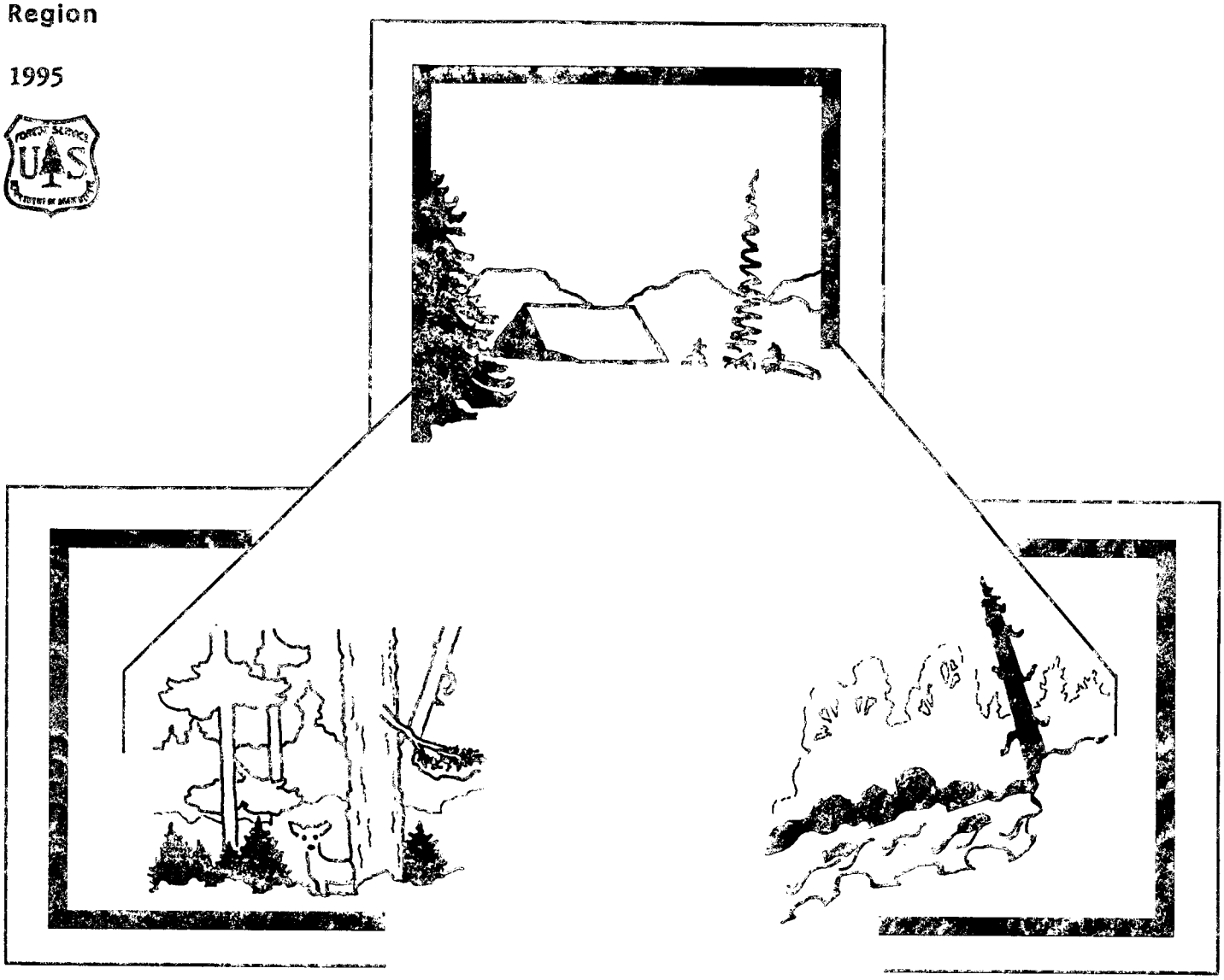
A 13.2:

G 72x

Forest Service
Pacific
Northwest
Region

1995



Grayback/Sucker Pilot Watershed Analysis

Version 1.0

Siskiyou National Forest

April 1995

Table of Contents
Grayback/Sucker Pilot Watershed Analysis

WATERSHED ANALYSIS RESULTS

The Analysis: 1

The Watershed: 1

Key Findings: 2

Management Recommendations: 4

Analysis Considerations: 7
- 1. Community Assessment 7
- 2. Land Use and Conflict 8
- 3. Roads and Trails 9
- 4. Recreation in the Watershed 10
- 5. Physical Setting 11
- 6. Erosion and Sediment Delivery 11
- 7. Water Quantity and Temperature 13
- 8. Water Use 13
- 9. Fish Habitat 14
- 10. Fish Species, Distribution, and Population Trends 17
- 11. Other Aquatic-dependant Species 18
- 12. Terrestrial Ecosystem 19

WATERSHED OVERVIEW

Social Setting O1

Management Context O4

Physical Setting O4

Biological Setting O6

Summary of Recommended Monitoring Points O7
- Aquatic Monitoring O7
- Terrestrial Monitoring O8

Recommended Supplement Criteria O8
- Terrestrial Criteria O8
- Aquatic Criteria O8

Acronyms Used O9

Core IDT Members O9

Key Support IDT Members O10

Summary of Management Recommendations and Opportunities
- Managment Recommendations O11
- Opportunities O16

Findings O21

Summary of Data Gaps O21
- Aquatic Data Gaps O21
- Terrestrial Data Gaps O22
- Social Data Gaps O23

AQUATIC ECOSYSTEMS MODULE

Watershed Values A1

Key Questions A1

Conditions and Trends: Physical Setting (climate, geology, soils, and landforms) A2

Conditions and Trends: Disturbance Processes: Channel Disturbance History A8

Conditions and Trends: Disturbance Processes: Sediment Delivery A9

Conditions and Trends: Disturbance Processes: Large Wood Delivery A13

Conditions and Trends: Streamflow Processes A15

Conditions and Trends: Streamflow Processes: Water Yield A15

Conditions and Ttrends: Streamflow Processes: Peak Flow A17

Conditions and Trends: Streamflow Processes: Low Flow A19

Conditions and Trends: Channel Morphology and Substrate A20

Conditions and Trends: Water Quality A22

Conditions and Trends: Water Quality: Water Clarity A22

Conditions and Trends: Water Quality: Stream Temperature A23

Conditions and Trends: AquaticBbiology: Fisheries: Species, Distribution, and Trends A28

Conditions and Trends: Aquatic Biology: Population Dynamics A30

Conditions and Trends: Aquatic Biology: Fisheries: Habitat Conditions, Connectivity and Fragmentation **A31**

Conditions and Trends: Aquatic Biology: Other Aquatic Species: Species, Distribution, and Trends **A39**

Conditions and Trends: AquaticBbiology: Other Aquatic Species:Ppopulation Dynamics **A41**

Conditions and Trends: Aquatic Biology: Other Aquatic Species: Habitat Conditions, Connectivity and Fragmentation **A41**

Conditions and Trends: Subwatersheds: Upper Sucker Creek **A41**

Conditions and Trends: Subwatersheds: Cave Creek **A43**

Conditions and Trends: Subwatersheds: Grayback Creek **A43**

Conditions and Trends: Subwatersheds: Lower Sucker **A45**

Literature Cited **A46**

Appendix A - Index of Relevant Information, Including Maps **A51**

Appendix B - Methods and Data Standards Used in Analysis **A54**

TERRESTRIAL ECOSYSTEM MODULE

I. Introduction T1
Purpose of Document T1
Integration of Terrestrial, Aquatic, and Social T1
Organization T1

II. Areas of Focus T2
Uses and Values T2
Key Questions T2

III. Processes and Conditions Which Address the Key Questions T3
Key Processes, Functions, and Conditions T3
Past Processes and Conditions T6
Past Disturbance Regimes T7
Past Landscape Scale Habitat Conditions T8
Past Sub-landscape Scale Habitats T10
Past Micro-scale Habitats T10
Past Wildlife Species Use in the Watershed T11
Current Conditions and Processes T11
Current Disturbance Regimes T11
Current Condition of Landscape Scale Habitats T12
Current Condition of Sub-landscape Scale Habitats T14
Current Condition of Micro Habitats T15
Current Species Use T16
Trend of Conditions and Processes that Effect Future Land Management T17
Current and Future Trends for Disturbance T18
Current and Future Trends of Landscape Scale Habitat T18
Current and Future Trends for Sub-landscape Scale Habitats T20
Current and Future Trends for Micro Habitats T20
Current and Future Trends for Species Use T21

IV. Guidance for Project Level Planning & Analyses T21
Findings Relevant to Project Planning T21
Landscape Scale Habitats T22
Disturbances T22
Succession/structural Sstage- Patch Size andConnectivity T22
Succession/structural Stage- % Area Covered by Older Forest Habitat T23
Riparian Areas T24
Soils T24

Sublandscape Scale Habitats T24
Meadows and Deciduous Oak/Pine Savannas T24
Evergreen Hardwood Stands T25
Lakes/ponds T25
Rock and Talus Areas. T25
Abandoned Buildings T25
Micro Habitats T25
Large Trees T25
Snags and Down Wood T26
Species Use T26
Guidance for Project Level Planning and Analysis T27
Project Guidance: Disturbance T27
Project Guidance: Landscape Scale Habitats T27
Project Guidance: Sub-landscape Scale Habitats T28
Project Guidance: Micro Habitats T28
Project Guidance: Species Use T29

Terrestrial References Cited T30

Appendix A

Information Used to Perform Analysis T32
Information Needed for Project Design T34

Appendix B T35
Past Species Use T35
Analysis Used to Address the Key Questions T37
Soils Analysis Methods T37

Appendix C - Structural/seral Condition Table/Older Forest Habitat Table T38

Appendix D - Detailed Stand Replacement and Water Yield Discussion T43
Trends in High Intensity Disturbance Frequency T43
Affect of Vegetation Structural Trends on Water Availability T47

SOCIAL MODULE

Non-Consumptive Use S1
- Overview S1
- Developed Recreation S3
  - Interpretive Sites S3
  - Developed Campgrounds and Facilities S4
  - Oregon Caves National Monument S6
  - Trails S8
  - Roads (general) and Utilities S11
- Dispersed Recreation S14
  - Red Buttes Wilderness S14
  - Botanical Areas S15
  - Back Country Recreation S16
  - Dispersed Campsites S16
  - Scenic Viewpoints S17

Consumptive Use S19
- Timber Harvest S19
- Cutting Firewood S22
- Picking Mushrooms S23
- Farming S25
- Mining S25
- Water Use S26
- Range Use S29
- Hunting S30
- Fishing S30

Social Literature Cited S32

Social working References S34

PROCESS MODULE

Summary **P1**

Chronology of Important Points in the Analysis **P2**

Overview of Process **P3**

Interagency Participation **P4**

Public Involvement **P4**

Element and Flow Matrix **P5**

Step One of the Federal Guide: Values, Issues, and Key Questions **P7**

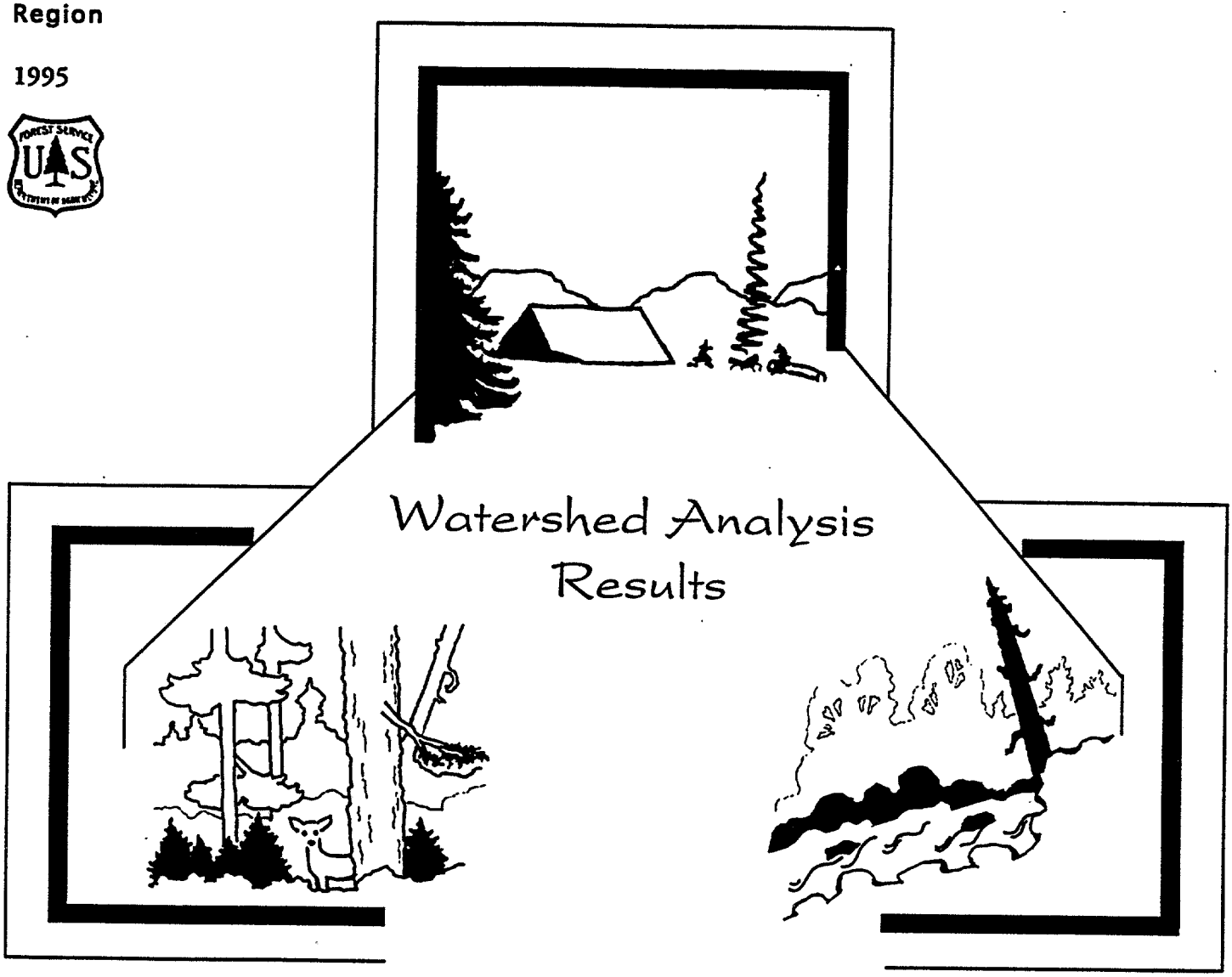
Step Two and Three: Key Questions to Analysis Components **P8**

Steps Four - Seven: Analysis and Synthesis **P8**

United States
Department
of Agriculture

Forest Service
Pacific
Northwest
Region

1995



Grayback/Sucker Pilot Watershed Analysis

Version 1.0

Siskiyou National Forest

April 1995

THE ANALYSIS:

The Grayback/Sucker Watershed Analysis Results summarizes key information developed from the Pilot Watershed Analysis. The analysis considered physical, biological, and social conditions and trends relevant to the Grayback/Sucker watershed. The analysis followed the eight steps of the Federal Guide for Pilot Watershed Analysis (1994).

Information and ideas from several federal, state and local agencies and the public was included in the analysis. The analysis considered the entire watershed, but most of the data collected is from lands under federal management (Forest Service, Bureau of Land Management, National Park Service). Additional analysis documentation includes data files, maps, computer model runs, specialist reports, lists of data gaps, monitoring recommendations and process records. New information will be appended to the analysis as it is collected. Thus, the analysis is considered an ongoing process.

The Grayback/Sucker watershed is one of 15 Pilot Watershed Analysis Areas within the Pacific Northwest and Northern California. It was selected for study because:

1. It is a key federal watershed, designated in the President's Forest Plan.
2. A mix of land ownerships and management allocations occurs (see Figures 1 and 2).
3. Its importance to Oregon Southcoast fisheries is recognized by state managers.
4. Potential restoration and other projects exist in the watershed.

THE WATERSHED:

The Grayback/Sucker watershed is part of the Rogue River basin in southwestern Oregon. At about 62,000 acres, it makes up 10 percent of the 628,000 acre Illinois River basin. The Illinois River basin, in turn, makes up 20 percent of the 3.3 million-acre Rogue River basin.

The watershed provides for many beneficial uses. Water from the watershed is appropriated for irrigation, livestock, industrial and domestic use. The forests in the watershed are among the most productive in the Illinois basin. Sucker Creek is the principal producer of salmonid fish in the Upper Illinois (above Cave Junction). Developed recreation and tourism are higher in this watershed than any other in the basin. The watershed provides habitat for many plant and animal species valued for their commercial, aesthetic, or intrinsic worth.

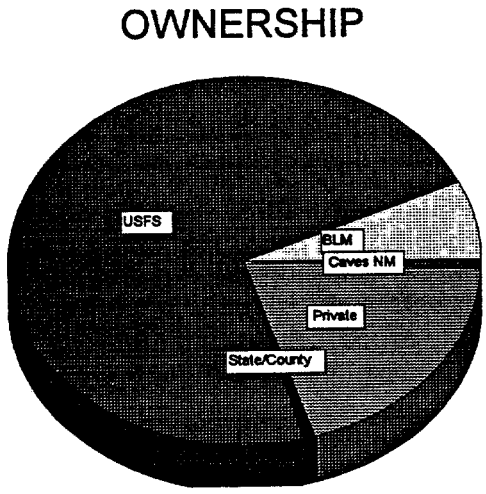
KEY FINDINGS:

Summer low flows in Sucker Creek are not adequate to accommodate all beneficial uses.
Summer water temperatures in the lower reaches of Sucker and Grayback creeks are outside of the historic range and can be lethal to salmonids. Warm temperatures favor non-native redside shiners that compete with salmonids for habitat.
Fish habitat in the lower reaches of Sucker and Grayback Creeks has less large wood, and fewer high quality pools and side channels, than required for optimum habitat. The lower reaches should be areas of high productivity.
Riparian areas along the lower reaches of Grayback and Sucker Creeks have been disturbed from the 1964 flood, salvage of large wood, mining, logging, and agricultural activities. Hardwoods and conifers growing along these reaches are not large enough to provide for habitat complexity, nor will be large enough for decades.
Port-Orford-cedar root disease infection sites occur in the watershed, but the area adversely affected by the disease is small.
Timber harvesting has resulted in a decrease in older forests in the watershed, and decreased the size of individual older forest stands. The predominance of Late-Successional Reserve allocation on federal lands in the watershed (see Figure 2) will likely lead to an increase in stand size and overall acreage of older forest (within 50-150 years, given no stand-replacement disturbances).
Fire suppression has led to increased vegetation density in unmanaged stands. More stands have a developed understory (ladder fuels). Stands have a greater proportion of shade-tolerant trees (tanoak, white fir), which can lead to forest health stress and increased fire hazard.
In the past, the oldest forests were on north aspects, in moist, lower elevation sites. Timber harvest patterns and fire suppression activities have shifted the predominance of older forest to higher elevations.
Hardwood stands and meadows are less prevalent than in the past.
Landscape views from watershed peaks have been altered by land use activities, and in some cases are below Siskiyou National Forest standards. These areas are considered spiritual sites by some people. **Increased regional population will bring increased demands** for recreation development and potential conflicts between users in the watershed.

FIGURE 1.
LAND OWNERSHIP

Approximate Area

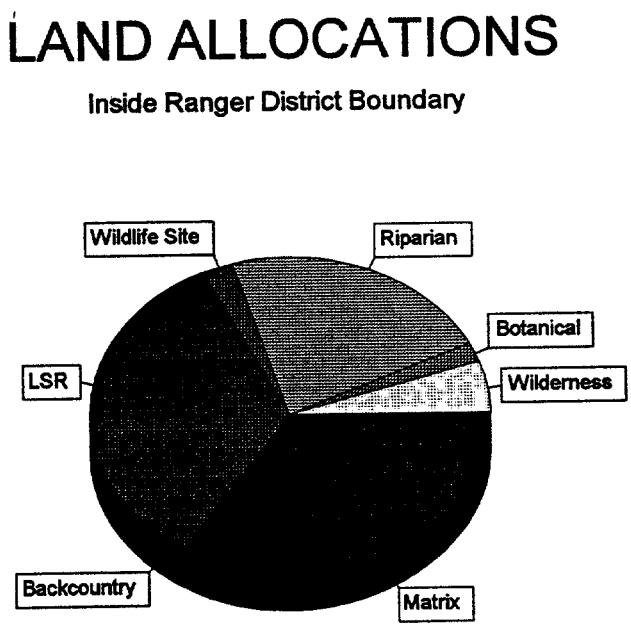
USFS.....42,000 acres
BLM.....6,000 acres
Private.....12,000 acres
State/County..... 300 acres
Caves NM.....500 acres



Note: Approximately 80% of the watershed is managed by public agencies. About 19 % is privately owned. Less than one percent is managed by state and county agencies.

FIGURE 2. LAND ALLOCATIONS
Approximate Area

Wilderness.....3,000 acres
Botanical.....1,000 acres
Backcountry Rec.....2,200 acres
Special Wildlife.....1,200 acres
Riparian Reserves.....10,400 acres
Late-Succ. Reserve...14,000 acres
Matrix.....13,000 acres



Note: Acreage is within Ranger District Boundary. Definitions of these and other land management allocations are available by contacting the Ranger District Office.

MANAGEMENT RECOMMENDATIONS:

Based on key findings, the following table summarizes management recommendations for the watershed. The recommendations apply primarily to lands under federal management. The Illinois Valley Watershed Action Plan, developed by the Illinois Valley Watershed Council, includes complementary recommendations for private lands (for more information, consult the Oregon State Watershed Health Group in Grants Pass, or the Illinois Valley Soil and Water Conservation District in Cave Junction) .

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS
Riparian areas vary as to how well they provide for objectives of aquatic conservation strategy.	Meet Aquatic Conservation Strategy Obectives for riparian areas.	Riparian Reserves.	Maintain interim reserve widths, including unstable earthflows yet to be mapped; prescribe restoration treatments on a site-specific basis.
Recreation and commercial mushroom harvesting adjacent to water may conflict with Aquatic Conservation Strategy.	Meet President's Plan while providing quality recreation.	Riparian Areas, particularly within Grayback Campground.	Educate public about need for riparian protection. Determine how best to meet public need while preserving habitat.
Lack of large conifers in riparian areas (lower reaches). Low shade contributes to high water temperatures.	Restore large conifers to riparian areas in the long term.	Tiger Springs. Mined areas in Sucker Creek. Along Grayback Creek. Valley floor.	Plant conifers. Reduce competition from hardwoods. Thin overstocked young conifers. Encourage private landowners to plant/protect riparian vegetation. All efforts will lead to long term shade and wood recruitment.
Port-Orford-Cedar (POC) is important for stream shade and the best source of long term riparian wood. POC root disease is killing trees in some areas.	Maintain and restore Port-Orford-cedar.	Port-Orford-cedar habitats.	Preserve Port-Orford-cedar habitats (shady riparian areas). Reduce risk of spread of POC root disease by closing roads in wet season, removing POC along open roads, and isolating infection centers. Public education
Channels have become less complex in terms of large wood and side channel habitat for fish.	Maintain and restore floodplain inundation large wood delivery.	Confluence of Grayback and Sucker Creeks.	Manage for large wood recruitment and side channel development in all activities (including Grayback Campground and adjacent facilities).
Debris flows may not deliver large wood to channels where they are intercepted by roads.	Maintain and restore large wood delivery processes and sediment regime.	Sites with a high probability of debris flows, such as along Roads 4612080, 4612540, and 4612098.	Redesign road crossings to allow debris flow passage. Decommission roads and remove crossings.
Pool habitat is below healthy levels in streams in terms of amount, depth, and cover within pools.	Increase pool habitat complexity.	Fish bearing streams.	Place brush bundles and other cover in pools. Place boulders and large wood in streams to increase pool depth and frequency.

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS
Mining and fish habitat improvements can trigger erosion in ancient slide deposits adjacent to stream channels.	Avoid destabilizing ancient slide deposits.	These areas are mapped (see analysis files).	Ensure that mining activities and fish structure placement do not trigger erosion of these landslides.
Simplified channel form (including riparian disturbance) has led to increased stream velocity.	Maintain and restore integrity of aquatic system and instream flows.	Sucker Creek (Reach 2B; see map in files).	Mitigate effects of past mining and discourage future mining activities that reduce structure and channel roughness. Place large wood or boulders in stream. Restore riparian forests.
Some roads are contributing higher than natural rates of sediment to stream channels.	Maintain and restore water quality (i.e. low turbidity and the sediment regime) by reducing rill and gully erosion from road drainage interception.	Shotgun culverts; road segments with inadequate culvert or drainage spacing; sites where quarries, landings, tractor yarding, or fire lines intercept drainages.	(1) Outslope roads. (2) Rip and hydrologically decommission roads. (3) Decrease spacing of road drainage outlets. (4) Revegetate fillslopes. (5) Winter Closures.
Some roads have stream crossings where plugged culverts may divert water down the road during storms, eroding new channels.	Maintain and restore water quality (i.e. low turbidity and the sediment regime).	(1) Road crossings that failed during the 1964 storm (see map and list). (2) Road crossings with diversion potential within sensitive soil types.	(1) Field inventory to prioritize specific sites. Provide armored diversion paths and adjust grade. Decommision roads and remove crossings. Increase culvert capacity to reduce plugging.
Some road fill are not stable and may fail during storms.	Maintain and restore water quality (i.e. low turbidity and the sediment regime).	See analysis file maps for specific sites.	Geotechnical stabilization. Sidecast fill pullback. Revegetation. Road decommissioning.
Some roads cross streams, expanding the length of the stream drainage network by road ditches. Peak flows may be increased, and low flows may be decreased.	Maintain and restore instream flows, protect timing, magnitude, duration, and distribution of peak, high, and low flows.	Where roads expand length of drainage network (sites unknown at this time).	Identify specific treatment sites. Decrease drainage distance between outlets where soils can promote reinfiltration. Decommission roads
Dense stands reduce penetration and storage of snowpack.	Increase penetration and storage of snow.	North and east facing slopes above 4500 feet and other high elevation sites.	Thinnings and small patch cuts to reduce snow intercept.
Overstocked stands are susceptible to large scale losses from disease, insects drought, and stand-replacement fire. They also reduce spring/summer stream flow because they have high water demand.	Reduce stand densities to improve forest health, reduce fire hazard, and increase streamflow.	Watershed wide; in and around patches of interior forest and urban interface.	(1) Thinning with removal or treatment of fuels. (2) Prescribed fire

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS
Fire suppression and other management activities have increased risk of stand-replacement fire. Stand-replacement fires can lead to increased surface erosion and water quality problems.	Reduce susceptibility of stand-replacement fire and subsequent erosion.	Urban interface, Oregon Caves Monument area, high density LSR stands, conifer stands with developed hardwood understories. Areas where risk factors are high on sensitive soils.	Create and maintain fuel break. Thinning, understory removal, or burning to reduce fuel ladder and increase fire tolerance. Long term maintenance through precribed fire.
Decline in shade-intolerant species such as ponderosa and sugar pine from management activates (harvest and fire suppression).	Maintain and restore ponderosa and sugar Pines where they existed historically.	High elevation undisturbed sites and lower elevation harvested areas.	Favor these species in precommercial thinnings and commercial harvest. Encourage replanting of pine on all ownerships. Maintain openings around pines through thinning or fire
Older forest habitat is fragmented.	Restore long-term interior forest habitat.	Older forests, along perennial streams, low on slope, and north aspects.	Preference for harvest in already fragmented areas. Reduce risk of wildfire by reducing fuels at edges of older forest and underburning.
Competition from hardwoods and conifers is slowing development of young stands.	Accelerate growth and development of young stands.	Plantations and young natural stands in LSR's adjacent to old growth patches.	(1) Thin and release young stands. (2) Fertilization (in matrix land only).
Large hardwoods and conifers are at reduced levels in managed stands.	Long term restoration of large trees.	Entire watershed, especially managed stands, and Riparian and Late-Successional Reserves.	Thinning and manual release to hasten development of large conifers and tree-form hardwoods.
Snags and down wood are at reduced levels in managed stands.	Restore sufficient dead wood where it is lacking.	Entire watershed emphasizing managed stands within Riparian and Late Successional Reserves.	Create snags and down wood adjacent to managed stands in the short-term and managed stands in the long-term.
During foreseeable future, high proportion of stands will be in mid age class (50-150 years).	A historic balance of stands in all size classes to promote biological diversity.	Throughout watershed; with opportunities tailored to management allocation..	Use thinnings and prescribed fire to promote development of healthy older stands and regeneration harvest to create young stands. Preference for treating 50 - 100 year old stands.
Decline of deciduous oak woodlands, brushfields and meadows.	Restore oak woodlands, brushfields and meadows.	Younger forest habitats, deciduous oak woodlands, and meadows that are filling in.	Thin younger forest to encourage hardwoods and oaks. Cut encroaching conifers in meadows. Burn both habitat types.
Wildlife increasingly disturbed by people and development..	Minimize disturbance to wildlife during critical time periods (e.g. breeding).	Wildlife emphasis areas (PETS, game species habitats).	Seasonal or permanent road closures. Conduct management activities outside of critical periods.

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS
Oregon Caves viewshed is in a Heavily Altered condition, and does not meet Siskiyou LRMP Standards & Guidelines.	Meet Siskiyou LRMP visual guidelines.	Within the Oregon Caves Viewshed, and along Caves Highway and Grayback Road.	Consider mitigating past scenic degradatiion in future project design.

ANALYSIS CONSIDERATIONS:

Following are 12 physical, biological, or social elements considered in the analysis. They are primary factors affecting the past and current condition of the watershed, and its future.

1. Community Assessment
2. Land Use and Conflict
3. Roads and Trails
4. Recreation
5. Physical Setting
6. Erosion and Sediment Delivery
7. Water Quantity and Temperature
8. Water Use
9. Fish Habitat
10. Fish Species, Population and Distribution
11. Other Aquatic Dependent Species
12 Terrestrial Ecosystem

1. Community Assessment

Population surrounding the Grayback/Sucker watershed has increased, and changed in economic focus over the past decade. The nearest communities are small and are located in the Illinois, Rogue and Applegate River basins, all within Josephine County.

A community assessment of the Applegate Valley (Preister, 1994) noted that the population in the county grew by 6.4% between 1980 and 1990. The retirement community also grew, bringing money and stimulating trade and service employment (especially medical). At the same time, employment related to wood products and manufacturing declined steadily.

The shift has affected the culture of the area. Four key cultural findings were discovered in the assessment:

> "...1) Valley residents have a strong land ethic . . . 2) Community discussions centered on oldtimer/newcomer themes . . . 3) The rural culture still works, which means, despite frequent comparisons between oldtimers and newcomers, relations of cooperation and support still predominate . . . 4) Caretaking systems are stretched to their limit. The community has been fragmented by the influx of new people and the decline of the agricultural and forest base."

2. Land Use and Conflict

Mining, agriculture, timber harvesting and recreation have had a dramatic impact on the watershed since its settlement (by non-Indian people) in the mid-1800's. Conflicts between different uses and values continue, despite many efforts at resolution.

Mining

The discovery of gold was the catalyst for development of the watershed. There were two rushes to Sucker Creek -- one in 1853, and one in 1856 -- attracting about 2,000 people during the height of activity. Mining has been sporadic since that time. One larger-scale operation exists on Sucker Creek today; most of the other operations that occur over the estimated 500 claims are small. The effects of historic, large scale mining on riparian and aquatic habitat remain.

Agriculture

Soon after gold was discovered, small farms began to provide produce to the miners. Water rights for the farms were established between 1853 and 1934. Limited summer streamflow remains an issue within the watershed. Range use is limited to small private ranches and part of one grazing allotment (40 head of cattle, administered by the Rogue River National Forest). Periodically, some of the cattle wander into the Bigelow Lakes Botanical Area; visitors object to the presence of the cows, and "cow patties."

Timber Harvesting

Timber harvest occurred on a small scale in the watershed between 1851 and 1945. After 1945, it increased dramatically because of demand and mechanized equipment. Forest Service lands in the watershed produced an average annual volume of 36 million board feet between 1960 and 1979, and 22 million board feet between 1980 and 1989 (U.S. Forest Service, 1990). Many conflicts resulted from the timber cutting. For instance, the scenery from viewpoints in the watershed was degraded when the trees were removed. The acceptable thresholds for impacts to the scenery (as set in the Siskiyou LRMP) were exceeded in the Grayback, Oregon Caves, and Horse Mountain Viewsheds.

The harvest of federal lands was reduced sharply in 1990, when the northern spotted owl became protected under the Endangered Species Act. Since 1990, about 26 million board feet has been produced in the watershed on Forest Service lands. An additional 22 million board feet have been produced on Bureau of Land Management (BLM) lands produced about 22 million board feet (Dunham, 1994) in that same time.

The reduction in federal timber harvest has encouraged harvest on private land; currently at its highest level ever (Young, 1994). Reduction in federal harvest has also contributed to layoffs at local mills and logging companies. The unemployment rate for Josephine County (7.8%) was the highest in Oregon for September 1994.

Efforts have been made at conflict resolution. The Siskiyou National Forest Land and Resource Management Plan (LRMP) was completed (signed) in 1987. Full implementation of the LRMP was suspended by the listing of the northern spotted owl and marbled murrelet as threatened species under the Endangered Species Act. The Siskiyou LRMP was amended in 1994, when President Clinton signed the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (commonly referred to as the President's Forest Plan). The President's Forest Plan established land allocations and guidelines for all activities on federal lands. Figure 2 shows land allocations for the Grayback Sucker watershed.

Mushroom Harvesting

Some issues cannot be resolved by regional plans. Mushroom harvesting is an example of a more local conflict. Most of the harvest within the Illinois River basin occurs in the Grayback/Sucker watershed. Social and ecological conflicts have arisen from the mushroom harvest. Land managers have difficulty providing adequate lodging, camping and sanitation for the large and sudden influx of migrant harvesters. Local pickers often distrust the migrants, feeling that their harvest practices can disrupt duff and remove developing spores. Resource managers and other citizens are working to resolve the questions and conflicts related to the mushroom harvest at the local level. The effects of different mushroom harvest practices have not been quantified.

3. Roads and Trails

Road closures are, and will continue to be, a controversial issue in the Grayback/Sucker watershed. About 290 miles of road have been built within the watershed. Of these, about 75 miles are maintained for passenger cars, 45 miles are currently closed, and 170 miles require the use of high clearance vehicles. All roads, except Caves Highway and the first segments of FS 4611 and 4612 (asphalt paved), have a rock or native soil surface.

Two recent Bureau of Land Management closures have drawn fire: one road accessed a popular hunting area (Sellards, 1994) and the other accessed a firewood cutting area (Dunham, 1994). More conflicts are expected as roads may be closed for ecological restoration (sediment reduction, Port-Orford-cedar root rot, etc.) or because funding is not available to keep roads maintained to safety standards. This watershed analysis has recommended some road decommissioning (see Management Recommendations).

The major access routes through the watershed will likely be maintained to allow for recreational access, as well as forest and fire management.

The trail system in the watershed is currently used primarily for recreation. It evolved from American Indian trails, and trails built for fire suppression when the Siskiyou National Forest was established in 1906. Miles of trail have been replaced by timber access and other roads. Maps of roads and trails, and corresponding descriptions are in the analysis file.

4. Recreation in the Watershed

Two types of recreation sites are available in the watershed: developed (established facilities) and dispersed (scattered, undeveloped areas). The developed sites are used more than dispersed sites. Grayback/Sucker is the only watershed on the Siskiyou National Forest where developed recreation predominates. Five developed campgrounds are found within the watershed: Bolan Lake, Cave Creek, Grayback, Caves Trail, and the Goldleaf Resort. The first three campgrounds are managed by the Forest Service, and are the only developed campgrounds on the Illinois Valley Ranger District. The other two campgrounds are privately-owned. Several small, undeveloped campsites are dispersed through the watershed. Some of these have been used since the late 1800's.

Oregon Caves National Monument

The Oregon Caves was discovered in 1873 by Elijah Davidson. In 1909, 480 acres were set aside as the Oregon Caves National Monument. The monument is managed by the National Park Service (United States Department of the Interior). Visitor use to the monument has been gradually decreasing over the last 20 years, from approximately 181,000 people in 1977 to about 100,000 in 1993. In the 1970's most of the visitors were from non-western states; in latter years, almost all are from Oregon, Washington, and California (Oregon, Economic Development Department, 1994).

Wilderness, Backcountry and Botanical Areas

Several areas in the Grayback/Sucker watershed provide for dispersed recreation, but usage by large numbers of people and motorized vehicles are of concern. The Red Buttes Wilderness (about 3500 acres of which is in Sucker Creek) receives about 1200 visitor use days per year (Rogue River LRMP, Appendix E, E-9). Tannen Lakes and the Boundary Trail are popular destinations within the Wilderness. The concentration of people using the Tannen Lakes may be above capacity in terms of the limits to acceptable change (ibid.). Occasional, prohibited motorcycle use on wilderness trails is another concern (Keown, 1994).

The Boundary Trail crosses two National Forests (Siskiyou and Rogue River) and the Red Buttes Wilderness. Some conflicts result, since motorized use is allowed on some parts of the trail, and not on others. The High Divide Backcountry Recreation Area is adjacent to the wilderness. Approximately 2,300 acres are designated "Motorized Backcountry" (Siskiyou National Forest LRMP IV-97). Most of the use is concentrated on primitive roads, jeep and hiking trails, and dispersed campsites.

Three botanical areas are found in the watershed: Bolan Lake, Bigelow Lakes, and Grayback Mountain (see Siskiyou National Forest LRMP Appendix F, Volume I, F-55, 60, 88 for descriptions of the areas). Mount Elijah is a popular destination for hikers in the Bigelow Lakes Botanical Area. Views from the peak are expansive; it and other peaks are considered sacred sites for many people.

5. Physical Setting

Grayback/Sucker Watershed is located near the geographic center of the Klamath Mountains geologic province. The watershed is unusual for its limited amount of serpentine geology (compared to other Illinois River watersheds), and the presence of marble caves.

Elevations range between 1,400 feet at the mouth of Sucker Creek to 7,000 feet on the Applegate Divide. The high ridges are snow-covered for several months each winter, but no permanent snow fields or glaciers are present. Past glaciation is evidenced by a dozen glacial cirques (rock basins carved by mountain glaciers). Three of these cirques are occupied by Bolan Lake and the Tannen Lakes. Maps of these and other landforms in the watershed are available in the analysis files.

A variety of soil types occur in the watershed. Parent materials are granitics and metamorphics (with some serpentine). The granitics tend to be the finest grained, deepest soils and are most sensitive to management activities. A map of soil classes and corresponding acreage is available in the analysis file.

6. Erosion and Sediment Delivery

Landslides have affected the current condition of the watershed, and must be considered in future management. Human activities have accelerated erosion with the area. Figure 3 displays the relationship between land use, riparian disturbance, and erosion (sediment delivery). Various sizes, ages, and types of landslides are found in the watershed, from large ancient earthflows (deep, slow-moving features), to small recently-active debris flows (shallow, rapid, scouring events).

Fifty-one recent landslides have been noted in the watershed between 1940 and 1986. Most of these were connected with the famous 1964 flood[1]. Forty-three percent of the slides are in granitics (granitics cover 25 percent of the watershed). Some of the recent debris flows are related to diversions or plugged culverts at road crossings (see Management Recommendations for restoration potential in these areas).

FIGURE 3. RIPARIAN CONDITION THROUGH TIME

Time Period	Condition
1850-1941	Gold mining on Sucker Creek (to Fehley Gulch) was extensive. Miners set fires to improve access and visibility. Agriculture was developed in the lower reaches. These activities removed riparian vegetation and delivered sediment. Small scale logging occurred in the lowest elevations.
1941-1964	Mining activity decreased. Some riparian areas in the mid to upper reaches of Sucker Creek became revegetated. Fire suppression became more effective when mechanized equipment became available, following World War II. At the same time, demand for lumber and tractor logging increased. Sidecast and poorly designed, temporary roads; clear cuts; and riparian logging delivered sediment to Sucker Creek. Agricultural development continued to remove riparian vegetation and contribute sediment.
1964	December rains melted heavy snowpack. Road failures, culvert washouts, streambank erosion, and debris flows in Cave, Tannen and Grayback Creeks resulted. Riparian vegetation was scoured. The effects of the storm were intensified by human activities, especially the presence of roads.
1964-1970	Timber harvest continued. Large wood created during 1964 storm was salvaged from accessible areas. Agricultural lands continued to be developed, along with land clearing for homes, vineyards, and other uses.
1970 - present	Timber harvest continued, but practices became more conservative and effects of harvest lessened. Little riparian harvest occurred on public lands. Large scale mining resumed on Sucker Creek, but settling ponds and channel diversions reduced sediment delivery. Dredging in the stream loosened bedload and delivered some sediment. Road cuts and fill slopes, older harvest units, and riparian areas began to be revegetated with conifers, alder, and other hardwoods.
future trend	Higher standards for road and culvert design reduce risk of failure. Some riparian areas near cleared land become revegetated as other lands continue to be cleared. Mining continues at present levels. Areas disturbed by past mining in lower Sucker Creek are susceptible to severe bed and bank erosion during peak flows. Refined land use practices and restoration emphasis result in less riparian disturbance.

[1]More information on the 1964 flood, and a chronology of other flood events is available in the analysis files. The flood was a natural event, but its effects were exacerbated by human activities.

7. Water Quantity and Temperature

Water quantity and temperature are significant issues in the Grayback/Sucker watershed, especially because summer low flows are associated with temperatures that are lethal for salmonids (see Figure 5, Water Temperature and Its Effects on Salmonids).

According to the Rogue River Basin Report of 1985, beneficial uses (existing and potential) are: domestic, livestock, municipal, industrial, irrigation, agriculture, mining, recreation, wildlife and fish.

Water quantity is measured by three parameters: total annual flow, low flow, and peak flow. Total annual flow is mostly correlated to precipitation. Form of precipitation affects timing of flow: when precipitation falls mostly as snow, peak flows are diminished, and flows remain higher into the late spring and summer. Rain on snow or other intense melting events result in high peak flows, with lower flows sooner in the year. Riparian disturbance (see Figure 3), roads, and timber harvest have intensified peak flows (and reduced low flows) in the Grayback/Sucker watershed.

Water temperatures are affected by amount of streamflow, channel form and solar exposure during high summer. The Regional Ecosystem Assessment Project (REAP, 1993) found that streams in western Oregon are warmer than historic times. Streams in the Grayback/Sucker watershed follow this trend. Water withdrawal has tended to increase water temperature in Sucker Creek, because it reduces water quantity during times of high solar radiation (June and July).

A broad, shallow channel has warmer temperatures that one with similar flow that has deeper pools. Sediment deposited from the 1964 flood, channel widening from early placer mining, salvage of large wood, straightening of channels with bulldozers, construction of berms for water diversion, and removal of gravel bars near bridges contribute to a broader, shallower channel in the lower reaches of Sucker Creek.

Removal of riparian vegetation, streambed disturbance from mining, and removal of stream structure (wood) have also contributed to increased stream temperature. Hardwoods have replaced conifers in some disturbed riparian areas in the lower reaches of Sucker and Grayback Creek; hardwoods do not provide as much shade as taller, denser crowned conifers.

8. Water Use

Summer low flows in Sucker Creek are not adequate to provide for all needs. That has been apparent since 1934, when a State Engineer withdrew the stream from further water rights because of insufficient flow. As of 1994, there are consumptive water rights for 47 cubic feet per second (cfs) on Sucker Creek, and 3 cfs on its tributaries.

As the flows decrease through the summer, water use is cut back to the earliest dated rights. In 1924, water use on Sucker Creek was cut back to the single oldest right (which is 1853) in July and eliminated by the end of August (per monthly reports for the Assistant Water Master). In 1994, water use was cut back to 1865 rights (about 15 cfs).

Some water withdrawn for irrigation returns to the stream channel, either overland or subsurface. The quantity of this return flow has not been measured. The water table rises when irrigation season begins (as measured in wells), indicating that excess irrigation water seeps into the subsurface aquifer.

Ground water is presently a source for domestic use, and could be developed further, with proper study of the complex interactions between it and stream flow. Storage of winter streamflow in a reservoir, for release during summer low flows, could also ease competition between some beneficial uses and create possibilities for growth. A dam site on Sucker Creek was periodically investigated by the Bureau of Reclamation from 1940 to 1971, but the potential project was put on hold, primarily for economic reasons (Bureau of Reclamation, 1964, 1971).

Several issues are related to the Sucker Creek, or other dam proposals. The effects of regulating streamflow on fish habitat and migration; the need for relocation and reconstruction of the Caves Highway on steeper, less stable ground; and a reevaluation of sediment delivery rates and the inundation of gold deposits are all serious considerations.

9. Fish Habitat

The watershed analysis considered five fish habitat attributes in the lower reaches of Sucker and Grayback Creeks: pools per mile, depth of pools, pieces of large wood per mile, number of side channels and water temperature. All fish attribute values are below expected in the lower reaches of both creeks (see Figure 4). The low rankings indicate reduced carrying capacity for salmonids in the most important fish production areas in the watershed[2]. Each fish habitat attribute is examined in the following pages.

Fish habitat improvement structures were placed in Grayback Creek and Cave Creek in the late 1980's to improve habitat for coho salmon and rainbow trout respectively. Additional fish improvement opportunities are discussed under Management Recommendations.

---

[2]The lower reaches of Grayback and Sucker Creeks are critical fish production areas. Maps and descriptions of the conditions and fish habitat attributes associated with stream reaches in the watershed are available in the analysis files.

FIGURE 4. FISH HABITAT ATTRIBUTES IN THE LOWER REACHES OF GRAYBACK AND SUCKER CREEKS.

	NUMBER OF DEEP POOLS PER MILE		PIECES OF LARGE WOOD PER MILE		MAXIMUM WATER TEMPERATURE	
	Expected	Actual	Expected	Actual	Expected	Actual
Sucker Creek (Boundary to Nelson Ck.)	12 to 31	4	40 to 80	1.7	Less than 65 degrees	70 (1993) 72 (1994)
Sucker Creek (Nelson Ck. to Grayback Ck.)	15 to 37	2.5	40 to 80	4.4	Less than 65 degrees	64 (1993) 70 (1994)
Grayback Creek (mouth to White Rock Ck.)	29 to 73	8	40 to 80	2.8	Less than 65 degrees	60 (1993) 63 (1994)
Sucker Creek (Grayback Ck. to Yeager Ck.).	15 to 38	5.8	40 to 80	1	Less than 65 degrees	59 (1993) 60 (1994)

Pool Depth and Pools Per Mile

Pools are important to salmonids during all life stages, but are most important for juvenile salmon during the summer months. Pools with depths greater than three feet are of the highest value because they provide cooler water and cover. The number of pools of any depth, and the number of deeper pools, are below expected values in the lower reaches of Grayback and Sucker Creeks.

Large Wood

Large wood (small-end diameter greater than 24 inches over 50 feet long) is lacking in streams in the Grayback/Sucker watershed, particularly in the lower reaches. Large wood is important for stream complexity, aquatic and riparian ecosystem processes, and fish habitat. Large wood is delivered by direct input and channel shifting in riparian forests, by landslides, and by streams during high flows.
The lack of large wood is attributed to:

(1) Direct removal by mining, and salvage following the 1964 flood; (2) logging and riparian clearing for agriculture; (3) bank stabilization that inhibits channel shifting; and (4) interception of wood by bridge abutments and midslope roads.

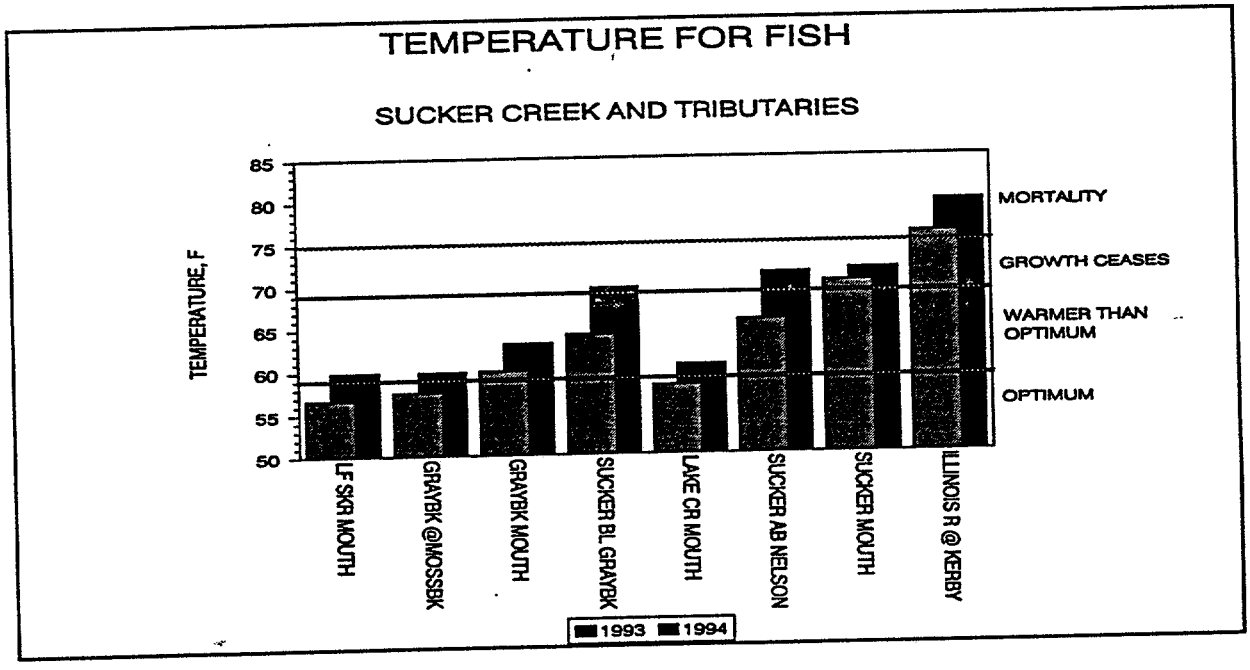
Side Channels

Side channels are critical to overwintering juvenile salmonids, especially coho. Side channels have been reduced from historic levels in Grayback and Sucker Creeks. The conditions and activities that have raised water temperature, reduced large wood, and reduced the number of pools have limited the development of side channels.

Water Temperature

Summer water temperatures are sub-lethal[3] to salmonids in the lower reaches of Grayback and Sucker Creeks. Optimum fish habitat upstream is fragmented by the warm water. The warm water favors non-native reside shiners that compete with salmonids. The annual phenology (timing of spawning, smoltation, etc.) for coho salmon is not adaptable to the elevated water temperatures. Figure 5 displays the water temperatures measured in the watershed and their relationship to fish habitat.

FIGURE 5. WATER TEMPERATURE AND ITS EFFECTS ON SALMONIDS.



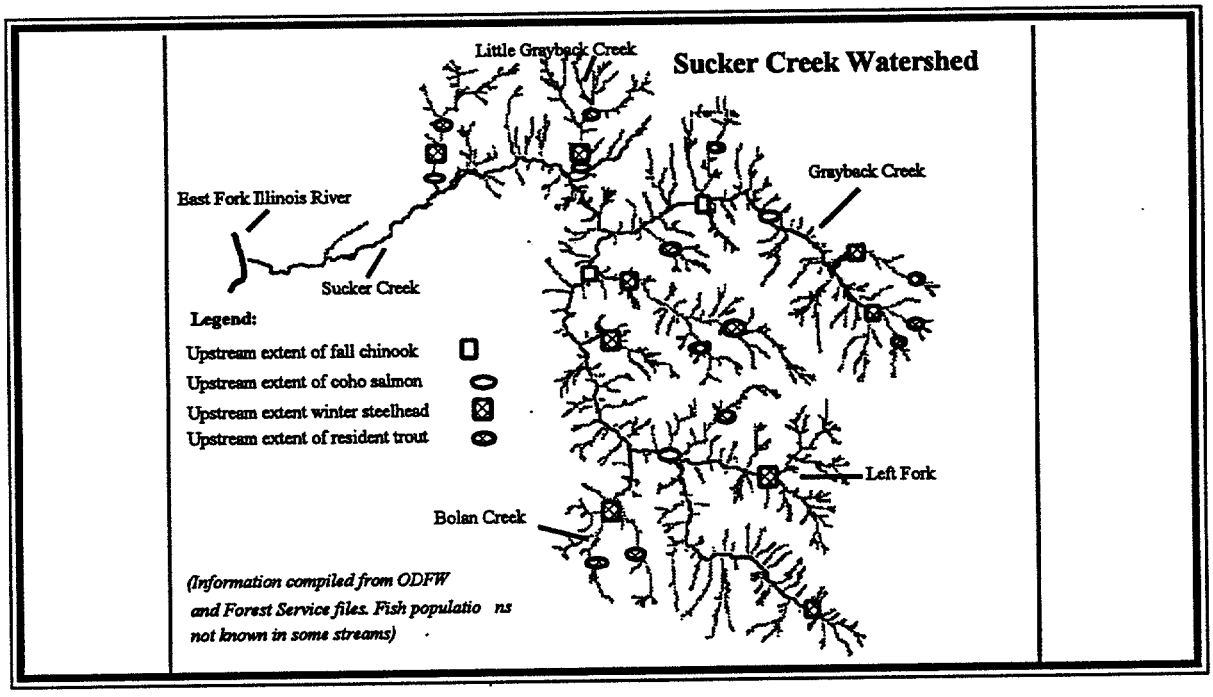
[3]Sub-lethal means that the water is too warm for salmonid fish to grow.

10. Fish Species, Distribution, and Population Trends

Anadromous and resident salmonid fish are native to the watershed. Anadromous species include: fall chinook (king) salmon, coho (silver) salmon, and steelhead trout. Resident salmonid species are: rainbow and cutthroat trout. Other native fish species found within the watershed include: Pacific lamprey and sculpin. Redside shiner and eastern brook trout are present but are not native to the watershed.

Figure 6 shows current anadromous fish distribution as observed during Forest Service and ODFW surveys. Rainbow trout are present in many tributary streams above and below the anadromous barriers. The trout have been planted in the high lakes in the watershed and the lower reaches of Grayback Creek. The extent to which planted stock has mixed with native stock is not known.

FIGURE 6. FISH DISTRIBUTION MAP.



The Oregon Department of Fish and Wildlife (ODFW) currently stocks Bolan Lake with rainbow trout. Rainbow used to be planted in East and West Tannen Lakes (Red Butte Wilderness), but not within the last few years. Historically, Bolan Lake was also stocked with Eastern brook trout. Eastern brook trout have been observed in the lower reach of Cave Creek in years past (USDA, 1972), but they have not been seen recently.

Cutthroat trout are present in the upper reaches of the watershed. Historically, cutthroat were well distributed in the lower reaches of Grayback Creek (Craig, 1994).

Sculpin have been observed in Sucker Creek to the confluence with the Left Fork, and in the lower reaches of Grayback Creek. Pacific lamprey are thought to be restricted to the alluvial reaches of both Sucker Creek and Grayback Creek. Redside shiner are well distributed in the lower reaches of Sucker Creek.

