Clavey River

Wild and Scenic River Value Review

It is hereby declared to be the policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Congress declares that the established national policy of dam and other construction at appropriate sections of the rivers of the United States needs to be complemented by a policy that would preserve other selected rivers or sections thereof in their free-flowing conditions to protect the water quality of such rivers and to fulfill other national conservation purposes. (Wild and Scenic Rivers Act, Section 1 (b), P.L. 90-542)

December 1997

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A

Overview

This report contains the findings of the Clavey River Wild and Scenic River Value Review (Clavey Review). The Clavey Review is a collaborative assessment of the affects of Stanislaus National Forest management on the 8 Outstandingly Remarkable (OR) values of the Clavey River:

1	Ecologic (a)	Bell Meadow contains the largest stand of aspen in the Sierra, south of the Eldorado National Forest and, a rich variety of habitats.
2	Ecologic (b)	The Clavey River (including Bell and Lily Creeks) has a combination of landscape ecology features making it distinct within the Sierra Nevada.
3	Fish	The Clavey may be the only "rainbow trout" river left, in the Sierra Nevada, with its original fish assemblage still intact.
4	Scenic (a)	Outstanding Variety Class A landscape at Bell Meadow provides one of the most dramatic displays of seasonal colors in the entire Sierra.
5	Scenic (b)	Outstanding Variety Class A landscape includes a deep, V-shaped, river-cut canyon and, a variety of water forms and vegetation patterns.
6	Historic/Cultural	Relatively undisturbed section of the 1853 Emigrant Route, used during the early mining period of California.
7	Wildlife	Five SOHAs and two fisher reproductive units are located on or adjacent to the river, within 8,000 acres of older mature forest habitat.
8	Recreation	Access is limited and portions are remote and wild, resulting in a rare opportunity for solitude and non-motorized recreation experiences.

The Clavey Review uses existing information to describe the status of the Clavey's Wild and Scenic River values. The review draws some relationships between the condition of the values and forest management practices. It identifies information gaps and makes suggestions on further Forest Service actions that are needed to improve our knowledge and insure protection and enhancement of the Clavey's Wild and Scenic values. The findings are intended as a resource to be used by the Stanislaus National Forest when considering management within the Clavey watershed. The review findings also serve as the foundation for further collaborative approaches to management within the watershed.

This Section contains background information on the Wild and Scenic River process and descriptions of the issues and the collaborative process. Sections 1-8 contain technical review findings and recommendations for each of the 8 OR values. The findings and recommendations contained in this report are not considered consensual advice as they are the product of individual technical assessments. While this review refers to the findings of the Sierra Nevada Ecosystem Project (SNEP) and the California Owl Revised Draft Environmental Impact Statement (CA Owl RDEIS) it recognizes neither of these sets of documents establishes new policy. "Official release" of the CA Owl RDEIS will occur after additional review by a scientific committee chartered under the Federal Advisory Committee Act (FACA).

Background

The Clavey River (Map A.1) begins at the confluence of Bell Creek and Lily Creek, approximately four miles southeast of Strawberry, California (Strawberry, CA is located on Highway 108 northeast of Sonora, CA) and drains into the Tuolumne River. The headwaters of Lily Creek consists of two forks, the western originating from Chewing Gum Lake and the eastern from Y Meadow Lake, both within the Emigrant Wilderness. The headwaters of Bell Creek originate approximately 0.5 mile southeast of Burst Rock, also within the Emigrant Wilderness. The western headwaters of Lily Creek are located approximately 1 mile due east of the headwaters of Bell Creek.

The Wild and Scenic River Study (River Study) contained in the Environmental Impact Statement (EIS) to the Stanislaus National Forest Land and Resource Management Plan (Forest Plan) documents the eligibility of the Clavey River, including the tributaries of Bell and Lily Creeks, for Wild and Scenic River designation (USDA 1991). The Record of Decision for the Forest Plan found the river unsuitable for designation. Through the Forest Service appeal process, the Forest Service Chief directed the Pacific Southwest Regional Forester to "review the suitability determination for the Clavey River in light of all new information concerning outstandingly remarkable values and potential uses of the river, and make a new recommendation." A review of information obtained since Forest Plan completion resulted in the Regional Forester's July 25, 1996 determination that the Clavey River and its two tributaries are suitable and recommended for Wild and Scenic River designation. The following factors influenced that new determination:

1. The Federal Energy Regulatory Commission (FERC) recommended no license in the Clavey Project DEIS, and the project proponent, Turlock Irrigation District, has deferred action on the proposal. Therefore, the Clavey Project, as proposed, is no longer considered a "Foreseeable Potential Development" for the purpose of determining suitability for Wild and Scenic River designation. No other current, specific proposals for water developments exist at this time.

2. The Sierra Nevada Ecosystem Project (SNEP) reinforces previously identified values and recognizes the Clavey for its high biodiversity values.

Table A.1 highlights some of the major events in the Wild and Scenic River process on the Clavey River.

Table A.1 ***The Wild and Scenic River Process***; Clavey River; Stanislaus National Forest.

Year	Description
1968	Wild and Scenic Rivers Act designates initial components and identifies initial study rivers; Clavey not included.
1979	President Carter directs Federal agencies to inventory potential Wild and Scenic Rivers and assess suitability for designation.
1982	Nationwide Rivers Inventory Phase II (AZ, CA, NV) lists potential Wild and Scenic Rivers; Clavey included. USDA/USDI issue "The National Wild and Scenic Rivers System; Final Guidelines for Eligibility, Classification and Management of River Areas".
1986	Turlock Irrigation District (TID) files Clavey Project preliminary application with the Federal Energy Regulatory Commission (FERC).
1990	FERC accepts Clavey Project license application. Proposed Stanislaus National Forest Land and Resource Management Plan (Forest Plan) shows Clavey eligible, but unsuitable for Wild and Scenic designation with Alternate Management protection of its Wild and Scenic River values.
1991	Regional Forester approves Forest Plan and determines Clavey eligible, but unsuitable for Wild and Scenic River designation with Alternate Management protection. Several Forest Plan appeals contest the unsuitable determination and Alternate Management protection.
1994	FERC Clavey Project DEIS recommends no license for the project as proposed.
1995	TID defers action on the Clavey Project. Appeal review decision affirms Alternate Management protection, but directs Regional Forester to make a new Wild and Scenic determination in light of new information concerning OR values and potential uses.
1996	Sierra Nevada Ecosystem Project (SNEP) reinforces previously identified values and recognizes the Clavey for its high biodiversity values. Regional Forester reviews new information and determines the Clavey suitable for Wild and Scenic River designation.

General Direction

The Wild and Scenic Rivers Act (1968 as amended); Forest Service Manual (FSM) 2354; and, Forest Service Handbook (FSH) 1909.12, Chapter 8 provide general direction for protecting Wild and Scenic River values.

The Wild and Scenic Rivers Act - Section 10 (a)

Each component of the national wild and scenic rivers system shall be administered in such a manner as to protect and enhance the values which caused it to be included in said system without, insofar as is consistent therewith, limiting other uses that do not substantially interfere with public use and enjoyment of these values. In such administration primary emphasis shall be given to protecting its esthetic, scenic, historic, archeologic, and scientific features. Management plans for any such component may establish varying degrees of intensity for its protection and development, based on the special attributes of the area

Forest Service Manual (FSM) 2354.21 - Management of Study Rivers

Manage wild and scenic river study areas to protect existing characteristics through the study period and until designated or released from consideration.

Resource management activities may be carried out provided they do not cause a negative or reduced classification recommendation.

Land management plans must identify the areas managed for the wild and scenic study river values.

Forest Service Handbook (FSH) 1909.12, Chapter 8

Management prescriptions for river corridors identified in the National River Inventory, or otherwise identified for study, should provide protection in the following ways:

To the extent the Forest Service is authorized under law to control stream impoundment's and diversions, the free flowing characteristics of the identified river cannot be modified.

Outstandingly remarkable values of the identified river area must be protected and, to the extent practicable, enhanced.

Management and development of the identified river and its corridor cannot be modified to the degree that eligibility or classification would be affected (i.e., classification cannot be changed from wild to scenic or scenic to recreational).

Current Management

Table A.2 (Map A.2) shows management area allocations for the Clavey watershed and the potential Wild and Scenic River corridor. Table A.3 (Map A.3) shows the current Forest Plan direction for protecting Wild and Scenic River values through Alternate Management (USDA 1991).

Table A.2 ***Management Area Allocations***; Clavey River watershed and potential Wild and Scenic River corridor; Stanislaus National Forest Land and Resource Management Plan (USDA 1991); percents shown as portion of total watershed or corridor.

#	Management Area	Watershed (acres)	%	Corridor (acres)	%
1	Wilderness	6,464.73	6.44	2,070.68	13.26
2	Wild and Scenic River	53.86	0.05	1.22	0.01
3	Near Natural	14,500.32	14.45	6,099.78	39.06
4	Wildlife	25,460.54	25.37	4,253.15	27.24
6	Research Natural Area	1,483.64	1.48	616.91	3.95
8	Scenic Corridor	2,321.69	2.31	99.46	0.64
9	General Forest	41,583.68	41.43	2,224.58	14.25
10	Developed Recreation	517.74	0.52	20.17	0.13
	Private Land	7,966.38	7.93	228.12	1.46
	No Data	16.78	0.02	0.00	0.00
	Totals	100,369.36	100.00	15,614.07	100.00

Table A.3 ***Alternate Management of Wild and Scenic River Values***; Clavey River; Stanislaus National Forest (USDA 1991).

#	Segment Description	Length (miles)	Wild and Scenic Values	Alternate Management
1	**Bell Creek**, from its source .5 mile southeast of Burst Rock to Lily Creek and the Clavey River	7.0	Ecologic (a) Ecologic (b) Scenic (a) Historic/Cultural	**Wilderness** (1 mile) **Wildlife** (5 miles) **RNA** (1 mile)
2	**Lily Creek**, from its sources at Chewing Gum Lake and Y Meadow Lake to Bell Creek and the Clavey	11.0	Ecologic (b)	**Wilderness** (5 miles) **Wildlife** (6 miles)
3	**Clavey River**, from Bell Creek and Lily Creek to 3N01	5.0	Ecologic (b) Fish	**Wildlife**
4	**Clavey River**, from 3N01 to Cottonwood Road	8.0	Ecologic (b) Fish, Wildlife	**Wildlife**
5	**Clavey River**, from Cottonwood Road to the Tuolumne River	16.0	Ecologic (b) Fish, Wildlife Scenic (b) Recreation	**Near Natural**

Collaboration

In April of 1996, R-5 Regional Forester, Lynn Sprague, established the Clavey collaborative review as part of a three-phase process associated with review of the Clavey River's suitability for recommendation for Wild and Scenic River designation. The suitability review (Phase 1) resulted in the Regional Forester's July 25, 1996 determination that the Clavey River is suitable and recommended for Wild and Scenic River designation. The Clavey collaborative review (Phase 2) followed the suitability review. Phase 3, Forest Plan amendments, may be deemed necessary based upon the suitability review and subsequent collaborative review.

The Regional Forester defined the collaborative review process as the following:

> *"...a collaborative endeavor looking at ongoing and proposed projects in the Clavey watershed in light of public concerns. It will begin with an early collaboration on establishing the process to be used, and a mutual understanding of expectations. We need to work together to monitor whether our Forest Plan decisions (standards and guidelines), are accomplishing the intended goals of maintaining the values of the Clavey River."*

The Tuolumne River Preservation Trust (TRPT) and the Clavey River Preservation Coalition (CRPC), two groups with long standing concerns regarding protection of the Clavey River, proposed this collaborative process to the Forest Service. Among their concerns was a belief the Outstandingly Remarkable (OR) values of the Clavey River were not being protected. They questioned whether Forest Plan direction adequately protects OR values, whether the plan is being fully implemented and whether it is being monitored and evaluated.

Prior to initiating the project, the Forest and the Regional Office more clearly established the intent of the Clavey collaborative review which was not clear in the Regional Forester's original direction. The Forest Service intended a review with a goal of maintaining the Clavey's Wild and Scenic River values, not "the values of the Clavey River". A review of all resource values in the watershed would require a watershed assessment and was beyond the scope of this effort. Letters initiating the Clavey collaborative review stated the purpose as an assessment of the cumulative effects of past, present, and planned activities in the Clavey watershed on the Wild and Scenic River values. TRPT and CRPC envisioned the collaborative process as being of broader scope and continued to express an interest in determining how past, current and proposed projects are affecting the Clavey watershed's ecological health. This difference of opinion caused difficulty and was never fully resolved. In time, participants agreed on the following Mission Statement:

> *We help the USFS determine whether or not Land Management Plan Standards and Guidelines, as implemented, are causing degradation of the Clavey River's OR (Outstandingly Remarkable) values.*

Another indication of differing expectations occurred after presentation of preliminary findings by the Technical Team and just prior to preparation of the draft report. Known for 10 months as the Clavey Watershed Review (CWR), a name change was suggested since this effort was not a watershed review, it was a Wild and Scenic value review. Participants agreed to change the name to the Clavey River Wild and Scenic Value Review. The mission remained as described above.

Process

The Regional Forester and Forest Supervisor selected a Team Leader responsible for management of the collaborative process. The Team Leader recruited technical Team members based on interest, availability, and professional resource skills. The Team Leader also invited Steering Committee members as external stake holders interested in management within the Clavey watershed. The Technical Team and Steering Committee worked together to refine the task, develop roles and responsibilities, and establish steps needed to complete the report. The Technical Team conducted assessments of existing information such as studies, reports, historic records, resource inventories, monitoring data, and scientific literature. The Steering Committee provided insight into resource issues. As a key step, both groups developed a detailed list of resource questions (Appendix A). It was the intent of the Technical Team to answer the questions as part of the assessment work. It was also the intent of collaborative participants that the Technical Team bring forward questions that could not be answered as recommendations for further action.

Synthesis

This section provides the Team Leader's overview and interpretation of the key findings of the individual OR value assessments. It is an attempt to integrate and synthesize the findings. It is not a consensus evaluation, so there may be differing viewpoints. Hopefully, it will be viewed as a meaningful and objective look at the findings.

Key Findings

Value 1

Ecologic (a)

There are concerns regarding existing resource conditions associated with this OR value. Bell Creek is incised into the surface of Bell Meadow forming a large gully with unstable banks and poor riparian conditions. The downcutting likely caused de-watering of the meadow soils. Meadow vegetation has shifted from wet meadow species to dry meadow species, and the willow component appears to be in decline. There continue to be questions regarding the health and condition of the aspen stand. These conditions have been evident for a number of years. It is uncertain what event or process started the downcutting of Bell Creek and its tributaries.

Bell Meadow is now managed as part of a Research Natural Area (RNA) with direction to protect against activities that modify the environment. Upper Bell Meadow is excluded from grazing use and lower Bell holding pasture is grazed only for two weeks in late September. Implementation of the grazing allotment permit needs to be improved. Cattle trespass into upper Bell Meadow retards natural recovery processes. It appears that Forest Plan Standards and Guidelines for Riparian Areas and Streamside Management Zones are not being met along portions of Bell Creek including the portion within the lower Bell holding pasture. Summit District personnel are aware of the trespass and have plans to correct the situation with a program of improved fence maintenance.

The assessment of existing conditions is primarily the result of monitoring and inventory information collected prior to 1991. It allows for some understanding of ecological processes and the affects of historic management but is not considered of sufficient quality to meet management objectives for the RNA. Recognizing this, the Stanislaus National Forest has requested and has been awarded a 1997 grant for monitoring within the Bell Meadow RNA. The study will fill in missing data that can be used to enhance and protect the OR values and RNA integrity. The primary recommendation is the preparation of an RNA Management Plan that includes detailed restoration, maintenance, fire

suppression and monitoring direction. A key objective is to protect or enhance the Ecologic (a) OR value by protecting and enhancing the meadow's hydrology and vegetation.

Value 2
Ecologic (b)

The status of the four attributes of the Clavey River which constitute Ecologic (b) OR value remains unchanged since 1991. The Clavey is free-flowing, relatively remote and undeveloped with the same character of life zones and elevation as in 1991. The Ecologic (b) OR value remains intact.

Forest Plan management practices are unlikely to alter this OR value. However there is uncertainty regarding "health" of vegetation which was a concern expressed during the review. No data exists to evaluate heath of vegetation types within the proposed Wild & Scenic Corridor. The greatest risk to vegetation is a stand replacing wildfire.

As Team Leader, I will take the liberty to add comment regarding the evaluation of Ecologic (b) OR value. Although the assessment finds this OR value is at low risk there was considerable interest and questions among collaborative participants regarding ecological health within the Clavey watershed. For example, there were concerns regarding timber harvest, road management, grazing affects on riparian systems, dispersed recreation and OHV use, and the status of amphibians and wildlife. These questions could not be answered within the context of Ecologic (b) OR value, and many were beyond the scope of this Wild and Scenic Value Review. For the above reasons, the Ecologic (b) assessment contains a recommendation to perform a watershed analysis for the Clavey watershed. A watershed analysis recommendation is also found in the Value 3, Fish assessment and the Value 7, Wildlife assessment. See the Value 7 assessment for a description of spatially explicit landscape scale planning.

Value 3
Fish

The Fish OR value remains a unique attribute of the Clavey River and the historic native fish assemblage remains largely intact and abundant. However, existing information on fish population and status is limited. Understanding of trophic ecology of the Clavey River and its tributaries is general at best.. The assessment identifies the important connection between the health of tributary streams and the Fish OR value. It also identifies management practices and natural events that pose risk to the Fish OR value. An emphasis is placed on protecting tributary streams and conducting watershed analysis to improve knowledge of watershed conditions and processes, affects of forest management activities, and status and trends for aquatic resources. Tributary streams and streamside zones should be managed to protect aquatic/riparian resources in order to protect the downstream Fish OR value in the Clavey River. Impacts to tributary streams are transmitted downstream through physical and biological processes.

Among the management practices that pose risk is grazing within riparian areas. Specifically, conditions at Bell Meadow are of concern. Riparian and stream bank conditions are poor [see Ecologic (a)]. Bell Meadow appears to be a significant source of sediment to lower stretches of Bell Creek and the Clavey River. Stand replacing wildfire and large flood events are a risk to the Fish OR value.

A watershed analysis is recommended. In addition, a number of approaches are proposed for the protection of aquatic biodiversity. One approach is to consider the Clavey watershed as an “Aquatic Diversity Management Area” (Moyle, 1996). Another would establish the Clavey River as an “emphasis watershed” as outlined by the CA OWL.RDEIS (USDA 1996).

Value 4
Scenic (a)

The key finding for Scenic (a) OR value, at Bell Meadow, is its close relationship to the Ecologic (a) OR value. The aspen and rich variety of meadow habitats that provide the Ecologic (a) OR value are the same attributes that provide the scenic quality associated with Scenic (a) OR value. The ecologic conditions and processes provide the scenery. One can assume the Scenic (a) OR value is protected as long as the Ecologic (a) OR value is protected. For that reason the Scenic (a) and Ecologic (a) assessments include the same recommendations for increased monitoring, restoration and improved management.

Value 5
Scenic (b)

Forest Plan management direction is sufficient to protect or enhance the Scenic (b) OR value. It is unlikely that any of the management activities prescribed by the Forest Plan under Near Natural Management would alter the Variety Class A landscape, deep, V-shaped canyon, or the variety of water forms.

Value 6
Historic/Cultural

Forest Plan management direction is sufficient to ensure continued preservation of the Historic/Cultural OR value. The Emigrant Trail follows the approximate pathway used by the 1853 emigrants, and no visible remnants exist to preserve. The historic value is primarily one of interpretation and setting.

Value 7
Wildlife

The Wildlife OR value assessment relies on the 1991 Stanislaus National Forest GIS vegetation layer to provide insights regarding current amounts and spatial distribution of late-seral vegetation in the Clavey watershed. It was difficult to draw accurate conclusions because of errors in classification rates for the larger tree size classes in the GIS database. Although uncertainty exists, this preliminary assessment indicates that late-seral/mature conifer vegetation appears to be relatively abundant and distributed in relatively large continuous patches, thus providing opportunities for management alternatives that incorporate the best available scientific information. Late-seral conditions appear to have changed little since the database was developed because no extensive management activity has occurred.

There are a number of significant recommendations of actions that are needed to manage late-seral/old growth forests and insure continued protection of the Wildlife OR value. The assessment describes the many limitations of the existing vegetation database and recommends the development of an accurate map designating the amounts and spatial configuration of existing vegetation types and structural classes at the watershed scale. A reliable map is a necessary first step in a key recommendation to move toward a management approach that utilizes recent developments in ecosystem management and landscape ecology. This approach emphasizes the fundamental importance of large-scale dynamics in both space and time in the management of natural resources. A full assessment of the status of wildlife associated with late-seral forest areas in the Clavey River watershed is beyond the scope of this report. Review of data for wildlife species related to vegetative conditions should be an important component of future landscape or watershed analysis.

The assessment contains a number of additional recommendations regarding inventory and monitoring of wildlife. Special recognition is given to the uncertain status of amphibians and the need to increase survey efforts to document abundance and distribution. As a final recommendation the Forest should reconsider the manner in which the Wildlife OR value is described. The current definition is unclear and should be modified to reflect a more accurate and ecologically justifiable spatial delineation.

> ***Note***: A review of Wild and Scenic River Study planning notes shows the original intent of the Wildlife OR value was not clearly communicated. A new description needs to include the value the Clavey River as an important connecting corridor providing continuous linkage for migration and reproductive habitat needs for important wildlife species.

Value 8
Recreation

Forest Plan management direction is sufficient to protect or enhance the Recreation OR value. It is unlikely that any of the management activities prescribed by Near Natural Management would alter the remote and wild recreation characteristics of Segment 5

Steering Committee Recommendations

The Clavey Review Steering Committee has reviewed the Technical Team findings and recommendations contained in this report and has identified the following priorities for the Forest Service to consider.

1. Conduct a Clavey watershed analysis. Use the Clavey Review findings and recommendations to help identify key issues and information needs.

2. A Bell Meadow RNA management plan should be completed and implemented.

3. Address issues and concerns raised in this review in all planning documents for projects in the Clavey watershed.

4. Consider amending Forest Plan Chapter V to include specific key indicators for outstandingly remarkable values.

5. Continue to use a collaborative approach to management within the Clavey watershed.

For immediate action:

- Improve and repair fencing around Bell Meadow to prevent cattle trespass. Support and encourage District and Forest range personnel in order to facilitate proficient range management and permit administration.

- With cooperation of permittees, exclude grazing use from lower Bell holding pasture until an alternative water source can be developed and the riparian corridor in this pasture fenced from grazing. An alternative strategy would be development of a new holding pasture nearby that provides for better protection of aquatic/riparian values.

- Resample Clavey fishery index stations in 1997 to observe population effects of the January, 1997 flooding.

- Survey Bell Creek in 1997 to identify extent, distribution, and relative abundance of brook trout.

- Re-install the Clavey River streamflow gauge at the 1N01 bridge.

- Enter information (e.g., timber harvest, prescribed fire, brush control, etc.) into the GIS vegetation layer database in a timely manner.

Clavey Review Steering Committee

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Value

1

Ecologic (a)

(Segment 1) The largest stand of aspen (Populus tremuloides) on the Forest is located at Bell Meadow. It is the largest stand of aspen in the Sierra, south of the Eldorado National Forest. The meadow also has a rich variety of habitats including wet and dry meadow, meadow shrub (Salix) and conifer forest.

Historic Setting

As described in the River Study, the Ecologic (a) "Outstandingly Remarkable" (OR) value applies to Segment 1; (**Bell Creek**, from its source .5 mile southeast of Burst Rock to Lily Creek and the Clavey River) (USDA 1991, Maps 1.1 and 1.2). The description of the Ecologic (a) OR value is similar to that of the Scenic (a) OR value: "outstanding Variety Class A landscape at Bell Meadow. The strongly defined patterns of mixed conifer, aspen, riparian and meadow vegetation provide one of the most dramatic displays of seasonal colors in the entire Sierra".

District Archaeologists found thirteen prehistoric sites in Bell Meadow after surveying approximately one quarter of the area. Though not dated, other Central Miwuk sites in the Clavey drainage date to 4,000-5,000 years before present (DeHart pers. com. 1997) Bell Meadow sites include bedrock milling stations, associated pestles, arrowheads, scrapers and the stone remains of making these tools (DeHart pers. com. 1997). Though Miwuk people made many uses of meadows, a principal attraction of the Bell Meadow area was probably the large summer deer population (Leopold et. al. 1951).

The Forest Service used Bell Meadow as an administration site to stop over and rest horses between 1910 and into the 1920s. Also at this time, what was probably a cattle allotment cabin and fence were constructed in the lower Bell (Map 1.3) (DeHart pers. com. 1997). The cabin was burned and bull-dozed in the early 1970s to prevent illegal use, but the fence remains.

