based on easily identified indicators of rangeland health;

(5) give consideration to other resource values associated with rangelands on the forest; and

(6) can be implemented forest-wide in a timely manner.

CHAPTER II. MANAGEMENT ALTERNATIVES

This chapter displays the alternatives which were considered for amendment of forest-wide grazing standards and guidelines. The proposed alternatives have been edited to provide easier reading and clarity. All of the active grazing allotments on the Sierra National Forest are currently using continuous, season-long grazing strategies. Therefore, a distinction was not made between allowable use levels and the intensity of livestock management being used (i.e., rest-rotation grazing systems).

2.1 ALTERNATIVE ELIMINATED FROM FURTHER CONSIDERATION

Discontinued Livestock Grazing -- This alternative was formulated to represent the discontinuance of livestock grazing in the Sierra National Forest by permitted livestock. This alternative would allow rangelands in the Forest to improve and reach potential natural community (PNC) or desired condition at a faster rate. The alternative was eliminated from further study because grazing is a statutorily authorized, multiple-use of National Forests. The Forest Plan provides for livestock grazing, and grazing is one of the goals of the Plan. This alternative would not meet the purpose and need of the proposed action, which authorizes the continuance of grazing on the Forest, in conformance with specified standards.

2.2 DESCRIPTION OF ALTERNATIVES CONSIDERED IN DETAIL

Discussion of Meadow Range Condition -- In alternatives 1, 2, and 3, meadows are classified as being in excellent, good, fair, or poor range condition. Alternative 4 also allows for, but does not require, the use of these ratings as one criteria in selecting proper use levels. Further discussion will be given in alternative 4 regarding resource values, ecological status, and rangeland health. A meadow in excellent range condition is described as having 95 percent or greater ground cover and a plant composition dominated by "decreaser" or "climax" plant species. If meadows are overused, "decreaser" plant species will begin disappearing and "increaser" and/or "invader" plant species will dominate the site. Refer to Appendix B:B-1 to B-3, Vegetation and Soil Condition Ratings on Montane Meadows in the Sierra Nevada, which provides a summary of the Species Composition Method for determining range condition on wet, moist, and dry meadows in excellent, good, fair, or poor range condition. There has been criticism of the range condition rating system in the professional literature, particularly as to the concept of "climax" as applied to meadows; the term most often used today is potential natural community. A discussion and summary of that criticism by the Forest Botanist is also contained in Appendix B:B-7 to B-10.

2.2.1 Alternative 1 -- Maintain Current Grazing Guidelines as Described in the Forest Plan. Develop and Implement Allowable Use Standards When Permits are Issued or Renewed. Program Emphasis in Riparian Areas (No Action).

The current guidelines, as described in the Forest Plan and illustrated below, would remain in effect. The Forest Plan would not be further amended to include specific standards from the allowable guides in the (draft) R-5 FSH 2209.21 Rangeland Analysis Field Guide (May, 1993). Term grazing permits, temporary grazing permits, private land grazing permits, and special use pasture permits

would be modified to incorporate those standards when issued or renewed, or through annual operating instructions until permit specific rangeland project decisions are made.

Annual Grasslands & Oak Woodland Sites. The existing guidelines for establishing residual dry matter (RDM) standards on California annual grasslands would remain in effect. These guides are derived from University of California's Cooperative Extension as described in Leaflet 21327 (Clawson, McDougald, and Duncan 1982) and illustrated in Table 1 below. In annual grasslands, proper use levels have usually been determined by the amount of residual vegetation and litter left on the ground prior to the wet season (November & December). Recommended guides for establishing residual dry matter standards take into account: (1) topography; (2) local precipitation levels; (3) site specific soil conditions; and (4) other specific resource values (i.e., cow/calf operation or deer management unit). Generally, lower flat slopes occur on grasslands below 1,000 foot elevation along the edge of the San Joaquin Valley; gentle slopes are typically in the oak woodlands between 1,000 and 2,500 foot elevation; and steep slopes are oak woodland and oak timberlands at elevations greater than 2,500 foot.

Table 1. Current Suggested Guides for Development of Residual Dry Matter Standards on Annual Grasslands in Central Valley Foothill Zone (No Action)

Annual Grasslands & Oak Woodlands	Lower Flat Slopes	Average Gentle Slopes	Upper Steep Slopes
	400 lbs/ac	600 lbs/ac	800 lbs/ac

Guideline. Increase the standard, if needed, to meet site specific management objectives including: (a) to provide early season forage during the early-green growth period; (b) a buffer against drought; and (c) aesthetic, wildlife or other resource needs.

Guideline. Residual Dry Matter values are assumed to be determined at the the time of germination in the fall. If measurements are made at the beginning of the dry season (May/June), assume a loss of residual dry matter of approximately 5% per month until germination at the beginning of the wet season (total of 25 to 35%).

2.2.1 Alternative 1. -- continued

Riparian Areas and Wetlands, Including Wet, Moist & Dry Meadow Sites. Guidelines for establishing utilization standards, by height-weight, would be based on the Forage Condition Rating of each site. For example, the allowable use standard for a wet meadow in excellent condition would be less than or equal to sixty percent (60%); and for a dry meadow in excellent condition would be less than or equal to fifty-five percent (55%). For a wet meadow in fair condition, the allowable use standard would be less than or equal to forty-five percent (45%); and for a dry meadow would be less than or equal to forty percent (40%). These allowable use guidelines are derived from the Draft R5 Field Guide (p. 103) and illustrated in Table 2.

Table 2. Guides for Establishing Utilization Standards by Vegetative Condition Classes on Key Species in Key Areas, Continuous Season Long Grazing Systems, Sierra National Forest (No Action)

RANGELAND VEGETATIVE CONDITION ADJECTIVE	MINIMUM DECREASERS [1] (PERCENT)	MAXIMUM INCREASERS [2] (PERCENT)	DECREASERS AND INCREASERS [3] (Cond. Score)	ALLOWABLE USE FACTOR (PERCENT) WET MDW.	DRY MDW.
VERY POOR	0	0		10	5
	1	0		11	7
AND	2	1		14	10
	3	5	0 TO 25	17	13
POOR	5	5		19	15
	8	5		22	18
	9	5		25	20
FAIR	10	15		27	22
	15	15	25 TO 50	31	25
	20	15		36	31
	25	15		39	34
	29	15		45	40
GOOD	30	20		46	42
	35	20	50 TO 75	48	43
	40	20		51	46
	45	20		54	46
	49	20		57	52
EXCELLENT	50	25		\	
	60	25	75 TO 100	> 59	54
	70	25		/	
	80	25		\	
	90	25		> 60	55
	100	25		/	

1 - Minimum percentage of composition allowed.

2 - Maximum percentage of composition allowed; excess percentage contributes to amount of invader species.

3 - Range in percentage of the composition of decreaser and allowed increaser species permitted for the condition class.

Upland, Transitory & Subalpine; Bunchgrasses, Shrubs & Tree Sites. Guidelines for establishing utilization standards on these sites are shown in Table 3. All guidelines are based on current year's growth. Utilization standards for herbaceous plants would be by percent weight removed; and utilization standards for browse plants would be by leader growth removed. Guidelines for aspen are currently noted as Aspen Range Types in the regional field guide, and are included under shrubs and trees. Current forest-wide willow standards are thirty percent (30%) use of current year's leader growth.

Table 3. Maximum Guides for Utilization of Key Species by Vegetative Condition Classes on Key Areas (No Action)

Forage Condition Class	Bunchgrasses, Shrubs and Trees	Willows
Good to Excellent	36 to 45%	30%
Fair	26 to 35%	30%
Poor	11 to 25%	30%
Very Poor	0 to 10%	30%

Monitoring and Administrative Procedures.

(1) Utilization monitoring would be accomplished by Forest Service employees. Monitoring in wet, moist, and dry meadows would require recognition of key plant species, measurements of average plant heights, and selection of a transect that best represents average utilization (FSH 2209.21 Range Environmental Handbook, January 1969).

(2) Forest-wide sample monitoring would be conducted during the first two years. The monitoring would best be accomplished using a team composed of a range conservationist, the affected permittee, and a member of the interested public.

(3) Residual dry matter monitoring on annual grasslands would continue to be accomplished using a combination of Ocular Estimate by Plot and Clipped Plot methods.

(4) If allowable use limits are reached prior to the end of the permitted grazing season, livestock would be moved to another unit or area which has not reached the maximum allowable use standard. Livestock would be allowed to graze regrowth if standards were not exceeded by the end of season. If the maximum utilization standards have been reached on all key areas of the allotment, then the livestock would be removed from National Forest System lands.

2.2.2 Alternative 2 -- Maintain Current Grazing Guidelines as Described in the Forest Plan. Develop and Implement Forest-Wide Utilization Standards From Those Guidelines and Incorporate the Standards into All Relevant Permits.

This alternative is similar to Alternative 1. The Forest Plan would be amended by replacing the wording in the first sentence of S&G 85b with specific allowable use standards rather than guidelines for all rangeland landscapes. The standards for wet, moist, and dry meadows, montane uplands, and annual grasslands would be similar to guidelines in Alternative 1. The willow utilization standards would be changed from the current thirty percent (30%) standard to those standards shown in Table 5. All term grazing permits, temporary grazing permits, private land grazing permits, and special use pasture permits would be modified to incorporate standards applicable to those permits.

Annual Grasslands & Oak Woodland Sites. The standards for residual dry matter measurements on annual grasslands would be implemented as shown in Table 4. These standards are based on UC Cooperative Extension guidelines (Clawson, McDougald, and Duncan 1982) and soil sensitivity ratings for the predominate soil families (Auberry and Coarsegold) covering these vegetation types (USDA Forest Service 1993a). In annual grasslands, proper use levels have usually been determined by the amount of vegetation and litter left on the ground prior to the wet season (November & December). Recommended guides for establishing residual dry matter standards take into account: (1) topography; (2) local precipitation levels; (3) site specific soil conditions; and (4) other specific resource values (i.e., cow/calf operation or deer management unit). Generally, lower flat slopes occur on grasslands below 1,000 foot elevation along the edge of the San Joaquin Valley; gentle slopes are typically in the oak woodlands between 1,000 and 2,500 foot elevation; and steep slopes are oak woodland & oak timberlands at elevations greater than 2,500 feet.

Table 4. Proposed Minimum Standards for Residual Dry Matter on Annual Grasslands in the Central Valley Foothill Zone (Alternatives 2&3)

Annual Grasslands & Oak Woodlands	Lower Flat Slopes < 5% Slope	Average Gentle Slopes < 15% Slopes	Upper Steep Slopes > 16% Slopes
	400 lbs/ac	600 lbs/ac	800 lbs/ac

Guideline. Increase the standard, if needed, to meet site-specific management objectives, including to provide: (1) early season forage during the early green growth period; (2) a buffer against drought; and (3) aesthetic, wildlife, or other resource needs.

Guideline. Residual dry matter (RDM) values are assumed to be determined at the the time of germination in the fall. If measurements are made at the beginning of the dry season (May/June), assume a loss of RDM of approximately 5% per month until germination at the beginning of the wet season (total of 25 to 35%).

Willow Sites. On sites where the resource value of willows is of primary importance, willows would be used as a key indicator of desired form class, as shown in Table 5.

Table 5. Proposed Maximum Allowable Use of Willows on Key Areas (Alternatives 2&3)

[a]Age Classes	[a]Form Classes	[b]Allowable Use
Seedling	Form Class 1 & 4	40%
Young		
Mature	Form Class 2 & 5	20%
Decadent		
Sprout	Form Class 3 & 6	10%

[a]Apparent or Measured Age and Form Classes:
Class 1 = All willows are available; little or no hedging.
Class 2 = All willows are available; moderately hedged.
Class 3 = All willows are available; heavily hedged.
Class 4 = Willows largely available; little or no hedging.
Class 5 = Willows largely available; moderately hedged.
Class 6 = Willows largely available; heavily hedged.
Class 7 = Willows mostly unavailable.
Class 8 = Willows unavailable.

[b]Percent, by volume of current year's leader growth, available twigs and leaves clipped or browsed.

Guideline. Monitoring would involve identifying sites that: (1) are at least two acres in size; (2) are between 1,500 and 8,000 feet in elevation; and (3) have ten or more willows per acre that are moderately or heavily hedged.

Guideline. Willows measurements would be taken at selected benchmarks: (1) in early summer, after full growth but before browsing begins, and again after cattle have been removed; (2) using either Extensive Browse or Twig Length Measurement monitoring methods, depending upon monitoring objectives (Appendix D); and (3) using a photo record of benchmark sites to monitor apparent trend away from or toward the desired condition.

Guideline. In conjunction with the monitoring, the permittee would be notified of any over-utilization and would be responsible for reducing or eliminating cattle use in that area. If over-utilization continued, then mitigation measures would be implemented, including additional herding, fencing, stocking, change in season of use, and stocking adjustments.

Riparians, Meadows, Wetlands; Upland Grass, Shrub, Tree & Subalpine Sites. Standards for establishing allowable use levels would be based on the Vegetative Condition Class of each site. For example, the allowable use standard for a wet meadow in excellent condition would be less than or equal to sixty percent (60%); and for a moist to dry meadow in excellent condition would be less than or equal to fifty-five percent (55%). For a wet meadow in fair condition, the allowable use standard would be less than or equal to forty-five percent (45%); and for a moist to dry meadow would be less than or equal to forty percent (40%). Allowable use standards are illustrated in Table 6.

Table 6. Proposed Maximum Utilization Standards of Key Species on Key Areas by Vegetative Condition Class and Continuous Grazing (Alternative 2)

Vegetative Condition	Riparian Wet Meadow	Moist to Dry Meadow	Bunchgrasses, Shrubs Trees, Subalpine
Excellent to Good	60%	55%	45%
Fair	45%	40%	35%
Poor	25%	20%	25%
Very Poor	16%	12%	10%

Guideline. The utilization standards would establish the amounts of herbaceous forage which can be utilized from current year's forage production on mountain meadows, annual grassland, annual grass/chaparral, broadleaf shrubs and trees, and subalpine zones. The degree of use would vary depending on range type or plant association, range ecological condition and trend, season of use, and the physiological needs of key plant species. Range condition and trend in ground cover and vegetation would be the primary criteria for determining utilization standards for any given range.

Monitoring and Administrative Procedures. Monitoring would be the same as described in Alternative 1. Refer to Appendix D for a detailed description of monitoring methods.

(1) Utilization monitoring would be accomplished by Forest Service employees. Monitoring in wet, moist, and dry meadows would require recognition of key plant species, measurements of average plant heights, and selection of a transect that best represents average utilization (FSH 2209.21 Range Environmental Handbook, January 1969).

(2) Forest-wide sample monitoring would be conducted during the first two years. The monitoring would best be accomplished using a team composed of a range conservationist, the affected permittee, and a member of the interested public.

(3) Residual dry matter monitoring on annual grasslands would continue to be accomplished using a combination of Ocular Estimate by Plot and Clipped Plot methods.

(4) If allowable use limits are reached prior to the end of the permitted grazing season, livestock would be moved to another unit or area which has not reached the allowable use standard. Livestock would be allowed to graze regrowth if standards were not exceeded by the end of season. If the maximum utilization standards have been reached on all key areas of the allotment, then the livestock would be removed from National Forest System lands.

2.2.3 Alternative 3 -- Maintain Current Grazing Guidelines as Described in the Forest Plan. Develop and Implement Forest-Wide Allowable Use Standards from Those Guidelines. Also, Develop and Implement Utilization Standards for Montane Meadows Based on Residual Dry Matter. Incorporate the Standards into All Relevant Permits.

This alternative is similar to Alternative 2 with regard to standards for: (1) Annual Grassland & Oak Woodland Sites (Table 4); (2) Willow Sites (Table 5); and (3) Streamside Riparians, Upland Grass, Shrub, Tree, & Subalpine Sites (Table 6). The standards for Wet, Moist, & Dry Meadows would be based upon residual dry matter guidelines illustrated in Table 7. The standard for Aspen Sites would be implemented as illustrated in Table 8. All term grazing permits, temporary grazing permits, private land grazing permits, and special use pasture permits would be modified to incorporate standards applicable to those permits.

Dry, Moist, and Wet Montane Meadows. Allowable use of montane meadows would be based on retention of various pounds of residual dry matter (RDM), considering meadow type, meadow range condition, and elevation. The information in Table 7 illustrates the use of guidelines for establishing desired RDM standards. That table is based on suggested procedures in Managing Livestock Grazing on Meadows of California's Sierra Nevada (Ratliff, George, and McDougald 1987). The objective of the alternative would be to develop site specific residual matter standards that closely match the average amount of vegetative material left on the meadow after the grazing season with the amount of vegetation that would naturally decompose during the year.

Guideline. For wet and dry meadows, the RDM figures in Table 7 are based upon leaving 65 percent of average production for excellent condition, 70 percent for good condition, 75 percent for fair condition, and 80 percent for poor condition.

For moist meadows, the RDM is based upon leaving 55% of average production for excellent condition, 60% for good condition, 65% for fair condition, and 70% for poor condition.

Guideline. The desired residual herbage should equal that amount of plant mass that would decompose annually under natural conditions. The intent is to have, or manage toward, self sustaining meadows.

Guideline. The estimates given in Table 7 are considered to be a conservative starting point. Development and monitoring for residual dry matter standards for specific meadows would be based on management objectives and range condition trend analysis. Monitoring would be conducted to determine whether enough residue is being left to maintain or improve the site. Methods of measuring RDM would be similar to those used on annual grasslands.

Table 7. Proposed Guidelines to Establishing Minimum Standards for Residual Dry Matter (RDM) on Montane Meadows within the Sierra National Forest by Elevation, Condition Class, Estimated Total Production, Recommended Utilization, and Moisture Regime (Alternative 3)

5,000 ft elev.	Wet Meadows			Moist Meadows			Dry Meadows		
Condition Class	Total lbs/ac	% Use	RDM lbs/ac	Total lbs/ac	% Use	RDM lbs/ac	Total lbs/ac	% Use	RDM lbs/ac
Excellent	4,500	35%	2,900	4,800	45%	2,650	2,150	35%	1,400
Good	2,900	30%	2,050	3,100	40%	1,850	1,400	30%	1,000
Fair	2,000	25%	1,500	2,100	35%	1,350	950	25%	700
Poor	1,100	20%	900	1,200	30%	850	550	20%	450

7,000 ft elev.	Wet Meadows			Moist Meadows			Dry Meadows		
Condition Class	Total lbs/ac	% Use	RDM lbs/ac	Total lbs/ac	% Use	RDM lbs/ac	Total lbs/ac	% Use	RDM lbs/ac
Excellent	3,400	35%	2,200	3,800	45%	2,100	1,600	35%	1,050
Good	2,200	30%	1,550	2,450	40%	1,450	1,050	30%	750
Fair	1,500	25%	1,100	1,650	35%	1,100	700	25%	500
Poor	850	20%	700	950	30%	650	400	20%	300

9,000 ft elev.	Wet Meadows			Moist Meadows			Dry Meadows		
Condition Class	Total lbs/ac	% Use	RDM lbs/ac	Total lbs/ac	% Use	RDM lbs/ac	Total lbs/ac	% Use	RDM lbs/ac
Excellent	2,300	35%	1,500	2,750	45%	1,550	1,100	35%	700
Good	1,450	30%	1,050	1,800	40%	1,100	700	30%	500
Fair	1,000	25%	750	1,200	35%	800	500	25%	350
Poor	550	20%	450	700	30%	500	250	20%	200

11,000 ft elev.	Wet Meadows			Moist Meadows			Dry Meadows		
Condition Class	Total lbs/ac	% Use	RDM lbs/ac	Total lbs/ac	% Use	RDM lbs/ac	Total lbs/ac	% Use	RDM lbs/ac
Excellent	1,150	35%	750	2,750	45%	1,550	550	35%	350
Good	750	30%	500	1,800	40%	1,100	350	30%	250
Fair	450	25%	350	1,200	35%	800	250	25%	200
Poor	300	20%	250	700	30%	500	150	20%	100

Aspen Sites. Guidelines for aspen are currently noted in the R5 Field Guide as Aspen Range Type. Based on those guidelines, utilization levels are at 45% for satisfactory conditions under alternative 2, Table 6. This alternative proposes the following aspen utilization standards:

Table 8. Proposed Maximum Allowable Use of Aspens on Key Areas (Alternatives 3&4)

Age Classes	Moving Toward Desired Stand Structure	Percent Allowable Use of New Growth
≥2 Age Classes	Yes	20%
<2 Age Classes	Yes	0%
≥2 Age Classes	No	0%
<2 Age Classes	No	0%

Guideline. The objectives in aspen stand management would be to manage for a minimum of two age classes. Allowable use is based on total percent of new growth either consumed or damaged annually. Sites with less than two age class years and/or no regeneration were considered unsatisfactory and given 0% allowable use. Sites in satisfactory condition, where there is adequate regeneration and desired stand structure, could be given 20% allowable use.

Monitoring and Administrative Procedures. (1) Utilization monitoring would be accomplished by Forest range management specialists. Monitoring utilization in wet, moist, and dry meadows would involve ocular estimates and clipping and weighing one square foot plots using the Double Sampling Method. (See Appendix D). Monitoring would not require the ability to identify key grass species. Monitoring residual dry matter (RDM) in annual grass would be the same as in Alternatives 1 and 2. Monitoring of willows would be the same as in Alternative 2.

(2) Monitoring of aspen would include a determination of proper utilization standards and whether or not standards are exceeded. If utilization standards are exceeded, mitigation measures such as felled trees or fence exclosures would be implemented to ensure adequate regeneration protection of the site.

(3) In montane meadows, permittees would also be able to monitor themselves for documentation of proper cattle distribution using ocular estimates of residual matter followed by clip & weigh measurements of several square foot plots that best represent the average herbage height and condition in a meadow. The combination of ocular estimates followed by clip & weigh measurements would provide the permittee confidence in determining when herd movement would be required.

(4) Allowable use standards would be the same as Alternatives 1 and 2 except in regard to aspen which is provided for above.

2.2.4 Alternative 4 -- Implement Revised Forest-Wide Allowable Use Standards and Guidelines Based Upon Desired Condition. Establish Proper Use for Annual Grasslands Using Residual Dry Matter Standards; for Montane Meadows Using Stubble Height Standards; and for Upland Herbaceous and Woody Vegetation using Utilization Standards. Incorporate the Standards into All Relevant Permits.

This is the Forest Service proposed alternative. This alternative was derived from a combination of all the other alternatives, including the Stubble Height alternative which was eliminated from further study in the initial January 6th environmental assessment. The standards, in this alternative, were also established to correlate directly with a proposed Desired Condition statement for satisfactory and unsatisfactory rangelands. The intent of this alternative is to provide for more direct standards and guidelines which allow for emphasis of other resource values.

Discussion of Desired Condition, Resource Values, Ecological Status and Rangeland Health

Many reviewers of the initial environmental assessment felt that there had not been adequate consideration or discussion given to ecosystem management, other resource values, or rangeland health and that the Discussion of current concepts of range condition rating for LRMP amendment, by Forest Botanist Joanna Clines (Appendix B:B-7 to B-10), could have been a central theme to the document. The process by which this forest defines rangeland condition is fundamental to establishing proper utilization standards and guidelines. In this alternative, additional discussion is given to the subject.

Desired Condition

The term "Desired Condition" is defined as land or resource conditions which are expected to result if planning goals and objectives are fully achieved. Formerly this was called "Desired Future Condition" or "Future Condition" (USDA Forest Service 1995b:201). In order to measure if grazing is being kept at proper use levels, a picture of "desired condition" must be defined. There must also be a process for determining what is the desired condition relative to what actually exists. The Forest Plan discusses "future condition" in terms of desired condition. It provides direction on how to deal with rangelands in poor condition but does not qualitatively define key phrases such as "poor condition", "amenity values of other resources" or "riparian in less than satisfactory condition".

To provide clear direction in applying proper grazing standards, the following desired condition of rangelands for the Sierra National Forest is proposed:

> **All rangelands are in satisfactory condition, and all grazing activities occurring on the forest will have management strategies which achieve or maintain rangeland conditions in satisfactory condition.**
>
> **Satisfactory Condition will be defined as having either:** (1) a livestock Forage Condition Rating of good or excellent; -OR- (2) having a late seral ecological status greater than or equal to sixty percent (60%) similarity to Potential Natural Community; -OR- (3) having a Resource Value Rating of greater than or equal to seventy-six percent (76%) similarity to Desired Condition; -AND- (4) having stable soils with continuous vegetative cover and rooting throughout available profile.

Resource Value Ratings

Resource Value is defined as the value of an ecosystem for a particular use or benefit on an ecological type. This value may be expressed as the actual amount or as a relative rating, when compared to the maximum value for an ecological type. The resource value can be used for both vegetative and physical attributes on a site if the specific use or value is identified (FSM 2090.11).

Resource values can also be measured as a percent similarity to the desired condition of the site. The concept has been referred to in some handbooks as a Desired Future Condition Rating (R4 FSH 2209.21). The term has most often been used to describe the values associated with various types of vegetation to a particular animal, such as cattle or deer, using low (0-25%), moderate (26-50%), high (51-75%) or desired (76-100%) similarity groups (FSH 2090.11). Several examples in applying the concept will best demonstrate its application.

For a Cow-Calf Operation -- On summer rangelands of the Sierra National Forest, highest grazing values for a cow-calf operator are found in meadow complexes that offer a mix of palatable aquatic and dryland perennial grasses and sedges desirable to cattle. Range analysis has generally been based on Forage Condition Ratings (which are resource values for livestock) relative to preferred, high quality livestock forage plants expressed as being either excellent, good, fair or poor. The rating is based on departure from the maximum production and species composition that could prevail on the site under existing environmental conditions. The term, resource value, is useful in distinquishing between ecological status and forage condition (FSH 2209.14). Several references for defining resource values on this forest include An Evaluation of Range Condition Assessment on California Annual Grassland (George et al. 1990) and Meadows in the Sierra Nevada of California: state of knowledge (Ratliff 1985).

For Willow flycatcher habitat -- Harris, Sanders, and Flett (1986) described some high value habitat characteristics as being undisturbed, multi-age class willow communities in montane meadows with standing or moving water where: (1) meadows have an average percent wetness greater than 40%; (2) riparian sites have streams at least four feet in width; (3) meadows are greater than 40 acres; (4) willow foliage density is 61% at ground level and 67% at four feet above ground; and (5) there are relatively large willow clump sizes with minimum disturbance. Several references for defining resource values on this forest include Habitat Suitability Index Model: Willow Flycatcher (Kings River Conservation District 1985) and Habitat Capability Model, Willow Flycatcher (Fowler et al. 1991).

For wild cutthroat trout fisheries -- The Resource Value Rating for a wild trout fisheries may include well gravelled substrates, overhanging streambanks for cover, and deep pools for late summer and winter habitat. Fish & Wildlife Service describes the following desired attributes for stream fisheries in the Recovery Plan for the Lahontan Cutthroat Trout (Coffin and Cowan 1995:38-40): (1) summer water temperatures averaging 55 degrees $\pm$ 7 degrees; (2) pools in close proximity to cover, and velocity breaks to provide hiding cover and spawning areas; (3) well vegetated, stable steam banks; (4) 50 percent or more of stream area providing cover; and (5) a relatively silt-free rocky substrate in riffle-run areas.

Ecological Status Ratings

In this Region's guidebook, Sustaining Ecosystems, ecological status is defined as the degree of similarity between the present community and the potential natural community on a site. Ecological status considers secondary succession for vegetation and the degree of similarity between existing soil conditions and soil conditions at the potential (USDA Forest Service 1995). Ecological status is described using an adjective rating scale of 0 to 100. Each region or forest must define its own ratings for the similarity groups that are usually classed (FSM 2090.11). The Intermountain Region 4 Rangeland Handbook (FSH 2209.21) gives the following ratings: Potential Natural Community (86-100%); Late Seral (60-85%); Mid Seral (40-59%); and Early Seral (0-39%).

In recent years, ecologists have moved away from using value statements, such as "good", "high", or "climax ecological condition" to describe ecological status. Ecological status is rated irrespective of management objectives and therefore is not used directly to rate the success of management. The importance in knowing ecological status is to enable us, as managers, to define resource values for the land that are realistic, achievable, and measurable (see Resource Value Ratings). The Sierra National Forest currently does not have ecological scorecards applicable to rangelands, but there is considerable effort that has been made in this area relative to Southern Sierra meadows (i.e. Meadows in the Sierra Nevada of California: state of knowledge (Ratliff 1985)). An example of the usefulness in having ecological scorecards for rangelands is given below.

