EAST FORK OF THE ILLINOIS RIVER

WATERSHED ANALYSIS

AQUATIC MODULE

US FOREST SERVICE
Illinois Valley Ranger District

BUREAU OF LAND MANAGEMENT
Grants Pass Resource Area

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Aquatic Module

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I. INTRODUCTION

The East Fork of the Illinois River watershed is a 57,774 acre fifth field watershed (HUC #1710031101). That portion of it that is within California is a Tier 1 Key Watershed per the Northwest Forest Plan (NFP) designation.

The land ownership in this watershed is characterized by a combination of public lands (including federal wilderness land) and private lands. Also included are portions of the city of Cave Junction, the town of Takilma and agricultural lands. The East Fork of the Illinois River is a major tributary and contributor to the water quality and anadromous and resident fisheries of the main stem of the Illinois River.

II. GEOLOGY

A. Regional Setting

The East Fork Illinois River watershed lies within the Klamath Mountain geomorphic province which includes the Siskiyou Mountains of southwest Oregon and northern California. The Klamath Mountain province is a very old accretion of volcanic, ocean crust and sedimentary rocks that have undergone intense tectonic activity, altering their physical and chemical characteristics. They are widely considered to represent portions of an ophiolite suite (ancient sea floor and/or island-arc volcanic deposits). The structural pattern consists of arcuate bands of rocks trending northeast and convex to the west. The oldest rocks are to the east, with successively younger rock belts to the west. These are bounded by steep, east-dipping and high-angle faults along which older rocks are thrust over younger rocks. Older rocks include the metamorphosed volcanic and sedimentary rocks of the Applegate group and associated ultramafic peridotites and serpentine. Younger formations in the watershed include metamorphosed rocks of the Rogue and Galice Formations. These formations also have associated bodies of intrusive diorite and gabbro. Fossil-bearing, marine sedimentary rocks (sandstone and conglomerate) occur in the western part of the area, and lie, unconformable, over older rocks in the area.

Tectonic activity, including deep burial, uplift, faulting and shearing, concomitant with cycles of erosional processes, has influenced the underlying geomorphic setting. Present geomorphic structure and channel morphology reflect weathering and erosional processes produced from the last few million years of continued uplift, sea level changes, glaciation, and climatic changes. Geology in the watershed is highly diverse, with widely dissimilar rock types located adjacent to one another in complex faulted relationships.

Elevation ranges from 800 feet at the confluence of East Fork Illinois and main stem Illinois Rivers to 5,800 feet at Sanger Peak. Recent alluvial and colluvial deposits of low to moderate steepness dominate both glacially formed upper valleys and lower stream valleys. Steepness of mountain slopes is directly related to erosion resistance of underlying rock types (see Map 6: East Fork Watershed Analysis Percent Slopes). Stream channel morphology ranges from entrenched, deeply incised channels in narrow V-shaped canyons to moderately entrenched streams in broad U-shaped valleys created through glacial action. The course of major streams, such as the main stem East Fork Illinois River and Dunn Creek, are strongly influenced by northeast fault trends. Crosscutting fault trends, large landslide deposits (both ancient and recent), and differing resistance to erosion is reflected in stream channel offsets and diversions.

Four major types of geology are found within the watershed. Magnesium-rich serpentine and peridotite are found in large, discontinuous pockets. The oldest rocks in the watershed are of the Applegate group, divided between metavolcanics (pillow lavas, tuff, breccia, agglomerates and metagabbros) and metasediments (slatey siltstone, argillite, quartzite, phyllite, schist, chert, conglomerate and marble lenses). Metavolcanics occur in large discontinuous pockets and metasediments are found in north/south trending bands east of the river and in the far-eastern portion of the watershed. Galice Formation metasediments (younger than the Applegate metasediments), which include slaty siltstone, sandstone and shale, are found in the extreme southwest corner of the watershed. Minor amounts of gabbro are found in small scattered pockets primarily in the southeast and southwest corners of the watershed. A small granitic (diorite) intrusion occurs near the southeast corner of the watershed, near Page Mountain. The last major geologic component of the East Fork Illinois River watershed consists of alluvial clays, sands and gravels that form a wide band along both sides of the river corridor and constitute two ancient landslide deposits found in the southwest corner of the watershed.

Geology is mapped and discussed as Groups or Formations. The following section outlines a brief description of these rock types and a generalized slope stability description. (See Map 5: East Fork Watershed Parent Materials and Soil Depth). *Geology and Mineral Resources of Josephine County, Oregon* (1979), *Geologic Mapping of the Weed Quadrangle, California* (1987), *Geology and Mineral Resources of Josephine County, Oregon* (1979), *Soil Resource Inventory Siskiyou National Forest* (1979) and *Soil Survey of Josephine County, Oregon* (1983) were used to determine lithology and structural geology of the area. Aerial photographs from 1964 and 1996 were used to interpret and map land forms and stability features.

Applegate Group; 190-150 million years (Ras, Rav):

The Applegate Group consists of moderate to high-grade metamorphosed volcanic (pillow basalts, flow breccias, tuffs) rocks that have locally been intruded by diabase and gabbro. Metasedimentary rocks in the group include argillite, slaty siltstone, chert, tuffaceous sedimentary rock and conglomerate. Contact relationships are complex; both interbedded and faulted contacts are reported. For example, in a rock quarry on Page Mountain, lenses of argillite, greenstone and quartzite were noted either in the field or on quarry drill logs.

Rogue and Galice Formations; metavolcanic (Jrgv) and metasedimentary rocks (Jgs); 160-140 million years:

Volcanic rocks of Rogue and Galice Formations are typical of island-arc volcanoclastic sediments (fragmental textures) deposited in a marine environment. Within the watershed, they have been subjected to low-grade (greenschist) metamorphism. Basaltic dikes intrude along fracture planes throughout the Formation and form discontinuous but resistant ridges and rock outcrops. Sedimentary rocks of the Galice Formation consist of low-grade metamorphosed shales or slates with small amounts of sandstone or conglomerate.

Ultramafic rocks; peridotite and serpentine (Um):

Serpentine (metamorphic), peridotite (igneous), and partly serpentinized peridotite in the watershed are a portion of the Josephine ultramafic sheet. This sheet is believed to represent upper mantle material, or the lowest portion of an ocean floor (ophiolite) sequence, which was emplaced during major tectonic movement. Most of the ultramafic rocks show serpentinization. Narrow bodies and zones of more intense shearing may have complete alteration to serpentine minerals. Near Elder Creek, areas of green, slickensided serpentine are interspersed with reddish-brown peridotite outcrops and soil. The age of ultramafic rocks is uncertain, since there may have been several intrusions of serpentine via faults and fractures. They are most commonly associated with the Triassic Applegate Group.

Granitic Rocks; diorite (di):

The quartz diorite intrusion found at Page Mountain may be related to the Grayback Pluton, dated at 140 - 150 million years. Much of the material is deeply weathered and forms knobs and ridges of low relief. These poorly cohesive soils pose a high hazard for surface erosion, such as debris flows and gully erosion, especially from diversion of subsurface and surface water. The 1997 Forest Flood Report determined that the greatest potential for debris flows occurs in this rock and soil type.

B. Land Forms and Erosional Processes

Structurally, the area represents a long history of faulting, alteration, uplift and subsequent erosion. Although regional geology maps show large blocks of rock types or formations, more site-specific field mapping revealed numerous faults and fractures that juxtapose several differing rock types, often within a few square miles. For example, along road 4808060 in the Dunn Creek drainage, serpentinized peridotite is inter-fingered with metamorphosed volcanic rocks of the Rogue Formation, and cut by resistant dikes of greenstone. North of Crazy Peak, pods of granitic rock are exposed and interspersed with a melange of peridotite and highly sheared metasedimentary and metavolcanic rocks.

Physical and chemical alteration, increased weathering, concentration of groundwater, and deeper soil development often result from pervasive faulting and fracturing of underlying rock. Over eons of uplift, plate tectonics, and climate changes (including several episodes of glaciation), steep slopes have experienced locally extensive, deep-seated landsliding. Mapping from aerial photos of both recent and ancient landslide forms reveals that many recent failures are associated with the toes (deposits) and lateral margins of more ancient forms. Because of the location of slide deposits (often in steep, unstable inner gorges of streams) sediment from these failures can be delivered directly to a stream. In Dunn Creek, for example, ancient landslide deposits (with possible augmentation of glacial deposits) have coalesced along lower slopes. Over-steepened, unstable slopes were created as Dunn Creek and other creeks in the watershed cut through these older deposits, possibly in response to tectonic uplift, changes in sea level, or periods of greater precipitation and runoff.

Ancient landslide forms were also noted in areas underlain by ultramafic rock, especially in sheared serpentine or peridotite that have undergone intense fracturing and weathering. Where deeper soils have developed, they exhibit high porosity but low permeability. Extensive deposits of deep-seated rotational slides and earth flows can store groundwater and may have fens and bogs that develop in areas of high groundwater tables or springs. Seepage from these areas can contribute surprisingly cool water to creeks, even in summer months.

Unstable conditions can also develop along small tributary streams as soils collect and deepen in swales and channels in response to cycles of weathering, soil development, surface erosion and deposition. These areas of less consolidated material are prone to surface erosion from gully formation and soil creep. Past intensive (clear-cut) timber harvest and concentration of subsurface and surface water by roads also change stability parameters. Therefore, numerous landslides that occurred during the 1964 flood are related to changes in both natural events and management activities.

The most common types of erosion processes are debris slides, slumps (rotational failures), and debris flows. Occurrence and timing of these processes can be influenced by humans and/or nature. Debris slides are translational failures (occurring along discrete, parallel planes to the slope plane, as opposed to rotational failures) of debris along relatively narrow zones that break up into smaller blocks as they approach the toe of the slope (*SNF Resource Geology Manual*). An example of this process is the Chicago slide. Rotational slides are most common in deep, cohesive soils. The majority of rotational slides mapped in the watershed are sub- to inactive (Table A-1; See also Map 7: Landslide Points). Several excellent examples of rotational slides are located high on slopes above Dunn Creek.

Table A-1: Landslide Activity Level (modified from SNF Resource Geology Manual).

Landslide Definition	Activity Level	Relative Age
Currently active or active in recent past. May have fresh scarps, tension cracks, or leaning trees indicating recent movement. Unweathered hummocky terrain or terrace-like slopes may indicate recent movement.	Active	Recent Approximately 0 - 20 years
Periodically occurring movement, or landslide features more weathered than Level 1. Leaning or bowed trees with straight growth at the top may indicate no recent movement, or that the slide is temporarily dormant.	Sub-active	Recent Approximately 20 - 50 years
No indication of movement in recent past. Only oldest trees are bowed or bent. Landslide features are well-weathered and revegetated. Field evidence is difficult to interpret. Low probability of reactivation.	Inactive	Old Approximately 100 - 300 years
Ancient, usually large-scale features discernible only from topo maps or aerial photos. Field evidence is obscured by weathering, erosion, and vegetation. Very low risk of reactivation.	Ancient Inactive	Very old Approximately 300 + years

Debris flows differ from translational or rotational slides in that movement is not concentrated along discrete planes. Debris flows often occur in steep upland draws and can entrain or scour out more material as they advance, often going for great distances and causing significant deformation and disintegration of material along the way. Gutted stream channels are often the result of debris flows (*SNF Resource Geology Manual*). Numerous examples of both natural and management related debris flows occur within the Dunn Creek drainage.

Out of 74 recorded recent debris slides or debris flows on National Forest lands within this watershed, by far the majority of them (50) occurred within the Dunn Creek drainage, and most are associated with existing roads (see Map 7: East Fork Watershed Analysis Landslide Points). Within the Dunn Creek drainage, 40% of the slides occurred in either the headwaters or main stem of Dunn Creek. About 15% of the slides were in the North Fork (NF) of Dunn Creek, and 10%

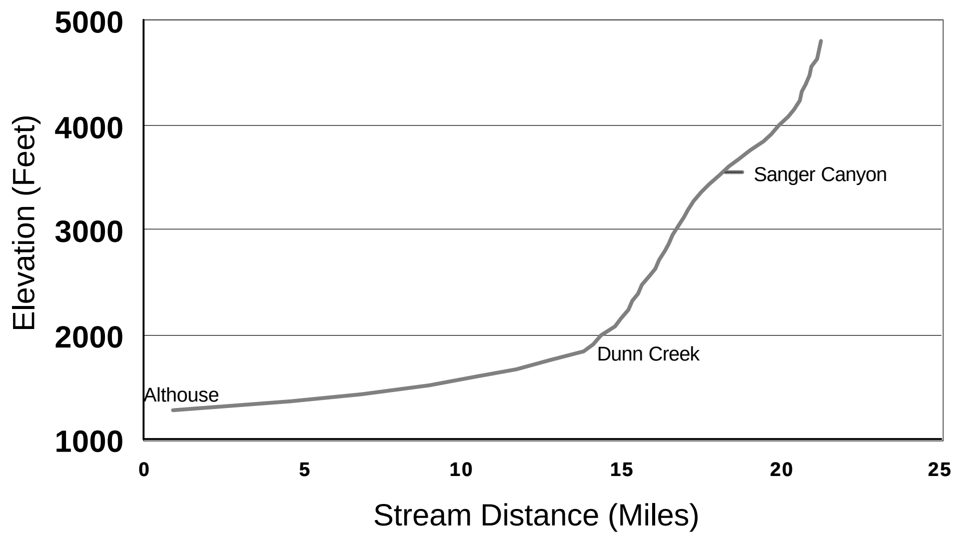
were in the main stem below NF Dunn Creek. Another area of significant past debris slide activity is Chicago Creek/Chicago Peak area, where 10 debris slides were recorded and where the largest slide resides. However, none of the sub-watersheds within East Fork Illinois River watershed seem to be immune to past mass wasting events; sliding activity is evident throughout the watershed. Approximately 90% of the recent mapped failures were not evident on pre-1964 aerial photos. This would indicate that the 1964 flood might have played a major role in mass-wasting events. However, the Longwood fire, timber harvest and road construction have also contributed to these erosion processes.

III. HYDROLOGY

A. Channel Morphology

East Fork Illinois River is characterized as having entrenched, confined streams in narrow V-shaped canyons, to moderately entrenched streams in broad U-shaped glaciated valleys with moderate to steep sided slopes in common association with alluvial terraces (Figure H-1).

Figure H-1: East Fork Illinois River Stream Profile
Beginning at Confluence of Althouse Creek.



The stream profile shows a flat gradient main stem, which steepens at the confluence of Dunn Creek, then flattens for a few miles in the vicinity of Chicago Creek and Sanger Canyon, terminating with a steep gradient within wilderness area. Flat portions on the stream profile, below Dunn Creek, are segments where areas of aggradation are expected. High peaks and upper valleys have been carved by glaciers, as evident by the hanging valleys, cirque lakes and moraines upstream of Sanger Creek. Whisky Lake is a unique feature ponded by a large moraine.

The inner canyon, with occasional generally limits stream width and channel alignment. Substrate is bedrock with large boulders, cobbles, and gravels. A wide shallow stream is generally observed in the wide valley bottoms throughout the main stem below Dunn Creek.

Main tributaries to East Fork Illinois River are Black, Chapman, Chicago, Dunn, Elder, Kelly, Khoeery, Little Elder, NF Dunn, Packers, Page, Perdin, Poker, Rattlesnake, Skag, and Tycer Creeks, Sanger Canyon, Allen, Bybee, Cedar, Long, and Scotch Gulches.

B. Historical and Existing Conditions

About 64% (36,688 acres) of this watershed is managed by Forest Service, and 9% (5,043 acres) by the BLM. The remaining 27% is primarily mixed private ownership and includes portions of the city of Cave Junction and the town of Takilma.

There are more than 350 miles of perennial and intermittent streams in the East Fork Illinois watershed and more than 16,250 acres of riparian reserves (44% of the land area) (USFS PMR data). Approximately 120 miles of these perennial and intermittent streams are on BLM and private lands, including approximately 35 miles of fish bearing streams.

Past mining included placer and lode mining for gold, platinum, copper, and chromium. Some of the historical mines are the Llano de Oro, Esterly, Queen of Bronze, and Waldo mines. Pit mines were common and their effects included removal or stockpiling of surface materials and the loss of vegetative cover. They were, and continue to be, sources for sediment delivery to the streams.

Current mining activity within the watershed includes 19 placer claims (none located on National Forest lands) and 11 lode claims (2 of which are located on National Forest lands) (BLM microfiche, November 1998). Mining is expected to continue. Most of the current mining is recreational and consists of small in-stream dredging operations or upland adits (small tunnels) or pockets (small hand diggings). Large mineral reserves and potential for future commercial recovery still exist, especially in lower East Fork Illinois River.

Mining in East Fork Illinois River watershed began in the 1850s. Areas such as Allen, Sailor, and Scotch Gulches were intensively mined (Ramp and Peterson 1979). Hydraulic mining results in increased sediment loading, entrenchment, lower sinuosity, and channel widening. A system of mining ditches was developed to bring water to hydraulic mine operations. One notable ditch still existing on BLM land within the watershed is Logan Cut, which transports water from East Fork Illinois River drainage to West Fork Illinois River drainage. Along with mining came settlements, road construction, and logging. Some of the initial (late 1800s) significant effects on water quality were due to mining and roads constructed for mining access. Many dredge ponds from mining operations remain on BLM and adjacent private land; Esterly Lakes are a few of the larger ponds. (See Social Module for more mining information.)

By 1940, agriculture, city and rural development land uses dominated the East Fork Illinois valley downstream of Page Creek. Timber harvest and road construction were soon to follow with clear-cut timber harvest on National Forest land beginning in 1948. The 1964 flood widened main stem channels and removed miles of riparian vegetation. The 1987 stand replacing Longwood Fire burned several miles of riparian vegetation on Forest Service Land. There have been no recent stand replacing fires on BLM lands.

A total of 8,552 acres or 23% of National Forest lands and 2,278 acres or about 50% of BLM lands within the watershed have experienced some type of timber harvest activity. Timber harvest and road construction significantly altered the landscape from 1960 through the 1980s. An estimated eight to 50% of the riparian acreage has been affected in any given sub drainage. The 1987 Longwood Fire along with the subsequent salvage was a stand replacement event that affected approximately 25% of National Forest lands within the watershed.

Approximately 331 miles of road are located within the watershed. National Forest lands include 144 (44%) miles, BLM lands 25 (7%) miles, and the remaining 162 (49%) miles are located on private lands. Many of these roads were built for timber harvest access.

Riparian Reserve interim widths for this watershed are those set by the NFP Standard and Guidelines C-30, and, ROD B-9. A site potential tree in the watershed ranges from 150 feet to 210 feet depending on the site. While no changes in the interim widths are recommended in the watershed analysis at this time, individual project planning and site specific analysis would be the context and basis for localized changes of these widths and is anticipated.

Siskiyou National Forest Land and Resource Management Plan (LRMP) guidelines for the East Fork Illinois River riparian reserves are under prescription B: maintain 85% of pretreatment effective canopy on Class I, II, and 70% on Class III streams. Additionally, no more than 11% of the Riparian Area acreage within the planning basin shall be entered per decade (MA11-6) on Forest Service lands. Selection harvest will be the dominant harvest system in riparian reserves on National Forest lands (LRMP IV-15). The BLM's RMP does not include standards and guides of this nature.

The Forest Service and the BLM both adhere to the standards and guidelines of the Northwest Forest Plan (NFP). The NFP guides activities in Riparian Reserves to promote the attainment of the Aquatic Conservation Strategy Objectives.

The current condition of streams and riparian areas within the watershed is generally described as being in various stages of recovery from effects of management and natural catastrophic events. Water temperatures are elevated above historic ranges. Instream water availability is below historic ranges. Stream channels are wider and shallower with less riparian vegetation. Population growth is expected to continue in the watershed which will continue to increase the water demand in the watershed.

