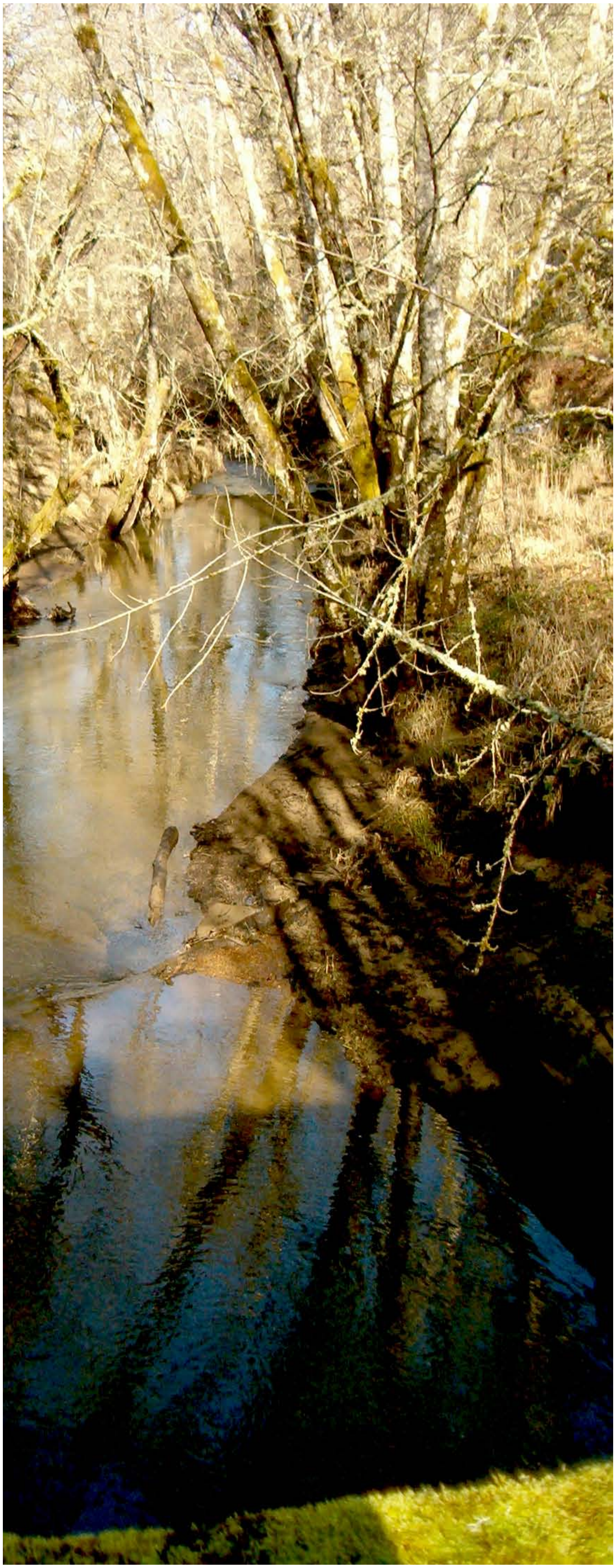
East Fork Nehalem Watershed Assessment

The East Fork Nehalem Watershed Assessment

Prepared by Demeter Design for the Upper Nehalem Watershed Council, 2008

We would like to extend special thanks to the Bureau of Land Management, the Oregon Department of Fish and Wildlife, the Upper Nehalem Watershed Council, Oregon State University, Portland State University, the Natural Resource Heritage Center, the Confederated Tribes of the Grand Ronde, the Wild Salmon Center, the Bureau of Land Management, Boswell Consultants, the Oregon Department of Fish and Wildlife, Bio-Surveys LLC, the Wild Salmon Center, Columbia County, and the Oregon Department of Environmental Quality for providing technical and financial support of this project. Finally, thank you to the staff and volunteers of the Upper Nehalem Watershed Council for providing endless hours and extensive data without which this report would not have been possible.

Copies of this report can be obtained for a nominal fee by contacting Demeter Design or by contacting the Coordinator at the Upper Nehalem Watershed Council.



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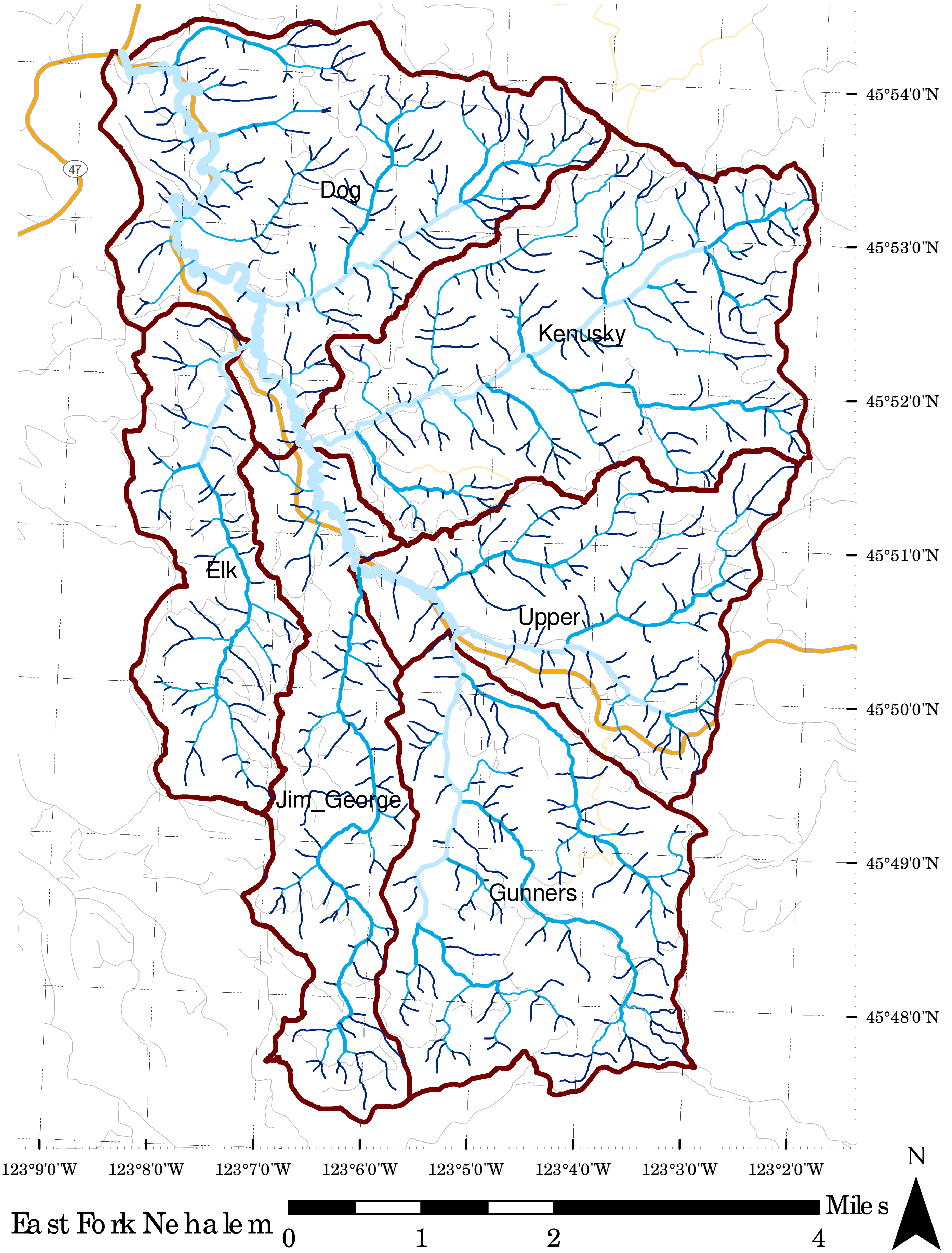

Map 1a - Overview

Summary

The East Fork Nehalem (EFN) is a 6th field sub-watershed (HUC-6 # 171002020109) containing six 7th fields: Dog, Kenusky, Upper EFN, Gunners Fork, Jim George, and Elk Creek catchments. The EFN lies within the larger Nehalem River 4th field sub-basin or cataloguing unit (HUC# 17100202) which contains three 5th field watersheds; the Upper, Middle, & Lower Nehalem.[1] Predominantly managed for timber, the Nehalem region has experienced significant disturbance over the past century. Past and present land-use practices impact habitat quality and quantity within both the EFN itself and the larger Nehalem River sub-basin. The EFN experienced more logging before 1992 while other 6th fields within the Nehalem have had more recent logging. Aquatic habitat within the EFN is degraded relative to Oregon Department of Fish and Wildlife (ODFW) derived habitat benchmarks and Environmental Protection Agency (EPA) reference conditions. Upland vegetation is dominated by second and third growth timber with minimal habitat available to old-growth dependent species. Water quality is limited by increased summer temperatures and likely impaired by excess fine sediments. Large woody debris (LWD) recruitment potential is low in most 7th field catchments within the EFN as are key LWD pieces. No area within the EFN remains untouched by humans of European decent. Few areas have been undisturbed since the beginning of the twentieth century. Almost no old-growth dependent species remain in the area as very few areas have not been harvested or burned over the past 150 years. Although flood gages do not occur within the watershed, it is possible that these land-use practices within the watershed have impacted peak flows as stream channels, especially the EFN mainstem, are often disconnected from their floodplains. Fish use within the basin is lower than estimates of historical usage and ODFW fish biologists have determined that the EFN ranks among the lowest basins on the Oregon coast in terms of those that can support salmonid life. This is in large part a result of the many anthropogenic disturbances that have occurred within the watershed over the last century in addition to those impacts that occur outside of the watershed such as take or climate change.

Background

This assessment was conducted by the Upper Nehalem Watershed Council (UNWC) to update and expand the previous EFN Watershed Analysis completed by the Bureau of Land Management (BLM) in 1996. In addition to answering the specific questions outlined in the Oregon Watershed Enhancement Board's (OWEB) Watershed Assessment Manual, the UNWC and the BLM initiated this assessment to understand what needed to be done to improve fish habitat, to answer questions raised in the initial Watershed Analysis, if possible to answer questions raised in the larger Nehalem River Watershed Assessment, and to provide a resource for those working and interested in the EFN. Data was compiled from a variety of sources, field observations from UNWC staff, ODFW surveyors, and independent contractors; Geographic Information Systems (GIS) data was used to answer critical questions raised by the OWEB Watershed Assessment Manual; and finally a team of natural resource professionals was consulted to determine the validity of the analytical conclusions drawn. The initial meeting of interested members concluded that the following issues were key priorities: salmonid populations and habitat, the impact of land-use practices on aquatic habitat, barriers to passage, and road conditions and impacts.

1 http://www.nrcs.usda.gov/programs/rwa/Watershed_HU_HUC_WatershedApproach_defined_6-18-07.pdf

Watershed Overview

The EFN watershed is a sub-watershed within the Nehalem River sub-basin and is located in Columbia County in the northern portion of the Oregon Coast Ecoregion III. More specifically, the EFN falls within the Willapa Hills level IV Ecoregion and is considered part of the North Pacific Maritime Mesic-Wet Douglas-fir-Western Hemlock Forest.[1] The EFN mainstem is roughly nine miles long and has a tributary system of approximately 200 miles within the 32 square mile (20611 acres) watershed (refer to Map 1a on page 13). For the purpose of this assessment, the 7th field catchment delineation, based on the Coastal Landscape Analysis and Modeling Study (CLAMS) delineated 7th fields, was used to divide the watershed into six catchments: Jim George, Elk, Dog, Kenusky, Upper EFN, and Gunners Fork. Watershed elevations range from 586' at the mouth of the mainstem to 2,265' at the peak of Long Mountain. Average minimum air temperatures range from 29°F in the valley bottoms to 31°F on the hill-slopes while average maximum temperatures are more variable and range from 73°F to 77°F. Average annual air temperatures range between 47°F and 49°F. The EFN watershed typically receives between 49" of rain in the lower watershed and 77" on the ridge-tops. Rainfall is lowest in July when the area receives approximately .75" of rain. During December, the watershed receives around 7" of rain near the mouth of the mainstem and 14" of rain in the highest elevations.[2] Peak stream flows occur in December.[3] The geology within the EFN watershed is dominated by erodible marine sedimentary and tuffaceous rocks (~80%) with resistant Columbia River basalts (~20%) becoming more common above 1400'.[4] Soils within the watershed are characterized as silty-loams with the majority being prone to erosion. The Soil Survey of Columbia County details seventeen different soil series within the region.[5]

Historically, a variety of habitat types existed within the region including riverine wetlands, oak savannas, and coniferous forests. While oak savannas were more common along the mainstem upstream of the confluence with the EFN, this habitat type was not present within the EFN basin. Coast Douglas-fir (Pseudotsuga menziesii spp. menziesii) was historically the dominant vegetation within the EFN.[6] Presently the most common land-use is forestry.[7] The forests are dominated by western hemlock (Tsuga heterophylla) and Douglas-fir of uniform age with local stands of older Douglas-fir, western red cedar (Thuja plicata), and less commonly, noble fir (Abies procera). Riparian areas and unstable moist hill-slopes often are comprised of red alder (Alnus rubra) and Oregon (or Bigleaf) maple (Acer macrophyllum). The forest under story is dominated by vine maple (Acer circinatum), salal (Gaultheria shallon), sword fern (Polystichum munitum), and dull Oregon grape (Mahonia nervosa), with salmonberry (Rubus spectabilis), Indian-plum (Oemleria cerasiformis), and devil's club (Oplopanax horridus) present as common riparian associates.[8] The EFN is home to 16 private residences which account for 234 acres within the watershed. Most of these residences are located on terraces adjacent to the mainstem EFN within the Dog Creek 7th field.[9]

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1 Ecological System Comprehensive Report, Unique Identifier: CES204.002 International Terrestrial Ecological Systems Classification.
2 http://www.ncdc.noaa.gov/oa/ncdc.html
3 Timing of Annual Peak Flows Oregon Coast Coho Salmon ESU Map - NOAA Fisheries Map - 2004
4 USGS - http://nwdata.geol.pdx.edu/OR-Geology/. Interactive Database
5 Columbia County Soil Survey - http://soildatamart.nrcs.usda.gov/Manuscripts/OR009/0/or009_text.pdf
6 CLAMS Historical Vegetation GIS Data.
7 CLAMS Historical Vegetation GIS Data, BLM timber surveys
8 Aquatic Inventory Data (AQI data), Plants of the Pacific Northwest Coast. Pojar & Mackinnon. Lone Pine Press, 1994
9 Columbia County Tax GIS Data

Recreational activities within the watershed include hunting, fishing, and off-highway vehicle (OHV) use.[1] There is evidence of exotic fish having been stocked in at least one of Gunners Lakes as well as in Floaters Pond for recreational fishing.[2]

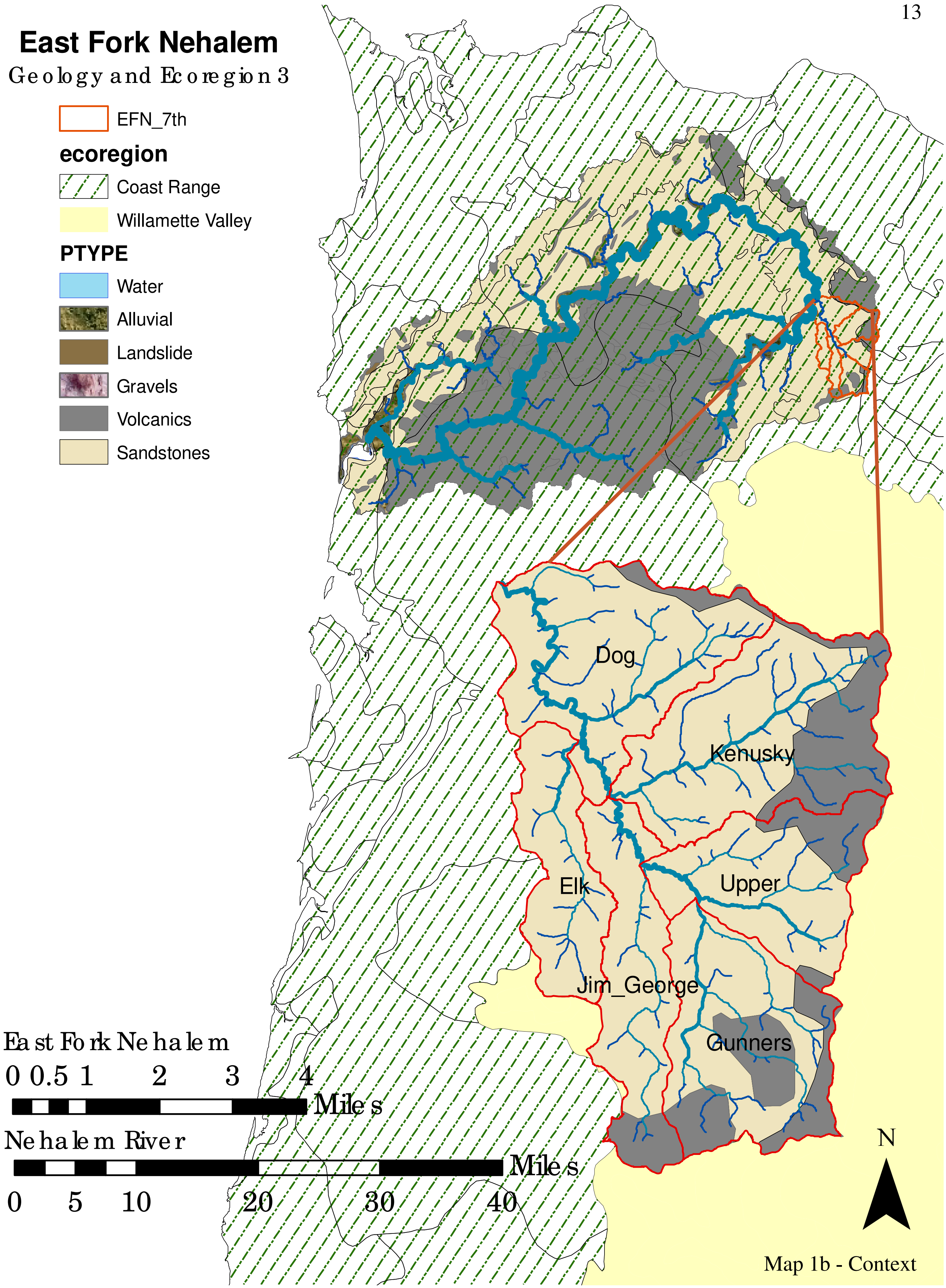
Historically, the EFN provides rearing and spawning habitat for winter steelhead, fall chinook, coho salmon, and cutthroat trout. [3] A Rapid Bio Assessment (RBA) was conducted during the summer of 2008. This summer snorkel survey found that while emergent coho fry were present in the mainstem, several culverts blocked access to spawning habitat limiting production of coho in some tributaries. Additionally, the EFN 6th field is not seeded to capacity. Steelhead were present but in very low abundance. Fall chinook were not observed. Please refer to the RBA report scheduled for publication in 2009 available through Bio-Surveys LLC or through the UNWC. Further the RBA found that the mainstem contained almost no spawning materials and was a silt/bedrock dominated system. This is consistent with previous Aquatic Inventory (AQI) survey data collected throughout the watershed. Bedded sediment levels have not been directly quantified within the watershed although turbidity data has been collected and ocular estimates of streambed sediments have been made. Both survey methods indicate that sedimentation is a serious concern in the watershed.

Temperature may be limiting summer rearing potential. Seven day maximum average temperatures were collected at the mouth and ~2 km upstream on the mainstem on the EFN. During this time sub-lethal temperatures of 66.3° F and 65.4° F were reached for both sites from the mouth to the second site upstream respectively. While these temperatures are not immediately lethal they do decrease survival rates over a period of weeks to months. Despite these elevated temperatures Forward Looking Infrared Radiography (FLIR) data suggests that the EFN is a cold water source for the larger Nehalem River. A temperature Total Maximum Daily Load (TMDL) has been developed for Oregon's North Coast which applies to the EFN.[4] Climax vegetation is used as a surrogate for direct solar input . Refer to chapter 5 for an evaluation and discussion of riparian conditions within the EFN.

Participants in Issue Identification

Upper Nehalem Watershed Council, Bureau of Land Management, Oregon Department of Fish and Wildlife, Oregon State University, Historical Societies and Museums, Private Citizens, Consultants, Confederated Tribes of the Grand Ronde, Private Timber Representatives, and the Oregon Department of Environmental Quality.

1 East Fork Nehalem Watershed Analysis. BLM. 1996
2 Personal Communication ODFW
3 Electrofishing Data provided by the Oregon Department of Fish and Wildlife, United States Forest Service.
4 http://www.deq.state.or.us/wq/assessment/assessment.htm



Map 1b - Context

Focus Issues

Focus issues were identified using the concerns raised in the initial stakeholder meeting. The most pertinent natural resource issues within the watershed are: Aquatic and Riparian Habitat Degradation and Loss; Upland Habitat Degradation and Loss; Urban and Rural Impacts; Land Management Impacts; and Federal and State Laws. A brief discussion of these issues is included below.

Aquatic and Riparian Habitat Degradation and Loss

Sedimentation – Excess fine sediments in the stream can lead to degraded fish spawning habitat and impair migration. When excess fine sediments settle they can fill the interstitial space in spawning gravels suffocating developing eggs. Turbidity can reduce the ability of migrating salmonids to sense their way to natal streams. Bedded sediments have many sources. Sediment levels can vary greatly within minimally disturbed watersheds. Similarly, sediments suspended within the water column also vary by location and time of year. By comparing reference values (from minimally disturbed watersheds) to the sediment values within a watershed, the extent of impairment can be determined. Turbidity was measured throughout the Nehalem Watershed over the course of a decade. These scores are reported in Chapter 6 along with potential sediment sources and the results of the numerous AQI surveys conducted within the watershed.

Temperature – Increased summer temperatures limit rearing potential and can cause direct mortality of aquatic species. Reduction of riparian shade increases solar radiation and heats the water column. Loss of riparian vegetation in spawning areas can also impact winter temperatures. Coniferous cover not only insulates the streams but conifers also emit long wave radiation actively warming the stream channel. Without this action, streams can reach freezing temperatures which leads to faster egg development and earlier emergence of poorly prepared salmonids which are more likely to be washed downstream in higher winter and spring flows. FLIR data was collected throughout the Nehalem River sub-basin and is reported in chapter 9. Direct temperature monitoring is also reported in Chapter 9 along with shade values collected during AQI surveys.

Stream Barriers – Undersized and improperly placed culverts block or degrade migratory corridors. High velocities in undersized culverts can prevent young salmonids from migrating to off-channel habitat during high flows. Culverts downstream of the EFN can impede fish migration into the EFN. Additionally, road crossings can also prevent LWD and sediments from passing out of headwaters into lower gradient response reaches. Barriers to salmonid passage both into and out of the watershed were evaluated and reported in Chapter 9 as were culverts blocking debris flows.

Habitat Modification – Historical land-use practices within Oregon included the active removal of large wood from streams, splash damming, logging through the riparian area, and the eradication of habitat enhancing beavers. These historical practices, most of which and more having occurred within the EFN, have significantly impacted the quantity and location of rearing and spawning habitat. Additionally, channel widening can increase water temperature as a result of decreased pool volumes and increased surface area. Legacy effects appear to be present throughout the basin and are evaluated in Chapter 2.

Upland Habitat Degradation and Loss

Forest Composition – Forest fragmentation diminishes the quality of existing habitat for old-growth dependent species such as the spotted owl, the marbled murrelet, and the red tree vole. Uniform forests may retain soils and minimize the effects of precipitation on peak flows but do not provide any critical features required by old-growth dependent species. Further, uniform stand age increases the susceptibility of the forest to catastrophic stand replacing fires, diseases, and infestations. Upland forest condition is discussed in Chapter 10.

Invasive Weeds – Both Japanese and giant knotweed (Polygonum cuspidatum and P. sachalinense respectively), Scotch broom (Cytisus scoparius), Himalayan Blackberry (Rubus discolor), and other invasive weeds have been introduced into many regions of the north coast. Relatively remote areas such as the EFN are often the last to experience the impacts of invasive weeds. As human use increases throughout a watershed, invasive weeds become more common although birds, other mammals, water, and wind are also dispersal mechanisms for invasive weed seeds and rhizomes. These weeds degrade riparian habitat, push out native species, and reduce forest complexity. Known invasive weeds are discussed in Chapters 5 and 10.

Rural and Urban Issues

Flooding – The creation of impervious surfaces such as buildings, compacted roads, and paved areas prevents the even percolation of water into the soil. Excess water enters the stream channel as overland flow carrying with it hill-slope and road sediments, pesticides, herbicides, fertilizer, and other chemicals. Additionally, excess water increases peak high flows increasing the impact of downstream flooding in neighboring watersheds. Timber harvests can modify the temporal distribution of peak flows and temporarily increase peak flows directly after harvest. These issues are discussed in Chapter 4.

Potential issues related to land management

Forestry – Issues generated through forestry activities include:soil disturbance which increases turbidity and habitat degradation; reduced LWD recruitment potential; increased overland water flow which alters the timing and magnitude of peak flows; and increased snow pack which also alters hydrology of drainages. These issues are discussed throughout this assessment and in detail in Chapter 4.

Exotic and Hatchery Fish – Hatchery production has increased competition and predation. The introduction of hatchery fish also dilutes the gene pool due to the decreased competition young fish face during the hatchery rearing process. The impacts of hatchery fish on the EFN are discussed in Chapter 9 as is the potential impact of exotic fish stocked in ponds.

Transportation – In addition to directly changing the direction and flow of stream channels, roads can alter sediment and wood inputs, block biotic migratory corridors, and serve as invasive weed dispersal pathways. These impacts are discussed throughout the document and in detail in Chapters 5 and 10.

Recreation – Recreation has direct impacts on the biotic community in many ways such as direct take, introduction of exotic and hatchery stock, reduction of available habitat, or voluntary extirpation due to anthropogenic disturbance in breeding or rearing areas. OHV use, when not properly managed, can increase road density and reduce road quality in many areas which can lead to degraded aquatic habitat. Recreational fishing may result in a decreased fitness of returning spawners due to the stress associated with inadvertent catch. Disturbance at parks and campgrounds along stream corridors can increase the quantity of fine sediments entering the system. These issues are discussed in Chapters 6 and 10 as well as throughout this document.

Aquatic Resource Issues Involving State and Federal Laws

There is one federal water quality listings that directly applies to the EFN. The EFN was placed on the 303(d) list for presumably having temperature and sediment limitations. A temperature TMDL was developed for the North Coast Basin. Additionally, both the mainstem Nehalem River and the EFN were added to the 303(d) database for sediment although there was insufficient data for listing at the time. AQI, turbidity, and observational data for the basin strongly suggests the possibility of sediment impairment.

The EFN contains habitat which historically could support numerous species. Species diversity is not well understood within the EFN as few wildlife surveys have been completed. The BLM has monitored for selected species within the basin (e.g. spotted owl) and a juvenile salmon survey was conducted during the summer of 2008 to estimate abundance and density of coho, Chinook, steelhead, and cutthroat trout throughout the EFN. The Natural Heritage Information Center (NHIC) has created a wildlife presence model that uses historical and current distribution data in conjunction with habitat requirements for a variety of species in order to create an estimated spatial distribution layer for many known species. This data was used to identify species whose range would historically included the EFN and is reported in Chapter 10. Additionally, species whose native range includes the EFN and have been identified for concern or protection under the Federal Endangered Species Act (ESA), the Oregon Threatened and Endangered Species list (T&E), the BLM Special Status Species list (SSS), the ODFW species of concern list, the National Marine Fisheries Service (NMFS) list, and/or the NHIC list are reported in Chapter 10.

Materials, Methods, and Resources

Data was collected, synthesized, reviewed, and analyzed using a variety of resources: AQI, culvert, macroinvertebrate, temperature, and turbidity data was either collected in the field by UNWC volunteers, staff, ODFW employees, or independent subcontractors; land cover, timber harvest data, landslide risk, aerial photography, additional AQI data, and flow data was provided by partners or available on public databases; other data was collected from sources such as the BLM Watershed Analysis, the Nehalem Watershed Assessment, several history books of the Nehalem, and anecdotal evidence, or personal communications.

Data was given a confidence rating of high, moderate, or low quality and a coverage rating of complete, moderate, or minimal. These confidence ratings are consistent with the approach used during the OWEB funded Coastal Limiting Factors Assessment completed in 2007. These ratings are listed in the metadata and can be found in the bibliography in Appendix B. Data was analyzed using a combination of GIS tools and local knowledge. Oregon State University (OSU) researchers, UNWC employees and subcontractors, and management agency employees all contributed to the analysis of the data found within this document. The following chapters include information pertaining to the biology, hydrology, and health of the EFN river watershed. In addition to being integrated throughout the document additional maps and photography can be found in Appendix A.

There are 11 chapters, including the introduction. Chapter 2 describes the known historical conditions of the EFN and documents historical disturbance. Chapter 3 describes the channel habitat types within the watershed. Chapter 4 describes the hydrology and water use within the watershed. Chapter 5 contains an assessment of the riparian and wetland condition within the watershed. Chapter 6 identifies potential sediment sources and assesses the current condition of sedimentation within the EFN. Chapter 7 is a channel modification assessment. Chapter 8 is a water quality assessment. Chapter 9 examines fish use and fish habitat. Chapter 10 evaluates the overall condition of the watershed. Chapter 11 details a monitoring plan based on the assessments and analysis conducted for this document.

Chapters 2-10 are organized into five sections:

• Relevant Critical Questions – This is a list of the critical questions raised in the OWEB Watershed Assessment Manual. Questions that were raised in the manual that did not pertain to the EFN were explicitly omitted in this document.

• Summary Introduction – This is a summary the chapters key findings.

• Materials, Methods, and Resources – This details how and when data analysis techniques deviated from the assessment manual and summarizes the general methods detailed in the OWEB manual.

• Results – This section contains data summary tables, maps, and short summaries of other data used to answer the critical questions.

• Analytical Conclusions – These are conclusions that explain the results of the analysis.

• Key Findings and Recommendations

Chapter 2

Historical Conditions
& Historical Disturbance

Critical Questions

1. What were the characteristics of the EFN at the time of European discovery?
2. Where were historic floodplain, riparian, and wetland areas located?
3. How has anthropogenic disturbance impacted the location of these features?
4. What are the historical land-uses in the EFN?
5. When and where did the historical land-uses within the EFN take place?
6. What are the historical accounts of fish populations and distribution?