For Deer Hiding Cover -- If the desired resource value is to perpetuate a multi-species, multi-layered moist meadow-shrub complex, then it would be valuable information to know where ecological types would most likely be occupied by particular shrub species, and then the ecological status of the site so that an achievable desired condition could be described and managed toward. It is often times assumed that a particular type of vegetation should occupy a site when, in truth, it may never occupy the site.

Rangeland Health

The National Research Council defined rangeland health as the degree to which the integrity of the soil and the ecological processes of rangeland ecosystems are sustained (National Resource Council 1994:4).

That council recommended evaluating rangelands in terms of whether they are healthy, at risk, or unhealthy. There were three criteria given for determining whether a rangeland is healthy, at risk, or unhealthy: (1) degree of soil stability and watershed function; (2) integrity of nutrient cycles and energy flow; and (3) presence of functioning recovery mechanisms (National Resource Council 1994:8). (Also see the Rangeland Health Evaluation Matrix (National Research Council 1994) in Appendix B:B-11). The concept is based on using multiple evaluation criteria for meaningful assessment of rangeland health.

In this report we are using the phrase "satisfactory rangeland condition" in the same context as "healthy" rangelands. "Unsatisfactory rangeland condition" would be analogous to rangelands "at risk" or "unhealthy". Our objective is to establish proper use on each of the grazing allotments on the forest. In Ratliff's words, "proper use" is the degree and time of use of meadows and watershed resources which, if continued, either maintains or restores ecological integrity and is consistent with the conservation of other natural resources (Ratliff 1985:47).

An important note to the reader is that today much more emphasis is being placed on looking at rangelands, and particularly soils, as living ecosystems rather than just vegetation communities. Subtle indicators of overall rangeland health are usually reflected first in soil characteristics. It is anticipated that upon re-evaluating the montane meadows on this forest, many of those sites that have generally been considered to be "healthy", as indicated by existing vegetation, may be considered to be "at risk" or "unhealthy", as indicated by soil stability, nutrient levels, or the direction of energy flows.

Proposed Grazing
Standards and Guidelines

Annual Grasslands & Oak Woodlands. The standards in this alternative (Table 9) are similar to those found in Table 4, which are based on recommended guidelines from UC Cooperative Extension (Clawson, McDougald, and Duncan 1982) and soil sensitivity ratings for the predominate upland soil families (Auberry and Coarsegold) (USDA Forest Service 1993a). This alternative differs from alternatives 1, 2, and 3 in that it considers several assumptions: (1) grasslands on the national forest begin above 1,000 feet elevation, and, therefore, typically fall into the "average gentle" or "upper steep" slope categories with mean annual precipitations greater than twenty inches; (2) soil sensitivity is moderate on slopes less than 15 percent and high on slopes over 15 percent; and (3) the residual dry matter values are set at higher levels to account for annual decomposition. For these reasons, the standards would be applicable at the end of grazing season, which is typically early summer. These standards are comparable to guidelines which have been recommended in the Eastern Madera County Voluntary Oak-Woodland Management Guidelines for uplands above 1,000 foot elevation (Coarsegold Resource Conservation District 1995) .

Moist and Wet Montane Riparian Zones & Meadows. This alternative (Table 9) has been developed to provide minimum herbaceous vegetation stubble height standards which would be left at the end of the grazing season. The standards are based on recommended guidelines suggested by Clary and Webster in Managing Grazing of Riparian Areas in the Intermountain Region (1989). It provided sufficient herbaceous forage biomass to meet the requirements of plant vigor maintenance, streambank protection, and sediment entrapment on most meadows or meadowlike situations. The management objectives in this alternative are similar to those found under Alternative 3 for residual dry matter of meadows, but the allowable utilization may be five to ten percent greater.

Montane and Subalpine Dry Meadows, Uplands, Transitory Range, and Low Elevation Riparian Zones. The standards for these vegetation types would be the same as those listed under alternative 2, in Table 6 for herbaceous perennials (Table 10). Low elevation riparian zones are added to this standard to account for perennial and annual vegetation more similar to montane upland vegetation than to annual grasslands and montane wetlands including moist and wet meadows.

Aspen, Willow, and Other Shrubs. The standard for aspen would be the same as those listed under alternative 3, Table 8. The standard for willows and other woody shrubs, which are preferred browse species, would be set at a forest-wide standard of 20% if the site is in satisfactory condition, and would be reduced to 10% if the site is in unsatisfactory condition (Table 10).

All term grazing permits, temporary grazing permits and private land grazing permits would be modified to incorporate standards applicable to those permits.

Table 9. Proposed Minimum Residue Standard on Annual Grasslands, Oak Woodlands, Montane and Subalpine Riparians & Wetlands including moist/Wet Meadows by Desired Condition Class on Sierra National Forest (Alternative 4)

Landscape	Land Form	Vegetation Type	Satisfactory Condition	Unsatisfactory Condition
Annual Grassland & Oak Woodland (Uplands)	1,000-2,500 ft. Elevation or Gentle Slopes ≤ 15%	Herbaceous Annuals & Perennials	700 Lbs. Per Acre Residual Dry Matter	900 Lbs. Per Acre Residual Dry Matter
	> 2,500 ft. Elevation or Steep Slopes > 15%	Herbaceous Annuals & Perennials	1,000 Lbs. Per Acre Residual Dry Matter	1,200 Lbs. Per Acre Residual Dry Matter
Montane & Subalpine Riparian/Wetlands (including moist & wet meadows)	Basin Meadows Sloped Meadows Stream Meadows	Herbaceous Aquatic & Riparian	4" Stubble Height @ End of Season	6" Stubble Height @ End of Season

Table 10. Proposed Maximum Allowable Utilization Standards for Key Species on Key Areas in Montane & Subalpine Dry Meadows, Perennial Uplands, Shrubs & Trees by Desired Condition Class, Sierra National Forest (Alternative 4)

Landscape	Land Form	Vegetation Type	Satisfactory Condition	Unsatisfactory Condition
Transitory, Montane & Subalpine Dry Meadows & Uplands	>2,000 ft. Elevation	Herbaceous Perennials	45% Use by Percent Weight	35% Use by Percent Weight
Low Elevation Riparian Areas in Annual Grassland and Oak Woodland	<3,500 ft. Elevation	Herbaceous Perennials & Annuals	45% Use by Percent Weight	35% Use by Percent Weight
Upland and Riparian Areas	All Landforms Forest Wide	Willows/Other Woody Shrubs	20% Use Annual Leader Growth	10% Use Annual Leader Growth
		Aspen/Other Trees	20% Use by Percent Volume	0% Use by Percent Volume

Guideline. For all herbaceous sites: (1) the proper use standard would be based on whether or not the site is satisfactory as described under the Desired Condition statement in this alternative; (2) overall soil stability would be given primary consideration in determining whether a site is in satisfactory condition; (3) utilization monitoring would be conducted using the Key Area and Key Species concept (Appendix D.) on sites selected by an interdisciplinary team when the scheduled allotment is under detailed analysis and planning; (4) existing range condition benchmarks (Appendix C.) and/or additional temporary benchmarks would be used by the the Range Specialist to determine proper use standards on any active allotment which has not undergone detailed analysis and planning; (5) a minimum of one key area benchmark would be selected, for each sub-unit or pasture within an allotment, which would be the basis for establishing standards across the entire sub-unit or pasture on that landscape type; (6) at a minimum, documentation of benchmark sites would include an Apparent Trend Rating, Condition Rating for Soils, and Photo Point Record; (7) grazing activities and effects, on the remainder of the allotment, would be documented by field notes and use pattern mapping based on visual observations and estimates;

Guideline. For aspens, willows, and other shrub sites: (1) it would be assumed that the plant community is in satisfactory condition unless identified through an interdisciplinary process as being in unsatisfactory condition; (2) the interdisciplinary team would use age and form classes, along with associated management issues, to determine satisfactory or unsatisfactory condition; (3) the three degrees of hedging (light, moderate, and severe) would be based on the length and appearance of two-year-old wood (previous year's leaders); (3) measurements would be taken at selected benchmarks, after full growth but before browsing begins and then again after cattle have been removed; (4) either Extensive Browse or Twig Length Measurement monitoring method could be used, depending upon monitoring objectives (Appendix D.); and (5) a photo record of benchmark sites would be kept to monitor apparent trend away from or toward the desired condition.

Guideline. In conjunction with the monitoring, the permittee would be notified of any over-utilization and would be responsible for reducing or eliminating cattle use in those areas. If proper use standards are exceeded, then mitigation measures would be implemented. Those measures would include management practices such as additional herding, fencing, changes in season of use, and stocking adjustments.

Monitoring and Administrative Procedures. Monitoring procedures would differ from those described under Alternatives 1 thru 3, but monitoring methods would be similar to those described under Alternatives 1 thru 3. Refer to Appendix D for a detailed description of monitoring methods.

(1) Utilization monitoring would be accomplished by Forest Service employees on the selected benchmarks. Utilization mapping would be conducted on all other portions of the allotment using ocular estimate by the same people. Monitoring within wet, moist, and dry meadows would require recognition of key plant species within the benchmark's specified plant association.

(2) Utilization benchmarks would be established on each active allotment during the first two years. Permanent, long-term benchmarks would be selected by an interdisciplinary team during the detailed analysis process. Temporary, short-term benchmarks would be selected by the range specialist for those allotments that have not been analyzed. The affected permittee would be consulted in the selection of the benchmark locations. Interested publics would be consulted in the selection of long-term benchmark locations during the public scoping and detailed analysis process.

(3) If allowable use standards were reached or exceeded on key areas prior to the end of the permitted grazing season, livestock would be moved to other areas that are within standards. If livestock return repeatedly to areas where standards have been exceeded, or if maximum utilization standards have been reached on all key areas of the allotment, then livestock would be removed from the allotment.

CHAPTER III. AFFECTED ENVIRONMENT

This chapter will discuss the affected environment in terms of management issues that have been raised during this analysis period and the advantages or limitations that each management alternative would likely provide.

3.1 GENERAL DESCRIPTION OF THE FOREST

The analysis area is located in Central California on the west slope of the Sierra Nevada Range. Elevations range from less than 1,000 feet at the western boundary to nearly 14,000 feet at Mt. Humphreys on the Sierra Crest.

The Forest landscape is quite diverse, ranging from steeply rolling foothills covered with chaparral and grass/woodland to barren, windswept rocky crags on the Sierra Crest. The mid-elevations are characterized by steep-walled river canyons interspersed with gentler, highly productive, heavily forested areas. The knife-edged ridges, sharp peaks, and steep-walled basins at the higher elevations owe their form to the abrading action of past glaciers. The steep-walled canyons and rolling topography of the lower elevations developed through water and wind erosion.

The climate of the Forest is variable. Average annual precipitation is 45 to 50 inches, ranging from 23 inches near Meadow Lakes to 82 inches near Iron Mountain. More than half of the precipitation falls in January, February, and March, while less than 3 percent falls in the summer. Summers are usually dry, but summer thunder showers are common at higher elevations. The mean temperature is approximately 80 degrees Fahrenheit in the summer and 20 degrees Fahrenheit in the winter. Strong, dry east winds, locally known as Monos, occasionally occur in the summer, causing very dangerous fire conditions.

The area considered by this Environmental Analysis covers the lower elevation of the Forest from approximately 1,000 to 3,500 feet and 3,500 to 10,000 feet in the higher elevations. The lowest elevations are found in steep canyons of the two major rivers (Kings River and San Joaquin River). Vegetation in the area is mixed conifer, ponderosa pine, gray pine/woodland oak forest types, several chaparral associations, and annual grass in combination with shrub and woodland species.

The annual grass-oak woodland type is found from the Valley floor up to 1,500 feet elevation, mostly on south facing slopes. Chaparral occurs from 1,500 feet up to 3,500 feet and commercial forest land occurs higher than 3,500 feet. Range forage in the annual grass-oak woodland type is provided mostly by annual grasses of the genera Bromus, Vulpia, Hordeum, and Avena. There are some perennial grasses such as melic grass, California brome, blue wildrye, needlegrass, and a variety of annual forbs in the composition, as well as rushes and grasses in riparian areas. Typical shrubs include buckbrush, deerbrush, poison oak, and mountain mahogany.

In the higher elevations of the Forest, the primary forage areas are wet and dry meadows. Wet meadows occur where water is at or near the surface for most of the growing season, following spring runoff. They generally occur with a great variety of herbaceous plant species; therefore, it is not possible to generalize species composition. Plant species may differ, but several genera are common to wet meadows such as: Carex, Juncus, Eleocharis, Luzula, Scirpus; and several Graminoids such as: Poa, Agrostis, Calamagrostis, Phleum, Glyceria, Muhlenbergia and several perennial forbs and shrubs.

Moist to dry meadows occur where water is at or near the surface early in the growing season and later dry out. They generally occur with a great variety of herbaceous plant species, many which are also found in wet meadows. Plant species differ from wet meadow species as do some genera such as: Deschampsia, Hordeum, Trisetum, and Danthonia. Species of the genera Carex, Juncus, Eleocharis, and Scirpus also occur in the dry meadows; although they differ from those occurring in wet meadows. There are approximately 37,900 acres of meadows on the Forest.

3.2 COMMERCIAL LIVESTOCK GRAZING ON THE FOREST

The Forest's grazing allotments encompass approximately 954,000 acres, but only 104,300 acres are considered suitable for livestock use and are actually grazed. About 33% of this suitable range is below 4,000 feet, in the annual grass-oak woodland type. The balance is comprised of small to medium-sized dry, moist and wet meadows, and transitory range. Forage types are components of three general range categories: perennial, transitory, and annual grass-chaparral.

Perennial range includes plant communities that are naturally self-regenerating and are composed of perennial forage species. These communities include montane meadows, perennial grass, and riparian zones. They are generally located above 5,000 feet and are scattered over a broad area. There are approximately 37,000 acres in this range category, and capacities are generally between 0.5 and 8 acres/Animal Unit Month (AUM). An AUM is the amount of forage consumed in one month by a mature cow (1,000 pounds) or the equivalent.

Transitory range in the commercial forest zone is created by timber harvesting and natural or prescribed fire. This range is between 4,500 and 8,500 feet. Timber harvesting and fire stimulates early successional grass, forb, and shrub growth which is useable for 10 to 25 years, depending on subsequent treatment. About 20% of the cutover areas produce sufficient forage to support livestock for an extended period. Frequently, however, harvested areas regenerate quickly with mountain whitethorn, manzanita, lupine, and bear clover species not readily eaten by livestock. Cattle make incidental use of these areas as they drift between primary forage areas. With subsequent treatment to remove or reduce competing brush in established conifer plantations, additional herbaceous forage is produced and is useable for 10 to 25 years. There are 386,000 acres in this category with carrying capacities between 6 and 30 acres/AUM.

Transitory range in the chaparral zone is created by natural or prescribed fire and is useable for up to 10 years. Carrying capacities are between 3 and 30 acres/AUM.

Annual grass/chaparral range occurs below 4,500 feet. It includes forage types such as annual grass, annual grass/savannah, oak woodland/gray pine, and chaparral. The annual grass is an important component as it provides about 33% or 34,420 acres of the primary range. Annual grass range is a unique resource; it is totally dependant upon adequate seed source with sufficient and timely rainfall. Normal seasonal precipitation patterns are adequate to produce sufficient annual forage and permit livestock grazing from about mid-February/March to the end of June. Early fall rains favor abundant forage growth. Occasionally, compared to normal years, there are years of abundant rainfall and favorable timing that produces abundant forage.

On annual grasslands, cattle graze on slopes up to about 50 percent, although cattle trails seldom exceed 7 percent. In the transition zone, cattle graze on slopes less than 35 percent with trails that seldom exceed 7 percent. Cattle tend to utilize the outer edge of a wet meadow first and then gradually, as the season progresses, graze toward the stream channel or wetter portion of the meadow, as the drying effects of the season occur.

Range allotments are managed and monitored using representative areas called "key" areas. The key area management concept is based on the premise that evaluation of correctly identified small areas is a reliable guide to grazing management on an entire allotment. Range readiness measurements, mid-season utilization monitoring, and post-season monitoring are taken in the key areas.

The Forest Land and Resource Management Plan documented an annual use of 37,500 AUMs with a goal of providing 38,100 AUMs by the year 2002. In 1994 permitted use was 36,919 AUMs; actual use was 31,900 AUMs.

In most cases, 5-15 percent of total forage needs of the typical grazing operation comes from the Forest Service permit privileges, but permittees who have both spring and summer ranges obtain more than 50 percent of their total forage needs from National Forest. The rest comes from the home ranch (irrigated pasture and range), other leased range, and purchased feed (hay and supplements).

Traditionally, permittees graze their private property during fall and early winter, bring cattle onto low elevation annual grass allotments in late winter/early spring, and then move their cattle to upper elevation allotments during summer. Some cattle drives still occur, but for the most part, cattle are moved by truck.

3.3 CURRENT CONDITION OF RANGELANDS

Current range management emphasis on the Forest is to maintain present vegetative range conditions that are good to excellent and improve vegetative range conditions that are poor to fair. Appendix B provides descriptions for vegetative range conditions. Appendix C provides locations for monitoring benchmarks across the forest. Information compiled from individual allotment condition and trend transect measurements indicate that most primary range types are in fair or better ecological condition. Only five percent of the available primary range is in poor condition. In a few isolated areas, ecological range condition has declined because of past overgrazing. Range condition and trend measurements; however, have documented improved range conditions over the last ten years on several allotments.

3.4 RELATIONSHIP OF LIVESTOCK GRAZING TO WILDFIRE MANAGEMENT

There are three environmental factors which affect wildfire behavior: weather, topography, and fuels. Weather and topography are unchangeable. Fuels can be manipulated to change fire behavior. Generally if fuel size and volume are reduced, fire intensity will be reduced and fire suppression efforts become more successful. For an overall, gross average it can be assumed that annual grasslands produce between 1,500 and 3,000 pounds per acre. In annual grasslands, grazing is one method of fuels reduction. Cattle readily eat grass which has the same affect as mowing, with the bonus of reduced residue.

When fires initiate in grazed-over areas, they generally have a relatively slower rate of spread until there is some change in the weather, topography or fuels. Grazed areas can be used as control points (fire breaks), safety zones for firefighters, and staging areas for fire equipment. Fires burning in heavy-use areas are usually easy to control by crews with hand tools.

3.5 SOCIAL AND ECONOMIC CONSIDERATIONS

Rangelands on the Sierra National Forest are important forage sources for twenty-four ranch operations in eastern Fresno and Madera counties. It is roughly estimated that there are approximately 100 people employed either full or part time with these ranch operations. Changes in the available forage supplies on the Forest would require those operations to seek other available sources or supplement there agribusiness with other products, services, or incomes. Although effects to some individual family businesses could be significant, the overall social and economic effect to these counties would be slight. When additional forage becomes available, the Forest Service grant process for permit issuance, has typically been used to minimize significant adverse changes to individual permittees (FSH 2209.13).

Other social and economic benefits associated with forest rangelands include wildlife, fisheries, recreational sports, and water quality values. For this analysis, it has not been determined how many people are employed with businesses that depend directly or indirectly on these rangeland resources. However, the Sierra National Forest rates among the top fifteen National Forests in total recreation use with a projection of 2.5 million Recreation Visitor Days for 1995 (re: Sierra NF LRMP/EIS, figure 3.01).

3.6 CURRENT CONDITION OF WATERSHEDS AND QUALITY OF WATER

The most important water uses on the Forest are nonconsumptive and include lakes, streams, and reservoirs that provide fish habitat, fishing, swimming, boating, and other water related activities.

Currently 98 percent of the water flowing off the Sierra National Forest meets State and Federal water quality objectives. Land disturbing activities such as timber harvesting, road building, and grazing present a potential for a reduction of water quality. In order to protect water quality in accordance with State and Federal standards, the Forest implements what are known as Best

Management Practices, which are a series of practices tailored to types of projects, and which are designed to prevent and/or minimize erosion and sedimentation.

The Forest has been systematically inventorying erosion problems since 1989. These are included in the Watershed Improvement Needs Inventory (WINI). From the current inventory, 960 instances of water quality problems have been identified on the Forest. Of those, 210 are within meadows. Existing erosion problems are repaired at the rate of 100 to 200 affected acres per year. Under the present grazing situation, erosion in meadows is being aggravated by animal use along channel banks and at watering spots.

Many current meadow erosion sources originated off-site, and the resulting gullies have migrated upstream into the meadows. The causes are often nick points started from a road or skid trail crossing the drainage. Cattle trails have also been noted as nick points. Existing management direction includes primary management emphasis in riparian areas to protect and enhance riparian ecosystem, riparian vegetation, water quality, soils, fish, and wildlife resources. In addition, the Forest is to maintain or enhance productivity of Forest meadows to accommodate wildlife, fisheries, and range resources. Protection to streams, meadows, and riparian areas are presently accomplished by using Streamside Management Zone and Riparian Management Area directions listed in the Forest Plan and Forest Service Handbook 2509.22, Sierra Supplement #1.

3.7 SOILS ASSOCIATED WITH FOREST RANGELANDS

Grazing occurs in two primary areas on the Forest: on annual grasslands that occur at low elevations, and on montane meadows at higher elevations. Below is a list of the soil families that occur in these areas. The information was taken from the Sierra National Forest Soil Survey (USDA Forest Service 1993a). A technical description of the soil profile characteristics and interpretations for management is provided in the survey report.

3.7.1 Soils in Annual Grasslands

Annual grassland vegetation occurs within the following soil map units: 101, 102, 103, 105, 106, 107, 108, 109, 110, 127, 128, 129 and 130. Other kinds of vegetation may also occur in the map units as well. Listed below are the major soils and the map units in which they occur.

Soil Name	Occur in Map Units
Ahwahnee family	101, 102, 103, 107, 108
Auberry family	105, 106, 107, 107, 108, 109, 110, 127, 128
Coarsegold family	127, 128
Delpiedra family	129
Dystric Lithic Xerochrepts	130
Tollhouse family	110, 166, 167
Typic Argixerolls	168, 169
Ultic Haploxeralfs	130

3.7.2 Soils in Meadows

Meadow vegetation occurs within the following soil map units: 104, 134, 143, 161, 163, and 174. The major soil is Aquic Dystric Xerochrepts. It is the major soil in map unit 104 but is a minor component or only an inclusion in the remaining map units listed above.

3.8 TIMBERED RANGELANDS

Invasion of meadow sites by lodgepole pine (Pinus contorta var. murayana) has been documented for many years. A meadow transition begins with scattered small trees which grow and develop into a stand of trees which eventually take over a meadow. In order for lodgepole seedlings to become established, they need a mineral soil seedbed in well-lit, warm, moist environments (Ratliff 1985).

3.9 INSECT AND WILDLIFE SPECIES OF CONCERN ON FOREST RANGELANDS

Unless otherwise noted, the following discussions are based on biological assessments (BAs), biological evaluations (BEs), and specialist reports prepared by the Forest regarding the various animal and plant species at issue. For a more detailed discussion, see Appendix A which identifies the individual BAs, BEs, reports, and where they may be reviewed or obtained.

3.9.1 Valley Elderberry Longhorn Beetle

The Valley elderberry longhorn beetle is federally listed as threatened. Preferred habitat consists of elderberry shrubs and trees in a variety of habitats and plant communities, but most often in riparian savannah or moist valley oak woodlands. Elderberry shrubs are most often found along the margins of rivers and streams in the lower Sacramento Valley and upper San Joaquin Valley. It is more abundant in dense native plant communities with a mature overstory and a mixed understory (Barr 1991). Common associated plants include Populus spp., Salix spp., Fraxinus spp., Quercus spp., Juglans spp., Acer negundo, Ailanthus altissima, Rosa spp., and in the south, Baccharis spp. (Barr 1991). Adults feed in riparian areas on the foliage and perhaps flowers of elderberry trees or shrubs Sambucus mexicana (Presl.) and S. racemosa L. var. microbotrys (Rydb.). Adults are generally present from March to early June (Barr 1991).

Mating and egg laying occurs in May (Barr, 1991). This is when the beetles are most visible. Eggs are laid on Sambucus and placed in bark crevices or the junction of stem/trunk or leaf petiole/stem (Ibid). Eggs are deposited on stems greater than 1 inch in diamter, as measured at the base, on healthy and unstressed plants. The eggs hatch shortly after being laid. Larvae bore into the pith of larger stems and roots. When ready to pupate, they work their way up from the roots through the pith, open an emergence hole through the bark and then return to the pith for pupation. The entire life cycle encompasses two years, although the duration of each life stage is unknown. Adult emergence occurs at the same time the elderberry plant flowers. Many Cerambycid beetles feed on flowers. It seems likely that VELB, a Cerambycid beetle, also feeds on Sambucus flowers. Exit holes in Sambucus are usually in stems with maximum

diameter of 2.5 to 30 inches; about 74 percent (n=51) were in elderberry plants 3 to 9 inches in diameter, with 70 percent of the exit holes at heights of 4 feet or greater. These holes are circular to slightly oval, with a diameter or 7 to 10 mm (Barr 1991).

Valley elderberry longhorn beetles utilize both species of Sambucus discussed in this document. The limited data indicate that one species is not preferred over the other, and that the longhorn beetle use whichever is available.

3.9.2 Sensitive Wildlife Species

Following is a list of sensitive species which occur in the Forest. The effects of the proposed alternatives on these sensitive species are addressed in detail in the Biological Evaluation and are summarized in 4.0 Environmental Consequences. These species are:

3.9.2.1 Willow flycatcher -- The willow flycatcher breeds in riparian and mesic upland thickets in very few areas in the Forest and winters from Veracruz and Oaxaca, Mexico south to Panama. It is a rare to locally uncommon summer resident in wet or moist meadow and montane riparian habitats 2,000 to 8,000 feet in elevation. Factors which may have contributed to the decline are: nest parasitism by brown-headed cowbird, grazing interaction disturbances, loss of meadow habitat due to reservoir and hydroelectric development, historical prescribed fires in meadows or areas of riparian deciduous shrubs, lodgepole pine encroachment into meadows, and disturbances on wintering grounds (Serena 1982). Potential willow flycatcher habitat has been affected on the Forest in isolated locations where willows are moderately or heavily hedged, making these willow assemblages unsuitable habitat.

In 1983 and 1984, intensive studies were conducted on the willow flycatcher near Dinkey Creek. In 1983, 12 adult willow flycatchers were color banded at Dinkey Meadow on private land. In 1994, Long Meadow (National Forest) was added as a study site and three pairs were observed.

Results of this study suggest that willow flycatcher production may not be affected by cowbird parasitism, but may be affected by the interaction of cattle and nesting birds. The study documented several instances where cattle brushed against willows and knocked the nest loose from supporting limbs. In some instances, this occurred after the young had fledged; in others, either fledglings or eggs were in the nest (Stafford and Valentine 1985).

There are four known nesting sites on National Forest land. Of these four, two are fenced and one is in an area closed to grazing. The Forest has plans to enclose the one known site that is not fenced. As additional active nest sites are identified, the intended management would be to protect the site from any disturbances, including livestock.

3.9.2.2 California Spotted Owl -- The California spotted owl occurs in coniferous forests, mixtures of conifers and hardwoods, and in hardwood forests in the western Sierra Nevada. Most owl pairs in the Forest occur in mixed conifer forest type. They may also occur in denser stands of riparian/hardwood forests, especially in foothills bordering eastern portions of the Central Valley (CASPO Report, 7/92).

Nest stands in conifer forests of the Sierra National Forest usually have some large snags and an accumulation of fallen logs and limbs on the ground; downed woody debris is not a major component of nest sites in lower-elevation riparian/hardwood forests (CASPO Report, 7/92). Suitable habitats described above occur in 24 allotments between 4,500 feet and 8,000 feet in the Forest. A total of 103,050 acres of suitable spotted owl habitat are designated in 184 PACS and 29 Base Habitat Areas (BHA).

3.9.2.3 Northern Goshawk -- In the Sierra Nevada, goshawks breed from mixed conifer forests at low elevations up to and including high elevation lodgepole pine forests and eastside ponderosa pine habitats. Goshawks winter from the lodgepole pine habitats downslope to blue oak savannah (Pacific Southwest Experiment Station 1980:122)

3.9.2.4 Pacific Fisher -- In California, fisher most often occur at somewhat lower elevations than marten, between 2,000 and 5,000 feet in the North Coast Region, and 4,000 to 8,000 feet in the southern Sierra Nevada (USDA Forest Service 1991).