National Forest and BLM lands in the matrix land allocation are, in particular, expected to continue to be the sites of various forest management activities including timber production. Within the riparian reserves, recovery of streams towards properly functioning conditions, can be accelerated by using riparian silvicultural techniques such as selective thinning from below, snag creation, leaving large wood on the ground or placing it in a channel. Road restoration options may include storm proofing, road reconstruction or relocation, and decommissioning. Management actions that can help encourage watershed recovery include riparian planting, in-channel restoration, and fish passage improvement. Current and future forest management on federal lands must be designed to meet the objectives of the Aquatic Conservation Strategy (NFP).

While presettlement conditions provide a point of reference for historical conditions, total restoration to these conditions is not possible. To totally restore water quality and channel condition to its' previous morphology, complexity, quality, quantity, and sediment transport regime, land uses and infrastructures such as major road systems would have to be removed and relocated.

KEY QUESTION #A-1: Large Wood

A-1. What are the past and current amounts of large woody material? What processes affect large wood supplies, and where do they occur?

Stream order may be used to classify a stream (Horton 1945). A small, un-branched tributary is a first-order stream; two first-order streams join to make a second-order stream. A third-order stream has only first and second-order tributaries. There is no consistent relationship between stream order and stream class. In general, most of the main stem tributary streams in the watershed are 3rd to 5th order streams (intermediate sized streams) with enough stream power to move and redistribute large wood. In intermediate sized streams, large in-stream woody material strongly influences the morphology of the stream channel and routing of sediment and water, and may be the principle factor in determining the characteristics of aquatic habitats (Franklin et al. 1981). (See Map 28: Stream Orders)

Natural deposits of large wood come from landslides, including debris flows, and direct fall from localized riparian tree mortality. Transport is dependent on stream flow during storm events. Harvest, including salvage, of mature riparian trees have depleted some stream segments of current and future supplies of large wood.

Although the overall historic quantity of large wood in the watershed is unknown, it is known that current levels are lower than levels documented in old growth forest stands. (Swanson and Lienkaemper 1976). Large wood was depleted within the watershed as a result of hydraulic mining, commercial timber harvest, floods, and urban development.

The Longwood Fire and related salvage activity affected current and future large wood supply of Long and Bybee Gulch tributaries. Approximately 50% of Bybee and all of Long Gulch have been depleted of current and near future supply of large wood.

Recommendation: Concentrate future in-stream large wood projects on 4th order or smaller streams. For those on higher order streams, use large whole trees with root wads attached to provide anchoring of the wood.

Recommendation: Apply silvicultural methods in the riparian reserves / riparian vegetation to increase the availability and long-term recruitment of wood of varying sizes (Jimerson 1989). This would improve channel complexity and stability, habitat complexity and productivity for fish, and sediment transport and storage dynamics. Large wood could be imported to streams and/or riparian reserves within Dunn Creek, Long Gulch, and Bybee Gulch tributaries. Other sites may be added after site-specific analysis.

Recommendation: Implement silvicultural methods in riparian reserves / vegetation to encourage the growth of large trees in primary conifer and secondary hardwood vegetation to provide a long-term balanced source of large wood and shade. These prescriptions would include planting and silvicultural practices, *e.g.*, girdling and thinning for density reduction, thinning from below Prescribed burning is also a tool for riparian treatment. Known priorities are on Dunn Creek, Long Gulch, Bybee Gulch, Little Elder Creek, and Elder Creek.

KEY QUESTION #A-2: Sediment Delivery

A-2. What processes deliver sediment and where do they occur?

Sediment delivered to a stream channel may be transported or stored depending on amount, particle size, timing of input and stream flow. Coarse materials transported through the stream changes channel equilibrium through aggradation or degradation. Increased sediment input may cause channel widening, abrading, storage of sediment on flood plains, in gravel bars, and within the channel, causing decreased pool area (Sullivan et. al. 1987).

Sluicing of sediments from one part of the drainage, and the deposition and accumulation of sediments to another part of the drainage, can alter fish habitat. Debris torrents (Dunn Creek), landslides (Chicago Creek slide), surface erosion (especially on lands affected by high intensity burns from the Longwood Fire, and on agricultural lands within the main stem's floodplain), and road-related surface erosion and failures all contribute to sedimentation. Eroding stream banks are also a source of sediment. Stream surveys that evaluate the extent of stream bank erosion have only been completed on portions of the lower East Fork Illinois (main stem) which are agricultural areas. The data indicate 66% of the stream survey area has actively eroding stream banks (ODFW 1994) which is a very high level.

Mining in the watershed has also resulted in increased sediment input to many tributaries. Past hydraulic mining denuded many stream banks which continue to erode. Ditches associated with past mining still exist throughout the watershed. These ditches intercept stream flow and often will fail along the ditch resulting in gully and rill erosion. The failures may be at streams, dry drainages of weak points along the ditches.

Stream sediment dynamics could be returned to a more natural balance by reducing erosion and sediment from roads and recreational trails. An overall reduction of road miles would reduce sediment supplied by transportation system. Total restoration of channel condition to pre-European settlement morphology, complexity, and sediment transport regime, would require removing and/or relocating valley bottom roads and roads occupying historic stream channel flood plains, and mining ditches.

<u>Recommendation</u>: Reduce accelerated and direct erosion from roads and other managed lands by decommissioning unneeded roads (returning those lands to a vegetated condition) and storm proofing "at risk" roads. Special attention for stabilization and restoration of vegetation should be given to slides, skid roads, landings, and other areas resistant to natural re-vegetation. This will restore soil permeability and decrease surface runoff. Where possible, mining ditches should be recontoured at stream draws to restore natural stream drainage.

Numerous opportunities to upgrade and provide additional drainage relief exist including such things as armoring and improving culvert inlet, outlet, and ditch line functions in areas that have been re-vegetated. All culvert replacements affecting or in riparian areas should meet 100 year event flow capacities.

Both the amount and location of disturbance determines what systems are at high risk of sediment delivery. The main stem of East Fork Illinois River below the confluence of Long Gulch is affected by infrastructure and federal, state, county, and private land management activities.

KEY QUESTION #A - 3: Water Quality

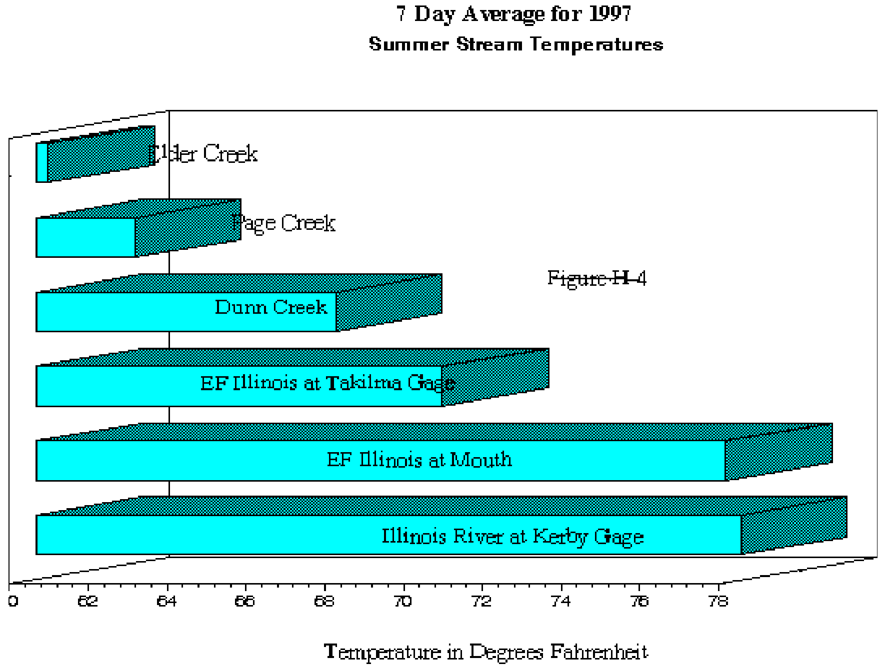
A-3. What is the past and current water quality? What is the expected water quality trend and what processes may affect it?

a. Stream Temperature

Solar radiation is the primary factor affecting summer stream water temperature (Brown 1980). Stream discharge or flow is a factor that may modify the impacts of incident radiation thereby affecting stream temperature (Brown 1980). Stream shading is the amount of solar radiation blocked from reaching the stream by vegetation or topographic features. Stream shade can be lost by natural processes (*e.g.*, fire, floods) or may result from human activities (*e.g.*, harvest, roads, mining). The 1964 flood removed large amounts of streamside vegetation from the main stem of East Fork Illinois River and Dunn Creek. National Forest lands in Long Gulch lost essentially all of its riparian vegetation from the 1987 stand replacement Longwood Fire.

Canopy cover and stream shading by riparian vegetation along headwater streams influences the temperature of fish-bearing streams (Amaranthus et. al. 1989). When under stress from water temperatures exceeding 70EF, salmonid fish populations may have reduced fitness, greater susceptibility to disease, decreased growth and changes in time of migration or reproduction. Growth begins to decline and eventually ceases as water temperature approaches the upper lethal limit of 75EF (Beschta et al. 1987). Summer peak stream temperature for East Fork Illinois River ranges from 73E to 81EF (Figure H-2).

Figure H-2: 7 Day Average Summer Stream Temperature.



The applicable State water quality standard for temperature is OAR 340-041-0365(2)(b)(A). Under this standard the seven day moving average of the daily maximum shall not exceed 64EF unless under a Oregon DEQ approved Water Quality Management Plan (WQMP).

The main stem of the East Fork of the Illinois River from the mouth to the California border is listed on the 1998 Oregon List of Water Quality Limited Water Bodies 303 (d)(1) as water quality limited due to summer stream temperatures (a 7-day average high stream temperature greater than 64EF). A WQMP for East Fork of the Illinois River is scheduled for development in the year 2000. Dunn Creek has been similarly listed for stream temperature from its confluence with East Fork Illinois River to its headwaters and will be included in the East Fork Illinois WQMP.

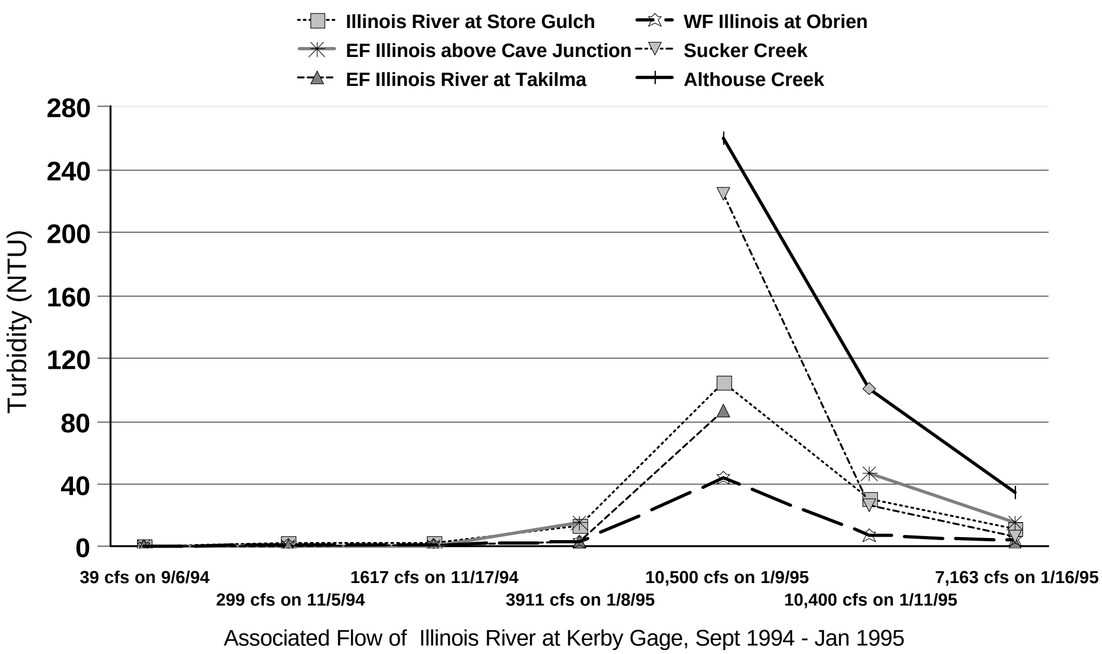
Low elevation streams within this latitude often have summer water temperatures that exceed state 303 (d) standards. An analysis of Lawson Creek on the Gold Beach Ranger District (Park 1993), for example, concluded that *historic* stream temperatures were above current state standards. It is expected that the East Fork Illinois River is similar to Lawson Creek in that pre-managed historic stream temperatures exceeded current state standards in the main stem from the mouth upstream to some unknown point in the drainage. However, it is suspected that the East Fork Illinois River currently has a temperature range higher than historic water temperatures due to: a) the amount of water withdrawals for domestic and irrigation use, b) the current vegetative conditions of some riparian reserves, c) mining, and d) the transportation system maintained throughout the main stem system. Alterations of riparian vegetation have been caused by road construction, timber harvest, mining, agricultural and urban development, wildfire, and flooding from storm events.

Recommendation: To reduce stream temperature implement riparian silvicultural techniques including thinning and planting to encourage mature riparian vegetation where appropriate. Maintain riparian health with low intensity under-burning at historic fire levels. Return abandoned transportation system within riparian reserves to vegetative-productive conditions. Implement better management of water withdrawals to minimize the effect on instream flow levels and water quality.

b. Turbidity

Turbidity is an indicator of suspended sediment or dissolved solids moving through the system. The relatively low levels of turbidity in both the East and West Fork Illinois River main stems are indicators of low to moderate amounts of fine suspended sediment and dissolved solids (Figure H-3).

Figure H-3: East Fork Illinois River Turbidity Measurements from Sept 1994 to Jan 1995.



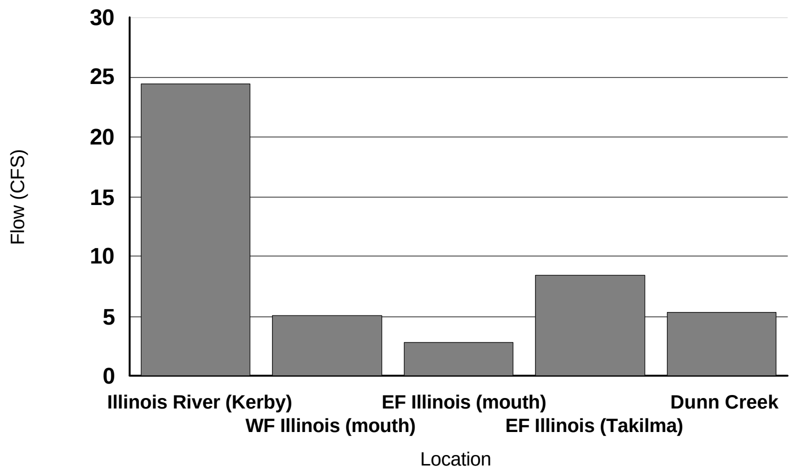
Turbidity was sampled and measured during the 1995 wet season. Figure H-3 compares two locations on East Fork Illinois River (one near the mouth and the other approximately 4 miles above the mouth) with sites on the main stem of the Illinois, West Fork (WF) Illinois, Althouse, and Sucker Creeks. When flows rise above 10,000 cfs, turbidity is 80 times background levels. Althouse and Sucker Creeks, tributaries to East Fork Illinois River, can have turbidity values 3 times greater than the East Fork Illinois River during storm related flows. Therefore, Althouse and Sucker Creeks contribute to increasing turbidity in the East Fork Illinois River. Similarly, WF Illinois River has half the turbidity values of East Fork Illinois River and is improving overall water quality for the parameter of turbidity in the Illinois River main stem.

c. Water Quantity

Droughts and floods have the potential to change the magnitude and frequency of stream flow. Southwest Oregon experienced a drought cycle from 1985 to 1992. Lower than average flows were recorded in East Fork Illinois River watershed during these years. The flood of 1964 had dramatic site-specific effects within the watershed.

The main stem of the East Fork Illinois River from the mouth to the California border was listed on the 1998 Oregon List of Water Quality Limited Water Bodies 303 (d)(1) as water quality limited for flow modification (Figure H-4).

Figure H-4: Illinois River Summer Low Flows for 1992.



Summer low flows are much lower than average winter low flows largely due to precipitation patterns in the Pacific Northwest. This is compounded by the seasonal demand for domestic water and agricultural water use. Most of the precipitation occurs between November and March. Records of East Fork Illinois River show the stream being dry during summer months downstream of large diversions and summer low flows dropping down to 3 cfs.

The demand for water use on the East Fork Illinois River exceeds the continuous flow requirements (Water Resources Dept 1999). Existing allocated in-stream water rights are as follows: on the mouth of the main stem of the Illinois River a continuous flow of 208 cfs; 80 cfs for the mouth of East Fork Illinois River; and 4.6 cfs for East Fork Illinois River at Takilma. These in-stream water rights are essential for providing water for fish, wildlife and recreation. Whether these in-stream water rights will be met depends on the precipitation in a given year and the priority date.

Communities in the Illinois Valley depend on water provided by East Fork Illinois River. The municipal water supply for Cave Junction comes from groundwater (1.6 cfs from wells). Surface water comes from East Fork Illinois River (3 cfs water right). Approximately 5,300 acres of agricultural land, predominantly pasture grass and hay, is irrigated within the East Fork Illinois River drainage area. Other consumptive uses include domestic, municipal, and industrial use.

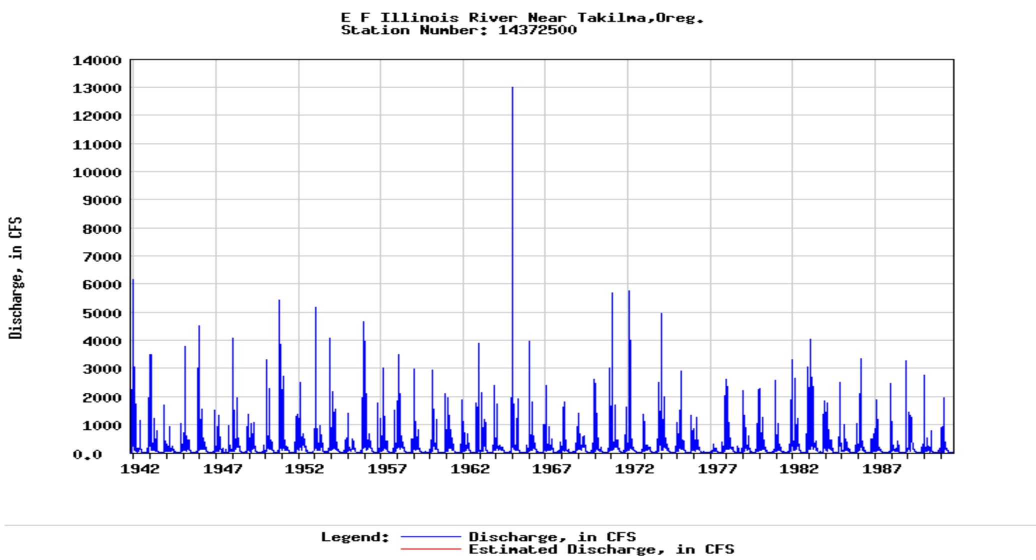
There has been no significant change in water rights for East Fork Illinois River watershed since 1983. In 1983, 578 cfs of a total of 699 cfs in water rights were mining water rights (typically winter season use). In 1999, 597 cfs of a total of 698 cfs in water rights were industrial water rights (mining not separated from other industrial).

There are four gravel push-up dams in the East Fork Illinois River watershed. These gravel push-up dams are fish barriers during low flow (ODFW 1999). Use of these dams is less efficient than other means of water withdrawal because they remove water from the stream, send it through a system of ditches where evaporation and warming occurs. Water is then withdrawn from the ditches and the rest is returned to the stream.