Annual grazing records for the Bell Meadow Allotment show cattle use of up to sixteen hundred (1600) animal unit months (AUMs) in the early 1900s. One AUM is equivalent to the amount of forage one cow and her calf eat in a month, or approximately one thousand (1000) pounds of feed. This was a period of very high grazing use, interspersed with periods of light or no grazing due to range wide outbreaks of hoof and mouth disease (USDA 1961). Around 1920 the Forest Service began to regulate grazing in the Bell Allotment and reduced animal use to between 430 and 700 AUMs annually. At this time Bell Meadow proper was privately owned. The Forest Service re-acquired Bell Meadow in 1963 and an Allotment Plan from 1975 included the following grazing history:

> From 1957 through 1959 cattle use was light with non-use in 1960. 1961 through 1968 saw use by 15 to 20 bulls, and from 1969 through 1974, the permittee was allowed both cows and horses...90 AUM. Since 1964, the permit covers the fenced portion of Bell Meadow only. For several years now, the permittee runs cattle on the allotment at large, avoiding the fenced upper portion of Bell Meadow because of a danger of larkspur poisoning to the cattle. The fenced lower portion of Bell Meadow is used for sick horses and for gathering cattle.

The 1975 Allotment Plan directed the Forest to manage Bell Meadow allotment jointly with the Bear Lake allotment. The 1975 plan also recommended that grazing be withheld from the upper portion of the meadow due to soil loss and it allowed for 54 AUM in the lower meadow holding pasture.

The history of timber harvesting in the Clavey drainage began with railroad logging in the early 1900s. No records of specific harvest locations are available until 1945. Map 1.4 shows that portions of clear cuts from 1948, 1952, 1965 and 1974 are upstream of Bell Meadow. The most recent logging activity upstream of Bell Meadow is a unit of the Crab timber sale (sold 1987) cut in 1993-1995 The majority of this sale was not upstream of Bell Meadow. No known monitoring of runoff or sediment loading from the Crab sale occurred. Monitoring the effects of the Crab or other past timber sales in 1997 will be difficult because of the overriding effects of the 1996/97 floods.

It is uncertain what event or process started the down cutting of Bell Creek and its tributaries. The first mention of down cutting in Bell Meadow comes from a range survey report by Alan McCrady in October of 1961 (USDA 1961). The report reads: "There was lively interest and discussion on the extent and origin of the deep gullies that have lowered the water table over much of the private land in Bell Meadow proper." Unfortunately aerial photos from 1944 and 1957 are poor, so it is difficult to track the origin of the erosion. McCrady thought the down cutting began with sheep over-grazing in the 1930s. In 1974, Forest personnel and CCC crews attempted to slow meadow degradation by installing rock check dams in the side gullies of Bell Creek (Beck pers. com. 1997). Though effective at retaining sediment, the dams did not stop, nor were they designed to stop the progress of headcuts in the side channels (Frazier pers. com. 1997).

Existing Condition

The most recent description of down cutting in Bell Meadow comes from a 1989 geomorphic review by DeGraff:

> Bell Creek is incised into the surface of Bell Meadow to depths of 7 to 8 feet in some locations. No active knick points leading to further lowering of the channel were seen. In Section 30, the steep, rocky slopes encroach on the margins of the meadow. Bell Creek incised down to a bedrock lip associated with the slopes encroaching on the meadow. This provides a base level control which is unlikely to permit further down cutting on Bell Creek. This is upstream from the more pronounced narrowing which nearly divides Bell Meadow into an upper part and lower part; the lower part containing Lily Lake. Two headcuts roughly 3 to 4 feet high are found on the main tributary to Bell Creek which heads in the direction of Pine Valley. These headcuts are present near where the tributary enters the meadow. They are encountering bedrock at shallow depth and are unlikely to progress much farther upstream. Active headcuts are found on tributaries to this tributary and on tributaries to Bell Creek downstream from its junction with this main tributary. Time did not permit similar examination for headcuts in the lower part of Bell Meadow (DeGraff 1989).

DeGraff concluded that "it is reasonable to expect headcuts to continue to migrate upstream in the foreseeable future."

In 1996, Lentz (1996) surveyed two stream reaches in Bell Meadow. Each survey included characterization of the streambank stability. The first reach was a 840 foot section down stream of the holding pasture in lower Bell. It was characterized as having 40 percent of its banks in stable condition, but 70 to 80 percent of the stream banks probably or potentially would erode during bank full conditions. Surveyors of a 662 foot reach in upper Bell Meadow estimated zero (0) percent stable banks, 100 percent of which probably or potentially would erode during bank full conditions. Additional monitoring in 1997 will determine the extend of the stream bank instability.

A range Condition and Trend (C&T) transect, established in 1961, identifies changes in species composition. The transect was located just east of "the Narrows" (Map 1.2) in an area mapped as sedge (Carex sp.) dominated. At that time the transect condition was "fair" with 57 percent vegetation cover and 2 percent bare soil. By 1969, under the grazing prescription of 90 AUMs, the transect condition had degraded to "very poor" with 59 percent bare soil and 16 percent vegetation cover. The most striking change was the loss of sedges (Carex sp.) and the increase in meadow barley (Hordeum bracheanthumem) and annual forbs. Repeat of this survey in 1973 found meadow barley as the dominant grass and the condition still "very poor." Bare soil increased to 67 percent cover and disturbance favored species like yarrow (Achillea sp.) and Pussy paws (Calyptridium sp.) were present. In 1985 Keeler-Wolfe mapped the area of the C&T transect as "dry meadow" dominated by Stipa columbiana. Keeler-Wolfe did not include a measure of bare ground, but he did comment that some recovery of vegetation cover had taken place. No current data is available to determine how this trend continued.

By comparing 1961 range maps (Map 1.3) to the 1985 vegetation map prepared by Keeler-Wolfe (Map 1.6) it seems that a net loss of wet meadow vegetation occurred. The 1961 Bell Meadow allotment map lists three vegetation type descriptions for the entire meadow area: Aspen/California brome (Bromus carinatus) , willow/sedge (Carex sp.), and sedge. The latter of these, sedge, most likely corresponds to wet meadow conditions. Though these old records do not name the species of sedge, photographs by Beck (1973) along the transect show what was probably Nebraska sedge (Carex nebrascensis) (Keeler-Wolfe 1985). Because Nebraska sedge is "the wet meadow site Carex species, (sedge) least affected by livestock disturbance (trampling and defoliation)" it is the most likely sedge to have persisted during historic grazing levels (Menke et. al. 1996). In 1985 Keeler-Wolfe mapped a large portion of this 1961 sedge area as dry meadow, dominated by needle grass (Stipa columbiana). Because the old range maps were highly stylized, an acre for acre analysis is inappropriate.

Early discussions of the meadow by Leopold et. al. (1951) mention the abundance of willow and corn lily as excellent deer fawning habitat. However, in an early range report (USDA 1961) one of the participants mentioned that his father remembered when there were no willows in Bell Meadow. The report refers to "willow encroachment." A cursory analysis of aerial photographs 1944 to 1992 was inconclusive about willow encroachment, however it did bring to light a decline in willow vegetation cover that started between 1966 and 1972. No documentation confirmed this trend until 1996 when the USFS Remote Sensing Lab (RSL) conducted an analysis of change in vegetation cover for the Sierra Nevada. The RSL compared satellite imagery taken in 1990 to 1995 imagery and subjectively assigned a measure of change: little or no, small, moderate, or large. The GIS maps generated from this analysis show a small decrease in vegetation had taken place in the willow areas of Bell Meadow (Map 1.6). The decrease may be due to decadence of older willows and poor regeneration. Keeler-Wolfe (1985) noted willow regeneration occurring only in the gullies with many of the adult shrubs covered in a fungal rust. It is uncertain if this disease would cause willow mortality or if it indicated general plant stress. Caution should be employed when using the GIS vegetation change maps (see Monitoring and Evaluation, Ecologic (b), Life Zones and Vegetation).

Limited data is available for existing conditions in the aspen stands of Bell Meadow. The Remote Sensing Laboratory evaluation of changes in vegetation between 1990 and 1995 indicated a slight increase in cover in the aspen stand west of the narrows (Map 1.6). It is unknown if the small increase is due to aspen or conifer growth, but a 1985 survey of two other aspen stands in the meadow found little conifer encroachment (Keeler-Wolfe 1985). It can be inferred that the change is due to aspen growth, but further monitoring would be needed to validate this hypothesis. The RSL evaluation also found a small decrease in vegetation cover in the aspen stand to the east of the narrows (Map 1.6). With no monitoring conducted in this stand, we can only speculate about the many possible causes for the decrease in vegetation cover. Monitoring is necessary to determine if this trend is continuing and if it is a threat to stand integrity or part of natural aspen stand succession in the absence of fire.

In 1985 Keeler-Wolfe surveyed two aspen stands in Bell Meadow; one large stand in the center of Lower Bell, and another at the southeast end of Upper Bell (Map 1.5). Keeler-Wolfe analyzed stand structure, successional patterns and seral stages for each stand. Both were found to be static or "climax" in nature with aspen regeneration typical of that seral stage. According to Keeler-Wolfe, the aspen stand in Upper Bell Meadow reached maximum basal area with complete canopy closure and was dominated by even aged (approximately 75 years old) stems (Keeler-Wolfe 1985, Mueggler 1994). Regeneration occurred in the relatively open stand edges, adjacent to the meadow. This is considered normal for a "climax" stand at this point in its development (Harniss and Harper 1982). Baring a disturbance event such as fire, it is expected that the oldest stems will decline and fall at around 120 years of age (the year 2020). Suckering will be stimulated by the gaps in the stand canopy and loss of dominant stems. The stand will then undergo a period of rejuvenation (Mueggler and Bartos 1977, Mueggler 1994).

The large aspen stand in Lower Bell contained stems of at least two age groupings. One group are large (greater than 20 inches diameter at breast height, (dbh) and have mostly fallen down. Another group of stems were young (less than about 45 years) and ranged in size from 4 to 11 inches dbh in 1985. The younger stems are probably the result of light gaps created by the senescence and loss of the older stems. The new sprouts have matured to form the existing canopy. It should be noted that a complete age distribution sequence was not conducted in this stand and that other authors found a poor relationship between stem size and age in aspen (USDA 1992). Further research is needed to verify this stand's history and seral stage.

Keeler-Wolfe (1985) identified four conifer forest types in Bell Meadow RNA: lodgepole pine-white fir, white fir-Jeffrey pine, white fir-red fir, and Jeffrey pine (Map 1.5). According to the RSL evaluation the area of Jeffrey pine at the north west end of the meadow showed both small and moderate decreases in vegetation cover between 1990 and 1995 (Map 1.6). Keeler-Wolfe did not note mortality in this area but this area is associated with the trail head and parking for the Emigrant Trail. Further investigation is needed to positively identify causal agents or threats to OR Values. Keeler-Wolfe noted the lodgepole pine-white fir type as the only type at risk because of little lodgepole pine regeneration. Lack of regeneration of lodgepole pine is not a rare occurrence and may be related to a lack of fire (Potter pers. com. 1997). Long term monitoring is needed to determine if lodgepole are truly decreasing.

Management Direction

Forest personnel identified Bell Meadow as a possible Research Natural Area (RNA) and nominated it to the Regional RNA Committee in 1981. A Forest Plan amendment signed by the Regional Forester established the Bell Meadow RNA in 1994. The Chief of the Forest Service denied an appeal and upheld the decision to establish the RNA in 1995. RNAs are a unique group of managed lands that serve as control or benchmark areas for monitoring the effects of resource management techniques and practices, as baseline areas for studying ecological processes, and measuring long-term ecological changes (FSM 4063.02). Under the Forest Plan management emphasis calls for maintenance of select vegetative and aquatic elements in natural conditions and protection against activities that directly or indirectly modify ecological processes (USDA 1991).

The Forest Standards and Guidelines (S&Gs) that apply to RNAs fall under the heading of Management Area 6. Recreation is semi-primitive non-motorized, and RNAs are managed to protect against activities that modify the environment. S&Gs for recreation prohibit uses (picnicking, camping, hunting, and fishing) if they threaten serious impairment of research or education values. Grazing is not permitted in the upper part of the Bell Meadow RNA. General direction is to protect identified RNAs as undisturbed ecosystems for future research. Activities are to be coordinated with the PSW/R5 RNA Committee (USDA 1991).

Further direction for management of RNAs is located in the Forest Service Manual section 4063 - Research Natural Areas. "Research Natural Areas may be used only for research, study, observation, monitoring, and those educational activities that maintain unmodified conditions" (FSM 4063.03). Grazing is not specifically prohibited in RNAs, but where grazing occurs the objectives, practices and acceptable levels of use must be defined in a RNA Management Plan. The Bell Meadow Establishment record (USDA 1994) requires the Forest to "prepare a Management Plan for the Bell Meadow RNA in consultation with the Pacific Southwest Research Station. The plan will specify project prescriptions, practices, uses, and monitoring conducive to the objectives for establishment of the Bell Meadow RNA." The objective for establishing the Bell Meadow RNA as stated in the Establishment Record was "to preserve an example of the Aspen Forest target element for the Southern Sierra physiographic province." Because of the recent establishment and appeal decision, no management plan exists for this RNA.

Current grazing allotment management calls for using lower Bell Meadow as a holding pasture grazed by 45 cows and their calves for two weeks in late September (approximately 35 AUM), and the upper portion is excluded from grazing use. S&Gs for Riparian Areas state that on primary range for cattle, allowable forage utilization levels will be set according to the Regional Standards that will contribute to the achievement and maintenance of good to excellent vegetative and soil conditions. Though portions of the meadow may not be defined as riparian, general direction is to leave a minimum of 4 inches of stubble height at the close of a grazing season, or to adhere to percent of weight removal standards (USDA 1991). The measurement chosen is the one that leaves the most amount of vegetation at the end of the grazing season. The past few years the District used the 4 inch stubble height as the standard for removing cattle. S&Gs for primary range also state that 50% of the available annual growth of all woody riparian species (within 4 1/2 feet of the ground) is to be retained. It is usual that if cattle are removed when the grasses reach the 4 inch stubble height (as per the S&G), that the remaining annual growth of woody riparian species exceeds 50% and so compliance is met, but not monitored(VanKeuren pers. com. 1997). Supplemental feeding by the permittee has also been employed as a way of preventing some of the grazing pressure on the meadow. It should be noted that the Regional grazing standards are currently under revision.

Additional S&Gs for Streamside Management Zones (SMZs), Fisheries habitat management and Riparian areas that apply include: Provide cover and forage for wildlife species dependent on meadows and the adjacent forest edge in order to maintain viable populations. Conduct surveys and monitoring necessary to detect potentially damaging disturbances, changes in known populations, and locations of new populations. Retain streamside vegetation so that at least 60% of the stream surface is shaded from 11 AM to 4 PM from June 1 to September 30. Streambanks and streambeds - maintain or achieve at least 90% of natural streambank and streambed stability. SMZ slopes - from the stop (sic) of the streambank to the outer edge of the SMZ, maintain or achieve at least 70% of the natural ground cover capability.

The Clavey Wild Trout Management Plan provides direction for trout management.

Monitoring and Evaluation

Based on available monitoring data, it appears that changes have occurred, and are occurring to the habitats in Bell Meadow. Because most of the monitoring information we have is from before 1991, we cannot determine the trends between 1991 and 1997 except in a few instances.

Aerial photographs and remote sensing data show that the willow shrub community is decreasing (aerial photographs 1972 and 1994, RSL data 1996). The cause of willow decline is not documented, but a strong case exists that the gullying and subsequent drop in water table are primarily responsible (Dunne and Leopold 1943). Keeler-Wolfe (1985) notes a general lack of willow regeneration on the stream terraces, with

willow regeneration occurring only in the gullies "where the water table was closer to the soil surface." Also, since willow seeds need a bare mineral soil to survive, the gullies may be the only locations where bare mineral soil and water requirements are met (VanKeuren pers. com. 1997). The willow vegetation type is important habitat for fawning and summering of the Jawbone deer herd (Leopold et al. 1951). There are no specific S&Gs addressing deer habitat, but this habitat type is specifically listed as part of the Ecologic (a) OR Value.

According to surveys and photographs, some portions of Bell Creek are at an unacceptable level of natural streambank and streambed stability (USDA 1973, DeGraff 1989, Keeler-Wolfe 1985, Lentz 1996). S&Gs for Riparian areas and Streamside Management Zones are not being met. Complete surveys will enable the Forest to determine the full extent to which the streambanks are unsatisfactory condition, and to take appropriate actions.

Based on data collected in 1985, two of the largest aspen stands in Bell Meadow were not at risk. Recent remote sensing data show a small increase of vegetation cover in the aspen stand west of the Narrows. At this time we have no data to indicate if the increase is due to aspen growth or to conifer encroachment.

Vegetation cover decreased slightly in the aspen stand east of the Narrows (Map 1.6). This stand may be changing for a number of reasons, primarily natural senescence of mature aspen stems, and, or a lack of regeneration. No monitoring occurred in this stand, but it is interesting to note that the creek tributary this stand is on, was home to a beaver pair from 1944 to the mid 1970's (Beck pers. com. 1997). Release from the beaver's harvest pressure would seem to call for an increase in aspen regeneration and cover (Hall 1960). Conversely, because a beaver dam raises the local water table, it may have allowed the original aspen stand to expand in range. When the beaver dam disintegrated and the water table dropped the aspen stand would need to reach a new equilibrium with the lower water table level. Further surveys will determine existing conditions and trends in all the aspen stands. These surveys need to be extended into stands not considered by Keeler-Wolfe, particularly the stands that showed a decrease in cover and stands west of the holding pasture that are part of the general cattle allotment.

The Jeffrey pine forest type near the trailhead and parking area shows a slight decrease in vegetation cover. No data is available regarding the change. Wildlife species associated with this habitat are spotted and great gray owls. A 1994 survey by Rickman found spotted owls in Bell Meadow on two nights but no day activity centers. This implies that it was a foraging area only at that time. Rickman found no great gray owls even though they are known to use large trees surrounding meadows as primary habitat. Bell Meadow is not mapped as spotted owl or great gray owl habitat in the Forest Plan. S&Gs state that the Forest will provide cover and forage for wildlife species dependent on meadows and the adjacent forest edge in order to maintain viable populations. Follow up surveys are recommended to verify current owl use of the meadow and vegetation trends.

The Washington Office awarded a competitive matching grant for 1997 to the Stanislaus National Forest for monitoring in the Bell Meadow RNA. The project description includes: retaking photos of Bell Meadow to determine causes and rate of down cutting in Bell Creek and its side channels, re-examining the range condition and trend transect, examining the status and benefits of the side channel stabilization treatments done in 1974, reviewing all existing data on Bell Meadow and producing a current status report on the condition and trend of the RNA, and making recommendations of research needed to answer important questions or management actions needed to protect the area. This study will fill in missing data that can be used to enhance and protect the OR values and RNA integrity. This monitoring is in compliance with Forest Grazing S&Gs that recommend "monitoring of ecological condition and trend...on a ten year schedule." Also, Riparian area S&Gs direct forest personnel to "conduct surveys and monitoring necessary to detect potentially damaging disturbances, changes in known populations, and locations of new populations."

Discussion

The greatest threat to the integrity of the Bell Meadow RNA and to the Ecologic (a) OR value is the down cutting of Bell Creek and its tributaries. This is because the resulting gully lowers the local water table which affects plant species composition (Dunne and Leopold 1943). Bell Meadow experienced a net loss of sedge dominated wet meadow, a decline in willow populations, and a shift toward more xeric (drier) meadow plant communities. One area of aspen also experienced a small decrease in vegetation cover. All of these trends are consistent with the lowering of the water table.

In contrast, the two largest aspen stands in Bell Meadow surveyed in 1985 appeared to be stable and not declining as a result of gully erosion or water table changes (Keeler-Wolfe 1985). According to Keeler-Wolfe (1985), the top of the water table below the aspen stands ranged from 2 to 6 feet in depth. This level was still within reach of aspen roots that penetrate depths of up to 9 feet (Jones and DeByle 1985). Also, there appears to be no direct threat by gully erosion into the aspen stands (DeGraff 1989). And finally, the small increase in vegetation mapped by the RSL may represent a slight increase in aspen cover in one area (Map 1.7). Additional monitoring will be needed to determine if this is due to conifer encroachment or aspen growth.

Several people expressed concern over the effects of grazing in Bell Meadow (Buckley pers. com. 1997, Little pers. com. 1997). As stated above, the current management direction withdraws upper Bell from grazing and restricts grazing of lower Bell holding pasture to a two week period. However, the degree to which the terms of the permit are implemented and followed is unclear. Cattle trespass has occurred and was documented on a number of occasions in Upper Bell Meadow (Summit District range records 1983, 1995, 1996, 1997). Fence maintenance in upper Bell Meadow seems to be the primary problem (Frazier and Apperson 1996). District personnel are working with the permittee to ensure that the permittee repairs the fence in 1997 and that the other terms of the permit are followed.

Also of concern is the timing of cattle "on dates" in the lower Bell holding pasture (Buckley 1996). This pasture contains the greatest portion of wet meadow in the RNA (Keeler-Wolfe 1985). Cattle impact wet meadows by trampling and chiseling the meadow sod layer. These actions leave the meadow vulnerable to erosion processes (Hagberg 1995). To prevent this type of damage, S&Gs for cattle "on dates" are tied to soil moisture. These standards are vague and it is unknown to what degree District personnel are able to follow them without proper training.

The impacts of grazing on the stability of channels in Bell requires consideration. Grazing in riparian zones destabilizes stream channels and retards the natural tendency for riparian systems to re-vegetate (Kattelmann and Embury 1996, Menke et. al. 1996). The greatest amount of damage to riparian species occurs when animals are confined to a small area with no alternative water source away from the riparian zone (Kovalchik and Elmore 1992). Lower Bell holding pasture is a confined area with only one water source, Bell Creek. To relieve pressure on the stream banks, development of an alternative water source away from the stream coupled with cross fencing to eliminate cattle from the riparian strip are necessary. District range personnel are working with the permittee in 1997 to rebuild the fences around Bell Meadow and to ensure permit compliance. It is doubtful if funds will be available to construct any additional fencing or water sources in the current fiscal year.

Cattle trespass into upper Bell Meadow may not only exacerbate the unstable streambank conditions, but may be impacting willow populations. The effects of cattle grazing on willows are tied to grazing intensity (Clarey and Medin 1990, Kovalchik and Elmore 1992). The greatest impact from cattle browsing occurs under heavy grazing late in the grazing season when other more palatable species are gone (Kovalchik and Elmore 1992, Shaw 1992). Impacts are also increased when cattle are allowed to congregate in riparian zones. Congregation often results in physical damage to willow shrubs and seedlings. Physical damage decreases shrub stability and suppresses regeneration (Kovalchik and Elmore 1992). Documented

cattle damage to willows includes: hedging, trampling of seedlings, and pedestaling of the root crowns (Kovalchik and Elmore 1992, Leopold et al. 1951, Loft et. al. 1987). Hedging and pedestaling of willows in Bell Meadow is noted but not quantified (Apperson pers. com. 1997, Buckley pers. com. 1997, Frazier pers. com. 1997). Adequate fencing, maintenance of the fencing, and enforcement of the allotment permit will prevent the opportunity for further cattle impacts.

Another concern is the negative impacts of grazing on aspen regeneration. Keeler-Wolfe's monitoring of two aspen stands suggests grazing did not limit aspen regeneration because no surge of regeneration corresponded to the exclusion of grazing in 1975. Even with cattle trespass, use levels were reduced in 1975, so there ought to have been a detectable surge in regeneration. Furthermore, most authors seem to agree that while heavy grazing, particularly late in the season effects aspen regeneration, light grazing does not (Clary and Medin 1990, DeByle 1985, Mueggler and Bartos 1977). Clary and Medin (1990) found that sprouts subject to heavy grazing were not killed, but were prevented from reaching tree size. Because no observations of stunted, heavily browsed aspen were made in 1996 field visits to the meadow or in Keeler-Wolfe (1985) this does not appear to be occurring in Bell Meadow. However, where aspen provide the only shade in a pasture, physical trampling can effect regeneration even at light grazing levels (DeByle 1985). Range maps show that aspen and willows provide the majority of shade within the upper pasture. It is unknown if cattle trespass occurs at sufficient levels to physically suppress aspen seedlings.

The only documented evidence that can be linked to grazing's influence on the aspen stands comes from the species composition of the aspen understory. The most frequent species encountered by Keeler-Wolfe (1985) were blue wild rye (Elymus glaucus), corn lily (Veratrum californicum), Osmorhiza chilensis, and tansy mustard (Descurainia richarsonii). Presence of blue wild rye is an indication of light grazing, but an abundance of corn lily indicates heavy grazing, especially historic heavy grazing by sheep (Menke et al. 1996). Recent light grazing and historic heavy grazing are documented in the range records. Tansy mustard is a forb common to open aspen stands, but Ozmorhiza chilensis is a forb associated with disturbed areas (Hickman ed. 1993). Weather or not the disturbance in these aspen stands is due to cattle grazing or water table changes or some other factor is unknown at this time. By re-sampling the aspen understories, current species shifts or trends can be determined and disturbance factors better defined.