Introduction

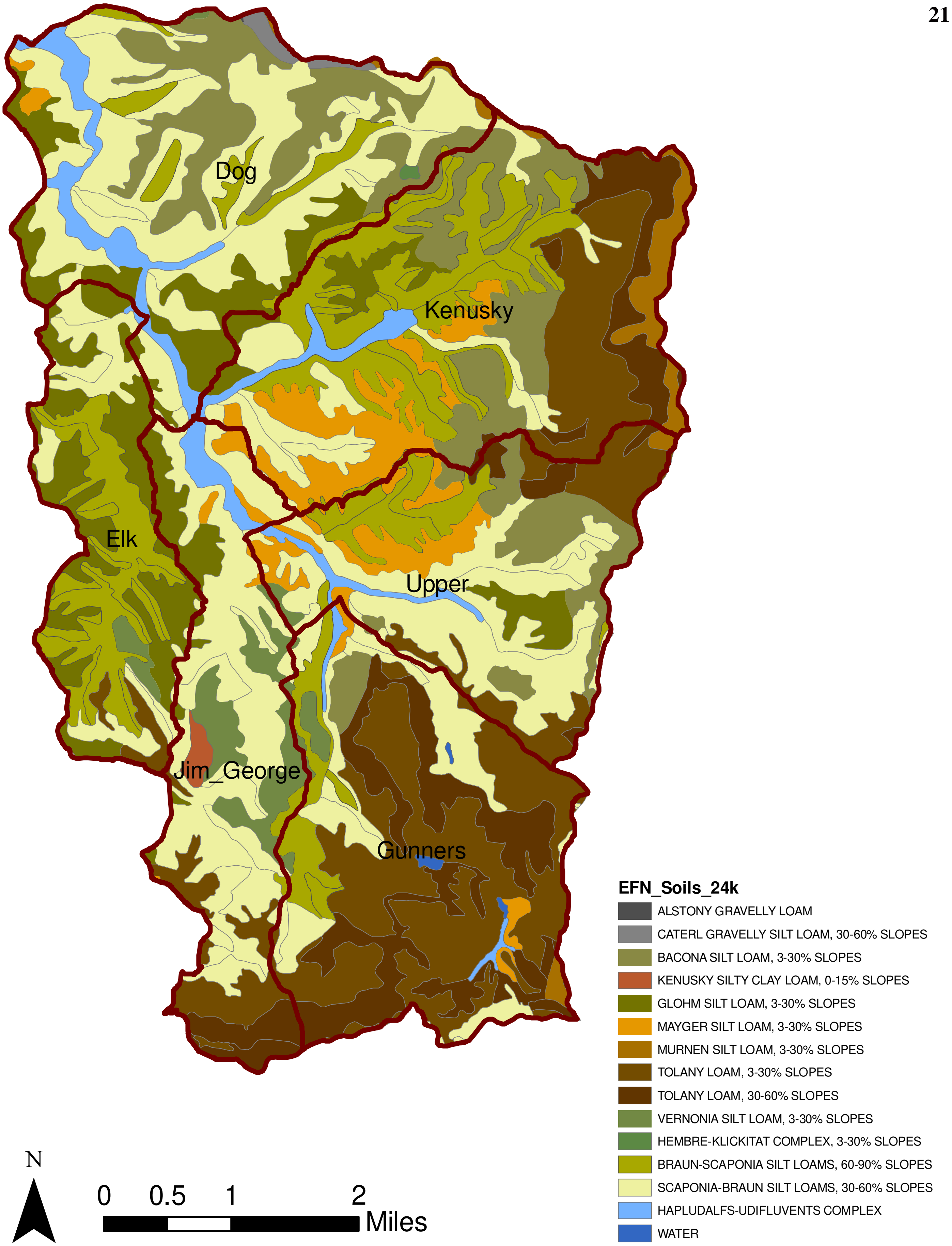
Historical conditions are often difficult to ascertain at a 6th field scale. Narratives and anecdotal evidence generally lack the spatial specificity and accuracy needed to provide quantitative analysis of historical conditions. An alternative to relying on watershed-specific historical data is to use contemporary data from minimally disturbed reference areas with similar physical attributes to the area of interest. Areas that have been minimally disturbed by humans have been sampled extensively by the Oregon Department of Environmental Quality (ODEQ), ODFW, and other groups throughout Oregon, the results of which are stored in numerous databases. Data collected in reference areas is used to develop Ecoregion specific water quality and habitat benchmarks to determine if and by how much disturbance has impacted other areas within the same Ecoregion. Several habitat protocols are used within Oregon to collect the data necessary to develop reference standards. ODFW uses the AQI survey protocol to evaluate fish habitat. The ODEQ and the EPA both use the Environmental Monitoring Assessment Program (EMAP) survey protocol to assess habitat conditions. Data is collected from reference sites or stream reaches identified within minimally disturbed (anthropogenic disturbance) watersheds. Frequently high road density is the prime indicator of disturbance. Benchmarks developed from these datasets account for the natural variation and disturbance regimes within a watershed. Data collected within a specific region such as the EFN is compared to reference data by calculating the proportion of sites within a study area that do not meet benchmark standards. For the purposes of this assessment, the assumption was made that Ecoregion level III (Oregon Coast) reference data was representative of pre-disturbance conditions within the EFN. This data was further aggregated by lithology; the EFN is predominantly erodible and therefore only erodible reference standards were used in this analysis. This is a conservative approach as erodible watersheds are often more prone to disturbance and sedimentation issues than resistant watersheds. Although the EFN contains a small (20%) proportion of resistant substrate, this was not taken into consideration when assessing habitat concerns. Were resistant reference conditions used in the analysis contained within this document the EFN values would only be driven more toward fine sediment impairment. Additionally, information on historical vegetation was compared to current vegetation patterns to understand historical upland conditions and how they have been impacted by land-use practices. Current vegetation conditions are described in Chapter 10. This chapter evaluates historical conditions, land-use, and potential trends, drawing conclusions about how past land-use may have resulted in the conditions observed within the EFN watershed today.

Materials, Methods, and Resources

In order to identify the characteristics of the EFN at the time of European discovery, historical land-uses narratives and anecdotal accounts were synthesized and past disturbances were identified using the best available GIS data. Historical floodplains were identified primarily using two datasets; the United States Geological Survey (USGS) 1:24K soils map was used to identify fluvial soils and the CLAMS data was used to identify historical floodplains. In addition to documenting the known historical disturbances, AQI data was used to describe how the EFN varies from minimally disturbed basins. AQI and EMAP reference data was compared to EFN AQI data to evaluate the location of anthropogenic disturbances. Averages for the following metrics were evaluated: percent sands and fines (%SAFN), stream width to depth ratios (W:D), percent shade (%Shade), percent slackwater pools (%SWP), and riparian bank condition. AQI and EMAP reference conditions within the Oregon Coast are listed in Table 2a below. Further, the 1998 Oregon Gap Analysis Program (GAP) vegetation data was used to identify both historical and current vegetation conditions. Although there are no constraints on the use of this data it is considered most valid when used at a 1:100,000 level and is only as a coarse-filter approach to habitat conditions. The 30 meter digital elevation model (DEM) was used to identify areas with slopes under 2.5% in order to determine reaches that could potentially contain high floodplain connectivity. Finally, historical accounts and surveys of fish populations and distribution were analyzed at the larger Nehalem sub-basin scale and for the EFN.

EMAP "Erodible Lithology" Reference Conditions			
Indicator	Mean	SD	SE
%SAFN	19.95%	18.58%	3.96%
W:D	8.68	2.97	0.65
ODFW "Erodible Lithology" Reference Conditions			
Metric	Average	Low	High
Wood >3m length and > 15 cm diameter per 100 m of stream	16		
%Shade	84	77	92
%SWP		0	>7
%SAFN Riffles	11	15	5

Table 2a - Example of EMAP and AQI Reference Data



Map 2a - Soils of the EFN

Results

The EFN watershed occurs within the Coastal Western Hemlock Climate Zone (Canadian distinction) or the Oregon Coastal Climate Zone (Oregon Distinction). The Coastal Climate Zone was historically dominated by coniferous old-growth forests with Sitka spruce dominating the lower elevations, and western hemlock dominating the upper elevations. In drier locations, Douglas-fir becomes the dominant species.[1] Historical vegetation surveys of the EFN indicate that Douglas-fir would be the dominant hill-slope species. This is consistent with available precipitation data which suggests that the EFN is drier than other Oregon coast range watersheds such as the upper Wilson River directly to the southwest which receives up to 180" of rain. While Douglas-fir dominates in these areas as well largely as a result of the timber markets, the most salient difference between these neighbors is the presence of oak savannah habitat within the EFN area. Although largely absent today, oaks would not survive the precipitation the upper Wilson drainage receives. Further the recent outbreak of Swiss Needle Cast, which defoliates younger Douglas-fir, has resulted in most plantations being restocked with western hemlock. One hypothesis is that the outbreak was the result of planting Willamette Valley stock Douglas-fir which has not evolved to withstand the high rates of precipitation and the fungal infections associated with this much rain. The EFN appears to have no impacts associated with Swiss Needle Cast and most timber plantations are stocked with Douglas-fir.

The easily-eroded soils which dominate the basin allow for broad floodplain development and extensive riverine wetland habitat throughout the valley bottoms. Isolated wetlands have been mapped in GIS layers of historical vegetation. In the upper Gunners Fork, Kenusky, and Jim George drainages, small marshy areas were historically present. The wetlands in upper Gunners Fork have largely been converted to lake or pond habitat by the presence of dams and roadways which create Gunners Lakes and Floeters Pond. There is no evidence of significant historical wetland habitat elsewhere in the watershed although it is likely that, where gradient allowed, wetland habitat would be associated with most lower riparian reaches and beaver presence.

1 SRS 913 Climate of Oregon Climate Zone One. Taylor, G. Bartlett, A. 1993

Industrial forestry is the dominant stand shaping force, followed by fire, then by windthrow and storm events. Natural fire regimes for coastal temperate rain forests vary. A study examining charcoal concentrations, locations, and age in western North American temperate rain forest soils found that some sites within the study area (from Alaska to the southern Oregon coast) did not see one fire within 6000 years. Other areas had only one or two fires within that same time frame. Areas that were dominated by Douglas-fir were found to have more frequent fire return intervals suggesting that the EFN would have a natural fire regime in the lower end of this study's range of ~300-1000 years.[1] The long period of time between forest fires would allow for the accumulation of a large quantity of biomass both in the understory and in the canopy. This biomass would burn during intense wildfires after which disturbance-dependent species such as Douglas-fir would rapidly grow into open areas. Western hemlock would germinate in the older Douglas-fir forests, followed by western red cedar and Pacific yew. Evidence suggests that fire return intervals became more frequent as a result of European settlement. Over 800,000 acres of coastal Oregon were destroyed by forest fires between 1846 and 1853.[2] Although Willamette Valley Native Americans conducted controlled burns to maintain browse for deer and elk and habitat for game birds, north coast Native Americans such as the Tillamook (several tribes collectively called Tillamook or Killamook) relied on fishing and trading with other local tribes and were less dependent on open hunting areas.[3] In contrast to the historically infrequent fire return interval, the EFN experienced small fires between 1850 and 1940 (See Map 2b, 2c, 2d, and 2e on page 24). While not all of the four Tillamook burns which occurred in the early to middle twentieth century reached the EFN, the region was moderately impacted by the 1940 burn (Refer to Map 2e).

Wind-throw is another dominant factor in shaping the composition of the forest and was likely the most frequent form of forest disturbance in the EFN before European settlement. Although the impacts of a forest fire are often more catastrophic, fires are not as common as storm events. Windstorms in 1880, 1951, and 1962 along the Oregon coast range blew down an estimated 6.7 billion board-feet of timber.[4] Windstorms that cause tree uprooting are frequently annual events on the Oregon coast.

Timber management is the dominant factor shaping the forest. The majority of the EFN sub-watershed is densely planted for even age stand management. There are few mature timber stands and those that do occur are more often than not on public lands or along fish-bearing streams. Timber harvest over a period of three decades can be seen in Map 2f on page 25.

Finally, localized and watershed wide flood events helped shape the Nehalem forests. Landslide prone areas and riparian zones were historically vegetated by red alder. Debris flow and mass wasting often scoured headwaters supplying lower reaches with woody debris. This aided in reconnecting larger rivers with the floodplains regularly.

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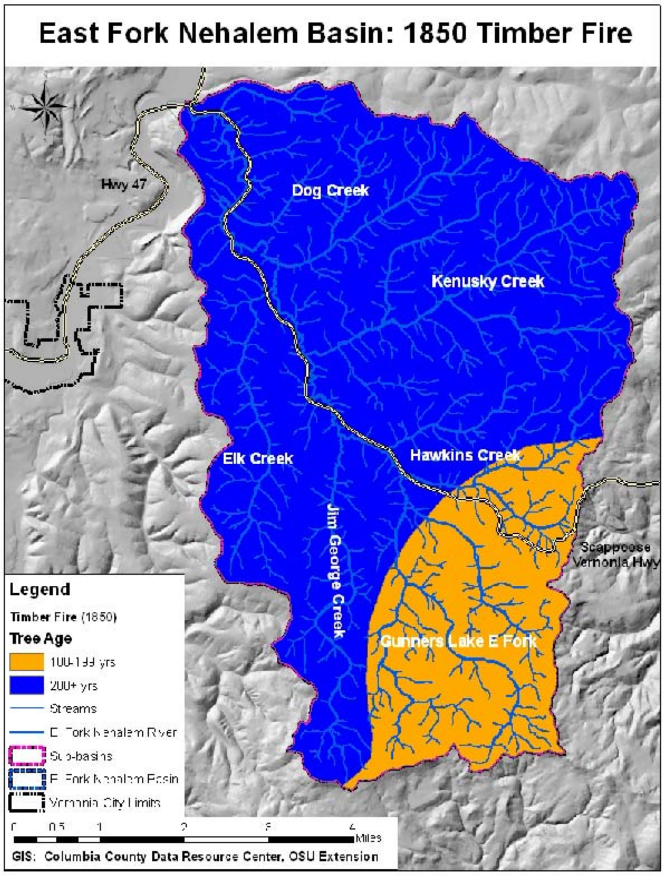
1 Long-Term Fire Regime Estimated from Soil Charcoal in Coastal Temperate Rainforests. Lertzman, K, Gavin, D. Hallett, D. Brubaker, L. Lepofsky, D. and Mathewes, R. 2002. ES Home. Vol. 6, No. 2. Art. 5

2 Northwest Oregon State Forest Management Plan. 2000. Appendix H-13. History of the Northwest Oregon State Forests ODF.

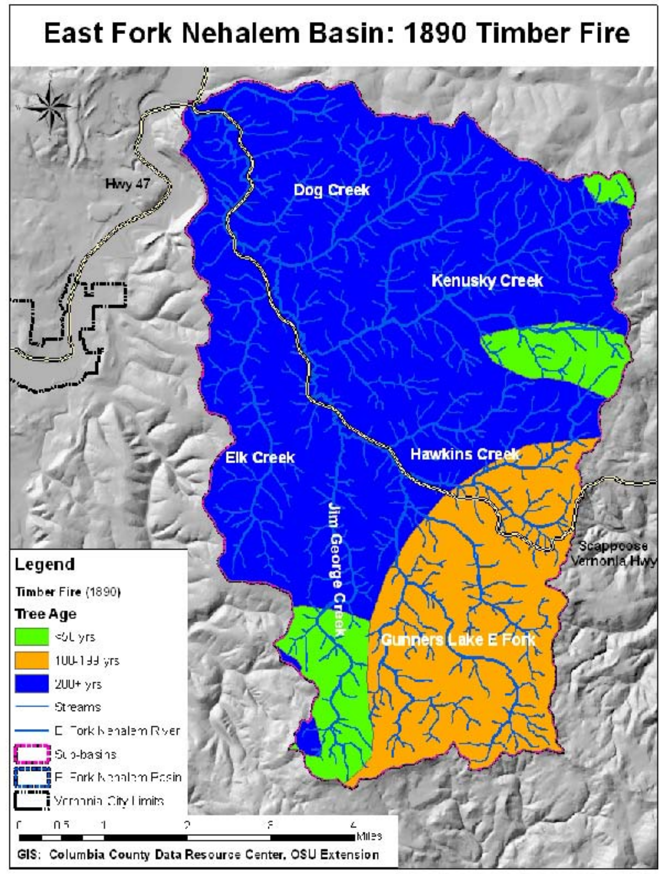
3 Northwest Oregon State Forest Management Plan. 2000. Appendix H-13. History of the Northwest Oregon State Forests ODF.

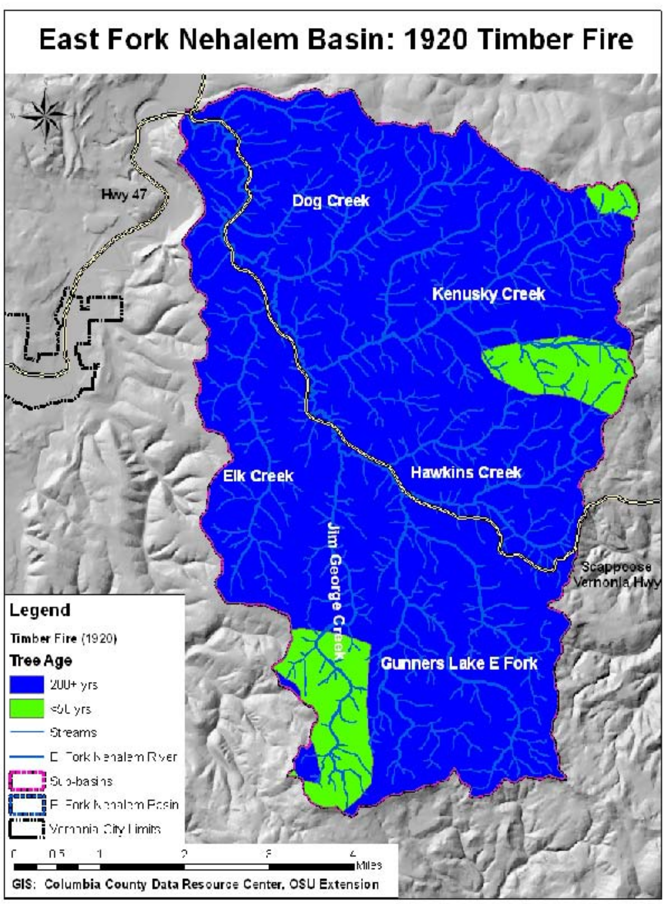
4 Elliot State Forest Watershed Analysis. Chapter 3. ODF. 2003

Map 2b - 1850 Timber

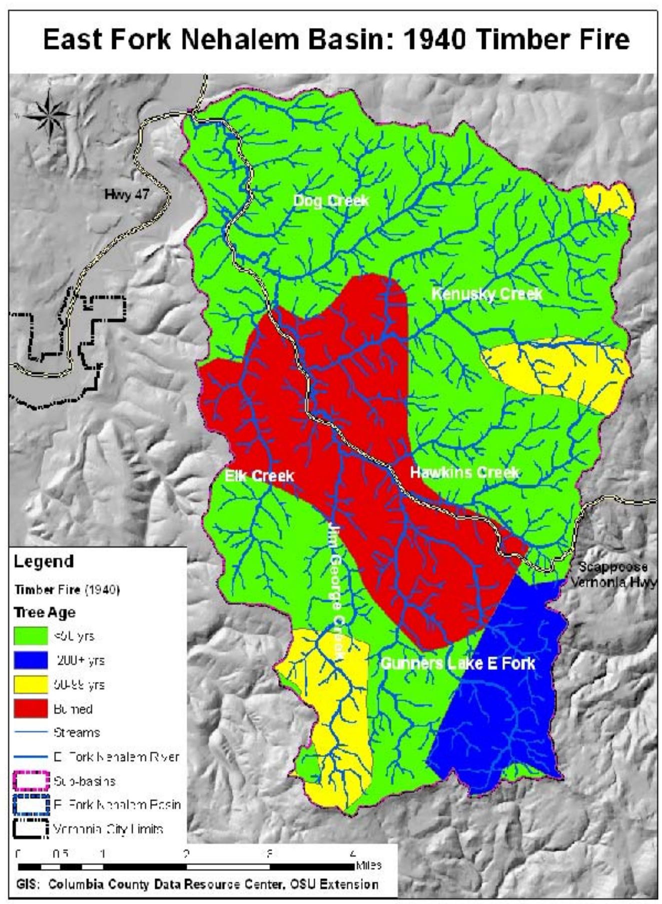


Map 2c - 1890 Timber

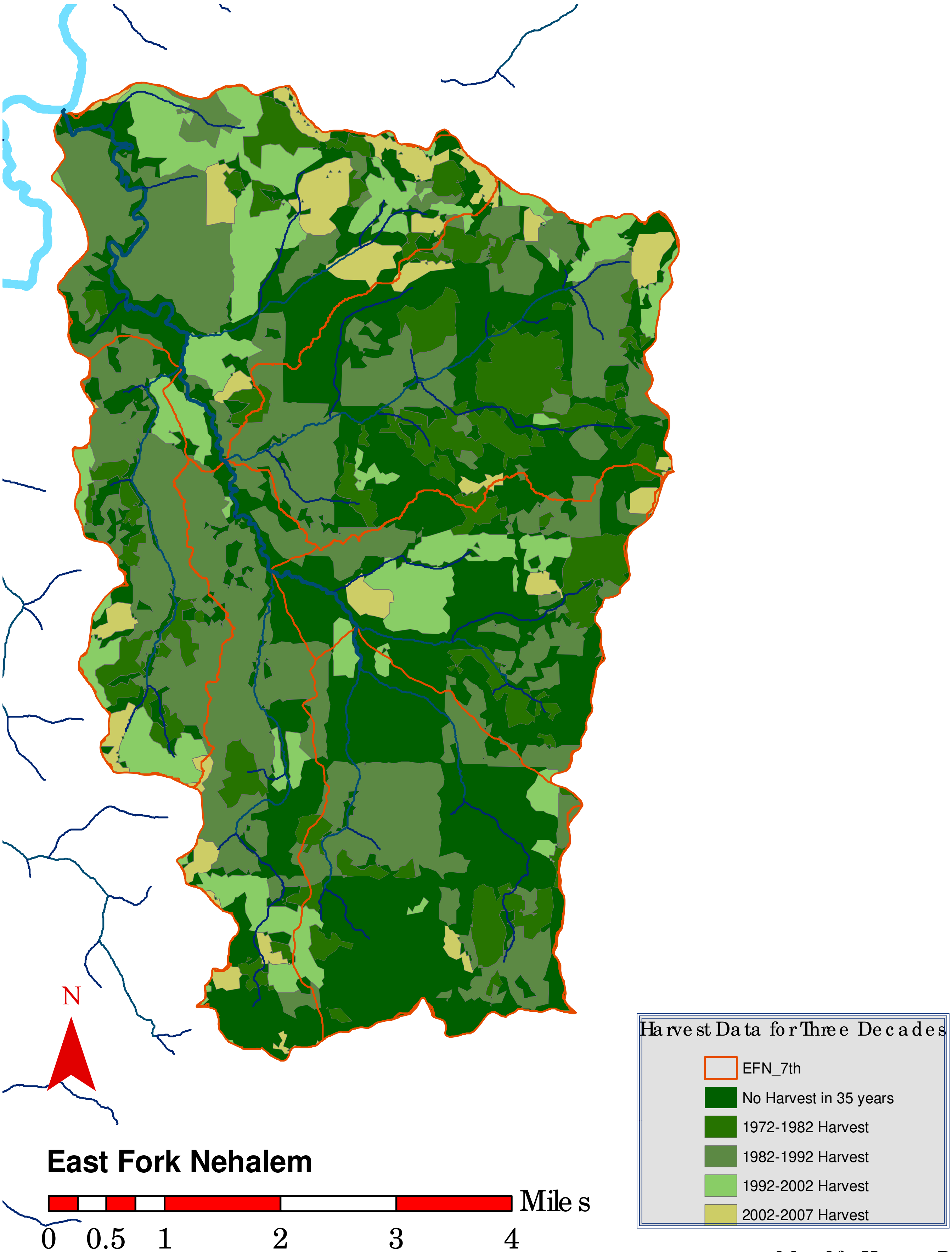




Map 2d - 1920 Timber



Map 2e - 1940 Timber



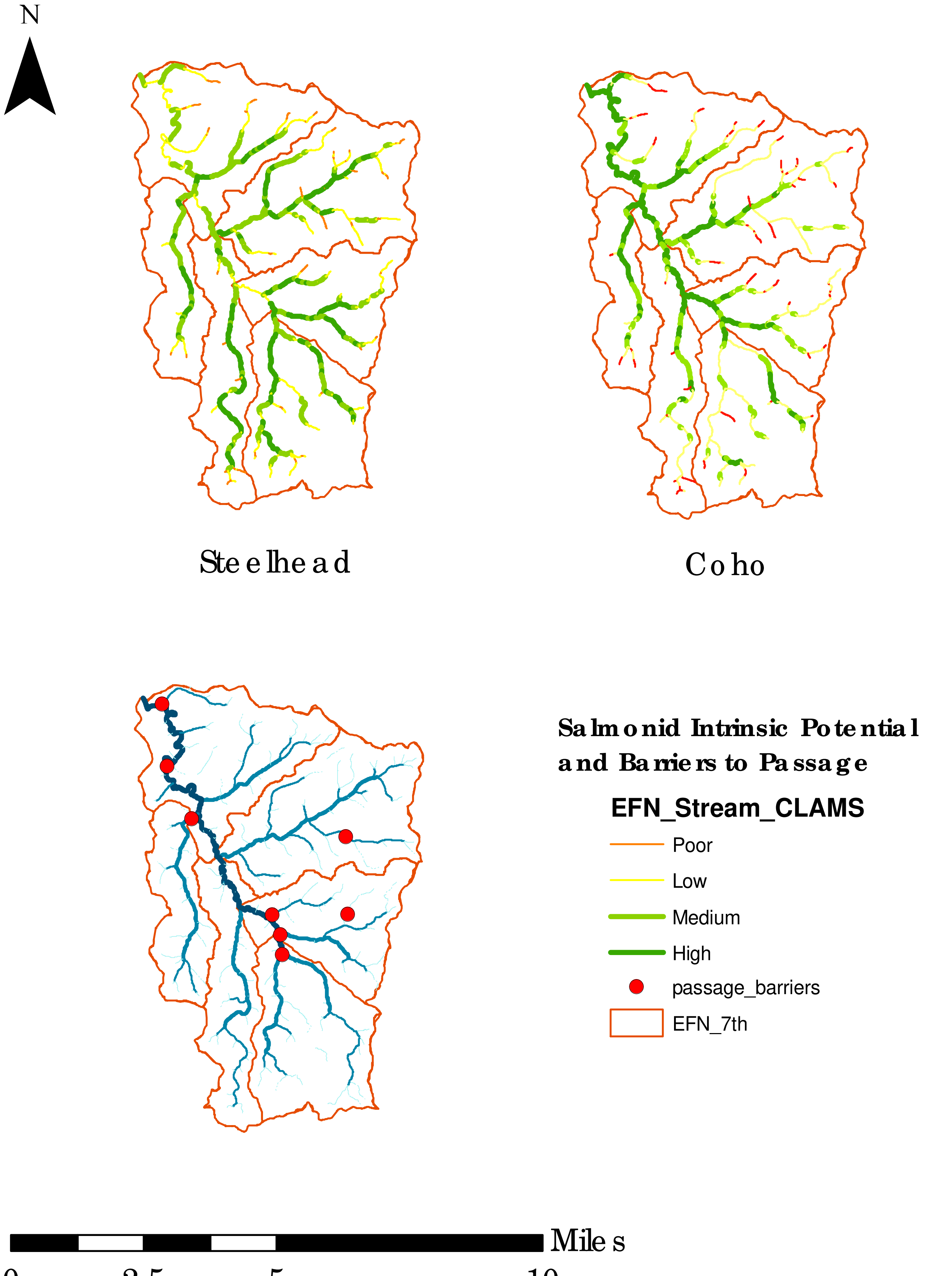
Map 2f - Harvest Data

After European settlement, timber was the dominant natural resource extracted from the watershed. Although splash damming was a common method of log transportation throughout Oregon, there is no known record of splash damming taking place within the EFN, possibly as a consequence of the low gradients and broad floodplains common throughout the basin. A 20' dam was built across the mouth of the EFN in 1877 to supply power to a saw-mill in Pittsburgh.[1] This dam had major impacts on the hydrology, habitat, and fish use of the watershed. The dam blocked all fish passage during its life-time.

Peak lumber exports from the Nehalem River basin were estimated at 1 million board-feet per day. The mill at Wheeler alone produced an average of 150,000 board-feet per day and surveys conducted in the early 20th century indicate that the EFN sub-watershed was heavily utilized for timber.[2] Railroads used to haul timber out of the watershed required gentle gradients which are not present outside of the river valleys. Several of the main railways were built along the stream banks.[3] There are currently no active railways within the watershed. A historic line runs along the mainstem EFN although the tracks and ties were removed in 1944.[4] Truck hauling became the dominant method of transportation after 1944 increasing the use of forest roads and potentially the sediments they supply.[5] Spurs were constructed to access steeper slopes. These spurs were often built up ridges and across deep tributary valleys. To build roads across steep hill-slopes, the hill-side was cut and the material cast over the side of the hill, often leading to increased fine sediment input, soil creep, and mass failure leaving lasting impacts on the watershed. Steep valleys were often filled to build an extensive road network throughout the drainage.[6] This reduced the capacity for the watershed to deliver LWD to the system. In addition to creating access to merchantable timber, roads were also created for fire control. The Crown Zellerbach Mainline is currently being used as both a pedestrian trail and a timber road.[7]

There is no pre-European fish abundance data for the EFN although anecdotal evidence suggests that salmonid populations within the Nehalem River were high. Available data indicates that there has been a severe decline in coho, steelhead, and Chinook populations throughout the Pacific Northwest. ODFW data identifies the EFN as having the potential to support healthy populations of coho, steelhead, cutthroat, and Chinook. The Coastal Coho Assessment identified the Nehalem River sub-basin as having the potential to support more than 17,500 (fully seeded) coho, although catch records from the middle of the twentieth century indicate that there were more than 50,000 coho in the entire Nehalem sub-basin. [8] Additionally, spawning surveys from the early 1950s indicate that chum may have utilized the EFN although it is unclear if chum could make the jump over the Nehalem falls.[9] Intrinsic potential is a good estimate of historical overwintering habitat. Intrinsic potential for coho and steelhead within the EFN is shown in Map 2g along with known barriers to passage. Historical habitat quality has declined throughout the Nehalem Basin and at least one ODFW biologist has suggested that the EFN is the among the most impaired sub-watersheds within the larger Nehalem River sub-basin.[10]

1 Nehalem Watershed Assessment and http://www.ferdun.info/NehalemEstuary/3%20Historical.pdf
2 http://www.ferdun.info/NehalemEstuary/3%20Historical.pdf
3 BLM EFN Watershed Analysis 1996
4 Nehalem Watershed Assessment.
5 BLM EFN Watershed Analysis 1996
6 Field Observation
7 The Columbia County Crown Zellerbach Trail Mission and Goal Statement, Draft 2006
8 ODFW 1993
9 G.F Woods, personal communication. "East Fork of Nehalem River" by Breuser, R. Pulford, E. Aquatic Biologists
10 Michele Long ODFW



Map 2g - IP and Barriers

Refer to the "Guide to Interpreting Stream Survey Reports", available through ODFW on their website, for definitions of AQI metrics, how they are collected, and what they represent.[1] Table 2b displays 7th field values by reach and a weighted average for each stream for %Shade, W:D, %SWP, %SAFN and %SAFN riffles, and woody debris greater than 3 meters in diameter every 100 meters (LWD m3/100m). Metrics highlighted in red are those than do not fall within ODFW and/EPA derived reference standards or are 1 standard deviation below benchmarks. Those metrics in orange are those that are on the border of impairment.

Most of the habitat metrics within EFN do not meet ODFW and EPA reference standards. The mainstem EFN is classified as low gradient, unconfined using the Channel Habitat Type (CHT) classification described in Chapter 3. In contrast, stream surveys conducted primarily by Boswell Consultants and by ODFW indicate that essentially the entire mainstem is confined by hill-slope and/or terrace. Secondary channel habitat makes up a fractional component of this portion of the stream network. Large wood is variable with some areas having high volumes and others having low volumes with most catchments having above average wood volumes and below average key pieces. Wood volume is often driven by debris jams comprised of many small pieces and not by key pieces, which the EFN sub-watershed is lacking. This likely explains the wood volume discrepancies between survey years as small wood is more likely to be flushed out during high flows, although this may be the result of surveyor error.