Preferred habitat is characterized by dense (60 to 100 percent canopy), multi-storied, multi-species, late seral stage coniferous forests with a high number of snags (>30" dbh.) and down logs. These areas also include close proximity to dense riparian corridors and saddles between major drainages or other landscape linkage patterns used as adult and juvenile dispersal corridors, and with an interspersion of small openings (<2 ac.) with good ground vegetative cover used for foraging (USDA Forest Service 1991).

Studies in the southern part of the Sierra Nevada Province have shown that fisher have rested in a variety of locations including cavities in black oak (Quercus kelloggi) and canyon live oak (Q. chrysolepis), snags, logs, and squirrel nests (Pacific Southwest Experiment Station 1994).

3.9.2.5 American Marten -- In California and in the Forest, marten most often occur at somewhat higher elevations than fisher. Recent surveys have shown that fisher and marten ranges overlap in the western part of Sequoia National Park, Sequoia National Forest, and Mountain Home Demonstration State Forest (Pacific Southwest Experiment Station 1994). The elevational records for the northern Sierra Nevada ranged from 3,400 feet up to 10,400 feet, averaging 6,600 feet. In the southern Sierra Nevada the range was from 4,000 feet to 13,000 feet, averaging 8,300 feet elevation (Pacific Southwest Experiment Station 1994).

These areas also include close proximity to dense riparian corridors and saddles between major river drainages used as travelways for adult and juvenile dispersal corridors, and an interspersion of small (1 ac.) openings with good vegetative ground cover used for foraging.

3.9.2.6 Sierra Nevada Red Fox -- The Sierra Nevada red fox inhabit forested areas interspersed with riparian streams and meadows and alpine fell-fields. Sierra Nevada populations may be found in a variety of habitats including alpine dwarf shrub, wet meadow, subalpine conifer, lodgepole pine, red fir, aspen, montane chaparral, montane riparian, mixed conifer and ponderosa pine. (USDA Forest Service 1991).

They occur mainly at elevations greater than 7,000 feet and seldom below 5,000 feet, inhabiting the Hudsonian and Canadian Life Zones (USDA Forest Service 1991). They move seasonally from the higher elevations in the winter to mid-elevation forests in the summer. They are opportunistic hunters. Their diet is omnivorous over most of the year, but meat is the most prevalent item in the winter. They hunt small and medium-sized mammals such as ground squirrels, gophers, mice, voles, marmots, woodrats, pikas, and lagomorphs (USDA Forest Service 1991).

3.9.2.7 Great Gray Owl -- In the Sierra Nevada, great gray owls are found in mixed coniferous forests from 2,000 to 8,000 feet elevation where such forests occur in combination with meadows or other vegetated openings. The preferred habitat during the breeding season is, on the lower margins, mixed conifer consisting of ponderosa pine, sugar pine, white fir, douglas fir, incense cedar, and smaller amounts of black oak. On the upper margins, red fir forest is preferred, consisting of red fir, lodgepole pine, Jeffrey pine, and western white pine.

Except for birds dispersing up or down slope, nearly all great gray owl observations in California are of birds found in or near meadows. There are seven recorded observations in seven grazing allotments of great gray owls in the Sierra National Forest, all associated with montane meadows.

3.9.3 California Mule Deer

California mule deer is an important big game species on the Sierra National Forest. They occur from the 1,000 foot elevation in their winter ranges to over 10,000 feet in their summer ranges. Deer utilize six major plant communities. Winter range areas are comprised of foothill annual grass/woodland, chaparral, and the lower edge of the Yellow Pine forest. Deer summer range sites are comprised of Yellow pine forest, red fir forest, subalpine forest, and Alpine fell-fields plant communities. Most deer in the forest are migratory; that is, they migrate upslope and downslope with the seasons, using traditional migration routes.

On low elevation deer winter ranges, deer are primarily browsers as they arrive in November. Normally, annual grass and forbs turn green by early November when stimulated by October storms, and growth is slow due to cold temperatures. By late January, the volume of annual grasses and forbs has increased and deer switch to a predominantly grass/forb diet. From January to April, deer continue to graze on herbaceous forage plants. New growth on shrubs begins in March. As a result, deer begin to forage more heavily on the new browse growth with its high protein content.

By late April and early May, deer leave the winter range for their traditional summer ranges, and their diet changes to include approximately 31% browse, 26% grass, and 38% forbs. Browse levels increase in the diet while herbaceous forage use decreases (to about 5%). Proportionately high use of browse continues through early to mid-June while deer are on their migration routes and in the lower summer ranges.

Pregnant does appear to select their home ranges from available areas near where they were raised. Common to all sites is the proximity to meadow or riparian types, availability of forested areas or brushy thickets for shaded bedding and escape cover, and nearby brushfields or logged-over areas for forage. Down trees or cull logs are also used for hiding cover for fawns.

Pregnant does drop their fawns in dense conifer thickets, dense shrub thickets, and sometimes in dense shrub/young conifer thickets adjacent to some montane meadows or other riparian areas. They seek habitat conditions which provide ample forage, water, and cover to permit successful rearing of fawns. They avoid areas in direct sun, and areas with low soil and air temperatures to drop their fawns. Fawn parturition takes place about the first week of July. After parturition in dense vegetated thickets (fawning areas), Neal (ret. PSW, pers. comm.) found does with newborn fawns utilizing stringer meadows more than open meadow situations. Stringer meadows provide the elements needed for fawn rearing such as: conifer cover, shrub cover, tall forbs for fawn hiding and thermal cover, and an abundance of herbaceous forage (near dense thickets) to meet the dietary needs of lactating does. Does with fawns will use conifer thickets, dense shrubs, and available willow thickets adjacent to meadows to hide their fawns as they forage in the open meadow situations. The early few weeks of a newborn fawn's life are spent in secluded, densely vegetated habitat which provides suitable hiding, thermal cover, and foraging habitat. Deer foraging activity in open meadow situations usually does not occur until late July and early to mid-August when fawns are old enough and strong enough to follow their mother.

Willow stands are important deer hiding cover on the Forest. This habitat is particularly important when associated with meadow edges and riparian areas. Willows are not a preferred source of food for either cattle or deer. Both cattle and deer browse willows when their preferred food source is not available. Browsing of willow by deer increases as stocking rate of cattle increases and herbaceous forage availability declines (Loft et al. 1987).

Aspen habitat provides important thermal cover, hiding cover, and forage for both deer and cattle. Even though aspen is a minor vegetation component on the Forest, they are disproportionately preferred by deer before cattle arrive early in the summer. Long-term grazing of aspen habitat by livestock can result in composition shifts to less palatable herbaceous species. Because of repeated browsing, fire suppression, and succession, the area of aspen habitat is likely declining on public rangelands in the Sierra Nevada (Loft et al. 1987).

False helebore stands may be present in many meadow-riparian areas largely because of past grazing abuse (Loft et al. 1987). While corn lily provides valuable cover, the prevalence of dense stands would not likely occur when good range management practices are utilized. Cattle often trample stands of corn lily by mid-summer, but even in the absence of cattle, hiding cover provided by corn lily is not a dependable resource because it is subject to weathering (Loft et al. 1987).

3.10 FISH AND HERPTILES

The Sierra National Forest has 1,580 miles of fish-bearing streams (1,800 miles of perennial streams total) that support populations of rainbow, brown, brook, and golden trout as well as native species of riffle sculpin, hardhead, squawfish, and suckers. These streams also support populations of amphibians and reptiles (herptiles) such as foothill yellow-legged frogs, mountain yellow-legged frogs , Yosemite toads, Pacific chorus frogs, and Western pond turtles. California red-legged frogs, a species proposed for federal listing, have not been observed on the Forest recently or historically. Western pond turtles are a Forest Service sensitive species. Portuguese and Cow Creeks are designated as essential habitat for Lahontan cutthroat trout, a

federally-listed threatened trout species. Paiute cutthroat trout, also a federally-listed threatened trout species, are found in two high elevation streams (Stairway and Sharktooth Creeks).

3.10.1 Lahontan Cutthroat Trout -- Pure Lahontan cutthroat trout (LCT) presently inhabit approximately 1.5 miles in West Fork of Portuguese Creek and one of its tributaries. This population of LCT was planted in Portuguese Creek in about 1897 by Mr. Claude Williams who had a trout rearing facility in Arnold Meadow. The carrying capacity of West Fork Portuguese Creek is about 100 LCT adults.

Pure LCT presently inhabit approximately 2 miles in West Fork Cow Creek and one of its tributaries. This population of LCT was planted into Cow Creek in about 1884 by personnel of the California Biological Survey (California Department of Fish and Game (CDF&G)).

In 1994, and again in 1995, the Fish and Wildlife Service (FWS) completed formal consultation concerning the effects of grazing on LCT in Portuguese Creek and West Fork of Cow Creek. The Biological Opinion was ... "the proposed grazing authorizations are not likely to jeopardize the continued existence of the federally-threatened Lahontan cutthroat trout (USDI Fish and Wildlife Service 1994, USDI Fish and Wildlife Service 1995)."

The Biological Opinion (1994, 1995) outlined specific restrictions to be implemented with regard to grazing in both Cow and Portuguese Creeks. These requirements are more stringent than any of the proposed action alternatives for this Forest Plan amendment and will be strictly enforced. They are applicable in all alternatives. The Biological Opinion (1994, 1995) and BA for the Plan amendment are on file for review in the Supervisor's Office.

3.10.2 Paiute Cutthroat Trout -- The present population status of Paiute cutthroat trout (PCT) in Sharktooth Lake and Sharktooth Creek is questionable at this time. Population surveys have not been conducted there since 1975. At that time the population was low. In 1973 cursory observations of the lake and outlet stream also revealed no fish. In 1975 CDFG biologists found limited numbers of Paiute trout in the outlet stream below the lake, and while no fish were seen again in the lake, it appears that a population has now become established in Sharktooth Creek (Ryan and Nicola 1976). This lake is inaccessible to cattle, therefore Sharktooth Creek is not affected by cattle grazing.

PCT occupy about 1.5 miles of stream in Stairway Creek. The approximate population size is 200 fish. Stairway Creek was last surveyed in 1991 and the strain was found to still be pure with no introgression. Stairway Creek is not affected by cattle grazing and is not located in an active allotment.

3.10.3 California Red-Legged Frog -- The California red-legged frog inhabits quiet pools and streams, marshes, and occasional ponds. They occur west of the Sierra-Cascade crest and along the Coast Ranges the entire length of the State (Stebbins 1985). It is the largest of the native frogs.

Adults feed on aquatic and terrestrial insects and crustaceans and snails, as well as worms, small fishes, and smaller frogs (USDA Forest Service 1993b). Aquatic larvae (tadpoles) are herbivorous. They are highly aquatic, preferring shorelines with extensive emergent vegetation. They usually escape to water (3 ft. deep or more) at bottom of pools to escape terrestrial predators.

The red-legged frog breeds from January to July. Females lay 750 to 4,000 eggs in clusters up to 10 inches across, attached to vegetation 2 to 6 inches below the surface (USDA Forest Service 1993b). Tadpoles require 11 to 20 weeks to reach metamorphosis (USDA Forest Service 1993b). They may require rain for dispersal. Tadpoles and adults are subject to predation by aquatic invertebrates and vertebrates such as introduced fishes (bass, crappie, bluegill, etc.), introduced bullfrogs, snakes, wading birds, and small mammals during all life stages (USDA Forest Service 1993b).

3.10.4 Mountain Yellow-Legged Frog -- This is a truly mountain species, occurring primarily at elevations from 4,500 feet to over 12,000 feet. In the Sierra, this species is associated with streams, lakes, and ponds in montane riparian, lodgepole pine, subalpine conifer, and wet meadow habitat types. The mountain yellow-legged frog (MYF) feeds primarily on aquatic and terrestrial invertebrates and favors terrestrial insects. Adults have been observed eating tadpoles of Yosemite toad (USDA Forest Service 1993b). Tadpoles graze on algae and diatoms along rocky bottoms in shallow water of streams, lakes, and ponds.

MYF usually crouch on rocks or clumps of grass within a few feet of water. When disturbed, they dive into water and take refuge under rocks. During dry conditions they may enter rodent burrows near water for refuge to escape the hot dry conditions. Breeding and egg laying at higher elevations usually occur from June to August depending on local conditions. Reproduction does not take place until lakes and streams are free of ice. Like most ranid frogs, males probably defend areas around themselves during the breeding season (USDA Forest Service 1993b). Roundish clusters of up to 500 eggs (usually 200 to 300) are deposited in shallow water and attached to gravel or submerged rocks. Tadpoles may require up to two over-wintering periods to complete their aquatic development (USDA Forest Service 1993b).

The Forest has documented sightings of MYF in five allotments, listed below. There are three confirmed sighting of MYF in three vacant wilderness allotments. A complete survey has not been done on the Forest for this species.

Blasingame Allotment (Active)
Patterson Allotment (Active)
Paiute Allotment (Vacant)
Upper Mono Allotment (Vacant)
Red Mtn./Black Cap Allotment (Vacant)

3.10.5 Foothill Yellow-Legged Frog -- Habitat is primarily in or near rocky streams in a variety of habitats, including valley-foothill hardwood, valley-foothill hardwood/conifer, valley-riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow types. The foothill yellow-legged frog (FYF) may occur as high as 6,000 feet in the Sierra.

Adults feed on aquatic and terrestrial invertebrates. This species is rarely encountered far from permanent water. Eggs are laid in spring in compact clusters of 150 to 1,000 eggs around stones in cool water (<18.3 C) streams at edges of riffles from March through June. The incubation period is 1 to 2 weeks. Tadpoles require 2 to 4 months to reach appropriate size for metamorphosis. FYF reach maturity 1 to 3 years after metamorphosis.

There are six historical sightings (1970) in four allotments in the Forest. A complete survey has not been conducted for this species on the Forest. Only the Jose allotment has confirmed sightings (1994). The others are presumed extant. FYF have been sighted in the following creeks:

Kings River RD	Sycamore allotment	Big Creek
Minarets RD	Non-grazing area	S.F. Willow Creek
Kings River RD	Sycamore allotment	Rush Creek
Pineridge RD	Jose allotment	Jose Creek

3.10.6 Yosemite Toad -- This toad is restricted to the vicinities of wet and dry meadows in the central High Sierra Nevada range. It ranges from Eldorado County south to southern Fresno County. It occurs at elevations of 6,400 to 11,300 feet. The Yosemite toad (YT) primarily frequents montane wet and dry meadows, but also occurs in seasonal ponds associated with lodgepole pine and subalpine conifer forests.

Their diet includes beetles, ants, mosquitos, dragonfly nymphs, larval Lepidopterans, centipedes and spiders (Grinnel and Storer 1924; USDA Forest Service 1993b). Tadpoles feed on bottom detritus or by filtering suspended plant material and planktonic animals.

During inactive periods, YTs seek cover inside abandoned rodent burrows or move to adjacent forest stands (USDA Forest Service 1993b). Individuals occasionally hide under rocks in streambeds. When disturbed, they often hop into nearby water (USDA Forest Service 1993b) or seek cover in abandoned rodent burrows.

The mating system is polygynous. Males defend small areas around themselves during the breeding period. These defended spaces change as the toad moves location. Breeding and egg-laying occur from mid-May to mid-July, and males generally appear at breeding sites a few days before the females. Mean clutch size is about 8,000 eggs (USDA Forest Service 1993b). Females may not breed every year. Tadpoles metamorphose during the first summer or fall after eggs are deposited. First breeding is at 3 to 5 years for males and 4 to 6 years for females (USDA Forest Service 1993b).

There are several recorded sightings of YT on five active allotments and three vacant wilderness allotments, listed below. Numbers of individuals observed range from <50 to several hundred in meadows within these allotments. A survey for this species has not been completed on the Forest.

Blasingame allotment	Pineridge RD
Kaiser allotment	Pineridge RD
Paiute allotment (vacant)	Pineridge RD
Bear Creek (vacant)	Pineridge RD
Mt. Tom allotment	Pineridge RD
Red Mtn/Black Cap (vacant)	Kings River RD
Dinkey allotment	Kings River RD
Iron Creek allotment	Mariposa RD

3.10.7 Western Pond Turtle -- Western pond turtle (WPT) is uncommon to common in suitable aquatic habitats throughout California, west of the Sierra-Cascade crest. The Central Valley area of California and the Sierra National Forest is defined as a zone of intergradation between northwestern pond turtle and southwestern pond turtle (pers. comm. Holland 1994). It ranges from sea level to 6,000 feet. WPT is associated with permanent or

nearly permanent water in a wide variety of habitat types such as small streams or ponds. In the Sierra National Forest, turtles are found in a variety of aquatic habitats such as the major rivers (Kings River and San Joaquin River), small tributary streams in the foothill annual grass, chaparral, and oak woodlands, major reservoirs and afterbays, stock ponds, and marshy bogs. WPTs are considered omnivorous, feeding on aquatic plant material, including pond lilies, beetles, and a variety of aquatic invertebrates, as well as fishes, frogs, and sometimes carrion (USDA Forest Service 1993b).

Western pond turtles have been observed in twelve allotments with numbers of sightings ranging from one to several within each allotment. While not all potential areas of suitable habitat have been surveyed, it is expected that the numbers of recorded sightings will increase as surveys are completed. Several private farm ponds or small man-made reservoirs on private land outside the National Forest boundary (base property) also support populations of western pond turtles. Sugarloaf Allotment has several man-made stock ponds which support 25+ turtles (pers. comm. Bickel, USFS 1993). Western pond turtles have been sighted in the following creeks tributary to the San Joaquin and Kings Rivers below 4,500 feet:

MARIPOSA RD	ALLOTMENT
Carter Creek	Soquel

MINARETS RD	ALLOTMENT
North Fork Willow Creek	N/A
South Fork Willow Creek	N/A
Whiskey Creek	Castle Peak
Indian Creek	Castle Peak
Saginaw Creek	Castle Peak
Hookers Creek	N/A
Ross Creek	N/A
Fish Creek	N/A
Rock Creek	Haskell
Chiquito Creek	Chiquito
W.F. Chiquito Creek	Chiquito
Willow Creek	Castle Peak/Long Ridge

PINERIDGE RD	ALLOTMENT
Italian Creek	Jose
Jose Creek	Jose
Mill Creek	Jose
Stevenson Creek	Jose
Big Creek	Jose
Black Creek	N/A
Aspen Creek	Kaiser
Horse Thief Creek	Kaiser
Mill Creek (lower)	Mt. Tom
Musick Creek	Jose
Trib. 6 to Jose Creek.	Jose
Trib. 1 to 5 Jose Creek	Jose

KINGS RIVER RD	ALLOTMENT
Big Creek	Sycamore/Thompson
Lower Rancheria Creek	Thompson
Sycamore Creek	Sycamore
Dinkey Creek	Thompson/Patterson
Basin Creek	Patterson
Patterson Creek	Patterson
Billy Creek	Billy Creek
Trib. 21 to Big Creek	Sycamore/Haslett
Providence Creek	Blue Canyon
Rush Creek	Sycamore

3.11 PLANT SPECIES OF CONCERN ON FOREST RANGELANDS

Of the 20 sensitive plant species on the Sierra National Forest list, 11 are not likely to experience effects of cattle grazing because of their location in ungrazed areas or the inaccessibility of their habitat. (See Biological Evaluation for Sensitive Plants for details). Four species have the potential for some grazing impacts, and three are directly affected by grazing to varying degrees. Two species, Carpenteria californica and Calyptridium pulchellum were proposed for federal listing on October 4, and are treated in a Biological Assessment.

3.11.1 SENSITIVE PLANT HABITATS WHICH ARE NOT USED EXTENSIVELY BY CATTLE

The following sensitive plant species could be affected by cattle if a particular population were used as a thoroughfare or a bedding area, but do not generally occupy habitat that is likely to directly attract cows.

3.11.1a Mono Hot Springs evening primrose (Camissonia sierrae spp. alticola) -- An ephemeral annual which grows in gravelly granite "pans" associated with granite outcrops, generally above 4,000 feet. Plants germinate, flower, and set seed in the course of just a few weeks, often before on-dates for cattle. The rocky areas inhabited by these plants are not likely to be traversed by cows.

3.11.1b Kettle Dome buckwheat (Eriogonum prattenianum var. avium) -- A low, rounded sub-shrub first described in 1989. Plants are restricted to granitic and metamorphic outcrops between 6,000 and 9,500 feet. The rocky habitat is generally inaccessible to cattle.

3.11.1c Many-flowered fawn lily (Erythronium pluriflorum) -- A bulb-forming perennial, generally restricted to granitic rocky slopes, but also found in subalpine coniferous forest where canopy closure is significant. Most plants grow in rocky areas on granite domes around Shuteye Peak and Chiquito Ridge, but a few areas could experience incidental cattle use, though they do not contain abundant forage.

3.11.1d Golden lupine (Lupinus citrinus var. citrinus) -- This annual lupine occurs between 2,000 and 5,000 feet in the foothills and lower conifer forest of Fresno and Madera Counties. Thirty four of the approximately 50 known populations occur on the Sierra National Forest south of the San Joaquin River. Typical habitat is edges of and gravelly shelves of granite outcrops in exposed, treeless areas not expected to attract cattle.

3.11.2 SENSITIVE PLANT HABITATS WHICH ARE USED EXTENSIVELY BY CATTLE

3.11.2a Rawson's flaming trumpet (Collomia rawsoniana) -- Collomia rawsoniana (CORA) is a riparian-dependent perennial herb that relies upon the moist, cool conditions found along streams in mid-elevation conifer forests. It is endemic to the Sierra National Forest, and is largely restricted to the San Joaquin River watershed at elevations of 3,500 to 7,000 feet. The most vigorous colonies occur at 4,500 to 6,000 feet, usually within 100 feet of streams or meadows. CORA populations are difficult to enumerate, as they occur in colonies of varying sizes distributed at varying densities along perennial streams and their tributaries. Colonies range from less than 10 stems to several thousand stems.

CORA spreads vegetatively by rhizomes. Rhizomatous growth may extend the area occupied by one genetic individual (genet) greatly, and at this time the extent of a typical CORA genet is unknown. Flowering in CORA starts in June at the lower elevations and continues through August at the higher elevations. Hevron (1989) studied the pollination ecology of CORA and determined that hummingbirds are important CORA visitors, bringing about cross-pollination, which is important for maintenance of genetic variability. Seedling establishment in CORA appears to be a rare event (Hevron 1989, Liskey 1993). Knowledge of genetic variation within and between populations is needed in order to know how crucial it is to protect CORA seedlings from livestock disturbance.

The Haskell and Central Camp allotments encompass most of the known CORA, each containing over 10 miles of streams documented to support CORA populations. The Soquel, Castle Peak, and Chiquito allotments contain small populations of CORA, less than 2 miles total each.

An Interagency Agreement (IA) between the United States Forest Service and the United States Fish and Wildlife Service was signed in 1985 and extended in 1988 (USDI Fish and Wildlife Service 1985, USDI Fish and Wildlife Service 1988). The IA restricts management activities within a 150-foot zone on either side of 13 stream reaches. (See the Species Management Guide for CORA prepared by Lorenzana, Sierra National Forest 1987). The emphasis at that time was on protecting CORA from timber harvest, but the IA does state that intensive livestock grazing should not be allowed either.

CORA has the most potential for impact by cattle of all the Sierra National Forest sensitive plants. In 1991, a study to assess the effects of several types of disturbance on CORA was begun. It involved taking extensive data on plant vigor, reproduction, and area occupied in relation to environmental variables such as light, soil moisture, and soil compaction in connection with logging, cattle grazing, and fire (Liskey 1993). Data was taken before and after treatments such as thinning and skidding, excluding cattle, and burning. In 1992, the first year after the experimental treatments, many of the eighteen 5 x 5 m plots were heavily grazed and trampled, to the point that the experiments were rendered inconclusive in some cases. In 1993, the same level of grazing or worse was seen in all plots that were not fenced. Data was taken on grazing pressure all 3 years. By 1994, 13 plots had been fenced, leaving 5 open to cows. Data was taken again in 1994, and is currently being analyzed along with videotape footage of all study plots at the beginning and the end of the 1994 grazing season. Measures are being developed to lessen the likelihood of direct and indirect impacts to CORA through terms of the grazing permit and annual operating instructions.

3.11.2b Yosemite ivesia (Ivesia unguiculata) -- Ivesia unguiculata (IVUN) occurs in montane meadows in conifer forests between 5,000 and 8,000 feet elevation in Madera and Fresno Counties. There are approximately 54 known occurrences, 48 of which are found on the Sierra National Forest, and 5 of which are found in Yosemite National Park. New populations continue to be discovered each year during surveys in appropriate habitat, all within the currently mapped range of the species.

IVUN is a perennial growing in densely arranged tufts from a thick caudex. The plants reach heights of 3.5 dm, stems are glandular and tend to have a reddish cast. Leaves are silky-hairy and finely divided into dissected leaflets reminiscent of yarrow leaves (Achillea millefolium). Inflorescences are usually fewer than 10-flowered, and the white petals are 3 to 4 mm long. Flowering is from June to August.

There have been no studies of the effect of grazing and trampling on IVUN, only subjective observations that it responds favorably to grazing and other types of disturbance. (IVUN is classified as an invader or low value species for purposes of determining range condition). Ungrazed IVUN populations in Yosemite National Park or in the PG&E exclosure at Hall Meadow on Kings River Ranger District are more erect and tall in stature, and appear to flower more vigorously (J. Clines observation).

3.11.2c Bolander's clover (Trifolium bolanderi) -- Trifolium bolanderi (TRBO) is known only from Fresno, Madera, and Mariposa counties, in meadows between 6,800 to 7,300 feet (Ratliff and Denton 1993). Approximately 30 occurrences are on the Sierra National Forest, and 5 are in Yosemite National Park. Populations range in size from a few hundred to more than 10,000 plants. TRBO is a perennial plant reproducing by both rhizomes and seed. Plants are glabrous, and stems are up to 2.5 dm long, with reflexed lavender corollas and dark purple to black calyces.

There is little information on ecological status or response to grazing for TRBO, but it has been predicted to be an "increaser" (a species that initially responds to overgrazing by increasing in abundance) (Ratliff and Denton 1993). It seems to prefer wet sites on cool slopes where snow remains longer (Ratliff and Denton 1993). A study of habitat characteristics such as aspect, shade, hydrology, and elevation found no obvious correlation between any of these factors and the limited distribution of TRBO (Ratliff and Denton 1993). TRBO was found to have a wide ecological amplitude with regard to soil acidity, temperature, and water relationships (Ratliff and Harding, 1993). Current research on rhizobial relationships may help explain the limited distribution of TRBO. Currently, defoliation experiments are being conducted on TRBO by PSW, to increase understanding of its probable response to grazing. Ratliff and Denton (1993) noted that a more decumbent growth habit was observed in grazed versus ungrazed plants, but that population size did not appear to be correlated with grazing (the smallest populations [<100] occurred on grazed sites, as did the largest [>10,000]). Ratliff concludes total protection from cows is not necessary based on their findings.

3.11.3 PLANT SPECIES PROPOSED FOR LISTING

3.11.3a Carpenteria (Carpenteria californica) -- Carpenteria californica (CACA) is an evergreen shrub that occurs only in a 225 square mile region of the Sierra Nevada foothills in eastern Fresno County. It is currently being considered for listing as threatened under the federal Endangered Species Act and was listed as

state-threatened in 1991. CACA is considered a relictual species, formerly more widespread when the climate was cooler and moister. Plants are found from 1500 to 4,000 feet, mostly in chaparral, but some plants are found in the lower yellow pine belt. CACA shrubs tend to concentrate and grow most vigorously in draws and ravines in well-drained granitic soils where moisture is relatively abundant.

Cattle have been shown to damage seedlings and resprouts of CACA after wildfire (Clines 1994); however, damage from cattle grazing or trampling has not been seen in mature stands of CACA. Any wild or prescribed fires in CACA habitat will be carefully protected from cattle access during the first few years after burning.

3.11.3b Mariposa pussy paws (Calyptridium pulchellum) -- Calyptridium pulchellum (CAPU) is a tiny annual known from only 6 sites. Habitat is gravelly soil on granite outcrops. The one CAPU population on the Sierra National Forest has been fenced for 3 years. Despite intensive searching for additional populations in appropriate habitat, CAPU has not been found elsewhere on the Forest. CAPU has been proposed for endangered status under the federal Endangered Species Act.

3.12 RIPARIAN RANGELANDS

Riparian areas are water courses and assemblages of vegetation associated with water. These areas occur at all elevations in the Forest and consist of the aquatic ecosystem, riparian ecosystem, floodplains, wetlands (including wet meadows), and the first 100 feet of the Streamside Management Zones (SMZs) on either side of perennial streams. Typically, riparian vegetation forms a narrow band of deciduous shrubs and trees that is distinctly different from adjacent vegetation.