Population Trends

Salmonid populations have been declining for decades within the Illinois River Basin; the Grayback/Sucker watershed is no exception. Anadromous fish produced in the watershed are affected by downstream and ocean conditions, particularly fishing and predation. Lack of irrigation system screening affect downstream migrating steelhead trout. Habitat loss or modification throughout river systems affects spawning and rearing salmonids.

Coho salmon (1993), throughout the range of the species, and winter run steelhead (1992), throughout the Illinois River Basin, have recently been petitioned to the National Marine Fisheries Service for listing under the Endangered Species Act. Klamath Mountain Province steelhead trout have been proposed for listing as of March 1995.

Historically, the watershed was one of the most popular fishing areas in Oregon and a destination point for fly fishers. Tannen Lakes and Bolan Lake were also used for winter ice fishing. Today, due to declining populations, salmonid fishing is prohibited in the watershed, other than in Bolan and Tannen Lakes.

11. Other Aquatic-dependant Species

Several species of amphibians, reptiles, birds and mammals depend on the cool-water fish habitats described above. Riparian areas provide the link between aquatic and upland habitats. The human activities and natural processes that disturbed riparian areas, and degraded fish habitat, likely had detrimental effects on the other aquatic-dependent species. Species lists are available in the analysis files.

Macro-invertebrates in Sucker, Left Fork Sucker and Grayback Creeks were sampled in 1993 and 1994. No sensitive or rare species were present. Species collected in Sucker and Grayback Creeks are typical of cool (not cold) water streams that lack complexity. Several warm-water species are also present. Species collected in Left Fork Sucker Creek are typical of year-round cold-water habitats.

12. Terrestrial Ecosystem

The Grayback/Sucker watershed is located near the center of the diverse Klamath Province ecosystem. The habitat in the watershed is part of a link between the Cascade Range and the Siskiyou Mountains. This ecosystem provides habitat for a variety of species, including several sensitive and threatened species. For example, the largest concentration of northern spotted owls within the upper Illinois River is found in the watershed. The terrestrial ecosystem analysis focused on critical habitat components identified in the Siskiyou LRMP, as amended by the President's Forest Plan. Lists of known wildlife species in the watershed are available in the analysis files.

Habitat is created, modified, or eliminated by landscape disturbances. Fire, timber harvest, road building, agricultural clearing, and floods are the primary disturbance agents in the watershed. Timber harvest has reduced the size of individual forest stands, and their complexity (canopy layers, dead and down wood, etc.). Fire suppression has had an extensive effect than timber harvest by increasing vegetation densities (live and dead, standing and down) throughout the watershed. Road building allows light into dense forest stands and increases edge habitat. Agricultural clearing and floods have removed riparian forests (see Figure 3).

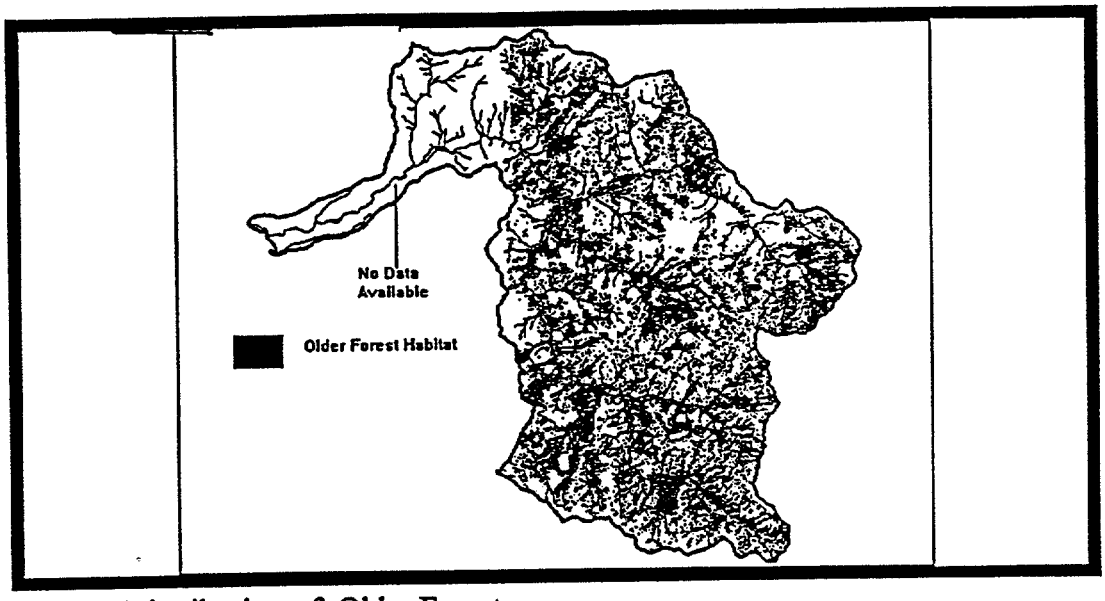
Many species are closely associated with older forest conditions. Much of the watershed has been allocated to Late-Successional Reserve (see Figure 2), with the primary purpose of providing current and future habitat for these species. The amount of older forest, and the spatial distribution (size and connectivity) of older forest stands affect how well the watershed can support these species. Figure 7 shows 1948 distribution of older forest, compared to current distribution.

Younger forest conditions also support a variety of species. Meadows, deciduous oak savannas, evergreen oak woodlands, younger forests and brushfields were maintained by wildfire and Native American burning (Atzet, 1979). These habitats are declining in the watershed. Disturbance is necessary to maintain these conditions.

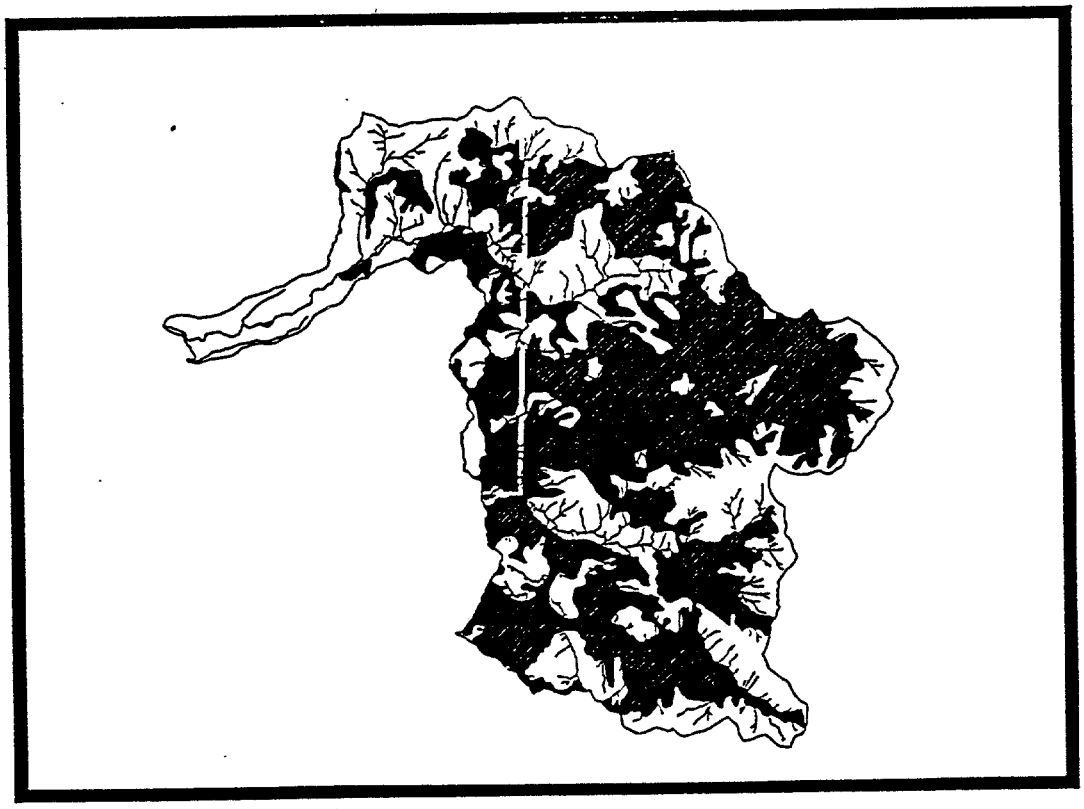
Individual large trees, snags and down wood are important to wildlife, whether they exist in older or younger stands. Clear-cuts do not provide as many large trees as burned-over stands of similar age, since wildfires tend to maintain some of the large trees in a stand. More trees are being retained in harvesting than in the past. President's Plan guidelines require that at least 15 percent of the acreage in harvest units be left uncut, as well as retention of forests in Riparian Reserves.

Figure 8 displays various forest characteristics and how they have changed since fire suppression and extensive timber harvest began in the watershed. It also predicts how they will continue to change given the President's Plan and continued fire suppression. The characteristics described here are considered vital to providing adequate habitat for the plants and animals in the watershed.

Figure 7. Current and Historic Distribution of Older Stands.



Current Distribution of Older Forest



1948 Distribution of Older Forest.

FIGURE 8. HABITAT COMPONENTS PAST, PRESENT AND TREND.

	Pre-1940	Present-Day	Trend[4]
Vegetation Density	Stands of all ages tend to be more open due to frequent, low-intensity burns.	Dense vegetation in unmanaged stands of all ages.	Stand densities increase in unmanaged stands. Higher risk of stand-replacement fire.
Overall Percent Older Forest	53% across the watershed.	35% across the watershed	Increasing percentage of older forest in Late-successional Reserves.
Size and Connectivity of Older Interior Forest Stands	Stands of older forest are large (up to 16,500 acres) and well-connected.	Older forest stands are smaller and more fragmented. Edge effects more acreage.	President's Plan allocations should increase the size of older forest stands and decrease edge effects.
Location of Older Forest	Lower elevation, north slopes, where less prone to stand-replacement fire.	Higher elevation sites that are less accessible.	Recovery of older forest in lower elevations.
Younger (Early Successional) Conditions	Meadows, brushfields and oak groves maintained by fire.	These habitats have been reduced by brush cutting and fire suppression	Future management will maintain these habitats through site specific prescriptions.
Riparian Areas	Riparian areas composed of older forest, even where adjacent upland stand is younger.	Riparian harvest and clearing in low elevation lands result in younger, alder-dominated stands.	Conifer stocking in riparian areas increases. Riparian areas provide dispersal and migration corridors.
Plant Species Composition	More shade-intolerant species associated with open forest conditions (pine, Douglas-fir).	Encroachment of shade-tolerant species (white fir, tanoak) as density increases.	Trend to shade-tolerant species with increasing vegetation density. Increased stress on forest health.
Trees, Snags and Down Individual Large Wood	Scattered throughout young and older forest habitats.	Denser in unharvested stands and reduced in harvested stands. Overall reduction in watershed.	Large snags, trees and down wood continue at reduced levels in harvested stands. Density increases (along with fuel load and fire hazard) in unmanaged stands.

[4]Trend predictions assume harvest levels consistent with the President's Forest Plan, vegetation density treatments, and continued fire suppression.

Core IDT Members

Jeff Walter - Team Leader (March - September 1994)
Peter Gaulke - Team Leader (October 1994 - February 1995)
Trish Carroll - Hydrologist (March - September 1994)
Cindy Ricks - Geologist (October 1994 - February 1995)
Rochelle Desser - Public Involvement/Writer-Editor
Randy Miller - Wildlife Specialist
Kellie O'Neill - Social Module Leader
Connie Risley - Hydrologist (October 1994 - January 1995)
Dave Vezie - Fish and Wildlife Leader
Chip Weber - Plant Ecologist

Key Support IDT Members

Jay Dunham - Bureau of Land Management Liaison
Sue Livingston - US Fish and Wildlife Service Liaison
Randy Frick - Fisheries Biologist, Siskiyou National Forest
Joel King - Forest Planner, Siskiyou National Forest
Joe Cornell - Geologist (Retired)
Ed Gross - Westside Soil Scientist, Siskiyou National Forest
Tom Atzet - Area Ecologist, Area 5, USDA Forest Service
Siskiyou National Forest GIS - Don Lyke, Debbie Kroeger, Stan Wedekind, Susan Dibble
Illinois Valley Ranger District GIS - Dorothy Garner, Valarie Graham
John Roth - Oregon Caves National Monument

Non-Agency Editor

Terrie Claflin

Cover Design

Paula Fong

For further information contact:

Illinois Valley Ranger District
26568 Redwood Highway
Cave Junction, OR 97523

The policy of the United States Department of Agriculture Forest Service prohibits discrimination on the basis of race, color, national origin, age, religion, sex, or disability, familial status, or political affiliation. Persons believing they have been discriminated against in any Forest Service related activity should write to: Chief, Forest Service, USDA, P.O. Box 96090, Washington, DC 20090-6090.

United States
Department
of Agriculture

Forest Service
Pacific
Northwest
Region

1995

Grayback/Sucker Pilot Watershed Analysis

Version 1.0

Siskiyou National Forest

April 1995

WATERSHED OVERVIEW

Social Setting

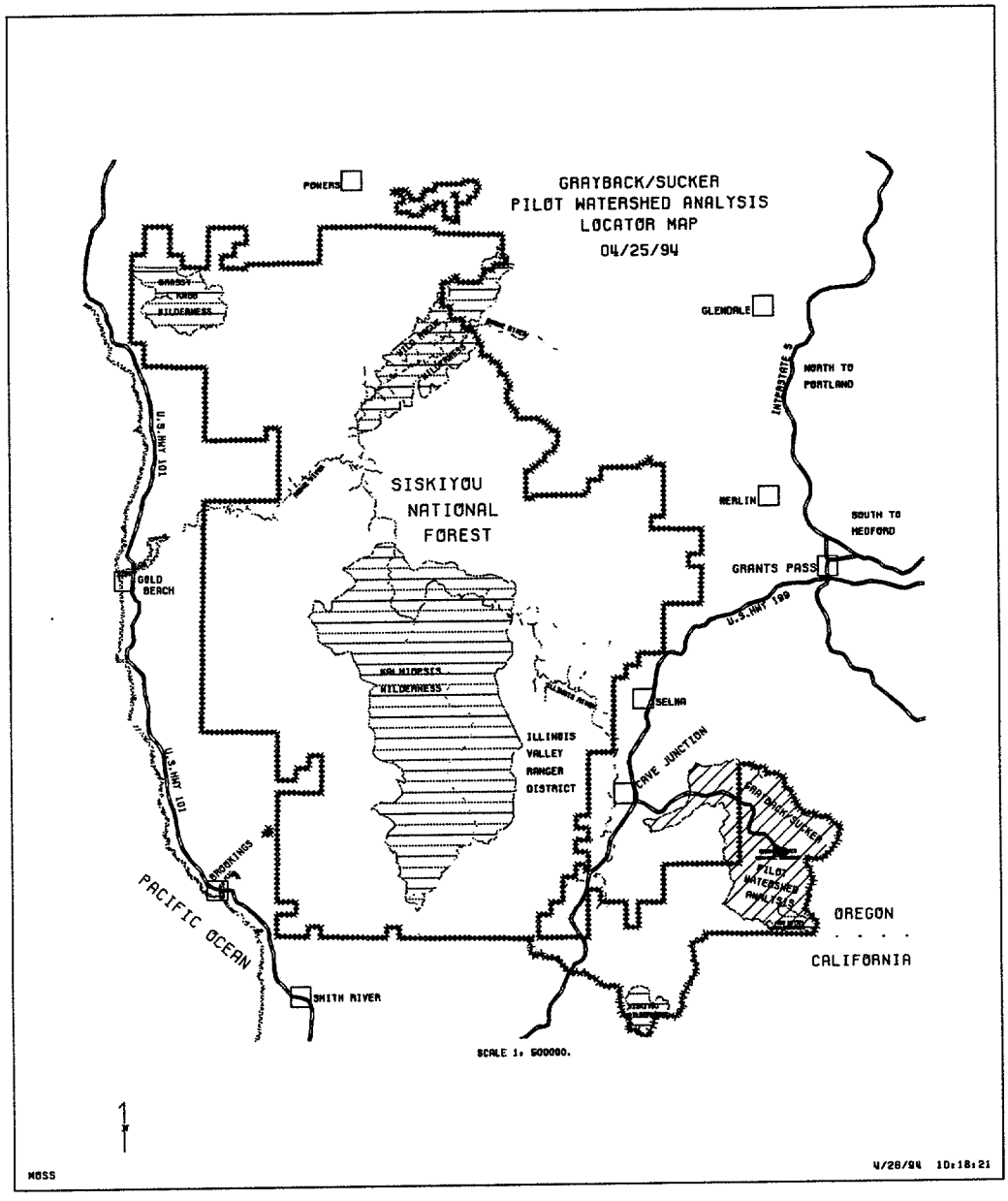
Historically, the Grayback/Sucker watershed has been the most important watershed on the Siskiyou National Forest for recreational use for dispersed and developed recreation sites. It began with dispersed use by local residents who traveled by horse or foot to the high lakes during the hot summer months. It then increased with the discovery of the Oregon Caves National Monument in the late 1800's, later, the demand began to shift from dispersed campsites to "comfortable" developed campsites. At present, this watershed has the highest use of and demand for developed campgrounds and facilities on the Siskiyou National Forest. Most of the developed use, as well as the dispersed use occur along watercourses, which have resulted in several issues surrounding the riparian habitat. Fishing was popular in Sucker Creek and Grayback Creek with early settlers.

Throughout historic times, several industries within the watershed have made significant contributions to the local economy. Early, in the historic period, gold mining on Sucker Creek produced millions of dollars for miners lucky enough to "strike it rich." The industry experienced several distinct eras, gradually declining in importance, particularly following World War II. Today, mining for gold still occurs along Sucker Creek, but its economic importance is less significant. For many miners, it is a "way of life"; it is the hard work and the outdoor living which is more important to them. In many cases, the amount of gold extracted in a day, or a week is too little for miners to depend on for an income. Several controversial issues surround mining. Most of these issues are related to the impacts of mining operations on the environment.

Conversely, the timber industry began slowly, mostly in support of the mining industry, providing timber for hydraulic mining ditches, flumes, and cabins. World War II marked the beginning of large scale timber extraction until just a few years ago, when harvest of northern spotted owl habitat was enjoined. Several social issues regarding timber harvest continue to prevail within the watershed. These include impacts to scenery, wildlife habitat and water quality; the loss of wildland; and indirect issues such as the effects on local employment. Timber harvest effects on wildlife and water quality are discussed in the Terrestrial and Aquatic Ecosystems documents.

Ranching has a long history, dating back to shortly after the arrival of miners. It experienced some fluctuation, but has remained relatively stable throughout historic times and present times. A portion of one Federally administered allotment can be found within the watershed. The allotment is managed by the Rogue River National Forest.

Figure 1 Grayback/Sucker Watershed Vicinity Map



Use of water in Sucker Creek also has a long history dating back to the earliest mining days when water was needed to operate hydraulic systems (monitors). Competition among miners and soon thereafter with ranchers downstream was only the beginning of what has become a major issue in the watershed. Today, existing water supplies remain inadequate to satisfy all the users within the watershed, and the restrictions put on water use have resulted in several more controversial issues, including the proposed Sucker Creek Dam project.

The mushroom industry is very new, having begun only in the past decade. In recent years, wild mushroom harvesting is an annual multimillion dollar industry with a large amount of harvesting occurring on National Forest lands in southern Oregon. It brings to the Illinois Valley Ranger District a sudden seasonal influx of migrant mushroom pickers during the month of November. Most mushroom picking on the Illinois Valley Ranger District takes place within the analysis area. Many potential conflicts are associated with mushroom picking throughout the Pacific Northwest. Some conflicts identified within the watershed include impacts to riparian areas and potential spread of Port-Orford- cedar root disease.

The trail system in the watershed evolved from aboriginal Indian trails. These trails were further developed by early settlers to serve isolated homesteads and mining areas. Following the creation of the Siskiyou National Forest in 1906, many administrative trails were developed primarily for fire protection purposes. As development of the area progressed, many miles of trails were replaced with administrative, mining and timber sale roads. Recreational use of the still existing trails has been growing and now constitutes the primary use of the trail system.

The Grayback/Sucker watershed is surrounded by several small communities in the Illinois, Rogue and Applegate watersheds (Josephine County, Oregon). A community assessment was done for the Applegate Valley (Preister, 1994); it reflects the general culture of the area. Four key cultural findings were discovered in the assessment:

> "...1) Valley residents have a strong land ethic . . . 2) Community discussions centered on oldtimer/newcomer themes . . . 3) The rural culture still works, which means, despite frequent comparisons between oldtimers and newcomers, relations of cooperation and support still predominate . . . 4) Caretaking systems are stretched to their limit. The community has been fragmented by the influx of new people and the decline of the agricultural and forest base."

The assessment reported that population growth in Josephine County grew by 6.4 percent between 1980 and 1990. The retirement community also grew, bringing money and stimulating service employment (especially medical). Employment related to wood products and manufacturing has declined steadily as trade and service employment has increased steeply.

Management Context

The Grayback/Sucker watershed is part of the Rogue River basin in the Oregon Klamath Physiographic Province (ROD, 1994). The Illinois River drains about 628,000 acres, or 20 percent of the 3.3 million acre Rogue River basin. Grayback/Sucker is about 62,000 acres (10 percent of the Illinois River basin). Ownership within the watershed is predominately Federal, with a smaller percentage of the land base held by private and industrial landowners, and county lands (See Figure 2). The Siskiyou National Forest Land and Resource Management Plan, as amended by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA, USDI, 1994), has created management allocations on Federal Lands within the watershed. These allocations define the type of management activities on Federal Lands (See Figure 3).

Physical Setting

Grayback and Sucker Creeks drain a 62,159 acre watershed located between the north-facing slopes of the Siskiyou Mountains and the Illinois Valley. Lower Sucker Creek flows within the broad Illinois Valley, and its upper reaches occupy narrow valley floors and canyons. The eastern and southern headwaters begin at rocky peaks, such as Grayback Mountain and Tannen Mountain. Elevations range from 1400 feet at the mouth of Sucker Creek to 6000 and 7000 feet on the divides.

The current climate is characterized by moist and cool winters with warm and dry summers. Average precipitation generally increases with elevation, from 50" on the valley floor to 80" near Bolan Peak. It falls predominantly as rain below 2500' elevation, alternating rain and snow from 2500' to 4000', and winter snow pack above 4000'.

The watershed of Grayback Creek contributes about one quarter of the total drainage area to Sucker Creek before it flows through the Illinois Valley and into the East Fork of the Illinois River.

Vegetation species and associations reflect plant migrations in response to climate change. During the last 10,000 years, temperatures were cooler and precipitation greater than at present. This may have allowed conifers to grow on south-facing slopes where conifer reproduction is now difficult. There have also been other fluctuations that have occurred during this time period

Grayback/Sucker Watershed is located near the geographic center of the Klamath Mountains geologic province. These rocks were added to the edge of the continent by plate tectonics over millions of years. The Triassic (over 190 million years old) Applegate Group includes

metamorphosed volcanic and sedimentary rocks. At the Oregon Caves National Monument, subterranean passages (caves) have been eroded into deposits of marble by ground water. The marble is part of a long, narrow band of metasedimentary rocks that extend through the area for about 5 miles. Other exposures of marble are found near the Monument and at least two or three places in upper Sucker Creek. Numerous small lode gold mines and extensive placer deposits have been mined in Sucker Creek, where the Applegate Group contains the mineralization.

Granitic rocks intruded the Applegate Formation about 150 million years ago. The granitics mainly occur along the eastern boundary of the watershed within a rock body known as the Grayback Pluton. The largest area of serpentinite occurs on the middle reach of Grayback Creek and encompasses about two square miles. This area has thicker soil and supports more vegetation than most serpentine areas.

The relatively warm, humid climate promotes deep weathering of bedrock to soils. Soils derived from the metamorphic rocks generally have more rock fragments than soils derived from granitics. Where granitics are weathered to sandy soils, they are subject to surface erosion as well as landslides.

Steep slopes, narrow canyon bottoms, and incised streams are products of glacial processes and of geologically recent and possibly continuing regional uplift. Nearly two million years of intermittent glaciation dramatically changed the landscape. At times, precipitation was perhaps several times as great as that of present, and rates of surface erosion and landsliding increased. Glaciation denuded the higher elevations of soil, exposing the rock ridges and peaks along the eastern edge of the watershed.

River deposits along lower Sucker Creek range from 10 feet to more than 100 feet deep and bedrock is generally not exposed in the stream beds. Grayback Creek flows in alluvium downstream of Mossback Creek. Active flood plains that are inundated more-or-less annually are present along lower Sucker Creek. Both Sucker and Grayback Creeks have more narrow, incised middle reaches. Upland basins are present in the headwater reaches of Sucker and Grayback Creeks. These have more gentle stream gradients and broader canyon bottoms than the narrow reaches downstream.

The peaks and high ridges of the east and south boundaries range in elevation from 5000 to over 6000 feet. The high ridges are very rocky with thin soils. They are snow-covered for several months each winter, but no permanent snow fields or glaciers are present. There are about a dozen glacial cirques (rock basins carved by mountain glaciers) of varying ages. The three youngest-appearing cirques are occupied by Bolan Lake and the Tannen Lakes, which are small lakes (tarns) ponded behind the moraines. The older glacial basins that no longer have lakes, and other high elevation sites have numerous meadows and water seeps. Seeps, bogs, and fens are mostly high-elevation features where shallow soil, snow melt, and rainfall provide year-round

water for springs and water-loving vegetation.

Several ancient landslides were formed during a wetter climate, and may have been triggered by subsequent earthquakes. A few large debris slumps or slides have confined stream channels in the watershed, creating local reaches with lower gradients and sediment deposition. Ancient earthflows are masses of soil and decomposed rock that became wet enough to slowly flow. Sagponds are common on these large features.

Biological Setting

The Rogue River Basin is part of the Oregon Klamath Terrestrial Ecosystems Physiographic Province (ROD, April 1994). The Rogue River Basin is approximately 3.3 million acres in size. The Oregon Department of Fish and Wildlife (ODFW) considers the Rogue River Basin the most productive anadromous fish basin in the State outside the Columbia River Basin. Moreover, the Illinois River Sub-Basin is presently thought to contain 75% or more of the total wild Coho Salmon escapement in the Rogue River Basin. Both the Grayback Creek and Sucker Creek Watersheds are Tier 1 Key Watersheds (ROD), which presently serve as refugia for aquatic biological diversity.

The Illinois River Sub-Basin is approximately 628,000 acres. The Grayback/Sucker Watershed includes about 10 percent of the Illinois River Sub-Basin and is located near the geographic center of the physiographic province. Both the fauna and flora within the sub-basin reflect one of the more biologically diverse regions of western North America. The sub-basin provides habitat linkage with the California Klamath Terrestrial Ecosystems Physiographic Province.

The fauna and flora within the analysis area are representative of the lower-middle portion of the River Basin. Much of the sub-basin flora reflects the unique geology of the Klamath Geologic Province. Many rare plant species within the river basin are commonly associated with serpentine geology. This serpentine geology, although relatively common within the sub-basin, is not as extensive within the Grayback/Sucker watershed.

Biologically important aquatic and riparian habitat-dependant species inhabiting both the sub-basin and the Grayback/Sucker Watershed includes: fall chinook salmon, fall coho salmon, winter steelhead trout, coastal cutthroat trout and other aquatic or wetland dependent species.

Biologically important terrestrial habitat-dependant species include: northern spotted owl, Del Norte salamander, and western big-eared bat. The largest concentration of northern spotted owls within the upper Illinois River Sub-Basin is contained within the watershed.

The forested portion of the watershed has a mixture of conifers and hardwoods with a ground cover of forbs, grasses and shrubs. The composition and structure of vegetation in the watershed are influenced by a diverse physical environment with variable soils, topography, and climate and by disturbance history. Important disturbances include fire, insect and disease, flood, and windthrow.

The vegetation is classified into plant series, which are aggregations or associations of plants dominated by a specific climax species. There are six plant series in the Sucker/Grayback watershed. The Port-Orford-cedar, Shasta red fir, and Jeffrey pine series are minor components of the forested landscape. The majority of the vegetation is in the white fir, tanoak and Douglas-fir series. Port-Orford-cedar root disease has infected stands in the watershed. Individual stand densities in the watershed have been increasing since the advent of fire exclusion practices.

Summary of Recommended Monitoring Points

Monitoring is fundamental to resolving analytical uncertainties and understanding how management affects ecosystem response. Monitoring is considered to be an extension of watershed analysis, rather than an afterthought. Monitoring results will inform future updates or revisions to watershed analysis as well as help link watershed analysis to site analysis and project planning and design.

Aquatic Monitoring

(1) Continue annual summer snorkel surveys, established in 1992, within the presently identified Critical Reaches (Grayback Creek and Left Fork Sucker Creek).
(2) Establish additional critical reach on the lower gradient segment of the main-stem of Sucker Creek above the confluence with Bolan Creek. Snorkel survey on annual basis.
(3) Maintain adult spawning survey established on both Sucker Creek and Grayback Creek in winter of 1994.
(4) Conduct USFS R-6 Level I & II Stream Inventories, established in 1987, on a 10-year return cycle.
(5) Establish a smolt trap on the lower reach of Sucker Creek. Monitor to determine annual relative abundance of down stream migration.
(6) Continue to monitor and maintain all existing habitat improvements (e.g., log weirs with pool).
(7) Remeasure cross-sections (established in Grayback Creek in 1994), after each peak streamflow that equals or exceeds a five-year return frequency. Establish cross-sections in Sucker Creek, within Reaches 2B and 3, and at bridges.
(8) Continue periodic stream water temperature and low flow measurements at critical

Terrestrial Monitoring

(1) Distribution and abundance of structural stage patch sizes, connectivity, and proportions of younger to older forest habitats.
(2) Distribution and abundance of riparian areas, meadows, deciduous oak/pine savannas, evergreen hardwoods, big trees, dead wood, PETS species, and Survey and Manage species.
(3) Current measurements of habitat fluctuations and wildlife/plant population dynamics.
(4) The relationship between wildlife reserve tree standards and guidelines and post implementation results.

Recommended Supplement Criteria

Watershed analysis is an iterative process, not an endpoint. This watershed analysis will be updated and revised if and when substantial new issues come forward, when important new information becomes available, or when significant changes in watershed conditions occur. The following is a list of recommended supplement criteria and is not considered to be an exclusive list.

Terrestrial Criteria

(1) Improved accuracy of structural/successional condition data will trigger supplements to analysis that is based on this information. Structural/successional condition data is the foundation for most terrestrial analysis conducted (e.g., spotted owl habitat condition, relationship each watershed analysis area has with presettlement range of variability for structural condition and big trees, and the condition each plant series is in relative to structural condition).
(2) Improved accuracy of structural/condition data will allow mapping of existing older forest habitat connection and large interior patches. This data will also allow mapping of potential future connections and large patches of older forests that can be developed from areas where younger forests currently exist.

Aquatic Criteria

(1) Increased numbers or intensity of disturbance on placer mining claims.
(2) Wildfire, burning on sensitive soils, across debris flow headwalls, or into perennial stream riparian reserves.
(3) Earthquake large enough to trigger landslide activity.

Acronyms Used

FEMAT - Report of the Forest Ecosystem Management Assessment Team
FSEIS - Final Supplemental Environmental Impact Statement
CCC - Civilian Conservation Corps
NOAA - National Oceanic and Atmospheric Administration
NPS - National Park Service
ODFW - Oregon Department of Fish and Wildlife
ODWR - Oregon Department of Water Rights
POC - Port-Orford-cedar
REAP - Regional Ecosystem Assessment Program
ROD - Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl
ROS - Recreation Opportunity Spectrum
RRNF LRMP - Rogue River National Forest, Land and Resource Management Plan (Rogue River Forest Plan)
RVD's - Recreation Visitor Days
SCS - Soil Conservation Service (Currently known as the National Resource Conservation Service)
SNF LRMP - Siskiyou National Forest, Land and Resource Management Plan (Siskiyou Forest Plan)
USFS - United States Forest Service
USGS - United States Geological Survey
WAA - Watershed Analysis Area (Smaller drainages delineated in the Siskiyou Forest Plan used for ecosystem analysis. Usually 500-2500 acres.)

Core IDT Members

Jeff Walter - Team Leader (March - September 1994)
Peter Gaulke - Team Leader (October 1994 - February 1995)
Trish Carroll - Hydrologist (March - September 1994)
Cindy Ricks - Geologist (October 1994 - February 1995)
Rochelle Desser - Public Involvement/Writer-Editor
Randy Miller - Wildlife Specialist
Kellie O'Neill - Social Module Leader
Connie Risley - Hydrologist (October 1994 - January 1995)
Dave Vezie - Fish and Wildlife Leader
Chip Weber - Plant Ecologist

Key Support IDT Members

Jay Dunham - Bureau of Land Management Liaison
Sue Livingston - US Fish and Wildlife Service Liaison
Randy Frick - Fisheries Biologist, Siskiyou National Forest
Joel King - Forest Planner, Siskiyou National Forest
Joe Cornell - Geologist (Retired)
Ed Gross - Westside Soil Scientist, Siskiyou National Forest
Tom Atzet - Area Ecologist, Area 5, USDA Forest Service
Siskiyou National Forest GIS - Don Lyke, Debbie Kroeger, Stan Wedekind, Susan Dibble
Illinois Valley Ranger District GIS - Dorothy Garner, Valarie Graham
John Roth - Oregon Caves National Monument

Summary of Management Recommendations and Opportunities,

MANAGEMENT RECOMMENDATIONS

"Management Recommendations" are recommendations for programmatic direction. They are intended to provide the Purpose and Need for project level development, and not site-specific guidance.

EXISTING CONDITION & TRENDS	OBJECTIVE	LOCATIONS	RECOMMENDATION	TIE TO WATERSHED ANALYSIS
Areas adjacent to streams vary as to how well they provide for objectives of aquatic conservation strategy.	Meet Aquatic Conservation Strategy Objectives for riparian areas.	Riparian Reserves dispersed through entire Watersheds.	Leave reserve widths as they stand. Decision to enter is project specific and site specific. Most of the potentially unstable debris flow sites will be contained within the Interim Riparian Reserves at the heads of intermittent streams.	T11, T21, T24, A14-17, A23, A26-27
Fire regime has been altered from frequent low intensity to infrequent high intensity fires. Areas are currently predisposed to high intensity stand replacement events. Continued fire suppression exacerbates this condition.	Reduce risk of high intensity fire that threatens high value resources.	Entire Watershed.	Restore fire regime or fuel profile to prefire conditions.	T7, T16-21
Dense stands reduce penetration and storage of snowpack. This may affect late season flows and adversely impacts anadromous fishery. Large openings also reduce late season snowpack through accelerated melting.	Increase penetration and storage of snow.	North and east facing slopes above 4500 feet elevation are highest priority. Other high elevation areas are important also.	Consider treatments at high elevation to reduce interception and storage of snow. Emphasize thinnings combined with small openings.	T20, A8, A21

EXISTING CONDITION & TRENDS	OBJECTIVE	LOCATIONS	RECOMMENDATION	TIE TO WATERSHED ANALYSIS
Highest proportion of unmanaged stands are currently in the 50-100 year old age/size class. Stand age and size class distribution in managed areas are shifting toward older forests due to fire suppression.	Restore a balance of presettlement habitat conditions.	Dispersed watershed-wide (LSR & Matrix).	Preference for treating stands in the mid age/size class. Use thinnings to promote development of healthy older stands and regeneration harvest to shift acres toward young age classes. Consider use of prescribed fire.	T6-7, T10-11
Existence of unnatural patterns of landscape scale. (Seral/structural condition, fragmentation of older forests)	Maintain natural range of patch sizes for older and younger forest habitats, particularly large interior older forest patches	Older forest habitats, along perennial streams, low on slope, and north aspects. Younger forest habitats, upper slopes, especially south aspects	Minimize fragmentation of older forest patches caused by stand replacement fire or harvest. Restore natural patterns by increasing size of some younger forest habitat openings.	T8,T12,T17,T21,T26
Lack of connectivity between older forest habitat.	Maintain the watershed's contribution to species diversity and viability by restoring the natural connectivity of older forest habitat	Older forest habitats, along perennial streams, low on slope, and north aspects. Younger forest habitats, upper slopes especially south aspects	Minimize fragmentation of older forest patches caused by stand replacement fire or harvest. Restore natural connectivity by scheduling harvest to create and maintain connected habitat for future older forest habitat needs.	T8,T12,T17,T21,T26
Deciduous oak woodlands and meadows have been reduced from natural conditions and size.	Maintain the watershed's contribution to species diversity and viability by protecting and restoring deciduous oak woodlands and meadows throughout watershed.	Where they currently occur and adjacent to where they occurred naturally.	Consider treatments to manually reduce encroachment and maintain with controlled burn. Address trend in LSR Assessment.	T9,T14,T19,T23,T26
Woody hardwood brush fields and smaller tree habitats are at reduced levels in younger forest habitats	Maintain the watershed's contribution to species diversity and viability by maintaining hardwood dominated habitats.	Younger forest habitats including managed stands	Manage for natural range and distribution and abundance of hardwood dominated habitats.	T10,T14,T23,T26

EXISTING CONDITION & TRENDS	OBJECTIVE	LOCATIONS	RECOMMENDATION	TIE TO WATERSHED ANALYSIS
Large trees (hardwoods and conifers) are at reduced levels in managed stands	Maintain the watershed's contribution to species diversity and viability by increasing the frequency of occurrence of large trees	Entire watershed emphasizing managed stands including Riparian and Late Successional Reserves.	Use silvicultural techniques to emphasize the development of large individual trees.	T10,T14,T19,T24,T27
Dead wood (snags and down wood) are at reduced levels in managed stands.	Maintain the watershed's contribution to species diversity and viability by providing a diversity of habitats.	Entire watershed emphasizing managed stands including Riparian and Late Successional Reserves.	Develop strategies to create snags and down wood adjacent to managed stands in the short-term and managed stands in the long-term.	T10,T14,T15,T19,T24, T27
Disturbance to wildlife by humans is higher than natural conditions	Minimize disturbance of wildlife by humans during critical time periods (e.g. breeding season).	Where the management emphasis is on PETS and/or game species.	Seasonal and/or permanent road closures. Conduct management activities outside of breeding season, or other critical seasons where possible.	T15,T16,T20,T25,T27
Development of side channels on valley floors is restricted by human activities. Few valley floor riparian forests with large trees remain.	Maintain and restore floodplain inundation and riparian forest composition and structure supplying large wood. (Aquatic Conservation Strategies #7 & 8)	Highest quality valley floor riparian forest at Grayback Campground.	Restore existing and design new recreational facilities to (1) accommodate delivery of large wood and nutrients to current and future channels (i.e. retain hazard trees), (2) allow flooding and scour development of side channels. Restore function where any past bank stabilization measures have discouraged side channel development.	A16
Some ancient slide deposits are adjacent to stream channels.	Maintain sediment regime. (Aquatic Conservation Strategy #5)	Channel reaches confined by ancient debris slides/slumps (as shown on landform/landslide map).	Review sites proposed for mining operations and placement of habitat improvement structures to ensure stream flow direction does not erode these deposits.	A14

EXISTING CONDITION & TRENDS	OBJECTIVE	LOCATIONS	RECOMMENDATION	TIE TO WATERSHED ANALYSIS
Channel form has been simplified by wood removal and past mining disturbances, leading to increased velocity stream flow.	Maintain and restore physical integrity of aquatic system and instream flows. (Aquatic Conservation Strategies #3 & 6)	Particularly in Sucker Creek Reach 2B.	(1) Discourage activities under mining operation plans that reduce structure and channel roughness. (2) Mitigate mining operations by increasing structure and channel roughness where appropriate (as identified by a hydrologic analysis).	A24
Large wood supply has been reduced in riparian areas. Because Port-Orford-cedar wood decays more slowly, it is particularly valuable for restoring channel structure.	Maintain and restore species composition in riparian areas. (Aquatic Conservation Strategy #8)	Where Port-Orford-cedar is present in riparian areas.	Design reserve widths and treatments to maintain and restore microclimates favored by Port-Orford-cedar.	A16
Oregon Caves viewshed is in a Heavily Altered condition, does not meet Siskiyou"Forest Plan" Standards & Guidelines, and is unacceptable to a large segment of the public.	Restore or maintain a Natural Appearing (Retention VQO) to Slightly Altered (Partial Retention VQO) Forest setting. (LRMP MA12 & 13)	Within the Oregon Caves Viewshed, and along Caves Highway and Grayback Road.	Conduct scenic analysis for all activities which may effect the visual quality of the viewshed.	S8,S20,S21
Views as seen from Mt. Elijah have been affected by timber harvest. Future harvest will likely impact the scenery in Matrix lands.	Maintain foreground, and middle ground scenic views as scene from Mt. Elijah and other viewpoints along the divide.	On Matrix lands within the Horse Mountain Viewshed or Sucker Creek drainage.	Complete visual cumulative effects assessment of potential timber harvest removal.	S17,S18

EXISTING CONDITION & TRENDS	OBJECTIVE	LOCATIONS	RECOMMENDATION	TIE TO WATERSHED ANALYSIS
There exists a conflict between desired public activities and the riparian resource. Use of and demand for dispersed and developed recreation has increased and will continue to increase for sites near water. Under the Record of Decision, riparian protection measures are required for these sites. Accurate public use and preference will need to be determined before management implements changes in the riparian area.	Inform recreation users about watershed conservation and restoration.	Focus on high risk (POC) areas, and riparian habitats.	Implement environmental education and interpretive programs for forest visitors, through the Illinois Valley Visitor Center, the Oregon Caves National Monument, and/or campground hosts. Forest users will need to be educated if certain uses can no longer be provided.	S5,S10,S15,S16
Availability of riparian biological resource is limited and uses of and demands for dispersed and developed recreation have increased and will continue to increase for sites near water. Under the Record of Decision, riparian protection measures are required for these sites. Accurate use and preference will need to be determined before management implements changes in the riparian area.	Determine accurate use and preference of dispersed and developed recreation.	The entire watershed	Design a survey or questionnaire that focuses on constituent expectations, desires or preferences. Forest users will need to be educated if certain uses can no longer be provided.	S5,S10,S15,S16

OPPORTUNITIES

"Opportunities" are intended to guide project level activities. They are intended to provide the purpose and need for project definition and are not designed to be site-specific.

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS	TIE TO WATERSHED ANALYSIS
Large conifers are lacking in some riparian areas and they are needed for shade and structure.	Encourage growth of riparian shading vegetation, particularly large conifers, to decrease stream water temperatures for aquatic depended species. Maintain and restore water quality (i.e. instream temperatures). (Aquatic Conservation Strategy #4)	(1) Shade-enhancing activities will have the greatest effect on south banks, for example in Tiger Springs area. (2) Areas along Sucker Creek that were stripped to bedrock or piled with boulders during mining activities. (3) Lower Sucker Creek where riparian shade is lacking (see Riparian Condition Map). (4) Along Grayback Creek where disturbed riparian forests are growing back with mixed conifers and hardwoods.	(1) Replant areas lacking conifers growing in riparian reserve. (2) Release or thin young trees (conifers) with competition from hardwoods or dense conifers. (3) Thin stands overstocked with small merchantable conifers. (4) Limited type conversion of hardwood dominated areas to conifers. (5) Establish microsites which collect organic matter and soil in areas denuded of vegetation where plantable soil is lacking. (6) Placer mine reclamation including plant conifers in areas where they are likely to survive and provide shade. (7) Field map to determine if revegetation can be enhanced. (8) Promote cooperative agreements with private landowners to plant and protect riparian shade trees. (9) Field inventory stands to determine if growth would be enhanced by thinning, fertilization, or planting.	T8, T11, T21, A16, A27, A35

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS	TIE TO WATERSHED ANALYSIS
High density stands are susceptible to large scale losses from disease, insects and drought. Mortality rates are increasing and accumulation of dead material increases susceptibility to stand replacement fire. High vegetation densities result in lower spring/summer water yields as vegetation quickly utilizes soil water.	Reduce stand densities to increase vigor and reduce susceptibility to large scale losses. Remove fuels to reduce fire hazard. Decrease vegetation densities to increase available water.	Watershed wide, based on stand conditions. In and around patches of mid and late successional habitat, particularly those with interior forest attributes. (See Patch Analysis Map)	(1) Thinning with removal or treatment of fuels. (2) Prescribed fire.	T10-11, T16, T23-24
Shift toward mid and late successional stands, increasing stand densities and preferential harvesting have resulted in decline of ponderosa and sugar pine	Maintain species within Presettlement ranges at all elevations. Regrow or maintain large pine throughout the watershed.	High elevation undisturbed sites and lower elevation harvested areas throughout the watershed.	(1) Continue to favor these species in management of plantations and in selection of leave trees during harvest operations. (2) Encourage replanting of pine on all ownerships. (3) Maintain openings around pines through thinning or fire.	T16-19, T22
Competition from hardwoods and conifers is slowing development of young stands.	Accelerate growth and development of young stands toward late seral or old growth conditions.	Plantations and young natural stands in LSR's. Highest priority are those adjacent to late seral or old growth patches where development of these characteristics will reduce fragmentation.	(1) Thinning and release of young stands. (2) Fertilization.	T7-1-, T16, T22-23
POC comprises a substantial percentage of the overstory in some riparian areas contributing to shade and structure. Risk of infection is high where stands are adjacent to roads or other human activity centers.	Lower the risk of infection.	Listed in POC Analysis document. Generally areas with greater than 20 percent of the overstory comprised of POC which are adjacent to roads.	(1) Close roads during the wet season. (2) Decommision roads. (3) Remove host along roads which are kept open. (4) Isolate infection centers by removing adjacent host.	T11-12

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS	TIE TO WATERSHED ANALYSIS
Channel form has been simplified by wood removal and past mining disturbance, leading to increased velocity stream flow.	Maintain and restore physical integrity of aquatic system and instream flows by increasing structure and channel roughness. (Aquatic Conservation Strategies 3 & 6)	Where channel has been simplified by wood removal and mining disturbance (e.g. Sucker Creek Reach 2B)	(1) Perform hydrologic site analysis to determine locations to place large wood or boulders. (2) Promote growth of riparian forest (see shade objective above.) (3) Reconnect side channel habitats.	A24
Recent mining has altered channel form making some sites vulnerable to accelerated bank erosion at high stream flows.	Maintain and restore physical integrity of aquatic system and instream flows. (Aquatic Conservation Strategies #3 & 6)	Site in Sucker Creek Reach 2B where mining-related sediment appears to have been placed in the active channel (Aerial photo 186-155)	Perform site analysis and reclamation	A24
Fire regime has been altered from frequent low intensity to infrequent high intensity fires. Areas are predisposed to high intensity stand replacement events. Continued fire suppression exacerbates this condition.	Reduce surface erosion from storms following catastrophic fires. Maintain and restore water quality (i.e. low turbidity and the sediment regime). (Aquatic Conservation Strategies # 4 & 5)	Where fire risk factors are high on sensitive soils. Urban interface, Oregon Caves Monument area, high density LSR stands, interior habitat patches, conifer stands with developed hardwood understories.	(1) Creation and maintenance of fuel breaks around key areas. (2) Thinning of stands to reduce fuel ladder and increase fire tolerance. (3) Understory removal or underburning to reduce ladder fuels. (4) Long term maintenance through prescribed fire. (5) Prescribed natural fire in wilderness or other reserves.	T17-20, A14

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS	TIE TO WATERSHED ANALYSIS
Some roads are contributing higher than natural rates of sediment to stream channels.	Maintain and restore water quality (i.e. low turbidity and the sediment regime) by reducing rill and gully erosion from road drainage interception. (Aquatic Conservation Strategies #4 & 5)	(1) At "Shotgun" culverts, particularly in sensitive soils, identified from road logs. (2) Along road segments with inadequate spacing of drainage outlets identified from road logs. (3) Sites where quarries, landings, tractor yarding, and fire lines intercept drainages (see map and list)	(1) Outslope roads. (2) Rip and hydrologically decommission roads. (3) Decrease spacing of road drainage outlets. (4) Revegetate fillslopes. (5) Winter Closures.	A14
Some roads cross streams, expanding the length of the stream drainage network by road ditches. Peak flows may be increased, and low flows may be decreased.	Maintain and restore instream flows, protect timing, magnitude, duration, and spacial distribution of peak, high, and low flows. (Aquatic Conservation Strategy #6)	Locations to be identified pending analysis of increased drainage distance along roads at stream crossings.	(1) Decrease drainage distance between outlets where soils can promote reinfiltration. (2) Hydrologically decommission roads	A21
Debris flows may not deliver large wood to channels where they are intercepted by roads.	Maintain and restore connectivity within watersheds, providing physically unobstructed routes. Maintain and restore the sediment regime, including character of sediment input. Retain patterns of wood routing. (Aquatic Conservation Strategies #2, 5, 6)	Sites with a high probability of debris flows, such as along Roads 4612080, 4612540, and 4612098.	(1) Redesign road crossings to allow debris flow passage. (2) Hydrologically decommission roads and remove crossings.	A16

EXISTING CONDITION & TRENDS	OBJECTIVE	PRIORITY LOCATIONS	TREATMENT OPTIONS	TIE TO WATERSHED ANALYSIS
Some roads have stream crossings where plugged culverts may divert water down the road during storms, eroding new channels.	Maintain and restore water quality (i.e. low turbidity and the sediment regime). (Aquatic Conservation Strategies #4 & 5)	(1) Road crossings that failed during the 1964 storm (see map and list). (2) Road crossings with diversion potential within sensitive soil types.	(1) Field inventory diversion potential (priority in sensitive soil types). (2) Provide armored diversion paths and adjust grade. (3) Hydrologically decommision roads and remove crossings. (4) Increase culvert capacity to reduce plugging.	A14
Some road fill are not stable and may fail during storms.	Maintain and restore water quality (i.e. low turbidity and the sediment regime). (Aquatic Conservation Strategies #4 & 5)	Sites tentatively identified on aerial photographs (see map and list). Prioritize by delivery potential.	(1) Geotechnical stabilization. (2) Sidecast fill pullback. (3) Revegetation. (4) Hydrologically decommissioning of roads.	A14
Reduced aquatic habitat complexity.	Increase aquatic habitat complexity (carrying capacity).	All fish bearing streams.	(1) Placement of brush bundles and/or other cover materials in existing pools. (2) Increase frequency of pool occurrence in lower gradient reaches using large wood or boulder placement.	A35, A38

Findings

A Finding is knowledge which was generally unknown or has been confirmed through watershed analysis. Findings are facts which are reasonable inferences based upon all the relevant information.

(1) The area negatively affected by Phytophthera lateralis is a minor component of the overall riparian system.

(2) Quantities of standing and down dead wood were found to be higher in unmanaged, mid and late seral stands in Grayback/Sucker Creek ecosystem than current direction requires to be left during harvest activities.

(3) BLM and Northern California vegetation/habitat maps and databases are not compatible as well as hardware limitations preventing use of large data files.

(4) The amount of area in meadows and deciduous hardwood habitats is declining due to vegetation encroachment and site conversions to agricultural or timber lands.

(5) Natural lakes, ponds, and wet areas, at some locations, have been degraded by agricultural development on private lands and timber harvest activity.

(6) Changes in channel morphology, such as aggradation, may change the amount of water available for fish habitat even if the amount of flow at the gage remains constant. There are areas were changes in channel morphology, including aggradation, are adversely affecting fish habitat even though flow downstream remains constant.

(7) There is no accounting of how much withdrawal of water on Sucker Creek is actually available as return flow to the stream, or how much is actually withdrawn and consumptively used.

Summary of Data Gaps

Aquatic Data Gaps

(1) The volume of flow leaving Sucker Creek in relation to the amount of flow in the Illinois River. Because the flow decreases from the Sucker Creek gage to the mouth, this information cannot be derived from the gage record.

(2) Extent of 1964 flood aggradation and channel widening on the Lower Sucker floodplain. Rate of recovery and extent of disturbance of channel

morphology by annual water diversion (the 1963 M-JOS photo set has good coverage, but need to interpret a post-1964 set such as the 1989 color infrareds).

(3) The capacity and diversion potential of culverts.

(4) Estimates of the distance of increased drainage due to road densities that may contribute to increased peak flows, i.e., artificially increased "Drainage density."

(5) Comparisons of channel cross-sections using historic bridge surveys (records not yet located) to document channel adjustments following aggradation from the 1964 flood.

(6) Movement rates of earthflows in the watershed.

(7) The extent of channel incision or expansion in high elevation meadows and seeps related to adjacent to harvest and roads.

(8) The effect of tree cover on snow avalanche generation, including effects of stand-replacing fires.

(9) Potentially unstable areas within the ancient earthflows and slump/debris slides will need to be mapped in order to delineate Riparian Reserve boundaries.

(10) Species specific phenology (Timing of Spawning, Smoltation, etc.) relative to human water uses (i.e,. water withdrawal and physical diversion barriers in lower segment of Sucker Creek).

(11) Annual adult escapement information for anadromous fish within the watershed.

(12) The site-specific range of natural variability for aquatic habitat carrying capacity attributes (pools per mile, large wood per mile) within the watershed.

Terrestrial Data Gaps

(1) Existing condition of riparian stand structures, particularly with respect to large tree component. Natural range of habitat variability.

(2) Filed verified intermittent stream Riparian Reserves and the stand structure associated with them.

(3) Habitat information across administrative and ecological boundaries. Integration of province based databases.

(4) Skid trails have not been sampled for their compaction and infiltration effects in the field.

(5) Historic hardwood distribution and abundance.

(6) Compatible habitat and species location databases or the ability to integrate databases between agencies responsible for managing lands in the Grayback/Sucker Creek ecosystem.

(7) Structural/successional condition map (Provincial, Southwestern Oregon, and Northern California) and database with common attributes for all ownerships.

(8) The range of variability for: structural stage, i.e., patch sizes, connectivity, and interior patch sizes as well as their location on the landscape through time; and distribution and abundance of evergreen hardwood brushfield tree dominated stands, big trees and dead wood for different plant series and structural condition, especially younger forest habitat.

(9) Habitat associations are needed, especially for listed species (e.g., when in habitat succession do Del Norte salamander distribution and abundance return to older forest levels? Which species are associated with interior forest habitat?).

(10) Species location information, an integration of Province databases, and the conduct of field surveys.

(11) The natural range of variability in species composition based on local long-term climate change, available from pollen cores taken from Bolan Lake that have not yet been interpreted (K.Hackala, 1994).

(12) There appears to be variation in large wood amounts between different plant series, but with 66% of the plots taken in the white fir series a larger sample of the other series is needed before those differences can be statistically tested.

Social Data Gaps

(1) A high demand for road use can be qualified, but not quantified. Actual use and preference are unknown.

(2) A high demand for trail use can be qualified, but not quantified. Actual use and preference are unknown.