Josephine County's estimated growth during the past decade was 15% (USDA 1996). With continued population growth the demand on East Fork Illinois River as a supplier of domestic water source will also grow.

A gaging station was established in 1926 in Takilma. The drainage area for this gage is 42.3 square miles. A maximum discharge of 15,700 cfs (14.9' gage height) occurred Dec. 22, 1964 (100 yr flood) (Figure H-5).

Figure H-5: Historical Streamflow Daily Values for EF Illinois River near Takilma



Normal winter stream flow and velocity of the East Fork Illinois River is moderate due to the estimated average of 45 to 100 inches of rainfall during non-drought years. Winter flows range from 100 to 4,000 cfs during one to four year storm events. Typical average winter stream flows are insufficient for moving bedload sediment through the lower reaches of due to its current widened and flattened condition. Aggradation is common on localized low-gradient reaches. Summer flows occasionally go subsurface in these areas. The stream head-cuts and braids through islands of sediment and recovering vegetation until a major storm event, like the 1964 flood, widens the channel and moves sediments and streamside vegetation downstream.

Increases in water yield (low and peak flows) can be associated with forest management activity. Road surfaces and cut slopes intercept water, and road ditches act as intermittent streams transporting water more rapidly than natural subsurface processes. This can change timing and increase the size of peak flows. The potential for effects from increased peak flows are greatest in areas where road density is high and roads are located in riparian reserves.

The effects of roads on the hydrology in the watershed can be inferred from work done by Megahan (1988). Megahan measured subsurface flow interception by roads constructed on steep granitic slopes in Idaho and found that prior to logging, the total volume of water intercepted by roads averaged about 35% of the total runoff for perennial study watersheds. This runoff is estimated to be 7 times the amount of accelerated, direct runoff from roads, which is caused by precipitation (rain and snow melt) falling directly on roads. Post logging subsurface flow intercepted by the road was estimated to exceed direct road runoff by a factor of 18.

The actual effect that harvest and road construction has had on timing of peak flows the within East Fork Illinois River watershed is unknown. However, any changes in the flow resulting from management activities would most likely occur on small streams directly below areas that have been heavily managed. If any changes from historic stream-flow timing and quantities have occurred, they are likely to continue because of the amount of acres in recovering managed stands and miles of road in proximity to streams (excess runoff, stream confinement, and accelerated water velocity).

Within federally managed lands, Chicago, Dunn and Elder Creeks are the drainage areas most affected as they have the highest road densities in conjunction with high harvested acres. Although Long Gulch has the most affected riparian system, these effects are primarily due to the stand replacement Longwood Fire in combination with from harvest and roads. It is not currently possible to separate the effects of wildfire from those of past management activities in Long Gulch.

Historic mining ditches continue to affect water quantity in the East Fork Illinois River watershed due to diversion and evaporation. These ditches continue to intercept water from perennial and intermittent streams and transport it out of the drainage and watershed. Logan Cut, a ditch originally created to transport water from East Fork to West Fork Illinois, is still intact and continues to transport water out of East Fork Illinois River watershed.

The transient snow zone in this watershed extends from 2,500 to 4,000 feet elevation. Approximately one-third of the East Fork Illinois River watershed lies within the transient snow zone.

Increases in water yield are associated with large wildfires (Amaranthus et. al. 1989) and timber harvest. Both reduce the level of evapotranspiration by reducing the amount of live vegetation thereby increasing runoff and stream flow. The 1987 Longwood fire may continue to affect tributary summer flows in Longwood and Bybee Gulch.

Recommendation: In conjunction with the DEQ, complete a water quality management plan for the East Fork Illinois River watershed. (Tentatively scheduled for completion in 2003.) Encourage push-up dam removal and support the use of other more efficient methods of water withdrawal, such as infiltration galleries and direct pumping.

Recommendation: Further evaluate the hydrologic effects of roads and other openings in the transient snow zone area.

KEY QUESTION #A-4: Channel Morphology

A-4. Has channel morphology changed from historic conditions? What are the expected trends?

Channel morphology has changed from historic conditions. Mining in the 1850s heavily impacted portions of the watershed. Hydraulic mining in EF Illinois River watershed altered channel morphology. Lateral stability changed due to removal of riparian vegetation. Floodplain connectivity was lost and sediment load increased. After mining activity declined in the watershed, much of the landscape had time to begin restoring itself. The next major disturbance came with timber harvesting which began in earnest in the late 1940's. While aerial photos from 1940 do not depict presettlement conditions, they do provide historic information about the watershed conditions at that point in time. (see Social Module).

A comparision of aerial photograph taken in 1940, 1964, and 1996 confirms that a general widening of the channel has occurred on the main stem of the East Fork Illinois from the mouth to Sanger Canyon, and also on the main stem of Dunn Creek from its confluence with the East Fork Illinois River to its headwaters. This was primarily due to debris flows generated during the 1964 flood that caused channel scouring and deposition, and removal of streamside vegetation. Because stream morphology is highly dependent on large wood, the trend since 1964 towards full recovery is hampered by a lack of current and future large wood supply on 4th order and smaller streams. Partial recovery is also limited by the current transportation system where it encroaches or confines 5th and 6th order streams. This is because stream morphology is highly dependent on flood plain connectivity, confinement, and sinuosity. Flood events of a magnitude similar to the 1964 flood will occur in the future and similar results are predicted.

The channel of Chicago Creek has been altered at and above the mouth due to combined effects of flood, timber harvest, and road management. Aerial photographs from 1964 confirm the stream has become wider and shallower in the vicinity of Chicago Slide. The vicinity of Chicago slide was noted on historic photos as a steep, unstable slope, possibly underlain by poorly consolidated glacial deposits. Lower slopes have hummocky terrain and benches. Road construction may have undercut unstable slopes and diverted ground and surface water. The recent failure may be attributed to natural instability, compounded by road construction and the sudden aggravation of the 1964 flood. Numerous small debris slides and debris flows off the road system are also evident on the 1964 aerial photos. Slides are currently aggravated by storm event high flows in a tributary that has naturally flashy run off due to the predominately rocky nature of its headwaters. The expectation is that the slides will continue to be aggravated by high flow events until soils are eroded to bedrock.

The reaches of the East Fork Illinois River, from the mouth up to Long Gulch and all the confluences with each of the tributaries, have been appreciably altered by roads, agriculture land, and housing developments. Continued population growth should be anticipated in the watershed. These will continue to provide increasing pressure on the watershed's systems and resources in the future.

GENERAL QUESTION #A-1: Historic Disturbance Patterns

A-1. What are the historic disturbance patterns for the watershed? How have management activities affected these patterns? In what way and how has the watershed responded to these disturbances?

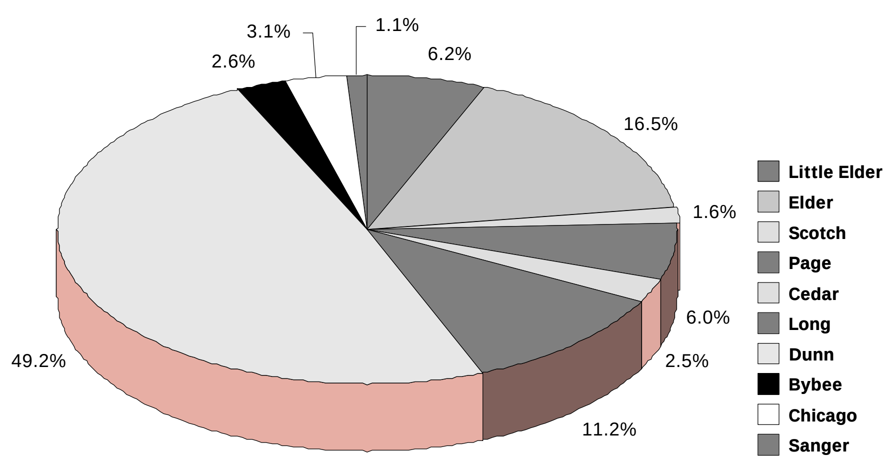
a. Disturbance

Natural components of forest ecosystems that may have been affected by land management activities are flood, wildfire, disease, and insects. Disease and insect control using pesticides, and wildfire control by suppression, may have altered processes that naturally helped shape watershed health. Upland silviculture techniques, which often included treatment of riparian areas on ephemeral swales and seasonal and perennial low-order streams, created even-aged stands that are more susceptible to high rates of loss from wildfire and insect epidemics. Unmanaged stands that have been protected from wildfire and insect loss may exhibit high amounts of ladder or ground fuels and higher levels of organic matter and biomass, especially in their riparian areas. There may be a higher than expected abundance of fuels in the headwater areas of the East Fork Illinois River watershed, especially where fire has been excluded. Approximately 3/4 of the watershed has not had an appreciable fire event for over 100 years. This is well beyond the natural fire return interval for the vegetation types and systems in the watershed.

Wildfire suppression may have increased the risk of disease and insect epidemic. Overall risk of catastrophic wildfire, disease, and insect epidemic, has increased in this watershed (with the exception of the Longwood Fire area) and continues to increase with time. A catastrophic fire, disease or insect epidemic in a tributary could reduce riparian shade and resulting in temporary summer water temperature increases.

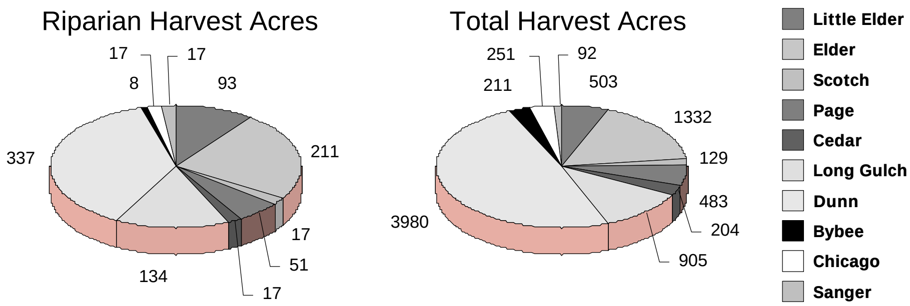
Harvest and transportation systems (roads and landings) are a disturbance factor (Figure H-6). Long Gulch, Dunn, Elder, and Little Elder Creeks have been the primary areas for timber harvest on National Forest lands in the watershed.

Figure H-6: Percent of Timber Harvest by Subwatershed on National Forest Lands



Timber harvest has occurred on approximately 11% of the riparian reserves on National Forest lands.

Figure H-7: Acres Harvested Within Subwatersheds



*Long Gulch acres reflect stand replacement fire and managment effects

There have been significant mining effects on sediment budget, water quality, and channel morphology for some portions of East Fork Illinois River watershed (e.g., Allen Gulch, Scotch Gulch, and Esterly Lakes).

Floods are responsible for sudden changes in stream morphology and riparian structure. Management activity can affect the way a watershed reacts to storm events as it pertains to the interception and release of precipitation, sediment production and timing of stream flow. The 1964 flood event is responsible for much of the current conditions within riparian corridors along the main stem of the East Fork Illinois River. Included are localized slope instability, sediment loading, and lack of channel complexity. Significant mass wasting and extensive slope failures were triggered by the 1964 flood event. Many of these areas continue to fail or ravel, and are chronic sediment contributors. The 1964 flood moved existing large wood deposits out of the system while adding some new deposits, mostly from debris flows and slope failures.

Increases in water yield (low and peak flows) can be associated with forest management activities. Road surfaces and cut slopes intercept water, and road ditches act as intermittent streams transporting water more rapidly than natural subsurface processes. These can combine to change the timing and levels of peak flows. The potential for effects from increased peak flows are greatest in areas where road density is highest and located in riparian areas.

The extent that harvest and road construction has had on timing of peak flows during storm events is unknown. However, it is expected that there have been effects due to the amount of harvest and road construction in small streams in the watershed. Any changes from historic stream-flow timing and quantities are likely to continue.

<u>Recommendation</u>: Reduce fuel hazard (mechanical, manual, prescribed fire treatments) in riparian reserves. Reestablish the natural fire return interval. Restore large trees in areas most likely to deliver large wood to fish-bearing streams.

The following are brief summaries of drainage conditions within the entire East Fork Illinois watershed. Refer to Table A-2 for specific drainage information.

Table A-2: Management Effects on Perennial and Intermittent Riparian Reserves (RR)

Sub - Drainage (Analysis Areas)	Perennial Stream Miles	Intermittent Stream Miles	Road miles w/in RR per Stream Mile	Road Crossings per Stream Mile	[g] Riparian Harvest/ Early Seral or Seedling / Sapling	[i] Riparian Affected by Mgmt (%)	Drainage Area (mi^2 and acres)	[h] Road miles (miles and Road Density)	[j] Total Harvest (acres and percent)	Harvest in Past Decade (acres)
[a]Allen Gulch	5	2	0.54	1.71	0.15 mi 5.5 ac	DATA-GAP	2.05 mi^2 1,311ac.	10.85 mi 4.8 mi/ mi^2	DATA-GAP	0
Bybee Gulch	1.6	0.7	0	0.44	0.2 mi. 8 ac.	25%	0.64 mi^2 412 ac.	1.28 mi 2.0 mi/ mi^2	211 ac. 51%	90 ac.
Cedar Gulch	[k]4.3	[k]2.2	[k]0.22	[k]0.77	0.4 mi. 17 ac.	40%	1.14 mi^2 731 ac.	1.6 mi 1.4 mi/ mi^2	204 ac. 28%	0
Chapman Gulch	4.4	14.1	0.25	1.47	1.0 mi 0.0 35.8 ac.	DATA-GAP	3.97 mi^2 2,542 ac.	17.94 mi 4.8 mi/ mi^2	DATA-GAP	0
Chicago Creek	4.7	5.5	0.25	0.78	0.4 mi. 17 acres	38%	2.13 mi^2 1,369 ac.	7.25 mi 3.4 mi/ mi^2	251 ac. 18%	90 ac.
Dunn Creek	66.2	61.3	0.17	0.56	4.0 mi. 337 ac.	31%	25.8 mi^2 16499 ac.	52.45 mi 2 mi/ mi^2	3980 ac. 25%	0
[b] EF Illinois below Chapman	5.0	5.7	0.24	1.5	0	DATA-GAP	3.55 mi^2 2,274 ac.	18.77 mi 5.3 mi/ mi^2	DATA-GAP	0
[c] EF Illinois Lower	12.4	5.3	0.25	1.24	0	DATA-GAP	8.45 mi^2 5,411 ac.	41.17 mi 4.9 mi/ mi^2	DATA-GAP	0
[d] EF Illinois Scotch to Dunn	7.8	5.5	0.19	1.5	0	DATA-GAP	2.32 mi^2 1,482 ac.	11.3 mi 4.9 mi/ mi^2	DATA-GAP	0
e EF Illinois Bybee to Chicago	8.9	9.5	0.05	0.11	0.5 mi. 19 ac.	DATA-GAP	3.8 mi^2 2,429 ac.	9.9 mi 2.6 mi/ mi^2	160 ac. 7%	20 ac.
[f] EF Illinois Upper	16.3	17.4	0.03	0.03	0	5%	7.45 mi^2 4,766 ac.	1.94 mi 0.3 mi/ mi^2	3 ac. <1%	2
Elder Creek	[k]18.5	[k]16.0	[k]0.29	[k]1.04	2.5 mi. 211 ac.	48%	6.08 mi^2 3,888 ac.	23.31 mi 3.8 mi/ mi^2	1332 ac. 34%	17
Kelly Creek	7.4	14.4	0.20	1.56	0.3 mi. 6.9 ac.	DATA-GAP	4.16 mi^2 2,662 ac.	16.52 mi 3.8 mi/ mi^2	DATA-GAP	0
Khoeery Creek	3.8	6.4	0.38	3.14	0	DATA-GAP	2.68 mi^2 1,713 ac.	14.51 mi. 5.3 mi/ mi^2	DATA-GAP	0
Little Elder Creek	[k] 9.5	[k] 7.4	[k]0.21	[k] 0.89	1.1 mi. 93 ac./ 0.38 mi 13.8 ac.	43%	3.56 mi^2 2,279 ac.	8.63 mi. 2.4 mi/ mi^2	503 ac. 22%	20
Long Gulch	4.5	3.2	0.17	0.91	[l]3.2 mi 134 ac.	[m]100%	1.64 mi^2 1,055 ac.	3.98 mi. 2.4 mi/ mi^2	905 ac. 86%	0
Page Creek	11.1	14.4	0.12	0.51	0.6 mi. 51 ac.	25%	3.39 mi^2 2,170 ac.	4.16 mi. 1.2 mi/ mi^2	483 ac. 22%	0
Sanger Canyon	3.5	4.2	0.08	0.26	0.4 mi. 17 ac.	23%	1.78 mi^2 1,143 ac.	0.86 mi. 0.5 mi/ mi^2	92 ac. 8%	0
Scotch Gulch	[k] 5.4	[k] 4.8	[k] 0.21	[k] 0.30	0.4 17 ac.	32%	1.56 mi^2 1,000 ac.	3.51 mi. 2.2 mi/ mi^2	129 13%	0
Tycer Creek	7.2	15.7	0.28	2.66	0.6 mi. 22 ac.	DATA-GAP	3.73 mi^2 2,389 ac.	19.01 mi 4.2 mi/ mi^2	DATA-GAP	0

Table A-2: Management Effects on Perennial and Intermittent Riparian Reserves (RR)										
Sub - Drainage (Analysis Areas)	Perennial Stream Miles	Intermittent Stream Miles	Road miles w/in RR per Stream Mile	Road Crossings per Stream Mile	[g] Riparian Harvest/ Early Seral or Seedling / Sapling	[i] Riparian Affected by Mgmt (%)	Drainage Area (mi^2 and acres)	[h] Road miles (miles and Road Density)	[j] Total Harvest (acres and percent)	Harvest in Past Decade (acres)
HUC5 totals	207.5	215.7	Mean= 0.21	Mean= 1.1	DATA-GAP	DATA-GAP	90.27 mi^2 57,774 ac.	331.04 mi 3.7 mi/ mi^2	DATA-GAP	684 ac.

[a] HUC7 is BLM #17100311010321, the East Fork Illinois River below Scotch Gulch, above the bridge and includes Allen Gulch

[b] East Fork Illinois River from mouth to Chapman confluence (HUC #17100311010351 and #17100311010357)

[c] Lower East Fork Illinois River (HUC #17100311010333, #17100311010345, and #171003110154) from Chapman confluence to apx. 0.5RM above confluence of Khoeery Creek

[d] Illinois River above Scotch Gulch below Dunn Creek (HUC #17100311010303, #17100311010309, and #17100311010315). This analysis area contains USFS #15L07F and a portion of #15L14F. The analysis area does not include Long Gulch (it was analyzed separately). The portion between Dunn Creek and Bybee Gulch was neglected due to USFS and BLM HUC7 boundary differences.

[e] East Fork Illinois River above Bybee Gulch below Chicago Creek (USFS #15U02F)

[f] Upper East Fork Illinois River (above RM 19.7)

[g] For National Forest lands, riparian harvest is defined as any recorded harvest in riparian reserves. For BLM lands, early seral or seedling/sapling is defined as any stand in early seral, seedling, or sapling stage from either mining, fire, harvest, or any other disturbance.

[h] Road mileage and density for watersheds outside National Forest lands were calculated with BLM GIS maps containing BLM and non-BLM roads.

[i] For analysis areas outside National Forest lands, the percent affected by management is a DATA GAP, though much of the areas have been affected by historic mining.

[j] Total harvest on BLM lands by drainage area is a DATA GAP. See Terrestrial Module for harvest figures by township. Total recorded harvest on BLM lands in the East Fork Illinois watershed before 1986 is 1,834 acres. Since 1986, 444 acres have been harvested on BLM lands in this watershed. The majority is in T39S, R08W and includes Chapman, lower Tycer, and the eastern portion of East Fork Illinois River below Althouse.

