FISH HABITAT ASSESSMENT IN THE OREGON DEPARTMENT OF FORESTRY ELLIOTT STUDY AREA

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Project Description

A collaborative project between the Oregon Department of Forestry (ODF) and the Oregon Department of Fish and Wildlife (ODFW) was initiated to synthesize aquatic habitat and fisheries information for the Elliott State Forest study area, which includes portions of the Coos, Umpqua, and Tenmile Lake drainages, to assist in the development of operational management plans, stream habitat restoration projects, habitat conservation planning, and watershed analysis. The project summarizes the condition of stream habitat, the distribution and abundance of salmonid fishes, and the potential for restoration. The ODFW Aquatic Inventories Project has conducted stream habitat surveys as part of its basin survey project and habitat assessment project under the Oregon Plan for Salmon and Watersheds. The goal of these surveys was to document the status and trends of stream conditions in coastal drainages. These surveys in conjunction with fish distribution, fish abundance, potential barriers to passage, and past restoration activities form the basis of the analyses.

The Elliott State Forest is in the mid-south coastal portion of Oregon (Map 1). The Elliott State Forest is comprised of segments of the Coos, Umpqua, and Tenmile Lake watersheds. The lower reaches of many streams that originate on the forest are tidally-influenced in the Coos and Umpqua regions and are lake-influenced in the Tenmile region. The Elliott State Forest is approximately 93,000 acres in size, contains 282 km of stream (1:100,000 resolution), and is comprised of portions of two hydrologic units (HU); 17100303 – the lower Umpqua, and 17100304 - the Tenmile Lake and Coos drainages. Map 3 depicts the 6th field HUs and Oregon Department of Forestry "6th field" management basins. The management basins are nested within the 6th field HUs. Table 1 lists the major river basins, 6th field hydrologic units, streams, and ODF Management basins, and it corresponds with Maps 2 and 3. Streams within the Elliott State Forest project area on which ODFW had habitat surveys and salmonid spawning surveys are depicted on Map 4. In this report, we summarized and discussed information by three regions – Coos, Tenmile Lake, and Umpqua – but presented information for individual streams and reaches in tabular and map forms.

Within the study area, ODF ownership is located primarily in the mid and upper portions of the Coos and Tenmile Lakes watersheds and upper portions of streams low in the Umpqua watershed. Other land ownerships in the drainage include private industrial, private non-industrial, public, agricultural, and urban and rural residential (Map 5). Land use in the drainage is dominated by forest-related activities.

The entire Elliott study area is underlain by sedimentary geology, specifically Tyee Formation sandstone. The Tyee formation is comprised of micaceous, feldspathic, lithic, or arkosic marine sandstone and micaceous carbonaceous siltstone. Channel geology is sand (Map 6). Overall, the gradient of streams in the Elliott study area was low to moderate (0-5%), with higher gradients found in some of the upper stream reaches, noticeably in the Umpqua basin. Riparian vegetation in the Elliott State Forest is comprised primarily of hardwood trees of varying sizes and ages (within 30m of the channel) and of conifers beyond the 30m zone (Andrus 2003).

The area delineated by ODF is referred to as the Elliott project area; the area delineated by ODFW for this aquatic assessment is termed the Elliott State Forest study area (Map 1). All of the information presented in this report is specific to the Elliott State Forest. If information is presented for land off the forest, it is specifically stated.

GIS coverages – sources and scales

Two digitized maps layers were used for different features of this synthesis. The primary layer is the 1:100,000 USGS stream layer. It is a standardized and routed coverage and has a unique latitude and longitude field associated with each stream (Hupperts 1998). Fish distribution and aquatic habitat data are joined to the 1:100,000 coverage. The Coastal Landscape and Analysis and Modeling Study (CLAMS: http://www.fsl.orst.edu/clams/) provided a 1:24,000 coverage and a standardized 6th field Hydrologic Unit coverage. The CLAMS coverages displayed all streams at a 1:24,000 scale, and determined the valley width, mean annual flow, channel size, and gradient of streams less than 10% gradient (Map 7).

Fish Distribution and Abundance

Coho salmon (*Oncorhynchus kisutch*), fall Chinook salmon (*O. tshawytscha*), and winter steelhead (*O. mykiss*) occur in the mainstem and tributaries of the Elliott study area (Map 8). Additionally, Chum salmon (*O. keta)*, resident and anadromous cutthroat trout (*O. clarki clarki*), and Pacific lamprey (*Lampetra tridentata*) are present. The Tenmile Lakes region and the Umpqua and Coos estuaries are very productive environments for juvenile salmon. These areas are located immediately outside the forest boundaries.

Non-salmonid species are present, but their distributions are either not well-documented or are they are not the subject of targeted studies. Due to the extent of the tidal areas, many species are found in areas adjacent to the Elliott State Forest. Striped bass (*Morone saxatilis*) have been caught in the Umpqua River up to the Scottsburg area, east of the study area, and they have been seen in Scholfield Creek (Umpqua region), as well as in rivers entering the Coos estuary. Shad (*Alosa sapidissima*) are in the Umpqua and Coos/Millicoma Rivers. Sturgeon (A*cipenser medirostris* (green) and *A. transmontanus* (white)) are in the Coos and Umpqua Rivers and Loon Lake. Millicoma Longnose Dace (*Rinichthys cataractae)* is listed as a "peripheral or naturally rare" on the state sensitive species list. The dace have been found in the West and East Forks of the Millicoma River, South Coos, and streams outside the study boundaries (J. Brick and A. Ritchey, ODFW, personal communication).

ESA Designations

Two fish species are listed under the federal Endangered Species Act (http://www.nwr.noaa.gov/). Coho salmon are listed as threatened, while winter steelhead are considered a species of concern. Others species are not listed at this time.

Fish Populations in the Elliott State Forest

Chum salmon distribution is primarily limited to lower Marlow Creek (Coos region), and they occasionally enter the West Fork Millicoma River (A. Ritchey, personal communication) (Map 9).

Fall Chinook salmon spawn and rear in the lower gradient portions of the study area, primarily in the Coos and Millicoma systems and lower reaches of Mill Creek (Umpqua region) (Map 9). They return to the Elliott study area beginning in September and start spawning in October with peak counts observed in mid to late November through December. Peak counts of spawning Chinook salmon throughout the index reaches vary but tend to be greater than 40 fish per reach (2002 and 2004 ODFW Coastal Salmon Inventory Project survey data) in the West Fork Millicoma River (Coos region). However, there was an increase in the peak count in 2003 (live and dead Chinook) of 209 fish (which extrapolates to 418 fish per mile), due to favorable ocean conditions. Fall Chinook populations have slowly rebounded from an extremely depressed status in the mid-1950s. In the late 1800s and early 1900s, commercial landings were recorded as high as 39,000 fish in the Coos system (Nicholas and Hankin 1988).

Coho salmon reside extensively throughout study area, though gradient precludes their dispersal into upper reaches (Maps 9 and 10). Coho salmon begin returning to the Elliott State Forest in October and early November after spending 6 months to 1.5 years in the ocean. The peak spawning period occurs between mid-November and mid-January. Coho prefer to spawn in the smaller tributaries and have been observed in the upper reaches of the mainstem as well. Spawning surveys have been conducted in the Elliott State Forest from 1989 to 2003 by the ODFW Coastal Salmon Inventory Project (Map 11). The approximate amount of coho salmon spawning habitat in the Elliott project area is as follows: Umpqua region: 25.7 miles, Tenmile Lakes region: 38.0 miles, Coos region: 53.4 miles. The number of coho salmon observed throughout these reaches has varied dramatically from 1989 to 2003 (Maps 9 and 12). Map 9 depicts the small watersheds (6^{th} field hydrologic units) in the study area which demonstrated higher than average abundances from 1989-2000. Highlighted HUs show the percentage of years that the average number of adult coho salmon was greater than 4 (Coos and Umpqua regions) or 43 (Tenmile Lakes) fish per mile for the 12 year period from 1989 – 2000, which generally coincided with a period of low abundance due to unfavorable ocean conditions. Coho were most abundant in the West Fork Millicoma River, Palouse, Larson (Coos region), and Scholfield Creek (Umpqua region) watersheds, based on survey data.

Coho populations expanded rapidly beginning in 1999 because of good ocean conditions with average spawning counts consistently above 20 fish per mile (Map 12). Recent years have experienced record abundance of adult coho salmon on the spawning grounds. Streams in the Elliott State Forest had higher adult coho salmon counts than streams in other coastal basins (Figure 2). The higher numbers are in part driven by the high density of fish spawning in streams in the Tenmile Lakes system. The production of adult coho salmon is heavily influenced by the availability of rearing habitat during the winter in low gradient areas downstream of the Elliott State Forest boundary. This appears to be particularly important for the Tenmile Lakes region populations.

Winter steelhead reside extensively throughout the three regions (Map 9) with barriers and/or steep gradient limiting further dispersal. Data are limited but accessibility to historic spawning and rearing areas is thought to be complete. Spawning surveys (1 site on Charlotte and Mill Creeks (Umpqua region), 2 sites on Palouse Creek (Coos region), 2 in West Fork Millicoma River, and 1 site on Elk Creek (Coos region) conducted under the ODFW Coastal Salmon Inventory Project documented high abundance of steelhead in the in the West Fork Millicoma (Coos region) watershed. In 2004, densities for the West Fork Millicoma averaged 53 redds per mile and Elk Creek averaged 10 redds per mile. Palouse Creek (Coos region) also had abundances of adult steelhead, numbering 25 adults and 16 redds per mile. Abundance of spawning adults (redd counts) in 2003 were somewhat higher. For example, Palouse Creek had 45 redds per mile.

Maps depicting the distribution of Pacific lamprey have not been developed yet. However, Pacific lamprey redds and adults have been included as a part of the ODFW steelhead surveys. While fish counts were higher than usual in 2003, lamprey counts were higher in 2004 than 2003. In 2003, no lamprey nor redds were observed (zero counts recorded). In 2004, Palouse Creek (Coos region) had 1 adult and 9.2 redds per mile; West Fork Millicoma River (Coos region) had 3 adults and 43 redds per mile.

Anadromous and resident cutthroat trout are not the focus of any population monitoring program; therefore, counts of adults are unknown, although they are present in most streams in the ODF study area.

A summary of salmonid fish populations in the coastal basins (including those in the study area) was developed by Talabere and Jones (2004) to identify the 6th field HUs that supported higher than average densities of salmon during 1989 - 2000. The map depicts the small watersheds that had above average densities for more than 50%, 75%, and 90% of the 12 years (Map 9 and Table 2). Watersheds in each region within the study area were most important for coho salmon, and select watersheds, primarily the West Fork Millicoma River and Marlow Creek (Coos region), were also important for winter steelhead, chum, and fall Chinook (Table 2).

Historic Fish Distribution

Lacking historic fish distribution information, we used a map of stream size and gradient developed by the Coastal Landscape Analysis and Modeling Study (CLAMS: http://www.fsl.orst.edu/clams/) to identify areas above current fish distribution that could have potentially supported salmon in the past. We assumed that fish distribution in the three regions would be limited by stream gradient if impediments such as physical barriers or poor habitat were not present. Comparing current maps of fish distribution with the CLAMS generated gradient maps (representing potential historic distribution) indicated that fish composition and distribution may have been similar to that at present (Map 8). However, chum salmon had much higher abundance and distribution in the Coos Basin than at present.

The map of high intrinsic potential indicates the areas that may have had the highest level of productivity for juvenile coho salmon in the past (Map 17). With the exception of selected areas in the upper West Fork Millicoma drainage, most of the high intrinsic stream areas border the state forest. This suggests that streams in the state forest may support the spawning fish populations while the best winter rearing habitat for juvenile coho salmon lies immediately below the forest boundary. The character of aquatic habitat and riparian stands on forest lands may dictate the flow of sediment and large wood to the reaches below.

Salmon and Lamprey life history in coastal basins

Chinook salmon return early September to early November with peak spawning activity observed in mid-November to mid-December. Chinook salmon prefer to spawn in larger streams at the tail crest of pools and glides and tend to use larger substrate, gravel and cobble, in which to build redds. The fry emerge in early spring. Some will migrate immediately to the estuary while others will remain in freshwater until summer or early fall. After spending the summer and early fall in the estuary they will migrate to the ocean. Most will remain in the ocean an average of 3 to 4 years and then come back to their native streams to repeat the cycle. Habitat requirements for adult Chinook are clean, ample gravel for spawning, cold, clean, well-oxygenated water, and deep pools for cover. Juvenile Chinook salmon need cool, clean water, pools, and large wood debris for cover while in their freshwater environment. Estuaries and associated wetlands provide vital nursery areas for the fish prior to their departure to the open ocean. The Coos region is important for Chinook salmon growth and survival, as is apparent from the abundances of fish returning to that region.

Coho salmon begin returning to the watershed in October and early November after spending 6 months to 1.5 years in the ocean. The peak spawning counts occur between mid-November and mid-January. Coho prefer to spawn in the smaller tributaries and have been observed in the upper reaches of the mainstem as well. The fry emerge in early spring and remain in their freshwater environment for a complete year. Thus, due to this life history trait, high quality habitat conditions are necessary year-round in order to insure over-winter survival. Attributes including off-channel and beaver pond habitat to provide refuge from high velocity winter flows, large wood debris to provide cover from predators, and low levels of fine sediment in spawning gravel provide this. The Tenmile Lakes region is a valuable rearing area for juvenile fish due partially to its low gradient, and primarily due to the winter rearing habitat afforded by the lake environment.

Winter steelhead return to their natal streams from November to April after spending from 1 to 3 years in the ocean. Unlike other Pacific salmonids, some steelhead may survive after spawning and return to the ocean and become repeat spawners. Spawning occurs in the winter and early spring, and when the fry emerge they remain close by or occasionally migrate to the upper or lower reaches of streams and rivers. Like other salmon species, juveniles and adults rely on streams, rivers, and marine habitat during their lifecycle. Juveniles usually stay in their freshwater environment for two years before migrating to the ocean in the spring. Habitat requirements include clean, ample gravel for spawning, cold, clean, well oxygenated water, deep pools and large wood debris for cover.

Coastal cutthroat trout may exhibit four main life history strategies; an anadromous form that migrates to the estuary and/or ocean before returning to freshwater to spawn, an adfluvial form that migrates from a lake to smaller tributaries to spawn, a fluvial form that migrates to small streams from other parts of the watershed to spawn, and a resident form that both resides and spawns in small streams. Both anadromous and resident cutthroat trout are found throughout the mainstem and tributaries of the Coos, Umpqua, and Tenmile Lakes regions, but specifically resident cutthroat tend to be found in the upper headwater reaches of the tributaries. Anadromous adults enter streams during the fall. These adults will spawn from December through May (peak in February) depending on water conditions. Fry emerge from the gravel in about 2 months. The young utilize slow flowing backwater areas, low velocity pools, and side channels for rearing. Young cutthroat can spend 1 to 9 years in fresh water before they migrate to the estuaries and ocean in the spring, but most commonly it takes three years from emergence. Adults usually spend less than one year in the ocean before returning to spawn. Like steelhead, sea-run cutthroat trout usually survive after spawning and will return to the ocean in late March or early April. In freshwater, adult cutthroat typically reside in large pools while the young reside in riffles.

Pacific lamprey are anadromous. Mating pairs construct a nest by digging together using rapid vibrations of their tails and by moving stones using their suction mouths. Adults die within days of spawning and the young hatch in 2-3 weeks. The juveniles swim to backwater or eddy areas of low stream velocity where sediments are soft and rich in dead plant materials. They burrow into the muddy bottom where they filter the mud and water, eating microscopic plants (mostly diatoms) and animals. The juvenile lamprey will stay burrowed in the mud for 4 to 6 years and stay in the same habitat, rarely migrating within the stream system. They metamorphose into adults averaging 4.5 inches long. Lamprey migrate to the ocean in late winter during periods of high water. After 2 to 3 years in the ocean they will return to freshwater to spawn.

Habitat Survey Approach and Methods

ODFW Aquatic habitat surveys were conducted in the Elliott State Forest from 1993 – 2004 (Map 18; Table 1). Summaries reflect only those streams within the Elliott State Forest. All surveys described the channel morphology, riparian characteristics, and features and quality of instream habitat during summer flow, following methods described in Moore et al. (2002) (http://osu.orst.edu/Dept/ODFW/freshwater/inventory/publicatn.htm). Each habitat unit is an area of relatively homogeneous slope, depth, and flow pattern representing different channel forming processes. The units are classified into 22 hierarchically organized types of pools, glides, riffles, rapids, steps, and cascades, including slow water and off-channel pool habitat. Length, width, and depth was estimated or measured for each habitat unit. In addition, water surface slope, woody debris, shade, cover, and bank stability were recorded. Substrate characteristics were visually estimated at every habitat unit. Estimates of percent silt, sand, and gravel in low gradient (1-2%) riffles were used to describe gravel quantity and quality. The surveys also provided an inventory of site-specific features such as barriers to fish passage (e.g., falls or culverts),

Riparian transects described tree type and size, canopy closure, and ground cover associated with the floodplain, terraces, and hillslopes adjacent to the stream. Each transect was 5m wide and extended 30m perpendicular on each side of the stream.

Descriptions of channel and valley morphology followed methods developed at Oregon State University and described in detail in Moore et al. (2002). Valley and channel morphology defined the stream configuration and level of constraint that local landforms such as hillslopes or terraces imposed upon the stream channel (Grant 1988, Gregory et al. 1989; Moore and Gregory

1989). The channel was described as hillslope constrained, terrace constrained, or unconstrained. Channel dimensions included active (or bankfull) channel width and depth, floodprone width and height, and terrace widths and height. These descriptions of channel morphology have equivalents within the OWEB and Rosgen channel typing system (Rosgen 1994).

Two survey designs were used within the Elliott State Forest. Surveys conducted in 1993 – 2003 followed a basins, or census, survey design. The basins survey followed methodology proposed by Hankin (1984) and Hankin and Reeves (1988). The sampling design is based on a continuous walking survey from the mouth or confluence of a stream to the headwaters. Each stream is stratified into a series of long sections called reaches and into short habitat units within each reach. Within a watershed, field crews surveyed major streams and a selection of small tributaries. The methodology provided flexibility of scale, allowing information to be summarized at the level of microhabitat, associations of habitat, portions or reaches of streams, watersheds, and subunits within regions. The continuous-survey approach provided field-based estimates of habitat conditions throughout a stream, described habitat and hydrologic relationships among streams or landscape features, and permitted stream-wide estimates of fish distribution and abundance. We repeated the surveys during winter to permit a more accurate description of channel features during winter base flow, especially off channel features.

The second survey design (referred to as OR Plan) was intended to provide estimates of habitat conditions across a broad geographic region. To accomplish this, we randomly selected sites each year from 1998-2004 in coastal drainages. Of the total, 8 sites fell within the Elliott study area and are reported here. Field protocol was similar to the basins surveys except that sites were 500m to 1,000m in length. The randomly selected sites were combined with the basins survey reaches to describe aquatic conditions in the study area.

The basins and OR Plan surveys were integrated into coverages in a Geographical Information System (Jones et al 2001). The basins surveys were routed and displayed at the channel reach and habitat unit scales, and the random surveys were displayed as points with reach summary data.

The methods manual for basins and random surveys is available online at http://oregonstate.edu/Dept/ODFW/freshwater/inventory/index.htm.

Analysis

Habitat data were summarized at the reach (basins surveys) or site (OR Plan surveys) scale to describe channel morphology, habitat structure, sediment supply and quality, riparian forest connectivity and health, and in-stream habitat complexity. Individual attributes include:

Channel morphology	Channel dimensions
	Channel constraint features, if any
	Gradient
	Percent secondary channels
	Floodplain connectivity

Pool habitat	Percent pool Percent slow, backwater, and off-channel pools Deep Pools (>1m deep) Complex pools (contain > 3 pieces large wood)
Large Wood	Pieces of large wood (>0.15 diameter and >3m length) Volume of large wood (m3) Key pieces of wood (>0.6m diameter and >12m length)
Substrate	Percent fines, gravel, cobble, boulder, bedrock Percent fines and gravel in low gradient riffles
Riparian	Shade Density of conifer trees, by size category Density of hardwood trees, by size category

Results are presented in tables and as frequency distribution graphs, and in GIS coverages. Values were standardized as a percent or by reach length. Information from a reference database was used to provide a standard point of comparison.

Metadata for the GIS coverages is available online at http://oregonstate.edu/Dept/ODFW/freshwater/inventory/index.htm

An interpretation guide for aquatic habitat data is available online at http://oregonstate.edu/Dept/ODFW/freshwater/inventory/index.htm

Individual stream survey reports for the Elliott State Forest are available from the Aquatic Inventories Project in Corvallis, the ODF State Forest Office in Coos Bay, and the ODFW district office in Charleston.

Habitat quality

Individual habitat attributes portray a view of stream characteristics. They provide a point of comparison to view the relative differences between streams and reaches within a drainage network. We integrate habitat attributes in three different fashions, considering fish, landscape, or historic perspectives. The first is in comparison to a historic context, expressed in the character of streams located in minimally human disturbed areas. These sites are referred to as reference sites, and while they provide a general context and range of stream attributes. These compare current conditions with minimally human-influenced conditions. They are not intended to be prescriptive in nature.

The second and third perspectives express stream quality in terms of potential carrying capacity of a reach for juvenile coho salmon (Habitat Limiting Factors Model), and potential survival of coho salmon at each life stage (HabRate). We collected information on attributes relevant to determining the potential quality and carrying capacity of aquatic habitat for different life stages of coho salmon: stream substrate (fine sediment, gravel, and cobble), habitat unit type (scour, beaver, and off channel pools), cover (large wood, undercut banks), and channel morphology (secondary channels, gradient). Again, each model provides a comparison of stream attributes from a salmonid biology perspective.

Reference conditions

Reference values (Table 6) were derived from streams in areas with low impact from human activities. We used a reference database that is most similar to the lower gradient streams predominant in the Elliott study area. A total of 124 "reference" sites, surveyed between 1992 and 2003, were selected within the Oregon Coast Coho ESU (from Sixes River to the Necanicum, including the upper Umpqua in the Cascade ecoregion) to represent conditions within the range of coho salmon. A summary of the reference site characteristics is as follows:

Attribute	**Value**
Number of Reaches or Sites	124
Distance Surveyed - Total (km)	161.9
Reach or Site Length (m)	
Mean (median)	1306 (971)
Range	174 - 6776
Active Channel Width (m)	
Mean (median)	9.28 (7.28)
Range	1.5 – 31.5
Gradient (%)	
Mean (median)	2.8 (2.3)
Range	0.5 – 19.2
Ownership	primarily federal
Ecoregions	Coastal 80% Cascades 20%
Geology	Sedimentary 72% Volcanic 21% Mixed 7%

Reference sites were selected using methods outlined in Thom et al. (2001). A thorough discussion of the site characteristics and locations of the reference sites used in this report will be available in the ODFW Habitat Report on the Coast Coho Assessment website at ftp://nrimp.dfw.state.or.us/OregonPlan/. Sites were initially selected based on land use and riparian classifications usually associated with low human impact (e.g. wilderness or roadless area, late-successional or mature forest). Each site was inspected using USGS 7.5 minute topographic maps for human-caused stressors such as roads, development, and forest management. While few of the sites were completely absent of human influence, we assumed that the reference sites represented a natural range of conditions. The range of data for each reference stream variable was subdivided into quartiles, 0-25%, 25-75%, and 75-100%. The value within each of the three quartiles was labeled as either low, moderate, or high. Thus, we considered that the 25th and 75th quartile breakpoints represented the values we considered low or high within a natural context. The middle 50% quartile was considered a moderate or average level. We used these values not to predict historic conditions in the Elliott study area, but to more broadly represent the potential range of historic conditions in lower gradient (<5%) fish-bearing streams in coastal Oregon.

Habitat Limiting Factors Model (HLFM)

The HLFM model estimates the potential carrying capacity of stream habitat and identifies the limiting factors for coho salmon production (Nickelson et al 1992, Nickelson 1998). We used this model to quantify critical habitat factors for juvenile coho salmon during the summer and winter, and highlight differences between reaches. The HLFM model focuses on the amount of pool habitat in a reach, particularly the beaver pool and off-channel pool habitat. Summer habitat capacity is a function of the amount of total pool habitat, and winter habitat is governed by the amount of beaver and off-channel pool habitat.

Stream capacity to support juvenile coho salmon during the summer was considered high if the value exceeded 2,430 fish per kilometer and low if the value was below 1250 fish per kilometer. Similar values for capacity to support winter parr were 1950 and 1000 fish per kilometer. Habitat quality was measured as the average number of juvenile fish per square meter in a kilometer of stream. The breakpoints for high and low quality were 0.15 and 0.38 fish per m^2 in the summer, and 0.12 and 0.30 fish per m^2 in the winter.

HabRate

HabRate (Burke et al. 2001) describes the quality of aquatic habitat in relation to survival of Coho salmon at a particular life stage. HabRate was based on our interpretations of the published literature. Habitat requirements for discrete early life history stages (i.e. spawning, egg survival, emergence, summer rearing, and winter rearing) were summarized and used to rate the quality of reaches as poor, fair, or good, based on attributes relating to stream substrate, habitat unit type, cover and structure (large wood, undercut banks), and gradient. Reach level summaries of stream habitat were entered into a computer spreadsheet, and interpreted by logical statements to provide a limiting factor assessment of potential egg-to-fry and fry-to-parr survival for each reach. The model is a decision making tool that is intended only to provide a qualitative assessment of the habitat potential of stream reaches within a basins context. Information not common to standard stream survey designs, such as seasonal flow or temperature extremes were excluded from this analysis. Model output ranks habitat quality from 1 to 3: poor, fair, and good.

The primary difference between the HLFM and HabRate models is that HabRate considers the influence of large wood in structuring habitat complexity, whereas HLFM model emphasizes the importance of beaver ponds and alcove habitat. Both models provide an assessment of habitat features that influence the survival of Coho salmon juveniles from parr to smolt. We include the finding from both models to describe habitat quality.

An evaluation of incorporates the biological significance of stream habitat attributes and knowledge of salmonid life history. The reference benchmarks are a useful point of comparison for determining whether the value of a physical stream characteristic is high or low relative to the range of natural conditions. Fish habitat models, HLFM and HabRate, view the physical habitat from a salmon biology perspective. Values of high or low capacity reflect the importance of physical features to the productive capacity of habitat for coho salmon. Values of high or low quality describe the influence of habitat on the survival of coho salmon during a particular life stage, or from one life stage to the next.

Aquatic Habitat Conditions

Aquatic Habitat overview

The ODFW Aquatic Inventories Project has conducted summer aquatic habitat surveys in the Elliott State Forest since 1993. Three distinct watersheds exist within the project area and are identified as the Ten Mile Lakes, Umpqua River, and Coos regions throughout this report (Table 1). There are approximately 206 kilometers of surveyed stream habitat associated with 117 identified reaches of various lengths within the ODF Elliott project area (Tables 4A-B, 5A-B, 6A-8B). Most of the streams surveyed in the project area were small to moderate sized tributaries. The active channel width (bankfull width) on the surveyed streams ranged from 0.8m to 36.9m (average of 8.3m and a median of 6.3m). The gradient ranged from 0.3% to 32% with an average of 5.1% and median of 3.7% (Table 11 and Figure 9). Fifteen percent of the habitat survey length had an average gradient between 5 and 9 percent and approximately 7 percent of the survey length had an average gradient greater than 9 percent (Figure 9).

The habitat analysis focused on thirteen core habitat attributes considered important for successful spawning, rearing, and survival throughout various life history stages. These core attributes are identified as the amount of pool habitat, quantity of deep pools per kilometer, percent of slack water habitat, percent of secondary channel area, percent of fines and gravel found in riffle substrate, percent bedrock substrate, large wood pieces, volume and key pieces, shade, and large conifers in the riparian zone. These attributes are compared to habitat values derived from reference stream reaches and conditions. Reference sites provide a general context and range of stream attributes of minimally human-influenced sites, and they are intended to provide a point of comparison to view the relative differences between streams and reaches within a drainage network. Reference values are not meant to be prescriptive, that is, to indicate the value each reach of stream must attain. Table 10 compares the average and a median value of the 13 core attributes in relation to the reference reach's habitat reference values. In addition, Figures 3 through 10 are cumulative frequency graphs of these attributes within the identified watershed regions. These graphs help visualize the condition of the habitat relative to the reference conditions at the low and high reference values (25^{th} and 75^{th} percentiles).

With the exception of bedrock substrate, large wood debris volume, and conifers in the riparian zone, habitat conditions for all core habitat attributes within the Elliott project area are within the moderate to high categories. Tenmile Lakes and Coos regions had a moderate abundance of pool habitat, deep pools, and slow water pools. The Umpqua River region had a low amount of pool habitat overall but of the pool habitat available there were moderate amounts of deep and slack water pools. The area of secondary channel habitat was moderate for all three regions. The amount of gravel in the streambed and structural complexity (LWD) was moderate. Shade levels were moderate to high throughout the three regions. The amount of fine sediment embedded within riffle habitat was moderate for both the Tenmile and Coos regions, while the Umpqua River region met the low reference value of the reference reach comparison. The number of large riparian conifers within the project area was low for all three regions with only a few individual reaches meeting the high level criteria (Tables 7, 8, and 9).

Although the means and medians of the habitat conditions indicate the majority of stream habitat is in fair to good condition it should be pointed out that there are individual reaches within the project area that rate exceedingly well in comparison to the reference habitat breakpoints. Tables 7 through 9 display highlighted reaches where at least 5 of the core attributes met or exceeded the high benchmark values for individual reaches. The use of these tables in conjunction with the high quality habitat identified from HabRate and HLFM modeling is a preliminary step for identifying restoration opportunities and priorities.

Relationship of fish populations to aquatic habitat

The surveys described components and processes that contribute to the structure and productivity of a stream and fish community. As mentioned earlier, the Aquatic Inventories Project selected core attributes to describe important indicators of sediment supply and quality, instream habitat complexity, and riparian forest community. These variables were summarized for reaches and sites on ODF lands within the Elliott project area in Table 10. We also used cumulative frequency distribution graphs to examine the survey data on ODF lands (Figures 3 through 10).

The response of salmonid fishes to the character of aquatic habitat varies by life stage and time of year. Adult fish seek deep pools for holding areas while preparing to spawn and need gravel and cobble substrate that is free of fine materials to build redds and deposit eggs. Furthermore, redds require a steady flow of oxygenated water to allow the eggs and alevins to mature. Increasing amounts of fine sediments increases the egg mortality in the gravel (Everest et al. 1987). The amount of silts and fines associated with riffles is an indicator of embeddedness in spawning areas. A high percentage of fine sediment can settle (embed) in the interstitial spaces of the gravel and armor it such that it is difficult for spawning fish to dig an adequate redd (nest), and prevent oxygenated water from reaching the eggs. High amounts of fine sediment lowers the survival of fish eggs to emergence. Fine sediment also reduces the production of aquatic invertebrates, thereby reducing the growth and survival of juvenile steelhead (Suttle et al., 2004), and likely other salmonids. Again, no lower threshold exists as to not have an effect on aquatic food webs. Maps 19 and 21 indicate where desirable conditions for spawning may exist. The average of each region, with the exception of the Umpqua, had fine sediment in excess of the reference values derived from the reference reaches. However, 42 reaches (72km) of the 117 (206km) identified in the project area had individual sediment values that met or were below the reference value. Based on the 75th percentile of reference streams, fine sediment values less than 8% are desirable (Table 3). Data analysis indicates that the average amount of gravel and cobble are at moderate levels within the study area. Twenty nine reaches (55km) had gravel levels that met or exceeded the high habitat reference value.

After emergence in the spring, salmonid fry typically remain in freshwater for a few weeks to two years before migrating to the ocean, depending on species. Edge cover and backwater habitats are particularly important to the survival of fry in the spring, but less so as they grow and move into larger pools during the summer. The distribution of juvenile salmonids is limited primarily by the availability of pool habitat, food resources, and acceptable water quality. In the winter, coho salmon parr prefer complex pool habitat which has low velocity refugia from high winter streamflows. This habitat is often found in the form of off-channel alcoves, dam pools, and beaver ponds (Nickelson 1992). Complex off-channel habitats are also important in these large stream reaches during the winter. Large wood is an important structural component contributing to the complexity of these preferred habitats (Sedell 1984). Juvenile coho salmon extend their distribution downstream in the winter to inhabitat areas previously limited by high water temperature, including tidally influenced wetlands. Juvenile steelhead and cutthroat trout are more opportunistic in regards to habitat type, residing in pools, riffles, rapids, and cascades. Additionally, pools provide resting places and over-wintering habitat for fish. Deep pools (greater than or equal to 1 meter deep), provide temperature refugia and provide year-round cover. Deep pool habitat within the Elliott project area averaged a moderate level in relation to the reference values derived from the reference reaches (greater than 3 pools 1+ meter deep per kilometer). The Coos region had the highest amount (Map 20) of deep pools (approximately 14km of the 20km which meet or exceeded the reference values). Slack water pools include backwater habitat, dammed pool, and beaver ponds. A high level is greater than 7% of total available habitat; six reaches (7.8 km) meet or exceed this reference value. Map 22 shows the general location of these pools at the individual unit scale. The majority of these reaches are located within the Coos region of the ODF Elliott project area. The higher gradient reaches are dominated by fast water habitat types.

Instream wood serves many functions in a stream channel. The wood helps to scour deep pools, provide cover and nutrients, trap sediment, and provide cover from predators. Wood acts as an obstacle at higher flows, forcing the stream to cut new channels, to scour new pools, and to create undercut banks. The amount of wood in the three regions varied with stream size and gradient. The Tenmile Lakes region of the project area had the highest percentage (50% of the surveyed streams) of stream habitat containing wood that met or exceeded the reference value (Tables 7, 8, and 9). The pools in the Elliott project area are relatively simple, with low to moderate amounts of large wood. Pool habitat was moderate to low in comparison to the reference reaches (a high level is greater than 45% of total habitat). Approximately 40km of the 206km surveyed had pool reference values that exceeded reference values. The amount of secondary channel indicates moderate connectivity to the floodplain. Secondary channels increase the potential habitat available to fishes, particularly to juveniles. Often the habitat has slower moving water than the primary channel. It provides over-wintering and summer rearing habitat for juvenile fish. Based on the 75th percentile of the reference reaches, a desirable amount of secondary channels is 5.3% or more of the total channel area. Thirty four kilometers met or exceeded these reference values (Map 22); the percentage for each region is similar (11% Coos, 8.7% Tenmile, 9.5% Umpqua).

Riparian vegetation is indirectly an important component of fish habitat. The riparian trees stabilize the bank, are a recruitment source of large woody debris, buffer against flood impacts, and provide shade. Stabilized stream banks are more likely to develop undercut banks, which serve as important cover for fish, and less likely to contribute fine sediments. The canopy cover (shade) in all reaches rated moderate in relation to the reference conditions. There were very few large conifers observed in the riparian zones of any of the reaches. This is a limiting factor for recruitment of large wood (greater than 60 cm dbh) into the channel and thus limitations for increasing pool and channel complexity. Reach 2 of Deer Creek and reach 5 of Mill Creek stood out with the highest amounts of large conifers greater than 20 inches in diameter (518 and 366 per 1000 feet of stream length respectively).

Winter habitat surveys have been conducted by the Aquatic Inventories Project in the Elliott State Forest since 1993 to identify and quantify habitats important during the overwinter life stage for juvenile coho salmon and other salmonids. The streams were usually surveyed throughout the months of January to March during high residual flows. The identification of off-channel habitats is accomplished most accurately during winter baseflow period. Approximately 188 kilometers of stream habitat associated with 105 identified reaches of various lengths was surveyed within the ODF Elliott project area. Of these, 162 km were within the range of coho salmon. Most of the surveys directly overlap the summer surveys within the range of coho salmon, a few do not. Approximately 68 percent of the total surveyed length is located in the Coos region, 16 percent in the Tenmile Lakes region, and 15 percent in the Umpqua River region. At this time, no reference values have been derived for winter habitat surveys so for this analysis we have used the summer habitat reference values to identify low, moderate, and high status of stream reaches as guidelines.