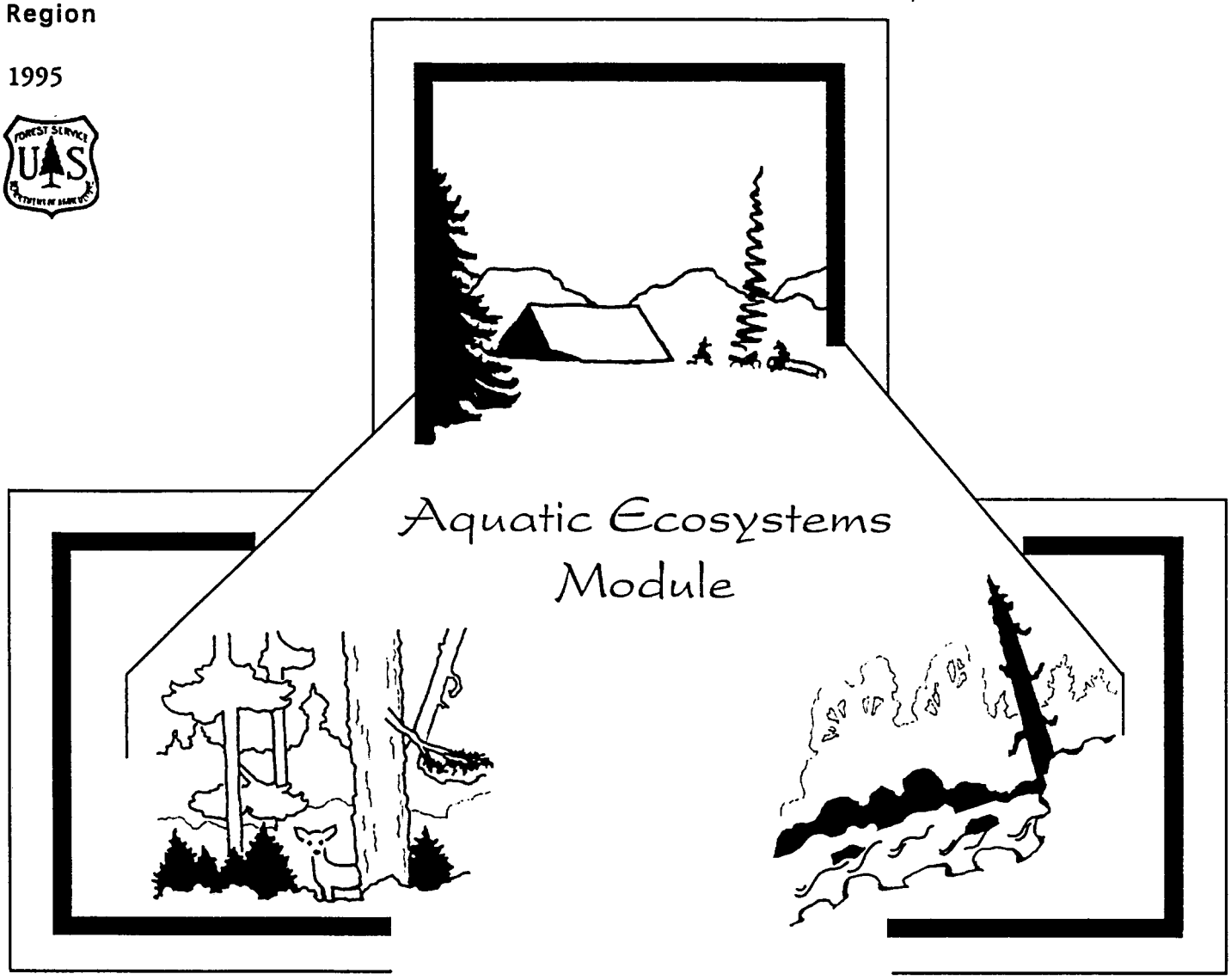
(3) Forest users' preferences related to the demand for dispersed and developed recreation sites is not well known.

(4) The magnitude of historic grazing activities, and its effects on high elevation soils and vegetation.

United States
Department
of Agriculture

Forest Service
Pacific
Northwest
Region

1995



Grayback/Sucker Pilot Watershed Analysis

Version 1.0

Siskiyou National Forest

April 1995

AQUATIC ECOSYSTEMS MODULE

Watershed Values

The watershed values, developed in part through public participation, as defined in this analysis are:

* Importance to Illinois River system.
* Water valued for water uses and for aquatic habitat.
* Aquatic-dependent species, including fish

Key Questions

The following Key Questions were used to guide the watershed analysis:

(1) What are the factors that affect water quantity and quality in Sucker Creek and its tributaries? Which of these are affected by human activities?

(A) Is there evidence that the quantity and timing of streamflow in Sucker Creek and its tributaries have changed during historic time? What natural and management-related processes influence streamflow?

(B) Where and for how long are stream temperatures above optimum for growth and survival of aquatic organisms, particularly salmonids? Are the stream temperatures changed from historic ranges? What natural and management-related processes reduce shade and increase stream water temperature and where do they occur? What are the future trends in stream shade and how can these be improved?

(2) What are the factors that affect habitat conditions within the watershed for aquatic-dependent species? Which of these are affected by human activities?

(A) What are the processes that deliver sediment, and where do they occur? How much sediment has been delivered by natural processes and by human-caused activities, and where?

(B) What are the processes that deliver large wood, and where do they occur? Where have human activities reduced the large wood supply below natural levels? Where are the areas of concern for future wood supply?

(C) Where are channels sensitive to increased sediment and decreased large wood? Is there evidence that channel morphology and sediment storage have changed from historic conditions? What trends in channel morphology and storage conditions are expected? How can channel conditions be improved?

(3) What are the factors that affect aquatic site productivity and population/mortality rates for anadromous and resident fish within the watershed?

(A) What are the factors that affect fish mortality/natality rates within the watershed?

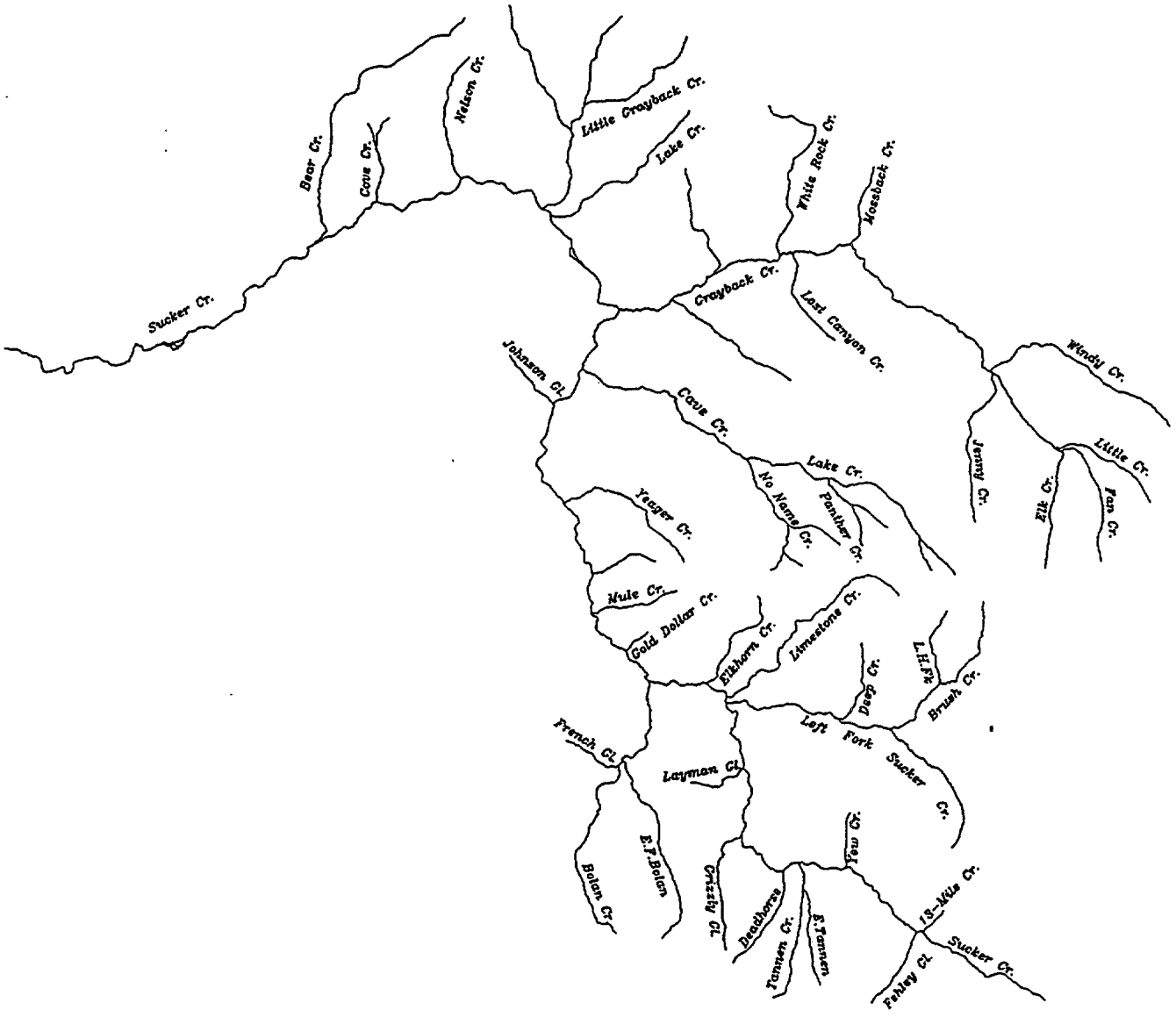
(4) What is the species-specific phenology (timing of spawning, smoltation, etc.) for anadromous fish within the watershed?

(A) How does human activity within the watershed affect these behavioral and physiological responses?

Conditions and Trends: Physical Setting (Climate, Geology, Soils, and Landforms)

The metamorphosed volcanic and sedimentary rocks of the Applegate Group typically include greenstones and argillite. The granitic rocks are composed primarily of quartz diorites with scattered gabbros. The 1:125,000 scale Josephine County Geologic Map (Ramp and Peterson, 1979) includes numerous small granitic rock bodies within the primarily metamorphic areas, and small blocks of metamorphic rocks occur within the granitics. In addition to the mapped serpentinite area, numerous small masses of serpentinite bedrock are included in the Applegate Group. These are concentrated along the ridge west of Sucker Creek between Mule Creek and Grayback Creek (Figure 1).

Figure 1
Grayback/Sucker Watershed



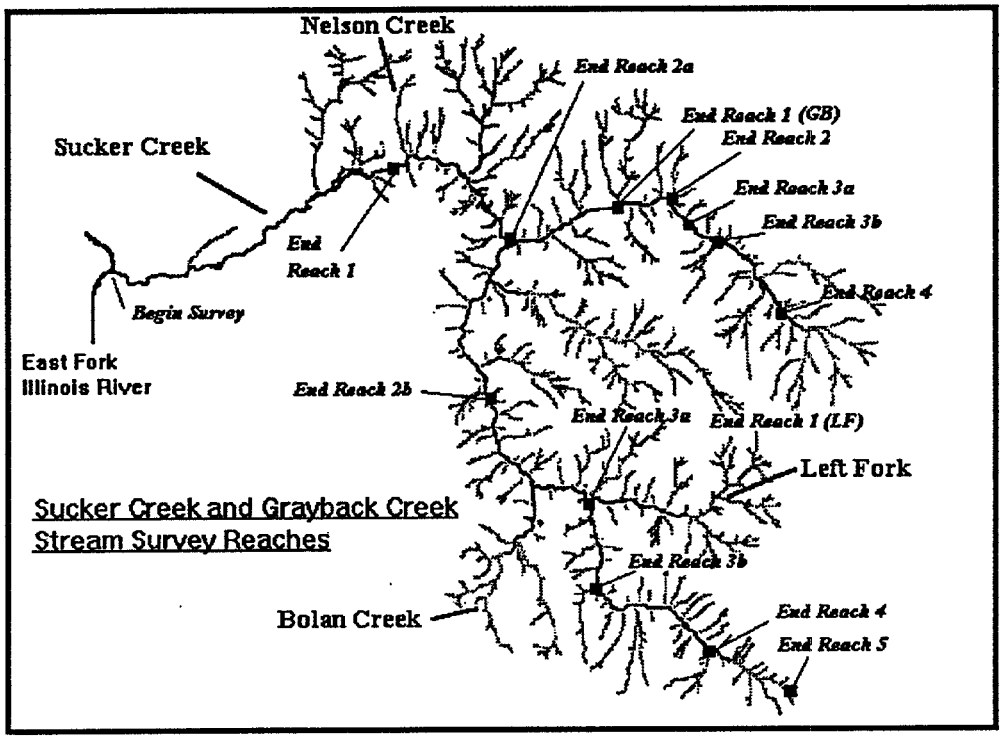
The region has been above sea level for most of the time since the end of the Cretaceous Period. Prior to glaciation, the landscape is thought to have had about half the topographic relief present today. Valleys were broader, hillslopes were more gently sloping, and soils were thicker. This explains the many relic landforms and soils, now at middle to higher elevations. In addition to increased precipitation, lowered sea levels promoted downcutting of streambeds into valley bottoms, producing narrow canyons. Thus, the present steep lower-elevation slopes were carved out of the older landscape. Grayback/Sucker canyons are not classic inner gorges, like those formed by rapid uplift of the Coast Ranges. However, many slopes near the canyon bottoms are oversteepened in the sense that slope inclination exceeds the angle of repose of the soils on the slopes.

Although some large rivers traversed the region during the Pleistocene, ancient river deposits are not found outside the present channels in this watershed. The Illinois Valley was occupied by a lake, perhaps several times, when faulting raised the mountains west of the valley and dammed the river. Sedimentary deposits of the Llano de Oro Formation rim the Illinois Valley (Ramp and Peterson, 1979), but it is unknown whether any alluvial deposits in the Sucker Creek watershed are related to the ponding.

Soil texture is a product of bedrock type as well as topography and geologic history. On gentle slopes where soils have weathered for longer periods of time, soils tend to be more fine-grained. Gravels and talus are common below bedrock outcrops all along the eastern ridgeline. Typically, loamy and loamy skeletal inceptisols form in granitics and fine and fine-loamy alfisols in metamorphics. Soils derived from the metamorphic rocks generally have more rock fragments than soils derived from granitics, although metasediments produce sandy soils in some places. Where granitics have weathered to sandy soils and sandy subsoils, they are subject to surface erosion as well as landslides. Soil thickness ranges from less than 20 inches to more than 60 inches over rock; and available water capacity varies from two inches per foot of soil on the granitics to three inches per foot on the metasediments. Soils formed in alluvial deposits of the floodplains are limited in extent, but important for riparian species of the upper stream reaches and for agricultural crops along lower Sucker Creek. Soils have been grouped by parent material and thickness (Soil/Rock Materials Unit Map, described in Appendix A).

Geologic history and rock types are reflected in hillslope and channel landforms. Landforms associated with glaciation, large landslides, and a variety of other features such as meadows and water seeps are shown on a Landform/Landslides Map (described in Appendix A). Channels were subdivided into segments or reaches on the basis of differences in landform, gradient, and valley floor width (Figure 2).

Figure 2
Stream Reaches Surveyed in Sucker Creek, Grayback Creek and Left Fork Sucker Creek



Alluvial plains occupy stream banks along the lower reach of Sucker Creek to about Johnson Gulch (Reach 1, 2A, and part of 2B) (see Figure 1). The alluvial deposits were derived from the upstream canyons, and sediment is probably still depositing in this reach, although rates have decreased since glaciation. Overbank deposition of sediment on the alluvial plains occurs only during the highest floods. Active floodplains are present along Reach 1 of lower Sucker Creek, and at scattered locations along Reach 2A up to Grayback Creek. Grayback Creek flows in alluvium downstream of Mossback Creek (Reach 1, 2, and 3A). These landforms are subject to enlargement resulting from removal of riparian vegetation and/or floods.

Strath terraces are former streambeds that were eroded into bedrock, now isolated from the channel. They occur on Sucker Creek from Johnson Gulch nearly up to Bolan Creek (most of Reach 2B). The stream flows in a narrow bedrock channel that is downcut 10 to 30 feet into the strath terrace, present on one or both sides of the stream. Streams in such bedrock notches cannot readily shift their channels. Where the incised channel intersects the toe of a slope, the stream may destabilize hillslopes. Alluvium on the terraces is usually less than 20 feet thick, and was mined for gold, leaving bare bedrock with boulder piles in many places.

Upstream from the alluvial reaches on Grayback Creek, and from the strath terraces on Sucker Creek, both streams have incised reaches with valley floor widths of less than 100 feet (Sucker Reach 3B, and Grayback Reach 2A). Bedrock is exposed along these relatively steep incised reaches and substrates are coarse-grained. The incised reaches may be explained by glacial downcutting, because erosion-resistant bedrock does not correlate well with their presence (Joe Cornell, 1994). Where the canyon bottom is very narrow, high stream flows can erode or undercut the toe slopes and cause severe surface erosion or landslides. Sediment from hillslopes may be delivered immediately to the stream without being deposited on valley floor terraces.

Upland basins are present in the headwater reaches of Sucker Creek (Reach 4) and Grayback Creek (Reach 3B and 4). Upper Sucker Creek flows for several miles in a long straight canyon with a wide sedimentary deposit (probably a glacial moraine). Its U-shape is also characteristic of formerly glaciated valleys. The upper Grayback basin is more fan-shaped, although there are smaller glacial landforms at higher elevations. The basins on both main stems are mostly underlain by granitic rocks, which may explain the wider valley landforms. However, these may also be remnants of ancient topography, where the granitic rocks decomposed deeply in humid climates, producing copious quantities of sand-sized mineral grains. The basins have the largest areas of deep sandy soils in the area, except for the alluvium of the lower reaches. Thick soils along stream banks in the upland basins are sensitive to disturbance by land use activities or channel erosion. The valley bottoms are not flat or wide enough that the streams meander or move their channels laterally. Relatively few of the stream banks are composed of bedrock.

Glacial cirques occur mainly among the high peaks along the southern margin of the area, including the U-shaped upper reach of Sucker Creek. Others are at Bigelow Lakes and a few places along the eastern boundary ridge. The Bigelow Lakes appear to be older features, being very shallow from filling by sediment and down-cutting of the outlets. At Bolan Lake the outlet is now 30 feet below the top of the moraine.

Pollen deposits from the last 12,000 years provide evidence for both cooler and warmer periods in Washington State and Northern California (Whitlock, 1992, and West, 1984). In southern Oregon, few areas are expected to contain long records. A core was recently recovered from Bolan Lake that contains a 15,000-year pollen record, but it has not yet been interpreted (K.Hackala, 1994). From 8,000-4,000 years ago, a warmer, dryer period is known as the xerothermic. The Little Ice Age was a minor glacial advance between ~1350 A.D. and ~1870 A.D.

The 5000-6000+ elevation slopes receive larger amounts of precipitation, including snow, than the valleys. However, even the 1964 storm caused few landslides at these elevations, likely because of the rocky and thin soils. The lower ridge tops and higher mid-elevation slopes range from 4000 to 5000 feet in elevation. These elevations are snow-covered for several months each winter and during most years, the spring thaw causes the snow to melt slowly, with intermittent replacement. Most of the sediment delivered during the rapid melt from rain-on-snow in 1964 was by landslides from this elevation zone. The headwalls, upper ends of many drainages, and many stream banks have soil deep enough to be mobilized by the rare great storm event; by land use activities; or by intense precipitation after stand replacement fires.

Meadow and seep areas typically have a high water tables. These areas are susceptible to long-term changes in precipitation or lowering of water tables. Meadows and seeps that dry up will likely become covered by trees and brush.

Seven earthflows have been mapped. All are located in the Grayback watershed, except for one on the west side of Sucker Creek above the confluence with Yeager Creek which is in serpentinite. The Grayback earthflows are all in granitic terrain, except for one on serpentinite in the White Rock area. They range in size from 40 acres to about 300 acres. None of the earthflows appear to be actively creeping; however they have not been monitored for movement. One or two have large soil cracks that may be only a few hundred years old. The main response to timber harvest has been erosion and small slides on steep stream banks. Where the toe of an earthflow or debris slump/slide reaches the streambank, the thick soils are susceptible to erosion by streamflow.

A sinkhole, the bottom of which was filled with soil, was found at one of the upper Sucker exposures of marble (Joe Cornell, 1994).

Three small natural ponds are located near the north boundary: one is near the top of Lake Creek,

and two are near the top of White Rock Creek. These features may dry and fill in response to long-term climatic changes.

Conditions and Trends: Disturbance Processes: Channel Disturbance History

1850's to 1941: The valley of lower Sucker Creek was settled. Mining relics such as boulder piles and ditches provide evidence that gold was mined along Sucker Creek from the confluence of Grayback Creek to above Fehley Gulch, nearly to the headwaters. Besides the placer mining of the main stem, Bolan Creek, and Left Fork Sucker, a number of lodes (bedrock deposits) were mined. Downstream of Grayback Creek, the overburden is too deep for small-scale mining, and large dredges were apparently not used. Mining of the Sucker Creek stream bed, stream banks and terraces down to bedrock, contributed new sediment and loosened bedload sediments. Sediment was also contributed from plowing and other agricultural disturbances along streams. Mining roads were narrow without large cuts and fills and had little effect. Fires were set to improve access to mineral deposits. Riparian shade was removed primarily from mining and agriculture/grazing. Logging on private lands began low in the valley.

1941-1964: Riparian zones on public lands appear well-vegetated except for mined stretches of Sucker Creek. Major storms and floods had not occurred for a long time or the dense vegetation had prevented major episodes of stream bank failure and sedimentation. Gold mining shut down during WWII and never returned to former levels. Mining-depleted riparian vegetation began to recover along mid and upper Sucker Creek. Modern timber harvest on public lands and on private lands within the Forest involved considerable disturbance, including tractor logging through streams, total removal of riparian vegetation and sidecast road construction. Fire suppression became effective due to mechanization after WWII. The 1955 storm had little visible effect on channels.

The storm of December 1964 with related floods, landslides, erosion, and sedimentation was the peak of modern watershed disturbance. Much riparian vegetation was scoured and large volumes of sediment were delivered to streams, especially Cave Creek. Sucker Creek appeared to be less affected in reaches where bedrock stream banks were left by mining. Some pools were probably filled in lower reaches of major streams. Large wood was salvaged from channels where road access was available.
1964 to late 1960's: Timber harvest practices, as described above, continued.

Late 1960's: Land use practices began to improve, at least on National Forest land; end-haul of road excavation, better road drainage, beginnings of riparian zone protection and shift from land-based too aerial (hi-lead) logging systems.

1970 to late 1980's: More conservative land use practices caused fewer landslides and less surface

erosion. Most major road systems were already constructed, so new roads are mostly on ridges or farther from streams and built with tight construction limits. Timber harvests shift largely to skyline systems. Stream Management Unit protection emphasized. Unstable areas largely removed form suitable landbase. Older roads and impacted stream banks gradually begin to revegetate with hardwoods and a few conifers. Large-scale mining is renewed along Sucker Creek upstream of Cave Creek in 1979 (Throop and Smith, 1986).

Late 1980's to 1994: Lack of major storms and reduced timber harvest activities in riparian and unstable areas allow stream banks, riparian vegetation, road fillslopes and cutslopes to revegetate with alders, other hardwoods, and numerous young conifers up to 30 feet high. Many older harvest areas are becoming well vegetated.

Conditions and Trends: Disturbance Processes: Sediment Delivery

Sediment delivery processes include various types of landslides, surface erosion, channel erosion and transport, and mining disturbance.

Various sizes, ages, and types of landslides are found in the watershed, from large ancient earthflows (deep, slow-moving features), to small recently-active debris flows (shallow, rapid, scouring events). Effects of landslides vary by the proportion of the slide delivered to streams, particle sizes of the delivered materials, large wood content, and channel characteristics at the delivery site.

The canyon deepening and slope steepening from glaciation influences the locations of landslides. Most failures involve soil materials and few bedrock failures have been observed in the watershed. A large proportion of the landslides have involved soils that are derived from granitic bedrock and are thicker than 40 inches (Table 1). This pattern is observed from slides during the aerial photo record, and for many older landslides.

Table 1
Landslide number, production, and per area yield by Soil/Rock Materials Unit (1940-1986)

Soil/Rock Material	Number	Volume (cubic yards)	Area (acres)	Yield (c. yards/acre)	Frequency (#/1000 acres)
Granitics, Thick	16	56,185	8244	6.8	1.9
Granitics, Medium	4	111,694	3193	35.5	1.3
Granitics, Rocky	2	1736	3634	0.5	0.6
Metamorphics, Thick	17	212,561	24,904	8.5	0.7
Metamorphics, Medium	12	91,566	13,941	6.6	0.9
Metamorphics, Rocky	0	0	4387	0.0	0.0

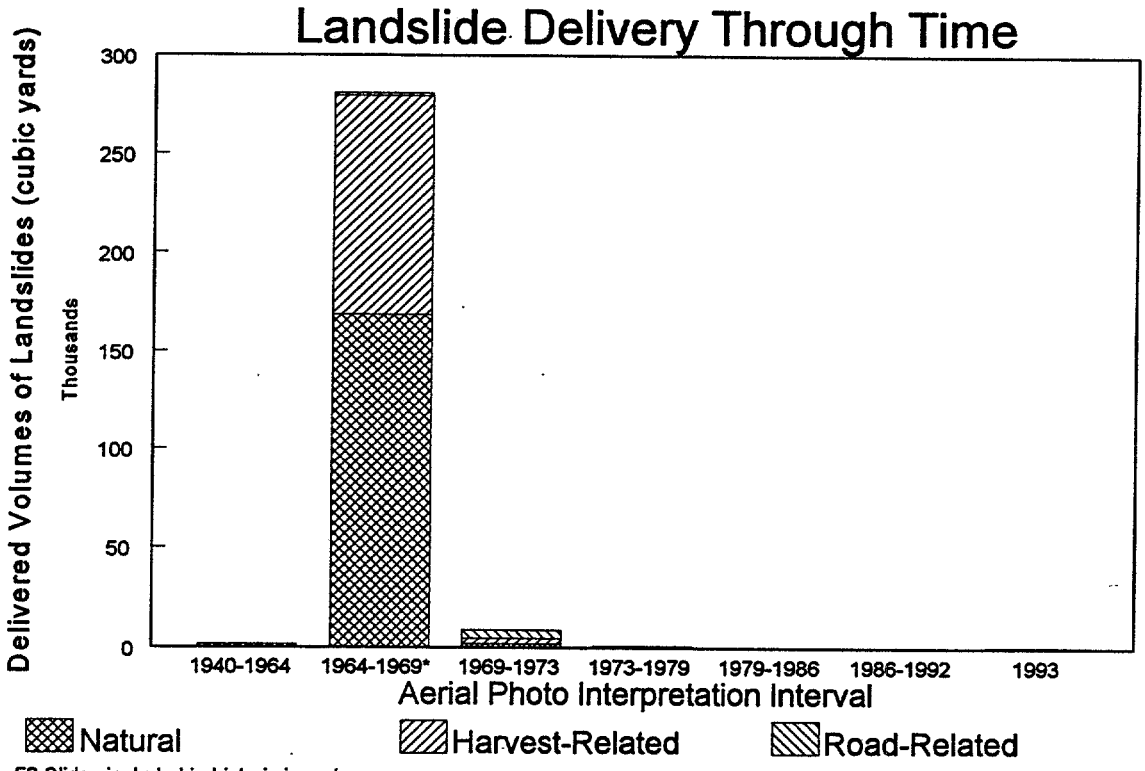
Landslide volumes were estimated using methods described in Appendix B. Figure 3 displays the natural, harvest-related, and road-related landslide volumes for each aerial photograph time interval. Based on local history and eyewitness accounts, it is known that most of the sediment delivered during the 1964-1969 interval resulted from the 1964 storm. The largest debris flows were naturally-occurring. The debris flow in Upper Grayback may have been affected by the presence of the crossing on Road 4611. Although the largest landslide in 1964 is listed as harvest-related, other factors may have contributed to the size of the slide. It was located in a stream bank position, and the toe may have been scoured by the debris flow in Cave Creek.

Debris flows run out to a location that is affected by the stream gradient, and angles of tributary junctions with main channels. When large wood is incorporated in the debris flow, the run out distance may be shorter (Montgomery and Buffington, 1993). Deposition typically occurs at gradients from 3-6 degrees (5-10%). However, debris flows on Upper Grayback and Cave Creeks did not deposit until reaching more gentle gradients, possibly due to recharge of the water content

of the flow during run out.

The relatively low landslide rates for the other time intervals are typical of the Galice and Illinois Valley Ranger Districts. The only known slide that postdates the 1986-87 photos occurred below Road 4611070 in Jenny Creek during the winter of 1992-93. For more details see the Conditions and Trends: Subwatersheds: Grayback Creek section below.

Figure 3
Landslide Sediment Delivered to Streams



52 Slides included in historic inventory
* Inc. 3 large slides: harvest-related 8 2,500, and natural 71,000 & 52,000

Each road-related landslide delivered an average of 16% of the sediment produced, while harvest-related and natural slides averaged 45% and 54% respectively.

Sediment delivery from road-related landslides and erosion is generally observed during high precipitation and streamflow events. The most sensitive sites include:

- Fills located in potentially unstable headwalls
- Drainage outlets that concentrate flow on potentially unstable headwalls or stream banks
- Stream crossings with inadequate capacity to pass flow or sediment from upslope.

The chronology of floods is discussed in the Streamflow Processes: Peak Flows section . The 1964 flood followed a period of intensive logging and associated roading, resulting in road failures, culvert washouts, and stream bank erosion in areas harvested prior to the flood (see Managed Stands Map, Appendix A). Tractor yarding and haul road construction created numerous blockages in small perennial and intermittent streams that were eroded, delivering sediment and woody material.

Diversions (where water leaves the stream channels and flows down the road) of water from plugged culverts can lead to landslides or severe erosion, such as the bank erosion in Grayback Creek below the Mossback Creek culvert that plugged during the 1964 storm (Dennis Sellards, 1994). Forest Service direction for design of major culverts prior to Riparian Reserve Standard and Guideline RF-4 (ROD, 1994) was not adequate to pass infrequent high flows. Culverts along Road 4612 above the Grayback Creek bridge were observed to be overflowing and diverting during one of the early to mid-1970's storms (Cliff Phillips, 1994). Woody debris may plug culverts even when designed with adequate flow capacity. Crossings may be designed to discourage diversions. The capacity and diversion potential of culverts in the watershed has not yet been assessed. Sites with potential for road fill failures have been identified on aerial photographs and are listed/mapped.

Potentially unstable areas within the ancient earthflows and slump/debris slides will need to be mapped in order to delineate Riparian Reserve boundaries. Most of the potentially unstable debris flow sites will be contained within the Interim Riparian Reserves at the heads of intermittent streams.

Surface erosion is generally limited to disturbed areas on soils with a low percentage of rock fragments and little cohesion. Diversion of water onto hillslopes may result in rill or gully erosion. Surface erosion on natural slopes or relatively undisturbed timber harvest units is rare. Watersheds in the Klamath River Basin have experienced severe surface erosion following stand-replacing fire on granitic soils similar to those in this watershed (de la Fuente and Haessig, 1993). Reducing the risk of stand replacement fires on sensitive soils is desirable.

Rill or gully erosion has been observed from road drainage outlets (particularly at "shotgun culverts," where water falls from the outlet to the ground, causing gully erosion where energy is

dissipated on fine-textured soils, culverts), from road segments with infrequent spacing of drainage outlets, or where cross-drainage design/structures are from sediment or debris, and at sites where quarries, landings, tractor yarding, and fire lines intercept drainages. High priorities for preventing future erosion include projects to treat road crossings that failed during the 1964 storm, and at post-1964 road crossings having diversion potential within sensitive soil types.

Incision or expansion of channels in high elevation meadows and seep areas is a potential source of sediment, and could lower groundwater levels in these storage areas. Interpretation of recent aerial photographs suggests that channels have incised or expanded in some areas adjacent to harvest and roads. The extent of this effect is not known and could be investigated using historic aerial photos, harvest unit maps, and site visits.
Erosion of sediment from stream beds and banks is a source of sediment for downstream reaches. Periodic channel erosion results from naturally-occurring high streamflow, but may be accelerated by increased peak flows, changes in channel form, or decreased bank or bed stability. Processes that may have altered peak flows and channel morphology are discussed in the Conditions and Trends section (see below). Channel erosion as a sediment source in Grayback Creek is described in the Condition and Trends: Subwatersheds, Grayback Creek section (see below).

Coarse sediments were delivered to stream channels during the historic mining prior to World War II. Subsequent floods have mixed many boulder piles into the bedload, particularly in Sucker Creek above Grayback Creek. Fine sediment transport and redeposition was evident from plumes of turbid water observed downstream regularly until about the 1930's, when the Rogue Mining Board was formed (Don King, 1994).

Modern mining operations have rerouted the Sucker Creek channel away from the large-scale active disturbance (Throop and Smith, 1986). These operations include settling ponds for the purpose of minimizing the amount of fine sediments entering the channel. Small suction dredges within the active channel may loosen the stream bed, allowing the substrate to move at lower streamflows that before.

Conditions and Trends: Disturbance Processes: Large Wood Delivery

In some types of channels, large wood provides obstructions that strongly influence channel flow, creating scoured pools. In most channels, large wood also provides cover, slack water overwintering habitat, and nutrient sources and storage areas.

Historically, shifting of channel locations on valley floors was an important source of large wood. New riparian habitats and side-channel overwintering habitat for fish were created by channel overflow during high flow, scouring some areas and accessing new forest. Beaver activity may have once enhanced the development of side channels and ponding. Overflow channels appear to

have been abundant along Grayback in 1940's aerial photos. Channel shifting occurred along lower Sucker during 1964 flood.

Currently, overflow and shifting processes on the wide valley floors are restricted by features such as bridge abutments, mining disturbance, bank armoring, and channel incision into the floodplain. The removal of large wood from the channel is likely to have contributed to channel incision and decreased interaction with the floodplain. Instream wood has been salvaged in the past to promote flood control, fish access, and to improve access to placer deposits.

The species composition and size of the remaining valley floor forests have been substantially altered by fire and timber harvest. Fires were ignited by miners to improve access and establish sites for cabins (Atzet, 1979). Riparian trees have been salvaged for their timber value, for sanitation of Port-Orford-cedar (POC) stands infected by root rot, and for clearing incidental to mining activities and a Civilian Conservation Corps camp near the mouth of Grayback Creek. The most extensive remaining high quality valley floor forest along the lower reach of Sucker Creek is located on the alluvial terrace occupied by Grayback Campground.

The potential future loss of POC from root disease is discussed in the Terrestrial Ecosystems document. Because POC decays more slowly than other species, these trees are more valuable for sediment storage and flow functions in the channel. After the mid-1970's, salvage of POC was discontinued (Larry Pera, 1995).

The hardwood versus coniferous composition of riparian forests adjacent to channels in the Upper Illinois River Basin has been estimated from high elevation aerial photographs (Riparian Condition Map, Appendix A). Many of the channels flowing through valley floors have predominantly hardwood riparian vegetation. The types of disturbances that have replaced conifers with hardwoods have been mapped (Riparian and Channel Disturbance Map, Appendix A). Disturbance along individual reaches is described in the Condition and Trends: Subwatersheds section.

Debris flows from headwalls in steep tributaries have been important sources of large wood, particularly for the Left Fork and Upper Sucker Creek. Debris flows mobilize large wood along stream banks by scouring, and deposit in the channel at the tributary junction. Historic fires on the upper slopes of these drainages appear to have reduced the amount of large wood available. Large wood has been harvested from a few stream banks (shown on the Riparian and Channel Disturbance Map). Where road crossings prevent debris flows from continuing down tributaries, or catch part of the woody material, this process may be disrupted. Restoration of this process will require redesign of road crossings to allow debris flow passage at sites with a high probability of debris flows, such as along Roads 4612080, 4612540, and 4612098.

Snow avalanche chutes are steep narrow drainages up to one mile in length. Several dozen occur

along the upper slopes of the eastern rim and in the upper reaches of Sucker Creek. The shallowly incised drainages may have been formed by ancient debris torrents, but landslides have been rare in them for at least the last 50 years. Many have only a few feet of soil, and most have a cover of stunted Sitka alder and vine maple that is buried under snow for a few months during most winters. Some appear younger than others due to the sharp contrast between neighboring tree-covered slopes and the short vegetation in the chute. Vegetation in the chutes does not appear to have changed much since 1940, so some process maintains the chutes as they are now. The tracks through the vegetation diverge in some places from the shallowly incised drainage, making their paths difficult to predict. Infrequent development of new chutes may supply a minor amount of large wood to channels.

Snow avalanches have not been observed directly because they occur when the roads are blocked by snow. Only once in the last 20 years has it been necessary to repair a road due to such activity. A retaining wall about 5 feet high had to be built to replace the outer edge of the Bolan Lake Road at one of the chutes. A few other sites probably had snow avalanches cross high elevation roads without damage. The effect of tree cover on snow avalanche generation has not been investigated by a review of the literature or by direct observation. It is unknown whether stand-replacing fires might alter the frequency of snow avalanches.

The potential for storage or remobilization of large wood varies with the size of wood and channel characteristics. Large wood in channels may slow debris flows as noted above, or may be remobilized, depending on channel gradient and valley width. Where valley floors are wider, more wood may be stored in stable positions rather than subject to higher velocity flow. However, in large streams, large wood is more mobile, and has less effect on channel morphology (Sullivan, et. al., 1987).

Conditions and Trends: Streamflow Processes

The natural condition of the Sucker/Grayback stream system is a "gaining" system from the headwaters downstream to approximately Nelson Creek (the valley floor). Numerous streams, springs, and seeps add water to the stream. This water is held in the channel, and the amount of flow increases as it goes downstream. The valley floor is composed of porous alluvial gravel, varying in depth up to 180 feet. When Sucker Creek enters this alluvium near Nelson Creek, the channel no longer holds all of the water, and the stream becomes a "losing" system. This is most noticeable during summer months when there is less water in the channel, soils are drying out, and the ground water table is dropping.

Conditions and Trends: Streamflow Processes: Water Yield

The total water yield for the watershed is a result of the amount of precipitation falling during the

year diminished by evaporation, changes in storage in the soil or in ponds, evapotranspiration by vegetation, and withdrawal for human use. Human activities can affect the total annual water yield by altering storage (constructing or eliminating dams), altering vegetation (harvesting, planting, burning, clearing), and removing water for consumptive uses.

Precipitation varies from year to year, and within the watershed. Average precipitation ranges from 50" on the valley floor to 80" near Bolan Peak, in general increasing with elevation. Phase is predominantly rain below 2500' elevation, alternating rain and snow from 2500 to 4000', and winter snowpack above 4000'. The phase affects peak and low flows.

Precipitation for the watershed is indicated by the National Oceanic and Atmospheric Administration (NOAA) rain gage at Cave Junction (1963 to present), which is assumed to reflect the variation from year to year although it measures only the lower amounts in the valley. The NOAA Grants Pass rain gage (1928 to present) has a reasonable correlation with Cave Junction, so although Grants Pass average precipitation is 20" less than Cave Junction, the longer data record can be used for relationships between rain and snow, and precipitation and flow. Snow data are available from the National Resource Conservation Service (formerly Soil Conservation Service (SCS)) for Page Mountain, Althouse, Grayback, and Bigelow Camp.

Annual precipitation at the Cave Junction rain gage varied from 29" in 1976 to 103" in 1983 (1972 missing). The period of record is too short to show trends. Total annual precipitation at Grants Pass shows a gradual increasing trend from 1928 to the 1950s, a period of stability with little variation through the 60s, and wide variation with overall gradual decrease since the early 70s. This corresponds to trends noted elsewhere in the Pacific Northwest (Ames, 1992, Meko and Stockton, 1984).

Snowpack, in inches of water equivalent, was greatest at Grayback and least at Page Mtn, but the curves plotted from April snowpack were similar for all four snow measurement locations, and showed wide variation from year to year with some decrease over the past 20 years.

Vegetation species composition and cover affect the level of transpiration in the watershed. Increasing the amount of vegetation on a site results in decreased water availability for stream flow as plants more rapidly utilize soil water for transpiration. Some species of plants, such as Douglas-fir and tanoak, are more water demanding than others and have a greater effect on soil moisture retention and water surpluses or deficits. Total annual water yield will show a greater effect from vegetation changes than will either peak or low flows (Keppeler and Ziemer, 1990). Effects of historical management in the watershed would vary: clearcut harvest of conifers, or wide scale burning of tanoak such as the miners used in the late 1800's, could increase the water yield; fire suppression, with resulting increased density and root mass of tanoak, could reduce water yield; and regrowth of riparian vegetation could reduce water yield. Records from the USGS Sucker

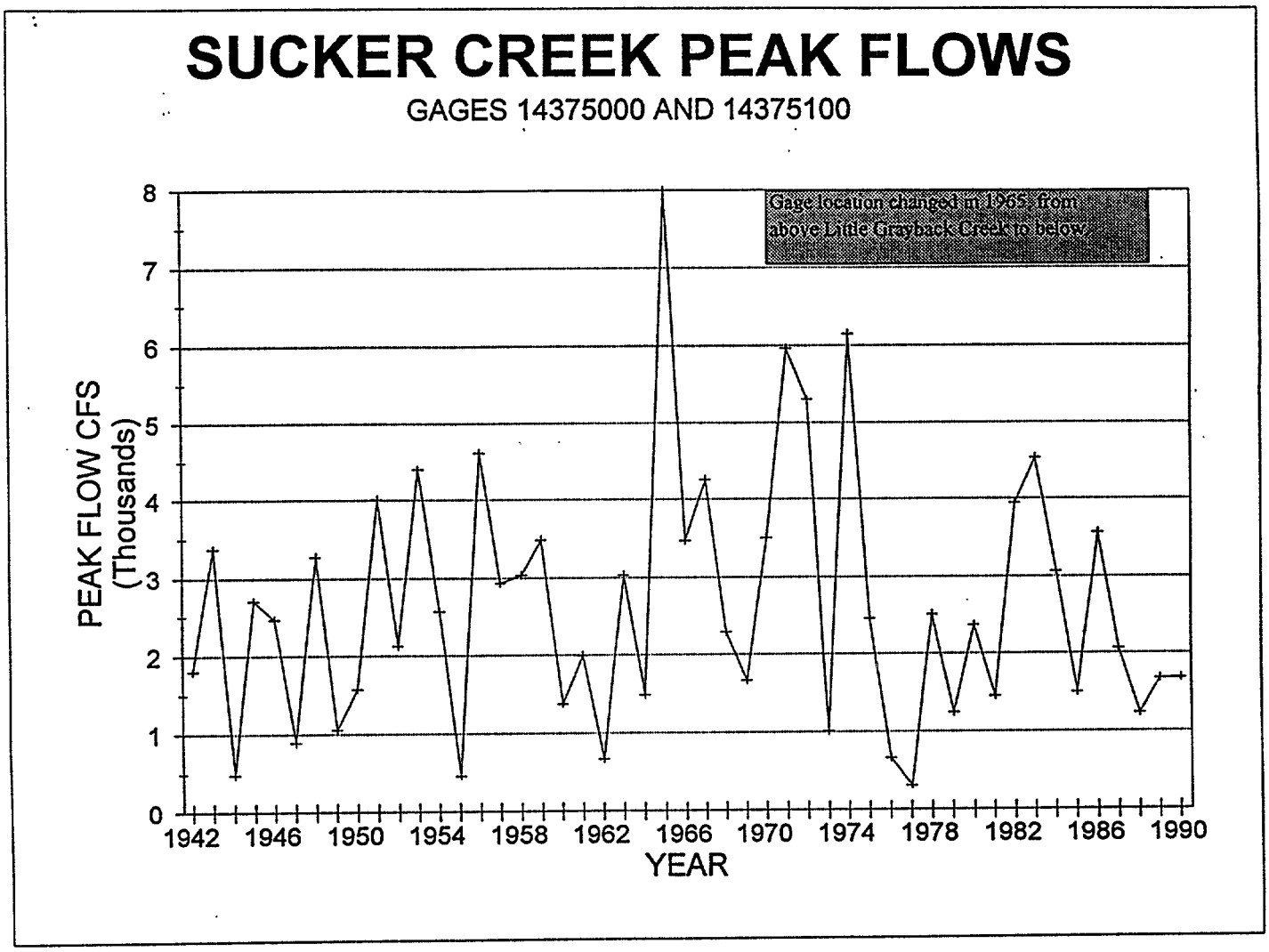
Creek gage since 1940 show no visually perceivable trend in annual water yield other than a reflection of the precipitation trends.

Streamflow will vary from year to year with the precipitation patterns. If future human activities include constructing a dam, altering the vegetation, or changing the amount of water withdrawn, these will affect the flow. Effects of possible future reductions in vegetation cover on summer water availability were modeled for the Grayback/Sucker Creek watershed using the Soil Moisture Retention Program (Atzet and Amaranthus, 1985). The assumptions and results of this modeling are discussed in the Terrestrial Ecosystems document.

Conditions and Trends: Streamflow Processes: Peak Flow

Peak flows, or flood events, occur as the result of intense rain, rapid snowmelt, or rain on snow combining these two. The flood of 1964 was a rain on snow event (Figure 4).

Figure 4


SUCKER CREEK PEAK FLOWS
GAGES 14375000 AND 14375100
Gage location changed in 1965, from above Little Grayback Creek to below
PEAK FLOW CFS (Thousands)
0
1
2
3
4
5
6
7
8
1942
1946
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
YEAR

The size of peak flows can be affected by human activities. Roads intercept water on their surfaces that would have filtered into subsurface flow. They route water more efficiently through their ditches, thereby delivering more of a storm's precipitation directly to the streams. The importance of this effect varies with the road's location and drainage design. The high rock fragment content of most soils in the watershed allows water leaving culverts to reinfiltrate into subsurface flow, rather than creating gullies and expanding the channel network. The increased drainage distance along roads at stream crossings has not yet been estimated. The results of this analysis would help to prioritize road decommissioning and drainage improvements when used with soils mapping.

Timber harvest, especially with tractor yarding, can compact the soil and have an effect similar to that of roads. Harvest in the transient snow zone increases snowpack by changing wind currents and decreasing canopy interception, both of which deposit more snow on the ground. More snow is available to be melted during rain-on-snow events, which can increase peak flows. In Lower Sucker Creek and Grayback Creek, harvest prior to 1964 primarily on private lands cleared a large percentage of the area drained by small tributaries, with extensive roading and tractor yarding. This harvest likely contributed to the increased size of the peak flow in these subwatersheds.

Removal of instream large wood decreases resistance and increases flow velocity. Post-1964 wood salvage may have released sediment and slowed vegetative regrowth along the banks, thereby increasing erosional effects of more recent high flows along some reaches.

Conditions and Trends: Streamflow Processes: Low Flow

Low flows vary naturally with the amount of total precipitation, whether it occurs as rain or snow, and when in the year it occurs (vegetative effects are discussed above under Water Yield). Most precipitation in the watershed falls during the winter months. This combines with transmissive soils and little elevation in the snow zone to produce low summer flows. Most hillslopes have thin soils that store little water. Fractures and faults in bedrock carry groundwater that feeds numerous seeps and springs.

Comparison of total precipitation and April snowpack to total water yield and low flow shows that in years of low total precipitation but high snowpack (1949, 1969, and 1985), the total water yield was low but the low flows were moderate to high.

The loss of water through infiltration into the alluvium in the "losing" portion of Sucker Creek greatly diminishes flows from Nelson Creek to the mouth. The pre-settlement condition of the stream may have included periods of negligible flow during the summer months, in years of little snowpack and low spring and summer precipitation.

Activities that increase peak flows may have the effect of decreasing low flows, by delivering more

water to streams closer in time to the precipitation event and leaving less water for base flow.

On the portion of stream above Little Grayback Creek, 7-day low flows over the period of record 1942 to 1990 have varied from 13 cfs in 1975 to 35 cfs in 1983. The 7Q10 (the seven-day average flow that occurs at a ten-year return interval) for the old gage site 1942-1965 was 24 cfs; for the current site 16 cfs. This might suggest decreasing flows. However, a moving average without the artificial break in the middle shows a trend similar to the precipitation trend, with gradually increasing low flows from 1942 to the mid-1950s, fluctuations about a stable high in the mid-50s to early 70s, and a drop to early 1940s levels in the mid-70s, with wide fluctuations in the 1980s. Adding the anecdotal reports in the watermaster's records from 1924 to 1945, it seems likely that variation in low flow from year to year, with longer scale cyclical variation, is typical for this stream system.

Changes in channel morphology, such as aggradation, may change the amount of water available for fish habitat even if the amount of flow at the gage remains constant.

Below Little Grayback Creek, water withdrawal has the greatest effect on low flows. Water rights were issued on Sucker Creek and its tributaries from 1853 to 1934, when a State Engineer withdrew the stream from further rights because of insufficient flow. In 1994 there are consumptive water rights for 47 cfs on Sucker Creek, and 3 cfs on tributaries. As the flows decrease through the summer, water use is cut back to "prior rights" or the earliest dated rights. The cutoff is usually in the 1860s, with extreme dry years in the 1850s and extreme wet years in the 1870s (Josephine County Watermaster's Office). Monthly reports for the Assistant Watermaster in 1924 state that water use on Sucker Creek was cut back to the single oldest right in July, and by the end of August there was "too little water to administer." In 1994, the cutoff date was 1865 - water rights dated more recently could not be used during the driest part of the summer. This would reduce the allowed withdrawal from a total of 50 cfs to 15 cfs. There is no record of how much of this legal limit is actually available in the stream, or how much is actually withdrawn. Observation of irrigation patterns in nearby drainages (Williams Cr) found that because of variation in users' irrigation patterns, actual withdrawals at any one time were about 30% less than the total legal limit (Bob Pierce, 1994).

Some of the water withdrawn for irrigation returns to the stream channel, either overland or subsurface. The quantity of this return flow has not been measured. From the rise in water table as measured in wells when the irrigation season begins, likely most excess irrigation water seeps into the subsurface aquifer.

Conditions and Trends: Channel Morphology and Substrate

Changes in channel morphology (form) result from complex interactions among flow, large wood,

sediment delivery volume and particle size; and direct alteration. Channel morphology changes affect habitat types, sequences, and dimensions available to aquatic-dependent species. Changes in the frequency or location of sediment transport may affect the mobility of the substrate used for fish spawning and survival of emerging juveniles.

Channel reaches differ in their sediment transport potential and sensitivity to disturbance. Direct measurements of historic channel conditions are limited to observations of increased channel width or changes in riparian forest cover on aerial photos. Differences in channel conditions among similar channel types may be related to disturbance history. More subtle changes in condition may be inferred, by comparing characteristics of similar channel types that have had different disturbance histories.

Removal of riparian vegetation along stream banks and major floods, such as that of 1964, can enlarge relatively small floodplains such as the one along Reach 2 of Sucker Creek. However, comparisons of available aerial photos from before and after the 1964 event suggest that changes were limited to local deposition and scour, local loss of streamside vegetation, filling of some side channels with sediment, and changes, mostly decreases, in size of pools. Width of the stream channel and floodplain did not increase appreciably.

Sediment delivered by landslides and erosion during the 1964 flood was partially transported downstream. Much of the finer-grained sediment is stored in bars and terraces along the lower reaches. Post-1964 channel erosion has been observed on debris fans deposited in 1964, and locally along the lower reaches of Sucker Creek (Martin Trso, 1994). Channel adjustments to 1964 aggradation could be documented by comparing historic bridge surveys with current conditions, but these records have not yet been located.

Where channels were hydraulically mined or rerouted, sequences and connections of habitat types and substrates have been rearranged. Current suction dredge operations likely affect mobility of the substrate, affecting pool development and possibly survival of juveniles salmonids. General locations of historic and current mining activities are shown on the Channel Disturbance Map (Upper Sucker, Bolan, Left Fork), but data on volumes and sizes of mined material have not been compiled. Interactions among channel morphology changes from mining, loss of large wood, and the 1964 flood are likely responsible for the low numbers of pools and percentage of deep pools, and low numbers of large wood pieces in Sucker Creek Reach 2B (see Conditions and Trends: Subwatersheds: Upper Sucker Creek section below).

Interactions among 1964 flood deposition, salvage of large wood, periodic straightening of channels with bulldozers, annual construction of berms for water diversion, and periodic removal of gravel bars near bridges are likely responsible for the low numbers of pools, and percentage of deep pools in Sucker Creek Reaches 2A and 1.

In low gradient channels that have little large wood to provide resistance to high flows and promote scour of pools (such as Sucker Creek Reaches 2B, 2A, 1, and Grayback Creek Reach 1), future high flows may not improve habitat conditions as rapidly as expected. Although pre-1964 mining removed some wood from the channel, additional simplification has occurred more recently from post-flood salvage, rerouting of the channel, and additional riparian disturbance. Increased flow velocities in Sucker Creek Reach 2B, combined with bank armoring downstream, could cause locally severe bed and bank erosion along Sucker Creek Reaches 2A and 1. This would further isolate channel habitats from the lower floodplain. Restoration projects designed to increase structure and channel roughness in Sucker Creek Reach 2B are desirable.

Placement of mining-related sediment in the active channel (as observed from aerial photographs at one site in Sucker Creek Reach 2B) is likely to confine high flows and increase erosion of bank materials. Restoration of such sites is desirable.

Channel reaches confined by ancient debris slides/slumps (Landform/Landslide Map) may be sensitive to changes in flow direction resulting from mining or placement of habitat enhancement structures.

Conditions and Trends: Water Quality

Stream water temperature has been cited as the limiting factor in this watershed (ODFW, ODWR, Siskiyou Forest Plan FEIS). Dissolved oxygen (DO) also affects fish growth and survival, and is a function of stream temperature and organic loading. Because stream temperature is analyzed below, DO is not considered further in this analysis.

Conductivity and pH are not expected to be limiting factors in this watershed. In summer 1994, conductivities of 100-110 micromhos were measured in various parts of the watershed, and pH ranged from 7.7 at the Lower Holland Loop bridge to 8.5 in Upper Sucker and Limestone Creek (USDA Forest Service, 1994a, 1994b, and 1994c).