[k] Calculated using USFS GIS layers

[l] Effects due to Longwood Fire of 1987. Unable to statistically separate management effects from natural wildfire at time of report.

[m] Combined effects of Longwood Fire and Management.

C. Drainage Analysis Areas of the East Fork Illinois River Watershed

To facilitate this watershed analysis, the East Fork Illinois watershed was divided into drainage analysis areas. These drainage analysis areas are delineated based on similar management and resource issues. They do not, in all cases, coincide with the currently delineated HUC 6 or 7 watersheds.

1. Allen Gulch

All of what is known as "Allen Gulch" is in BLM ownership. However, the 7th field drainage that includes Allen Gulch (the East Fork Illinois River below Scotch Gulch and above the bridge) is divided evenly between BLM and private ownership. The landscape in Allen Gulch is dominated by impacts of historic mining. An intermittent creek flows through the gulch. Based on ODFW Benchmark standards, this creek is characterized by inadequate large woody debris, a lack of channel structure, sedimentation, and inadequate riparian vegetation. Fish presence has not been verified. There are 12 road crossings on intermittent and perennial streams in the entire drainage, which includes the adjacent portion of the East Fork Illinois River. Road density in the entire drainage, which includes private land is high (see Table A-2).

2. Bybee Gulch

A unique geologic feature on the lower slopes of this drainage is an ancient landslide deposit, which covers approximately one square mile and extends across and into Long Gulch. Hummocky terrain, subdued scarps, incised drainages and sag ponds characterize the deposit. The Longwood Fire of 1987 (a stand replacement fire) burned across this drainage, consuming vegetation on the landslide deposit and upland riparian areas. This has resulted in localized sedimentation within draws, intermittent creeks, and along poorly vegetated road cuts.

Recommendation: Roads located on this feature are expected to be difficult to maintain and are good candidates for decommissioning.

Approximately one half of the Bybee Gulch drainage was salvage harvested after the fire. Both the fire and subsequent harvest resulted in effects to Bybee Gulch. The drainage is in the process of recovery.

Recommendation: Implement active riparian silviculture treatments to restore riparian conditions. This would include treatments such as pre-commercial thinning to encourage growth of larger mature trees.

3. Cedar Gulch

Cedar Gulch shows appreciable effects of past fire, timber harvest, and related activities. The 1987 Longwood Fire affected the drainage. In the headwaters, the even-aged stands in harvested units were burned with high intensity. Large areas of unproductive soils (rock outcroppings) acted as natural fire-breaks, which slowed the Longwood Fire and protected more productive sites. As a result, riparian productivity in the headwaters is currently lower than before the stand replacement event. It has high restoration potential. A cooling trend in summer water temperatures is expected over time as vegetation recovers in riparian areas. There are approximately 35 acres of TML (timber marginal land due to landslides) land near the headwaters that were harvested during the 1960s. This area was subsequently burned during the Longwood Fire and recovery has been poor. The lower portion of the drainage is primarily un-roaded and has mature vegetative cover.

4. Chapman Creek

Chapman Creek is in the best condition of the streams in the northern portion of the watershed. This perennial creek flows south to join the East Fork Illinois River approximately 3 miles upstream of the Highway 199 bridge. The presence of mayflies and caddisflies in Chapman Creek may indicate good water quality but more information is needed to make a determination on overall water quality. Large woody material (LWM) levels are at approximately 16 pieces/mile is considered "poor" based on ODFW benchmarks. BLM ownership accounts for approximately 50% of this subdrainage. Private land comprises the remainder. There are 42 road crossings on perennial and intermittent streams. Road density is high in the entire Chapman Creek drainage (see Table A-2).

Recommendation: Improve LWM levels where appropriate.

5. Chicago Creek

The headwaters of Chicago Creek has a very high road density. While road locations are primarily located on the ridge top, there are at least eight stream crossings. In unmanaged areas, riparian vegetation is in primarily mid to late seral stages. There has been a lack of fire during the past 50 years. Currently, 38% of the perennial riparian reserve area has been harvested and is recovering from management related effects. The potential for recovery is good.

The Chicago Creek Slide area contains a number of debris slides that occurred off Chicago Peak most recently after 1964. They are debris slides that converge at Chicago Creek. The upper and larger of the slides is over 0.25 miles long and averages 250 feet across. The failure is within an older landslide headwall, which may have contained poorly consolidated glacial deposits such as the Crazy Peak failure. A road drainage failure from a road near the top of the peak initiated the 1964 failure, and other road crossings on the slope below may have contributed to the magnitude of the failure. The lower slide is located below a road, but has no road crossings. As the slide incorporated more water and debris, it developed into a debris flow causing numerous other stream bank failures as it scoured first Chicago Creek and finally the East Fork Illinois River. There are currently 4.5 miles of road per square mile in the area of the slide, located on land classified as TML (timber marginal land due to landslides). The slide is still active due to undercutting at the toe from Chicago Creek and from road intercepts.

Recommendation: Roads in the vicinity of the Chicago Creek Slide have been decommissioned but should be periodically monitored for recovery and to insure drainage is away from the slide.

6. Dunn Creek

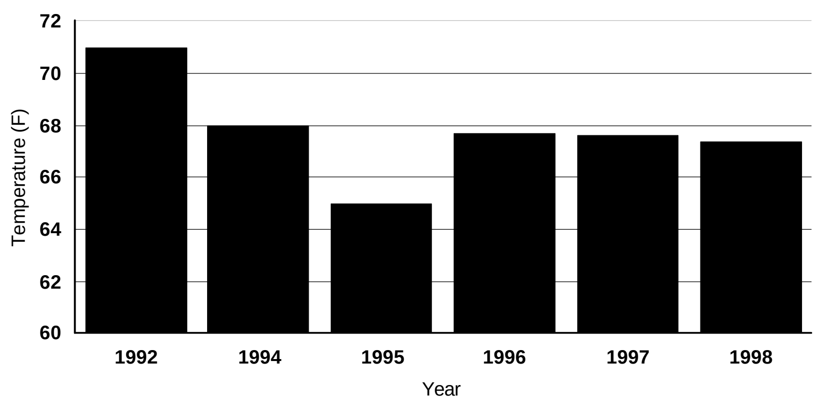
The largest subdrainage within the watershed is Dunn Creek. Dunn Creek has a drainage area of 16,499 acres. It is a fifth order, Class I stream. At the divide between Black Butte and Lookout

Mountain, Dunn Creek originates at an elevation of 5,200 feet and joins the East Fork Illinois River at an elevation of 1,560 feet. Approximately 320 acres are privately owned with the remainder federally owned. Black, Packers, Poker, and NF Dunn Creeks are main tributaries to Dunn Creek.

Dunn Creek is a portion of the East Fork Illinois River Tier 1 Key Watershed. Dunn Creek has been listed on the 1998 Oregon List of Water Quality Limited Water Bodies 303 (d)(1) List) as water quality limited from the mouth to the headwaters for summer stream temperature criteria. Average 7-day high stream temperature is greater than 64EF.

Although stream temperature data exists for Dunn Creek at the mouth and limited data for NF Dunn, there is a lack of data for main tributaries and on its main stem. Restoration activities could be assessed with more credibility if the heating regime of the system were known (Figure H-8).

Figure H-8: Dunn Creek Summer Stream Temperature, 7-day Average High.



<u>Recommendation:</u> Summer stream temperature monitoring on the main stem from the mouth to headwaters to determine the temperature regime of the entire main stem and named tributaries.

Lower Dunn Creek: The first mile of Dunn Creek is a wide alluvial plain, which was geomorphically influenced by an ancient alluvial deposit from East Fork Illinois. A low level of large wood is documented in this reach. This is common for a 5th order stream with its associated stream power. The flood plain averages 250 feet and can exceed 600 feet at times.

Alder, tan oak, and willow dominate the lower two miles of riparian vegetation, with conifers dominating in the remainder of the system. Vegetation in the lower two miles is recovering from the 1964 flood and the 1987 wildfire and could benefit from riparian silviculture treatments such as encouraging the growth of willow and conifer.

Poker Creek: A unique habitat or feature for Poker Creek watershed is an unnamed shallow lake or bog approximately 35 acres in size located at the headwaters. It has been virtually unchanged since the 1940s. Immediately downstream of the lake, Poker Creek is unusually wide for a 2^{nd} order class IV stream and averages 50 to100 feet in width. This condition is historic and no change in trend is predicted. This unique channel morphology is continuous for approximately one mile, after which the channel narrows considerably into what is considered a more common classification for a low order stream. The lake and morphology of the low gradient stream is likely glacial in origin.

Placer mining activity occurs intermittently on Poker Creek and on the main stem of Dunn Creek below the confluence of Poker Creek. These are localized small dredging operations, which on average cumulatively move less than 100 cubic yards per year.

Upper and Middle Dunn Creek: The 1964 flood is responsible for much of the current conditions within the riparian corridor, including localized stream bank instability, sediment loading, and lack of channel complexity. Significant mass wasting and extensive slope failures were triggered by this event. These areas are chronic sources of sediment to the stream. The reach of Dunn Creek between Crazy Peak and the confluence of Dunn and NF Dunn is geologically complex. Several rock types faulted and sheared together. Deposits of large, ancient landslide forms coalesce along lower slopes creating unstable banks of an inner gorge. These poorly consolidated features are prone to debris slides that can be triggered by undercutting of the banks by the stream.

The Crazy Peak slide is the single most significant of these failures in this tributary. The most recent failure in Dunn Creek is attributed to the 1964 flood. The Crazy Peak slide originates in poorly consolidated glacial deposits. Forest System road 4906 is directly over the head of the slide, which undercutting by the road or diverted stream drainage may have contributed to the failure. Including drainage relief into Black Creek, the slide is 0.75 miles in length and up to 1,000 feet in width. Crazy Peak slide is located 2,000 feet above the confluence of Black Creek and Dunn Creek. The effects of the debris torrent as a result of this landslide are evident in Black Creek and Dunn Creek. The slide scoured the channel, resulting in removal of mature riparian vegetation and general channel widening. Vegetation is currently growing on the entire length of the slide. Other smaller inner gorge landslides were historically common in Black Creek and Dunn Creek but none of the magnitude of the Crazy Peak Slide.

Two other landslides on Dunn Creek, one located 1.5 and the other 2.5 miles above the Black Creek confluence, can be similarly dated to the 1964 flood and together are the size and magnitude of the Crazy Peak slide. These landslides added to stream channel degradation on Dunn Creek downstream from these failures. Above the confluence of Black Creek, numerous stream bank failures were mapped off large, older landslide deposits. Smaller debris torrents also occurred off the road system above Dunn Creek. Many of the roads have been decommissioned and drainages restored, but streams and draws scoured by failures triggered by the 1996 flood will continue to contribute sediment until vegetated and stabilized. The current condition of Dunn Creek is an aggraded streambed, with sediment being contributed from both adjacent, over-steepened stream banks and smaller drainages. This condition is expected to continue for many years until sediment decreases to a natural rate and channel forms stabilize.

North Fork Dunn Creek: North Fork Dunn Creek is a 3rd order tributary and contributes 11% to the flow of Dunn Creek. During the summer, peak stream temperatures range from 59E to 63EF with summer flows as low as 0.44 cfs. Riparian vegetation is primarily hardwoods (USFS 1993).

Other tributaries to Dunn Creek: Black Creek is a 3rd order tributary and four miles long. Poker Creek is a 4th order stream contributing 28% of the total stream flow to Dunn Creek and is approximately four miles long.

Slopes on Page Mountain that are within the Dunn Creek watershed are underlain by granitic and metamorphic bedrock. Slopes above NF Dunn Creek are range from 15 to 50%. Several inactive failures, and possible glacial land forms such as wide swales and possible old tarns were noted on the southwest slopes of Page Mountain. Large, ancient slumps or earth flows with deep soils and leaning trees are present on lower slopes. Draws are deeply incised through these land forms, with evidence of multiple debris flows, including scars on riparian vegetation at a height of 20 feet. A recent debris torrent originating in a drainage crossed by road 4808015 has contributed to stream aggradation and stream bank instability in a tributary to NF Dunn Creek. Three miles of road on Page Mountain are on low gradient slopes (less than 50%) in the NF Dunn Creek drainage. These roads are in a "stacked" configuration on the slope.

Recommendation: These stacked roads should be a priority for continued road maintenance to insure their future stability or they should be considered for decommissioning.

Dunn Creek Vegetation: The 1987 fire was responsible for riparian vegetation mortality on Dunn Creek and has influenced future large wood availability. The 1964 flood moved existing large wood deposits out of the system while adding some new deposits, mostly from debris flows and slope failures. Deposits of large wood associated with debris torrents are expected to migrate downstream during large flow events. Natural deposits of large woody material are generally lacking in the lower reaches of Dunn Creek. The inherent nature of Dunn Creek's drainage area is one of high winter stream velocities, which tend to move large wood out of the system. This large stream may be less dependent on wood and more dependent on other natural features for maintaining channel complexity. Inverted V wood gabions and installed deflector logs are the primary sources of large wood in the lower main stem, which are designed to add channel complexity.

The upper reaches of Dunn Creek, where stream order and stream velocities support large wood accumulation, have approximately 72% of ODFW benchmark standards for adequate large wood.

Approximately 24% or 3,980 acres of the Dunn Creek tributary have had some form of harvesting. The heaviest decade of harvest was 1980 to 1989. A right-of-way 3.5 miles long for power lines is cleared and maintained in a strip 200 feet wide across the headwaters. For analysis purposes, this feature is factored as equal to an 85-acre strip clear-cut.

Historic timber harvest and the associated roads, crossings, and landings on National Forest lands removed varying amounts of riparian vegetation in accordance with Forest Plan guidelines on 18.6 miles of perennial streams in this tributary.

Based on the seral stage distribution map (GIS 1996), variable degrees of vegetative recovery are evident at most sites. Recovery is not complete as the stage of recovery is mostly in early to mid-seral series. These areas are located on the main stem of Dunn Creek downstream from Poker Creek.

Continued timber harvest is expected on localized matrix lands within the Dunn Creek drainage analysis area. Gradual decrease in stream temperature is predicted over time with the recovery of 1964 flood-removed riparian vegetation. Future large storm events and roads are expected to impact the aquatic system, as they have in the past. Sediment from debris torrents stored behind large wood deposits will be released over time during storm events. Future large wood supply is expected to be low for the long term unless management actions for watershed rehabilitation and riparian silviculture are implemented. Existing landslides may be reactivated by large storm events.

Recommendation: Conduct a stream rehabilitation survey and design on the main stem of Dunn Creek from its confluence with Poker Creek to its headwaters. Review the transportation system for candidates for road decommissioning. Increase large wood availability and in-stream placement to 25 to 80 pieces/mile on Dunn Creek. Increase channel complexity by placing wood or vegetation on channel bars in a manner conducive for sediment storage. Evaluate the biological integrity of the unnamed lake in the headwaters of Poker Creek.

7. East Fork Illinois River below Confluence of Chapman Creek

This analysis area extends from the mouth of the East Fork Illinois River to approximately one river mile below the confluence of Althouse Creek (see Table A-2). A stream survey was conducted by ODFW along the East Fork Illinois River in 1994. The survey extends from Highway 199 bridge, approximately 0.9 miles upstream from the confluence with the West Fork Illinois River, up to the Waldo Road bridge (total 10.8 miles). The first two reaches identified in the survey have 66% of actively eroding streambanks which is not properly functioning for stream bank condition according to NMFS standards (1969) and may indicate a degrading channel. Possible causes for eroding streambanks and channel degradation are: excessive water removal, overgrazing, channelization, removal of riparian vegetation, and gravel removal operations. Logging, road construction, the 1964 flood, riparian area clearing, agriculture, and other development have probably increased water temperatures and intermittent turbidity within this drainage analysis area. Moderately high summer water temperatures in the lower reaches are due to a wide shallow channel, open riparian area, and low summer flow.

Road density is high in this area, 5.3 mi/mi^2. While it would be beneficial to stream health to reduce road miles, most of the roads are located on private land and are not subject to federal recommendations or options for road decommissioning.

Data gap: There is little data presently available regarding channel habitat, channel morphology, erosion, shade on this section of the East Fork. Most of this drainage analysis area is privately owned.

8. Lower East Fork Illinois River (From Chapman Creek Confluence to Apx. 0.5 Rm above Khoeery Creek)

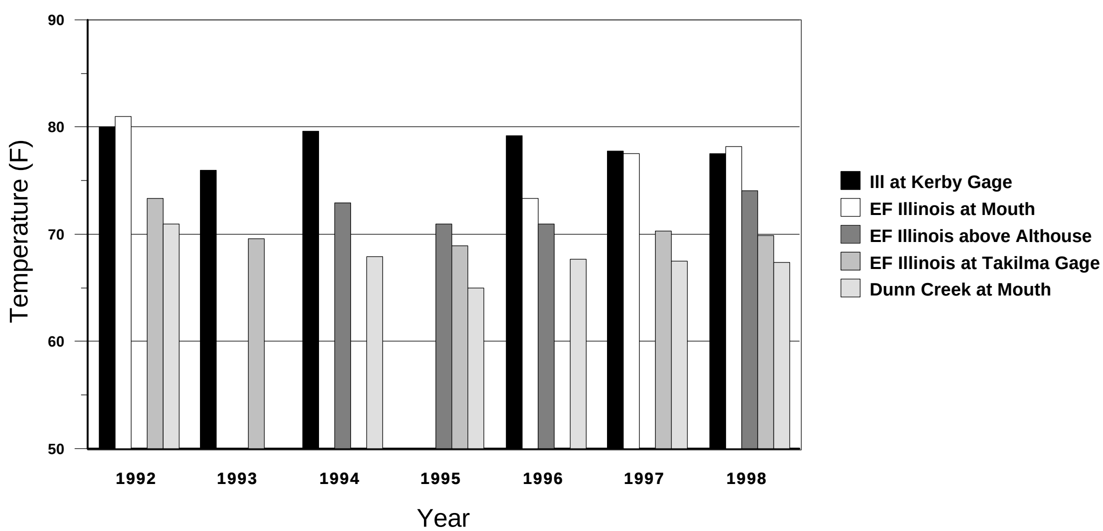
This analysis area includes three HUC7 watersheds (# 17100311010333, 17100311010345, and 17100311010354) and encompasses 5,411 acres. The East Fork Illinois River is a 6th order stream in this reach.

Current shade values throughout the main stem of the East Fork Illinois River are variable. They range from 15 to 80% (IVRD Stream Surveys) on National Forest lands with an average less than 50%, which is rated as poor to fair (USDA 1994). Shade values on the main stem of the East Fork Illinois River below the Forest Service boundary are generally lower averaging less than 15%.

This decrease in shade is due to an increase in stream width and loss of riparian vegetation. Summer peak stream temperatures range from the high 60EF to low 70EF upstream from the East Fork Illinois River gaging station and mid 70EF to low 80EF near the mouth (Fig. H-9).

The East Fork Illinois River is entrenched in a wide valley in this reach. High velocity flows and natural erosion processes are limiting factors for quantity and quality of available vegetative shade. Topographic shade is not dominant due to wide valley bottoms. Large wood is scarce and deposited on occasional flood plains and terraces. Large wood is not the driving factor for channel formation or pool cover in this high order stream. Riparian vegetation has been altered by human disturbance in this stream section. Shade provided by riparian vegetation is less than pre-settlement levels.

Figure H-9: East Fork Illinois Watershed 7-day Average High Summer Stream Temperatures



Much of the main stem of Lower East Fork Illinois River in this reach is open to agricultural use and housing development in private holdings, and timber management on federal lands. Past land clearing for housing development, road construction, placer mining, agriculture, and timber harvest has been responsible for removal of shade producing riparian vegetation and for non-point sources of sedimentation along the main stem of Lower East Fork Illinois River. The infrastructure of developed lands in this portion of the watershed is expected to be maintained and will continue to influence stream side vegetation, shade, and stream temperature.