As mentioned earlier, coho salmon parr and other salmonid species prefer low velocity refugia from high stream flows in the winter. Refugia habitat is primarily complex pool habitat with large wood, and off-channel habitats such as alcoves and backwaters. Slow water pool habitat types (beaver ponds, dam pools, alcoves, and backwaters), other pool habitats, and large wood debris have a major influence on the survival of juvenile coho salmon during the critical over-winter period. Reaches (represent average values for a length of stream) within the ODF Elliott project area that meet desirable values of these attributes are indicated on Map 23. High amounts of pool habitat are present in the Umpqua region, and some reaches in the Tenmile and Coos regions. Most importantly, the highest amounts of slack water pool habitat occur predominantly in tributaries to the upper West Fork Millicoma (Coos region) and Big Creek (Tenmile Lakes). Likewise, the reaches with moderate and high amounts of large wood debris are evident in selected reaches in the Tenmile Lakes and Umpqua regions. An analysis of the habitat unit information provides a more comprehensive picture of conditions in the watershed. While few reaches have a high average of slackwater pools or large wood, many short sections of stream or individual habitat units have secondary channel features, slackwater or complex, deep pools (Map 24). Secondary channel habitat has the potential to improve juvenile coho salmon survival rates as it may provides off channel refuge from high winter flows. Map 24 indicates where this attribute meets desirable values. Secondary channel habitat and complex pool habitat is observed in all three regions of the ODF Elliott project area, however, it is lacking in larger streams (West Fork Millicoma River). These maps, along with the estimates for carrying capacity (Table 12), could be used to identify reaches lacking in the winter attributes mentioned above and thus provide a first cut of where restoration activities should be directed and prioritized. It is apparent that stream features advantageous to overwinter survival of coho and other salmonid species is present in forest streams. However, on average, the values are low in most streams.

Habitat quality for Coho salmon

The Habitat Limiting Factors Model (HLFM) and HabRate model integrates individual habitat attributes to provide an overall assessment of conditions for adult and juvenile Coho salmon. The HLFM determines the quality and carrying capacity of habitat for juvenile Coho salmon during summer and winter, and HabRate estimates the quality of habitat for adult and juvenile Coho salmon at every life stage. Each model provides an accurate, but different perspective on habitat in the Elliott State Forest (Tables 12 and 13). The HLFM focuses on the availability and type of pool habitat, particularly the amount of beaver pond and alcove habitat during the winter. HabRate considers the complexity of habitat, incorporating a combination of structural components such as large wood and big substrate, as well as gradient, secondary channels and pool habitat. Carrying capacity indicates how many fish can be supported within a reach of stream, and the quality indicates the density independent survival (productivity) of fish at a given life stage (emergence, summer parr, winter parr to smolt).

The capacity of stream habitat to support juvenile coho in the summer is moderate to high in the Coos and Tenmile Lakes regions and low to high in the Umpqua Region (Table 12 and Map 13). Habitat quality is uniformly high during the summer as well in streams in the Elliott State Forest (Table 12 and Map 15). The HLFM indicates that pool habitat is adequate to support a moderate to high density of coho salmon parr during the summer. However, the HabRate model which considers complexity of pool habitat rated the quality of summer habitat in the Coos region as moderate with a few reaches as high and a few as low (Table 13). The two reaches rated in Johnson Creek were rated as low and moderate, and the streams in the Umpqua region generally had a low rating.

The capacity and quality of winter habitat, as rated by HLFM (Table 12 and Maps 14 and 16) in streams of the Elliott State Forest are low in all three regions. Joes Creek (Coos Region) stands out as an exception with rating of high for both quality and capacity. HabRate, which considers structural complexity in its ranking, highlights a few more streams in tributaries to the upper Millicoma drainage and Palouse Creek as moderate and high quality reaches (Table 13).

The quality ranking of habitat for spawning adults and emerging alevins integrates gradient, availability of pools for adults to rest, the amount of gravel and cobble, and the amount of fine sediment embedded in the riffles. The quality of habitat for spawning and emergence is high in tributaries and mainstem of the upper West Fork Millicoma habitat. Sufficient areas of good spawning habitat are present in streams in all three regions, however.

Streams flowing from the Elliott State Forest into the lower Umpqua have ample spawning habitat and quality for emergence of alevins, moderate capacity for summer rearing of juveniles, and poor capacity for winter rearing. Juvenile coho salmon would have to take advantage of rearing capacity in the lower portions of streams and mainstem Umpqua River off forest lands during the winter. The Tenmile Lakes region has ample spawning habitat, high capacity and quality habitat for juvenile coho salmon during the summer, but very limited stream habitat during the winter. The juvenile coho salmon must use lower stream reaches off the forest and the lakes for rearing during the winter. The Coos region has high quality spawning habitat in the upper West Fork Millicoma drainage, high capacity and quality for juvenile coho salmon during the summer and areas of high structural complexity but low capacity in the upper West Fork Millicoma for juvenile coho salmon during the winter. This suggests that the juvenile coho salmon that remain in the upper West Fork Millicoma River may survive at a high rate, but that the capacity of habitat to support large numbers of juvenile coho salmon is low. Fish in the Millicoma system must use lower reaches of the Millicoma drainage and upper estuary habitat for fall and winter rearing. The limiting factor for coho salmon in the Umpqua and Coos regions of the Elliott State Forest is the quantity and quality of winter rearing habitat. Winter rearing habitat is probably not limited by stream habitat in the Tenmile Lakes region because of the availability of the lake environment.

The coho populations in the Elliott State forest in the Umpqua, Coos, and Tenmile Lakes regions use stream, lake, and estuarine habitat on the forest and in adjacent areas. The connectivity and use of the array of habitats is important for the productivity of these populations. As a result, the populations and stream habitat on the Elliott State Forest should be viewed in the larger context of the areas from estuary to headwater, on and off the forest proper. The quality of habitat and stream processes on the forest influence the survival of fish at each life stage.

Barriers

Barriers and potential barriers to anadromous and resident fish exist in most riverine systems due either to human-caused or natural processes. A barrier, which includes culverts, dams, velocity barriers, natural falls, lack of sufficient water flow, etc., is defined as an impediment to the movement of any fish at any life stage. The Umpqua, Coos, and Tenmile regions have 16 recorded barriers, as determined by Streamnet (Map 25 and Table 14). These barriers are found both within and outside known fish distribution. Fish distribution may extend beyond a partial barrier because the barrier may be specific to a species or life stage, or at a particular time of year.

The Streamnet barrier database incorporated the culvert inventory database; therefore, culverts in the dataset are those which do not meet acceptable fish passage criteria, not necessarily those which prevent all fish at all times. Of the 16 listed barriers, three are culverts. These barriers are rated as to the degree, or lack thereof, of fish passage. One is thought to have complete blockage, one is thought to be partial blocking, and one has unknown passage. Movement may be prevented due to high velocity of water through the culvert, incorrectly sized culvert, culvert deterioration, or debris blocking the culvert. Data are not available to assess fish presence above all of the potential barriers.

Anadromous fish distribution ends at or below some of the listed barriers (Map 26). However, many barriers, such as those on the West Fork Millicoma River and on Elk Creek (Coos region) allow passage for some species, such as Coho and winter steelhead. All but three barriers allow some passage, although distribution is unknown above four barriers. Two streams with impassable culverts (Record ID 2381 and 2383) have no mapped fish distribution. Resident cutthroat trout, lamprey, and sculpin may be present above the natural and human-caused barriers.

Additionally, aquatic habitat survey crews documented many potential barriers to migratory fish (Map 27). They identified high gradient cascades with slopes up to 25% and steps ranging from 1.7 – 3.8 meters high. In some cases, anadromous and resident salmonid fishes were found above these potential barriers. The few barriers that did not allow for anadromous fish passage were typically located in the headwaters.

Documentation as to the species and life stage affected by each barrier is limited (Table 14). Field surveys are recommended to improve documentation, although passage does not appear to be a major issue.

Restoration

Restoration is a technique and process used in an attempt to improve stream habitat in the short term and to achieve long-term recovery goals. The goals of restoration range from improving spawning and rearing habitat, to improving natural stream processes. Treatment projects focus on improving summer and winter rearing for juvenile salmonids, improving spawning habitat, increasing nutrients in the stream, reducing sedimentation and bank erosion, and replanting native streamside vegetation. Instream habitat improvement projects to improve rearing conditions for juvenile salmon target increasing complexity of pools (large wood additions) and creating off-channel and slow water pool habitat. Monitoring is a critical aspect of the restoration effort, as it is important to gauge whether the methods employed helped to achieve the desired effects. Achieving noticeable response may take several high flow events; biological response could take longer.

Since 1996, sixty-one instream projects have been completed on ODF lands (Table 15 and Map 28) in the Coos, Umpqua River, and Tenmile Lakes regions. The projects focused on instream enhancement, passage issues, riparian conditions, and road/drainage improvements in these basins. Thirty projects placed large wood and/or boulders in the streams, five completed riparian planting or improvements, one constructed off-channel ponds, one reconnected a historic stream oxbow, eight improved the road and drainage system, and sixteen improved fish passage.

Of these, four sites (Charlotte Creek, Miller Creek – Umpqua region, Knife Creek, WF Millicoma River – Coos region) were monitored by ODFW. In each case, large wood structure was added to the stream to improve stream structure and complexity, to allow the stream to better interact with the floodplain, and to improve overall stream habitat. Since these are fairly recent sites and winter flows have been relatively benign, substantial changes in pool area or gravel recruitment have not been observed.

In the mid-1990's, stream restoration guides were created by Oregon Department of Fish and Wildlife for all of the coastal basins, including the Umpqua River and the Tenmile, Coos and Coquille systems. Candidate streams were selected based on numerous criteria, through both in-house techniques and field verifications (Nicholas et al 1996, Talabere et al 1997). Overall, stream areas suitable for Coho salmon habitat enhancement are those areas flowing through an unconstrained valley, gradient <5%, moderate size - channel width 4-12 meters, and either have or are adjacent to a known Coho population area. These guides can be a useful reference when selecting potential restoration sites, although in all cases, field verification of sites will be necessary.

Areas within and outside of the Elliott Forest are known to have a high intrinsic potential (Map 17) – the potential to respond favorably to restoration treatments and improve winter rearing habitat for Coho salmon. Most streams in the Tenmile Lakes basin, along with Palouse and Larson Creek in the Coos system, and Schofield and Dean Creeks in the Umpqua show a great deal of potential well into their upper reaches. The West Fork Millicoma system is also an excellent candidate, with most restoration potential in select segments in the upper reaches of the main stem and several tributaries. It is worth noting that intrinsic potential is based on several stream characteristics – gradient, active channel width, and valley width. Since the main channel of the West Fork Millicoma and sections of major tributaries such as Elk Creek have either a fairly wide channel or a narrow valley, many of these segments were excluded from having high restoration potential. However, using the technique of pulling in entire large conifers, with the rootwads attached directly into the stream channel, many of these segments that have been excluded would make excellent restoration candidates. In these relatively wide river/narrow valley segments with low gradients, creating pools or edge habitat could enhance over-wintering survival of coho salmon.

Summary of fish populations and aquatic habitat conditions in the Elliott study area

Fish distribution

What fish species are documented in the watershed?

- Anadromous species in the Elliott study area include coho salmon, fall Chinook salmon, chum salmon, winter steelhead, cutthroat trout, and Pacific lamprey. Also documented are resident cutthroat trout, green and white sturgeon, and Millicoma Longnose Dace. Other documented species in the watershed include introduced striped bass and shad. The occurrence and distribution of other native fishes is not well-documented.

Are any of these species currently state- or federally listed as endangered, threatened, or candidates?

- Coho salmon is listed as threatened, while winter steelhead are considered a species of concern in the coastal Oregon basins including those in the Elliott State Forest (see NOAA Fisheries web site for current status - http://www.nwr.noaa.gov/). Millicoma Longnose Dace (*Rinichthys cataractae)* is listed as a "peripheral or naturally rare" on the state sensitive species list.

Are there any fish species that historically occurred in the watershed that no longer occur there? Map potential historical fish distribution.

- No species have been extirpated from the Elliott State Forest study area.
- We believe current distribution is similar to historical distribution. However, the abundance and distribution of chum salmon is more restricted than historically.

Which salmonid species are native to the watershed, and which have been introduced?

- All of the aforementioned salmonid species are native to the watershed.

Are there potential interactions between native and introduced species?

- Potential interactions include competition for food and habitat resources and predation.

Current habitat conditions

Show current condition of key habitat characteristics.

- Habitat conditions for all key habitat attributes within the Elliott project area are within the moderate to high categories, with the exception of bedrock substrate, large wood debris volume, and conifers in the riparian zone.
- Tenmile Lakes and Coos regions had a moderate abundance of pool habitat, deep pools, and slow water pools. Umpqua River region had a low amount of pool habitat overall but of the pool habitat available there were moderate amounts of deep and slack water pools.
- The area of secondary channel habitat was moderate for all three regions.
- The amount of gravel in the streambed and structural complexity (large wood debris - LWD) was moderate.
- Shade levels were moderate to high throughout the three regions.

- The amount of fine sediment embedded within riffle habitat was moderate for both the Tenmile and Coos regions, while the Umpqua River region met the low reference value of the reference reach comparison.
- The number of large riparian conifers within the project area was low for all three regions with only a few individual reaches meeting the high level criteria.

Compare to benchmarks and/or reference streams for each characteristic.

- Reference sites provide a general context and range of stream attributes of minimally human-influenced sites, and are intended to provide a point of comparison to view the relative differences between streams and reaches within a drainage network. Reference values are not meant to be prescriptive, that is, to indicate the value each reach of stream must attain.
- Although the mean and median of the habitat conditions indicate the majority of stream habitat is in fair to good condition, it should be pointed out that there are individual reaches within the project area that rate exceedingly well in comparison to the reference habitat reference values. Tables 7 through 9 have highlighted reaches which have individually met or exceeded 5 or more of the reference values of the core attributes. These tables illustrate that there are reaches within the project area that have exceedingly good habitat conditions even though the means and medians for the entire project area indicate otherwise.

What stream reaches have high, moderate, and low levels of key pieces of large wood (>24-in) in the channel.

- Tables 4 - 9 list individual reaches in the Coos, Tenmile, and Umpqua regions within the Elliott project area rated as having a high number of keypieces and thus met or exceeded breakpoints for LWD volume and number of pieces.

What is the condition of the fish habitat in the watershed (by region) according to existing habitat data?

- Summer rearing for juvenile coho salmon is ample, although the structural complexity is low in the Umpqua region.
- Winter capacity is low in all three regions. Habitat quality is low throughout in terms of beaver ponds and off-channel habitat. However the structural complexity is high in the mainstem upper West Fork Millicoma and tributaries.
- Spawning habitat is available in most streams on the forest. A number of reaches in the upper Millicoma drainage had high quality spawning habitat.
- High quality spawning habitat and summer rearing opportunities are present in streams on Elliott State Forest. Winter rearing opportunities are limited, and depend on areas downstream of the forest boundary. Connectivity of stream habitat process and fish populations on and off the forest is important for the productivity of coho populations, and likely other salmonid species in all three regions of the forest.

How many miles of fish-bearing or potentially fish-bearing streams are blocked by culverts, and where are these blockages?

- Sixteen fish barriers were identified on ODF lands. Three of these are culverts which may warrant closer inspection. One of the culverts is noted as impassable, one is noted as partial blocking, and the status of the remaining one is unknown. The other potential barriers are natural waterfalls. It is possible that other barriers that have not been noted here do exist.

- The amount of aquatic habitat with restricted access due to culverts in the Umpqua, Coos and Tenmile regions based on Streamnet barrier data is estimated to be 5.0 kilometers. Footlog Creek (Umpqua region) has a high velocity culvert that may restrict passage at some life stages. Roberts Creek Tributary (Tenmile region) has a high velocity culvert that may block fish passage, although fish use is not mapped for this stream. Alder Creek Tributary (Tenmile region) also has a culvert that may block fish passage, but fish use has not been mapped for this stream. Documentation as to the species and life stage affected by each barrier is limited. Field surveys to improve documentation is recommended, although passage does not appear to be a major issue.

Are there watersheds where the current level of instream wood is a limiting factor for achieving properly functioning aquatic systems?

- Only a few reaches were surveyed where instream wood (combination of total pieces, volume, and key pieces) are comparable to reference conditions. Reaches 1 and 2 of Palouse Creek Trib, reach 1 of Noble Creek, and reach 3 of Johanneson Creek. Additional large wood would increase the opportunity for complex instream habitat, creation of off-channel habitat, and sediment sorting.

Analyze restoration potential

Which reaches have the most potential to increase fish populations?

- Site selection will require an in-depth analysis of the unit level GIS and Oregon Plan site data coupled with field verification. Habitat complexity and floodplain connectivity requires the placement of large wood in selected stream segment to create complex pool and bank overflow opportunities. Taking advantage of the existing secondary channels will accelerate the process.
- Reduction of fine sediment will require a detailed hydrologic study to determine source, transport, and storage of sediment in the basin. The data available through the stream surveys only identify areas collecting excessive amounts of fine sediment.
- Site verification prior to restoration planning is necessary because some of the surveys are 10 years old, and proper implementation depends on site-specific factors.
- Some segments of the West Fork Millicoma and its tributaries (Coos region) are relatively bedrock-rich, possibly from historic management practices. Using the proper restoration techniques, these areas may have a high potential for trapping cobble and spawning gravels.

Which reaches have the most potential to meet or exceed benchmark levels?

- All of the reaches have the potential to meet many of the benchmark conditions over time. Restoration and protection strategies can expedite the opportunity to improve aquatic habitat complexity, sediment, and riparian structure in the Coos, Tenmile and Umpqua regions.

What is the magnitude of possible additional habitat with restoration of access?

- As much as 5.0 kilometers (3.1 miles) on ODF land may be made accessible or better accessible with the removal of artificial barriers.

What is the relative priority of barriers for removal, replacement, or repair?

- The ODF and Streamnet barrier databases do not provide a lot of detail. Footlog Creek (Umpqua region) has a partial barrier to fish passage. Removal or replacement of this culvert could improve access to as much as 5.0 kilometers (3.1 miles) of stream. Site checks are necessary to verify the nature and extent of the passage issues.

Describe the types and locations of potential enhancement projects?

- Based on the intrinsic potential information (valley width, stream gradient, active channel width), many of the streams on ODF land are good candidates for enhancement activities. With the exception of the smallest tributaries and the headwaters areas, most streams are low gradient, in moderate to wide channels and valleys. Many streams would benefit from the addition of large woody debris, which would entrap substrate, scour deep pools, and provide cover for fish. Examples include the Millicoma system and its tributaries (Coos region) and several of the Tenmile Lake tributaries.
- Enhancement activities can be more effective when a watershed approach is utilized. For example, rather than constructing one or two habitat structures in each of ten widely scattered locations, constructing these same structures in one watershed can enhance a longer continuous section of stream. With riparian plantings and the removal of a passage barrier, a whole stream could be improved.
- Priorities related to fish habitat are discussed above – improving habitat complexity, floodplain connectivity, collection of spawning gravels, and reduction of fine sediment.
- Riparian plantings to increase the number, size, and species of conifer trees in the riparian zone would benefit floodplain stability, and increase shade levels and long-term large wood recruitment. Riparian enhancement for larger and a greater mix of conifer species will again require site visits to identify appropriate floodplain and terrace sites within the stream corridors.
- The riparian surveys are a sample (not a census) of conditions along the various streams, and hence only indicate the need for restoration.

Describe confidence level in restoration analysis.

- The aquatic surveys, between 1992 and 2003, described the overall conditions within each reach at the time of the survey. Restoration recommendations were based on existing habitat surveys (although selected attributes of the habitat data may out of date for this use), channel and valley configuration, general knowledge of local ODFW staff, and digital elevation models. Because successful restoration depends on site-specific characteristics, we recommend: 1) site visits prior to final planning, 2) analysis of habitat data (available in GIS and database) at the habitat unit scale, 3) re-examination of gradient and valley form, 4) more comprehensive road and barrier information, and 5) more detailed description of riparian conditions.

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Tables, Figures, and Maps

Table 1. ODF Elliott State Forest study area by HU and ODF management designations.

Basin	6th field HU	ODFW surveyed streams	ODF 6th Field Management Basin
Umpqua River Region			
	171003030501	none	none
	171003030502	none	Basin 15
		none	Basin 16
	171003030503	Mill Creek	Basin 15
		Footlog Creek	Basin 15
	171003030504	none	Basin 15
	171003030801	Johanneson Creek	Basin 03
		Dean Creek	Basin 03
		Charlotte Creek	Basin 02
		Luder Creek	Basin 02
	171003030802	Miller Creek	Basin 04
		Scholfield Creek	Basin 04
Tenmile Lakes Region			
	171003040301	Benson Creek	Basin 06
		Roberts Creek	
		Johnson Creek and tribs	Basin 07
	171003040302	none	Lighthouse
		none	Basin07
	171003040303	Murphy Creek	Basin 05
		Big Creek	
		Alder Fork Big Creek	
		Noble Creek	
Coos Region			
	171003040201	none	none
	171003040202	Marlow Creek	Basin 10
		none	Basin 11
		none	Basin 16
	171003040203	Schumacher Creek	Basin 09
		West Fork Millicoma River	
		Beaver Creek	Basin 12
		Buck Creek	
		Deer Creek	
		Joes Creek	
		Knife Creek	
		Otter Creek	
		Trout Creek	
		West Fork Millicoma River	
		Crane Creek	Basin 14
		Cougar Creek	
		Elk Creek	
		Fish Creek	
		Hidden Valley Creek	
		Kelly Creek	
		Panther Creek	
		West Fork Millicoma River	
	171003040404	none	none
	171003040405	none	Basin 08
	171003040406	Larson Creek	Basin 08
		Palouse Creek and tribs	
		Sullivan Creek	

Table 2. Salmon Habitat and Diversity Watersheds: Species abundance within Elliott study area

Coho, Fall Chinook, and Chum: based on 1989 – 2000 spawning survey data.
Steelhead: based on professional judgment of ODFW biologists and steelhead status review (Chilcote 1997).
Colors and percentiles on map match percentiles listed below.
Study Area refers to ODF Elliott Habitat Assessment project area.

HU	Sub-watershed Name	Coho	Fall Chinook	Chum	Steelhead	Within Project Area
171003030502	Lower Lake Creek					X
171003030503	Mill Creek / Loon Lake					X
171003030801	Dean / Luder Creeks					X
171003030802	Scholfield Creek	>90				X
171003040301	Johnson Creek	>75				X
171003040302	Tenmile Lake					
171003040303	Big / Benson Creeks	>90				X
171003040202	Marlow / Glenn Creeks	>50	>75	>90	>50	X
171003040203	West Fork Millicoma River	>90	>90		>90	X
171003040405	Kentuck Creek / Coos River	>75	>50			X
171003040406	Palouse / Larson Creek	>90	>50		>75	X

Table 3. Habitat benchmarks based on reference streams within the distribution of coho salmon.

Parameter	Definition	Low break point	High break point
percent pools	percent primary channel area represented by pool habitat	<19%	>45%
deep pools/km	pools > 1m deep per kilometer of primary channel	=0	4
percent slackwater pools	percent primary channel area - slackwater pool habitat (beaver pond, backwater, alcoves, isolated pools).	=0%	>7%
percent seccondary channels	percent total channel area represented by secondary channels	<0.8%	>5.3%
pieces lwd/100m	# pieces of wood > 0.15m diameter X 3m length per 100 meters primary stream length	<8	>21
volume lwd/100m	volume (m3) of wood > 0.15m diameter X 3m length per 100 meters primary stream length	<17	>58
key pieces lwd/100m	# pieces of wood > 60 cm diameter X > 12 meters long per 100 meters primary stream length	<0.5	>3
percent fines in riffles	visual estimate of substrate composed of <2mm diameter particles	>22%	<8%
percent gravel in riffles	visual estimate of substrate composed of 2-64mm diameter particles	<26%	>54%
percent bedrock in stream	visual estimate of substrate composed of solid bedrock	>11%	<1%
# conifers > 50 cm dbh	number of conifer trees larger than 50 cm dbh within 30m both sides of stream per 305m of primary stream length	<22	>153
# conifers > 90 cm dbh	number of conifer trees larger than 90 cm dbh within 30m both sides of stream per 305m of primary stream length	=0	>79
percent shade	percent of 180 degree sky; includes topographic and tree shade	<76%	>91%

Table 4A. Summary of stream reaches surveyed within the Coos region of the ODF Elliott project area.

ODF ELLIOTT PROJECT AREA: COOS REGION
REACH SUMMARY

STREAM	SURVEY DATE	REACH #	REACH LENGTH (m)	% AREA IN SIDE CHANNELS	GRADIENT	VWI	*VALLEY FORM	*CHANNEL FORM	*LAND USE DOM	*LAND USE SUB-DOM	SHADE %	BEDROCK %	FINES IN RIFFLES %	GRAVEL IN RIFFLES %	LARGE BOULDERS #/100m
BEAVER CREEK	8/20/2001	1	1511	2.6	6.4	1.6	MV	CH	MT	ST	90	1	21	45	57
BEAVER CREEK	8/22/2001	2	954	4.4	5.6	3.5	CT	CT	MT	ST	68	1	23	48	52
BEAVER CREEK	8/22/2001	3	1000	2.9	8.9	6	CT	CT	YT		84	0	38	37	40
BUCK CREEK	9/6/1999	1	1028	10.2	5.9	2.2	SV	CH	LT	MT	93	30	30	70	6
COUGAR CREEK	9/20/1994	1	4043	1.8	3.4	1.3	SV	CH	LT	ST	94	46.4	6	51	6
CRANE CREEK	8/10/1994	1	1698	5.3	4.2	1.2	SV	CH	OG	TH	92	39.4	11	61	26
DEER CREEK	9/21/1993	1	3358	0.9	1	1.1	MV	CH	ST		73	6.4	11	39	29
DEER CREEK	9/23/1993	2	1728	3.5	1.8	1.8	MV	CH	ST		79	6.2	13	61	9
DEER CREEK	9/30/1993	3	601	0.0	6.8	1.5	MV	CH	ST		80	0			15
DEER CREEK TRIBUTARY	9/30/1993	1	530	0.0	6.6	1.5	MV	CH	ST		84	0			0
ELK CREEK	9/2/1999	1	987	3.1	2.3	3.1	MV	CH	ST	LT	97	0	0	0	55
ELK CREEK	7/25/1994	1	2791	0.2	1.5	1.5	MV	CH	LT	TH	86	0.8	6	37	18
ELK CREEK	8/1/1994	2	1714	0.2	1.7	1.6	MV	CH	LT	TH	88	1.7	5	32	17
ELK CREEK	8/2/1994	3	2181	0.7	0.6	1.6	MV	CH	LT	TH	86	15.9	5	82	14
ELK CREEK	8/3/1994	4	8712	0.7	1.5	1.3	SV	CH	LT	TH	87	33.5	6	66	3
FISH CREEK	9/14/1994	1	4512	9.8	3.7	1.2	SV	CH	ST	MT	94	34.5	7	57	25
HIDDEN VALLEY CREEK	8/10/1994	1	1955	0.0	6.9	1.3	SV	CH	OG	TH	90	28.7	5	77	23
JOES CREEK	8/26/2002	1	577	2.3	1.2	3.6	CT	CA	LT	ST	79	14	5	45	12
JOES CREEK	8/27/2002	2	535	5.3	4.9	1.7	MV	CH	YT	FF	67	13	9	48	61
JOES CREEK	8/27/2002	3	504	1.2	2.1	1.3	MV	CH	ST	LT	87	23	10	51	33
JOES CREEK	8/28/2002	4	485	0.4	3	1	MV	CH	ST		68	23	32	63	0
JOES CREEK	9/3/2002	5	782	2.8	8.1	1.3	MV	CH	ST	YT	80	12	24	67	20
KELLY CREEK	9/19/1994	1	2166	0.4	6.4	1.1	SV	CH	TH	ST	88	67.9	5	60	16
KNIFE CREEK	9/6/1994	1	5083	2.5	3.5	1.1	SV	CH	LT	TH	88	34	5	55	12
LARSON CREEK	8/29/2001	1	1172	2.7	2.8	3.2	MT	CA	ST	LT	91	1	23	39	40
LARSON CREEK	8/30/2001	2	2256	5.6	8.7	1.3	MV	CH	TH	LT	88	0	19	51	31
MARLOW CREEK	8/1/2001	1	2434	3.9	2.3	2.6	CT	CT	YT	ST	84	0	16	39	75
MARLOW CREEK	8/6/2001	2	956	1.6	1.1	2.6	MV	CH	ST	LT	90	1	13	44	48
MARLOW CREEK	8/7/2001	3	2086	8.8	2.9	2.7	MV	CH	ST	LT	92	1	23	43	43
MARLOW CREEK	8/13/2001	5	487	2.0	10.9	1.4	SV	CH	TH	YT	75	5	28	40	38
OTTER CREEK	9/4/2002	1	809	2.2	2.8	1.6	MV	CH	LT	MT	87	9	12	26	21
OTTER CREEK	9/5/2002	2	409	5.9	3.7	4.3	CT	CT	YT	PT	79	17	22	39	6
OTTER CREEK	9/9/2002	3	408	18.3	5.3	4.3	CT	CA	ST	YT	87	14	13	44	17
OTTER CREEK	9/9/2002	4	311	11.1	9.3	1.5	MV	CH	MT		86	4			8
PALOUSE CREEK	8/16/1994	3	3487	0.2	0.5	6.5	CT	CA	HG	TH	62	54.7	14	46	5
PALOUSE CREEK	8/17/1994	4	1456	19.9	0.5	3.9	CT	CA	HG	TH	66	38.7	6	66	2

* see methods for abbreviations

Table 4A. Summary of stream reaches surveyed within the Coos region of the ODF Elliott project area.

ODF ELLIOTT PROJECT AREA: COOS REGION
REACH SUMMARY

STREAM	SURVEY DATE	REACH #	REACH LENGTH (m)	% AREA IN SIDE CHANNELS	GRADIENT	VWI	*VALLEY FORM	*CHANNEL FORM	*LAND USE DOM	*LAND USE SUB-DOM	SHADE %	BEDROCK %	FINES IN RIFFLES %	GRAVEL IN RIFFLES %	LARGE BOULDERS #/100m
PALOUSE CREEK	8/17/1994	5	969	0.3	1.7	1.4	SV	CH	LT	TH	84	10.7	5	55	13
PALOUSE CREEK	8/17/1994	6	4226	4.4	2.4	1.2	SV	CH	LT	TH	92	24.3	5	53	11
PALOUSE CREEK TRIB A	8/31/1994	1	580	33.6	6.2	5	WF	US	LG	LT	86	65.3	5	86	6
PALOUSE CREEK TRIB A	8/31/1994	2	1051	0.0	11.6	1.1	SV	CH	LT	TH	94	46.4	18	53	9
PALOUSE CREEK TRIB F	8/25/1994	1	1958	3.3	6.6	1.3	SV	CH	TH	LT	93	32.2	5	36	24
PANTHER CREEK	9/10/2002	1	1362	4.8	1.8	2.6	CT	CA	YT	LT	69	6	5	55	68
PANTHER CREEK	9/11/2002	2	2374	3.7	3.9	2.9	CT	CA	LT	YT	73	15	5	53	49
SCHUMACHER CREEK	8/30/2001	1	1000	3.0	12.2	5.8	MV	CH	MT	YT	86	0	23	65	40
SCHUMACHER CREEK (MS-5037)	9/3/2002	1	509	1.7	12.1	1.2	MV	CH	ST	NU	88	0	21	26	
SULLIVAN CREEK	8/19/2002	2	697	3.0	3.7	1.6	MV	CH	MT		86	12	42	31	9
SULLIVAN CREEK	8/20/2002	3	836	10.7	3.5	3.5	MT	CA	MT	YT	79	18	25	36	15
TROUT CREEK	8/28/2001	1	538	0.8	6.2	3.1	CT	CT	ST	MT	94	0	25	45	45
TROUT CREEK	8/15/2001	2	1777	1.7	3.5	3.9	MV	CH	ST	LT	93	1	14	47	37
TROUT CREEK	8/19/2001	3	1092	13.7	18.1	1.3	SV	CH	ST	YT	79	1	14	40	26
WEST FORK MILLICOMA RIVER	10/8/1998	1	1223	0.1	0.8	1.2	SV	CH	ST	MT	73	1	7	11	46
WEST FORK MILLICOMA RIVER	7/20/1993	1	7709	0.9	0.8	3.9	CT	CA	ST	YT	64	0	11	13	13
WEST FORK MILLICOMA RIVER	7/21/1993	2	8476	1.1	1.1	1.9	MV	CH	MT		73	0	8	12	14
WEST FORK MILLICOMA RIVER	8/5/1993	3	12839	1.8	0.7	2.1	MV	CH	MT	LT	72	0.4	9	24	15
WEST FORK MILLICOMA RIVER	8/16/1993	4	4339	1.9	1	2.2	MV	CH	MT		89	2.1	9	33	26
WEST FORK MILLICOMA RIVER	8/17/1993	5	3553	1.3	2.7	1.8	MV	CH	MT	YT	92	6.1	14	46	20

* see methods for abbreviations

Table 4B. Summary of stream reaches surveyed within the Coos region of the ODF Elliott project area.

ODF ELLIOTT PROJECT AREA: COOS REGION
REACH SUMMARY

STREAM	REACH LENGTH (m)	ACTIVE CHANNEL WIDTH (m)	CHANNEL WIDTHS/ POOL	PERCENT POOLS	PERCENT SLACKWATER POOLS	POOLS >1m DEEP/km	RESIDUAL POOL DEPTH (m)	WOOD DEBRIS PIECES #/100m	WOOD DEBRIS VOLUME (m3)/100m	KEY PIECES #/100m	CONIFER TREES TOTAL/1000ft	RIPARIAN CONIFERS #>20in dbh /1000ft	RIPARIAN CONIFERS #>35in dbh /1000ft
BEAVER CREEK	829	5.7	7	27	1	1.8	0.54	23	14	0.2	146	12	12
BEAVER CREEK	1602	3.3	16.1	16	5	0	0.45	28	28	0.6	122	0	0
BEAVER CREEK	372	2.3	18.2	19	0	0	0.31	23	14	0.1	305	61	0
BUCK CREEK	1091	2.6	34.8	10	1	0	0.31	25	27	0.7	142	122	81
COUGAR CREEK	2497	5.6	20.2	29		0	0.4	19	39	1.6	173	61	30
CRANE CREEK	1226	4.2	33.5	38		0.5	0.3	16	58	3.9	122	30	0
DEER CREEK	2086	10.6	6.6	42			0.6	17	16		533	168	61
DEER CREEK	826	8.1	6.7	31			0.5	29	30		1219	518	122
DEER CREEK	1539	4	150.3	1			0.3	19	13			0	0
DEER CREEK TRIBUTARY	1315	4	66.3	5			0.3	32	27			0	0
ELK CREEK	461	11.1	3.8	63	13	4.5	0.71	7	3	0	325	20	0
ELK CREEK	434	11.4	5	58		4.3	0.6	6	11	0.4	305	91	30
ELK CREEK	2819	11	7.1	46		1.7	0.6	8	12	0.5	0	0	0
ELK CREEK	2196	9.2	6.9	63		1.8	0.5	9	13	0.9	213	91	91
ELK CREEK	1161	8.5	6.9	78		3.9	0.6	12	33	1.6	146	73	61
FISH CREEK	3460	4.8	29.8	18		0.2	0.4	21	34	1.3	113	12	6
HIDDEN VALLEY CREEK	514	4.1	29.7	30		0	0.4	13	52	4.3	122	122	61
JOES CREEK	1490	3.5	7.6	44	1	0	0.33	6	3	0	122	30	30
JOES CREEK	705	5	11.1	15	0	0	0.32	13	9	0	122	0	0
JOES CREEK	1306	2.9	36.6	8	0	0	0.26	12	9	0	122	0	0
JOES CREEK	472	3.5	49.7	96	82	1	0.62	3	2	0	0	0	0
JOES CREEK	1187	2		0	0			16	14	0.1	0	0	0
KELLY CREEK	1549	3.7	119.5	4		0	0.3	19	44	3	91	91	61
KNIFE CREEK	872	7.9	31.2	29		0.4	0.5	17	31	1.1	219	61	37
LARSON CREEK	954	5.6	12.5	26	0	0.8	0.55	20	13	0.4	30	0	0
LARSON CREEK	1476	3.9	19.3	16	0	0.8	0.48	26	17	0.3	37	0	0
MARLOW CREEK	2031	8.7	6.2	39	1	1.5	0.53	27	16	0.3	81	10	0
MARLOW CREEK	2199	6.7	7.2	42	1	1	0.42	55	32	0.5	142	20	0
MARLOW CREEK	257	6.1	7.2	42	0	1.2	0.41	43	34	0.5	134	0	0
MARLOW CREEK	972	1.8	47.4	13	0	0	0.28	33	10	0.2	366	0	0
OTTER CREEK	809	4.5	16	12	0	0	0.23	7	13	0.9	91	30	30
OTTER CREEK	409	2.8	26.9	12	0	0	0.36	31	31	1.7	0	0	0
OTTER CREEK	408	1.9	63.7	7	0	0	0.33	8	9	0.2	183	0	0
OTTER CREEK	311	1.4	0	0	0	0	0	3	3	0	61	61	0
PALOUSE CREEK	3487	6.3	27.9	47		2.3	0.8	3	5	0.4	0	0	0

Table 4B. Summary of stream reaches surveyed within the Coos region of the ODF Elliott project area.