Similarly, the Condition and Trend transect showed an increase in disturbance related annual forbs in the meadow. It is not definite which disturbance caused the increase in annual forbs, but this trend in meadows is typically associated with cattle grazing (Menke et al. 1996). Cattle generally prefer to eat grasses, so cattle grazing reduces the grasses ability to compete which favors annual forbs (Menke et al. 1996). Continued monitoring of the transect will document future trends and allow the Forest to gauge recovery.

Aspen stands in the Sierra Nevada are most likely the result of past climate regimes that provided the necessary conditions for seed germination and seedling survival. Due to climatic shifts those conditions do not occur in most of the Western US today and current regeneration is primarily vegetative, or clonal (McDonough 1985). Sprouts or clones are sent up from an extensive mat-like root network. Sprouting can be stimulated by a variety of things including grazing, fire, blowdowns and other disturbance factors (Shepperd and Smith 1993). Aspen stands are classified as either successional to conifer forest, or static (climax) maintaining an aspen overstory through time (Harniss and Harper 1982). Aspen in Bell Meadow are classified as static (Keeler-Wolfe 1985). They generally maintain an aspen overstory, but like most California ecosystems, they are subject to fires at regular intervals (Barbour and Major eds. 1988). Aspen stands are difficult to burn, but aspen stems are highly sensitive to heat (Brown and DeByle 1989). Of the two stands surveyed by Keeler-Wolfe, the one in lower Bell contains large numbers of downed logs. This stand could be vulnerable to a stand replacing event if weather conditions allowed. Because aspen sprout from roots, they regenerate freely after fire (Jones and DeByle 1985). It is unlikely that a stand replacing event would cause permanent loss of the OR Value, aspen (Brown and

DeByle 1989). In the event of a fire, RNA direction is to adopt where possible, a "let burn" fire policy (FSM 4063 addendum 1995). The fire management of this area should be outlined in a RNA Management Plan.

Conclusions

Bell Creek and its tributaries are undergoing a period of down cutting (DeGraff 1989, Keeler-Wolfe 1985, USDA 1975). Down cutting and gully erosion lowers the local water table (Dunne and Leopold 1943). Indications of the drop in water table at Bell Meadow are: a loss of wet meadow, a shift toward more drought tolerant species, and a decline in willow populations. Though much of the down cutting occurred prior to 1991, negative trends have continued and streambanks are at unacceptable levels of bank stability (Lentz 1996). Cattle trespass seems to be a problem (Frazier and Apperson 1996), and may be aggravating the unstable nature of the streambanks (Kattelmann and Embury 1996).

Management practices, general direction, and standards and guidelines (S&Gs) as written in the 1991 Forest Plan for Research Natural Areas are sufficient to protect or enhance the Ecologic (a) OR value of Bell Meadow. Management emphasis calls for the maintenance of select vegetative and aquatic elements in natural conditions and protection against activities that directly or indirectly modify ecological processes. Similarly, most of the direction for management of Streamside Management Zones, Fisheries Habitat and Wildlife, Grazing, and Riparian Areas adequately protect the OR value. However, implementation of these standards seems to be the weak link and is not always successful. Unsatisfactory streambank conditions exist in Bell Meadow (Lentz 1996); vegetation cover is decreasing in willow populations and one aspen stand (RSL 1996); and, grazing use does not always comply with permit requirements (various District Range records). Ways to improve implementation of S&Gs in Bell Meadow are dependent on funding, staffing, and collaborations with the public. This document is an excellent first step.

Action is being taken in 1997 to see that range permit compliance is met. District personnel are working with the permittee for the Bell Meadow/Bear Lake allotment to repair the fencing around Bell Meadow. Maintenance of the fencing and vigorous administration of the permit will be needed for long term prevention of cattle trespass.

Monitoring will also be conducted in 1997 by the Forest and Pacific Southwest Research Station. The Forest obtained a matching grant specifically to monitor erosion and vegetation in Bell Meadow. This monitoring will be of great use for filling information gaps noted above in this Review. It will also be useful in developing a RNA Management Plan as required for all established RNAs.

Recommendations

Recovery of gullies and re-vegetation can take years to decades with recovery of riparian areas largely dependent on the ability of the vegetation to trap and hold sediments (Stevens et. al. 1992, Kattelmann and Embury 1996). The only way to protect or enhance the Ecologic (a) OR value is to stabilize the meadow's hydrology and enhance re-vegetation. Even though RNA management calls for no disturbance, the Forest Service Manual for RNAs (FSM 4063.05) includes a provision for restoration activities. Where needed "under unusual circumstances, deliberate manipulation may be utilized to maintain the unique features that the RNA was established to protect."

1. As directed in the Bell Meadow RNA Establishment Record (USDA 1994), a RNA Management Plan should be written. This plan should include detailed restoration, maintenance, fire suppression and monitoring direction and be coordinated with the Pacific Southwest Research Station. Particular attention should be paid to data gaps identified in this document and listed below.

2. Improve and repair fencing around Bell Meadow to prevent cattle trespass. Support and encourage District and Forest range personnel in order to facilitate proficient range management and permit administration.

3. With cooperation of permittees, exclude grazing use from lower Bell holding pasture until an alternative water source can be developed and the riparian corridor in this pasture fenced from grazing. Another option would be to establish a new holding pasture in which the riparian corridor can be more easily protected.

4. Develop, fund, and implement a complete monitoring strategy for Bell Meadow RNA as part of the RNA Management plan which will include but not be limited to monitoring of the following items:

    a. Amphibian and fish populations

    b. Stream bank stability and riparian vegetation

    c. Spotted and great gray owl populations

    d. Monitor plant species cover and composition to determine current and future trends in all vegetation types listed by Keeler-Wolfe (1985). Pay particular attention to areas experiencing decreases in vegetation cover and to stream banks. Establish monitoring plots in similar vegetation types outside of the RNA, in the general cattle allotment, to provide contrasting data which will assist in determining the extent of damage by cattle in the RNA.

    e. Monitor erosion in Bell Meadow and develop comprehensive erosion control plans adhering to Regional native plant standards and RNA direction. A first step was recommended by DeGraff as installing filter cloth and rock to stabilize headcuts and prevent further gully formation (DeGraff 1989).

5. Incorporate monitoring into planning efforts. For example, use monitoring of amphibian and deer populations and habitats to add S&Gs for these animals to the FLRMP.

6. Coordinate management planning and actions in the RNA with the Pacific Southwest Research Station in Albany.

7. Form/continue collaborations with non-agency groups to develop and fund implementation of restoration activities in Bell Meadow.

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Value
2

Ecologic (b)

(Segments 1-5) The Clavey River (including Bell and Lily Creeks) has a combination of landscape ecology features making it distinct within the Sierra Nevada: 1) free-flowing characteristics; 2) abundance and quality of life zones and vegetation; 3) elevation range; and, 4) relative remoteness and lack of development.

The Clavey River is one of the longest remaining free-flowing streams in the Sierra Nevada. It is 47 miles from source to mouth, including both headwater forks, Bell and Lily Creeks. Free-flowing condition is an important value because little remains in the Sierra Nevada. From the Feather River on the north to the Kern River on the south, all but one (the Consumnes) of the 15 major rivers in the Sierra, are impounded. Of 90 major tributaries, only four streams greater than 40 miles are free-flowing with no impoundments or diversions from headwaters to mouth.

The Clavey River contains all but one Sierra Nevada life zone within its watershed. Elevation ranges from 1,200 feet at its mouth to 9,200 feet at its headwaters, allowing for all life zones except true alpine. At its headwaters, sub-alpine forests of red fir, lodgepole, western white pine and mountain hemlock combine with mountain meadows and granite-bound lakes. All forest habitats are found as elevation decreases, ending with the California chaparral type at the mouth of the river. Within the Clavey's wide variety of high to low elevation vegetative types, one is truly unique: Bell Meadow, at 6,500 feet along Bell Creek, contains the largest stand of quaking aspen (110 acres) in the southern half of the Sierra Nevada.

Another feature of the Clavey River is its minimal development. It is almost entirely under federal ownership; even the portions outside of Wilderness are relatively undisturbed and remote. Private lands and developments such as towns and roads line portions of most other rivers in the Sierra. The Clavey, although crossed by several roads, has remained relatively undisturbed because of its remoteness, rugged nature and its north-south geographic orientation. For much of its length, the Clavey runs perpendicular to the east-west trend of major roadways in its watershed.

Historic Setting

As described in the River Study (USDA 1991), the Ecologic (b) “Outstandingly Remarkable” (OR) value applies to the Clavey River (including Bell and Lily Creeks).

Free-flowing Characteristics

The Clavey River remained free-flowing throughout the history of human settlement of the area. It is part of a Sierran river system which includes 15 major streams divided into the two largest river basins in California, the Sacramento and San Joaquin. These rivers remained largely free-flowing until the early 20th century when, one by one, impoundments were constructed up and down the Sierra Nevada. Prior to that, each river's flow responded to a winter snowpack and a dry summer season. Heavy spring runoff caused flooding in the Central Valley where, in many years, a large wetland existed for months on end. Low summer flows followed and the annual cycle of high and low flow periods carved river canyons in the mountains and provided fertile soil for the large valley to its west.

The Sierra Nevada dam construction era began in the early 1900's and continued through the 1960's. Water supply from the Sierra Nevada for agriculture and municipal uses became a State and federal priority. Developments store and deliver massive volumes of water from the Sierra Nevada . Significant impoundments, diversions and altered runoff patterns affect all but one of the 15 major rivers.

Following the more than a half century of water developments in the Sierra Nevada, few major streams remain free flowing. Most are tributaries of the 15 principal rivers, including the Clavey River. As one of the longest remaining free flowing streams, the Clavey is a unique watershed in the Sierra Nevada.

Life Zones and Vegetation

The Sierra Nevada has experienced human use and management for approximately 10,000 years or more (Anderson and Moratto 1996). Prior to 1850, Native American vegetation management techniques included: pruning, tilling, transplanting, weeding, fire and others. Of these, fire had the largest overall effect on Sierra Nevada ecosystems. Native Americans employed burning in order to maintain open areas for travel, encourage acorn production, and stimulate sprouting of vegetation for wildlife and other resources. From thousands to hundreds of thousands of acres burned each year in the Sierra Nevada (Anderson and Moratto 1996).

The advent of fire suppression in the early 1900s and the climatic shift toward warmer and moister conditions have altered plant communities of the Sierra Nevada. Many forests have heavy fuel loads (amount of combustible material per acre) and stand structures are more dense than prior to fire suppression. This is particularly true at middle elevations in Ponderosa pine, Montane hardwood, and Sierran Mixed conifer forests (Chang 1996). With changes in stand structure and fuel loading have come changes in fire behavior. Today, uncontrolled fires tend to burn with higher intensity and are more likely to be stand replacing (Skinner and Chang 1996).

Other management activities that contributed to changes in Sierran plant communities include: grazing, mining, water impoundments, timber harvest, road building, and irrigation diversions. These activities have had the greatest effect in the riparian portions of the landscape. Many riparian areas of the Sierra Nevada have experienced sedimentation, streambank degradation, loss of riparian vegetation cover, and an invasion of non-native species (Kondolf et al. 1996).

The effects of human caused disturbances on riparian areas are compounded because these areas are subject to frequent natural disturbances like flooding. Floods of various intensities occur each spring during snow melt and during rain on snow events like the winter of 1996/97. Floods scour streambanks, remove vegetation, redistribute sediments, and clean gravel of fine sediments (Kattelmann 1996). The ability of a stream channel and streambank to withstand the impacts of flooding is partially related to the amount of riparian vegetation along the stream. As human impacts de-vegetated riparian areas, they decreased the areas natural ability to withstand flood events (Kattelman and Embury 1996).

Elevation Range

Elevation ranges from 1,200 feet at the Clavey’s confluence with the Tuolumne, to 9,200 feet at the headwaters of Lily Creek.

Relative Remoteness and Lack of Development

Private land, major state or federal highways and permanent human settlements line portions of most rivers in the Sierra Nevada. The Clavey River's ruggedness and it's north-south orientation,

perpendicular to desired local travel routes, minimized human encroachment along the river. This left the Clavey relatively undeveloped and remote from human activities among Sierra rivers.

Existing Condition

Free-flowing Characteristics

The Clavey River is one of the longest remaining free-flowing streams in the Sierra Nevada. It is 47 miles from source to mouth, including both headwaters forks, Lily and Bell Creeks. All but one of the 15 major rivers in the Sierra, from the Feather River on the north to the Kern River on the south, are dammed. Of 90 principal tributaries within these drainages there are only four greater than 40 miles in length which are free flowing from source to mouth. That is, no impoundments or diversions which measurably impair the natural magnitude, timing, velocity or duration of seasonal or annual runoff.

Of the 90 principal tributaries, 50 are dammed. Of the un-dammed ones only 8 are longer than 40 miles. Of these, only four are fully free-flowing; the Clavey River, the North and Middle Forks of the Consumnes River, and the South Fork Merced River. The other four, while un-dammed, have impoundments immediately below them which backs up flat water and prevents them from being free-flowing from source to mouth. These include the North Fork Yuba River, the North Fork American River, the Upper North Fork Kern River and the South Fork Kern River.

Life Zones and Vegetation

The west slope of the Sierra Nevada contains five life zones: Alpine, Sub-alpine, Upper Montane, Lower Montane, and Foothill (Whitney 1979). These zones correspond to general elevation bands and are used to demonstrate the principal that as elevations increase, temperatures decrease. For instance the Foothill zone runs from the Central Valley floor (0 to 100 feet) to approximately 2800 feet and precipitation is dominated by winter rain. The Lower Montane from 2800 feet to 5000 feet in elevation experiences cooler temperatures than in the Foothill zone, and winter precipitation may include snow. With the exception of Alpine, all other life zones are represented in the Clavey watershed.

The Draft EIS/EIR Clavey River Project (USDA 1994) lists 8 types of terrestrial vegetation habitat types for the project area: Sierran mixed conifer forest, Montane chaparral, Montane hardwood, Montane hardwood-conifer, Ponderosa pine, Wet meadow, Dry meadow, and Montane riparian. The following additional vegetation habitat types probably occur in the potential Wild and Scenic corridor and are included in this review: Sub-alpine forest, Upper montane forest (Red fir, Lodgepole pine, and Jeffrey pine), Aspen forest, and California chaparral (Mayer and Laudenslayer eds. 1988). Table 2.1 shows acres (from 1990 remote sensing existing vegetation GIS maps) of each vegetation type in the potential Wild and Scenic river corridor. These maps are general in nature and contain some errors. The table lists vegetation by Cal-Veg types which the author has converted into the vegetation habitat types discussed below.

Table 2.1 ***Vegetation Types***; Stanislaus National Forest, Clavey River potential Wild and Scenic River corridor; from 1990 vegetation GIS layer.

Cal-Veg Type	Vegetation Habitat Type	acres
Barren	None	2,597
Basin Sagebrush High Elevation Chaparral Montane Chaparral	Montane Chaparral	927
Low Elevation Chaparral Interior Live Oak	California Chaparral	1,016
Grass	Dry Meadow or California Chaparral	62
Jeffrey Pine	Jeffrey Pine Forest	25
Lodgepole Pine	Lodgepole Pine Forest	156
Mixed Conifer-Fir	Sierra Mixed Conifer	2,985
Mountain Hemlock Western White Pine	Sub-alpine Forest	28
Mixed Conifer-Pine Ponderosa Pine	Ponderosa Pine Forest	3,567
Canyon Live Oak	Montane Hardwood	811
California Black Oak	Montane Hardwood-Conifer	1,349
Willow White Alder	Montane Riparian	162
Red Fir	Red Fir Forest	1,786
Water	Water	52

A general description of each habitat type is given below. These descriptions provide an overview and are not meant to address all plant associations documented for a given vegetation type. Furthermore, although some records do exist, there is a lack of data to confirm the existence and “health” of these vegetation types within the Wild and Scenic corridor. Existing data includes: timber surveys, ecological plots (upper montane only), and FIA data. Most of this information is probably from the greater watershed area rather than in the W&S corridor. Due to time constraints, the data was not analyzed, but it is recommended that the data be explored and gaps identified as part of a watershed analysis. Unless otherwise noted, the following narratives were excerpted from Mayer and Laudenslayer eds. 1988, *A Guide to Wildlife Habitats of California*. The individual author(s) responsible for each habitat type in Mayer and Laudenslayer (1988) are cited at the end of each section. Some minor deviations from the original text make them more specific to the Clavey.

Sub-alpine forest

Several species dominate canopies of this type in different localities, either singly or in mixtures of two or more. These include mountain hemlock, western white pine, lodgepole pine, whitebark pine, and red fir. Typical structure is open forests with needle leafed evergreen trees of low to medium stature.

Stand density and tree height are typically greater at lower limits of its elevation range. In protected sites at lower elevations, tree height may exceed 30 m (100 ft), but trees on exposed sites and windy ridges near tree line are shaped into krummholz-stunted, mat-like forms often about 1 m (3 ft) tall (Verner and Purcell 1988, Sub-alpine conifer).

Red fir forest

Stands in the Red fir plant association are characteristically dense multi-layered forests with little ground cover. Total tree cover is one of the highest in the upper montane. The overstory is dominated by a single species - red fir. Understories are sparse. Associated species are white fir, Jeffrey pine, western white pine, and lodgepole pine. Distribution of associated species is generally tied to aspect, elevation and soil productivity within the red fir stand. Understory composition is strongly influenced by these same factors and disturbance frequency (e.g., fire, erosion, logging). (Excerpted from Potter 1994, Red fir association description and others).

Lodgepole pine forest:

Stands in this plant association are moderately dense forests with open understories. Tree cover is moderate. Tree overstories are dominated by lodgepole pine in a mix with very scattered red fir. Western white pine is a rare member of the stand. The shrub layer is essentially absent. On moist sites the understory can be dominated by Gray's lovage and a rich variety of other forbs. (Excerpted from Potter 1994, Lodgepole pine association and others).

Jeffrey pine forest

Stands are characteristically open woodlands with a prominent shrub layer. Tree cover is among the lowest of any of the forested associations, while the shrub cover is significantly higher than most other sites. The overstory is distinguished by a relatively high component of Jeffrey pine. Red fir and white fir are commonly present. Shrub understories include greenleaf manzanita, snowbrush, whitethorn, sagebrush, pinemat manzanita, and huckleberry oak. The latter of these is the dominant species present in Montane chaparral areas of the Clavey drainage. (Excerpted from Potter 1994, Jeffrey pine/greenleaf manzanita-snowbrush association and others).

Aspen forest

Aspen stands are typically composed of clones representing one or more genetic lines. They vary from a few stems on less that 1 ha (2.5 acres) to thousands of stems on 20 ha (50 acres) or more. Associated subdominant species may include willows, alders, black cottonwood, lodgepole pine, Jeffrey pine, red fir and white fir. In communities near climax, however, quaking aspen is conspicuously the dominant species in the canopy. Understory forbs are usually more abundant than grasses and sedges and the herbaceous component is typically so rich and diverse as to defy description. Mature stands of quaking aspen usually have relatively open canopies, often shared with other deciduous trees and a few conifer species, typically pines (Verner 1988).

Montane chaparral

The species composition of montane chaparral changes with elevation and geographical range, soil type, and aspect. One or more of the following species usually characterize montane chaparral communities: whitethorn ceanothus, snowbrush ceanothus, deerbrush, greenleaf manzanita, pinemat manzanita, huckleberry oak, and sierra chinquapin. The growth form of montane chaparral species can vary from tree-like (up to 3 meters) to prostrate. Its structure is affected by site quality, history of disturbance (e.g., fire, erosion, logging) and the influence of browsing animals. For example on shallow granitic soils in the Sierra Nevada, low dense growths of pinemat manzanita and huckleberry

oak characterize an edaphic climax community, associated with scattered conifers and much exposed granite. Following fire in the Mixed conifer forest habitat type, whitethorn ceanothus dominated chaparral may persist as a sub-climax community for many years (Risser and Fry 1988).

Montane hardwood

Steep, rocky south slopes of major river canyons often are clothed extensibly by canyon live oak and scattered old-growth conifers. Higher elevation overstory associates are typical mixed conifer and California black oak. Lower elevation associates are foothill pine and interior live oak. Associated understory vegetation includes snowberry, greenleaf manzanita, birchleaf mountain mahogany, deerbrush, and whiteleaf manzanita. A typical montane hardwood habitat is composed of a pronounced hardwood tree layer, with an infrequent and poorly developed shrub stratum, and a sparse herbaceous layer (McDonald 1988).

Montane hardwood-conifer

This type includes both conifers and hardwoods, often as a closed forest. In the southern Sierra Nevada, common associates include: California black oak, black cottonwood, canyon live oak, Jeffrey pine, Douglas-fir, ponderosa pine, sugar pine, and incense-cedar. The habitat often occurs in a mosaic-like pattern with small pure stands of conifers interspersed with small stands of broad-leaved trees (Sawyer 1980). Relatively little understory occurs under the dense, bi-layered canopy (Anderson 1988).

Ponderosa pine

The ponderosa pine habitat includes pure stands of ponderosa pine as well as stands of mixed species in which as least 50% of the canopy area is ponderosa pine. Associated species vary depending on site location. Typical tree associates include white fir, California black oak, incense-cedar, Jeffrey pine, sugar pine, and Douglas-fir. Associated shrubs include whiteleaf manzanita, greenleaf manzanita, buck brush, interior live oak, and bearclover. Tree spacing in ponderosa pine stands varies from open patchy to extremely close depending on site productivity, elevation and disturbance history (e.g., fire, erosion, logging) (Fitzhugh 1988).

Mixed chaparral

Mixed chaparral is a floristically rich type that supports approximately 240 species of woody plants. Composition changes with aspect and soil type. Dominant species include: interior live oak, whiteleaf manzanita, buck brush, toyon, poison oak, California buckeye, birchleaf mountain mahogany, chamise, and yerba santa. Individual sites may support pure stands of these shrubs or diverse mixtures of several species. Mixed chaparral is a structurally homogeneous brushland type dominated by shrubs with thick, stiff, heavily cutinized evergreen leaves. Shrub height and crowns vary considerably with age since last burn, aspect and soil type (England 1988).

Wet meadow

Wet meadows occur with a great variety of plant species; therefore it is not possible to generalize species composition. Several genera are common in wet meadows throughout the State. They include Agrostis (bent grass), Carex (sedge), Danthonia (oatgrass), Juncus (rush), Salix (willow), and Scirpus (bullrush). Wet meadows at all elevations generally have a simple structure consisting of a layer of herbaceous plants. Shrub or tree layers are usually absent or very sparse; they may however, be an important feature of the meadow edge (Ratliff 1988).

Dry meadow

Keeler-Wolfe found three subtypes of dry meadow, in Bell Meadow RNA, The dominant species were: Stipa columbiana, Madia glomerata, and a Lotus sp.-Euphorbia sp. association. Structure of the dry meadow community is probably simple, dominated by a single layer of herbaceous plants except in areas of tree encroachment. (No description available. Information taken from Keeler-Wolfe 1985).

Montane riparian

The vegetation of montane riparian zones is quite variable and often structurally diverse. Usually the montane riparian zone occurs as a narrow, often dense grove of broad-leaved, winter deciduous trees up to 30 m (98 ft) tall with a sparse understory. At high elevations, the montane riparian zone may not be well developed and may occur in the shrub stage only. In the Sierra Nevada, characteristic species include white alder, aspen, black cottonwood, dogwood, and willow. Substrate and flood cycle influence species composition and stand structure (Grenfell 1988).

Elevation Range

The elevation range of the Clavey River watershed, 1,200 to 9,200 feet, remains the same.

Relative Remoteness and Lack of Development

This 47 mile river system includes only 0.5 mile (1%) which traverses through undeveloped private lands. The remaining 46.5 miles are all National Forest System lands. By including lands within approximately ¼mile from each side of the river up to a total of 320 acres per mile, preliminary estimates show 15,040 acres within the proposed river corridor. This figure includes approximately 200 acres of the Bell Meadow Research Natural Area which is beyond ¼mile of Bell Creek.

The following sections provide more information for each river segment. Table 2.2 shows roads and trails within the Clavey River watershed and potential Wild and Scenic River corridor, relative to the entire National Forest.

Segment 1

Crabtree Trailhead is a developed site providing paved parking, restrooms and a trail bridge crossing Bell Creek for those visiting the nearby Emigrant Wilderness. Forest Roads 4N26 and 4N26B access a portion of Bell Creek, paralleling the stream for approximately 0.75 mile downstream from Crabtree Trailhead. Forest Road 4N02Y accesses an undeveloped parking area, just outside the Bell Meadow Research Natural Area. This parking area provides access to the Bell Meadow Trail which crosses Bell Creek, continues on to Lily Creek and beyond to the Emigrant Wilderness. A study in the early 1960's identified Bell Meadow as a potential location for a 12,000 acre foot water storage reservoir (USDA 1991).