9. East Fork Illinois River above Scotch Gulch below Dunn Creek

This drainage analysis area is currently delineated to include Long Gulch. For this watershed analysis, Long Gulch is discussed separately due to the extent of disturbance in the drainage (see below).

There are 13.3 stream miles in the drainage and 100% of the riparian reserve is mid-seral (11-21" DBH size class. This area contains a high road density and high number of road crossings per stream mile (See Table A-2).

Data gap: East Fork Illinois River above Dunn Creek below Bybee Gulch was not included in the current analysis due to differences in USFS and BLM HUC7 boundary delineation. This area is less than one square mile in area.

Recommendation: Designate in USFS and BLM GIS the Long Gulch tributary its own unique drainage giving it an individual analysis area.

10. East Fork Illinois River above Bybee Gulch below Chicago Creek

This analysis area, which along with the Upper Illinois River forms the Upper East Fork Illinois 6th field sub-watershed, has a high road density. However, the majority of the roads are not in the riparian reserves and there are only two stream crossings in the drainage. Seven percent (160 acres) of the drainage has been harvested and there is a low amount of riparian harvest. (See Table A-2).

11. East Fork Illinois River – Upper (beginning RM 19.7)

This drainage is currently in or very near historic pre-managed condition. Upper East Fork Illinois contains unique geologic features (moraines and glacial geologic land formations). Approximately 50% of the area is in wilderness. Approximately 5% is roaded and has experienced timber harvest activities. There are currently no future plans for harvest or road construction in this drainage for the next decade. Inner gorge landslides are common and a natural form of mass wasting in the main stem and in steep intermittent side channels.

12. Elder and Little Elder Creeks

Woody material on Elder Creek on Forest Service surveyed lands are above ODFW benchmark standards and range from 130 to 478 pieces per mile. Large wood ranges from 103 to 441 pieces per mile. Pool formation and channel stability in Elder Creek are highly dependent on large wood. Large wood often causes log jams, waterfalls, and plunge pools. Spawning sized gravels are concentrated in and around logjams, in addition to short-term micro-sites of stream side soils and young vegetation. Stream banks are generally well armored by riparian vegetation (see Fisheries section).

The lower main stems of Elder and Little Elder parallel each other through a small valley for about one mile. Though they are only 1,000 feet apart, they are two distinct streams and drain separate canyons. The lower valley of both Elder and Little Elder Creeks mostly consists of private agricultural land. In the foothills, private and federal lands were harvested after the 1940's. Based on 1940, 1964 and 1996 aerial photography interpretation, private timber stand recovery is approximately 50% of reference conditions and the stands are approximately 30 years from consideration for standard commercial harvest. The upper portions of both tributaries are within National Forest lands. Road density in the drainage is moderately high.

Peridotite, serpentine and other ultramafic rock types underlie much of the upper portions of Elder Creek drainage. Soils developed from these rock types are less productive because of soil

chemistries reduced in calcium and increased in heavy metals such as chromium, nickel and magnesium. Soils typically have a high rock (clast) content in a matrix of clay and silt. The clays exhibit high porosity, but low permeability. Some areas have weathered to expansive clays. Because of the above, vegetation tends to be sparse and limits the amount of organic material incorporated into the soil profile further inhibiting the development of deeper, productive soils. Shallow serpentine soils are prone to gully erosion and sheet wash. Where groundwater tables are perched, bogs and seeps can be found, along with down slope movement of clumps of soil and vegetation (solifluction). Gully erosion and head-cutting in swales and intermittent streams was most noticeable in areas that had experienced intense fire. Ancient,
deep-seated slump/earth flows were mapped from aerial photos. These can be found in association with deeper soils on the west slopes of Elder Mountain and Buckhorn Ridge. Stream bank instability was noted in Elder Creek where deposits from these large, old features terminate at the creek.

Both ancient and recent slump/earth flows were mapped on the middle slopes of Page Mountain in the Elder Creek drainage. Road construction and timber harvest, especially along Roads 4808, 4808015, and 4808065 have reactivated many of these failures, mostly as debris torrents along the lateral margins of the failures.

Timber harvest has occurred on 34% of the National Forest lands in Elder Creek. Additionally, a 200 feet wide, 5.4-mile length of maintained and cleared right-of-way for power lines is located across Elder and Little Elder Creek drainages.

Recommendation: The power line right-of-way should be factored as a permanent infrastructure and for analysis purposes as a strip clear cut equal to the following: 81 acres for WAA 15L03W, 32 acres for WAA 15L02F, and 18 acres in WAA 15L01W. These acres should be used for harvest-by-decades calculation for cumulative effects analysis.

Evaluate Forest Service roads 4808, 4808015, and 4808065 to determine what upgrades are needed to stabilize the roads from future failures where they cross the earth flow area. Consider decommissioning if other options are available to meet future access needs.

13. Kelly Creek

Kelly Creek drainage is mostly in private ownership with only approximately 15% administered by the BLM . Kelly Creek is perennial and flows southwest to its confluence with the East Fork Illinois after being joined by Tycer Creek 0.5 miles upstream of the mouth. There are 34 road crossings on perennial and intermittent streams. Road density is high (3.8 mi./sq. mi.). Kelly Creek is probably below ODFW benchmark standards for large woody debris, riparian condition, channel complexity, and low flow.

14. Khoeery Creek

Khoeery Creek is a tributary to Elder Creek with its confluence located 0.6 miles above the mouth of Elder Creek. This creek flows north through Takilma to its confluence with Elder Creek. Land ownership is primarily private in the valley, and private, BLM (15% of the drainage), and National Forest lands in the uplands. National Forest lands consist of 521 acres of riparian reserve (32% of the National Forest land in the drainage). The upper reach and tributaries are supported by perennial springs, but the main stem goes dry in the summer. Ninety percent of the stream reaches surveyed on BLM land are properly functioning. Road density in the drainage is high (5.3 mi./sq. mi.). There are 32 road crossings on perennial and intermittent streams in the drainage. Most of the roads are located on private land and are not subject to federal road decommissioning to reduce road density.

15. Long Gulch

The lower portion of this watershed contains a large, ancient landslide deposit, which comprises the slopes between Long and Bybee Gulch. The Longwood Fire burned over the drainage, including the upland riparian areas, resulting in areas of localized erosion that has contributed to at least one road failure. Roads located on this feature are expected to be difficult to maintain and are good candidates for decommissioning. Sediment traps built during the 1988 Longwood Fire rehabilitation work were monitored. Several of these sediment traps were notably filled to capacity levels.

Cumulative effects from this fire are difficult to separate from those of management activities. Almost all of this drainage was affected by natural wildfire and salvage activity during the past decade, and by road construction and timber harvest activity over the past several decades. It is expected that there will be no future harvest in Long Gulch in the next decade.

Recommendation: Riparian silvicultural methods, including pre-commercial thinning, may help to accelerate growth of larger trees, and to reduce the risk of high intensity wildfire. Roads within Long Gulch would be good candidates for road decommissioning.

16. Page Creek

Page Creek status on the 1998 Oregon List of Water Quality Limited Water Bodies 303 (d)(1) List is "need data" for temperature, flow, and habitat modification. Temperature data collected from 1997 and 1998 indicates a range of 7-day average peak summer temperatures of 62.5 to 63.8EF, which is below the 64EF threshold set by the DEQ. Currently there is no flow or habitat modification information for this stream.

Recommendation: Collect flow, stream temperature, and habitat information on Page Creek.

The Cowboy mine is a patented private holding surrounded by National Forest lands. It has affected localized riparian conditions where roads are dense and crossings occur on where two main forks of Page Creek have their confluence. The channel has been locally widened. Recovery of riparian vegetation is occurring with poor recovery outside the riparian area where soils are shallower and less productive.

Underlying rock type for Page Creek consists of ultramafic rock, and faulted and often intensely fractured metamorphic sedimentary and volcanic rock types. A deeply weathered granitic intrusion is exposed on the upper slopes of Page Mountain.

Glacial land forms were mapped from aerial photos in the upper Page Creek drainage, along with three large, ancient slump/earth flows into the drainage off the ridge between Page Mountain and

Mount Hope. These may be relic, deep glacial deposits. Within two of the failure forms, debris flows have scoured numerous drainages along road 4808019, and contributed to stream bank instability and aggraded channels in Page Creek.

Recommendation: Reconstruct, storm-proof, or decommission Road 4808019.

17. Sanger Canyon

Deep deposits of un-consolidated sand, gravel, and boulders characterize Sanger Canyon. Post-glacial debris from steep slopes may be covering earlier glacial deposits. The stream has cut a notch up to 50 feet deep through the detritus. Cirque lakes are common in the headwaters with Sanger Lake being one of the larger, which is approximately 5 acres in size.

Timber harvest in this sub-watershed removed approximately 17 acres of riparian vegetation. Recovery is generally in the early-mid seral stages.

18. Scotch Gulch

The south portion of Scotch Gulch was affected by the 1987 Longwood Fire and from large areas harvested by clear-cutting in the 1960s. As a result, riparian productivity in the headwaters has been degraded and is less than historic conditions. The restoration potential is very good. A cooling trend in summer water temperatures is expected over time as vegetation recovers in more productive riparian areas. The lower portion of the drainage is primarily un-roaded and has good vegetative cover. Scotch Gulch has a moderate road density (see Table A-2).

19. Tycer Creek

Tycer Creek flows southwest into Kelly Creek approximately four miles upstream of the Highway 199 bridge. Ownership in this drainage is primarily private with a small amount of BLM administered land. Low flows and loss of riparian vegetation are characteristic of Tycer Creek. Tycer Creek is perennial in the lower reach and intermittent in the upper reach due to irrigation withdrawals and changes in watershed hydroperiod resulting in flashier flows. Substrate is dominated by sand and habitat complexity is inadequate, as are shade and large woody debris according to ODFW benchmark standards. There are 61 road crossings on perennial and intermittent streams. Road density in the entire Tycer Creek drainage, which includes private land, is high (see Table A-2).

Recommendation: Evaluate the road transportation system to identify which roads are candidates to be decommissioned to reduce overall road density. Determine where riparian silviculture treatments could be used to improve future stream shade and large wood recruitment.

D. SUMMARY OF HYDROLOGY RECOMMENDATIONS

1. Recommendation: Improve mature and old-growth component, snags and LWM recruitment, and reduction of fire hazard.

2. Recommendation: Manage roads to reduce their contribution to the erosion processes such as

landslides, surface erosion, stream diversion, and gully formation. Prioritize roads for decommissioning or storm-proofing based on stability and erosion potential. Minimize or avoid new road construction in areas underlain by granitic or serpentine soils, and in areas containing poorly consolidated glacial deposits.

3. Recommendation: Decommission unnecessary roads as identified through the interdisciplinary process. To minimize soil disturbance or gully formation, evaluate the appropriateness of ground disturbing restoration techniques such as scarification. Evaluation should include but is not limited to parameters such as slope gradient, aspect and soil type.

4. Recommendation: Numerous recent failures are associated with older landslide forms. These are currently mapped in the Kingfish, Cougar Ridge and Elder Mountain planning areas. Guide future management decisions with a consideration of the ancient and inactive landslide forms in the remainder of East Fork Illinois River watershed.

5. Recommendation: Increase availability and long-term recruitment of large wood, and wood of varying sizes on 4th order and lower streams. This would improve channel complexity and stability, habitat complexity and productivity for fish, and improve sediment transport and storage dynamics. Large wood could be imported to streams and/or adjacent side slopes, or cultured through silvicultural practices in Dunn Creek, Chapman Creek, Bybee Gulch, and Long Gulch.

6. Recommendation: Implement riparian improvement work such as planting and silvicultural techniques (e.g., thinning primary conifer and secondary hardwood vegetation) to accelerate the growth of larger trees and provide a long-term balanced source of large wood and shade. Known priorities are on Dunn and NF Dunn Creeks, Bybee Gulch, Long Gulch, Elder, Tycer and Little Elder Creeks.

7. Recommendation: Return abandoned transportation system in riparian reserves to vegetative productive conditions. Reduce accelerated and direct runoff from roads and other managed lands by decommissioning unused facilities and returning those lands to a productive vegetative condition, or by upgrading by storm proofing facilities that are still in use. Special attention regarding stabilization and restoration of vegetation should be given to slides, skid roads, landings, and other areas resistant to re-vegetation applications. This will restore the soil permeability and lessen the effect of management in regard to increases in water yield from direct runoff.

8. Recommendation: Where possible, mining ditches should be recontoured at stream draws and stream crossings to return diverted flow to instream flow. This would follow culture resource review.

9. Recommendation: All culverts limiting fish movement should be assessed and replaced or removed.

10. Recommendation: Complete a water quality management plan for the East Fork Illinois River.

11. Recommendation: Reduce fire hazard in riparian areas to “low” using appropriate techniques such as prescribed fire and mechanical methods. Target frequency of under-burning to be within

historic ranges to improve watershed health. Sanger Canyon, Elder, and Little Elder drainages may be appropriate candidates for prescribed burning or thinning. Use fire hazard analysis to direct priority of locations for fuel hazard reduction.

12. Recommendation: Increase the large wood availability and in stream placement to 25-80 pieces/mile on Dunn Creek. Increase channel complexity by developing micro sites on channel bars by placing wood or vegetation in a manner conducive for the channel sediment storage. Identify other stream rehabilitation opportunities.

13. Recommendation: The power line right-of-way in Dunn, Elder, and Little Elder drainages should be considered permanent infrastructure and, for analysis purposes, treated as strip clear cuts. 85 acres in Dunn Creek. For Elder and Little Elder, 81 acres for WAA 15L03W, 32 acres for WAA 15L02F, and 18 acres in WAA 15L01W. These acres should be used for harvest-by-decades calculation for cumulative.

14. Recommendation: Apply riparian silviculture methods, including pre-commercial thinning, in Bybee Gulch and Long Gulch to encourage and accelerate the recovery of riparian vegetation from the 1987 Longwood Fire. Roads in the Long Gulch drainage are good candidates for road decommissioning.

15. Recommendation: Collect more site-specific stream data, especially on Allen Gulch, Chapman Creek, Page Creek and Elder Creek.

16. Recommendation: Complete the Transportation Management Objectives (TMOs) for BLM roads to provide the basis for road management and maintenance in the watershed. On National Forest lands identify “Transportation System Needs” on a site-specific basis.

IV. FISHERIES

A. Introduction

Within the Rogue River Basin, the Illinois River and its tributaries are important spawning and rearing habitats for both anadromous and resident salmonids. The Illinois River constitutes a significant portion of the remnant native wild fish population/habitat within the Rogue River Basin. Thus, the Illinois River watershed is believed to be the stronghold for wild anadromous fish populations in the Rogue Basin. Primary tributaries of upper the Illinois River include: East Fork and West Fork Illinois River, Deer Creek and Sucker Creek. The East Fork Illinois River watershed is classified as a Tier 1 Key Watershed south of the Oregon - California border (NFP 1994). Tier 1 Key watersheds are designated because they contribute directly to conservation of protected, endangered, threatened, and sensitive fish species (see Map 29: Perennial Streams and Fish Distribution).

Anadromous salmonids present within the watershed are: fall chinook (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and winter steelhead (*O. mykiss*) (RVCOG 1997a & 1997b, USDA v.1.0 1995, ODFW 1995). These anadromous species represent important fish populations in the ESUs (Evolutionarily Significant Units) of the region.

Resident salmonids within the watershed include rainbow trout (*Onchorhynchus mykiss irideus*) and cutthroat trout (*O. clarki clarki*). Other native fish species present within the watershed include Pacific lamprey (*Lampetra tridentata*) and sculpin (*Cottidae sp.)*. Non-native fish species found within the watershed include the Redside shiner (*Richardsonius balteatus*) and Eastern brook trout (*Salvelinus fontinalis*) (USDA 1989, 1992, 1993, 1994).

Both resident and anadromous salmonid population trends have been in decline for decades and are considered to be at depressed population levels throughout the Illinois River basin (ODFW 1992). Historically, ODFW harvest data was the only measure of anadromous fish population levels within the Illinois River basin. As a result of declining population levels, ODFW presently prohibits trout fishing within the entire Illinois River basin.

The long-term trend for upper Illinois River salmonid populations remains a question for both State and Federal agencies. Degraded habitat, extended drought conditions, and water withdrawals continue as key factors limiting production of anadromous salmonids within the East Fork Illinois River watershed. Public lands in the watershed play an important role in the survival of salmonids as they provide cool water and large woody material to fish habitat lower in the system and provide refugia during summer months when water temperatures are lethal in the valley segments.

Fish presence surveys conducted by ODFW (1995) have been completed for Cedar Gulch, Elder, Khoeery, Little Elder, and Page Creeks. Forest Service personnel conduct annual fish presence and Level III stream surveys on 0.50 mi reaches of Dunn Creek and the East Fork Illinois River. These surveys verify salmonid distribution. In addition, monitoring efforts indicate that steelhead, coho and some chinook are found primarily in transition between the headwaters and valley where migration is possible.

A smolt-trapping project was conducted on the East Fork Illinois during 1994-1996 by ODFW and Siskiyou National Forest to estimate total salmonid smolt production within the basin. Results of downstream migrating chinook, steelhead, and coho fry are likely underestimated because of peak flows hindering trapping efforts (Vogt 1996). Trap catches peaked from mid-April to early-June (Vogt 1996) with the majority of 1+ yr old fish out-migrating before the 0+ (<1 yr old) fish.

B. Coho Salmon

Coho salmon within East Fork Illinois River watershed are part of the Southern Oregon/Northern California Coho ESU, which was federally listed as threatened on May 6, 1997 (Fed. Reg./Vol. 62, No. 87). The ESU includes all naturally spawned populations of coho salmon in coastal streams between Cape Blanco, Oregon and Punta Gorda, California. Most of the coho in this ESU are in the Rogue River, with the largest remaining population in the Illinois River (Stouder et. al. 1997). Current summer water temperatures in the valley limit coho production from reaching historical levels (USDA 1995).

Habitat designated by the National Marine Fisheries Service (NMFS) as critical to the recovery of Southern Oregon/Northern California coho encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and Elk River in Oregon, inclusive. Critical habitat includes all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassible barriers (*i.e*., natural waterfalls in existence for at least several hundred years). Adjacent riparian zones have been defined by NMFS as part of critical habitat designation and are now based on a functional rather than a quantitative description. Based on NMFS criteria, critical habitat includes riparian areas because they provide the following functions: shade; sediment, nutrient, or chemical regulations; stream bank stability; and input of large woody material or organic matter. It is important to note that habitat quality is intrinsically related to the quality of riparian and upland areas and of inaccessible headwater or intermittent streams that provide key habitat elements crucial for coho in downstream reaches. More detailed critical habitat information (*i.e.*, specific watersheds, migration barriers, habitat features, and special management considerations) for this ESU can be found in the May 5, 1999 Federal Register notice.

On National Forest lands within the watershed, juvenile coho salmon have been observed as follows: throughout the main stem of East Fork Illinois River up to 1.0 mile past the confluence of Dunn Creek; up 1.0 mile on Page Creek, just past the Forest Service boundary on Elder Creek; up to 1.0 mile past the confluence of NF Dunn Creek; and in the lower reaches of Scotch Gulch and Cedar Gulch. There are no survey data on the distribution of juvenile coho outside National Forest lands within the watershed.

Critical habitat for coho extends throughout the main stem of the East Fork Illinois River including tributaries up to a 15 foot boulder waterfall located approximately one mile below the confluence of Chicago Creek. In Dunn Creek, critical habitat for coho includes all tributaries to the headwaters and is limited on the North Fork of Dunn Creek by a 7 foot waterfall located approximately 1/3 mile up from the mouth.