ODF ELLIOTT PROJECT AREA: COOS REGION
REACH SUMMARY

STREAM	REACH LENGTH (m)	ACTIVE CHANNEL WIDTH (m)	CHANNEL WIDTHS/ POOL	PERCENT POOLS	PERCENT SLACKWATER POOLS	POOLS >1m DEEP/km	RESIDUAL POOL DEPTH (m)	WOOD DEBRIS PIECES #/100m	WOOD DEBRIS VOLUME (m3)/100m	WOOD DEBRIS KEY PIECES #/100m	CONIFER TREES TOTAL/1000ft	RIPARIAN CONIFERS #>20in dbh /1000ft	RIPARIAN CONIFERS #>35in dbh /1000ft
PALOUSE CREEK	1456	7.6	15.5	65		1.7	0.6	48	86	1.7	30	0	0
PALOUSE CREEK	969	7.1	17.5	24		1	0.7	17	57	2.4		0	0
PALOUSE CREEK	4226	7	17	28		0	0.4	20	60	3	61	0	0
PALOUSE CREEK TRIB A	580	3.3	110	3		0	0.3	47	98	4.7	122	122	0
PALOUSE CREEK TRIB A	1051	3.6	146	3		0	0.4	68	150	6.2	61	30	0
PALOUSE CREEK TRIB F	1958	6	33.8	5		0.5	0.5	14	60	3.7	41	41	20
PANTHER CREEK	1362	6.3	7.5	42	0	4	0.49	18	21	0.5	41	0	0
PANTHER CREEK	2374	4.5	19.1	14	0	0	0.48	21	32	1.3	37	37	24
SCHUMACHER CREEK	1000	6.6	12.3	8	0	0	0.45	6	5	0.1	122	0	0
SCHUMACHER CREEK (MS-5037)	509	4.7	8.6	18	3	0	0.35	8	6	0	122	0	0
SULLIVAN CREEK	697	3.6	20.4	14	0	0	0.39	14	11	0.1	91	0	0
SULLIVAN CREEK	836	2	24	56	52	3	0.47	26	20	0.1	20	0	0
TROUT CREEK	538	5	11	26	0	0	0.31	12	7	0	122	0	0
TROUT CREEK	1777	5.6	7.8	42	8	0	0.36	31	16	0.1	171	0	0
TROUT CREEK	1092	3.2	64.7	13	0	0	0.31	22	14	0.1	213	0	0
WEST FORK MILLICOMA RIVER	1223	28.2	5.5	37	0	2.4	0.6	2	4	0.2	183	41	0
WEST FORK MILLICOMA RIVER	7709	36.9	4.2	29			0.7	3	4		152	71	10
WEST FORK MILLICOMA RIVER	8476	23.4	9.1	13			0.8	5	17		325	102	51
WEST FORK MILLICOMA RIVER	12839	16.4	21.7	10			0.8	5	5		168	99	53
WEST FORK MILLICOMA RIVER	4339	12.5	16.5	11			0.7	12	10		467	81	30
WEST FORK MILLICOMA RIVER	3553	8.3	8.2	45			0.5	29	38		549	61	17

Table 5A. Summary of stream reaches surveyed within the Tenmile Lakes region of the ODF Elliott project area.

ODF ELLIOTT PROJECT AREA: TENMILE LAKES REGION

REACH SUMMARY

STREAM	SURVEY DATE	REACH #	REACH LENGTH (m)	% AREA IN SIDE CHANNELS	GRADIENT %	VWI	*VALLEY FORM	*CHANNEL FORM	*LAND USE DOM	*LAND USE SUB-DOM	SHADE %	BANK EROSION %	FINES IN RIFFLES %	GRAVEL IN RIFFLES %	LARGE BOULDERS #/100m
ALDER FORK BIG CREEK	9/22/2002	1	829	6.4	3.1	5.7	CT	CA	MT		73	15	9	29	270
ALDER FORK BIG CREEK	9/23/2002	2	1602	2.9	8.4	1.8	MV	CH	MT	YT	83	18	15	49	94
ALDER FORK BIG CREEK	9/25/2002	3	372	1.7	7.7	1.8	MV	CH	MT		91	14	27	9	91
BENSON CREEK	7/17/2001	1	1091	0.8	0.6	3	CT	CT	ST		74	2	12	24	112
BENSON CREEK	7/17/2001	2	2497	2.8	2.1	2.9	CT	CA	MT		71	0	10	24	59
BENSON CREEK	7/23/2001	3	1226	1.5	3.4	2.3	MV	CH	LT		82	0	18	49	35
BIG CREEK	10/22/2002	1	2086	2.1	0.3	8.1	CT	CT	LG	ST	50	24	17	79	1
BIG CREEK	10/23/2002	2	826	3.0	0.4	3.9	CT	CA	ST	MT	71	11	5	83	2
BIG CREEK	10/23/2002	3	1539	3.6	4	1.6	MV	CH	ST	MT	73	4	6	38	74
BIG CREEK	10/23/2002	4	1315	7.9	4.9	1.7	MV	CH	ST	MT	69	4	10	45	31
BIG CREEK	10/23/2002	5	461	3.4	4.2	1.2	MV	CH	YT	ST	69	4	5	30	47
BIG CREEK	10/25/2002	6	434	5.3	7.3	1.8	MV	CH	YT	MT	76	24	10	40	10
BIG CREEK TRIB	10/23/2002	1	2819	4.7	9.1	2.1	MV	CH	MT	LT	98	7	27	42	49
JOHNSON CREEK	6/28/1993	3	2196	2.3	0.5	20	CT	CT	LG	ST	59	80.4	44	52	1
JOHNSON CREEK	7/7/1993	4	1161	3.6	1	4.7	MT	US	ST		80	30.4	26	71	7
JOHNSON CREEK	7/7/1993	5	3460	0.7	6	1.7	CT	CA	ST		93	6.3	12	27	56
JOHNSON CREEK TRIB 1	6/30/1993	1	514	1.7	0.7	4.3	MT	US	ST		89	63.4	22	50	3
JOHNSON CREEK TRIB 1	7/1/1993	2	1490	4.7	1.6	4.7	MV	CH	ST		89	17.5	18	34	27
JOHNSON CREEK TRIB 1	7/1/1993	3	705	7.5	7.6	6.9	SV	CH	ST		94	5.5	10	20	130
JOHNSON CREEK TRIB 2	7/6/1993	1	1306	1.0	8.1	1.7	SV	CH	ST		88	3.9	9	15	53
JOHNSON CREEK TRIB 2	7/6/1993	2	472	0.0	24.8	2	SV	CH	YT		63	0			26
JOHNSON CREEK TRIB 3	7/6/1993	1	1187	0.0	14.4	1.2	SV	CH	ST		89	0	10	20	17
MURPHY CREEK	7/30/2001	1	1549	2.4	2.7	6.8	CT	CT	YT	ST	96	2	21	41	27
MURPHY CREEK	7/31/2001	2	872	10.6	11.8	1.3	MV	CH	YT	ST	100	0	19	37	59
NOBLE CREEK	7/12/2001	1	954	13.3	1.4	5.8	CT	CA	LT		86	0	32	46	34
NOBLE CREEK	7/12/2001	2	1476	6.1	7	2	MV	CH	ST		93	0	25	35	83
ROBERTS CREEK	7/2/2001	1	2031	3.3	1.9	3	MT	US	LT	MT	80	1	27	41	50
ROBERTS CREEK	7/6/2001	2	2199	5.1	4.3	2.1	SV	CH	YT		80	0	21	33	89
ROBERTS CREEK	7/11/2001	3	257	15.7	4.7	4.7	CT	CT	YT		96	0	36	33	125
ROBERTS CREEK RESURVEY (OR. PLAN)	9/12/2001	1	972	6.1	2.8	2.5	MV	CH	ST	MT	74	4	15	43	39

* see methods for abbreviations

Table 5B. Summary of stream reaches surveyed within the Tenmile Lakes region of the ODF Elliott project area.

ODF ELLIOTT PROJECT AREA: TENMILE LAKES REGION
REACH SUMMARY

STREAM	REACH LENGTH (m)	ACTIVE CHANNEL WIDTH (m)	CHANNEL WIDTHS/ POOL	PERCENT POOLS	PERCENT SLACKWATER POOLS	POOLS >1m DEEP/km	RESIDUAL POOL DEPTH (m)	WOOD DEBRIS PIECES #/100m	WOOD DEBRIS VOLUME (m3)/100m	KEY PIECES #/100m	CONIFER TREES TOTAL/1000ft	RIPARIAN CONIFERS #>20in dbh /1000ft	RIPARIAN CONIFERS #>35in dbh /1000ft
ALDER FORK BIG CREEK	829	5.4	7.1	36	0.2	0	0.28	11	9	0	0	0	0
ALDER FORK BIG CREEK	1602	4.8	19.8	8	0	0	0.44	23	23	0.2	15	0	0
ALDER FORK BIG CREEK	372	3.9		0	0	0		14	9	0.3	61	0	0
BENSON CREEK	1091	11	2.6	53	2.5	2.7	0.58	34	32	1.5	76	30	30
BENSON CREEK	2497	7.4	9.3	39	0	1.1	0.47	12	11	0.5	0	0	0
BENSON CREEK	1226	7.5	6	33	0	0.8	0.46	16	19	0.7	152	91	30
BIG CREEK	2086	8.4	3.9	77	17.1	13	0.66	3	2	0	102	41	20
BIG CREEK	826	9	3.4	63	0.5	7	0.71	9	10	0.2	0	0	0
BIG CREEK	1539	8.3	6.3	27	0	0	0.51	10	15	0.5	46	0	0
BIG CREEK	1315	7.7	4.2	37	0	1	0.44	14	33	1.4	37	12	0
BIG CREEK	461	5.8	8.1	17	0.1	0	0.29	5	8	0.4	61	0	0
BIG CREEK	434	3.4	19.7	19	0	0	0.26	14	18	0.7	0	0	0
BIG CREEK TRIB	2819	4.1	48.7	8	0.4	1	0.4	18	59	3.2	171	24	0
JOHNSON CREEK	2196	8	5.1	83			0.8	27	7		0	0	0
JOHNSON CREEK	1161	20.9	1.1	88			0.7	49	86		18.1	0	0
JOHNSON CREEK	3460	17.1	3.3	29			0.4	41	56		0	0	0
JOHNSON CREEK TRIB 1	514	15	2.1	55			0.6	13	17		0	0	0
JOHNSON CREEK TRIB 1	1490	14.2	3.6	30			0.6	14	32		0	0	0
JOHNSON CREEK TRIB 1	705	3	39.2	8			0.4	17	35		0	0	0
JOHNSON CREEK TRIB 2	1306	9.8	4.4	18			0.5	81	112		18.1	0	0
JOHNSON CREEK TRIB 2	472	12	0	0			0	2	3		0	0	0
JOHNSON CREEK TRIB 3	1187	6.3	3.2	14			0.3	15	34		30.2	0	0
MURPHY CREEK	1549	4.4	10.7	43	6	0	0.36	21	11	0.2	15	0	0
MURPHY CREEK	872	2.8	29.6	13	0	0	0.3	24	10	0	0	0	0
NOBLE CREEK	954	4.9	10.7	31	0.1	0	0.32	48	76	4.1	41	41	20
NOBLE CREEK	1476	4.2	12.1	18	0	0.6	0.34	36	39	2.9	132	51	10
ROBERTS CREEK	2031	8.8	6	35	0.6	0.4	0.49	32	18	0.1	24	24	12
ROBERTS CREEK	2199	6.7	9.1	30	2.4	0	0.35	30	49	2.4	264	61	30
ROBERTS CREEK	257	4.1	9.4	17	3.1	0	0.32	47	56	3.1	274	0	0
ROBERTS CREEK RESURVEY (OR. PLAN)	972	9.3	6.5	49	0.6	0	0.53	19	31	0.6	0	0	0

Table 6A. Summary of stream reaches surveyed within the Umpqua River region of the ODF Elliott project area.

ODF ELLIOTT PROJECT AREA: UMPQUA REGION

REACH SUMMARY

STREAM	SURVEY DATE	REACH #	REACH LENGTH (m)	% AREA IN SIDE CHANNELS	GRADIENT %	VWI	*VALLEY FORM	*CHANNEL FORM	*LAND USE DOM	*LAND USE SUB-DOM	SHADE %	BEDROCK %	FINES IN RIFFLES %	GRAVEL IN RIFFLES %	LARGE BOULDERS #/100m
CHARLOTTE CR TRIB	6/30/1999	1	501	15.3	7	3.5	MT	US	YT	ST	87	1	16	70	176
CHARLOTTE CREEK	7/15/1993	1	2180	1.9	2.3	1.6	MV	CH	ST		92	9.5	11	56	42
CHARLOTTE CREEK	7/15/1993	2	813	4.7	3.5	2.5	SV	CH	ST	MT	82	0			65
CHARLOTTE CREEK	8/2/1993	3	331	2.9	13.7	1.5	SV	CH	MT	ST	84	0			114
CHARLOTTE CREEK TRIBUTARY	8/2/1993	1	238	0.0	13.6	3	CT	CA	MT	ST	93	0			50
DEAN CREEK	6/30/1994	5	1631	2.5	0.5	3	WF	US	LG	ST	49	36.4	10	90	2
DEAN CREEK	7/7/1994	6	1522	6.6	0.6	2.2	MV	CH	TH	LT	81	11.1	15	76	5
DEAN CREEK	7/8/1994	7	2745	2.5	3.3	1.5	SV	CH	MT	ST	83	0.2	11	50	32
FOOTLOG CREEK	9/4/2001	1	1756	0.8	3.8	1.9	SV	CH	LT	MT	86	0	16	44	76
FOOTLOG CREEK	9/4/2001	2	2503	5.5	7.1	7.6	MT	CT	ST	LT	97	4	20	35	66
FOOTLOG CREEK	9/6/2001	3	660	6.1	14.9	1.9	SV	CH	LT		85	0			73
JOHANNESON CREEK	10/22/2002	1	1625	4.1	3.6	4.4	CT	CA	MT	LT	94	11	10	15	55
JOHANNESON CREEK	10/22/2002	2	327	3.8	4.6	3	CT	CA	MT	YT	96	1			51
JOHANNESON CREEK	10/22/2002	3	292	6.8	4.8	2	MV	CH	MT	ST	93	6	0	11	59
JOHANNESON CREEK	10/22/2002	4	644	2.7	10.9	1.8	MV	CH	MT	LT	97	11			73
JOHANNESON CREEK	10/22/2002	5	598	1.0	10.1	3	MV	CH	ST	YT	97	3			53
LUDER CREEK	8/6/2002	1	852	1.0	0.8	2.1	MV	CH	MT		81	19	0	70	78
LUDER CREEK	8/7/2002	2	673	16.8	4.2	1.7	MV	CH	YT		68	16	0	10	181
LUDER CREEK	8/8/2002	3	1113	19.4	3.6	2.1	MV	CH	MT		81	24	5	20	187
LUDER CREEK	8/14/2002	4	1041	2.0	10.7	2.8	MV	CH	MT		82	16			218
LUDER CREEK	8/15/2002	5	319	0.0	16.2	1.2	SV	CH	YT		60	25	0	0	66
LUDER CREEK	8/15/2002	6	298	3.0	32.6	2.5	SV	CH	MT		88	1			9
MILL CREEK	6/19/1996	1	624	0.8	0.4	1.5	MV	CH	LT		55	2.7	18	64	8
MILL CREEK	6/19/1996	2	1686	0.4	0.4	1.3	MV	CH	LT		60	0	19	67	6
MILL CREEK	6/19/1996	3	5282	1.0	0.9	1.2	MV	CH	LT		57	0	11	23	13
MILL CREEK	6/20/1996	4	2771	0.9	0.6	1.5	MV	CH	LT	YT	59	0.6	25	52	13
MILL CREEK	6/25/1996	5	2302	7.3	6.6	1.1	SV	CH	LT	ST	59	0	5	25	99
MILLER CR RESURVEY (OR. PLAN)	9/6/2000		980	0.3	5	1.9	MV	CH	ST		100	2	11	25	45
MILLER CREEK	7/27/1994	1	1843	8.4	4.3	1.4	SV	CH	LT	ST	90	18.3	10	83	40
SCHOLFIELD CREEK	7/19/1994	3	1655	3.0	0.9	2.6	WF	US	TH	LG	79	18	31	68	13
SCHOLFIELD CREEK	7/19/1994	4	3408	4.3	3.8	1.2	SV	CH	TH	MT	89	4.3	11	55	33

* see methods for abbreviations

Table 6B. Summary of stream reaches surveyed within the Umpqua River region of the ODF Elliott project area.

ODF ELLIOTT PROJECT AREA: UMPQUA REGION
REACH SUMMARY

STREAM	REACH LENGTH (m)	ACTIVE CHANNEL WIDTH (m)	CHANNEL WIDTHS/ POOL	PERCENT POOLS	PERCENT SLACKWATER POOLS	POOLS >1m DEEP/km	RESIDUAL POOL DEPTH (m)	WOOD DEBRIS PIECES #/100m	WOOD DEBRIS VOLUME (m3)/100m	KEY PIECES #/100m	CONIFER TREES TOTAL/1000ft	RIPARIAN CONIFERS #>20in dbh /1000ft	RIPARIAN CONIFERS #>35in dbh /1000ft
CHARLOTTE CR TRIB	501	4.8	18.1	2.1	0.4	0	0.29	15	7	0	102	20	20
CHARLOTTE CREEK	2180	17.5	2.8	39.1			0.5	25	31		0	0	0
CHARLOTTE CREEK	813	8	0	0.0			0	37	53		121	121	60
CHARLOTTE CREEK	331	9	38.3	0.8			1	183	272		121	121	0
CHARLOTTE CREEK TRIBUTARY	238	2.5	31.7	13.0			0.4	39	34				
DEAN CREEK	1631	15.2	5	85.2	46.9	18	1.12	3	2	0.1	0	0	0
DEAN CREEK	1522	11.3	5.6	56.7	0.0	8	0.64	4	3	0	41	41	20
DEAN CREEK	2745	8.2	11.2	26.3	0.0	2	0.41	15	12	0.2	107	61	0
FOOTLOG CREEK	1756	4.7	12.3	30.7	0.0	0.5	0.5	9	5	0	91	15	15
FOOTLOG CREEK	2503	3.4	0	0.0	0.0	0	0	24	19	0.3	61	30	30
FOOTLOG CREEK	660	2	0	0.0	0.0	0	0	27	24	0.2	0	0	0
JOHANNESON CREEK	1625	5.6	20.1	6.4	0.0	0	0.35	11	22	0.7	81	41	20
JOHANNESON CREEK	327	6.6	52.2	1.7	0.0	0	0.49	22	57	3.7	549	0	0
JOHANNESON CREEK	292	8.7	37.8	2.2	0.0	0	0.25	38	112	8.9	366	0	0
JOHANNESON CREEK	644	5.1	133.1	1.0	0.0	1	0.99	16	93	4.3	122	0	0
JOHANNESON CREEK	598	3			0.0			8	14	1.3	122	91	61
LUDER CREEK	852	8.5	17.1	10.3	0.0	0	0.65	44	46	0.6	61	0	0
LUDER CREEK	673	8.7		0.0	0.0			77	58	0.3	305	0	0
LUDER CREEK	1113	7.4	101.4	0.7	0.0	0	0.35	31	18	0.1	61	30	0
LUDER CREEK	1041	3.2			0.0			20	22	1.1	122	61	0
LUDER CREEK	319	2.7			0.0			12	12	0	61	0	0
LUDER CREEK	298	0.8			0.0			9	5	0.3	122	61	0
MILL CREEK	624	36.8	17	17.0		1.5	2.7	12	16	0	305	0	0
MILL CREEK	1686	33.7	50	2.8		0.6	0.6	1	2	0.1	152	61	0
MILL CREEK	5282	36.5	18.1	7.1		1.1	1.5	1	2	0.2	229	61	15
MILL CREEK	2771	30.6	18.1	11.2		1.1	1.5	1	3	0.1	122	30	0
MILL CREEK	2302	29	9.9	19.3		2.7	2.2	1	6	0.3	549	366	122
MILLER CR RESURVEY (OR. PLAN)	980	4.8	14.6	12.7	0.0	0	0.38	9	5	0.2	61	0	0
MILLER CREEK	1843	6.4	48	9.4		0	0.2	2	1	0.1	0	0	0
SCHOLFIELD CREEK	1655	10.8	7	61.7		2.3	0.7	10	7	0.1	61	0	0
SCHOLFIELD CREEK	3408	10	12.2	21.0		0.5	0.5	17	28	1.1	46	0	0

Table 7. Comparisons of attributes between reaches within the ODF Elliott project area

ODF ELLIOTT PROJECT AREA: COOS REGION
HABITAT ATTRIBUTES
Values meeting or exceeding the high reference level are in bold. Reaches with 5 or more attributes at the high level are highlighted.

STREAM	SURVEY DATE	REACH #	REACH LENGTH (m)	% AREA IN SIDE CHANNELS	GRADIENT	ACW	VWI	SHADE %	BEDROCK %	FINES IN RIFFLES %	GRAVEL IN RIFFLES %	POOLS %	SLACKWATER POOLS %	POOLS >1m DEEP/km	WOOD DEBRIS PIECES #/100m	WOOD DEBRIS VOLUME (m3)/100m	WOOD DEBRIS KEY PIECES #/100m	RIPARIAN CONIFERS #>20in dbh /1000ft	RIPARIAN CONIFERS #>35in dbh /1000ft
BEAVER CREEK	8/20/2001	1	1511	2.6	6.4	5.7	1.6	90	23	21	45	26.7	0.6	1.8	**22.6**	13.5	0.2	12	12
BEAVER CREEK	8/22/2001	2	954	4.4	5.6	3.3	3.5	68	2	23	48	16.2	4.6	0	**28.0**	27.5	0.6	0	0
BEAVER CREEK	8/22/2001	3	1000	2.9	8.9	2.3	6	84	**0**	38	37	18.7	0.2	0	**22.8**	14.3	0.1	61	0
BUCK CR	9/6/1999	1	1028	**10.2**	5.9	2.6	2.2	**93**	15	30	**70**	10.3	1.4	0	**24.8**	26.6	0.7	122	**81**
COUGAR CREEK	9/20/1994	1	4043	1.8	3.4	5.6	1.3	**94**	n/a	**6**	51	28.6	0.0	0	19.3	38.5	1.6	61	30
CRANE CREEK	8/10/1994	1	1698	5.3	4.2	4.2	1.2	**92**	n/a	11	**61**	38.1	0.0	0.5	15.8	57.7	**3.9**	30	0
DEER CREEK	9/21/1993	1	3358	0.9	1	10.6	1.1	73	n/a	11	39	42.1	0.0	0	17.2	15.7	0.0	**168**	61
DEER CREEK	9/23/1993	2	1728	3.5	1.8	8.1	1.8	79	n/a	13	**61**	30.7	0.0	0	**28.6**	29.9	0.0	**518**	**122**
DEER CREEK	9/30/1993	3	601	0.0	6.8	4	1.5	80	n/a	**0**	0	0.6	0.0	0	19.3	13.3	0.0	0	0
DEER CREEK TRIBUTARY	9/30/1993	1	530	0.0	6.6	4	1.5	84	n/a	**0**	0	4.6	0.0	0	**31.7**	26.6	0.0	0	0
ELK CR	9/2/1999	1	987	3.1	2.3	11.1	3.1	**97**	54	**0**	0	**63.2**	**13.1**	**4.5**	7.4	2.5	0.0	20	0
ELK CREEK	7/25/1994	1	2791	0.2	1.5	11.4	1.5	86	n/a	**6**	37	**58.2**	0.0	**4.3**	5.9	10.6	0.4	91	30
ELK CREEK	8/1/1994	2	1714	0.2	1.7	11	1.6	88	n/a	**5**	32	**45.9**	0.0	1.7	7.9	11.5	0.5	0	0
ELK CREEK	8/2/1994	3	2181	0.7	0.6	9.2	1.6	86	n/a	**5**	**82**	**63.4**	0.0	1.8	9.2	13.0	0.9	91	**91**
ELK CREEK	8/3/1994	4	8712	0.7	1.5	8.5	1.3	87	n/a	**6**	**66**	**77.7**	0.0	**3.9**	12.4	33.0	1.6	73	61
FISH CREEK	9/14/1994	1	4512	**9.8**	3.7	4.8	1.2	**94**	n/a	**7**	**57**	17.7	0.0	0.2	**21.4**	34.0	1.3	12	6
HIDDEN VALLEY CREEK	8/10/1994	1	1955	0.0	6.9	4.1	1.3	90	n/a	**5**	**77**	29.8	0.0	0	13.4	51.5	**4.3**	122	61
JOES CREEK	8/26/2002	1	577	2.3	1.2	3.5	3.6	79	24	**5**	45	43.7	1.1	0	5.5	2.6	0.0	30	30
JOES CREEK	8/27/2002	2	535	**5.3**	4.9	5	1.7	67	17	9	48	15.2	0.0	0	13.1	9.2	0.0	0	0
JOES CREEK	8/27/2002	3	504	1.2	2.1	2.9	1.3	87	**0**	10	51	8.3	0.0	0	12.1	8.6	0.0	0	0
JOES CREEK	8/28/2002	4	485	0.4	3	3.5	1	68	**0**	32	**63**	**96.1**	**81.8**	1	2.5	2.2	0.0	0	0
JOES CREEK	9/3/2002	5	782	2.8	8.1	2	1.3	80	14	24	**67**	0.0	0.0	0	15.6	13.5	0.1	0	0
KELLY CREEK	9/19/1994	1	2166	0.4	6.4	3.7	1.1	88	n/a	**5**	**60**	4.2	0.0	0	19.3	44.4	**3.0**	91	61
KNIFE CREEK	9/6/1994	1	5083	2.5	3.5	7.9	1.1	88	n/a	**5**	**55**	29.0	0.0	0.4	17.0	31.4	1.1	61	37
LARSON CREEK	8/29/2001	1	1172	2.7	2.8	5.6	3.2	**91**	21	23	39	25.5	0.0	0.8	19.9	13.3	0.4	0	0
LARSON CREEK	8/30/2001	2	2256	**5.6**	8.7	3.9	1.3	88	31	19	51	15.6	0.0	0.8	**26.0**	16.5	0.3	0	0
MARLOW CREEK	8/1/2001	1	2434	3.9	2.3	8.7	2.6	84	14	16	39	39.0	0.7	1.5	**26.6**	16.4	0.3	10	0
MARLOW CREEK	8/6/2001	2	956	1.6	1.1	6.7	2.6	90	11	13	44	42.0	0.8	1	**54.8**	31.7	0.5	20	0
MARLOW CREEK	8/7/2001	3	2086	**8.8**	2.9	6.1	2.7	**92**	9	23	43	41.7	0.0	1.2	**42.5**	34.2	0.5	0	0
MARLOW CREEK	8/13/2001	5	487	2.0	10.9	1.8	1.4	75	2	28	40	13.0	0.0	0	**32.7**	9.8	0.2	0	0
OTTER CREEK	9/4/2002	1	809	2.2	2.8	4.5	1.6	87	28	12	26	11.7	0.0	0	7.0	13.4	0.9	30	30
OTTER CREEK	9/5/2002	2	409	**5.9**	3.7	2.8	4.3	79	**0**	22	39	11.6	0.0	0	**31.3**	30.9	1.7	0	0
OTTER CREEK	9/9/2002	3	408	**18.3**	5.3	1.9	4.3	87	5	13	44	6.6	0.0	0	7.9	9.2	0.2	0	0
OTTER CREEK	9/9/2002	4	311	**11.1**	9.3	1.4	1.5	86	**0**	**0**	0	0.0	0.0	0	2.9	3.2	0.0	61	0
PALOUSE CREEK	8/16/1994	3	3487	0.2	0.5	6.3	6.5	62	n/a	14	46	**47.1**	0.0	2.3	2.6	5.2	0.4	0	0
PALOUSE CREEK	8/17/1994	4	1456	**19.9**	0.5	7.6	3.9	66	n/a	**6**	**66**	**65.4**	0.0	1.7	**48.0**	**86.3**	1.7	0	0
PALOUSE CREEK	8/17/1994	5	969	0.3	1.7	7.1	1.4	84	**0**	**5**	**55**	24.0	0.0	1	17.1	56.5	2.4	0	0
PALOUSE CREEK	8/17/1994	6	4226	4.4	2.4	7	1.2	**92**	**0**	**5**	53	28.1	0.0	0	20.3	**59.5**	**3.0**	0	0

Table 7. Comparisons of attributes between reaches within the ODF Elliott project area

ODF ELLIOTT PROJECT AREA: COOS REGION
HABITAT ATTRIBUTES
Values meeting or exceeding the high reference level are in bold. Reaches with 5 or more attributes at the high level are highlighted.

STREAM	SURVEY DATE	REACH #	REACH LENGTH (m)	% AREA IN SIDE CHANNELS	GRADIENT	ACW	VWI	SHADE %	BEDROCK %	FINES IN RIFFLES %	GRAVEL IN RIFFLES %	POOLS %	SLACKWATER POOLS %	POOLS >1m DEEP/km	WOOD DEBRIS PIECES #/100m	WOOD DEBRIS VOLUME (m3)/100m	KEY PIECES #/100m	RIPARIAN CONIFERS #>20in dbh /1000ft	RIPARIAN CONIFERS #>35in dbh /1000ft
PALOUSE CREEK TRIB A	8/31/1994	1	580	**33.6**	6.2	3.3	5	86	n/a	**5**	**86**	2.9	0.0	0	**46.9**	**97.7**	**4.7**	122	0
PALOUSE CREEK TRIB A	8/31/1994	2	1051	0.0	11.6	3.6	1.1	**94**	**0**	18	53	2.6	0.0	0	**67.9**	**150.2**	**6.2**	30	0
PALOUSE CREEK TRIB F	8/25/1994	1	1958	3.3	6.6	6	1.3	**93**	n/a	**5**	36	5.4	0.0	0.5	14.2	**59.7**	**3.7**	41	20
PANTHER CREEK	9/10/2002	1	1362	4.8	1.8	6.3	2.6	69	12	**5**	**55**	41.8	0.2	**4**	17.6	20.9	0.5	0	0
PANTHER CREEK	9/11/2002	2	2374	3.7	3.9	4.5	2.9	73	2	**5**	53	14.1	0.0	0	**21.0**	32.4	1.3	37	24
SCHUMACHER CR	8/30/2001	1	1000	3.0	12.2	6.6	5.8	86	50	23	**65**	8.3	0.0	0	6.4	5.0	0.1	0	0
SCHUMACHER CREEK (MS-5037)	9/3/2002	1	509	1.7	12.1	4.7	1.2	88	31	21	26	17.8	3.2	0	7.5	6.4	0.0	0	0
SULLIVAN CREEK	8/19/2002	2	697	3.0	3.7	3.6	1.6	86	19	42	31	13.8	0.0	0	13.8	11.0	0.1	0	0
SULLIVAN CREEK	8/20/2002	3	836	**10.7**	3.5	2	3.5	79	11	25	36	**56.1**	**51.7**	**3**	**26.4**	19.5	0.1	0	0
TROUT CREEK	8/28/2001	1	538	0.8	6.2	5	3.1	**94**	25	25	45	26.4	0.0	0	12.3	6.8	0.0	0	0
TROUT CREEK	8/15/2001	2	1777	1.7	3.5	5.6	3.9	**93**	10	14	47	41.7	**8.1**	0	**31.1**	15.7	0.1	0	0
TROUT CREEK	8/19/2001	3	1092	**13.7**	18.1	3.2	1.3	79	38	14	40	12.9	0.0	0	**21.9**	13.6	0.1	0	0
WEST FORK MILLICOMA RIVER	10/8/1998	1	1223	0.1	0.8	28.2	1.2	73	63	**7**	11	36.6	0.0	2.4	2.2	3.5	0.2	41	0
WEST FORK MILLICOMA RIVER	7/20/1993	1	7709	0.9	0.8	36.9	3.9	64	n/a	11	13	28.9	0.0	0	3.0	4.1	0.0	71	10
WEST FORK MILLICOMA RIVER	7/21/1993	2	8476	1.1	1.1	23.4	1.9	73	n/a	**8**	12	12.7	0.0	0	5.0	17.1	0.0	102	51
WEST FORK MILLICOMA RIVER	8/5/1993	3	12839	1.8	0.7	16.4	2.1	72	n/a	9	24	9.6	0.0	0	5.2	4.7	0.0	99	53
WEST FORK MILLICOMA RIVER	8/16/1993	4	4339	1.9	1	12.5	2.2	89	n/a	9	33	11.0	0.0	0	12.4	10.1	0.0	81	30
WEST FORK MILLICOMA RIVER	8/17/1993	5	3553	1.3	2.7	8.3	1.8	**92**	n/a	14	46	**45.4**	0.0	0	**29.2**	37.9	0.0	61	17

Table 8. Comparisons of attributes between reaches within the ODF Elliott project area

ODF ELLIOTT PROJECT AREA: TENMILE LAKES REGION
HABITAT ATTRIBUTES
Values meeting or exceeding the high reference level are in bold. Reaches with 5 or more attributes at the high level are highlighted.