Segment 2

The upper 9 mile portion of Lily Creek is accessible only by trail. Several Forest Roads and one crossing (4N50Y) access the lower 2 miles.

Segment 3

Forest Roads 3N29, 3N26, 3N21 and 3N01 access and cross this upper portion of the Clavey River.

Segment 4

In addition to the 3N01 crossing, several Forest Roads parallel the upper 4 mile portion of this segment. Other than the Cottonwood Road (1N04) crossing, only portions of Forest Road 2N40 and several spurs exist within 0.25 mile of the lower 4 mile portion. In 1986, Tuolumne County and Turlock Irrigation District proposed a hydroelectric project with developments on Segments 4 and 5 of the Clavey. The proponents withdrew their application from the Federal Energy Regulatory Commission (FERC) in 1995, citing "…declining growth due to the downturn in California's economy…."

Segment 5

The Cottonwood Road (1N04) crosses and then parallels the upper 1.75 miles of this segment. Forest Road 1N01 crosses near the mid-point of this segment then parallels the River for approximately 2 miles downstream.

Table 2.2 ***Roads and Trails***; Stanislaus National Forest, Clavey River watershed and potential Wild and Scenic River corridor; percents shown as portion of total National Forest roads or trails; from 1997 GIS layers.

Area	Roads (miles)	%	Trails (miles)	%
Stanislaus National Forest	5,475.6	100.00	767.9	100.00
Clavey River Watershed	522.9	9.55	68.1	8.87
Potential Clavey Wild and Scenic Corridor	30.9	0.56	13.8	1.80
Segment 1 Corridor **Bell Creek**, from its source .5 mile southeast of Burst Rock to Lily Creek and the Clavey River	3.1	0.06	3.3	0.43
Segment 2 Corridor **Lily Creek**, from its sources at Chewing Gum Lake and Y Meadow Lake to Bell Creek and the Clavey River	3.9	0.07	8.5	1.11
Segment 3 Corridor **Clavey River**, from Bell Creek and Lily Creek to 3N01	9.4	0.17	0.0	0.00
Segment 4 Corridor **Clavey River**, from 3N01 to Cottonwood Road	9.2	0.17	1.8	0.23
Segment 5 Corridor **Clavey River**, from Cottonwood Road to the Tuolumne	5.3	0.10	0.2	0.03

Management Direction

The Ecologic (b) OR value applies to segments 1-5. The Forest Plan includes direction (Table A.3) to protect this Wild and Scenic River value in: Management Area 1, Wilderness; Management Area 3, Near Natural; Management Area 4, Wildlife; and, Management Area 6, Research Natural Area (RNA).

Monitoring and Evaluation

Free-flowing Characteristics

Since 1991, no change occurred in the free-flowing character of the Clavey River. The Clavey Hydroelectric project proponents withdrew their application from the Federal Energy Regulatory Commission (FERC) in 1995, citing "...declining growth due to the downturn in California's economy...."

Recently, the USGS discontinued use of the stream gauge on the lower Clavey River due to funding constraints. This prevents monitoring unimpaired river flows of a major Sierra stream. The Clavey River is essentially a reference watershed for natural hydrologic flow patterns in the Sierra Nevada.

The draft Emigrant Wilderness Management Plan (USDA 1996a) proposed phasing out the Bear Lake and Y Meadow dams on Lily Creek. Doing so is complementary with the goal of Wild and Scenic River designation for the Clavey. These two small check dams store such a small amount of water that they do not have a measurable effect on the free flowing status of the Clavey River. Neither is managed to purposely alter flow in Lily Creek and the dams act only to change water level from that which would occur naturally.

Life Zones and Vegetation

The elevation of the Clavey drainage is from 1200 to 9200 feet, and it includes all Life Zones with the exception of the Alpine. The delineation of Life Zones is strictly tied to elevation which is not subject to human caused changes. Because vegetation responds to temperature regimes (elevation) and forms of precipitation (snow verses rain) the concept of Life Zones is tied to vegetation types. However, this is not an exact relationship. For example, north facing slopes with deep, fine textured soils provide the conditions under which a species from one Life Zone may occur at lower elevations (Whitney 1979). A more accurate way of characterizing the landscape is through Ecological Unit Inventory mapping. This process incorporates five elements: elevation, geology, geomorphology, soils, and aspect and uses them to determine an area's potential natural vegetation. Potential natural vegetation is the vegetation an area could support given fuels reduction, reintroduction of fire, and time. In many areas it would take decades and perhaps centuries for an area to reach its potential natural vegetation. However, Ecological Unit Inventory maps and potential natural vegetation provide a benchmark against which management can verify assumptions about a given area. Ecological Unit Inventory maps are available for the Clavey watershed at the Land Type Association level. This map provides a starting point for future Landscape or Watershed Analysis as directed in the Regional Ecosystem Guide, Sustaining Ecosystems, a Conceptual Framework (USDA 1995).

Very little field monitoring of the existing vegetation habitat types occurred outside of the Bell Meadow RNA. Recent surveys covering portions of the Clavey drainage, found no threatened, endangered, and sensitive (TE&S) plants (Ashmead pers. com. 1997). Dr. Lentz (1996) collected general plant cover information while conducting fish surveys. Because of time limitations and the non-specific nature of Dr. Lentz' plant data, this data was only reviewed for Bell Meadow (see Ecologic (a)). As mentioned above, there are other sources of data on stand structure and species composition for the watershed at large: timber stand records, timber inventories, ecology plot data, and Forest Inventory and Analysis data. Compilation and assessment of this data is recommended for future planning efforts.

In 1996 the USFS Remote Sensing Laboratory (RSL) conducted an analysis of change in vegetation cover for the Sierra Nevada (RSL 1996). The RSL compared satellite imagery taken in 1990 to 1995 imagery and subjectively assigned a measure of change: little or no, small, moderate, or large. The

RSL did not measure areas of shadow or water. By intersecting the vegetation change map (RSL 1996) with the existing vegetation GIS map (RSL 1990), the number of acres which experienced change can be calculated for each vegetation type (see Table 2.3). The category of change is subjective with no correspondence to any particular quantitative measure of canopy cover. As a result, the table contains errors. For example, 3 acres of bare area experienced a moderate decrease in vegetation cover. Other inconsistencies are due to errors in the existing vegetation GIS maps (RSL 1990). For instance, the analysis shows no aspen in the potential Wild and Scenic Corridor even though over 100 acres of aspen exist in Bell Meadow. The Forest contracted Pacific Meridian to correct and re-map the existing vegetation in 1997. It is not known if the RSL will re-evaluate the vegetation cover change analysis.

Table 2.3 shows that approximately 1% of the potential Wild and Scenic River corridor experienced a moderate or small decrease in vegetation cover between 1990 and 1995. The analysis, conducted prior to the Rogge fire of 1996, shows no areas experiencing a large decrease in cover. Current figures are expected to be different. Vegetation habitat types effected in the Rogge fire include: California chaparral, Montane hardwood, and Ponderosa pine types. Between 1990 and 1995 roughly 3% of the acreage mapped as Sierran mixed conifer, and 1% of the mapped Ponderosa pine type experienced a moderate or small decrease in vegetation cover. Wet meadow also appears to have decreased, however, meadow delineations were problematic in the existing vegetation GIS map (RSL 1990). What is reflected in this category is largely due to the decrease of willow cover detected in Bell Meadow (see Ecologic A).

Increases in vegetation cover are biased toward the lower elevation vegetation types in the Clavey potential Wild and Scenic River corridor. This is because these areas were in a period of re-growth after the Complex fire in 1987. In the Ponderosa pine, Montane hardwood, Montane hardwood-conifer, and California chaparral types, 12% of the acres experienced increases in vegetation cover.

Management practices including fire suppression in the Sierra Nevada create highly flammable forest conditions: fuel loads are high, forests are dense, and ladder fuels are abundant (Skinner and Chang 1996). Consequently, the probability of a large wildfire has increased (Erman and Jones 1996). The situation is compounded where forests are dense because individual trees are under severe competition with their neighbors for water which leads to high levels of mortality during periods of drought (Chang 1996). This situation can be seen in the Clavey drainage north of Cottonwood Road in Mixed conifer and Ponderosa pine forests. Fire risk is expected to be particularly high in these areas though no fire risk assessment was conducted for this document (Apperson pers. com. 1997).

Historically, Native American and lightning ignition sources maintained very different forest and shrubland structures. Chaparral and Montane hardwood vegetation types burned with high frequencies. Fires tended to burn in smaller, more patchy patterns at low and moderate intensities. This type of fire regime provided conditions maintaining high species biodiversity (Chang 1996, Minnich 1987).

Prior to 1850, Montane hardwood-conifer Ponderosa pine and Sierra mixed conifer types burned frequently. One study on the Sierra National Forest found that fire return intervals from 1776 to 1876 ranged from 3 to 7 years on one acre plots in Ponderosa pine and Mixed conifer forests (Phillips 1997). Frequent fires prevented fuels from accumulating, so fires burned at low to moderate intensities. Generally, frequent fires maintained stands in more open conditions than exist today. High fire frequency influenced stand structures in two ways. First, as seen in the Ponderosa Pine and Montane hardwood-conifer types, stands were kept open. Horizontal stand structure was coarse grained with large relatively uniform areas differing because of site productivity and time since last burn. Herbaceous layers were well developed and brush distribution patchy. Interior live oaks and California black oaks were maintained in the stands because of their ability to sprout after fire and their preference for open stand conditions. In contrast, fires in Sierran mixed conifer forests created a patchwork comprised of small canopy gaps (0.5 to 5.0 acres) each dating to a different disturbance event (e.g. fire, wind throw, disease outbreak). The primary reasons for the differences in these two

forest types are that the Mixed conifer forests produce more fuels than Ponderosa pine forests. Also, white fir which occurs in Mixed conifer forests is shade tolerant so it can grow up under the forest canopy and provide ladder fuels. Trees near ladder fuels are susceptible to crown scorch which may result in mortality. Subsequent fires burn the dead trees created in the previous fire and leave an opening in the canopy. Gaps were the primary location for tree regeneration. Fires generally did not spread to large stand replacing events because of the broken patchy nature of the forest's horizontal structure (Chang 1996).

Table 2.3 ***Vegetation Cover Change***; (acres) 1990 to 1995; Stanislaus National Forest, Clavey River potential Wild and Scenic River corridor. Total acres differ from Table 2.1 because the category of "shadow" (change not characterized) is not included (RSL 1996). No areas experienced large decreases in vegetation cover between 1990 and 1995.

	Increase			Little or	Decrease	
Vegetation Habitat Type	Large	Mod	Small	None	Mod	Small
Barren	12	248	114	2,115	3	13
Montane Chaparral	-	49	15	738	2	15
California Chaparral	4	398	72	508	-	3
Dry Meadow or California Chaparral	-	47	-	12	-	-
Wet Meadow	-	-	-	71	-	10
Jeffrey Pine	-	-	-	23	-	-
Lodgepole Pine	-	-	-	128	-	-
Red Fir	-	16	22	1,705	-	-
Sub-Alpine	-	-	-	26	-	-
Sierra Mixed Conifer	-	4	8	2,400	39	25
Ponderosa Pine	-	187	76	1,680	21	5
Montane Hardwood	-	60	25	522	-	-
Montane Hardwood - Conifer	-	17	3	670	2	6
Montane Riparian	-	-	8	124	-	-

Generally speaking, red fir and other upper montane forests have not experienced the large scale changes that occurred at lower and middle elevations from fire exclusion. Fires were historically cool, and small in the red fir forests. This is because Upper montane forests generally produce little fuel and they do not support a dense understory of flammable plants. Also, natural fire breaks are provided by the rocky and broken nature of the Upper montane Sierra Nevada. There are areas of exception, but it is thought that Upper montane forests are the least affected by fire suppression (Chang 1996).

Elevation Range

Since elevations change measurably only at the geologic time scale, monitoring or evaluation of this attribute of the Clavey River is not applicable.

Relative Remoteness and Lack of Development

The relative remoteness and lack of development in the Clavey River corridor compared to most rivers in the Sierra Nevada is unchanged since 1991. Road status remains the same and no new development occurred. Recreation use remains extremely low (see Table 8.1). Other management activity (timber harvest, grazing, etc.) remains essentially the same as in 1991.

Conclusions

Free-flowing Characteristics

The Clavey River, a principal tributary of the Tuolumne River, is considered one of the few fully free-flowing large streams in the Sierra Nevada. Built in the 1930's to augment summer flow downstream for fisheries purposes, two very small "check dams" exist on the upper portion of Lily Creek. Since they impound only 0.02% of the average annual water yield of the Clavey River they do not affect the free-flowing regimen of this 100,000 acre watershed. The draft Emigrant Wilderness Management Plan (USDA 1996a) proposed phasing out both dams.

The free-flowing status of the Clavey River is unchanged. Therefore, this significant element of the Ecologic (b) OR value remains intact.

Life Zones and Vegetation

The potential Wild and Scenic river corridor of the Clavey watershed includes four Life Zones (Whitney 1979). Because Life Zones are a concept tied to elevation, they cannot be changed or affected by human impacts.

This area potentially contains fourteen habitat vegetation types. Although some may be experiencing minor changes in vegetation cover there is no reason to believe that any of the vegetation habitat types have disappeared entirely from the Clavey Wild and Scenic corridor in the last seven years. However, there is no pre-1991 data or sufficient existing vegetation data to verify this. Further analysis of existing data and field verification of GIS map layers are needed in order to draw conclusions.

No data exists to evaluate the "health" of the vegetation types or to measure implementation of Forest Standards and Guidelines in the Clavey W&S Corridor. However, like most middle and lower elevation forests of the Sierra Nevada, historic management of fire suppression allowed fuel levels to build and forests to become increasingly dense (Skinner and Chang 1996). The greatest risk to the abundant vegetation types in the Clavey watershed is probably a catastrophic fire. Prescription burns and thinning may be necessary to prevent such an occurrence.

Human caused degradation of riparian ecosystems is a prominent problem in the Sierra Nevada (Kattelmann and Embury 1996). De-vegetation due to human caused disturbances decreases a riparian area’s ability to withstand natural disturbances like flooding. Meadows in particular are at risk. No data is available for meadows outside of Bell in the Wild and Scenic River corridor. This information gap needs to be filled if S&Gs are to be implemented and applied in the Clavey watershed. Given the current status of funding for this type of activity (uncertain at best), it is probable that a subset of meadows will need to be identified, evaluated and restored where necessary, in a triage fashion.

Elevation Range

Elevation is not changed or affected by human impacts.

Relative Remoteness and Lack of Development

Because the status of management activity remains essentially the same since 1991, the relative remoteness and lack of development of the Clavey River corridor is unchanged.

Summary

The status of the four attributes of the Clavey River which constitute the Ecologic (b) OR value remains unchanged since 1991. The Clavey is free-flowing, relatively remote and undeveloped, with the same character of life zones and elevation as in 1991. However, there is little existing data to confirm this conclusion particularly in regards to the abundance and quality of vegetation habitat types. To the best of our knowledge, the Ecologic (b) OR value remains intact, though further study is required.

Recommendations

Free-flowing Characteristics

1. Re-install the Clavey River streamflow gauge at the 1N01 bridge. Coordinate with USGS to include it as part of their benchmark gauge network. The benchmark network are primary flow monitoring sites which are of long term national hydrologic importance. The Clavey represents a truly unimpaired flow and could serve as a long-term reference watershed.

Life Zones and Vegetation

1. The greatest risk to this portion of the Ecologic (b) OR Value is a stand replacing fire. In order to reduce the risk of fire an interdisciplinary watershed analysis needs to be conducted which includes a fire risk evaluation, a fire management plan, and a fuels reduction strategy. Tools such as thinning, prescription burns, fuel mastication, and others need to be considered as viable methods for reducing fuel loads. The Sustaining Ecosystems conceptual framework (USDA 1995) provides a model for watershed analysis. This model incorporates using the natural range of variability for ecological and social variables, in directing management practices. Ecological Unit Inventories work with this model to guide management objectives and identify given parameters for ecosystem processes in the landscape. It is recommended that a Land Type Ecological Unit Inventory be conducted in the Clavey watershed and a watershed analysis based on the Sustaining Ecosystems model follow it. The watershed analysis process should include review of range management, timber, recreation, flooding and other uses and impacts in this drainage. Although many watershed analyses are conducted based on existing information, the large data gaps in the Clavey watershed dictate that current vegetation conditions need to be field verified. Areas that do not meet Forest S&Gs or areas likely to be affected by management need to be identified. Key indicators for impacted or potentially impacted areas should be carefully chosen and monitored in order to assess management effects. Provision for future monitoring of key indicators with a feedback loop for revision of monitoring strategies and management practices needs to be built into the Forest budget.

2. Particular attention should be paid to riparian condition and health. Currently the Regional standards for measuring meadow and riparian health are being revised and expanded. Upon completion, application of these standards in assessing the Clavey's riparian areas is recommended.

Elevation Range

1. One full time employee needs to be assigned for careful observation of the rate of uplift in the Sierra Nevada. Potential duty stations include Leavitt Peak, Matterhorn Peak or the top of Mt. Whitney. Ben and Jerry's ice cream and pizza would be delivered bi-weekly.

Relative Remoteness and Lack of Development

1. Review road access and developments in the Clavey River corridor for necessity and determine which are vital for National Forest purposes. Consider extraneous roads, road crossings, and developments for removal and restoration. Such a review will accomplish the goal of maintaining or enhancing the relative remoteness and lack of development in the Clavey River corridor.

List of Preparers

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Value
3

Fish

(Segments 3-5) One of the first streams in California to be designated as a Wild Trout Stream, representing a mid to low elevation trout stream in a remote location. Wild Trout streams provide self-sustaining trout fisheries which are not supplemented by hatchery stocking. It is believed that almost the entire basin contains only fish "native" to this portion of the Sierra Nevada. About 95% of the basin has an original fish assemblage. Rainbow trout is the only trout species in the basin (Lily Creek is reported to have some brook trout and brown trout may spawn at the confluence with the Tuolumne River). Rainbow trout are found in all of the Clavey and its tributaries capable of supporting cold water fish. The lower portion of the Clavey also contains a native assemblage of warm water fish including Sacramento suckers, Sacramento squawfish and hardhead. Due to extensive planting of non-native trout species and the illegal introductions of non-native warm water fish species, few other streams in the Sierra contain only the original assemblage of fish species. The Clavey River may be the only "rainbow trout" river left, in the Sierra Nevada, with its original fish assemblage still intact and relatively unaffected by introduced species.

Historic Setting

The Clavey River watershed is recognized as an important system because it supports an abundant native fish fauna with its aquatic communities still largely controlled by natural processes (Moyle and Randall 1996). It is one of the few streams in the Sierra with intact fish and amphibian communities and lacking in dams and diversions. The lack of dams and diversions has been a key factor in maintaining the native fish assemblage, recognized as one of the Outstandingly Remarkable (OR) Values of the Clavey River. The fish community is dominated by the native coastal rainbow trout. One of the earliest historical references to the Clavey's native fishes was found in an early California railroad travel magazine (1880's) which featured a story about people who collected trout from Bell Meadows and took them over the Sierra crest to stock Lundy Lake in the Mono Lake drainage in 1878 (Gerstung, E., pers. com.).

It is uncertain whether anadromous fish (e.g. chinook salmon, steelhead) used the Clavey River historically. Early accounts of salmon and steelhead in the Tuolumne River suggest that they may have used the main river up to Preston Falls and into the lower parts of the Clavey, Cherry Creek, and other tributaries. Early mining dams and diversions as early as 1852 may have affected spawning runs in the Tuolumne and tributaries, but Wheaton Dam built in 1871 and later, La Grange Dam significantly diminished and blocked salmon and steelhead access (Yoshiyama et al. 1996).

The native fishes known to inhabit the Clavey watershed include rainbow trout (Oncorhynchus mykiss), Sacramento sucker (Catostomus occidentalis), and California roach (Lavinia symmetricus). In the lower reaches of the Clavey near the Tuolumne River, Sacramento squawfish (Ptychocheilus grandis), hardhead (Mylopharodon conocephalus), and riffle sculpin (Cottus gulosus) may be found.

The Clavey River was designated a "Wild Trout Water" by the California Fish and Game Commission in 1972. The Wild Trout policy does not allow stocking of domestic strain, catchable size trout but stocking of suitable strains of wild or semi-wild hatchery-produced sub-catchable or fingerling trout are

permitted when necessary to supplement natural reproduction. Fish stocking last occurred in the Clavey River as recently as 1976. Stocking of fingerling brown and rainbow trout occurred nearly annually from the mid 1930's to 1953 (Department of Fish and Game file records). Non-native brown trout (Salmo trutta) fingerlings were stocked at least as early as 1920. Because brown trout were not able to successfully reproduce and get established in the Clavey River an experiment to "superimpose" brown trout on the rainbow population was conducted by DFG biologists in 1975 and 1976. Over 100,000 brown trout fingerlings were stocked both years and yet despite showing faster growth than the rainbow trout, brown trout have not been able to maintain themselves and persist in the Clavey River after this experiment. At the time of these brown trout stockings fisheries management philosophy was oriented towards enhancing the angling experience by providing a popular game fish with less emphasis on preservation of native fish communities. Current management direction emphasizes maintaining optimum habitat and water quality levels for a mid-elevation wild trout stream (Robertson, 1985).

Existing Condition

As described in the River Study, the “Outstandingly Remarkable” (OR) Fish value applies to segments 3-5 (USDA 1991).

Resource Status

The historic native fish assemblage in the Clavey River remains largely intact and abundant for a mid-elevation west slope Sierra stream. Since the Wild Trout designation, DFG stream survey crews sampled fish in segments 3, 4, and 5 (Table A.3) by backpack electro-fishing from 1984-1996 (Table 3.1). Populations were estimated by using the multiple-pass removal method. A computer algorithm with a maximum likelihood estimator was used to calculate population size estimates.

Surveys found only rainbow trout in the upstream Segments 3 and 4. Expanded population estimates have ranged from about 2,000 to over 5,000 trout per mile. The samples from these areas have been comprised of mostly smaller trout. Rainbow trout over six inches in length are usually about 10 to 15 percent of the total captured. The habitats sampled in the index stations are largely shallow riffle, run, and boulder-pocket water. Deep pools have not been evaluated in this sampling. It is likely that larger trout are concentrated in the deeper habitats found in the more remote, lower and middle parts of the river. This could be confirmed by conducting direct observation snorkel counts in these larger pools.

Native fishes sampled in the downstream Segment 5 include rainbow trout, Sacramento sucker, and California roach (Table 3.2). Rainbow trout are less abundant in this lower elevation reach of the river but almost two-thirds of the trout were six inches or larger in 1996. Foothill yellow-legged frogs (Rana boylii), a California "Species of Special Concern", were also found in the reach just upstream of the Road 1N01 bridge in 1996. The introduced brown trout is an occasional user of the lowest reaches of the Clavey River. It is likely that some brown trout and rainbow trout from the Tuolumne River use the lower Clavey for spawning.

Because non-native rainbow trout have been stocked in the drainage in the past there is some uncertainty about the genetic status of the Clavey's rainbow trout. Recent genetic evaluation of rainbow trout from the Clavey River has not been able to definitively conclude their evolutionary status (Nielsen 1997). However, two mitochondrial DNA haplotypes (MYS1 and MYS3) were detected in the Clavey samples that are shared by California hatchery strains (and other wild populations) of rainbow trout while another (MYS12) was found that has not been observed in hatchery strains. Microsatellite DNA loci suggest that Clavey rainbow trout have been separated from coastal steelhead and golden/redband lineages throughout recent history and "represent a probable endemic freshwater trout population with polyphyletic (redband and coastal) origins" (Nielsen, 1997).

The presence of brook trout (Salvelinus fontinalis) alters the native fish assemblage in the headwater tributaries, Bell Creek (Segment 1) and Lily Creek (Segment 2). The non-native brook trout are apparently numerous in Lily Creek from Bear Lake, in the Emigrant Wilderness, downstream to Pine Valley. Rainbow trout have been stocked in the lakes on Lily Creek by airplane since the 1950's. Surveys in Bell Creek at Bell Meadow, found a single brook trout out of 25 trout sampled in 1995 and one individual was captured out of 339 fish handled in 1996. Density of brook trout upstream of Bell Meadows is not known. The presence of brook trout in both Lily and Bell Creeks is not currently explained by fish stocking records.

Risks

Degradation of the habitat, either by natural events or by human-influenced activities, may result in possible risks to the native fish assemblage. A natural event such as the January 1997 "New Year's flooding" can have dramatic effects on fish populations and on the aquatic and riparian habitats. Consultants for the Clavey River hydroelectric project found reduced trout population numbers in the Clavey following the February, 1986 storms and flooding. The January 1997 flood, with an estimated peak flow of 47,000 cubic feet per second, was more than twice the previous recorded high flow on the Clavey River (Frazier, J., pers. com.). This flooding may have washed a large percentage of the fish population downstream and out to the Tuolumne, especially age 0+ fish. Also, it is possible that a few brook trout washed out from Bell and Lily Creeks may now be found in the main stem of the Clavey.