Historical floodplain connection would have been much greater than it currently is (refer to discussion of CHTs in Chapter 4 and riparian condition in Chapter 5 for a more in depth analysis). The W:D values of many reaches indicate either entrenchment or widening neither of which are conducive to good floodplain connectivity. Additionally, the mainstem EFN has almost no side channels and is often confined by high terraces that are only accessed in extreme flood events. Historically, the EFN mainstem migrated greater distances across the valley floor and provided more off channel habitat than it currently does. Further, there were more key pieces diverting floodwaters onto the floodplain which created backwater and wetland habitat (Refer to discussion of fish habitat in Chapter 9). Finally, the EFN and its tributaries appear to have an elevated input of fine sediments. Almost every reach exceeded reference standards for both %SAFN and %SAFN in riffles.

At least three wetlands have been impounded which collectively create Floeters Pond and Gunners Lakes (two areas totalling ~50 acres). In addition to the direct loss of wetlands from the creation of reservoirs, it is unclear as to exactly what role beavers play in the EFN in regards to wetland creation and destruction. It is likely that the EFN sub-watershed is similar to other coastal watersheds in Oregon and that beaver populations are well below their historical numbers.

1 Scott C. Foster, Charles H. Stein, Kim K. Jones. 2001. http://nrimp.dfw.state.or.us/crl/Reports/AI/interpgd.pdf

Reach	%Shade	W:D	%Slackwater Pools	%SAFN	% SAFN in Riffles	LWD m3/100m
EFN Mainstem 1993						
1	16	8.91	5.49	53	44	12.9
2	27	5.06	12.59	63	50	7.9
3	14	10.86	3.41	39	27	8.5
4	12	27.4	0	10	8	3.5
5	13	8.83	57.11	41	32	28.6
6	5	12.5	52.34	58	48	9.5
Average	16.2	9.3	17.2	51.3	41.1	12.3
Kenusky Creek 1993						
1	27	21.5	23.9	45	27	34.9
2	20	24	25.66	34	20	28.2
3	3	14.5	0	31	24	18.2
Average	14.6	20	15.6	34.5	22.6	25.4
Kenusky Creek 1999						
1	76	13	0.31	54	62	14.3
Kenusky Creek 2005						
1	69	10.4	20.87	55	30	15.9
2	67	13.3	19.67	57	38	11.4
3	74	15.2	2.5	37	19	17
4	69	18.8	20.83	44	0	16.6
Average	70.3	14.6	13.8	46.9	22.5	15.2
Kenusky Creek 2006						
1	82	13.75	0.44	61	37	14.9
2	89	14.6	2.79	41	21	21.4
3	85	11	0	50	27	28.8
4	84	17.33	21.75	52	21	27.7
5	89	21.5	0	37	17	33.5
Average	85.6	15.5	2.7	49.6	26.9	22.1
Elk Creek 1993						
1	7	3.75	8.98	64	60	7.2
2	14	3	62.51	85	80	25.9
3	9	5.5	68.62	81	60	76.3
4	15	***	61	100	*	0
Average	9.8	4.2	50.8	78.3	60.6	43.1
Elk Creek 2005						
1	79	9.83	62.94	63	58	15.2
2	76	10.8	54.68	60	39	19.4
Average	77	10.5	57.3	61	45.2	18
Gunners Lake 2001 - 1000m long from Gunners lake down						
1	95	11	0	7	*	6.3

Table 2b - Habitat Indicators

Reach	%Shade	W:D	%Slackwater Pools	%SAFN	% SAFN in Riffles	LWD m3/100m
Gunners Lake 2005						
1	73	20	15.27	33	10	11.2
2	82	15	0.95	13	10	28.3
Average	78.9	16.7	5.9	19.9	10	22.4
Jim George 2005						
1	78	11.6	35.51	47	23	8.1
2	74	9	8.73	39	18	11.4
Average	76.6	10.7	26.4	44.3	21.3	9.2
Upper East Fork Nehalem including Hawkins - 2005						
1	80	14.2	8.9	36	15	11
2	89	10.2	0	16	21	6.4
1H	77	10.25	2.71	32	15	14.1
Average	80.1	12.2	5.4	32	15.8	11.6
Dog Creek 1993						
1	19	26.5	55.16	58	31	23.3
2	24	***	65.49	42	22	48.2
Average	19.8	22.5	56.7	55.6	29.6	27
Dog Creek 2005						
1	76	16.4	12	55	27	23.2
2	79	12.5	22.2	51	25	24.5
3	83	6.5	0	11	25	57.5
1A	81	12	0	31	30	13.7
Average	79.5	12.6	6.5	37.8	27.6	25.6

Table 2b Continued - Habitat Indicators

Analytical Conclusions

Kenusky, Elk, Jim George, and Dog 7th fields are all below reference standards for shade values and few of these drainages meet reference conditions for the W:D, %SAFN, and %SAFN in riffles. The values for backwater pools (%BWP) are much more variable with Elk Creek containing the highest %BWP and Gunners Fork the least. Kenusky, Upper East Fork, and Gunners Fork, all of which have above average W:D values and below average %BWP. Habitat surveys consistently indicate that there is minimal secondary channel habitat and disproportionate W:D. Wood volumes are also variable but often exceed reference standards suggesting that stream cleaning either was not as common as in other coastal watersheds or that woody debris continues to enter the basin from the lesser disturbed headwaters. Jim George and Upper East Fork contain the lowest wood volumes within the basin. Additionally, Elk Creek contained large quantities of instream LWD in 1993 while the 2005 habitat surveys suggest that these values were more than halved. It is possible that there was a misestimation of wood volumes or that this wood was washed out during the numerous floods which occurred between surveys and may be the result of too few key pieces. Riparian conditions in low gradient areas of the EFN are moderate to poor suggesting that riparian restoration aimed at increasing floodplain connectivity and riparian community complexity should be a priority for land managers and local groups.

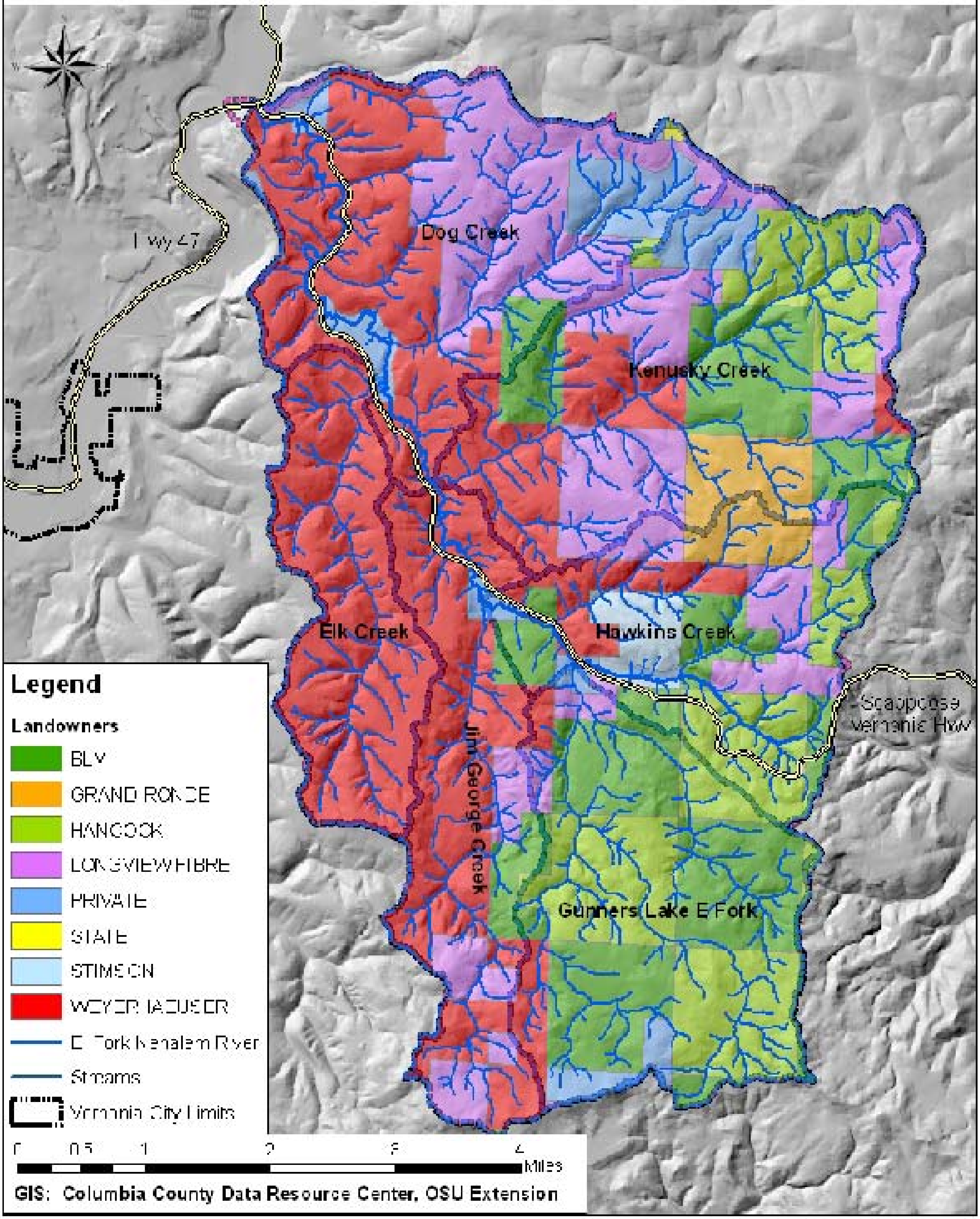
The W:D values for the watershed suggest that many channels within the EFN have widened, which when coupled with historical down-cutting can prevent the stream from connecting with the floodplain during higher flows. Floodplain disconnection limits the creation of off-channel habitat. High quality rearing habitat is critical for the survival of juvenile salmonids. The importance of high quality rearing habitat is much greater for sub-populations spawning far from estuarine habitats as these fish must be stronger swimmers to handle the downstream journey than their counterparts lower in the watershed. Additionally pisciverous predation is less likely to occur to larger juveniles therefore increasing off channel habitat decreases the likelyhood that unprepared fish will be washed from the EFN during high flows.[1]

Past land management practices were not as stringent at maintaining watershed complexity as they are today suggesting that water quality and habitat issues impacting the area are largely legacy effects. The EFN has a high percentage of private industrial ownership although the EFN has a higher proportion of federal land than the larger Nehalem River watershed. While private lands are not required to maintain riparian buffers on nonfish -bearing streams, federal land managers will often maintain a vegetative community even over high-gradient headwaters. Maintaining riparian vegetation throughout all ownership types within the EFN is important for retaining fine sediments and for providing future LWD which will mitigate some of the effects of past habitat modification.

1 Pacific Salmon Life Histories; Life History of Coho Salmon; Pages 415-418. Ed. Groot and Margolis. 1991

Map 2h - Ownership - *Please reference other ownership maps as BLM ownership has changed.

East Fork Nehalem Basin: Land Ownership

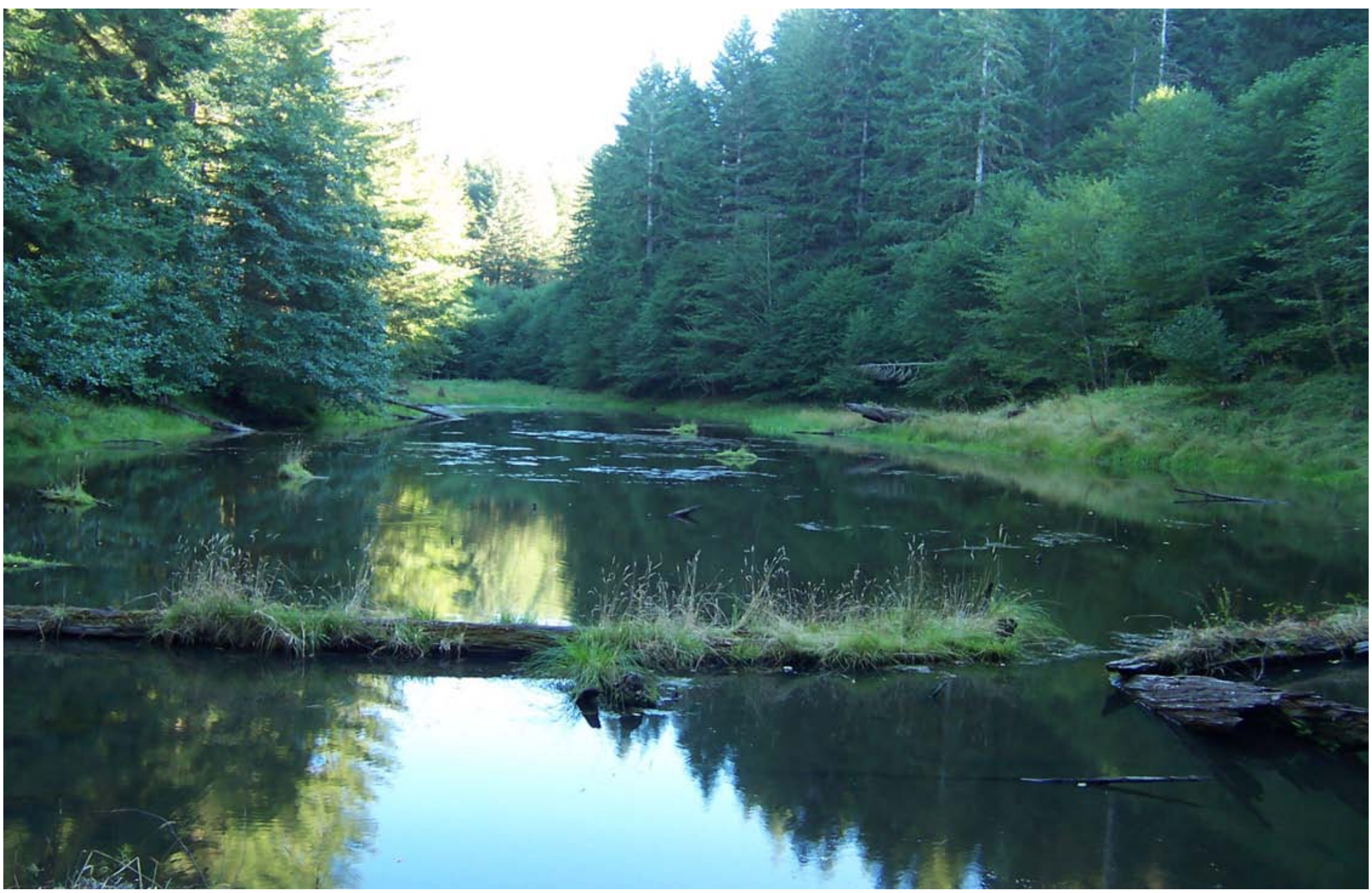


Key Findings

• The EFN was historically dominated by Douglas-fir old-growth forests.
• Riparian vegetation has been impacted by extensive logging resulting in both channel incision and widening.
• Anecdotal evidence suggests that salmonid populations were historically abundant throughout the EFN.
• The mainstem EFN was completely closed off to power a saw mill.
• Ongoing timber harvest is the dominant land-use in the basin.
• The Crown Zellarbach Mainline, the highway, and private residences within the riparian zone have confined much of the lower half of the mainstem.
• Aquatic habitat often does not meet biological standards for shade and sediment metrics, suggesting degraded spawning and summer rearing habitat relative to pre-European conditions.
• Pool volume is high in the EFN mainstem and several tributaries while off channel habitat is low suggesting that rearing habitat quality may be limited.

Recommendations

• Headwater systems should be evaluated for potential future contributions of LWD.
• Riparian set asides of privately owned land should be considered.
• Maintenance of riparian conifers should be encouraged for both shade and a long term source of LWD.
• A limiting factors assessment should be conducted to determine winter and summer habitat limitations.



Chapter 3

Channel Habitat Type Classification

Critical Questions

1. Where are the locations of the various CHTs and what is their function within the EFN?
2. Which 7th fields are most prone to changes in watershed condition?

Introduction

Generalizations can be made about a streams response to restoration and disturbance based on the characteristics of the channel morphology. Streams that are unconfined are able to migrate throughout the floodplain. When disturbance such as a debris torrent occurs the stream has the capability of adjusting its morphology to reach a new equilibrium. Naturally unconfined streams can become confined due to the presence of a road or through habitat simplification which can lead to downcutting. Naturally confined streams are often higher gradient and more prone to debris flow and slope failure. These streams are considered sediment and LWD supply systems. Confined streams cannot easily migrate and will not develop off channel habitat as readily as other channel types. CHTs describe the physical characteristics of stream reaches according to gradient, size and valley form. This standard method is outlined in the OWEB assessment manual. Channel sensitivity describes the frequency and probability of changes to the stream channel.

Materials, Methods, and Resources

The CLAMS hydro layer was used as the foundation for this analysis. CHTs for the EFN were first determined using the OWEB manual guidelines which lead to the classification of 130 out of a possible 200 stream miles. A second analysis was run to type the channels that were not typed in the initial classification. It was found that the CHT method did not account for certain channel habitat types (e.g. unconfined channels with gradients between 4% and 6%). The initial attempt to classify CHTs not only resulted in the misclassification of several headwater reaches but ~65% of the stream network went unclassified. Using the new classification system, headwater channels and channels with gradients between 4% and 6% were typed. The CHT classifications used in this second analysis is found in Table 3a - CHT System on the following page. This second analysis corrects for gaps in the initial CHT classification system. It contains attributes indicating gradient, valley width, and stream size. Each stream segment was rated as high, medium, or low for sensitivity to change based on the CHT. CHTs were verified using the OWEB classification system. Ten percent of the six 7th field basins were randomly sampled to determine the validity of the initial CHT classifications although this was conducted before the new CHTs were added. All but two of the preliminary designations matched the field surveys. The erroneously classified segments were headwater areas that could be classified with two different CHTs. These segments were given the more appropriate CHT and a second field verification of similar sites took place. Some of those sites were also misclassified and corrected.

Code	CHT Name	Gradient	Confinement	Flow
ES	Small Estuary	<1%	Unconfined to Moderately Confined	Small to Medium
EL	Large Estuary	<1%	Unconfined to Moderately Confined	Large
FP1	Low Gradient, High Flow, Unconfined	<1%*	Unconfined	High*
FP2	Low Gradient, Medium Flow, Unconfined	<1%*	Unconfined	Medium*
FP3	Low Gradient, Low Flow, Unconfined	<1%*	Unconfined	Low*
LM1	Low Gradient, Moderately Confined, High Flow	<1%	Moderately Confined	High*
LM2	Low Gradient, Moderately Confined, Medium Flow	<1%	Moderately Confined	Medium
LM3	Low Gradient, Moderately Confined, Low Flow	<1%	Moderately Confined	Low
LC1	Low Gradient, Confined, High Flow	<1%	Confined	High*
LC2	Low Gradient, Confined, Medium Flow	<1%	Confined	Medium
LC3	Low Gradient, Confined, Low Flow	<1%	Confined	Low
MU1	Moderate Gradient, Unconfined, High Flow	1-6%	Unconfined	High*
MU2	Moderate Gradient, Unconfined, Medium Flow	1-6%	Unconfined	Medium
MU3	Moderate Gradient, Unconfined, Low Flow	1-6%	Unconfined	Low
MM1	Moderate Gradient, Moderately Confined, High Flow	1-6%	Moderately Confined	High*
MM2	Moderate Gradient, Moderately Confined, Medium Flow	1-6%	Moderately Confined	Medium
MM3	Moderate Gradient, Moderately Confined, Low Flow	1-6%	Moderately Confined	Low
MC1	Moderate Gradient, Confined, High Flow	1-6%	Confined	High*
MC2	Moderate Gradient, Confined, Medium Flow	1-6%	Confined	Medium
MC3	Moderate Gradient, Confined, Low Flow	1-6%	Confined	Low
SV	High Gradient, Narrow Valley	>6-16%	Variable*	High*
MV	High Gradient, Narrow Valley	>6-16%	Variable	Medium
HH	High Gradient Headwater, Variable Confinement	>6-16%	Variable	Low
MH	Moderate Gradient Headwater, Variable Confinement	1-6%	Variable*	Low
VH	Very High Gradient Headwater, Variable Confinement	>16%	Variable*	Low
AF	Alluvial Fan	1-5%	Variable	Small to Medium
BC	Bedrock Canyon	1->20%	Confined	Variable

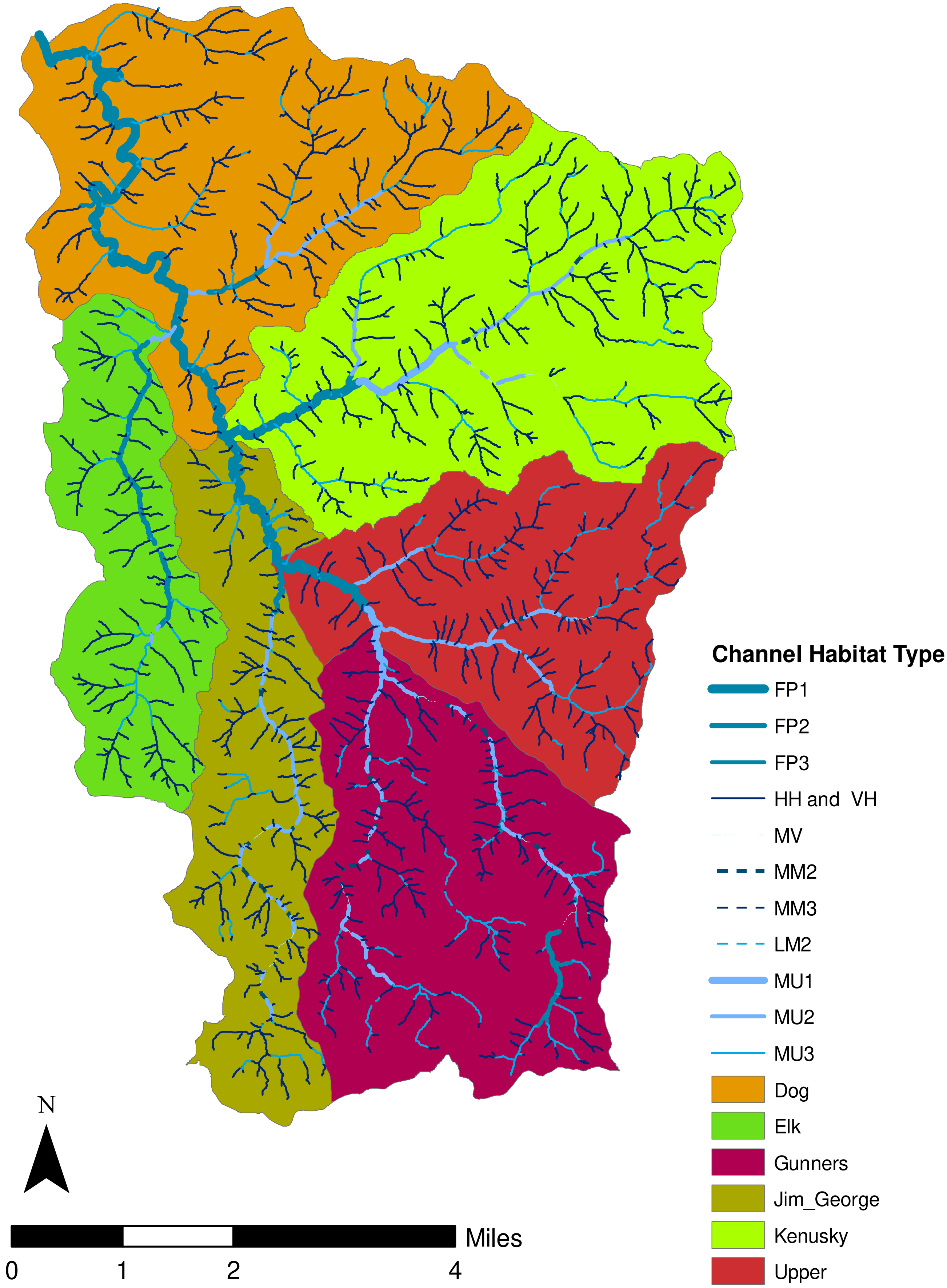
Table 3a - Channel Habitat Type Classification System *Additions

Results

Twelve habitat types have been identified within the EFN as displayed in Table 3b below and in Map 3a.

CHT	Stream Miles	Stream %
FP1	9.65	4.69%
FP2	4.17	2.03%
FP3	1.16	0.56%
HH	72.46	35.25%
LM2	0.1	0.05%
MM2	2.72	1.32%
MM3	0.25	0.12%
MU1	1.45	0.70%
MU2	13.7	6.66%
MU3	36.28	17.65%
MV	2.18	1.06%
VH	61.45	29.89%
East Fork Nehalem	205.57	100.00%

Table 3b - Channel Habitat Type Results


Channel Habitat Type
FP1
FP2
FP3
HH and VH
MV
MM2
MM3
LM2
MU1
MU2
MU3
Dog
Elk
Gunners
Jim_George
Kenusky
Upper
N
Miles
0
1
2
4

Map 3a - CHT

The most frequent stream habitat type is low flow, high gradient headwater channels with over half the stream network characterized as such. These channels are commonly sediment and LWD supply systems, prone to debris flows. They are generally located outside of the range of fish distribution but supply wood and gravels to fish-bearing streams. Restoration might include plantings and riparian set-asides to re-establish the natural LWD input regime. Most of the EFN has been logged within the last 30 years and contains few mature conifers critical for long term high quality instream habitat. Roughly half of the stream network consists of HH and VH channels. These are considered LWD supply systems and are the most prone to rapid debris flows.

Low gradient, unconfined channels with broad floodplains (FP) make up roughly 7% of the watershed. These stream types have the highest intrinsic potential to provide over winter habitat for juvenile coho. The Dog Creek, Kenusky Creek, and Elk Creek basins have the highest percentage of this habitat type (*data not shown*).

Moderate gradient, unconfined channels make up roughly 25% of the stream network. Large to medium (MU1 and MU2) channels of this type possess the necessary stream power to sort gravels for spawning. These channel types are most common in the Upper EFN, Jim George, and Gunner Lake 7th fields.

Based on a visual assessment conducted for this report, the mainstem EFN is often confined by the highway and homesteads on the east bank and the Crown Zellerbach Mainline on the west bank for much of its lower length so that restoration potential may be limited.

Analytical Conclusions

HH and VH streams, which account for roughly half of all stream types within the EFN, are predominantly nonfish-bearing streams and therefore are subject to riparian harvesting. LWD may be a future problem if these riparian areas are not protected from harvest.

Low and moderate gradient systems with unconfined channels and broad floodplains are often ideal for restoration as the gradient is low enough for minimal LWD movement while the channel has enough room to respond to the input of restorative structures. Projects in Kenusky, Elk, and Dog where these CHTs are most common could include large wood placement to create off channel habitat, sort gravels, and provide shelter from predation; riparian plantings to reduce stream temperatures; and road decommissioning to allow channels to meander more naturally.

Key Findings

• The majority of the stream network is composed of high gradient headwaters, the majority of which do not receive any riparian protection.

• Only 7% of the watershed is characterized as low gradient with broad floodplains.

Recommendations

• Low gradient channels in the Dog and Elk Creek catchments and moderate gradient channels in the Upper EFN, Jim George, and Gunners Lake catchments should be prioritized for active restoration.

• A headwater evaluation would allow land managers to determine which riparian areas would benefit downstream ecosystems the most through set asides.

• A direct assessment of spawning potential within CHT types MU1 and MU2 would allow land managers to determine if endangered and managed species usage of the EFN is being impacted by the high percentage of sands and fines found within the watershed.

• Moderate gradient unconfined channels areas should be assessed for restoration potential.

Chapter 4

Hydrology and Water Use

Critical Questions

1. What are the dominant land-uses in the EFN?
2. What is the flood history in the EFN?
3. Do land-uses in the basin impact peak and low flows?
4. Do water uses in the basin have an effect on peak and low flows?
5. What are the beneficial uses in the EFN?
6. From what source is water derived?
7. What type of storage has been constructed in the basin?

Introduction

Alterations to the hydrology of a stream network can adversely impact aquatic habitat, biota and downstream infrastructure. Excess water withdraws for drinking, irrigation, and industrial uses can result in below average minimum flows. Decreased water volumes during low flow periods, especially in areas with poor riparian canopy cover, can increase warming which leads to decreased salmonid survival. Low stream flows increase the concentration of pollutants such as fertilizers, herbicides, pesticides, and other chemicals. Degraded riparian conditions decrease the water storage capacity of the watershed and disconnected floodplains decrease the total water delivery to the stream network which can result in lower summer stream flows. Additionally, disconnected floodplains may increase peak flows as more water is concentrated in the stream channel. Peak flows are also influenced by the road network and other impermeable surfaces. Compacted forest roads reduce infiltration of rainfall into the soil and redirect runoff which can enter the stream network. Roads can intercept shallow subsurface flow and increase the peak flows of stream networks specifically when drainage ditches run directly into the stream channel. The removal of vegetation by some logging methods increases annual water yield.[1] The reduction of vegetative cover increases the total quantity of rainfall infiltrating the soil and reduces the water which reenters the atmosphere as transpiration. This excess water then enters the stream network either through hyporheic flow or in localized pockets of overland flow which both increase peak flood events. Snow pack and timing also influences annual flooding. When snow accumulates and ambient temperatures fluctuate between freezing and minimally above freezing, snow pack remains but precipitation falls as rain. This rainfall not only is unable to penetrate the soil but also melts the top layer of snow increasing the impact of a rain event on peak flows. When precipitation occurs as snow and ambient temperatures remain cold enough so that all future precipitation also falls as snow, rain-on-snow (ROS) flooding does not happen. Where snow pack is not possible because ambient temperatures do not remain at or below freezing, ROS events are also not possible. These flood events are associated with the transient snow zone which, in the Oregon coast range, is 2000’. In most cases, warmer temperatures inhibit snow accumulation below 1000’ as precipitation falls mainly as rain and ambient temperatures are too warm to sustain snow pack. Between 1000’ and 3600’, there is potential for snow accumulation and subsequent melt by warm air and rain.[2] As snow accumulates more rapidly in clearings than in forested zones, timber harvest directly influences the impact of ROS events.

1 Hicks et. al. 1991

2 http://www.ce.washington.edu/~hamleaf/Hyd_and_Wat_Res_Climate_Change.html Climate Change in the Columbia River Basin; University of Washington . Alan F. Hamlet, JISAO Climate Impacts Group

Snow which lands on trees is subject to the re-emittance of long-wave radiation from conifers which causes rapid melting. The melting snow falls to the insulated forest floor, melts further, and is then absorbed by the extensive forest root network. Conversely, snow in clearings is not subject to the warming action of trees and is kept cold by winds and ambient air temperature allowing the snow to stay frozen longer and thus having a prolonged impact on the hydrology. Additionally snow pack reduces the total surface area available for infiltration and the heat energy associated with rainfall melts the snow resulting in higher runoff levels in clearings than in forested areas.

Finally, agriculture and open grasslands often found on homesteads also impact the hydrology within a watershed. Infiltration of rainfall on grazed lands is reduced due to soil compaction. Additionally, pastures are often found in or close to riparian areas where soils generally reach saturation more quickly.