C. Chinook Salmon

Chinook salmon within the East Fork Illinois River are fall-run and belong to the Southern Oregon and Northern California Coastal chinook ESU, which was proposed for listing on March 9, 1998. In September 1999, the National Marine Fisheries Service (NMFS) identified this ESU as not warranted for listing under the Endangered Species Act. Regional Forester Robert Williams, however, designated chinook salmon and other salmonids within the Pacific Northwest Region as sensitive for Forest Service management purposes (FC 2670-1920; August 20, 1997).

Juvenile chinook are present in the main stem of the East Fork Illinois River usually through at least June (ODFW 1988). Their distribution extends up to the confluence of Dunn Creek. They spawn from October through early January with a peak usually during November.

D. Steelhead Trout

Steelhead within the East Fork Illinois River belong to the Klamath Mountains Province ESU and is a candidate species for listing. Land management activities, including logging and road building, have impacted critical steelhead habitat along the southern Oregon coast where watersheds are particularly unstable. The winter steelhead population in Illinois River has declined based on catch records. Sports harvest declined from 2,500 fish in the 1970s to less than 200 fish in 1992. Irrigation withdrawals have been a major impact to steelhead production in the Illinois River basin, and were particularly severe during the recent drought.

Steelhead are ubiquitous within the East Fork Illinois River basin, extending up to the confluence of Chicago Creek, up Dunn Creek about 0.25 mi above Poker Creek, and up Poker Creek about 0.75 mi.

E. Resident Cutthroat and Rainbow Trout

Cutthroat and rainbow trout are distributed throughout many of the reaches of all tributaries above and below anadromous fish barriers. The resident rainbow population within Illinois River is sympatric with winter steelhead. The Illinois River trout population appears to be much smaller than that observed in the 1950s.

F. Non-Native Fish

Eastern brook trout were documented in the East Fork Illinois River above the anadromous barrier during the 1989 stream survey. The species was thought to have been planted at higher elevation lakes or within the headwaters of the East Fork Illinois River in the past. Native cutthroat can vanish after nonnative trout become established (Behnke 1992).

Redside shiners were first identified in the lower Illinois River at the base of Illinois River falls in May 1960. Redside shiners compete directly with juvenile salmonids and are able to reduce trout production up to 54% in warm water (66.2E to 71.6EF) (Reeves 1987).

G. Fish Habitat

In 1997, the Governor's Salmon Recovery Science Team designated 27 core habitat areas in Southwest Oregon for protection and restoration. Core habitat areas are defined as reaches or watersheds that are judged to be of critical importance to the maintenance of salmon populations that inhabit those basins. Core areas are identified so that they might be managed to best protect and enhance critical habitat and recognize obligations under the Endangered Species Act (RVCOG 1997a). The East Fork Illinois River and Dunn Creek are identified as core areas for coho salmon (RVCOG 1997a) and contribute 10 % (25.2 mi of 247.6 mi) of the total core stream miles of the Rogue Basin and South Coast core areas. Within the Illinois River watershed, the East Fork Illinois River and Dunn Creek contribute 42 % (25.2 miles of 60.7 miles) to the core stream miles identified.

There are approximately 250 miles of perennial streams are in the East Fork Illinois River watershed. Approximately 19% of the 145 miles of perennial streams on National Forest lands have been surveyed (Table A-3).

Table A-3: Stream Miles Surveyed on Forest Service Lands

Stream Surveyed ** (includes tributaries)	Total perennial miles	Miles Surveyed	% Perennial miles surveyed by sub-basin
East Fork Illinois River	16.33	8.77	29.2
Dunn Creek	66.2	9.8	14.8
Elder Creek	18.5	0.57	3.1
Total		19.14	

** USDA Level II Stream Survey Protocol

Forest Service stream surveys conducted in 1989, 1992, 1993, 1994, and 1997 document habitat conditions within the East Fork Illinois, Dunn Creek, and Elder Creek. Results of surveys show the upper reaches of the East Fork Illinois River and Dunn Creek as relatively unaltered, while smaller tributaries to the East Fork Illinois and Dunn Creek have been extensively logged and roaded (USDA 1993). Remaining boulders and large woody material (LWM) from the 1964 flood provide some structure in aggraded reaches (USDA 1995). The lower reaches of the East Fork Illinois and Dunn Creek provide spawning and rearing habitats essential to the survival of salmonids in the Illinois River system when flows are optimum.

Lower East Fork Illinois River: ODFW conducted a stream survey along the East Fork Illinois River in 1994. The survey extended from the Highway 199 bridge (approximately 0.9 miles upstream from the confluence with the West Fork Illinois) up to the Waldo Road bridge (total 10.8 miles). The first two reaches identified in the survey have 66% of actively eroding stream banks, which is "excessive" (NMFS 1997) and may indicate a degrading channel. Possible causes for eroding stream banks and channel degradation are: excessive water withdrawal, overgrazing, channelization, removal of riparian vegetation, and gravel removal operations. The third reach, beginning above Elder Creek confluence, showed 21% actively eroding stream banks. Logging, road construction, the 1964 flood, riparian area clearing, agriculture, and other development have probably increased water temperatures and intermittent turbidity within the East Fork Illinois River. Moderately high summer water temperatures in the lower reaches are due to a wide shallow channel, open riparian area, and low summer flow (see Hydrology section).

Dunn Creek. The most important tributary to the East Fork Illinois River is the seven mile long Dunn Creek which lies entirely in California. Analysis of Forest Service Level II stream survey data indicates that in the entire watershed accessible to anadromous salmonids, populations of steelhead and coho are currently limited by adult escapement (a lack of adult spawning fish). Fish densities are considered below fully seeded levels for the habitat and province. Historically, Dunn Creek contained a strong viable and widely dispersed rearing population of coho. The current abundance of coho is extremely low with rearing populations found only in the premier habitats of North Fork Dunn Creek and Poker Creek, and the main stem adjacent to the confluence of these tributaries. Steelhead density is also below fully seeded levels.

Little Elder Creek: ODFW (1994, 1995) and USFWS (1995) surveys found steelhead and cutthroat trout present to river mile 0.75 and 1.5, respectively. Surveyors also found a private ford through the creek causing silting downstream at approximately 0.3 mile up Little Elder Creek, and eroding stream banks and cattle grazing within the creek system at approximately 1.0 mile upstream. There are 15 road crossings on perennial and intermittent streams in the drainage. Road density in the drainage is moderate (see Table A-2).

Elder Creek: ODFW (1994, 1995) and USFS (1989) fish presence survey data indicate that Elder Creek supports coho and steelhead 3.8 miles upstream to a 10 foot tall natural barrier and rainbow and cutthroat trout 7.1 miles upstream onto National Forest lands. The creek flows northwest from USFS land to its confluence with the East Fork Illinois River. There is no BLM ownership within the riparian reserve of the creek. Road density in the drainage is moderately high (see Table A-2). There are 36 road crossings on perennial and intermittent streams in the drainage.

Pool formation and channel stability in Elder Creek are highly dependent on large wood. Large wood often causes log jams, waterfalls and plunge pools. Spawning sized gravels are concentrated in and around log jams. Most fish are observed spawning near the vicinity of log jams.

Khoeery Creek: This creek flows north through Takilma to its confluence with Elder Creek. The upper reach is supported by perennial springs, but the main stem goes dry during summer. ODFW fish presence survey data (1995) indicate that cutthroat trout are present to river mile 2.0. BLM ownership accounts for approximately 15% of the entire drainage area. Ninety percent of the stream reaches surveyed on BLM land in the Khoeery Creek drainage are properly functioning. Road density in the drainage is high (see Table A-2). There are 32 road crossings on perennial and intermittent streams in the drainage.

Allen Gulch. All of what is known as “Allen Gulch” is in BLM ownership. However, the entire 7th field drainage of which it is a part is divided evenly between BLM and private ownership. The landscape in Allen Gulch is dominated by impacts of historic mining. An intermittent creek flowing through the gulch can be characterized relative to ODFW benchmark standards as follows: it has inadequate large woody debris, lacks channel structure, sedimentation, and it has inadequate riparian vegetation structure. Fish presence is not verified. The riparian acreage is comprised mostly of young and mid-seral stage vegetation. There are 12 road crossings on intermittent and perennial streams in the drainage analysis area, which includes the adjacent portion of the East Fork Illinois. Road density in the drainage is high (see Table A-2).

Tycer Creek: Tycer Creek flows southwest into Kelly Creek approximately four miles upstream of Highway 199 bridge. Land ownership in this drainage is primarily private with a small amount in BLM ownership. Low flows and loss of riparian vegetation are limiting factors for habitat on

Tycer Creek. Tycer Creek is perennial in the lower reach and intermittent in the upper reach due to irrigation withdrawals and changes in watershed hydroperiod. Cutthroat trout and winter steelhead are present (BLM surveys 1999). Compared to ODFW benchmark standards, the substrate is dominated by sand and habitat complexity is inadequate, as are shade and large woody debris. There are 61 road crossings on perennial and intermittent streams. Road density is high in the Tycer Creek drainage (see Table A-2).

Chapman Creek: Chapman Creek is in the best condition of the streams in the northern portion of the watershed. Chapman Creek flows south to join the East Fork Illinois River approximately three miles upstream of the Highway 199 bridge. The creek is perennial and supports cutthroat trout to RM 2.5 and winter steelhead to RM 1.0 (ODFW, undated). Winter steelhead are present but are probably limited by lack of spawning habitat. Spawning gravel in Chapman Creek is naturally limited with 50% embeddedness and 10% sand. The presence of mayflies and caddisflies in Chapman Creek may indicate good water quality, but more information to determine overall water quality. Large woody debris levels are inadequate relative to ODFW benchmark standards (16 pieces/mi.). BLM ownership accounts for approximately 50% of the drainage, with private land comprising the remainder. There are 42 road crossings on perennial and intermittent streams. Road density is high in the Chapman Creek drainage analysis area (see Table A-2).

Kelly Creek: This drainage is mostly in private ownership with approximately 15% in BLM ownership. There is no USFS ownership. Kelly Creek flows southwest to its confluence with East Fork Illinois after being joined by Tycer Creek 0.5 miles upstream of the mouth. Kelly Creek is perennial and probably supports limited numbers of cutthroat trout and winter steelhead. There are 34 road crossings on perennial and intermittent streams. Road density is slightly less than high in the drainage (see Table A-2). Kelly Creek is likely to be limited for large woody debris, riparian condition, channel complexity, and low flow.

See Hydrology section for discussion on stream geomorphology.

KEY QUESTION #A-5: Fish Production

> ***A-5: What are the factors that affect overall fish production within this watershed, and what can be done to improve overall spawning and rearing habitats?***

The primary overall limiting factor identified in the East Fork of the Illinois River Watershed Analysis (EFIRWA) Version 1.0 (1995) was a reduced overall ecosystem function resulting in reduced overall carrying capacity for anadromous salmonids within the watershed. This reduced ecosystem function identified in the EFIRWA 1.0 was directly linked to the following ecosystem function limiting factors: timing and intensity of headwater flow, headwater sediment delivery, transport and storage, large wood, Port-Orford cedar root disease, fire exclusion, the existing condition of managed stands in both Late-Successional Reserves and Riparian Reserves.

Other specific factors associated with the reduced ecosystem function, and which directly affect overall fish production identified in version 1.0, included: depressed anadromous fish populations, annual elevated water temperatures and reduced flows, fish bearing reaches lack adequate large wood and/or mature riparian reserve vegetation, fish bearing reaches lack channel complexity and abundance of side channels. Human uses such as water withdrawal, with its associated seasonal reduced in-stream flow resulting from irrigation ditches, and impoundments were also identified in version 1.0 as specific factors affecting overall fish production.

1. Existing Condition

The existing condition for the entire East Fork Illinois River watershed has changed very little since the first iteration (version 1.0) of the watershed analysis in spring 1995. However, at a site-specific scale, there have been some recent changes due to debris flows and recent landslide activity (see Geology section).

The existing condition was most recently (1997) described in the Southwest Oregon Salmon Restoration Initiative (RVCOG 1997a). The primary limiting factors that affect overall fish production remain those previously identified.

The Forest Service has identified both winter-run steelhead trout and cutthroat trout as USFS Region 6 sensitive species. The direct involvement of the National Marine Fisheries Service, a regulatory agency of the Federal government, in natural resources management activities on both State and Federal lands which may affect listed and/or proposed fish species has resulted in a standardized analysis/display of the existing conditions. The ongoing collaboration between the Forest Service, BLM, and NMFS has resulted in further delineation of the Environmental Baseline (NMFS 1997) in regards to standardized relevant indicators for the Klamath/Siskiyou Mountains.

2. Trend of the Habitat Indicators

Freshwater anadromous fish habitat conditions are often described in key attributes or habitat indicators, which characterize overall carrying capacity (USDA 1991). These attributes can collectively be used to qualitatively rate the habitats available to anadromous salmonids. Present trend of Habitat Indicators for the Rogue basin is documented in the Southwest Oregon Salmon Restoration Initiative (SOSRI) (RVCOG 1997a). In general, the overall trend for limiting indicators (*e.g.*, riparian zone canopy/shade, sediment, temperature) is described as either improving or stable. In the SOSRI the present status of agricultural development was deemed acceptable for the maintenance of salmonid populations, however the trend was documented as deteriorating. Stream return flows status and trend were documented as unknown.

Factors such as water quality, access, habitat elements, channel conditions and dynamics, flow and hydrology, and overall watershed conditions are under ongoing evaluation. In most of the anadromous fish bearing reaches in the watershed, most Environmental Baseline indicators, such as seasonal water temperatures, are either presently classified to be “At Risk”, or “Not Properly Functioning”, relative to the Klamath/Siskiyou Mountains Environmental Baseline. Table A-4 describes the existing environmental baseline for the East Fork Illinois River watershed relative to the Klamath / Siskiyou Mountains Factors and Indicators. This baseline is commonly used in any determination of Endangered Species Act Effects to Listed or Proposed for Listed status regarding Biological Evaluations, Biological Assessments, and Biological Opinions by NMFS.

Table A-4: Klamath/Siskiyou Mountains Environmental Base Line*			
Indicator	***Properly Functioning *****	***At Risk*** **	***Not Properly Functioning *****
Water Quality *Temperature	Elder Creek Page Creek	Rest of watershed	[2] Lower EF Illinois
Sediment/turbidity		Entire watershed	
Habitat Access *Physical barriers (Human caused)		Rest of watershed	[1]Lower EF Illinois
Habitat Elements *LWM		Rest of watershed	Bybee Gulch, Long Gulch, Page Creek, Elder Creek, Little Elder Creek, [1] Lower EF Illinois
*Substrate	Rest of watershed	[1] Lower EF Illinois	
*Pool frequency		Rest of watershed	Dunn Creek, [1] Lower EF Illinois, [2] Lower EF Illinois
Pool habitat		Rest of watershed	[1] Lower EF Illinois
Off-channel Habitat			Entire watershed
Channel Condition & Dynamic *W/D Ratio by Channel type		Entire watershed	
Stream bank Condition		Rest of watershed	Long Gulch
Floodplain Connectivity		Upper EF Illinois	Rest of sub-basins
Flow & Hydrology Changes in Peak Flow		Rest of watershed	[1] Lower EF Illinois
Watershed Condition *Rd Density & Location	Upper EF Illinois, Sanger Canyon, Bybee Gulch, Cedar Gulch, Scotch Gulch	Dunn Creek, Long Gulch, Page Creek	[1] Lower EF Illinois, [2] Lower EF Illinois, Elder Creek, Little Elder Creek, Chicago Creek
Disturbance History		Rest of watershed	Long Gulch, [1] Lower EF Illinois
Riparian Reserves			Entire watershed
Landslide Rates		Entire watershed	

** These are based on NMFS definitions / criteria (USFS 1998)

*The Environmental Baseline conditions are derived from the interpretation of stream survey data gathered from Forest Service, Oregon Department of Fish and Wildlife, and BLM records. The synthesis of these data and evaluation of the effects of any activities that may affect listed or proposed fish is an ongoing process on public lands.

[1] The portion of the East Fork Illinois outside National Forest lands.

[2] The portion of the East Fork Illinois inside National Forest lands (excluding the Upper East Fork Illinois subwatershed).

Low gradient segments serve as barometers used to evaluate and measure the relative health of fish 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.

Temperature: When under stress from water temperatures exceeding 70ºF, salmonid fish populations may have reduced fitness, greater susceptibility to disease, decreased growth and changes in time of migration or reproduction. Growth begins to decline and eventually ceases as water temperature approaches the upper lethal limit of 75º F (Beschta et al. 1987). Temperatures in excess of 75ºF result in fish mortality, while growth ceases within the range of 69º to 75ºF. Temperature is less than optimum for fish within the range of 59º to 69ºF, and optimum within the range of 45º to 59ºF.

Temperature data (see hydrology section) is available for the lower East Fork Illinois River, Elder, Page, and Dunn Creeks. Year-to-year variations in the extent of the range of sub-lethal water temperatures are evident. Lower East Fork Illinois exhibits the highest range of temperature, which can be lethal for salmonids within the watershed. Summer peak stream temperatures for the East Fork Illinois River ranges from 73º to 81ºF. Stream temperature in Elder, Page, and Dunn Creeks are less than optimum for salmonids.

Sediment/Turbidity: Logging roads produce the most sediment generated among forest management practices. The density and length of logging road distribution can be major factors in determining the level of sediment production. The greatest accumulation of fine sediments in streambeds occurs when road areas exceed 2.5% of a basin area (Waters 1995). Road areas within this analysis area do not exceed 2.5% of the watershed area.

Lower East Fork Illinois River, Long Gulch, Chicago, Dunn, and Elder Creeks, are at risk of sedimentation because of landslide and erosional processes (see Hydrology section).

Fish Barriers: Fish barriers can be defined as any physical/chemical/biological factor that prohibits upstream or downstream migration of juvenile or adult fish. Examples are dams, culverts, low water flow, temperature, waterfalls, and predation. Significant waterfalls that act as barriers within the East Fork Illinois River watershed occur along the East Fork Illinois about one mile above Chicago Creek, up Dunn Creek about one-fourth mile above Poker Creek (USDA 1995), and up NF Dunn Creek about 1.2 mile. Anadromous fish probably cannot pass these waterfalls to utilize the habitat in the upper reaches of East Fork Illinois and Dunn Creek.

Fish presence survey reports from ODFW (1995) include observations of fish barriers within areas surveyed. One culvert (Road 4804) in the headwaters of Elder Creek is identified as a fish barrier. An ODFW Rogue Fish Barrier (1999) inventory sheet identifies four gravel push up dams as fish barriers during low flow within the entire East Fork Illinois basin. Three are on the East Fork Illinois River within the analysis area: T40S, R8W, Sec 34, 27, and 2.

High temperatures in the lower valley may also act as a barrier during low flow. Low flows are a barrier when the river is not able to provide refugia during the hot summer months or passage to cooler, deeper pools. However, cool, clear water produced in the upper reaches contribute to the quality of fish habitat in the lower reaches.

Large Wood Material (LWM): Live trees or downed wood that intercept bankfull flow in a substantial fashion and are large enough to influence the formation of habitats for fish should be within the frequency range of 25 to 80 pieces per mile (NMFS 1997). Of the streams surveyed from 1992 to 1994, Elder Creek, Poker Creek, and NF Dunn have a large wood frequency within the expected range for southern Oregon. Dunn Creek and the East Fork Illinois River are at risk of not being within the range of expected large wood. Remaining LWM and large boulders from the 1964 flood and natural debris flows provide some structure for fish.

See "riparian area" section below and Hydrology section for more discussion on future large wood recruitment.

Substrate: The majority of substrate information for this analysis area comes from USFS and ODFW stream surveys. The lower reaches of the East Fork Illinois and Dunn Creek provide spawning and rearing habitats essential to the survival of wild anadromous salmonids in the Illinois River system. Dominant substrate in the lower reaches is cobble/gravel, and cobble/boulder size material in the upper reaches. Areas that have had recent debris flows and landslides are dominated by gravel. Most of the sediment from the 1964 flood has been flushed by winter flows.