Wildfires that burn riparian and upslope vegetation can have a variety of effects on habitat and fish. High temperatures from fire are known to have killed fish in small, low-flow tributaries in the Cleveland fire on the Eldorado National Forest (Lehr, S., pers. com.) and in the Stanislaus Complex fire on the Stanislaus National Forest (Quelvog, B., pers. com.). Lost riparian vegetation can diminish trout supporting habitat by decreasing shade, cover, terrestrial invertebrate food sources, and by increasing water temperatures. Loss of upslope vegetation may result in increased sedimentation that alters spawning habitat, juvenile over-wintering habitat and aquatic invertebrate-producing substrates.

Excessive sedimentation has become an increasing problem on several California Wild Trout Waters. Severe degradation due to sediment deposition has created ongoing problems on Hat Creek and Fall River in Shasta National Forest and on the East Walker River near Bridgeport. Although the degree of habitat damage from sedimentation in the Clavey River is unknown there have been observations of excessive deposition. Large deposits were observed by DFG upstream of the 3N26 road crossing in 1995. Stream surveys conducted in 1983 by Harvey and Stanley Associates (Miwok Ranger District Files) noted sedimentation and bank erosion in areas between River Miles 17 and 22 (Segment 4), an area where logging had occurred on the east and south sides of the river. In October of 1983, the surveyors noted: "This section has significant sand deposition in pools caused by bank erosion and logging operations on steep slopes which are slow to revegetate" and, recommended: "Revegetate the logged slopes to the south of the channel between Mile 19 and 22. Bare ground is predominate there and in clearings near the channel".

A possible risk to the native fish assemblage could be the downstream spread of brook trout into the Wild and Scenic segments on the main stem Clavey. The brook trout found in Lily and Bell Creeks have probably been present for decades. The California Department of Fish and Game fish stocking records indicate that no brook trout have been planted in Bell or Lily Creeks or the lakes since the first recorded aircraft plants in 1952. Since brook trout have not yet been found in the Clavey it is a low probability that they will get established there, similar to the situation with another non-native, fall-spawning fish, the brown trout. Brown trout did not persist despite years of annual fingerling stocking.

Table 3.1 ***Rainbow Trout Population Sampling***; from electro-fishing of Clavey River Index Stations, 1984-1996; Wild and Scenic (W&S) River segments 3-5 (Table A.3); Clavey River; Stanislaus National Forest.

DFG Section	Year	Length (feet)	Population estimate	±95% C.I.	Fish per mile	Fish/mi. ≥150mm	W&S Segment
1	1984	355	169	14	2,514	588	3
1	1985	360	67	4	986	243	3
6	1985	300	185	13	3,255	908	3
6	1996	300	130	1	2,288	229	3
9	1996	350	122	6	1,840	172	3
3	1984	330	254	13	4,064	1,132	4
3	1985	322	234	7	3,837	690	4
3	1989	207	162	14	4,132	253	4
7	1989	329	340	15	5,450	513	4
7	1996	328	300	10	4,829	335	4
8	1989	318	245	6	4,068	407	4
8	1996	330	243	10	3,911	337	4
2	1985	340	156	8	2,423	390	5
2	1989	344	63	7	969	82	5
2	1996	376	67	6	940	617	5
4	1984	273	83	16	1,605	136	5
5	1984	166	51	14	1,622	189	5

Table 3.2 ***Fish Population Sampling***; 1984-1996; Wild and Scenic (W&S) River segment 5 (Table A.3); Clavey River; Stanislaus National Forest.
(*) Population not estimated due to non-decreasing removal pattern.

Species	DFG Section	Year	Length (feet)	Population estimate	±95% C.I.	Fish per mile
Rainbow Trout	2	1996	376	67	6	940
Sacramento Sucker	2	1996	376	82	14	1,151
California Roach	2	1996	376	57	13	800
Rainbow Trout	2	1989	344	63	7	969
Sacramento Sucker	2	1989	344	42	13	640
California Roach	2	1989	344	89	5	1,372
Rainbow Trout	2	1985	340	156	8	2,423
Sacramento Sucker	2	1985	340	42	3	652
California Roach	2	1985	340	89	14	2,904
Rainbow Trout	4	1984	273	83	16	1,605
Sacramento Sucker	4	1984	273	40	14	774
California Roach	4	1984	273	>79*	*	*
Rainbow Trout	5	1984	166	51	14	1,622
Sacramento Sucker	5	1984	166	6	3	191
California Roach	5	1984	166	14	11	445

Tributaries

Most of the Clavey's tributaries also provide important habitat for rainbow trout (Map 3.1). DFG and Stanislaus National Forest crews conducted surveys, on most of the larger tributaries, by electro-fishing, snorkel count, and direct observation methods. Since 1980, these surveys consistently found rainbow trout in suitable habitats on Bell Creek (1980, 1996), Lily Creek (1991), Bourland Creek (1991,1992), Hull Creek (1980), Reynolds Creek (1980), Reed Creek (1989), Two-mile Creek (1989), and Cottonwood Creek (1992).

Those tributaries appear important as nursery and rearing streams and provide recruitment of fish to the Clavey, helping sustain its fishery values. Even relatively small streams that went intermittent in some years were important rearing and nursery areas. The tributary streams are important in maintaining the Fish OR value (Quelvog, B., pers. com.). These tributary streams need to be protected to ensure protection of the fishery in the Clavey River.

Potential adverse impacts were noted in several reports. Heavy recreational use or development immediately adjacent to the streams can impact the stream banks and vegetation. Angling is currently controlled with regulations and does not appear to be causing significant impacts. Cattle grazing can and has lead to bank de-stabilization, down-cutting, trampling & chiseling, increased sedimentation, loss of spawning and rearing areas, meadow damage and loss of riparian vegetation. Logging impacts have resulted when activities occurred too close to the stream without adequate protection resulting in increased sedimentation, loss of large woody debris to the system, and loss of stream shading that can result in increased stream temperatures and loss of habitat for trout.

Recent observations in the area indicate that the network of roads has the potential to significantly increase sedimentation to the tributary streams and the main Clavey River. Part of the potential problem appears to be due to recent fire suppression activity. Another component seems to be associated with timber harvest activities. No data is available on the amount of sediment that may be reaching the streams from road sources as part of the fishery survey information.

Fish population sampling was conducted at two stations on Bell Creek (Segment 1) at Bell Meadow, in October, 1996 (Table 3.3). One station was located in the upstream fenced area and the other alongside the downstream holding pasture. Considerable bank damage and sparse riparian vegetation was observed in the holding pasture reach along with an average channel width about one-third larger than in the fenced reach. Although rainbow trout density was higher in the downstream reach the sample had a higher proportion of smaller trout than the fenced area sample. The upstream reach had an estimated standing crop of 32.2 lb./acre and about 39% of the fish were 150 mm (6 in) or larger, while in the downstream reach, estimates were 22.6 lb./acre standing crop and only 14% of trout were 150 mm or larger.

Table 3.3 ***Rainbow Trout Population Sampling***; from electro-fishing Bell Creek at Bell Meadow, 11 October 1996; Wild and Scenic (W&S) River segment 1(Table A.3); Clavey River; Stanislaus National Forest.

DFG Section	Location	Length (feet)	Population estimate	±95% C.I.	Fish per mile	Fish/mi. ≥150m
1	upper fenced area	662	92	3	733	281
2	lower holding pasture	840	245	7	1,540	220

A major concern noted was the impacts in the Bell Meadow area from cattle grazing in and outside the holding pasture area within the meadow. Most of the stream section within the holding area had significant adverse impacts for trout from cattle activities. The stream banks were trampled and chiseled by the cattle. Stream banks were sloughing sediment into the stream channel and down-cutting of the stream channel was evident. Vegetation was heavily browsed where present along the stream banks. In addition, whenever cattle were in the stream, sediment was stirred up and clouded the water.

Cattle were observed walking in, lying in, and crossing the stream, further breaking down the stream banks during fish sampling activities in 1996. They were also grazing along the stream banks. They were observed to walk in the creek and immediately adjacent to the fence between the pasture and the RNA section of Bell Meadow. They would then cross through the fence into the RNA portion of Bell Meadow. Impacts similar to those seen in the holding pasture were observed in the upper meadow within the RNA due to cattle grazing. The direct impacts from cattle grazing were usually less in the upper meadow. However, down-cutting is more significant in the upper meadow area. Whether this is due directly to grazing activities, or, is just continuing due to past damage from cattle is not known. However, current grazing is continuing to impact the stream banks and is therefore, not allowing the area to heal even naturally at an optimum rate.

Management Direction

The Fish OR value applies to segments 3-5. The Forest Plan includes direction (Table A.3) to protect this Wild and Scenic River value in: Management Area 3, Near Natural; and Management Area 4, Wildlife. The Wildlife direction emphasizes late seral stage management indicator species and wildlife which require mature and older forest habitats for life cycle completion. For resident trout species the general direction is: "Provide medium to high quality habitat... according to the habitat capability models for these species", with Standards and Guidelines for implementing structural fish habitat improvements if funding is available. The Near Natural management direction is more protective than Wildlife and places emphasis on providing a natural appearing landscape in a non-motorized setting with land altering practices limited in scope and duration. There are no specific Standards and Guidelines for fish except that habitat activities are to be conducted to improve or restore habitats to natural conditions in order to meet Forest wildlife objectives.

Additional direction is provided by the Wild Trout Habitat Management Plan (Robertson, 1985). The plan provides the Forest Service with "management direction and guidelines for maintaining... the integrity and quality of the aquatic and streamside habitat for which the Clavey River was designated". The plan incorporates a habitat capability model for resident trout to guide maintenance of "optimum" water quality and fish habitat levels for a mid-elevation stream. The plan requires a 100-foot riparian corridor on each side of the river with some specific restrictions on timber harvest, stream shading and canopy closure standards, ground cover vegetation protection, and road crossing requirements and restrictions. Some of the plan elements are obsolete and some of the guidelines may have been superseded by the Forest Plan. The Wild Trout plan is due for revision and will be a priority for DFG Wild Trout program staff to work on.

Monitoring and Evaluation

The Stanislaus National Forest 1994-1996 Monitoring and Evaluation Report shows that the Core Team could not evaluate conditions because the Forest Plan does not include monitoring standards or limits of variability for Wild and Scenic River values. Although the Core Team could not determine conditions, it is unlikely that trends could be established for most, over the short 5 years since Forest Plan approval, even with more information and unlimited monitoring budgets (USDA 1997).

The DFG has established goals for monitoring designated Wild Trout Waters based on the stream or lake's levels of access and angler use. For waters like the Clavey River which are primarily remote, canyon streams with light fishing use, fish population sampling is usually scheduled at least every five years. Waters with roadside access and heavy fishing pressure have shorter population sampling intervals with some being monitored annually. The patterns of natural variability in fish population size are not likely to be discerned with a sampling interval of five years but comparisons to similar streams can be made to characterize population status generally. Wild Trout monitoring was conducted in 1984-85, 1989, and 1996.

The monitoring approach used by the DFG Wild Trout Program is to establish index stations to sample fish populations by electro-fishing. Index stations are assumed to be "representative" habitats and population trends can be followed by repeated sampling. Population characteristics (size and age structure, biomass, standing crop) can be estimated by measurement of captured fish. Not all habitat types are represented so index station data cannot be fairly extrapolated to all of the river. Direct observation (snorkel counts) surveys can be used to sample under represented habitats.

Conclusions

The historic native fish assemblage in the Clavey River remains largely intact and abundant for a mid-elevation west slope Sierra stream. Existing information on fish population status and trends is limited. Information on status of important habitats and other components of the aquatic ecosystem such as amphibians and benthic macro invertebrates is missing. Understanding of trophic ecology of the Clavey River and its tributaries is general at best.

The Fish OR value remains a unique attribute of the Clavey River.

The tributaries are of vital importance to the Fish OR value and to the maintenance of the native rainbow trout fishery. Many tributaries provide spawning, recruitment, and refuge to the Clavey's fishery. Failure to maintain the health and integrity of the aquatic systems tributary to the Clavey River could adversely impact the Fish OR value of the Clavey River.

Recommendations

Watershed Analysis

1. All actions necessary to maintain, and where possible, restore or enhance the aquatic system to a proper functioning system should be undertaken.

2. A current watershed analysis including aquatic surveys of the Clavey River and its tributary streams is needed and should be a high priority in any future activity within the drainage. The watershed analysis should include a sediment budget and a road system analysis. The sediment budget will determine sediment sources, evaluate transport processes and identify the disposition of sediment within the fluvial system. The road analysis should assess system and non-system roads to determine affects on watershed condition. The objective is a road treatment plan to improve watershed conditions while providing a managed road system that meets public and administrative needs. Due to a lack of recent adequate and coordinated information, the watershed analysis should include a plan to collect current information on the fisheries in the Clavey River and all its tributaries. This should include surveys of not only fish populations, but other associated aquatic communities, substrate, flows (throughout the year & over several water year types) and a general watershed inventory. This should include sediment and large woody

debris potential and could lead to a management plan for managing the entire watershed to provide for maintenance of the Fish OR value and other attributes that help maintain the quality of the area.

3. Riparian, and adjacent, areas should be managed to minimize impacts to riparian and aquatic resources. Management activities within the riparian zone should maintain riparian and aquatic dependent species. No management should be planned for non-riparian dependent species or activities.

BMP Monitoring

1. Best Management Practice (BMP) monitoring for road maintenance should be improved. The existing BMP evaluation only looks at the adequacy of road maintenance associated with project activities such as timber sales. Therefore, BMP evaluations do not assess the quality of road maintenance for a great majority of roads on the Forest. With decreasing Forest Service road maintenance budgets, great concern exists regarding the condition of native surface roads and the sediment that is likely delivered to the aquatic system (Apperson, pers. com.).

Protection of Aquatic Biodiversity

1. A number of approaches have been proposed for the conservation of important aquatic habitats and native biota in Sierra watersheds. The Clavey River is recognized as having one of the highest scores on an Index of Biotic Integrity (IBI) in the Sierra (Moyle and Randall, 1996). Moyle (1996) has recommended establishment of a system of "Aquatic Diversity Management Areas". Recognizing the Clavey's high IBI and the value of its habitats and biota, the Clavey watershed should be considered for the special management treatments such a designation would provide. This would follow the recommendations made as part of the Sierra Nevada Ecosystem Project's report to Congress.

2. Another approach would be consideration of establishing the Clavey River as an "emphasis watershed" for both its biological diversity and its high quality fishery. This designation would result from the adoption of a Aquatic/Riparian Conservation Strategy as outlined by the CA Owl RDEIS (USDA 1996). Similar strategies have been developed in the Pacific Northwest under the Northwest Forest Plan and PACFISH. In California, Conservation Strategies are under development elsewhere in the Sierra such as for golden trout in the South Fork Kern River drainage (Stephens, S., pers. com.).

3. It is recommended that in the next phase of the collaborative process on Clavey watershed management, the above strategies be carefully studied and a consensus reached regarding the best approach for the protection of the Clavey watershed aquatic resources. The Collaborative Process should consider consultation with authors/practitioners of these methods and, following review, recommend to the Forest Supervisor appropriate protection measures.

4. A related recommendation should be the consideration of expanding the designated Wild Trout area to include important tributaries or to the entire watershed. The revision of the Wild Trout Management Plan should incorporate watershed/tributary features. The Fish and Game Commission has already established the Wild Trout watershed precedent with the March, 1997 designation of the South Fork Kern River drainage (above Dutch John Flat).

Fisheries

Bell Meadow

1. The cattle need to be kept away from the stream. Alternative livestock watering methods should be considered/developed. If the pasture is to be maintained, then adequate protection must be ensured for the meadow system and the stream.

2. Past down-cutting needs to be halted and the system stabilized, repaired, and brought back into a good, proper functioning meadow."

Clavey and Tributaries (including Bell Meadow)

1. Monitoring of fishery at index stations every 5 years or more often, as needed, in response to management activities or natural occurrences.

2. Resample Clavey fishery index stations in 1997 to observe population effects of the January, 1997 flooding.

3. Survey Bell Creek in 1997 to identify extent, distribution, and relative abundance of brook trout.

4. A complete stream habitat and channel typing of the Clavey Watershed.

5. Determine the relative recruitment of trout from each of the tributaries of the Clavey River to the Clavey River. Set up criteria for determining their relative importance to the Fish OR value. (e.g. even if the lowest tributary contributes significant numbers of fry, it will not be important to the upper Clavey River because the fish cannot physically get up the river).

6. Establish base transects for fish population sampling on the tributaries that are the most important for maintaining the Clavey River's Fish OR value. This should include aquatic macro invertebrates, fish, amphibians, aquatic vegetation, and other factors that can affect the fish population.

7. A one time fishery, aquatic, and riparian survey of the entire Clavey River to establish the current baseline conditions. This may need to be carried over to the tributaries to determine if impacts to the tributaries result in impacts on the Clavey River. We know this occurs for fish and sediment, but not necessarily for other values.

8. Establish flow monitoring stations at various locations on the Clavey River and each of the main tributary streams to determine late summer base flows and the contributions of all tributary streams to the Clavey River and its OR values.

9. Establish a USFS monitoring program for each approved management activity to determine if current Best Management Practices (BMPs) are adequate to ensure the protection or restoration of the Clavey River OR values. Furthermore, determine for each OR value if a BMP exists and if not develop and monitor the new BMPs for effectiveness.

Aquatic Conservation Strategy

The primary goal should be to protect and restore riparian habitats, process, and biodiversity. To do this the management strategies need to include the following:

1. Manage riparian areas for riparian dependent resources.

2. Manage riparian areas for proper functioning condition.

3. Develop consistent Riparian Standards and Guidelines.

4. Standardize procedures for management of riparian areas.

5. Address riparian objectives / issues in all planning documents.

6. Make effective riparian monitoring a high priority to protect riparian resources and ensure compliance of permit requirements in riparian areas.

7. Protect unique systems, areas, and biota as a priority issue.

8. Develop a prioritized restoration and implementation schedule based on potential for success.

9. No management activities directed toward non-riparian dependent species should be planned in riparian zones. This would include timber harvest, fuelwood cutting, developed recreational sites, etc. These activities could occur if it is for the benefit of riparian dependent species and is done pursuant to guidelines developed by fishery and wildlife biologists.

10. Roads should be located outside riparian zones when possible. Prevent sediment delivery to streams from road surfaces. Outsloping of roadways surfaces is preferred, except in cases where outsloping would increase sediment delivery to streams or where outsloping is infeasible or unsafe. Route road drainage away from potentially unstable stream channels, fills, and hillslopes.

11. Avoid disruption of natural hydrologic flow paths.

12. Avoid side casting of soils or snow in Riparian Management Zones on into areas where the material is likely to enter stream courses or RMZs.

13. All new, improved or reconstructed, and when possible existing, stream crossings should be built to accommodate a 100 year flood, the maximum recorded or estimated flow, or potential maximum flow, whichever is the largest, including associated bedload and debris. Base priority for upgrading on risks to fish and their habitat and the ecological value of the riparian resources affected. Give priority to permanent structures.

14. Provide and maintain fish passage at all road crossings of existing and potential fish-bearing stream.

15. Modify grazing practices that retard or prevent attainment of riparian goals and objectives or that are likely to adversely affect fish or riparian dependent species. Locate or relocate livestock handling and management facilities outside of Riparian Management Zones (RMZs).

16. Limit livestock trailing, bedding, watering, salting, loading, and other activities to those areas and times that will not retard or prevent attainment of riparian goals and objectives or adversely affect fish or other riparian dependent species.

17. Design, construct, operate, and maintain recreational facilities, including trails and dispersed sites in a manner that does not retard or prevent attainment of the riparian goals and objectives. These facilities should be kept out of RMZs as far as possible and feasible. Crossing of RMZs should minimize impacts to all riparian values and should be done in a manner that does not affect the riparian resources including fish.

18. Mining activities should be done in a manner that is not likely to adversely affect fish or riparian dependent species. Structures and support facilities and roads if permitted should be outside the RMZs.

19. Design fire management activities, including, but not limited to fuel treatment, fire suppression, etc so as not to prevent attainment or riparian goals and objectives and to minimize disturbance of riparian systems including ground cover, vegetation and natural flow regimes.

20. Vegetation management within RMZs should be for attaining riparian goals and objectives. Any trees felled for safety reasons will be left on site to meet woody debris objectives unless removal is needed to meet riparian goals and objectives under the direction of input provided from fishery and wildlife biologists.

21. Application of herbicides, pesticides and other chemicals will be done in a manner that does not retard or prevent attainment of riparian goals and objectives and avoids adverse effects on fish, unless the goal is to change the fish population structure and composition.

22. Water drafting sites will be located and water drafting will be done in a manner that avoids adverse effects to fish and other riparian dependent species, and instream flows. Drafting will be done in a manner that does not retard or prevent attainment or riparian goals and objectives.

List of Preparers

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Value
4

Scenic (a)

(Segment 1) Outstanding Variety Class A landscape at Bell Meadow. The strongly defined patterns of mixed conifer, aspen, riparian and meadow vegetation provide one of the most dramatic displays of seasonal colors in the entire Sierra.

Historic Setting

Bell Meadow falls within the strongly glaciated crest zone of the Sierra Nevada. Peaks towering above glaciated rocky basins offer outstanding scenic quality in the crest zone. Located in the east-central portion of the Forest, the 490 acre meadow area contains 110 acres of aspen stands along with wet mountain meadow and riparian vegetation. It lies within the larger 8,200 acre Bell Meadow Roadless Area as identified in the RARE II Roadless Area Review and Evaluation (USDA 1979).

As described in the River Study, the "Outstandingly Remarkable" (OR) Scenic (a) value applies to Segment 1 (**Bell Creek**, from its source .5 mile southeast of Burst Rock to Lily Creek and the Clavey River) is "outstanding Variety Class A landscape at Bell Meadow (USDA 1991). The description of the Scenic (a) OR value is similar to that of the Ecologic (a) OR value of Segment 1: "the largest stand of aspen (Populus tremuloides) on the Forest is located at Bell Meadow. It is the largest stand of aspen in the Sierra, south of the Eldorado National Forest. The meadow also has a rich variety of habitats including wet and dry meadow, meadow shrub (Salix) and conifer forest."

Existing Condition

The Forest Service Visual Management System provides a systematic analysis for the visual landscape and evaluates the visual impacts of proposed management activities. A series of Forest Service Handbooks (USDA 1974) provides detailed information about this system and its implementation. It consists of the following components:

1. Variety Class, which categorizes landscapes according to visual quality;

2. Sensitivity Level, which measures the magnitude of public concern over a particular landscape;

3. Distance Zone, which measures the relative distance between the seen area and the viewer; and,

4. Visual Quality Objectives (VQOs), which provide measurable standards for landscape management.

The Stanislaus completed an Existing Visual Condition (EVC) inventory in 1980 for all National Forest land. This inventory measured the existing condition of the landscape as compared to a landscape in a natural appearing condition. EVC is a tool used to measure actual conditions and it does not relate to or compare with Visual Quality Objectives (VQOs). EVC classes range from I. (only ecological change) to VI. (changes are in glaring contrast to the natural appearance). The EVC Inventory rated the Bell Meadow area as:

I. Areas in which only ecological change has taken place except for trails needed for access.

Management Direction

The Scenic (a) OR value applies to Segment 1 at Bell Meadow. The Forest Plan (Table A.3) allocates Bell Meadow and its surrounding slopes to Management Area 6, Research Natural Area (RNA) with direction to protect its Wild and Scenic River values (USDA 1991). The objective for establishing the Bell Meadow RNA, as stated in the Establishment Record, is "to preserve an example of the Aspen Forest target element for the Southern Sierra physiographic province" (USDA 1994).

The VQO for the Bell Meadow RNA is:

- Preservation
  Allows ecological change only. Management activities, except for very low visual impact recreation facilities (such as hiking trails), are prohibited.

Monitoring and Evaluation

EVC has not been updated since 1980 and without site-specific land management activities no other visual resource evaluations occurred. This is not unusual without planned land alterations generating a need and funding for such monitoring (USDA 1997).

The Stanislaus National Forest 1994-1996 Monitoring and Evaluation Report shows that the Core Team could not evaluate conditions because the Forest Plan does not include monitoring standards or limits of variability for Wild and Scenic River values. Although the Core Team could not determine conditions, it is unlikely that trends could be established for most, over the short 5 years since Forest Plan approval, even with more information and unlimited monitoring budgets (USDA 1997).

As previously discussed, the Scenic (a) and Ecologic (a) OR values are similar and related. In addition, it is the components of the Ecologic (a) OR value that provide one of the most dramatic displays of seasonal colors in the entire Sierra. Monitoring information pertaining to the Ecologic (a) and RNA values of Bell Meadow (see Ecologic (a)) adequately indicate Scenic (a) OR value conditions.