Characteristics of riparian vegetation change with elevation. The lower elevation streams and rivers are usually bordered by dense stands of water-loving trees and shrubs. With increasing elevation, the width of the riparian zone decreases and the size and density of associated trees and shrubs is reduced. Riparian areas of the Forest have not all been individually inventoried or mapped, but Forest data indicates 480 inventoried lakes and 1,800 miles of perennial streams and rivers. The perennial water courses (approximately 157,000 acres) and lake margins (approximately 4,000 acres) comprise the riparian habitat in the Forest. In addition, there are approximately 37,900 acres of wet meadows. About half of the Forest's riparian areas are located in wilderness or remote areas.

Many riparian areas have been surveyed/inventoried on the Forest during Avian guild monitoring, WINI, and fish habitat surveys. The presence of water and green vegetation makes riparian areas attractive and important to grazing. Fish are totally dependent upon the surface waters within riparian areas, and riparian areas are either important or essential habitat for the majority of wildlife species on the Forest. While occupying relatively small areas of land, riparian areas strongly influence how watersheds function. By influencing the timing and quality of water produced, the condition of riparian areas can have significant, far-reaching, economic and environmental consequences. In addition, diversity of vegetation is an important characteristic of the Forest riparian areas. Woody and herbaceous plants slow overland flood flows and provide a protective blanket against the erosive force of water. Foliage provides shade for streams keeping water temperatures low. Riparian vegetation

produce a variety of root systems that bind the soil and keep it in place. It also filters out sediments which builds streambanks and forms productive wet meadows and floodplains and reduces sedimentation in water supply and hydroelectric reservoirs (Chaney, Elmore, and Platts 1991).

3.13 HERITAGE RESOURCES

Archaeology resources were described and analyzed in the Final Environmental Impact Statement for the Forest Plan. Heritage resources will not change because of actions analyzed in this document. Heritage resources will be addressed in site specific NEPA documents for individual allotments. It is anticipated NEPA will be completed for all active allotments within 7 years.

Heritage resource properties in the Forest represent the record of human land use over at least the past 7,000 years. This record is contained primarily in archaeological, ethnographic, and historic properties.

Archaeological properties range from small scatters of obsidian toolmaking debris to large habitation sites containing a wide variety of features and artifactual remains. Information about past lifeways and environments is extracted through the scientific study of these features and artifacts, as well as the contextual relationships among them.

Historic properties represent about 125 years of relatively intense use of the Forest's natural resources, primarily by Euro-American cultural groups. Homesteading, mining, forest products extraction, hydroelectric development, grazing, recreation, and Forest Service administration are major activities that left a mark on the land. Historic properties include transportation and communication networks, cultural landscapes, mining activities, cabins, trapping, cow camps, dams and flumes, and the remains of early logging systems. Heritage resources also include areas of cultural and religious importance to local Native groups. In addition there are cultural resources connected with forest land use by various ethnic and occupational groups, such as Basques, retired loggers, and ranchers. Approximately 385,000 acres or 30% of Federal land within the Forest have been reliably surveyed for cultural resources, yielding 3,954 properties.

CHAPTER IV. ENVIRONMENTAL CONSEQUENCES OF EACH ALTERNATIVE

This chapter of the assessment discusses the expected or potential direct, indirect, and cumulative impacts on each of the resource areas described in 3.0 Affected Environment of the alternatives considered in detail in 2.0 Alternatives Including the Proposed Action. The intent of this chapter is to provide a scientific and analytical basis by which to compare the alternatives.

4.1 Alternative 1 - Maintain Current Grazing Guidelines (No Action)

4.1.1 Range -- By not formalizing specific utilization standards in the Forest Plan, implementation and compliance problems would most likely continue. There would be lack of clarity with the public, permittees, and other Forest Service employees as to allowable use and means of measuring that use. This would result in a slower rate of compliance than Alternatives 2, 3, and 4.

In addition, subjectivity regarding the selection of monitoring transects in wet, moist, and dry meadows, and the process of measuring individual plant heights would continue to maintain skepticism about how much use is actually occurring. Monitoring would not be repeatable, i.e., two individuals would not necessarily measure along the same transect or measure the same grass heights. Random sample monitoring with a team would reduce mistrust, at least for those who participated. Some knowledge of plant identification would be required making independent monitoring by the public difficult. Allowable use is based on growth which changes on a yearly basis making accurate ocular estimates by permittees difficult.

4.1.2 Meadow Range Condition

Under the No Action Alternative there would be a continued slow, long-term improving trend toward an increase in climax species (Excellent Condition) in wet, moist, and dry meadows. Members of the public as well as a number of Forest Service employees feel many meadows are improperly rated to allow a higher rate of utilization. This alternative would not respond to the issue concerning the accuracy of meadow range condition ratings, nor would it change the opinion of those who feel meadows are rated too high. Utilization levels would continue to be based on meadow range condition ratings and annual herbage growth, i.e., the higher the meadow rating, the more that can be utilized. Monitoring would not provide information that would suggest that a meadow range condition was or was not properly classified.

4.1.3 Fire -- Although it is difficult to quantify the effect grazing of annual grasslands has on fire management, there is no doubt grazing at the proposed levels reduces potential light or flashy fuel-loading. Reduced fuel-loading results in smaller fires that cost less to suppress and are contained in a shorter time frame.

4.1.4 Economic and Social -- The extent of reduced permit numbers or seasons of use that would result from this alternative is not known. However, it is anticipated that there would be little or no change to Forest permittees or their current operations as compared to Alternatives 2, 3, or 4. The extent to which adjustments are made on any given allotment would depend on the trend in range condition ratings associated with each allotment. Costs to implement this alternative would be spread out over the length of the analysis scheduled to be completed by 2003.

4.1.5 Water Quality -- Stream bank erosion, aggravation of existing erosion in meadows, nick points leading to gully erosion, and downstream sediment caused from cattle watering or crossing channels would continue.

4.1.6 Soils -- Utilization is based upon what growth has occurred during a particular year. The productivity of annual grasslands and montane meadows can vary significantly due to drought or a shortened growing season due to a prolonged heavy snow pack. When production in montane meadows is below normal there would be: (1) less residual grass height for soil cover; (2) less herbage to cushion soil from cattle trampling; and (3) less organic matter left after grazing to maintain soil productivity.

In years with above normal vegetative growth there would be: (1) increased grass height left for soil cover, (2) more herbage to cushion cattle trampling, and (3) increased additions of organic matter to the soil to maintain productivity.

If future years were normal or above normal then the utilization standards would provide for the protection and long-term productivity of the soil. If, however, there are many years with below normal vegetative growth, there is an increased risk of: (1) soil erosion, (2) decrease in soil porosity, and (3) reduction in soil organic matter and productivity.

4.1.7 Timber -- The allowable use standards will result in no impacts to adjacent timber stands. None of the alternatives differ as to the indirect effects that may occur to individual tree plantations from mechanical damage or browsing.

4.1.8 Wildlife

4.1.8.1 Valley Elderberry Longhorn Beetle -- Alternative 1 of the Forest Plan amendment and incorporation of allowable use standards for herbaceous forage removal should not create a direct effect on Valley elderberry longhorn beetle (VELB). Cattle are normally on the low elevation allotments at a time when there is an adequate volume of green herbaceous annual grass forage, upon which cattle concentrate on during the spring time of the year. The incorporation of Forest forage allowable use standards for annual grass ranges are considered adequate to protect the resources. This standard maintains 400 lbs./acre of residual dry matter (RDM) on flat areas, 500 lbs./acre on gentle slopes, and 800 lbs./acre on steeper slopes. The Forest allows no overgrazing of these ranges. It is also unlikely that livestock will consume stems greater than one inch in diameter. Cattle have been observed foraging on elderberry plants; however, damage to plants was not observed (Barr 1991:53). The Biological Assessment for VELB concluded that there are no direct, indirect, or cumulative effects from the proposed Forest Plan amendment to incorporate specific allowable use standards for cattle grazing in Alternatives 1, 2, 3, or 4.

Because the Valley elderberry longhorn beetle does not rely on willows or aspen for mating, egg laying, and pupation, the proposed willow and aspen standards will not be discussed further in this document for VELB.

4.1.8.2 Willow Flycatcher -- No improvement of hedging and highlining of potential willow flycatcher habitat would occur. Identified willow flycatcher

nests would be fenced, but potential interaction of cattle and nesting birds and accidental nest destruction by brushing against the willow plants may continue where bird locations are not known. The Forest Service will be conducting a detailed survey and monitoring of flycatchers in California, during the next ten years.

4.1.8.3 California Spotted Owl, Northern Goshawk, Great Gray Owl, Fisher, Marten and Sierra Nevada Red Fox -- There would be no loss of nesting, denning, and resting habitat (dense canopied conifer forest) from implementation of this alternative. In addition, the Forest has established a management strategy for spotted owls by setting aside 103,050 acres of designated spotted owl base habitat areas (BHA) and Protected Activity Centers (PACs) on twenty-four allotments. The Forest has also established a management strategy by setting aside Furbearer Habitat Areas (FHAs) totalling 62,140 acres and 4,180 acres of travel or dispersal corridors. Fourteen allotments support portions of the FHAs, while nine allotments support portions of the designated travel or dispersal corridors. There would be no loss of prey base from implementation of this alternative.

4.1.8.4 California Mule Deer -- In isolated areas where cattle concentrate, there would be continued competition for herbaceous forage between cattle and deer. This competition would be particularly evident in riparian areas where willows are hedged and/or highlined. Corn lily stands, aspen, and other tall vegetation used by fawns for hiding cover in meadow-riparian areas would continue to be impacted by cattle. Hedging and highlining of willows having potential to become hiding habitat for deer would continue in isolated areas.

4.1.9 Fish and Herptiles

There are several direct and indirect effects of grazing on fish and herptiles. These potential effects pertain to all alternatives.

1. Removal of streamside vegetation by cattle leads to higher water temperatures, which is detrimental to fish and juvenile stages of herptiles. Streamside vegetation is also important for foraging and hiding cover for adult and young herptiles.

2. Silt-free gravel substrates are important habitat components for Lahonton cutthroat trout and other trout species. When livestock trample stream banks, this can introduce sediment into the stream and cause vegetation loss on the banks.

3. Bank trampling and chiseling leads to reduction of undercut banks which are used by both fish and amphibians for escape cover. This also causes widening of stream channels, which causes them to become shallower and, therefore, of lower quality for herptiles and fish, which need deep pools for high quality habitat.

4. Frequent crossing of streams and watering instream by cattle can cause increased sediment input, leading to reduction of pool frequency (filling of pools) and depth. Pools are important rearing and resting habitat for both fish and herptiles. Sedimentation of spawning gravels and other substrates can also occur, which is detrimental to fish and insect production.

4.1 Alternative 1. - continued

5. Frequent crossings of streams and watering instream by cattle can directly disturb and dislodge frog eggs attached to rocks and vegetation within streams. Disturbance by livestock discourages turtles from basking in open areas around ponds or stream edges.

6. Western pond turtles can also be affected by livestock grazing away from the stream. Livestock can directly disturb turtle nest sites which can be up to 1,200 feet from water, usually in open grassy terrain. This affect can occur from early May to July, and includes damage to eggs within nests and disruption of female nesting behavior.

   Hatchlings usually overwinter in the nests (Holland 1991:33,35), so they are vulnerable to cattle trampling from July to March. The hatchlings are also susceptible to cattle trampling as they travel from the nest to the stream in the spring. Some hatchlings leave the nests as early as November and travel to the stream, so winter grazing could affect them.

   Some Western pond turtle adults migrate great distances (up to .5 km) from water to find suitable overwintering sites under logs, duff, and litter in forested areas (Holland 1991). If there is winter grazing, adult Western pond turtles are susceptible to cow trampling as they travel to and from these overwintering sites and while in hibernation.

7. Yosemite toads are also vulnerable to cattle trampling in areas outside riparian zones. Yosemite toad movement to and from breeding sites can be extensive (1/2 mile). Yosemite toads also move away from riparian/meadow areas in the winter to adjacent forest stands to hibernate. They sometimes hibernate in meadow sod. During these times, they are susceptible to trampling by cattle. Eggs are laid in shallow pools in wet meadows or in shallow tarns surrounded by forest. Eggs and hatchlings are susceptible to cow disturbance from April to August.

8. There are no verified observations of California red-legged frogs (CRF) within or adjacent to the Sierra National Forest. All historical observations we have are in locations well outside the Forest boundary, and they are more than a decade old. It is thought that the CRF has been eliminated from as much as 75% of its historic range, including the mountain ranges and foothills of Southern California, as well as the Central Valley floor (Bombay 1993). The Biological Assessment for the CRF concluded that, since there are no CRF on the Forest, there are no direct, indirect, or cumulative effects from Alternatives 1, 2, or 3.

   Recent surveys of all historic sighting locations in the San Joaquin Valley were conducted by Jennings, and no California red-legged frogs were found (pers. comm. Buck, USFS).

All alternatives considered in detail have the same potential to affect herptiles in non-riparian areas. The alternatives differ in their potential to affect streamside vegetation, bank stability, instream sedimentation and direct impacts to fish and herptiles within riparian areas. Research suggests that utilization rates of 65% or higher result in altered riparian habitat condition while 25% or less had little affect (Clary and Webster 1989). Allen (1989) found that if utilization was 60% or lower, no meadows in the study site had signs of erosion, stream bank

widening, or bare eroded surfaces. None of the alternatives would allow utilization over 60%. For willows, Alternative 1 would be similar to Alternatives 2 and 3, at 30% maximum use.

When compared to the other alternatives, this alternative has: (1) the highest risk of trampling herptile eggs and adults; (2) less escape and forage cover for herptiles; (3) more trampling and chiseling; (4) higher stream temperatures; and (5) more sedimentation.

4.1.10 Threatened, Endangered, Proposed, and Sensitive Plants

For Camissonia sierrae spp. alticola, Eriogonum prattenianum var. avium, Erythornium pluriflorum, and Lupinus citrinus var. citrinus, there is no difference in effects between alternatives.

4.1.10a Collomia rawsoniana -- None of the alternatives proposed in the EA will significantly change the status quo for Collomia rawsoniana (CORA). Cumulative effects have occurred as a result of cattle grazing and trampling over the years, especially during the intensive overgrazing that occurred in the late 1800s and early 1900s by sheep and cows. CORA has also been impacted by logging, skidding, and road building associated with timber management, although these impacts are probably relatively insignificant today given measures taken to protect streamside zones and adherence to the terms of the Interagency Agreement with USFWS. Specific grazing guidelines to protect CORA on a site-specific basis will be recommended for development and implementation in 1995 regardless of which alternative is selected.

4.1.10b Trifolium bolanderi and Ivesia unguiculata -- These species would continue to be grazed at the current level and would be expected to maintain the number and size of populations currently in existence. Cumulative effects have occurred for both species, caused by severe overgrazing of meadows in the past, logging practices before meadow protection measures became important, and, in some cases, recreational use by pack stock. Monitoring will be implemented so that site-specific measures can be taken to protect either species if there is evidence of a declining trend.

4.1.10c Calyptridium pulchellum and Carpenteria californica -- None of the alternatives would be expected to change the status quo for Calyptridium pulchellum, since the only population on the Forest is fenced, or for Carpenteria californica (CACA), since the annual grassland standards are not being significantly changed, and since CACA generally grows in chaparral that is difficult for cattle to access. CACA is vulnerable to grazing for the first 3 years after wildfire, and restrictions on grazing would need to be applied on a case-by-case basis in these situations.

Cumulative effects to both species have occurred over the years as a result of fire suppression, fuel break construction and maintenance, type conversion of chaparral to nonnative grassland, road construction, introduction of nonnative annual grasses and forbs, and off-road vehicle use. On adjacent private land, loss of habitat for CACA continues as residential development accelerates.

4.1.11 Riparian -- Livestock use in riparian areas under Alternative 1 will continue as in the past. Without monitoring a key indicator species, it will not be known if the general health of riparian area would be changing.

4.1.12 Heritage Resources -- The impacts to heritage resources would remain at current levels. It is not fully known what those levels are at this point in time. Livestock grazing may be considered part of the setting for a historic property, such as a historic "cow camp", and so long as it would not alter the cow camp, grazing would have a beneficial effect on this heritage resource. Under all alternatives, heritage resources would be assessed on a site-specific basis during analysis for term permit issuance.

4.2 Alternative 2 - Amend Forest Plan to Incorporate Utilization Tables from Draft Region 5 Rangeland Analysis Field Guide (1993)

4.2.1 Range -- Formalization, incorporation, and publication of specific utilization standards into the Forest Plan would result in better compliance because both Forest Service employees and the public would better understand the utilization tables and how to use them. However, subjectivity regarding selection of monitoring transect locations and the process of measuring individual plant heights would continue, as described in Alternative 1. Monitoring of wet, moist, and dry meadows would not be repeatable. As in Alternative 1, use of a monitoring team would help, at least for those who participated. Some knowledge of plant identification would be required, making independent monitoring by the public difficult. Utilization would be based on growth which changes every year, making accurate ocular estimate by permittees difficult.

Monitoring of the willow utilization standard would result in more herd movement especially where willows are heavily hedged.

4.2.2 Meadow Range Condition -- This alternative would result in a slightly faster rate of range condition change toward good and excellent ratings and an increase of climax species in wet, moist, and dry meadows than under Alternative 1. This slow improvement results from formalization, incorporation, and publication of specific utilization standards into the Forest Plan, which makes implementation easier and simpler and results in improved compliance. There would be continued external and internal mistrust concerning range meadow condition classification, as described in Alternative 1.

4.2.3 Fire -- Same as Alternative 1.

4.2.4 Economic and Social -- The extent of reduced permit numbers or seasons of use that would result from this alternative is not known. However, it is anticipated that there would be relatively less forage available than under Alternative 1, and relatively more forage made available than under Alternatives 3 or 4. The extent to which adjustments are made on any given allotment would depend on the trend in range condition ratings associated with each allotment. Costs to implement this alternative would be minimal once grazing permittees and/or interested publics are adequately trained to conduct the monitoring. Initial high administrative costs for range analysis and monitoring would occur the first several years.

4.2.5 Water Quality -- Stream bank erosion, aggravation of existing erosion in meadows, nick points leading to gully erosion, and downstream sediment caused from cattle watering or crossing channels will be reduced. With the addition of

the willow standard and improved compliance, cattle will spend less time in and immediately adjacent to stream channels. This will result in an improvement in water quality when compared to Alternative 1.

4.2.6 Soils -- Same as Alternative 1.

4.2.7 Timber -- Same as Alternative 1.

4.2.8 Wildlife

4.2.8.1 Valley Elderberry Longhorn Beetle -- Same as Alternative 1.

4.2.8.2 Willow Flycatcher -- Potential nesting habitat would improve as highlined and hedged plants improve from form classes 3 and 6 to 1 and 4, i.e., hedged willows would take on a more natural appearance and form class. This improvement would also correspond to less cattle use in riparian areas which would slightly reduce the potential for interaction of cattle and nesting birds. Identified active nests will be fenced to protect them.

4.2.8.3 California Spotted Owl, Northern Goshawk, Fisher and Marten -- Same as Alternative 1.

4.2.8.4 Sierra Nevada Red Fox and Great Gray Owl -- Same as Alternative 1.

4.2.8.5 California Mule Deer -- Willows are not a preferred source of food for either cattle or deer. This makes willows an excellent indicator of locations where cattle are competing with deer for food. The utilization standard for willows would focus attention on locations where willows are hedged. The intent would be to improve the form class of moderately and heavily hedged willows (form class 2, 3, 5, and 6 toward a little or no hedged form class (form class 1 and 4). This improvement would improve hiding cover. Corn lily stands, aspen, and other tall vegetation used by fawns for hiding cover in meadow-riparian areas would be affected, by cattle, similar to Alternative 1.

4.2.9 Fish and Herptiles

Alternative 2 has less use in riparian areas than Alternative 1, and the effects would be less than those described in Alternative 1. Alternative 2 has more use in meadows than Alternatives 3 or 4, especially during a prolonged drought or a short growing season. When compared to Alternatives 3 and 4, Alternative 2 has: 1) a higher risk of trampling turtle eggs and adults, 2) less escape and forage cover for turtle, 3) more trampling and chiseling, 4) higher stream temperatures, and 5) more sedimentation. There are no verified observations of California red-legged frogs within or adjacent to the Sierra National Forest; therefore, no direct, indirect, or cumulative effects from Alternatives 1, 2, 3, or 4 on that species.

4.2.10 Threatened, Endangered, Proposed, and Sensitive Plants

4.2.10a Collomia rawsoniana -- Same as for Alternative 1, except for the slight improvements in riparian habitat that might result from the willow utilization standard, in some cases. A review of species noted as being associated with Collomia rawsoniana (CORA) indicates that willows are sometimes found with CORA, but not predictably enough to judge that CORA would be protected by protection of willows.

4.2.10b Trifolium bolanderi and Ivesia unguiculata -- The effect would be the same as for Alternative 1, except for possible reduced impact if the willow standard results in earlier removal of livestock from the meadows inhabited by these species.

For other sensitive plant species, and for proposed plant species, effects are the same for all alternatives.

4.2.11 Riparian -- The utilization standard for willows and willow monitoring would improve the form class of moderately and heavily hedged willows (form class 2, 3, 5, and 6 toward a little or no hedged form class (form class 1 and 4). This gradual improvement should also reflect an overall gradual improvement in riparian areas where hedging of willows is occurring. Components of affected riparian that would show gradual improvement include water temperature, vegetation cover, fish habitat, and diversity of plant and wildlife species. In addition, there would be more stable stream banks and reduced sedimentation. Riparian areas, with heavily hedged willows and a 10% willow use standard, would be used lightly if willow browsing is the limiting factor of use.

4.2.12 Heritage Resources -- This alternative would be similar to Alternative 1, except that the expected improvement in compliance would lead to less risk of over-grazing and soil compaction, which would, in turn, reduce the risks of trampling and exposure to heritage resources. Livestock grazing may be considered part of the setting for a historic property, such as a historic "cow camp", and so long as it would not alter the cow camp, grazing would have a beneficial effect on this heritage resource.

In addition, by reducing cattle concentrations in riparian areas, the willow standard provided under this alternative should add some extra protection for those heritage resources, particularly archeological resources, which are found in high concentrations in riparian areas. Under all alternatives, heritage resources would be assessed on a site-specific basis during analysis for term permit issuance.

4.3 Alternative 3 - Forest Plan Amendment Based on Residual Dry Matter

4.3.1 Range -- Formalization, incorporation, and publication of Residual Dry Matter (RDM) standards, standards for annual grass, and utilization standards for willow and aspen into the Forest Plan would result in better compliance because Forest Service employees, permittees, and the public would have an understanding of the utilization tables and how to use them. There would be less skepticism regarding monitoring results because: (1) monitoring could be repeated using compass and tape, and a review team could repeat the procedure to ensure the process has been properly followed; 2) if would randomly sample the entire meadow, not a preselected transect; and 3) it would require little training--therefore, permittees and the public could monitor independently. For a quick, rough estimate of RDM for cattle distribution purposes, permittees would be able to clip and weigh one or two plots they felt best represented average residue levels. In addition, permittees should be able to quickly become proficient in making accurate ocular estimates because of their experience, i.e., permittees have always based cattle distribution decisions on stubble heights, not on what has been consumed.

4.3.2 Meadow Range Condition -- This alternative would result in a slightly faster rate of range condition change toward good and excellent ratings and an increase in climax species in wet, moist, and dry meadows than under Alternatives 1 and 2. Implementation would also greatly improve trust that meadows would be properly classified because a meadow in excellent meadow range condition has more RDM than a meadow in fair range meadow condition. This means that a meadow improperly classified at a higher than actual rating would become apparent during monitoring the first year. For example, a wet meadow located at 5,000 feet in elevation and classified excellent, would have 2,900 pounds of herbage per acre left at the end of the season. If in actuality, the meadow was in fair condition, then 1,500 pounds of herbage would be left. In all likelihood, a meadow in this situation would not even grow 2,900 pounds per acre, and the discrepancy would become readily apparent.

4.3.3 Fire -- Same as Alternatives 1 and 2.

4.3.4 Economic and Social -- The extent of reduced permit numbers or seasons of use that would result from this alternative is not known. However, it is anticipated that there would be relatively less forage available, on summer allotments, than under Alternatives 1, 2, or 4. The extent to which adjustments are made on any given allotment would depend on the trend in range condition ratings associated with each allotment. Costs to implement this alternative would be minimal once grazing permittees and/or interested publics are adequately trained to conduct the monitoring and standards for key meadows have been developed. As with Alternatives 2 and 4, initial high administrative costs for range analysis and monitoring would occur the first several years. In addition, there would be a cost associated with developing site-specific forage production records and residual dry matter standards from the guidelines (see table 7), for each key meadow being monitored. It is anticipated that sampling would need to occur for four seasons.

4.3.5 Water Quality -- Stream bank erosion, aggravation of existing erosion in meadows, nick points leading to gully erosion, and downstream sediment caused from cattle watering or crossing channels will be less. Reduced utilization in meadows, coupled with the willow standard, would result in cattle spending less time in and adjacent to stream channels than under Alternatives 1 and 2. This would reduce erosion in riparian areas and improve water quality.

4.3.6 Soils -- This alternative would maintain a minimum herbage residue level (stubble height) regardless of the amount of forage produced in a particular year. In below normal forage production years, there would still be sufficient stubble for: (1) soil cover, (2) cushion to reduce trampling, and (3) organic matter incorporation into the soil (from decay) to maintain long-term soil productivity. Given the fluctuation of climate and forage production, this alternative should meet the management requirements for soil in more years than under utilization standards for Alternatives 1 or 2.

4.3.7 Timber -- Same as Alternatives 1 and 2.

4.3.8 Wildlife

4.3.8.1 Valley Elderberry Longhorn Beetle -- Same as Alternatives 1 and 2.

4.3.8.2 Willow Flycatcher -- Potential nesting habitat would improve as described in Alternative 2. The potential for interaction of cattle and nesting birds would be somewhat less than Alternatives 1 or 2 because the willow standard and lower utilization level would reduce potential contact between cattle and willows. Identified active nests will be fenced to exclude cattle interaction.

4.3.8.3 California Spotted Owl, Northern Goshawk, Fisher and Marten -- Same as Alternative 1 and 2.

4.3.8.4 Sierra Nevada Red Fox and Great Gray Owl -- Same as Alternatives 1 and 2, except there would be a slight improvement over Alternatives 1 and 2 in habitat for voles and gophers, which are part of the prey base for Sierra Nevada red fox and the great gray owl. The improved habitat is a result of more residual grass height in this alternative.

4.3.8.5 California Mule Deer -- This alternative would be the same as Alternative 2 in regards to effects on California mule deer, except there would be a slight improvement in all aspects of deer hiding cover. Even though aspen is a minor vegetation component in the Sierra, aspen types are disproportionately preferred by deer. Excluding cattle from impacted stands of aspen, as a result of this alternative, would improve browse and hiding cover in these isolated stands. In addition, this alternative reflects less use in meadow/riparian areas. Less use in these areas would result in a slow improvement in fawn hiding cover because of less herbage consumption and less trampling of vegetation by cattle.

4.3.9 Fish and Herptiles

Alternative 3 has both the willow utilization standards and the lowest use level. This should lead to riparian areas in relatively stable condition because vegetative cover and bank stability would be best maintained in this alternative. Therefore, compared to Alternatives 1 and 2, Alternative 3 has: 1) less risk of trampling herptile eggs and adults, 2) more escape and forage cover for herptiles, 3) less trampling and chiseling, 4) lower stream temperatures, and 5) less sedimentation. There are no verified observations of California red-legged frogs within or adjacent to the Sierra National Forest; therefore, no direct, indirect, or cumulative effects from Alternatives 1, 2, 3, or 4 on that species.

4.3.10 Threatened, Endangered, Proposed, and Sensitive Plants

4.3.10a Collomia rawsoniana -- There might be a slight improvement for Collomia rawsoniana (CORA) growing around meadows because more herbage should be left in general. Neither willow nor aspen predictably grow with CORA, so the aspen utilization standard cannot be relied upon to protect CORA.

4.3.10b Ivesia unquiculata and Trifolium bolanderi -- The effects to Ivesia unquiculata and Trifolium bolanderi would be least under Alternative 3, as it theoretically allows less grazing and thus less trampling. Indirect and cumulative effects are generally the same as for alternatives 1, 2, and 4.

For other sensitive plant species, and for proposed plant species, effects are the same as for all alternatives.

4.3.11 Riparian -- Effects would be the same as Alternatives 2 and 4, except there would probably be a slightly faster rate of improvement on riparian since this alternative theoretically allows less grazing.