STREAM	SURVEY DATE	REACH #	REACH LENGTH (m)	% AREA IN SIDE CHANNELS	GRADIENT	ACW	VWI	SHADE %	BEDROCK %	FINES IN RIFFLES %	GRAVEL IN RIFFLES %	POOLS %	SLACKWATER POOLS %	POOLS >1m DEEP/km	WOOD DEBRIS PIECES #/100m	WOOD DEBRIS VOLUME (m3)/100m	KEY PIECES #/100m	RIPARIAN CONIFERS #>20in dbh /1000ft	RIPARIAN CONIFERS #>35in dbh /1000ft
ALDER FORK BIG CREEK	9/22/2002	1	829	**6.4**	3.1	5.4	5.7	73	10	9	29	36.1	0.2	0	11.3	9.0	0.0	0	0
ALDER FORK BIG CREEK	9/23/2002	2	1602	2.9	8.4	4.8	1.8	83	41	15	49	8.2	0.0	0	**22.5**	22.9	0.2	0	0
ALDER FORK BIG CREEK	9/25/2002	3	372	1.7	7.7	3.9	1.8	**91**	39	27	9	0.0	0.0	0	13.7	9.2	0.3	0	0
BENSON CREEK	7/17/2001	1	1091	0.8	0.6	11	3	74	20	12	24	**52.6**	2.5	2.7	**33.6**	32.1	1.5	30	30
BENSON CREEK	7/17/2001	2	2497	2.8	2.1	7.4	2.9	71	18	10	24	39.3	0.0	1.1	12.3	11.2	0.5	0	0
BENSON CREEK	7/23/2001	3	1226	1.5	3.4	7.5	2.3	82	35	18	49	33.0	0.0	0.8	16.4	18.9	0.7	91	30
BIG CREEK	10/22/2002	1	2086	2.1	0.3	8.4	8.1	50	**0**	17	**79**	**76.6**	**17.1**	**13**	3.3	1.7	0.0	41	20
BIG CREEK	10/23/2002	2	826	3.0	0.4	9	3.9	71	**0**	**5**	**83**	**62.9**	0.5	**7**	9.1	10.2	0.2	0	0
BIG CREEK	10/23/2002	3	1539	3.6	4	8.3	1.6	73	45	**6**	38	27.4	0.0	0	10.2	15.3	0.5	0	0
BIG CREEK	10/23/2002	4	1315	**7.9**	4.9	7.7	1.7	69	27	10	45	37.4	0.0	1	13.8	33.2	1.4	12	0
BIG CREEK	10/23/2002	5	461	3.4	4.2	5.8	1.2	69	57	**5**	30	17.3	0.1	0	4.8	8.4	0.4	0	0
BIG CREEK	10/25/2002	6	434	5.3	7.3	3.4	1.8	76	16	10	40	18.5	0.0	0	13.8	18.3	0.7	0	0
BIG CREEK TRIB	10/23/2002	1	2819	4.7	9.1	4.1	2.1	**98**	20	27	42	8.1	0.4	1	18.2	**59.1**	**3.2**	24	0
JOHNSON CREEK	6/28/1993	3	2196	2.3	0.5	8	20	59	n/a	44	52	**82.5**	0.0	0	**27.0**	6.8	0.0	0	0
JOHNSON CREEK	7/7/1993	4	1161	3.6	1	20.9	4.7	80	n/a	26	**71**	**87.7**	0.0	0	**48.8**	**85.7**	0.0	0	0
JOHNSON CREEK	7/7/1993	5	3460	0.7	6	17.1	1.7	**93**	n/a	12	27	29.0	0.0	0	**41.2**	56.1	0.0	0	0
JOHNSON CREEK TRIB 1	6/30/1993	1	514	1.7	0.7	15	4.3	89	n/a	22	50	**54.7**	0.0	0	12.8	17.4	0.0	0	0
JOHNSON CREEK TRIB 1	7/1/1993	2	1490	4.7	1.6	14.2	4.7	89	n/a	18	34	30.1	0.0	0	14.0	32.4	0.0	0	0
JOHNSON CREEK TRIB 1	7/1/1993	3	705	**7.5**	7.6	3	6.9	**94**	n/a	10	20	7.9	0.0	0	16.9	35.1	0.0	0	0
JOHNSON CREEK TRIB 2	7/6/1993	1	1306	1.0	8.1	9.8	1.7	88	n/a	9	15	18.1	0.0	0	**80.7**	**112.3**	0.0	0	0
JOHNSON CREEK TRIB 2	7/6/1993	2	472	0.0	24.8	12	2	63	n/a	**0**	0	0.0	0.0	0	2.3	2.8	0.0	0	0
JOHNSON CREEK TRIB 3	7/6/1993	1	1187	0.0	14.4	6.3	1.2	89	n/a	10	20	13.5	0.0	0	15.4	33.8	0.0	0	0
MURPHY CREEK	7/30/2001	1	1549	2.4	2.7	4.4	6.8	**96**	4	21	41	43.0	6.0	0	**21.1**	11.4	0.2	0	0
MURPHY CREEK	7/31/2001	2	872	**10.6**	11.8	2.8	1.3	**100**	16	19	37	12.7	0.0	0	**24.3**	9.8	0.0	0	0
NOBLE CREEK	7/12/2001	1	954	**13.3**	1.4	4.9	5.8	86	11	32	46	31.4	0.1	0	**47.7**	**76.3**	**4.1**	41	20
NOBLE CREEK	7/12/2001	2	1476	**6.1**	7	4.2	2	**93**	30	25	35	17.8	0.0	0.6	**35.7**	39.4	2.9	51	10
ROBERTS CREEK	7/2/2001	1	2031	3.3	1.9	8.8	3	80	21	27	41	34.7	0.6	0.4	**32.4**	17.5	0.1	24	12
ROBERTS CREEK	7/6/2001	2	2199	5.1	4.3	6.7	2.1	80	23	21	33	29.6	2.4	0	**29.7**	48.8	2.4	61	30
ROBERTS CREEK	7/11/2001	3	257	**15.7**	4.7	4.1	4.7	**96**	16	36	33	17.0	3.1	0	**47.0**	56.0	**3.1**	0	0
ROBERTS CREEK RESURVEY	9/12/2001	1	972	**6.1**	2.8	9.3	2.5	74	18	15	43	**48.6**	0.6	0	19.0	30.6	0.6	0	0

Table 9. Comparisons of attributes between reaches within the ODF Elliott project area

ODF ELLIOTT PROJECT AREA: UMPQUA RIVER REGION
HABITAT ATTRIBUTES

Values meeting or exceeding the high reference level are in bold. Reaches with 5 or more attributes at the high level are highlighted.

STREAM	SURVEY DATE	REACH #	REACH LENGTH (m)	% AREA IN SIDE CHANNELS	GRADIENT	ACW	VWI	SHADE %	BEDROCK %	FINES IN RIFFLES %	GRAVEL IN RIFFLES %	POOLS %	SLACKWATER POOLS %	POOLS >1m DEEP/km	WOOD DEBRIS PIECES #/100m	WOOD DEBRIS VOLUME (m3)/100m	KEY PIECES #/100m	RIPARIAN CONIFERS #>20in dbh /1000ft	RIPARIAN CONIFERS #>35in dbh /1000ft
CHARLOTTE CR TRIB	6/30/1999	1	501	**15.3**	7	4.8	3.5	87	2	16	**70**	2.1	0.4	0	15.4	7.1	0.0	20	20
CHARLOTTE CREEK	7/15/1993	1	2180	1.9	2.3	17.5	1.6	**92**	n/a	11	**56**	39.1	0.0	0	**24.6**	31.4	0.0	0	0
CHARLOTTE CREEK	7/15/1993	2	813	4.7	3.5	8	2.5	82	n/a	**0**	0	0.0	0.0	0	**37.3**	53.1	0.0	121	60
CHARLOTTE CREEK	8/2/1993	3	331	2.9	13.7	9	1.5	84	n/a	**0**	0	0.8	0.0	0	**182.9**	**271.9**	0.0	121	0
CHARLOTTE CREEK TRIBUTARY	8/2/1993	1	238	0.0	13.6	2.5	3	**93**	n/a	**0**	0	13.0	0.0	0	**39.0**	33.7	0.0	0	0
DEAN CREEK	6/30/1994	5	1631	2.5	0.5	15.2	3	49	**0**	10	**90**	**85.2**	**46.9**	**18**	3.2	1.8	0.1	0	0
DEAN CREEK	7/7/1994	6	1522	**6.6**	0.6	11.3	2.2	81	**1**	15	**76**	**56.7**	0.0	**8**	3.8	2.7	0.0	41	20
DEAN CREEK	7/8/1994	7	2745	2.5	3.3	8.2	1.5	83	33	11	50	26.3	0.0	2	15.0	11.5	0.2	61	0
FOOTLOG CREEK	9/4/2001	1	1756	0.8	3.8	4.7	1.9	86	**1**	16	44	30.7	0.0	0.5	9.1	5.2	0.0	15	15
FOOTLOG CREEK	9/4/2001	2	2503	**5.5**	7.1	3.4	7.6	**97**	**1**	20	35	0.0	0.0	0	**23.8**	18.5	0.3	30	30
FOOTLOG CREEK	9/6/2001	3	660	**6.1**	14.9	2	1.9	85	**0**	**0**	0	0.0	0.0	0	**27.0**	23.7	0.2	0	0
JOHANNESON CREEK	10/22/2002	1	1625	4.1	3.6	5.6	4.4	**94**	32	10	15	6.4	0.0	0	11.3	21.6	0.7	41	20
JOHANNESON CREEK	10/22/2002	2	327	3.8	4.6	6.6	3	**96**	40	**0**	0	1.7	0.0	0	**22.3**	57.2	**3.7**	0	0
JOHANNESON CREEK	10/22/2002	3	292	**6.8**	4.8	8.7	2	**93**	17	**0**	11	2.2	0.0	0	**38.3**	**111.5**	**8.9**	0	0
JOHANNESON CREEK	10/22/2002	4	644	2.7	10.9	5.1	1.8	**97**	54	**0**	0	1.0	0.0	1	16.0	**93.4**	**4.3**	0	0
JOHANNESON CREEK	10/22/2002	5	598	1.0	10.1	3	3	**97**	32	**0**	0	0.0	0.0	0	7.7	14.3	1.3	91	61
LUDER CREEK	8/6/2002	1	852	1.0	0.8	8.5	2.1	81	5	**0**	**70**	10.3	0.0	0	**44.4**	46.1	0.6	0	0
LUDER CREEK	8/7/2002	2	673	**16.8**	4.2	8.7	1.7	68	**0**	**0**	10	0.0	0.0	0	**76.9**	**58.4**	0.3	0	0
LUDER CREEK	8/8/2002	3	1113	**19.4**	3.6	7.4	2.1	81	**1**	**5**	20	0.7	0.0	0	**31.4**	17.7	0.1	30	0
LUDER CREEK	8/14/2002	4	1041	2.0	10.7	3.2	2.8	82	3	**0**	0	0.0	0.0	0	20.0	22.4	1.1	61	0
LUDER CREEK	8/15/2002	5	319	0.0	16.2	2.7	1.2	60	56	**0**	0	0.0	0.0	0	12.2	11.5	0.0	0	0
LUDER CREEK	8/15/2002	6	298	3.0	32.6	0.8	2.5	88	60	**0**	0	0.0	0.0	0	9.1	5.4	0.3	61	0
MILL CREEK	6/19/1996	1	624	0.8	0.4	36.8	1.5	55	**0**	18	**64**	17.0	0.0	1.5	12.3	15.9	0.0	0	0
MILL CREEK	6/19/1996	2	1686	0.4	0.4	33.7	1.3	60	n/a	19	**67**	2.8	0.0	0.6	1.4	2.1	0.1	61	0
MILL CREEK	6/19/1996	3	5282	1.0	0.9	36.5	1.2	57	n/a	11	23	7.1	0.0	1.1	0.6	2.1	0.2	61	15
MILL CREEK	6/20/1996	4	2771	0.9	0.6	30.6	1.5	59	n/a	25	52	11.2	0.0	1.1	0.6	3.0	0.1	30	0
MILL CREEK	6/25/1996	5	2302	**7.3**	6.6	29	1.1	59	n/a	**5**	25	19.3	0.0	2.7	0.5	5.5	0.3	**366**	**122**
MILLER CR RESURVEY	9/6/2000	1	980	0.3	5	4.8	1.9	**100**	26	11	25	12.7	0.0	0	9.1	4.7	0.2	0	0
MILLER CREEK	7/27/1994	1	1843	**8.4**	4.3	6.4	1.4	90	n/a	10	**83**	9.4	0.0	0	1.8	1.2	0.1	0	0
SCHOLFIELD CREEK	7/19/1994	3	1655	3.0	0.9	10.8	2.6	79	n/a	31	**68**	**61.7**	0.0	2.3	10.3	6.5	0.1	0	0
SCHOLFIELD CREEK	7/19/1994	4	3408	4.3	3.8	10	1.2	89	n/a	11	**55**	21.0	0.0	0.5	16.9	28.2	1.1	0	0

Table 10. Summary of conditions for key habitat attributes.

Habitat survey reach values and habitat parameters relative to 2004 Reference Conditions.

		Habitat variables for ODF regions within the Elliott State Forest Project Area							
		Tenmile Lakes Region 40km n=30		Umpqua River Region 43km n=31		Coos Region 123km n=56		All Regions 206km n=117	
Parameter	Habitat Breakpoints	average	median	average	median	average	median	average	median
	Low <19%			15%	6%				
percent pools	Moderate	34%	30%			26.8%	24.8%	28.5%	17.8%
	High >45%								
	Low 0		0		0		0		0
deep pools/km	Moderate	0.5		1.2		0.6		1	
	High >3								
	Low 0		0%		0%		0%		0%
% slackwater pools	Moderate	2%		4%		4%		3%	
	High >7%								
	Low <0.8								
% secondary channel area (m2)	Moderate	5%	3%	5%	3%	4%	2%	3%	3%
	High >5.3								
	High >22%								
% fines in riffles	Moderate	18%	16%		10%	13%	11%	12%	11%
	Low <8%			8%					
	Low <26%				25%				
% gravel in riffles	Moderate	40%	38%	34%		45%	45%	41%	41%
	High >54%								
	High >11%	21%	20%	14%		19%	14%	19%	17%
% bedrock	Moderate				5%				
	Low <1%								
	Low <8								
pieces LWD/100m	Moderate		17.6		15	17.8	17.2	17.1	16.9
	High >21	25.4		44.3					
	Low <17				15.9		15.7		
volume LWD/100m	Moderate	35.8	20.9			22.4		24.6	17.1
	High >58			61.2					
	Low <0.5		0.5	0.5	0.2		0.4		0.3
key pieces/100m	Moderate	1.2				1.3		1.1	
	High >3								
	Low <22	16.3	0		15		12		0
# conifers >50cm dbh	Moderate			62.2		51.4		49.6	
	High >153								
	Low 0		0		0		0		0
# conifers >90cm dbh	Moderate	6.1		16.9		21.4		20.8	
	High >79								
	Low <76%								
% shade	Moderate	80%	81%	81%	84%	83%	86%	81%	86%
	High >91%								

Table 11. Comparison of reach length, active channel width, gradient, ownership, ecoregions, and geology between reference surveys and Elliott project area regions.

Attribute	Reference Reaches	Reaches within: Tenmile Lakes Region	Umpqua River Region	Coos Region	All Regions
Number of Reaches or Sites	124	30	31	56	117
Distance Surveyed - Total (km)	161.9km	40km	43km	123km	206km
Mean (median)	1306m (971m)	1329m (1206m)	1393m (1041m)	2193m (1292m)	1760m (1187m)
Range	174m - 6776m	257m - 3460m	238m - 5282m	311m - 12839m	238m - 12839m
Active Channel Width (meters):					
Mean (median)	9.28 (7.28)	7.9 (7.4)	11.1 (8.0)	6.9 (5.3)	8.3 (6.3)
Range	1.5 – 31.5	2.8 - 20.9	0.8 - 36.8	1.4 - 36.9	0.8 - 36.9
Gradient (%):					
Mean (median)	2.8 (2.3)	5.2 (4.1)	6.3 (4.2)	4.4 (3.5)	5.1 (3.7)
Range	0.5 – 19.2	0.3 - 24.8	0.4 - 32.6	0.5 - 18.1	0.3 - 32.6
Ownership	Primarily federal	State	State	State	State
Ecoregions	Coastal 80% Cascades 20%	Predominantly Coast Range sedimentary with some coastal uplands	Coast Range sedimentary	Coast Range sedimentary	Predominantly Coast Range sedimentary
Geology	Sedimentary 72% Volcanic 21% Mixed 7%	Sedimentary	Sedimentary	Sedimentary	Sedimentary

Table 12. Estimates of carrying capacity for coho salmon parr in basins of the Elliott State Forest. Only stream reaches that support coho salmon and are within state forest boundaries are included.

REGION/STREAM	Channel Length (m)	Wetted Habitat Area (m^2)	Summer Parr Total	Summer Parr/km	Summer Parr/m^2	Summer Habitat Capacity	Summer Habitat Quality	Winter Channel Length (m)	Wetted Habitat Area (m^2)	Winter Parr Total	Winter Parr/km	Winter Parr/m^2	Winter Habitat Capacity	Winter Habitat Quality
COOS														
BEAVER CREEK	3465	8569	4306	1243	0.502	low	high	na	na	na	na	na		
COUGAR CREEK	4043	8870	6066	1500	0.684	moderate	high	3824	15194	690	181	0.045	low	low
DEER CREEK and TRIBUTARY	3888	14770	12739	3277	0.862	high	high	8290	46450	4193	506	0.090	low	low
ELK CREEK	15399	88650	118057	7667	1.332	high	high	14034	88462	8561	610	0.097	low	low
FISH CREEK	4512	11798	5744	127	0.487	low	high	4809	27151	2235	465	0.082	low	low
HIDDEN VALLEY CREEK	1955	3375	2180	112	0.646	low	high	na	na	na	na	na		
JOES CREEK	2100	7642	9490	4519	1.242	high	high	2739	12433	10258	3745	0.825	high	high
KELLY CREEK	2166	3257	603	278	0.185	low	moderate	na	na	na	na	na		
KNIFE CREEK	5083	10816	7583	1492	0.701	moderate	high	4654	20283	1017	219	0.050	low	low
LARSON CREEK	3428	8528	3781	1103	0.443	low	high	2996	13035	555	185	0.043	low	low
MARLOW CREEK	5476	24809	19586	3577	0.790	high	high	7131	42182	4288	601	0.102	low	low
NOBLE CREEK	2431	6301	3074	1265	0.488	moderate	high	na	na	na	na	na		
OTTER CREEK	1937	4391	1102	569	0.251	low	moderate	1913	4936	295	154	0.060	low	low
PALOUSE CREEK and TRIBUTARY	6689	24022	26189	3915	1.090	high	high	4263	30265	5699	1337	0.188	moderate	moderate
PANTHER CREEK	1362	4543	3674	2698	0.809	high	high	5316	16002	1129	212	0.071	low	low
SULLIVAN CREEK	1533	5765	4904	3198	0.851	high	high	1951	6515	901	462	0.138	low	moderate
TROUT CREEK	2685	7564	5411	2015	0.715	moderate	high	2606	11419	733	281	0.064	low	low
W. FK MILLICOMA R.	36917	545027	126500	3427	0.232	high	moderate	36011	635141	13244	368	0.021	low	low
SubTotal	**105,066**	**788,698**	**360,988**	**3,436**	**0.458**	**high**	**high**	**100,534**	**969,466**	**53,800**	**535**	**0.055**	**low**	**low**
TENMILE LAKES														
ALDER FORK BIG CREEK	2431	6686	2914	1198	0.436	low	high	4343	13739	1205	277	0.088	low	low
ALDER GULCH	na	na	na	na	na			901	2164	56	62	0.026	low	low
BEAVER CREEK	na	na	na	na	na			3732	17358	861	231	0.050	low	low
BENSON CREEK	3588	17634	15704	4377	0.891	high	high	4120	29103	2520	612	0.087	low	low
BIG CREEK	4450	15457	17787	3997	1.151	high	high	8643	47884	6895	798	0.144	low	moderate
JOHNSON CREEK,TRIBUTARIES	4487	19755	6693	1492	0.339	moderate	moderate	5101	37618	2206	432	0.059	low	low
MURPHY CREEK	1549	4344	3586	2315	0.826	moderate	high	3418	11846	271	79	0.023	low	low
NOBLE CREEK	na	na	na	na	na			2489	8310	536	215	0.064	low	low
ROBERTS CREEK	2031	9220	6945	3420	0.753	high	high	4005	22542	1386	346	0.061	low	low
SubTotal	**18,536**	**73,096**	**53,629**	**2,893**	**0.734**	**high**	**high**	**36,752**	**190,564**	**15,935**	**434**	**0.084**	**low**	**low**
UMPQUA														
CHARLOTTE CREEK	3323	14727	4299	1294	0.292	moderate	moderate	3565	21506	1949	547	0.091	low	low
DEAN CREEK	5898	24854	23578	3998	0.949	high	high	5770	25264	3113	540	0.123	low	moderate
FOOTLOG CREEK	8517	26586	5816	683	0.219	low	moderate	4792	17238	874	182	0.051	low	low
LUDER CREEK	1525	11073	1192	782	0.108	low	low	1260	6782	922	732	0.136	low	moderate
MILL CREEK	12664	251427	43632	3445	0.174	high	moderate	na	na	na	na	na		
MILLER CREEK	1843	1722	399	217	0.232	low	moderate	na	na	na	na	na		
SCHOLFIELD CREEK	5063	20549	15826	3126	0.770	high	high	3927	27784	686	174.7378	0.024695	low	low
SubTotal	**38,833**	**350,938**	**94,742**	**2,440**	**0.270**	**high**	**moderate**	**19,313**	**98,574**	**7,545**	**391**	**0.077**		
Total	**162,435**	**1,212,732**	**509,360**	**3,136**	**0.420**	**high**	**high**	**156,599**	**1,258,603**	**77,280**	**493**	**0.061**	**low**	**low**

Table 13. Estimates of habitat quality for coho salmon in basins of the Elliott State Forest using the HabRate model. Only stream reaches that support coho salmon, were surveyed prior to 2001, and are within state forest boundaries are included. Scores of 3 = high, 2 = moderate, 1 = poor.

REGION/STREAM	**Reach**	**Spawning & Emergence Quality**	**Summer Habitat Quality**	**Winter Habitat Quality**
COOS				
COUGAR CREEK	1	3	2	3
DEER CREEK	1	3	3	2
DEER CREEK	2	3	1	2
ELK CREEK	1	3	3	1
ELK CREEK	2	1	3	2
ELK CREEK	3	3	2	3
ELK CREEK	4	3	2	3
FISH CREEK	1	3	1	1
HIDDEN VALLEY CREEK	1	2	3	1
KELLY CREEK	1	2	1	1
KNIFE CREEK	1	3	2	3
PALOUSE CREEK	1	1	1	1
PALOUSE CREEK	2	1	2	3
PALOUSE CREEK	3	1	3	2
PALOUSE CREEK	4	1	2	3
PALOUSE CREEK	5	3	2	3
PALOUSE CREEK TRIBUTARY "A"	1	1	2	1
PALOUSE CREEK TRIBUTARY "A"	2	2	2	1
W. FK MILLICOMA R.	1	1	2	3
W. FK MILLICOMA R.	2	1	2	1
W. FK MILLICOMA R.	3	2	1	1
W. FK MILLICOMA R.	4	3	2	2
W. FK MILLICOMA R.	5	3	3	1
Average		**2.1**	**2.0**	**1.9**
TENMILE LAKES				
JOHNSON CREEK,TRIB. #1	1	1	2	1
JOHNSON CREEK,TRIB. #1	2	3	1	1
Average		**2.0**	**1.5**	**1.0**
UMPQUA				
CHARLOTTE CREEK	1	3	1	1
CHARLOTTE CREEK	2	1	1	1
CHARLOTTE CREEK	3	2	1	1
DEAN CREEK	5	1	1	1
DEAN CREEK	6	1	2	1
DEAN CREEK	7	3	3	3
MILL CREEK	1	1	1	1
MILL CREEK	2	3	1	1
MILL CREEK	3	2	1	2
MILL CREEK	4	3	2	1
MILL CREEK	5	1	1	1
MILLER CREEK	1	2	1	1
SCHOLFIELD CREEK	3	1	1	1
SCHOLFIELD CREEK	4	3	1	2
Average		**1.9**	**1.3**	**1.3**

Table 14. Barriers and associated features (as identified by Streamnet) within the Umpqua, Coos, and Tenmile regions.

Stream LLID	Stream name	Record id	Barrier type	Passage*	Adult passage**	Comments
1238683436420	Footlog Creek	2637	culvert	2	coho, steelhead above	Gradient varies; water velocity is high. Passable when backfilled.
1241075437117	Schofield Creek	53609	falls	99	coho, steelhead above	
1240096436091	Big Creek Tributary	52461	falls	99	ends at or below	
1240382436077	Alder Fork Big Creek	52460	falls	99	coho end, steelhead above	
1238764436554	Mill Creek	53624	cascade/gradient/velocity	99	ends at or below	
1240627435871	Alder Creek Tributary	2381	culvert	99	fish use not mapped	Small creek, fenced.
1239320435826	Elk Creek	56048	falls	99	coho, steelhead above	
1239320435826	Elk Creek	51130	falls	99	coho, steelhead above	Information confirmed by RefID 51824.
1240562435505	Roberts Creek Tributary	2383	culvert	1	fish use not mapped	Culvert slope creates high velocity barrier to fish passage which could be alleviated by removal of tidegate and subsequent backfilling. Marshy habitat above.
1240763435275	Hatchery Creek	56031	falls	99	fish use not mapped	Not a passage barrier--falls is on Hatchery Creek.
1241899434658	Palouse Creek	51133	falls	99	ends at or below	Information confirmed by RefID 51824.
1240300434241	WF Millicoma	52442	falls	99	coho, steelhead above	Falls reported as 'laddered and passable'.
1239831435073	WF Millicoma Tributary	52438	falls	99	fish use not mapped	Probably passable at high flows.
1240300434241	WF Millicoma	52441	falls	99	end chinook use	Falls are reported as passable.
1240300434241	WF Millicoma	56052	hatchery facility structure	99	all fish above	hatchery release point (coho)

*Passage 1=complete 2=partial 4=nonblocking 99=unknown

**Migratory fish passage (coho, fall Chinook, winter steelhead) as mapped by Streamnet

Table 15. OWEB-funded instream restoration projects on ODF land in the Umpqua, Coos and Tenmile regions, highlighting some actions and goals and the species benefitting from the restoration project.

					Targeted Species			
Basin	Stream name	Year	Project description	Project goals	coho	steelhead	chinook	cutthroat
Coos	Fish Cr, trib of	2001	1 culvert replaced		x	x		x
Coos	Hidden Cr	2001	1 culvert replaced		x	x		x
Coos	Old Mill Pond Cr	1997	1 culvert replaced		x	x		x
Coos	Palouse Cr, trib of	1998	1 culvert replaced		x	x		x
Coos	Cougar Cr, trib of	1999	1 culvert replaced and weir installed below outlet		x	x		x
Coos	Crane Cr	1999	1 culvert replaced and weir installed below outlet		x	x		x
Coos	Elk Cr, trib of	1999	1 culvert replaced and weir installed below outlet		x	x		x
Coos	Y Cr	1999	1 culvert replaced and weir installed below outlet		x	x		x
Coos	Elk Cr	2000	1 culvert replaced, 1 culvert with weirs installed below outlet		x	x		x
Coos	Elk Cr, trib of	2000	1 culvert replaced, 1 culvert with weirs installed below outlet		x	x		x
Coos	Skunk Cr	2000	1 culvert replaced, 1 culvert with with weirs installed below outlet		x	x		x
Coos	Marlow Cr, U tribs of	1997	1 culvert with rock weirs installed below the outlet		x	x		x
Coos	Elk Cr	2000	1 diversion modified		x	x		x
Coos	Palouse Cr, tribs of	2002	2 culverts removed and not replaced		x	x		x
Coos	Marlow Cr	1998	reconnected historic creek oxbow w/2 new culverts adding 600' of stream habitat		x	x	x	x
Coos	Deer Cr	1999	anchored structures, deflectors boulder placement	improve stream complexity improve gravel recruitment improve floodplain interaction	x	x		x
Coos	West Fork Millicoma R	1999	anchored structures, deflectors V structure, boulder placement	improve stream complexity improve gravel recruitment improve floodplain interaction	x	x		x
Coos	Elk Cr	1999	boulder placement	improve stream complexity improve floodplain interaction	x	x		x
Coos	Palouse Cr	1996	off-channel ponds (3 ponds each 350 cu yds) riparian planting & fencing	improve rearing habitat improve overwintering habitat improve refuge/cover	x			
Coos	Y Cr	1997	repair of existing rock weirs	improve fish passage	x	x		
Coos	Palouse Cr, trib of	1998	rootwad placement	improve overwintering habitat improve overwintering habitat	x	x		x
Coos	Marlow Cr	1999	weirs	improve fish passage	x	x	x	x
Coos	West Fork Millicoma R	2002	weirs	improve stream complexity improve spawning habitat	x	x	x	
Coos	Cougar Cr	1997	instream large wood placement	improve overwintering habitat	x	x		x
Coos	Elk Cr	1998	instream large wood placement	improve overwintering habitat improve stream complexity improve gravel recruitment	x	x		x
Coos	Fish Cr	1997	instream large wood placement	improve overwintering habitat improve stream complexity	x	x		x
Coos	Fish Cr	1998	instream large wood placement	improve stream complexity improve overwintering habitat improve floodplain interaction	x	x		x
Coos	Fish Cr	2001	instream large wood placement	improve stream complexity improve floodplain interaction improve gravel recruitment improve spawning habitat improve rearing habitat improve pool habitat improve overwintering habitat improve summer habitat improve fish passage	x	x		x
Coos	Hidden Cr	2001	instream large wood placement	improve stream complexity improve floodplain interaction improve gravel recruitment improve spawning habitat improve rearing habitat improve pool habitat improve overwintering habitat improve summer habitat improve fish passage	x	x		x
Coos	Kelly Cr	1998	instream large wood placement	improve stream complexity improve overwintering habitat improve rearing habitat	x	x		x

Coos	Kelly Cr	1999	instream large wood placement	improve stream complexity improve overwintering habitat	x	x		x
Coos	Knife Cr	2002	instream large wood placement	improve stream complexity improve floodplain interaction improve gravel recruitment improve spawning habitat improve rearing habitat improve pool habitat improve overwintering habitat improve summer habitat	x	x		x
Coos	Panther Cr	1998	instream large wood placement	improve stream complexity improve overwintering habitat improve floodplain interaction	x	x		x
Coos	West Fork Millicoma R	1998	instream large wood placement	improve stream complexity improve overwintering habitat improve floodplain interaction improve rearing habitat	x	x		x
Coos	Cougar Cr	1998	instream large wood placement 1 culvert replaced	improve overwintering habitat improve fish passage improve stream complexity	x	x		x
Coos	Cougar Cr	1999	instream large wood placement natural boulder placement boulder deflector	improve stream complexity improve floodplain interaction improve gravel recruitment	x	x		x
Coos	Palouse Cr	1997	instream large wood placement rootwad placement	improve overwintering habitat improve stream complexity	x	x		x
Coos	West Fork Millicoma R	1999	instream large wood placement weirs, deflectors	improve gravel recruitment improve spawning habitat	x	x		x
Coos	West Fork Millicoma R	2003	instream large wood placement riparian tree planting	improve stream complexity improve floodplain interaction improve gravel recruitment improve spawning habitat improve rearing habitat improve pool habitat improve overwintering habitat improve summer habitat future lwd recruitment future shading streambank stabilzation erosion control	x	x		x
Coos	Knife Cr	1998	instream large wood placement road survey	improve overwintering habitat improve stream complexity improve gravel recruitment	x	x		x
Coos	Deer Cr	1998	instream large wood placement road survey, road vacated peak flow passage improvements	improve overwintering habitat improve stream complexity road drainage upslope stability	x	x		x
Coos	Deer Cr	2000	instream large wood placement Voluntary Riparian Tree Retention surface drainage improvements	improve stream complexity improve floodplain interaction improve overwintering habitat improve pool habitat	x	x		x
Coos	Otter Cr	2000	instream large wood placement Voluntary Riparian Tree Retention surface drainage improvements	improve stream complexity improve overwintering habitat improve pool habitat improve gravel recruitment improve spawning habitat	x	x		x
Coos	Joes Cr and trib	2000	instream large wood placement Voluntary Riparian Tree Retention surface drainage improvements road closure	improve overwintering habitat improve pool habitat improve gravel recruitment improve spawning habitat improve stream complexity	x	x		x
Coos	Elk Cr	1997	peak flow passage improvements	erosion control				
Coos	Elk Cr, trib of	1997	peak flow passage improvements	upslope drainage				
Coos	Elk Cr, trib of	1997	peak flow passage improvements	erosion control				
Coos	Elk Cr, trib of	1997	peak flow passage improvements	erosion control				
Coos	West Fork Millicoma R, trib of	1997	peak flow passage improvements	upslope drainage				
Coos	West Fork Millicoma R, trib of	1997	peak flow passage improvements	fish passage				x
Coos	Elk Cr	1998	road closure; 2 culverts removed		x	x		x
Coos	WF Millicoma & Shake Cr	2002	surface drainage improvements road seeding 3 low water crossings improved voluntary riparian tree retention	future lwd recruitment future shading erosion control upslope drainage	x	x		x
Coos, Tenmile La	several	1998	peak flow passage improvements surface drainage improvements	erosion control				
Tenmile Lakes	House Gulch Cr	2000	1 culvert replaced with bridge		x	x		x
Tenmile Lakes	Big Cr	1996	hardwood conversion upland erosion control	streambank stabilzation future lwd recruitment	x	x		

			road survey	future shading				
Tenmile Lakes	Big Cr	1996	off-channel habitat riparian tree planting riparian fencing	decrease stream temperature future lwd recruitment future shading	x	x		
Tenmile Lakes	Big Cr	2001	riparian tree planting	future lwd recruitment future shading streambank stabilzation	x	x		x
Tenmile Lakes	Johnson Cr	2000	riparian tree planting	future lwd recruitment future shading	x	x		x
Tenmile Lakes	Johnson Cr	2001	riparian tree planting	future lwd recruitment future shading	x	x		x
Umpqua	Charlotte Cr	2000	instream large wood placement	improve stream complexity improve floodplain interaction improve gravel recruitment improve spawning habitat improve rearing habitat improve pool habitat improve overwintering habitat improve summer habitat	x	x		x
Umpqua	Miller Cr	1999	instream large wood placement	improve stream complexity improve floodplain interaction improve gravel recruitment improve spawning habitat improve rearing habitat improve pool habitat improve overwintering habitat improve summer habitat	x	x	x	x

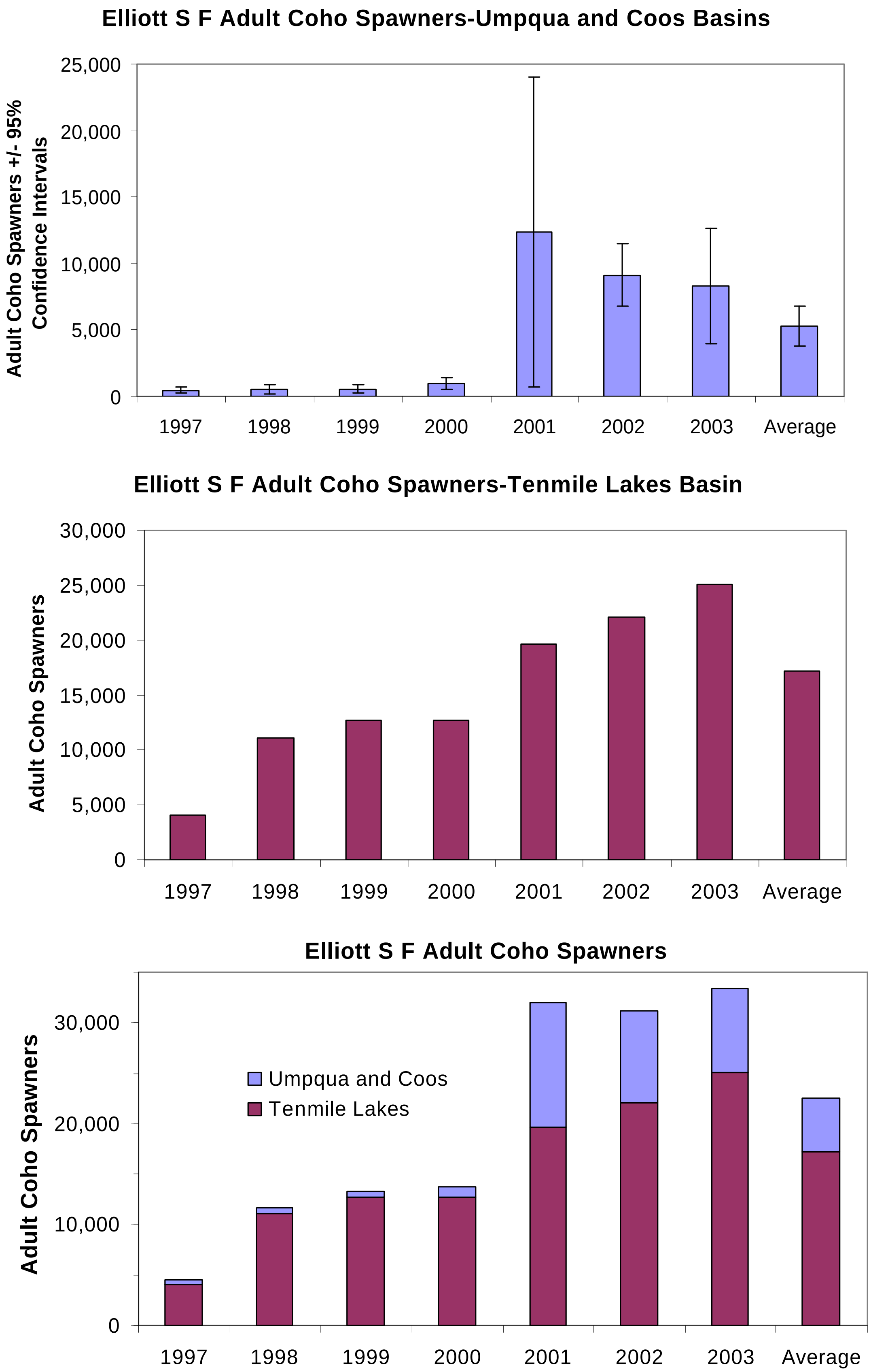
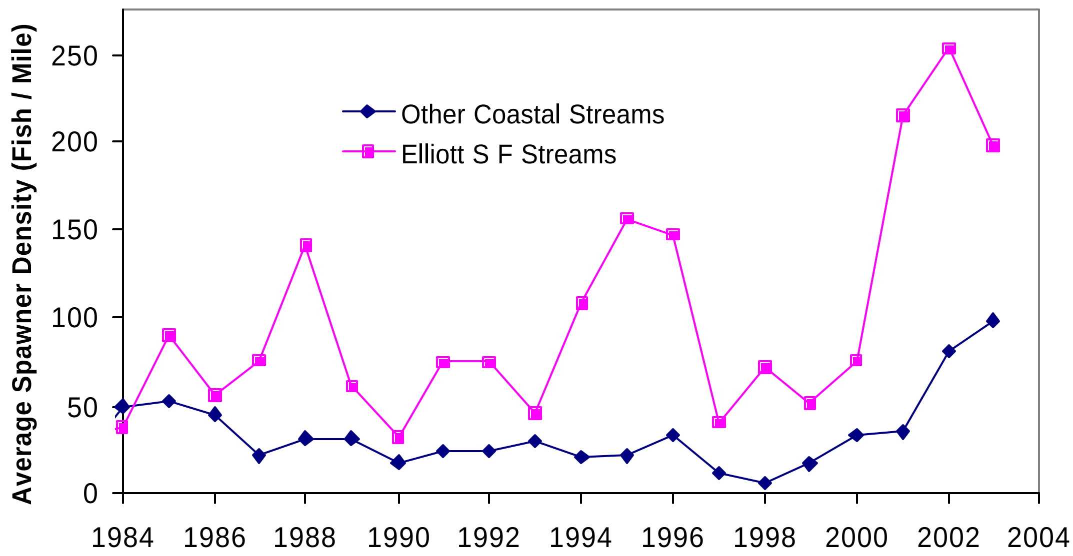


Figure 1. Adult Coho salmon spawner abundance estimates for streams originating within the Elliott State Forest project area. Estimates of precision are not available for the Tenmile Lakes component. Note that the maximum y-axis value differs between the three figures.