Conclusions

Conditions of the Scenic (a) OR value are directly related to and dependant upon the conditions of the Ecologic (a) OR value. Forest Plan direction is sufficient to protect or enhance the Scenic (a) OR value. However, implementation of this direction is not always successful (see Ecologic (a)). Management and protection of the Ecologic (a) OR value will provide protection for the Scenic (a) OR value.

The Forest Plan does not identify specific indicators of resource conditions, standards or limits of variability for Wild and Scenic River values (USDA 1991). Wild and Scenic River Management Plans normally established those items, after designation by Congress (USDA 1988).

Recommendations

Specific actions needed to protect or enhance the Scenic (a) OR value include:

1. Improve and repair fencing around Bell Meadow to prevent cattle trespass. Support and encourage District and Forest range personnel in order to facilitate proficient range management and permit administration. [also included within Ecologic (a)]

2. With cooperation of permittees, exclude grazing use from lower Bell holding pasture until an alternative water source can be developed and the riparian corridor in this pasture fenced from grazing. [also included within Ecologic (a)]

3. Monitor stream bank stability and riparian vegetation. [also included within Ecologic (a)]

4. Monitor plant species cover and composition to determine current and future trends in all vegetation types listed by Keeler-Wolfe (1985). Pay particular attention to areas experiencing decreases in vegetation cover and to stream banks. Establish monitoring plots in similar vegetation types outside of the RNA, in the general cattle allotment, to provide contrasting data which will assist in determining the extent of damage by cattle in the RNA. [also included within Ecologic (a)]

5. Monitor erosion in Bell Meadow and develop comprehensive erosion control plans adhering to Regional native plant standards and RNA direction. [also included within Ecologic (a)]

6. Amend Forest Plan Chapter V to include specific key indicators for Wild and Scenic River values.

7. Establish specific Wild and Scenic River management direction and limits of acceptable change, after designation by Congress, in a Wild and Scenic River Management Plan

List of Preparers

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Value
5

Scenic (b)

(Segment 5) Outstanding Variety Class A landscape includes a deep, V-shaped, river-cut canyon through meta-sedimentary rock. The river provides a variety of water forms including rapids, cascades and pools. Vegetation patterns are varied, including scattered ponderosa pine and oak/grass woodland. The scenic values of the lower Clavey are similar to the those of the lower Tuolumne Wild and Scenic River.

Historic Setting

Segment 5 falls within the front country zone of the Sierra Nevada. Brush fields with a mix of tree species including digger pine, oak, and ponderosa pine dominate the front country. The ponderosa pine forests are of lighter color, more open, and frequently interrupted by large brush fields at the lower elevations. The portion of Segment 5 below Forest Road 1N01 lies within the larger 17,300 acre Tuolumne River Roadless Area as identified in the RARE II Roadless Area Review and Evaluation (USDA 1979). As described in the River Study, the "Outstandingly Remarkable" (OR) Scenic (b) value applies to Segment 5 (from Cottonwood Road to the Tuolumne River).

Existing Condition

The Forest Service Visual Management System provides a systematic analysis for the visual landscape and evaluates the visual impacts of proposed management activities. A series of Forest Service Handbooks (USDA 1974) provides detailed information about this system and its implementation. It consists of the following components:

1. Variety Class, which categorizes landscapes according to visual quality;
2. Sensitivity Level, which measures the magnitude of public concern over a particular landscape;
3. Distance Zone, which measures the relative distance between the seen area and the viewer; and,
4. Visual Quality Objectives (VQOs), which provide measurable standards for landscape management.

The Stanislaus completed an Existing Visual Condition (EVC) inventory in 1980 for all National Forest land. This inventory measured the existing condition of the landscape as compared to a landscape in a natural appearing condition. EVC is a tool used to measure actual conditions and it does not relate to or compare with Visual Quality Objectives (VQOs). EVC classes range from I. (only ecological change) to VI. (changes are in glaring contrast to the natural appearance). Except for the Cottonwood and 1N01 road corridors (III. natural appearance remains dominant), the EVC Inventory rated Segment 5 as:

I. Areas in which only ecological change has taken place except for trails needed for access.

Management Direction

The Scenic (b) OR value applies to Segment 5. Except for the Cottonwood and 1N01 road corridors (Management Area 8, Scenic Corridor), the Forest Plan (Table A.3) allocates Segment 5 and its surrounding slopes to Management Area 3, Near Natural with direction to protect its Wild and Scenic River values (USDA 1991).

The VQO for both the road corridors and Near Natural is:

- Retention
  Allows management activities that are not visually evident. Activities may only repeat form, line color, and texture that are frequently found in the characteristic landscape.

Monitoring and Evaluation

EVC has not been updated since 1980 and without site-specific land management activities no other visual resource evaluations occurred. This is not unusual without planned land alterations generating a need and funding for such monitoring (USDA 1997).

The Stanislaus National Forest 1994-1996 Monitoring and Evaluation Report shows that the Core Team could not evaluate conditions because the Forest Plan does not include monitoring standards or limits of variability for Wild and Scenic River values. Although the Core Team could not determine conditions, it is unlikely that trends could be established for most, over the short 5 years since Forest Plan approval, even with more information and unlimited monitoring budgets (USDA 1997).

Conclusions

Although no specific visual monitoring occurred, it is unlikely that any of the management activities prescribed by the Forest Plan under Near Natural Management would alter the Variety Class A landscape, deep, V-shaped, river-cut canyon through meta-sedimentary rock, or the variety of water forms including rapids, cascades and pools. Since the Forest Plan allocates Segment 5 and its surrounding slopes (from canyon rim to rim in most areas) to Management Area 3, Near Natural, it is unlikely that any planned land altering activities would be visible from the potential Wild and Scenic River corridor. Forest Plan direction is sufficient to protect or enhance the Scenic (b) OR value of Segment 5.

The Forest Plan does not identify specific indicators of resource conditions, standards or limits of variability for Wild and Scenic River values (USDA 1991). Wild and Scenic River Management Plans normally established those items, after designation by Congress (USDA 1988).

Recommendations

1. Amend Forest Plan Chapter V to include specific key indicators for Wild and Scenic River values.

2. Establish specific Wild and Scenic River management direction and limits of acceptable change, after designation by Congress, in a Wild and Scenic River Management Plan

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Value
6

Historic/Cultural

(Segment 1) Relatively undisturbed section of the 1853 Emigrant Route, used during the early mining period of California.

Historic Setting

The Emigrant Route is part of the larger California Trail system that brought pioneer-settlers to California during the Gold Rush. In 1852 and 1853, merchants and politicians from Columbia and Sonora sent representatives to intercept wagon trains in Nevada and encourage them to travel a new and alternate route to the gold fields. Historic accounts indicate this route was actually the worst possible way to cross the Sierra with wagons. For that reason, use of the trail dropped drastically after 1853. Records list a total of 485 people, 135 wagons and over 3000 head of livestock used this direct route (CHISPA 1996).

Historic accounts that described geographic landmarks identify an approximate location of the route. In addition, later travelers confirmed the pathway of the Emigrant Route by observing the remnants of broken wagons, dead animals and discarded personal items. It is likely the Me-wuk and Washoe originally used the trail as a trading route. For many years the trail served backcountry recreation (Conners pers. com. 1997).

As described in the River Study (USDA 1991), the "Outstandingly Remarkable" (OR) Historic/Cultural value applies to Segment 1 (**Bell Creek**, from its source .5 mile southeast of Burst Rock to Lily Creek and the Clavey River). In 1992, the Emigrant Trail was added to the National Historic Trail System as part of the California Trail System (Tuolumne County Museum).

Existing Condition

Today the Emigrant Trail is part of the Emigrant Wilderness trail system. The small portion considered a Historic/Cultural OR value is near Burst Rock close to the headwaters of Bell Creek. The trail is one of the more popular wilderness trails (Brougher pers. com. 1997).

Visible remnants of the historic use are few and difficult to find. Remnants such as wagon trace or rock fill work are not evident (CHISPA 1996). The only visible remnants are found east of Bell Creek and Lily Creek. These include gouges in rock faces formed by the lowering of wagons with ropes, and a wagon wheel nailed to a granite rock face. Apparently some square nails can still be found (DeHart pers. com. 1997).

The current trail, reconstructed in 1990, is maintained periodically. Reconstruction included the rebuilding of sections of trail and rerouting steep hazardous areas. Maintenance usually consists of drainage work to minimize trail surface erosion (Brougher pers. com. 1997).

Management Direction

The Historic/Cultural OR value applies to a portion of Segment 1. The Forest Plan (Table A.3) allocates this portion to Management Area 1, Wilderness with direction to protect its Wild and Scenic River values (USDA 1991). Management emphasis includes preservation of historic values..

Forest Plan management practices for cultural resources include: inventory and evaluation; protection; and enhancement and interpretation.

Established as a National Historic Trail in 1992, any proposed work on the Emigrant Trail requires consultation with the State Historic Preservation Officer.

Monitoring and Evaluation

The Forest Plan does not identify specific indicators of resource conditions, standards or limits of variability for Wild and Scenic River values (USDA 1997). Wild and Scenic River Management Plans normally established those items, after designation by Congress (USDA 1988). However, cultural resource management requires monitoring the effectiveness of mitigation measures used to protect cultural resources that may be affected by resource management activities.

Conclusions

The Historic/Cultural OR value associated with this section of trail does not appear at risk. The existing trail follows the approximate pathway used by the 1853 emigrants. No visible remnants exist to preserve. The existing historic value is primarily one of interpretation and setting. Management direction is sufficient to ensure continued preservation of the Historic/Cultural OR value.

Recommendations

1. Develop an interpretive brochure to inform backcountry visitors of the historic Emigrant Trail.

List of Preparers

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Value
7

Wildlife

(Segments 4-5) A large tract of late seral stage forest habitat is centered on the Clavey River between Reed Creek and Road 3N01, and between the Cottonwood Road and halfway to Road 1N01. Five SOHAs and two fisher reproductive units are located on or adjacent to the river, within 8,000 acres of older mature forest habitat. It is unusual to have this much older mature forest habitat at this elevation in the Sierra.

Historic Setting

Forests of the Sierra Nevada have undergone significant changes in structure and composition as a result of timber harvest, fire suppression, and grazing practices since the mid-1800s (see reviews in McKelvey and Johnston 1992, Franklin and Fites-Kaufmann 1996, Franklin et al. 1997). Franklin and Fites-Kaufmann (1996) reported information on the amounts and distribution of late-seral, old-growth (LS/OG) forest areas by vegetation type and administrative units at the scale of the entire Sierra Nevada. Their major findings are summarized below. Overall, they concluded that the extent of LS/OG forest is believed to be far below levels that existed prior to western settlement and that key structural elements such as large trees, snags, and logs are generally at low numbers, particularly in the commercial forest zones. Commercially important forest types, such as mixed-conifer and east-side pine, are most deficient in high-quality late-successional forest relative to their potential and pre-settlement conditions. Considering all forest types, national parks provide the major concentrations of high-quality late-successional forests and, on a percentage basis, have approximately twice as much highly-rated forest as adjacent national forests (Franklin and Fites-Kaufmann 1996, Table 21.5). However, considering only the mid-elevation forest types (i.e. forests on the most productive sites) indicates that national parks have about four times more high-quality late-successional forests than national forests at the current time (Franklin and Fites-Kaufmann 1996, pp. 652). The authors considered the amounts found in national parks to be a benchmark for pre-settlement conditions.

Franklin et al. (1997, Table 1) provided summations from comparisons of high-quality late-successional forests between national parks and national forests by forests type. Key findings reported were that for the westside mixed-conifer forest type about 15.8% of the total acres were classified as high-quality late-successional forest. Stratifying by administrative unit, approximately 11.5% of the acres on national forests and 66.6% of the acres on national parks were classified as high-quality late-successional forests. For the red fir forest type, similar percentages were 24.8% for the total acres, 17.1% for national forests, and 59.8% for national parks. For the east-side pine forests type, comparative percentages were 1.5% for the total acres, 1.1% for national forests, and 98% for national parks.

These authors concluded that present levels of high-quality late-successional forests are believed to be far below levels present prior to western settlement (Franklin et al. 1997). Further, they concluded that many pre-settlement LS/OG forests were complex fine-scale mosaics of varied stand structures that incorporate the full range of vertical and horizontal structural complexity. Importantly, they noted that the relatively open patches typical of natural forests are generally small (e.g., 0.01-0.5 ha) and retain high levels of structural complexity (large trees, snags, and logs). Levels of key structural elements

such as large trees, snags, and downed logs are generally at low levels throughout Sierra Nevada forests. Further, large contiguous areas of high-quality LS/OG forests did occur in the pre-settlement landscape and that the matrix between these areas contained high levels of key structural elements that may be important in maintaining functional connectivity between the blocks. Hence, the authors inferred from the pre-settlement patterns of large contiguous blocks of LS/OG forests that some organisms or processes may require or prefer such conditions, although data does not exist either to support or refute this hypothesis (Franklin et al. 1997). On the positive side, Franklin and Fites-Kaufmann (1996) noted that the forest cover of the Sierra Nevada is relatively intact and most forest stands have sufficient structural complexity to provide for at least low levels of late-successional forests function.

Existing Condition

As described in the River Study (USDA 1991), the "Outstandingly Remarkable" (OR) Wildlife value applies to segments 4 and 5.

Methods

In order to develop an understanding of the existing condition of late seral forest vegetation in the Clavey watershed it is first necessary to understand the amount, spatial distribution and management status of late seral forest vegetation. Thus, the objective of this review is to provide an understanding of the amount and distribution of late seral vegetation by major forest type and management direction based on the available data. The review focuses on the spatial scale of the watershed for summarizing the existing conditions of late seral forest vegetation because: 1) the spatial delineation of the OR value is not clearly identified; and, 2) an ecologically justifiable spatial scale is more appropriate.

The 1991 Stanislaus National Forest GIS vegetation layer provides an estimate of the existing condition of late seral forest vegetation in the Clavey River watershed. These data are derived from Landsat TM imagery and digital terrain data (Woodcock and Gopal 1992). The Clavey River watershed includes 100,369.36 acres. A total of 9,939.94 acres burned in the 1996 Rogge fire. Because of that change to the vegetation, this review of existing vegetation conditions includes only the remaining 90,426.44 acres.

The GIS database provides a list of total acres by vegetation type, tree size class and density class stratified by management direction. This review includes only the conifer vegetation types identified in the database (ponderosa pine, mixed conifer, red fir, sub-alpine fir). Table 7.1 lists the definitions of the tree size and density classes available in the database.

In several ways these data provide insights regarding the existing condition of late seral forests in the watershed. First, the information helped generate a series of tables summarizing acreage by: 1) management direction; 2) tree size (size classes 3 and 4) and density class (density classes G, N and pooled P and S) by management direction pooled across all conifer vegetation types; and, 3) size/density classes 4G and 4N by management direction by major forest type. The tables provide an overview of the amounts and distribution of the larger tree and density classes by management direction and major forest type that are useful for understanding the existing condition of late seral forest vegetation. In addition to the summary tables, maps, depicting the spatial distribution of existing vegetation classes in relation to management direction, are included. The maps are useful for viewing the actual, spatially-explicit landscape patterns as recognized in the existing management plan. Finally, a brief synopsis of status and management recommendations for selected wildlife species is provided. A full assessment of wildlife issues is beyond the scope of this review and should be explicitly addressed in a more complete future watershed assessment.

Table 7.1 ***Tree Size Class and Density Class Labels***; Stanislaus National Forest 1991 vegetation database. One (1) foot of tree crown diameter equals approximately one (1) inch of tree diameter at breast height.

Size Class	Code	Crown Diameter (feet)
Seedlings	0	-
Saplings	1	-
Poles	2	CD < 12
Small Timber	3	12 < CD < 24
Medium Timber	4	24 < CD < 40
Large Timber	5	CD > 40
Not Determined	X	-

Density Class	Code	% Crown Closure
Non-stocked	O	0 - 9
Sparse	S	10 - 19
Poor	P	20 - 39
Normal	N	40 - 69
Good	G	70 - 100
Not Determined	X	-

Several caveats regarding the accuracy of the vegetation database must be acknowledged in order to temper conclusions based on the limitations of the vegetation data. Woodcock and Gopal (1992) assessed the accuracy of the Stanislaus National Forest vegetation database. In summary, they reported that classification rates of vegetation polygons to the conifer class are high. Classification rates of conifers to specific types are generally accurate, however, both the ponderosa pine and red fir types are dramatically less accurate than the mixed conifer. Density class classification rates are quite consistent and accurate with an overall accuracy of 86%. The results for conifer tree size classification are generally low and indicate that the labels for individual polygons are unreliable. The best overall classification rates were 68%. Size class 3 classification rates are quite accurate (best=85%), although they suffer from significant errors of omission. Classification rates for size classes 4 (76%) and 5 (13%) were less reliable and many polygons were better characterized by smaller trees. Due to the low accuracy classification rates for size class 5, size classes 4 and 5 have been pooled in the vegetation database. Overall, Woodcock and Gopal (1992) concluded that classification rates for the larger tree size classes are unreliable on a per-stand basis, but may be more meaningful at the population level, and that the number of size class 4 polygons is overestimated.

Tables 7.2 and 7.3 show recent timber management activities in the Clavey River watershed. At the present, these data are being input into the GIS layer and will change the existing vegetation classification for the polygons where these timber management activities occurred.

Table 7.2 ***Timber Management Activities 1979-1995***; Clavey Watershed; Mi-Wok Ranger District; Stanislaus National Forest (mbf=1,000 board feet).

Sale Name	Harvest Year	acres	Prescription	Volume (mbf)
Rock	1991-92	680	Insect Salvage	1,460
Bell Lake	1992	1,006	Insect Salvage	910
Rush	1992	2,292	Insect salvage	1,220
Trout	1992	300	Insect Salvage	500
Clear Lake	1986-92	284	Clearcut, Thinning	5,800
Thompson Meadow	1983-92	624	Clearcut with residuals	13,310
Reynolds	1991-93	525	Insect Salvage	350
Hells	1992-93	17	Insect Salvage	179
White Fang	1992-93	520	Insect Salvage	550
Camp 34	1979-93	1,826	Sanitation, Overstory Removal	14,420
Hilly	1993-95	93	Clearcut with residuals	1,730
Clavey Meadow	1993-95	89	Clearcut with residuals	2,240
Thirteen Mile	1985-95	328	Clearcut and Thinning	8,560
Tract 50		107	Small clearcuts with residuals	376

Table 7.3 ***Timber Management Activities 1991-1995*** Clavey Watershed; Groveland Ranger District; Stanislaus National Forest (mbf=1,000 board feet).

Sale Name	Harvest Year	acres	Prescription	Volume (mbf)
Bone	1991	111	Insect Salvage	150
Hot	1991	102	Insect Salvage	250
Sugar Creek	1991	21	Insect Salvage	50
Sugar Island	1991	24	Insect Salvage	100
Fir Island	1992	97	Insect Salvage	60
Reynolds	1992	42	Insect Salvage	250
Cherry Lava	1995	25	Insect Salvage	50
Surge	1995	10	Insect Salvage	10

The results from the accuracy assessment and the modifications of vegetation from timber management activities both have important implications for this review. First, errors in classification rates for tree size class 4 (which includes size class 5), resulting in overestimates of the amounts of this size class, introduce uncertainty, thereby making it difficult to accurately develop an understanding of the current amounts and spatial distribution of late seral vegetation. Second, it would be valuable to differentiate between size class 4 and 5, which is not possible given the current resolution of the available vegetation data. Third, it is not possible to measure the amounts and distribution of specific habitat elements such as large trees, snags and downed logs that are important to many late-seral associated species and forest processes. Thus, interpretations and conclusions of vegetation status

and condition as summarized in this review should be tempered with caution given the limitations of the available database for conducting watershed or landscape level assessments. In spite of these limitations the data can provide at least a preliminary estimate of the amounts and distribution patterns of forest structural classes. Additional efforts are required to develop more accurate maps of the existing vegetation in order to validate the current database and increase confidence in the results of future assessments.

Results

Excluding the 9,939.94 acres burned in the 1996 Rogge fire, the existing vegetation data based on the 1991 Stanislaus National Forest GIS vegetation layer was summarized for 90,426.44 acres in the Clavey River watershed (Table 7.4 and Map 7.1). Approximately 16,676 acres (18.4% of the total watershed) are classified as conifer structural class 4G, 17,010 acres (18.8%) as 4N, and 7,404 acres (8.2%) as 4P/4S (Tables 7.5-7.7). Approximately 3,330 acres (3.7%) are classified as 3G, 3,578 acres (4.0%) as 3N, and 17,448 acres (19.3) as 3P/3S (Tables 7.8-7.10 and Map 7.1). These data provide estimates of the amount of each size/density class pooled across the four conifer vegetation types:

- 7,272 acres (8.0% of total watershed) classified as ponderosa pine (Table 7.11).
  Of this total, about 2,097 acres (28.8% of total Ponderosa Pine, 2.3% of total watershed) are classified as structural class 4G. Approximately 1,822 acres (25.1% of total Ponderosa Pine, 2.0% of total watershed) are classified as structural class 4N (Table 7.11 and Map 7.2).

- 53,039 acres (58.7% of total watershed) classified as mixed-conifer (Table 7.12 and Map 7.3).
  About 13,880 acres (26.2% of total mixed-conifer, 15.3% of total watershed) are classified as 4G. Mixed-conifer 4G comprises about 83.2% of the total structural class 4G vegetation in the watershed. Approximately, 11,488 acres (21.7% of total mixed-conifer, 12.7% of total watershed) are classified as 4N. This acreage comprises about 67.5% of the total structural class 4N vegetation in the watershed.

- 11,503 acres (12.7% of total watershed) classified as red fir (Table 7.13 and Map 7.4).
  Of this total, about 609 acres (5.3% of total red fir, 0.7% of total watershed) are classified as 4G. Approximately 3,700 acres (32.2% of total red fir, 4.1% of total watershed) are classified as 4N.

- 1,325 acres (1.5% of total watershed) classified as sub-alpine.
  Approximately 90 acres (6.8% of total sub-alpine, 0.1% of total watershed) are classified as structural class 4G. No acres are classified as structural class 4N in the current database (Table 7.14 and Map 7.5).

Management Direction

The Wildlife OR value applies to segments 4 and 5. The Forest Plan includes direction (Table A.3) to protect this Wild and Scenic River value in: Management Area 3, Near Natural; and, Management Area 4, Wildlife.

Table A.2 and Map A.4 show the 1991 Forest Plan management area allocations for the entire Clavey River watershed. Table 7.4 shows current (1997) distribution of management direction as recognized in the Forest GIS vegetation layer. Approximately 25,424 acres (28.1 % of the total watershed acreage) are managed for wildlife (Furbearer Management Areas (FMAs), and Spotted Owl Habitat Areas (SOHAs) and Protected Activity Areas (PACs). Approximately, 42% of the watershed (38,018 acres) is managed as General Forest, with 29,772 acres (32.9%) designated as suitable for timber management and 8,246 acres (9.1%) designated as unsuitable. The other predominant management

direction items are Near Natural with 9,218 acres (10.2%), Wilderness with 6,428 acres (7.1%) and Private Land with 7,741 acres (8.6%).

Table 7.4 ***Management Direction***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS layer.

Management Direction	acres	%
Spotted Owl Habitat Areas (SOHA)	5329.58	5.9
Protected Activity Center (PACs)	5645.37	6.2
Furbearer	14449.35	16.0
General Forest - Suitable	29772.02	32.9
General Forest - Unsuitable	8246.22	9.1
Wilderness	6428.41	7.1
Special Areas	1483.34	1.6
Developed Recreation	523.28	0.6
Near Natural	9218.96	10.2
Scenic Retention	404.75	0.5
Scenic Partial Retention	1139.53	1.3
Wild and Scenic River	28.24	<0.1
Private Land	7740.95	8.6
No Data	16.46	<0.1
Totals	90426.44	100.0

Of the estimated 16,676 acres of structural class 4G conifer vegetation present in the watershed, approximately 7,191 acres (43.1% of total 4G) are currently managed in FMAs, SOHAs, and PACs (Table 7.5). An additional 8,080 acres (48.4% of total 4G) of structural class 4G conifer vegetation is managed as General Forest, with 7,405 acres (44.4% of total 4G) managed as suitable for timber management and 674 acres (4.0%) designated as unsuitable. The majority of structural class 4G vegetation in the Clavey River watershed is managed for wildlife or as general forest, with smaller amounts managed under the additional directions (Table 7.5). Regarding the estimated 17,010 acres of structural class 4N conifer vegetation, approximately 5,492 acres (32.4% of total 4N) are currently managed in FMAs, SOHAs, and PACs. An estimated 8,178 acres are managed as general forest, with 6,981 acres (41.0% of total 4N) designated as suitable for timber management and 1,197 acres (7.0%) considered unsuitable (Table 7.6). Tables 7.7-7.10 show similar information for structural classes 4P/4S, 3G, 3N, and 3P/3S vegetation.