4.3.12 Heritage Resources -- The consequences to heritage resources would be similar to Alternative 4 in that the increased vegetative material left behind would possibly provide additional protection to unidentified heritage resources. Livestock grazing may be considered part of the setting for a historic property, such as a historic "cow camp", and so long as it would not alter the cow camp, grazing would have a beneficial effect on this heritage resource. Under all alternatives, heritage resources would be assessed on a site-specific basis during analysis for term permit issuance.

4.4 Alternative 4 - Forest Plan Amendment Based Upon Desired Condition

4.4.1 Range -- Incorporation of the standards in this alternative based on minimum forage stubble height retention at the end of the permitted grazing season in montane meadows would result in better livestock distribution, uniform herbaceous residual levels, and accelerated improving range conditions. This method, because of it's simple application, is becoming a well-accepted method for expressing rangeland use. Stubble height measurements are simple, quick, and accurate. This method can be used to monitor large areas in less time than with traditional utilization study methods. Statistical reliability improves because numerous measurements can be taken in a relatively short time. This method has been used with great success in riparian areas (USDA Forest Service 1995c). With a minimum of training, utilization monitoring can be conducted by anyone. It would be simple and quick, be repeatable, and can be accomplished by Forest Service personnel, Forest grazing permittees, and interested publics. Some plant identification would be required, however, only a few key representative species would be used. Permittees and interested publics would be able to become proficient in the monitoring techniques (see Appendix D).

4.4.2 Meadow Range Condition -- This alternative would maintain herbaceous residue level (stubble height) in montane meadows, regardless of the annual forage production. It would contribute towards an accelerated rate of improvement of most riparian areas, including meadows. Elmore suggests that retention of a minimum 3 to 4 inch stubble height would maintain plant vigor, provide streambank protection, and aid deposition of sediments to rebuild degraded streambanks (Clary and Webster 1989). Studies by others indicate that vigorous woody plant growth and at least 6 inches of residual herbaceous plant height at the end of the growing/grazing season typified the riparian areas in excellent, good, or rapidly improving condition (Clary and Webster 1989). The residual plant cover appeared to provide adequate streambank protection and sediment entrapment during high streamflow periods. This rationale would also apply to most montane meadows without an incised channel (stream), except where springtime overland flows are spread uniformly over a broader area.

An approximate relationship between percent utilization and stubble height of riparian graminoids was developed based on published studies. The data suggests average utilization levels of 24 to 32 percent were obtained when riparian graminoids were grazed to a 6-inch stubble height, that average use levels of 37 to 44 percent were obtained when grazing to a 4-inch stubble height, and that average use levels of 47 to 51 percent were obtained when grazing to a 3-inch stubble height (Clary and Webster 1989). This relationship shows some continuity between the recommendation of 40 to 50 percent allowable use and the recommendation of leaving 3 to 4 inches of residual stubble height for maintenance of plant vigor (Clary and Webster 1989). The additional stubble height of 6-inches may be necessary to accelerate the improvement rate for meadows in poor or fair (unsatisfactory) range condition to reach the goal of good or excellent (satisfactory) condition as determined through range analysis.

4.4.3 Fire -- There should be no impact from implementation of the minimum stubble height levels in montane meadows and riparian areas. Wildfires historically do not burn in wet or moist meadow situations. Although it is difficult to quantify the effect that grazing of annual grasslands has on fire management, there is no doubt that livestock grazing at the proposed levels reduces the potential light or flashy fuel-loading. The residual dry matter levels proposed for annual grasslands will aid in reducing the fuel-loading while providing sufficient herbage residue to protect the soil from water and/or wind erosion.

4.4.4 Economic and Social -- As with alternatives 2 and 3, the extent of reduced permit numbers or seasons of use that would result from this alternative is not known. However, the 4-inch and 6-inch stubble height standard was tested during the 1994 grazing season with little or no change to Forest permittees or their operations. The extent to which adjustments are made on a given allotment would depend on desired condition of resource values associated with that allotment. Generally, this alternative allows for approximately 5 to 10% more use of available forage on montane meadows than Alternative 3. Costs to implement this alternative would be minimal once grazing permittees and/or interested publics are adequately trained to conduct the monitoring. This alternative has the most efficient combination of utilization standards and measurement methods for the various rangeland types that occur on the forest. As with Alternatives 2 and 3, there would be initial high administrative costs for establishment of new monitoring benchmarks or re-evaluation of existing range analysis benchmarks during the first several years.

4.4.5 Water Quality -- This alternative would result in a uniform vegetative stubble height in montane meadows and riparian areas based on associated range condition as determined by the most recent range analysis. The 4 and 6 inch stubble height levels for wet and moist ecosystem grasslands is intended to leave adequate herbaceous forage residue to protect streambanks, provide for adequate sediment entrapment, and accelerate improvement of any degraded areas, resulting in long-term improving water quality. In some areas, there would be reduced or limited livestock use in meadows with these standards, coupled with allowable use standards for willow assemblages, which would result in reduced potential for livestock-caused erosion. The overall effects would be similar to alternative 3.

4.4.6 Soils -- This alternative would maintain long-term soil productivity as one of the primary objectives of the Forest Range Management Program at levels greater than alternatives 1, 2, or 3. For a site to be considered in satisfactory condition, soils would be stable with continuous vegetative cover and rooting throughout the available profile. More restrictive standards would be used on those sites which have unsatisfactory soils conditions. The proposed stubble height levels for montane meadows and herbage residual dry matter levels for annual grasslands would provide for the following:

1) Help prevent soil loss by maintaining adequate soil cover at the end of the permitted grazing season to protect the soils, especially during overland flow in montane meadows during spring snow melt.

2) Maintain the porosity of the soil. Soil porosity (or the pore space in the soil) affects the aeration, water infiltration, and permeability of the soil.

3) Maintain an adequate level of organic matter in the soil. Soils that occur in the annual grasslands and meadows generally have high organic content in the surface. Ratliff and others (Ratliff, George, and McDougald 1987) suggest that for site protection, the herbage remaining after grazing should equal the proportion of the forage production that decomposes naturally. This translated into utilization rates of 35 to 45 percent on excellent condition meadows, which is similar to what Clary found (Clary and Webster 1989).

4.4.7 Timber -- Same as Alternatives 1 through 3.

4.4.8 Wildlife

4.4.8.1 Valley Elderberry Longhorn Beetle -- Same as Alternatives 1 through 3.

4.4.8.2 Willow Flycatcher -- Potential nesting habitat would improve at a rate greater than alteratives 1, 2, or 3 under the proposed allowable use standards for montane meadows and willow in riparian areas using resource value ratings for this species in those key habitat areas. As with the other alternatives, the potential for interaction of cattle and known nesting birds would be reduced through fencing of known sites to exclude cattle interaction. Even with improved willow conditions, potential interaction of cattle and unidentified nesting birds would still exist.

4.4.8.3 California Spotted Owl, Northern Goshawk, Fisher and Marten -- As with the other alternatives, there would be no loss of nesting, denning, and resting habitat (dense canopied forest) from implementation of Alternative 4. In addition, the Forest has established a management strategy for spotted owls by setting aside 103,050 acres of designated spotted owl base habitat areas (BHA) and Protected Activity Centers (PACs) on twenty-four allotments. The Forest has also established a management strategy by setting aside Furbearer Habitat Areas (FHAs) totalling 62,140 acres and 4,180 acres of travel or dispersal corridors. Fourteen allotments support portions of the FHAs, while nine allotments support portions of the designated travel or dispersal corridors. It is anticipated that the current prey base would increase from implementation of this alternative similar to alternative 3.

4.4.8.4 Sierra Nevada Red Fox and Great Gray Owl -- The proposed minimum stubble height levels for montane meadows should result in a more uniform herbage residue level in all meadow areas, which will improve foraging and hiding cover for small mammals which are dependant upon these montane meadows. It should enhance habitat conditions to maintain a small prey base (voles and gophers) for red fox and great gray owls similar to alternative 3.

4.4.8.5 California Mule Deer -- In those areas where it is applicable, the use of resource values for deer habitat to determine range conditions, under this alternative, would have greater benefits than alternatives 1,2 or 3 in addressing important deer habitat areas. The proposed allowable use standards would accelerate improvement of all aspects of deer hiding cover. Herd movement to achieve better cattle distribution during the permitted grazing season would become more frequent as primary forage areas are monitored to comply with the proposed stubble height levels and allowable use standards for willow assemblages.

4.4.9 Fish and Herptiles

In using resource value ratings to establish grazing standards, the benefits under this alternative would be greater than alternatives 1 or 2 and similar to alternative 3. The proposed stubble height levels for montane meadows would maintain plant vigor, provide streambank protection, and aid deposition of sediments to rebuild degraded steambanks (Clary and Webster 1989). There would be improved water quality and relatively stable riparian areas through improved vegetative cover leading to improved fisheries habitat over the long term. For many streams, vegetation with woody root systems (in combination with grasses, forbs, and other types of vegetation) provides a physical barrier to the effects of high velocities and turbulence, and creates banks with considerable surface roughness and relative stability (Platts 1990). Vegetation in the streambanks, with other characteristics such as soil particle size, control local streambank morphology. Sod-forming grasses and sedges can adequately protect banks of low gradient streams or ephemeral channels (Platts 1990). In those streams containing Lahontan cutthroat trout, a federally-listed threatened species, allowable use standard requirements issued by the U.S. Fish and Wildlife Service in their Biological Opinion will be implemented to protect this species. These standards are found in the Biological Opinion which is on file in the Supervisor's Office, Clovis CA (USDI Fish and Wildlife Service 1994, USDI Fish and Wildlife Service 1995).

The stubble height levels, allowable use standard for willows, and the residual dry matter levels in the annual grassland should lead to relatively stable riparian area conditions because vegetative cover and bank stability would best be maintained in Alternative 4. This alternative has: 1) less risk of trampling herptile eggs and adults, 2) provides more escape and forage cover for herptiles, 3) has less potential for trampling and chiseling, 4) maintains the potential for lower stream temperatures, and 5) provides for less sedimentation.

There are no verified observations of California red-legged frogs within or adjacent to the Sierra National Forest; therefore, no direct, indirect, or cumulative effects from Alternatives 1, 2, 3, or 4 on that species.

4.4.10 Threatened, Endangered, Proposed, and Sensitive Plants

Livestock grazing under this alternative would have minimal effects on Camissonia sierrae spp. alticola, Eriogonum prattenianum var. avium, Erythornium pluriflorum, and Lupinus citrinus var. citrinus.

4.4.10a Collomia rawsoniana -- Removal of some or all flowering vegetative stems may occur, as would the potential for trampling when cattle are moved out of the meadows and begin foraging in streamside zones. Impacts may be lessened for Collomia rawsoniana (CORA) populations growing in and around meadows, but there is still potential for grazing of CORA in areas other than defined meadows.

4.4.10b Ivesia unguiculata -- Effects to Ivesia unguiculata (IVUN) might be lessened under this alternative. The 4 and 6 inch stubble height levels in wet and moist meadows should be sufficient to provide some protection to most populations of IVUN (through less grazing and thus less trampling).

IVUN grows in moist to dry montane meadows. Partly because IVUN is classified as an "invader" or low-value species, meadows containing abundant IVUN populations have often been given ratings of poor or fair range condition. Meadows rated poor or fair would retain higher levels of stubble height (6 inches).

4.4.10c Trifolium bolanderi -- Retention of the 4 and 6 inch stubble height levels theoretically would allow less utilization and trampling, especially in better condition meadows where many Trifolium bolanderi (TRBO) populations occur. Preliminary studies by Ratliff and Denton (1993), indicate that TRBO is probably withstanding cattle grazing adequately (see the 1995 Biological Evaluation for Sensitive Plants by Clines on file at the Sierra National Forest Supervisor Office in Clovis, CA). TRBO would be expected to occur in good and excellent condition meadows classified as wet or moist, and since populations are found in a narrow elevational band at about 7,000 feet, under alternative 4, allowable use would equate to roughly 40 to 45 percent (by weight).

4.4.10d Calyptridium pulchellum and Carpenteria californica -- None of the standards discussed in Alternative 4 would be expected to change the status quo for Calyptridium pulchellum (the only known population on the Forest is fenced) or for Carpenteria californica (CACA) since this species generally grows in dense chaparral that is difficult for cattle to access. CACA is potentially vulnerable to grazing for the first 3 years after a wildfire, especially where range improvements (fences) or natural barriers (dense chaparral) are altered by wildfires. Restrictions on grazing, in the event of a fire, will need to be applied on a case-by-case basis.

Cumulative effects to both species have occurred over the years as a result of fire suppression, fuelbreak construction and maintenance, type conversion of chaparral to nonnative grassland, road construction, introduction of nonnative annual grasses and forbs, and off-highway vehicle use. On adjacent private lands, loss of habitat for CACA continues as residential development accelerates.

4.4.11 Riparian -- Implementation of proposed Alternative 4 allowable use standards for meadows and riparian areas will aid in acceleration of improving conditions in the riparian areas. Foliage provides shade for streams, maintaining low water temperatures. Woody and herbaceous vegetation impede overland flood flows and provide a protective cover against the erosive forces of water. Large organic debris added by the root systems of woody plants (willows and alders) helps form the stair-stepped gradients in small streams that are necessary for dissipating stream energy and slowing velocity. Both the woody root systems of willows, alders, and other riparian shrubs, and the fibrous root systems of perennial grasses and sedge, serve to: (1) bind the soil together, (2) protect the streambank, and (3) filter out and deposit sediment. All these things help reduce sedimentation of our water supplies and hydroelectric reserves. In addition, deposition of sediment helps build streambanks and form productive wet meadows and flood plains (Chaney 1991, Platts 1990).

4.4.12 Heritage Resources -- The impacts to heritage resources would be similar to Alternative 3 in that residual herbage levels remaining after the end of the grazing season would provide additional protection to unidentified heritage resources. Livestock grazing may be considered part of the setting for a historic property, such as a historic "cow camp", and so long as it would not alter the cow camp, grazing would have a beneficial effect on this heritage resource. Under all alternatives, heritage resources would be assessed on a site-specific basis during analysis for term permit issuance.

CHAPTER V. CONSULTATION AND COORDINATION

5.1 MEMBERS OF THE PUBLIC

A public scoping letter was mailed October 28, 1994, and a clarification letter was mailed November 3rd. A third letter describing the third alternative was mailed November 14th. A public scoping meeting was held at the Clovis Veterans Memorial Building on November 15th. Meeting notes, from the 40 people who attended, were recorded, summarized, and mailed November 18th to those who attended. On January 6, 1995 an initial environmental assessment report was sent out for public review and comment. A total of fourteen responses were received during the final review period. The mailing list and names of those who attended the public meeting, along with those written comments from the initial environmental assessment (1/95), are on file at the Sierra National Forest Supervisor's Office located at 1600 Tollhouse Road, Clovis, California.

5.2 OTHER AGENCIES WHO RECEIVED THE SCOPING DOCUMENT

California State Department of Fish and Game, Fresno, California
California State Lands Commissioner, Sacramento, California
California State Board of Forestry, Sacramento, California
Fresno County Board of Supervisors, Fresno, California
Madera County Board of Supervisors, Madera, California
U.S. Bureau of Land Management, Folsom, California
U.S. Fish and Wildlife Service, Sacramento, California
U.S. Forest Service, Pacific Southwest Research Station, Fresno, California

5.3 CONSULTATION WITH OTHER RESEARCH AND MANAGEMENT SPECIALISTS

Frost, Bill. UC Cooperative Extension
Fuller, Ken. U.S. Fish and Wildlife Service
Kie, John G. Pacific Southwest Research Station
Ratliff, Raymond D. Pacific Southwest Research Station
Stubbs, Kevin. U.S. Fish and Wildlife Service
Warne, Betty. U.S. Fish and Wildlife Service
Lomelli, Henry. California Fish & Game
Lechner, Matt. Sequoia National Forest
McDougald, Neil. UC Cooperative Extension

5.4 GROUP BRIEFINGS AND TEAM MEETINGS

Ruffner Rodgers Ridge Tour, February 22, 1995.
Forest Range Staff Group Meeting, March 6, 1995.
Forest and Plantiffs Meeting, April 5, 1995.
Southern Sierran Forests Province Meeting, April 21, 1995.
South Zone Resource Group Meeting, April 27th.
Forest Wildlife Biologist Meeting, May 2nd.
Forest Interdisciplinary Team Meeting, May 16, 1995.
Forest Permittee Meeting, May 16, 1995.
Forest Range Staff Group Meeting, May 18, 1995.
Regional Standards and Guides Meeting, May 24, 1995
Sierra NF Management Team meeting, July 18, 1995.

5.5 LIST OF PARTICIPANTS
SIERRA NATIONAL FOREST

Boynton, James. Forest Supervisor
Buck, Mary Kay. Forest Fisheries Biologist
Clines, Joanna. Forest Botanist
Elliott, Terry. Assistant Forest Land Management Planner
Everest, Loren. Pineridge District Fisheries Biologist
Franks, Earle. Forest Hydrologist
Frolli, Tom. South Zone Range Conservationist
Hehnke, Merlin. Forest Land Management Planner
Lorenzana, John. Supervisory Wildlife Biologist
Miller, Karen. Forest Archaeologist
McCandliss, Dave. Kings River District Fuels Specialist
Porter, Ray. Kings River District Ranger
Quan, Alan. Forest Ecosystem Coordinator
Rich, Paul. Forest Resource Officer
Roath, Brent. Forest Soil Scientist
Shackelford, Jim. North Zone Range Conservationist
Sova, Susan. Kings River District Resource Support
Yamanaka, Gordon. Forest Wildlife Biologist

APPENDIX A

LIST OF BIOLOGICAL
ASSESSMENTS & EVALUATIONS,
AND OTHER SPECIALIST REPORTS

REPORT	SPECIES	PAGES	PREPARED BY
Biological Assessment	Threatened, Endangered, and Proposed Plants carpenteria Mariposa pussypaws	7	Joanna Clines, Forest Botanist
Biological Assessment	California Red-legged Frog	17	John Lorenzana, Supervisory Wildlife Biologist
Biological Assessment	Lahontan Cutthroat Trout	15	Mary Kay Buck, Forest Fisheries Biologist
Biological Assessment	Threatened Species Valley Elderberry Longhorn Beetle	18	John Lorenzana, Supervisory Wildlife Biologist
Biological Evaluation	Sensitive Wildlife Willow Flycatcher Western Pond Turtle California Spotted Owl Northern Goshawk Fisher Marten Sierra Nevada Red Fox Great Gray Owl	39	John Lorenzana, Supervisory Wildlife Biologist
Biological Evaluation	Sensitive Plants Mono Hot Springs Evening Primrose Rawson's Flamimg Trumpet Kettle Dome Buckwheat Many-flowered Fawn Lily Yosemite Ivesia Golden Lupine Bolanders Clover	18	Joanna Clines, Forest Botanist
Specialist Report	Sensitive and Proposed Plants Mono Hot Springs Evening Primrose Rawson's Flamimg Trumpet Kettle Dome Buckwheat Many-flowered Fawn Lily Yosemite Ivesia Golden Lupine Bolanders Clover Carpenteria Mariposa pussypaws	6	Joanna Clines, Forest Botanist

REPORT	SPECIES	PAGES	PREPARED BY
Specialist Report	Lahontan Cutthroat Trout Paiute Cutthroat Trout Mountain Yellow-legged Frog Foothill Yellow-legged Frog Yosemite Toad Western Pond Turtle	8	Mary Kay Buck, Forest Fisheries Biologist
Specialist Report	Soils	2	Brent Roath, Forest Soil Scientis
Specialist Report	Range	4	John Lorenzana, Supervisory Wildlife Biologist
Specialist Report	Watershed	3	Earle Franks, Forest Hydrologist
Specialist Report for Species Under Review by the U.S. Fish and Wildlife Service	Mountain Yellow-legged Frog Foothill yellow-legged Frog Yosemite Toad	20	John Lorenzana, Supervisory Wildlife Biologist
Specialist Report	Deer	2	John Lorenzana, Supervisory Wildlife Biologist
Specialist Report	Economics	1	Michael J. Skinner, Regional Economist

APPENDIX B

VEGETATION AND SOIL CONDITION RATINGS ON MONTANE MEADOWS IN THE SIERRA NEVADA

Vegetation and soils condition ratings have generally been referred to collectively by range condition classes. These classifications are a series of arbitrary categories expressed as either excellent, good, fair, poor, or very poor (Ratliff 1985). The four class system, excellent thru poor, is usually adequate for evaluating most meadows in the Sierra Nevada (Ratliff 1985).

Evaluating range condition, by comparing current productivity relative to natural capability, includes subjective factors also. Evaluation of range condition will, therefore, vary. To some, condition is excellent only if herbage production and species composition are near climax. To others, condition is excellent only if calf or steer weight gains produced are maximum (Ratliff 1985).

Range condition trend is defined as "the direction of change in range condition" (Ratliff 1985). Measured trend usually requires the re-measurement of long-term progressive or regressive change in vegetative composition or soil condition. Apparent trend is based on either an estimate on existing indicators noted or measured during a one-time observation.

One method of determining range condition is the Species Composition Method (Ratliff 1985). Primary to the species composition method is recognition of range sites (Ratliff 1985). A range site is a kind or class of land. A range site is similar to a meadow site association (Ratliff 1985). The difference is the definition of meadow associations by current vegetation. As potential vegetation of meadow sites are defined, the differences are eliminated. Conceptually, each range site has the potential to produce a unique combination of species and amounts of them, provided that physical characteristics have not deteriorated. Conditions of a range site individual (Ratliff 1985), can be determined if the potentials of the class to which it belongs are known.

Vegetative Condition Rating

Plant species are categorized as decreasers, increasers, and invaders. Decreaser plant species are usually major constituents of the plant composition at climax, while increaser plants are usually minor constituents of the plant composition at climax. As conditions on the ground deteriorate, the decreaser plants are reduced in the composition, and the increasers increase in percentage of the total plant composition. With further deterioration, the decreaser and increaser plants are further reduced in the composition and invaders increase significantly in the composition. Range site individuals with the composition consisting of 75 to 100 percent climax decreaser and increaser species are considered to be in excellent condition. This attempts to define the current state of vegetation relative to what is perceived to represent "pristine" or "climax" conditions, that is, the ecological status of the present vegetation. One should not confuse ecological classification of species with their resource value classification. Resource value classification is based on species of highest value for a particular resource product, i.e., deer, elk, etc. The percentage of increaser plants allowed is limited and is based on the concept that an amount equal to the maximum expected in the climax is normal.

Regardless of the amount of decreaser species present, therefore, an amount up to the percentage of increasers normally expected in the composition is added to the decreaser percentage in determining condition score. Ratliff (Ratliff 1985) proposes that where invader species are few in the composition, as in many Sierra Nevada meadows, the percentage of increaser species allowed should be reduced for good and fair conditions. When decreaser species and allowed percentage of increasers together comprise between 50 and 75 percent of the composition, condition is considered good. Fair condition sites contain 25 to 50 percent decreaser and increaser species, and poor condition sites contain less than 25 percent decreaser and increaser plant species in the composition. On sites in excellent condition, the combined amounts of two or three primary species usually make up more than 50 percent of the composition (Ratliff 1985).

For rating vegetative condition, Ratliff (Ratliff 1985) used actual basal hits of plants over foliar hits. Basal hits are affected less by current grazing than species composition or cover based on foliar hits. Foliar composition is, however, the better measure on ungrazed meadows.

Table 1. Vegetative Condition Standards for Meadows of the Sierra Nevada, California

Minimum Decreasers	Maximum Increasers 1	Decreasers and Increasers 2	(ADJECTIVE RATING) Vegetative Condition 3
50	25	75 to 100 *	Excellent
30	20	50 to 75 *	Good
10	15	25 to 50 *	Fair
--	--	0 to 25 *	Poor

1. Minimum percentage of composition allowed.
2. Maximum percentage of composition allowed; excess percentage contributes to amount of invader species.
3. Range in percentage of the composition of decreaser and allowed increaser species permitted for the condition.

* Condition Score.

Soil Condition Rating

Stability of the soil is implicit in the species composition method. A specific range site individual must have the potential of the range site to which it belongs. It loses that if the soil is gone. For meadows in satisfactory or good condition, foliar and litter cover should combine so no bare soil can be seen (Ratliff 1985). Total vegetation cover is essential to protect the soil from the forces of weather and animals. While it is desirable to maintain 100% plant cover, it is expected that out of 100 tallied points, that some bare soil will be tallied (hits). For meadows in excellent condition, bare soil tallies of 0 to 5 percent is considered acceptable. With increased bare soil tallies (out of 100 hits), the adjective rating for the

condition is reduced. For example, bare soil tallies of 5 to 10 percent would reduce the adjective rating to good condition, and bare soil tallies of 10 to 15 percent would further reduce the rating to fair. This reduction of adjective rating would also correspondingly reduce the allowable use for the site.

The following observations can serve as general guides to meadow vegetative condition (Ratliff 1985). Meadows in excellent or good condition appear to have a dense, even stand of vegetation. After grazing, such a meadow should give the impression of having been mowed because of the rather uniform forage value of the plant species present. Fair condition meadows appear dense, but unevenly covered. Poor condition meadows have a distinct patchy appearance.

Another useful observation which can serve as a general guide is the presence or absence of colorful wildflowers. Good condition meadows are not particularly colorful during flowering, scattered forb blossoms are not conspicuous, whereas, fair condition meadows may be much more colorful during flowering (Ratliff 1985). Because a meadow full of wildflowers is beautiful, these general guides may seem reversed (Ratliff 1985). Better condition meadows should have fewer forbs to produce flowers than poorer condition meadows (Ratliff 1985). Also, free choice or season-long grazing did not decrease the abundance of meadow wildflowers (Ratliff 1985).

A condition class of Ellison and others (Ratliff 1985) is encountered in mountain meadows where soils are stable. With stable soil, an evaluation of condition depends upon the relative biologic departure of the site from a standard. The frequently accepted standard for excellent condition is biologic stability at or near climax. Species composition is the usual indicator for departure from climax. Species evaluation in the Species Composition Method tend to reflect grazing values more than ecological position (Ratliff 1985).

References:

Ratliff, Raymond D. 1985. Meadows in the Sierra Nevada of California: state of knowledge. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Gen. Tech. Report PSW-84. 52 pp.

APPENDIX B

RANGE CONDITIONS FOR
CALIFORNIA ANNUAL GRASSLANDS

California's highly productive annual grasslands have been rated in POOR condition by range condition assessments that classify both native and introduced "naturalized" annual species in low seral stages of succession. Annual grasslands also include the understory of the Valley-foothill hardwood cover type, the coastal scrub, and chaparral (George et al. 1990). The "poor" condition was based on substantial deviation from the climax or perceived "pristine" perennial vegetation which was present before the coming of sheep and cattle to California. Humphrey (George et al. 1990) defined an approximate relationship between plant succession stages and range condition classes based upon forage production potential of the site. "Under most circumstances ranges classed as excellent or good represent the higher stages in a given plant succession". However, exceptions to this generalization "may occur in the case of highly productive annual grass and weed ranges, or land reseeded to perennial grasses other than those (of) climax". In these cases, non-climax plant communities may be classed as in good or even excellent condition (George et al. 1990). Range condition assessment that uses "climax" as a reference point should not be used on California's annual grasslands. The pristine vegetation for the annual grasslands is not known, therefore estimates of species composition of the climax vegetation is likely to be inaccurate. Protection from grazing is not followed by succession toward a perennial dominated grassland. Site protection and maintenance of site productivity is not necessarily dependant on maintaining climax or near climax vegetation (George et al. 1990).

Heady (George et al. 1990) proposed an adaption of SCS's range condition methods to California's annual ranges. His system of determining condition on annual range categorizes dominant plant species in upper, middle and lower groups according to their grazing value. Rather than consider the climax to be perennial bunchgrass, the highest type of annual grassland (dominated by soft chess and ripgut brome) is considered "climax annual". The terms upper, middle and lower replace traditional terminology (decreaser, increaser, and invader) since the annual range flora is dominated by alien species that are likely to maintain their dominance. The alien species are now considered by some to be "introduced naturalized" annual species. (writer's emphasis).