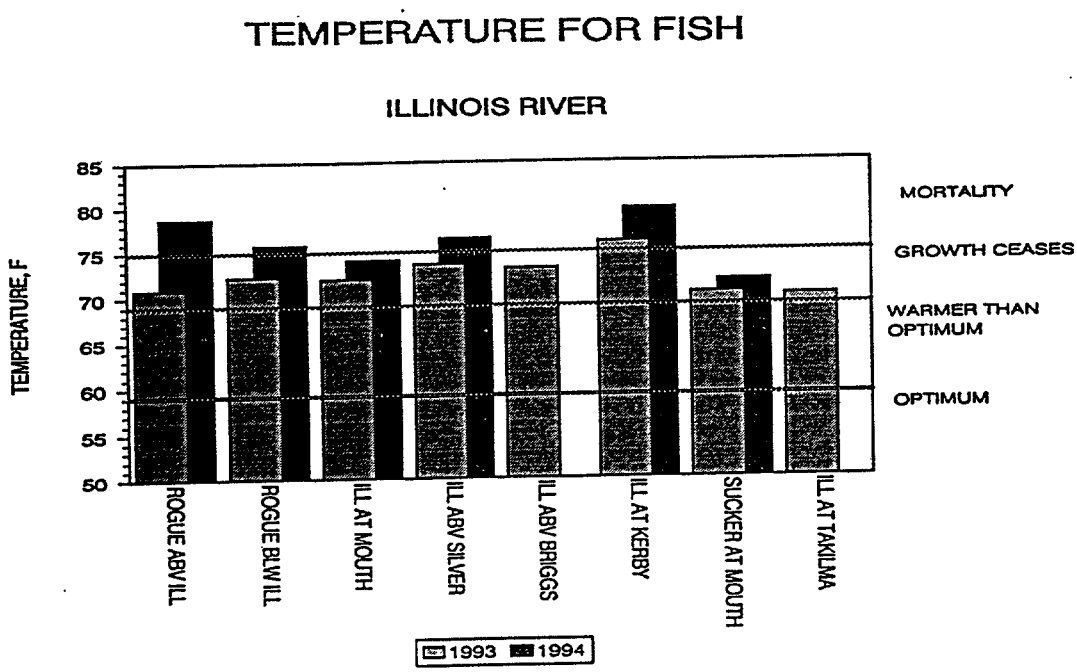
Conditions and Trends: Water Quality: Water Clarity

Turbidity can also be limiting for aquatic organisms, but it has not been observed to be a limiting factor in the watershed. Relatively high levels of turbidity may accompany high flows, but are generally of short duration. Turbidity is a greater concern on small streams with domestic or recreational uses. In the early 1980's, the Caves National Monument water supply was affected by a small landslide on Lake Creek.

Conditions and Trends: Water Quality: Stream Water Temperature

The Regional Ecosystem Assessment Project found that most streams in Western Washington and Oregon have temperatures higher than they were historically. Most current modes are above the historic averages; many are above the historic range of extremes; nearly all have summer maximum temperatures well above the historic maximums. The Rogue Basin is typical of the regional findings, with current mode on Upper Rogue and Applegate above historic averages, and Lower Rogue and Illinois at the top of the historic range; and maximum temperatures well above the historic range. Past disturbances, including management history, climatic change, and dams, are identified as contributing to the increased temperatures. (REAP, 1993).

Figure 5

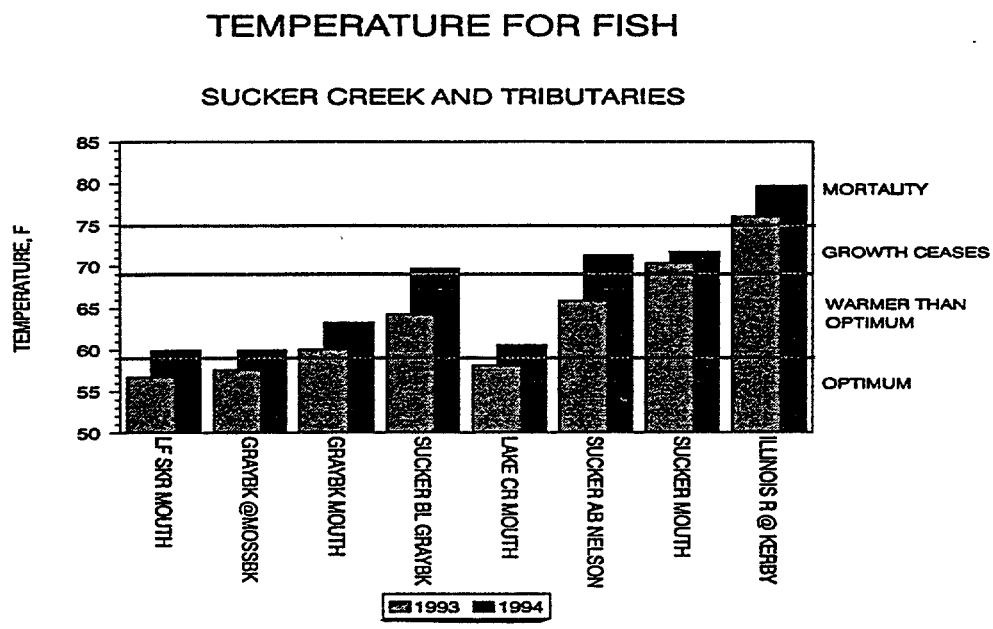


The 1993 Temperature Monitoring Report for the Rogue River Basin (Brazier & Park, 1994) found temperatures in the Rogue Basin generally acceptable for fish in that high flow year, with the

exceptions of Elk Cr. (Upper Rogue), lower Applegate River, and the Illinois River near Kerby (16 miles downstream from the mouth of Sucker Creek). High temperatures were attributed to removal of streamside vegetation, changes in channel morphology, and withdrawals of water for irrigation and other uses. (See Figure 5, Temperature for Fish - Illinois River.)

> "Of note in this study is the very high temperature in the Illinois River at the Kerby gage (76 degrees). As the river moves downstream into the canyon and picks up volume from cooler tributaries, it recovers somewhat, but never fully. The high temperature at Kerby is attributed to a degraded channel and to water withdrawals." *(Brazier & Park, 1994).*

Figure 6



Sucker Creek flows into the East Fork Illinois River. The importance of the temperature of the water flowing out of Sucker Creek to the Illinois River, and particularly the peak at Kerby, depends on the amount of flow leaving Sucker Creek in relation to the amount of flow in the Illinois River. Because the flow decreases from the Sucker Creek gage to the mouth, this information cannot be derived from the gage record.

The primary source of heating for stream water is solar radiation, or sunlight directly hitting the water surface. Riparian vegetation, topographic shading, logs, and boulders in the stream contribute to shading. The most effective vegetation for shading is tall conifers, closely spaced, with dense canopies. Hardwoods are generally shorter, so provide less shade in summer when the sun's angle is high; and they have more open canopies, so allow some sunlight through. Width/depth ratios of the stream also affect the rate of heating: broad, shallow streams expose more surface to the sun per unit area of water than do narrow, deep streams.

If channel shape and riparian vegetation are the same from year to year, the sources of variation in stream temperature are weather-related: differences in the number of days that clouds shade the stream, and differences in the amount of water in the stream. Because of the inverse relationship between flow and temperature, withdrawal of water from streams tends to increase maximum temperatures. Although streamflow decreases naturally from near Nelson Creek to the mouth, withdrawal extends the period of low flow. Early summer withdrawals that reduce the flows during the period from late June through July, when solar heating is greatest, have the greatest effect on increasing temperatures. The relationship in Sucker Creek is complex. Withdrawal-related factors that would increase temperature are decreased streamflow, and overland "return flow" from irrigation. Factors that would decrease temperature are reduction of instream flow causing a larger proportion of intergravel or hyporheic flow; and subsurface "return flow."

Changes in field irrigation practices from flooding to sprinkler systems has caused water to be used more efficiently, allowing irrigation of greater areas with the same amount of water. However, because sprinklers only apply water to the rooting zone, rather than saturating the soil profile, subsurface return flow has been reduced. Conversion to sprinklers began in the late 1950's, with substantial conversion in the mid-1960's, continuing through the 1970's (Fred Craig, 1995).

Historic changes in riparian vegetation affecting temperature are summarized in the Conditions and Trends: Disturbance: Channel Disturbance History and Large Wood Delivery sections, with detailed reach descriptions in the Conditions and Trends: Subwatersheds section. A 1990 survey of the Sucker Creek between Grayback Creek and Bolan Creek identified segments where mining had reduced the canopy. Percent reduction varied from 20% to 90%, with approximately half of the reduction in areas with active or recent activity. On public land, very little of the riparian canopy has been affected by timber harvest, trees were generally not cut within shading distance of the stream, and salvage operations had a minor effect on shade. The current shade condition on Sucker Creek is estimated in the ODFW 1993 stream survey. It shows variations around a mean of 50% open sky from the mouth to Grayback Creek, increasing shade from 30 to 15% open sky from Grayback to Bolan Creek, and variations around a mean of 10% open sky from Bolan Creek to the headwaters.

On Grayback Creek, field surveys in 1994 found that stream banks have a good canopy of alders

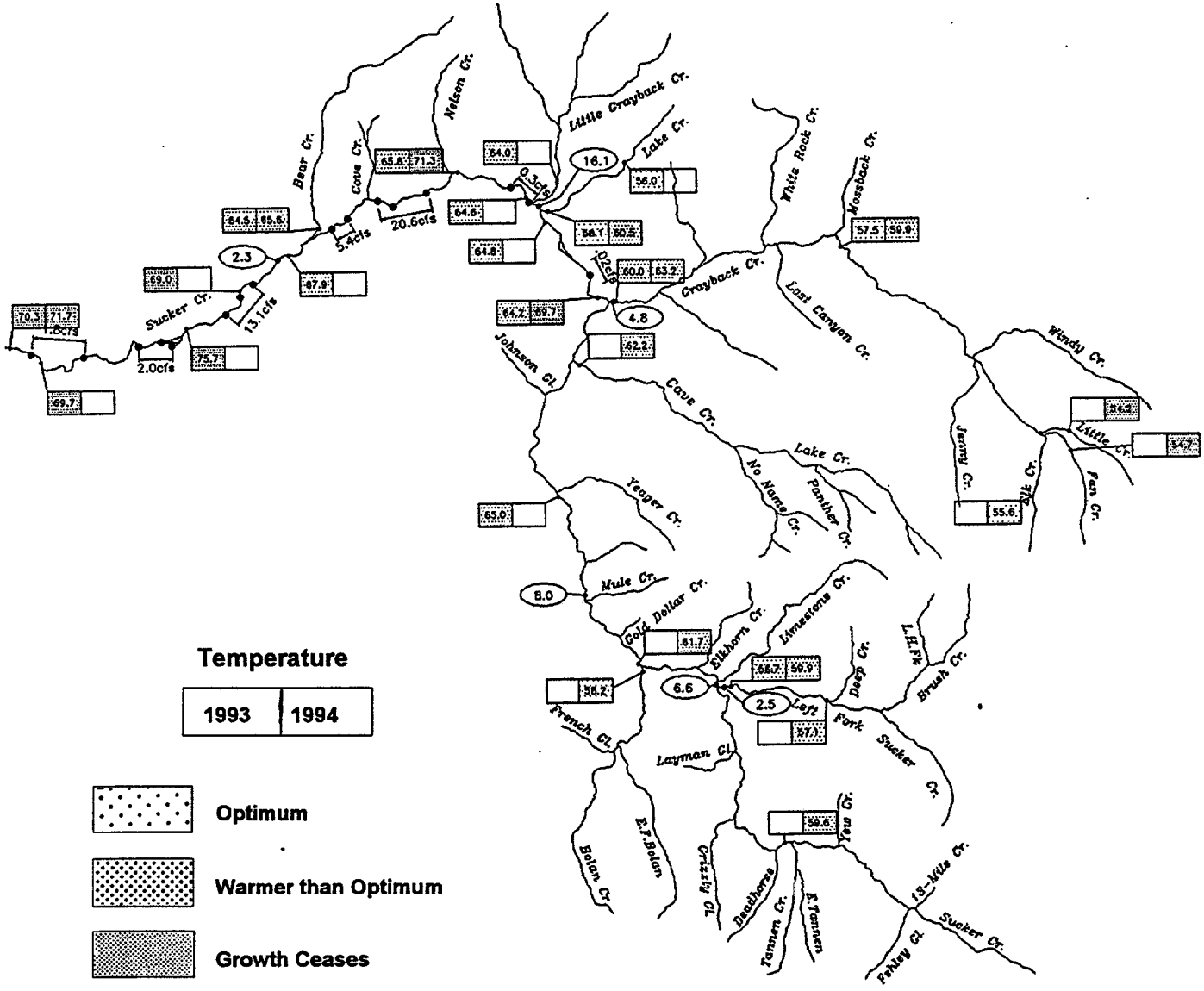
and young conifers. The debris torrent that scoured Cave Creek during the 1964 storm destroyed most of the riparian vegetation. The stream bed became barren gravel with no shade. In 1994, vegetation is growing back along the banks.

The greatest effect on channel morphology on Sucker Creek was the early placer mining. Bedload sediments were loosened and turned over, and material washed downstream decreasing pool depths and aggrading the channel. More water surface area per unit volume was exposed to the sun, increasing heating. However, aggraded sections may have increased subsurface flow, which would help to maintain cooler temperatures. In Grayback Creek, the timber harvest and roading that reduced shade also increased sediment delivery, reducing pool depth and aggrading the channel. The 1964 storm greatly magnified these effects. The massive disruption of Cave Creek in the 1964 storm also increased its width to depth ratio, and temperature.

Maximum summer temperatures in Sucker Creek are currently warmer than optimum for salmonids (Figure 6). Temperatures in 1994 were warmer than in 1993, because there was less stream flow. Because the flows during the maximum temperature period for these two years were well within the range for the gaging record and may be representative of typical variation, the differences in temperature for specific locations were compared (Figure 7). Of particular note is the segment from Yew Creek to below Bolan Creek, which was optimum for salmonids in 1993 and warmer than optimum in 1994, and the segment from above Grayback Creek to below Bear Creek which was warmer than optimum in 1993 and limiting for fish growth in 1994.

Figure 7

Grayback/Sucker Watershed
1993 and 1994 Stream Water Temperatures



As vegetation continues to grow along stream banks, it will provide more shade which will tend to reduce maximum temperatures. Storms and debris torrents will periodically remove stretches of riparian vegetation, occasionally at the scale of the 1964 event.

With the exception of Grayback Creek, timber harvest has not had an appreciable effect on stream temperature in the past; and with increasing emphasis on riparian protection, is unlikely to have much future effect.

Large scale mining has not taken place in the watershed since 1930, and is not expected to resume in the future. If mining activities continue as they are at present, they will slow the reestablishment of vegetation along those segments of Sucker Creek where claims are active and continue to have a destabilizing effect on channel morphology.

Agricultural activities along lower Sucker Creek will continue to withdraw water for irrigation. Vegetation may grow and provide increased shade in some areas, and be periodically cleared off in others.

Conditions and Trends: Aquatic Biology: Fisheries: Species, Distribution, and Trends

The anadromous salmonids present within the analysis area are: Fall Chinook (King Salmon, Coho (Silver) Salmon, and Steelhead (Rainbow) Trout. In addition, resident Rainbow trout and Cutthroat trout are presently distributed within the watershed analysis area. Other native fish species found within the analysis area include: Pacific Lamprey and Sculpin. The non-native fish also present within the analysis area are: Redside Shiner and Eastern Brook Trout (observed in the recent past).

Adult Fall Chinook Salmon range up Sucker Creek to a point above the confluence with Grayback Creek. Relatively large numbers were observed in the lower reaches of Grayback Creek in 1991 (Fred Craig, 1994).

Juvenile Coho Salmon have been observed from the confluence of Sucker Creek with the East Fork of the Illinios River to a point approximately one-half mile above Bolan Creek on the main-stem of Sucker Creek. In addition, juvenile coho are seasonally distributed on Grayback Creek above the confluence of Mossback Creek with Grayback Creek.

Steelhead (Rainbow) Trout have been observed throughout most of Sucker Creek into the Red Buttes Wilderness. The species has been observed on Grayback Creek above the confluence with Mossback Creek. In addition, the species is present on the lower reaches of most of the tributaries of Sucker Creek including Cave Creek, Bolan Creek, and the Left Fork of Sucker Creek.

Resident Rainbow Trout are distributed throughout many of the reaches of all the tributaries above and below anadromous fish barriers. In addition, Rainbow trout were planted in the lower reaches of Grayback Creek. The extent to which planted stock have mixed with native stock remains unknown.

Cutthroat Trout are present in many of the upper reaches within the entire analysis area, above anadromous barriers, on the tributaries (e.g., Windy Creek, Fan Creek, and Elk Creek) of Sucker Creek. Historically, Cutthroat were well distributed in the lower reaches of Grayback Creek (Fred Craig, 1994). Sea-run Cutthroat are not known to occur within the upper Illinois River Basin. However, the extent to which sea-run cutthroat may have occurred in historical times is unknown.

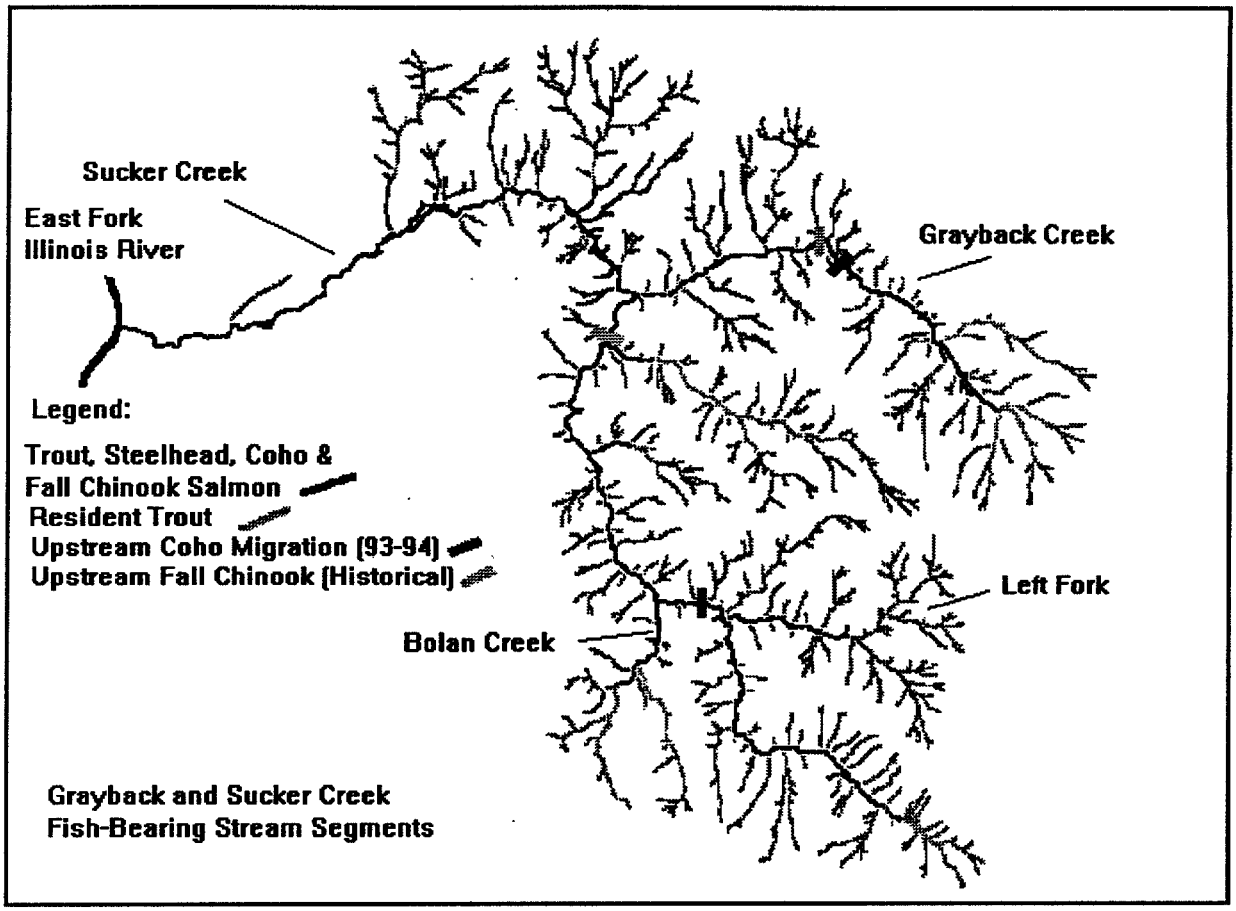
Sculpin have been observed in Sucker Creek to the confluence with the Left Fork, and in the lower reaches of Grayback Creek. Pacific Lamprey are thought to be restricted to the lower gradient reaches of both Sucker Creek and Grayback Creek.

Redside Shiner are well distributed in the lower reaches of Sucker Creek. The species was first identified in the lower Illinois River at the base of the Illinois River falls by Don King, in May of 1960. The species was not observed in Sucker Creek above the confluence with Little Grayback Creek during the late summer of 1994.

In 1972, Eastern Brook Trout were documented in the lower reach of Cave Creek (USDA, 1972), however, they have not been seen in recent years. In the past, the species was thought to have been planted at higher elevation lakes (i.e., Bolan Lake) on the Siskiyou National Forest.

Conditions and Trends: Aquatic Biology: Fisheries: Population Dynamics

Figure 8: Grayback and Sucker Creek Fish-Bearing Stream Segments



Both resident and anadromous salmonid population trends have been in decline for decades within the Illinois River Basin. Historically, ODFW harvest data was the only measure of anadromous fish population levels within the Illinois River Sub-Basin, a portion of the Rogue River Basin, (i.e., Upper Rogue District, Oregon Department of Fish and Wildlife). As a result of declining population levels, ODFW presently prohibits trout fishing within the entire Illinois River Basin, including Sucker Creek and its tributaries.

The long-term trend for upper Illinois River salmonid populations remains a question for both State

and Federal agencies. Steelhead trout, Coho Salmon and Fall Chinook are presently considered to be at depressed population levels throughout the Illinois River Basin (ODFW, 1992). Degraded habitat, extended drought conditions, and water withdrawals continue as key factors limiting production of both Steelhead Trout and Coho Salmon (ODFW, 1994).

Coho Salmon (1993), throughout the range of the species, and Winter Run Steelhead Trout (1992), throughout the Illinois River Basin have recently been petitioned to the National Marine Fisheries Service for listing under the Endangered Species Act.

The non-native redside shiner is established in the lower reaches of Sucker Creek. Based on a review of existing stream survey information, over the last couple of decades, Eastern Brook Trout are not present in most streams. Eastern Brook Trout are stocked in Bolan Lake every other year by ODFW. The status of Pacific Lamprey, Sculpin and other non-game species is thought to be relatively stable within the watershed.

Annual (1992-94) USFS summer juvenile fish counts on the lower reach of Grayback Creek and the lower reach of Left Fork of Sucker Creek provide limited data (USDA, 1994). The number of both Steelhead Trout and Coho Salmon juveniles have increased in total numbers during the sampling period (1992-94) on Grayback Creek. Coho Salmon Juveniles have not been found during the same sampling period on the Left Fork of Sucker Creek. During the same period, the observed number of juvenile Steelhead Trout have declined on the Left Fork of Sucker Creek, though still healthy.

Migratory fish are subject to a large number of direct and indirect mortality variables. Harvest and predation appear to be the most important direct variables affecting adult escapement. Lack of irrigation system screening may be a variable affecting downstream migrating winter Steelhead Trout. Habitat loss or modification limits overall carrying capacity for both spawning and rearing salmonids. Periodic 7-10 year flood events can destroy a larger measure of years fish eggs (i.e., Grayback Creek 1995 Coho Salmon). Intra-specific and inter-specific competition plays a large role in pre-smolt survival (e.g., Redside Shiner, of all age classes, compete directly with juvenile salmon inside of the upper part of the water column, within the pool habitats in the lower reaches of Sucker Creek). An array of limiting factors are affecting salmonid population levels over the range of both resident and anadromous salmonids presently utilizing the analysis area.

Conditions and Trends: Aquatic Biology: Fisheries: Habitat Conditions, Connectivity and Fragmentation

Freshwater anadromous fish habitat conditions are often described in key attributes which characterize overall carrying capacity (USDA, 1991). These attributes can collectively be used to qualitatively rate the habitats available to anadromous salmonids. The degree of fragmentation or

the lack of connectivity of habitats further contributes to the overall carrying capacity of the habitats. Site-specific standards for key attributes have yet to be developed for the upper Illinios River basin. Fish habitat effectiveness monitoring parameters (attributes) developed for the Section 7 (Endangered Species Act) Fish Habitat Monitoring Protocol for the Upper Columbia River Basin can be useful in assessing existing conditions within the watershed analysis area.

The key attributes evaluated in this watershed analysis area are limited to: water temperature, frequency of occurrence of pools, depth of pools, frequency of occurrence of various sizes of in-channel wood, and frequency of occurrence of side channel slack water areas during peak flow conditions. Stream gradient and stream bed substrata influence utilization by anadromous fish. Therefore, the lower gradient reaches and/or sub-reaches are the focal points of this assessment of the condition of the overall habitat. ODFW and USFS stream survey data, 1992-1993 were used in assessing the relative abundance of the above attributes (USDA, 1992a, 1992b,1993a,1993b; and ODFW, 1993c)

The low gradient segments (Table 2) serve as barometers used to evaluate and measure the relative health of instream salmonid habitat. For this analysis, the values developed over the past several years for the Pacific Northwest are utilized to assess habitat. These values were developed from extensive inventory data from streams in Oregon, Washington, Idaho and Alaska.

The low gradient reaches compared below have stream gradients equal to or less than two percent (2%) and have the capability of lateral movement in an unconfined or moderately-confined valley (Reach 1 - Sucker Creek) or alluviated canyons with terraces (Reaches 2a, 2b - Sucker Creek; Reach 1 Grayback Creek) (see Valley Width Index in Tables 3-5). Streams in these valley types generally form pool/riffle sequences rather than step/pool sequences. These types of stream segments are important aquatic production areas, generally wood and bedload deposit in these areas. Stratifying the stream reaches into low gradient unconfined (Rosgen "C" channel-type) segments for analysis allows for comparison with stream segments of similar geomorphology.

Table 2
Grayback/Sucker Watershed Low Gradient Segments

Stream & Segment No.	Expected Pools > 3 ft. depth/ Mile	**Actual Pools per Mile**	**Expected Large Wood Pieces per Mile**	**Actual Large Wood Pieces per Mile**	**Expected Maximum July-August Max. Water Temp. F.**	**Actual Maximum July-Aug Max. Temp. F.**
Sucker Ck. Reach 1	12-31 pools/ Mile	4 pools/ Mile	40 to 80 pieces/mile	1.7 pieces/ Mile	Less than 65 degrees	70 (1993) 72 (1994)
Sucker Ck. Reach 2a	15-37 pools/ Mile	2.5 pools/ Mile	40 to 80 pieces/mile	4.4 pieces/ Mile	Less than 65 degrees	64 (1993) 70 (1994)
Grayback Ck. Reach 1	29-73 pools/ Mile	8 pools/ Mile	40 to 80 pieces/mile	2.8 pieces/ Mile	Less than 65 degrees	60 (1993) 63 (1994)
Sucker Ck. Reach 2a	15-38 pools/ Mile	5.8 pools/ Mile	40 to 80 pieces/mile	1 piece/ Mile	Less than 65 degrees	59 (1993) 60(1994)

Note: Reach 1 of Grayback Creek has seven (7) side channels. This information is not available from the Sucker Creek data, field observations note side channel habitat in Reach 1. Left Fork Sucker Creek stream survey data indicates no side channels.

Expected pools per mile were calculated based on a pool frequency of three (3) to nine (9) channel widths, assuming pools counted will have a length equal to or greater than the wetted width.

Expected wood per mile was calculated using a range developed for Pacific Northwest streams by researching stream survey records and providing a range indicative of large wood in the Siskiyou Mountains.

SUCKER CREEK PROFILE

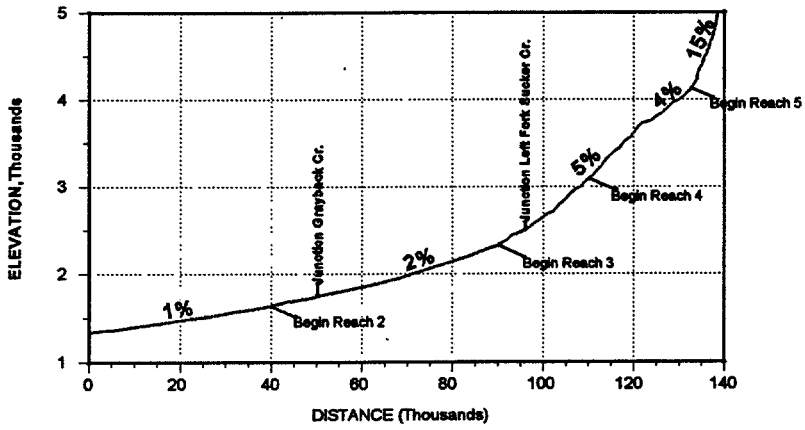


Table 3: Fish Habitat Attributes for Sucker Creek

Reach No	1	2a	2b	3a	3b	4	5
Valley Width Index	19.5	4.9	4.9	1.8	1.8	3.1	2.2
Reach Length (miles)	10.1	2.4	4.9	1.5	2.7	2.0	2.3
Percent Pools > 3 ft. Depth	54%	50%	77%	71%	75%	100	0
Pools/Mile	4.0	2.5	5.8	4.5	3.0	2.5	0
Avg. Width in feet	41.8	34.7	29.3	23.3	13.4	10.8	4.8
Large Wood/Mile	1.7	4.4	1.0	7.1	11.2	2.5	10.7
Riparian Tree Diam (DBH, ")							
Conifer	1-6	12-20	12-20	6-12	6-12	6-12	12-20
Hardwood	1-6	12-20	12-20	12-20	1-6	1-6	1-6

* Data derived from Oregon Department of Fish and Wildlife Stream Survey - 1993. Transects taken every thirty habitat units and at beginning of each new reach. Diameter class most frequently encountered in reach is shown.

LEFT FORK SUCKER CREEK PROFILE

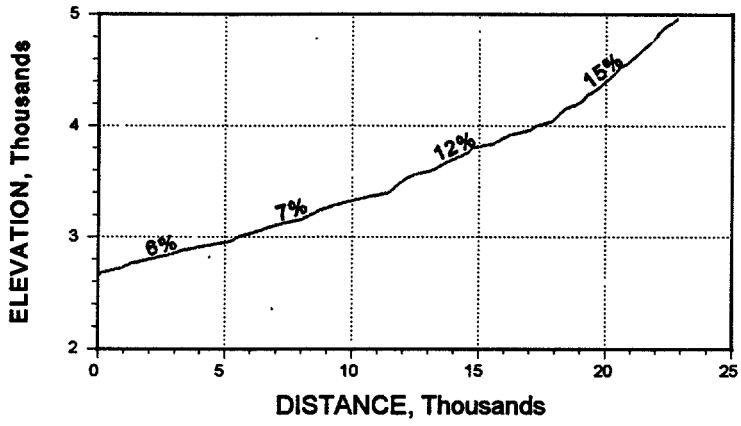


Table 4: Fish Habitat Attributes of Left Fork Sucker Creek (for Reach 1, up to 10,xxx feet)

Reach No	1
Valley Width Index	?
Reach Length (miles)	2.0
Percent Pools > 3 ft. Depth	21%
Pools/Mile	20
Avg. Width in feet	16.6
Large Wood/Mile	416
Riparian Tree Diameter (inches) Conifer Hardwood	 20-30 12-20

GRAYBACK CREEK PROFILE

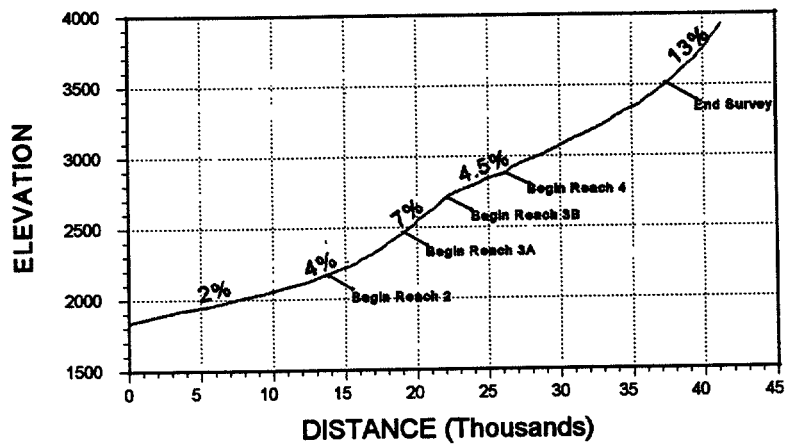


Table 5: Fish Habitat Attributes of Grayback Creek

Reach No	1	2	3a	3b	4
Valley Width Index	5.4	8.3	1.3	3.9	7.6
Reach Length (miles)	1.9	1.1	0.4	0.9	2.4
Percent Pools > 3 ft. Depth	68%	91%	100%	80%	18%
Pools/Mile	8	10.3	28.8	11.5	9.2
Avg. Width in feet	18.3	15	16.6	17	13
Large Wood/Mile	2.8	4.4	0	0	0
Riparian Tree Diameter (inches) Conifer Hardwood	 12-20 8-12	 12-20 8-12	 12-20 8-12	 12-20 8-12	 20-30 8-12

Notes: Valley Width Index is a measure of channel confinement. VWI = Valley floor width/channel width. Estimated from aerial photographs and surveyed bankfull widths.
Large Wood per Mile is calculated using only wood that is > 24 inches diameter at the small end and longer that 50 feet.
** Data derived from Forest Service stream surveys. Plots were taken each tenth pool, riffle or glide habitat unit. Most prevalent diameter class shown for each reach.

Elevated water temperatures can be lethal for salmonids. Mortality can occur when water temperature exceed 75 degrees F for extended periods. Growth often ceases in juvenile fish when water temperatures exceed 68 degrees F. Optimum salmonid water temperature is considered to be at levels below 59 degrees F. Water temperatures become elevated in association with (1) Wider, low gradient areas, (2) diminished flows, and (3) reduced stream-side shade.

Seasonal low flow water temperatures are characterized as ranging from optimum in the higher gradient reaches in the headwaters to sub-lethal (growth-ceases) in the lower reach of Sucker Creek. Year-to-year variations in the extent of the range of sub-lethal water temperatures are evident. The lower reach of Grayback Creek is annually warmer than optimum. Water temperatures may annually be warmer than optimum on Sucker Creek to a point above the confluence of Bolan Creek and Sucker Creek.

The frequency of occurrence of pools is a key attribute of anadromous habitat. All species of salmonids utilize pool habitat. Pool habitat is of particular significance to juvenile salmon during summer months.

The number of pools per mile for Grayback Creek, Sucker Creek, and the Left Fork of Sucker Creek ranges, from 2.5 to 28.8 pools per mile, depending on reach. Key lower gradient reaches for Grayback Creek and Sucker Creek are substantially below expected pool frequencies for stream segments of similar morphology.

Pool depth is a measure of overall pool quality. Pools with depths greater than three feet are of the highest value. Pools of this depth often provide both cooler water temperatures and hiding and/or escape cover for juvenile salmonids. The percentage of pools greater than three feet in depth in Grayback Creek, Sucker Creek, and the Left Fork of Sucker Creek range, depending on individual reach, from 0-100 %. As with the frequency of occurrence of pools, key lower gradient reaches for Grayback Creek and Sucker Creek are substantially below the expected number of pools greater in depth than three feet for stream segments of similar morphology.

Although in-channel wood of any size provides cover for all age classes of anadromous fish, large wood is of the greatest value. Large wood has been defined as any piece with a small-end diameter greater than twenty-four inches and a length of fifty feet or more. The number of pieces of large wood per mile, depending on the specific reach, ranges from none on Grayback Creek and Sucker Creek to 416 on the lower reach of the Left Fork of Sucker Creek. Key lower gradient reaches for Grayback Creek and Sucker Creek are substantially below expected observed large wood values for stream segments of similar morphology. (See Channel Morphology subsection.)

Side-channels are of great importance to overwintering juvenile salmonids. Coho Salmon juveniles may make greater use of side-channels during high flow condition than Steelhead Trout juveniles. Simplification of stream channels often reduces the overall availability of side channel habitats. Side-channels in lower gradient sections are part of the functional floodplain. Side-channel habitat is lacking on the main stem of Sucker Creek above the confluence of Grayback Creek with Sucker Creek. The primary tributaries of Sucker Creek (e.g., Grayback Creek), and the Left Fork of Sucker Creek lack any significant side-channel habitats.

Summary of Habitat Conditions, Connectivity and Fragmentation: Based on a review of existing site-specific information, the overall condition of the aquatic habitat is considerably less than optimum for production of salmonids. All the major habitat attributes (i.e., water temperature, frequency of occurrence of pools, depth of pools, frequency of occurrence of various sizes of in-channel wood, and frequency of occurrence of side channel slack water areas during peak flow conditions) occur considerably less frequently than highly productivity sites.

Of specific concern is the annual elevated water temperature in the lower-gradient reaches of both Grayback Creek and Sucker Creek. These temperature conditions annually range from lethal to sub-optimum in most areas utilized by juvenile salmon in the summer months. The frequency of occurrence of in-channel large wood in the lower-gradient reaches is also of great concern.

The overall complexity of low-gradient aquatic habitats, as well as the connectivity of the existing complex low-gradient aquatic habitats, is less than desirable for the production of Coho Salmon. Seasonally elevated water temperatures result in both inter-specific competitions between juvenile salmon and Redside Shiner within key sub-reaches. Therefore, seasonally elevated water temperature further reduces the overall connectivity of key aquatic habitats for extended periods of time. The annual phenology (timing of spawning, smoltation, etc.) for Coho Salmon is not adaptable to these seasonally elevated water temperatures.

A series of fish habitat improvement projects was initiated on Cave Creek during the late 1980's (USDA, 1987; USDA, 1987b). Up stream log "V" weirs, horizontal weirs, cover logs, root wad/rock complexes, and rocks/rock clusters were all placed on Cave Creek in the vicinity of the Cave Creek Campground. These improvements were intended to raise the carrying-capacity for resident Rainbow Trout.

Habitat improvements were also initiated in 1987 to raise the carrying-capacity for Coho Salmon in Reach 1 of Grayback Creek (USDA, 1987g). These improvements included: rock weirs, log weirs with pools, boulder/log deflector complexes, cover logs, boulder or rootwad cover complexes, rock clusters, and alcoves.

Placer Mining and Carrying Capacity: Oregon Department of Fish and Wildlife conducted relative

abundance surveys of disturbed (placer mining) and undisturbed sites on Sucker Creek (above the confluence with Cave Creek) from 1985-1987 (Throop and Smith, 1986). The sampling results indicate that Steelhead fry were abundant in both disturbed and undisturbed sites. Coho fry in the undisturbed area out numbered those in disturbed areas.

> "The large expanse of gravel in the rechanneled area . . . is not ideal for coho." Sculpin, small bottom-dwelling nongame fish were found in much greater numbers in the disturbed areas. "The actual moving of the stream bed during mining destroyed spawning habitat, eggs, and fry in the gravel during the year it was moved." (Throop and Smith, 1986)

The production of aquatic insects was also temporarily eliminated.

Lakes: Bigelow Lake is a shallow wetland presently unsuitable for salmonids. Bolan Lake is periodically stocked by ODFW with Rainbow Trout and historically with Eastern Brook Trout. East and West Tannen lakes were historically stocked with Rainbow Trout. The Tannen Lakes are within the Wilderness Boundary and have not been stocked in the past several years.

Phenology: Salmonid behavioral and physiological responses resulting from site-specific human activities (i.e., seasonal de-watering of the lower reach of Sucker creek, and the overall simplification of the aquatic habitats throughout the watershed) remains a key question in understanding long term maintenance of the anadromous salmonid populations utilizing the watershed. It can be speculated that the behavioral response would likely be the migration to more suitable sites outside the analysis sites.

Conditions and Trends: Aquatic Biology: Other Aquatic Species: Species, Distribution, and Trends

Many aquatic and/or semi-aquatic organisms (amphibians, mollusks) are associated with the microclimates of cold-water (< 59 degrees F) fish bearing, non-fish bearing, and intermittent streams. In addition, side-channel habitats, wetlands, and other slack water areas are important habitats for many aquatic species. The array of specific micro-habitats for many of the aquatic organisms is not adequately known (SAT, 1993). Many of these species likely benefit from increased aquatic/riparian habitat protection outlined in the Aquatic Conservation Strategy (Record of Decision for Admendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, USDA-FS, USDI-BLM 1994).

Recent (1993 & 1994) macro-invertebrate collections in Grayback Creek and the Left Fork Sucker Creek have been analyzed (Wisseman, 1994). Sucker Creek: Most taxa are common and characteristic of cool but not cold streams. The fauna are typical of streams lacking habitat complexity. Left Fork Sucker Creek: The majority of the taxa are common, and characteristic of

water temperature that are cold year-round. The invertebrate community & Bioassessment indicates some habitat impairment. Grayback Creek: Most taxa present are common and characteristic of cool but not cold streams. Nonsensitive or rare taxa, or taxa with isolated distributions, are present. There are several taxa present that are more typical of open, warmer streams.

Although most amphibians are dependent on aquatic environments for some stages of the life cycle, a few species are more dependent on aquatic habitats. The following aquatic species utilize the analysis area: Tailed Frog and Pacific Giant Salamander.

Although most reptiles are not dependent on aquatic environments for any stages of the life cycle, a few species are more dependent on aquatic habitats than others. The following more heavily aquatic dependent species utilize the analysis area: Pond turtle, Aquatic Garter Snake.

Several bird species are dependent on aquatic environments as primary foraging habitat. The following species have been periodically observed within the analysis area: Bald Eagle, Osprey, King Fisher, Dipper (Water Ouzel). The Bald Eagle is not known to nest or winter in the analysis area.

Several mammals are dependent on aquatic environments as primary habitat. Beaver are presently utilizing sections of Reach 1 Sucker Creek.

Trends: The overall trend in aquatic and semi-aquatic species populations levels within the analysis area remains uncertain. The major habitat alterations directly associated with mining, timber harvest, and agriculture development have already taken place. For those species most dependent on the association of mature forests and aquatic habitats, the overall condition of the riparian habitats may be stabilizing after years of degradation. Complete recovery of the Riparian Reserve and associated aquatic habitats remains to be achieved.

Some species (Bald Eagle, Osprey) likely utilized the lower reaches of Sucker Creek more commonly than today. The Beaver population may have been more extensively distributed along Sucker Creek and, to some extent, Grayback Creek in earlier times. Cold water dependent amphibians (Tailed Frogs, Pacific Giant Salamanders) also were likely to have been more extensively distributed and relatively more abundant within the analysis area. It is believed that habitat attributes, such as those identified of major importance to salmonids, also benefit a host of associated aquatic species. Therefore, overall carrying capacity for most endemic aquatic and/or semi-aquatic species is related directly to the quality of the salmonid habitats.

Conditions and Trends: Aquatic Biology: Other Aquatic Species: Population Dynamics

Aquatic and semi-aquatic species are subject to a large number of direct and indirect mortality variables. Habitat loss or modification, limit overall carrying capacity for a wide range of aquatic dependent species. Intra-specific and inter-specific competition plays a role in overall survival for any individual, regardless of species. Inter-specific competition relative to most of the aquatic species inhabiting the area is poorly understood. An array of limiting factors may be affecting aquatic population levels utilizing the analysis area. However, human-caused habitat alteration may be the most important factor presently affecting the present distribution and relative abundance.

Conditions and Trends: Aquatic Biology: Other Aquatic Species: Habitat Conditions, Connectivity and Fragmentation

Lakes, Wetlands, and Springs: Bigelow Lake, Bolan Lake, and Tannen Lakes are relatively important wet/aquatic sites. There are also a number of higher elevation springs and associated wetlands. Little site-specific information relative to aquatic plant or animal communities occupying these areas is available. Aquatic invertebrate sampling, amphibian sampling, and general site-specific inventory work has yet to be initiated. One field survey revealed the presence of Pacific Giant Salamander, tailed frog, and western toad larva at Bigelow lake in the summer of 1994.

Summary of Habitat Conditions, Connectivity and Fragmentation: Based on a review of existing site-specific information, the overall condition of the aquatic habitat is less than desirable for most aquatic species directly associated with cold-water fisheries habitats. The overall connectivity of key reaches has been reduced by a reduction in the frequency of occurrence of key attributes (i.e., large wood, large trees, wetlands, side-channel development, deep pools, and seasonal water temperatures) within the historic past. Many of the aquatic and semi-aquatic species are presently at relatively depressed population levels within the analysis area, based on the inferred carrying-capacity of the pristine condition of the habitat.

Conditions and Trends: Subwatersheds: Upper Sucker Creek

All of Sucker Creek from Grayback Creek to near the headwaters had the bedload turned over and stream bank soil added from mining. The 1940 photos show the extent of placer mining along Sucker Creek. The canopy was broken and spotty, and small patches of gravel or bare bedrock were numerous. Mining of strath terraces reduced shade because the soil was removed, leaving boulder piles and bare bedrock where trees have not yet grown back. Some original old-growth trees survived the mining because they were growing out of solid rock along stream banks or at

other places not worth mining. There was a general long-term loss of shade along Sucker Creek due to placer mining. A recent trip to a few of these found re-growth of alders and small conifers, but that the widened places still lacked shade (Paula Fong, 1990).

Within the more recently mined reaches, the Sucker channel was rerouted to the east side of valley (Throop and Smith, 1986). Mine reclamation needs include replanting (even off-channel vegetation might be accessed during a flood), and correcting the apparent constriction of the active channel (site circled on aerial photo 186-155).

Inventoried landslides have delivered 89,000 cubic yards to Upper Sucker Creek, with the largest slide in Tannen Creek delivered to the main stem.

The wide glaciated reach of Upper Sucker (Reach 4) has the largest volume of wood (ODFW, 1993). However, much of the wood is in small pieces.

Within the Upper Sucker watershed, road 4612098 was constructed in 1966, with no culverts shown as greater than 30 inches in diameter, though several are present upslope on road 4612540. The capacity of these culverts has not been tested by a storm as large as the 1964 event. These should receive a relatively high priority in capacity analyses, or for site modifications to control drainage diversions and pass debris flows.

Left Fork Sucker Creek deposits a debris fan at its confluence with Sucker Creek. Mining appears restricted to local rock piles and pocket pools created by old dredging (USFS, 1989). The Kester mine is located near the mouth of the stream. Stream surveyors have observed that the Left Fork has a healthy population of fish compared with other streams nearby. The Left Fork is also cooler than the main stem Sucker Creek.

Surveys along the lower mile of the Left Fork report the presence of spawning size gravel throughout (not embedded) with large wood accumulations and dense riparian vegetation. Pools commonly have cover by wood and undercut banks. (USFS, 1989 and USFS, 1992). At 4964', a possible barrier is present (eight foot log jam), and at 6688', a probable barrier (nine foot log jam). At 6519', a flooded cedar snag patch may be the result of a debris flow. Near the end of the survey, it was noted that Brush Creek contributes approximately half the flow.

Within the Left Fork Sucker watershed, road 4612080 was constructed in 1966 and 1970, with seven culverts that are greater than 40 inches in diameter. The capacity of these culverts has not been tested by a storm as large as the 1964 event. These should receive a relatively high priority in capacity analyses, or for site modifications to control drainage diversions and pass debris flows.

Bolan Creek is the only major tributary with substantial historic gold mining activity. Mining

extended into the headwaters of the West Fork and its tributaries up to French Peak and No.8 Peak. Current activity includes a water diversion ditch for hydraulic mining at D. Hodges claim (noted at 2.6 miles upstream by stream surveyors - USFS 1989). The channel gradient increases from 5% in the lower reaches to 7-8% upstream (USFS, 1989). The riparian zone is narrow, bedrock is exposed, and boulder cascades are common. A possible barrier to fish migration is located ~ 1 mile upstream (bedrock cascade, four feet high, 15 feet long), and a definite barrier occurs ~ 1.6 mile upstream (falls, 22 feet high). Mining activity may have stripped the channel, resulting in high velocities and no instream wood. Spawning gravels are limited, and where present are embedded with larger than expected quantities of silt and sand, attributed to current mining activity (USFS, 1989).

Conditions and Trends: Subwatersheds: Cave Creek

Local knowledge and written history indicate that Cave Creek had little or no mining. However, renewed mining activity along Sucker Creek (Throop and Smith, 1986) includes settling ponds at the mouth of Cave Creek that have been pumped and rechanneled. Approximately one half mile upstream, a barrier to fish migration is present (15 foot high fall), before the channel enters a steep v-shaped canyon.

An estimated 141,000 cubic yards of sediment have been delivered to Cave Creek by landslides, primarily due to a large 1964 debris flow that began in the southwest corner of the Oregon Caves National Monument and affected most of the 5 to 6 miles to Sucker Creek. In the upper part, the stream banks were undercut and numerous landslides added to the torrent. In the lower parts, deposition filled the narrow canyon up to 30 feet deep. The part downstream from the bridge was less affected than upper parts, although there were a few stream bank failures. Much of the sediment deposited in the narrows at the bridge. This site is at the end of a 2.5-5.0% gradient reach, and confined by 300 feet of hard rock outcrops on both sides of the stream. The entire length of stream bed was turned essentially into a barren gravel bed with no shade. Every large pool above the narrows was probably filled with sediment. Thirty years later, shading vegetation is regrowing along the banks.

Because of the relatively high density of roads in Cave Creek watershed, it would be desirable to reduce road drainage effects. Roads 4614017 and 4614024 are located in midslope positions, and partly within thick granitic and metamorphic soils. Site analysis of road drainage interactions with unstable slopes and streams (including intermittent) will help to prioritize road projects.

Conditions and Trends: Subwatersheds: Grayback Creek

Local knowledge and written history indicate that Grayback Creek had little or no mining.

Upper Grayback Creek was disturbed prior to 1964. Section 36 of private timber land was clearcut by tractor logging several years before 1964. Trees were removed from stream banks, and numerous tractor trails went straight up and down the banks. Other disturbed areas include the watershed of White Rock Creek below the intensely logged and roaded section 16 of private land, and the part of the main stem in the section 28 of private land 28 below Mossback Creek. There were also several large early clearcuts on Forest land above the private section.

Downstream on National Forest land, which had not been logged, the aerial photos clearly show aggradation of the stream bed and loss of soil and shade from several stream banks. The landslide inventory shows 65,000 cubic yards of sediment, delivered primarily from a naturally-occurring debris flow initiated from above Road 4611079. The debris flow deposited in a forested reach with 2.5-5.0% gradient.

The 1964 flood likely deposited the cobble and boulder fan that remains at the mouth of Grayback Creek today, and transported the finer particles down Sucker Creek. Within Grayback Creek, debris fans were deposited at several tributary junctions. Hillslope and stream bank landslides and erosion from pre-1964 logging practices were the primary source for these fans. Sediment continues to fill pools associated with habitat enhancement structures in the lower reach (Sarah Mayer, 1994). Grayback Reach 1 is dominated by cobbles and small boulders with less gravel and sand, but greater than 35% embeddedness is reported (USDA Forest Service, 1989h). Erosion of the tributary fans is one sediment source, evidently the result of ongoing channel adjustment by downcutting in deposits that have post-1964 alder growth (Martin Trso, 1994).

Post-1964 salvage of large wood may have also released sediment that filled pools in lower Grayback. The decrease in channel roughness is likely to increase flow velocities, and mobilize coarser sediments. The lack of fines in pools is indicated by relatively low values of V^* (Lisle, 1992), averaging 0.01 in Grayback Creek (below Mossback Creek), and 0.25 in its tributaries (Martin Trso, 1994). However, relatively high values of q^* (Dietrich, 1989), in reach 1 seems to indicate an abundant supply of bedload that prevents an armor layer from developing on gravel bars.

A summer 1994 visit confirmed the evidence of aggradation, with abundant sand and gravel in the stream bed, but the stream banks have a good canopy of alders and young conifers.

Because of potential for increased flow in channels located within sensitive granitic soils, it would be desirable to reduce the road drainage effects in the Jenny Creek area. However, the current transportation system accesses Matrix lands. Both roads 4611070 and 4611063 are located in midslope positions in the thick granitic soils, adjacent to earthflow terrain. Road 4611970 is closer to a toeslope position, and intercepts subsurface flow (Engineering road logs, 1994). Site-analysis will be required on these roads to assess road drainage interactions with unstable slopes and streams

(including intermittent) and other issues such as fire escape routes for Caves National Monument, recreational use, Port-Orford-cedar infection, and economic factors such as maintenance costs.

The 1993 "Jenny Creek" slide was a debris flow that failed from the shoulder of the 4611070 road (constructed in 1959). The initial field inspection detected no observable relationship between the failure and the harvest below or the road. Water emerged from subsurface piping within the weathered granitics, but well below the road fill, and away from any root or groundwater influence of the harvest unit. However, an older culvert had been blocked to prevent drainage onto the road shoulder, because a smaller slide had occurred there previously (Joe Cornell, 1993). That previous road-related slide may have altered the site enough to cause the later debris flow.

Conditions and Trends: Subwatersheds: Lower Sucker

The channel conditions resulting from historic mining are similar from Cave Creek to Grayback Creek (within Reach 2B) to those reported for Upper Sucker.

Within Reach 2A, the ODFW Aquatic Inventory (1993) reports that the channel is confined by alluvial terraces. It is suspected that bank armoring is now or will in the future prevent channel interaction with the valley floor. Facilities located on alluvial terraces include the main road system, Grayback Campground, and private residences.

In the past, large areas of non-Forest land along lower Sucker Creek were tractor-logged with much road construction. No landslides were identified in the USFS inventory, but one landslide area was identified for BLM lands. Sediment in the lower Sucker channel is derived from transport from upstream sources, and local bank erosion.

The extent of 1964 flood aggradation and channel widening on the Lower Sucker floodplain has not been interpreted from aerial photographs (the 1963 M-JOS photo set has good coverage, but need to interpret a post-1964 set such as the 1989 color infrareds). The East Fork Illinois and Sucker are recovering from 1964 aggradation and channel widening, but the process may be slowed at least partially by annual construction of water diversion ditches (Trish Carroll, 1994), and by periodic removal of gravel bars near bridges (Clayton Fincher, 1994). Removal of large wood post-1964 may have increased bank erosion in some areas, by promoting downcutting and bank adjustments. Multiple terraces, secondary channels, and beaver activity are present, indicating some recovery of more stable side channel habitat.

AQUATIC ECOSYSTEMS
Literature Cited

Ames, K.W., 1992, Tree-ring data reveal droughts part of normal Northwest climate: The Oregonian, June 25, 1992.

Atzet, T., 1979, Description and classification of the forests of the Upper Illinois River Drainage of southwestern Oregon: Oregon State University PhD Dissertation.

Atzet, T. and Amaranthus, M., 1985, Soil Moisture Retention Program (SMRP) documentation and use, USDA Forest Service Pacific Northwest Region, Siskiyou National Forest, R6-ECOL-209-1986.

Brazier, J. and Park, C., 1994, Rogue River Basin 1993 Temperature Monitoring Report, Rogue and Siskiyou NF (unpublished).

Carroll, Trish, 1994. Oral Communication with Cindy Ricks. Illinois Valley Ranger District, Siskiyou National Forest.

Cornell, Joe, 1993, Oral communication with Cindy Ricks, Illinois Valley Ranger District, Siskiyou National Forest.

Cornell, Joe. 1994, Written communication, Illinois Valley Ranger District, Siskiyou National Forest.

Craig, Fred. 1994, Oral communication with Dave Vezie, December 11, 1994. Siskiyou National Forest, Illinois Valley Ranger District.

Craig, Fred, 1995, Oral communication with Bob Ettner, March 13, 1995, Siskiyou National Forest.

de la Fuente, J. and Haessig, P.A., 1993, Salmon sub-basin sediment analysis, Klamath National Forest, Final Report for Interagency Agreement #14-16-0001-91522.

Dietrich, W.E., Kirchner, J.W., Ikeda H., and Iseya F., 1989, Sediment supply and the development of the coarse surface layer in gravel-bedded rivers: Nature, v. 340, p. 215-217.