Materials, Methods, and Resources

Several analyses were used to determine if the hydrology of the EFN had been adversely impacted or altered as a result of anthropogenic disturbance:

• Timber harvest over several decades was calculated using data layers provided by the Wild Salmon Center.

• The percentage of open canopy was evaluated using 1996 and 2000 CLAMs data layers.

• Non-permeable and semi-permeable surface areas were calculated to determine what percentage of the watershed was prone to complete runoff and/or partial absorption:

- The area of unpaved forest roads was calculated using a buffer width of 25’ (12.5’ on each side).
- The area of paved roads was calculated using a 35’ buffer (17.5 feet on each side).

• The area susceptible to increased peak flows due to the impact of land management actions was calculated in two ways:

1) Annual temperatures by elevation within the catchment were evaluated as was precipitation data to determine how much area had annual winter temperatures within the range of months cold enough to provide snow. Slope aspect was used to determine which areas were protected and which areas were exposed to winter storm events. Timber harvest data was used to determine decade-average open canopy area. This data was used to determine the time frame during which ROS events could occur and how much of the watershed was susceptible to these events.

2) In addition to the standard 2000’ transient snow zone limit used in ROS calculations, 1000’ was also used in calculating area capable of contributing to a ROS event. Local sources indicate that snow pack occurs on a regular basis as low as 1000’ and this standard was used as a liberal approach to estimating the impact of harvest on peak flows and flood timing.

• Water withdraw was evaluated for the impact on average minimum flows using available OWRD GIS layers and Oregon State Water Rights permits.

Results

The EFN is hydrologically unique among many north Oregon coast watersheds in that it is near the Columbia River, drains to the Pacific Ocean, and yet is in the rainshadow of the Oregon Coast Range and is therefore relatively sheltered to incoming westerly winter storms. Average annual rainfall within the EFN is well less than half of what the upper Wilson and Kilchis, just to the southwest of the EFN, receive. As a result of this climate shift, the EFN catchment contains more fire-dependent species such as Douglas-fir than other watersheds in the western hemlock zone.

The beneficial uses of water in the Nehalem River watershed include: Fish Rearing and Spawning; Wildlife; Fishing and Hunting; Recreational Contact; Drinking Water; Irrigation; and Livestock Watering. The EFN receives ~150,000 acre-feet of water annually. The EFN was identified as needing minimum flows of 1 cubic feet per second (cfs) in July, August, and September to sustain anadramous fish use; however optimum flow rate for this time period is identified as 10 cfs. Data obtained below the EFN confluence in July and August 1971 suggest that historic low flows were roughly 39 cfs.[1] The Oregon Water Resources Department (OWRD) and USGS jointly maintain and monitor stream flow stations in northwest Oregon. There have been no gaging stations within the EFN watershed, making it impossible to directly evaluate the water yield, low flows, and peak flows.

There are 8 water rights within the EFN basin for .62 cfs.[2] The majority of these water rights are not for private home use but rather for logging, railroad, and fish culture uses. It appears that Floeter Pond was created for fish culture while Gunners Lake was created for fire protection. There are few direct withdraws made for drinking water and it would appear that the majority of the 16 homesteads within the basin utilize well water. There are two privately owned properties within the EFN watershed that are used for grazing. These two areas make up less than 250 acres and do not appear to be used heavily. There is only one paved public road within the EFN; the Scappose-Vernonia Highway. This road runs along the mainstem and, along with homesteads, confine the channel in many places. Timber harvest was evaluated for a period of 30+ years by sub-basin. The results are listed in the tables 6a and 6b below. Additionally, this data is displayed in Map 2f.

Table 4a - 7th Field Acres Harvested by Decade							
Time Interval	Dog	Kenusky	Upper East	Gunners Fork	Jim George	Elk	EFN
No Harvest	1109.42	1798.05	1489.48	2185.91	902.96	353.81	7839.63
1972 - 1982	320.35	979.28	368.07	332.8	160.3	291.16	2451.97
1982 - 1992	1363.35	1513.15	565.2	1069.56	1205.53	986.31	6703.09
1992 - 2002	1035.54	252.07	426.62	185.93	258.73	335.64	2494.53
2002 - 2007	516.44	172.05	124.86	26.43	115.42	102.36	1057.56
Table 4b - 7th Field Percent Harvested by Decade							
Time Interval	Dog	Kenusky	Upper East	Gunners Fork	Jim George	Elk	EFN
No Harvest	25.03%	38.98%	51.68%	58.24%	33.06%	16.22%	38.04%
1972 - 1982	7.23%	21.23%	12.77%	8.87%	5.87%	13.35%	11.90%
1982 - 1992	30.75%	32.80%	19.61%	28.50%	44.14%	45.22%	32.52%
1992 - 2002	23.36%	5.46%	14.80%	4.95%	9.47%	15.39%	12.10%
2002 - 2007	11.65%	3.73%	4.33%	0.70%	4.23%	4.69%	5.13%

1 Environmental Investigations; a North Coast Basin Supplement. Fish and Wildlife Resources and their Requirements. Lauman, J. Smith, A. Thomson, K. Oregon State Game Commission 1968.

2 State of Oregon, Columbia County Water Rights Certificate Records.

Rain-On-Snow

Using the OWEB guidelines of 2000', few areas of the EFN are susceptible to ROS events as the vast majority of the watershed is below 2000'. Additionally, current annual open canopy has not been greater than 30% since 1992. This finding however is not supported by watershed specific local knowledge of flood events. Using the 1000' elevation, ~4% of Gunners Fork and Upper East Fork, 9% of Jim George, Elk, and Kenusky, and ~15% of Dog basins are susceptible to ROS events. Using modified OWEB guidelines, the risk of peak flow enhancement is low with an approximately 8-10% increase in flow.

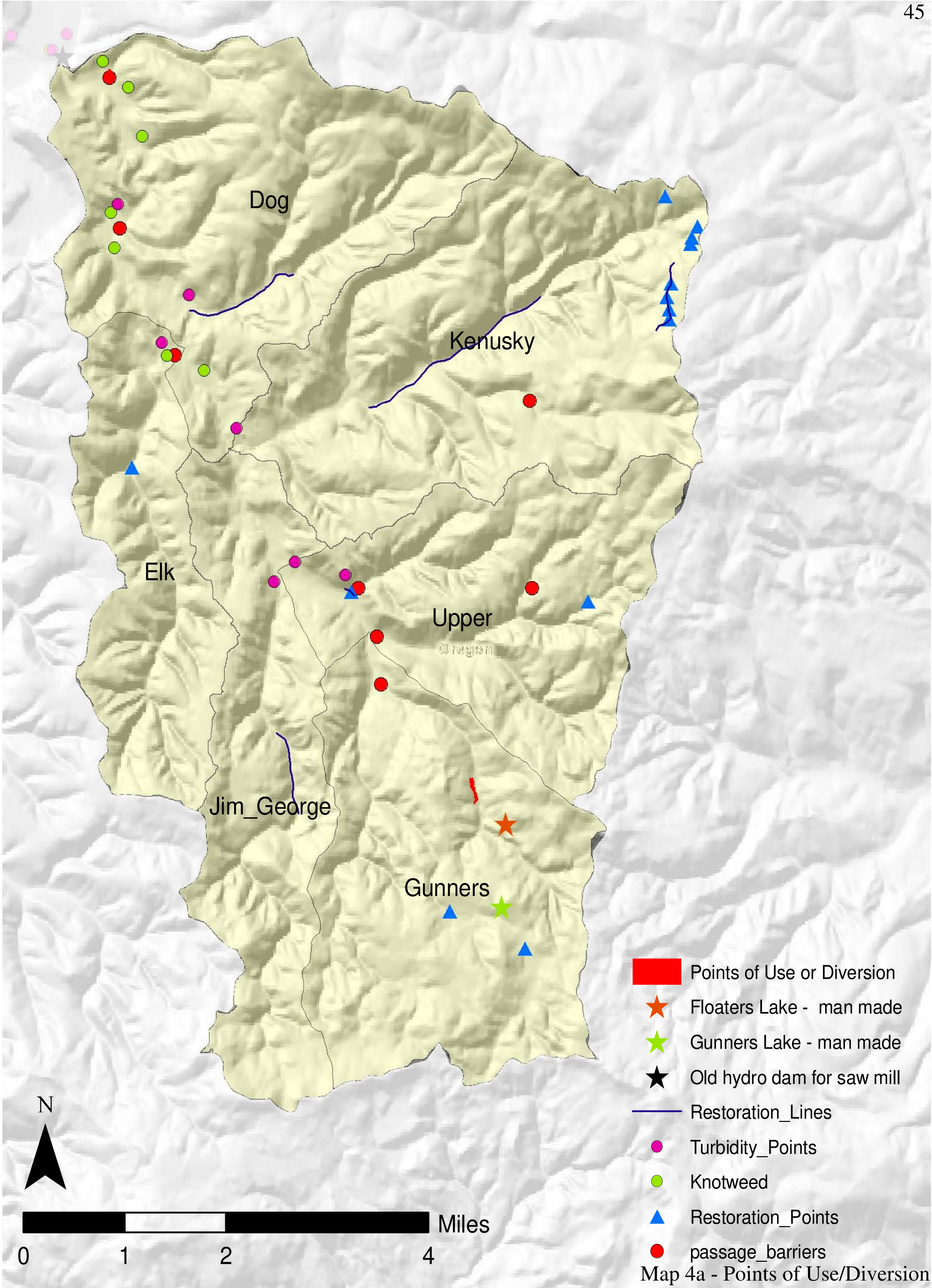
Climate data suggests that all first year clearings are susceptible to snow accumulation between late November and early March. West facing drainages such as Dog Creek and Kenusky are more exposed to winter rain storms. Dog Creek is the most susceptible to ROS events as this basin contains the most open canopy and the greatest exposure while Gunners Fork may be the least susceptible due to the low recent harvest rates, the rain-shadow effect, and impoundments which can delay flood events. Private homesteads occur in the lower elevations and make up less than 1% of the total watershed. This open canopy is not a likely factor in increase peak flows during ROS events. Timber harvest within the basin between 2002-2007 was not greater than 6% suggesting that current rotations do not clear enough land to impact hydrology by increasing the area open to snow-pack.

Other information

Only three known legal water storage structures occur within the subwatershed; Floaters Pond has a water right for 9 acre feet for fish culture while Gunners Lakes (34 acres feet and 15.5 acres feet) were created to store water for fire control. When rural forest roads are analyzed as an impermeable surface, they make up ~1% of the catchment. Few homesteads exist within the basin and no urban development is present. The only paved highway takes up <1% of the total watershed. Although is not likely to have an impact on peak flows, it may be limiting migration thus causing channelization which leads to floodplain disconnection and possibly lower summer flows and higher winter flows. A more detailed assessment of floodplain connection and hydro-modeling would be needed to determine the validity of this hypothesis. The OWRD and the USGS jointly maintain and monitor stream flow stations in northwest Oregon. Although no gaging stations existed in the EFN, nearby stations with similar watershed characteristics provide an estimate of what peak discharge rates likely are. The nearest gage operated at Oak Ranch Creek immediately north of the EFN (#14300200) from 1958 until 1969. During this time, the station collected data from an eleven square mile watershed with similar land use and precipitation as the EFN. Mean, minimum, and maximum flow data is listed in Table 4c below.

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1965	12/21/64	18.46	514
1968	02/20/68	13.67	170
		Average Peak High Flow	314

Table 4c - Peak flow discharge at Oak Ranch Creek HUC #14300200



Map 4a - Points of Use/Diversion

Analytical Conclusions

It does not appear that water withdraws have a significant impact on stream flows within the EFN. This is consistent with the OWEB driven Oregon Water Resource Inventory (OWRI) flow assessment conducted for the Nehalem Basin.[1] It is possible that the loss of floodplain habitat has decreased average summer flows. Further investigation is needed to determine the impacts of floodplain loss and flow reduction.

Although snow pack is not consistent, snow events are common throughout the north coast. Using OWEB guidelines the majority of the EFN is not susceptible to ROS events although this assessment may need to be reevaluated accounting for both the unique climate of the rainshadow of a coastal rainforest and the possible impacts of ongoing global climate change. A second analysis evaluating the average annual minimum temperatures and peak rainfall events suggest that the entire EFN is susceptible to ROS events when snow-pack occurs although current timber harvest data suggest that canopy cover is greater than 80%. As long as timber harvest remains at this level, the available data suggests that ROS is not a significant issue within the EFN.

Harvest within the EFN was greatest between 1982 and 1992. This time frame follows the general statewide occurrence of LWD removal from streams for the purposes of cleaning or salvage logging. Although there is no documentation of splash damming some areas within the EFN contain low wood volumes and almost all catchments are lacking key pieces. Further, RBA surveyors noted that remnant LWD was often buried by silt in the mainstem. The majority of the stream network is not protected from logging thus consistently reducing future LWD recruitment potential. This may have resulted in a systemic problem of floodplain disconnection in the mainstem EFN and lower tributaries. This prolonged impact on stream network hydrology possibly caused an overall increase in peak winter flows and decrease in summer low flows.

Finally AQI data indicates that well less than 2% of the mainstem EFN is in side channels and that 4 of the 6 reaches surveyed were either confined by hill-slope, alternating hill-slope and terrace, or terrace. This is not consistent with the channel habitat typing that suggests the lower river should be unconfined, which only occurs on two reaches totalling ~3300 meters. These areas were also confined to a single channel. Roughly 50% of the mainstem is classified as being unconfined but recent data suggests that ~22% is unconfined.

Key Findings

- From the limited data available, current land-use practices do not seem to be directly increasing peak high flows although reducing the capacity of headwaters to deliver LWD may have exaggerated peak low and high flows.
- Disconnected floodplains may be decreasing summer low flows and increasing winter peak high flows.

Recommendations

- Placing a gage in the East Fork mainstem would be beneficial in understanding how a lack of LWD is impacting flow.
- Headwater harvest should be evaluated and limited in areas identified as major contributors of LWD.
- Floodplain connectivity and channel complexity should be improved in areas with low gradients and unconfined channels such as the lower reaches of most tributaries and the mainstem EFN.

1 The Oregon Plan Stream Flow Restoration Priorities, Flow Restoration Priorities for Recovery of Anadramous Salmonids in Coastal Basins.

Chapter 5

Riparian Area and Wetland Condition

Critical Questions

1. Riparian

1. What are the current conditions of riparian areas in the watershed?
2. What areas within the watershed need protection?
3. What are the appropriate restoration and conservation activities within the watershed?

2. Wetlands

1. Where are the wetlands within the watershed?
2. What are the general characteristics of wetlands within the watershed?
3. What opportunities exist to restore wetlands within the watershed?

Introduction

A functioning riparian area is critical to retaining and filtering sediments, regulating flows, and preventing erosion. The riparian area is also critical for numerous plant and animal species both aquatic and terrestrial. Riparian areas throughout Oregon have been heavily impacted by current and past practices which include logging over the stream channel, grazing or cultivation of the riparian area, and the building of homes and roads adjacent to waterways. Although current timber management is generally more protective of aquatic resources than past practices, the impacts of historical harvest activities are still present and in some cases, systemic. The removal of LWD from the stream channel has likely resulted in downcutting which disconnects rivers from their floodplains. This alters the composition of the riparian vegetative community in addition to increasing the competence of the stream network. Few river systems remain undisturbed in Oregon. Minimally disturbed watersheds are used to assess if and by how much similar watersheds have been degraded by anthropogenic disturbance. In Oregon, minimally disturbed riparian areas are often dominated by large diameter conifers. In contrast, most coastal riparian areas are currently dominated by short-lived red alder, Oregon maple, and shrub species. Although all of these species would naturally be found in undisturbed watersheds it is the distribution, quantity, composition, and function that differs in disturbed watersheds. In disturbed watersheds, riparian trees are often similar in age, spacing, and do not provide the critical habitat components of a climax coniferous community. Wetlands are often associated with riparian areas and are critical for the rearing of young salmonids. Wetlands mitigate downstream flooding by storing, intercepting, or delaying surface runoff. Wetlands adjacent to the floodplain retain water that has over-topped the channel. Wetlands are sources of groundwater discharge that may help extend stream flows into the drier summer months. Additionally, beaver activity often creates gradient changes that result in wetland habitat.

One purpose of the BLM Watershed Analysis was to evaluate the current riparian buffers and the effectiveness of riparian management area (RMA) mandates. The following chapter will evaluate riparian condition with the EFN for several parameters; future LWD and gravel recruitment potential, shade condition, and floodplain connectivity. The water quality chapter contains a more detailed discussion of water temperature. Additionally, this chapter will evaluate the location and, when possible, the condition of wetlands within the EFN.

Riparian Condition - LWD and Substrate Recruitment Potential

Areas at risk for rapidly moving landslides (RMLs) were distinguished using the Department of Geology and Mineral Industries (DOGAMI) RML layer. High RML risk areas are identified using GIS layers for slopes and soils then verified by field surveys. Landslide initiation areas are defined as either a) non-headwater slopes found to be steeper than 80% or b) headwaters or draws steeper than 70%. Additionally, field identification of conditions deemed by a geotechnical specialist to be atypical for the region are classed as equivalent to either (a) or (b) above. Ultimately, the State Forester makes the final determination of equivalent hazard.[1] Other slopes are classed as either transport or deposition reaches also using slope as the determining classification factor. Areas at risk for RMLs are given an attribute labeled "true." High risk slopes were also evaluated using a 30 meter digital elevation model (DEM). Slopes over 65% were classified as high risk.

In order for the LWD recruitment potential to be greater than zero the height of the tree must at least be equal to its linear distance from the stream.[2] LWD and gravel supply basins (high risk for RMLs) were evaluated for the percentage of the 200' (100 linear feet on each side) stream buffer which had been harvested over a variety of time periods to determine the current potential of each 7th field to supply wood and spawning gravels to the EFN. A linear buffer was used rather than map distance for several reasons; to account for the input of climax community LWD, to account for the increased transport of LWD in higher gradient systems, and primarily to have a consistent metric for calculations. These areas are displayed in the maps to follow.

Streams managed by private forestry groups (BLM buffers all streams regardless of fish presence) were classified as either fish-bearing or nonfish-bearing using the BLM stream layer (non-verified). Nonfish-bearing streams on private lands were grouped for landslide risk. A 500' distance from fish-bearing streams was used to determine how many miles of nonfish-bearing streams were susceptible to harvest. The layers used to identify RML hazard and fish presence did not easily allow for linear referencing and therefore the distance was estimated using the ArcMap measure tool. Streams were also identified as either HH or VH CHTs in Chapter 3. These streams classifications were used as an alternative analysis for high risk slopes and potential LWD supply channels.

Riparian Condition - Riparian Vegetation and Shade

Riparian vegetation and canopy cover data was evaluated using comprehensive AQI data, field survey data collected by UNWC staff, and data from a fish abundance survey (RBA) conducted during 2008. There are no reference benchmarks for AQI riparian transects. Dominant vegetation classes that do not meet ODEQ reference standards are highlighted in red in Table 5b. Field surveys provide superior reach specific estimates of vegetation throughout the EFN than could be obtained with GIS analysis. A previous study conducted by Portland State University (PSU) delineated vegetation types.

Wetland Condition and Location

Historical wetland location was identified using several public data layers: the USGS 7.5' quads, the BLM water-body layers, and the EPA water-body layers. No data was available from the National Wetlands Inventory (NWI) for the EFN. Finally, the RBA surveys identified and evaluated wetland habitat associated with beavers.

1 http://egov.oregon.gov/ODF/PRIVATE_FORESTS/docs/fp/LandslideTechNote6.pdf
2 "The Impact of Riparian Forest Management on Large Woody Debris (LWD) Recruitment Potential"by Jason Cross

Results

Riparian Conditions

Table 5a describes the total riparian area in acres within a 100' buffer and BLM ownership within that area and in the broader 7th field. Generally, BLM ownership within riparian areas is equal to or less than their ownership in non-riparian areas suggesting that there is a slight disproportion in riparian ownership.

Basin	% Watershed Riparian	% Watershed BLM Non-Riparian	% Watershed BLM Riparian
Dog	23.46	7.24	7.48
Kenusky	23.13	42.1	19.23
Upper	22.48	92.6	6.52
Gunners	21.88	77.3	18.31
Jim_George	19.3	40.5	2.89
Elk	18.71	NA	NA
EFN	21.89	43.4	12.7

Table 5a - Riparian Area and Ownership

Table 5b summarizes the riparian condition of the EFN and tributaries between 1993 and 2006. Vegetation class codes indicate the average size of the most common vegetative community such as hardwood (HW,) mixed (MIX indicates a relatively even mix of hardwoods and conifers,) and conifers (CON.) The percentage of riparian canopy cover within three 10 meter intervals was collected during AQI surveys. From the available data riparian areas within the EFN are dominated by HW and MIX/CON stands. It appears that a reduction in shade has occurred throughout the basin between 1993 and 2005. This may be the result of red alder and Oregon maple senescence as both species are relatively short lived, blowdown from one of several windstorms, or due to surveyor error. Additionally, only the 1993 survey on Elk Creek showed banks dominated by conifers. These conifers provided little shade being relatively small and far from the water, suggesting that they will have little impact on water temperature until they mature. The 2005 surveys did not indicate that these conifers are still present although this may be the result of surveyor error.

Reach	Cover% 10m	Cover% 20m	Cover% 30m	Vegetation Class
EFN Mainstem 1993				
1	71	50	53	HW 15-30 cm
2	83	46	44	HW 15-30 cm
3	85	20	20	HW 15-30 cm
4	74	54	56	HW 3-15 cm
5	76	74	71	HW 3-15 cm
6	38	53	70	HW 3-15 cm
EFN Mainstem	72.1	47.8	50.4	
Kenusky Creek 1993				
1	71	48	45	HW 3-50 cm
2	55	35	31	HW 3-50 cm
3	90	78	73	HW 30-50 cm
Kenusky	70.7	53.3	49	
Kenusky Creek 1999				
Kenusky	46	43	42	HW 3-50 cm

Table 5b - Riparian Condition

Reach	Cover% 10m	Cover% 20m	Cover% 30m	Vegetation Class
Kenusky Creek 2005				
1	53	58	73	MIX 3-50 cm
2	30	28	38	MIX 3-50 cm
3	61	49	46	MIX 3-50 cm
4	50	49	43	MIX 3-90 cm
Kenusky	49	44.7	47.7	
Kenusky Creek 2006				
1	68	69	63	MIX 3-90 cm
2	90	86	84	MIX 3-90 cm
3	94	85	78	MIX 3-90 cm
4	69	76	76	MIX 3-90 cm
5	80	80	80	MIX 3->90 cm
Kenusky	78.1	77.3	74	
Elk Creek 1993				
1	60	40	25	MIX 3-90 cm
2	61	36	50	MIX 3-50 cm
3	0	0	5	CON 15-30 cm
4	63	43	24	MIX 3-90 cm
Elk	32	20.5	20.5	
Elk Creek 2005				
1	58	55	58	MIX 3-90 cm
2	48	58	68	MIX 3-90 cm
Elk	51.3	57	64.7	
Gunners Lake 2001 - 1000m downstream of impoundment				
Gunners Fork	64	63	60	MIX 3-50 cm
Gunners Lake 2005				
1	45	35	35	HW 3-30 cm
2	42	47	53	MIX 3->90 cm
Gunners Fork	43	42.9	46.8	
Jim George 2005				
1	56	36	44	MIX 3->90 cm
2	26	14	29	MIX 3-30 cm
Jim George	45.8	28.5	38.9	
Upper East Fork Nehalem including Hawkins - 2005				
1	61	36	50	MIX 3-90 cm
2	73	85	85	MIX 30-50 cm
1H	59	53	39	MIX 3-90 cm
Upper East Fork	61.8	48.7	50.4	

Table 5b - Riparian Condition

Dog Creek 1993				
1	72	76	61	MIX 3-90 cm
2	84	86	83.5	MIX 3-90 cm
Dog	73.8	77.5	64.4	
Dog Creek and Tributaries - 2005				
1	50	55	57	MIX 3-90 cm
2	56	48	50	MIX 3-90 cm
3	30	40	45	MIX 3-50 cm
1A	83	88	55	MIX 15-90 cm
Dog	59.9	64.3	53.4	

Table 5b - Riparian Condition

Harvest of High Risk Slopes and Riparian Areas

The majority of the high risk slopes are not managed by the BLM and occur in Elk, Jim George, and Upper EFN. Additionally the BLM has harvested proportionally less within these high risk areas than other land managers over the same time period (See Table 5c). While harvest methods within these areas may vary, Oregon Forest Practices Act (OFPA) requirements do not mandate riparian buffers on high landslide risk channels that are nonfish-bearing and are greater than 500' from a fish-bearing stream or on nonfish-bearing streams that are not at a high risk of rapidly moving landslides.[1] A total of 85 stream miles are subject to harvest within the riparian area as a result of being more than 500' from a fish-bearing stream or a low risk for landslides (Refer to Map 5a - Non-verified Fish Distribution).

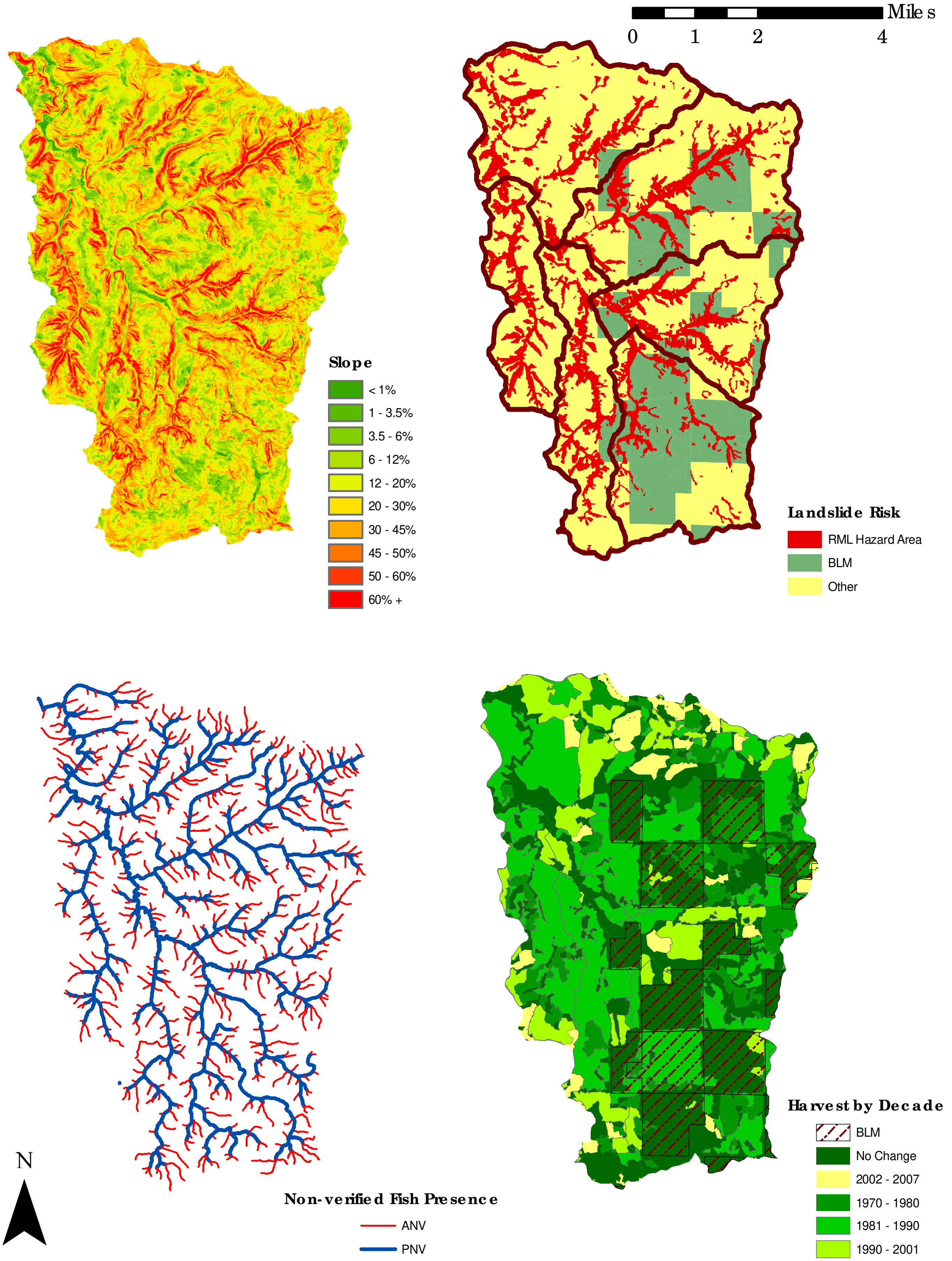
The majority of HH and VH streams were not located in high RML risk areas and, the majority being nonfish-bearing are also susceptible to headwater harvest. These headwater channels provide LWD for downstream channels. There are ~100 miles of HH and VH streams that have no legal mandate for riparian buffers. Please see chapter 9 for a discussion of verified fish distribution. The potential for future LWD recruitment is greatly reduced by the lack of riparian protection on these channel types. Of the 7th fields, Elk Creek has low LWD recruitment potential, Jim George Creek has several reaches with high LWD recruitment potential, Kenusky Creek has high LWD recruitment potential.

Owner	Total acres managed	Acres Harvested in High RML Risk Areas over 30 years	% of total
BLM	5167	1046	20.25%
Other	15444	3302	21.38%
Total	20611	4348	21.10%

Table 5c - Rapidly Moving Landslide Risk Area, Ownership, and Harvest

Using only the 30 meter DEM derived slope map and a 65% slope threshold (See map 5c - Slopes), Gunners Fork 7th field was identified as containing the fewest high risk slopes. The upper watershed is dominated by a series of historical wetlands (some of these wetlands have been converted into ponds, see discussion on wetland condition). Elk Creek contains the most high risk slopes using this method. Jim George contains more high risk slopes using the RML layer than the slope method.