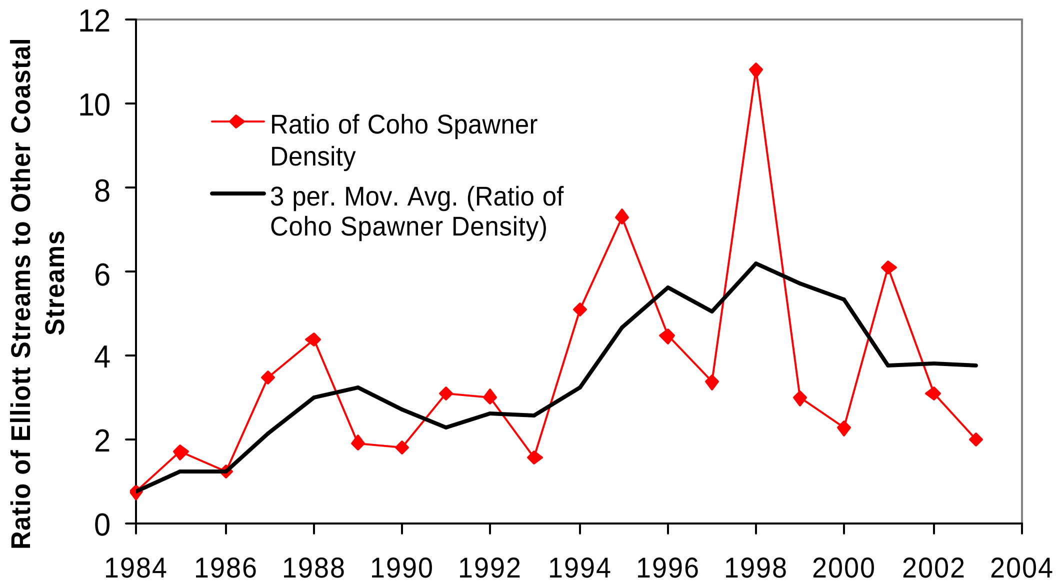
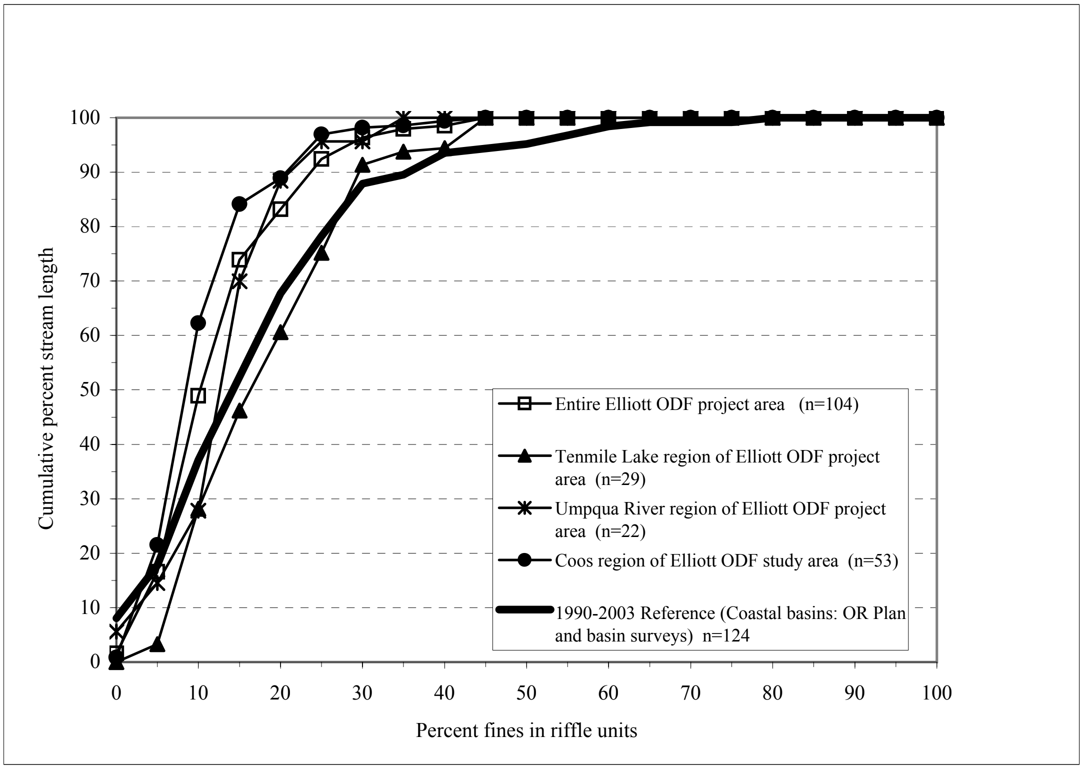


Figure 2. Twenty-year trends of Coho salmon spawner abundance in streams originating in the Elliott State Forest and streams in other portions of the Oregon coast range. Data are from standard index sites.

ODF ELLIOTT STATE FOREST PROJECT AREA



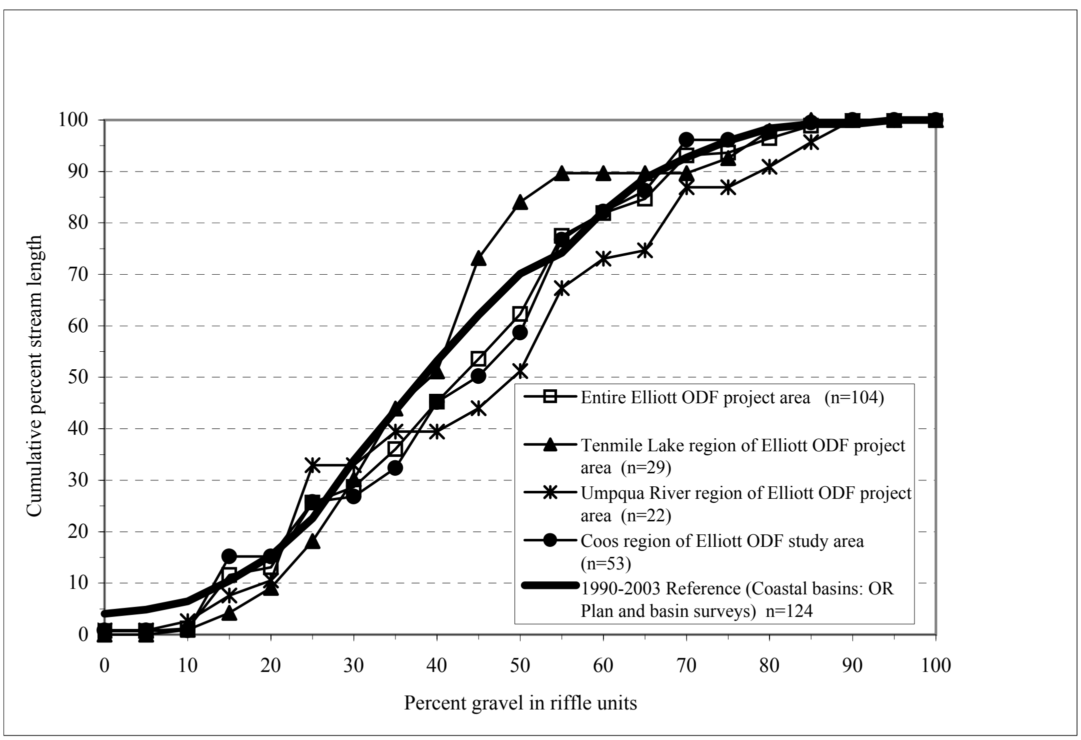
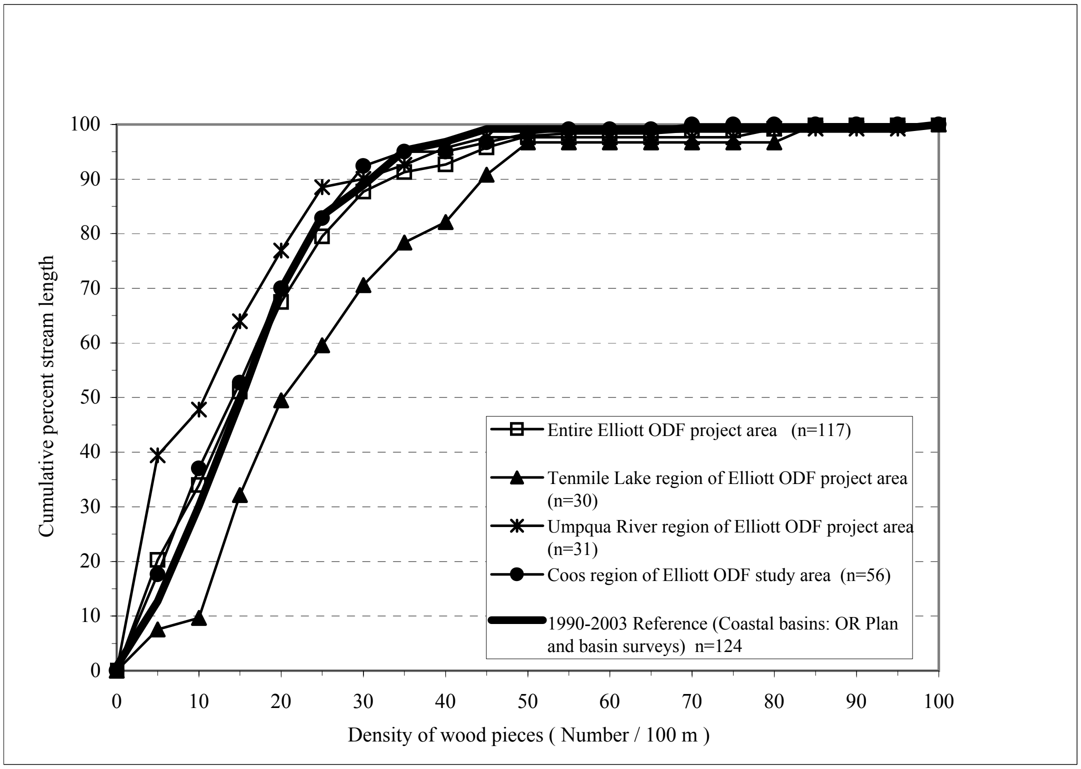


Figure 3. Cumulative frequency distribution comparing fines and gravel to reference conditions within the ODF Elliott project area.

ODF ELLIOTT STATE FOREST PROJECT AREA



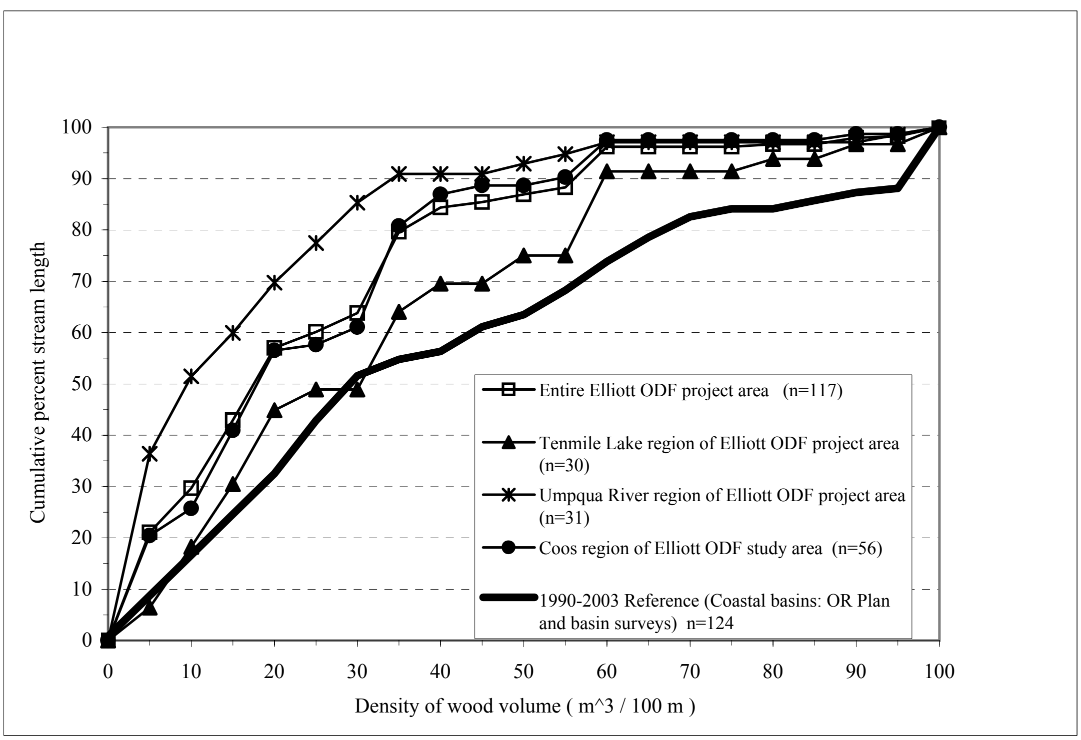
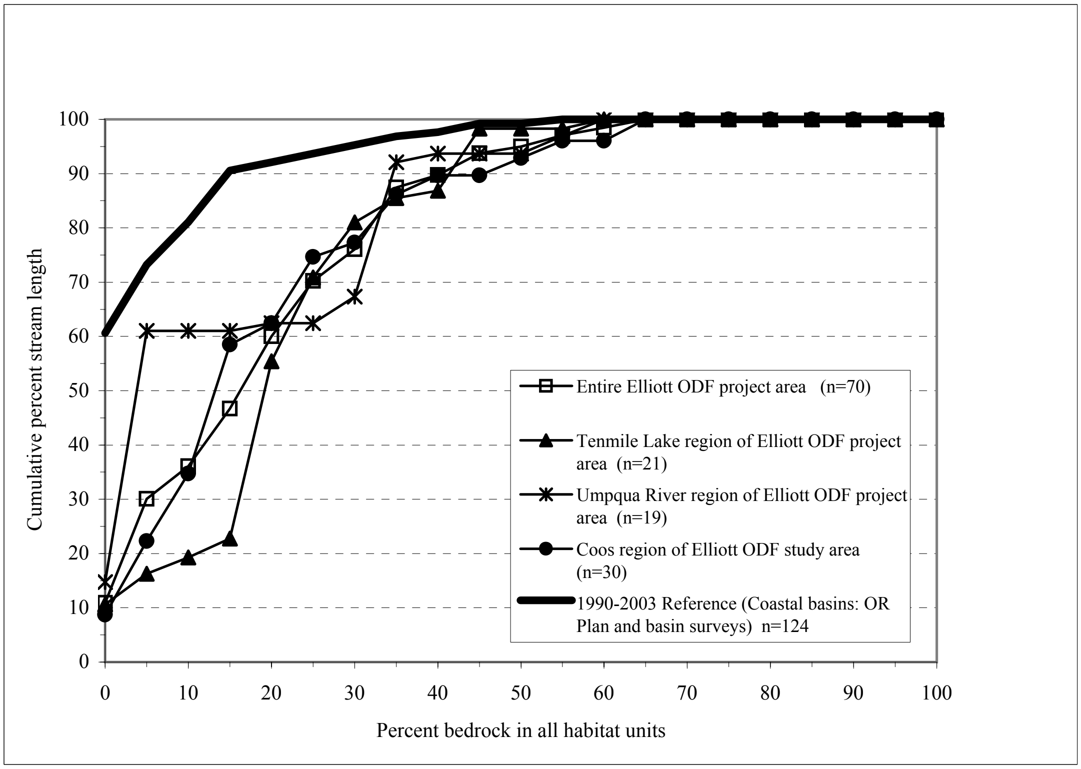


Figure 4. Cumulative frequency distribution comparing wood volume and pieces to reference conditions within the ODF Elliott project area.

ODF ELLIOTT STATE FOREST PROJECT AREA



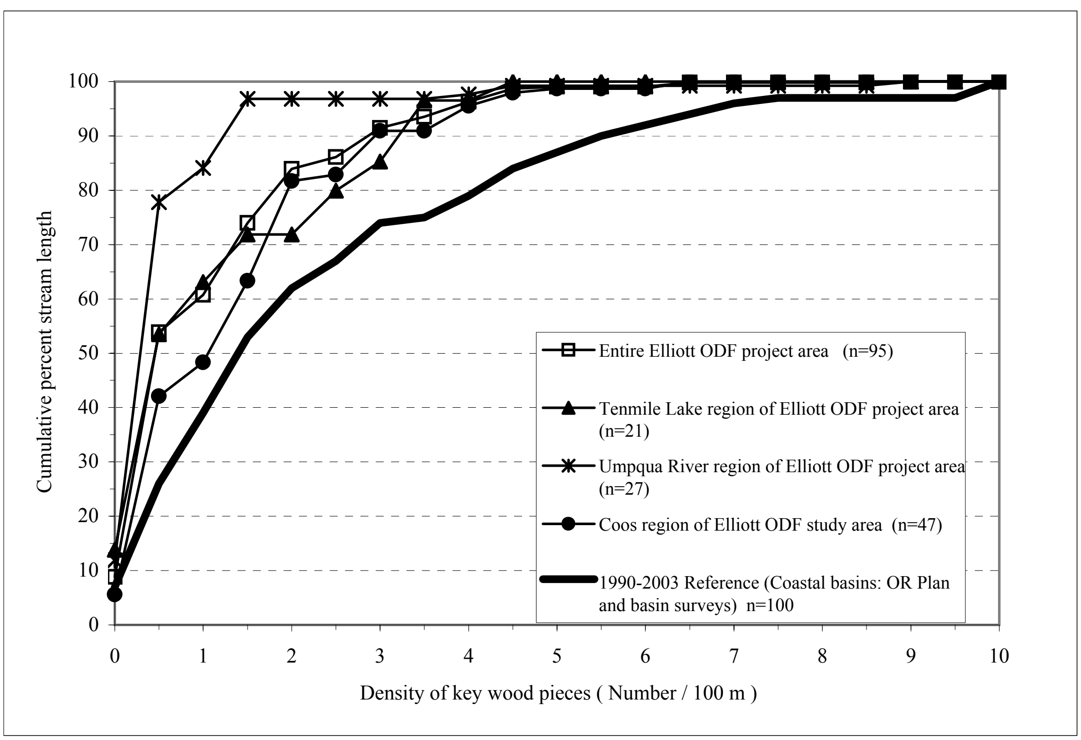
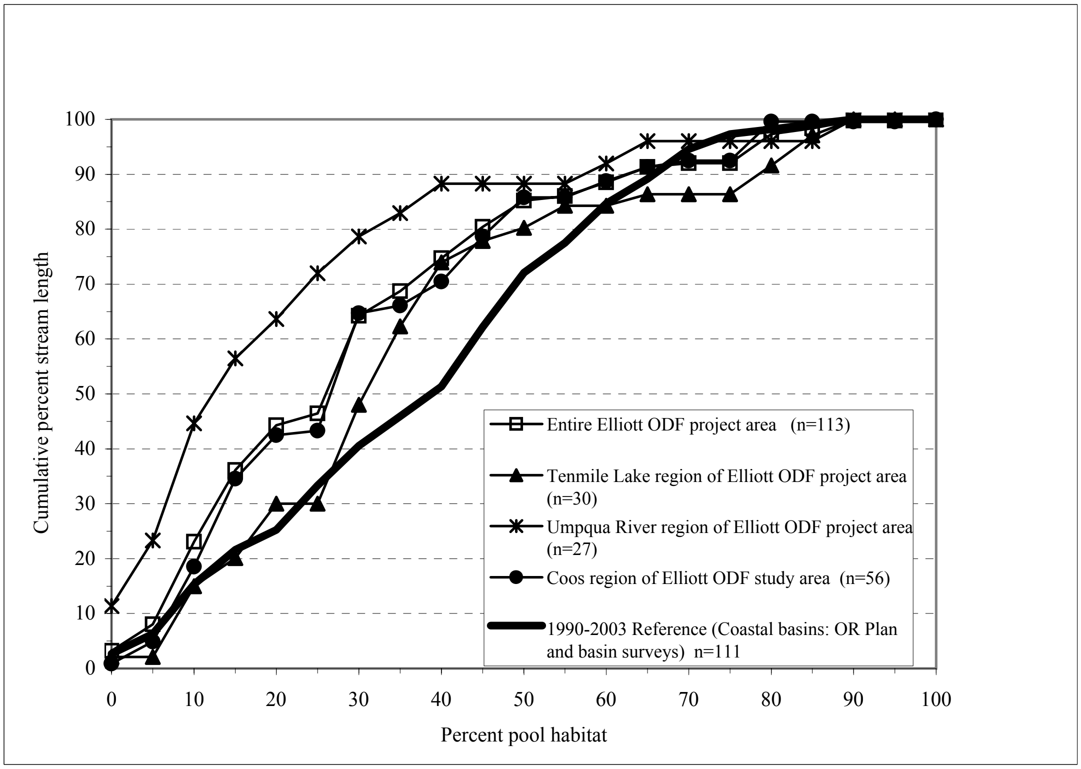


Figure 5. Cumulative frequency distribution comparing LWD keypieces and bedrock to reference conditions within the ODF Elliott project area.

ODF ELLIOTT STATE FOREST PROJECT AREA



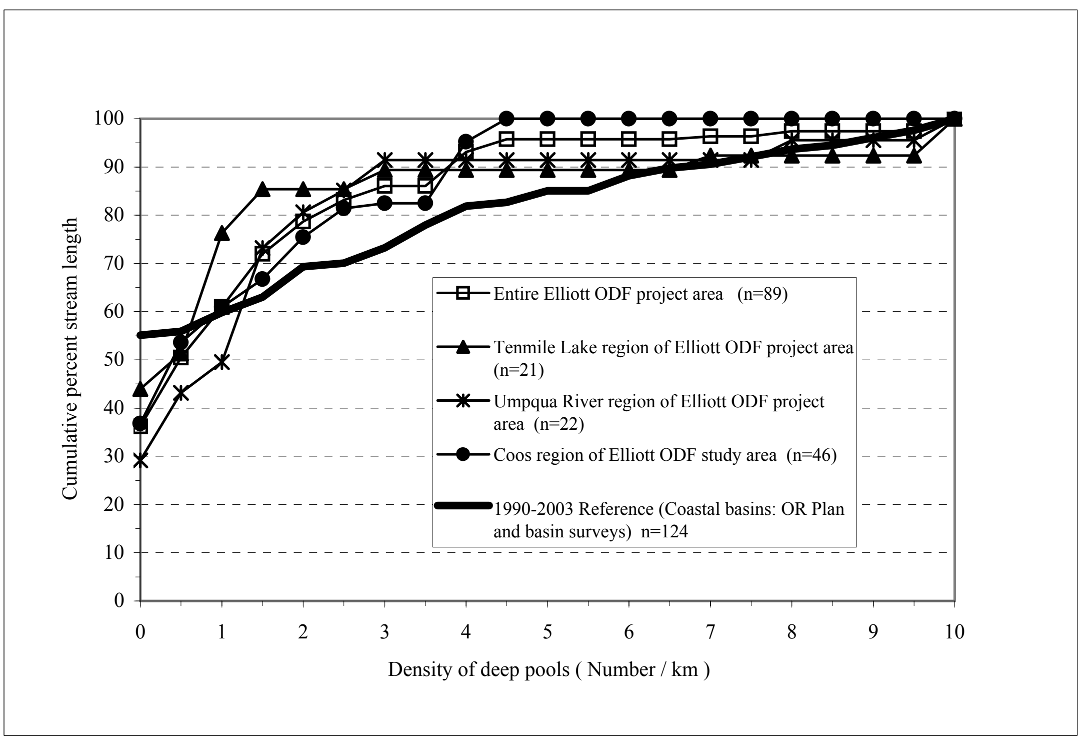
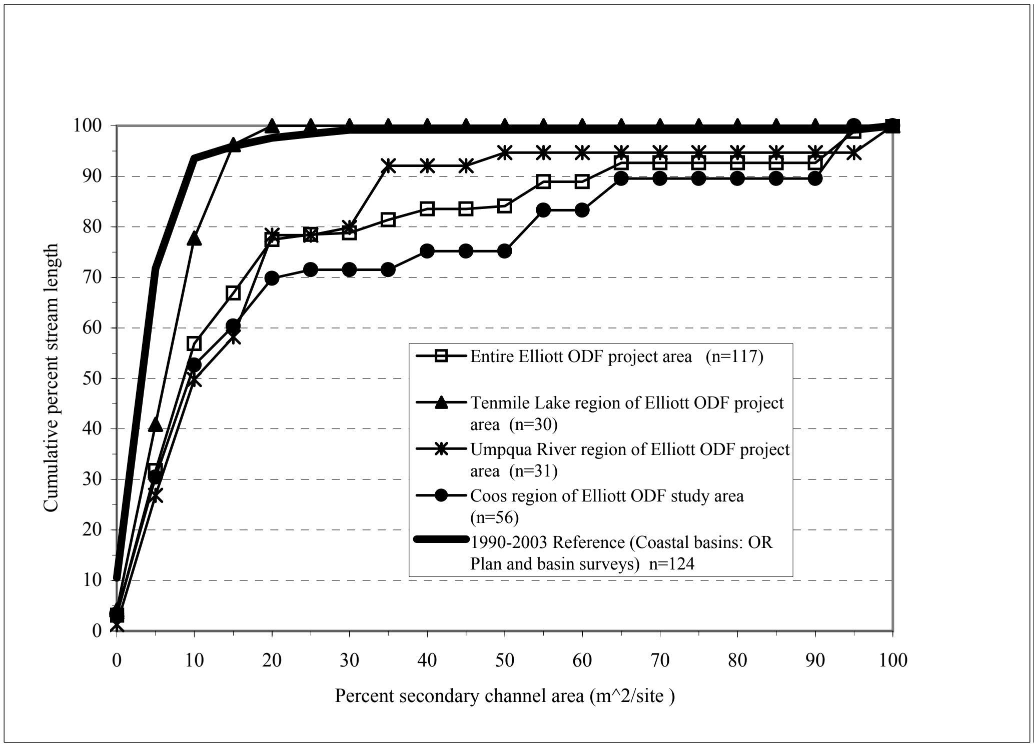


Figure 6. Cumulative frequency distribution comparing pools to reference conditions within the ODF Elliott project area.

ODF ELLIOTT STATE FOREST PROJECT AREA



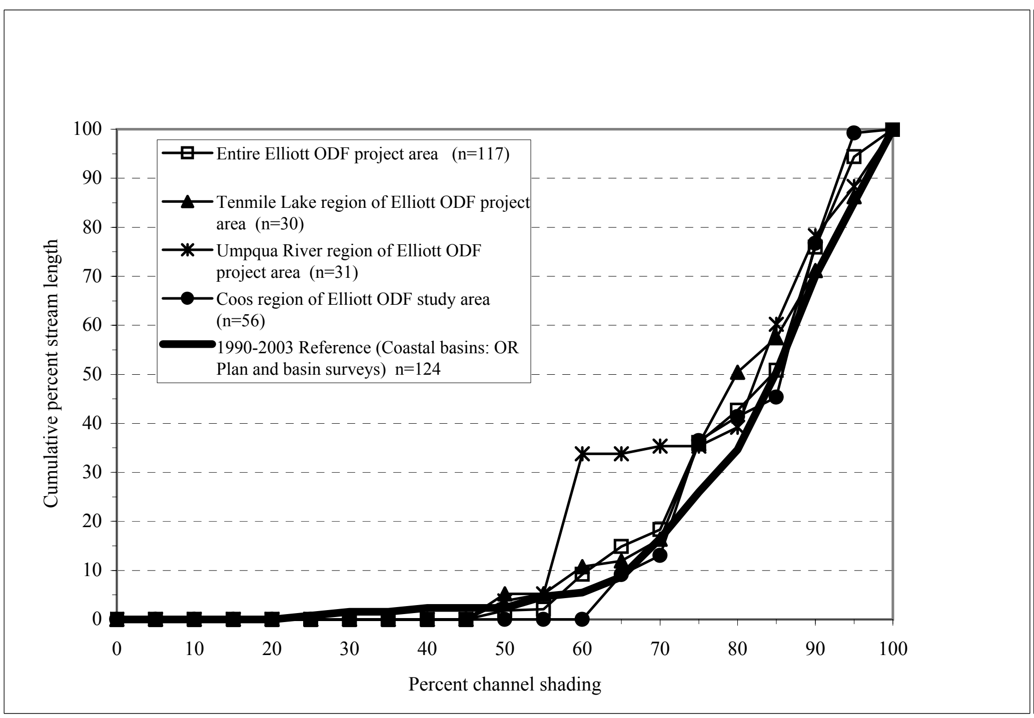
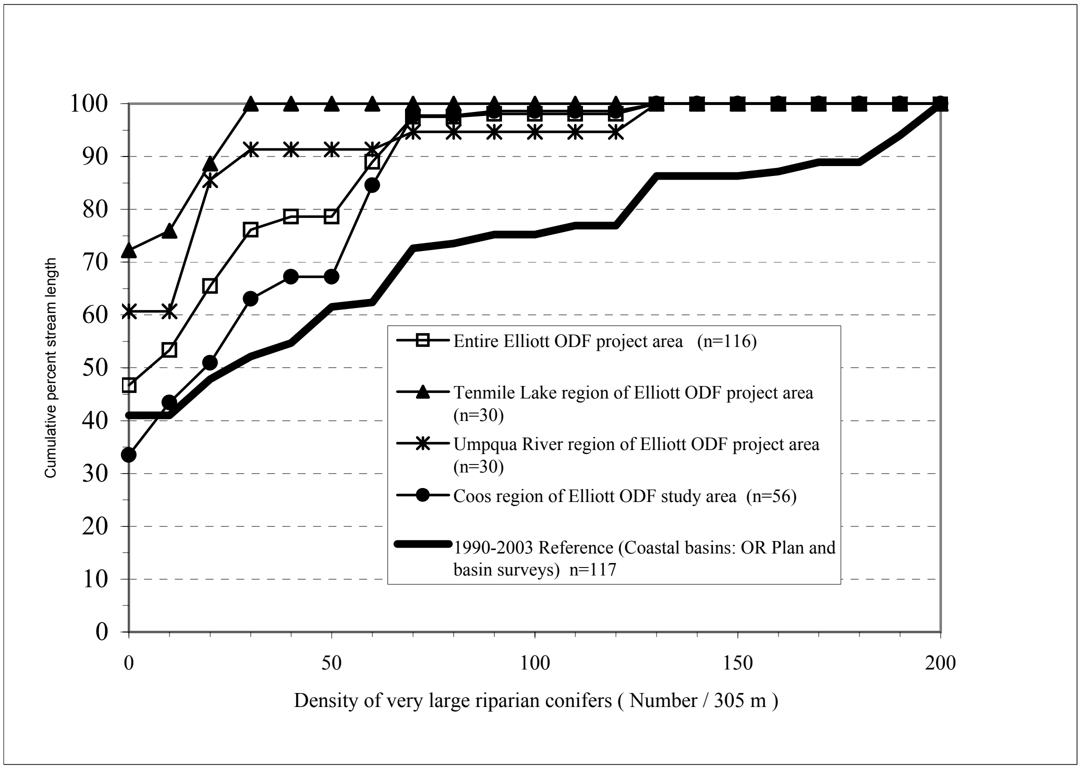


Figure 7. Cumulative frequency distribution comparing secondary channel and shade to reference conditions within the ODF Elliott project area.

ODF ELLIOTT STATE FOREST PROJECT AREA



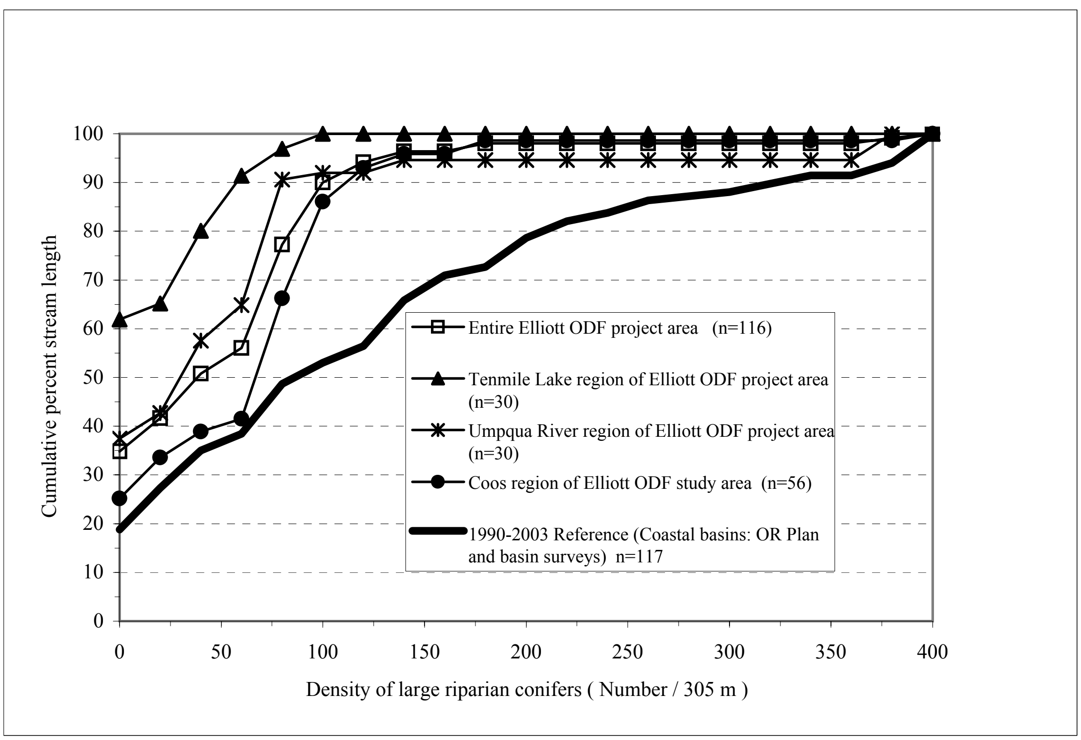
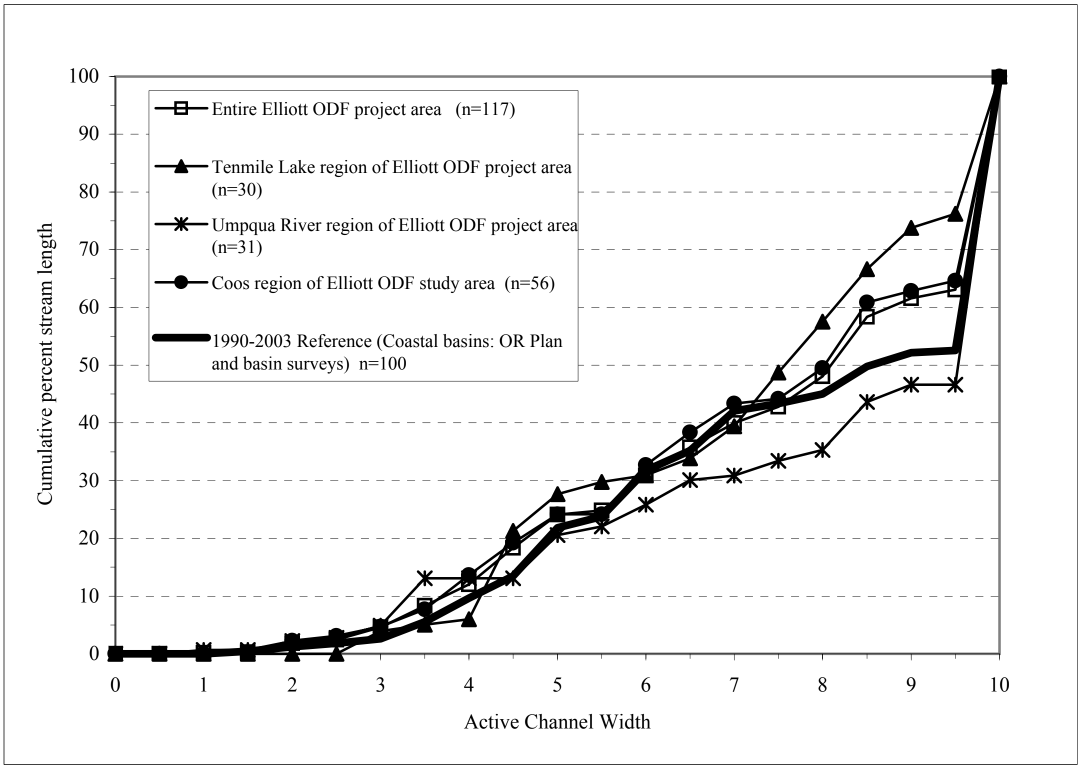


Figure 8. Cumulative frequency distribution comparing riparian conifers to reference conditions within the ODF Elliott project area.