Fincher, Clayton, 1994, Oral communication with Randy Frick, Illinois Valley Ranger District, Siskiyou National Forest.

Fong, Paula, 1990, Written communication for China Left Project Analysis File, Illinois Valley Ranger District, Siskiyou National Forest.

Hackala, K. 1994, Written communication to Siskiyou National Forest.

Harr, R. Dennis and Roger A. Nichols, 1993, Stabilizing Forest Roads to Help Restore Fish Habitat: A Northwest Example. Fish 18(4):18-22.

Hicks, Brendan J., Robert L. Beschta, and R. Dennis Harr, 1991, Long-Term Changes in Streamflow Following Logging in Western Oregon and Associated Fisheries Implications. Water Res. Bul. 27(2):217-226.

Huntington, H., 1994, The dark December: Grants Pass Daily Courier, December 17, 1994 [interview with Harry Christiansen, Oregon Caves Chateau manager during December 1964 flood].

Keppeler, E.T. and Ziemer, R.R., 1990, Logging effects on streamflow: Water yield and summer low flows at Caspar Creek in Northwestern California, Water Resources Research, Vol 26 No. 7, pp. 1669-1679.

King, Don, 1994, Oral communication with Dave Vezie, December 12, 1994. Siskiyou National Forest, Illinois Valley Ranger District.

Lisle, T.E. and Hilton, S., 1992, The volume of fine sediment in pools: An index of sediment supply in gravel-bedded streams: Water Resources Bulletin, v.28, p.371-383.

Mayer, Sarah, 1994, Oral communication with Dave Vezie, Illinois Valley Ranger District, Siskiyou National Forest.

Meko, D.M. and Stockton, C.W., 1984, Secular variations in streamflow in the Western United States, Journal of Climate and Applied Meteorology, Vol. 23 No.6, pp. 889-897.

Meyer, L.C., and Amaranthus, M.P., 1979, Siskiyou National Forest Soil Resource Inventory, USDA Pacific Northwest Region.

Montgomery, D.R. and Buffington, J.M., 1993, Channel classification, prediction of channel response, and assessment of channel condition: Report for SHAMW committee of the Washington State Timber/Fish/Wildlife Agreement, TFW-SH10-93-002.

Pera, Larry, 1995, Oral communication with Cindy Ricks, February 13, 1995. Illinois Valley Ranger District. Siskiyou National Forest.

ODFW, 1993a. Illinois River Basin Temperature Study 1992-1993: A Cooperative Study. Oregon Department of Fish and Wildlife, Siskiyou National Forest, Bureau of Land Management, Oregon Department of Water Resources [David A. Krebs, writer/editor].

ODFW, 1992. Status of Anadromous Salmonids In Oregon Coastal Basins.. Oregon Department of Fish and Wildlife, Research and Development Section and Ocean Salmon Management [T.E. Nickelson, et al.]. December 1992.

ODFW. 1993c ODFW Stream Aquatic Inventory Project [Sucker Creek] Stream Report. Oregon Department of Fish and Wildlife [M. Evenson et al.] March 29-30, 1994.

ODFW. 1994 Fish Management Review Southwest Region: Upper Rogue District Stream Report, Oregon Department of Fish and Wildlife.

ODFW, 1993, ODFW Stream Aquatic Inventory Project [Sucker Creek] Stream Report. M. Evenson, et.al., March 29-30, 1994.

ODFW, 1994, Fish Management Review Southwest Region: Upper Rogue District Stream Report.

Phillips, Cliff, 1994. Oral Communication with Ed Gross. Illinois Valley Ranger District, Siskiyou National Forest.

Pierce, Bob, 1994. Oral Communication with Connie Risley. Illinois Valley Ranger District, Siskiyou National Forest.

Ramp and Peterson, 1979, Geology and Mineral Resources of Josephine County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 100.

Sellards, Dennis, 1994. Oral Communication with Cindy Ricks. Illinois Valley Ranger District, Siskiyou National Forest.

Soil Conservation Service, 1983, Soil Survey of Josephine County.

Sullivan, K., Lisle, T.E., Dolloff, C.A., Grant, G.E., and Reid, L.M., 1987, Stream channels: The link between forests and fishes: in Salo, E.O. and Cundy T.W., eds. Streamside Management: Forestry and Fisheries Interactions.

Throop, A.H. and Smith, A.K., 1986, Fishing and placer mining: Are they compatible?: Oregon Geology, vol. 48, no. 3, pp. 27-34.

Trso, Martin, 1994. Written Communication with Cindy Ricks. Illinois Valley Ranger District, Siskiyou National Forest.

USDA, Forest Service & USDI Bureau of Land Management, April 1994, Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Spotted Owl.

USDA. Forest Service. 1994 Annual (1992-1993) Critical Reach Summer Juvenile Fish Counts Database. Siskiyou National Forest, Illinois Valley Ranger District.

USDA, Forest Service. 1994a. Sucker Creek Aquatic/Riparian Survey - Lower Sucker to Grayback Creek. Stream Survey, Unpublished Records [Frick Memo], Siskiyou National Forest. August 1, 1994

USDA, Forest Service. 1994b. Sucker Creek FisheriesSurvey - Grayback Creek to Left Fork Sucker Creek. Stream Survey, Unpublished Records [Frick Memo], Siskiyou National Forest. August 16, 1994

USDA, Forest Service. 1994c. Sucker Creek Fisheries Survey - Left Fork Sucker Creek. to Red Buttes Wilderness, Grayback Creek Stream Survey, Unpublished Records [Frick Memo], Siskiyou National Forest. August 13, 1994

USDA, Forest Service. 1994d. Grayback Creek Critical Reach Snorkel Survey Stream Survey, Unpublished Records, Siskiyou National Forest. August 23, 1994

USDA, Forest Service. 1994e. Left Fork Sucker Creek Critical Reach Snorkel Survey Stream Survey, Unpublished Records, Siskiyou National Forest. August 30, 1994

USDA, Forest Service. 1994f. Illinois Valley [Water] Temperature Monitoring Data For 1994 Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA, PNW, Forest Service.1993. REAP, An Ecological Assessment, A First Approximation.

USDA, Forest Service. 1993a. Grayback Creek Stream Survey Summary Tables. R6 Stream Survey, Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA, Forest Service. 1993b. Illinois Valley [Water] Temperature Monitoring Sites For 1993. Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA, Forest Service. 1992a. Illinois Valley [Water] Temperature Monitoring Sites For 1992.

Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA, Forest Service. 1992b. Siskiyou National Forest Illinois Valley Ranger District 1992 Stream Inventory (Critical Reach) Summary Tables (Althouse Creek, Canyon Creek, Dunn Creek, Grayback Creek, Sixmile Creek, Left Fork Sucker Creek, and Trapper Gulch). SMART Tables, RES-93-2. Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA, Forest Service. 1992c. Siskiyou National Forest Illinois Valley Ranger District 1992 Stream Inventory Summary Tables (Deer Creek, Elder Creek, Fall Creek, Rancherie Creek, West Fork Rancherie Creek, Sixmile Creek, Left Fork Sucker Creek, and Trapper Gulch). SMART Tables, RES-93-1. Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA. Forest Service. 1991 Influences of Forest and Rangeland Management on Salmonid Fishes and their Habitats [Book]. American Fisheries Society Special Publication Number 19.

USDA, Forest Service. 1989a. Bolan Creek: 1989 Survey. Strteam Survey, Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA, Forest Service. 1989h. Illinois Valley Ranger District 1989 Stream Survey Report. Stream Survey, Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA, Forest Service. 1987b. Cave Creek Fish Habitat Improvement Project Site Descriptions. Habitat Improvement, Unpublished Records, Siskiyou National Forest, Illinois Valley Ranger District.

USDA, Forest Service. 1972. Cave Creek Stream Survey. Stream Survey, Unpublished Records, Siskiyou National Forest.

West, G.J., 1984, Holocene vegetation and climatic changes in California's North Coast Ranges: From Hayes and Hildebrandt, Archeological Investigation on Pilot Ridge: Results of 1984 field season, USFS 53-9A47-4-46.

Whitlock, C., 1992, Vegetational and climatic history of the Pacific Northwest during the last 20,000 years: Implications for understanding present-day biodiversity: The Northwest Environmental Journal: v. 8, p. 5-28.

Wisseman, Bob. 1995. Macroinvertebrate Results For 1992/93 Sucker Creek, Left Fork Sucker Creek and Grayback Creek. Aquatic Biology Associates.

Appendix A
Index of Relevant Information, including Maps

Water

Almy, Robert B., 1981, Ground water resources of the Illinois River Basin, Oregon

Bureau of Reclamation, 1955, Rogue River Basin Project, Illinois Valley Division, Boise, ID. [Sucker Creek Dam proposal]

Bureau of Reclamation, 1964, Rogue River Basin Project, Illinois Valley Division, Boise, ID. [revised Sucker Creek Dam proposal]

Moffatt, R.L., Wellman, R.E. and Gordon, J.M., 1990, Statistical Summaries of Streamflow Data in Oregon: Volume 1--Monthly and Annual Streamflow, and Flow-Duration Values, USGS, Portland.

Moffatt, R.L., Wellman, R.E. and Gordon, J.M., 1993, Statistical Summaries of Streamflow Data in Oregon: Volume2--Annual Low and High Flow, and Instantaneous Peak Flow, USGS, Portland.

NOAA Precipitation records:
- Cave Junction, 1963-1990
- Brookings, 1931-1987
- Grants Pass, 1928-1990

Oregon Water Resources Department, 1985, Rogue River Basin Study, section 6 Illinois River Basin

SCS Snow records:
- Althouse #2, 1937-1993
- Althouse #3, 1982-1993
- Page Mtn, 1955-1993
- Bigelow Camp, 1981-1994
- Grayback Peak, 1936-1993

USGS Daily Flow Records:
- 14375000 Sucker Creek near Holland, OR, 1941-1965
- 14375100 Sucker Creek below Little Grayback Cr, 1965-1993
- 14377000 Illinois River at Kerby, OR, 1926-1961
- 14377100 Illinois River near Kerby, OR, 1961-1987

Water Rights on Sucker Creek and tributaries, Josephine County Water Master's Office, (with Department of Water Resources located in Grants Pass Municipal Center, 6th and A St.)

Haight, Dave, 199x, River Basin Temperature summary commissioned by ODFW -

Channel Morphology, Riparian Condition and Sediment

Stream Gradient Map Overlay: mapped from 1:24,000 topographic base.

Stream Reach Map Overlay

Riparian and Channel Disturbance Map Overlay

Landforms/Landslides Map Overlay

Soil/Rock Materials Map Overlay (GIS layer SO3): Soil mapping units from the Josephine County Soil Survey (SCS, 1983) have been grouped based on parent material and soil thickness, to produce a Soil/Rock Materials Map. This map also reflects updated geologic mapping by Joe Cornell, retired Siskiyou NF Geologist.

Riparian cover on Sucker Creek mined areas, map by Paula Fong compiled for China Left Timber Sale

1994 Grayback stream survey, contracted

Report by Martin Trso, 1994, DRAFT Observations on Grayback Creek

Road Construction Dates Map: Dates obtained by Cindy Wedekind from engineers that were at Zone I Engineering for long periods of time. Word Processing List was converted to a Paradox database and linked to GIS Road layer to produce the plot.

Managed Stands Map: includes both USFS and BLM timber harvest. Private harvest not shown because dates have not been interpreted from the historic aerial photos.

1940 Black and White aerial photographs, pieced together as a photo mosaic

1963 Black and White aerial photographs covering Lower Sucker Creek (provided by Kevin La Strapps of the SCS).

Riparian Condition Map: High-altitude (1:30,000) 1989 aerial photographs were interpreted by Kelly Starnes, geologist, to delineate regrowth and composition of riparian vegetation. The first phase was completed for tributaries in Grayback, Sucker, and Althouse Creeks, and is described in a document titled "Regrowth of riparian vegetation along 1964 storm impacted streams" and dated 9/16/92. Additional interpretation was completed for the remaining Upper Illinois River Basin in partnership with Oregon Dept of Water Resources, including off-forest areas. A mylar overlay on the District inch/mile base map shows four vegetation categories. Apparently three classes were used in manuscripting the 16 quads for GIS that reside in the SO, awaiting digitizing.

Fisheries

Illinois Valley Ranger District Siskiyou National Forest Stream Survey and Habitat Improvement Records for Sucker Creek and Grayback Creek (Including Tributaries), December 1994, compiled by Dave Vezie.

Tape of interview with Archie Anderson, former Sucker Creek miner and long-term Illinois Valley resident, now in Brookings

Notes from interview with Don King, retired Siskiyou NF Fisheries Biologist

Misc

SCS Report: Upper Illinois River Watershed Enhancement Project

Appendix B
Methods and Data Standards Used in Analysis

Landslide Inventory: The historic landslide inventory was done by Kelly Starnes, geologist, in 1992, as one of the studies of the upper drainages of the Illinois River Basin. Editing was done by Joe Cornell in July, 1994. The landslide inventory used several sets of aerial photographs going back to 1940 to describe and estimate sediment volumes. Many smaller landslides are hidden by forest canopy, although the volume of such small ones is probably much less than the combined volume of visible slides.

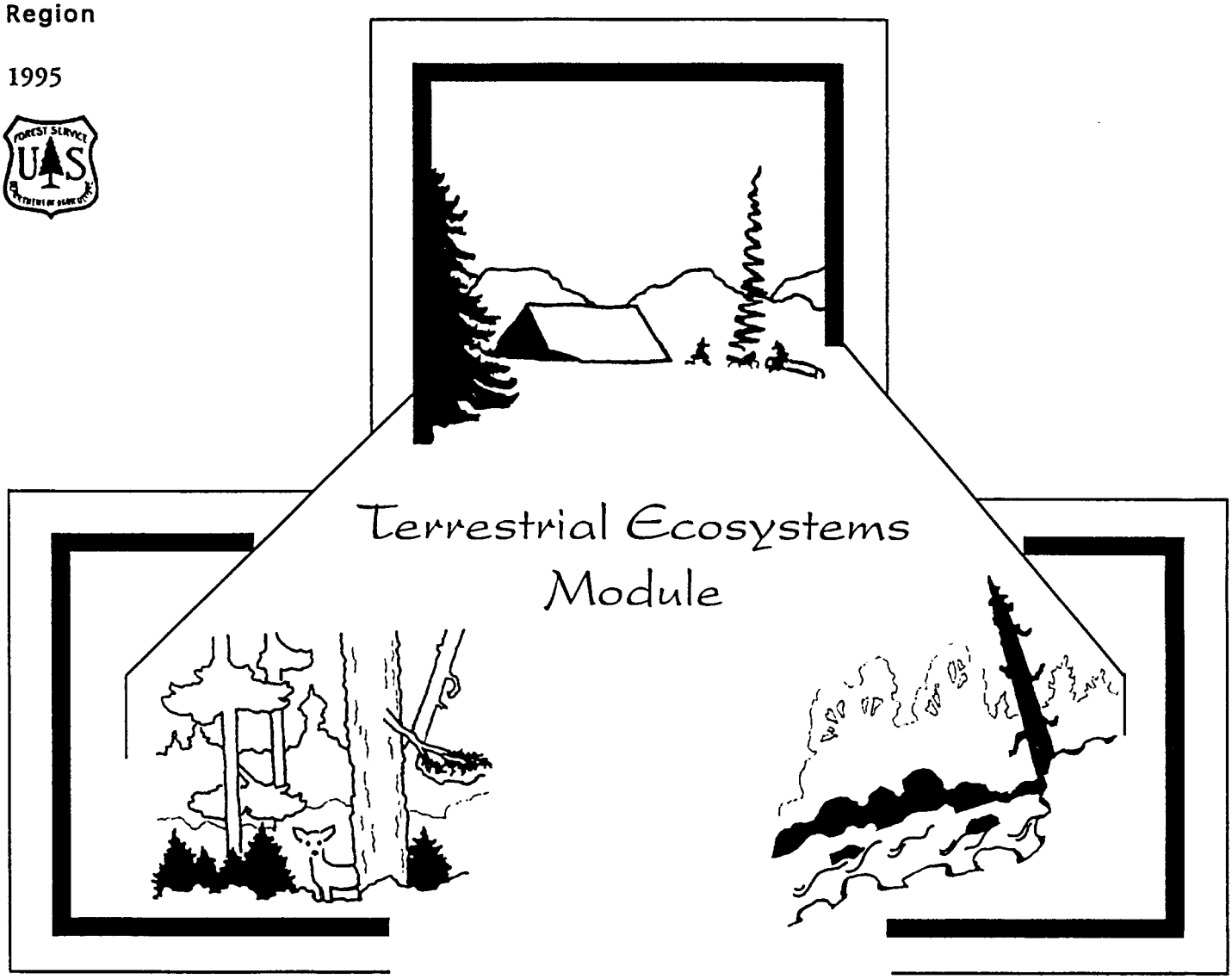
Surface Erosion/Compaction/Organic Matter Loss: Cliff Phillips, Dennis Sellards, Melody Culp, Joe Cornell, Larry Pera, Don McLennan, and Dwight Fickes provided information to Ed Gross on their field observations from the 1970s to the present. Aerial Photos used: 1964 B/W, 1973 Color IR, and 1986 Color.

Josephine County Geologic Map and Soil Map were used.

United States
Department
of Agriculture

Forest Service
Pacific
Northwest
Region

1995



Grayback/Sucker Pilot Watershed Analysis

Version 1.0

Siskiyou National Forest

April 1995

Terrestrial Ecosystem Module

I. INTRODUCTION

PURPOSE OF DOCUMENT

The following documentation provides evidence and facts that are important for future land management decisions in the Grayback/Sucker watershed.

This analysis provides important evidence and facts that will be used to meet the social/legal obligations for species management. These laws are incorporated within the USDA Forest Service Manual (2620, p.9) which requires that "Management of habitat provides for the maintenance of viable populations of existing native and desired non-native, wildlife, fish, (36 CFR 219.19) and plant species (USDA Regulations 9400-4) generally well distributed throughout their current geographic range." The Grayback/Sucker Creek watershed contributes to overall ecosystem sustainability through maintenance of its contributions to species viability and biological diversity.

INTEGRATION OF TERRESTRIAL, AQUATIC, AND SOCIAL

Although this module is titled "Terrestrial," it contains a blending of information with the aquatic and social modules. This integration is necessary for the land manager to make sound decisions.

ORGANIZATION

A trail of evidence flows throughout this document.

That trail starts with the focus areas. The focus areas are those uses and values within the watershed that are valuable and subject to change. These uses and values have important interactions which we need to question to gain understanding. The key questions are a result of this need.

Then, the important processes and conditions associated with the key questions are presented. The history, current conditions, and future trends of these processes and conditions are presented in this section.

Last of all, the trends for the future may or may not be desirable. Possible projects and management recommendations are given for possible implementation. Enjoy your journey along this trail.

II. AREAS of FOCUS

USES AND VALUES

The terrestrial document concentrates on several areas of use and value within the Sucker Grayback watershed. These uses and values are:

1. Habitats for a variety of plant and animal species which are critical to ecosystem health, worth money, are valuable just for their existence, and are pleasing to people.

2. Qualities which can sustain this habitat.

The social module documents the many uses people have for the watershed. In addition, the aquatic module focuses on the values of water quality and quantity as well as viability of anadromous fish. These links are obvious and the reader needs to refer to these other modules as needed.

KEY QUESTIONS

From these uses and values, the key questions focus the remainder of the analysis. These questions are:

Key Questions 5, 5B, 6, 7 and 8. (Refer to the Process Module for more information on Key Questions.) The purpose of these questions is to address the values of biological diversity in the watershed. The watershed characteristics analyzed are important habitat components for a range of plant and animal species which exist in the watershed. The analysis was predicated on several assumptions which have basis in literature on ecosystem management and in the planning documents supporting the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA, USDI, 1994) (herein referred to as the ROD). These assumptions are:

(1) A diverse and healthy ecosystem will provide the greatest benefits to humans over time.
(2) Habitat information can be used as a surrogate for population information.
(3) Providing for habitat diversity will provide for diversity of plant and animal species.

Key Questions 5 and 5B combined

How does this watershed contribute to overall ecosystem sustainability through biological diversity and species viability, i.e., what is the condition of important habitat components considered critical to maintaining species viability? How are these components arranged across the landscape and where can they best be maintained? What is known or can be predicted about species use within the area.

Key Question 6

What factors and processes affect soil quality in the Grayback/Sucker Watershed? Which of these are affected by human activities? How have these factors and processes been changed by management or natural events?

Key Question 7

What is the role of disturbance in the watershed and how has that been affected by management?

Key Question 8

How is Port-Orford-cedar root disease affecting riparian vegetation structure and composition?

The analyses used to address these key questions are discussed in Appendix B, and the Step 2 Documents found in the Analysis File.

The processes and conditions which answer these questions are discussed in the next section.

III. PROCESSES AND CONDITIONS WHICH ADDRESS THE KEY QUESTIONS

KEY PROCESSES, FUNCTIONS, AND CONDITIONS

The following pertinent processes and conditions provide evidence for answering the key questions.

To assess processes and conditions affecting biological diversity and species viability, analysis stratified the watershed into habitat components and important factors that effect these attributes. Habitat components analyzed were those identified by the Siskiyou National Forest

Plan Land and Resource Management Plan, as amended by the ROD. Habitats were stratified at three spatial scales to facilitate organized analysis and discussion. These scales are:

(1) Landscape scale habitats. Successional/structure condition, riparian areas, and soils. This analysis used Siskiyou National Forest classification of structural/successional condition into pioneer, early, mid, late, and climax using tree size structural information from satellite imagery. This vegetative information was used to describe forest successional patterns and stand age class distributions across the watershed. These successional classes were grouped into younger forest habitat using pioneer and early successional condition classes; and older forest habitat using mid, late, and climax successional classes.

(2) Sub-landscape scale habitats. Important localized habitats such as meadows, hardwood stands, lakes/ponds, and rock areas.

(3) Micro-habitats. Elements of structural composition which provide important components of diverse habitats include large trees (conifer and hardwood) and dead wood (standing and down).

Past species use was addressed for the watershed as a whole (see Appendix B).

The process of disturbance on important habitat components is critical to ecosystem health. (FEMAT, 1993, p. II-98). Fire, timber harvest, road building, clearing of land for agricultural use and flood have been the major disturbances (agents of change) affecting this watershed. Insects and diseases have the potential to become more influential than in the past as stands in the watershed increase in density and competitive stress is elevated, thus weakening the ability of trees to defend themselves against insect attacks.

FEMAT (1993, p. II-98) states:

> "Change happens. Change is an inevitable and necessary attribute of biological systems. Species have evolved in an environment characterized by change, sometimes gradual as in succession, and sometimes sudden as in catastrophic storms or fires or as caused by human activities."

To maintain species viability the range of conditions which species are adapted to must be maintained over the total distribution of each species. The range of variability with which species evolved includes conditions that have occurred over geological time scales. The most relevant time period to species survival today is the most recent few thousand years, as it reflects adaptations to recent environmental conditions, particularly climate.

It is not possible, given currently available data, to define the range of variability for all attributes contributing to species viability. The responses of species to past variation in habitat elements are also unknown. Furthermore, species management across their ranges is inhibited by varying ownership and objectives. For example, migratory birds are greatly influenced by conditions elsewhere.

It is important, however, to recognize the legal requirement to maintain species viability commands managers to assess species needs. Whether using a species by species or ecosystem approach, both lead to evaluating habitat components. This is why this analysis focused heavily on those components identified by the Siskiyou National Forest Land and Resource Management Plan as amended by the ROD. Analysis focused on attempting to understand the variability of these components within the limitations listed above. Monitoring of habitat components and species' responses to changes in these components will increase understanding of desired ranges of variability and improve the ability to manage species viability in the future.

The location and amount of important habitat attributes are influenced by disturbance. Maintaining a desirable range of variability is dependent on maintaining the effects of disturbances similar to the effects of the past. These disturbances affect the composition and structure of habitat elements, and in turn the population dynamics of species in the ecosystem.

Interpretation of the range of variability for any element of concern requires consideration of effects at several temporal scales (see Figure 1). Variation in natural systems follows a trend which can be described by a sine curve like the one in Figure 1. Descriptors of this relationship include the following.

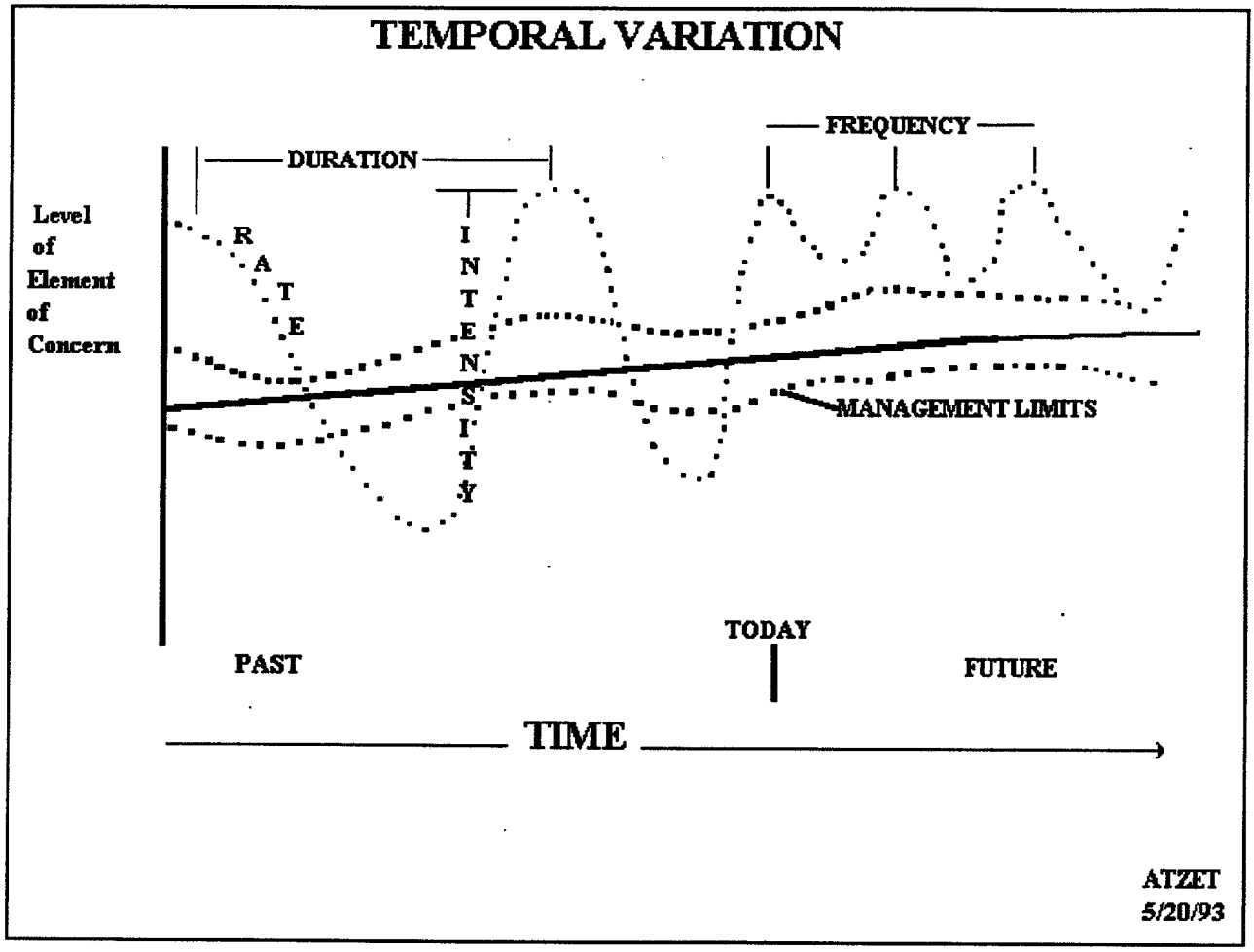
Duration - the time period (temporal scale) over which the relationship is being considered.

Frequency - how often does a given condition occur within the period of consideration. For example, how often do we have 90 percent of the watershed covered with old growth?

Rate - What is the rate of change in the condition of the element? Does it change rapidly or slowly? For example - On the Olympic Peninsula, huge stand replacement fires caused rapid changes in seral stage distributions over large areas every few hundred years. In contrast, this watershed's frequent smaller fires caused this change to occur slowly.

Intensity - The range of conditions which occur between peaks and valleys on the curve. How much variation is there?

This analysis recommends managing for conditions in the middle portion of the range of variability. Analysis has not been able to completely define the range of variability but we



giveexamples which show large fluctuations in watershed conditions, both temporally and spatially. Potential biologic or ecologic conditions are extremely variable in this watershed. The "management limits" recommended recognize that many of the extreme fluctuations are responses to factors outside human control. Like El Nino or the Silver Fire, they will happen regardless of our efforts.**Figure 1 Schematic of the Natural Range of Variability**

PAST PROCESSES AND CONDITIONS

1. Disturbances
2. Landscape Scale Habitats
    a. Succession/structural Stage

1. Patch Size and Connectivity
2. % Area Covered by Older Forest Habitat

b. Riparian Areas
c. Soils

3. Sublandscape Scale Habitats
   a. Meadows and Deciduous Oak/Pine Savannas
   b. Hardwood Stands
   c. Lakes/Ponds
   d. Rock and Talus Areas.
   e. Abandoned Buildings
4. Micro Habitats
   a. Large Trees
   b. Snags and Down Wood
5. Species Use

Past Disturbance Regimes

Disturbances affect all scales of habitat.

The history of low intensity disturbances, such as underburns, is difficult to understand because their effects are less visible and are easily muted over time. High intensity events such as stand replacement fire, clearcutting or the 1964 flood reset succession and can be tracked through their effects on vegetation succession and age classes. Age class trend analysis was used to determine effects of management on the disturbance regime for those high intensity events.

Stand replacement frequency under pre-suppression conditions was determined through reconstruction of existing stand age distributions. This method of analysis assumes an evenaged stand development pattern with distinct stand replacement events. In Southwest Oregon the pattern has historically been frequent fire events with local variation in intensity which tends to create unevenaged mosaic stands. Therefore while this analysis has utility in determining trends in high intensity disturbance regimes it does not function well as a descriptor of the overall disturbance pattern for this watershed. Past high intensity fire disturbance regimes are discussed in Appendix D of this document.

For thousands of years many habitats were influenced or maintained with wildfire and burning by Native Americans (Joyer, 1995). One habitat, the deciduous oak/pine savanna, was maintained in the Illinois River valley and lower reaches of Grayback/Sucker Creek. Oaks and pine are the plant foods most used by wildlife of North America (Martin, Zim, and Nelson, 1951). Native Americans also maintained meadows with burning. Early settlers introduced livestock that may have reduced tree encroachment rates on these meadows with heavy grazing (Joyer, 1995).

Wild and human-caused fires during summer and fall created conditions favorable for early successional species like deer and elk. High value forage plants, such as members from the ceanothus and grass families were abundant in these fire areas.

Past Landscape Scale Habitat Conditions

Past Successional/Structural Condition- Patch Size and Connectivity: Interior patch sizes and connections between patches are important to many species, especially to those which utilize older forest habitats (mid, late, and climax successional conditions). Appendix G of the Final Supplemental Environmental Impact Statement (FSEIS) on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA, USDI, February 1994, p.G-17) affirms this.

A historic timber map of Josephine County (1948), 1940 aerial photos, and the Silver Fire area were analyzed to begin understanding the range of variability for patch sizes. Analysis indicated preharvest conditions of older forest habitat included very large patches (16,486; 5,188; 2,230; and 1,827 acres in Grayback/Sucker) of interior habitat. Most large patches were on north aspects or low on mountain slopes under pre-harvest conditions in Grayback/Sucker and the existing condition of Silver Fire, which is considered to be in a natural condition (Atzet, 1995). Interior habitat is the area not impacted by edge effect, e.g., temperature, humidity, and predators from younger forest

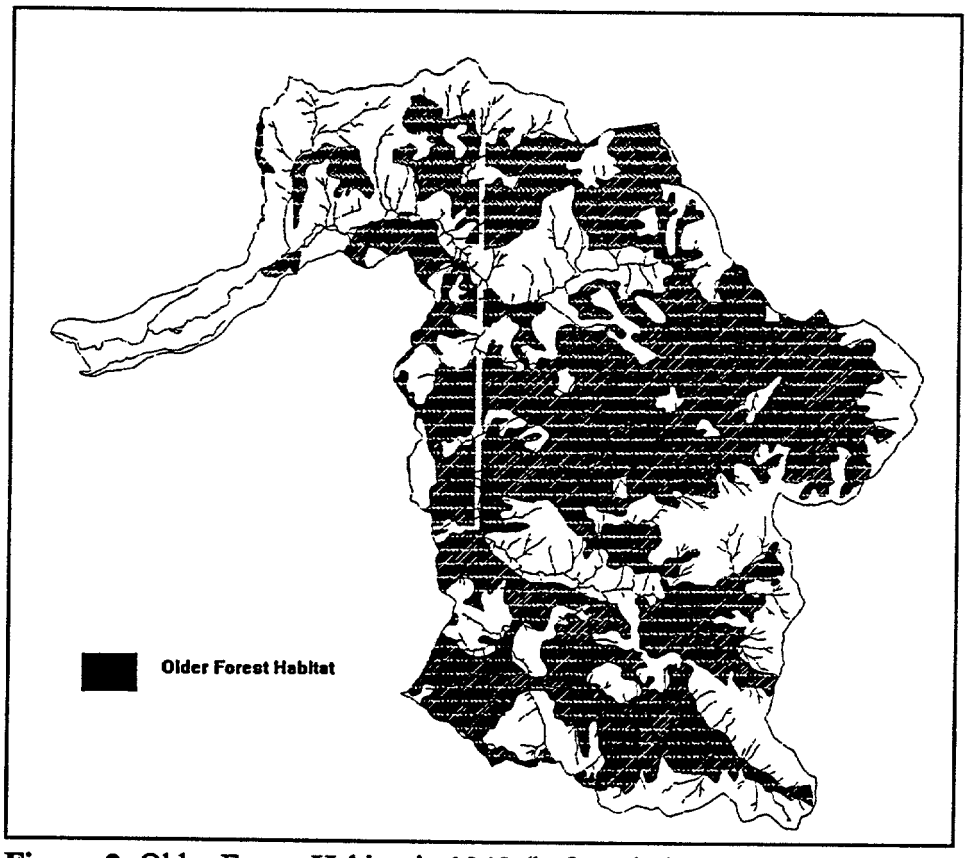


Figure 2 Older Forest Habitat in 1948 (before timber harvest on public land)

habitats (pioneer and early successional conditions) affect the edge much differently than they affect the interior of older forest habitat. In our model we assume edge effect continues for 400 feet from patches of younger forest (Siskiyou structural conditions of pioneer and early) greater than 3 acres.

Before the advent of extensive timber harvest and decades of effective fire suppression, the Grayback/Sucker Creek ecosystem contained very large well-connected patches of older forest habitat in this 62,153 acre watershed. Contiguous patches of older forest habitat contained large disjunct patches of young forest.

Within younger forest habitat, patch size and arrangement reflected pre-suppression fire patterns. These patches contained stringers of older forest along many streams where fire intensity was often lower. These stringers of older forest provided opportunities for older forest species to disperse through portions of areas dominated by younger forest conditions.

Past Successional/Structural Condition - Area Covered by Older Forest: The composition and structure of vegetation in the watershed are influenced by the physical environment including soils, topography and climate. These factors have strong influence on disturbance history. The historic condition, as described in the Southwest Oregon Ecological Assessment Team (Atzet/SWEAT, 1993), is for older forests to cover approximately 45% of forest lands on the Siskiyou National Forest. The range of variability around that mean (45%) is not known, but examples as low as 10% or as high as 90% have been identified (Atzet, 1995). The 1948 Josephine County Timber Map showed ranges between 14-99%, for any one WAA, with a total of 53% older forest habitat over the Grayback/Sucker ecosystem.

Past Riparian Areas: Pre-settlement riparian areas were a critical part of the dispersal system (gene flow) for older forest dependent species. These areas were the most productive and probably contained the highest abundance of large trees and dead wood in the Grayback/Sucker Creek ecosystem. Areas along the lower reaches of Sucker Creek near the Illinois River valley contained the most highly productive riparian habitat available in this ecosystem for many species. Examples include western pond turtle, California mountain kingsnake, and elk calving areas.

Past Soil Conditions: Soil is an essential component of ecosystem health, affecting both terrestrial and aquatic ecosystems. Soil properties such as particle class, thickness, volume of coarse fragments, and nutrient and organic matter levels; affect infiltration, storage and availability of water, and thereby water yield as well as soil organisms and plant growth. Soils in the Grayback/Sucker Watershed provide for ecosystem resilience by storing organic and inorganic nutrients. The availability of these nutrients is important for reestablishment of plant and animal communities after disturbance. This system can recover rapidly, from intense disturbances, as long as soil quality is maintained, in contrast to systems which store more of

these elements in living organisms, such as tropical rain forests. Both human-caused and natural disturbances may result in soil erosion, compaction, and organic matter losses.

Past Sub-Landscape Scale Habitats

Meadows and deciduous oak/pine savannas were maintained by wildfires and Native American burning. Pine and oak are the food plants used most by wildlife of North America (Martin, Zim, and Nelson, 1951).

Evergreen hardwood dominated stands of younger forest were probably common in areas of high intensity fires.

Lakes and ponds, were probably disturbed to some degree by humans (Native Americans, trappers and early settlers).

Cliffs, talus, and caves were relatively undisturbed.

Abandoned buildings and wooden bridges did not exist prior to the mid-1800's.

Past Micro-Scale Habitats

Large Conifer and Hardwood Trees: Large trees (>32" dbh) were more abundant in areas where high intensity fires occurred infrequently. These areas were along many streams, on north aspects, or low on mountain slopes. Frequent fire events maintained many stands in an open condition. Although large trees were present, overall stand densities were lower. Frequent low intensity fires removed brush and young trees, periodically reducing competition for water and nutrients. This is evident from past aerial photos and measurement of stand age and growth patterns.

Snags and Down Wood: High intensity fires killed large conifers and hardwoods resetting succession from older to younger forest condition, leaving large snags and down wood on the site. The variation in amounts left after fire is not known. There were many areas shown on 1940 aerial photos, where large brushfields did not contain visible large snags. These were mainly found in areas subject to frequent fires, such as upper portions of south facing slopes. Smaller snags and pieces of down wood were created in early stages of stand development where competition between densely spaced trees and brush caused mortality.

Moist areas along streams, north aspects, and the lower portion of mountain slopes provide more stable supplies of down wood. For example, in the Port-Orford-cedar series, which is primarily riparian in this watershed, large wood amounts increase between infrequent high

intensity fires. Variation in decomposition rates controls the amount of wood present at any given time or place during the period between these fire events.

Past Wildlife Species Use in The Watershed

Species evaluated were from the Siskiyou National Forest Land and Resource Management Plan, as amended by the Record of Decision, or species listed as endangered or threatened. (See Appendix B). The habitat components evaluated by this analysis are critical to maintaining viability of most of the species identified.

CURRENT CONDITIONS AND PROCESSES

1. Disturbances
2. Landscape Scale Habitats
    a. Succession/structural Stage
        1. Patch Size and Connectivity
        2. % Area Covered by Older Forest Habitat
    b. Riparian Areas
    c. Soils
3. Sublandscape Scale Habitats
    a. Meadows and Deciduous Oak/Pine Savannas
    b. Hardwood Stands
    c. Lakes/Ponds
    d. Rock and Talus Areas.
    e. Abandoned Buildings
4. Micro Habitats
    a. Large Trees
    b. Snags and Down Wood
5. Species Use

Current Disturbance Regimes

Fire suppression and timber harvest have had widespread impacts on forest habitat at all scales. Fire suppression has caused high densities of vegetation in stands not manipulated by people. Timber harvest, while resetting succession like natural fire, does not emulate fire disturbance in many ways. Other impacts caused by fires suppression and timber harvest are discussed in the remainder of this Current Condition section.

Current Condition of Landscape Scale Habitats

Current Condition of Successional/Structural Stage

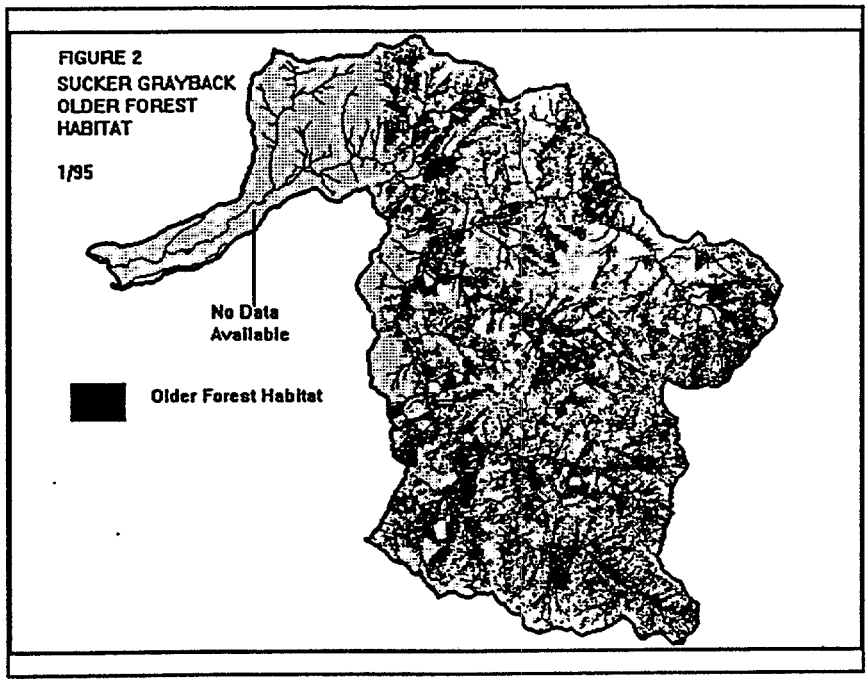
The watershed's existing habitat condition was developed by interpreting vegetative satellite imagery. The vegetative information was available as polygon data or pixel data. The polygon data needs more work before it can be used for analysis. Polygon data was not consistent with actual conditions. The pixel data showed acceptable accuracy and therefore was used for analysis. Some evaluation of existing condition could not be conducted with the pixel data, e.g., existing interior older forest patches and connectivity of older forest habitat. This analysis is recommended prior to regeneration harvest of older forest habitat.

Current Successional/Structural Condition- Patch Size and Connectivity: Analysis shows a highly fragmented landscape with much fewer large patches of older forest habitats now, than in the past. Comparisons were made to the patches defined in the 1948 timber type map. Based on those comparisons, large (greater than 500 acres), connected interior older forest habitats have been nearly eliminated, primarily by timber harvest.

Fire suppression has resulted in high fuel levels, which puts the existing large older forest patches at risk of stand replacement fires. Locations of important, large (≥300 acres) patches of interior older forest habitat were determined using 1987 Orthographic photos overlayed with managed stand map. The largest patches are on high elevation, mostly white fir plant series sites (Figure 4 below).

Current Successional/Structural Condition-Area Covered by Older Forest Habitat: Where vegetative data was available (primarily National Forest land), existing younger and older forest habitat was compared to past conditions. Sources of information on this include, REAP, the patches produced by the Silver Fire, the 1948 Josephine County Timber Map, and earlier conditions reconstructed from current data (Tables 1 and 2 in Appendix C).

Older stands cover about 35 percent of the watershed where data is available. At the individual WAA level, older forest habitat ranges from 15-60%. This compares to values from the 1948 timber map which range from 14% to 99% older forest, and averaged 53% of the watershed. The Silver Fire analysis averaged 46% of older forest, over a 35,000 acre area, with unknown variability for WAA's. Refer to Older Forest Habitat Table (Appendix C, Tables 1 & 2).



Areas within WAAs at the low end of variability, particularly at low elevations, in Late Seral Reserves or Riparian Reserves (ROD) are priority locations for restoring older forest conditions.

Current Condition of Riparian Areas: Some existing riparian areas in managed stands and near roads have low levels of big trees, dead wood, and hardwoods compared to fire generated stands. Current condition of riparian areas needs further analysis (after mapping of intermittent streams) to determine representation of structural/successional condition, large trees, disturbance history, etc. along streams.

Port-Orford-cedar root disease (Phytophthera lateralis) has been present in the watershed for over 40 years. It has affected riparian Port-Orford-cedar (POC) on a number of sites in the drainage. The disease is fatal to POC and concern for its spread has been addressed through interregional management guidelines across its range.

Port-Orford-cedar is primarily a riparian species in the Grayback/Sucker Creek watershed. Water availability limits it's growth and survival in the uplands. Its importance as a component of riparian vegetation varies as it occurs in mixed stands. It is valuable to aquatic and riparian habitat quality as it provides shade, stabilizes banks, and supplies long lasting down wood and snags. In some areas it comprises more than 40 percent of the overstory canopy cover. The POC plant series covers about 1500 acres in the watershed (about 2%).

The Region Five-Region Six, Port-Orford-cedar Root Disease Action Plan (USDA, 1988), provides direction to ensure viability and continued presence of the species in the ecosystem, throughout its range.

Port-Orford-cedar root disease is causing reduced canopy cover in infected stands. Approximately 460 acres are known to be infected in the watershed. Of these, over 200 acres still fall into the highest cover class and are producing shaded riparian and in-stream habitat.

Some of the remaining acres have lost canopy cover from other causes. Riparian harvest has removed some cover and the 1964 flood scoured approximately one mile of the infected area along Grayback Creek. In these areas it is difficult to assess how much canopy loss can actually be attributed to the disease. Positive effects of the disease include the creation of long lasting riparian snags and contributions of large wood to riparian and aquatic systems. Overall, the area negatively affected by Phytophthera lateralis is a minor component of the riparian system in the watershed.

The risk and hazard from further infection varies by drainage. Areas with high proportions of POC in the canopy have the greatest hazard for diminished habitat quality if infection should occur. Roads are vectors for spreading infection in the watershed. Specific road segments which present the highest risk having been identified as have important POC stands to protect. (Refer to POC - Phytopthera Analysis for locations.)

Current soil conditions: Soil conditions are good to excellent for the bulk of the basins where compaction from yarding has not occurred and erosion from yarding and roads is low. However, where yarding and road construction took place on private and federal lands in the 1950's through the 1980's, soil conditions are in a state of recovery. There, tractor skid trails compacted soils and disrupted storm runoff causing extensive erosion on some 5,000 to 8,000 acres. Ephemeral streams were diverted by trails and roads causing channel and upland erosion. Soils were compacted by use of tractor skidders over 20 to 35 percent of the logged areas. Recovery continues today, taking place in the form of revegetation in gullies and on compacted soils, returning lands to a productive condition.

Current Condition of Sub-Landscape Scale Habitats

Current meadows and deciduous oak: The amount of area in meadows and deciduous oak habitats is declining due to vegetation encroachment and site conversions to agricultural or timber lands.

Currently, evergreen hardwood dominated stands of younger forest have declined in the watershed due to timber management practices which favor domination by conifers. Also, successful fire suppression has prevented fires that would naturally result in many acres of

hardwood dominated forest regeneration. In older forest habitat of the tanoak plant series, extensive hardwood understories have developed due to fire exclusion. The result is a more mature hardwood component across the landscape and less of the youngest hardwood dominated stands than in the past.

Currently, lakes, ponds, and wet areas, at some locations, have been degraded by agricultural development on private lands and vegetation management. At some locations large trees, dead wood, and hardwoods have been removed. Many ponds have also been created for agricultural, mining, and fire suppression purposes.

Currently, rock outcrops, talus, and cave habitats are degraded at some locations by development of rock pits, gravel sources, and by recreational use, for example at Oregon Caves National Monument. In some talus habitats, vegetation management and road construction activities have decreased humidity. These activities decreased humidity on microsites where natural disturbance would not have caused equivalent declines.

Currently, abandoned buildings and wooden bridges provide habitat useful to some species (bats).

Current Condition of Micro Habitats

Currently, large conifer and hardwood trees are less frequent in managed stands. Natural disturbance agents often leave a legacy of large trees, which have not been provided for in harvest prescriptions until recently. This is especially apparent in riparian areas, and moister slopes such as found on north aspects.

WAAs with low amounts of late and climax successional conditions provide fewer large trees. These are identified in Appendix C, Tables 1 & 2.

Currently, snags and down wood; were found by Ecology Plot data to be higher in unmanaged, mid and late seral stands in Grayback/Sucker Creek ecosystem than current direction requires to be left during harvest activities.

Analysis of ecoplot data within the watershed shows considerable variation in amounts of down wood per acre 6-10 inches in diameter. The amount of large wood, greater than 10 inches in diameter, averaged 19 pieces per acre with a standard deviation of 14 pieces per acre. Managing of "legacies" after harvest within a range of plus or minus 1 standard deviation (5-33 pieces per acre) would maintain sites within the range of natural variation. Analysis of ecoplot data revealed an average number of snags per acre to be 3.1, with average dbh of 28". These numbers are higher than Forest Plan Standards and Guidelines for post harvest down wood and snags. However, they are based on a sample of mid and late seral stands. Sampling of early seral or

pioneer stands created by fire or other "natural" disturbances may indicate other levels are appropriate for those areas. There appears to be variation in large wood amounts between different plant series but with 66% of the plots taken in the white fir series a larger sample of the other series is needed before those differences can be statistically tested.

The range of variability for these components in younger forest habitat is not known. (Atzet, 1995) Current sampling occurs in "unmanaged" older forest areas influenced by fire exclusion. The amounts which were present under past fire regimes cannot be determined.

Dead wood may be at reduced levels in managed stands, including commercially thinned stands as past guidelines have not provided for retention of amounts equivalent to those found where harvest has not occurred. The regime of accretion, decomposition and consumption of dead wood has been affected by fire suppression more in unmanaged stands of the Jeffery pine, Douglas fir, and tanoak series which are prone to frequent fires. Less fire prone plant series (white fir and red fir) have not been as greatly affected by fire suppression and are believed to be within the historic natural range of variability (Atzet, 1994).

Current Species Use

Many species associated with well-connected large patches of interior older forest habitats have declined as habitats were removed or became more fragmented. These species include: northern spotted owl, pine marten, fisher, northern goshawk, pileated and some other woodpeckers, red tree vole, and many species of fungi, bryophytes, lichens, and vascular plants.

Species associated with younger forest conditions include deer and elk. Elk are occasional visitors to the analysis area. Market hunting probably occurred, depleting elk herds in the decades of settlement following displacement of Native Americans (ODFW, 1992). Loss of winter range to human habitation has prevented reestablishment of elk populations. This ecosystem is in an area designated as "elk de-emphasis area" by Oregon Department of Fish and Wildlife's recent draft Population Management Objectives (ODFW, 1994).

Deer and elk habitat has been maintained by timber harvest activities that create forest openings. Some timber management activities have not emulated natural disturbances and have created less favorable conditions. Habitat quality in recent harvest units is lower due to management activities, such as low intensity spring burning, which leaves conditions less favorable to good forage plants like ceonothus and grasses. The period during which harvest units remain high quality habitats for deer and elk has been truncated by timber management practices, which favor conifer species and elimination or reduction of grasses, forbs, brush, and hardwood competition. These timber management activities include high planting densities of conifers, brush control, and pre-commercial thinning.

Species associated with large river corridors, such as bald eagle, osprey, western pond turtle, and common kingsnake are declining from habitat loss associated with development of residential and agricultural land.

Species associated with lakes, ponds, wet areas, and adjacent riparian areas are less abundant than in the past due to removal of shade, large trees, and dead wood in managed stands faster than habitat can grow back at other locations. These species associated with riparian areas include red-legged frog, and western pond turtle, pine marten and fisher, fringed myotis, silver-haired bat, long-eared myotis, long-legged myotis, and pallid bat. The bull frog, a non-native species found in the watershed, may negatively affect western pond turtles and red-legged frogs.

Species associated with deciduous oak/pine savannas and meadows are declining in numbers due to encroachment on these habitats. Species associated with oak/pine savannas include California Mountain kingsnake, deer, and elk. Species associated with meadows include the willow flycatcher, deer, and elk.

Species associated with talus in older forest habitat are less abundant overall, due to timber management and road building activities in managed stands removing or degrading habitat faster than it can grow back at other locations. These activities occasionally destroy habitat but more often reduce habitat quality by decreasing humidity, when shade is removed from otherwise suitable habitat. Species associated with talus habitat in older forests include the Del Norte salamander.

TREND OF CONDITIONS AND PROCESSES THAT EFFECT FUTURE LAND MANAGEMENT

1. Disturbances
    2. Landscape Scale Habitats
        a. Succession/structural Stage
            1. Patch Size andConnectivity
            2. % Area Covered by Older Forest Habitat
        b. Riparian Areas
        c. Soils
    3. Sublandscape Scale Habitats
        a. Meadows and Deciduous Oak/Pine Savannas
        b. Hardwood Stands
        c. Lakes/Ponds

d. Rock and Talus Areas.
e. Abandoned Buildings

4. Micro Habitats
   a. Large Trees
   b. Snags and Down Wood
5. Species Use

Current and Future Trends for Disturbance

Fire suppression will continue to have major impacts on habitat components. Increasing stand densities and the fire hazard created by high stand densities will require elevated levels of effort to prevent catastrophic fires. As stand densities increase, fire prevention and suppression efforts will also need to increase.

Timber harvest will have much less impact on the watershed than in the past.

Other impacts caused by fires suppression and timber harvest are discussed in the remainder of this Trends section.

Current and Future Trends of Landscape Scale Habitats
Trends for Structural/Successional Conditions:

Trend for Successional/Structural Condition- Patch Size and Connectivity: The trend of habitat patch sizes has been toward an unnatural habitat pattern on the landscape. Management trends were directed toward activities such as extending road systems for timber management. These activities tended to produce a more fragmented forest habitat than fire generated disturbance.

The majority of timber harvest has occurred at elevations below 3,000 feet. The largest patch of older forest seen on 1940 aerial photos in this area has been lost to harvest and fragmentation. Many of the unmanaged stands that have developed into older forest are above 3,000 feet elevation or in upper Grayback and Sucker Creeks. This has resulted in a shift of older forest habitat from lower elevations of Grayback and Caves Creeks to upper elevations and the steep upper portions of Grayback and Sucker Creeks. Accumulation of abnormally high fuel loads in older forest habitat will continue in Matrix and Reserve land allocations.

Future older forest trend for interior habitat, in Late Successional Reserve's, is the development of larger patch sizes and improved connectivity over the next 50 to 100 years and loss of small (< 3 acre) openings due to fire suppression and no scheduled timber harvest. As fuel loading increases risk of catastrophic fire, prevention activities, such as fuel reduction, will require substantial investments of time and money to protect older forest habitat. Before successful fire suppression, frequent low intensity fires reduced probability of stand replacement events by

removing low vegetation from older forest habitat. Matrix land allocations will continue losing large interior patches and large (wider than Riparian Reserves) connections.

Younger forest habitat trend is loss of area in this habitat type due to continued fire prevention efforts on all land allocations as well as no allowable timber harvest in Late Successional Reserves in this watershed. Timber harvest will continue to create small (10 - 40 acre) forest openings in Matrix land allocations but large openings of younger forest habitat will exist only on low private land, which is on lower elevations of this ecosystem.