Table 2. Combined Classification of "Climax Annual" Plant Species from Paxton (George et al. 1990) and Heady (George et al. 1990)

Upper Group	Middle Group	Lower Group
Soft chess	Vulpia (3 sp)	Hairgrass
Ripgut	Bur clover	Quaking grass
Wild oats	Broadleaf filaree	Annual bluegrass
Slender wild oats	Nitgrass	Wild barley
Annual rye grass	Red brome	Trifoliums
Red-stem filaree	Spanish clover	Annual lupine
Vetch	Blue dicks	Tarweed
Purple needlegrass (per)	Miner's lettuce	Milk thistle
	Popcorn flower	Fiddleneck
		Turkey mullein

References:

George, Melvin R., et al. 1990. An evaluation of range condition assessment on california annual grassland. 42 pp.

APPENDIX B

VEGETATIVE AGE AND FORM CLASSES FOR
WILLOWS, ASPENS AND OTHER WOODY PLANTS

The following information has been derived from the draft Interagency Rangeland Monitoring Guide, Utilization Studies (1734-3). Vegetative condition of willows and other shrubs is based primarily on the age and form class of the plant community and the associated resource values described by an interdisciplinary team. These willow age and form class are arbitrary divisions that aid in describing the condition of the willow or other shrub stands. The following age and form classes are described under the Extensive Browse Method:

Age Classes -- Age class data reflect the establishment, survival, and decadence of key browse plants by species.

Seedling New plants that have survived at least one growing season, but are not more than two or three years old. The basal stems are generally 1/8 inch or less in diameter.

Young Young plants usually less than 10 years old. Elongated growth form and simple branching with basal stems no greater than approximately 0.5 inches in diameter.

Mature Plants more than 10 years old. Distinguished by heavier, often gnarled stems, and complex branching. Canopy made up of more than 50 percent living wood. Basal stems are often greater than 0.5 inches in diameter.

Decadent Browse plants with more than 50 percent of the canopy area dead.

Form Classes -- Form classes are identified by plant species and the availability of browse from individual plants to the animals.

Class 1 = All available; little or no hedging
Class 2 = All available; moderately hedged
Class 3 = All available; severely hedged
Class 4 = Partially available; little or no hedging
Class 5 = Partially available; moderately hedged
Class 6 = Partially available; severely hedged
Class 7 = Unavailable
Class 8 = Dead

Degree of Hedging -- Three degrees of hedging are used. They are based on the length and appearance of two-year-old wood (previous year's leaders) immediately below the current leaders. If more than one degree of hedging is evident on a plant, form class is based on the predominant condition.

Little or no hedging — Two year old wood is relatively long and unaltered or only slightly altered.

Moderately hedged — Two-year-old wood is fairly long but most of it has been altered from the normal growth form.

Severely hedged — Two-year-old wood is relatively short and/or strongly altered from the normal growth form.

APPENDIX B

DISCUSSION OF CURRENT CONCEPTS
FOR RANGE CONDITION RATINGS

TO: Paul Rich, Interdisciplinary Team Leader	DATE: December 20, 1994
FROM: Joanna Clines, Forest Botanist	SUBJECT: Discussion of current concepts of range condition ratings for LMRP amendment.

In response to public comments on the proposed plan amendment, the following is a discussion and summary of concepts of range condition in the current professional literature and my views of that discussion.

Certain concepts of ecological succession upon which range condition ratings were based have been seriously questioned by ecologists since about the late 1940s (Smith, 1989). Early American plant ecology was greatly influenced by Frederick Clements whose theory of plant succession leading to a final end product or climax formed the basis for early range management. Clements' view of a "monoclimax" suggests that in a given vegetation type, the seral stages follow one another predictably until they reach a definite endpoint, the climax. The climax is supposedly the most pristine, and the most stable, vegetation that can exist at that site. Climax is "best" because stability is greatest and vegetation is in equilibrium with climate and soil, thus climax plant communities are said to be in excellent condition (Smith, 1989).

To this day, range management is dominated by Clements' views of linear succession and climax, despite evidence that the ecological assumptions have been at least partially disproved (Smith, 1989). The important thing is that range condition ratings are meant to indicate departure of a plant community from climax, which is by definition excellent condition. The less the current vegetation resembles climax, the poorer the condition. The idea of succession as a linear (and reversible) series of successional stages with a predictable endpoint (climax) is not always applicable (Ratliff, pers. comm. 12/20/94; Smith, 1989; Risser, 1989).

Ecological succession is defined as "**the non-seasonal, directional and continuous pattern of colonization and extinction on a site by species populations**" (Begon et. al., 1986). A simpler description is "**the gradual replacement of one assemblage of plant species with others through time until some relatively stable climax community is reached**" (Kie et. al., 1994). Usually succession is defined in terms of some sort of disturbance, e.g., fire, logging, cattle grazing. Succession is easy to conceptualize in plant communities like California chaparral, where after fire a wave of fire-dependent herbs emerges the first growing season and is replaced by other herbs and then maturing chaparral shrubs as the years go on. Some

plant communities do not exhibit a clear and definable sequence of successional stages after a disturbance, or they may undergo succession that has a wide variety of possible endpoints depending on the precise combination of environmental conditions at the time of disturbance.

The application of the concept of linear succession to montane meadows in the Sierra may no longer be an appropriate concept for determining range condition. Dr. Howard Latimer, Plant Ecology professor at CSU Fresno agrees that the concept of succession does not apply as well for meadows as it does for some other plant communities. There is no clearly definable early, mid, and late seral vegetation. The hydrologic regime appears to determine species composition more than grazing pressure per se (Ratliff, 1987). The categorization of plant species into decreasers (primary), increasers (secondary), and invaders (low value) is largely based on their suitability as forage and their reaction to grazing by cattle, a nonnative animal species not present in the Sierra Nevada until recent time, geologically speaking. This is not to say that certain plant species cannot indicate deteriorated conditions in meadows. Overgrazed meadows in an advanced state of deterioration tend to support nonnative weeds and weedy native annuals that would not be found in a healthy meadow with intact sod and a normal water table (Sharsmith, 1959).

Problems with the current system of classification of decreasers, increasers, and invaders are illustrated by considering that species such as timothy (Phleum pratense) and alfalfa (Medicago sativa) are classified by some as decreasers, implying that if you had a meadow composed of 75% or more of these species you'd be looking at a climax, pristine meadow (admittedly, this is stretching the point, but it's useful as an example). On the other hand, Yosemite ivesia (Ivesia unguiculata) is rated as a low value, or invader species. Yosemite ivesia is a Sierra National Forest sensitive plant known from less than 60 populations in the Sierra NF and Yosemite National Park. By the current method of determining range condition, a meadow with abundant Yosemite ivesia would rate out as poor or early-seral. The implication here is that the Forest would need to manage toward a poor condition to sustain ivesia populations. FSM 2670 and the LRMP state that the Forest will manage sensitive plant species to maintain their long term viability and to prevent listing as threatened or endangered. A species composition scheme emphasizing native species that indicate healthy ecosystems rather than a forage-based scheme would be more useful here.

Recent assessments of the value of range condition ratings suggest that a new method is needed. The National Research Council (1994) states that the "current system of rangeland assessment will not serve as an adequate evaluation of rangeland health," and that "it does not adequately assess soil stability or the integrity of ecological processes such as nutrient cycles and energy flows." Smith (1989), in his critique of range condition ratings, concludes that climax-based range condition and trend assessment has created problems and should be abandoned.

Pieper and Beck (1990) suggest using the terms **climax, late-seral, mid-seral, and early seral** in place of **excellent, good, fair, and poor.** They point out problems with the practicality of measuring departure from climax because of the difficulty in determining climax or potential natural community in the first place. However, their proposal rests on the premise that range management should remain closely tied to the concept of succession. The benefit of using ecological terms is that it disconnects the state of the vegetation from a value judgement in terms of a particular land use such as livestock production. However, in light of criticism of the ecologically-based system of classifying range condition (Smith, 1989: Risser, 1989; National Research Council, 1994) it seems that this approach does not address the fundamental problem: range condition classification no longer represents current ecological thought, no matter what terms are used.

Holechek (1989, pp. 166-167) summarized weaknesses of using condition ratings:

1. The terms excellent, good, fair, and poor may not make sense from the standpoint of management practices. Managing for a seral stage other than climax may well be optimal for certain wildlife species.

2. It is not practical to think that we can really determine and define climax.

3. The method doesn't work at all in rangelands invaded by alien plants (annual grassland in California) or in artificially seeded areas.

4. For forest or wooded rangelands, the climax would probably <u>not</u> be the best rangeland.

In summary, the National Research Council (1994) recommends evaluating rangelands in terms of whether they are healthy, at risk, or unhealthy. The point made throughout their book <u>Rangeland Health</u> is that new methods of assessing rangeland health are needed, so there are no concrete "how-to" suggestions that the Forest could take straight to the field. As the Forest proceeds with NEPA analyses on grazing allotments, as well as with the development of the land plan amendment, my recommendation is that ID teams keep in mind the three criteria recommended by NRC to determine whether a rangeland is healthy, at risk, or unhealthy (also see Table 4-8 from the book, attached): 1) degree of soil stability and watershed function, 2) integrity of nutrient cycles and energy flow, and 3) presence of functioning recovery mechanisms.

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Risser, P.G. 1989. Range condition analysis: past, present, and future. In: Secondary Succession and the Evaluation of Rangeland Condition. W.K. Lauenroth and W.A. Laycock, eds.

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APPENDIX B

Rangeland Health Evaluation Matrix
(National Research Council 1994)

Indicator	Healthy	At Risk	Unhealthy
	Phase 1: Soil stability and watershed function		
A-horizon	Present and distribution unfragmented	Present but fragmented distribution developing	Absent, or present only in association prominent plants or with other obstructions
Pedestaling	No pedestaling of plants or rocks	Pedestals present, but on mature plants only; no roots exposed	Most plants and rocks pedestaled; roots exposed
Rills and gullies	Absent, or with blunted and muted features	Small, embryonic, and not connected into a dendritic pattern	Well defined, actively expanding, dendritic pattern established
Scouring or sheet erosion	No visible scouring or sheet erosion	Patches of bare soil or scours developing	Bare areas and scours well developed and contiguous
Sedimentation or dunes	No visible soil deposition	Soil accumulating around plants or small obstructions	Soil accumulating in large barren deposits or dunes or behind large obstructions
	Phase 2: Distribution of nutrient cycling and energy flow		
Distribution of plants	Plants well distributed across site	Plant distribution becoming fragmented	Plants clumped, often in association with prominent individuals; large bare areas between clumps
Litter distribution and incorporation	Uniform across site	Becoming associated with prominent plants or other obstructions	Litter largely absent
Root distribution	Community structure results in rooting throughout the available soil profile	Community structure results in absence of roots from portions of the available soil profile	Community structure results in rooting in only one portion of the available soil profile
Distribution of photosynthesis	Photosynthetic activity occurs throughout the period suitable for plant growth	Most photosynthetic activity occurs during one portion of the period suitable for plant growth	Little or no photosynthetic activity on location during most of the period suitable for plant growth
	Phase 3: Recovery mechanisms		
Age-class distribution	Distribution reflects all species	Seedlings and young plants missing	Primarily old or deteriorating plants present
Plant vigor	Plants display normal growth form	Plants developing abnormal growth form	Most plants in abnormal growth form
Germination microsite	Microsites present and distributed across the site	Developing crusts, soil movement, or other factors degrading microsites; developing crusts are fragile	Soil movement or crusting sufficient to inhibit most germination and seedling establishment

APPENDIX C
BENCHMARK LOCATIONS OF KEY AREAS
SIERRA NATIONAL FOREST

ALLOTMENT	KEY AREA	TRANSECT	BENCHMARK LOCATION	ANALYSIS DATE	VEGETATIVE RATING	TREND	REMARKS
	Slide Rock	BM 1	T12S, R24E, S12	03/14/95	*	^	- Lower Billy Creek.
	Powerline Hill	BM 2	T12S, R24E, S12	03/14/95	*	^	- Upland site.
Billy Creek	Upper Billy Creek	BM 3	T12S, R24E, S12	03/29/95	*	^	
	Potatoe Patch	C1 T2	T05S, R23E, S28	08/**/70	Fair (40)	^	
Beasore	Upper Beasore Meadow	C2 T1	T05S, R23E, S07	08/16/70	Excellent (89)	>	
	Rock Meadow	C1 T1	T08S, R27E, S31	09/**/71	Fair (60)	*	
	Tamarack Meadow	C2 T1	T08S, R26E, S31	09/**/71	Good (58)	*	
	Lakecamp Meadow	C4 T1	T08S, R25E, S07	09/08/71	Excellent (100)		
Blasingame	Long Meadow	C3 T1	T08S, R27E, S32	09/07/71	Excellent (100)		
	Upper Cassidy Meadow	C1 T1	T05S, R25E, S24	08/26/71	Excellent (81)	*	- No use. Select a new site.
	Bull Meadow	C2 T1	T05S, R25E, S10	**/**/**	Fair (34)	*	
Cassidy	Red Rock Meadow	C3 T1	T05S, R26E, S11	**/**/**	Good (64)	*	
	Morgan Meadow	C2 T1	T06S, R23E, S34	06/30/77	Good (87)	^	- Establish Watershed Sign or
Central Camp	Beaver Ponds	C1 T1	T07S, R23E, S3/7	09/26/63	*	*	Exclosure Meadows Benchmarks.
	Summit Meadow	C1 T1	T06S, R24E, S27	08/12/71	Good (61)	>	
	Ryan Meadow	C2 T1	T06S, R23E, S11	08/12/71	Good (68)	>	
Chiquito	Little Jackass Mdw.	C3 T1	T06S, R24E, S09	08/12/71	Poor (100)	>	- Heavy LPP. Select new site.
	Garlic Meadow	R-1	T11S, R28E, S33	07/30/86	Excellent (79)	^	
Collins	Spanish Meadow	C2 T1	T11S, R28E, S34	06/27/72	Fair (54)	*	- Replace w/site @ Round Meadow.
	Cow Creek Meadow	L-5	T09S, R26E, S17	09/25/91	Fair (41)	^	- Lahontan cutthroats present.
	Cow Creek Area	L-3	T09S, R27E, S16	08/20/91	Excellent (91)	^	- Lahontan cutthroats present.
	Cow Creek w/excl.	L-4	T09S, R27E, S16	09/25/91	Excellent (91)	^	- Lahontan cutthroats present.
	Exchequer Meadow	C3 T1	T10S, R26E, S11	07/09/91	Good (52)	^	
	Glen Meadow	L11	T11S, R26E, S07	09/23/91	Excellent (90)	^	
	Miningtown Mdw.	C1 T1	T09S, R26E, S23	**/**/59	*	*	
	Wet Meadow	L7	T09S, R26E, S22	09/25/91	*	*	- Yosemite toads present.
	Willow Meadow	L8	T09S, R26E, S15	09/23/91	Good (56)	*	
Dinkey	Fence Meadow	L12	T11S, R26E, S18	09/24/91	Good (72)	*	- Low elevation - Discontinue.
Florence	Upper Jackass Mdw.	BM 1	T08S, R27E, S36	08/04/95	Fair (53)	^	- Under special use permit.
	Long Meadow	C1 T1	T07S, R23E, S10	09/21/72	Excellent (90)	^	- Establish a site @ Benedict Meadow.
Haskell	Brown's Meadow	C2 T1	T07S, R23E, S26	09/26/63	Excellent (96)	^	
Haslett Basin	Bear Dance Arbor	BM 1	T11S, R25E, S13	03/30/95	*	^	- Nutmeg Creek.
	First Plateau	C1 T1	T07S, R27E, S19	08/13/75	Fair (30)	*	
	Corbett Lake	C2 T1	T07S, R27E, S29	08/14/70	Excellent (82)	*	- No use. Discontinue.
Hot Springs	Camp 61	C3 T1	T07S, R27E, S18	08/13/75	Good (100)	*	- Too wet. Discontinue.
	Round Meadow	C1 T1	T05S, R22E, S20	09/17/70	Good (55)	>	
	Grizzly Cr. Meadow	C2 T1	T05S, R23E, S17	09/19/70	Good (69)	>	- Replace w/ Polk or Salt Log Meadows.
Iron Creek	Cold Spring Meadow	C3 T1	T05S, R23E, S07	09/17/70	Fair (28)	>	

*DATA MISSING

APPENDIX C
BENCHMARK LOCATIONS OF KEY AREAS
SIERRA NATIONAL FOREST

ALLOTMENT	KEY AREA	TRANSECT	BENCHMARK LOCATION	ANALYSIS DATE	VEGETATIVE RATING	TREND	REMARKS
	John Brown Meadow	C1 T1	T05S, R23E, S27	08/27/75	Good (66)	*	
	Indian Meadow	C2 T1	T04S, R25E, S32/33	09/30/60	Excellent (88)	*	
	Miller Meadow	C3 T1	T05S, R25E, S13	08/27/75	Good (62)	*	
	Frog Meadow	C5 T1	T05S, R24E, S02	08/28/75	Good (52)	*	
	Green Mountain	C6 T1	T04S, R25E, S29	10/12/65	Good (57)	*	
	Midlake Meadow	C8 T1	T03S, R24E, S27	09/04/75	Excellent (97)	*	- Consider dropping this site.
	Coyote Meadow	C9 T1	T04S, R24E, S12	09/03/75	Fair (29)	*	- Consider dropping this site.
	Clover Meadow	C10 T1		08/09/75	Fair (36)	*	- Discontinued.
	Detachment Meadow			08/25/81	Fair (44)\		
	Knoblock Meadow			08/24/81	Fair (30) \		- These were not key areas in
	Chetwood Meadow			08/26/81	Fair (37) /		1959.
Jackass	Isberg Meadow			08/27/87	Fair (31)/		- A dry meadow.
	Coarsegrass Meadow	C1 T1	T08S, R25E, S05	08/16/88	Good (67)	*	
Kaiser	LaSalle Meadow	C2 T1	T08S, R25E, S01	**/**/**	Good (68)	*	- Replace w/ Mary's Meadow.
	Markwood Meadow	BM 1	T10S, R25E, S03	08/11/95	Excellent (86)	^	- Unsatisfctory soils.
	Poison Meadow	BM 2	T10S, R25E, S05	06/27/94	Excellent (90)	^	- Satisfactory.
Markwood	Swanson Meadow	BM 3	T10S, R25E, S06	08/11/95	Excellent (86)	^	- Satisfactory.
	Upper Twin Meadow	BM 1	T06S, R27E, S03	08/01/95	Good (57)	^	- Unsatisfactory soils.
	Middle Twin Meadow	BM 2	T06S, R27E, S22	08/01/95	Good (69)	^	- Satisfactory
	Willow Meadow	BM 3	T06S, R27E, S24	08/01/95	Fair (50)	^	- Unsatisfactory soils.
	Lower Graveyard	BM 4	T06S, R28E, S01	07/31/95	Good (54)	^	- Satisfactory.
	Mono Meadow	BM 5	T07S, R27E, S03	08/03/95	Good (79)	^	- Unsatisfactory soils.
	China Camp Meadow	BM 6	T07S, R27E, S05	08/03/95	Excellent (100)	^	- Satisfactory.
Mono	Warm Creek Meadow	BM 7	T06S, R27E, S33	08/02/95	Excellent (76)	^	- Satisfactory.
	West Kaiser Pass			07/08/92	Good (69)	*	
	Mill Creek Meadow			09/12/90	Poor (32)	*	
	Upper Sample Meadow	C2 T1	T07S, R26E, S08	09/12/90	*	*	
	Kaiser Pass Meadow	C3 T1	T07S, R26E, S23	08/15/90	Good (57)	*	
Mount Tom	Hoffman Meadow	C1 T1	T06S, R25E, S13	09/12/90	Excellent (85)	*	
	Big Buck Meadow	C1 T1	T05S, R23E, S27	08/16/70	Excellent (85)	*	
	Klette Meadow	C2 T1	T05S, R23E, S02	08/17/70	Fair (64)	*	- Select a new site.
Mugler	FFA Meadow	C3 T1	T050S,R23E, S26	08/16/70	Excellent (82)	*	- Replace w/ Long Meadow.
	Stringer Meadow	C1 T1	T11S, R27E, S18	09/18/75	Good (54)	*	- Replace w/ Long Meadow.
	Shorthair Meadow	C2 T1	T10S, R27E, S15	09/23/75	Fair (34)	*	
Patterson Mtn	Snow Corral Meadow	L 1	T10S, R27E, S30	07/10/91	Fair (39)	*	
	Bear Wallow Trail	BM 1	T12S, R27E, S25	04/19/95	*	*	
Rodgers Ridge	Dead Horse Canyon	BM 2	T12S, R27E, S21	04/19/95	*	*	
	Jones Meadow	C1 T1	T06S, R23E, S18	09/19/75	Excellent (85)	*	
	Poison Meadow	C2 T1	T06S, R22E, S24	08/11/71	Good (58)	*	
	Kramer Meadow	C3 T1	T05S, R22E, S34	09/19/75	Good (67)	*	
Soquel	Cold Springs Meadow	C4 T1	T06S, R23E, S18	09/19/75	Excellent (86)	*	
	Bullfrog	BM 1	T12S, R25E, S04	05/17/95	*	*	- Along Big Creek.
Sycamore	Oak Flat	BM 2	T11S, R25E, S16	05/17/95	*	*	- Adjacent to Rush Creek
	Big Creek Bridge	BM 1	T12S, R25E, S03	03/30/95	*	^	- Annual grasses; satisfactory.
	Rock Spot	BM 2	T12S, R25E, S10	03/30/95	*	^	- Along Big Creek; satisfactory.
	Trib Crossing	BM 3	T12S, R25E, S03	03/30/95	*	V	- Unsatisfactory soils.
Thompson	Helispot Ridge	BM 4	T12S, R25E, S12	06/29/95	*	^	- Annual grasses; satisfactory.

*DATA MISSING

APPENDIX D

RANGELAND MONITORING METHODS

SECTION 1

Cover page, Table of Contents, Preface and pages 1 thru 6 of the Interagency Rangeland Monitoring Guide for Utilization Studies, Draft Publication 1734-3. Includes Criteria for selection of Key Areas and Key Species.

DRAFT

INTERAGENCY

RANGELAND MONITORING

UTILIZATION

STUDIES

1734-3

RANGELAND MONITORING - UTILIZATION

RANGELAND MONITORING - UTILIZATION STUDIES

I. Preface

The intent of this interagency utilization monitoring guide is to provide the basis for consistent, uniform, and standard utilization study methods that are low in cost, repeatable, statistically reliable, and technically adequate. This guide is not all inclusive. However, the primary utilization study methods used across the west are included. An omission of a particular method does not mean that the method is not valid in specific locations; it simply means that it is not widely used or recognized throughout the western states.

Proper use and management of our rangeland resources has created a demand for uniformity and consistency in rangeland health measurement methods used across the West. As a result of this interest, the USDI Bureau of Land Management (BLM) and USDA Forest Service (FS) met and agreed to establish an interagency technical team to jointly oversee the development and completion of vegetation sampling field guides.

This thirteen-member technical team first met in January 1994 to evaluate existing utilization techniques described in BLM Technical Reference TR 4400-3. This team consists of specialists from the FS, BLM, Soil Conservation Service (SCS), and Cooperative Extension Service. The team reviewed, modified, added, and eliminated utilization study techniques to be placed in this interagency reference, based on field needs. The technical guide went through peer review in early 1995 and was published in the summer of 1995.

II. Introduction.

Utilization is the percentage of annual herbage production that has been removed. Utilization data are important in evaluating the effects of grazing and browsing on rangeland. It is generally the percentage of available forage (weight or numbers of plants, twigs, etc.), that has been consumed or destroyed. Utilization is expressed in terms of the current year's production removed or the amount of available material remaining (stubble height). Permittees, lessees, other rangeland users, and interested publics should be consulted and encouraged to participate in the collection and use of utilization data.

A. Discussion of terms /concepts.

1. Objectives.

   a. Short-term Use of Utilization Data. In the short-term, utilization data are considered with actual use and climate data to determine resource use levels and to identify needed adjustments in management actions. These same data can be used in the short-term as the basis for adjusting grazing use by agreement or grazing decision.

   b. Long-term Use of Utilization Data In addition to the above short term objectives, Utilization data are considered along with other monitoring data to determine if management actions and/or practices are achieving management objectives identified in the land-use, coordinated resource management, and activity plans.

2. Utilization. The standard method of determining utilization is to measure or estimate the amount of annual herbage removed by weight. This process requires a comparison of the amount of herbage left compared with the amount of herbage produced during the year.

3. Residual measurements. Residual measurement is the determination of herbage material or stubble height left after a grazing or use period. It is independent of the amount of annual production. Management actions based on stubble height have an impact on plant health and soil and watershed protection because a specified amount of foliage will be left regardless of the amount of annual production. The important management consideration is the determination of proper use levels in order to leave the appropriate residual stubble height.

4. Removal verses residual. There are two problems with determining the amount of annual herbage removed, one is measuring the amount of annual production removed, and the second is determining the amount of total production for the year. Measuring remaining plant biomass or stubble height rather than utilization may be preferable because it is the plant biomass left undefoliated that will have an important impact on plant health, potential regrowth and on soil and watershed protection.

B. Guidelines. The techniques described here are guides for establishing and conducting utilization studies. They are not standards. Utilization sampling techniques and standards need to be based on management objectives. Techniques can be modified or adjusted to fit a particular resource situation or management objectives as long as the principles of the technique are maintained. Before adopting a modified technique it should be reviewed by agency monitoring coordinators and cooperators.

C. Key Areas and Key Species

1. Key Areas. Key areas are indicator areas that have the capability to reflect what is happening on a larger area as a result of on-the-ground management actions. Depending on management objectives, a key area may be a representative sample of a large stratum, such as a pasture, allotment, etc., or it may be a representative sample of a small stratum having important values, such as a heavy use area near water, a riparian zone, etc. A key area could also be a representative or critical area, such as a fragile watershed, sage grouse nesting ground, etc. Key areas may represent the "pulse" of the rangeland (pasture, allotment, wildlife habitat area, herd management area, watershed area, etc.) or they may represent only specific areas. Monitoring studies are located within key areas.

a. Selecting Key Area. Selection of key areas is tied directly to land use, coordinated resource management, and/or activity plan objectives. Proper selection of key areas is critical to the success of a monitoring program. An interdisciplinary team should be used to select these areas. In addition, permittees, lessees, and other interested publics should be invited to participate, as appropriate, in the selection of key areas. (See section II.D.) Poor information resulting from improper selection of key areas can result in misguided decisions and improper management. Some of the site characteristics and

other information that may be considered in the selection of key areas are:

(1) Soil.
(2) Vegetation (kinds and distribution of plants).
(3) Ecological sites.
(4) Ecological status.
(5) Topography.
(6) Location of water, fences, and natural barriers.
(7) Size of pasture.
(8) Kind and/or class of forage animals - livestock, wildlife, wild horses and wild burros.
(9) Habits of the animals, including foraging.
(10) Areas of animal concentration.
(11) Location and extent of critical areas.
(12) Erosion conditions.
(13) Threatened, endangered, and sensitive species - both plant and animal.
(14) Periods of animal use.
(15) Grazing history.
(16) Location of salt, mineral, and protein supplements.
(17) Location of livestock, wildlife, wild horse, and/or wild burro trails.

b. Criteria for Selecting Key Areas. Following are some criteria that should be considered in selecting key areas. A key area:

(1) Should be representative of the stratum in which it is located.

(2) Should be located within a single ecological site and plant community.

(3) Should contain the key species where the key species concept is used.

(4) Should be capable of and likely to show response to management actions. This response should be indicative of the response that is occurring on the stratum.

(5) May be selected to represent special or unique situations such as a riparian zone, fragile watershed, heavily grazed area, or crucial or important area.

c. Number of Key Areas. The number of key areas selected to represent a stratum depends on the size of the stratum and on data needs but may ultimately

be limited by funding and personnel constraints. If stratification is appropriate, one key area in each stratum may be adequate. Additional key areas may be selected, as appropriate.

d. Mapping Key Areas. Key areas should be accurately delineated on aerial photos and/or maps. Mapping key areas will provide a permanent record of their location.

2. Key Species. Key species are generally an important component of a plant community. Key species serve as indicators of change and may or may not be forage species. More than one key species may be selected for a stratum depending on management objectives and data needs. In some cases, problem plants (poisonous, etc.) may be selected as key species. Key Species may change from season to season.

a. Selecting Key Species. Selection of key species should be tied directly to management objectives in land-use, coordinated resource management, and activity plans. This selection is dependent upon the plant species in the present plant community, the present ecological status, and the potential natural communities for the specific sites. An interdisciplinary team should be used in selecting key species to ensure that data needs of the various resources are met. In addition, interested publics are invited to participate, as appropriate, in selecting these species. (See Chapter II.D.

b. Considerations in Selecting Key Species. The following points should be considered in selecting key species:

(1) Changes in density, frequency, reproduction, etc., of key species on key areas are assumed to reflect changes in these species on the entire stratum.