ODF ELLIOTT STATE FOREST PROJECT AREA



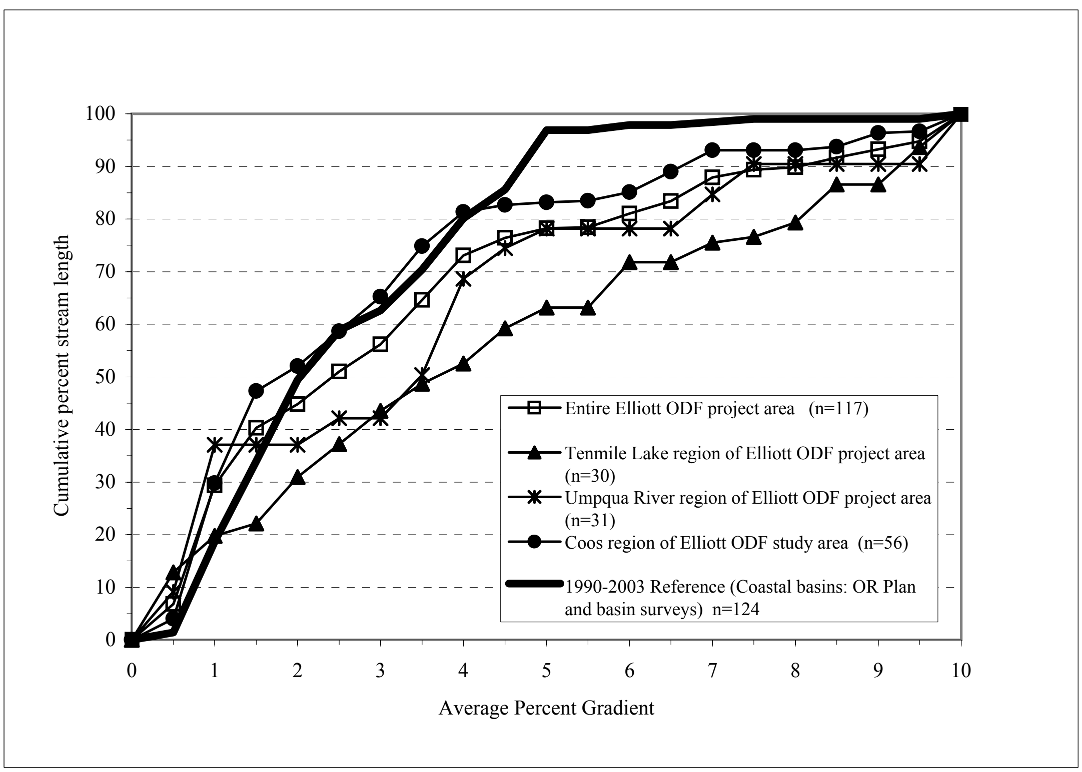


Figure 9. Cumulative frequency distribution comparing gradient and active channel width to reference conditions within the ODF Elliott project area.

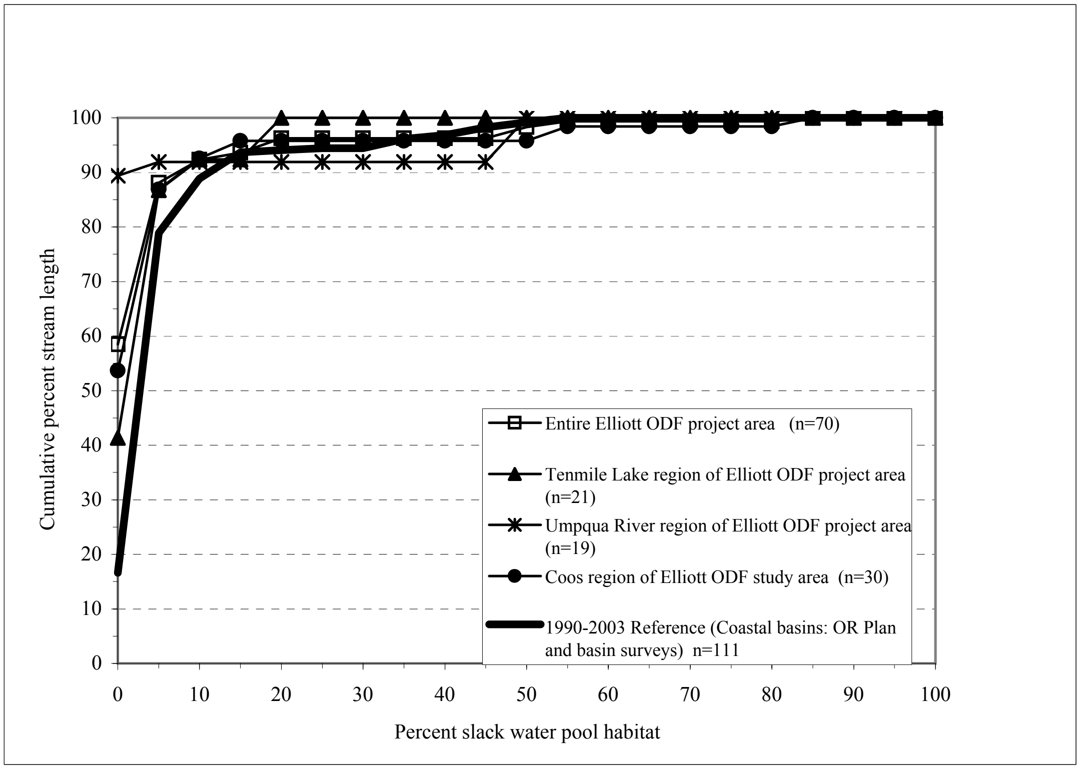
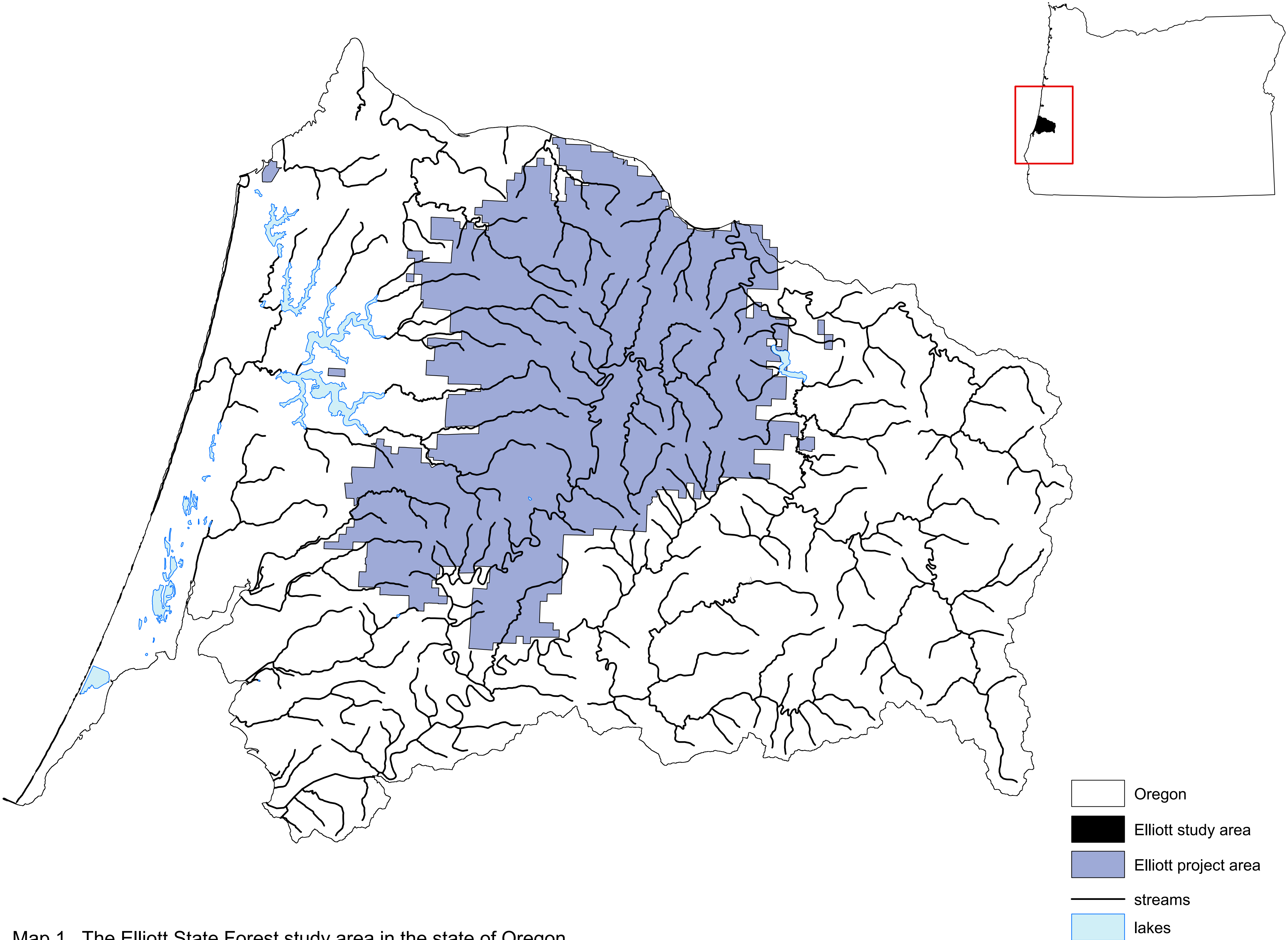
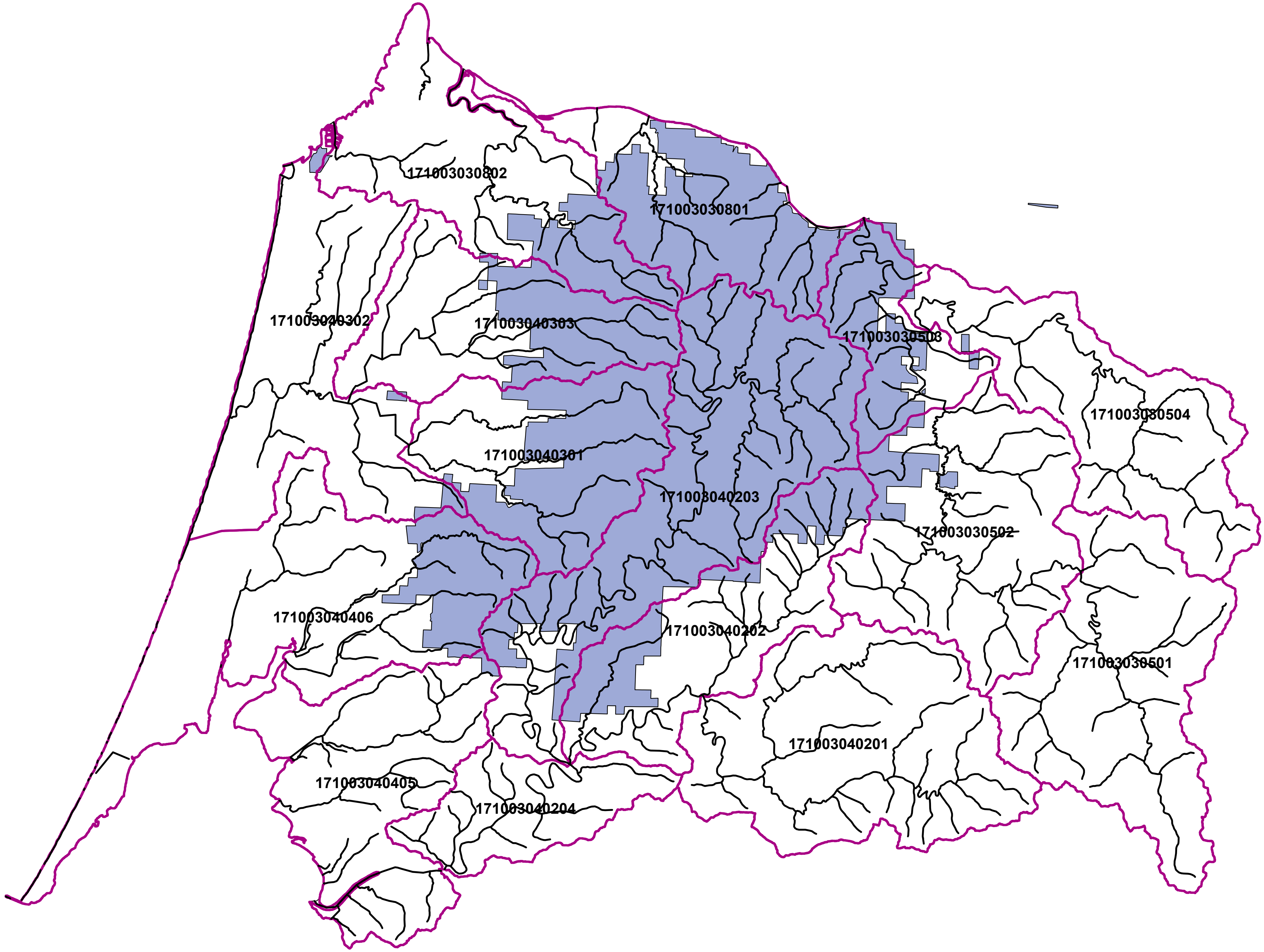


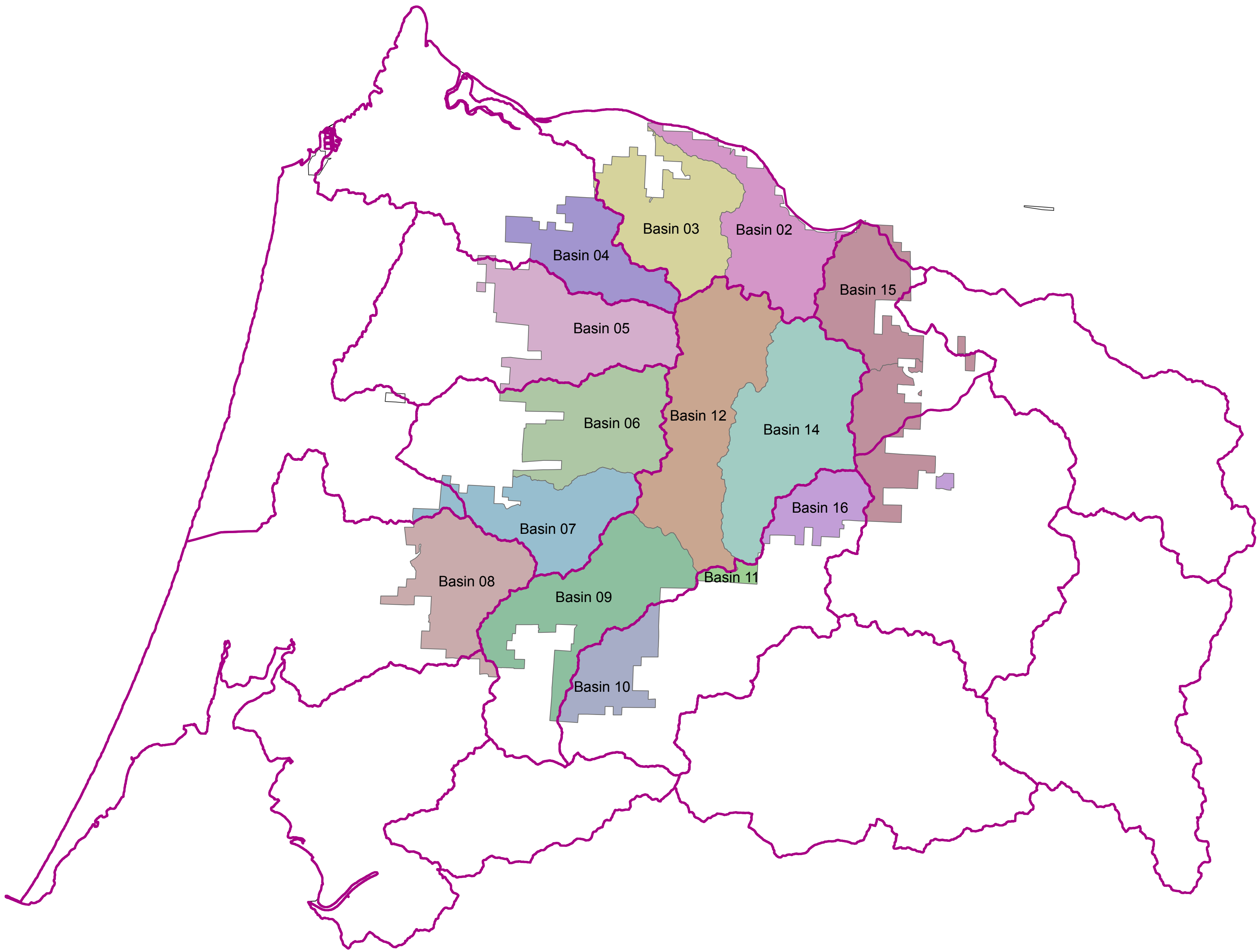
Figure 10. Cumulative frequency distribution comparing slackwater habitat to reference conditions within the ODF Elliott project area.



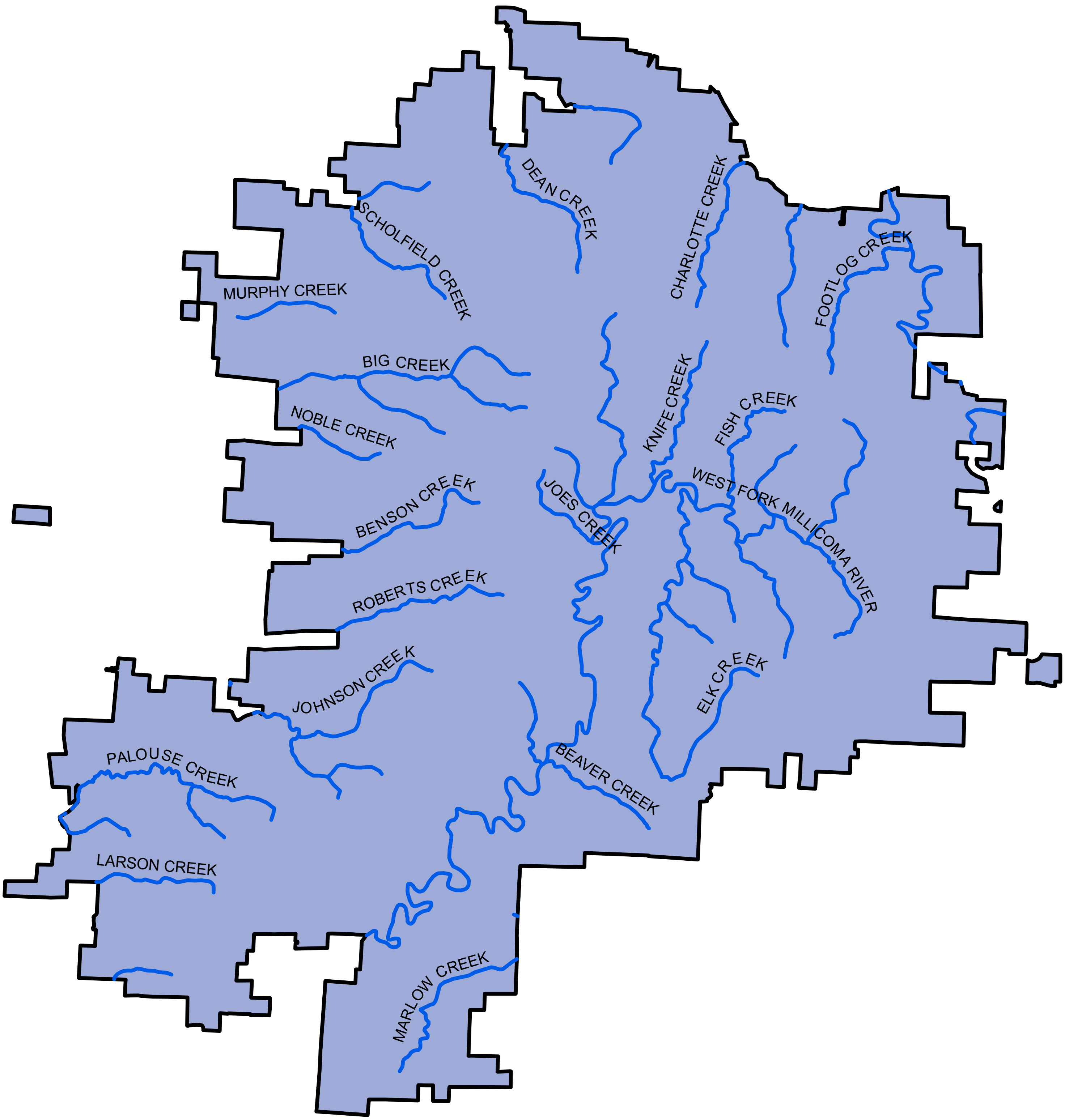
Map 1. The Elliott State Forest study area in the state of Oregon.



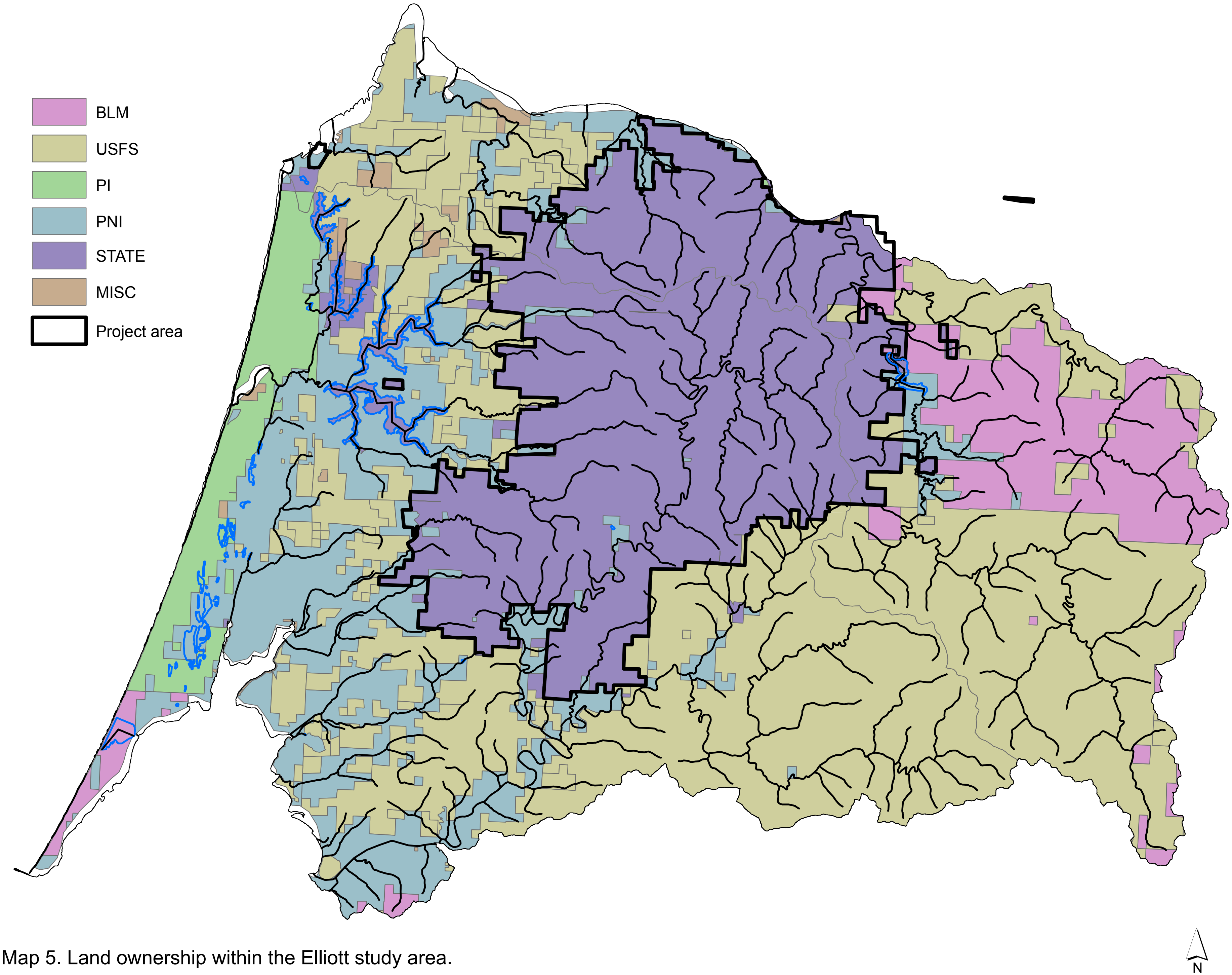
Map 2. Elliott study area sixth field HU identified and outlined in magenta.



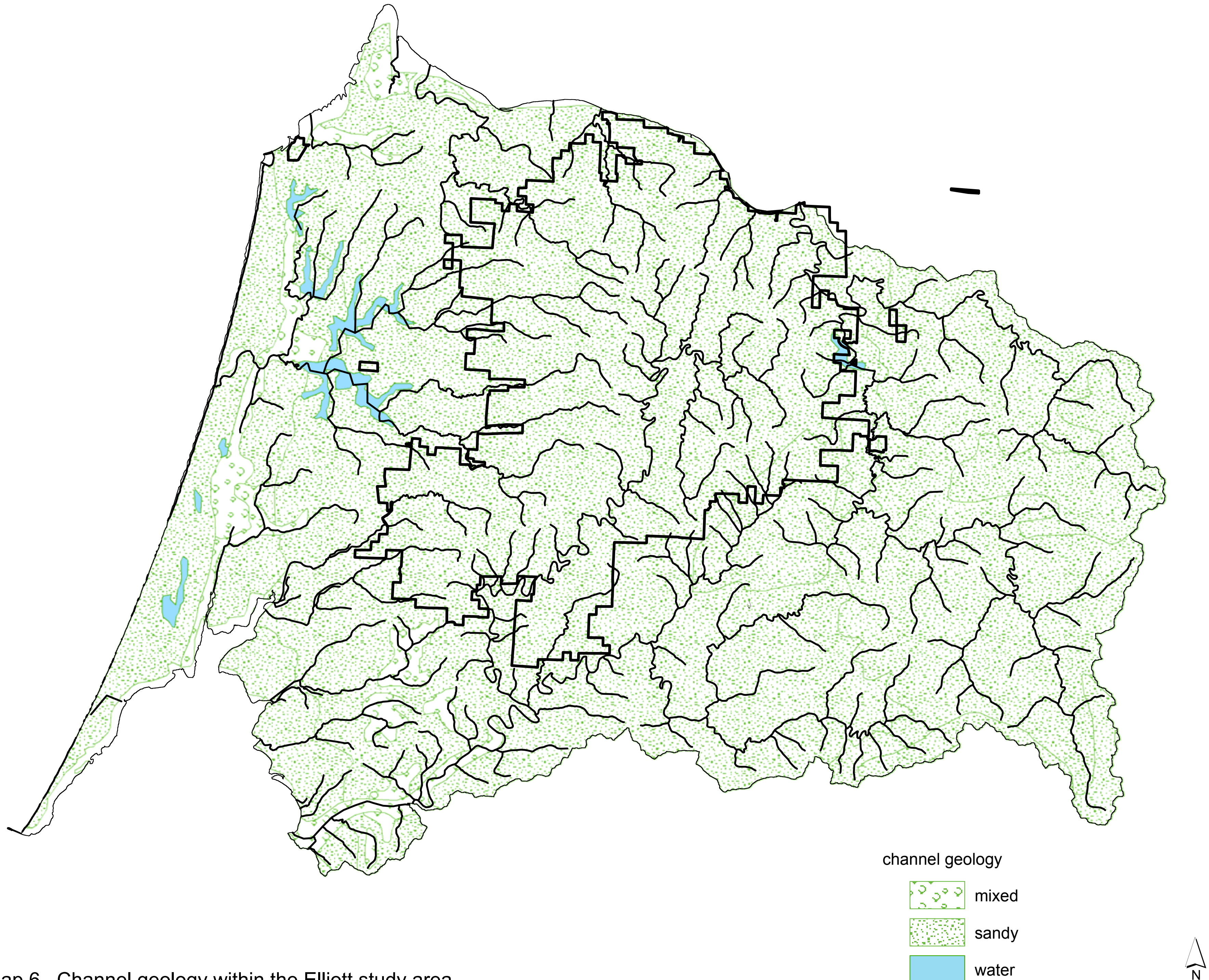
Map 3. Elliott study area with Oregon Department of Forestry management basins displayed as colored polygons and CLAMS sixth field HU outlined in magenta.



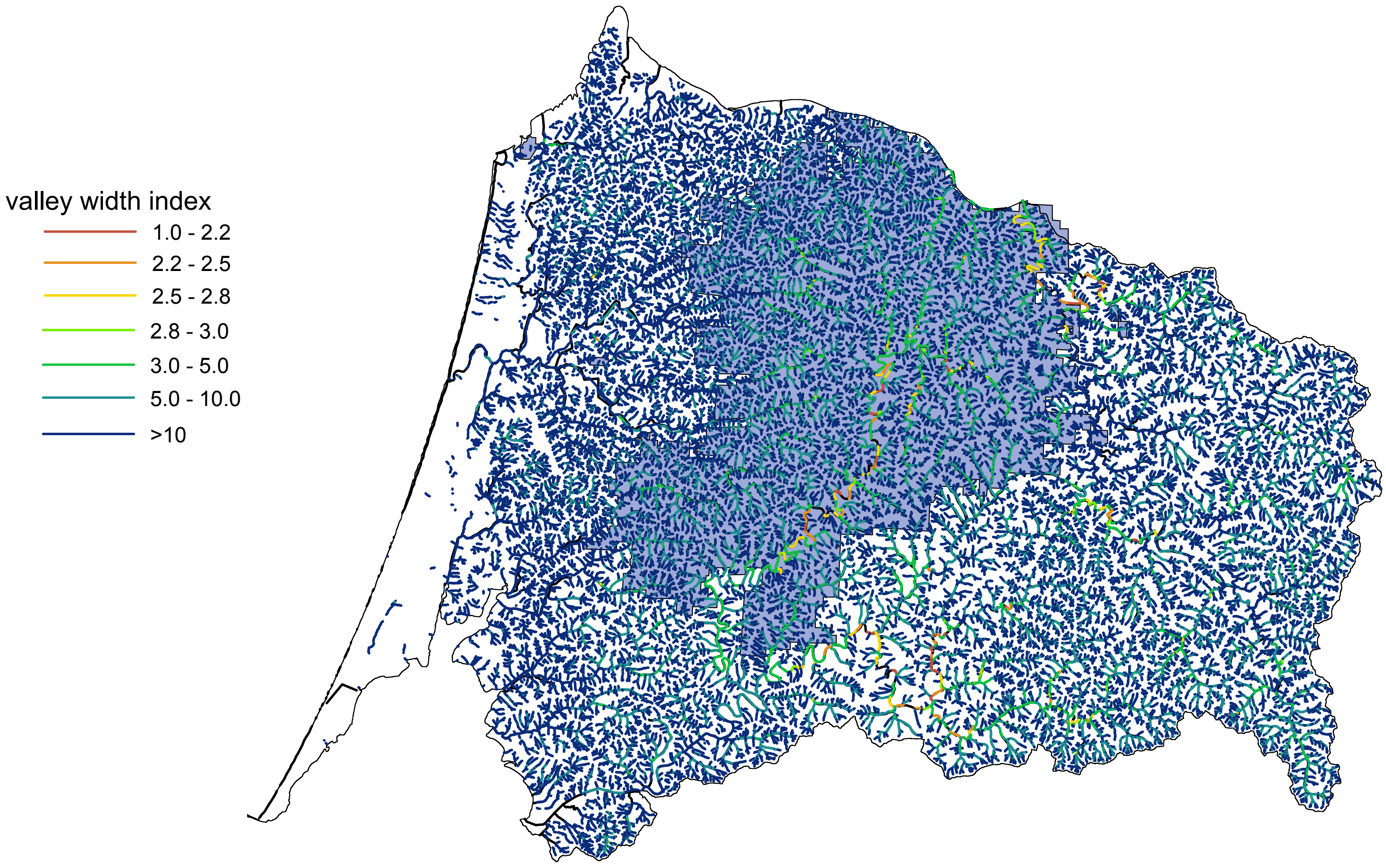
Map 4. Habitat survey sites identified by stream name within the Elliott project area.