During the winter, juvenile steelhead and cutthroat in larger streams (East Fork Illinois and Dunn Creek) generally seek refuge in the interstices of gravel and cobble substrate, while some juveniles migrate to smaller terrace tributaries to the East Fork Illinois and Dunn Creek.

Pool Habitat and Frequency: Pool habitat is of particular significance to juvenile salmon during all life stages of their life cycle. After emergence, coho salmon occupy low velocity stream margins near cover (above green bridge on the East Fork Illinois and in-stream structures on Dunn Creek), and gradually colonize pool habitat as they grow lager. Age 0+ coho salmon have a strong preference for low velocity pools and cover during the summer. The highest density of age 0+ juvenile steelhead tend to be in backwater pool areas, while 1+ juveniles occurring in small streams prefer scour pools, plunge pools, and cascades (Bisson et al. 1988).

The availability of pools or pool frequency will depend on channel width and type. Expected pools/mile for areas surveyed were calculated by dividing 5,280 feet by 7 times the wetted width for 2-4% gradient channels, and by 3 to 9 channel widths for gradients >4%, assuming pools counted will have a length equal to or greater than the wetted width.

North Fork Dunn Creek and the upper reaches of the East Fork Illinois are near or within the expected range of pool frequency for fish habitat. Areas with low gradient and lack of LWM have poor pool availability. In addition, pools within the lower reaches of the East Fork Illinois River may not have the appropriate depths or volume due to water withdrawal and low flows. Pools deeper than 3.0 feet provide adequate depth for juvenile salmonids. Stream segments surveyed showed average residual pool depth across all reaches on the East Fork Illinois as 2.1 feet, while Dunn Creek averaged 2.6 feet. The NF Dunn Creek and Elder Creek were below 2.0 feet.

Off-channel Habitat: Off-channel habitat areas in unconfined and lower gradient streams provide refuge areas for coho salmon when they typically migrate downstream during the fall and winter when the habitat is available. Juveniles will then leave winter habitat and migrate to sea at the end of their first year.

Properly functioning off-channel habitat areas have frequent active side-channels related to large wood and geomorphology. There are very few active side channels in the East Fork Illinois where stream gradient is low. The mid reaches of Dunn Creek, above the confluence of NF Dunn Creek, and above the green bridge on the East Fork Illinois River (FS Boundary) are low gradient areas where there is evidence of previous side channels.

Other Channel Conditions and Dynamics (Width/Depth ratio, stream bank condition, and floodplain connectivity), changes in peak flows, and landslide rates are discussed in the Hydrology section. Disturbance history is discussed in the Social Module.

Road Density and Location: Road density <2 mi/mi^2 (and no valley bottom roads) is an indicator of "properly functioning" in the Siskiyou Mountains matrix table for the East Fork Illinois Watershed (NMFS 1997). Dunn Creek, Page Creek, and Long Gulch are at risk of not properly functioning with some valley bottom roads and road densities of 2 mi/mi^2 and 2.4 mi/mi^2, respectively. The lower East Fork Illinois, Elder Creek, Little Elder Creek, Page Creek, Chicago Creek are not properly functioning. The upper East Fork Illinois, Sanger Canyon, Bybee Gulch, Cedar Gulch, and Scotch Gulch are properly functioning. Watersheds with some valley bottom roads and a road density between 2-3 mi/mi^2 are at risk of not properly functioning. Watersheds with well-roaded valley bottoms and a road density >3 mi/mi^2 are not properly functioning.

Riparian Areas: In major creeks within the East Fork Illinois River watershed, salmonid survival and production are dependent on a properly functioning physical environment that supports the different stages of the fish life cycle. The Aquatic Conservation Strategy (ACS) (ROD 1994) strives to maintain and restore ecosystem health at watershed and landscape scales to protect habitat for fish and other riparian-dependent species and resources, and restore currently degraded habitats as a result of historical mining and management.

Standards for riparian protection under state rules appear to be below what is required to promote recovery of degraded aquatic and riparian habitats on private lands. County zoning laws that regulate disturbance to riparian vegetation on private non-forest lands appear to be weak. Little improvement in riparian protection and road construction standards is expected on private lands over the next decade.

A riparian reserve is the lands along streams, and unstable and potentially unstable areas where special standards and guidelines direct land use. Riparian area is defined as the interface between terrestrial and aquatic ecosystems. Riparian ecosystems usually occur as an ecotone between aquatic and upland ecosystems but have distinct vegetation and soil characteristics. They are uniquely characterized by the combination of high species diversity, high species densities, and high productivity. Continuous interactions occur between riparian, aquatic, and upland terrestrial ecosystems through exchanges of energy, nutrients, and species.

The desired future condition in the East Fork Illinois River watershed is that riparian reserves provide adequate shade, large woody material recruitment, and habitat protection and connectivity for all aquatic biota, especially anadromous salmonids. According to NMFS (1997) a properly functioning riparian reserve system would have at least 80% in late-seral condition (mature and old growth $\geq$ 21 inch dbh) (NMFS 1997). However, some areas such as those underlain by serpentine, granitics, and moraine may not have the natural ability to support this level of late-successional forest (see Geology section).

Valley development has had a significant effect on the diversity and resilience of riparian areas. Fire exclusion has had the most profound effect on the distribution of age classes and vegetation structure in the headwaters. The result for both valley and headwaters for the Illinois River has been a simplification of ecological systems, leading to a loss of ecosystem function and diversity. The East Fork Illinois generally reflects these trends with some local exceptions. The Longwood Fire provides an excellent example of how fire exclusion and management activities can affect the intensity, pattern, and duration of wildfires (see Fire section). Local exceptions include the loss of late-successional forest in some sub-basins that have been heavily logged (see Terrestrial Module).

In healthy watersheds, mature and old-growth trees in intermittent and perennial riparian areas provide for future large wood recruitment. Future large wood recruitment depends heavily on riparian conditions in the headwater/valley segments and on delivery/transport mechanisms. Within The East Fork Illinois watershed, future LWM recruitment varies by sub-basin depending on proportion of mature to old-growth trees within riparian areas and inherent geology (Table A-5 and Table A-6). Potential future large wood recruitment according to PMR (Pacific Meridian Resources) data (1988) is high in Page Creek, Little Elder Creek, and the upper East Fork Illinois River. The lowest potential recruitment is in Cedar Gulch, Bybee Gulch, and Sanger Canyon. However, future large wood recruitment is heavily dictated by the inherent geology and soil productivity of riparian areas. Areas of serpentine geology often have sparse or stunted vegetation in the riparian area, and due to POC root disease mortality, often lack large conifers for either shade or large wood recruitment (see Geology section). Debris flows are a main source of large wood delivery to streams.

Most of the watershed possesses highly diverse vegetative characteristics, with large Douglas-fir being the dominant species. However, Port-Orford cedar is the dominant species in Sanger Canyon, and in the upper reaches of Dunn Creek. Bigleaf maple, Port-Orford cedar, red alder, vine maple, willow, tan-oak, and canyon live-oak are represented throughout the watershed (USDA 1992, 1993, 1994). Red alder and canyon live-oak dominated the floodplain vegetation in the sapling/pole condition (>10 ft tall, <8 inch dbh). Douglas-fir ranging from 8 to 32" dbh was the dominant species in the outer riparian zone.

Although proportions may not differ in overall riparian vegetation seral stage, vegetation composition may be different in intermittent corridors (see Terrestrial Module). On BLM owned land, 17% (873 acres) is mid-seral stage and 6% (327 acres) is early seral stage.

Table A-5a: Forest Service Acres and % of Riparian Vegetation Seral Stages for All Streams in Tributary Watersheds within the East Fork Illinois River Watershed (PMR data 1988).

Riparian Reserve Seral Stage	Little Elder Creek	Elder Creek	Scotch Gulch	Page Creek	Cedar Gulch	Long Gulch	Dunn Creek	Bybee Gulch	Chicago Creek	Sanger Canyon	Upper EF Illinois
Water/Rock/ Grass/Shrub	11 2%	72 6%	24 8%	13 1%	30 12%		474 9%	4 5%	63 14%	53 17%	179 12%
Seed/sap/pole	135 24%	461 36%	91 30%	232 23%	161 64%		2,271 41%	72 83%	183 42%	141 46%	405 27%
Young (9-21" dbh)	115 20%	188 15%	63 21%	149 15%	40 16%		518 9%	0	37 8%	30 10%	140 9%
Mature (21-32" dbh)	159 28%	290 22%	83 27%	280 28%	16 6%		1,435 26%	6 7%	109 25%	51 17%	458 30%
Old Growth (>32" dbh)	146 26%	283 22%	45 15%	327 33%	3 1%		905 16%	5 6%	46 11%	32 10%	342 22%
TOTAL	566 100%	1,294 100%	306 100%	1,001 100%	250 100%		5,603 100%	87 100%	438 100%	307 100%	1,524 100%

*Data gap Long Gulch; Total may not be the same as with Terrestrial Module information.

Table A-5b: BLM Acres and % of Riparian Vegetation Seral Stages for All Streams in Drainage Analysis Areas within the East Fork Illinois River Watershed.

Riparian Reserve Seral Stage	Kelly Creek	Tycer Creek	Chapman Creek	EF below Chapman	Lower EF Illinois	Little Elder Creek	Elder Creek	Khoeery Creek	Allen Gulch	Scotch Gulch	Cedar Gulch	EF below Dunn/ above Scotch
Serpentine	0	29 23%	1 <1%	0	7 10%	14 22%	0	40 48%	0	47 50%	0	0
Non-vegetated	0	0	0	3 11%	45 67%	0	0	0	14 14%	0	0	0
Early Seed/sap/pole (0-11” dbh)	7 10%	22 17%	36 14%	0	0	14 22%	0	0	5 6%	0	0	0
Mid seral (11-21” dbh)	25 37%	43 33%	2 <1%	0	0	0	0	0	39 41%	47 50%	6 100%	3 100%
Mature (>21” dbh)	36 53%	134 27%	216 85%	28 89%	15 22%	34 56%	0	43 52%	37 39%	0	0	0
TOTAL	67	228	255	31	67	62	0	83	95	94	6	3

*Data gap in Lower EF Illinois and Long Gulch; Total may not be the same as with Terrestrial Module information.

Table A-6: Acres and % of Riparian Vegetation Seral Stages for **Intermittent** (Class IV) Stream Tributaries to the East Fork Illinois River Watershed (PMR data 1988).

Riparian Reserve Seral Stage	Little Elder Creek	Elder Creek	Scotch Gulch	Page Creek	Cedar Gulch	Long Gulch	Dunn Creek	Bybee Gulch	Chicago Creek	Sanger Canyon	Upper EF Illinois	TOTAL
Water/Rock/ Grass/Shrub	3 1%	27 5%	14 19%	7 1%	2 5%		224 10%	0	28 13%	37 22%	117 18%	459 10%
Seed/sap/pole	53 22%	207 38%	25 33%	135 26%	32 74%		943 41%	17 81%	89 42%	71 43%	220 33%	1,792 37%
Young (9-21" dbh)	66 27%	95 18%	20 26%	80 16%	6 14%		235 10%	0	19 9%	17 10%	38 6%	576 12%
Mature (21-32" dbh)	73 30%	105 19%	13 17%	130 25%	3 7%		554 24%	3 14%	56 27%	22 13%	166 25%	1,125 24%
Old Growth (>32" dbh)	50 20%	110 20%	4 5%	168 32%	0		342 15%	1 5%	19 9%	19 12%	120 18%	833 17%
TOTAL	245 100%	544 100%	76 100%	520 100%	43 100%		2,298 100%	21 100%	211 100%	166 100%	661 100%	4,785 100%

*Data gap in Lower EF Illinois and Long Gulch.

Willow communities in Dunn Creek provide a significant contribution in bank stability and inner channel complexity. Willow presently growing within the active stream channel is currently the most valuable addition to aquatic habitat complexity and is increasing the diversity of channel morphology. Sediment deposition in these areas stabilizes the vegetative community, which will soon be supplemented by alder regeneration. This process is narrowing the active stream channel which provides diversion of the thalweg and the scouring that will create the complexity and pool depth currently limiting the rearing potential of the stream.

Existing mid to late-successional seral stage riparian vegetation coupled with steep topography results in a high shade factor for parts of the watershed (see Hydrology section). Average canopy cover for areas surveyed can be seen in Appendix 2.

In the early 1990s the Longwood fire burned over 10,000 acres, mostly within the East Fork Illinois River watershed. The riparian areas did not burn as intensely as the upslope areas, but many trees and shrubs were killed along streams (RVCOG 1997a). The 1964 flood triggered landslides, denuded riparian vegetation, and scoured stream banks throughout the watershed. Effects of the storm are still evident. During the 1994-95 season heavy winter rains brought substantial flooding and damage in the Dunn Creek drainage.

The habitat elements listed in Table A-7 are requirements for all life stages of coho. All opportunities for maintaining and improving freshwater productivity of anadromous salmonids should be identified so that individual and grouped land management actions (and other human activities) may be modified accordingly in order to prevent potential mechanisms that affect survival.

Table A-7: Summary of Environmental Factors and Potential Mechanisms of Mortality Affecting Freshwater Habitat Capacity and Related Density-independent Survival (By Life Stage) of Coho Salmon

Life Stage	Factors affecting population productivity	Potential mechanisms affecting survival
Egg to emergent fry	Substrate stability, amount of fine sediment in spawning gravels, spawning gravel permeability, water temperature, peak flows	High flow events cause loss of eggs due to streambed scour and shifting; reduced flow and DO levels to eggs due to high sedimentation cause increased mortality; high fine sediment levels cause entombment of fry; increased temperatures advance emergence timing, thereby affecting survival in next life stage; anchor ice reduces water exchange in redd causing low DO levels and/or eggs to freeze.
Emergent fry to September parr	Flow dynamics during emergence period, stream gradient, number of sites suitable for fry colonization, predators, temperature[1], nutrient loading[1]	Loss of emergent fry occurs due to being displaced downstream by high flows; advanced emergence timing causes fry to encounter higher flows; high gradient and lack of suitable colonization sites for emergent fry cause fry to move downstream increasing risk of predation; stranding and excessive temperature promote disease and cause mortality; temperature and nutrient changes affect growth thereby affecting other causes of density-independent loss.
September parr to smolt	Fall and winter flows, number of accessible winter refuge sites, temperature, predators	Displacement during high flows; stranding and death due to dewatering; loss of predators; loss due to poor health associated with winter conditions.1

1 Effects likely have both density-independent and dependent components. (adapted from NMFS 1997)

H. In-Stream Restoration and Enhancement Opportunities

In-stream enhancement activities on both the East Fork Illinois River and Dunn Creek occurred in the late 1980's. Wood structures were placed in the vicinity of the confluence of Dunn Creek to the East Fork Illinois River. The majority of structures placed on the East Fork Illinois did not hold in place and were washed down river. Most structures on Dunn Creek placed well up-stream from the confluence with the East Fork Illinois held in place, although those adjacent to the confluence were flushed out or placed up on the banks.

Structures further up-stream on Dunn Creek past the NF Dunn Creek confluence have held in place and been maintained and/or modified up to the present date. As recently as 1998, these structures under went maintenance by the Forest Service, California Department of Fish and Game, California Conservation Corps, and Americorps. Out planting of conifer seedlings within the Riparian Reserve immediately adjacent to this in-stream improvement site occurred in the winter of 1999 by the same partnership. During the spawning season, coho redds and carcasses are always found within this improved area. There is a concern that juvenile coho may have difficulty migrating over the “v-notch” structures during low flows.

The stream crossing on NF Dunn Creek was identified as a barrier to juvenile salmonids in 1993 (Bio-Surveys 1993). The replacement of this crossing with a bottomless arch occurred in 1995. Other in-stream opportunities identified by Bio-Surveys for Dunn Creek included the introduction of a mixed stand of conifers along the riparian corridor. Planting occurred within this corridor in both 1995 and again in 1998. Bio-Surveys also recommended the development of off-channel rearing habitat in the lower reach of Dunn Creek and some modification of existing structures to increase rearing habitat.

A.G. Crook (1994) surveyed the East Fork Illinois River and recommended installing new structures and/or maintenance of old ones for temporary watershed improvements. Reaches one and two were considered the best opportunity for improvements. A.G. Crook also identified that "all reaches of the stream would benefit from restoration of Douglas-fir to the riparian zone." The 1992 (USFS) survey of Elder Creek did not produce any recommendations for in-stream enhancement projects.

Since the first iteration of the East Fork Illinois watershed analysis in 1995, several other categories of watershed restoration activities have been initiated within the watershed. These other categories include, but are not limited to, various road treatments and management of both terrestrial and riparian vegetation.

I. Fisheries Recommendations

Watershed restoration efforts help restore/improve ecosystem function and meet ACS objectives and benefit fish and other aquatic biota both directly and indirectly. For example, by improving water temperature in the lower valleys, fish are expending less energy and are able to rear in available habitat. Fish benefit directly from in-stream enhancement measures such as placement of large woody debris. Most of the large wood currently providing cover and habitat in Dunn Creek is in constructed in-stream structures.

The following are recommendations based on the data available for this watershed.

- For habitat management strategies, continue to implement watershed strategies set forth in the 1995 East Fork Illinois Watershed Analysis Version 1.0 including the following:

  1. Road decommissioning (especially valley bottom roads in Allen Gulch, Long Gulch, Elder Creek, and Dunn Creek), including the removal of stream culverts, to facilitate delivery of large wood downstream.
  2. Develop an up-to-date inventory of existing roads on BLM, Forest Service, and private lands (i.e., mining roads, potential road barriers) for the entire watershed, then develop TMO recommendations for BLM and Forest Service roads.
  3. Storm-proof or remove culverts where fish passage is a problem and/or water course is compromised (e.g., Allen Gulch, Elder Creek).
  4. Where appropriate, in stream placement of large wood (must be $\geq$24" dbh and 50 ft long or twice the bankfull width) to raise towards benchmark levels, including on-site placement of whole Port-Orford Cedar trees that are removed for *Phytophthora lateralis* control.
  5. Protect tributaries to the East Fork Illinois River and Dunn Creek dominated by Port-Orford cedar from root disease (source of LWM mainly from Port-Orford cedar)
  6. Stream-side channel creation (only in low gradient areas where there have been previous side channels)
  7. Water Conservation and irrigation system improvement (help private landowners to implement conservation measures by assisting in project proposals, grant writing, etc to replace/improve water withdrawal methods *(i.e.,* 3 gravel push-up dams on The East Fork Illinois located in T40S, R8W, Sec 34, 27, and 2).
  8. Riparian Silviculture in areas where site-specific analysis verifies there is the need. Silvicultural activities could be used to increase LWM in aquatic system.
  9. Determine the distribution of the eastern brook trout and other non-native fish species in the watershed. These fish can be important competitors against resident and anadromous juvenile salmonids. Any fish stocking in headwater lakes should be evaluated with regard to the potential hazard to native species.

- Establish long-term monitoring strategies which include the following:

  1. Conduct Level II stream surveys above existing survey areas
  2. Conduct ODFW physical habitat stream surveys in tributaries to the lower East Fork Illinois.
  3. Work with ODFW and CDFW for fish presence above confluence of Chicago Creek and in Dunn Creek watershed (Brook trout presence and extent).
  4. Identify and map extent of exotic species within the entire basin.
  5. Monitor tributaries to the East Fork Illinois River and Dunn Creek for habitat condition.
  6. Establish permanent photo points for riparian plantings, possible silviculture activities, and prescribed fire.
  7. Evaluate habitat capacity of lentic water bodies within the East Fork Illinois watershed (springs, ponds).

8. Interpret future macro-invertebrate data to relate with watershed analysis findings.
9. Gather quantitative information on riparian canopy cover and shade values by using established field methods, such as the solar path-finder and moose-horn (stream surveys and GIS are subjective).
10. Inventory all permanent natural anadromous barriers to assess the extent of critical habitat for coho and other anadromous fish (see Fisheries section for definition of natural anadromous barrier).