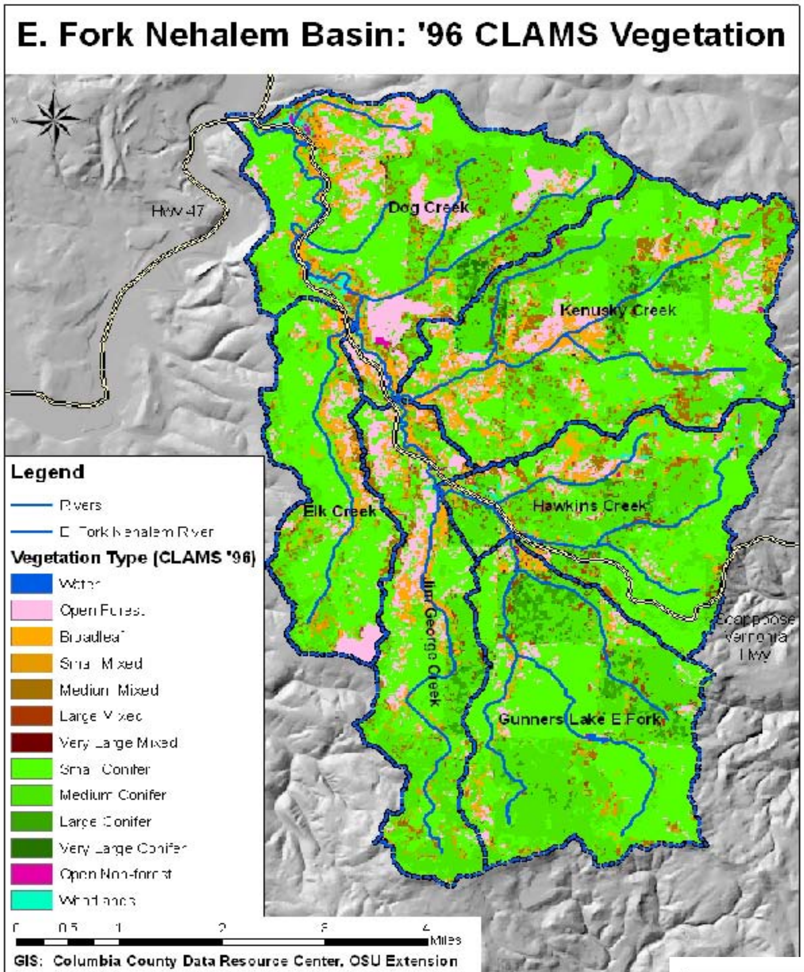
1 527.676 3d Oregon Forest Practices Act



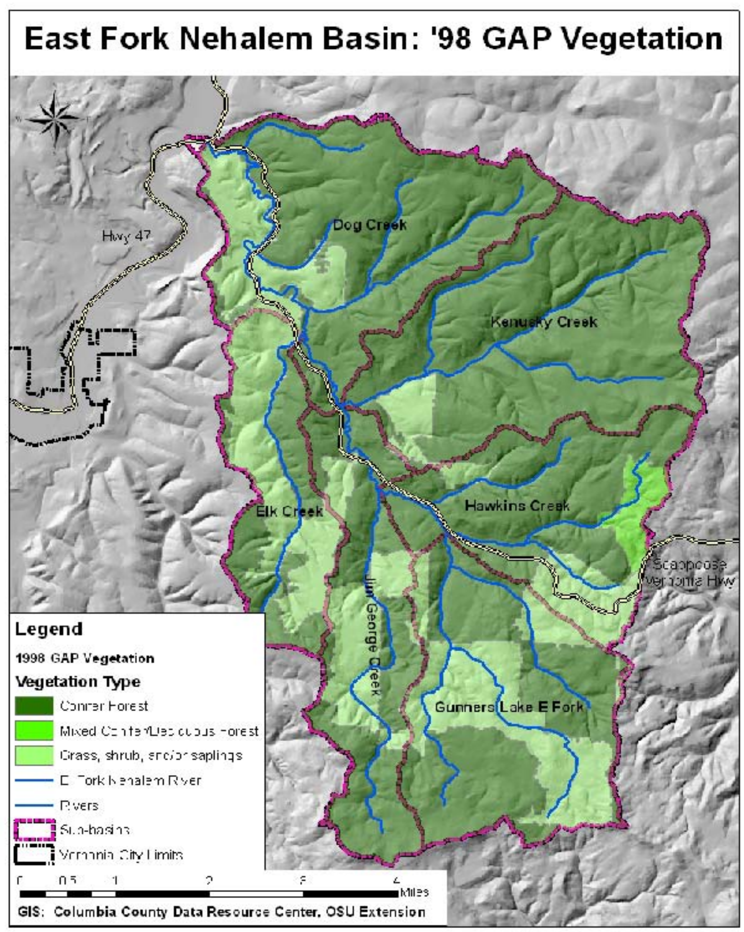
Map 5a - Landslide Risk, Fish Presence, Harvest by Decade

UNWC Staff Field Surveys

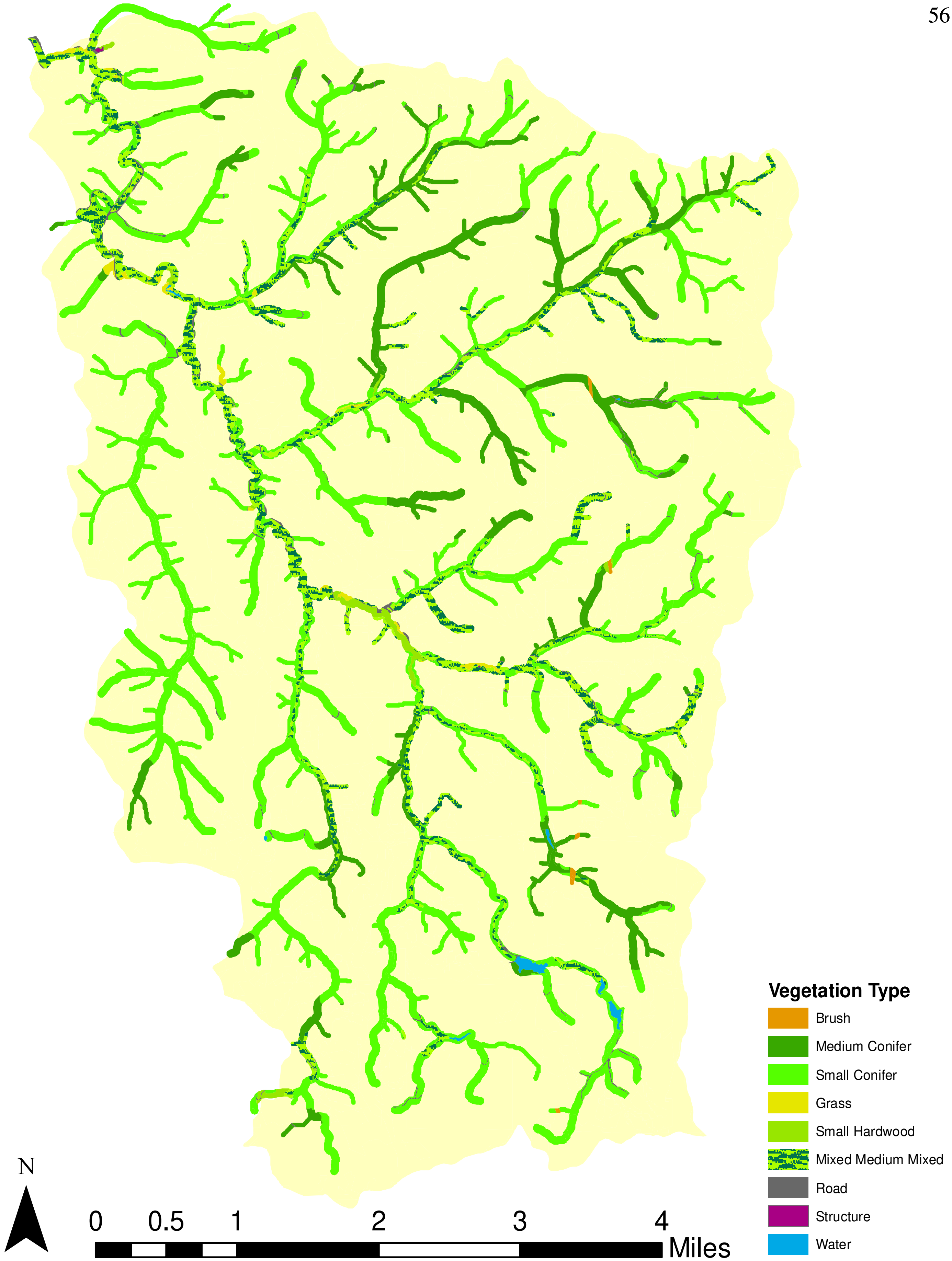
• Mainstem EFN - Vegetation along the mainstem is limited and consists of red alder, Oregon maple, reed Canary grass, Japanese knotweed, and scattered Douglas-fir.
• Dog Creek - Roughly 6% of the total area is grass or impermeable surfaces. Within the riparian area of Dog Creek medium sized Oregon maples and red alders dominate. The Dog Creek watershed has the most diverse array of riparian conditions of the six 7th field catchments.
• Elk Creek - There are narrow buffers surrounding the headwaters of Elk Creek, but lower reaches do contain some remnant second growth conifers. Erosion is high within the Elk Creek catchment and Elk Creek has the lowest shade values throughout the watershed.
• Jim George Creek - Jim George Creek has poor shade values which may be allowing the stream to reach higher summer water temperatures.
• Kenusky Creek - Kenusky has the highest percentage of riparian cover with 38% of the stream highly shaded. Conversely, 39% of the stream was poorly shaded. Kenusky Creek has good cover in the upper reaches, but moderate shade in the lower reaches which could cause temperature increases.
• Gunners Fork - Good shading along lower reaches might provide cooler waters to the East Fork main stem. This effect may be shadowed by the impact of the several impoundments within the basin.
• Upper East Fork - This catchment has good shade along the lower reaches.



Map 5b - 1996 CLAMS Vegetation



Map 5c - 1998 GAP Vegetation



Map 5d - PSU Study

Riparian Roads

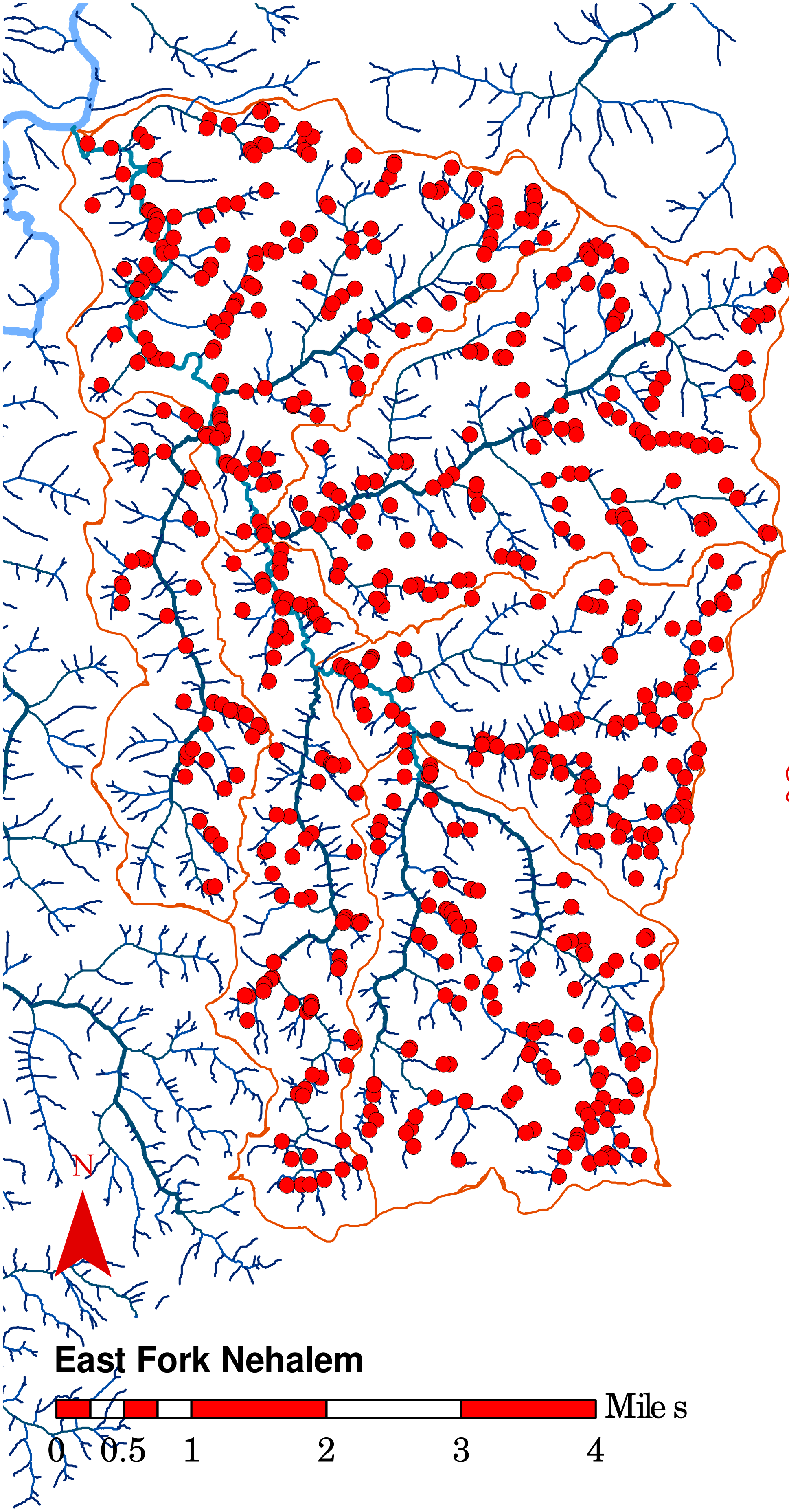
The road network is extensive throughout the EFN. There are ~167 miles of maintained and remnant roads within the EFN. For every one mile of stream there is roughly .85 miles of road. There are 37 miles of road within the 200’ (100’ on both sides) riparian buffer area. The majority of the roads are found within the Dog Creek basin (~37 miles) as are the majority of the riparian roads (~10 miles) although the watersheds with the highest road density are Upper East Fork and Jim George Creek. Refer to Tables 5d and 5e below for the results of the road density assessment. Riparian road density is highest in Dog Creek, Upper East Fork, and Jim George Creek. Roads density on BLM lands is lower than throughout the EFN although BLM managed riparian roads are the most dense in Jim George Creek. This is likely an artifact of the small total area managed by the BLM within the watershed. Road Crossings can be seen in Map 5e on the following page.

Watershed	Road Length/ Acre - All Owners	Road Length in Riparian/ Acre - All Owners	Road Length/ Acre - BLM	Road Length in Riparian/ Acre - BLM
Dog	0.0080	0.0090	0.0003	0.0050
Kenusky	0.0080	0.0070	0.0030	0.0070
Upper	0.0090	0.0090	0.0020	0.0080
Gunners Fork	0.0080	0.0080	0.0050	0.0060
Jim George	0.0090	0.0090	0.0009	0.0140
Elk	0.0070	0.0070	NA	NA
EFN	0.0080	0.0080	0.0020	0.0070

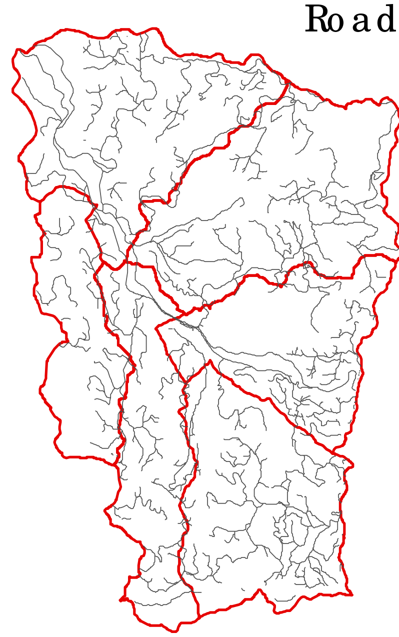
Table 5d - BLM Riparian Road Density vs. EFN Riparian Road Density

Basin	Total Area in Acres - All Owners	Total Riparian Area in Acres - All Owners	# of Road Crossings	Road Crossings/ Riparian Acres
Dog	4433	1040	151	0.15
Kenusky	4613	1067	125	0.12
Upper	2882	648	98	0.15
Gunners	3753	821	110	0.13
Jim_George	2731	527	89	0.17
Elk	2181	408	42	0.1
EFN 6th Field	20611	4511	615	0.14

Table 5e - Area, Riparian Area, Road Crossings, and Road Crossing Density



Ro a d s



Ro a d Cro ssing s
EFN_7th
Road Crossings

Map 5e - Road Crossings

Wetlands

It is likely that historically there would be a greater quantity of wetlands within the EFN than is present today. Many of these wetlands would be associated with the low gradient river systems and would most likely be associated with LWD or beaver presence. With the active removal of LWD, systemic reduction in LWD recruitment potential, and with falling beaver populations throughout most of the basin, wetlands are not common. Additionally, the confinement of the lower mainstem by roads, homesteads, and the Crown Zellerbach Mainline limit the area available for wetland formation.

The riverine wetland habitat largely removed from the EFN is currently being restored through active beaver activity within the Elk Creek basin. AQI surveys suggest that Elk creek is increasing in beaver activity which is quickly creating wetland habitats. LWD within Elk creek is also high suggesting that this entrenched channel will reconnect with the floodplain and create excellent off-channel habitat. A culvert blocking passage into Elk creek prevents juvenile salmonids from fully utilizing this off-channel habitat during high winter flows. Although beaver presence is high within this basin, the creek has not been fully reconnected with the floodplain. Beaver dams, although restorative in nature, may block further fish passage if the culvert is removed. Restorative actions would be complicated in this basin as the watershed does not easily lend itself to large equipment. Riparian plantings to increase beaver food and future LWD should be considered as the beaver activity will likely improve connectivity more efficiently than any other restoration activity. As beavers can remove all young vegetation from riparian planting projects, large areas should be fenced rotationally to discourage beavers, elk, and deer and open areas should be planted with densities to allow for wildlife and riparian objectives to be achieved.

The only available wetlands data maps suggest that historical wetlands were present throughout the upper regions of Jim George Creek and Gunners Fork. A 20’ (non-verified height) earthen dam at the mouth of one of Gunners Lakes impounds a historical marsh which could provide excellent wetland habitat for many species of birds, reptiles, and amphibians. Additionally, a dam within this basin also creates Floeters Pond which could potentially provide habitat from multiple species. Dam removal should be considered for part of both of these artificial lakes. These ponds are largely inaccessible to native salmonid species and increase downstream water temperatures (see water quality discussion). Ensuring that native species can access the wetlands while preventing nonnative fish from escaping is important.

Analytical Conclusions

As the entire EFN not within BLM ownership has been harvested at least once within the 30 years (not likely on private homesteads), it is assumed that these channels provide poor future LWD recruitment potential. These findings are consistent with the BLM EFN Watershed Analysis which found that the riparian habitat within the EFN was impacted by the removal of large conifer trees and logs.[1] Although the OFPA requires that managers maintain 50' buffers on fish-bearing streams (this may be reduced with the placement of instream wood) the OFPA does not protect nonfish-bearing streams that are not at a high risk of failure nor does it protect high risk streams greater than 500' from a fish-bearing stream. Fish presence within a watershed may be limited to a portion of their historical distribution due to degraded habitat which may increase harvest in areas that would be protected were fish present throughout their historical distribution. Further, headwater harvest may increase overall stream temperatures which impacts fish-bearing streams regardless of their proximity to headwaters. The reduction of potential of climax community conifers may sustain the current state of the EFN which is entrenched in many places. As climax community species can reach heights in excess of 350' (although wind-throw is a dominant factor in keeping the canopy much shorter at ~240') a 50' buffer limits LWD inputs.

During the Nehalem Watershed Assessment, the EFN was identified as having poor riparian conditions with narrow riparian buffers.[2] This assessment confirms this finding. The majority of the riparian area is dominated by hardwoods or mixed stands. Only one reach was dominated by conifers. Therefore nearly the entire watershed deviates from potential conditions. This is similar to the pattern observed throughout the Ecoregion.[3] An overall reduction in riparian vegetation was noted in Dog Creek and Kenusky Creek over the previous 15 years. This may be the result of timber operations Alder senescence. Riparian stand conversion should be considered along the mainstem EFN which is dominated by hardwoods and in the remaining basins which have a mixed vegetative community. Although the Upper EFN 7th field is highly shaded, the mainstem at the confluence with this catchment is exceeding temperature standards set by the ODEQ suggesting that the lakes are raising the temperature of the EFN.

Finally, Jim George, Dog, and Upper East Fork basins appear to be the most impacted by riparian roads. Roads occurring on private land are the most dense within these basins and are often more dense in the riparian zone, especially on roads within BLM lands. Additionally, the BLM should consider reducing riparian road density. BLM riparian road density is greater than BLM sub-watershed road density within all catchments of the EFN.

The general lack of high quality riparian habitat suggests that riparian reserves and buffers maintained by BLM are critical to maintaining functional ecosystems with the EFN.

1 BLM East Fork Nehalem Watershed Analysis. Page 45
2 Nehalem River Watershed Assessment 5.0 Riparian Conditions
3 ODFW Tillamook Habitat Assessment Kavanaugh, P. and Jones, K. 2005

Key Findings

• Riparian condition is generally poor throughout the EFN, the lower mainstem is particularly impacted.
• The EFN is more degraded than some watersheds within the Nehalem (Reference Site located near EFN) and Coast Range Ecoregion (Reference throughout the North Coast Ecoregion) but a large area of the Nehalem has been recently harvested while recent harvest levels within the EFN are relatively low.
• BLM managed riparian zones will provide important habitat over the long run due to the stringent protections in place.
• Wetland habitat is minimal throughout the basin.

Recommendations

• Headwater channels should be protected to restore long term watershed process.
• Thinning of riparian hardwoods may be an effective watershed scale strategy in conjunction with strategic conifer planting.
• Beaver activity in Elk Creek should be encouraged to promote the creation of wetland habitat and floodplain reconnection.
• Gunners Lakes and Floeters Pond may provide good potential for wetland restoration such as reducing the surface area open to solar exposure, introducing threatened, endangered, or managed native species such as pond turtles to the system, or by removing non-native fish.
• Temperature monitoring of likely heat sources such as Gunners Lakes and Floeters Pond should occur to ensure that they are not increasing the temperature of the EFN.

Chapter 6

Sediment Sources

Critical Questions

1. Where are the sediment sources occurring in the watershed?
2. Where are the high risk areas for future sediment input?
3. Where are the priorities for sediment control?

Introduction

Sediment impacts aquatic habitat in several ways; suspended sediments reduce the ability of migrating salmon to sense their way to spawning areas, embedded sediments reduce the dissolved oxygen that is required by developing salmon eggs, and excess sediment delivery to the stream channel can alter the channel morphology by filling pools and increasing the active channel width. The dominant erosion processes in systems such as the EFN are mass wasting and surface erosion. Mass wasting processes are dominated by landslides and debris flows, which occur mostly on steep hill slopes adjacent to streams. While these processes are necessary for the input of sediments and LWD, excess erosion can lead to excess sedimentation and a loss of LWD recruitment potential. Sedimentation can be evaluated using a number of techniques; total bedded fine sediments (%SAFN) (measured as the percentage of sands and fines which can be collected either as a grab sample or through pebble counts), relative bed stability (RBS) (a ratio of stream competence to average particle size as determined using pebble counts and measurements of channel morphology), sediments within the water column can be measured as either total suspended solids (TSS) or turbidity. The impact of fine sediments to the biotic community can be directly measured by taking samples of the macroinvertebrate community. These measurements are most effectively used together. This chapter examines the sediment and biotic data collected within the EFN over a period of ~10 years. Additionally, landslide prone slopes, riparian roads, and timber harvest data within the EFN were evaluated and discussed in the previous chapter and repeated in this chapter.

Materials, Methods, and Resources

• Turbidity in the East Fork Nehalem watershed has been measured by volunteers and staff of the Upper Nehalem Watershed Council periodically since 1998. The protocols used for gathering these samples can be found in the Water Quality Monitoring Technical Guide Book, published by the Oregon Plan for Salmon and Watersheds.

• Macroinvertebrate data was analyzed using the ODEQ RIVPACS and PREDATOR models.

Risk of slope failure was calculated by using data available from the Department of Geology and Mineral Industries (DOGAMI.)[1] Landslide risk was determined using the Hazard Map of Potential Rapidly Moving Landslides in Western Oregon – 2002.

• Harvest data provided by the Wild Salmon Center and Oregon Department of Forestry was analyzed for the percent of timber harvested within high landslide risk areas.

• The percentage of erosion prone soils was calculated for each 7th field using available Columbia County soils. Soil types were identified using NRCS/USDA soil classification maps. Area was calculated for individual soil types using the "EasyCalculate Expressions Field Calculator." Soils were classed into four general groups using descriptions in the USDA Taxonomic Soils Key (10th edition.) These groups are; erosion prone soils, erosion resistant soils, gravel soils, and fluvial soils.

• ODFW AQI reference standards were used to evaluate potential sediment problem areas by measuring the deviation from benchmark.

• Roads within 200' of a stream are the most likely to deliver unfiltered sediment to the streams. The total miles of road within this buffer zone was calculated using the available road layers and the BLM stream layer. To calculate the miles of riparian roads, 200' (100' on either side) stream buffers were generated on the BLM stream layer. This buffer layer was intersected with available road layers.

• Potential sediment sources were assessed using the OWEB guidelines and landslide inventories available for the region. Aerial photographic series were examined to determine when and where landslides had occurred. These photographs were overlaid onto available timber harvest data and soils data to determine if timber harvest influenced landslides and to identify natural rotating slides within the area.

• BLM geology specialists reviewed the findings found in this chapter.

ODFW Habitat Benchmark Metric	*Low*	*High*	
Fines in Riffle Units	>22%	<8%	
ODFW Reference Site Averages	*25th Percentile*	*75th Percentile*	*Average*
Fines in Riffle Units	15	11	5
EMAP "Erodible Lithology" Reference Conditions	*Mean*	*SD*	*SE*
%SAFN	19.95%	18.58%	3.96%

Table 6a - ODFW and EMAP Reference Conditions and Habitat Benchmarks

1 Hazard Map of Potential Rapidly Moving Landslides in Western Oregon. 2002. Hofmeister, R. et. al. State of Oregon Department of Geology and Mineral Industries.

Results

Soils

The EFN Watershed consists of Tmst, "a Tuffaceous and arkosic sandstone... with locally fossiliferous, tuffaceous siltstone, tuff, glauconitic sandstone, minor conglomerate layers and lenses, and a few thin coal beds," and Tc, "Subaerial basalt and minor andesite lava flows and flow breccia; submarine palagonitic tuff and pillow complexes of he Columbia River Basalt Group," geologic formations.[1] The majority of the soils within the EFN are classified as being prone to erosion with slow to rapid runoff and moderate permeability. Generally the Willapa Hills Ecoregion, which includes the EFN, is sensitive to disturbance and more prone to water quality sediment related impairments than other Ecoregions within the Oregon North Coast due to the high proportion of clays and silts.[2] Depths to bedrock range from 40 inches to greater than 60 inches. The most common soil type within the watershed consists of the Scaponia-Braun Series (~32%) which is described as having severe water erosion potential.[3] The second most common soil type is the Tolany Loams series (~21.5%). These soils are described by the NRCS as being well drained with moderate permeability. The Vernonia series (21%) is also well drained with slow to rapid runoff. Murnen Silt Loams make up ~14% of the watershed. This soil is typified by being moderately to well drained and having slow to medium runoff as are the Bacona series soils which make up around 8% of the watershed. Approximately 13% of the watershed consists of the Glohm soil series which has poor permeability in the fragipan horizon. A fragipan is present and prevents deep root penetration and thus soils developing over this formation are often shallow. Kenusky soils, which are poorly drained, make up <1% of the watershed and are localized a small area within upper Jim George Creek.[4] The distribution of soil types follows closely with the distribution of the parent material with soils more prone to erosion being more common within the sedimentary geology. Gravel loams are present but not common within the watershed. Udifluvent soils are found along the entire EFN mainstem in addition to the lower portions of Kenusky Creek, Dog Creek, East Fork of the EFN, Gunners Fork, and Elk Creek. The area by soil class is depicted in Table 6b on the following page. Map 6a displays soil class types.

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1 Interactive Geology Map of Oregon. http://nwdata.geol.pdx.edu/OR-Geology

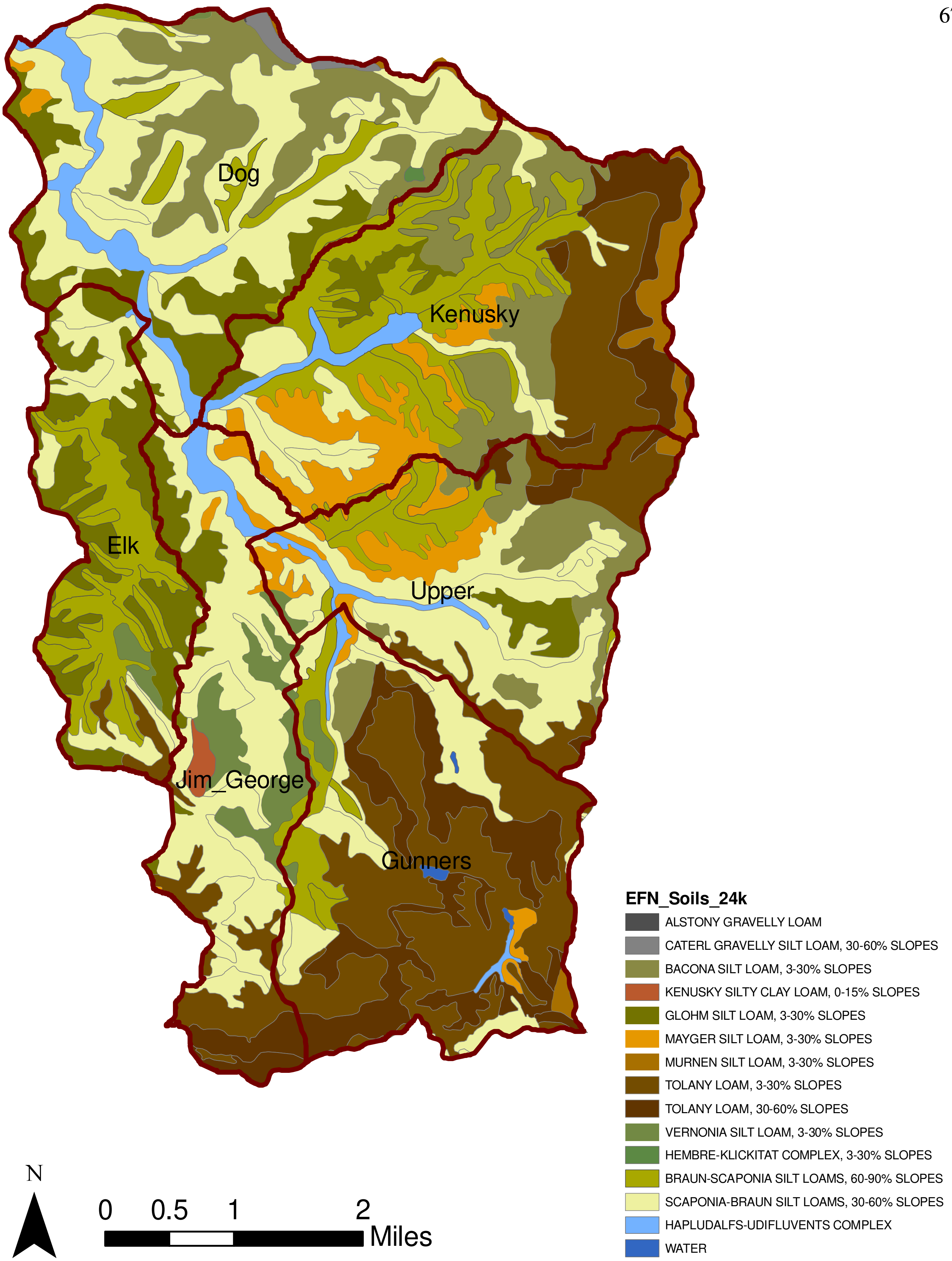
2 Ecoregions of Oregon Environmental Protection Agency

3 Bradwood Landing Terminal – Resource Report 7. Soils. Northern Star Natural Gas LLC. 2006 http://64.233.167.104/search?q=cache:Z9weonNn_RAJ:www.bradwoodlanding.com/filing-papers/FERC_PF05-10/t_resource-reports_03-02-06/Resource%2520Report%25207/Resource%2520Report%25207.pdf+scaponia-braun+series+description&hl=en&ct=clnk&cd=1&gl=us

4 http://www2.ftw.nrcs.usda.gov/osd/dat/V/VERNONIA.html

Soil Name	%Area
ALSTONY GRAVELLY LOAM, 60 TO 90 PERCENT SOUTH SLOPES	0.10%
BACONA SILT LOAM, 3 TO 30 PERCENT SLOPES	8.35%
BRAUN-SCAPONIA SILT LOAMS, 60 TO 90 PERCENT NORTH SLOPES	3.64%
BRAUN-SCAPONIA SILT LOAMS, 60 TO 90 PERCENT SOUTH SLOPES	5.60%
CATERL GRAVELLY SILT LOAM, 30 TO 60 PERCENT NORTH SLOPES	0.46%
GLOHM SILT LOAM, 3 TO 30 PERCENT SLOPES	12.68%
HAPLUDALFS-UDIFLUVENTS COMPLEX	2.14%
HEMBRE-KLICKITAT COMPLEX, 3 TO 30 PERCENT SLOPES	0.03%
KENUSKY SILTY CLAY LOAM, 0 TO 15 PERCENT SLOPES	0.15%
MAYGER SILT LOAM, 3 TO 30 PERCENT SLOPES	3.27%
MURNEN SILT LOAM, 3 TO 30 PERCENT SLOPES	13.74%
SCAPONIA-BRAUN SILT LOAMS, 30 TO 60 PERCENT NORTH SLOPES	10.70%
SCAPONIA-BRAUN SILT LOAMS, 30 TO 60 PERCENT SOUTH SLOPES	14.32%
TOLANY LOAM, 3 TO 30 PERCENT SLOPES	14.75%
TOLANY LOAM, 30 TO 60 PERCENT NORTH SLOPES	4.29%
TOLANY LOAM, 30 TO 60 PERCENT SOUTH SLOPES	3.57%
VERNONIA SILT LOAM, 3 TO 30 PERCENT SLOPES	2.13%
WATER	0.06%

Table 6b - Soil Class as Percentage of Total Watershed Area



Map 6a - Soil Types

High Risk Slope and Timber Harvest

There are ~4350 acres at high risk of rapidly moving landslides (RML) within the EFN or roughly 20% of the entire EFN watershed (refer to Map 5a on page 53). Timber harvest following European arrival began with modest operations and increased until the vast majority of the EFN sub-watershed was harvested multiple times. Only within the last decade has there been a reduction in harvesting. Sediment impacts are often systemic and pulses of sediments from a past disturbance can take as long as 40 years to exit a system.[1]

Elk Creek	Acres of High RML Risk Harvested by Decade	% of total Area
2002-2007	12.91	0.60%
1972-1982	124.25	6.00%
1982-1992	256.8	12.40%
1992-2002	50.99	2.50%
Total	600.23	~21.5%
Upper East Fork	Acres	% of total Area
2002-2007	28.81	0.97%
1972-1982	62.38	2.10%
1982-1992	63.09	2.12%
1992-2002	100.5	3.38%
Total	254.78	~8.57%
Jim George	Acres	% of total Area
2002-2007	13.56	0.51%
1972-1982	21.13	0.80%
1982-1992	312.51	11.82%
1992-2002	75.01	2.84%
Total	422.2	~15.97%
Kenusky	Acres	% of total Area
2002-2007	8.32	0.18%
1972-1982	146.2	3.10%
1982-1992	326.97	6.94%
1992-2002	29.21	0.62%
Total	510.7	10.83%
Dog Creek	Acres	% of total Area
2002-2007	46.23	1.06%
1972-1982	12.96	0.30%
1982-1992	297.24	6.84%
1992-2002	200.36	4.61%
Total	556.79	12.81%
Gunners Fork	Acres	% of total Area
2002-2007	0	0.00%
1972-1982	13	0.34%
1982-1992	176.54	4.64%
1992-2002	27.66	0.73%
Total	217.2	5.71%

Table 6c - Harvest In High Landslide Risk Areas

1 North Fork Siuslaw Sediment and Physical Habitat Assessment. Mico, C. and Mico, L. 2008

Table 6d below displays harvest within high landslide risk areas by acres and as a percentage of the total area for BLM and other ownership. The BLM harvests slightly fewer acres within high landslide risk areas than other land managers.