(2) The forage value of key species may be of secondary or no importance. For example, watershed protection may require selection of plants as key species which protect the watershed but are not the best forage species. In some cases, threatened, endangered, or sensitive species which have no particular forage value may be selected as key species.

(3) Any foraging use of the key species on key areas is assumed to reflect foraging use on the entire stratum.

(4) Depending on the selected management and/or periods of use, key species may be foraged during the growing period, after maturity, or both.

(5) In areas of yearlong grazing use and in areas where there is more than one use period, several key species may be selected. For example, on an area with both spring and summer grazing use, a cool season plant may be the key species during the spring and a warm season plant may be the key species during the summer.

(6) Selection of several key species may be desirable when adjustments in livestock grazing use are anticipated.

c. Key Species on Depleted Rangelands. The key species selected should be present on each key area on which monitoring studies are conducted; however, on depleted rangelands these species may be sparse.

(1) Key Species Sparse. Plants of the key species may be so sparse that they are found only on protected sites. If the species are the best plants for the area and their restoration is economically feasible, management should be based on increasing these species until they are a major component of the plant community. This may involve a severe change in grazing intensity and/or period(s) of use. When it becomes uneconomical or impractical to restore a species to a significant population base, management on these areas needs to be sensitive to creating an environment conducive to the establishment and growth of these rare plants while monitoring a species that is present on the site. If there is a species of concern that is not present use qualitative methods (ie. presence or absence).

(2) Key Species Absent. If a key area does not include any plants of the key species because of severe depletion, it may be necessary to conduct utilization studies on other species that comprise the bulk of the forage. Data gathered on non-key species must be interpreted on the basis of effects on the establishment and subsequent response of the

key species. If the key species does not respond favorably to the selected management system and does not appear on the key area within a reasonable length of time, the reason for its absence might be determined by analysis of data gathered on other forage species. For example, a high percent utilization on non-key species during the critical growth period of the key species may reflect high utilization on young plants of the key species, thereby curtailing their establishment. Conversely, heavy use during a critical growth period of non-key species may eliminate the competition and provide a desirable environment for accelerated reestablishment of the key species. It should be verified that the site has the ecological capabilities to produce the key Species.

D. Coordination. Utilization studies will be coordinated with livestock operators, other appropriate state and federal agencies and interested publics. Utilization studies should be planned and implemented on an interdisciplinary basis.

III. Study Design and Analysis.

A. Planning the study. Proper planning is by far the most important part of a monitoring study. Much wasted time and effort can be avoided by proper planning. A few important considerations are discussed below. The reader should refer to Technical reference 1734-2 Planning for Monitoring, for a more complete discursion of these important steps.

1. Identify management objectives. Based on land use and activity plans, identify management objectives appropriate for the area to be monitored. The intent is to evaluate the effects of management actions on achieving management objectives by collecting utilization data.

2. Design the study. The number of plots or transects (sample size) needed depends on the monitoring objectives and the efficiency of the sampling design. It should be known *before* beginning the study how the data will be analyzed. The frequency of data collection (e.g., every year, every other year, etc.) and data sheet design should be determined before studies are implemented.

   All utilization techniques described in this document can be set up using the following design. A baseline is established by stretching a tape measure of any desired

APPENDIX D

RANGELAND MONITORING METHODS

SECTION 2

Twig Length Measurement Method for measuring use on willows and other woody shrubs from pages 21 thru 29 of the Interagency Rangeland Monitoring Guide for Utilization Studies, Draft Publication 1734-3.

V. Methods

A. BROWSE REMOVAL METHODS

1. TWIG LENGTH MEASUREMENT METHOD.

With the Twig Length Measurement Method, utilization is determined by measuring twigs on 25 to 50 browse plants after full annual growth has occurred and again after the period of use. The difference between the two measurements is the amount of browse that has been utilized. Separate transects are run for different browse species. This method is used primarily on winter range.

a. Areas of Use. This method of determining utilization is restricted to use on browse species which clearly exhibit annual twig growth, such as bitterbrush and mountain mahogany.

b. Advantages and Limitations.

(1) Percent utilization determined by measurement is more accurate than when determined by ocular observation. This method is useful in determining the amount of use made on browse plants by livestock and the amount of use made on the same browse plants by wildlife, wild horses, and/or wild burros. The degree of direct forage competition among different kinds of animals can be determined where there are discrete periods of use by different animals. Growth and use indexes can also be determined.

(2) Good utilization estimates can be obtained with this method even though twig volume is not uniformly distributed along the length of twigs. The results will vary with species due to twig growth characteristics. The method is not reliable on species which do not clearly exhibit annual twig growth, such as sagebrush and serviceberry. It is also not reliable in areas of the southwest where annual twig growth may be masked by almost continuous growth or erratic seasonal growth after rains.

(3) Time and expense needed for gathering data are doubled because the measurements must be made twice a year.

c. Equipment.

(1) Study Location and Documentation Data Form. (See Appendix A)
(2) Twig Length Measurement Method Form. (See Illustration 1)
(3) Twenty-five to 50 numbered metal tags.
(4) Roll of soft copper or aluminum wire.
(5) 12-inch ruler or Metric equivalent
(6) Compass.
(7) Steel post.
(8) Post driver.

d. Training. This method does not require intensive training for field application. Examiners must be able to identify the plant species and recognize annual twig growth on the selected key species. (See Section II.D.11.)

e. Establishing Studies. Select key area(s) and key species and determine the number, length, and location of the transects. (See Section II.C.)

(1) Pilot Study. Collect data using several pilot transects to determine number of transects needed and the number of observations to be made on each transect. This data is needed to determine if a statistical valid sample has been collected. (See Section III.B).

(2) In mixed stands of key browse, such as bitterbrush and mountain mahogany, establish separate transects for each species.

(3) Permanently locate transects by means of a reference post placed near the beginning of the transect. An alternative is to select a reference point, such as a prominent natural feature, and give the bearing and distance to the beginning of the transect. If a post is used, it should be tagged to indicate that it marks the location of a monitoring study and that it should not be disturbed.

(4) At the beginning of each transect, determine the distance between observation point and the transect bearing. Select a prominent distant landmark such as a large tree, rocky point, etc., that can be used as the transect bearing point.

(5) Plot the transects on detailed allotment maps and/or aerial photos.

(6) Document the location and other pertinent information concerning a transect on the Study Location and Documentation Data Form. (See Appendix A)

f. Sampling Process. After examiners are trained and are confident in their ability to recognize annual twig growth on the key species, proceed with the collection of utilization data.

(1) Tag plants of only one species per transect.

(2) Tag 25 to 50 plants of the selected key species on each transect. Based on the analysis of past year data additional numbers of plants can be tagged to improve the precision of the estimate.

(3) Objectively tag plants along the transect. The first tagged plant should be a minimum of ten paces from the beginning point of the transect along the transect bearing. The distance between tagged plants, thereafter, should depend on the length of the transect. Be sure to document the number of paces on the study location form.

(4) At the end of each pacing interval, select and tag the closest plant of the key species within a 180 degree zone ahead of the examiner. (See Appendix B for a schematic of the 180 degree selection zone.)

(5) Using soft copper or aluminum wire attach a numbered metal tag to an individual branch that has a minimum of 10 twigs with new growth. The wire should be loosely attached on the branch to allow for future growth. Only one tag per plant is needed.

(6) Estimate the percent use that has already occurred and record on the Twig Length Measurement Form. (See Illustration 1)

(7) Measure the length of current growth (to the nearest ½ inch or nearest centimeter) on each twig from the point of tag attachment to the end of the branch. Record the data on the Twig Length Measurement Method Form. (See Illustration 1)

(a) Make the first measurements after plants of the selected key species have attained full annual growth.

(b) Make subsequent measurements after the period of use.

(8) Where use of tagged plants occurs prior to completion of full annual growth, estimate the use and enter the percentage by plant on the Twig Length Measurement Method Form. (See Illustration 1)

(9) Face the transect bearing point and begin the next pacing interval from the last tagged plant.

g. Calculations. Calculations can be made on the back of Twig Length Measurement Method Form. (See Illustration 1)

(1) Average Estimated Utilization Prior to Completion of Full Annual Growth. This is the utilization that has occurred up to the time the first measurements are taken. Determine this utilization percentage by totaling the estimated percent utilization for the individual plants and dividing the total by the number of tagged plants.

$$\frac{\text{Total estimated \% utilization for the individual plants}}{\text{Number of tagged plants}} = \text{Average estimated use prior to completion of full annual growth}$$

(2) Measured utilization can be calculated as follows:

$$\frac{\text{Total twig length for all tagged plants after full annual growth} - \text{Total twig length for all plants after period of use}}{\text{Total twig length for all tagged plants after full annual growth}} \times 100 = \text{Measured percent utilization}$$

(3) Total Percent Utilization. Determine the total percent utilization by adding the Average Estimated Utilization prior to completion of full annual growth (section (1)) and the Average Percent Utilization for the period(s) of use (Section (3) or (4)).

(4) Growth Index.

(a) The growth index is the average twig length for all tagged plants as determined from the

measurements obtained after completion of full annual growth. This index can be used to compare the amounts of growth which occur in different years and as an indication of species vigor.

(b) Calculate the growth index as follows:

$$\frac{\text{Total twig length for all tagged plants after full annual growth}}{\text{No. of twigs measured}} = \text{Growth index (Average twig length)}$$

(c) If use occurred on the plants prior to measurement after completion of full annual growth, adjust the growth index to account for this use as follows:

$$\frac{\text{Growth index (Average twig length)}}{100\% - \text{Average estimate use prior to completion of full annual growth}} \times 100 = \text{adjusted growth index}$$

(4) Use Index.

(a) The use index is an indication of the volume of browse removed. This index can be used to compare the amounts of browse removed in different years.

(b) Calculate the use index by multiplying the total percent utilization times the adjusted growth index and dividing by 100. For example, if total utilization is 50 percent and the adjusted growth index is 6 inches, the use index is 3. If total utilization is 50 percent and the adjusted growth index is 3 inches, the use index is 1.5. Although utilization is the same in both examples, twice as much browse was removed in the first example.

Illust. 1
Page 1

UTILIZATION STUDY DATA
TWIG LENGTH MEASUREMENT METHOD

STUDY NUMBER	DATE	EXAMINER	KIND AND/OR CLASS OF ANIMAL

KEY SPECIES	ALLOTMENT NAME & NUMBER	PASTURE	PERIOD OF USE

TAG NO	MEASUREMENTS AFTER FULL ANNUAL GROWTH NEAREST 1/2 INCH ☐ CENTIMETER ☐ 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL LNGTH	EST USE	NO TWIG MEAS	MEASUREMENTS AFTER PERIOD OF USE 1	2	3	4	5	6	7	8	9	10	11	12	TOTAL LNGTH	% USE BY PLNT
												TOTALS																TOTALS		

NOTES (USE OTHER SIDE OR ANOTHER PAGE, IF NECESSARY)

(INSTRUCTIONS FOR CALCULATIONS ON OTHER SIDE)

ILLUSTRATION 1 Page 2
TWIG LENGTH MEASUREMENT METHOD FORM - CALCULATIONS:

1. AVERAGE ESTIMATED USE PRIOR TO COMPLETION OF FULL ANNUAL GROWTH

Total estimated % utilization for the individual plants / Number of tagged plants = Average estimated use prior to completion of full annual growth

_____ =

2. PERCENT UTILIZATION BY INDIVIDUAL PLANTS

Total twig length by plant after full annual growth - Total twig length by plant after period of use = Percent utilization

_____ x 100 =

Total twig length by plant after full annual growth

3. TOTAL MEASURED PERCENT UTILIZATION

Total twig length for all tagged plants after full annual growth - Total twig length for all plants after period of use X 100 = Percent utilization

_____ =

Total twig length for all tagged plants after full annual growth

4. TOTAL PERCENT UTILIZATION

average estimate used prior to completion of full annual growth + measured percent utilization = total percent utilization

+ =

5. GROWTH INDEX

Total twig length for all tagged plants after full annual growth / No. of twigs measured = Growth index (Average twig length)

_____ =

6. ADJUSTED GROWTH INDEX

Growth index (Average twig length) X 100 = Adjusted growth index

_____ x 100 =

100% - Average estimate use prior to completion of full annual growth

7. USE INDEX

Total percent utilization x adjusted growth index / 100 = Use index

____x____ =
100

UTILIZATION STUDY DATA
TWIG LENGTH MEASUREMENT METHOD

STUDY NUMBER	DATE	EXAMINER	KIND AND/OR CLASS OF ANIMAL
04N-07W-17-03	9/1/84 11/30/84	BILLY JOE	CATTLE

KEY SPECIES	ALLOTMENT NAME & NUMBER	PASTURE	PERIOD OF USE
PUTR2	CHICKEN CREEK-0573		8/1 to 11/30

	MEASUREMENTS AFTER FULL ANNUAL GROWTH (NEAREST 1/2 INCH ☒ CENTIMETER ☐)															MEASUREMENTS AFTER PERIOD OF USE													
TAG NO	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL LNGTH	TEST USE	NO TWIG MEAS	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL LNGTH	% USE BY PLNT
1	5½	5	6	7	6½	6	7	5½	6	6½			61		10	5½	5	6	7	6	5	5	2	4	2			47¼	22
2	7	5½	6	6½	7	6	6½	5½	7	5½			62½		10	7	5½	6	6½	7	6	6½	4	5	4			57½	8
3	6½	6	6½	5½	6½	5	6	4	5½	6	5	6½	69		12	6½	6	6½	5½	5	5	5	4	4½	4½	4	4	60½	12
4	6½	7	6	6½	5½	5	6	5½	4	3½	2		57½	5	11	6½	7	6	6½	4½	4	6	5	3½	2	1		52	10
5	5½	6	6	6½	5½	6	7	4	6½	5			58		10	5½	6	6	6½	5½	4	3	4	3½	2			46	21
6	7½	6	5½	6½	7	6	6½	3	5½	6	5½		65		11	7½	6	5½	6½	7	6	6½	3	4	3½	5		60½	7
7	5½	7	7½	6	7	6½	6	6½	3	5½			60½		10	5½	7	7½	6	7	6½	6	6½	3	5½			60½	0
8	4	6½	5½	6	6½	4	3	4½	5	6	3	1	55	5	12	4	6½	5½	6	6½	4	3	4½	4	4	2	½	50½	8
9	6	4	4½	5½	5½	5	5½	6	4	7			53		10	6	4	4½	5½	5½	5	5½	6	4	5½			51½	3
10	6	5	6½	4	3½	7	6	6	6	3			53	5	10	6	5	6½	4	3½	7	6	3	2	2			45	15
11	6	5½	8	6	6½	5½	7	4½	6	6½			61½		10	6	5½	8	6	6½	5½	7	4	3½	4			56	9
12	5½	3	7	7½	5	6½	4	6½	5	4½			54½		10	5½	3	7	7½	5	6½	4	6½	5	4½			54½	0
13	7	7½	6	8	5½	7	4	5½	6½	7	6	5½	75½		12	7	7½	6	8	5½	7	4	5½	6½	5½	6	4	72½	4
TOTALS													786	15	138													714½	119

NOTES (USE OTHER SIDE OR ANOTHER PAGE, IF NECESSARY)

(INSTRUCTIONS FOR CALCULATIONS ON OTHER SIDE)

ILLUSTRATIONS
TWIG LENGTH MEASUREMENT METHOD FORM - CALCULATIONS:

1. AVERAGE ESTIMATED USE PRIOR TO COMPLETION OF FULL ANNUAL GROWTH

$$\frac{\text{Total estimated \% utilization for the individual plants}}{\text{Number of tagged plants}} = \text{Average estimated use prior to completion of full annual growth}$$

$$\frac{15}{13} = 1\%$$

2. PERCENT UTILIZATION BY INDIVIDUAL PLANTS

$$\frac{\text{Total twig length by plant after full annual growth} - \text{Total twig length by plant after period of use}}{\text{Total twig length by plant after full annual growth}} \times 100 = \text{Percent utilization}$$

$$\frac{61 - 47\frac{1}{2}}{61} \times 100 = 22$$

3. TOTAL MEASURED PERCENT UTILIZATION

$$\frac{\text{Total twig length for all tagged plants after full annual growth} - \text{Total twig length for all plants after period of use}}{\text{Total twig length for all tagged plants after full annual growth}} \times 100 = \text{Percent utilization}$$

$$\frac{738 - 714\frac{1}{2}}{738} = 9\%$$

4. TOTAL PERCENT UTILIZATION

$$\text{average estimate used prior to completion of full annual growth} + \text{measured percent utilization} = \text{total percent utilization}$$

$$1 + 9 = 10\%$$

5. GROWTH INDEX

$$\frac{\text{Total twig length for all tagged plants after full annual growth}}{\text{No. of twigs measured}} = \text{Growth index (Average twig length)}$$

$$\frac{786}{138} = 5.7 \text{ inc}$$

6. ADJUSTED GROWTH INDEX

$$\frac{\text{Growth index (Average twig length)}}{100\% - \text{Average estimate use prior to completion of full annual growth}} \times 100 = \text{Adjusted growth index}$$

$$\frac{5.7}{100 - 1} \times 100 = 5.8 \text{ inch}$$

7. USE INDEX

$$\frac{\text{Total percent utilizarion} \times \text{adjusted growth index}}{100} = \text{Use index}$$

$$\frac{10 \times 5.8}{100} = .6$$

APPENDIX D

RANGELAND MONITORING METHODS

SECTION 3

Extensive Browse Method for measuring use on willows, aspens and other woody shrubs from pages 41 thru 50 of the Interagency Rangeland Monitoring Guide for Utilization Studies, Draft Publication 1734-3.

3. EXTENSIVE BROWSE METHOD.

With the Extensive Browse Method, a pace transect is run to collect vegetation data. This method provides data on utilization, species composition, age class, form classes, availability, and hedging for the browse component of the plant community.

a. Areas of Use. This method can be used within a wide variety of vegetation types.

b. Advantages and Limitations. The Extensive Browse Method is rapid and can be used on all browse species. It is well adapted to situations where browse data must be obtained from large areas with limited personnel. All browse species within the plant community can be sampled on one transect. The method is more rapid than methods which require measurements. However, it is somewhat less accurate than measurement methods in determining utilization because estimates rather than measurements are used. This method is designed to eliminate personal bias and keep consistency at a maximum.

c. Equipment.

(1) Study Location and Documentation Data Form. (See Appendix A)

(2) Extensive Browse Method Form. See Illustration 3

(3) Tally counter (optional).

d. Training. The accuracy of utilization percentage estimates is dependent upon thoroughness of training. Examiners should be trained to identify browse species, recognize annual leader growth, availability of browse, percent utilization, degree of hedging, and age class of browse plants. (See Section III.D.11.)

e. Establishing Studies. Select key area(s) and key species and determine the number, length, and location of the transects. (See Section II.C.)

(1) Locate the "heaviest used" or "representative" areas in an allotment. The intent is to find several areas used intensively during the period of use. These may occur in the same general location each year, but will probably fluctuate. Transects are located in heavy use areas since

vegetation changes which occur as a result of browsing will be evident first on these areas.

(2) Place the transects in the areas selected for that year. Do not establish permanent transects because the area(s) selected for sampling may change from year to year.

(3) Select a transect starting point and a transect bearing point, such as a prominent natural feature, to help maintain the intended line of travel.

(4) Although transects are not permanent, plot them on detailed allotment maps and/or aerial photos for documentation and future reference.

(5) Record important information about the transect and any special resource conditions under "Notes" Extensive Browse Method Form, or on the Study Location and Documentation Data Form. (See Illustration 3 and Appendix A)

f. Sampling Process. After examiners are trained and are confident in their ability to recognize availability of browse, degree of utilization, degree of hedging, and age classes of browse plants, proceed with the collection of data.

(1) Pilot Study. Collect data using several pilot transects to determine number of transects needed and the number of observations to be made on each transect. This data is needed to determine the number of observations and the distance between observation points. It will also help determine if a statistical valid sample has been collected. (See Section III.B).

(2) At the beginning of each transect, randomly select a starting point, and determine the distance between observation points and the transect bearing. Select a prominent distant landmark such as a large tree, rocky point, etc., that can be used as the transect bearing point.

(3) Selecting the Sample Plants.

(a) At the end of each pacing interval, face toward the transect bearing point, select and sample the nearest browse plant that occurs within a

180 degree zone. (See Appendix B for a schematic of the 180 degree selection zone.)

(b) Begin each pacing interval from the last sampled plant. Pace toward the transect bearing point in the interspaces between browse plants. It is not necessary to pace in an absolutely straight line.

(4) Collecting Data: Make observations and estimates on the selected browse plant, and record the data by species on the Extensive Browse Method Form. (See Illustration 3) Use a dot count or tally counter to keep track of the number of plants sampled.

(a) Utilization. Select a branch and estimate the amount of utilization of current annual growth.

i. Select a branch at random. For example,

(i) Note the second hand location or the digital seconds readout on a watch.

(ii) Using the route of travel along the transect line as the 6 o'clock - 12 o'clock line, go to the position on the browse plant that is indicated by the location of the second hand or the digital second readout. (Example - 20 seconds represents the 4 o'clock position.)

(iii) Select an available branch on that side of the plant.

ii. Select ten leaders of annual growth and determine the number of these leaders which show any evidence of use. Convert this number to percent (i.e., two leaders used equals 20 percent use; six leaders used equals 60 percent use, etc.). Record the value by dot tally in the appropriate column on the form.

iii. After sampling the plant at the 50th point, figure the average utilization for each species encountered on the first half of the transect. Circle the plant code for all species averaging approximately 50

percent use at this point. (See Section V.A.3.g.)

iv. Sample points 51-100 as follows:

(i) Record the data in the same manner as for the first 50 plants.

(ii) If the next selected plants are not one of the circled species, record the data as previously described and in addition, locate the nearest plant of any of the circled species and record its utilization (only) in the appropriate column opposite the species plant code. Do not record age class and form class for these additional plants.

(b) Age Class. Age class data reflect the establishment, survival, and decadence of key browse plants. Observe the selected plant and record (by dot tally) the age class by species in the appropriate column on the form. The four age classes are as follows:

S - Seedling - New plants that have survived at least one growing season, but are not more than two or three years old. The basal stems are generally 1/8 inch or less in diameter.

Y - Young - Young plants usually less than 10 years old. Elongated growth form and simple branching with basal stems no greater than approximately .5 inch in diameter.

M - Mature - Plants more than 10 years old. Distinguished by heavier, often gnarled stems, and complex branching. Canopy made up of more than 50 percent living wood. Basal stems are often greater than .5 inch in diameter.

D - Decadent - Browse plants with more than 50 percent of the canopy area dead.

(c) Form Class. Observe the selected plant and record (by dot tally) the form class by species in the appropriate column on the form.

i. The form classes are as follows:

No.	Form Class
1	All available, little or no hedging
2	All available, moderately hedged
3	All available, severely hedged
4	Partially available, little or no hedging
5	Partially available, moderately hedged
6	Partially available, severely hedged
7	Unavailable
8	Dead

ii. Availability refers to browse available to the animals.

iii. The three degrees of hedging are based on the length and appearance of two-year-old wood (previous year's leaders) immediately below the current leaders. (See Appendix C) If more than one degree of hedging is evident on a plant, form class is based on the predominant or average condition. The three degrees of hedging are:

Little or no hedging - Two-year-old wood is relatively long and unaltered or only slightly altered.

Moderately hedged - Two-year-old wood is fairly long but most of it has been altered from the normal growth form.

Severely hedged - Two-year-old wood is relatively short and/or strongly altered from the normal growth form.

iv. Browse plants are considered to reflect the normal growth form when less than 50 percent of the two-year-old growth (the previous year's leaders) has clipped ends and a majority of the current leaders extend directly from terminal buds off two-year-old wood. Alterations from the normal growth form are reflected when 50 percent or more of the two-year-old wood has clipped ends. Current leaders occur mostly as extensions from lateral buds off two-

year-old wood in the moderately hedged condition or as clumped lateral and/or adventitious sprouts in the severely hedged condition.

v. The length of two-year-old wood reflects the relative vigor of the previous year's leader growth and/or the effects of prior use. Since the degrees of hedging are confined to two-year-old wood, they reflect the effects of use during a previous year, or a succession of previous years.

vi. The three degrees of hedging provide a measure of the relative condition of browse plants and assess shot-term effects of different intensities of leader use.

g. Calculations. Make the calculations and record the results in the appropriate columns on the Extensive Browse Method Form. (See Illustration 3)

(1) Average Utilization by Species.

(a) For each species, multiply the number of browse plants tallied in each percentage block by the percent indicated in the column heading (0, 10, 20, 30, etc.). Add the figures from each block and enter the total in the Total Percent Utilized Column on the form.

(b) Add the dot tallies for each browse species to determine the total number of plants sampled of that species and enter the total in the Number of Plants Column on the form.

(c) Calculate the average percent utilization for each species by dividing the total percent utilized by the total number of plants. Enter the value in the Average Percent Utilization Column on the form.

(2) Age Class Summary. Add the dot tallies for each age class and enter the totals in the Total Number of Plants Row on the form. Because the age class is determined for 100 plants on the transect, these totals represent the percent composition by age class for the browse portion of the plant community.

(3) Form Class Summary. Add the dot tallies for each form class and enter the totals in he Total Number of Plants Row on the form. Because the form class is determined for 100 plants on the transect, these totals represent the percent composition by form class for the browse portion of the plant community.

(4) Percent Composition by Species. Add the form class dot tallies for each browse species and enter the total in the Number of Plants Column on the form. Because the form class is determined for 100 plants on the transect, these totals represent the species composition percentages for the browse portion of the plant community.

Illustration 3
Page 1

UTILIZATION STUDY DATA
EXTENSIVE BROWSE METHOD

STUDY NUMBER	DATE	EXAMINER

ALLOTMENT NAME & NUMBER	PASTURE

KIND AND/OR CLASS OF ANIMAL	PERIOD OF USE

SPECIES	PERCENT UTILIZATION 0	10	20	30	40	50	60	70	80	90	100	TOTAL % UTILIZED	NUMBER OF PLANTS	AVG. % UTILIZ

SPECIES	AGE CLASS S	Y	M	D	FORM CLASS 1	2	3	4	5	6	7	8	NO PLNT (AND % COMP)
TOT NO PLANTS (AND % COMP)													

ES (USE OTHER SIDE OR ANOTHER PAGE, IF NECESSARY)

(INSTRUCTIONS FOR CALCULATIONS ON OTHER SIDE)

Calculating Average Utilization by Species

1. For each species, multiply the number of browse plants tallied in each percentage block by the percent indicated in the column heading (0, 10,20,30, etc.). Add the figures from each block to determine total percent utilized.

2. Add the dot tallies for each browse species to determine the total number of plants sampled of that species.

3. Calculate the average percent utilization for each species by dividing the total percent utilization by the total number of plants.

Age Class Summary Calculations

Add the dot tallies for each age class. Because the age class is determined for 100 plants on the transect, these totals represent the percent composition by age class for the browse portion of the plant community.

From Class Summary Calculations

Add the dot tallies for each form class. Because the form class is determined for 100 plants on the transect, these totals represent the percent composition by form class for the browse portion of the plant community.

Calculating Composition by species

Add the form class dot tallies for each browse species. Because the form class is determined for 100 plants on the transect, the totals represent the species composition percentages for the browse portion of the plant community.

Illustration 3
Page 3

UTILIZATION STUDY DATA
EXTENSIVE BROWSE METHOD

STUDY NUMBER	DATE	EXAMINER
27N - 01E - 19 - 01	3/21/84	SALLY CLUMP

ALLOTMENT NAME & NUMBER	PASTURE
WINDOW ROCK - 2129	BOULDER

KIND AND/OR CLASS OF ANIMAL	PERIOD OF USE
SHEEP	1/15 to 3/21

SPECIES	PERCENT UTILIZATION 0	10	20	30	40	50	60	70	80	90	100	TOTAL % UTILIZED	NUMBER OF PLANTS	AVG. % UTILIZ
PUTR2												3110	60	52
CEMO2												1030	44	23
CHVI8												280	22	12
ARTRV												130	14	9

SPECIES	AGE CLASS S	Y	M	D	FORM CLASS 1	2	3	4	5	6	7	8	NO PLNT (AND % COMP)
PUTR2													19
CEMO2													44
CHVI8													23
ARTRV													14
TOT NO PLANTS (AND % COMP)	5	25	66	4	72	12	2	9	3	2			100

ES (USE OTHER SIDE OR ANOTHER PAGE, IF NECESSARY)

(INSTRUCTIONS FOR CALCULATIONS ON OTHER SIDE)

APPENDIX D

RANGELAND MONITORING METHODS

SECTION 4

Stubble Height Method for measuring residue on wet, moist and stringer meadows and riparian areas from pages 51 thru 52 of the Interagency Rangeland Monitoring Guide for Utilization Studies, Draft Publication 1734-3. Includes sample forms developed from same publication (pp. 53 thru 56).