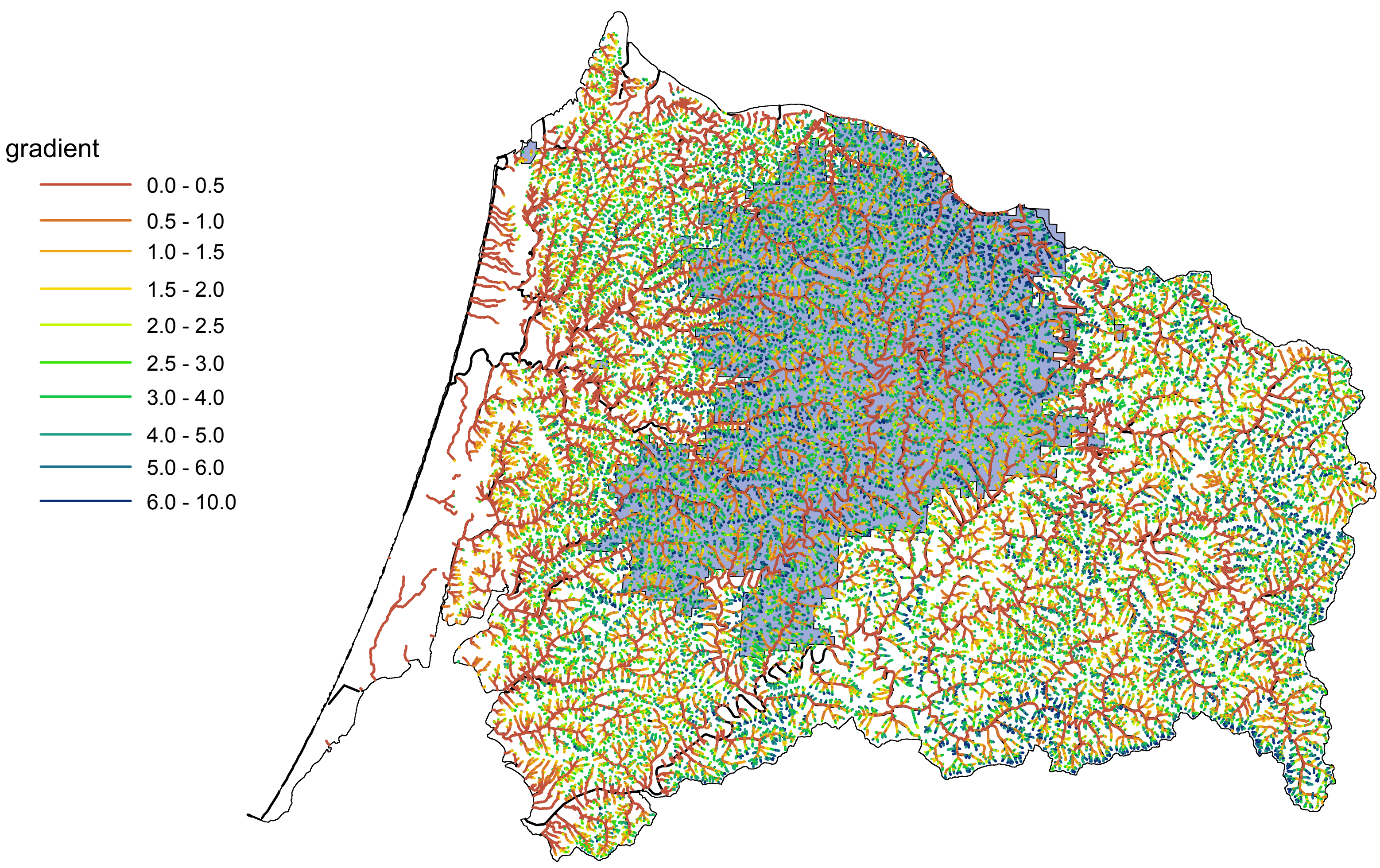


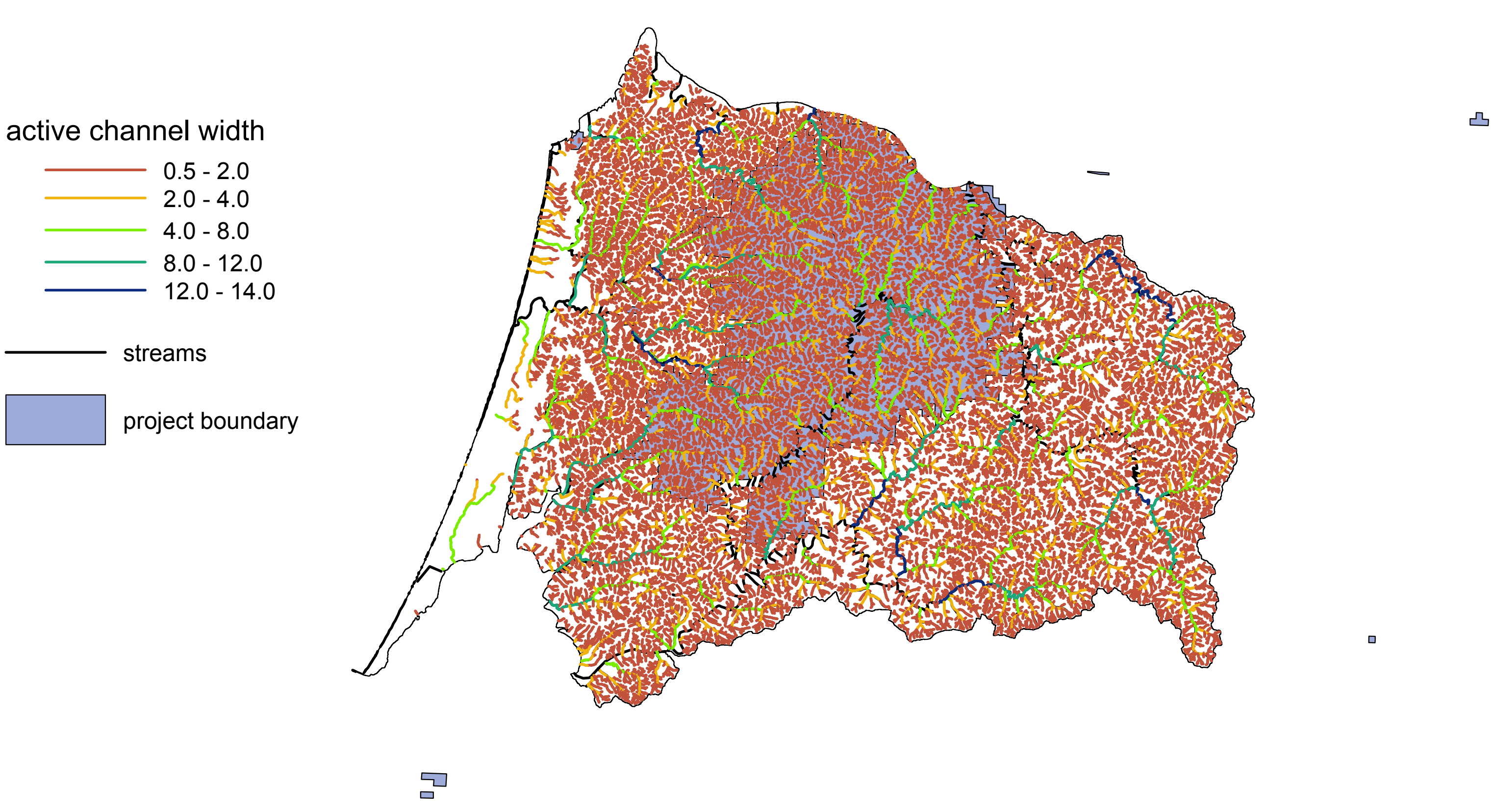
Map 5. Land ownership within the Elliott study area.



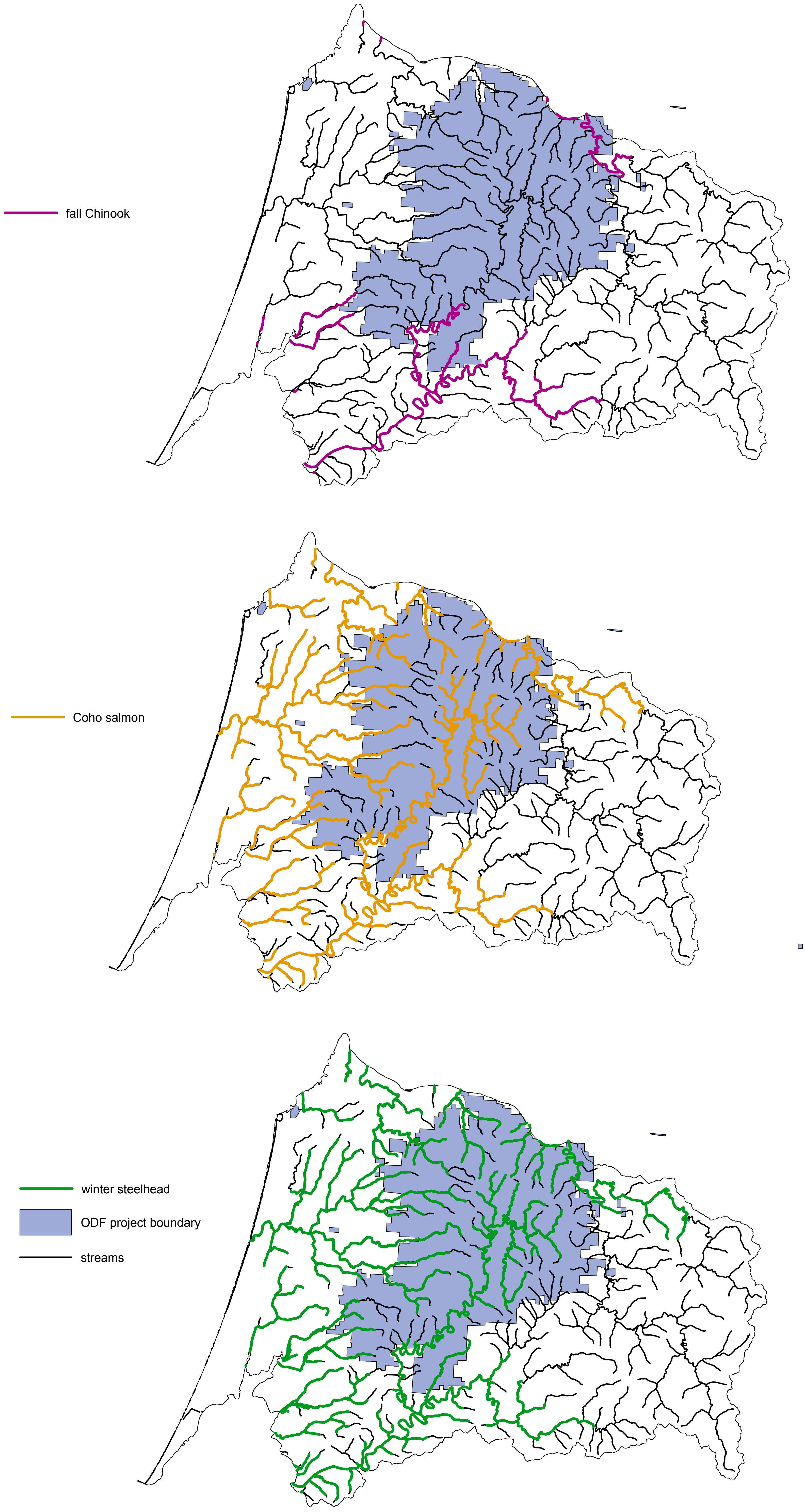
Map 6. Channel geology within the Elliott study area.





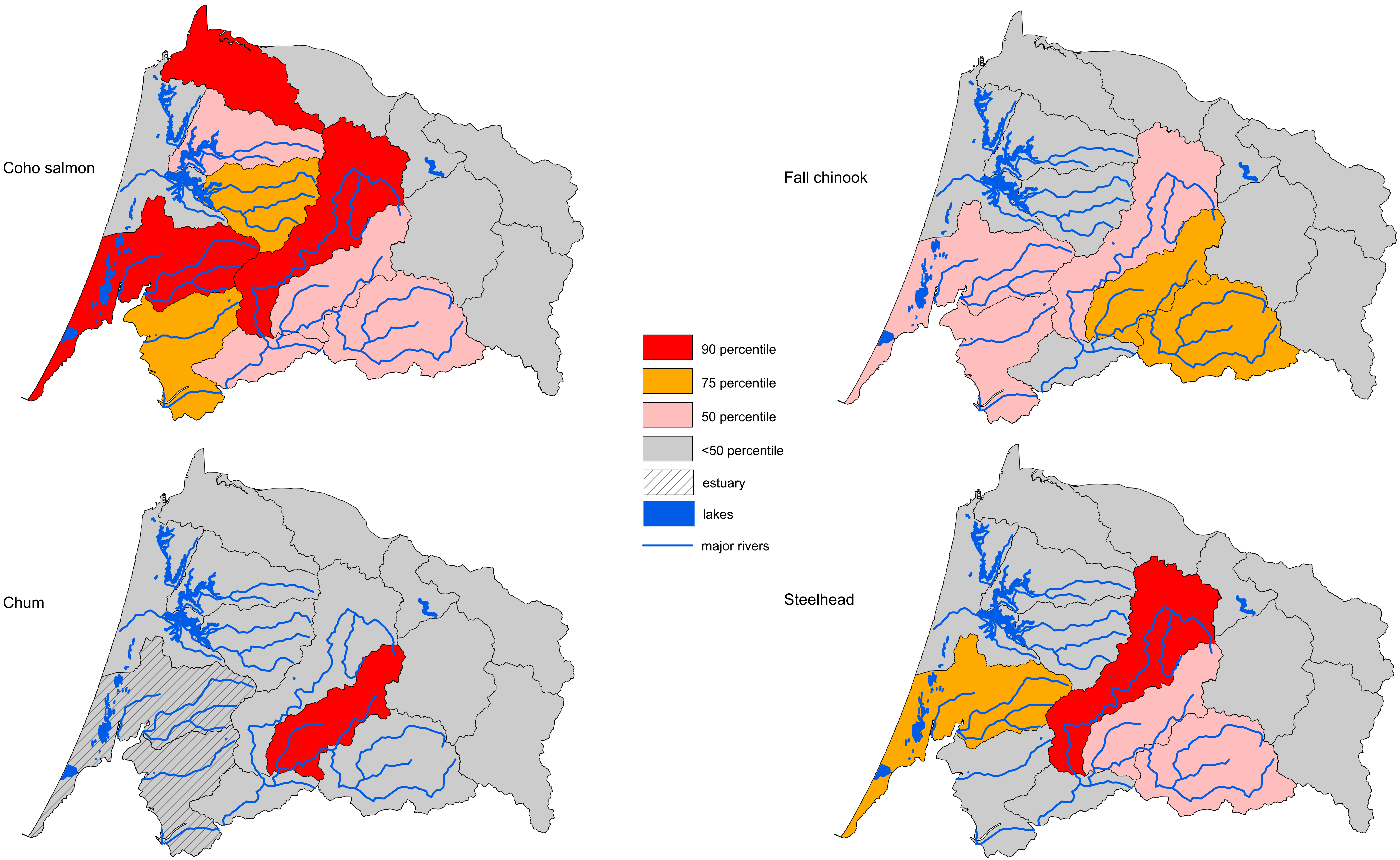


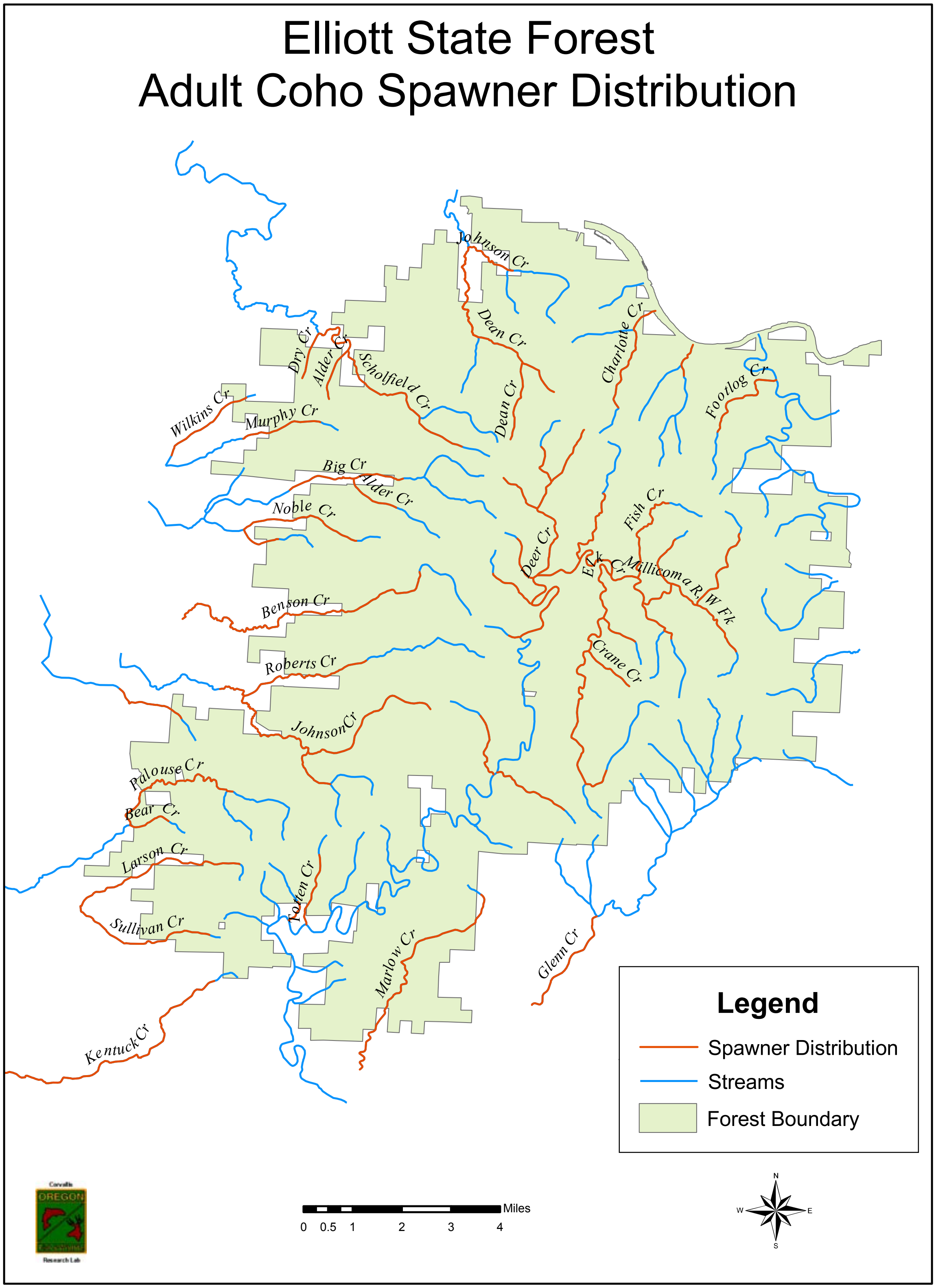
Map 7. Intrinsic Potential - gradient (%), valley width index, active channel width (meters) - within the Elliott study area (source: CLAMS).



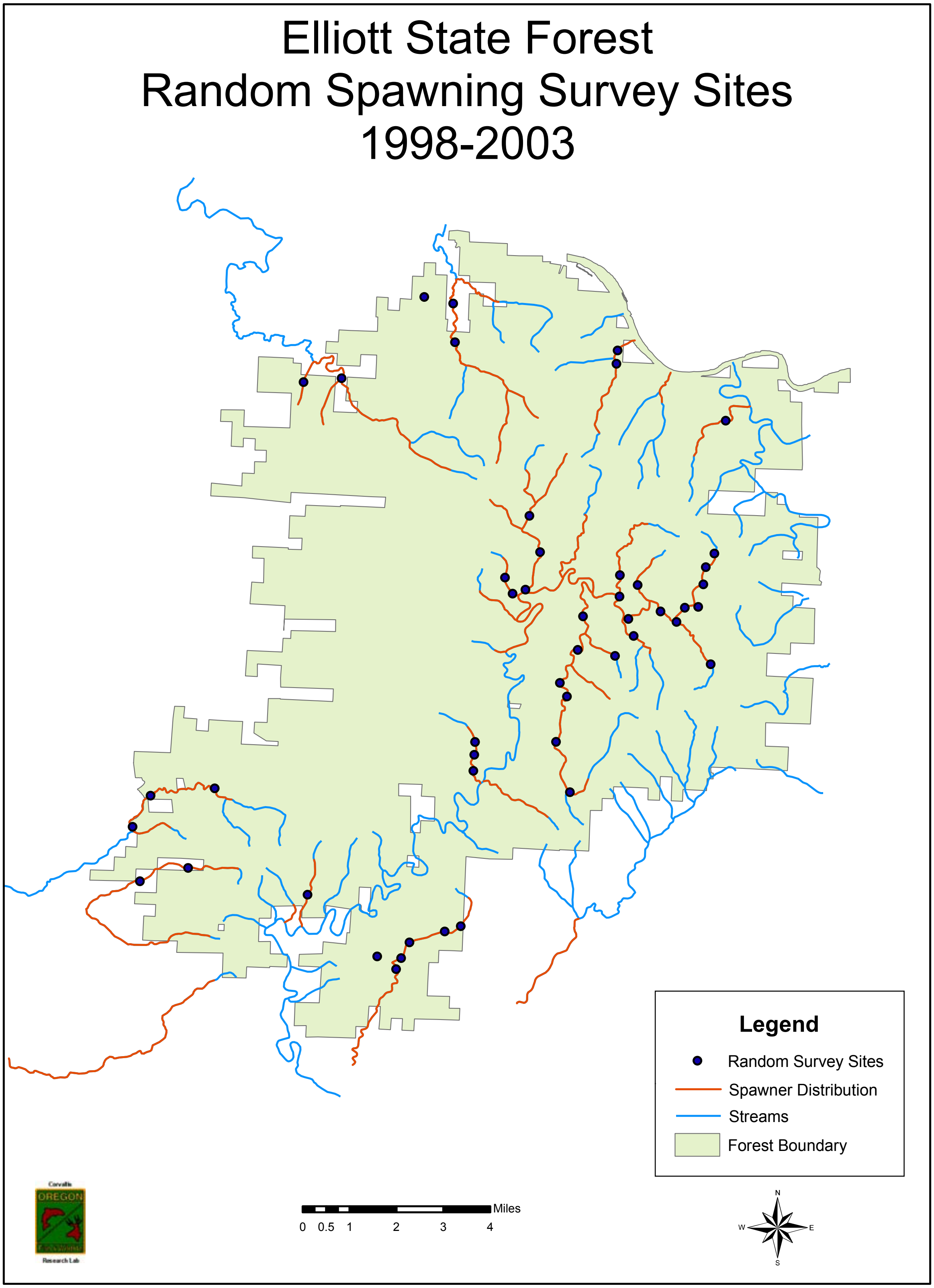
Map 8. Fish distribution - fall Chinook, Coho salmon, winter steelhead - within the Elliott study area.

Map 9. Species abundance and diversity within the Elliott study area per ODFW Coastal Salmonid Inventory Project data 1989 - 2000. Colored 6th field HUs indicate that at least half the years surveyed met the minimum indicated percentile for peak counts. Threshold values for peak spawning counts in the Umpqua region was 4.5 fish per mile, 4 fish per mile in the Coos region, and 43 fish per mile in the Tenmile Lake region. Hatchery fish are included in the peak counts.

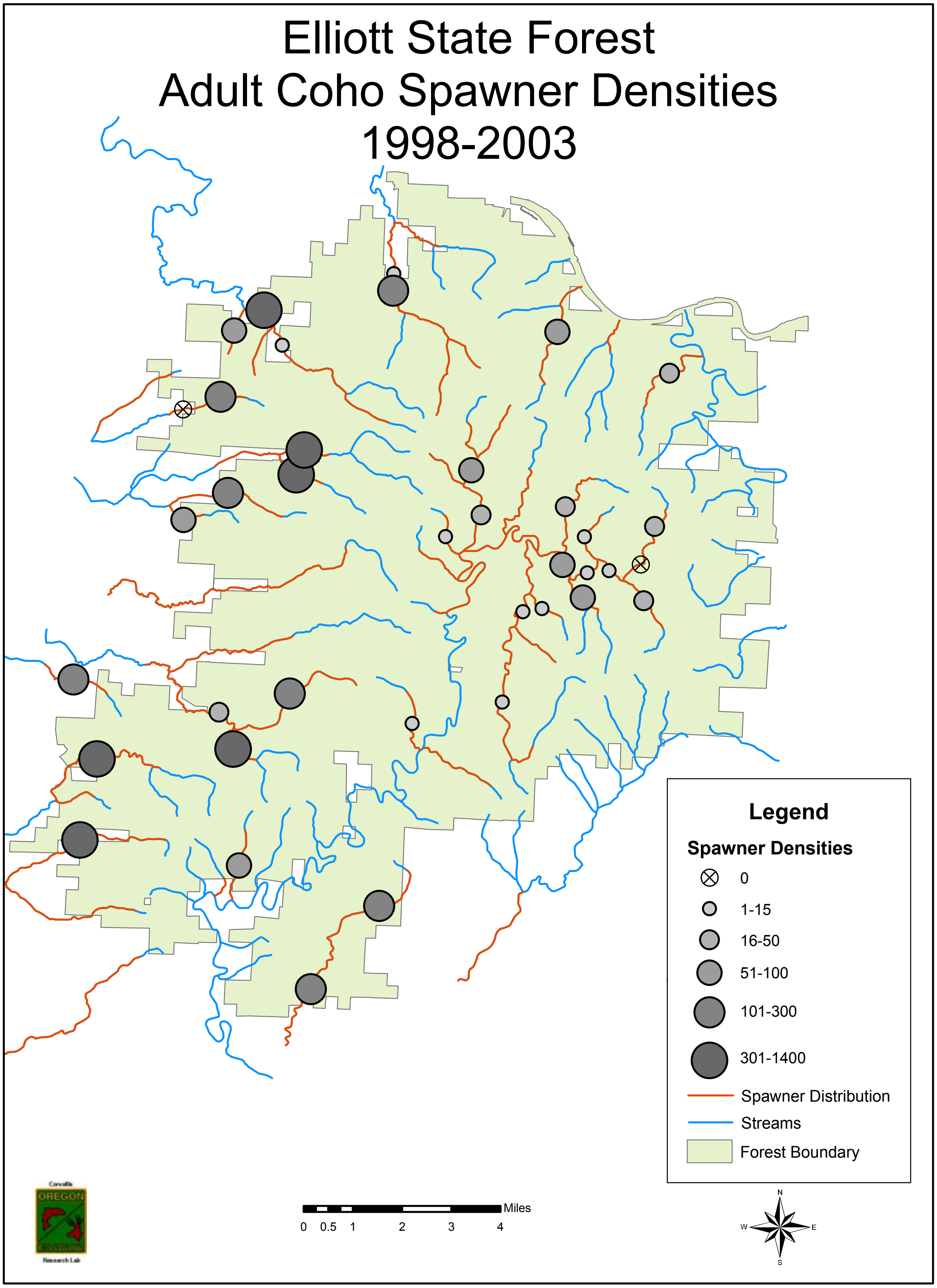




Map 10. Map of Elliott State Forest project boundary displaying streams in which Coho salmon spawn, based on 1:100,000 resolution stream coverage.



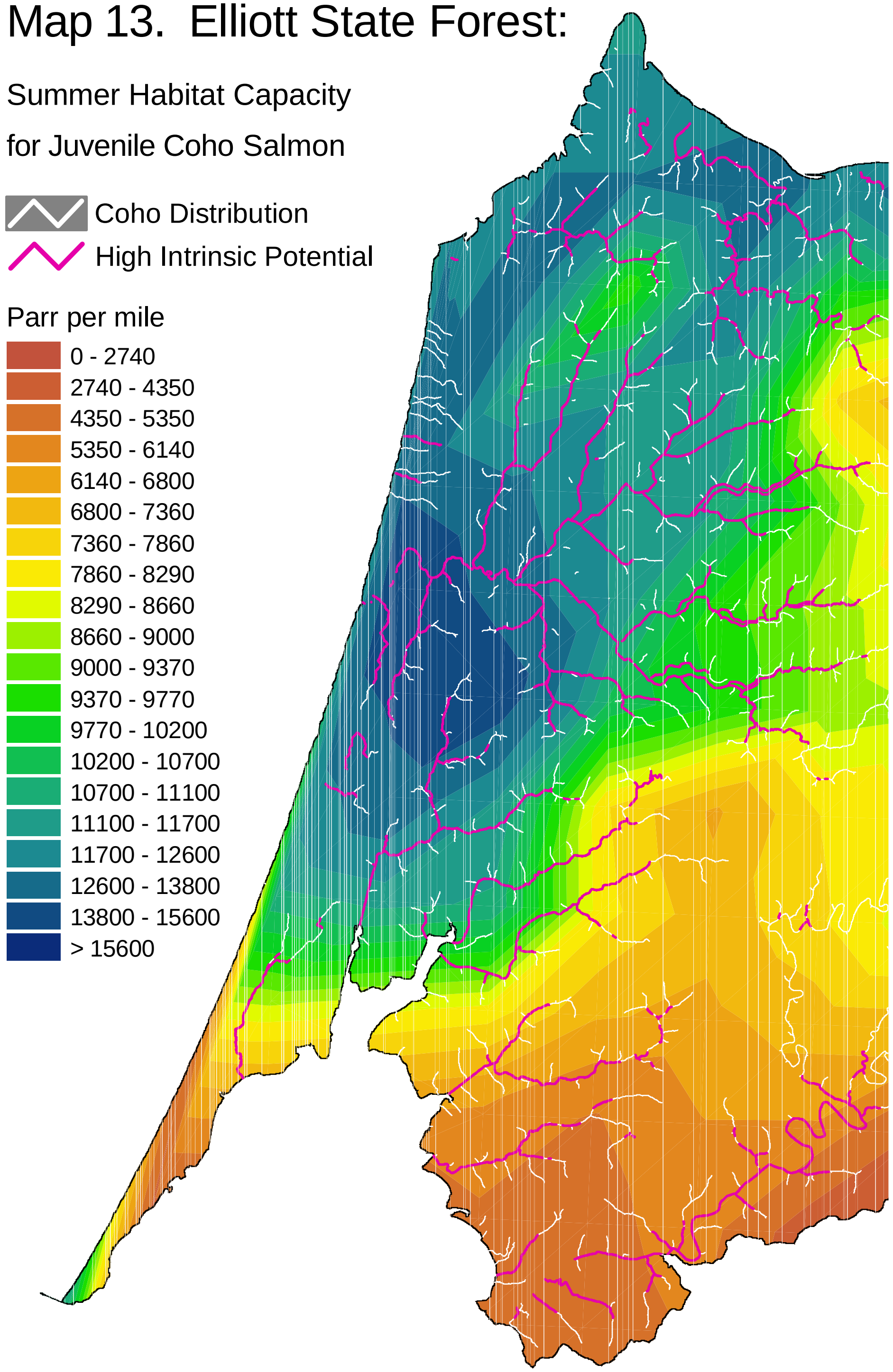
Map 11. Locations of randomly-selected surveys sites in the Elliott State Forest used in making population estimates of adult Coho spawners. Points not associated with a stream represent surveys conducted on 1:24,000 resolution tributaries.

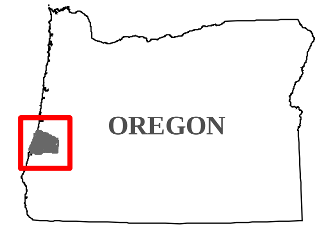


Map 12. Densities (fish/mile) of adult Coho salmon spawners observed during ODFW Coastal Salmonid Spawning surveys conducted on streams originating in the Elliott State Forest, 1998-2003. For surveys conducted during multiple years, values shown represent the maximum density observed.

Map 13. Elliott State Forest:

Summer Habitat Capacity for Juvenile Coho Salmon





Map 14. Elliott State Forest:

Winter Habitat Capacity

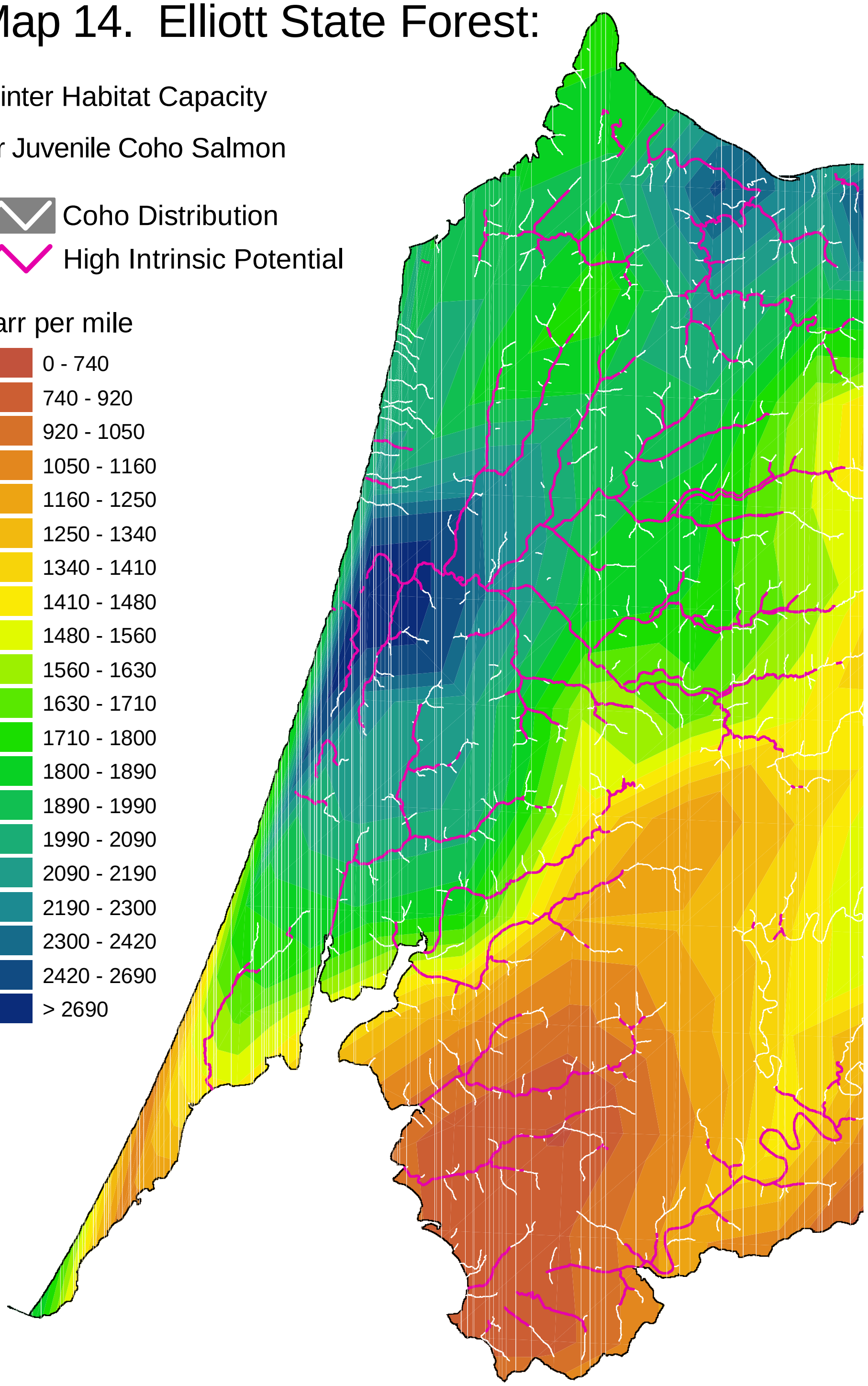
for Juvenile Coho Salmon

Coho Distribution

High Intrinsic Potential

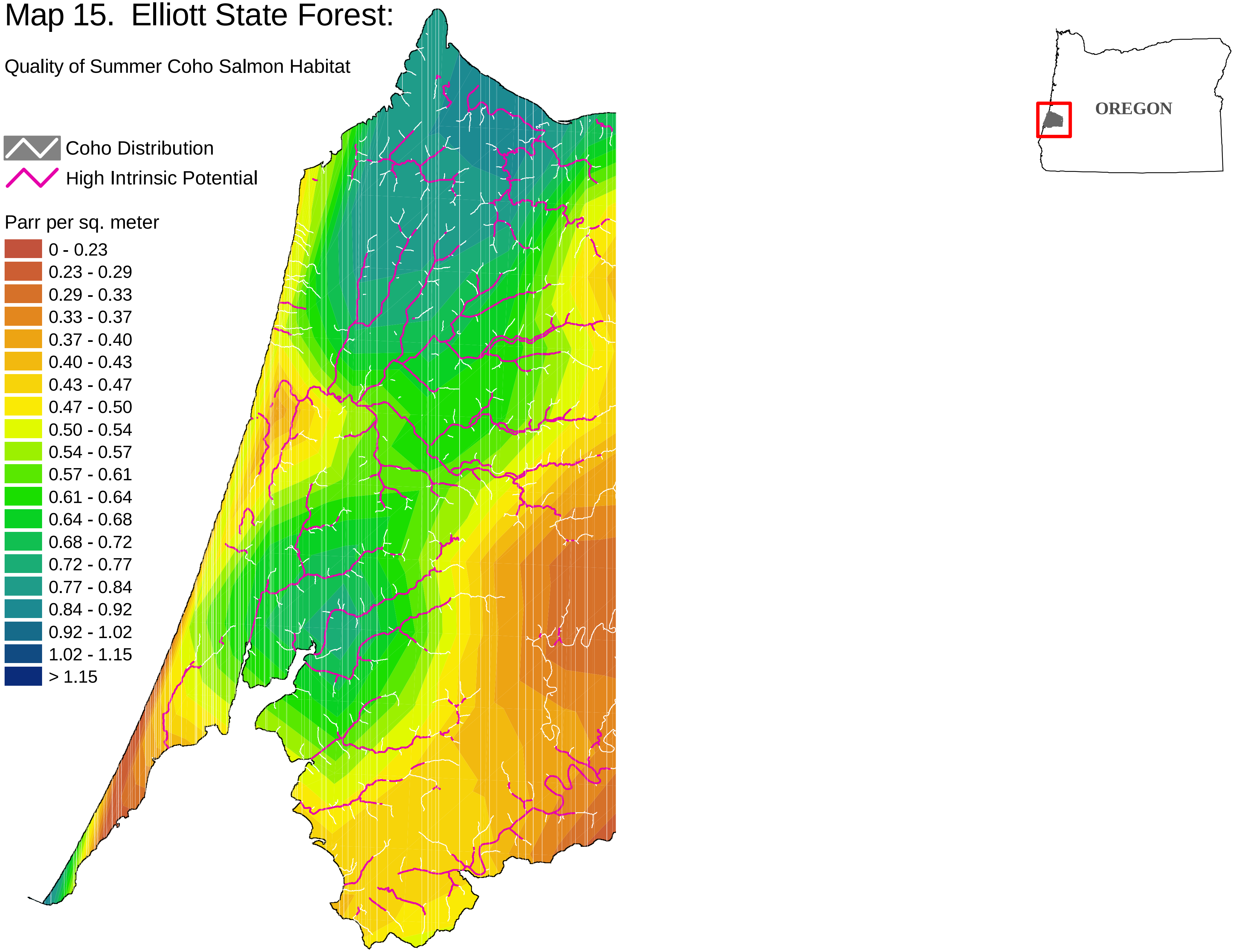
Parr per mile

- 0 - 740
- 740 - 920
- 920 - 1050
- 1050 - 1160
- 1160 - 1250
- 1250 - 1340
- 1340 - 1410
- 1410 - 1480
- 1480 - 1560
- 1560 - 1630
- 1630 - 1710
- 1710 - 1800
- 1800 - 1890
- 1890 - 1990
- 1990 - 2090
- 2090 - 2190
- 2190 - 2300
- 2300 - 2420
- 2420 - 2690
- > 2690