Owner	Total area managed	Harvest within RML	% total area managed
BLM	5167	1046	20.25%
Other	15444	3302	21.38%
Total	20611	4348	21.10%

Table 6d - Harvest in High Landslide Risk Areas

AQI

The analysis of the AQI data was complicated for several reasons; survey length varied by reach, year, and habitat unit and had to be weighted accordingly. There was no available reference data by habitat unit and data was not weighted in this manner therefore the substrate scores may not perfectly represent the actual condition of the EFN. The 1993 and 2005 surveys were compared for trend. Only Kenusky, Elk, and Dog Creeks are used in the 1993/2005 trend analysis as these are the only streams within the EFN with data from both years; the results are displayed below in Table 6e.

Basin	%SAFN	%SAFN in Riffle Only Habitat	Total Percentage Gravel
Kenusky, Elk, Dog 1993	48.4	31.7	39.4
Kenusky, Elk, Dog 2005	49.5	31.9	26.6

Table 6e - AQI Sediment Data for Trend Analysis

Additionally, the AQI data was weighted by reach length and averaged for each 7th field and year. The results are shown in Table 6f which follows.

Reach	%SAFN	% SAFN in Riffles	%Gravels
EFN Mainstem 1993			
1	53	44	27
2	63	50	31
3	39	27	51
4	10	8	34
5	41	32	28
6	58	48	10
EFN Mainstem	51.3	41.1	29.5
Kenusky Creek 1993			
1	45	27	53
2	34	20	41
3	31	24	49
Kenusky	34.5	22.6	45.8
Kenusky Creek 1999			
Kenusky	54	62	10

Table 6f - Weighted Averages AQI Sediment Data

Reach	%SAFN	% SAFN in Riffles	%Gravels
Kenusky Creek 2005			
1	55	30	34
2	57	38	29
3	37	19	29
4	44	0	16
Kenusky	46.9	22.5	27.4
Kenusky Creek 2006			
1	61	37	37
2	41	21	29
3	50	27	27
4	52	21	28
5	37	17	28
Kenusky	49.6	26.9	31.7
Elk Creek 1993			
1	64	60	33
2	85	80	11
3	81	60	19
4	100	*	0
Elk	78.3	60.6	20.1
Elk Creek 2005			
1	63	58	8
2	60	39	18
Elk	61	45.2	14.7
Gunners Lake 2001 - 1000m long from Gunners lake down.			
Gunners Fork	7	*	15
Gunners Lake 2005			
1	33	10	14
2	13	10	13
Gunners Fork	19.9	10	13.3
Jim George 2005			
1	47	23	29
2	39	18	27
Jim George	44.3	21.3	28.3
Upper East Fork Nehalem including Hawkins - 2005			
1	36	15	30
2	16	21	34
1H	32	15	32
Upper East Fork	32	15.8	31.3
Dog Creek 1993			
1	58	31	41
2	42	22	34
Dog	55.6	29.6	39.9

Table 6f Continued - Weighted Averages AQI Sediment Data

Reach	%SAFN	% SAFN in Riffles	%Gravels
Dog Creek and Tributaries - 2005			
1	55	27	45
2	51	25	36
3	11	25	41
1A	31	30	41
Dog	37.8	27.6	41.8

Table 6f Continued- Weighted Averages AQI Sediment Data

There appeared to be a reduction in gravels in the three catchments assessed for trend. This may be the result of consistent inputs of fine sediments to the system that result in buried gravels. Additionally, several large flood events occurred between 1993 and 2005, it is possible that these flood events flushed out or buried gravels with the fine sediments entering from the upper watershed. These values were compared to reference conditions using the ODFW habitat benchmarks, reference site averages, and the EPA EMAP reference averages for the Oregon Coast erodible lithologies. These values are shown in Table 6a. Data within the EFN appears to be above reference averages and well below habitat benchmarks for %SAFN and for %SAFN in riffles. Almost every reach was moderately to severely below the low break for habitat benchmarks, and many were at least 1 standard deviation above the EMAP %SAFN values. There were few reaches which fell at least 1 standard deviation below these benchmarks but more importantly, the distribution of the data is such that almost no reaches exceeded reference conditions except in gravel quantity.

Harvest data derived from LandSat data was evaluated as well. These values are depicted in the table below. Kenusky, Elk, and Dog 7th fields appear to contain the greatest quantity of fine sediments in all habitat types while Gunners Fork appears to contribute the least. Dams at the headwaters of Gunners Fork may be retaining excess fine sediments and creating 'hungry water' which leads to scour downstream. Sediment estimations for Elk Creek need further investigation as the majority of this basin contains beaver activity. The beaver dam pools within this basin trap large quantities of fine sediments. Additionally, there are larger volumes of LWD within Elk Creek compared to the rest of the EFN which can potentially trap more fine sediments behind them. Although Elk Creek may be retaining more fine sediments, this does not necessarily indicate that there are not elevated inputs. Elk Creek contained the fewest acres which had not been harvested in the previous four decades while Gunners Fork contained the most (refer to Table 6g below) suggesting that timber harvest may have some relationship with instream sedimentation within the EFN.

Time Interval	Dog	Kenusky	Upper East	Gunners Fork	Jim George	Elk	EFN
No Harvest	25.03%	38.98%	51.68%	58.24%	33.06%	16.22%	38.04%
1972 - 1982	7.23%	21.23%	12.77%	8.87%	5.87%	13.35%	11.90%
1982 - 1992	30.75%	32.80%	19.61%	28.50%	44.14%	45.22%	32.52%
1992 - 2002	23.36%	5.46%	14.80%	4.95%	9.47%	15.39%	12.10%
2002 - 2007	11.65%	3.73%	4.33%	0.70%	4.23%	4.69%	5.13%

Table 6g - Harvest Area by Decade and 7th Field

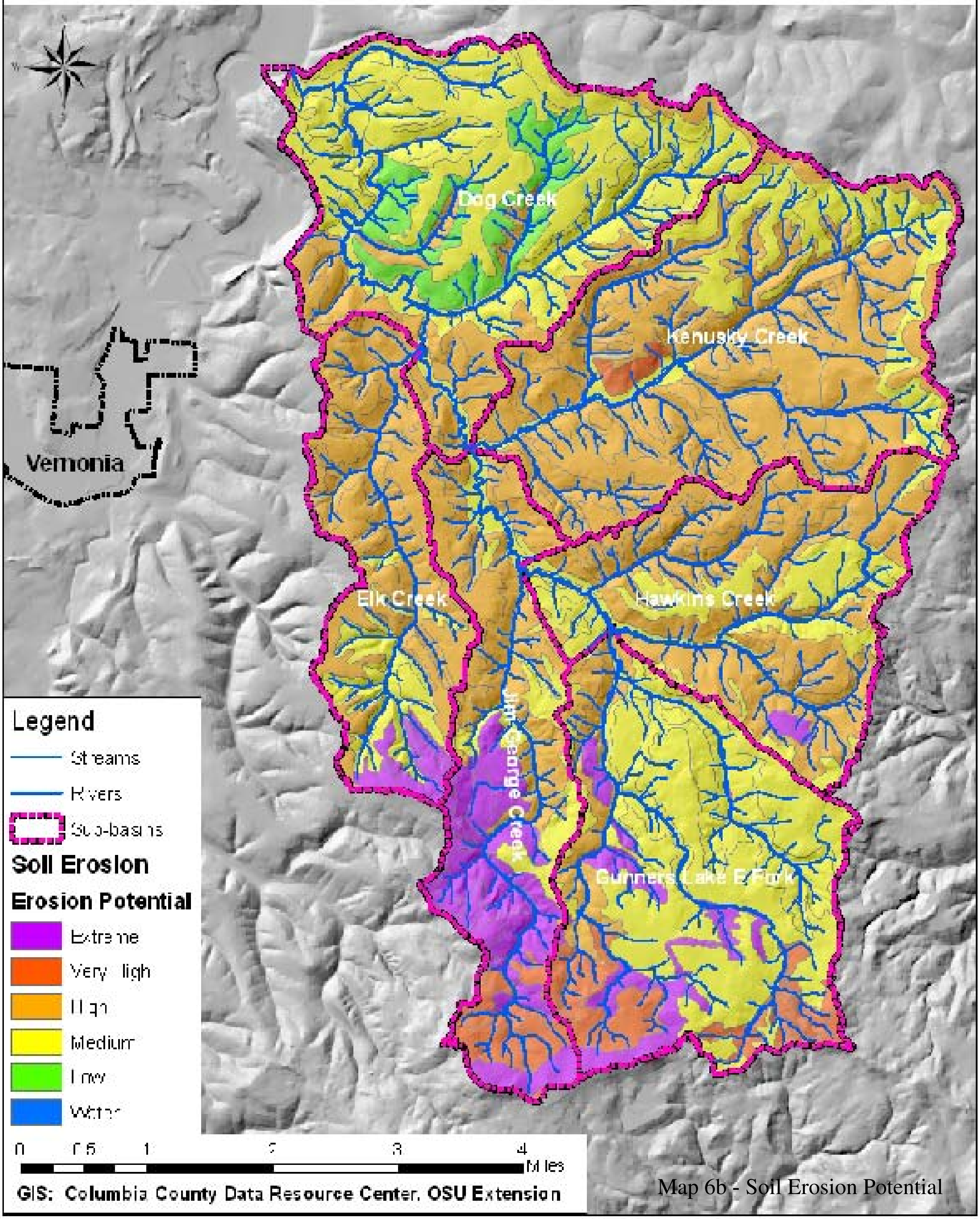
Macroinvertebrate, Turbidity, and Point-source Data

Sediment point sources are largely unknown. Field surveys were conducted for this assessment during which few landslides were noted. Beaver dams are common throughout some basins of the EFN and these may be retaining excess fine sediments reducing the overall impact of sedimentation within the watershed. Roughly 2.5% of the watershed area is road surface.

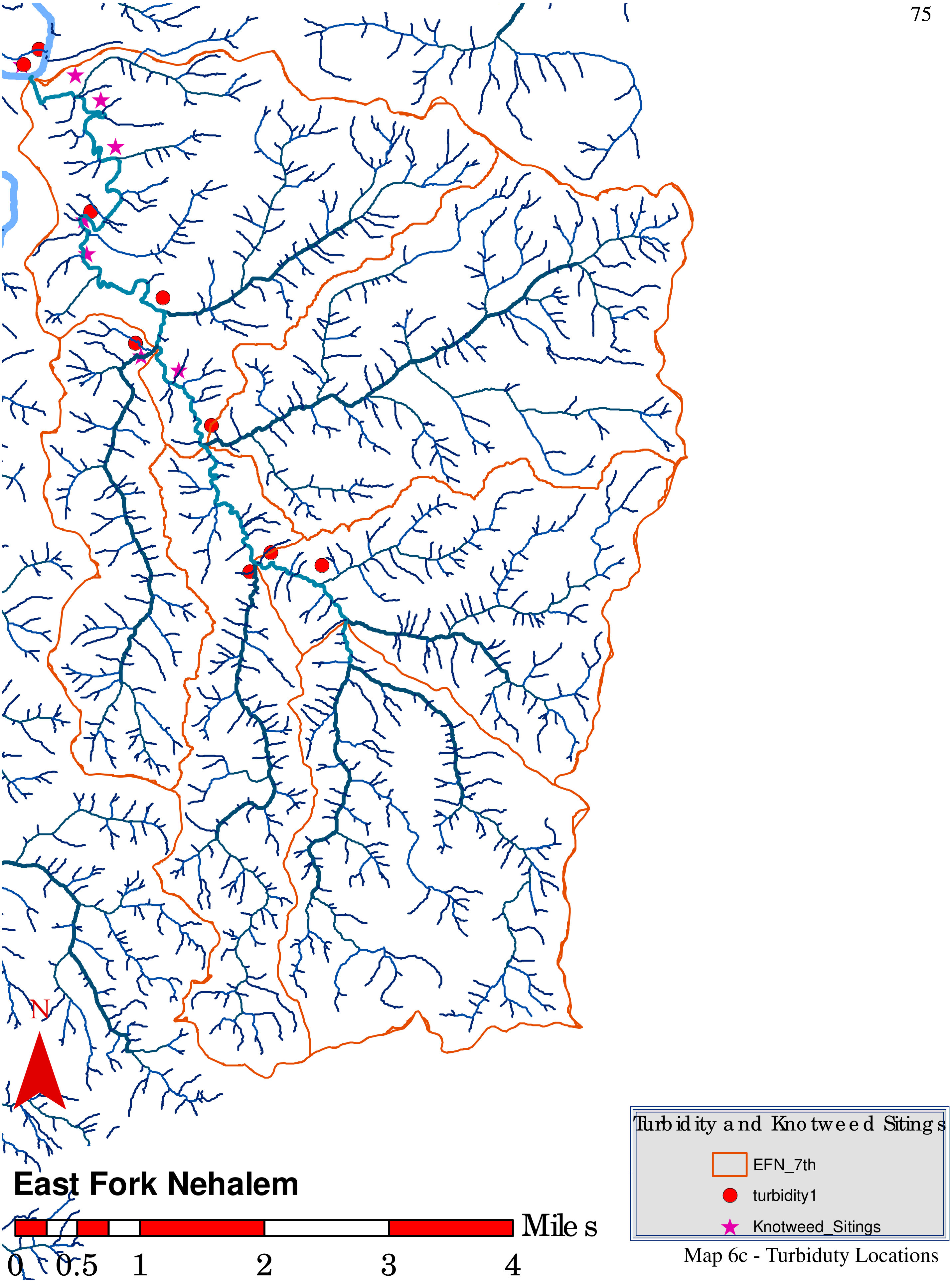
The Upper Nehalem Watershed Council and its partners have collected 10 years of turbidity and macroinvertebrate data within the EFN. 51 turbidity samples were taken with a high reading of 176 NTU in February of 1999 and a low reading of <1 NTU in December of 1998. Turbidity was <50 during high flow events except on two occasions. Measurements taken during an average rain event yielded readings below 25 NTU. Turbidity levels at the mouth of the EFN have been measured periodically since 2001, with a low of 1 NTU in November 2003. The EFN mainstem is often more turbid than the Nehalem River during the same rain event. In May of 2005, a sediment plume was observed at the mouth of the EFN. Turbidity data is currently being evaluated by the ODEQ.

Macroinvertebrate sample collection occurred between 1998 and 2003. Various locations within the EFN watershed have been sampled, but the only location consistently tested was at Scaponia Park at river mile 7.4. The samples from this site have been consistently unimpaired although the sample collected in 2002 was lower, with a Benthic Index of Biotic Integrity (B-IBI) of 36. When the data was analyzed using the RIVPACS model the samples concluded that the population distribution was different from reference and suggested that the macroinvertebrate populations examined were sediment stressed. Upper East Fork and Jim George Creek had a greater abundance of sediment tolerant species than the broader population suggesting that these two are more impacted by fine sediments. Stream bank erosion is not likely an important source of sediment due to the very small amount of eroding banks identified in the 1993 habitat survey (0-7%). Turbidity data points can be seen in Map 6c on page 75. Additionally, soil hazard data suggests that nearly the entire watershed is at medium or greater risk for soil erosion with Jim George and Elk Creek having the highest risk (refer to Map 6b on the following page). Finally, knotweed is known as both destabilizing banks and as an indicator of riparian impairment. Knotweed is present on the mainstem EFN suggesting that the banks may be unstable and providing localized excess fine sediments (refer to map 6c).

East Fork Nehalem Basin: Soil Erosion Potential



Map 6b - Soil Erosion Potential



Map 6c - Turbiduty Locations

Analytical Conclusions

Analysis of soil composition and geology throughout the EFN indicate a susceptibility to sediment impacts. Significant timber harvest has occurred over the past 30 years on unstable slopes. Instream habitat data indicates a high proportion of fine sediments in the stream bed. High turbidity levels and sediment stressed macroinvertebrate communities have been observed. All of these indicate a possible impairment by fine sediment. The homogenous land-use (forestry) in the basin suggests that past and present timber harvest may be the cause of this potential impairment. Debris flows are the major natural source of fine sediments in systems such as the EFN watershed and it is possible that timber harvest over headwaters has increased the occurrence of debris flows although this has not been verified during this assessment. Although localized excess fine sediment input from timber activities is often short-lived, the watershed-scale impact of systemic headwater harvesting is long-lasting. The impacts of these actions are exacerbated by the legacy effect of wood removal. The lack of LWD in headwater channels reduces the sediment storage capacity of the system so that sediment contributions from these channels over time is greater. The land-use patterns within the watershed suggest that at any point in time forestry may be contributing excess fine sediments into the system. Unfortunately, there is no quantifiable data available on the amount of sediment produced in the watershed. Given the high levels of sediment recorded in stream surveys and turbidity readings collected by UNWC during storm events, it is likely that sediment inputs to the watershed are high. Based on comparison of the EFN to reference averages, the sediment inputs within the watershed may be elevated. More investigation is needed to determine the validity of this hypothesis and a detailed sediment assessment is recommended, possibly as a component of a broader sediment assessment of the Nehalem River Watershed.

Key Findings

- The geology and soils of the EFN make it susceptible to sediment impacts.
- Macroinvertebrate data suggest possible sediment impairment.
- Instream sediments exceed reference conditions and do not meet habitat benchmarks.
- Turbidity data has been collected and is being analyzed by ODEQ.
- Timber actions over the past 35 years are extensive with a majority of the watershed harvested

Recommendations

- A detailed sediment assessment is recommended for the basin.
- An alternative to the sediment assessment would be to assume that the basin is impaired by fine sediments and to develop a restoration plan that addressed this issue. A limiting factors analysis would directly assess fine sediment impact on spawning habitat.

Chapter 7

Channel Modifications

Critical Questions

1. Where are channel modifications located?
2. Where are historical channel disturbances located?
3. What channel habitat types (CHT) have been impacted by channel modification?
4. What are the types and relative magnitude of past and current channel modifications?

Introduction

Before the European settlement of the Americas, streams within the North Coast contained larger volumes of large wood which served to sort gravels, provide shade and cover for aquatic species, and aided in the connection of rivers with their floodplains. When this wood was removed for navigation, salvage lumber, or as a result of splash damming, major changes in stream morphology occurred. Many streams were also straightened to increase navigability or to better channel floodwaters. Floodplains were leveled for grazing and agriculture, levees and dikes were placed to protect property, and dams were constructed to provide power for mills and homes. The result of these actions has been dramatic and many aquatic populations have declined. Channel modifications need not be direct. The impact of short rotation timber harvest and harvest over headwaters on a stream network can be as detrimental as the direct modifications previously detailed. Roads built to obtain timber often impact the stream channel long after the hill-slopes have been replanted. This chapter compares current instream physical habitat to reference conditions using AQI data and reports on any known habitat modifications.

Materials, Methods, and Resources

• Current instream and riparian habitat conditions were evaluated using comprehensive aquatic inventory (AQI) data collected in 2005-2007 by Boswell Consultants under contract to the UNWC and in various years by ODFW.
• AQI data was compared to reference benchmark standards and deviations from the benchmarks were considered modified from historical conditions. Only habitat metrics that depict possible disturbance were used in these analyses as sediment and shade have been discussed in detail in other chapters. EFN W:D were compared to reference conditions as was the total amount of off-channel habitat.
• Riparian road density was evaluated for each 7th field as riparian roads often confine channels.
• Known channel modification locations are reported.

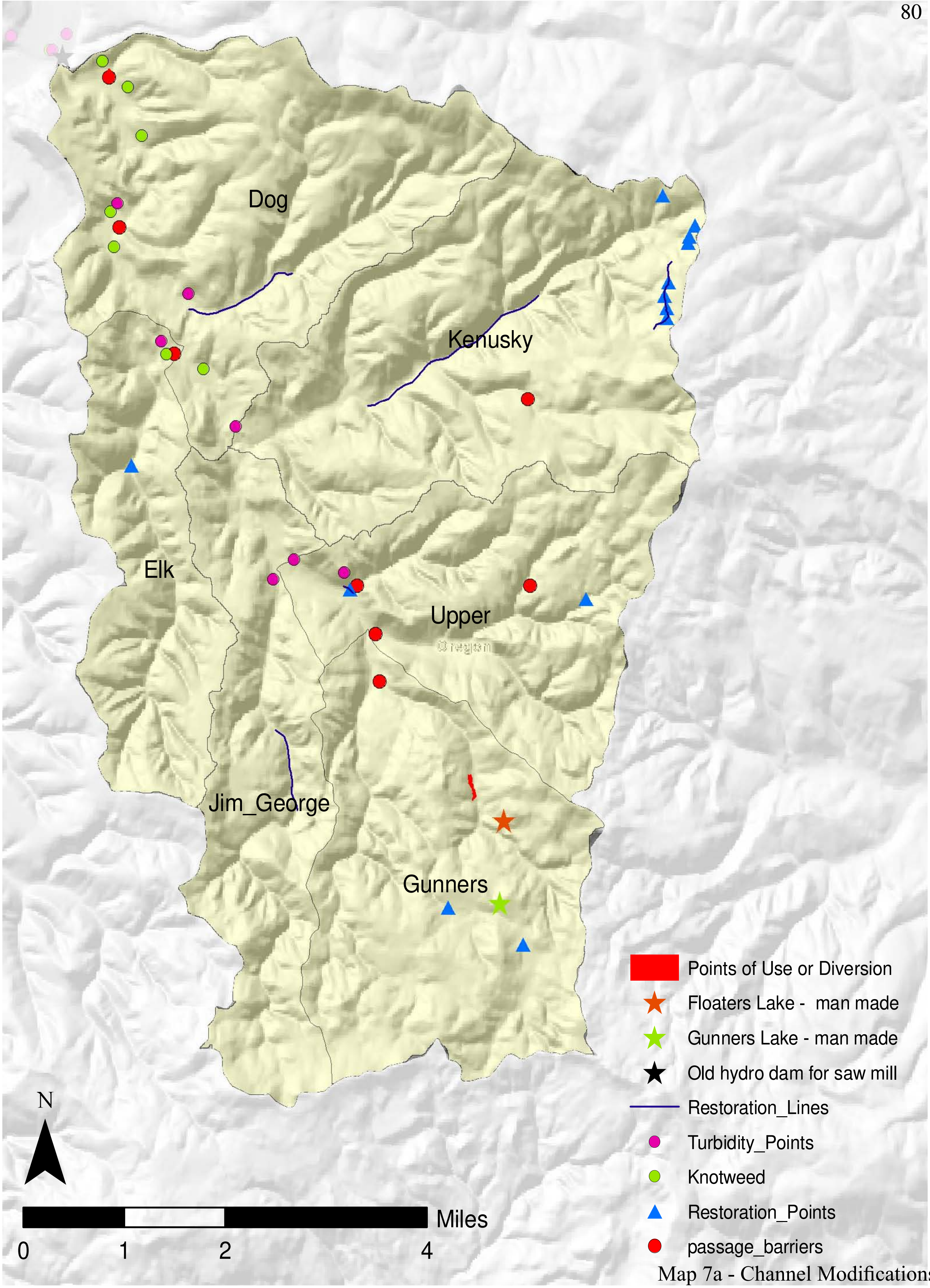
Results

During December of 1950 Elk Creek surveys revealed that the stream consisted primarily of clays with no gravels. Surveyors had noted that the creek flowed through a historic burned area and that recent logging had taken place.[1] In August of 1951 field biologists noted that the hill-slopes had been recently logged and that regenerative sapling Douglas-fir trees were common. The stream had a dense cover of willow (Salix sp.) vegetation but the first 200 yards of the mainstem had been scoured to bedrock and contained few spawning gravels. The remaining distance (~3.7 miles) was 80% sands and silt with ~20% large to small gravels. Stream color was noted as coffee brown indicating high turbidity.[2] This estimate of sands is nearly twice what more current averages are suggesting that the EFN is very prone to disturbance induced erosion. In October of 1978 the water turbidity was noted as murky.[3] Finally, data presented in Chapter Two and Chapter Eight indicates that current habitat conditions in a number of key metrics deviate significantly from reference conditions.

A dam was built across the mouth of the EFN in 1877 (refer to Map 7a). This dam was later removed and the stream channel downcut to bedrock (ranges from 2-21%). The mainstem EFN is currently a bedrock dominated system. There is a high proportion of sands and fines and a moderate amount of gravels but a great deal of bedrock persists. Although major flood events occurred in 1996, 1998, 2004, and 2007, surveys conducted pre and post flood indicated that the mainstem EFN riparian habitat had not changed significantly from the 1996 flood.[4] This is consistent with other downcut bedrock systems which are stable and confined. They are unable to migrate during high flow events. Photographic evidence of the impacts of 1996 flood indicate that while the stream channel remained relatively unchanged due to the dominance of the bedrock substrate and the confinement of the mainstem, the riparian area was greatly disturbed from this high water event. Instream habitat has been ranked low by ODFW due to the lack of LWD and floodplain habitat. These floods may be the result of poor floodplain connectivity.

Upper Gunners Fork has also been impacted by disturbance. Although historically the area contains several low gradient marsh systems, the creation of the road network has artificially raised the water table creating Gunners Lakes. These lakes are much deeper and static than they would be were they not impounded by roads or dams. The road network has impacted the entire EFN stream network in other ways as well. There are over 500 road crossings which can be seen on page 58 in Map 5e. Riparian roads significantly impact the mainstem EFN in that restoration potential is limited with the road present along sections of its lower length. A high tension power line crosses three drainages within the EFN; Kenusky, Hawkins, and Gunners Fork. A natural gas line also exists within the EFN. Although the exact locations have not been disclosed, permit data indicates that the line runs under points on Elk and Kenusky Creeks as well as two points on the mainstem EFN.[5] Presumably it runs from the Mist Natural Gas Field to the Columbia River for shipping. Riparian road density appears to be consistent in all CHTs although high gradient low flow channels are the most common type and thus the most frequently impacted by road crossings. Additionally, riparian road density is greater on BLM managed lands. See the discussion in chapter 5 for more information.

1 "Elk Creek East Fork of Nehalem River December 11, 1950" Henry, K. Heg, R. Aquatic Biologists.
2 "East Fork of Nehalem River" by Breuser, R. Pulford, E. Aquatic Biologists
3 Physical and Biological Stream Survey Form W. Weber.
4 FISH HABITAT ASSESSMENT IN THE OREGON DEPARTMENT OF FORESTRY UPPER NEHALEM AND CLATSKANIE STUDY AREA. Kavanagh, P. Jones, K, Stein, C. Jacobsen, P. 2005. ODFW Corvallis OR.
5 Official statement to Karen Kochenbach, Army Corps of Engineers, from the National Oceanic and Atmospheric Administration. 1999 Seattle, WA.



Map 7a - Channel Modifications

Analytical Conclusions

Nearly the entire EFN has been modified from historic conditions and all CHTs have been affected. Low gradient unconfined channels have been the most impacted in that many have become downcut single channels. Almost all private residences occur on this channel type and the mainstem is often confined by the Crown Zellarbach Mainline, homesteads, and the Scappose-Vernonia Hwy.

Although high gradient headwater channels have not be altered as much, they too have been impacted through the removal of timber within the riparian zone. The primary impact related to the extensive timber harvest within the headwaters was the reduced input of the woody debris needed by moderate and low gradient streams in order to connect to the floodplain. In addition to the reduction in fish habitat, this, compounded with possible global climate change, may be increasing downstream flooding.

All stream reaches deviate from ideal reference conditions in some way. Detailed information on instream habitat is contained in chapter 9.