Trend for Successional/Structural Condition- Area Covered by Older Forest: is for oldest age groups (late and climax) to gradually recover, in Late Successional Reserves, as mid and early successional forests continue to grow (assuming fire suppression remains effective as fuel loads continue to increase). The largest amount of area in the watershed is currently early successional condition (33%) followed by pioneer (23%), late (20%), mid (14%), and non-forest (9%).

Older forest habitat on steep slopes and on the upper portions of slopes (high elevation) has a higher probability of stand replacement during a wildfire compared to habitat elsewhere in the watershed. This is why 1940 photos and 1948 historical timber map show most older forest habitat on north aspects, or low on the mountain slopes.

There is a trend toward an increase in the amount of live and dead vegetation in unmanaged stands across the landscape due to fire suppression. When aerial photos from 1940 are compared to 1988 photos, the shift toward denser stands and the succession from forbs, grass and brush stages toward forested conditions can be seen where harvest has not occurred. The difference is even more striking when photos from fire lookouts in the watershed taken in 1934 are compared with photos from the same location taken in 1994.

There are also structural differences in older forest habitat resulting from fire exclusion and vegetation management. In the past, frequent low to moderate intensity underburning cleared forest understories and kept live vegetation densities down. These same fires reduced the amount of dead material on the forest floor. There are many more acres today, compared to the past, with highly developed understories of shade tolerant species like tanoak and white fir.

Trend for Riparian Areas: The trend for riparian areas, under the ROD's Riparian Reserve System, is the increased development of big trees, dead wood, shade, and other older forest conditions within riparian areas. This will tend to promote older forest conditions over more of the riparian areas than would have been true with continued fire occurrence, especially on steep slopes. Connectivity of older forest habitats along riparian corridors will improve as portions of these areas recover from timber harvest.

The trend for riparian impacts from Port-Orford-cedar (POC) root disease is for continued existence of the disease but a slower rate of spread than occurred over the past 40 years. Improved strategies for isolating the disease will reduce the rate of spread and genetic research may some day find a resistant strain of POC. Watershed wide impacts to riparian habitat will be small but they will be locally important. Focus for prevention and improvement should be where POC comprises a higher percentage of the overstory, generally over 20 percent.

Trend for soil quality: Soil quality is improving for lands logged in the past but remains more or less constant for lands not logged or roaded. Reforestation of harvested areas, and stabilization of roads have slowed erosion rates, reduced compaction, and begun to restore organic matter to soils. Future large storms are likely to cause additional overland flow, erosion, and potential losses of productivity. The magnitude of these effects is likely to be less than in the past, but may be reduced by restoration treatments. The priority for such treatments depends not only on reducing flow effects and sediment delivery (see Aquatic Ecosystems module), but on whether productivity or water yield losses are impairing other ecosystem functions, such as development of old growth habitat.

Current and Future Trends for Sub-Landscape Scale Habitats

The trend for meadows and deciduous oak/pine savannas is reduction of area containing these habitats due to vegetative encroachment and lack of disturbance, especially fire.

The trend for evergreen hardwood habitats is for reduction of acres in younger forest conditions due to reforestation practices and fire suppression. Trend is for increase of older evergreen hardwoods in unmanaged stands.

The trend for lakes, ponds, and wet areas is toward improvement on Federal lands due to Riparian Reserve protection. The trend for riparian vegetation disturbance on private land is likely to continue with current management practices.

The trend for rock outcrops and caves will likely remain similar to the existing condition, except the use of rock pits is expected to decline. Negative effects at Caves Monument should be somewhat reduced due to improved management practices. Talus habitat trend is likely to improve due to protection measures afforded to Del Norte salamander habitat.

Abandoned buildings and wooden bridges will likely continue to function as habitat with current management practices.

Current and Future Trends for Micro habitats

Trend for Large Trees and Dead Wood: The trend for large trees and dead wood in Reserve land

allocations will be toward accelerated recovery due to restoration efforts, especially in Riparian Reserves.

The trend for large trees and dead wood in Matrix land allocations will be inadequate numbers of each remaining after harvest. Recent experience has shown that implementation of standards and guidelines may not produce specified results for reserve wildlife trees. The relationship between standards and guidelines and results should be monitored. A conservative approach is recommended. Leave adequate wildlife trees and have a logging systems specialist coordinate with biologists where wildlife trees and snags should be protected.

The trend will be toward better understanding and management of large tree and dead wood requirements in various forest conditions. Also, for improved development of watershed specific standards and guidelines for these habitat components.

Current and Future Trends for Species Use

A trend for Federal lands will be toward the vastly improved ability of land managers to consider impacts of potential projects to species. This will be the result of improved management practices (ecosystem analysis at a watershed scale prior to project planning), improved data management, and required surveys.

A trend, under current law and management practices, is for listed species (Endangered, Threatened, or Sensitive) associated with riparian and older forest habitats to recover on Federal land but continued declines are expected on private lands. Species that need deciduous oak woodlands and/or meadows will continue to decline and species associated with younger forest habitats will decline on Federal lands except in the small areas designated as Matrix lands.

IV. GUIDANCE FOR PROJECT LEVEL PLANNING & ANALYSES

FINDINGS RELEVANT TO PROJECT PLANNING

1. Disturbances
    2. Landscape Scale Habitats
        a. Succession/structural Stage
            1. Patch Size and Connectivity
            2. % Area Covered by Older Forest Habitat
        b. Riparian Areas
        c. Soils
    3. Sublandscape Scale Habitats

a. Meadows and Deciduous Oak/Pine Savannas
b. Hardwood Stands
c. Lakes/Ponds
d. Rock and Talus Areas.
e. Abandoned Buildings

4. Micro Habitats
   a. Large Trees
   b. Snags and Down Wood
5. Species Use

Landscape Scale Habitats

Disturbances

Past Disturbances: For thousands of years many habitats were influenced or maintained with wildfire and burning by Native Americans (Joyer, 1995). One habitat, the deciduous oak/pine savanna, was maintained in the Illinois River valley and lower reaches of Grayback/Sucker Creek. Oaks and pine are the plant foods most used by wildlife of North America (Martin, Zim, and Nelson, 1951). Native Americans also maintained meadows with burning. Early settlers introduced livestock that may have reduced tree encroachment rates on these meadows with heavy grazing (Joyer, 1995). Wildfire and human-caused fires during summer and fall created conditions favorable for early successional species like deer and elk. High value forage plants, such as members from the ceanothus and grass families were abundant in these fire areas.

Current Disturbances: Fire suppression and timber harvest have had widespread impacts on forest habitat at all scales. Fire suppression has caused unnaturally high density of vegetation in stands not manipulated by people. Timber harvest, while resetting succession like natural fire, does not emulate fire disturbance in many ways.

Succession/structural Stage- Patch Size andConnectivity

Past Successional/Structural Condition- Patch Size and Connectivity: Before the advent of extensive timber harvest and decades of effective fire suppression, the Grayback/Sucker Creek ecosystem contained very large well-connected patches of older forest habitat of this 62,153 acre watershed. Interior patches of 16,486; 5,188; 2,230; and 1,827 acres were identified in the 1948 timber type map. Contiguous patches of older forest habitat contained large disjunct patches of younger forest which contained islands and stringers of older forest.

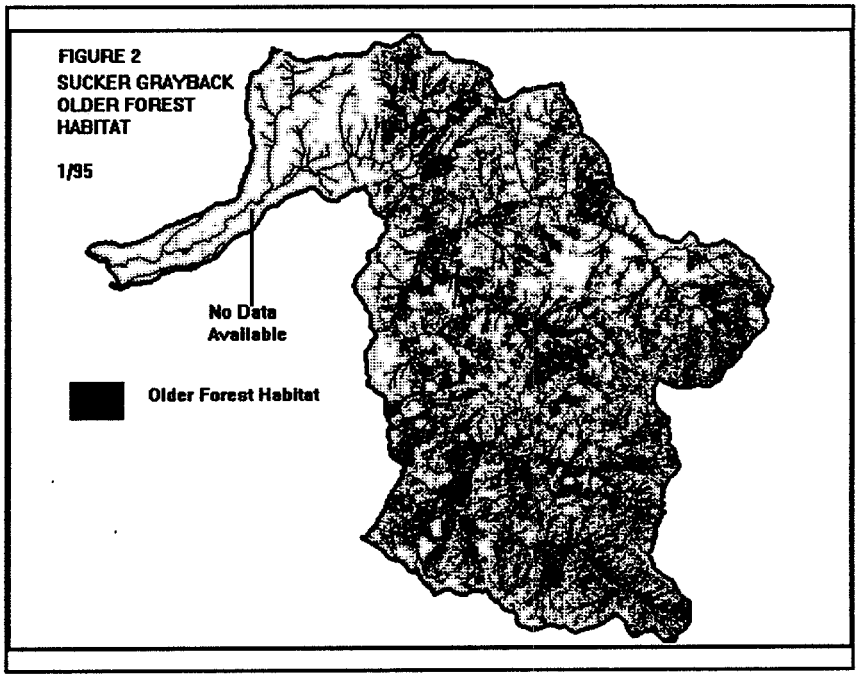
Current Successional/Structural Condition- Patch Size and Connectivity: Analysis shows a highly fragmented landscape with much fewer large patches of older forest habitats now, than in the past. Comparisons were made to the patches defined in the 1948 timber type map. Based on

those comparisons, large (greater than 500 acres), connected interior older forest habitats have been nearly eliminated, primarily by timber harvest and road building. The majority of timber harvest has occurred at elevations below 3,000 feet. Many of the unmanaged stands that have developed into older forest are above 3,000 feet elevation or in upper Grayback and Sucker Creeks. This has resulted in a shift of older forest habitat from lower elevations of Grayback and Caves Creeks to upper elevations and the steep upper portions of Grayback and Sucker Creeks. Fire suppression has resulted in unnaturally high fuel levels, which put the existing large older forest patches at risk. The largest patches are on high elevation, mostly white fir plant series sites (Figure 4). Some analysis of existing condition could not be conducted with the pixel data, e.g., existing interior older forest patches and connectivity of older forest habitat. This analysis is recommended prior to regeneration harvest of older forest habitat.

Succession/structural Stage- % Area Covered by Older Forest Habitat

Past succession/structural Stage- % Area Covered by Older Forest Habitat: The historic condition, as described in the Southwest Oregon Ecological Assessment Team (Atzet/SWEAT, 1993), is for older forests to cover approximately 45% of forest lands on the Siskiyou National Forest. The range of variability around that mean (45%) is not known, but examples as low as 10% or as high as 90% have been identified (Atzet, 1995). The 1948 Josephine County Timber Map showed ranges between 14-99%, for any one WAA, with a total of 34% older forest habitat over the Grayback/Sucker ecosystem.

Current succession/structural Condition- % Area Covered by Older Forest Habitat: : Older forest habitats cover about 35 percent of the watershed where data is available. At the individual WAA level, older forest habitat ranges from 15-60%. This compares to values from the 1948 timber map which range from 14% to 99% older unmanaged forest, and averaged 53% of the watershed. The Silver Fire analysis averaged 46% of older forest, over a 35,000



acre area, with unknown variability for WAA's. Refer to Older Forest Habitat Table (Appendix C, Tables 1 & 2).

Riparian Areas

Past Riparian Areas: Past riparian areas were the backbone of the dispersal system (gene flow) for older forest dependent species. These areas were the most productive and probably contained the highest abundance of large trees and dead wood in the Grayback/Sucker Creek ecosystem. Areas along the lower reaches of Sucker Creek near the Illinois River valley contained the most highly productive riparian habitat available in this ecosystem for many species.

Current Condition of Riparian Areas: riparian areas in most managed stands and near roads have low levels of big trees, dead wood, and hardwoods compared to fire generated stands. Port-Orford-cedar root disease (Phytophthera lateralis) has been present in the watershed for over 40 years. It has affected riparian Port-Orford-cedar (POC) on a number of sites in the drainage. Overall, the area negatively affected by Phytophthera lateralis is a minor component of the riparian system in the watershed. Roads are vectors for spreading infection in the watershed. Specific road segments which present the highest risk having been identified as have important POC stands to protect. (Refer to POC - Phytopthera Analysis for locations.)

Soils

Current soil conditions: Soil conditions are in good to excellent condition for the bulk of the basins where compaction from yarding has not occurred and erosion from yarding and roads is low.

Sublandscape Scale Habitats

Meadows and Deciduous Oak/Pine Savannas

Past Meadows and deciduous oak/pine savannas were maintained by wildfires and Native American burning. Pine and oak are the food plants used most by wildlife of North America (Martin, Zim, and Nelson, 1951).

Current meadows and deciduous oak: The amount of area in meadows and deciduous oak habitats is declining due to vegetation encroachment and site conversions to agricultural or timber lands. These areas have been dependent on fire both to maintain their size by limiting encroachment and to regenerate the grass/forb complex which makes them quality wildlife habitat.

Evergreen Hardwood Stands

Past Evergreen hardwood dominated stands of younger forest were probably common in areas of high intensity fires.

Currently, evergreen hardwood dominated stands of younger forest have declined in the watershed due to timber management practices which favor domination by conifers. Also, successful fire suppression has prevented fires that would naturally result in many acres of hardwood dominated forest regeneration. In older forest habitat of the tanoak plant series, extensive hardwood understories have developed due to fire exclusion. The result is a more mature hardwood component across the landscape and less of the youngest hardwood dominated stands.

Lakes/Ponds

Currently, lakes, ponds, and wet areas, at some locations, have been degraded by agricultural development on private lands and vegetation management. At some locations large trees, dead wood, and hardwoods have been removed. Many ponds have also been created for agricultural, mining, and fire suppression purposes.

Rock and Talus Areas.

Currently, rock outcrops, talus, and cave habitats are degraded at some locations by development of rock pits, gravel sources, and by recreational use, for example at Oregon Caves National Monument. In some talus habitats, vegetation management and road construction activities have decreased humidity. These activities decreased humidity on microsites where natural disturbance would not have caused equivalent declines.

Abandoned Buildings

Currently, abandoned buildings and wooden bridges provide habitat useful to some species (bats).

Micro Habitats

Large Trees

Past Large Conifer and Hardwood Trees: Large trees were more abundant in areas where high intensity fires occurred infrequently. These areas were along perennial streams, north aspects,

and low on mountain slopes. Frequent fire events maintained many stands in an open condition. Although large trees were present, stand densities were lower. Frequent low intensity fires removed brush and young trees, periodically reducing competition for water and nutrients.

Currently, large conifer and hardwood trees are less frequent in managed stands. Natural disturbance agents often leave a legacy of large trees, which have not been provided for in harvest prescriptions until recently. This is especially apparent in riparian areas, and moister slopes such as found on north aspects.

Snags and Down Wood

Past Snags and Down Wood: High intensity fires killed large conifers and hardwoods and reset succession from older to younger forest condition, leaving large snags and down wood on the site. The variation in amounts left after fire is not known. There were many areas shown on 1940 aerial photos, where large brushfields did not contain visible large snags. These were mainly found in areas subject to frequent fires, such as upper portions of south facing slopes. Smaller snags and pieces of down wood were created in early stages of stand development where competition between densely spaced trees and brush caused mortality. Moist areas along streams, north aspects, and the lower portion of mountain slopes provide more stable supplies of down wood.

Currently, snags and down wood; were found to be higher in unmanaged, mid and late seral stands in Grayback/Sucker Creek ecosystem than current direction requires to be left during harvest activities. Analysis of ecoplot data within the watershed shows considerable variation in amounts of down wood per acre 6-10 inches in diameter. The amount of large wood, greater than 10 inches in diameter, had a mean of about 19 pieces per acre and a standard deviation of 14 pieces per acre. Furthermore, snags and down wood are below historic levels in managed stands, including commercially thinned stands as past guidelines have not provided for retention of amounts equivalent to those found where harvest has not occurred.

Species Use

Currently, many species associated with the degraded habitats listed above are at lower distribution and abundance than in the past.

Recently, deer and elk habitat has been maintained by timber harvest activities that create forest openings. Some timber management activities have not emulated natural disturbances and have created less favorable conditions. Habitat quality in recent harvest units is lower due to management activities, such as low intensity spring burning, which leaves conditions less favorable to good forage plants like ceonothus and grasses. The period during which harvest

units remain high quality habitats for deer and elk has been truncated by timber management practices, which favor conifer species and elimination or reduction of grasses, forbs, brush, and hardwood competition. These timber management activities include high planting densities of conifers, brush control, and pre-commercial thinning.

GUIDANCE FOR PROJECT LEVEL PLANNING AND ANALYSIS

1. Disturbances
2. Landscape Scale Habitats
    a. Succession/structural Stage
        1. Patch Size andConnectivity
        2. % Area Covered by Older Forest Habitat
    b. Riparian Areas
    c. Soils
3. Sublandscape Scale Habitats
    a. Meadows and Deciduous Oak/Pine Savannas
    b. Hardwood Stands
    c. Lakes/Ponds
    d. Rock and Talus Areas.
    e. Abandoned Buildings
4. Micro Habitats
    a. Large Trees
    b. Snags and Down Wood
5. Species Use

Project Guidance: Disturbance

Emulate effects of fire disturbance where natural fire will not likely occur. Remove brush and other fire ladder material to emulate low intensity fires and reduce potential for stand replacement fires. Reducing vegetation cover, particularly in stands which have developed dense understories would simulate conditions which existed under pre-suppression fire regimes. It may also increase water yields and improve late season stream flow and water temperatures (See Appendix D for detailed discussion of water yield affected by plant densities).

Project Guidance: Landscape Scale Habitats

Project guidance for Successional/Structural Condition- Patch Size and Connectivity: Manage for large, well connected older forest habitats as well as their expected location on the landscape, e.g., large patches of older forest habitat along major streams, low on the slope, and/or on north

aspects. Allow natural events to create extremes in variability and manage within the central portion of that range.

Opportunities for development of large patches of interior older forest exist in areas where many acres of younger forest have been created by timber harvest. These areas are located in or near: Buck Peak, upper Grayback Creek, Little Grayback Creek east fork, White Rock Creek, and Lake Creek north of Squaw Mountain. Scheduling of harvest to consolidate large areas of relatively similar aged patches will create the opportunity to replace large patches of older forest habitat in the future and reduce further fragmentation of existing interior habitat.

Project guidance for Successional/Structural Condition- Area Covered with Older Forest Habitat: Manage for desired proportions of younger and older forest habitat. One scheme for managing within the preharvest and prefire suppression range of variability would be to manage for higher percentages in older forest in lands allocated to Late Successional Reserves and lower percentages in lands allocated to Matrix.

Project Guidance: Sub-Landscape Scale Habitats

Meadows and deciduous oak/pine savannas minimize encroachment and look for opportunities to use as a place to reduce fuel loads and create defensible positions against wildfires threatening to destroy private property. Maintain meadows and oak/pine savannas after removing encroachment by burning as frequently as needed.

Evergreen hardwood habitats: Manage for areas to become hardwood dominated where possible. Best opportunities may be in Late Successional and Riparian Reserve areas.

Lakes and ponds, rock sites, talus, abandoned buildings, and bridges; implementation of the Record of Decision's Survey and Manage requirements will identify protection and restoration needs for these habitats, where species are detected by surveys.

Project Guidance: Micro Habitats

Large Trees: Protect large trees as much as possible due to unnatural amounts of large trees removed by timber harvest. Culture large trees in managed stands, particularly Riparian and Late Successional Reserves. Leave portions of managed stands untreated to allow natural development.

Snags and down woody material: Manage for levels in harvest units within a range of plus or minus 1 standard deviation (5-33 pieces per acre for down wood with an average diameter of 12.3 inches at intersect and average 33.5 feet long). This would maintain sites within the range

of natural variation. Manage for the average number and size of snags; 3.1 per acre with average dbh of 28". Evaluate need to create snags and/or install nest boxes in areas dominated by younger forest habitats containing inadequate numbers of snags.

Project Guidance: Species Use

Implement use and integration of new databases to improve awareness of existing information, e.g., Region 6 version of Wildobs, Region 5 databases, STRIX, Heritage, and OSIS (Oregon Department of Fish and Wildlife).

Minimize impacts to populations of individuals listed as Endangered or Threatened by US Fish and Wildlife Service. Minimize impacts to populations of species listed as Sensitive in Region 6 of USDA Forest Service. Minimize impacts to species listed in C-3 of ROD (survey and manage species).

Terrestrial
References Cited

Atzet, T. and D. Wheeler Historical and Ecological Perspectives on Fire Activity in the Klamath Geological Province of the Rogue River and Siskiyou National Forests. USDA Forest Service R6-Range-102-1982 16 pp.

Atzet, T. Personal Conversation. Collection of Ecoplot Data in the Grayback/Sucker Creek Watershed. 1994

Atzet, T. and R.E. Martin Natural Disturbance Regimes in the Klamath Province. Proceedings of the Symposium on Biodiversity in Northwestern California 1991 9 pp.

Atzet, T. /SWEAT. Southwestern Oregon Ecosystem Assessment Team Report. Unpublished 1993.

Drew, J.T. and J. Flewelling Stand Density Management: An Alternative Approach and It's Application to Douglas-fir Plantations.

Dunham, J. Personal Conversation. Species Distributions on BLM Lands in the Grayback/Sucker Creek Watershed. 1994

Joyer, J. Personal conversation. Historical maintenence of meadows and deciduous oak savannas by Native Americans and early settlers. 1995

Long, J. N. and T.E. Daniel

Long, J.N., J.B. McCarter and S.B. Jack A Modified Density Management Diagram for Coastal Douglas-fir. Western Journal of Applied Forestry Vol. 3 No. 3 1979 pp. 518-532

Martin, A. and H. Zim and A. Nelson. American Wildlife and Plants A Guide to Wildlife Food Habitats. 1951 p. 475.

Martinez, P. and J. McCullough Classification to Seral Stage Using ISAT Vegetation Mapping Data. Unpublished Forest Service White Paper 1994

ODFW. Oregon Department of Fish and Wildlife. Elk by Prescription The "Managment Objective" Process. 1994.

ODFW. Oregon Department of Fish and Wildlife. Draft Elk Management Plan. 1992 pp. 1-2.

Rose, B.W. Range of Natural Variation Considering Specific Vegetation Zones Within Interior Southwest Oregon Eastern Siskiyou Mountains. Unpublished Forest Service White Paper 1993

Unknown Author (Initials H.R.) A Trip from Grants Pass to the Limestone Caves of Josephine County -- The Greatest Natural Curiosities of Oregon. The Courier 1896

USDA, Forest Service - USDI, Bureau of Land Management, Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl. April 1994

USDA, Forest Service Interegional Committee, Port-Orford-cedar Action Plan, unpublished, 1988, 11pp.

USDA, PNW, Forest Service. REAP, An Ecological Assessment, A First Approximation, 1993

USDA. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. 1994 Appendix G, p. G-17.

APPENDIX A

INFORMATION USED TO PERFORM ANALYSIS

Key Question 5B: Species Viability
Layer: title; "Sub-Landscape scale Habitats". Forest Plan MA9's without dispersed habitat. Forest Plan MA4's. Recommended MA9's and MA4's. Also need hardwood stands.

Layer: title; "Potential Del Norte salamander Habitat". Using Josephine County Soil Survey, map the following soil units: 3F, 8G, 9G, 23G, 24G, 28G, 29F, 30, 32F, 35F, 36F, 37G, 40F, 41F, 45E, 58F, 65F, 66F, 70F, 71F, 75F, 80F, 81F, 82G, 84F, 85G, and 86G.

DATA GAP-GIS Layer: title "Historic Hardwoods". Hardwoods from Historic County Forest Type Maps, using codes 4, 31, and 32.

GIS Layer: title "Plant Series by Seral Stages". Use Forest seral stage groupings of PMR data. Associated analysis seral stage/disturbance regime changes with fire exclusion.

GIS Layer: title; "Seral Stages with Canopy Closure". All Siskiyou seral stages were mapped by canopy closure, and reported by WAA. Each seral stage has a different color and that color, for each seral stage, has been used with various cross-hatching schemes to denote canopy closure, e.g., red for late seral and using a light hatching for low canopy closure, progressing to darker hatching as canopy closure increases.

DATA GAP- although this analysis was done, more spatially accurate data is needed to be useful. GIS Layer: title "Seral patch size". Patch size analysis does not include plant series. Patches will be analyzed by the following Siskiyou seral stage groupings: 1-pioneer; 2-early; 3-older, which includes mid, early, and late. Interior patch sizes will be calculated for these 3 categories, e.g., interior patch sizes for older stands will buffer away from stands that are in pioneer or early seral condition. Report by patch sizes in increments of 100 acres up to 1000 acres, then by 500 acre increments up to 5000 acres, and then 1000 acre increments for remainder. Report by sub-watershed. Joel and Randy

GIS Layer: title "Historical Seral Stages". Using Historical Timber Map 1949 (County). Generate maps of Sucker/Grayback area and adjacent areas at 2.64" and 1" = 1 mile. Report for Sucker/Grayback area by WAA. Use the following code groupings from historical County Forest Type Maps, lend number 3, to correlate with Siskiyou Seral Groupings for this product and for "Historical Patch Sizes" product:

(1) Older Forest (correlates to Siskiyou Seral; Mid, Late, and Climax) = codes 6, 8, 11, 14, 17, 17IC, 8, 19A, 20, 20_5, 20A, 23, 27, 27_5, 29, and 32.

(2) Early Seral Forest (correlates to Siskiyou Seral; Early) = codes 9A, 9B, 12A, 12B, 15A, 15B, 21, 28A, and 31.
(3) Pioneer Seral Forest (correlates to Siskiyou Seral; Pioneer) = codes 10, 13, 16, 19B, 22, 24, 28B, 28, and 30.

GIS Layer: title "Historical Seral Patch Sizes". Using Historical Seral Stages Map 1949 (County), generate maps of Sucker/Grayback area and adjacent areas at 2.64" and 1" = 1 mile. Report for Sucker/Grayback area by sub-watershed. This layer will be used for analysis of past patch sizes. Patches will be analyzed by the following Siskiyou seral stage groupings: 1-pioneer; 2-early; 3-older, which includes mid, early, and late. Interior patch sizes will be calculated for these 3 categories, e.g., interior patch sizes for older stands will buffer away from stands that are in younger forest, i.e., pioneer or early structural/successional condition. Report by patch sizes in increments of 100 acres up to 1000 acres, then by 500 acre increments up to 5000 acres, and then 1000 acre increments for remainder.

Note: Will also use report of patch size distribution from the Silver for comparison to large "natural" event.

GIS Layer: title "Klamath Province Seral Stage". Use same groupings as above, i.e., pioneer; early; and older. Do interior patch analysis on 'older' stands only, for patches greater than 500 acres in 500 acre increments up to 5000 acres, and then 1000 acre increments for remainder. Put acre sizes in each patch on the map. Report by patch sizes. DATA Gap- could not do patch analysis.

GIS Layer: title "Big Trees". Large and giant green conifers as well as large and giant green hardwoods. Map of Sucker/Grayback area using 4 different colors, i.e., 2 for conifers and 2 for hardwoods by size code. For size use PMR size/structure codes; 17, 18, 30-32, 37 for large trees and 19, 33, 34, 38, 39 for giant trees. For species use PMR Forest_Species_Group_Codes; 11, 12, 13 for hardwoods and 7-10, 14-25 for conifers. Report by WAA.

Reports from Ecology shop: title "Dead Wood and Big Trees" will report snags and down woody material by plant series from Ecology plot data in Sucker/Grayback. For snags and down wood, reports will include species, decomposition class, elevation, and whatever else comes up as statistically significant.

Did not receive- DATA Gap: GIS Layer: title "Riparian Habitat". Use; "Plant Series by Seral Stages" and "Big Trees" maps; intersect with Riparian Reserve boundaries. Report by stream class for each WAA: Large conifers, giant conifers, large hardwoods, giant hardwoods, seral stage acres, and plant series by seral stage acres.

Associated analysis: "Dead Wood" will be used for riparian areas to interpret areas with large wood available for streams.

GIS Layer: Clear Overlay with WAA boundaries.

GIS Layer: WILDOBS map(s).

Key Question #7: Role of Disturbance
GIS layer: Managed stand layer. Used in conjunction with seral stage layer and seral stage trend analysis already discussed.

Key Question #8: POC/Riparian
GIS Layer: Overstory POC by percent cover groupings.

GIS Layer: POC infection centers mapped by year of discovery. Already in GIS.

GIS Layer: Roads. Associated analysis of road densities and proximity to infected and uninfected areas.

GIS Layer: Streams with ROD buffers. Received map with class 1, 2, and 3 streams.

Information Needed for Project Design

(1) Location information for PETS species and Survey and Manage species, esp., from other agencies and results of required surveys.
(2) Mapped older forest habitat, large patches and connections, that should be protected from fire and fragmentation and those that should be developed for the future.
(3) WAA's at the extreme end of natural range of variability for important habitat components, esp., structural/successional condition, riparian habitat, large trees, dead wood, meadows, deciduous oak/pine savannas, and evergreen hardwoods.

APPENDIX B

Past Species Use
Species Use During Historic And/Or Recent Prehistoric Times (Past 1,000 Years)

Currently 'listed' as Endangered

* Peregrine falcon; was likely visitor and a possible resident
* Wolf; likely inhabitant.
* Grizzly bear; likely inhabitant.

Currently 'listed' as Threatened

* Northern spotted owl; abundant in large connected patches of older forest habitat.
* Marbled murrelet; not a likely inhabitant.
* Bald eagle; likely resident along lower reaches of Sucker Creek.

Currently 'listed' by Region 6 and/or Region 5 as Sensitive

* Western pond turtle and red-legged frog; likely inhabitants along slow moving reaches of lower Sucker Creek.
* Del Norte salamander; likely more abundant than present due to large areas of older forest interior habitat.
* Siskiyou Mountain salamander; no records.
* California Mountain kingsnake; likely inhabitant, especially in deciduous oak savannas in lower elevation areas near Illinois River valley.
* Common kingsnake; likely abundant along lower reaches of Grayback/Sucker Creek near Illinois River valley.
* Pacific Western big-eared bat; probably abundant in caves around Caves Monument.
* White-footed vole; no records.
* Wolverine; likely inhabitant.
* Sensitive plants in this watershed are found mostly on serpentine soils (Jeffrey pine series), on rock outcrops and in meadows.

Survey and Manage Species from the ROD

* Del Norte salamander see above.
* Siskiyou Mountain salamander; see above.
* Great Gray owl; unknown, may be outside of the range for this species.
* Pine marten and fisher; likely inhabitant and abundant in large connected older forest habitat.
* Red tree vole; likely abundant in large patches of connected older forest habitat.
* Fringed myotis; unknown, no records.

* Silver-haired bat, long-eared myotis, long-legged myotis, and pallid bat; likely inhabitants.
* Numerous fungi, lichens, bryophytes, arthropods, and mollusks were present.

Management Indicator Species and habitat they represent, from the Siskiyou Forest Plan

* Bald eagle - habitat corridors along large rivers; see above.
* Osprey - habitat corridors along large rivers; likely inhabitant along lower reaches of Grayback/Sucker Creek.
* Northern spotted owl-old growth; see above.
* Pileated woodpecker-mature forest; likely common due to large snags remaining after stand replacement fires.
* Woodpeckers - wildlife trees (snags); likely abundant due to numerous snags remaining after wildfires and lack of commercial thinning of timber, which is designed to 'capture mortality' of trees, i.e., prevent natural creation of snags caused by competition.
* Pine marten - mature forest; see above.
* Black-tailed deer, which are more dependent on the forage provided by early successional forest than on cover provided in older forests; were common in this ecosystem. Fires, natural and human caused, in the mountains and lowlands maintained excellent forage.

Existing Species Within and Adjacent to the Grayback/Sucker Watershed

* Endangered species: Peregrine falcons are not known to be present; wolves and grizzly bears no longer inhabitat this area.
* Existing Threatened species: northern spotted owls are present for habitat analysis and species use by WAA.
* Existing Sensitive species, Survey and Manage species, and Management Indicator species use will be summarized here. (See wildlife analysis for more detailed information).

Species known to be present recently in or near the watershed

* western pond turtle * Del Norte salamander * western big-eared bat
* willow flycatcher * pine marten * red tree vole
* deer and elk * pileated and other woodpeckers

Species thought by some to be present, but sightings not verified by expert observers

* wolverine * fisher.

Analysis Used to Address the Key Questions

The goal of this analysis is to identify and evaluate the habitats and habitat components that are essential to the viability of all species, and thus ecosystem sustainability.

The method used for this analysis was to evaluate potential impacts to the important habitats and habitat components identified for ecosystem health and species needs in the Siskiyou National Forest Land and Resource Management Plan (Siskiyou Forest Plan) as amended by the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD).

These analysis methods were used because they are repeatable and follow procedures generally accepted by the scientific community for addressing questions on temperate forest wildlife habitat.

The Grayback/Sucker Creek Watershed Analysis has used, as a basis for its analysis, the habitat components identified by the Sisikiyou Forest Plan and the Final Supplemental Environmental Impact Statement (FSEIS) of the ROD as important to maintenance of species viability and ecosystem health. (Option 9 Standards and Guidelines, p. 2-60 to 2-64 and Appendix B, p. B-143 to B-149)

Habitat components identified by Siskiyou Forest Plan as important for maintenance of species viability and biological diversity have also been incorporated into this analysis. (Page or S&G)

A summary of habitats and habitat components, identified by Siskiyou Forest Plan as amended by the ROD, considered important to analyze for Grayback/Sucker Creek ecosystem are:

(a) Successional/structural condition; early, late, and old growth including fragmentation and connectivity.
(b) Riparian areas; water and surrounding vegetation.
(c) Unique habitats such as; meadows, lakes/ponds, hardwood areas (deciduous and evergreen), and rock areas.
(d) Dead wood; standing and down.
(e) Large green trees.
(f) Soil and litter.

Soils Analysis Methods

District employees provided information on their field observations from the 1970s to the present for both watersheds. Aerial Photos used: 1964 B/W, 1973 Color IR, and 1986 Color. Josephine County Geology Map and Soil Map were used. Large wood distributions were analyzed using ecoplot data collected within the watershed.

APPENDIX C
STRUCTURAL/SERAL CONDITION TABLE
OLDER FOREST HABITAT TABLE

1/20/95
Sucker/Grayback Ecosystem Analysis
Structural/Seral Condition, existing condition, prepared by Randy Miller, Illinois Valley Ranger District, Siskiyou National Forest

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Existing Condition from PMR pixel data (satellite imagery)	total WAA acres	total seral acres	Pioneer Seral acres	*%seral acres; Pioneer*	Early Seral acres	*%seral acres; Early*	Mid Seral acres	*%seral acres; Mid*	Late Seral acres	*%seral acres; Late*	Climax Seral acres	*%seral acres; Climax*	non forest/ backgrnd	*% non forest/ backgrnd*
2	17c01f Cave Cr. mouth	1825	1756	477	*27.2*	637	*36.3*	234	*13.3*	400	*22.8*	8	*0.5*	64	*3.6*
3	17c02w Cave/No Name Crks.	1093	1060	232	*21.9*	262	*24.7*	173	*16.3*	371	*35*	22	*2.1*	29	*2.7*
4	17c03f Lake/Panther Crks	1922	1733	734	*42.4*	293	*16.9*	328	*18.9*	363	*20.9*	15	*0.9*	184	*10.6*
5	17c04w Lake Cr/Bigelow	730	583	131	*22.5*	202	*34.6*	171	*29.3*	77	*13.2*	2	*0.3*	146	*25*
6	***17c TOTALs, Cave Creek***	***5570***	***5132***	***1574***	***30.7***	***1394***	***27.2***	***906***	***17.7***	***1211***	***23.6***	***47***	***0.9***	***423***	***8.2***
7	17g01f Grayback Cr.mouth	1784	1714	510	*29.8*	747	*43.6*	154	*9*	294	*17.2*	9	*0.5*	66	*3.9*
8	17g02w Cr.nw of Buck Pk.	988	978	263	*26.9*	487	*49.8*	82	*8.4*	142	*14.5*	4	*0.4*	8	*0.8*
9	17g03w Cr.east of Squaw Bt.	590	588	163	*27.7*	323	*54.9*	61	*10.4*	41	*7*	0	*0*	1	*0.2*
10	17g04w White Rock Cr.	2028	1891	947	*50.1*	540	*28.6*	209	*11.1*	188	*9.9*	7	*0.4*	131	*6.9*
11	17g05w Lost Canyon Cr.	500	497	112	*22.5*	248	*49.9*	36	*7.2*	95	*19.1*	6	*1.2*	0	*0*
12	17g06f Mossback/Grayback	2102	2093	235	*11.2*	1103	*52.7*	315	*15.1*	429	*20.5*	11	*0.5*	5	*0.2*
13	17g07w Cr. n of Pepper Cmp	717	635	358	*56.4*	183	*28.8*	44	*6.9*	49	*7.7*	1	*0.2*	81	*12.8*
14	17g08f Fourmile/Grayback	1118	987	510	*51.7*	342	*34.7*	61	*6.2*	73	*7.4*	1	*0.1*	128	*13*
15	17g09w Windy Cr.	1299	1202	386	*32.1*	446	*37.1*	183	*15.2*	181	*15.1*	6	*0.5*	92	*7.7*
16	17g10w Jenny Cr.	950	690	218	*31.6*	208	*30.1*	156	*22.6*	106	*15.4*	2	*0.3*	257	*37.2*
17	17g11f upper Grayback	1115	1091	350	*32.1*	396	*36.3*	109	*10*	225	*20.6*	11	*1*	18	*1.6*
18	17g12w Fan/Little Crks.	1389	1283	95	*7.4*	440	*34.3*	282	*22*	438	*34.1*	28	*2.2*	101	*7.9*
19	17g13w Elk Cr.	968	904	115	*12.7*	335	*37.1*	189	*20.9*	258	*28.5*	7	*0.8*	62	*6.9*
20	***17g TOTALs, Grayback Creek***	***15548***	***14553***	***4262***	***29.3***	***5798***	***39.8***	***1881***	***12.9***	***2519***	***17.3***	***93***	***0.6***	***950***	***6.5***
21	17L01f Little Grayback mouth	558	556	94	*16.9*	199	*35.8*	81	*14.6*	175	*31.5*	7	*1.3*	0	*0*
22	17L02w Little Grayback west fork	971	561	190	*33.9*	151	*26.9*	132	*23.5*	87	*15.5*	1	*0.2*	407	*72.5*
23	17L03wLittle Grayback east fork	1985	1674	500	*29.9*	533	*31.8*	377	*22.5*	254	*15.2*	10	*0.6*	305	*18.2*
24	17L04w Lake Cr. (Squaw Mtn)	855	834	291	*34.9*	201	*24.1*	128	*15.3*	200	*24*	14	*1.7*	18	*2.2*
25	17L05f Sucker Cr. by Grayback	1746	1684	424	*25.2*	735	*43.6*	198	*11.8*	320	*19*	7	*0.4*	56	*3.3*
26	17L06f Sucker mouth	2066	0		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*
27	17L07w Cr. parallel to Sucker	595	0		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*
28	17L08w Bear Cr.	2480	0		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*
29	17L09f Sucker between Nelson and	1789	0		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*
30	17L10f Sucker between	1313	0		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*
31	17L10w Nelson Cr.	489	0		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*		*#VALUE!*
32	***17L TOTALs, lower Sucker Cr***	***14847***	***5309***	***1499***	***28.2***	***1819***	***34.3***	***916***	***17.3***	***1036***	***19.5***	***39***	***0.7***	***786***	***14.8***

1/20/95
Sucker/Grayback Ecosystem Analysis
Structural/Seral Condition, existing condition, prepared by Randy Miller, Illinois Valley Ranger District, Siskiyou National Forest

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
33	Existing Condition from PMR pixel data (satellite imagery)	total WAA acres	total seral acres	Pioneer Seral acres	*%seral acres; Pioneer*	Early Seral acres	*%seral acres; Early*	Mid Seral acres	*%seral acres; Mid*	Late Seral acres	*%seral acres; Late*	Climax Seral acres	*%seral acres; Climax*	non forest/ backgrnd	*% non forest/ backgrnd*
34	17s01f Sucker between Cave and	1551	1141	492	*43.1*	318	*27.9*	147	*12.9*	182	*16*	2	*0.2*	407	*35.7*
35	17s02w Yeager Cr.	1495	1478	468	*31.7*	526	*35.6*	153	*10.4*	323	*21.9*	8	*0.5*	14	*0.9*
36	17s03f Sucker between Mule and	1781	1688	551	*32.6*	695	*41.2*	156	*9.2*	279	*16.5*	7	*0.4*	86	*5.1*
37	17s04f Sucker between Mule and	1688	1602	380	*23.7*	458	*28.6*	324	*20.2*	428	*26.7*	12	*0.7*	82	*5.1*
38	17s05f lower Bolan Cr.	864	853	127	*14.9*	318	*37.3*	211	*24.7*	189	*22.2*	8	*0.9*	7	*0.8*
39	17s06w East Fork Bolan Cr.	1304	1010	118	*11.7*	324	*32.1*	198	*19.6*	356	*35.2*	14	*1.4*	289	*28.6*
40	17s07w upper Bolan Cr (includes	1761	1487	343	*23.1*	492	*33.1*	344	*23.1*	302	*20.3*	6	*0.4*	269	*18.1*
41	17s08f Sucker from Bolan to	1812	1767	325	*18.4*	690	*39*	298	*16.9*	440	*24.9*	14	*0.8*	39	*2.2*
42	17s09w Grizzly Gulch Cr.	626	426	161	*37.8*	100	*23.5*	93	*21.8*	70	*16.4*	2	*0.5*	199	*46.7*
43	17s10f upper Sucker face drainages	2888	2672	132	*4.9*	1295	*48.5*	439	*16.4*	775	*29*	31	*1.2*	207	*7.7*
44	17s11w East Tannen and Tannen	973	641	56	*8.7*	204	*31.8*	142	*22.2*	228	*35.6*	11	*1.7*	330	*51.5*
45	17s12w Fehley Gulch Cr.	571	340	69	*20.3*	111	*32.6*	62	*18.2*	91	*26.8*	7	*2.1*	229	*67.4*
46	17s13w upper Sucker Cr. (Red	1571	1379	134	*9.7*	544	*39.4*	293	*21.2*	394	*28.6*	14	*1*	190	*13.8*
47	17s14w Elkhorn Cr.	502	485	216	*44.5*	169	*34.8*	57	*11.8*	42	*8.7*	1	*0.2*	17	*3.5*
48	17s15w Limestone Cr.	1291	1216	372	*30.6*	428	*35.2*	234	*19.2*	171	*14.1*	11	*0.9*	73	*6*
49	17s16f Left Fork Cr. mouth	1570	1511	184	*12.2*	612	*40.5*	209	*13.8*	487	*32.2*	19	*1.3*	55	*3.6*
50	17s17w Deep Cr.	586	563	218	*38.7*	185	*32.9*	55	*9.8*	99	*17.6*	6	*1.1*	21	*3.7*
51	17s18w Brush Cr.	1918	1789	252	*14.1*	754	*42.1*	292	*16.3*	463	*25.9*	28	*1.6*	120	*6.7*
52	17s19w upper Left Fork Cr.	1436	1302	219	*16.8*	428	*32.9*	273	*21*	363	*27.9*	19	*1.5*	130	*10*
53	***17s TOTALs, Sucker Creek above Caves Cr.***	***26188***	***23350***	***4817***	***20.6***	***8651***	***37***	***3980***	***17***	***5682***	***24.3***	***220***	***0.9***	***2764***	***11.8***
54	Existing Condition from PMR pixel data (satellite imagery)	total WAA acres	total seral acres	Pioneer Seral acres	*%seral acres; Pioneer*	Early Seral acres	*%seral acres; Early*	Mid Seral acres	*%seral acres; Mid*	Late Seral acres	*%seral acres; Late*	Climax Seral acres	*%seral acres; Climax*	non forest/ backgrnd	*% non forest/ backgrnd*
55															
56	***SUCKER/GRAYBACK TOTALs***	***62153***	***48344***	***12152***	***25.1***	***17662***	***36.5***	***7683***	***15.9***	***10448***	***21.6***	***399***	***0.8***	***4923***	***10.2***

Jan 25, 1995

Sucker/Grayback Ecosystem Analysis. **Older Forest Habitat existing and historic condition for Sucker Creek ecosystem, and Silver fire area as example of natural condition for comparison**, prepared by Randy Miller, Illinois Valley Ranger District

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Existing Condition from PMR pixel data (satellite imagery). Historic from 1948 timber data	total WAA acres	total seral acres	Mid Seral acres	*%seral acres; Mid*	Late Seral acres	*%seral acres; Late*	Climax Seral acres	*%seral acres; Climax*	Older Forest habitat acres	*% Older Forest habitat acres*	Spotted Owl activity centers	Spotted Owl mgmt number	Historic Older Forest habitat acres	*% area Historic Older Forest hab. ac.*
2	17c01f Cave Cr. mouth	1825	1756	234	*13.3*	400	*22.8*	8	*0.5*	642	*36.6*	1	IV300	1476	*80.9*
3	17c02w Cave/No Name Crks.	1093	1060	173	*16.3*	371	*35*	22	*2.1*	566	*53.4*	0.5	IV41	1034	*94.6*
4	17c03f Lake/Panther Crks	1922	1733	328	*18.9*	363	*20.9*	15	*0.9*	706	*40.7*	0.5	IV41	1765	*91.8*
5	17c04w Lake Cr/Bigelow	730	583	171	*29.3*	77	*13.2*	2	*0.3*	250	*42.9*	0		337	*46.2*
6	**17c TOTALs. Cave Creek**	**5570**	**5132**	**906**	***17.7***	**1211**	***23.6***	**47**	***0.9***	**2164**	***42.2***	**2**		**4612**	***82.8***
7	17g01f Grayback Cr.mouth	1784	1714	154	*9*	294	*17.2*	9	*0.5*	457	*26.7*	0		501	*28.1*
8	17g02w Cr.nw of Buck Pk.	988	978	82	*8.4*	142	*14.5*	4	*0.4*	228	*23.3*	0		580	*58.7*
9	17g03w Cr.east of Squaw Bt.	590	588	61	*10.4*	41	*7*	0	*0*	102	*17.3*	0		82	*13.9*
10	17g04w White Rock Cr.	2028	1891	209	*11.1*	188	*9.9*	7	*0.4*	404	*21.4*	0.5	IV22	1557	*76.8*
11	17g05w Lost Canyon Cr.	500	497	36	*7.2*	95	*19.1*	6	*1.2*	137	*27.6*	0		281	*56.2*
12	17g06f Mossback/Grayback	2102	2093	315	*15.1*	429	*20.5*	11	*0.5*	755	*36.1*	0.5	IV22	944	*44.9*
13	17g07w Cr. n of Pepper Cmp	717	635	44	*6.9*	49	*7.7*	1	*0.2*	94	*14.8*	0		714	*99.6*
14	17g08f Fourmile/Grayback	1118	987	61	*6.2*	73	*7.4*	1	*0.1*	135	*13.7*	1	IV22??	1078	*96.4*
15	17g09w Windy Cr.	1299	1202	183	*15.2*	181	*15.1*	6	*0.5*	370	*30.8*	0		719	*55.4*
16	17g10w Jenny Cr.	950	690	156	*22.6*	106	*15.4*	2	*0.3*	264	*38.3*	0		762	*80.2*
17	17g11f upper Grayback	1115	1091	109	*10*	225	*20.6*	11	*1*	345	*31.6*	0		1072	*96.1*
18	17g12w Fan/Little Crks.	1389	1283	282	*22*	438	*34.1*	28	*2.2*	748	*58.3*	1	IV126	655	*47.2*
19	17g13w Elk Cr.	968	904	189	*20.9*	258	*28.5*	7	*0.8*	454	*50.2*	1	IV116	692	*71.5*
20	**17g TOTALs. Grayback Creek**	**15548**	**14553**	**1881**	***12.9***	**2519**	***17.3***	**93**	***0.6***	**4493**	***30.9***	**4**		**9637**	***62***
21	17L01f Little Grayback mouth	558	556	81	*14.6*	175	*31.5*	7	*1.3*	263	*47.3*	?		373	*66.8*
22	17L02w Little Grayback west fork	971	561	132	*23.5*	87	*15.5*	1	*0.2*	220	*39.2*	?		470	*48.4*
23	17L03wLittle Grayback east fork	1985	1674	377	*22.5*	254	*15.2*	10	*0.6*	641	*38.3*	1	IV221	656	*33*
24	17L04w Lake Cr. (Squaw Mtn)	855	834	128	*15.3*	200	*24*	14	*1.7*	342	*41*	0		813	*95.1*
25	17L05f Sucker Cr. by Grayback	1746	1684	198	*11.8*	320	*19*	7	*0.4*	525	*31.2*	1	IV220	731	*41.9*
26	17L06f Sucker mouth	2066	0		*#VALUE!*		*#VALUE!*		*#VALUE!*	0	*#VALUE!*	?		99	*4.8*
27	17L07w Cr. parallel to Sucker	595	0		*#VALUE!*		*#VALUE!*		*#VALUE!*	0	*#VALUE!*	?			*0*
28	17L08w Bear Cr.	2480	0		*#VALUE!*		*#VALUE!*		*#VALUE!*	0	*#VALUE!*	?		326	*13.1*
29	17L09f Sucker between Nelson and	1789	0		*#VALUE!*		*#VALUE!*		*#VALUE!*	0	*#VALUE!*	?		602	*33.7*
30	17L10f Sucker between	1313	0		*#VALUE!*		*#VALUE!*		*#VALUE!*	0	*#VALUE!*	?		626	*47.7*
31	17L10w Nelson Cr.	489	0		*#VALUE!*		*#VALUE!*		*#VALUE!*	0	*#VALUE!*	?		63	*12.9*
32	**17L TOTALs. lower Sucker Cr**	**14847**	**5309**	**916**	***17.3***	**1036**	***19.5***	**39**	***0.7***	**1991**	***37.5***			**4759**	***32.1***

1

Jan 25, 1995

Sucker/Grayback Ecosystem Analysis. **Older Forest Habitat existing and historic condition for Sucker Creek ecosystem, and Silver fire area as example of natural condition for comparison**, prepared by Randy Miller, Illinois Valley Ranger District

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
33	Existing Condition from PMR pixel data (satellite imagery). Historic from 1948 timber data	total WAA acres	total seral acres	Mid Seral acres	*%seral acres; Mid*	Late Seral acres	*%seral acres; Late*	Climax Seral acres	*%seral acres; Climax*	Older Forest habitat acres	*% Older Forest habitat acres*	Spotted Owl activity centers	Spotted Owl mgmt number	Historic Older Forest habitat acres	*% area Historic Older Forest hab. ac.*
34	17s01f Sucker between Cave and Yeager Crks.	1551	1141	147	*12.9*	182	*16*	2	*0.2*	331	*29*	?		926	*59.7*
35	17s02w Yeager Cr.	1495	1478	153	*10.4*	323	*21.9*	8	*0.5*	484	*32.7*	1	IV214	1181	*79*
36	17s03f Sucker between Mule and	1781	1688	156	*9.2*	279	*16.5*	7	*0.4*	442	*26.2*	2	IV169,IV279	1221	*68.6*
37	17s04f Sucker between Mule and Left Fork Crks.	1688	1602	324	*20.2*	428	*26.7*	12	*0.7*	764	*47.7*	1	IV42	885	*52.4*
38	17s05f lower Bolan Cr.	864	853	211	*24.7*	189	*22.2*	8	*0.9*	408	*47.8*	0.5	IV283	376	*43.5*
39	17s06w East Fork Bolan Cr.	1304	1010	198	*19.6*	356	*35.2*	14	*1.4*	568	*56.2*	1	IV43	488	*37.4*
40	17s07w upper Bolan Cr (includes	1761	1487	344	*23.1*	302	*20.3*	6	*0.4*	652	*43.8*	0.5	IV283	1402	*79.6*
41	17s08f Sucker from Bolan to Grizzly Gulch (Layman G)	1812	1767	298	*16.9*	440	*24.9*	14	*0.8*	752	*42.6*	1	IV369	1048	*57.8*
42	17s09w Grizzly Gulch Cr.	626	426	93	*21.8*	70	*16.4*	2	*0.5*	165	*38.7*	?		372	*59.4*
43	17s10f upper Sucker face drainages	2888	2672	439	*16.4*	775	*29*	31	*1.2*	1245	*46.6*	0.5	IV365	1723	*59.7*
44	17s11w East Tannen and Tannen	973	641	142	*22.2*	228	*35.6*	11	*1.7*	381	*59.4*	0.5	IV365	669	*68.8*
45	17s12w Fehley Gulch Cr.	571	340	62	*18.2*	91	*26.8*	7	*2.1*	160	*47.1*	0.5	IV125	138	*24.2*
46	17s13w upper Sucker Cr. (Red	1571	1379	293	*21.2*	394	*28.6*	14	*1*	701	*50.8*	0.5	IV125	342	*21.8*
47	17s14w Elkhorn Cr.	502	485	57	*11.8*	42	*8.7*	1	*0.2*	100	*20.6*	0.5	IV244	254	*50.6*
48	17s15w Limestone Cr.	1291	1216	234	*19.2*	171	*14.1*	11	*0.9*	416	*34.2*	0.5	IV244	600	*46.5*
49	17s16f Left Fork Cr. mouth	1570	1511	209	*13.8*	487	*32.2*	19	*1.3*	715	*47.3*	0.5	IV?	960	*61.1*
50	17s17w Deep Cr.	586	563	55	*9.8*	99	*17.6*	6	*1.1*	160	*28.4*	0.5	IV?	170	*29*
51	17s18w Brush Cr.	1918	1789	292	*16.3*	463	*25.9*	28	*1.6*	783	*43.8*	1	IV213	554	*28.9*
52	17s19w upper Left Fork Cr.	1436	1302	273	*21*	363	*27.9*	19	*1.5*	655	*50.3*	1	IV?	754	*52.5*
53	17s TOTALs, Sucker Creek	26188	23350	3980	*17*	5682	*24.3*	220	*0.9*	9882	*42.3*	13		14063	*53.7*
54	Existing Condition from PMR pixel data (satellite imagery). Historic from 1948 timber data	total WAA acres	total seral acres	Mid Seral acres	*%seral acres; Mid*	Late Seral acres	*%seral acres; Late*	Climax Seral acres	*%seral acres; Climax*	Older Forest habitat acres	*% Older Forest habitat acres*	Spotted Owl activity centers	Spotted Owl mgmt number	Historic Older Forest habitat acres	*% area Historic Older Forest hab. ac.*
55	*SUCKER/GRAYBACK TOTALs*	*62153*	*48344*	*7683*	*15.9*	*10448*	*21.6*	*399*	*0.8*	*18530*	*38.3*	*19*		*33071*	*53.2*
56	'Natural condition' example, Silver Peak fire area using PMR pixel data	35414	35414	8628	*24.4*	7485	*21.1*	197	*0.6*	16310	*46.1*	?		?	?