Table 7.5 ***Distribution of Structural Class 4G Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	4G (acres)	% of 4G	% of Watershed
Spotted Owl Habitat Areas (SOHA)	2456.96	14.7	2.7
Protected Activity Center (PAC)	2305.96	13.8	2.6
Furbearer	2428.28	14.6	2.7
General Forest - Suitable	7405.36	44.4	8.2
General Forest - Unsuitable	674.29	4.0	0.8
Wilderness	51.59	0.3	0.1
Special Areas	72.72	0.4	0.1
Developed Recreation	37.58	0.2	<0.1
Near Natural	370.86	2.2	0.4
Scenic - Retention	20.02	0.1	<0.1
Scenic - Partial Retention	63.60	0.4	0.1
Private Land	786.15	4.7	0.9
No data	3.11	<0.1	<0.1
Totals	16676.48	100.0	18.4

Table 7.6 ***Distribution of Structural Class 4N Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	4N (acres)	% of 4N	% of Watershed
Spotted Owl Habitat Areas (SOHA)	1022.11	6.1	1.1
Protected Activity Center (PAC)	1259.17	7.4	1.4
Furbearer	3210.64	18.9	3.6
General Forest - Suitable	6981.04	41.0	7.7
General Forest - Unsuitable	1196.68	7.0	1.3
Wilderness	65.61	0.4	0.1
Special Areas	259.76	1.5	0.2
Developed Recreation	193.25	1.1	0.2
Near Natural	903.13	5.3	1.0
Scenic - Retention	171.91	1.0	0.2
Scenic - Partial Retention	204.60	1.2	0.2
Private Land	1540.28	9.1	1.7
No data	1.55	<0.1	<0.1
Totals	17009.73	100.0	18.8

Table 7.7 ***Distribution of Structural Classes 4P and 4S Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	4P&4S (acres)	% of 4P&4S	% of Watershed
Spotted Owl Habitat Areas (SOHA)	129.87	1.8	0.1
Protected Activity Center (PAC)	322.91	4.4	0.4
Furbearer	1503.95	20.3	1.7
General Forest - Suitable	2697.82	36.4	3.0
General Forest - Unsuitable	1021.89	13.8	1.1
Wilderness	251.52	3.4	0.3
Special Areas	149.00	2.0	0.2
Developed Recreation	58.04	0.8	0.1
Near Natural	390.52	5.3	0.4
Scenic - Retention	72.50	1.0	0.1
Scenic - Partial Retention	129.65	1.8	0.1
Private Land	676.07	9.1	0.7
No data	0.67	<0.1	<0.1
Totals	7404.41	100.0	8.2

Table 7.8 ***Distribution of Structural Class 3G Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	3G (acres)	% of 3G	% of Watershed
Spotted Owl Habitat Areas (SOHA)	665.61	20.0	0.7
Protected Activity Center (PAC)	430.33	12.9	0.5
Furbearer	790.60	23.7	0.9
General Forest - Suitable	1202.91	36.1	1.3
General Forest - Unsuitable	49.81	1.5	0.1
Wilderness	0	0	0
Special Areas	27.35	0.8	<0.1
Developed Recreation	0	0	0
Near Natural	100.26	3.0	0.1
Scenic - Retention	0	0	0
Scenic - Partial Retention	15.57	0.4	<0.1
Private Land	3.34	0.1	<0.1
No data	44.03	1.3	0.1
Totals	3329.81	100.0	3.7

Table 7.9 ***Distribution of Structural Class 3N Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	3N (acres)	% of 3N	% of Watershed
Spotted Owl Habitat Areas (SOHA)	197.49	5.5	0.2
Protected Activity Center (PAC)	330.91	9.2	0.4
Furbearer	702.74	19.6	0.8
General Forest - Suitable	1168.22	32.7	1.3
General Forest - Unsuitable	122.98	3.4	0.1
Wilderness	95.85	2.7	0.1
Special Areas	124.98	3.5	0.1
Developed Recreation	18.68	0.5	<0.1
Near Natural	389.18	10.9	0.4
Scenic - Retention	20.24	0.6	<0.1
Scenic - Partial Retention	45.81	1.3	0.1
Private Land	0.89	<0.1	<0.1
No data	398.31	11.1	0.4
Totals	3577.81	100.0	4.0

Table 7.10 ***Distribution of Structural Classes 3P and 3S Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	3P&3S (acres)	% of 3P&3S	% of Watershed
Spotted Owl Habitat Areas (SOHA)	357.37	2.0	0.4
Protected Activity Center (PAC)	642.27	3.7	0.7
Furbearer	2703.16	15.5	3.0
General Forest - Suitable	3958.10	22.7	4.4
General Forest - Unsuitable	2382.69	13.7	2.6
Wilderness	1636.34	9.4	1.8
Special Areas	482.58	2.8	0.5
Developed Recreation	152.11	0.9	0.2
Near Natural	2676.47	15.3	3.0
Scenic - Retention	82.29	0.4	0.1
Scenic - Partial Retention	405.86	2.3	0.5
Private Land	1966.59	11.3	2.2
No data	2.00	<0.1	<0.1
Totals	17447.83	100.0	19.3

Tables 7.11-7.14 show estimated amounts of structural classes 4G and 4N vegetation by management direction for each of the four major conifer forest types. Of the approximately 2,097 acres of the structural class 4G ponderosa pine (PP) vegetation, 1,028 acres (49.0% of total PP4G) are managed as FMAs, SOHAs, and PACs. About 799 acres (38.1% of total PP4G) are managed as general forest suitable for timber management. Additionally, about 206 acres (9.8%) are located on private land (Table 7.11). Regarding ponderosa pine structural class 4N vegetation, approximately 609 acres (33.4% of total PP4N) are managed for FMAs, SOHAs, and PACs. About 668 acres (36.6 of total PP4N) are managed as General Forest suitable for timber management. Another 530 acres (29.1% of total PP4N) are located on private land (Table 7.11).

Table 7.11 ***Distribution of Ponderosa Pine (PP) 4G and 4N Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	PP (acres)	% of PP	PP4G (acres)	% of PP4G	PP4N (acres)	% of PP4N
Spotted Owl Habitat Areas	1076.80	14.8	542.85	25.9	205.49	11.3
Protected Activity Center (PAC)	449.00	6.2	180.80	8.6	75.39	4.1
Furbearer	1226.93	16.9	304.23	14.5	327.80	18.0
General Forest - Suitable	2261.93	31.1	798.60	38.1	667.84	36.6
General Forest - Unsuitable	143.89	2.0	46.48	2.2	6.45	0.4
Wilderness	0	0	0	0	0	0
Special Areas	0	0	0	0	0	0
Developed Recreation	0	0	0	0	0	0
Near Natural	496.59	6.8	17.57	0.8	8.23	0.5
Scenic - Retention	0	0	0	0	0	0
Scenic - Partial Retention	3.11	<0.1	0	0	0	0
Private Land	1610.34	22.2	205.71	9.8	530.18	29.1
No data	3.11	<0.1	0.89	<0.1	1.11	0.1
Totals	7271.70	100.0	2097.13	100.0	1822.49	100.0

The majority of structural class 4G and 4N vegetation in the watershed is comprised of mixed-conifer. Of the total 13,880 acres of mixed-conifer structural class 4G vegetation, approximately 5,906 acres (42.6% of total MC4G) are managed as FMAs, SOHAs, and PACs. About 7,126 acres (54.4% of total 4G) are managed as general forest with 6,507 acres (46.9% of total 4N) designated as suitable for timber management (Table 7.12). Regarding mixed-conifer structural class 4N vegetation, approximately 3,578 acres (31.1%) are managed as FMAs, SOHAs, and PACs.

Of the 11,503 acres classified as red fir, an estimated 609 acres (5.3% of total RF) are classified as structural class 4G. Approximately 224 acres (36.7% of total RF4G) are managed as FMAs and PACs. About 109 acres (17.8% of total RF4G) are managed as General Forest, with 99 acres (16.3%) designated as suitable for timber management. An additional 229 acres (37.6% of total RF4G) are managed as Near Natural, Scenic-Partial Retention or as Special Areas (Table 7.13). Regarding red fir structural class 4N vegetation, approximately 1,305 acres (35.2% of total RF4N) are managed as FMAs, SOHAs and PACs. About 938 acres are managed as General Forest, with 852 acres (23.0% of total RF4N) designated as suitable for timber management. Nearly 628 acres (17.0%) are managed as Near Natural (Table 7.13).

Table 7.12 ***Distribution of Mixed Conifer (MC) 4G and 4N Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	MC (acres)	% of MC	MC4G (acres)	% of MC4G	MC4N (acres)	% of MC4N
Spotted Owl Habitat Areas	3796.87	7.2	1914.11	13.8	785.93	6.8
Protected Activity Center (PAC)	4390.42	8.3	2051.33	14.8	887.11	7.7
Furbearer	8020.42	15.1	1940.13	14.0	1904.77	16.6
General Forest - Suitable	23352.29	44.0	6507.35	46.9	5461.45	47.5
General Forest - Unsuitable	5815.95	11.0	618.47	4.5	1103.94	9.6
Wilderness	85.39	0.2	0.22	<0.1	0	0
Special Areas	443.89	0.8	20.24	0.1	24.69	0.2
Developed Recreation	232.39	0.4	9.34	0.1	70.94	0.6
Near Natural	1801.13	3.4	230.17	1.7	266.65	2.3
Scenic - Retention	119.20	0.2	0	0	59.60	0.5
Scenic - Partial Retention	400.96	0.8	5.78	<0.1	44.70	0.4
Private Land	4569.33	8.6	2.22	<0.1	0.44	<0.1
No data	10.89	<0.1	580.44	4.2	877.33	7.6
Totals	53039.13	100.0	13879.80	100.0	11487.55	100.0

Table 7.13 ***Distribution of Red Fir (RF) 4G and 4N Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	RF (acres)	% of RF	RF4G (acres)	% of RF4G	RF4N (acres)	% of RF4N
Spotted Owl Habitat Areas	74.05	0.6	0	0	30.69	0.8
Protected Activity Center (PAC)	593.78	5.2	73.83	12.1	296.67	8.0
Furbearer	2634.44	22.9	149.67	24.6	978.07	26.4
General Forest - Suitable	2048.43	17.8	99.41	16.3	851.75	23.0
General Forest - Unsuitable	410.76	3.6	9.34	1.5	86.29	2.3
Wilderness	944.94	8.2	0	0	65.61	1.8
Special Areas	676.06	5.9	52.48	8.6	235.07	6.4
Developed Recreation	253.95	2.2	28.24	4.6	122.31	3.3
Near Natural	2695.82	23.4	118.67	19.5	628.25	17.0
Scenic - Retention	258.88	2.3	20.02	3.3	112.31	3.0
Scenic - Partial Retention	560.87	4.9	57.82	9.5	159.90	4.3
Private Land	350.93	3.1	0	0	132.77	3.6
No data	0	0	0	0	0	0
Totals	11502.91	100.0	609.48	100.0	3699.69	100.0

Only a small amount of the sub-alpine vegetation type (1,325 acres) is located in the Clavey River watershed. Approximately 90 acres are classified as structural class 4G, with the vast majority managed as FMAs or Wilderness (Table 7.14).

Table 7.14 ***Distribution of Sub-alpine (SA) 4G and 4N Vegetation***; Clavey River Watershed (excluding 9,939.94 acres in the Rogge fire); from 1991 Stanislaus National Forest GIS vegetation layer.

Management Direction	SA (acres)	% of SA	SA4G (acres)	% of SA4G	SA4N (acres)	% of SA4N
Spotted Owl Habitat Areas	0	0	0	0	0	0
Protected Activity Center (PAC)	0	0	0	0	0	0
Furbearer	144.33	10.9	34.25	38.0	0	0
General Forest - Suitable	0	0	0	0	0	0
General Forest - Unsuitable	0	0	0	0	0	0
Wilderness	1070.58	80.8	51.37	57.0	0	0
Special Areas	0	0	0	0	0	0
Developed Recreation	1.56	0.1	0	0	0	0
Near Natural	108.98	8.2	4.45	4.9	0	0
Scenic - Retention	0	0	0	0	0	0
Scenic - Partial Retention	0	0	0	0	0	0
Private Land	0	0	0	0	0	0
No data	0	0	0	0	0	0
Totals	1325.45	100.0	90.07	100.0	0	0

Monitoring and Evaluation

At the present time, the GIS vegetation layer is being remapped based on data from Landsat TM imagery and digital terrain data in a similar manner as the 1991 vegetation layer. Validation studies are needed to determine if technological improvements in methodology have improved the accuracy of classification rates, particularly related to tree size classes. The Forest Inventory Assessment (FIA) program is being developed and evaluated to ascertain it's usefulness for inventorying and monitoring vegetation changes over time as part of a larger effort to develop a Sierra Nevada scale monitoring strategy. The FIA program is a national effort to repeatedly sample grid based plots at 10 year intervals to assess changes over time. Further evaluation of data and sampling design are being conducted to evaluate the methods ultimate utility for monitoring change over time. Project level inventories for wildlife and vegetation are conducted and the spatial extent of project areas are being entered into the GIS layer to be able to spatially display all projects in relation to the landscape.

Conclusions

It is difficult to draw conclusions with a high degree of confidence about overall late-seral forest conditions in the Clavey River watershed at the present time. This is fundamentally due to the degree

of uncertainty introduced as a result of relatively high classification error rates for the larger tree size classes in the current vegetation database. For example, the current database indicates that approximately 16,676 acres, or 18.4% of the watershed, are classified as structural class 4G, which includes both tree size classes 4 and 5. However, classification error rates for size class 4 (24%) and size class 5 (87%) introduce a high degree of uncertainty, thus, precluding the ability to draw firm conclusions. Clearly, more accurate vegetation data are needed for conducting landscape assessments. Based on the available data just under half of the acres classified as structural classes 4G and 4N are currently managed under General Forest suitable for timber management. Accurate vegetation data and up-to-date changes as a result of vegetation management activities since the database was developed are needed to provide an accurate assessment of the existing condition of late-seral forests in the Clavey watershed and to be able to develop and an accurate landscape map.

Although the error classification rates introduce a high degree of uncertainty as to the existing conditions, no extensive management activity has occurred in SOHAs, PACs, of FMAs. Thus, a large proportion of the designated 4G and 4N vegetation has not been changed since the database was developed. However, management activities on a total of 6,061 acres in the watershed between 1991-1996 need to be incorporated into the database in order to accurately assess changes in the vegetation since the database was developed. Overall, although uncertainty exists, this assessment, as well as limited personal fieldwork and observations in the watershed indicate that significant amounts of forest exhibiting late-seral conditions distributed in relatively contiguous large blocks is present. However, a spatially-explicit map showing accurate representations of existing vegetation patches and their distribution is needed to fully assess the existing condition of late-seral forests in the Clavey River watershed.

Recommendations

Recent developments in ecosystem management and landscape ecology emphasized the importance of large-scale dynamics in both space and time in the management of natural resources (Hansson et al. 1995, Manley et al. 1995, Franklin and Fites-Kaufmann 1996, Harris et al. 1996, Holling and Meffe 1996, McCullough 1996, Crow and Gustafson 1997, Franklin et al. 1997, Kohm and Franklin 1997, Perry and Amaranthus 1997, Pickett et al. 1997). Franklin et al. (1997) emphasized the importance of spatially explicit landscape planning relative specifically to late-seral forests in the Sierra Nevada. They emphasized that the size, distribution, and landscape context of habitat patches (e.g., late-seral forest) is of fundamental importance. Further, the importance of spatial patterns and temporal dynamics are not always fully appreciated in plans that simply focus on the amount of a particular habitat and not on the spatial context. The use of non-spatially explicit models to estimate achievable timber harvest levels can result in inappropriate conclusions because of spatial constraints on activities (Franklin et al. 1997). Franklin et al. (1997) concluded that spatially explicit planning is important for any late-seral management strategy in order to: 1) ensure that the essential spatial pattern (e.g., patch size, shape, connectivity, etc.) of late-seral areas can be achieved; 2) display these patterns for managers, scientists, and stakeholders; and 3) higher levels of uncertainty are likely to be associated with management strategies that cannot be displayed spatially than with those that can be displayed.

In addition to spatial considerations, natural resource managers must also consider temporal dynamics and their potential influences on management strategies. Succession and fire frequency and severity patterns are fundamental processes that influence the dynamics of Sierra Nevada vegetation. Explicit recognition of the probabilistic nature of fire and it's effects on vegetation structure, composition, and successional dynamics needs to be recognized in management planning efforts. Efforts to develop spatially explicit models for incorporating the effects of fire on Sierra Nevada vegetation and under different management scenarios are being conducted and/or have been developed (Urban and Miller 1996, Johnson et al. 1997, Sessions et al. 1997). As these models are further developed and validated they may become valuable tools for projecting future conditions under different management scenarios. The

results of the management strategy can then be monitored over time to evaluate how well the models predicted the outcome or effects of the management strategy and how the models can be improved to improve their predictive ability in an interative manner over time. This is in essence the adaptive management process, whereby the effects of uncertainty and assumptions are explicitly modeled under different management scenarios, a management strategy is adopted based on these simulations, the outcome of the strategy is monitored, and the models and management strategy are improved in an interative process as knowledge is gained to address uncertainties (Walters and Holling 1990, Verner et al. 1992). The concept of adaptive management is widely misused and misunderstood, generally the full range of strategies are not modeled and monitoring is not adequate to evaluate the outcomes.

Acknowledging uncertainty and assumptions, and their potential impacts on management decisions, is of fundamental importance in natural resource management. Franklin et al. (1997) reviewed and summarized many existing uncertainties regarding the structure and function of late-seral forests in the Sierra Nevada and the ability of management to mimic and/or restore these attributes. Given the current limitations of our knowledge, they recommended that management should provide large blocks of late-seral forests and that connectivity in the matrix between blocks should be enhanced. Further they recommended that restoration of late-seral forest areas, key structural elements such as large, old trees, snags and logs, and light- to moderate-intensity fire regimes need to be important components of any management strategy.

The information outlined in the preceding paragraphs provides a selected overview of the current thinking regarding management of ecosystems and landscapes and the best available information on the status of late-seral forests in the Sierra Nevada. This information can form the basis for developing recommendations for managing late-seral forest areas in the Clavey River watershed.

Clearly, a reliable map showing an accurate distribution of vegetation types, tree size and density classes is needed to evaluate the amounts and spatial configuration of vegetation at the scale of the watershed. The present level of classification errors in the existing 1991 vegetation database does not permit conclusions to be drawn with a high level of confidence. Thus, the primary recommendation from this review is to develop an accurate map designating the amounts and spatial configuration of existing vegetation types and structural classes at the watershed scale. All further evaluations of wildlife habitat considerations and any potential landscape forest modeling efforts will require accurate vegetation data if the desired results are to be viewed with a high level of confidence. These types of accurate vegetation data might be obtained through a combination of plot-level vegetation samples and aerial photograph interpretation. Plot-level data can also provide measures of key structural elements such as large, old trees, snags and logs and understory structure that are important for many late-seral associated species and forest processes. These data could be used to monitor snag and downed log standards and guidelines. Additionally, it may be possible to supplement the data on existing vegetation from the plot-level samples with information on the potential natural vegetation of the site. Plot level data for monitoring changes in vegetation and key structural elements derived from the FIA sampling program under current evaluation may be able to provide some of these data. However, accurate and reliable maps depicting the size and juxtaposition of forest patches on the landscape in a spatial explicit manner are still needed and efforts to develop these data should be a high priority.

An accurate map of existing vegetation at the scale of the watershed will provide the opportunity to display to stakeholders all planned activities in the watershed and how the activities will affect and/or restore the amounts and spatial patterns of late seral forest areas and other vegetation classes in the watershed. This landscape perspective would provide an overview of how each specific project relates to the landscape and the desired condition. This shift from solely a stand or project level perspective to a landscape perspective is needed based on the best available knowledge from ecosystem management studies and landscape ecology. The first step needed to reach this goal is, again, an accurate map of existing vegetation.

Related to the need to maintain an accurate map of existing conditions, all activities that affect vegetation (e.g., timber harvest, prescribed fire, brush control, etc.) will need to be entered into the GIS vegetation layer database in a timely manner. This will be important for monitoring the effects of all activities by providing an accurate spatial depiction of the activities within the watershed, what changes the activities had on the structure and composition of the vegetation in the project area, and how these changes to the vegetation fit into the landscape or watershed vegetation patterns.

The above recommendations if achieved will allow for an accurate spatial depiction of vegetation patterns at the scale of the watershed. As discussed above these are necessary steps for managing the watershed. Once an accurate map of existing conditions is developed, the Forest should consider using one of the spatially-explicit landscape models discussed in the SNEP report (specific citations listed above) to incorporate temporal dynamics related to plant succession, fire patterns, and management and how they might interact in projecting future conditions. Changes in fire frequency and severity are a fundamental concern at the present time. Given the potential loss of late-seral forest areas to catastrophic disturbance events such as fire, planning efforts need to provide for a sufficient amount of late-seral forest areas to maintain the viability of late-seral forest systems given the probability of losses to catastrophic events (Franklin et al. 1997). Thus, models that incorporate the effects of fire, management, and succession might be able to provide at least initial estimates of conditions under various scenarios that could be used for management planning. An initial step would be to conduct these types of analyses at the watershed scale. These efforts would then need to be expanded to larger spatial scales to address concerns for processes that operate over larger spatial and temporal scales. For example, the distribution and abundance of wide-ranging species associated with late-seral forest conditions such as California spotted owls (Strix occidentalis), northern goshawks (Accipiter gentilis), American marten (Martes americana) and fisher (M. pennanti) in the Clavey River watershed are affected by population processes such as migration and dispersal operating at larger spatial scales. Addressing each specific management question at the appropriate spatial and temporal scale is of fundamental importance for planning and conducting scientifically credible management.

A full assessment of the status of wildlife associated with late-seral forest areas in the Clavey River watershed is beyond the scope of this review. Detailed review of the data for wildlife species related to vegetation conditions in the Clavey River watershed should be an important component of future watershed analyses. However, a few general recommendations can be made based on the available data. Current management direction for spotted owls requires scientific review for any management activities that are to be conducted in SOHAs/PACs. American martens and fishers are thought to be associated with late-seral forested areas with complex structure near the forest floor (Lyon et al. 1994). Large downed logs and snags are important habitat elements that function as denning, resting and foraging sites. Fragmentation of late-seral forests is thought to negatively impact marten and fisher populations (Lyon et al. 1994, Franklin et al. 1997). Inventory efforts to date have not documented the presence of fisher or marten in the Clavey River watershed. Statewide surveys have indicated that marten appear to still be distributed throughout the Sierra Nevada at high elevations (Kucera et al. 1996). However, currently there appears to be a gap in the historic distribution of fishers in the Sierra Nevada between Yosemite National Park and Mt. Shasta (Zielinski et al. 1996a). Zielinski et al. (1996a) recommended additional inventory efforts be focused on sampling in the gap. Therefore, one recommendation would be to increase standardized inventory efforts for detecting the presence of fishers in the Clavey River watershed. Based on the current available vegetation information there still appears to be large contiguous blocks of late-seral forest in the watershed that might support a low density of fishers. Project and occasional anecdotal observations suggest the possible presence of fishers. However, fishers can be difficult to identify and differentiate from martens under field conditions and verifiable evidence (track plates/photos) is required to produce acceptable records (Zielinski et al. 1996a). Surveys of longer duration are needed then typically conducted to date in order to increase the probability of detecting fishers occurring at low population densities (see Zielinski et al. In press for further discussion). Two unconfirmed records exist of fisher tracks and scat observed in 1987 during field surveys for the Clavey River Project.

An additional large-ranging, late-seral associated species that requires specific recommendations is the northern goshawk due to available information that is not reflected in current management standards and guidelines. There are at least 10-15 known goshawk territories in the Clavey River watershed. Recent studies conducted by Woodbridge and Detrich (1994) indicate that 200 acres of suitable nesting habitat should be provided for each territory. Suitable nesting habitat consists of stands with $\geq$ 70% canopy cover, low shrub cover, high numbers of trees in the 24-40" and >40" dbh (diameter at breast height), and relatively open understories (Keane, unpublished data). Current standards and guidelines should be updated to reflect the information provided by Woodbridge and Detrich (1994).

A second recommendation is that increased inventory effort be invested in surveys to locate additional territories in the watershed. This is important for planning purposes. Current surveys for proposed projects are generally conducted for only one year prior to a project, occasionally two years of surveys are conducted. This level of survey effort is inadequate given the known annual variation in goshawk reproductive activities. Not all pairs of goshawks will breed each year. The percentage of pairs that successfully breed in any one year can range from 30-90% and is associated with annual variation in prey, cone crop production, and weather (Keane, unpublished data). Detection rates for non-breeding pairs are extremely low and unreliable based on current survey methods and efforts. Detection rates of breeding birds are more successful, yet can still miss locating breeding pairs due to variable response rates in individual goshawks, the timing of the surveys in relation to the nesting phenology, and because of variation in the experience and reliability of technicians conducting the surveys. Overall, all of these factors influence the success of survey efforts. Therefore, at least 3 years of standardized surveys should be conducted for goshawks in project areas. This will require foresight and organization to make sure efforts are consistent and adequate across years.