Key Findings

• Essentially the entire EFN stream network has been modified with low gradient unconfined streams being the most impacted.
• Instream habitat is significantly different from minimally disturbed reference conditions.
• The mainstem EFN has been scoured to bedrock in some areas.
• A channel-spanning dam on the mainstem may have had long term impacts on fish habitat and populations.
• Headwater harvest may have modified natural sediment, solar, and wood inputs to the stream network.
• Road crossings in the upper watershed may impact natural movement of sediments and wood into the stream network.
• Power delivering infrastructure is present in the watershed, although the impacts are unclear.

Recommendations

• Restoration projects aimed at reconnecting the river to the floodplain should be considered near areas with high fish densities.
• LWD placement should be considered in the mainstem to aggrade gravels for spawning (assuming a direct assesment of spawning potential indicates that this is needed.)
• Riparian plantings and forest stand conversion should be considered to reestablish natural conifer dominated riparian communities as described in chapter 5.

Chapter 8

Water Quality

Critical Questions

1. What are the designated beneficial uses of water for the stream segment?
2. What are the water quality criteria that apply to the stream reaches?
3. Are the stream reaches identified as 303(d) water quality limited?
4. Are any stream reaches identified as high-quality waters?
5. Do water quality studies indicate that water quality has been degraded?

Introduction

Water quality is measured using a variety of metrics. Temperature, pollutant, and sediment levels as well as biotic community composition are among the most common used. Sediment is discussed separately in Chapter 6. Temperature impacts aquatic life in a variety of ways. Increased temperatures causes direct mortality of aquatic life. The ODEQ uses a 7 day average maximum temperature of 12.8 degrees Celsius for salmonid spawning and 17.8 degrees Celsius for salmonid rearing to determine temperature impairments. Biotic community composition is measured by collecting random samples of aquatic macroinvertebrate species and comparing this composition to models which were built using a variety of metrics for temperature, toxics, and sediment. Although these parameters are often not accurate enough to determine the exact nature and extent of impairment, they are used at a broad scale to determine which basins need further investigation. This chapter examines temperature and macroinvertebrate data taken over the course of a decade.

Materials, Methods, and Resources

• Impairments due to temperature were assessed using the ODEQ uses a seven-day moving average of the daily maximum, the RIVPACS, and the PREDATOR macroinvertebrate models.
• Data collected by the USGS, the EPA, and OWRD are used in this evaluation in addition to ODEQ data.[1]
• FLIR data was evaluated to determine how many cooling and warming reaches existed within the Nehalem. This data was used to determine if the EFN is warming the larger Nehalem River.

ODFW Habitat Benchmark Metric	Low	High	
% Shade	>76%	<91%	
ODFW Reference Site Averages	25th Percentile	Mean	75th Percentile
% Shade	77	84	92

Table 8a - Shade Reference Standards

1 Water quality data collected by these agencies can be downloaded from the EPA's STORET national database. The STORET code for the Nehalem River Watershed is its Hydrologic Unit Code (HUC) #17100202.

Beneficial Uses Affected: Salmonid spawning/rearing; Resident fish/Aquatic life.

At the time of the BLM EFN Watershed Analysis in 1996, no streams within the EFN had been listed on the 1994 303(d) list for water quality limitations. Authors of the BLM Watershed Analysis hypothesized that the ODEQ had not considered the EFN to be a major water quality contributor to downstream reaches. In 1998, the EFN was listed for temperature impairment.[1] A temperature TMDL was approved in 2003. There is no current listing for sediment due to insufficient data. The EFN and Kenusky Creek were added to the ODEQ database for sediment suggesting that there was evidence of increased sediment levels. Additionally, the Nehalem River has been listed for Alkalinity, Ammonia, Cadmium, Chloride, Chlorophyll, Dissolved Oxygen, E Coli, Fecal Coliform, Flow Modification, Lead, pH, Phosphate, and Temperature. A TMDL has been developed for Fecal Coliform and Temperature taking the Nehalem off the 303(d) list for these pollutants. The Nehalem River was placed on the 304(A) list for Flow Modification as the criteria for TMDL development requires a pollutant and flow modification is not considered a pollutant. While not all of these pollutants impact water quality within the EFN, any TMDL developed to control these pollutants would apply to all water bodies upstream of the lowest listed segment. Given that the EFN is a headwater drainage, this implies that any TMDL developed on the mainstem Nehalem below the confluence with the East Fork would apply.

The UNWC has been collecting water quality data from selected sites in the EFN since 1997. The UNWC collaborated with the BLM in 1997 and 1998 to collect continuous temperature data from several sites in the basin. A TMDL for the Nehalem River Basin, as a component of the North coast TMDL, has been established and was approved by the EPA in 2003. The ODEQ has an ambient monitoring site on the Nehalem River at Foley Road (Roy Creek Campground) at river mile 7.8 where data is collected approximately six times per year. The EFN River from river mile 0-9.8 was listed as water quality limited due to elevated temperature in the summer and from September 15th-May 31st on the ODEQ 303(d) list. The temperature TMDL for the North Coast was accepted and the entire Nehalem River basin including the EFN was taken off the 303(d) list. The EFN exceeded the temperature standard of 64°F with a maximum of 70.7°F in 1980, 1982, 1984-1993. Temperature was also recorded in 1997, 1998, 1999, 2002, 2003, and 2005. Summer temperatures most commonly exceed state water quality standards at the mouth of the EFN River. Although temperatures in Gunners Fork are among the lowest recorded, one of the Gunners Lakes has elevated temperatures. Both macroinvertebrate and continuous temperature monitoring data indicate that the creek is temperature impaired in its lower reaches and this is limiting production potential of aquatic species. If the temperature within the EFN were reduced, it is hypothesized that fish entering the EFN to escape the lethal temperatures of the Nehalem River mainstem would have an increased survival rate. Additionally, improved access through culvert removal and replacement would allow fish to navigate within the EFN to find even cooler tributaries.

Additionally, AQI habitat data suggests that lack of shade is the likely source of the temperature impairment. Almost every reach surveyed had low to poor shade covering. Table 8b displays the shade results of the AQI surveys and highlights in red streams that do not meet benchmarks and orange the streams that are close to lower reference conditions.

1 http://www.deq.state.or.us/wq/assessment/rpt0406/results.asp

Reach	%Shade
EFN Mainstem 1993	
1	16
2	27
3	14
4	12
5	13
6	5
Average	16.2
Kenusky Creek 1993	
1	27
2	20
3	3
Average	14.6
Kenusky Creek 2005	
1	69
2	67
3	74
4	69
Average	70.3
Kenusky Creek 2006	
1	82
2	89
3	85
4	84
5	89
Average	85.6
Elk Creek 1993	
1	7
2	14
3	9
4	15
Average	9.8
Elk Creek 2005	
1	79
2	76
Average	77

Table 8b - AQI Shade Results

Reach	Shade%
Gunners Lake 2001 - 1000m	
1	95
Gunners Lake 2005	
1	73
2	82
Average	78.9
Jim George 2005	
1	78
2	74
Average	76.6
Upper EFN & Hawkins - 2005	
1	80
2	89
1H	77
Average	80.1
Dog Creek 1993	
1	19
2	24
Average	19
Dog Creek 2005	
1	76
2	79
3	83
1A	81
Average	79.5

Table 8b Continued- AQI Shade Results

Analytical Conclusions

Temperature within the EFN appears to consistently exceed state water quality standards and is thus in a degraded condition. This is hypothesized to be the result of the poor shade conditions within the basin. Additionally, roughly half of the stream network has no legal mandate for riparian buffers suggesting that headwaters may need evaluation in terms of the impact harvest in the riparian corridor has on stream temperatures within the EFN. A sufficiency analysis was conducted by ODF and ODEQ to determine if the OFPA adequately protected water quality. This analysis was inconclusive in regards to headwater harvest and temperature impacts. A study evaluating the impacts of headwater harvest on stream temperature is currently underway by ODF and the results are expected to be completed by 2009. Culverts blocking passage into Hawkins Creek and Elk may limit the total quantity of cool water habitat available to salmonids. Finally, where not entrenched, the W:D often suggest that channel widening is present. This is likely increasing water temperature within the basin.

Key Findings

- Salmonid populations and resident biota are likely adversely impacted by excess water temperatures.
- Shade values are particularly low along the mainstem EFN.

Recommendations

- A generous buffer of nonfish-bearing streams and riparian plantings in areas with less than 75% shade.
- Conversion of hardwoods to conifers as conifers provide better shade and winter insulation.

Chapter 9

Fish Habitat and Distribution

Critical Questions

1. What fish species are documented in the watershed?
2. Are any of these species listed as threatened or endangered?
3. What is the jurisdiction of this listing?
4. What species have been eradicated from the watershed?
5. What is the distribution of fish species within the watershed?
6. What is the abundance of fish species within the watershed?
7. What is the status of Salmonid populations within the watershed?
8. Which fish species are native to the watershed and which are introduced?
9. What is the relationship between native and introduced fish species?
10 .What is the condition of fish habitat within the watershed?
11. Where are potential barriers to fish migration?

Introduction

Coastal coho salmon are currently listed as threatened under the ESA and are estimated to be at 5 to 10% of historic abundance levels.[1] Historically, coho were the most abundant species in the Nehalem drainage. Fisheries catch during the 1920's and 1930's show an average of over 50,000 coho were caught annually from the Nehalem drainage.[2] In a 2004 Oregon Coast Limiting Factors Analysis, populations within the Nehalem Bay Watershed were listed as being moderately impacted by lack of spawning gravels, temperature, and predation and highly impacted by fine sediments, lack of complex stream habitat, lack of floodplain connectivity, and poor riparian conditions.[3] Several barriers to passage have been identified that prevent fish access to critical and limited high quality winter habitat.[4] A severe decline has occurred since 1950 for a variety of reasons. Salmonids require cool streams for rearing. Coniferous shade cover is critical to the long term survival of many aquatic species. Many streams within Oregon coastal systems often exceed the sub-lethal and lethal limit for salmonid survival. Increased temperatures are not just the result of low shade; increased W:D increase the surface volume exposed to incoming solar radiation and decreases the total deep pool volume which can serve as temperature refugia. Coniferous riparian vegetation not only provides direct cover from incoming solar radiation but also provides the future LWD which is also critical for salmonid survival. LWD plays a vital role in maintaining channel complexity and fish populations by creating scour, trapping and sorting spawning gravel, and by providing shelter from high flows. LWD aids in the connection of the river with the floodplain. While coho salmon, steelhead and cutthroat trout vary in their seasonal habitat utilization, all require structurally diverse channels for the maintenance of healthy populations. During high flow periods juvenile coho salmon, steelhead and cutthroat trout depend on the low velocity habitats provided by pools and other LWD related habitat. Adult salmon and trout also use pools and wood structure for shelter from predators and for resting. During low flow periods young steelhead and cutthroat inhabit higher velocity areas associated with riffles, while coho continue to use pools. A lack of LWD related habitat, especially pools, results in a proportional lack in salmonid production and survival.

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1 Weitkamp et al., 1995
2 ODFW, 1993
3 Oregon Plan Coastal Coho Assessment – Science Assumptions and Assessment Framework. Bruce McIntosh. 2004
4 7-29-05 Habitat Tool

Finally, culverts, even when properly placed, often limit natural LWD and coarse sediment migration. Poorly placed and undersized culverts limit salmonid migration. This chapter examines AQI data for current wood volumes, backwater pool area, and W:D throughout the EFN in addition to evaluating road crossings. Riparian vegetation is evaluated in Chapter 5 and shade values are found in the results section below.

Materials, Methods, and Resources

The majority of this section was completed by synthesizing available information from a variety of sources. For the habitat condition evaluation, ODFW surveys were used for the streams which have been surveyed recently (since 1993). Individual parameters for pools, riffles, riparian species and LWD were identified as either desirable or undesirable according to ODFW benchmarks. AQI stream surveys conducted by ODFW and Boswell Consultants were used for this section. AQI surveys are used to determine habitat distribution and quality. The field data focuses on channel and valley morphology, riparian characteristics and condition, and instream habitat. For this assessment, survey data was evaluated in terms of habitat quality for presence of LWD, riffles and pools, and riparian vegetation. ODFW has established habitat benchmarks which indicate desirable and undesirable parameters for quality habitat. Several pieces of data were used to assign overall ratings. For example, the overall pool rating for each reach weighed pool area, pool frequency, residual pool depth, and complex pools.

The RBA of the EFN and tributaries was conducted during the summer of 2008. During this time every fifth pool (randomly seeded) was snorkeled and all fish were tallied by species. The results of this survey will be available through Bio Surveys LLC in the spring of 2009. The preliminary results for emergent Coho fry were analyzed by multiplying the surveyors estimates by a visual bias correction factor of 20% and then by 5 to determine how many fry were present within the basin and in five of the six 7th fields; Upper East Fork was surveyed but not specifically delineated as a 7th field and therefore combined within the EFN mainstem estimates. To estimate coho spawning pair abundance the following assumptions were made; each spawning pair produced 2500 eggs and 10% (high estimate of survival) of those survived to the following summer.

Results

Fish Habitat

AQI surveys have taken place over the 15 years throughout the EFN. Critical habitat features are summarized below by sub-basin and year. ODFW fisheries biologists list the EFN as containing critical habitat for salmonids. In the EFN watershed elements of structurally diverse habitat are frequently missing due to the lack of LWD in the stream channel and floodplain. Additionally, the W:D is above reference averages with an average of ~13. This may cause increases in temperatures. See Chapter 8 for a discussion of water quality and temperature. Historically beaver activity within many drainages was high although it appears that recent activity is low. This activity creates pools and reconnects the river to the floodplain. While this activity can reduce future LWD recruitment potential and shade, the overall impact beavers have on fish habitat is positive. Studies have shown that the number one factor increasing coho abundance and densities is beaver activity and their associated pool habitat.[1]

1 ODFW Nicholson Smolt Production Model

Reach	%Shade	W:D	%Slackwater Pools	%SAFN	% SAFN in Riffles	LWD m3/100m
EFN Mainstem 1993						
1	16	8.91	5.49	53	44	12.9
2	27	5.06	12.59	63	50	7.9
3	14	10.86	3.41	39	27	8.5
4	12	27.4	0	10	8	3.5
5	13	8.83	57.11	41	32	28.6
6	5	12.5	52.34	58	48	9.5
Average	16.2	9.3	17.2	51.3	41.1	12.3
Kenusky Creek 1993						
1	27	21.5	23.9	45	27	34.9
2	20	24	25.66	34	20	28.2
3	3	14.5	0	31	24	18.2
Average	14.6	20	15.6	34.5	22.6	25.4
Kenusky Creek 2005						
1	69	10.4	20.87	55	30	15.9
2	67	13.3	19.67	57	38	11.4
3	74	15.2	2.5	37	19	17
4	69	18.8	20.83	44	0	16.6
Average	70.3	14.6	13.8	46.9	22.5	15.2
Kenusky Creek 2006						
1	82	13.75	0.44	61	37	14.9
2	89	14.6	2.79	41	21	21.4
3	85	11	0	50	27	28.8
4	84	17.33	21.75	52	21	27.7
5	89	21.5	0	37	17	33.5
Average	85.6	15.5	2.7	49.6	26.9	22.1
Elk Creek 1993						
1	7	3.75	8.98	64	60	7.2
2	14	3	62.51	85	80	25.9
3	9	5.5	68.62	81	60	76.3
4	15	***	61	100	*	0
Average	9.8	4.2	50.8	78.3	60.6	43.1
Elk Creek 2005						
1	79	9.83	62.94	63	58	15.2
2	76	10.8	54.68	60	39	19.4
Average	77	10.5	57.3	61	45.2	18
Gunners Lake 2001 - 1000m long from Gunners lake down						
1	95	11	0	7	*	6.3
Gunners Lake 2005						
1	73	20	15.27	33	10	11.2
2	82	15	0.95	13	10	28.3
Average	78.9	16.7	5.9	19.9	10	22.4

Table 9a - Fish Habitat Data

Reach	%Shade	W:D	%Slackwater Pools	%SAFN	% SAFN in Riffles	LWD m3/100m
Jim George 2005						
1	78	11.6	35.51	47	23	8.1
2	74	9	8.73	39	18	11.4
Average	76.6	10.7	26.4	44.3	21.3	9.2
Upper East Fork Nehalem including Hawkins - 2005						
1	80	14.2	8.9	36	15	11
2	89	10.2	0	16	21	6.4
1H	77	10.25	2.71	32	15	14.1
Average	80.1	12.2	5.4	32	15.8	11.6
Dog Creek 1993						
1	19	26.5	55.16	58	31	23.3
2	24	***	65.49	42	22	48.2
Average	19.8	22.5	56.7	55.6	29.6	27
Dog Creek 2005						
1	76	16.4	12	55	27	23.2
2	79	12.5	22.2	51	25	24.5
3	83	6.5	0	11	25	57.5
1A	81	12	0	31	30	13.7
Average	79.5	12.6	6.5	37.8	27.6	25.6

Table 9a Continued - Fish Habitat Data

Fish Usage

There are seven fish stocks with Bureau status within the watershed. These are: the river lamprey; western brook lamprey; Pacific lamprey; sea-run cutthroat trout; coastal chum salmon; coastal fall Chinook salmon; and coastal spring Chinook salmon. Adult winter steelhead enter streams on their spawning migration upstream most abundantly December through March in the Nehalem drainage. Steelhead usually push further upstream than either Chinook or coho in search of spawning beds. The peak spawning period for wild steelhead ranges from late February to early May, with most streams peaking in March or April.[1] Chum were noted to spawn in a creek ½ mile above mouth of the EFN in 1951.[2] It is unclear if chum could migrate past the Nehalem falls.

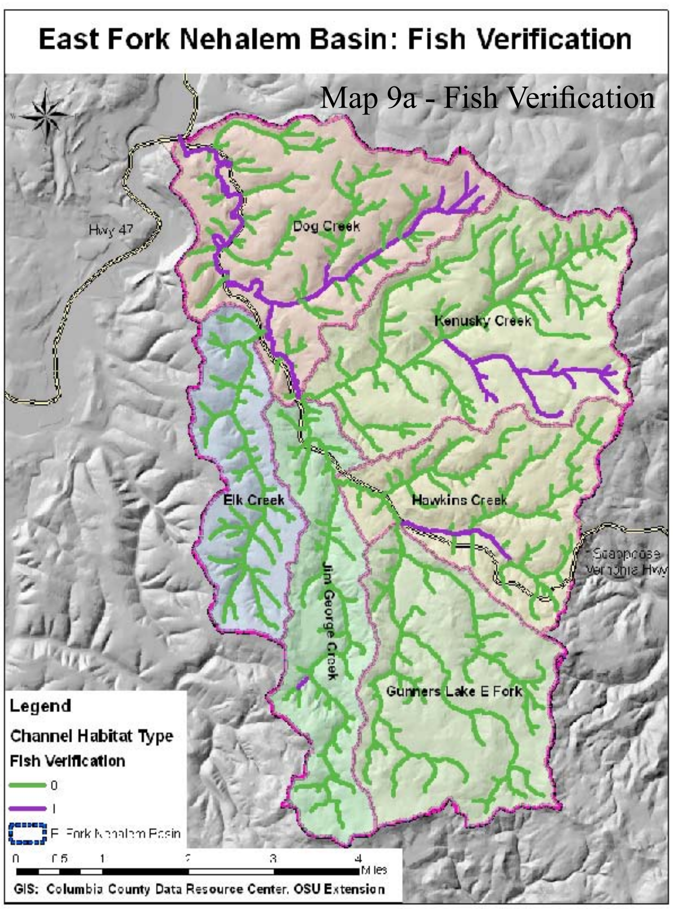
Fishermen have documented catching warm-water exotic fish such as blue gill and yellow perch in the upper-watershed lakes. Unauthorized stocking of these lakes occurred at some point although exactly when is unclear.[3] Water withdraw permits within the EFN list “fish culture” as a water use for two rights; one off the mainstem EFN and another in Gunners Lake. In the Nehalem River, ~17,500 Coho spawners are needed to seed to capacity the highest quality habitat. This implies that the quantity of potential Coho habitat in the Nehalem is nine times greater than in surrounding basins such as the Tillamook or the Nestucca.[4] In the Nehalem sub-basin, 95 miles of stream have been identified as having more than .3 fish per square meter.[5]

1 ODFW 1993
2 G.F Woods, personal communication. “East Fork of Nehalem River” by Breuser, R. Pulford, E. Aquatic Biologists
3 Personal Communication from Michele Long w/ Joe Sheahan (Aug 2005)
4 A Habitat Based Assessment of Coho Salmon Production Potential and Spawner Escapement Needs for Oregon Coastal Streams. Nickelson. ODFW Important Reports Number 98-4
5 ODFW Desired Status Presentation

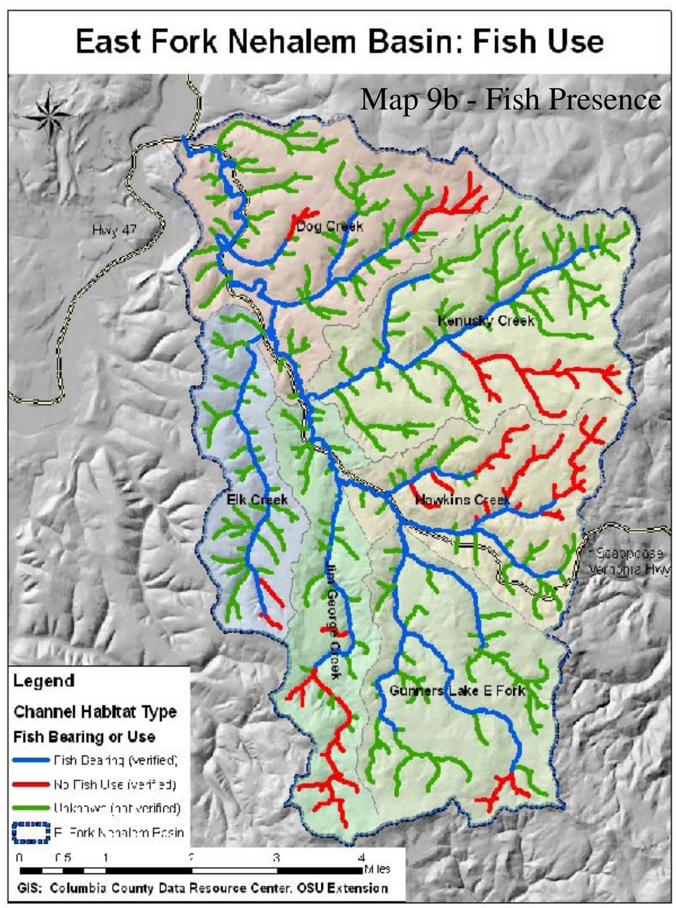
Summer snorkeling occurred during the summer of 2008 (refer to Table 9b). The report associated with this data is expected to be completed in 2009. Generally, surveyors noted that both steelhead and coho salmon use the lower basin for rearing, spawning is limited to reaches in the upper basin and often these areas are blocked by culverts. The EFN is home to more than 45,000 coho fry during the month of June, before peak temperatures are reached. Assuming that the EFN would be comparable to other 6th fields within the larger Nehalem River sub-basin which has 34 6th fields then the EFN would need ~500 spawning pairs to be seeded to capacity. If the assumptions made for this assessment are within reason than the EFN is not seeded to capacity with ~184 spawning pairs. Elk Creek has the fewest with 3 returning spawning pairs while Dog Creek hosts the greatest with 106 returning spawning pairs. Several 7th fields are contain culverts that are barriers to passage; Elk Creek, Jim George Creek, Kenusky Creek, and two unnamed tributaries.

Creek	Estimated Juvenile Abundance	Estimated Spawning Pairs
EFN Mainstem and Tribs	26505	11
Dog	2885	106
Elk	815	3
Jim George	8980	36
Kenusky	6950	28
Total	46135	184

Table 9b - Summer Juvenile Coho Abundance 2008



Map 9a - Fish Verification



Map 9b - Fish Presence

Analytical Conclusions

The mainstem of the EFN River has the potential to produce a sizable population of Coho. The current characteristics which negatively impact this potential production include the lack of LWD, an abundance of fine substrates, the potential for elevated water temperature, and lack of off channel habitat. Key LWD is low throughout the entire portion of the watershed which has been surveyed. Based upon the lack of LWD, the mainstem EFN ranks lowest in habitat quality of streams surveyed in the Nehalem watershed.

Dog Creek ranks highest in fisheries habitat quality of the streams surveyed. Relatively high quantities of LWD suggest potentially good habitat although the current habitat quality is potentially limited due to high amounts of fine sediment.

Kenusky Creek has an average gradient of 1.4% for the first 2.5 miles then changes to a 4.6% gradient for the remaining 1.5 miles surveyed. Although it ranks slightly above the mainstem in habitat quality, all reaches show low pool quality, low pool abundance, and an abundance of fine sediment. Reach three, 2.5 miles up Kenusky Creek, has very low pool abundance or quality but possess high amounts of wood relative to other surveyed streams in the watershed. This suggests a high sediment load or other erosion related problems.

Elk Creek has an average gradient of 1.7% over the 3.59 miles of stream surveyed. The two habitat features that help describe this tributary are a high number of dammed and backwater pools (61.5% of total) and a silt/organic substrate over 64% of the surveyed habitat.

Jim George Creek has AQI surveys from 2005. These surveys identify relatively low quantities of LWD within the basin and a slightly lower than expected W:D implying entrenchment and lack of floodplain connectivity.

Of the 200+ total stream miles in the watershed, approximately thirty could potentially be used by Coho at some time. Steelhead could potentially use an additional ten to fifteen miles of stream due to their greater ability to surmount barriers and their habitat preferences in the first year. Although salmonid habitat quality is currently in poor condition, there is excellent potential for improvement within the watershed. Beaver activity should be encouraged and riparian plantings should occur in basins with high beaver presence to ensure a constant food supply and to maintain or improve shade conditions.

Key Findings

- The EFN is utilized by multiple fish species.
- Habitat quality is low in the basin.
- Elk Creek is blocked by an impassible culvert.
- Chum may have been eradicated from the watershed although it is unknown if chum could migrate past the Nehalem falls.
- Coho are present in the watershed and are listed as threatened under the Federal ESA and are not likely seeded to capacity.

Recommendations

- Beaver activity should be encouraged through riparian plantings to promote the development of off channel habitat.
- A limiting factors analysis should be conducted to estimate how many coho can be supported based on gravel estimates.

Chapter 10

Overall Watershed Condition

Critical Questions

1. What are the information and data gaps identified in the assessment process?
2. What were the historical conditions of the aquatic riparian areas within the watershed?
3. What historic land-use management activities have impacted water quality and aquatic habitat?
4. What current land-use management activities have impacted water quality and aquatic habitat?
5. What land-use activities must be addressed in order to restore aquatic habitat and water quality?
6. What areas need restoration and protection?

Introduction

The availability of accurate, comprehensive, and up-to-date data often limits habitat studies. Fortunately a great deal of data has been collected within the EFN watershed although data gaps are always an issue. The following chapter details known data gaps and reiterates the information found in the previous chapters. Additionally, restoration priorities are also outlined at the end of the results section. These restoration priorities are based on guidelines detailed in the OWEB Watershed Assessment Manual. While these priorities are generally indicative of potential restoration success, they do not take into account the most current habitat condition and restoration projects already being pursued by the many management agencies within the watershed.

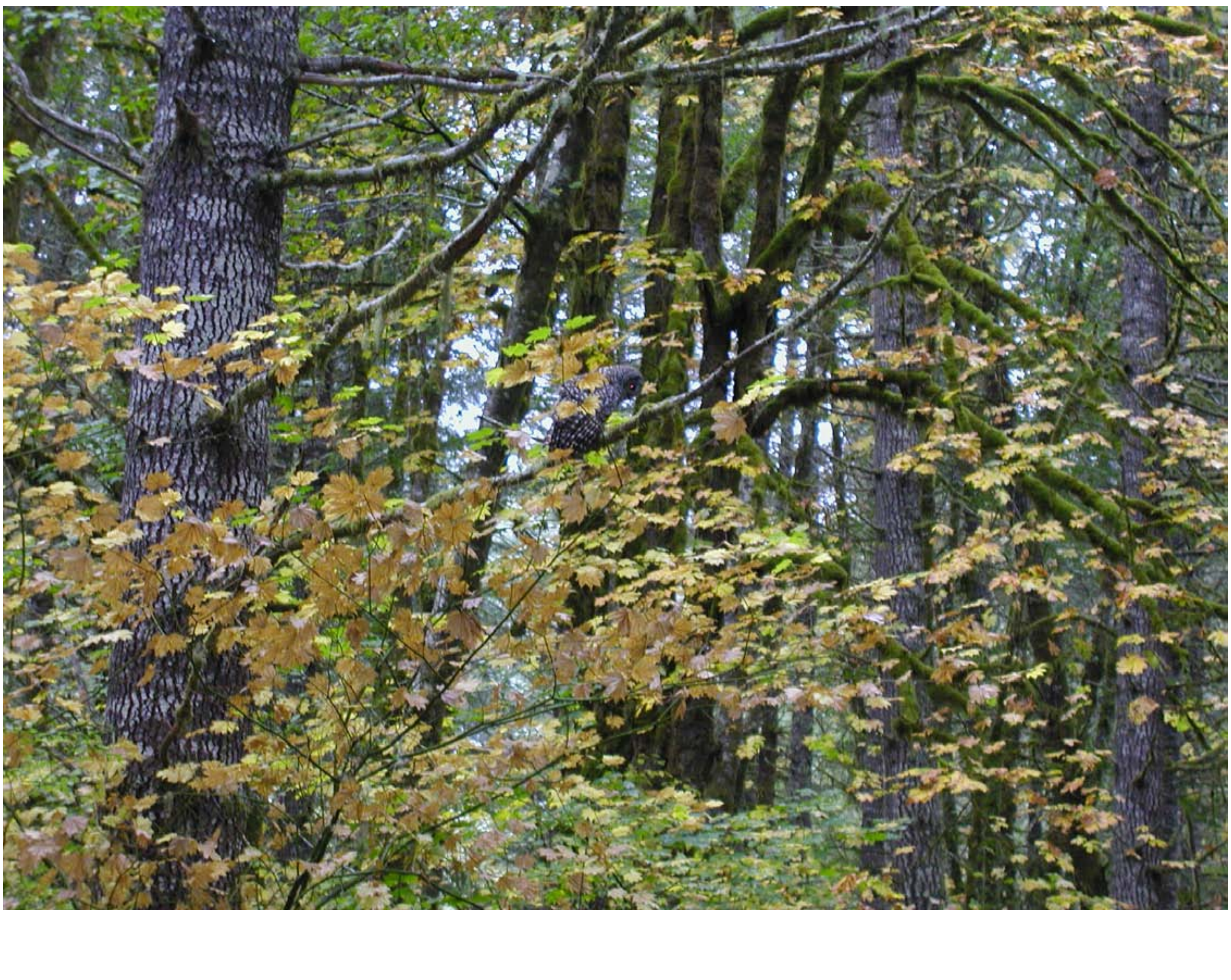
Materials, Methods, and Resources

• The CLAMS 1996 vegetation layer was used to determine modeled forest vegetation condition.
• CLAMS 2000 data was mapped as this newer model more accurately shows species composition but is less useful for the synoptic analysis described below.
• Timber harvest data throughout the watershed was evaluated using layers provided by the Wild Salmon Center.
• AQI data was used to evaluate the riparian corridor on fish-bearing streams.
• The Natural Heritage Information Center has created a wildlife model that uses historical and current distribution data, and habitat requirements for a variety of species in order to create an estimated spatial distribution layer for many known species. This data is ranked on a scale of 1-5 with 5 being abundant and 1 being imperiled to address the local issues of wildlife extirpation. This data was used to identify species whose range would have historically included the EFN.
• Local knowledge was used to determine the presence of non-native species.
• Data collection priorities were identified based on the results and conclusions of the previous sections.