APPENDIX D

Detailed Stand Replacement and Water Yield Discussion

Plant Series in the watershed: The watershed's vegetation has been classified into plant series, which are aggregations or associations of plants dominated by a specific set of climax species that reflect the physical environment and disturbance history. (Atzet and Wheeler, 1982) There are six plant series in the Sucker/Grayback watershed. The Port-Orford-cedar (Chamaecyparis lawsoniana), Shasta red fir (Abies magnifica var. shastensis), and Jeffrey pine (Pinus jeffreyi) series are minor components of the forested landscape with each covering between 1000 and 1500 acres. The majority of the land is in the white fir (Abies concolor, 21,000 acres) tanoak (Lithocarpos densiflorus, 14,000 acres) and Douglas-fir (Pseudotsuga menziesii, 5,500 acres) series.

These acreages reflect the area for which plant series have been mapped. The private and Bureau of Land Management lands along Sucker Creek from Little Grayback Creek west (about 20% of the watershed) have not been mapped. Judging from elevation, soil types and personal knowledge of the area, they have similar plant series present except for Shasta red fir. A larger proportion of these lands are in the tanoak, Jeffrey pine and Douglas-fir series than on National Forest lands (Dunham, 1994).

Plant series classifications reflect the potential of sites to support plant communities which tend toward a given climax species dominance. The existing plant community can also be classified by seral stage. This represents the point of development from a stand replacement event, i.e., stand beginning, toward the climax plant community.

Each plant series has vegetation in a range of age and size classes. Old growth, mature, young conifer, hardwoods, shrubs, and grasses/forbs occur in a variety of patch sizes. The age class distribution for each plant series was analyzed using size/structure information from the ISAT Vegetation Database. Past, current and future age class distributions are depicted in the trends section of this document.

Trends in High Intensity Disturbance Frequency

The table below (Table 3) shows the increase in period between high intensity events from 1890

to current and the predicted increase given continued fire suppression and lack of harvest in 2040.

The 100 year age class return intervals are based on the percent of the land base with vegetation less than 100 years old at the time for which the figures are calculated (1890, 1990 and 2040). For example, in the white fir series, existing condition, stands currently less than 100 years of age have a stand replacement frequency of 190 years. The chance of a high intensity event is 1/190 for any stand in any given year. The 200 year age class return interval includes all stands currently less than 200. (The 100 year group plus all stands between 100 and 200 years) Under existing condition for white fir Table 3 shows a stand replacement interval of 165 years. This demonstrates that the disturbance frequency has decreased during the last 100 years, likely due to fire suppression.

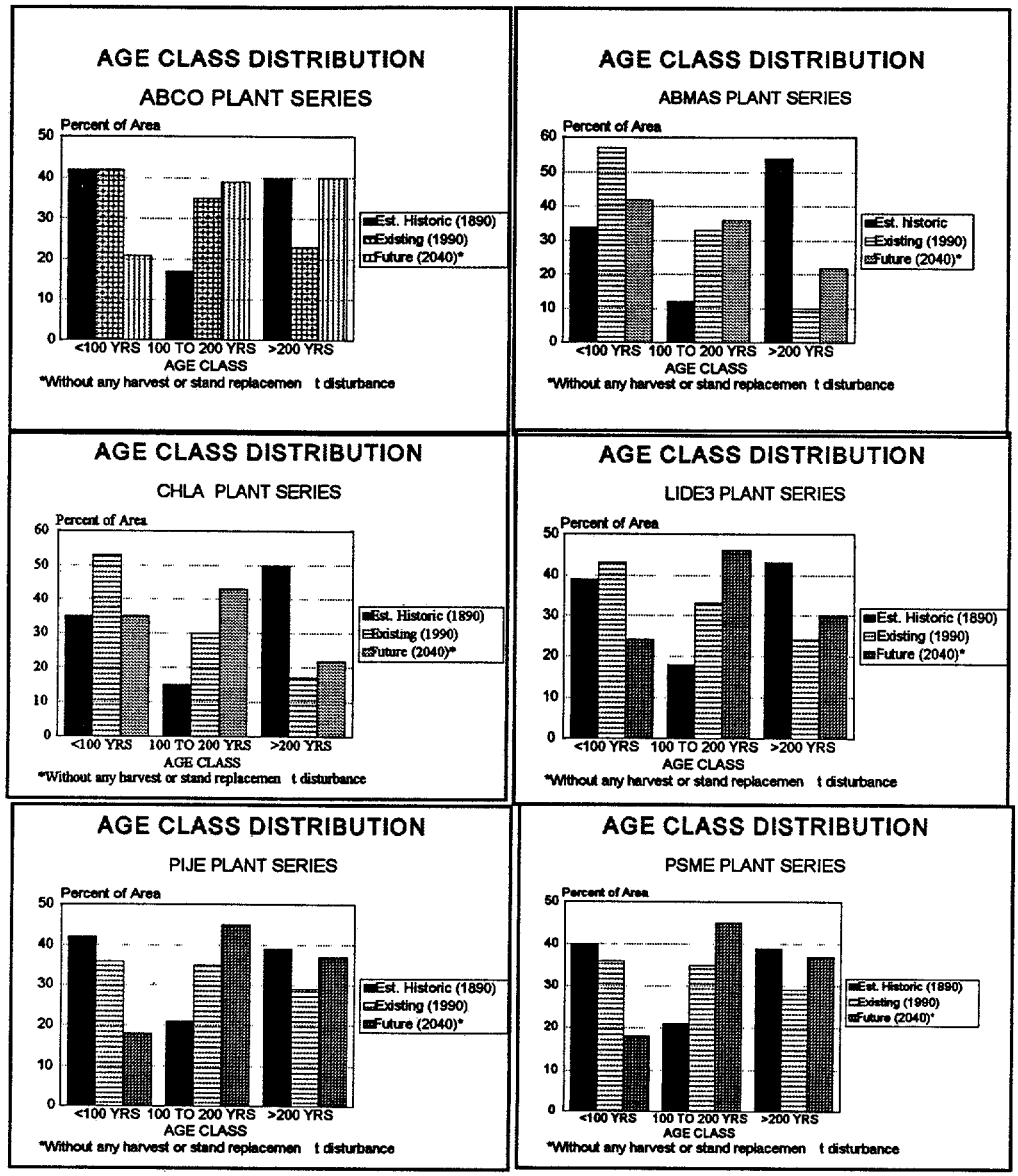
A comparison across Table 3 for white fir shows that the area in young age classes has stayed about the same over the last 100 years. Both 1890 and 1990 (existing) show the same disturbance periodicity. However, the expectation for the future (based on an assumption of continued fire suppression and no stand replacement harvest) is for the periodicity to increase to 390 years. This results in a shift in age class distributions toward older stands over the next 50 years and fewer stands in the 100 year or less age class compared to past conditions.

Comparisons for other plant series can also be made.

Table 3
Stand Replacement Frequencies

Plant Series	Age Class	Historical (1890)	Existing (1994)	Future (2040)
White Fir	< 100 years	190	190	390
	< 200 years	165	215	180
Shasta Fir	< 100 years	260	150	190
	< 200 years	260	130	165
Port-Orford-cedar	< 100 years	240	160	240
	< 200 years	255	115	160
Tanoak	< 100 years	210	190	340
	< 200 years	220	170	180
Jeffrey Pine	< 100 years	185	210	410
	< 200 years	210	170	190
Douglas-fir	< 100 years	200	230	450
	< 200 years	210	180	205

Figure 3
Age Class Distribution for White Fir, Shasta Fir, Port-Orford-cedar, Tanoak, Jeffery Pine and Douglas Fir



Affect of Vegetation Structural Trends on Water Availability

Vegetation species composition and cover affects the level of transpiration in the watershed. Increasing the amount of vegetation on a site results in decreased water availability for stream flow as plants more rapidly utilize soil water for transpiration. Some species of plants are more water demanding than others and have a greater effect on soil moisture retention and water surpluses or deficits. These effects were modeled for the Grayback/Sucker Creek watershed using the Soil Moisture Retention Program (Atzet and Amaranthus, 1985).

To ascertain the magnitude of the effect of that increase on water yield the water surpluses (runoff or seepage) were modelled for entire watershed comparing the existing condition yields to those with reduced vegetation cover.

Reducing the average cover for lands in the highest cover class by 30 percent resulted in a 14 percent increase in surplus water from this source. Most of the increase occurred during the April-May snow melt. It is not known when the effects of this increase would be felt in the lower reaches of the watershed. In years when the snowpack is sustained into the summer months with meltoff shifting to May and June this effect becomes more beneficial to fish. The proportion of streamflow comprised by this water is not known. The finding of the analysis is that there may be some benefit in increased streamflow from thinning vegetation but there is not sufficient information to warrant thinning solely for that purpose.

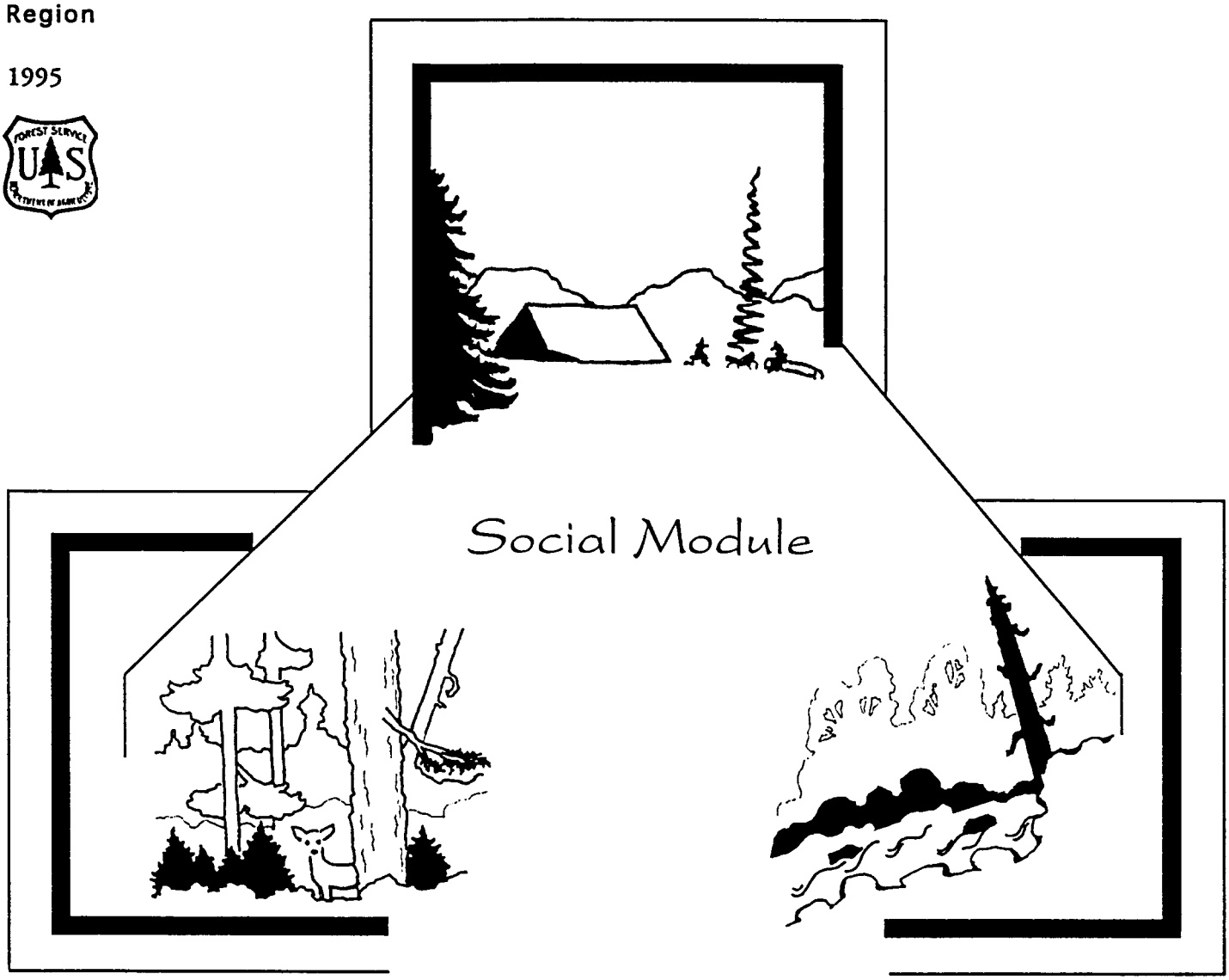
Snowpack effects were also modelled. Snowpack effectively shifts winter precipitation to the spring meltoff months of April and May. This has a significant effect on the timing of runoff. Areas with snowpack had much more water available during the late spring and summer with some sites maintaining surpluses through the month of August. The interaction between reduced cover and snowpack produced some of the largest water yield increases. That interaction is complex and opening patterns which favor penetration to the forest floor yet maintain enough shade to perpetuate the snow pack result in the most favorable late season water balances. This is a consideration for sites above 4000 feet in this watershed.

Reducing vegetation cover, particularly in stands which have developed dense understories would simulate conditions which existed under pre-suppression fire regimes. It may also increase water yields and improve late season streamflow and water temperatures.

United States
Department
of Agriculture

Forest Service
Pacific
Northwest
Region

1995



Grayback/Sucker Pilot Watershed Analysis

Version 1.0

Siskiyou National Forest

April 1995

SOCIAL MODULE
NON-CONSUMPTIVE USE

Overview

The Grayback/Sucker Watershed has been used for recreation since the mid-1800s. Initially, most of the use was by local residents, who hiked and packed into the area to camp, hunt, or fish. The Oregon Caves were discovered in 1873, and soon were attracting visitors from around the world. The Grayback Campground was built in the mid 1920's. This campground and other developments within the watershed were built to accommodate the visitors to the Oregon Caves and to enhance their experience in the outdoors.

Due to the heavy use of the Oregon Caves, developed recreational facilities within the watershed (campgrounds, trails) receive more visitor use than dispersed recreation (undeveloped campsites scattered throughout the watershed). This is the only watershed on the Forest where developed recreation predominates.

The use of and demand for dispersed, as well as developed, recreation opportunities within the Illinois Valley Ranger District are expected to grow in the next decade. The Siskiyou National Forest Land and Resource Management Plan (Siskiyou Forest Plan) states that, use is projected to increase at one-half percent each year from the actual recorded use in 1980 (Siskiyou National Forest FEIS III-142). This has not been quantified to date, however. Table 1 lists visitor use, by occasion, on the Illinois Valley Ranger District.

This analysis, and subsequent paper were designed to respond to the following Key Question and sub questions:

How does the watershed provide for human consumptive and non-consumptive uses? What are the watershed-specific conflicts between these uses?

> (A) What are the major access routes within the watershed that meet social needs and demands?
>
> (B) What natural and cultural settings and sites occur within the watershed and how do these provide for amenity, spiritual, health and security needs?

This report begins with a discussion of non-consumptive uses within the watershed followed by consumptive uses. The non-consumptive uses valued within the watershed include recreation, education, religious or spiritual activities. These can take the form of camping, hiking, swimming, picnicking, viewing scenery, driving on back country roads, studying/viewing nature and wildlife,

and prayer or worship. These types of activities are provided in a variety of landscape settings or sites, such as, interpretive sites, developed campgrounds and facilities, Oregon Caves National Monument, trails, roads, wilderness, botanical areas, back country recreation, dispersed campsites and scenic viewpoints. Consumptive uses include timber harvest, cutting firewood, picking mushrooms, farming, mining, water use, ranching, hunting and fishing.

TABLE 1
VISITOR USE ON ILLINOIS VALLEY RANGER DISTRICT

An occasion is one person engaging in the activity at least once during a 24 hour period.

ACTIVITY	OCCASIONS
Viewing Scenery	140,300
Automobile Travel	70,000
Hiking and Walking	46,500
Picnicking	33,100
Swimming	32,800
Camping, Tent	28,700
Camping, Vehicle	18,300
Watercraft	17,000
Camping, Trailer	16,800
Nature Study	14,600
Fishing, Anadromous	11,800
Mountain Biking	8,900
Snowplay	7,500
Horseback Riding	4,800
Viewing Interpretive Exhibits	4,300
Organization Camping	3,800
Cross Country Skiing	3,000

SOURCE: ILLINOIS VALLEY OREGON TOURISM ASSESSMENT

Conflicts identified through this analysis are between users and/or uses. Conflicts between users/uses and the biological resources have been addressed with the Aquatic and Terrestrial Ecosystems documents.

DEVELOPED RECREATION

INTERPRETIVE SITES

Landbase and Use: The Grayback/Sucker Watershed contains one interpretive site: Grayback Interpretive Area. The site is located adjacent to Grayback Campground. The interpretive area has been under construction for the past several years. Plans still remain for a handicap accessible trail system, parking, restrooms, information kiosks, and a visitor's center (See Site Plan in Analysis File).

The interpretive area will provide recreation opportunities for people who want to hike, picnic, and swim. Educational opportunities will include interpretation of the cultural and natural history of the local area. Visitor use projections have not been made for this area, but personal communications with employees of the Oregon Caves National Monument and the Illinois Valley Visitors Center have provided some qualitative data on visitor and interest of interpretation.

> "Fifteen percent of the 10,000 annual visitors ask questions regarding the history and prehistory of the local area. Of the many brochures available in the center, visitors annually take approximately 2,000 of the brochures dealing with history and prehistory" (Chadderton, 1994).
>
> "Ninety Five Percent of the letters and phone calls to the Monument ask for heritage information, along with information on geology and other natural history topics" (Roth, 1994).

Access: Major access to the site is the Caves Highway (State Highway 46).

Concerns/Conflicts: One conflict identified during analysis was over the site design of the interpretive area and the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA, USDI, 1994) (herein referred to as the ROD). The site design may not meet the objectives of the Aquatic Conservation Strategy.

Trends: Management will likely not meet the needs of the public with added emphasis on riparian values. The possible project design for the Grayback Interpretive Area may be redesigned to meet the objectives of the Aquatic Conservation Strategy (see Grayback Interpretive Area file on file at the Illinois Valley Ranger District).

DEVELOPED CAMPGROUNDS and FACILITIES

Landbase and Use: The first developed campsite within the analysis area was the Grayback Forest Camp, on the current site of the Grayback Campground. It was developed in the mid-1920s. Later, in the 1930s, when the Civilian Conservation Corps (CCC) began working in the area, major improvements were made to the campsite, including extensive rock-work, and including a "community kitchen." This site marked the end of the developed road and was the jumping-off point for horseback rides to Oregon Caves.

The CCC workers, from Camp Kerby (also known as "Camp Selma"), built a side camp at the mouth of Grayback Creek in the early 1930s. It was situated in the flat on the northeast side of the confluence, east of the Cedar Guard Station. The CCC proceeded to build the guard station (now listed on the National Register of Historic Places), improve the Grayback Campground, extend the road toward Oregon Caves, build administrative trails, construct phone lines, and fight fires. Later, in the 1950s, this flat served as the site of a 4-H camp.

Today, five developed campgrounds are found within the watershed: Bolan Lake, Cave Creek, Grayback, Caves Trail, and the Goldleaf Resort. The first three campgrounds are managed by the Forest Service. They provide vehicle access and parking, tent pads, firepits, and toilet facilities. Grayback and Bolan Lake are accessible to recreational vehicles (RV). Further, the Grayback Campground is accessible to people with disabilities. The Caves Trail Campground is owned and managed by Harold and Kathryn Medkeff. The Goldleaf Resort is owned by Don and Judy Kelly, and managed by Nancy and Kurt Prenpner. It provides vehicle access and parking, overnight camping, firepits, toilet facilities, and motel rooms. Table 2 lists the capacity and use of each campground.

TABLE 2
DEVELOPED DAY USE CAMPGROUNDS WITHIN WATERSHED

LOCATION	CAPACITY	USE (Per Year)
Bolan Lake	10 Tent/RV	15,000
Cave Creek	18 Tent	10,000
Grayback	35 Tent/RV	37,000
Caves Trail	Data Unavailable	Unknown
Goldleaf Resort	20 Tent/Motel	Unknown

SOURCE: ILLINOIS VALLEY OREGON TOURISM ASSESSMENT

The recreation season for the developed campgrounds is 110 to 150 days long, and the peak season is the 110-day period between Memorial Day and Labor Day. Grayback Campground is the most developed and widely used campground on the Siskiyou National Forest. It meets its carrying capacity during a 26-day intensive use season, (peak weekends and holidays during the summer). In Bolan Lake Campground occupancy is over 100% during the summer (Oregon Economic Development Department, 1994).

Camping, picnicking, swimming and hiking are the most popular activities in the campgrounds. National Forest campgrounds, with the exception of Bolan Lake Campground, and private campgrounds serve as overnight facilities for people en route to the Oregon Caves National Monument.

No new campgrounds or facilities are planned within the watershed. Bolan Lake Campground is proposed to be upgraded upon funding availability.

Access: Major road access to the campgrounds is on Caves Highway (State Highway 46), and/or Sucker Creek Road (FS 4612). Bolan Lake Campground is accessed by Happy Camp Road (FS 48) and Bolan Lake Road (FS 4812).

Concerns/Conflicts: Developed campgrounds on Federal lands are experiencing increased use; demand for new campgrounds is also apparent. Increased use of developed campgrounds adjacent to watercourses may have a negative effect on riparian habitat. These include, hazard tree removal which affects snag and down woody material recruitment, and human trampling outside developed areas which affects shrub development.

Trends: The use of and demand for developed campgrounds will likely increase within the watershed. Community members of the Illinois Valley have recently developed a plan: the Illinois Valley Strategic Action Plan. A component of the plan promotes tourism in the area. In doing so, recreation areas and facilities will be developed, and outdoor recreational activities will be promoted, thereby encouraging visitors to stay longer in the area. Within the analysis area, National Forests and BLM lands will be expected to partially supply this demand.

Under the ROD, riparian protection measures would be used for guidance for developed campgrounds on public lands within Riparian Reserves. Riparian conflicts will be resolved through the recreation Standards and Guidelines in the ROD.

OREGON CAVES NATIONAL MONUMENT

Landbase and Use: The Oregon Caves was discovered in 1873 by Elijah Davidson. As the story goes, Elijah was deer hunting in the area, and his dog cornered a bear in the cave. In 1909, 480 acres were set aside as the Oregon Caves National Monument.

The driving force behind the designation was as a tourist attraction, still, many considered the caves to be a "natural monument" set aside to preserve a "scientific object" (Cultural Resource Division, 1992). The amount of acreage reserved for the monument was considered the smallest area compatible with preservation of a resource while still allowing lumbering activity in the surrounding forest.

The caves were administered by the Forest Service until 1933, during which time, several new buildings and structures were designed and built on the site.

Under the monument's concessioner, a retaining wall formed the "old Chalet" courtyard, a rectangular pond was built below the cave entrance. Native plants were transplanted around the buildings, and the Oregon Caves Chateau was built just below the main entrance of the monument. In 1933, the monument was transferred to the National Park Service (NPS). The NPS brought significant change to the monument. The Chateau was opened. The CCC workers were hired to work on roads, trails, utilities, the ranger residence and park's campground. The parking lot was enlarged and upgraded to accommodate visitors. The last CCC project was the removal and replacement of the filling stations and toilets which had been damaged by a landslide in 1940. In 1942, the "new Chalet" was designed and built upon the site of the "old Chalet." Over the following decades, changes and alterations to the monument were usually in response to the climate, the flood of 1964 or the increase in visitors to the caves. According to Harry Christiansen, former Oregon Caves Chateau manager, the 1964 flood caused damage in the dining room, with five feet of muck oozing around wood (quoted in a newspaper article by Huntington, 1994).

Today, many of the same buildings and structures are still in use at the monument. The developed area includes a visitor's information and ranger office, utility buildings, seasonal employee housing, a ranger residence, access and parking, toilet facilities and the chateau-chalet plaza. The property is still administered by the National Park Service. Services are provided by the Oregon Caves Company under concession contract.

Visitor use to the monument has been gradually decreasing over the last 20 years. Visitor counts began in the mid-70s. Over 181,000 visitors were counted in 1977.

> "During the mid-70s, vehicles formed a line about one mile from the cave's entrance. A park ranger was located at the entrance. When one car left, the park ranger permitted one car to enter" (Cosby, 1995).

The caves experienced a major drop in visitation in 1985. This may have been due to the new methods developed by the NPS to count visitors; counts were much more accurate (Cosby, 1994). Following 1985, visitor use to the caves continued to increase until 1988, when the caves began to experience another drop. This decrease continued into 1993 (see Figure 1).

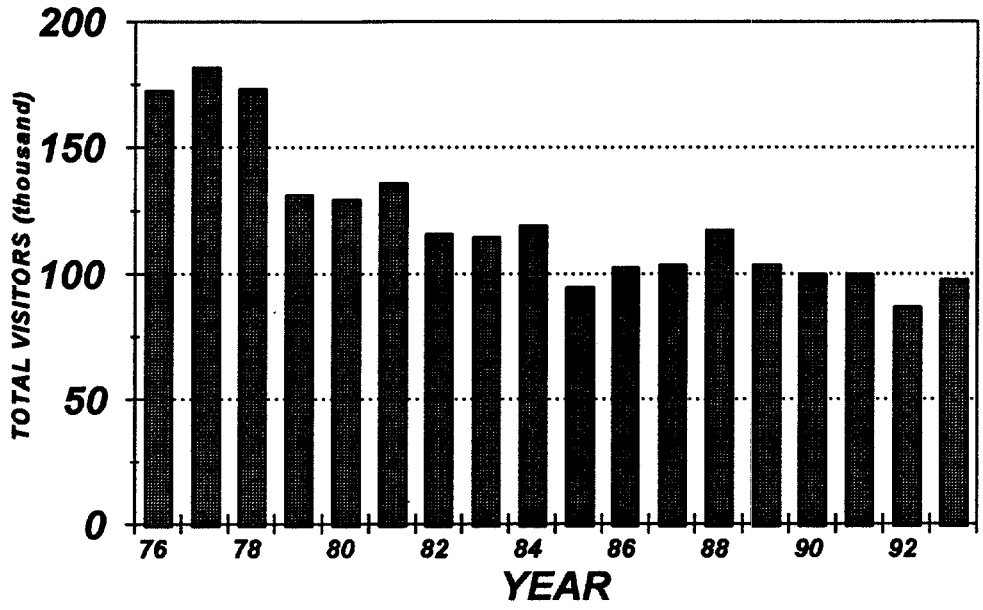


Figure 1 VISITATION BY YEAR
Oregon Caves National Monument

Reasons for the gradual decrease in visitation are unknown, however, there is some speculation. One possible reason is that admission fees have increased dramatically over the last ten years (Oregon, Economic Development Department, 1994). Another is the loss in visitors from non-western states. The NPS indicates that today, over 80% of the visitors are from Oregon, Washington and California, and only 20% are from other states, in the mid-70s this was reversed (Oregon Economic Development Department, 1994).

The average time spent at the caves is three to four hours (Oregon Economic Development Department, 1994). Caving, hiking, and camping are the most popular activities at the caves.

Access: Major road access is on the Caves Highway (State Highway 46). Access is also provided via Cave Creek Campground Trail (#1206) and Lake Mountain Trail (#1705).

Concerns/Conflicts: The NPS has expressed concern over the decrease in visitation to the monument.

Visitor use of the caves environment has impacted the macro-invertebrate population.

Past timber harvest has resulted in negative impacts on the scenery surrounding the monument; future timber harvest will continue to have effects, though not as severe.

The potential for winter floods and summer fires may impact the developments at the monument. Mature stands of mixed deciduous and conifer trees create dense crown fire conditions and ground fuels on hillslopes surrounding the developments within the monument.

During the 1964 flood, a debris flow scoured the channel and banks of No Name Creek, a tributary to the south of the facilities in the Caves Monument. If a similar debris flow were to scour down the channel that flows past the facilities, extensive damage from woody debris and sediment would be sustained. It is not known whether the probability of such an event has been evaluated by the NPS.

Trends: Visitation to the monument will likely continue. This is due in part to the current efforts of the NPS. They have initiated several projects that will likely encourage more people to visit the monument. These include, new wayside exhibits, new interpretive programs that would emphasize the environment surrounding the cave, and new programs for children that would allow them more active participation in the cave's experience.

Future timber harvest will likely impact the surrounding scenery of the monument. The monument is located within the Oregon Caves Viewshed (2) (refer to Figure 3 below). The viewshed is considered to be in a heavily altered visual condition, and has exceeded Siskiyou Forest Plan acceptable thresholds (O'Neill, 1993).

(See Terrestrial Ecosystems document for more information on fire potential in the area.)

TRAILS

Landbase and Use: Trail use is difficult to determine. The use on National Forest Lands comes from the Trail Resource Information System database. But, for the most part, the information on trail use supported by the database comes from anecdotal reports, and "best guess" estimates.

The trail system in the watershed evolved from aboriginal Indian trails. These trails were further developed by early settlers to serve isolated homesteads and mining areas. Following the creation of the Siskiyou National Forest in 1906, many administrative trails were developed, primarily for

fire protection purposes. One of the earliest trails developed for recreational use was the Boundary Trail, constructed in 1924. As development of the area progressed, many miles of trails were replaced with administrative, mining and timber sale roads. However, recently, recreational use of the still existing trails has been growing and now constitutes the primary use of the trail system on the Forest and within the analysis area. Table 3 shows the existing trail system and its use in the watershed.

TABLE 3
TRAILS IN THE GRAYBACK/SUCKER WATERSHED

TRAIL NAME	TRAIL #	USE
Meadow Mountain	1214	Moderate to Heavy
Limestone	1235	Light
Lake Mountain	1206	Moderate
Elk Creek	1230	Light
Cave Creek	1205	Moderate to Heavy
Boundary	1207N	Light to Moderate
Sucker Creek	1237	Light to Moderate
Fehley Gulch	1231	Light
Tannen Lake	1243	Moderate to Heavy
Bolan Lake	1245	Moderate
Kings Saddle	1245A	Light
Big Tree	Caves National Monument	Light
Kerby Peak	BLM- Unmaintained	Light

All of the trails, except for those trails located in the Wilderness and Back country Recreation, are within the Roaded Natural (Modified) Recreation Opportunity Spectrum (ROS) classification. This is an area that is characterized by predominately Natural-Appearing to a Slightly-Altered landscape, and moderate to low contact between people, using trails. Access for people with disabilities is of "moderate" challenge (see Analysis File for more information).

At present, no trails within the watershed, except for the proposed trail in the Grayback Interpretive

Area, are accessible to people with disabilities. However, some trails have the potential to become accessible.

The Big Tree, Cliff Nature and No Name Loop Trails are within the Oregon National Monument and maintained by the National Park Service. The Kerby Peak Trail, so named for its access to Kerby Peak, a historic fire lookout point, is on BLM lands and has not been maintained since the late 1970's. All other trails are on Forest Service lands and maintained by the Forest Service.

The Limestone, Elk Creek, Sucker Creek, Fehley Gulch, Kings Saddle and Kerby Peak Trails receive light use. All other trails receive moderate to heavy use. Recreation use on the trails occurs chiefly in the form of hunting, hiking, and trail riding on horseback, mountain bike and motorcycle.

More recently, Lake Mountain, Boundary, Meadow Mountain and Elk Creek Trails have been used by a horse packing tour guide.

Access: Major road access is Caves Highway (State Highway 46), Grayback Road (FS 4611) and Sucker Creek Road (FS 4612). The Kerby Peak Trail is accessed by BLM Road 38-6-18 (White Creek Road).

Concerns/Conflicts: Forest Service employees have reported some complaints from hikers over the use of motorcycles on the same trail, and over the presence of cows.

Trails that receive moderate to high use may not meet the objectives of the Recreation Opportunity Spectrum (ROS). The increased number of people along trails changes the kind of recreation experience offered, attracting new users and causing others to leave. This may cause conflict among the traditional users of the trails. Project analysis must take into account likely future uses and needs of these trails.

Increased use of system trails adjacent to watercourses may have a negative effect on riparian habitat. Some effects include, human trampling in areas adjacent to the trail, which prevents shrub development, litter, and disturbing wildlife.

(See section below titled, Back country Recreation for concerns associated with Boundary Trail.)

Trends: Conflicts between trail users are likely to increase, as more and more people seek this type of recreation.

Under the ROD, riparian protection measures would be considered for maintained trails on public lands within Riparian Reserves. Riparian conflicts will be resolved through the recreation Standards and Guidelines in the ROD.

ROADS (General) and UTILITIES

Landbase and Use: Prior to the building of roads in the analysis area, telephones allowed communications between remote lookouts and ranger stations. By 1933, Forest Service phone lines stretched throughout the lower elevations of the analysis area, connecting Cedar Guard Station with Bolan Peak, Oregon Caves, and the Ranger Station on Page Creek. In 1939, a metallic circuit phone line was built from O'Brien to Oregon Caves.

Roads in the analysis area were built for several purposes. The Happy Camp Road (just outside the analysis area) was built to connect two major river valleys, the Illinois and the Klamath. Others were built for timber access (such as the upper spurs of the roads up Grayback and Sucker creeks) and still others for recreation access (such as the Caves Highway).

Today, there are 290 miles of road under the Forest Service, BLM and State jurisdiction within the Grayback/Sucker Watershed. The average road density for the watershed is 3 miles of road for each square mile of area. About 75 of these miles are maintained for passenger cars, 45 miles are closed (See Figure 2), and the remaining 170 miles requires the use of high clearance vehicles. All roads, with the exception of Caves Highway and the first segment of roads (FS 4611 and 4612), have a rock or native soil surface. Figure 2 shows the existing road system within the analysis area.

Caves Highway (State Highway 46) is the main access and travel route into the watershed. It is listed as a Scenic Historic Road under the Oregon Scenic Historic Road Act. Open year round, it is the main travel route to the Oregon Caves National Monument. The Lake Creek Bridge site is a popular photo point for most people on their way to the Monument.

Grayback Road (FS 4611), intersects with Caves Highway. It serves as the main route for people heading for higher elevations along the divide, such as Grayback Mountain. Further, Grayback Road is a popular "scenic route" for people driving to the town of Williams (Craig, 1994). Most of the use occurs from June through January. A traffic counter is located on Grayback Road at the intersection of Caves Highway.

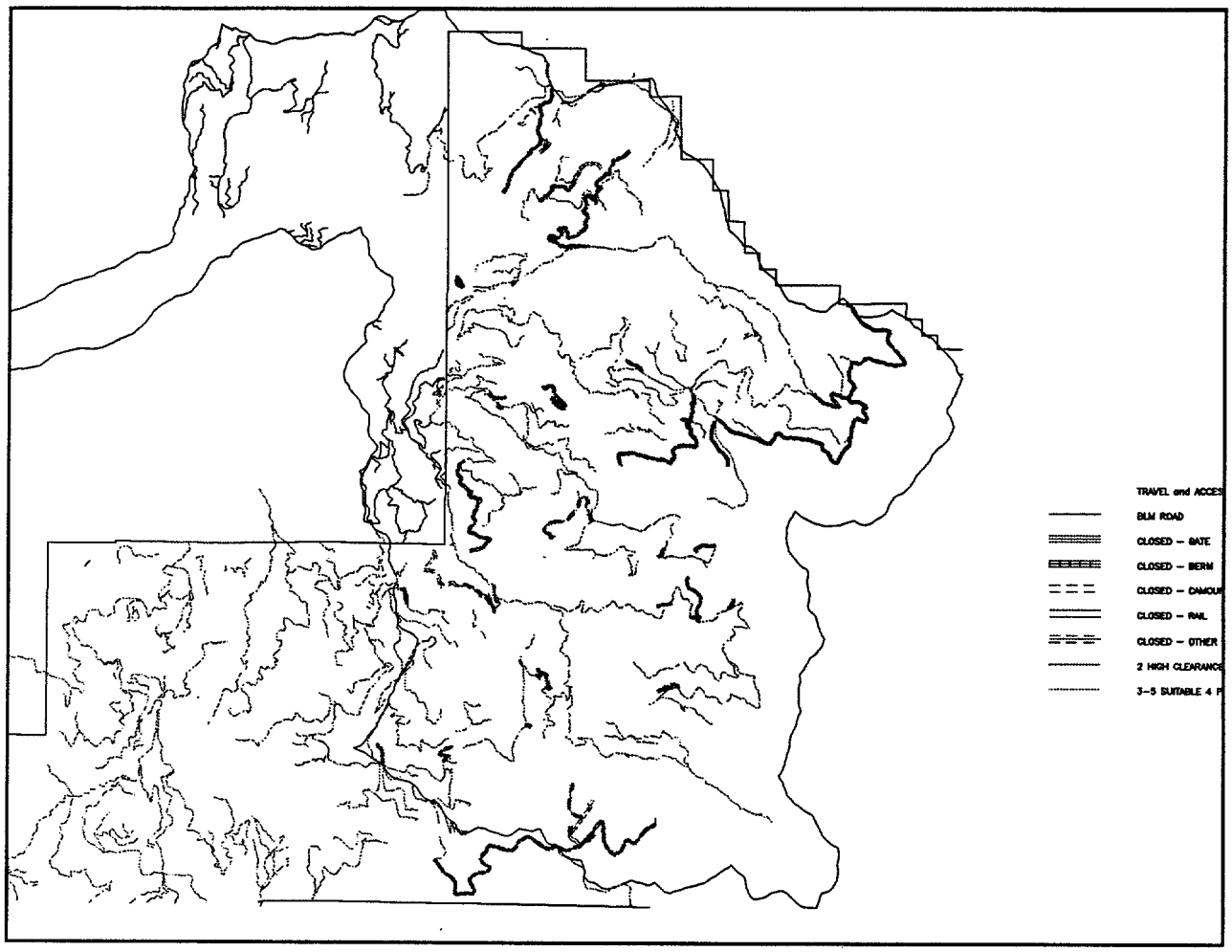


FIGURE 2 Grayback/Sucker Watershed Transportation System

Sucker Creek Road (FS 4612), intersects Caves Highway and travels south. It serves as the main access road into the Red Buttes Wilderness. Most of the use occurs from May through November. A traffic counter is located on Sucker Creek Road at the intersection of Caves Highway. See Table 4 for traffic counts on Grayback and Sucker Creek Roads for 1989 and 1993.

TABLE 4
ROADS IN THE GRAYBACK/SUCKER WATERSHED - 1989 & 1993

ROAD NAME	ROAD #	1989 USE (Vehicles)	1993 USE (Vehicles)
Sucker Creek Road	4612	11,000	5,000
Grayback Road	4611	5,000	9,000*

* - Traffic count for 9 months of 1993

Over 90% of the traffic received on Grayback and Sucker Creek Roads is recreational.

No statistical data exists that addresses the use patterns and preferences of roads other than Caves Highway, Grayback and Sucker Creek Roads. However, some conclusions can be drawn from anecdotal reports:

> "All roads are used to access hunting areas in this watershed." (Sellards, 1994).
>
> "A lot of road use in the watershed is spent driving on back country roads." (Craig, 1994).
>
> "There has been a significant increase in use of roads around the Bolan Lake area." (Sellards, 1994).

Concerns/Conflicts: Road closures and removal as part of the watershed restoration effort may become a potential conflict for people who travel on back country roads.

A seasonal road closure across BLM Road 39-6-3 (Holcomb Peak Road) has prevented vehicle access to a popular hunting area (Sellards, 1994). A seasonal road closure on BLM Road 39-6-9 (Rabbit Lake Road) to protect a Brewer spruce Research Natural Area has received criticism from woodcutters. (Dunham, 1994)

A potential conflict is the spread of Port-Orford-cedar (POC) root disease. The import of disease to uninfected areas within the watershed is due in part to traffic use along roads. POC analysis has identified several high risk infection areas adjacent to Grayback, Sucker Creek and other roads within the watershed (see Terrestrial Ecosystems document).

Another conflict is with habitat effectiveness for species such as deer and elk due to high road densities.

(See Aquatic Ecosystems document for information on road effects to physical aspects of the environment.)

Trends: Road closures and removal under the restoration effort will likely continue.

The major access routes through the watershed are expected to be maintained to allow for recreational access, forest management and fire management.

Road use is likely to increase. As the population grows within the area, more people will turn to the watershed for recreational opportunities. According to the Illinois Valley Tourism Assessment (Final Report, 1994) viewing scenery, and road travel are the two most popular activities on the Illinois Valley Ranger District.

Land agencies are expected to initiate projects to control the spread of POC root disease within the watershed (see Terrestrial Ecosystems document).

The proposed reconstruction of Lake Creek Bridge on Caves Highway may affect the surrounding scenery. The effects of the Lake Creek Bridge reconstruction on the surrounding scenery is currently being discussed and will be dealt with through the Oregon Department of Transportation Technical Advisory Committee. Further, under the Oregon Scenic Historic Road Act, all proposed projects on Caves Highway are subject to rigorous screening that protects the scenic values along the road.

DISPERSED RECREATION

RED BUTTES WILDERNESS

Landbase and Use: Approximately, 3,413 acres of the Red Buttes Wilderness is located at the headwaters of Sucker Creek; the remaining 20,000 acres extends to the south, into the Applegate and Klamath River drainages. The Wilderness is characterized by moderately rugged, high elevation peaks, old growth forests, small meadows, rocky open slopes, and several small lakes and ponds. The Rogue River National Forest is the lead administrative Forest for the Red Buttes Wilderness.

Most of the use is concentrated in the Tannen Lakes basin with the heaviest visitation on weekends and holidays from late June through October (Rogue River National Forest Land and Resource Management Plan, (RRNF LRMP) Appendix E, E-9). Camping, hiking, and fishing are the most popular activities in this area. The Boundary Trail (a National Recreation Trail) and the Sucker Creek Trail, receiving moderate to heavy use, are the most popular trails to and through the Red Buttes Wilderness in the Sucker Creek drainage. The trails are predominantly used for hiking and horseback riding. Overall, the Red Buttes Wilderness receives 1,200+ Recreation Visitor Days

(RVD's) per year (RRNF LRMP Appendix E, E-9).

Access: Major road access to this portion of the Wilderness is Happy Camp Road (FS 48) and Sucker Creek Road (FS 4612).

Concerns/Conflicts: The high concentration of people using the Tannen Lakes area has a direct affect on the lake environment. Use may be above capacity in this area (RRNF LRMP, Appendix E, E-9).

Another concern is occasional motorcycle use on wilderness trails (motorized use is prohibited in Wilderness).

> "Periodically, motorbikes and/or mountain bike users use the Red Buttes Wilderness as an exit" (Keown, 1994).

Trends: These conflicts over use of the Red Buttes Wilderness are expected to be dealt with through the review and update of Wilderness Management Plans.

BOTANICAL AREAS

Landbase and Use: Three botanical areas are found in the watershed: Bolan Lake, Bigelow Lakes, and Grayback Mountain (see SNF LRMP Appendix F- Volume I F- 55, 60, 88 for descriptions of the areas).

These areas provide opportunities for people who want to study or view nature. The Bigelow Lakes Botanical Area is one of the most popular (Mullens, 1994). The area receives many visitors per month during the spring and summer months (Empey, 1994).

Access: Access into the vicinity of the Grayback Mountain Botanical Area is Caves Highway (State Highway 46), Grayback Road (FS 4611), the trail system located on the Applegate Ranger District, and the Boundary Trail. Major access to the Bigelow Lakes Botanical Area is from the Caves Highway (State Highway 46), the Grayback Road, and FS Road 4611070. Access to Bolan Lake Botanical Area is from Happy Camp Road (FS 48), Bolan Lake Road (FS 4812) and Bolan Lake Extension Road (4812040).

Concerns/Conflicts: The Bigelow Lakes Botanical Area traditionally has always received a high number of visitors to the area. But, not all visitors visit the area for the same reason. Many people use the area for hunting, hiking or riding their motorcycles; this results in conflict with some people who use the area to study or view wildflowers (also, see section on "Range Use" for more information).

Trends: Conflicts between users will likely increase as more and more people visit this area.

The ROD would likely have little affect on the type and amount of recreation use into this area.

BACK COUNTRY RECREATION

Landbase and Use: A small portion of the watershed along the east boundary, adjacent to the Red Buttes Wilderness area, is allocated to Back country Recreation. Approximately, 2,300 acres are designated "Motorized Back country" in the High Divide Back country Recreation Area (SNF LRMP, IV-97).

Most of the use is concentrated on primitive roads, jeep and hiking trails, and dispersed campsites, with the heaviest use from June to November. Camping, hunting, hiking, horseback riding, and motorized use are the most popular activities in this area. The Boundary National Recreation Trail, which passes through this area, is used for hunting, hiking, and trail riding (horseback, mountain bikes and motorcycles); hiking is the most popular activity (Craig, 1994). The trail receives over 1,200 RVD's per year (SNF FEIS C-220).

Access: Major road access into this area is the Caves Highway (State Highway 46), the Grayback Road (4613), and the Sucker Creek Road (4612).

Concerns/Conflicts: A concern was identified over the conflicting use designations on the Boundary Trail. The trail winds back and forth along the divide between the Siskiyou and Rogue River National Forests. It is designated Motorized Back country within the Siskiyou National Forest and Non-motorized Back country within the Rogue River National Forest. A Forest Plan Amendment may resolve this concern.

DISPERSED CAMPSITES

Landbase and Use: Several small dispersed campsites have been identified in the watershed. Some are scattered at high elevations along the Boundary Trail; others are scattered at low elevations along Sucker and Grayback Creeks.

Most of these campsites have been used for many years. Some of them, such as Pepper Camp, have been used since the late 1800s. In the early 1920s, Pepper camp was a destination site for local residents from the Williams area, who packed into the area on horseback (Craig, 1994).

> "Half the population of Williams used to go up the Bigelow Lakes for the 4th of July every year" (Bigelow, 1994).

Today, most of the campsites are used by people who hunt, or hike at higher elevations, or by people who mine or pick mushrooms at lower elevations. Occupancy of the sites is constant during weekends and holidays, from June through November (Craig, 1994).

Access: Major road access to the campsites is the Caves Highway (State Highway 46), the Buck Peak Road (4613) and the Sucker Creek Road (4612).

Concerns/Conflicts: Dispersed camping along Sucker and Grayback Creeks may have a negative effect on the riparian habitat, (see section titled,"Mushroom Harvest" and "Mining" for more information).

Trends: The demand for dispersed campsites to adjacent creeks and lakes is high and will remain so within the watershed;

> "Forest visitors will continue to seek dispersed campsites on National Forest and BLM lands within the watershed if they are located along the river" (Dyer, 1994).

Under the Record of Decision riparian protection measures would be considered for dispersed campsites on public lands within Riparian Reserves.

SCENIC VIEWPOINTS

Landbase and Use: Several mountain peaks along the south and east boundary of the watershed offer spectacular views of the surrounding landscapes. These sites include Mt. Elijah, Tannen Mountain, Craggy Mountain, Lake Mountain, Bolan Mountain Lookout, and the Grayback Mountain Peak.

These viewpoints have traditionally provided a landscape setting or site for people who want to view nature. Panoramic views extend to natural appearing landscapes in the distant background.

Concerns/Conflicts: Some people have expressed concern over the loss of aesthetic values:

> "Many of the visitors to Mt. Elijah expressed the disappointment they felt looking at land management activities in middle and background landscapes amidst an otherwise pristine landscape" (Mullens, 1994).

The viewpoints are also spiritual-religious sites for other people; some people want to feel a part of nature or be alone. The sites afford a place of worship, a "sense of place," or a significant spiritual meaning which only the visitor can understand:

> "For many years, visitors have put notes in a large jar located on the peak of Mt. Elijah. Many of these visitors described their spiritual-type experiences from this mountain peak" (Ibid.).

Some people have expressed concern over the loss of spiritual values, as more and more people visit these sites. The sites are small, and more than one visitor at a time on a particular site can have a negative affect on another persons' experience.

> "More people visit these viewpoints than they did in the 50s, 60s, or 70s, due to easy access. Many people who visit the Bigelow Lakes Area, end up hiking to Mt. Elijah and other mountain peaks" (Craig, 1994).

Access: Major road access to the viewpoints is the Caves Highway (State Highway 46), the Grayback Road (4611) and the Sucker Creek Road (4612).

Trends: Dispersed use will likely continue, as well as increase, into these more remote settings and sites. Use for these settings are projected to increase at one-half percent each year from the actual recorded use in 1980 (SNF FEIS III-142).

Under the ROD timber harvest and road construction proposed on Matrix lands within the Grayback/Sucker Watershed would likely affect on foreground and middleground landscape views within the Sucker Creek drainage, as seen from Mt. Elijah and other scenic viewpoints, for up to 20 years.

CONSUMPTIVE USE

TIMBER HARVEST

Landbase and Use: Timber harvest in the watershed began in 1851 (Beckham, 1978). It may have occurred in the lower reaches of Sucker Creek where topography allowed use of animals to skid logs. Lumber production centered on houses, stores, mine structures, and other domestic uses. Logs were typically whipsawed. The forest was also cleared for agricultural purposes. An operation specific to Sucker Creek is recorded for this time period:

> "A single mill was built in 1868 by Beach, Platter & Brown, remained in operation on Sucker Creek. The mill's production was a very meager 1,000 board feet per day." (Beckham, 1978)

Lumber production continued to be centered in small family run mills located in the Illinois Valley until World War II. Gypo logging was a major theme of the lumber industry in southwest Oregon from the 1920's through the 1930's (Beckham 1978). Sugar and ponderosa pine were the preferred species.

Very small amounts of timber were cut until 1945 when the demand for lumber increased rapidly. New crawler tractor machines were able to reach otherwise inaccessible timber. The first recorded unit was harvested in 1948. This unit was located in the mid-reaches of the Grayback Creek drainage. Another unit was harvested about the same time in the Sucker Creek drainage. These units may have been harvested by Oregon Caves or Bold Ridge Lumber Companies (U.S. Forest Service, 1949-1969).

Extensive salvage operations occurred in the Grayback drainage in the 1970's as well as roadside salvage operations along Sucker Creek.

Harvest volumes on Forest Service lands produced an average of 36 MMBF between 1960 and 1979, and 22 MMBF between 1980 and 1989 (U.S. Forest Service, 1990). Approximately, 26 MMBF were cut since 1990 (Fickes, 1994). Harvest volumes on BLM lands produced about 22.9 MMBF since 1990 (Dunham, 1994), and substantially less on Private lands (Fickes, 1994). On Federal lands, harvest volumes are expected to increase over the volumes produced between 1990 and 1994.

Federal timber harvest levels in the watershed have dropped since the injunction on the harvest of northern spotted owl habitat three years ago.

Concerns/Conflicts: Many potential conflicts are associated with timber harvest throughout the Pacific Northwest. Some of the major potential and ongoing conflicts in the Grayback/Sucker Watershed are listed below.

Existing timber harvest and road construction within the watershed has impacted the scenery. The distribution of existing harvest units and roads within the watershed was analyzed quantitatively for each viewshed (see section titled, cumulative effects assessment, in process records). The Grayback (01), Oregon Caves (02), and Horse Mountain (04) Viewsheds exceed the acceptable thresholds identified in the Forest Plan (see Figure 3 for the location of viewsheds within the analysis area).

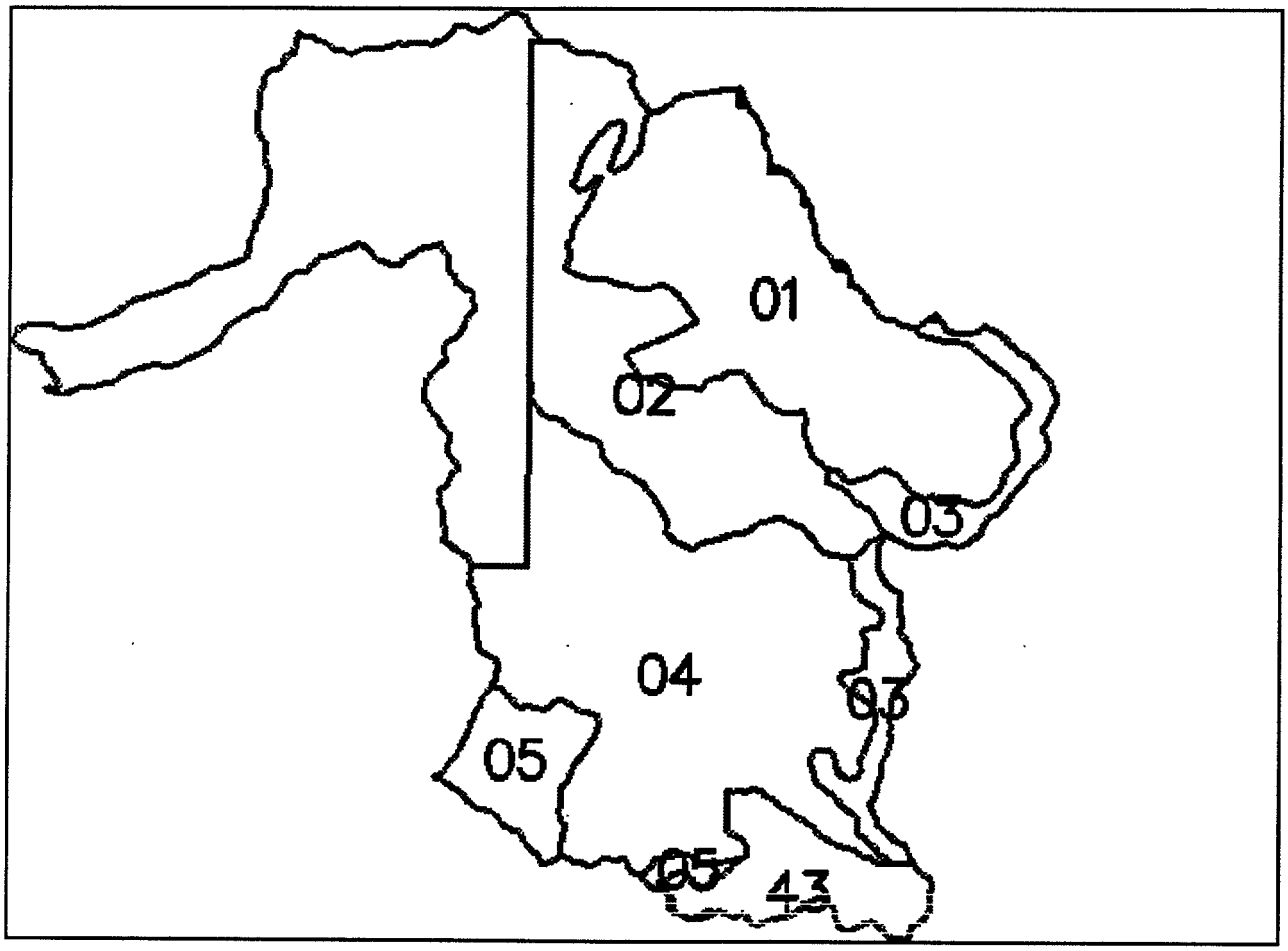


Figure 3 Siskiyou National Forest Viewsheds with the Grayback/Sucker Watershed

A conflict was identified over the Bare Nelsen Timber Sale on BLM lands in the Thompson Creek

sub watershed. Adjacent residents complained of the effects of burning slash. They felt that their health would be affected by the smoke.

Conflicts are ongoing over the Sugarloaf Sale on Forest Service lands in the Grayback watershed (see Sugarloaf Planning Area file on file at the Illinois Valley Ranger District for specific discussion on conflicts).