One final group of organisms that need to be explicitly recognized in future Clavey River watershed assessments are the amphibians. Many amphibian species have undergone dramatic declines in the Sierra Nevada (Jennings and Hayes 1994, Jennings 1996). Sporadic Forest Service surveys between 1992-1996 have documented the presence of both foothill (Rana boylii) and mountain yellow-legged frogs (Rana muscosa) in the Clavey River watershed. Survey efforts to date have not been systematically conducted throughout the watershed. Increased survey efforts to document the abundance and distribution of amphibians in the watershed is strongly recommended. The presence of these species in the watershed should be recognized as an outstandingly remarkable value given their widespread declines throughout the Sierra Nevada.

As a final recommendation, the Forest should reconsider the manner in which the outstandingly remarkable value is defined. As currently stated, it is not directly associated with the Clavey River corridor as defined in the Wild and Scenic River Act. The definition should also be modified to reflect a more accurate and ecologically justifiable spatial delineation. Although there are uncertainties regarding the accuracy of the vegetation database, overall, the amount and spatially contiguous distribution of forests with late-seral conditions in the Clavey River watershed is a unique value relative to late-seral forest conditions throughout the Sierra Nevada. Given the overall degraded condition of high-quality late-successional forests throughout the Sierra Nevada, the present amounts and spatially contiguous nature of late-seral forests in the Clavey River watershed can provide an opportunity to address many of the issues raised by Franklin et al. (1997) in future management of late-seral forests in the watershed. More specifically, explicit management attention needs to be given to the patch size and connectivity of existing late-seral forests.

List of Preparers

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Value
8

Recreation

(Segment 5) Hiking and fishing are the popular dispersed activities. Access is limited and portions are remote and wild, resulting in a rare opportunity for solitude and non-motorized recreation experiences, below the snow and available all year. This portion of the Clavey has been traversed by expert kayakers. It is a native trout fishery, and a State designated Wild Trout Stream which is significant to anglers. Hiking and swimming are the popular activities near the Clavey's confluence with the Tuolumne Wild and Scenic River.

Historic Setting

Located in the central portion of the Forest, Segment 5 is largely undeveloped and remote. The portion below Forest Road 1N01 lies within the larger 17,300 acre Tuolumne River Roadless Area as identified in the RARE II Roadless Area Review and Evaluation (USDA 1979). As described in the River Study (USDA 1991), the "Outstandingly Remarkable" (OR) Recreation value applies to Segment 5 (from Cottonwood Road to the Tuolumne River).

Existing Condition

The Stanislaus completed a Recreation Opportunity Spectrum (ROS) inventory in 1980 for all National Forest land. ROS presents a framework for defining the types of outdoor recreation opportunities the public might desire, and identifying those portions of the spectrum (from primitive to urban) a given National Forest might be able to provide (USDA 1980). The ROS classes present on the Stanislaus are: Primitive (P), Semi-Primitive Non-Motorized (SPNM), Semi-Primitive Motorized (SPM), Roaded Natural (RN), and Rural (R). Except for the Cottonwood and 1N01 road corridors, the ROS inventory rated Segment 5 as SPNM.

In 1996, 2.8 million Recreation Visitor Days (RVDs) of recreation use occurred on the Stanislaus (USDA 1996). One RVD is equivalent to one person visiting the National Forest for 12 hours. Table 8.1 shows forestwide recreation use compared to different portions of the Clavey watershed and the potential Wild and Scenic River corridor. The undeveloped areas of the Stanislaus provide opportunities for dispersed activities such as scenic driving, camping, hiking, boating, nordic skiing, horseback riding, hunting, fishing, and off-highway vehicle (OHV) use.

Table 8.1 ***1996 Recreation Use***; (RVDs); Stanislaus National Forest; percents shown as portion of total Stanislaus National Forest recreation use (USDA 1996).

Area	Developed Sites	%	Dispersed Activities	%	Total	%
Stanislaus National Forest	1,680,000	60.0%	1,120,000	40.0%	2,800,000	100.0%
Clavey River Watershed	30,000	1.1%	90,000	3.2%	120,000	4.3%
Potential Clavey Wild and Scenic River Corridor	10,000	0.3%	30,000	1.1%	40,000	1.4%
Segment 5 Corridor **Clavey River**, from Cottonwood Road to the Tuolumne	0	0.0%	3,000	0.1%	3,000	0.1%

Management Direction

The Recreation OR value applies to Segment 5. Except for the Cottonwood and 1N01 road corridors (Management Area 8, Scenic Corridor), the Forest Plan (Table A.3) allocates Segment 5 and its surrounding slopes to Management Area 3, Near Natural with direction to protect its Wild and Scenic River values (USDA 1991).

The ROS for both road corridors is:

- Roaded Natural
  Predominantly natural appearing environments with moderate evidence of human sights and sounds. Interaction between users is low to moderate. Resource modifications are evident but harmonize with the natural environment.

The ROS for Near Natural is:

- Semi-Primitive Non-Motorized
  Predominantly natural or natural appearing environments. Interaction between users is low but there is often evidence of other users. Motorized use is not normally permitted.

The lower ¼mile of Segment 5 falls within the Tuolumne Wild and Scenic River corridor. The California Wilderness Act of 1984 designated portions of the Tuolumne as components of the National Wild and Scenic Rivers System. The Forest completed the required Wild and Scenic River Management Plan in 1988 using the Limits of Acceptable Change (LAC) concept to develop strategies for managing use (USDA 1988). The LAC concept does not focus attention on limiting use to an estimated capacity, but it can provide an estimate of the desired level of use. River managers may have several possible solutions to overuse problems if they can encourage users to adjust habits. Allocating or limiting use may be necessary, if conditions deteriorate to such a degree. The planning process emphasizes objectives and establishes a monitoring system that trigger implementation of management options on the Tuolumne Wild and Scenic River to protect its unique qualities.

Monitoring and Evaluation

Monitoring activities specific to recreation on Segment 5 addressed ROS classes, effects of OHVs and Wild and Scenic River Management on the Tuolumne. Findings indicated conditions are within standards or not enough information exists (USDA 1997).

The Stanislaus National Forest 1994-1996 Monitoring and Evaluation Report shows that the Core Team could not evaluate conditions because the Forest Plan does not include monitoring standards or limits of variability for Wild and Scenic River values. Although the Core Team could not determine conditions, it is unlikely that trends could be established for most, over the short 5 years since Forest Plan approval, even with more information and unlimited monitoring budgets (USDA 1997).

Conclusions

Although monitoring information is limited, it is unlikely that any of the management activities prescribed by Near Natural Management would alter the remote and wild recreation characteristics of Segment 5. Forest Plan direction is sufficient to protect or enhance this Recreation OR value.

The Forest Plan does not identify specific indicators of resource conditions, standards or limits of variability for Wild and Scenic River values (USDA 1997). Wild and Scenic River Management Plans normally established those items, after designation by Congress (USDA 1988).

Recommendations

1. Amend Forest Plan Chapter V to include specific key indicators for Wild and Scenic River values.

2. Establish specific Wild and Scenic River management direction and limits of acceptable change, after designation by Congress, in a Wild and Scenic River Management Plan.

List of Preparers

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	Asst. Recreation Officer	Stanislaus National Forest	1991-1996
	Landscape Architect	Stanislaus National Forest	1980-1990
Education	University of Illinois	M.L.A.	1978
	Rutgers University	B.S. Landscape Architecture	1976

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A

Appendix

Questions from the Collaborative Group

Submitted by: Charles Little; John J. Maschi; Katie Phillips; Mike Albrecht; Nancy Rosasco; Will Dorrell; John Buckley; Steve Apperson; and, Glenda Edwards.

Ecologic (a)

What management practices or activities affect the largest stand of aspen in the Sierra, south of the Eldorado National Forest; or, the rich variety of habitats within the Bell Meadow RNA? *(J. Maschi)

The aspen stand of Bell Meadow.

- Current age of aspen stand?
- General health?
- Is aspen reproduction occurring? By seeds or sprouting?
- Need for management to maintain or enhance? *(M. Albrecht, N. Rosasco, W. Dorrell [M.A, N.R., W.D.])

What are the historic trends in:

1) Aspen stand size, extent and regeneration
2) Meadow vegetation cover and species composition
3) Channel morphology and stream condition *(K. Phillips)

How are current management (grazing, recreation, road building, timber harvest, and fire and fuels management) and planned management activities affecting these trends? *(K. Phillips)

What management activities could be employed to modify these trends where they have been determined to be detrimental to OR's? *(K. Phillips)

Is the Bell Meadow aspen stand thriving and not threatened by any foreseeable events or activities? *(C. Little)

Are all three of the habitats in Bell meadow, as well as their associated flora and fauna, thriving and un-threatened? *(C. Little)

Is the soil in the watershed as rich as it needs to be to allow regeneration of appropriate vegetation, or has it eroded away (in places)? *(C. Little)

Are the wet and dry meadow, meadow shrub habitat, aspen groves, and riparian habitat within the Bell Meadow RNA being negatively affected by continued cattle grazing, streambank sloughing, pocking, and trampling? *(J. Buckley)

What is meant by substantial interference with public use and enjoyment of OR values? Is the degradation of Bell Creek in Bell Meadow an interference with public use and enjoyment of the Ecologic values of that area? (OR values: aspen, scenic.) *(Glenda Edwards)

Ecologic (b)

What management practices or activities affect the free-flowing characteristics of Bell Creek, Lily creek or the Clavey River? *(J. Maschi)

Will maintenance, or non-maintenance, of the Y-Meadow and Bear Lake dams in the Emigrant Wilderness affect the free-flowing characteristics of Lily Creek or the Clavey River? *(J. Maschi)

What management practices or activities affect the abundance and quality of life zones and vegetation within 1/4 mile of Bell Creek, Lily Creek or the Clavey River? *(J. Maschi)

What management practices or activities affect the elevation range of Bell Creek, Lily Creek or the Clavey River? *(J. Maschi)

What management practices or activities affect the relative remoteness and lack of development within 1/4 mile of Bell Creek, Lily Creek or the Clavey River? *(J. Maschi)

Landscape ecology features along the Clavey River.

4) Have identified "life zones" always (past 100 years) been present?

5) What affect have past management practices and wildfire had on distribution?

6) What percentage of segments 1-5 is currently undeveloped?

7) What are future plans for development? *(M.A., N.R., W.D.)

List and map all existing barriers within the Clavey watershed to the free-flowing nature of the drainages, i.e.: dams, roads, culverts, cattle crossings and etc.

What are the extent and magnitude of head cuts within the Clavey watershed? How are the headcuts affecting the streams condition and adjacent vegetation?

What plans exist that may impede the free-flowing nature of the Clavey?

What management activities could be employed to modify current conditions where they have been determined to be impeding the free-flowing nature of the Clavey River?

Do current BMPs adequately protect the free-flowing nature of the Clavey River? *(C. Phillips)

What are the existing life zones within the Clavey watershed?

How do these differ from potential natural vegetation?

There any life zones that may be in danger of being eliminated (i.e.: aspen, meadow, ponderosa pine) due to management activities?

What management opportunities exist which will enhance or protect life zones determined to be in danger? *(C. Phillips)

Is the "OR" ecological quality of the Clavey River's life zones and vegetation being degraded by the recent past/current management approach taken by the Forest Service? *(J. Buckley)

What are the county, private, and Forest Service development plans in the Clavey?

How much of the watershed is in private holdings?

Are there any opportunities for land exchange that would increase holdings of endangered life zones or provide opportunities to reverse negative trends as identified by the Clavey review team? *(C. Phillips)

Are all the Sierra Nevada life zones (except true alpine) and "all forest habitats" in the watershed healthy including there associated species?

- What animal species should live in these zones?
- What animal species are indeed there, and how are they doing?
- Is the sub-alpine forest of red-fir, lodgepole, western white pine and mountain hemlock healthy and in appropriate ratios to each other?
- What native plants exist in these life zones, and are they threatened in any way? *(C. Little)

Is the Clavey watershed "relatively undisturbed," or does road access, camping in inappropriate places, and use by off-road-vehicles threaten its undisturbed nature? *(C. Little)

Does logging or other use of private lands in the watershed affect water quality, fisheries, or habitat, or corridors for species living in the watershed? *(C. Little)

Is the relative remoteness and lack of development within the Clavey River canyon being lost or degraded by increased road construction and by the cumulative effects of private and public land logging activities? *(J. Buckley)

Are grazing activities and associated fencing, salt stations, water troughs, or other livestock improvements reducing the "remote/lack of development" recreational value of the watershed? *(J. Buckley)

What is the current condition of Bell Meadow with regard to its OR values? *(S. Apperson)

Are current management practices at Bell Meadow protecting OR Values? *(S. Apperson)

What could be done to improve management and resource condition within the Bell Meadow area? *(S. Apperson)

What is the threshold resource management point at which a river receives a negative or reduced recommendation? How can such a threshold be traced in the absence of a monitoring program that tracks and records the cumulative affects of human activities? (OR

values: Abundance of quality and life zones and vegetation, relative remoteness and lack of development, wild trout stream, vegetation patterns varied) *(Glenda Edwards)

Fish

Have trout from the Clavey been isozyme tested to determine the degree of "native-ness" in the Clavey population? *(K. Phillips)

What are the "limiting habitats" (spawning, rearing, wintering and summering) for native fish in the Clavey watershed and how are current and planned management activities affecting them? Do the existing BMPs adequately protect these "limiting habitats"? *(K. Phillips)

What is the relationship between sediment produced within the Clavey watershed and Fish OR values? *(S. Apperson)

What management activities and what watershed conditions produce the greatest amount of sediment? *(S. Apperson)

Is sediment produced from Bell Meadow a problem foe Wild Trout? *(S. Apperson)

In the Clavey and its tributaries, are low season flows and water temperatures limiting factors for the sustainability and health of the Clavey native assemblage of fish? *(S. Apperson)

Would increased use of Rx fire improve summer streamflow in Clavey tribs and contribute to improved aquatic/habitat conditions for wild trout in the main stem of the Clavey?

How has the Rogge fire and suppression activities in the lower Clavey affected fish habitat?

- How are these affects being considered in the evaluation of the sediment load of the Clavey and the cumulative effects on the fish populations? *(K. Phillips)

Does the California Department of Fish and Game's fish stocking of lakes on Lily Creek within the Emigrant Wilderness, affect the original fish assemblage of the Clavey River, Below the Bell/Lily confluence? *(J. Maschi)

Is the fish assemblage in the basin still the "original fish assemblage"? *(C. Little)

Is the fish population healthy? Are the numbers and size of the fish appropriate? Are their food sources healthy? *(C. Little)

What is the situation with aquatic invertebrates? Is the riparian habitat being degraded by OHV use and camping, especially in tributaries in upper reaches? What are affects of grazing? *(C. Little)

What is the situation of amphibians (especially yellow-legged frog) and pond turtles? *(C. Little)

What are the trends based on the F&G surveys of:

- Fish populations?

- Sediment loading? Distribution?

- Water temperature?

Is the Clavey River's wild trout fishery being degraded by the effects of sediment from road construction/reconstruction and ground disturbance from timber sale activities? Is the wild trout fishery being degraded by pollution entering the river from high levels of nitrogen from livestock or human waste, or from petroleum wastes? *(J. Buckley)

Are fish food sources such as aquatic invertebrates being affected by the levels of sediment generated by the combination of roads, logging, and fire effects? *(J. Buckley)

Are egg-bearing gravels being degraded by sedimentation? *(J. Buckley)

Are roads that allow vehicles to drive across Clavey's tributaries adding unnecessary sediment into those streams and the main river? *(J. Buckley)

What is the effect of road related erosion and human related erosion on the sediment load in the Clavey and its tributaries and can specific road segments be identified that are contributing to sediment loading? (OR values: fish, recreation, native Trout.)*(Glenda Edwards)

To what extent are Best Management Practices measurably effective in controlling the accelerated erosion of the Clavey watershed related to roads and road related activities? (OR values: fish, Native Trout, recreation) *(Glenda Edwards)

What management practices or activities affect the strongly defined patterns of mixed conifer, aspen, riparian and meadow vegetation within the Bell Meadow RNA? *(J. Maschi)

Does the vegetation exist, and is it healthy, which produces "dramatic displays of seasonal colors." *(C. Little)

Bell Meadow, Realizing that "scenic" resources are purely subjective, what will be the effect on visual resources of the following:

- Conifer encroachment into the meadow and in the aspen understory?

- Note: aspen is not a climax species.

- Lowering of water table within Bell Meadow?

- Cattle grazing? *(M.A., N.R., W.D.)

Are OR scenic values of the Clavey River being degraded by logging, road construction, or reforestation practices? *(J. Buckley)

Are the wet and dry meadow, meadow shrub habitat, aspen groves, and riparian habitat within the Bell Meadow RNA being negatively affected by continued cattle grazing, streambank sloughing, pocking, and trampling? *(J. Buckley)

What is the current condition of Bell Meadow with regard to its OR values? *(S. Apperson)

Are current management practices at Bell Meadow protecting OR values? *(S. Apperson)

What could be done to improve management and resource conditions within the Bell Meadow area? *(S. Apperson)

Scenic (b)

What management practices or activities affect the deep, v-shape, river-cut canyon; or, the variety of water forms and vegetation within 1/4 mile of the Clavey River below cottonwood road? *(J. Maschi)

Is run-off in Clavey affected by logging in the entire watershed? Is there a more rapid run-off in the spring, and lower flow in the summer, due to logging, including all tributaries? *(C. Little)

Outstanding landscape features along the Clavey River.

- What effects have fire had on the visual quality of segment 5? *(M.A., N.R., W.D.)

Are the OR scenic values of the Clavey River being degraded by logging, road construction or reforestation practices? *(J. Buckley)

Historic/Cultural

What management practices or activities affect the relatively undisturbed section of the 1853 Emigrant Route along Bell Creek within the Emigrant Wilderness? *(J. Maschi)

Does the 1853 Emigrant Route remain "relatively undisturbed?" *(C. Little)

Are the cultural and historic values of the Clavey River watershed being fully protected under recent past/on-going/planned projects? *(J. Buckley)

Is the Emigrant Route recorded and protected during projects? *(M.A., N.R., W.D.)

Wildlife

What management practices or activities affect the large tract of late seral stage forest habitat within 1/4 mile of the Clavey River between Reed Creek and 3N01, and between Cottonwood Road and halfway to 1N01? *(J. Maschi)

How has/will management activities protect the large stand of older mature forests above Cottonwood Road? *(K. Phillips)

What is the risk of catastrophic fire in the Clavey watershed, and what management activities can be employed in order to reduce those risks while protecting OR values. i.e.: Prescription burning, fuel reduction program etc...? *(K. Phillips)

Is the late seral stage forest habitat intact and healthy? Is it threatened as habitat by management activities in or nearby? Is it at risk of a catastrophic fire? What is the status of LSOG dependant creatures there? Do these creatures have the corridors necessary to allow them to migrate to other habitat for breeding or whatever? *(C. Little)

Do cumulative effects of past, present, and planned logging degrade habitat and ability to reproduce and expand populations of spotted owls and fishers? *(C. Little)

- Age of oldest trees in the area?
- Difference between "late seral stage" and "older mature forest"?
- Acreage of each type?
- Status of SOHAs and fisher units? Occupied?
- Effects of past management and wildfires? (M.A., N.R., W.D.)

Are LMP-approved timber sale practices continuing to deplete late successional old growth (LSOG) habitat characteristics by allowing the removal of large trees over 30" dbh within the watershed, thus affecting LSOG dependant species? *(J. Buckley)

Is the "unusual" late seral stage forest habitat centered on the Clavey between Reed Creek and 3N01 and between Cottonwood Road and halfway to road 1N01 being degraded, or is its refugia value being diminished by a loss of connecting corridors? *(J. Buckley)

Has the agency's failure to successfully regenerate clearcuts/tree plantations within the watershed combined with drought, salvage logging, on-going public and private timber sales, road construction, and fires to create extensive fragmentation of coniferous habitat that reduces the likelihood of furbearers survival? *(J. Buckley)

Recreation

What management practices or activities affect the rare opportunity for solitude and non-motorized recreation experiences within 1/4 mile of the Clavey River below Cottonwood Road? *(J. Maschi)

What is the estimated recreation use in the Clavey watershed? How is this use projected to change in the coming years? Do current BMPs provide adequate protection for the OR values with these projected recreation changes? *(K. Phillips)

Do roads, trails and campsites (authorized and unauthorized) cut down on the opportunities for solitude and non-motorized recreation experiences? *(C. Little)

- Estimated yearly use by category:
- Hiking etc.?
- Fishing?
- Swimming?
- Whitewater sports? Kayaking? *(M.A., N.R., W.D.)

Are the OR recreational values of the Clavey River being degraded by grazing, logging, road construction, and other LMP-approved activities? *(J. Buckley)

Are grazing activities and associated fencing, salt stations, water troughs, or other livestock improvements reducing the "remote/lack of development" recreational value of the watershed? *(J. Buckley)

Is the noise generated by logging and road construction degrading the recreational values listed as OR? *(J. Buckley)

All or Other, "OR" Values

Within the main tributary areas of the Clavey River, is the extent of the current road system (actual, not just official) combined with planned new road construction in excess of the desired road-per-square-mile goals for furbearers and other sensitive wildlife species that contribute to the richness of the Clavey's Ecologic diversity? *(J. Buckley)

Are the cumulative affects of cattle grazing (on the eight allotments that overlap the Clavey watershed) contributing to degradation of the ecological health and diversity of vegetation within the watershed, and specifically, within the meadows of the watershed? *(J. Buckley)

Are already-fading amphibian populations along the Clavey's tributaries being stressed or extirpated by the cumulative affects of timber sale practices, grazing, recreational uses, and road construction activities? *(J. Buckley)

Is the agency's fire suppression management within the Clavey watershed leading to either a reduction in biological diversity or a fuels build-up with potential to devastate many of the Clavey's OR values? If fuel levels are likely exceeding the range of natural variability, what are the choices for fuels treatment within the canyon or within the watershed that have the most potential for enhancing the OR values? *(J. Buckley)

Is large-scale broadcast burning during mild, moist late fall conditions feasible both technically and budget-wise? *(J. Buckley)

Would large-scale prescribed burning have potential to enhance or degrade the River's OR values? *(J. Buckley)

Because the Rogge fire has burned such a large area across the lower end of the Clavey canyon, is there potential to use this burn area as a containment line to do low-intensity backing fires up-canyon or up-river in the coming year... while fuel levels are low? *(J. Buckley)

What can we learn from a knowledge of **historic land use** within the Clavey watershed and its affects on Clavey OR values?

- Related: How can we separate the effects of current land management practices (1991 LMP) on Clavey OR values from the effects and conditions caused by historic land use?

- Related: Are any of Clavey's OR values improving, or likely to improve, as a result of current management practices? *(S. Apperson)

Do large stand replacing wildfires pose a risk to Clavey OR values?

- Related: If so, what values are at risk, how big is the risk, and what are the potential effects? *(S. Apperson)

Which OR values are degraded to a point where they should be removed from the "OR" list? *(J. Maschi)

Do any of the 5 river segments no longer possess "OR" values? If so, are any such segments therefore not eligible for Wild and Scenic River designation? *(J. Maschi)

Is grazing harming in-stream and streamside habitat, and water quality, where it is currently allowed? *(C. Little)

Is the soil in the watershed as rich as it needs to be to allow regeneration of appropriate vegetation, or has it eroded away (in places)? *(C. Little)

Are the roads in the watershed to many or in bad repair so as to be eroding producing soil loss and poor water quality? *(C. Little)

Has the application of herbicides in the Forest negatively affected flora or fauna in the Clavey watershed, especially fish and amphibians, and perhaps birds? *(C. Little)

What is the meaning of "negative or reduced classification recommendation?" *(Glenda Edwards)

What new continuing projects have taken place in the Clavey watershed under LMP since 1990 that could be considered protective of OR values under alternative management? *(Glenda Edwards)

Have all the alternative management land designations intended to protect the OR values - wildlife, near natural, research natural, wilderness - been managed according to the LMP standards and guidelines? By what methods has the effectiveness of alternative management been measured? (OR values: all accept free flowing) *(Glenda Edwards)

Have projects in the Clavey watershed included, as part of the NEPA analysis, the potential effects of that project on the Clavey River's OR values? What form did this consideration of OR values take in the project analysis? (OR values: all except free flowing) *(Glenda Edwards)

What projects have taken place or are planned that affected or have the potential to affect the OR values? (OR values: all) *(Glenda Edwards)

Has grazing on the six allotments in the Clavey watershed been analyzed with respect to the effects this use may have on the OR values? (OR values: abundance and quality of life zones and vegetation, aspen, landscape at Bell Meadow, Wild Trout Stream, fish, recreation, Native Trout fishery, defined vegetation patterns.) *(Glenda Edwards)