- Develop appropriate in-stream enhancement projects such as the following:

  1. Use salmon carcasses for providing nutrients to stream ecosystems where appropriate.
  2. Maintain and enhance existing fisheries habitat enhancement structures on Dunn Creek (notch "v" structures so that juvenile migration is not compromised during low flows). Consider juvenile fish passage during low flows in designing future in-stream projects.
  3. Develop new fisheries habitat enhancement structures on lower Dunn Creek (near confluence).
  4. Improve existing side-channels on Dunn Creek.
  5. Work with private landowners and ODFW to improve side channels and existing habitat.
  6. Add to Fisheries enhancement structures previously placed on the East Fork Illinois.

- Limit adverse effects of prescribed fire and/or wildfire on fisheries resources.

- Continue to implement the Oregon Coastal Salmon Recovery Initiative (1997a, & 1997b) as it proposes to help recover habitat for salmon within the state of Oregon. The plans are identified as:

  Phase 1: *A Plan to stabilize the native Coho population from further Decline*
  Phase 1: *A Plan to stabilize the native Steelhead Population in Southwest Oregon*

- Continue ongoing Endangered Species Act Effects Consultation Process with NMFS to: Implement Aquatic Conservation Strategy, Further mitigate any actions deemed "Likely to Adversely Affect" Listed Species, Develop "Not Likely to Adversely Affect" Action Alternatives

J. Data Gaps

The following have been identified as data gaps:

- Condition and function of lentic water bodies within the entire watershed.
- Comprehensive identification of fish distribution.
- Total perennial and intermittent stream miles and acres outside of National Forest lands.
- Comprehensive road densities for the watershed at the HUC 7 level.
- LWM frequency for streams other than what has been surveyed.

- Pool quality and frequency for streams other than what has been surveyed.
- Quantitative information on canopy cover for streams other than what has been surveyed and compiled from PMR data.
- Harvest acres in riparian areas outside of National Forest lands.
- Percent of open land in transient snow zone of each drainage.
- Temperature and turbidity data outside of National Forest lands.
- Comprehensive analysis of roads and harvest within the transient snow zone.
- Shade value data outside of National Forest lands.

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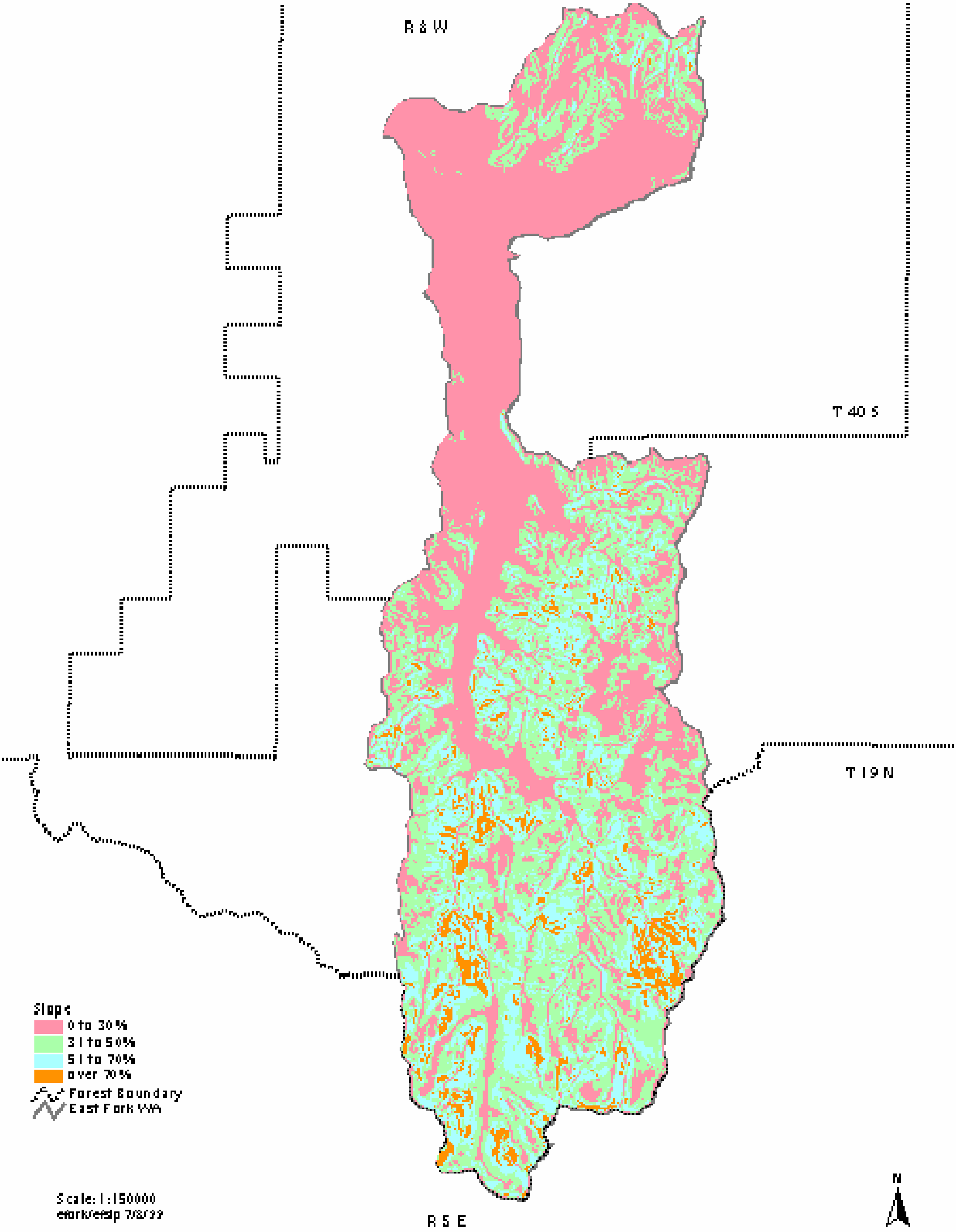
APPENDIX A: In-stream Habitat Comparison for Dunn Creek, Elder Creek, and the East Fork Illinois River.

Habitat Elements	Stream Name and Reach No.												
	Dunn Creek (USDA 1993)						East Fork Illinois (USDA 1994)					Elder Creek (USDA 1992)	
	1	2	3	4	NF Dunn	Poker Creek	1	2	3	4	5	1	2
Reach Gradient (%)	3	3	12	8	8	8	2	2	2	4	4	12	20
Reach length (mi)	1.84	1.78	2.31	1.04	0.54	1.05	1.3	1.43	0.9	1.1	0.7	0.44	0.13
Bankfull Width (ft)	23.8	23.1	18.2	13.7	13	13.9	38.7	31.4	35.2	34.7	32.7	7.5	63
Expected Pools/mile ** (based on 3 - 9 channel widths)	24 to 73	25 to 76	32 to 97	42 to 126	45 to 135	42 to 126	15 to 45	18 to 56	16 to 50	17 to 50	18 to 53	78 to 234	93 to 279
Observed Pools/mile	11.4	17.4	23.7	25	41.7	19.2	13	10	36.7	36.4	36	130	0
*Width/Depth	19.6	19.4	15.4	10.4	13.0	16.8	34.0	13.1	14.3	14.5	18.9	17.3	18.0
Large Wood Pieces / mile (>24" dbh, 50 ft length or 2X bankfull width) (>25/mi = Good <10/mi = Poor)	9	20	13	21	44	39	0.8	5.4	16	12	14	103	441
Canopy Cover (%)	20-30	30-60	20-30	20-30	90	90	20-30	20-30	20-30	20-30	20-30	20-30	20-30

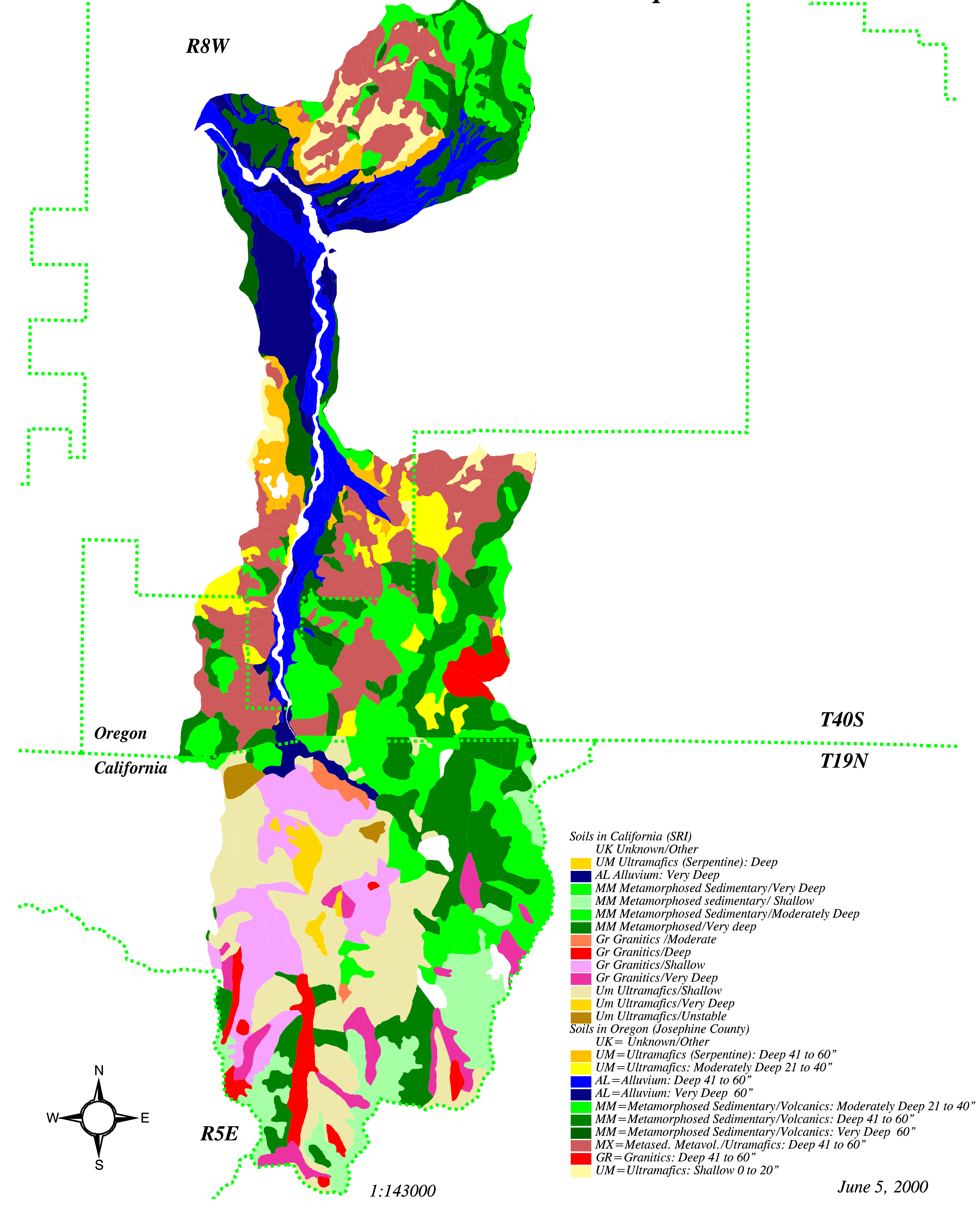
* In general, W/D ratios in excess of 12 for Rosgen A, E, and G channel types, and in excess of 30 for B, C, and F channel types are red flags that require further investigation.

** Range based on stream type, channel morphology, gradient.

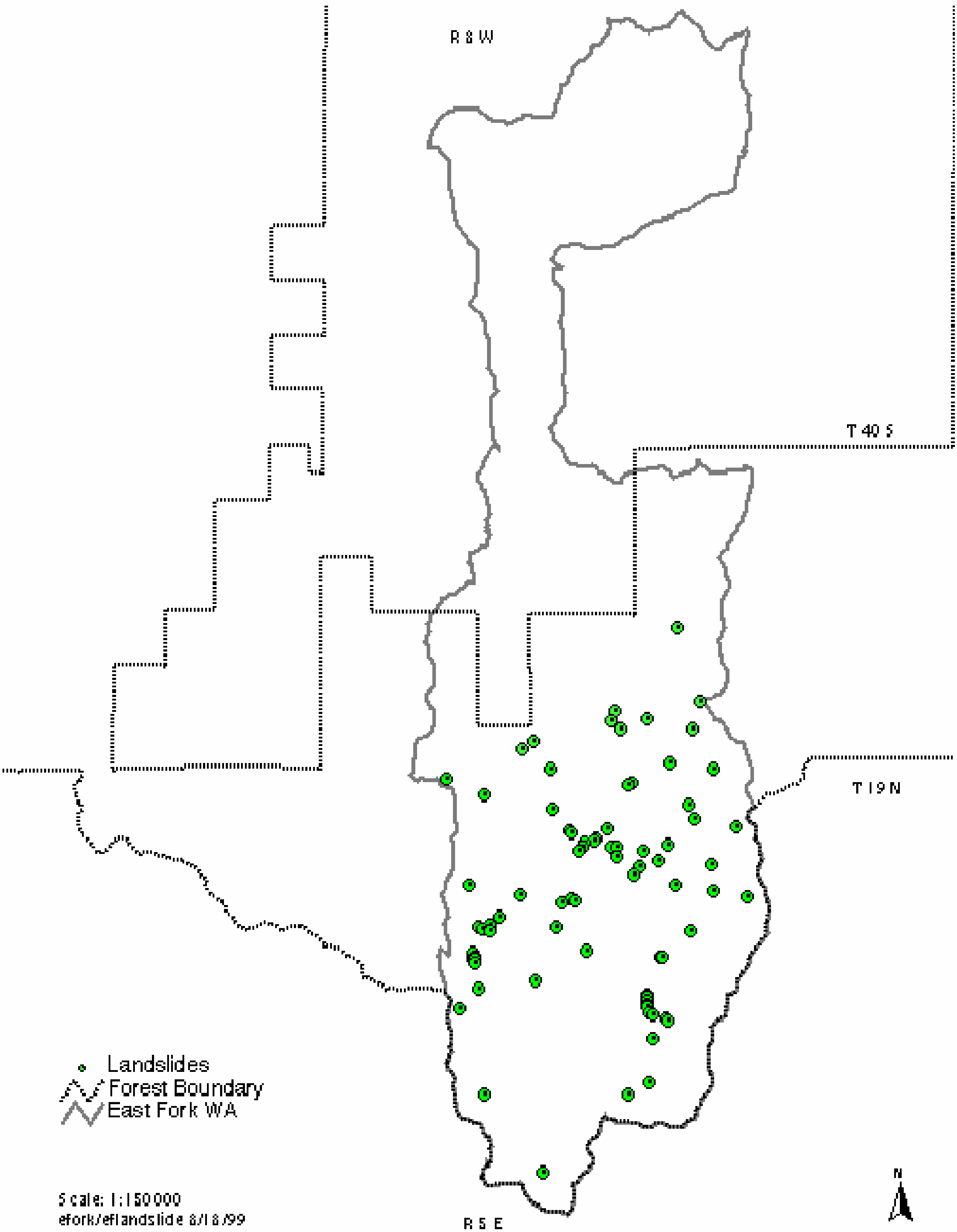
East Fork Watershed Analysis
Percent Slope

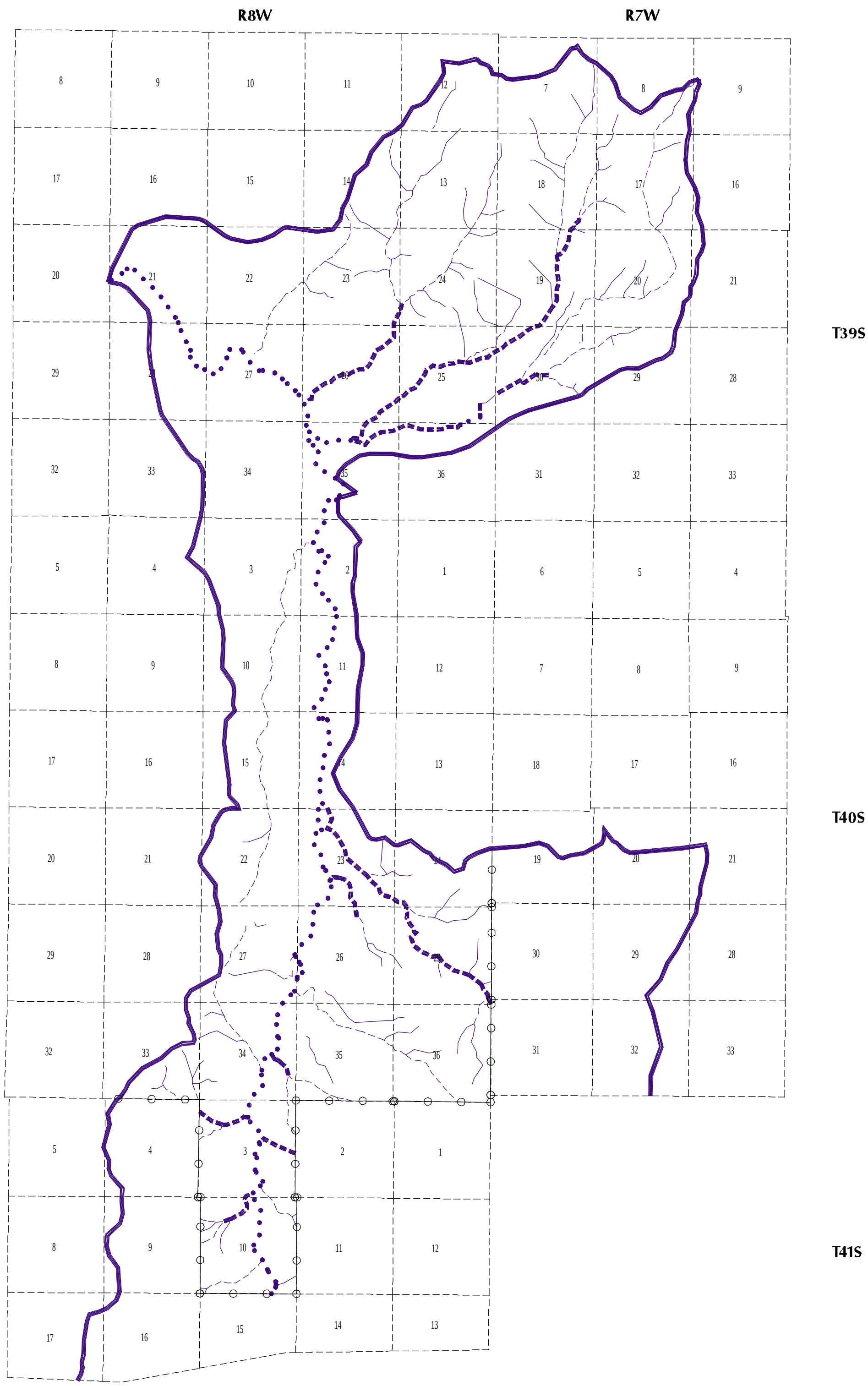


East Fork Illinois Watershed
Parent Material and Soil Depth



East Fork Watershed Analysis
Landslides





SCALE 1:110000

STREAM ORDERS (> 1)
OUTSIDE THE USFS BOUNDARY
IN THE EAST ILLINOIS WATERSHED

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

LEGEND

Symbol	Meaning
thin solid line	ORDER 2
thin dashed line	ORDER 3
heavy dashed line	ORDER 4
dotted line	ORDER 5 to 7
heavy double line	WATERSHED BOUNDARY
line with circles	USFS BOUNDARY

August 1999

John McGlothlin

N

East Fork Watershed Analysis
Perennial Streams and Fish Distribution