Timber harvest effects to wildlife, and water quality are discussed in the Terrestrial and Aquatic Ecosystems documents.

There are many indirect effects of timber harvest on the local community. Several are listed below. (See Preister, 1994 for other community issues associated with timber harvest).

> The reduction in timber harvest on Federal lands has effected timber harvest on nonfederal lands.
>
> Favorable prices for timber have encouraged more private land to be harvested. Most of the timber from private lands support the local mills.
>
>> "Historically, much of the timber harvested came from Federal lands, today it all comes from private lands." (King, 1994).
>>
>> "Harvest on private land is at its highest level ever." (Young, 1994).
>
> One local lumber mill has closed and two remain open in the Illinois Valley due, in part, to the decrease in timber harvest on public lands.

The unemployment rate for Josephine County was the highest rate in the State for the month of September 1994. The State of Oregon, Employment Department reports a 7.8% unemployment rate for the month of September 1994 in Josephine County. This is due partially to layoffs in logging, and sawmills.

Trends: Timber harvest is expected to increase from 1994 levels on Federal lands within the watershed compared to 1990-1994 levels. Approximately, 920 acres on Matrix lands (including Riparian areas) will be available for timber management on BLM lands, and over 10,000 acres of Matrix lands (ROD) on Forest Service lands.

Timber harvest on Matrix lands will likely impact the scenery within the Oregon Caves and Grayback Viewsheds.

Logging on private lands will likely decrease in the next five years (Young, 1994).

CUTTING FIREWOOD

Landbase and Use: Two types of firewood sale permits are sold to the Public. One is a personal and commercial use permit, the other is a commercial sale contract. Areas suited for firewood cutting can be found most anywhere on public lands. However, most are found on landings adjacent to timber sales.

Today, because of the reduction of timber sales, firewood permits and sales have become less available to the Public.

It is estimated that the Forest Service produces one-quarter the firewood for personal use as compared to levels produced during the 1980's. (Felgenhour, 1994).

The Illinois Ranger District sold 300 firewood (including personal and commercial use) permits in 1990 and 121 in 1993.

Within this watershed most of the firewood sales are for personal use (vs. commercial use) and purchased by local residents.

Concerns/Conflicts: Several conflicts have been expressed by the public and land managers.

Most people who typically have cut wood for personal use on public lands find it is not worth the effort anymore, and have sought other ways to heat their homes, such as pellet stoves, oil or gas (Felgenhour, 1994). Most of the firewood sale areas are difficult to access, and the wood is usually poor quality.

Many commercial users have left the business because they cannot depend on the firewood to be available each year. They cannot guarantee their customers a delivery.

Changing rules, and more restrictions attached to permits, result in public reluctance to buy permits. Traditionally, stands scheduled for conversion from hardwoods to conifers were selected for firewood sales. A half acre site would be sold, and cleared of its hardwood component. Today, the same stand is selected for a firewood sale, but the hardwoods are selectively cut for sale. Also, hardwoods and conifers require more protection. Firewood cutters find it increasingly difficult to remove firewood with these new regulations.

The potential firewood left in newly-harvested areas is usually left on the ground for site productivity. Formerly it would have been brought up to an accessible area for firewood cutters.

Trends: Firewood sales will likely become more available. Some timber harvest will likely occur on Matrix lands.

Silviculture treatments in younger stands will produce firewood as a by-product.

PICKING MUSHROOMS

Landbase and Use: Wild mushroom harvesting has occurred on a small scale since the early 1850s, when people first began to settle in the lower Grayback/Sucker Watershed. Several varieties were collected, along with a large variety of other "subsistence" foods found in the forest.

In recent years, wild mushroom harvesting has turned into an annual multimillion dollar industry.

In 1992, mushroom harvesters in the Pacific Northwest were paid about $8 million for 824,647 pounds of Matsutake mushrooms harvested from Idaho, Oregon, and Washington (Richards, 1994).

In southern Oregon, commercial mushroom picking began about 1989 in Cave Junction on the Illinois Valley Ranger District. In 1994, 1098 mushroom permits were issued on the District. Regulations are being developed to deal with the sudden seasonal influx of migrant mushroom pickers.

Caucasian, Asian, Native American and Hispanic cultural groups are the major groups represented among commercial pickers. In the Klamath Bioregion, 49% of the pickers are Asian and 51% are non-Asian. Most non-Asian pickers are underemployed Caucasians. They are former timber workers who value outdoor work settings without supervision and find wild mushroom harvesting a feasible alternative to the logging occupation. Most come from rural, timber-dependent communities (Richards, 1994). The southeast Asian population consists of several ethnic groups. Most immigrated to America in the 1970s following the Vietnam war. Many come from large metropolitan centers in central California (Richards, 1994).

Despite several differences found among the ethnic groups of Southeast Asians, many of their gathering practices are similar. They camp during the harvest, bringing their own supplies with them. They pick efficiently and often together. Asian pickers value the mushroom as a cash commodity and also value the associated camp life, which is similar to life in their home countries (Richards, 1994).

Sleeping areas may be constructed from Port-Orford- cedar boughs (Richards, 1994), or may consist of alder lean-tos (Empey, 1994). Campsites are preferred near water, downed wood (for campfires) and close to town or the buying stands (Richards, 1994).

Mushroom pickers usually pick in mixed-conifer forest with tanoak and madrone present, at about 3,000 feet elevation (Richards, 1994). On the Illinois Valley Ranger District, the picking is concentrated within the Grayback/Sucker Watershed, especially along the lower reaches of Grayback and Sucker Creeks and their tributaries (Phillips, 1994). The picking areas are large, and receive heavy use during a three or four week period in November.

Of note are two areas within the watershed that are set aside for Matsutake mushroom study. These are located on private, BLM and National Forest lands near the Boswell mine above Grayback Campground.

Access: Major road access is on Caves Highway (State Highway 46), Grayback Road (FS 4611) and Sucker Creek Road (FS 4612).

Concerns/Conflicts: Many potential conflicts are associated with mushroom picking throughout the Pacific Northwest. Some of the major potential and ongoing conflicts in the Grayback/Sucker Watershed are listed below.

Different values attached to harvest may affect the sustainability of the resource (Richards, 1994). Most migrant commercial pickers tend to gather all mushrooms, including smaller ones that could continue developing/maturing and older ones that could provide new spores to the forest floor. They also are believed to disturb the duff more than local gatherers. The results of such harvest and practices have not been quantified.

Pickers traditionally seek dispersed campsites near water (Richards, 1994). Alders are usually cut for their camping structures, and litter is often left in their campsites, with resulting impacts to riparian habitat (Empey, 1994) and water quality.

The large and sudden influx of migrant harvesters can catch land agencies unprepared to provide for adequate lodging, camping and sanitation. The large number of people in the woods can also create other problems, including increased litter, noise, and/or disturbance to wildlife. (Amaranthus/Pilz, 1994)

Another potential concern is human trampling of local, endemic sensitive plants and fungi.

The large number of mushroom pickers in the woods may have increased the likelihood of the spread of Port-Orford-cedar (POC) root disease to uninfected areas of the watershed (Amaranthus/Pilz, 1994). Dispersed camping, muddied tools, and traffic may transfer the disease spores from infected areas to uninfected areas (See District Analysis Files for Root Disease Centers).

Many local mushroom pickers believe the forest land and its resources belong to them alone. They don't believe they should have to buy permits to pick mushrooms on "their land." They also resent

non-local harvesters picking mushrooms on "their land."

Trends: Survey and management provisions under the ROD are identified for mushroom species, though these do not include the North American Matsutake mushroom.

Land managers will likely initiate projects to control the spread of POC root disease within the watershed (see Terrestrial Ecosystems document).

As harvest pressures increase, land managers will likely develop more regulations for protecting the resource.

Pickers will pick mushrooms as long as there are mushrooms (Richards, 1994).

FARMING

Small farms popped up as soon as gold was discovered in the watershed, to provide fresh fruits and vegetables for the miners. Soon thereafter, Donation Land Claims were made in the lower reaches of the drainage and permanent settlement began. Throughout historic times, farming in the area was primarily for subsistence purposes with occasional production of fruit crops. Mining booms provided temporary markets.

MINING

Landbase and Use: Mining activities within the watershed have been sporadic during the last 100 years.

The first discoveries of gold in the state of Oregon were made in the upper reaches of the Illinois drainage. The first major rush to Sucker Creek occurred in 1853. In 1856, a second major rush occurred, this time to "Bowling Creek" (presently known as Bolan Creek). At the height of activity, the population was 1-2,000. Mining on Sucker Creek tapered off by 1860, when new discoveries of gold, copper and other minerals drew miners to other areas.

Simple panning was the earliest technique used to mine placer gold in the Sucker Creek area. Gold was found the full length of the drainage, but was concentrated between Grayback and Bolan creeks. By the late 1850's, large hydraulic operations had developed, employing huge numbers of imported labor, primarily Chinese. This technique allowed miners to wash entire hillsides through their sluice boxes, and accounts for most of the landscape alterations (large headwalls and vast tailings piles) visible today. Hydraulic mining tapered off by the early 1880's.

The turn of the century saw a resurgence of mining activities. Various companies arrived from outside the area and invested capital in large-scale developments. Lode (or "hard rock" or "ledge") mining began to rival placer mining at this time. The Briggs Pocket Mine, near the Siskiyou Crest, yielded 2,000 oz of gold from three shallow pits. The 1930's saw a renewed interest in gold mining as individuals or loosely organized small groups of miners tried to make ends meet during the hard times of the depression era. Overall, these were small-scale operations. During WWII, the mining of non-strategic minerals was halted by the War Productions Board. Following the war, costs of labor and supplies had increased so much that mining, for the most part, was no longer profitable.

Today, three kinds of mining continue within the Grayback/Sucker Watershed, panning, placer and lode mining. The bulk of mining on BLM lands occurs in (40-7-1, 12 and 13). In this area there are 24 placer claims and 11 lode claims. Most of the mining on Forest Service lands occurs along Sucker Creek. The lands and mineral specialist with the FS estimated that there were about 200 to 500 claims (most of them placer claims) along Sucker Creek. The values of these claims have been recorded as among the highest in southwestern Oregon.

Access: Major road access to many of the claims is on Caves Highway, Grayback and Sucker Creek Roads.

Concerns/Conflicts: Most of the issues or conflicts raised by the Public and land agencies are associated with physical effects to the environment as a result of mining operations. (See the Aquatic Ecosystems document.)

Trends: Under the new mining regulations established in 1992, claimants are required to pay a rental fee of $100 per claim (exceptions are granted for 10 claims or less). Land managers expect that more speculative claims will be dropped, and fewer claims will be filed, as a result of the new regulations (Preister, 1994)

WATER USE

Landbase and Use: The natural condition of the Sucker/Grayback stream system is a "gaining" system from the headwaters downstream to Nelson Creek (the valley floor). Numerous streams, springs, and seeps add water to the stream. This water is held in the channel, and the amount of flow increases as it goes downstream. The valley floor is composed of porous alluvial gravel, varying in depth up to 180 feet.

When Sucker Creek enters this alluvium near Nelson Creek, the channel no longer holds all of the water, and the stream becomes a "losing" system. The amount of flow decreases as the stream flows on to its mouth. The pre-settlement condition may have included periods of negligible flow during the summer months, being for more years of low spring pronounced during precipitation.

This natural tendency to lose flow is exaggerated by the withdrawal of water for irrigation. Although some "return flow" of irrigation water to the stream channel, either overland or subsurface, has been documented, the quantity is small. Water rights were issued on Sucker Creek from 1853 until 1934, when an order by the State Engineer withdrew the stream from further rights because of insufficient flow. The irrigation season is from April 1 to October 31 each year. As the flows decrease through the summer, water use is cut back to "prior rights" or the earliest dated rights.

Monthly reports from the Assistant Water Master in 1924 states that water use on Sucker Creek was cut back to the single oldest right in July, and by the end of August there was "too little water to administer." In 1994, the cutoff date was 1865 - water rights dated more recently could not be used during the driest part of the summer. This would reduce the allowed withdrawal from a total of 48 cfs to 15 cfs. There is no record of how much of this legal limit is actually available in the stream, or how much is actually withdrawn.

The effect of this pattern of consumptive water use is to reduce the natural variation in low flows, because when more water is available more is withdrawn.

From Rogue River Basin Report of 1985, beneficial uses (existing and potential) are: domestic, livestock, municipal, industrial, irrigation, agriculture, mining, recreation, wildlife and fish. The total annual water supply is adequate for both existing and potential uses, but most stream flow is during the wet winter months. Summer low flows cause shortages and competition between beneficial uses. Conclusions for each use (pp.237-238, edited for Sucker Creek, with additional material from later in the report and other referenced sources):

Domestic, livestock and wildlife uses do not require large quantities of water. Supplies appear adequate for present and future needs.

Municipal and industrial uses likely pertain more to the Illinois River than to Sucker Creek and its tributaries. Existing water supply for these uses is adequate, but future growth would require development of additional water sources.

Mining use is considered to be non-consumptive. There are currently three water rights for mining on Sucker Creek.

Sucker Creek is a major tributary of the East Fork Illinois River. It contributes to flows in the East Fork Illinois and the Illinois River, including the Wild & Scenic portion of the lower Illinois River.

<u>Concerns/Conflicts</u>: Summer low flows limit the utilization of fish habitat in Sucker Creek and its tributaries. This has become increasingly important as fish populations decrease.

Existing water supplies for irrigation are not adequate, and have not been historically. Since the

1850's, when mining began, there has been conflict over rights to the water in Sucker Creek. Hydraulic mining required a high, steady flow of water. Meanwhile, ranches began to spring up downstream from the mines, adding even more demands for the limited water supply. The conflict was partially resolved by miners scheduling their work during the winter months, when flow was highest and agricultural demands lowest.

Sucker Creek was withdrawn from further water rights appropriation by a State Engineer's Order dated July 27, 1934, because summer flows were insufficient to satisfy the rights in existence then. No surface water permits have been issued since. Irrigation water from Sucker Creek is restricted beginning in July of most years, with water rights from the 1800s having priority.

Ground water is presently a source for domestic use, and could be developed for future beneficial uses, including substituting ground water for existing surface water rights, in order to increase stream flow for fish. The deep alluvial material on the valley floor has the greatest potential for development, but also requires careful well design to effectively utilize; and has a high potential for contamination. The ability of the alluvium to transmit water from surface to aquifer is illustrated by the rise in water level in wells when irrigation begins in the spring. Increased use of ground water could also decrease stream flow by lowering the water table. The interaction between surface and ground water is complex, and would need rigorous investigation before large-scale development of ground water resources.

At this time, permits are required to drill new wells; and water use permits are required for groundwater (well water) used to irrigate more than 1/2 acre or for domestic use exceeding 15,000 gal/day or commercial use exceeding 5,000 gal/day. Because single use domestic wells do not require a water use permit, locations are readily available only for commercial or newly drilled wells. (Water Resources Office brochure, "Your Josephine County Groundwater Resources")

Storage of winter stream flow in a reservoir, for release during summer low flows, could ease existing competition between beneficial uses and create possibilities for growth. However, water storage and release at rates outside the natural range of variability can adversely affect the ecosystem and thereby human uses. This is another topic that would require rigorous investigation before implementation.

A dam site on Sucker Creek was periodically investigated by the Bureau of Reclamation from 1940 to 1971. This dam would potentially provide irrigation water, with minimal flood control. However, the restriction on water rights described above could complicate the irrigation water question. The potential project was put on hold, primarily for economic reasons. (Bureau of Reclamation report, 1964; summary letter, 1971)

There were differing conclusions on the recreation potential of the proposal: Bureau of Reclamation, USFS, and USFWS projected an increase in recreation from the reservoir; US Park

Service objected to the flooding of Grayback Campground, and strongly felt the dam would detract from the Oregon Caves and not be used for water-related recreation because of the retreating shoreline and emerging stumps during summer "drawdown." (Bureau of Reclamation report, 1955)

Other issues relating to the proposed Sucker Creek Dam today would include increasing environmental concerns about regulating stream flow; effects on loss and change in fish habitat and migration; relocation and reconstruction of the Caves Highway on steeper, less stable ground; and a reevaluation of sediment delivery rates and the inundation of gold deposits.

RANGE USE

Landbase and Use: Historically, range use within the watershed has been cattle. Old records and discussions with permittees, show that use has been cyclic. Around the turn of the century, up to 250 head of cattle grazed on National Forest lands, about half of the cattle, at this time could be found in the Illinois drainage. In recent years the number has dwindled to about 100 head. Currently use has returned to about 250 head on the Siskiyou National Forest.

At present, a small portion of one grazing allotment can be found within the watershed. Managed by the Rogue River National Forest, the allotment is located along the divide between Lake Mountain and Grayback Mountain Peaks and is divided between the Grayback/Sucker watershed and the Applegate drainage. Approximately, 40 head of cattle occupy the grazing allotment.

For the past 20 years during open season about 10 head of cattle have occupied an area outside the allotment. During the dry months of the year the cattle have been seen grazing in the Bigelow Lakes Botanical area and Elk Creek Drainage.

Access: See Figure 2.

Concerns/Conflicts: Many hikers who use the same area object to the presence of cattle, and "cow paddies."

Some special interest groups have expressed concern about the grazing impacts on native plant composition.

Land managers of the Oregon Caves National Monument have expressed concern about the presence of cattle within the Monument parking lot, and in the stream above their domestic water supply.

Further, many concerns come from ranchers, such as grazing fee hikes, botanical setbacks (see Preister, 1994).

Trends
These concerns are currently being dealt with through the review and update of the Allotment Management Plan.

HUNTING

Landbase and Use: Hunting in the area is popular with people from across the country and around the world (Phillips, 1994). Most of the watershed is used by hunters, but a few areas are typically used more than others, such as the higher elevations along the divide between the Rogue River and Siskiyou National Forests. Many trophy hunters seek this area in search of a "larger buck" and a "quality" hunting experience (Craig, 1994).

Concerns/Conflicts: One conflict has surfaced within the Grayback/Sucker Watershed, concerning access for hunting (see section titled, Roads (General) and Facilities). Still, there are many more issues that have been raised by hunters in general (See, Preister, 1994, pp. 90-92).

Trends: Two trends will have a direct effect on hunting within the watershed:

Under the ROD, deer populations will likely decline. The land allocations and reserve tree Standards and Guidelines for timber management established under the ROD do not provide for early seral habitats. Timber harvest creates quality forage in created openings (see Terrestrial Ecosystems document).

The Oregon Department of Fish and Wildlife, considers the watershed an "elk de-emphasis area" in their 5-year plan. Elk will not be transplanted in the watershed (see Terrestrial Ecosystems document).

FISHING

Landbase and Use: Historically, the watershed was one of the most popular fishing areas in the state of Oregon. In the 1940s, residents from Williams would travel over the divide by foot or horseback to fish native trout in the waters of Grayback, and Sucker Creeks (Craig, 1994).

> "...caught creels full of native cutthroat trout and rainbows" (Stewart, 1994).

> "Grayback used to have great fishing, nice native trout" (Bigelow, 1994).

The watershed was also a destination point for fly fishermen. The Sucker Creek area adjacent to the Grayback Campground was a popular spot for fly fishermen from around the State (Frick, 1994).

Tannen Lakes, and Bolan Lake were also used for winter ice fishing.

The flood of 1964 effected fish habitat and some fish habitat was lost. (See Aquatic Ecosystems document for more discussion).

Today, to protect anadromous fish, no (trout) fishing is permitted in the watershed, other than in Bolan and Tannen Lakes. Fishing in these lakes is open all year. Access is difficult during the winter, hence, most of the fishing takes place during the summer months.

Concerns/Conflicts: Many local residents have complained about the restrictions on fishing in all parts of the watershed. Some find the restrictions unwarranted in some areas where there are no anadromous fish.

There was some mention of removing fish from the irrigation ditches, however, this has not been quantified.

SOCIAL
LITERATURE CITED

Amaranthus/Pilz., 1994. Managing the Matsutake Resource, 4th Draft, 16 pp.

Beckham, Curt., 1978. Gypo Logging Days. Myrtle Point, Oregon.

Beckham, Stephen Dow., 1978. Cultural Resource Overview of the Siskiyou National Forest. Report, pp. 127, 138.

Bigelow, Russ. 1995. Interview with Janet Joyer. January 7, 1995.

Chadderton, Millie. 1994. Illinois Valley Visitor's Center. Interview with Janet Joyer. December 9, 1994.

Cosby, Larry. 1994. Interview with the author, January 5, 1995.

Craig, Fred. 1994. Interview with the author, December 11, 1994.

Craig, Fred. 1994. Interview with the author, December 8, 1994.

Cultural Resource Division., 1992. Cultural Landscape Inventory of Oregon Caves National Monument: a Cultural Resource Report, Pacific Northwest Regional Office, Seattle, Washington.

Dunham, Jay. 1994. Notes to the author, November 30, 1994.

Dyer, Rita. 1994. Interview with the author, December 28, 1995.

Empey, Mark. 1994. Interview with the author, November 30, 1994.

Felgenhour, Dick. 1995. Interview with the author, January 7, 1994.

Fickes, Dwight. 1994. Notes to the author, November 30, 1994.

Frick, Randy. 1994. Interview with the author, November 30, 1994.

Keown, Mike. 1994. Interview with the author, December 28, 1994.

King, Joel. 1994. Interview with the author, December 15, 1994.

Mullens, Linda. 1994. Interview with the author, December 9, 1994.

Phillips, Clifford. 1994. Interview with the author, December 1, 1994.

O'Neill, Kellie. 1993, June, Visual Resource Assessment-Panther Beard Planning Area: Report, pp. 3, 4.

Oregon Economic Development Department, Rural Development Initiatives, Inc. Illinois Valley, Oregon. Tourism Assessment, June 30, 1994: final report, 37 pp.

Preister, Kevin., 1994. Words into action: a community assessment of the Applegate Valley. The Rogue Institute for Ecology and Economy, 132 pp.

Richards, Rebecca T., 1994. Draft., Wild Mushroom Harvesting in the Klamath Bioregion: A Socioeconomic Study. University of California, 96 pp.

Roth, John. 1994. Interview with Janet Joyer. December 9, 1994.

Sellards, Dennis. 1994. Interview with the author, December 20, 1994.

Stewart, Mel. 1994. Interview with Karen McCullough, January 3, 1995.

U.S. Department of Agriculture, Forest Service. 1989. Final Environmental Impact Statement on Land and Resource Management Plan. Siskiyou National Forest, Grants Pass, OR, III p. 142.

U.S. Department of Agriculture, Forest Service. 1989. Final Environmental Impact Statement on Land and Resource Management Plan. Siskiyou National Forest, Grants Pass, OR, C p. 220.

U.S. Department of Agriculture, Forest Service. 1990. Historical Cut and Sold Record 1960-1990: report.

U.S. Department of Agriculture, Forest Service. 1989. Land and Resource Management Plan, Siskiyou National Forest, Grants Pass, OR; IV p. 97.

U.S. Department of Agriculture, Forest Service. 1989. Land and Resource Management Plan, Appendix F, Volume I. Siskiyou National Forest, Grants Pass, OR, pp. 55, 60, 88.

U.S. Department of Agriculture, Forest Service. 1990. Land and Resource Management Plan. Rogue River National Forest, Medford, OR, Appendix E, p. 9.

U.S. Department of Agriculture, Forest Service. 1949-1969. Man Cause Hazard Atlas: report.

Young, Bob. 1994. Department of Forestry. Interview with Joel King. December 15, 1994.

SOCIAL
WORKING REFERENCES

Amaranthus/Pilz., 1994. Managing the Matsutake Resource, 4th Draft.

Beckham, Curt., 1978. Gypo Logging Days. Myrtle Point, Oregon.

Beckham, Stephen Dow., 1978. Cultural Resource Overview of the Siskiyou National Forest. USDA Forest Service, Siskiyou National Forest, Grants Pass, OR. Volume No. 1. 1978.

Cultural Resource Division., 1992. Cultural Landscape Inventory of Oregon Caves National Monument: a Cultural Resource Report, Pacific Northwest Regional Office, Seattle, Washington.

Economic Development Department, Oregon Tourism Division., 1993. A Plan for the Tourism Industry. Strategy Implementation Plan for Tourism Development 1992-1996. April 4, 1993.

McArthur, Lewis A., 1982. Oregon geographic names, fifth edition.

Mullens, Linda, Curt Ralston., A Proposal for Grayback Interpretive Area. USDA Forest Service, Siskiyou National Forest, Illinois Valley Ranger District, Cave Junction, OR.

O'Neill, Kellie., 1993. Panther Beard Planning Area-Visual Resource Assessment. June 15, 1993.

Oregon Caves National Monument Visitor Interviews., 1991. Tabulations of Summer 1990 survey. January 1991.

Oregon Economic Development Department, Rural Development Initiatives, Inc. Illinois Valley, Oregon. Tourism Assessment, June 30, 1994: final report.

Oregon State Parks and Recreation Division., 1988. Statewide Comprehensive Outdoor Recreation Plan 1988-1993. December, 1988.

Preister, Kevin., 1994. Words into Action: A Community Assessment of the Applegate Valley. The Rogue Institute for Ecology and Economy. May, 1994.

Reid, Leslie M., Robert E. Ziemer, Michael J. Furniss., 1994. What Do We Need to Know About Roads? USDA Forest Service Pacific Southwest Research Station. USDA Forest Service, Six Rivers National Forest.

Reinhart, Herman Francis., 1962. The Golden Frontier. The Recollections of Herman Francis

Reinhart, 1851-1869.

Richards, Rebecca T., 1994. Draft., Wild Mushroom Harvesting in the Klamath Bioregion: A Socioeconomic Study. University of California.

Southwestern Visitors Association., 1992. Profile of Off Season Visitors to Southwestern Oregon. Research Report. April 1992.

State of Oregon, Department of Geology and Mineral Industries., 1968. Gold and Silver in Oregon., Portland, OR. Bulletin 61. 1968.

State of Oregon, Employment Department., 1994. Grants Pass Labor Trends. Grants Pass, OR. November 1994.

State of Oregon, Department of Geology and Mineral Industries., 1952. Oregon Metal Mines Handbook. Josephine County Bulletin No. 14-C, Volume II, Section I (Second edition). Portland, OR. 1952.

State of Oregon. Water Resources Department., 1985. Rogue River Basin: report, section 6.

U.S. Department of Agriculture, Forest Service-U.S. Department of the Interior, Bureau of Land Management, 1994. Record of Decision for Admendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl.

U.S. Department of Agriculture, Forest Service., 1979. Chetco-Grayback Planning Unit, FEIS. Siskiyou National Forest, Grants Pass, OR.

U.S. Department of Agriculture, Forest Service. 1989. Land and Resource Management Plan, Appendix F, Volume I. Siskiyou National Forest, Grants Pass, OR.

U.S. Department of Agriculture, Forest Service. 1989. Land and Resource Management Plan, FEIS. Siskiyou National Forest, Grants Pass, OR.

U.S. Department of Agriculture, Forest Service. 1990. Land and Resource Management Plan. Rogue River National Forest, Medford, OR.

U.S. Department of Agriculture, Forest Service. 1990. Historical Cut and Sold Record 1960-1990: report.

U.S. Department of Agriculture, Forest Service., 1939. Historical study report. Siskiyou National Forest, Grants Pass, OR. January 1939.

U.S. Department of Agriculture, Forest Service., Landscape Aesthetics, a Handbook for Scenery Management, Agriculture Handbook Number 701.

U.S. Department of Agriculture, Forest Service. 1949-1969. Man Cause Hazard Atlas: report.

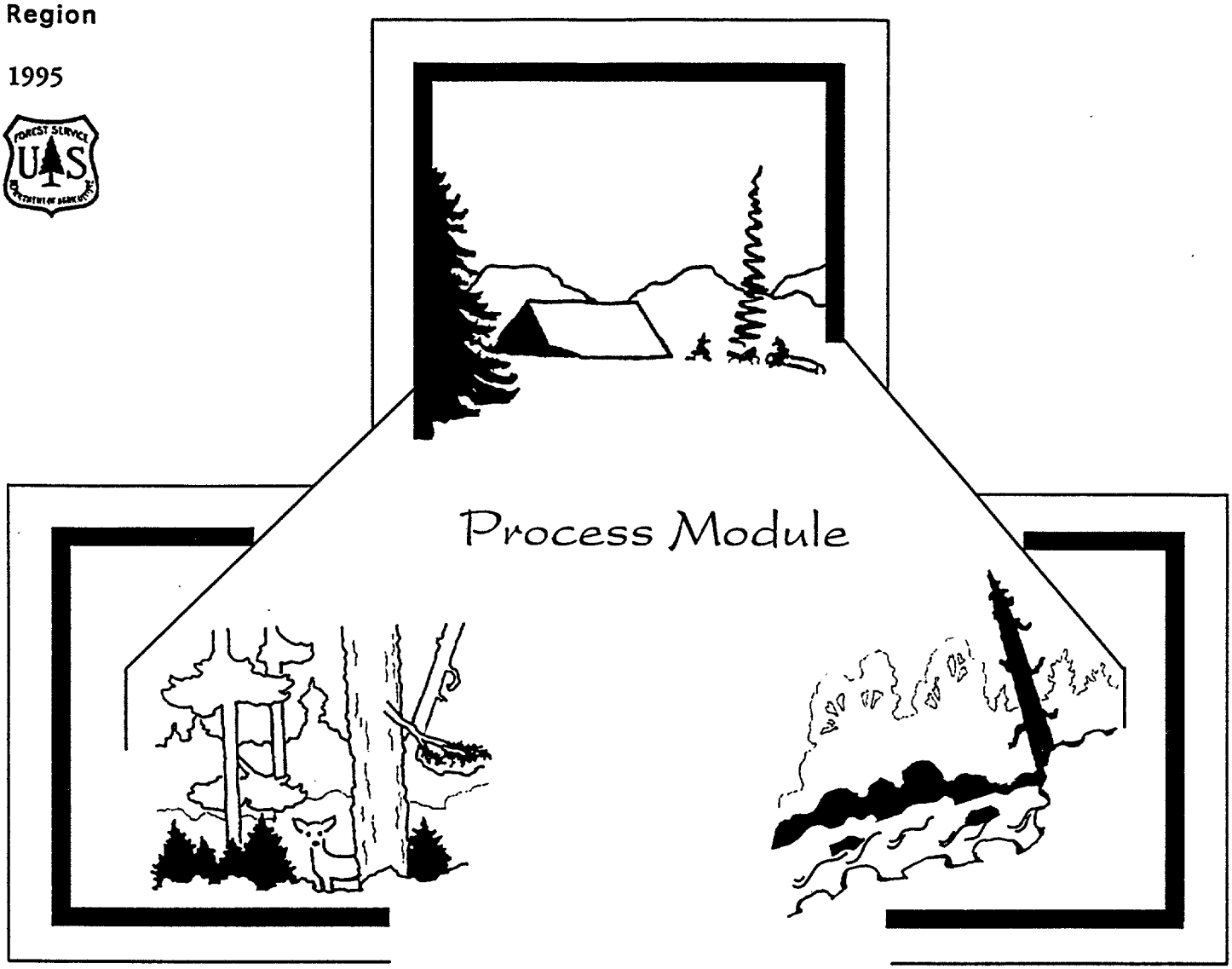
U.S. Department of Agriculture, Forest Service., 1994. Watershed Analysis, Elk River Watershed. Siskiyou National Forest, Grants Pass, OR.

U.S. Department of Interior, Bureau of Land Management., 1986. Visual Resource Inventory, BLM Manual Handbook 8410-1.

United States
Department
of Agriculture

Forest Service
Pacific
Northwest
Region

1995



Grayback/Sucker Pilot Watershed Analysis

Version 1.0

Siskiyou National Forest

April 1995

PROCESS MODULE

Summary

The Grayback/Sucker Pilot Watershed Analysis is one of fifteen in Western Oregon, Western Washington, and Northwestern California selected to test a comprehensive, analytical approach to ecosystem management and planning. This approach is intended for use by all federal land management agencies. Ecosystem analysis on the watershed scale is directed by the Record of Decision (ROD) for the President's Forest Plan (April 1994). *The Federal Guide for Pilot Watershed Analysis* (Federal Guide, 1994) was prepared by a team of scientists to provide overall guidance to the Pilot team and other analysis teams. The Pilot teams were directed to use the guidebook, but were not constrained by it. Through the Pilots, various approaches to the analysis are being tested.

The Grayback/Sucker team (herein referred to as the team or the G/S watershed team) was composed of employees from five different agencies. Primarily funding was provided by the Forest Service with the majority of the core team members coming from the Siskiyou National Forest. An attempt was made early on to include interested parties from federal, state, and local agencies. Many non-federal parties attended the first few meetings. On June 8, 1994, a letter from BLM and Region Six officials directed that structures including non-federal membership should cease until the application of the Federal Advisory Committee Act to the ROD could be interpreted. Since watershed analysis is directly related to the ROD, non-federal participation in Pilot Team meetings was discontinued (see June 21 letter to non-federal agencies). Non-federal members were asked to provide input and information in a support role.

Nationally, the 1994 Fire Season was one of the most intense in recorded history. Many of the team members were dispatched to remote fire assignments for extended periods. A large fire complex ignited after a lightning storm on the Illinois Valley District. This, along with the Pilot's team's other collateral duties, resulted in an interruption to the Pilot team's analysis. During October 1994 its primary focus was fire assignments until the end of the fire season.

The G/S team completed the analysis during the Winter of 1994. The team was then organized into work groups (terrestrial, aquatic, and social). The work groups came together early in December 1994 to discuss findings and integrate the three subsections.

Integration of the different resource areas remained an emphasis throughout the process. The team also focused the analysis on specific issues relevant to Grayback/Sucker.

Figure 1.0 shows the chronology of important points in the analysis.

CHRONOLOGY OF IMPORTANT POINTS IN THE ANALYSIS
FIGURE 1

APRIL	------ MULTI-AGENCY INITIATION MEETING
	------WATERSHED ORIENTATION Fundamental Data Layers
MAY	Field Data Collection Strategy Initiated Element/Flow Matrix
JUNE	------PUBLIC INVOLVEMENT STRATEGY Collect Mailing List Information FACA Interpretation
JULY	----- DATA COLLECTION Field Work Assemble Known Information -------FIRE SEASON
AUGUST	------STEP 1 - REFINE KEY QUESTIONS
	------NEWSLETTER #1
SEPTEMBER	------STEP 2, 3 - OUTLINE STUDY ELEMENTS Logic Tracking Between Key Questions, Cause and Effect Relationships, and Indicators to Study (Stratification) ------FIRE SEASON CONTINUES
OCTOBER	----- TEAM PERSONNEL SHIFT
NOVEMBER	------STEPS 4 through 7 - ASSEMBLE ANALYSIS GIS Products Interviews Data Interpretation
DECEMBER	------INTEGRATION OF FINDINGS
JANUARY 1995	-----PRESENT FINDINGS
FEBRUARY 1995	-----DOCUMENT, ANALYSIS RECORDS AVAILABLE

Purpose and Goals of Watershed Analysis: Watershed Analysis is part of President Clinton's Northwest Forest Plan. The purpose of the analysis is to assemble relevant information about the ecology of a given watershed.

> "Watershed Analysis is a procedure or developing and documenting a scientifically based understanding of the ecological structure, functions, and processes and interactions occurring within a watershed " (from the Federal Guide).
>
> "Watershed Analysis is ecosystem analysis at a watershed scale" (from R-5 and R-6 Regional Foresters' letter 7-26-94 in the Analysis File).

The Grayback/Sucker team emphasized the utility of the analysis to evaluate management options in the watershed. This approach is consistent with management direction, including the August 17, 1994 and December 14, 1994 Regional Forester (R-6) Letters available in the Analysis File. Social demands, and the physical and biological limits to meeting those demands were considered.

Why was Grayback/Sucker chosen as a Pilot?: Grayback/Sucker was chosen as a Pilot Watershed Analysis due to the following factors:

1. It is a Tier 1 Key Watershed as defined in the ROD
2. A mix of ownerships and management allocations
3. Interest from State Fishery Managers (ODFW and Strategic Water Management Group).
5. Experienced cadre of specialists from local station.
6. Potential restoration and other projects existed in the watershed.

The reasoning behind the selection of the Grayback/Sucker watershed is discussed at length in the Siskiyou National Forest Pilot Nomination Letter (Feb. 25, 1994) available in the Analysis File.

Relationship to the Federal Guide: The G/S team followed the Federal Guide very closely during the analysis process. The team spent considerable time PRIOR to initiating the guidebook analysis integrating the specialists' thinking (see element/flow matrix) and orienting themselves to the watershed. However, an objective of the team was to test the utility of the guide and, therefore, followed it fairly closely. Some interpretation was necessary; the guidebook is strong on aquatic analysis, but weak on terrestrial and social analyses. Some creativity and team input was necessary to complement the guide.

The Federal Guide lists seven steps to complete Watershed Analysis:

1. Identify Values, Describe Current Conditions, Formulate Key Questions
2. Identify Key Processes, Functions, and Conditions
3. Stratify the Watershed
4. Assemble Analytic Information

5. Describe Past and Current Watershed Conditions
6. Describe Condition Trends and Predict Effects of Future Land Management
7. Integrate, Interpret and Present Findings

The Seven Steps were completed in the order listed with some notable exceptions. Step One was developed after considerable early work pulling together basic watershed information and team watershed orientation. The Element and Flow Matrix was utilized to develop key questions, with values, issues and desired conditions developed later. While not described in the Federal Guide, the Grayback/Sucker team, along with other analysis teams, utilized an "Element and Flow Matrix Exercise" to complement Step One (see Element and Flow discussion below). Step Two was expanded to meet the intent of the Step and to provide logic tracking. Step Three was combined with Two, since the key processes, functions, and cause and effect relationships flowed directly into stratification scenarios. Steps Four through Seven were combined.

Interagency Participation

A great effort was made to include federal, state, and local agencies on the analysis team. Representatives from approximately nine Federal Agencies, two State, two County, other Pilot Teams from across the Region, and others were invited to attend the initial meetings (see Interagency Partners, Walter memo 4-12-94). The first several meetings saw high attendance. Participants were given a choice as to level and intent of team membership (see Roles, 4-26-94).

Some agencies such as the BLM, Oregon Caves National Monument, and Fish and Wildlife Service have sent representatives to meetings and provided direct input throughout the analysis. Other agencies participated at higher levels providing input through the Portland-based Watershed Analysis Coordination Team.

Early in June 1994, non-federal members were reduced from direct involvement with the team, due to direction regarding the Federal Advisory Committee Act. Non-federal Members were asked to continue participating through public involvement activities. See June 8 and June 21 letters in the Analysis File for more information. All initial members have been kept informed.

Public Involvement

A great effort was made to inform and invite input from interested people. The district mailing list, Forest Plan mailing list, BLM mailing list, and landowners in the watershed were sent a newsletter describing the analysis through step one. A pre-stamped response card was included; people were asked to return the card indicating whether they wanted to remain on the list. About 45% of the people contacted requested to remain on the list. Many were interested in receiving continued updates and the full analysis documentation. Others were interested in a summary of the analysis once it was complete.

Public involvement was intended to discover missing information, keep people informed about the analysis, and reach others who may not have participated in Forest Service planning in the past. The analysis will be available to all who desire the information.

Element and Flow Matrix

One of the initial activities in the analysis, which led to a greater integration among the specialists, was the Element and Flow matrix exercise (Figure 2). The idea for the exercise is based on *Forest Landscape Analysis and Design* (Diaz and Aposol), and was refined by the experience of other watershed analysis teams and the creativity of the G/S team. The exercise allowed specialists to focus on the ecosystem processes most influential in a given watershed. Detailed records of the exercise are in the Analysis File.

The matrix consists of a spreadsheet with columns headed by landscape Flows (things that move across the landscape), and rows headed by landscape Elements (things that are stationary features within a watershed). The cells formed by the intersection of column and row were systematically reviewed. The matrix provided a logical, interdisciplinary approach to identifying key issues, processes, and questions. The exercise follows this outline:

Elements and Flows Identified: The team spent several days listing, categorizing, and organizing elements and flows. Issues of scale and relative importance of the various landscape features were debated. First, the broad categories were listed. Then specific elements and flows were fit under the broad headings. At one point the list had over 200 entries; these were later reduced to 15. The team realized that not all the specifics could be handled separately in the matrix exercise; the broad categories were used as a screen, with specifics dealt with during interior cell discussions.

In future exercises, the team recommends a list of elements and flows (such as the one created) be used, rather than teams assembling their own. This would save several days.

FIGURE 2
ELEMENT AND FLOW MATRIX

FLOWS	ELEMENTS						
	WIND	EARTH PROCESS	WATER	FIRE	PLANTS	ANIMALS	PEOPLE
AIR	X	X	X	X		X	
ROCK	X	X	X	X	X	X	X
SOIL	X					X	X
LANDFORMS	X					X	
VEGETATION							
TERRESTRIAL HABITATS							
RIPARIAN HABITATS							
AQUATIC HABITATS	X				X		
DEVELOPMENTS	X						
LAND OWNERSHIP	X	X					
LAND ALLOCATION	X	X					

NOTE:Blocks without an "X" indicate an interaction between an element and flow which was used to formulate Key Questions, and eventually, analysis.

Eliminate Cells from Further Study: The broad categories of elements and flows were arrayed on a matrix. Each cell was considered for its relevance to Grayback/Sucker watershed. Specific elements and flows were available during this discussion to help the team focus.

The screening for relevance to the analysis consisted of the RIVER analysis; each cell was considered for Relevance, Intensity, Value, Extent, and Rate (RIVER):

Relevance - Is the interaction relevant to watershed analysis goals; can it be analyzed at a watershed scale?
Intensity - Does the flow affect the element intensely, or vice versa?
Value - Does the public place a value on this interaction?
Extent - Is the extent to which this interaction takes place in G/S significant enough to warrant further study?

Rate - Is the rate of change rapid enough to be useful to study?

The screen allowed the team to logically eliminate some interactions from a full discussion, and helped focus the entire analysis on relevant issues.

Analyze Remaining Cells: Once some cells were eliminated, a detailed discussion about the remaining cells followed. For each cell, the "5 W's and an H" were addressed in an interdisciplinary forum.

Which - subdivision of the major element or flow is/are relevant?
What - are the interactions of note?
Where - is the interaction happening in G/S?
When - historic, current, future and desired conditions.
Why - is this interaction important to our analysis?
How - does this interaction function in the watershed: input, output, storage or process?

As these aspects of the interaction between elements and flows were discussed, the key questions, issues, and processes became apparent. Detailed notes about the process were recorded. See the element and flow notebook in the Analysis File for a full discussion.

As the team refined and discussed the elements and flows, the team learned a lot about each other, both in terms of professional disciplines, and the way individual minds worked. This is useful for generating synergistic working relationships and set the stage for a truly integrated analysis. The element and flow exercise was useful in steps one and two of the Federal Guide since desired conditions, key questions and processes, values, and cause and effect relationships are covered.

Step One of the Federal Guide: Values, Issues, and Key Questions

The previously described matrix exercise led to development of key questions to drive the analysis. During the matrix exercise, individuals noted potential key issues and questions. These notes were consolidated. Three sub-teams were formed to evaluate and merge these questions. The teams were aquatic, terrestrial and social. Finally, the long list was pared down to nine key questions. Detailed information about Step One is available in the Analysis File Step One Notebook.

The social subgroup identified key values held by the public about Grayback/Sucker. These values were related to the key questions. Desired future conditions, relative to the values and key questions, were developed. A chart showing the relationship between values, desired future conditions, and key questions was sent to the public mailing list in Newsletter #1 and is available in the Step One notebook in the Analysis File.

An important consideration was whether the issues, values, key questions, and desired future conditions were appropriate at a watershed scale. Many questions exist that must be answered on a landscape, bioregional, or larger scale. Many social issues cannot be resolved at the local level. Some concerns are best handled during project level planning and were not appropriate for watershed analysis. These considerations were important to the final key questions and direction the analysis took.

Step Two and Three: Key Questions to Analysis Components

Step Two moved the analysis from key questions to the analysis elements needed to address the questions. The documents produced in Step Two form the foundation for the rest of the analysis. A summary document, process report, and the tie between study elements and key questions and processes is available in the Analysis File. Each key question was analyzed in terms of ecological processes, cause and effect relationships, stratification schemes, key indicators, and data sources. This information is not repeated here but those interested in how the analysis is designed are encouraged to request these documents.

Steps Four - Seven: Analysis and Synthesis

The analysis described in the mid-level and process documents was accomplished through work groups (aquatic, terrestrial, and social) and synthesized during team exercises. The integration of specialist information was emphasized throughout the process. Analysis findings were discussed during a team-teaching synthesis meeting. Data gaps, ties between different resource areas, and major trends in the watershed were addressed during this meeting.

Findings from the analysis are discussed in the Watershed Analysis Results document, and in technical modules (Terrestrial Ecosystems, Aquatic Ecosystems, Social Module, and Basin Overview).

GRAYBACK/SUCKER WATERSHED ANALYSIS INDEX OF KEY WORDS AND PHRASES

1964 Flood 2, 12, 13, 15, O20, O21, A-12, A14, A21, A44, A45, T7, T14, S6, S8
Backcountry Recreation 11, S16
Bear A26, T35, S6
Bigelow Lakes 8, 11, A7, A39, A41, S15, S16, S18, S29
Biological Diversity 6, O6, T1-T3, T37
Bolan Creek ..... O7, A6, A8, A25, A26, A28, A37, A42, A50 , S25
Bolan Lake 10, 11, 17, 18, O1, A7, A15, A29, A31, A39, A41, S4, S5, S9, S13, S15, S31
Botanical Area 8, 11, S15, S29
Campsites 10, 11, O1, S1, S2, S3, S4, S5, S16, S17, S23, S24
Caves Highway 7, 9, 14, O12, O13, S3, S5, S7, S10-S18, S24, S26, S29
Cave Creek 10, 14, 17, A8-A10, A26, A28, A29, A38, A43, A45, A50, S4, S7, S9
Channel 4, 5, 12-15, O12, O13, O16, O17, O20, O21, A2, A4, A6, A8, A9, A13-A15, A19-A22, A24-A26, A28, A32, A33, A36-A39, A41-A45, A47, A52, T14, S8, S26, S27
Coho 14, 16-18, O6, A28, A31, A38, A39
Commodity S23
Critical Habitat 19
Critical Reach O7, A49, A50
Dam 14, O3, A17, A51, S28, S29
Deer A50, T8, T16, T17, T22, T26, T27, T36, S6, S13, S30
Del Norte Salamander T17, T20, T32, T35, T36
Developed Recreation 1, 10, O1, O13, O14, O23, S1, S3
Dispersed Recreation 10, S1, S14
Dissolved Oxygen A22
Diversions 12, A12, A42
Domestic Use 1, 14
Douglas-fir 21
Eagle A40, T17, T35, T36
Ecoplot T15, T26, T30, T37
Ecosystem Health T2, T4, T9, T37
Edge Effect T8, T9
Endangered Species A31, A32, T36
Evapotranspiration A16
Federal Guide ..... 1, P1 , P3 , P4 , P7
Floods 19, A6, A8, A12, A13, A21, S8
Forest Health 2, 5, 21

Fragmentation O11, O16, A31, A38, A41, T18, T28, T34, T37
Fuel 6, 21, O10, O17, T12, T18, T19, T23, T28
Granitic 11, O5, A2, A6, A7, A9, A12, A43, A44
Grayback Creek
4, 13, 14, 17, 18, O1, O4-O7, O15, A2, A5, A6, A8, A11-A14, A19, A20, A22, A25, A26, A28, A29, A31-A33, A36-A41, A43-A45, A49, A50, A52, A53, T14, T28, T43, S14, S19
Grazing 8, O23, A8, T7, T22, S29
Habitat Improvement 14, O12, A38, A50, A53
Illinois River
1, 9, 11, 18, 19, O4, O6, O20, A1, A14, A24, A29-A31, A46, A48, A51, A53, A54, T7, T9, T22, T24, T35, S27
Interpretive Area S3, S10, S34
Irrigation 1, 13, 14, 18, A20, A24, A25, A28, A31, S27, S28, S31
Jeffrey Pine O7, T35, T43, T45
Key Question A39, T3, T32, T34, S1, P8
Lake Creek A7, A22, T28, S11, S14
Landslides 5, 11, 12, 15, O5, A4, A6-A9, A12, A15, A21, A42-A45, A52, A54
Matrix 3, 6, O11, O13, A44, T18, T19, T21, T28, S18, S21, S23
Mature Forest T36
Meadows
2, 6, 19, 21, O5, O7, O11, O20, O21, A4, A7, A13, T4, T7, T10, T11, T14, T17, T20-T22, T24, T27, T28, T30, T34, T35, T37, S14
Metamorphic O5, A2, A4, A43
Metasedimentary O4
Micro Habitats T7, T11, T15, T18, T20, T22, T25, T27, T28
Mining
2, 5, 8, 12, 13, 15, O1, O3, O8, O12, O13, O15, O17, A8, A9, A13, A14, A21, A22, A25, A26, A28, A38-A43, A45, A48, T15, T25, S2, S9, S17, S25-S28
Monitoring 1, O7, A23, 32, A46, A49, T5
Mossback Creek O5, A6, A12, A28, A44
Murrelet 9, T35
Mushroom 4, 9, O3, S17, S23-S25, S33, S35
National Marine Fisheries Service 18, A31
Nelson Creek A15, A19, A25, S26
Northern Goshawk T16
Northern Spotted Owl
8, 9, O1, O4, O6, O8, O9, A39, A49, T2, T8, T16, T31, T35-T37, S3, S19, S35
Oak 6, 19, 21, O7, O11, T7, T10, T11, T14, T17, T20-T22, T24, T27, T28, T30, T34, T35
Oregon Department Of Fish and Wildlife (ODFW)
17, O6, O8, A22, A25, A30-A32, A39, A42, A45, A48, A52, T16, T30, P3
Outcrops A4, A43, T15, T20, T25, T35, T15, T20, T25, T35
Patch . 5, O7, O11, O16, O22, A42, T7-T9, T11, T12, T17, T18, T21, T22, T27, T32, T33, T43

Peak Flow 13, A17, A19, A32, A38, A51
Peregrine Falcon T35
Pine Marten T16, T17, T35, T36
Plant Series O7, O8, O23, T12, T13, T15, T16, T23, T25, T32, T33, T43-T45
Pool 4, 15, O7, O19, A21, A26, A31-A33, A36, A37, A43
Port-Orford-cedar
2, 4, 9, O8, O13, O14, O16, A14, T14, T20, T24, T31, T34, T46, S13, S14, S24, S25
Port-Orford-cedar Root Disease (Phytophthera lateralis)
2, 4, O3, O7, O20, A14, T13, T14, T24, S13, S14, S24, S25
Precipitation 13, O4, O5A4, A7, A12, A15-A17, A19, A20, A51, T47, S26
Prescribed Fire 5, 6, O11, O16, O17
President's Forest Plan 1,4, 9, 19, 21, P1
Productivity 2, A2, A38, T20, S22
Record of Decision
9, O4, O6, O9, O13, O14, A12, A39, A49, T2, T4, T5, T11, T13, T29, T31, T34, T35, T37, S3, S5, S10, S16-S18, S21, S25, S30, S35, P1, P3
Red Buttes Wilderness 10, 11, A28, A49, S12, S14-S16
Red fir O7, T16, T43
Restoration 1, 4, 6, 9, 12, O14, A14, A22, T20, T21, T28, S13, S14, P3
Riparian Reserve 3, 19, O15, O21, A12, A40T19, T20, T28, T33
Road Construction A8, A12, A45, A52, T14, T15, T25, S18, S20
Road Decommissioning 5, 9, A19, S13
Recreation Opportunity Spectrum (ROS) O9, S9, S10
Salamander O6, O23, A40, A41, T17, T20, T32, T35, T36
Salmonid 1, 16-18, A30-A32, A37, A39, A40, A50
Salvage 2, 13, 15, A14, A19, A21, A22, A25, A44, S19
Sediment
4, 5, 7, 9, 11-14, O6, O12, O17-O19, A1, A2, A6-A14, A19, A21, A22, A26, A43-A47, A52, A54, T20, S8, S29
Sensitive Plants T35, S24
Serpentine 11, O5, O6, T35
Shrubs O6, T43
Siskiyou National Forest Plan (SNF LRMP) O9, A22, T36, T37, S1, S8, S15, S16
Snowpack 5, 12, O12, A16, A19, T47
Soil
4, 5, 9, 11, O5, O6, O9, O15, O16, O19, A4, A7, A9, A10, A13, A15-A17, A19, A25, A41, A44, A46-A48, A52, A54, T3, T9, T10, T14, T20, T24, T32, T37, T43, T47, S11
Spiritual Place 2, S1, S17, S18
Standard and Guideline A12, T37
Steelhead 17, 18, O6, A28, A31, A38, A39
Stream Flow 5, 14, O12, O17, A16, A26, T27, T47, S27-S29
Subsurface 14, A19, A20, A25, A26, A44, A45, S27

Succession
2, 6, 19, 2, O8, O12, O16, O21, O23,T4-T13, T15, T17-T19, T21-T23., T26-T28, T30, T32-T37, T43, P6
Sucker Creek
1, 2, 4, 5, 8, 10-15, T8, O1, O3-O7, O13, O15, O17, O20, O21, A1, A2, A4-A9, A13-A15, A17, A19-A22, A24-A26, A28-A35, A37-A45, A49-A53, T1, T7, T9, T13, T15, T22, T24, T26, T30, T35-T37, T43, T47, S5, S9, S10, S12-S19, S24-S30
Talus A4, T7, T10, T11, T15, T17, T18, T20, T22, T25, T27, T28
Tannen Lakes 10, 11, 17, 18, O5, A39, A41, S14, S15, S31
Tanoak 2, 21, O7, A16, T15, T16, T19, T25, T27, T28, S24
Threatened 9, 19, T11, T21, T29, T35, T36
Toad A41
Trails 7, 9-11, O3, O21, A44, T14, S1, S2, S4, S6, S8-S10, S14-S16
Trout 14, 17, 18, O6, A28-A31, A38, A39, S30-S31
Turbidity 5, O17, O19, A22
Turtle A40, T9, T17, T35, T36
US Fish and Wildlife Service O9, T29, P4
Vegetation Density 2, 21
Vegetation Management T15, T19, T25
Viability O11, O12, T1-T5, T11, T14, T32, T37
Vole T16, T35, T36
Viewshed 7, O13, S8, S20
Visual Quality Objective (VQO) O13
Water Quality 5, 6, O1, O15, O17, O19, A22, A23, S21, S24
Water Quantity 7, 13, A1, T2
Watershed Analysis Area (WAA) O8, O9, A28, A32, T9, T13, T23, T32-T34, T36
Water Temperature 13, 14, 16, O7, A1, A22, A23, A32, A37, A38, A40
Wells 14, A20, S28
Wetlands A39, A41
White Fir 2, 21, O7, O23, T12, T16, T19, T23, T43-T46
Wilderness 3, 10, 11, 17, O17, A28, A39, A49, S2, S9, S12, S14-S16
Wildfire 6, 19, O8, T7, T19, T22
Willow Flycatcher T17, T36
Woodpecker T36