B. Methods for Measuring Residue

1. - STUBBLE HEIGHT METHOD.

The concept of this method is to measure stubble height, or inches of herbage left un-grazed at any given time. This method, because of it's simple application, is becoming a well-accepted method for expressing rangeland use.

This method would be used after stubble height standards for specific plant communities had been developed. As an example, a stubble height of 4 inches might be specified to provide streambank protection, and to trap sediments and rebuild degraded stream channels in riparian areas.

a. Areas of Use. - Stubble height standards and measurements have been primarily used in riparian areas, however this method may also be used in upland sites. Adequate stubble height on streamside areas is needed at the end of the growing season for maintenance of plant vigor and stream bank protection.

b. Advantages and Disadvantages. - Stubble height measurements are simple, quick, and accurate. This method can be used to monitor large areas in less time than with traditional utilization study methods. Statistical reliability improves because numerous measurements can be taken in a relatively short time. Limitations of the method may stem from infrequent application in a variety of rangeland ecosystems. While stubble height has been used with great success in riparian areas, there needs to be more research in a variety of plant communities.

c. Equipment.

(1) Study Location and Documentation Data Form. (See Appendix A.)
(2) Stubble height form. (See Illustration 4)
(3) Tape measure

d. Training. - Minimal training of examiners is needed to use this method. Examiners must be able to identify the plant species. This method requires measuring stubble heights of selected key species. Measuring stubble height can be easily accomplished by agency personnel, permittees, or other interested individuals.

e. Establishing Studies. - Careful establishment of plot location is a critical element in obtaining meaningful data (See section III.D.10.). Select key area(s) and key species and determine the number, length, and location of the transects. Document the location and other pertinent information concerning the transect on the Stubble Height Form.

f. Sampling Process. This method can be completed by one, or preferably two, individuals.

(1) Pilot Study. Collect data using several pilot transects to determine number of transects needed and the number of observations to be made on each transect. This data is needed, to determine the number of observations and the distance between observation points. It will also help determine if a statistical valid sample has been collected. (See Section III.B).

(2) At the beginning of each transect, randomly select a starting point, and determine the distance between observation points and the transect bearing. Select a prominent distant landmark such as a large tree, rocky point, etc., that can be used as the transect bearing point.

(3) At specified intervals measure the stubble height of the key species nearest to the toe of your right foot and record on the Stubble Height Form (Illustration 4). Measurements should be in inches or centimeters of leaf stubble left. For riparian sites sampling should be done along both sides of a stream segment. For upland sites and wet meadow riparian sites, measurements are taken along a predetermined course or transect. In either situation stubble height data can be collected using the baseline technique described in section III.A.2. Design The Study.

g. Calculations. - Use data from the Stubble Height Form for calculating the median stubble height by species. Confidence levels should be calculated for the median. See technical reference 1734-2, Planning for Monitoring, for information on determining confidence intervals.

STUBBLE HEIGHT

Study Number	Date	Examiner

Allotment Name & Number	Location

	1		2		3	
Site (or)						
Species						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
TOTAL						
AVERAGE						

Average Stubble Height for Site or Species 1	
Average Stubble Height for Site or Species 2	
Average Stubble Height for Site or Species 3	
Σ for All Sites or Species	
Average for All Sites or Species	

Study Number	Range Condition - GOOD	Date	Examiner
M - 1		9/21/94	Jack Daniels

Allotment Name & Number	Location
MUGLER #5528	Long Mdw TWP 5S Rge 24E Sec. 23

	1		2		3	
Site (or)						
Species						
1	4	5	3	5	3	4
2	5	6	2	3	2	3
3	3.5	4.5	4	7	3	2
4	6	3	5	6	4	6
5	7.5	3	2	4	5	5
6	4.5	2	6	4.5	3	2
7	5	6	5.5	5.5	2	7
8	2	7	4	4	4	6
9	3.5	4	3	3	5	4
10	3	5.5	5	2	4	3
11	5	4.5	7	3.5	3	3
12	7	4	3	4	2	2
13	8	3	2	4.5	5	2
14	3	5	4	4	7	3
15	3.5	4	4.5	3	3	3
16	4	3	5	5	6	2
17	5	5	4	7	5	5
18	5.5	4.5	3	3	3	4
19	3	5	6	6	2	3.5
20	4	4	3	4.5	4.5	3.5
21	4.5	3	7	4.5	3.5	4
22	7	5	6.5	3.5	3	5.5
23	6	6	5	3	4.5	6
24	4.5	3	3	2	5.5	3.5
25	3.5	3.5	2	7	6	4
26	6	4	3	4	3	2
27	4	5.5	2	3	2	2
28	4.5	4	4	5	4	3
29	3.5	5	3.5	4	5	4
30	7	3	4	3	4	3
TOTAL		272.5		248.5		226
AVERAGE		4.5		4.1		3.8

Average Stubble Height for Site or Species 1	4.5
Average Stubble Height for Site or Species 2	4.1
Average Stubble Height for Site or Species 3	3.8
Σ for All Sites or Species	12.4
Average for All Sites or Species	4.13"

APPENDIX D

RANGELAND MONITORING METHODS

SECTION 5

Key Species Method (also referred to as Key Forage Species Method or Ocular Estimate by Plot Method) for measurement of use on upland herbaceous and browse vegetation from pages 82 thru 86 of the Interagency Rangeland Monitoring Guide for Utilization Studies, Draft Publication 1734-3. Includes sample forms R4-2200-47.

3. KEY SPECIES METHOD (formerly Modified Key Forage Plant Method). This technique is a combination of the Landscape Appearance Method (Section V.D.) and the Ocular Estimate Method (Section V.C.2). Utilization levels are based on an ocular estimate of the amount of forage removed by weight on individual key species and observations are recorded in one of seven utilization classes.

a. Areas of Use. This method is adapted to areas where perennial grasses, forbs, and/or browse plants are the key species.

b. Advantages and Limitations. This method is rapid. The estimated percentage of forage removed is recorded in one of seven broad classes rather than a precise amount. The method is also reasonably accurate, depending upon the ability of the examiners. Different examiners are more likely to estimate utilization in the same classes than to estimate the same utilization percentages. Vegetation is not disturbed. Reliability of estimates is increased by limiting observations to individual plants or small areas (plots). A limitation is that exclosures, cages, or fenced areas may be needed for training.

c. Equipment.

(1) Study Location and Documentation Data Form. (See Appendix A.)
(2) Key Species Method Form. (See Illustration 11)
(3) Tally counter (optional).
(4) Frames to delineate plots (if necessary).
(5) Clipping shears.
(6) Paper sacks.
(7) Spring scale, calibrated in grams.
(8) Cages (as required) See Appendix D

d. Training. The accuracy of estimating utilization percentages is dependent upon thoroughness of training and ability of examiners to identify plant species and the amount of use. The examiners must first compare their ocular estimates against actual weight values obtained by clipping and weighing. (See Section III.D.11.)

(1) Training Sites. Locate sites for training purposes on key areas or on similar unforaged or protected sites. If it is unlikely that a site containing unforaged vegetation will be available after the foraging season, it will be necessary to

construct temporary exclosures or install cages on key areas prior to the period of use.

(2) Making Ocular Estimates. Training involves estimating utilization on individual plants of the key species or on all plants of the key species on a small plot. If plots are to be used for the studies, use plots of the same size for training. The plots should be small enough so that the entire plot is clearly visible to the examiner. Examiners should practice making ocular estimates as follows:

(a) Clip individual plants of the key species, or plants of the key species, on a plot, to simulate foraging (sample A).

(b) Estimate the percentage of weight removed.

(c) Clip the remaining forage of the selected plants by removing all current year's growth available to the foraging animals (sample B).

(d) Put the clippings for samples A and B in separate paper sacks.

(e) Weigh samples A and B separately and subtract sack weight from the weight of each sample.

(f) Calculate the percent simulated use by dividing the weight of sample A by the combined weight of samples A and B and multiplying the value by 100.

(g) Compare estimates with the actual percent forage removed and determine the error of the estimates. Continue training until examiners can recognize the different percentages of use within limits of acceptable error.

(3) Identify Utilization Classes. Recognize the seven herbaceous or seven browse utilization classes using the written class descriptions.

e. Establishing Studies. Select key area(s) and key species and determine the number, length, and location of the transects. (See Section III.C.) Document the location and other pertinent information concerning a transect on the Study Location and Documentation Data Form. (See Appendix A)

f. Sampling Process. After examiners are trained and are confident in their ability to recognize various degrees of utilization, proceed with the collection of utilization data.

(1) Sampling Techniques.

(a) At each interval along a transect, select the plant of the key species nearest the toe and estimate and record the percent utilization by weight.

(b) If a plot is being used, place the frame immediately in front of the toe and estimate and record the percent utilization. If the key species does not occur in the plot proceed along the transect until the key species is encountered.

(c) Record each observation by dot count in the appropriate utilization class on the Key Species Method Form. (See Illustration 11)

(2) Herbaceous Utilization Classes. Seven utilization classes are used to show relative degrees of use of key herbaceous species (grasses and forbs). Each class represents a numerical range of percent utilization. Estimate utilization within one of the seven classes. Utilization classes are described as follows:

(a) (0-5%). The key species show no evidence or negligible grazing use.

(b) (6-20%). The key species have the appearance of very light grazing. Plants may be topped or slightly used. Current seedstalks and young plants are little disturbed.

(c) (21-40%). The key species may be topped, skimmed, or grazed in patches. 60 to 80 percent of current seedstalks remain intact. Most young plants are undamaged.

(d) (41-60%). Half of the available forage (by weight) on key species appear to have been utilized. Fifteen to 25 percent of current seedstalks remain intact.

(e) (61-80%). More than half of the available forage on key species appear to have been utilized. Less than 10 percent of the current seedstalks remain. Shoots of rhizomatous grasses are missing.

(f) (81-94). The key species appear to have been heavily utilized and there are indications of repeated use. There is no evidence of reproduction or current seedstalks.

(g) (95-100). The key species appear to have been completely utilized. The remaining stubble is utilized to the soil surface.

(3) Browse Utilization Classes. Seven utilization classes show relative degrees of use of available current year's growth (leaders) of key browse plants (shrubs, half shrubs, woody vines, and trees). Each class represents a numerical range of percent utilization. Estimate utilization within one of the seven classes. Utilization classes are described as follows:

(a) (0-5%). The key ~~browse~~ plants show no evidence of use; or have the appearance of negligible use.

(b) (6-20%). The key browse plants have the appearance of very light use. The available leaders are little disturbed.

(c) (21-40%). There is obvious evidence of leader use. The available leaders appear cropped or browsed in patches and 60 to 80% of the available leader growth remains intact.

(d) (41-60%). Key browse plants appear rather uniformly utilized and 40 to 60% of the available leader growth remains intact.

(e) (61-80%). The key browse plants are hedged and some plant clumps may be slightly broken. Nearly all available leaders are used and few terminal buds remain. Between 20 to 40% of the available leader growth remains intact.

(f) (81-94%). There are indications the key browse species have been utilized repeatedly. There is no evidence of terminal buds and

usually less than 20% of available leader growth remains intact. Some, and often much, of the second and third years' growth has been utilized. Hedging is readily apparent. Key browse plants frequently have broken branches.

(g) (95-100). Less than 5% of the available leader growth on the key browse plants remain intact. Most of the second and third years growth have been utilized. All key browse plants have major portions broken.

g. Calculating Percent Utilization. Calculate the percent utilization as follows:

(1) Convert the dot count to the number of observations for each utilization class.

(2) Multiply the number of observations in each utilization class times the midpoints of the class intervals.

(3) Total the products for all classes.

(4) Divide the sum by the total number of observations on the transect.

(5) Record the average percent utilization on the Key Species Method Form. (See Illustration 11)

UTILIZATION STUDY DATA
KEY FORAGE PLANT METHOD
(Reference FSH 2209.21)

FOREST	DISTRICT	DATE	EXAMINERS

ALLOTMENT NAME & NUMBER	ALLOTMENT UNIT

LOCATION	TWP.	RGE.	SECTION	PERIOD OF USE

		KEY SPECIES			KEY SPECIES		
CLASS INTERVAL	INT MID (M)	DOT COUNT	NO BY CLASS (C)	NO X MIDPT (C)(M)	DOT COUNT	NO BY CLASS (C)	NO X MIDPT (C)(M)
NO USE 0-5%	2.5						
SLIGHT 6-20%	13						
LIGHT 21-40%	30						
MODERATE 41-60%	50						
HEAVY 61-80%	70						
SEVERE 81-100%	90						
		TOTALS			TOTALS		
AVG. ((CM)* UTIL. (C		----------=		%	----------=		

NOTES: (Use Other Side or Another Page, if necessary)

Herbaceous Utilization Classes (Browse utilization classes are on the other side.)

1. No Use (0-5%) The rangeland shows no evidence of grazing use; or the rangeland has the appearance of negligible grazing.

2. Slight (6-20%) The rangeland has the appearance of very light grazing. The key herbaceous forage plants may be topped or slightly used. Current seedstalks and young plants of key herbaceous species are little disturbed.

3. Light (21-40%) The rangeland may be topped, skimmed, or grazed in patches. The low value herbaceous plants are ungrazed and 60 to 80 percent of the number of current seedstalks of key herbaceous species remain intact. Most young plants are undamaged

4. Moderate (41-60%) The rangeland appears entirely covered as uniformly as natural features and facilities will allow. Fifteen to 25 percent of the number current seedstalks of key herbaceous species remain intact. No more than 10 percent of the number of low value herbaceous forage plants are utilized. (Moderate use does not imply proper use.)

5. Heavy (61-80%) The rangeland has the appearance of complete search. Key herbaceous species are almost completely utilized with less than 10 percent of the current seedstalks remaining. Shoots of rhizomatous grasses are missing. More than 10 percent of the number of low value herbaceous forage plants have been utilized.

6. Severe (81-100%) The rangeland has a mown appearance and there indications of repeated coverage. There is no evidence of reproduction or current seedstalks of key herbaceous species. Key herbaceous forage species are completely utilized. The remaining stubble of preferred grasses is grazed to the soil surface.

*WHERE C = THE NUMBER OF OBSERVATIONS WITHIN EACH CLASS INTERVAL (C COLUMN), M = THE CLASS INTERVAL MIDPOINT (M COLUMN), AND Σ = THE SUMMATION SYMBOL.

UTILIZATION STUDY DATA
KEY FORAGE PLANT METHOD
(Reference FSH 2209.21)

FOREST	DISTRICT	DATE	EXAMINERS
ALLOTMENT NAME & NUMBER		ALLOTMENT UNIT	
LOCATION	TWP. RGE. SECTION	PERIOD OF USE	

CLASS INTERVAL	INT MID (M)	KEY SPECIES DOT COUNT	KEY SPECIES NO BY CLASS (C)	KEY SPECIES NO X MIDPT (C)(M)	KEY SPECIES DOT COUNT	KEY SPECIES NO BY CLASS (C)	KEY SPECIES NO X MIDPT (C)(M)
NO USE 0-5%	2.5						
SLIGHT 6-20%	13						
LIGHT 21-40%	30						
MODERATE 41-60%	50						
HEAVY 61-80%	70						
SEVERE 81-100%	90						
		TOTALS			TOTALS		
AVG. UTIL. ((CM)* / ((C)		----------= %			----------=		

NOTES: (Use Other Side or Another Page, if necessary)

Browse Utilization Classes.

1. (0-5%). The key browse plants show no evidence of use; or have the appearance of negligible use.
2. (6-20%). The key browse plant have the appearance of very little use. The available leaders are little disturbed.
3. (21-40%). There is obvious evidence of leader use. The available leaders appear cropped or browsed in patches and 60 to 80% of the available leader growth remains intact.
4. (41-60%). Key browse plants appear rather uniformly utilized and 40 to 60% of the available leader growth remains intact.
5. (61-80%). The key browse plants are hedged and some plant clumps may be slightly broken. Nearly all available leaders are used and few terminal buds remain. Between 20 to 40% of the available leader growth remains intact.
6. (81-94%). There are indications the key browse species have been utilized repeatedly. There is no evidence of terminal buds and usually less than 20% of available leader growth remains intact. Some, and often much, of the second and third years"s growth has been utilized. Hedging is readily apparent. Key browse plants frequently have broken branches.
7. (95-100). Less than 5% of the available leader growth on the key browse plants remains intact. Most of the second and third years growth has been utilized. All key browse plants have major portions broken.

*WHERE C = THE NUMBER OF OBSERVATIONS WITHIN EACH CLASS INTERVAL (C COLUMN), M = THE CLASS INTERVAL MIDPOINT (M COLUMN), AND (= THE SUMMATION SYMBOL.

UTILIZATION STUDY DATA
KEY FORAGE PLANT METHOD
(Reference FSH 2209.21)

FOREST	DISTRICT	DATE	EXAMINERS
SIERRA	PINERIDGE	9/28/93	Jack Daniels

ALLOTMENT NAME & NUMBER	ALLOTMENT UNIT
MARKWOOD 5321	MARKWOOD MEADOW

LOCATION	TWP.	RGE.	SECTION	PERIOD OF USE
MARKWOOD MDW	10S	25E	3	6/16 - 9/25

CLASS INTERVAL	INT MID (M)	KEY SPECIES CANE-1 DOT COUNT	NO BY CLASS (C)	NO X MIDPT (C)(M)	KEY SPECIES CARO-2 DOT COUNT	NO BY CLASS (C)	NO X MIDPT (C)(M)
NO USE 0-5%	2.5	Γ.	6	15	⁚	4	10
SLIGHT 6-20%	13	⁚	4	52	Γ.	6	78
LIGHT 21-40%	30	⊠ Γ.	16	480	⊠ Γ	17	510
MODERATE 41-60%	50	⊠ ⁚	12	600	⊠	10	500
HEAVY 61-80%	70	⁚	2	140	⁚	3	210
SEVERE 81-100%	90				:		
		TOTALS	40	1287	TOTALS	40	1308
AVG. ((CM)* / UTIL. (C		1287 / 40 = 32%			1308 / 40 = 32.7		

NOTES: (Use Other Side or Another Ppage, if necessary)

Herbaceous Utilization Classes (Browse utilization classes are on the other side.)

1. No Use (0-5%) The rangeland shows no evidence of grazing use; or the rangeland has the appearance of negligible grazing.

2. Slight (6-20%) The rangeland has the appearance of very light grazing. The key herbaceous forage plants may be topped or slightly used. Current seedstalks and young plants of key herbaceous species are little disturbed.

3. Light (21-40%) The rangeland may be topped, skimmed, or grazed in patches. The low value herbaceous plants are ungrazed and 60 to 80 percent of the number of current seedstalks of key herbaceous species remain intact. Most young plants are undamaged

4. Moderate (41-60%) The rangeland appears entirely covered as uniformly as natural features and facilities will allow. Fifteen to 25 percent of the number current seedstalks of key herbaceous species remain intact. No more than 10 percent of the number of low value herbaceous forage plants are utilized. (Moderate use does not imply proper use.)

5. Heavy (61-80%) The rangeland has the appearance of complete search. Key herbaceous species are almost completely utilized with less than 10 percent of the current seedstalks remaining. Shoots of rhizomatous grasses are missing. More than 10 percent of the number of low value herbaceous forage plants have been utilized.

6. Severe (81-100%) The rangeland has a mown appearance and there indications of repeated coverage. There is no evidence of reproduction or current seedstalks of key herbaceous species. Key herbaceous forage species are completely utilized. The remaining stubble of preferred grasses is grazed to the soil surface.

*WHERE C = THE NUMBER OF OBSERVATIONS WITHIN EACH CLASS INTERVAL (C COLUMN), M = THE CLASS INTERVAL MIDPOINT (M COLUMN), AND Σ = THE SUMMATION SYMBOL.

USDA Forest Service R4-2200-47 (1/93)

UTILIZATION STUDY DATA
KEY FORAGE PLANT METHOD
(Reference FSH 2209.21)

FOREST	DISTRICT	DATE	EXAMINERS
Sierra	Pineridge	9/28/93	Jack Daniels

ALLOTMENT NAME & NUMBER	ALLOTMENT UNIT
Markwood 5321	Poison Meadow

LOCATION	TWP.	RGE.	SECTION	PERIOD OF USE
Poison Mdw	10S	25E	3	6/16 - 9/25

CLASS INTERVAL	INT MID (M)	KEY SPECIES SALIX DOT COUNT	NO BY CLASS (C)	NO X MIDPT (C)(M)	KEY SPECIES PREM DOT COUNT	NO BY CLASS (C)	NO X MIDPT (C)(M)
NO USE 0-5%	2.5	⊠ ∴	12	30	∴	5	12.5
SLIGHT 6-20%	13	⊏	7	91	⊏	7	91
LIGHT 21-40%	30	⊠ ⊠	20	600	⊠ □	18	540
MODERATE 41-60%	50	⊠	9	450	∴ ∴	4	200
HEAVY 61-80%	70	∴	2	140	∴	4	280
SEVERE 81-100%	90				∴	2	180
		TOTALS	50		TOTALS	40	
AVG. UTIL. (C)		1311 / 50 = 26%			1303.5 / 40 = 32.6%		

NOTES: (Use Other Side or Another Page, if necessary)

Browse Utilization Classes.

1. (0-5%). The key browse plants show no evidence of use; or have the appearance of negligible use.
2. (6-20%). The key browse plant have the appearance of very little use. The available leaders are little disturbed.
3. (21-40%). There is obvious evidence of leader use. The available leaders appear cropped or browsed in patches and 60 to 80% of the available leader growth remains intact.
4. (41-60%). Key browse plants appear rather uniformly utilized and 40 to 60% of the available leader growth remains intact.
5. (61-80%). The key browse plants are hedged and some plant clumps may be slightly broken. Nearly all available leaders are used and few terminal buds remain. Between 20 to 40% of the available leader growth remains intact.
6. (81-94%). There are indications the key browse species have been utilized repeatedly. There is no evidence of terminal buds and usually less than 20% of available leader growth remains intact. Some, and often much, of the second and third years"s growth has been utilized. Hedging is readily apparent. Key browse plants frequently have broken branches.
7. (95-100). Less than 5% of the available leader growth on the key browse plants remains intact. Most of the second and third years growth has been utilized. All key browse plants have major portions broken.

*WHERE C = THE NUMBER OF OBSERVATIONS WITHIN EACH CLASS INTERVAL (C COLUMN), M = THE CLASS INTERVAL MIDPOINT (M COLUMN), AND ∑ = THE SUMMATION SYMBOL.

APPENDIX D

RANGELAND MONITORING METHODS

SECTION 6

Double Sampling Method for measuring residual dry matter on annual grasslands and montane meadows as described in the R-5 Rangeland Analysis Field Guide, Draft May 1993. Includes sample forms.

DOUBLE SAMPLING METHOD.

This is a combination of the ocular estimate by plot and clipped plot method. It requires less time than the clipped plot method and has the advantage of a larger sample size by the inclusion of ocular estimate: This method utilizes weight estimate and clipped plot methods. A five plot sample is acquired by clipping one plot and four plots are estimated.

1. Sampling is rapid once examiner is trained.

2. Sample clipped for training may be used the same as the clipped plot method.

3. Additional training may be required when changing range site or areas of district composition differences.

4. The examiner trains (himself/herself) by developing a mental image of a weight unit of vegetation through estimating weight on 5 plots then clipping one to arrive at a consistent estimate. After the initial training, the examiner should estimate, clip, and weigh enough plots each day to maintain the reliability of his estimates.

5. The total number of plots will vary with the individual site, depending upon the variability of the vegetation.

PROCEDURE

1. Select sample plots in multiples of five.

2. Sampling is carried out by first estimating production or herbage residue (RDM) on all plots in grams.

3. Then randomly select one of the plots for clipping. The plot is then clipped, weighed, and a correction factor is determined for the four estimated plots.

4. Plot size may be:

PLOT	RADIUS	CIRCUMFERENCE	CONVERSION FACTOR (grams to lbs./acre
9.6 Sq. foot	20.98 inches	131.80 inches	10
.96 Sq. foot	6.63 inches	41.66 inches	100
Square foot	6.77 inches	42.54 inches	96
Square foot	(12" x 12")		96

5. Example, using 9.6 square foot plot.

Clipped plot estimated weight 195 gm. Actual weight 190 gm.

$$\text{Correction factor} = \frac{\text{Actual weight}}{\text{Estimated weight}} = \frac{190}{195} = .974$$

PLOT NO.	ESTIMATED WEIGHT (GM)	CORRECTION FACTOR	CORRECTED WEIGHT (GM)
1	180	0.974	175
2	195	CLIPPED	190
3	175	0.974	170
4	190	0.974	185
5	205	0.974	200
	945		920

Mean weight per plot = 920 - 5 = 180 grams
Pounds per acre = 184 x 10 = 1840 lbs.

6. Example, using .96 square foot plot.

Clipped plot estimated weight 19.5 gm. Actual weight 19.0 gm.

$$\text{Correction factor} = \frac{\text{Actual weight}}{\text{Estimated weight}} = \frac{19.0}{19.5} = .974$$

PLOT NO.	ESTIMATED WEIGHT (GM)	CORRECTION FACTOR	CORRECTED WEIGHT (GM)
1	18.0	0.974	17.5
2	19.5	CLIPPED	19.0
3	17.5	0.974	17.0
4	19.0	0.974	18.5
5	20.5	0.974	20.0
	94.5		92.0

Mean weight per plot = 92.0 - 5 = 18.4
Pounds per acre = 18.4 x 100 = 1840 lbs.

PRODUCTION/UTILIZATION MEASUREMENT

DOUBLE SAMPLING METHOD

Forest:	Observer(s):
District:	Date:
Allotment:	Size of Plot:
Location (Key area, Vegetation type, Zone or elevation):	

Plot #	Estimated Weight (GM)	Correction Factor	Corrected Weight (GM)
1			
2			
3			
4			
5			
			Total:

Correction Factor = $\frac{\text{Actual Weight}}{\text{Estimated Weight}}$ = _____ = _____

Mean Weight per plot = _____ ÷ 5 = _____ grams

Pounds per acre =
Mean Weight _____ x Conversion factor _____ = _____ lbs/ac

Location: _____

Plot #	Estimated Weight (GM)	Correction Factor	Corrected Weight (GM)
1			
2			
3			
4			
5			
			Total:

Correction Factor = $\frac{\text{Actual Weight}}{\text{Estimated Weight}}$ = _____ = _____

Mean Weight per plot = _____ ÷ 5 = _____ grams

Pounds per acre =
Mean Weight _____ x Conversion factor _____ = _____ lbs/ac

~~PRODUCTION~~/UTILIZATION MEASUREMENT

DOUBLE SAMPLING METHOD

Forest: Sierra	Observer(s): LORENZANA / SMITH
District: Kings River	Date: 7/15
Allotment: THOMPSON	Size of Plot: 12"x12"
Location (Key area, Vegetation type, Zone or elevation): Secato Ridge. TWP 11S, R25E, S.14 20% slope. - annual grass	

Plot #	Estimated Weight (GM)	Correction Factor	Corrected Weight (GM)
1	5	1.1	5.5
2	4	1.1	4.4
3	6	1.1	6.6
4	5	CLIPPED	5.5
5	7	1.1	7.7
			Total: 29.7

Correction Factor = $\frac{\text{Actual Weight}}{\text{Estimated Weight}} = \frac{5.5}{5} = 1.1$

Mean Weight per plot = 29.7 ÷ 5 = 5.9 grams

Pounds per acre =
Mean Weight 5.9 x Conversion factor 96 = 566 lbs/ac

Location: SYCAMORE SPRINGS TWP. 12S, R26E, S. 4 slope 0-10%

Plot #	Estimated Weight (GM)	Correction Factor	Corrected Weight (GM)
1	4	0.9	3.6
2	5	CLIPPED	4.5
3	4.5	0.9	4.0
4	6	0.9	5.4
5	5	0.9	4.5
			Total: 22

Correction Factor = $\frac{\text{Actual Weight}}{\text{Estimated Weight}} = \frac{4.5}{5} = 0.9$

Mean Weight per plot = 22 ÷ 5 = 4.4 grams

Pounds per acre =
Mean Weight 4.4 x Conversion factor 96 = 422 lbs/ac

APPENDIX E

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