Results

Data Gaps

The most significant data gaps within the watershed remaining are; species presence and distribution (non-fish) and bedded sediment levels. Several threatened or endangered species were historically present within the watershed. Table 10a lists those species whose distribution is known to include the EFN region. Although this is not a comprehensive list of every species whose presence in the EFN subwatershed has been verified, it provides readers with an introduction to the flora and fauna that are threatened, endangered, or managed by various agencies. Although historical distribution is known, it is unclear how many of these species remain within the EFN and if so to what extent. The BLM conducts surveys to determine spotted owl presence although these are not conducted yearly or within the EFN. The last spotted owl survey determined that there was no permanent mating or rearing habitat within the EFN and that the owls present were migrating to or from other watersheds. The BLM also conducts clearance surveys for endangered plant species, however, the total area owned by the BLM, the infrequency of harvests, and the small size of recent harvest units makes it impossible to extrapolate from those surveys to the larger watershed. Additionally, direct sediment measurements have never been conducted within the watershed. Finally many restoration projects have taken place or are planned within the EFN.



Species	ESU	List	Status	Habitat	Presence	Recommendations
Fish						
Coho Salmon (Oncorhynchus kisutch)	Oregon Coast	USFWS - 2008	Threatened	Low to moderate gradient stream systems with associated off channel habitat, spawning gravels, and estuaries. Throughout the Northern Pacific Rim.	Present historically	Focus on restoring instream habitat through the placement of instream wood structures. Create off channel habitat (alcoves, backwaters, etc.) Remove barrier on Elk and Hawkins Creek. Plant riparian areas with conifers/ red alder, willow, ash and convert hardwood stands to conifer
Steelhead Salmon (Oncorhynchus mykiss)	Oregon Coast Steelhead	USFWS	Species of Concern	Moderate to high gradient stream systems with associated off channel habitat, spawning gravels, and estuaries. Throughout the Northern Pacific Rim.	Present historically	Focus on restoring instream habitat through the placement of instream wood structures. Create off channel habitat (alcoves, backwaters, etc.) Remove barrier on Elk and Hawkins Creek. Plant riparian areas with conifers/ red alder, willow, ash and convert hardwood stands to conifer
Coastal Cutthroat Trout (Oncorhynchus clarki clarki)	Lower Columbia River and Umpqua Basin/ coastal Cutthroat	USFWS/ ODFW	Endangered/ Species of Concern/ Strategy Species Umpqua listed as endangered, all coastal Cutthroat are being considered for the federal t&e list	Both anadramous and resident species. Can spawn multiple times unlike most salmon. From Prince William to northern California.	Present historically	Focus on removing barriers to passage in higher gradient streams. Monitor populations.

Table 19 - Species List and Recommendations

Species	ESU	List	Status	Habitat	Presence	Recommendations
Fish Continued						
Chinook Salmon (Oncorhynchus tshawytscha)	California Coastal	USFWS - 1999	Threatened – Fishing, habitat degradation	Mainstem systems with larger substrate. Historical distribution from Alaska to Central California	Present historically	Focus on restoring instream habitat through the placement of instream wood structures. Increase floodplain width along mainstem where Chinook utilization most likely. Plant riparian areas with conifers/ red alder, willow, ash and convert hardwood stands to conifer
River Lamprey (Lampetra ayresi)				Anadromous parasitic fish feeding on marine species and spawning in freshwater habitat	Unknown	Monitor status
Western Brook Lamprey (Lampetra richardsoni)	Oregon Coast SMU	ODFW	Oregon Native Fish Status Report "At Risk"	Clear mountain streams with gravels or sand. Historical distribution from Canada to Central California, likely reduced. Non-parasitic, non-anadramous	Unknown	Monitor status
Pacific Lamprey (Lampetra tridentata)		USFWS	Species of Concern	Anadromous parasitic fish feeding on marine species and spawning in freshwater habitat	Unknown	Monitor status

Table 19 Continued - Species List and Recommendations

Species	ESU	List	Status	Habitat	Presence	Recommendations
Mammals						
Columbian white-tailed deer (Odocoileus virginianus leucurus)	Columbia River	USFWS - 1968	Endangered – habitat loss	Densely forested swamps and upland Oak savannas from Cascades to Pacific and from Puget Sound to the Umpqua basin.	Unknown	Create wildlife corridor from Columbia River to Nehalem mainstem.
Red Tree Vole (Arborimus longicaudus)		USFWS	Species of Concern – habitat loss	Old growth snags.	Unknown	Maintain mature timber and snag habitat. Create snags where not present. Monitor status.
White-footed vole (Arborimus albipes)		USFWS/ ODFW	Species of Concern/ Protected	Temperate Forests	Unknown	Maintain mature forests. Monitor status.
Hoary bat (Lasiurus cinereus)		ODFW	Strategy Species	Mature coniferous forests with extensive riverine systems	Unknown	Maintain mature forests. Monitor status.
Yuma myotis bat (Myotis yumanensis)		USFWS/ ODFW	Species of Concern/ Protected	Migrates south in September. Closely associated with water	Unknown	Maintain mature forests. Monitor status.
Long-eared Myotis Bat (Myotis evotis)		USFWS/ ODFW	Species of Concern/ Protected	Coniferous forests and Red Alder/ Salmonberry riparian areas	Unknown	Maintain mature forests. Monitor status.
Fringed Myotis Bat (Myotis thysanodes)		USFWS/ ODFW	Species of Concern/ Protected	Mature coniferous forests	Unknown	Maintain mature forests. Monitor status.
Long-legged Myotis Bat (Myotis volans)		USFWS/ ODFW	Species of Concern/ Protected	High elevation mature Coniferous forests	Unknown	Maintain mature forests. Monitor status.

Table 19 Continued - Species List and Recommendations

Species	ESU	List	Status	Habitat	Presence	Recommendations
Mammals Cont.						
Silver-haired bat (Lasionycteris noctivagans)		USFWS/ ODFW	Species of Concern/ Protected		Unknown	Maintain mature forests. Monitor status.
Townsend's big-eared bat- Corynorhinus townsendii		USFWS/ ODFW	Species of Concern/ Strategy Species - Critical	Coniferous forests with caves or mine tunnels	Unknown	Maintain mature forests. Maintain Nehalem divide tunnel as possible roosting hibernacula. Monitor status.
California myotis (Myotis californicus)		ODFW	Strategy Species	Coniferous forests with snag habitat and other crevaces, water for feeding	Unknown	Maintain mature timber and snag habitat. Create snags where not present. Monitor status.
American marten- (Martes americana)		ODFW	Strategy Species	Old growth forests and Cedar swamp habitats	Unknown	Convert portion of upper lake areas back to historical swamp/marsh conditions. Plant Cedars. Monitor status and reintroduce if not locally present in neighboring watersheds.
Fisher (Martes pennanti)	West Coast	USFWS/ ODFW - 2000	Candidate/Species of Concern. Habitat Loss.	Historically present throughout west coast coniferous forests	Unknown	Maintain mature forests. Monitor status.
Gray Wolf (Canis lupus)	Western Oregon	USFWS/ ODFS - 2008	Endangered - maintained listing in 2008. Oregon maintained listing for all wolves. Habitat Loss and Hunting pressures.	Historically present in North America.	Extirpated	Maintain wildlife corridor along Columbia to Pacific.

Table 19 Continued - Species List and Recommendations

Species	ESU	List	Status	Habitat	Presence	Recommendations
Birds						
Marbled Murrelet (Brachyramphus marmoratus)	Western North America	USFWS/ ODFW - 1992	Threatened – habitat loss	Ocean habitat for feeding and up to 50 miles inland in old growth coniferous forests for nesting	Unknown/ Extirpated	Maintain mature timber and snag habitat. Create snags where not present. Monitor status.
Northern Spotted Owl (Strix occidentalis caurina)	Western North America	USFWS/ ODFW - 1990	Threatened – habitat loss	Old growth coniferous forests from the Cascades to the Pacific	Rare – few nests and owls noted	Maintain mature timber and snag habitat. Create snags where not present. Monitor status.
Northern Goshawk (Accipiter gentilis)		USFWS/ ODFW	Species of Concern/ Sensitive Species List	Old growth coniferous forests from the Cascades to the Pacific	Unknown	Maintain mature forests. Monitor status.
Yellow-billed cuckoo	West of the Rockies	USFWS - 2001	Candidate. Habitat Loss.	Cottonwood and Willow dominated riparian areas throughout the United States to the Pacific.	Unknown	Revegetate riparian areas with Cottonwood and Willow. Monitor status.
Streaked horned lark	Western Oregon	USFWS - 2001	Candidate. Habitat Loss	Savannas and Wetlands of the Coast Mountains and Willamette Valley	Unknown	Convert portion of upper lake areas back to historical swamp/marsh conditions. Reintroduce Oaks to open grassy areas.
Bald Eagle (Haliaeetus leucocephalus)	Oregon	ODFW	Threatened – habitat loss	Riverine systems with old-growth forests and snag habitat	Present historically	Maintain mature timber and snag habitat. Create snags where not present. Monitor status.

Table 19 Continued - Species List and Recommendations

Species	ESU	List	Status	Habitat	Presence	Recommendations
Amphibians						
Northern red-legged frog (Rana aurora aurora)		USFWS/ ODFW	Species of Concern/ Strategy Species	Forested wetland habitat closely overlapping with rough-skinned newt habitat	Unknown	Increase wetland quality by draining a portion of the artificial upper lake complex.
Coastal tailed frog (Ascaphus truei)		ODFW	Strategy Species	Fast running cool water from Cascades to Coast and south to Klamath	Unknown	Maintain healthy riparian communities through stand conversion and wood placement.
Reptiles						
Western Pond Turtle (Clemmys marmorata)		ODFW	Sensitive Species List	Deep and shallow slow moving water. Protection from cars, non-native predators. Western Oregon	Unknown	Reintroduce turtles to upper lake complex and maintain portion of Gunners Lake/ Floeters Pond for Turtle habitat.
Northern Pacific Pond Turtle (Actinemys marmorata marmorata)		USFWS	Species of Concern	Ponds and foothill streams along the Pacific Coast. From Washington Coast to Baja.	Unknown	Reintroduce turtles to upper lake complex and maintain portion of Gunners Lake/ Floeters Pond for Turtle habitat.
Plants						
Nelson's checker-mallow	Northwestern Oregon Coastal Mountains/ Willamette Valley	USFWS -1993	Threatened	Riparian and wetland habitat	Unknown	Reseed riparian areas with native seed stock.

Table 19 Continued - Species List and Recommendations

Species	ESU	List	Status	Habitat	Presence	Recommendations
Plants Continued						
Water howellia (Howell aquatilis)	Western United States	USFWS	Threatened – Habitat modification and loss	Winter aquatic plant	Unknown	Monitor and introduce if appropriate.
Oregon sullivantia (Sullivantia oregana)		USFWS/ ODFW	Species of Concern/ Endangered	Moist cliffs, near waterfalls, on basalt derived soils	Unknown	Survey resistant valley's and introduce if appropriate.
Invertebrates						
Evening Fieldslug (Deroceras hesperium)		BLM/ USFS	Bureau Sensitive Species	Perennial wet medows in forested habitats.	Unknown	Convert a portion of the artificial lake complex back to wetland and maintain medow habitat. Monitor.
Western Ridgemussel		USFWS	Vulnerable	Freshwater mussel.	Unknown	Monitor and maintain status if appropriate.
Oregon Megomphix		BLM/ USFS	Bureau Sensitive Species	Terestrial mollusk. Moist forested areas low to moderate elevations in western Oregon.	Unknown	Monitor and maintain status if appropriate.
California Floater		USFWS	Critically imperiled	Freshwater mussel. Shallow areas of clear lakes and ponds and large rivers. Soft silty substrate. Historically from Canada to Baja from Pacific to Wisconsin.	Unknown	Monitor and maintain status if appropriate.
Nerite Rams-horn (Vorticifex neritoides)		ODFW	Strategy Species		Unknown	Monitor and maintain status if appropriate.
Rotund Physa (Physella columbiana)		ODFW	Strategy Species		Unknown	Monitor and maintain status if appropriate.

Table 19 Continued - Species List and Recommendations

Current riparian conditions within the watershed, in many reaches, do not meet reference conditions. In most tributaries the riparian stands are dominated by alders or young conifers. Where slopes are amenable side channel habitats are rare. The mainstem EFN is extremely degraded when compared to historical conditions. The most recent surveys suggest that the mainstem is dominated by reed Canary grass. AQI surveys indicate that the mainstem is also often disconnected from the floodplain and almost no side channel habitat exists.

Historical land-use activities have greatly impacted the watershed by eliminating almost all of the old-growth habitat, encouraging downcutting and floodplain disconnection of the stream network, and by removing many species that shape the landscape such as beaver that move the stream channel and birds that spread seeds. Additionally, channel modifications such as dams and undersized or poorly placed culverts have prevented salmon from utilizing the EFN for spawning and rearing. Current land-use management activities have impacted water quality and aquatic habitat by altering the sediment deposition regime. By reducing floodplain connectivity in low gradient systems, sediment supplied upstream cannot dropout on the banks. This sediment is then transported further downstream and reduces the water quality of the mainstem Nehalem river. Management actions have also reduced the overall input of LWD by harvesting ~30% of high risk slopes. These slopes that normally supply large quantities of wood and gravels are reduced in their capacity to supply LWD as many high risk slopes receive no legal protections. In order to restore aquatic habitat and water quality, regulations on current harvest practices within land managed for private timber should be reevaluated as these do not appear to be adequate at protecting unstable slopes or LWD recruitment regimes. It is evident that all high risk slopes adjacent to streams need protection. Given adequate protection it is likely that the watershed will naturally restore its wood recruitment regime and in-turn restore floodplain connectivity. Further, beaver must be protected in order to shape this incoming wood and the riparian corridor. Finally habitat quality of the mainstem EFN is significantly reduced from its potential. Restoration from the mouth to the confluence of Gunners Fork should include the planting of conifers and shrub species to aid in the reduction of incoming solar radiation and to supply a food source for beaver. Where feasible wood placement should be considered to trap and sort gravels which are often absent or buried by sands and silts.

Basin	Total Acres	BLM Acres
Dog	4433	321
Kenusky	4613	1940
Upper	2882	2670
Gunners	3753	2900
Jim_George	2731	1107
Elk	2181	NA
EFN	20611	8938

Table 10b - Area by BLM ownership

Introduced Species

Introduced species within this assessment area include nutria, opossum, bullfrog and warm water fish. Warm water fish include bluegill, crappie, big mouth bass and perch. Within the EFN River watershed there are several identified noxious weeds. The following is a list of noxious weeds, in order of highest nuisance and priority of control and their classifications according the Oregon Department of Agriculture Noxious Weed Policy and Classification System: Japanese knotweed, "T"; English ivy, "B"; Scotch broom, "T"; bull thistle, "T"; Canadian thistle, "T"; tansy ragwort, "T." Japanese knotweed is the Upper Nehalem Watershed Council's number one priority for noxious weed eradication. Scotch broom and tansy ragwort are the two major noxious weeds found in the watershed. Himalayan blackberry, scotch broom and reed Canary grass all have an adverse impact within the EFN watershed. They are invading disturbed lands such as clear cuts, roadsides, landslides, and riparian areas. A recent survey of some of the BLM lands in Columbia County done by Oregon State University (OSU) students has found that BLM lands do not have any serious infestations at this time, especially on those lands that have not been recently harvested. An inventory of noxious weeds throughout the entire Nehalem watershed has been created and distributed to various state and federal agencies for inclusion within the regional database. The weeds on this list which are located within the EFN include English ivy, English holly, Japanese knotweed, Scotch broom, and Himalayan blackberry.

1996 Vegetation

Forest stand structure according to the 1996 CLAMS vegetation layer, is dominated by small to medium conifers usually blocked in large even age stands. The only mature timber appears to be located on BLM lands and smaller slivers on Tribal lands. These stands are rather small but could potentially support old-growth dependent species were smaller trees allowed to reach this size class. CLAMS 1996 provides a good overall impression of the relative size and composition of forest stand structure at a 30 meter resolution. There are several issues with the CLAMS layers, they are often out-of-date before they are published; many stands appear as mixed classes; and the 30m DEM is not accurate enough to discern small differences. The 2000 CLAMS layer is still a 30m DEM but contains more species information. While this is useful, the 1996 layer is much more straight-forward when assessing open canopy. Further, the Wild Salmon Center provide a layer of timber harvest by decade which was much more recent than either CLAMS layers. The following information is based on the 1996 CLAMS layer and the timber harvest data. Ownership patterns determined (and still do determine) forest stand structure with the majority of the older stands blocked together on BLM O&C and Tribal lands with regenerating stands of smaller forests predominantly located on private timber taxlots.

Time Interval	Dog	Kenusky	Upper East	Gunners Fork	Jim George	Elk	EFN
No Harvest	25.03%	38.98%	51.68%	58.24%	33.06%	16.22%	38.04%
1972 - 1982	7.23%	21.23%	12.77%	8.87%	5.87%	13.35%	11.90%
1982 - 1992	30.75%	32.80%	19.61%	28.50%	44.14%	45.22%	32.52%
1992 - 2002	23.36%	5.46%	14.80%	4.95%	9.47%	15.39%	12.10%
2002 - 2007	11.65%	3.73%	4.33%	0.70%	4.23%	4.69%	5.13%

Table 10c - Timber harvest by Decade

Dog Creek - The Dog Creek catchment had the highest proportion of open forest with over 700 acres lacking a canopy. The majority of the private non-industrial ownership lies along the lower mainstem which is within the Dog Creek 7th field. Roughly 1/3 of the forest stand contained trees under 25 cm diameter at breast height (DBH) and slightly more than 1/3 contained trees of medium size which were 25-50 cm DBH. This information is roughly consistent with the harvest data and supports the accuracy of the CLAMs layer. BLM has minimal ownership within the basin. Elk Creek catchment has the second lowest area of forest not harvested within the last 35 years and the highest proportion of forest harvested within the last decade.

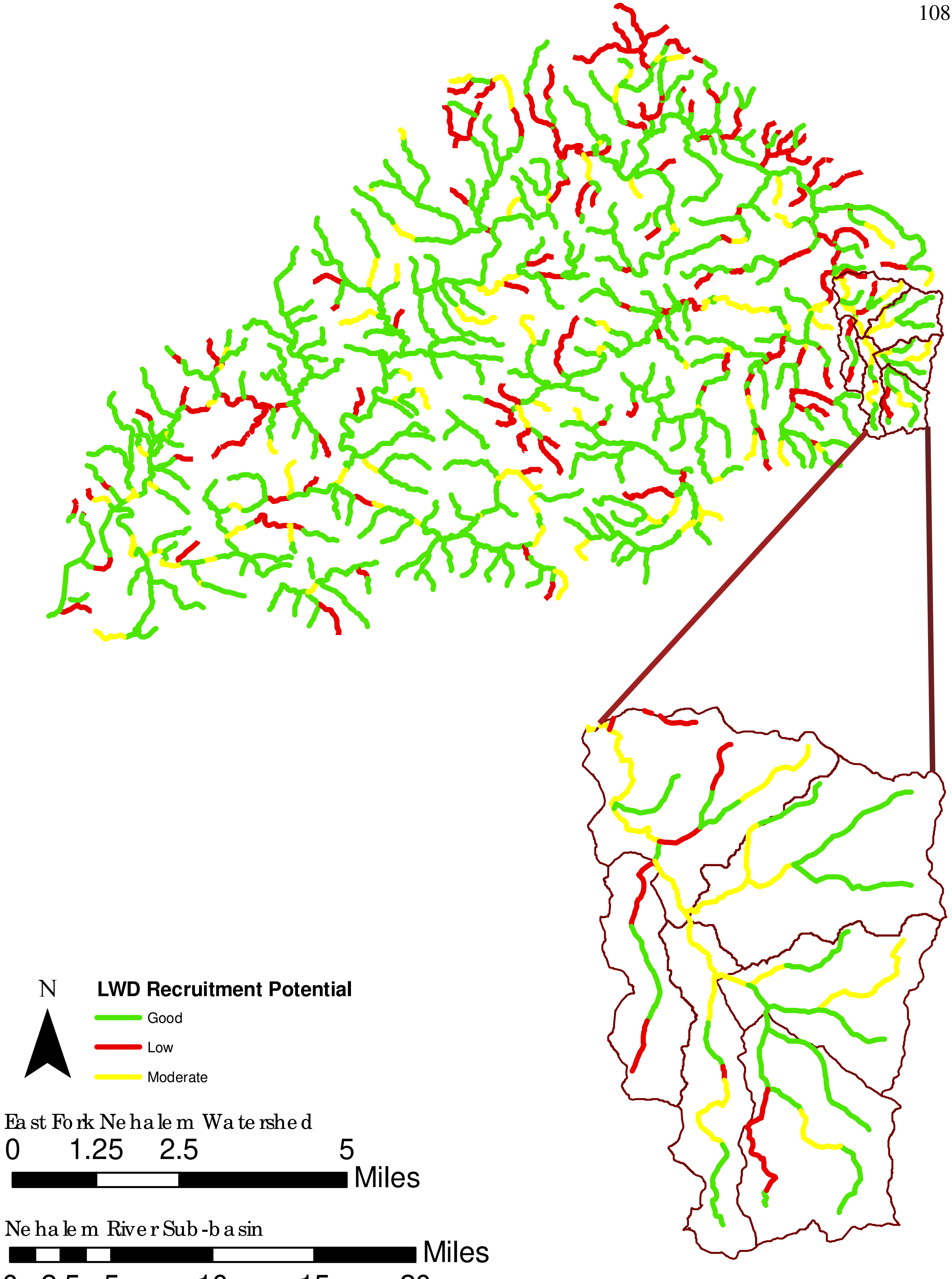
Elk Creek - 54% of the Elk Creek catchment contained conifers under 25 cm DBH. Only 3.3 acres of the forest contained trees over 50 cm in DBH. 10% of the forest is dominated by deciduous trees. This information is roughly consistent with the harvest data and supports the accuracy of the CLAMs layer. BLM has no ownership within the basin. Elk Creek catchment was harvested the most during the 1980s out of all the 7th fields within the basin. Elk Creek has the smallest area of forest not harvested within the last 35 years and the second greatest area harvested within the last decade.

Jim George Creek - Stand structure within the Jim George Creek catchment was dominated by small and medium conifers 932 acres (34%) and 844 acres (31%) respectively. There was ~350 acres (13%) open forest and ~71 acres (2.5%) large and very large conifers and hardwoods. Next to Elk Creek catchment, the Jim George catchment was harvested the heaviest during the 1980s. This information is roughly consistent with the harvest data and supports the accuracy of the CLAMS layer.

Kenusky Creek - The Kenusky Creek catchment had the greatest area of very large conifers and the greatest area of mixed stands of medium sized trees. This catchment had the second lowest harvest area within the most recent decade and not a great deal within the decade before that. This basin is nearly half BLM ownership (See Table 18b on following page). This information is roughly consistent with the harvest data and supports the accuracy of the CLAMS layer.

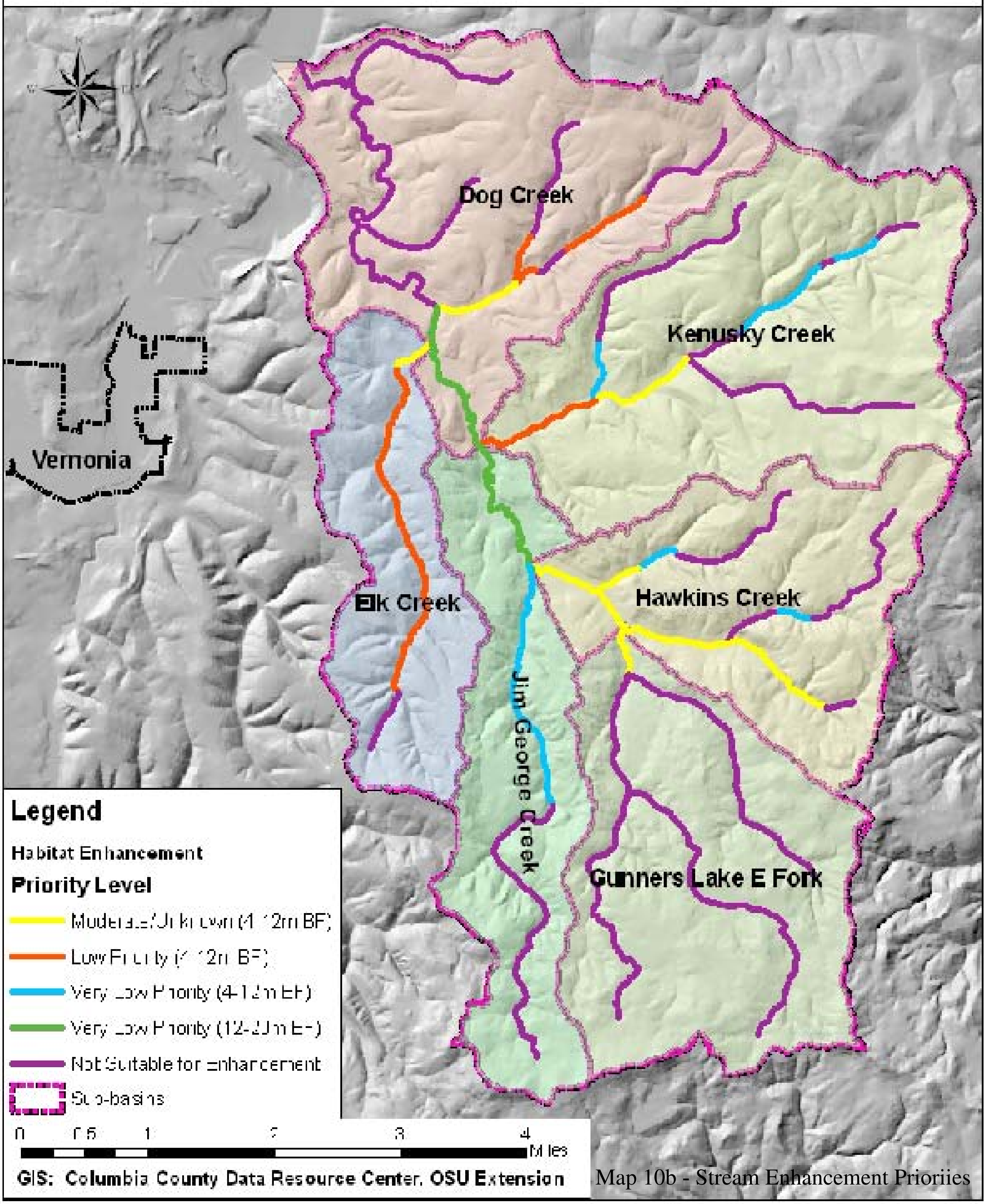
Upper East Fork - 37% (1080 acres) of the Upper East Fork catchment contained medium sized conifers and a larger proportion of small conifers. Only 66 acres supported large conifers and less than 5% was early regenerative growth. Deciduous trees made up 6% of the total area. This information is roughly consistent with the harvest data and supports the accuracy of the CLAMS layer. This catchment is predominantly BLM ownership and nearly half of the watershed has had no harvest within the past 35 years.

Gunners Lakes Fork - Gunners Lakes Fork had over 1600 acres of small coniferous forest, 39% of the total catchment area consisted of medium sized conifers, and there was nearly 260 acres of conifers with diameters greater than 50 cm. This catchment has had the least harvest within the most recent decade. This information roughly follows the harvest patterns and supports the accuracy of the CLAMS layer.



Map 10a - LWD Recruitment Potential

East Fork Nehalem Basin: Stream Enhancement Priorities



Map 10b - Stream Enhancement Prioriies

Analytical Conclusions

Dog Creek has had the most harvest within the last decade and also contains the majority of private non-industrial ownership. The lower mainstem is included within this7th field. It is likely that ~5% of the 25% area not harvested within 35 years is rural residential. Additionally, as there were 700 acres of open canopy in 1996, and moderate timber harvest the decade following, the catchment likely only made up 15% of the watershed at most which is the lowest within the sub-watershed.

AQI surveys noted that most stream reaches lacked complex LWD structures and key pieces, the mainstem EFN was scoured to bedrock in many areas, and the frequency of spawning and rearing structures was low. Also noted was a lack of off-channel habitat and a notable level of historic and current beaver activity. It is unclear how much of this activity was historic or current. Beaver populations throughout the coast have generally been on the decline.[1]

Although the distribution of many species would historically include the EFN, it is unclear how many are extant from those habitats. The overwhelming majority of the EFN is managed for timber production and any land-use impacts on water quality or aquatic and terrestrial habitat would historically and currently be the result of these timber activities.

Key Findings

- Current vegetation differs significantly from historical conditions.
- Instream habitat and riparian conditions are significantly degraded relative to historical conditions.
- Timber harvest is the primary land use impact to the EFN.

Recommendations

- Collection of detailed information on instream sediment impacts and potential sources should be considered the top priority for data collection.
- A detailed culvert prioritization should be conducted which relates specific barriers to the quality of available upstream habitat for multiple species. Both of these projects may be most appropriate at the scale of the Nehalem 4th field.
- Data gaps should be filled by conducting a limiting factors analysis and detailed restoration plan within the watershed. A limiting factors analysis would identify specific sites for aquatic and riparian restoration.
- Increased protection of riparian areas are needed throughout the EFN sub-watershed to protect and improve aquatic habitat and water quality.
- Terrestrial habitat improvements should include the management of forested areas near mature timber patches for old growth to create wildlife corridors. Management practices should promote the development of connected old growth coniferous forests to support the many species which rely on that habitat.
- Restoration projects within the basin could focus on improving connectivity through the use of beavers as a less costly form of restoration. Riparian planting over a series of years should occur to maintain beaver food and shade levels while still allowing floodplain restoration to occur naturally.
- Headwater riparian areas should be maintained for terrestrial habitat and future LWD recruitment.
- LWD placement should occur on the mainstem to provide immediate salmonid habitat.

1 Personal Communication, Steve Trask. 2008

Chapter 11

Monitoring Plan

Specific objectives

The key issues identified in this assessment should be revisited at ten year intervals. The specific objectives are as follows:

- Track changes in land use practices
- Track changes in upland vegetation
- Track changes in water quality with a focus on sediment and temperature using EMAP protocol
- Track changes in aquatic and riparian habitat
- Track changes in fish distribution and abundance
- Survey for endangered species in riparian areas, mature timber stands, and in remaining wetland habitat

Partners and funding resources

BLM, ODFW, and ODEQ are potential public sector partners. OWEB and NPS 319 funds may be available to support work in the basin.

Location and methods

Successful implementation of the objectives listed above will require a combination of GIS analysis and field surveys. Land use and upland vegetation can be assessed using GIS analysis. It is not however possible to specify what GIS data will be available in the coming decades. Timber harvest and road density as well as species composition and abundance should be evaluated and compared to the data presented in this document. Temperature monitoring should be carried out at the mouth of the mainstem and each major tributary using continuous data loggers. Fish distribution surveys should be completed using the Rapid Bio Assessment protocol. AQI surveys should be redone for the entire basin at regular intervals.