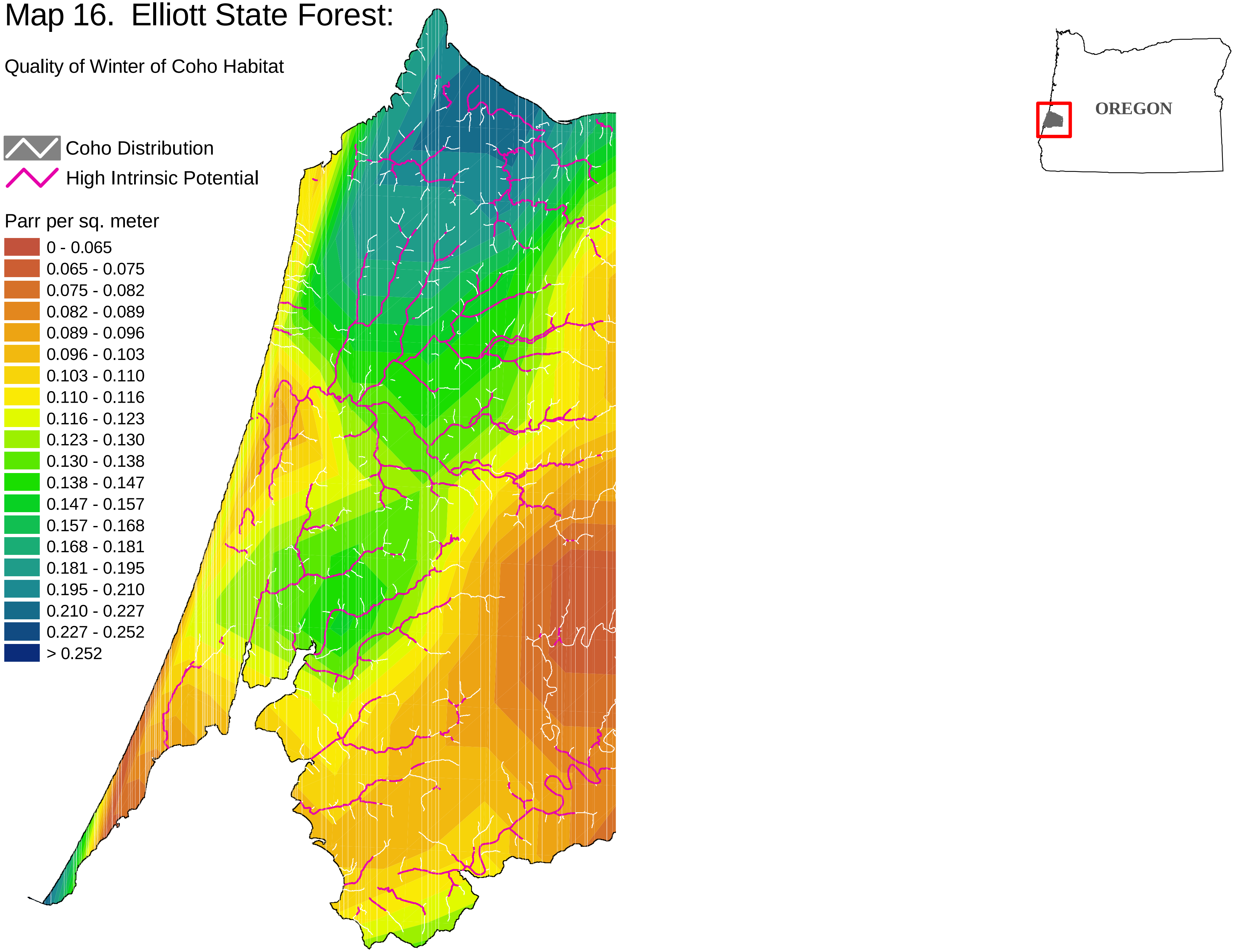
Map 15. Elliott State Forest:

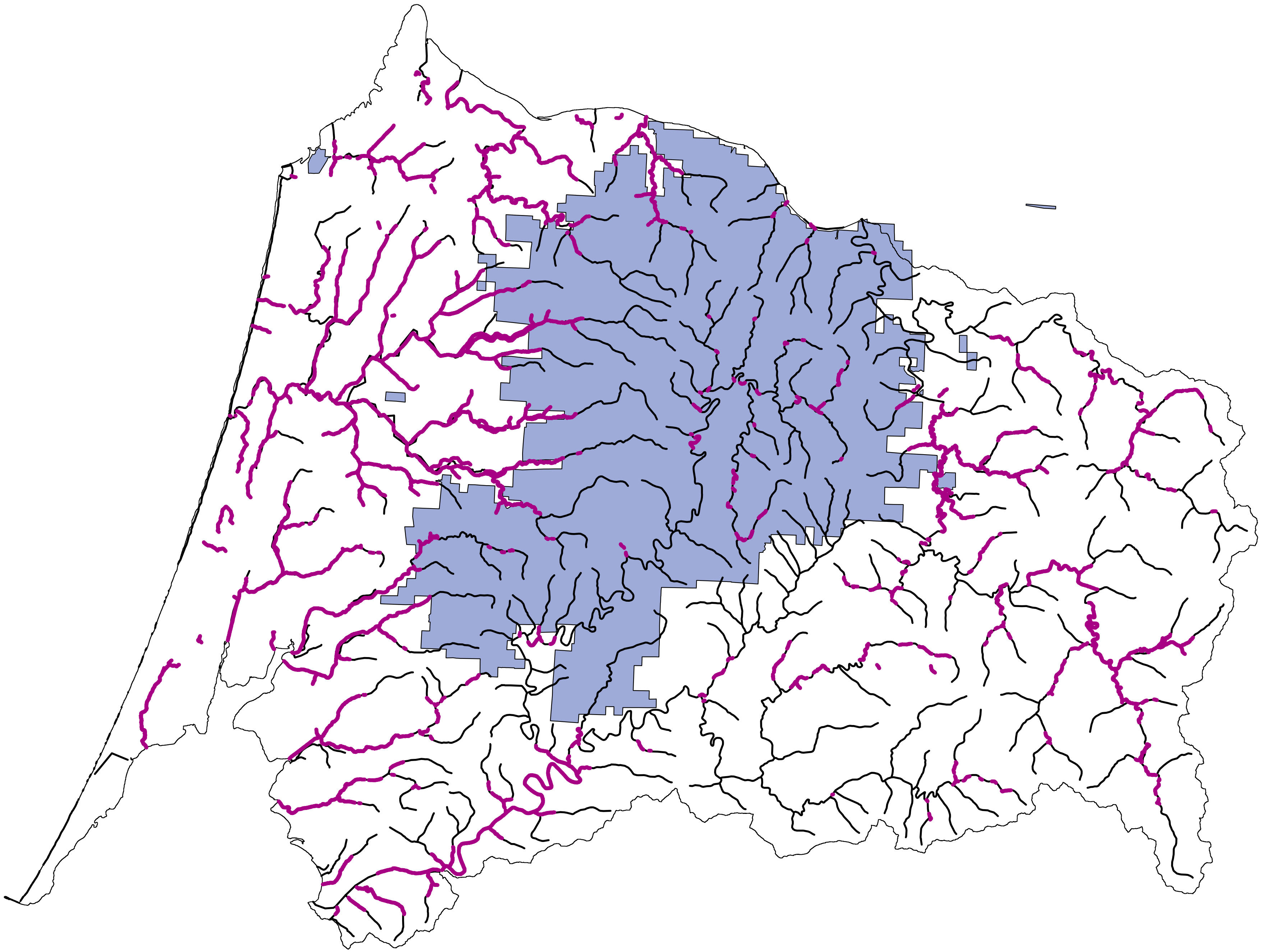
Quality of Summer Coho Salmon Habitat



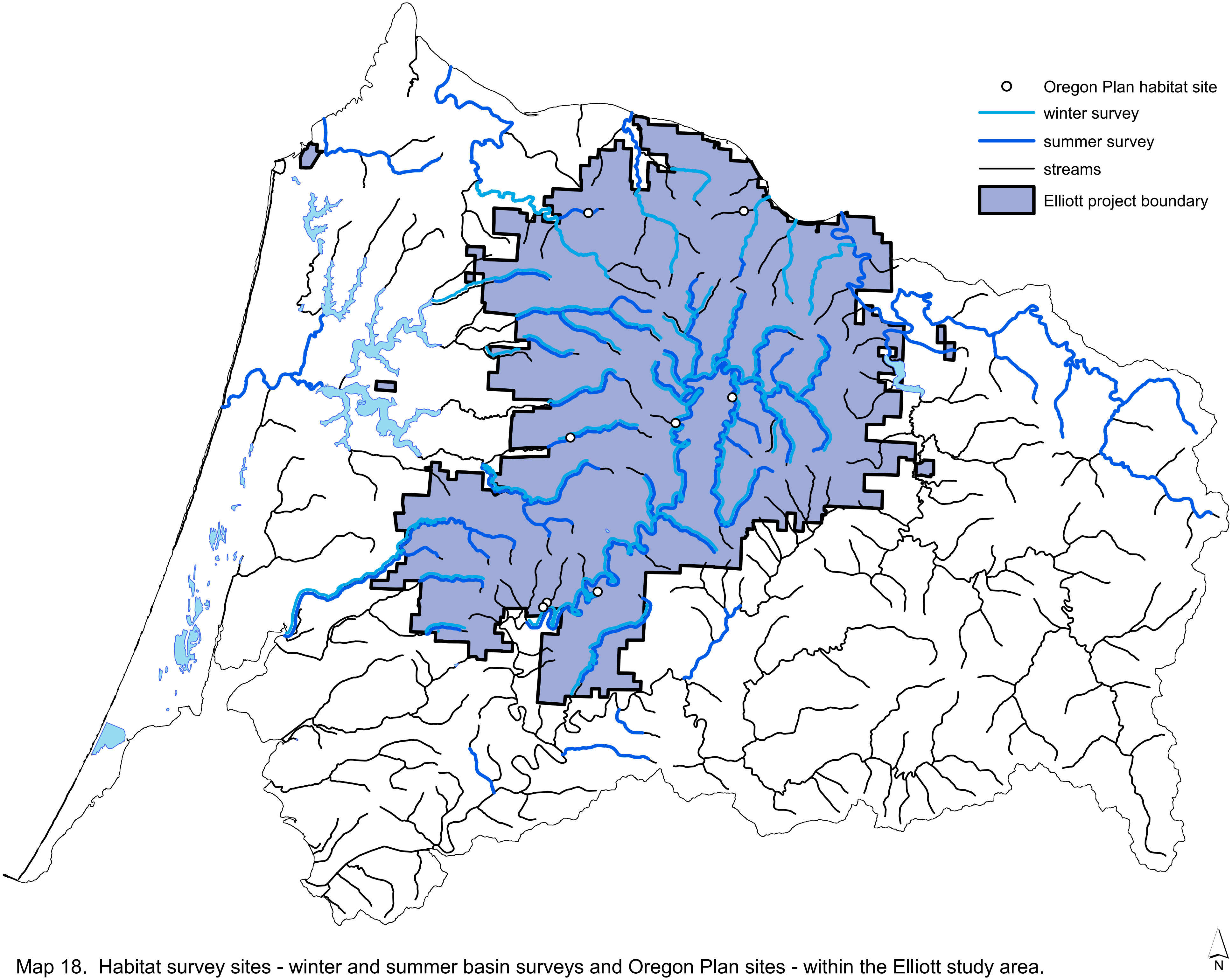
Map 16. Elliott State Forest:

Quality of Winter of Coho Habitat

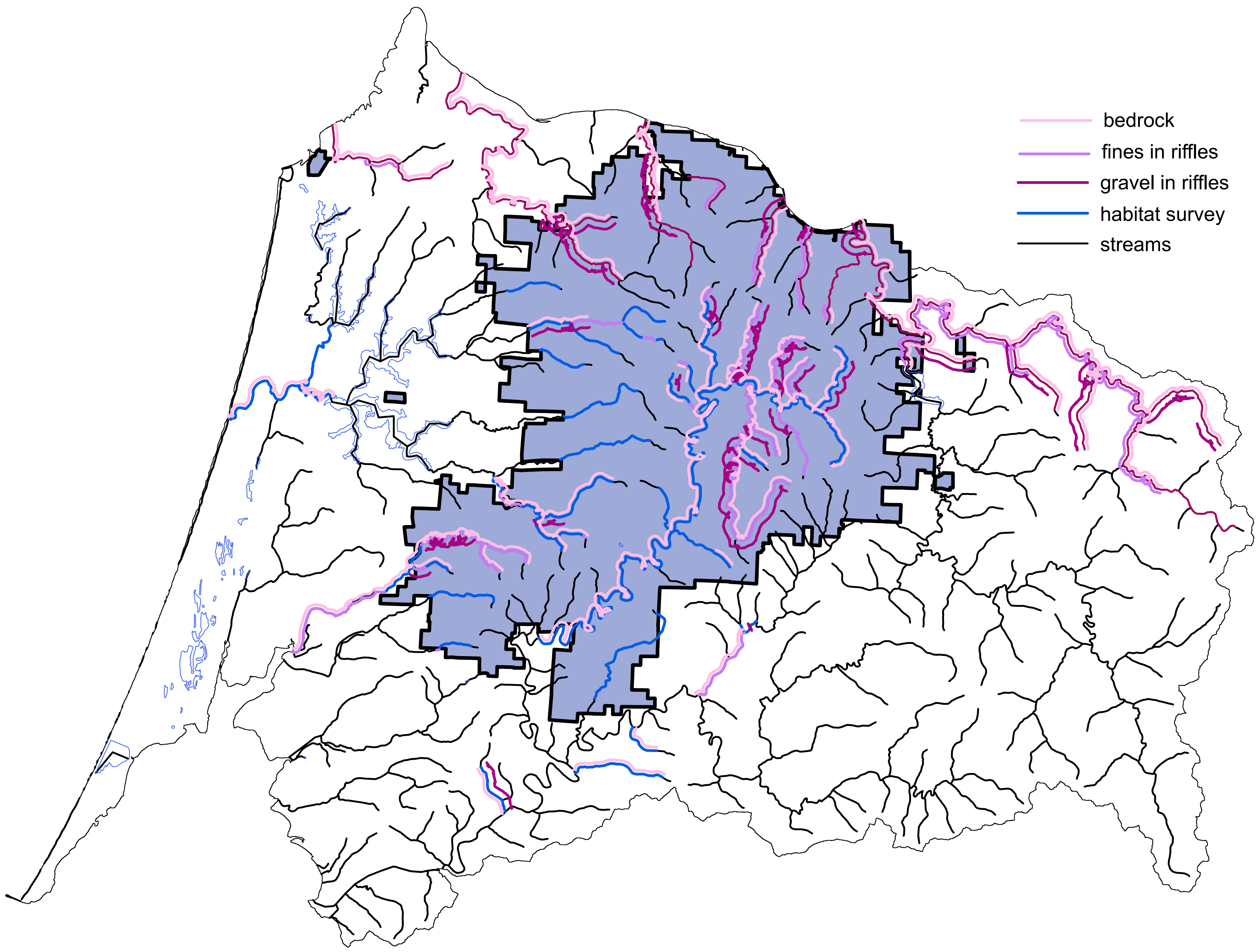


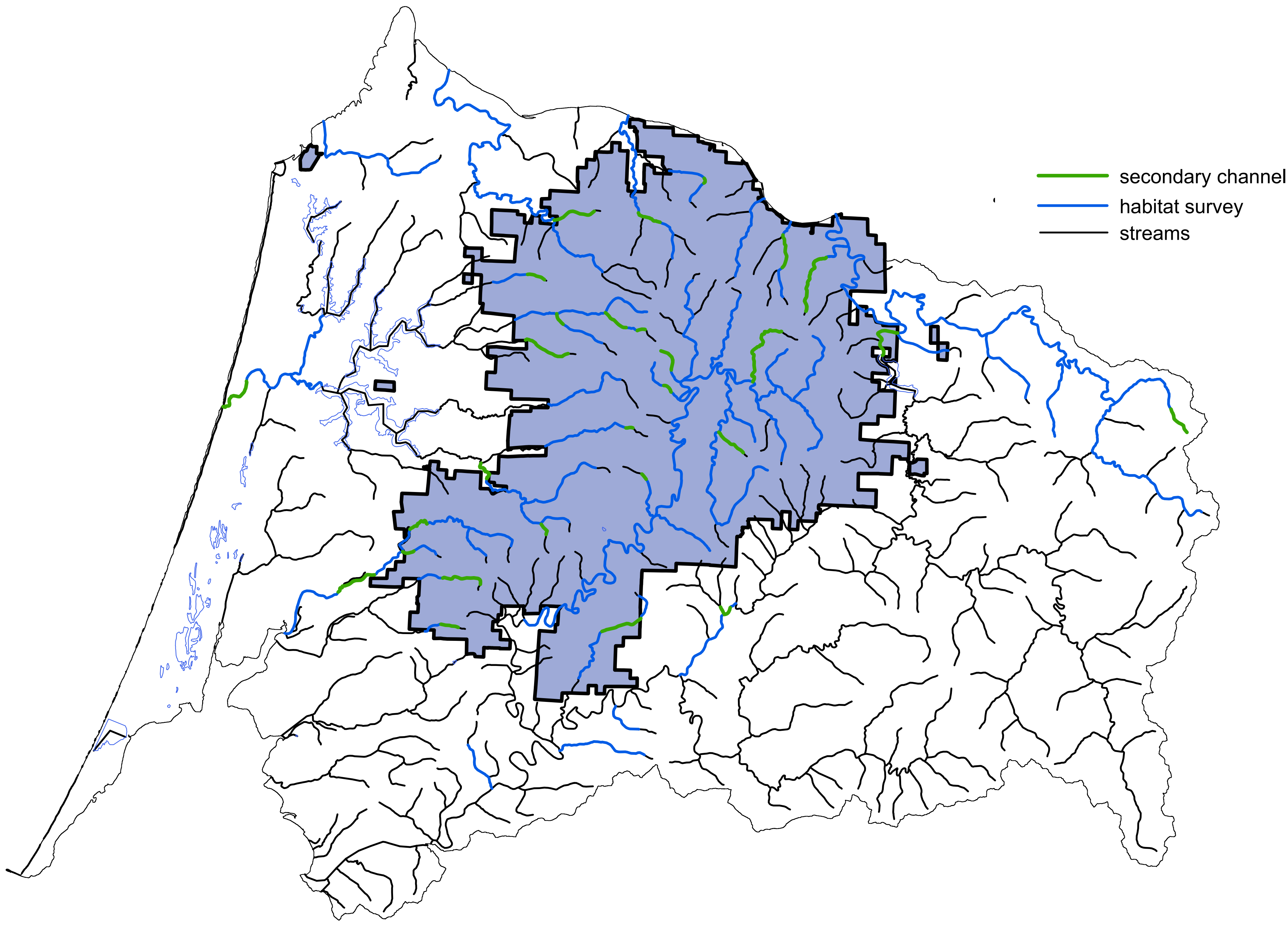


Map 17. Intrinsic potential for Coho salmon (>0.8 = high) within the Elliott study area (source: CLAMS).

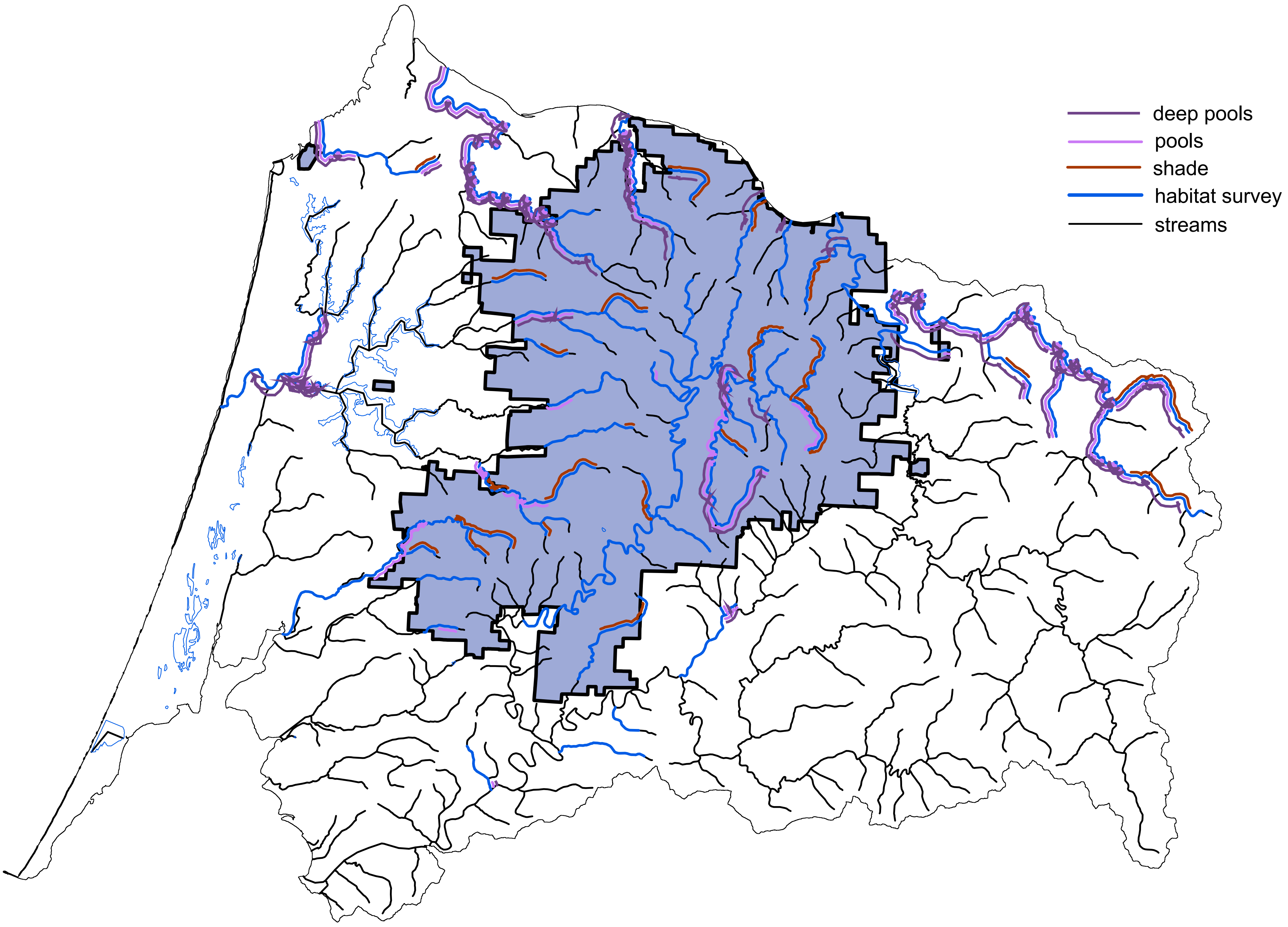


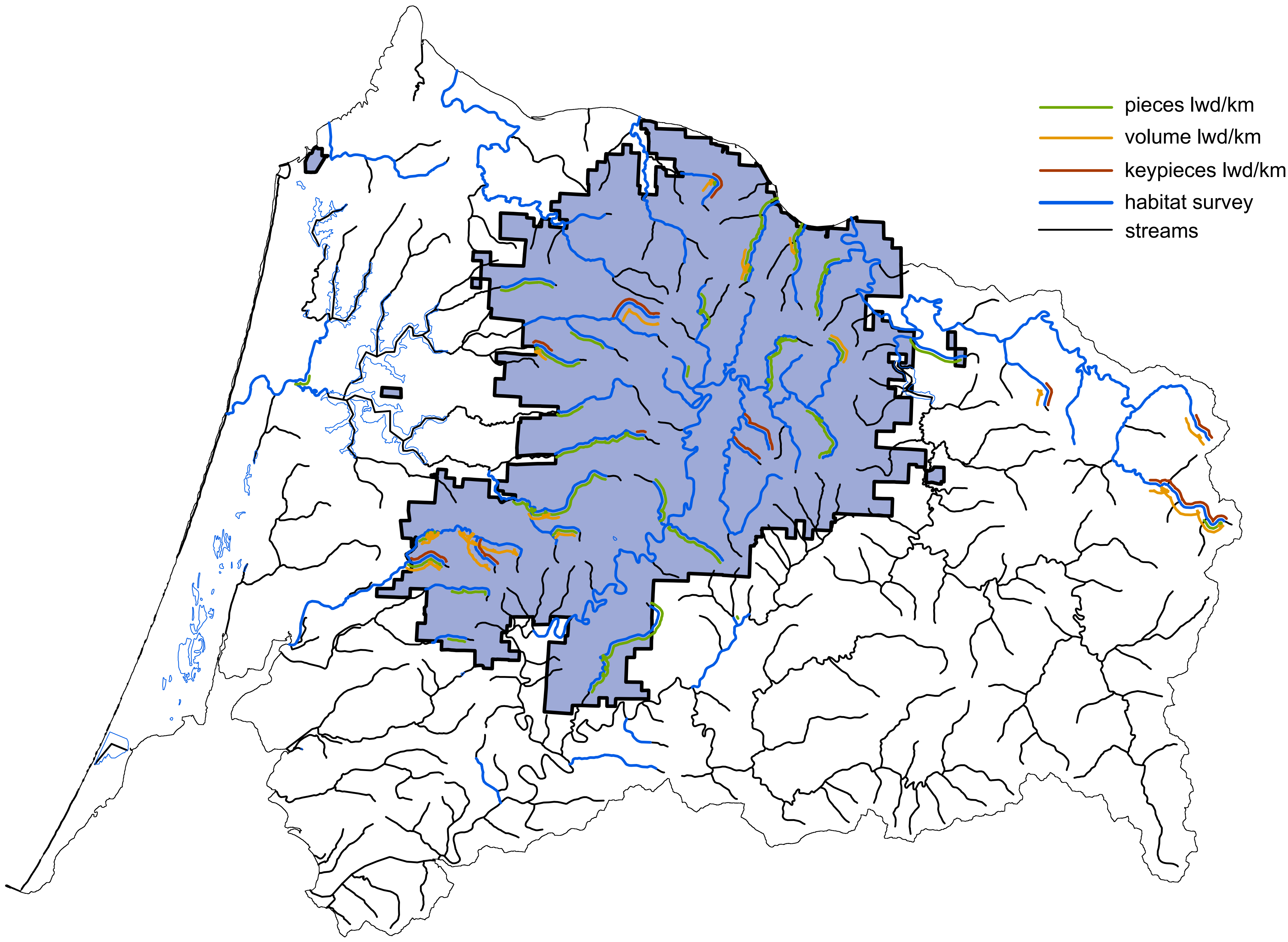
Map 18. Habitat survey sites - winter and summer basin surveys and Oregon Plan sites - within the Elliott study area.



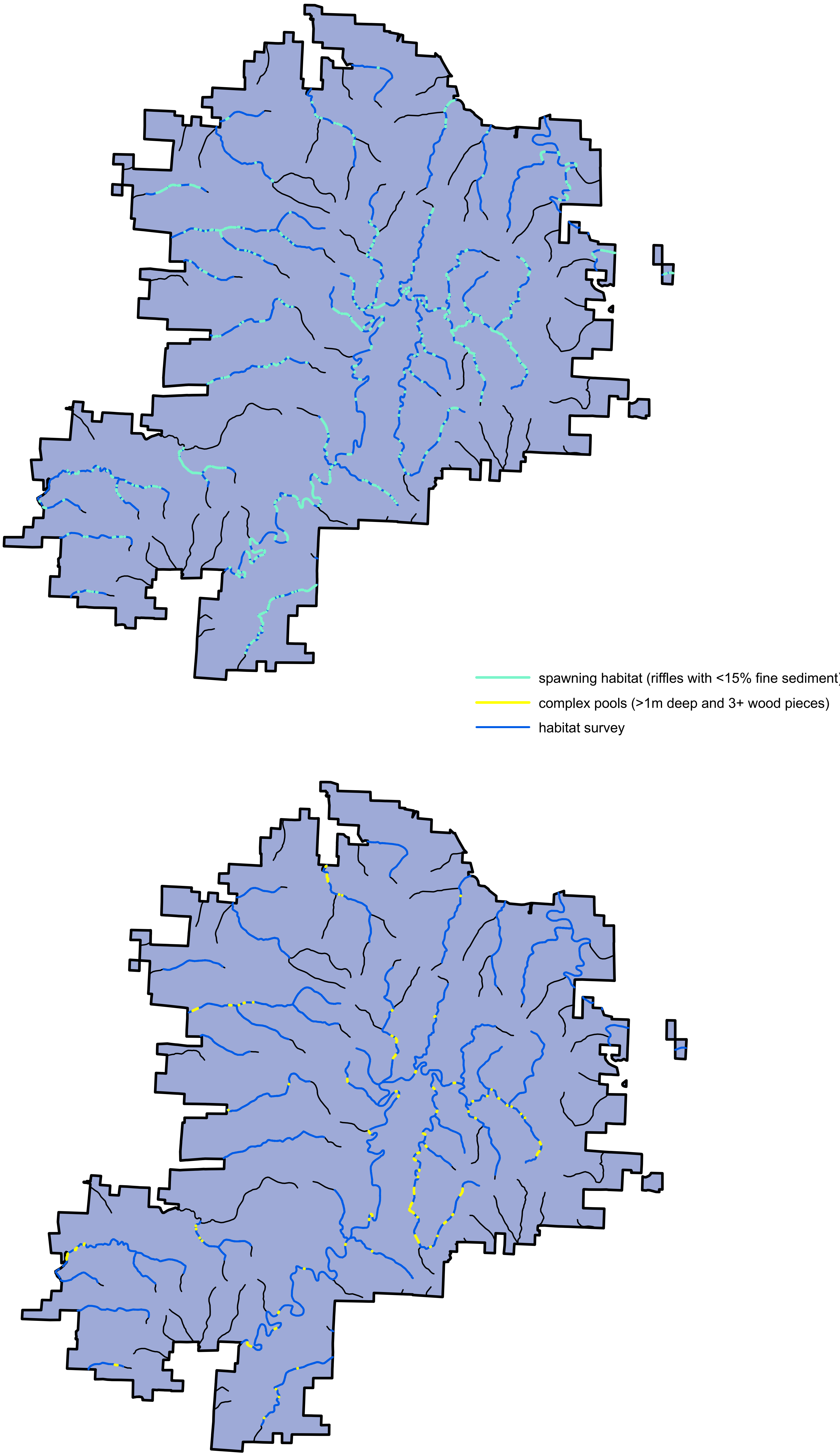


Map 19. Key habitat characteristics - percent fine and gravel substrates in riffle units, percent bedrock, and percent secondary channels - which meet or exceed high benchmark levels in the Elliott study area.

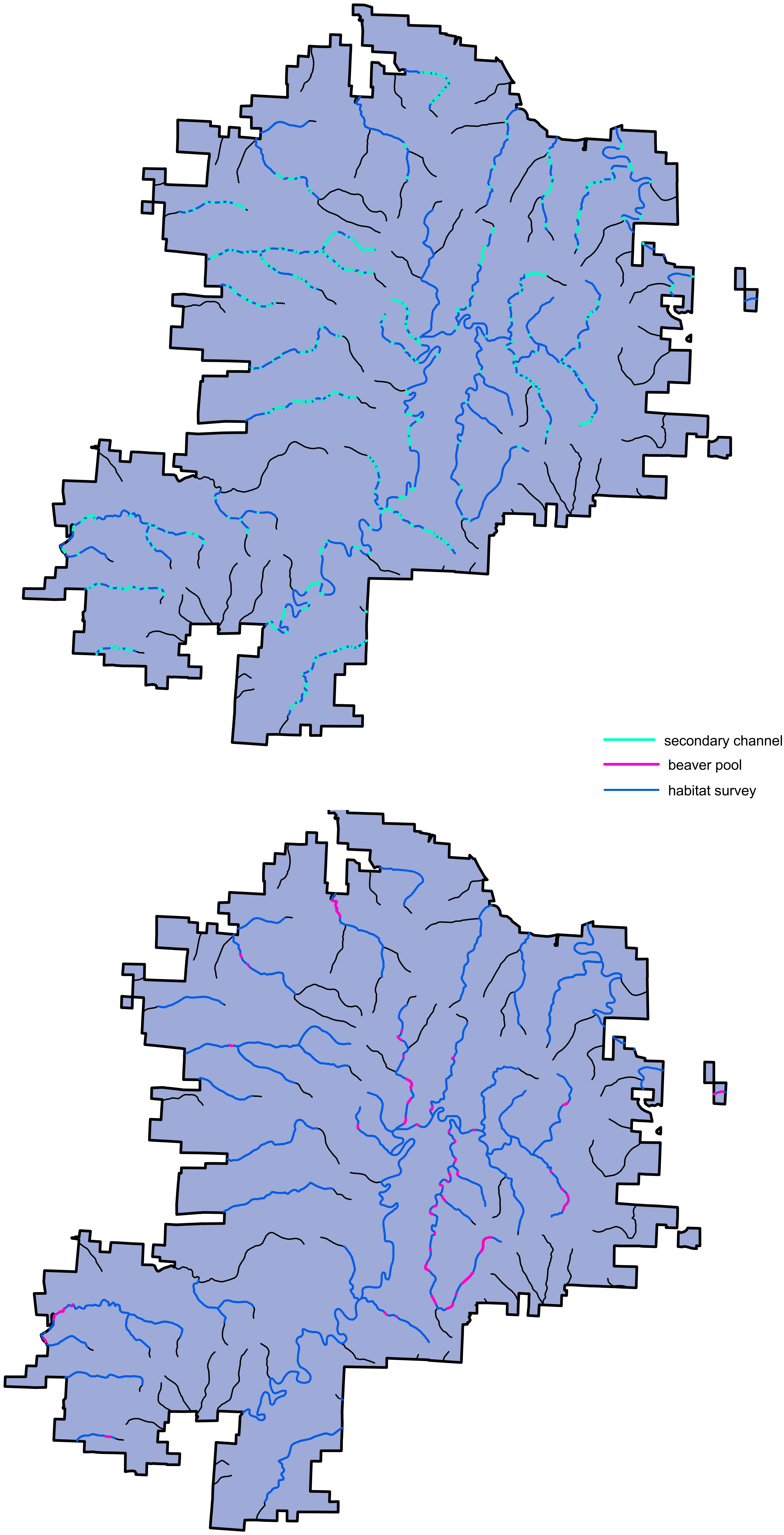




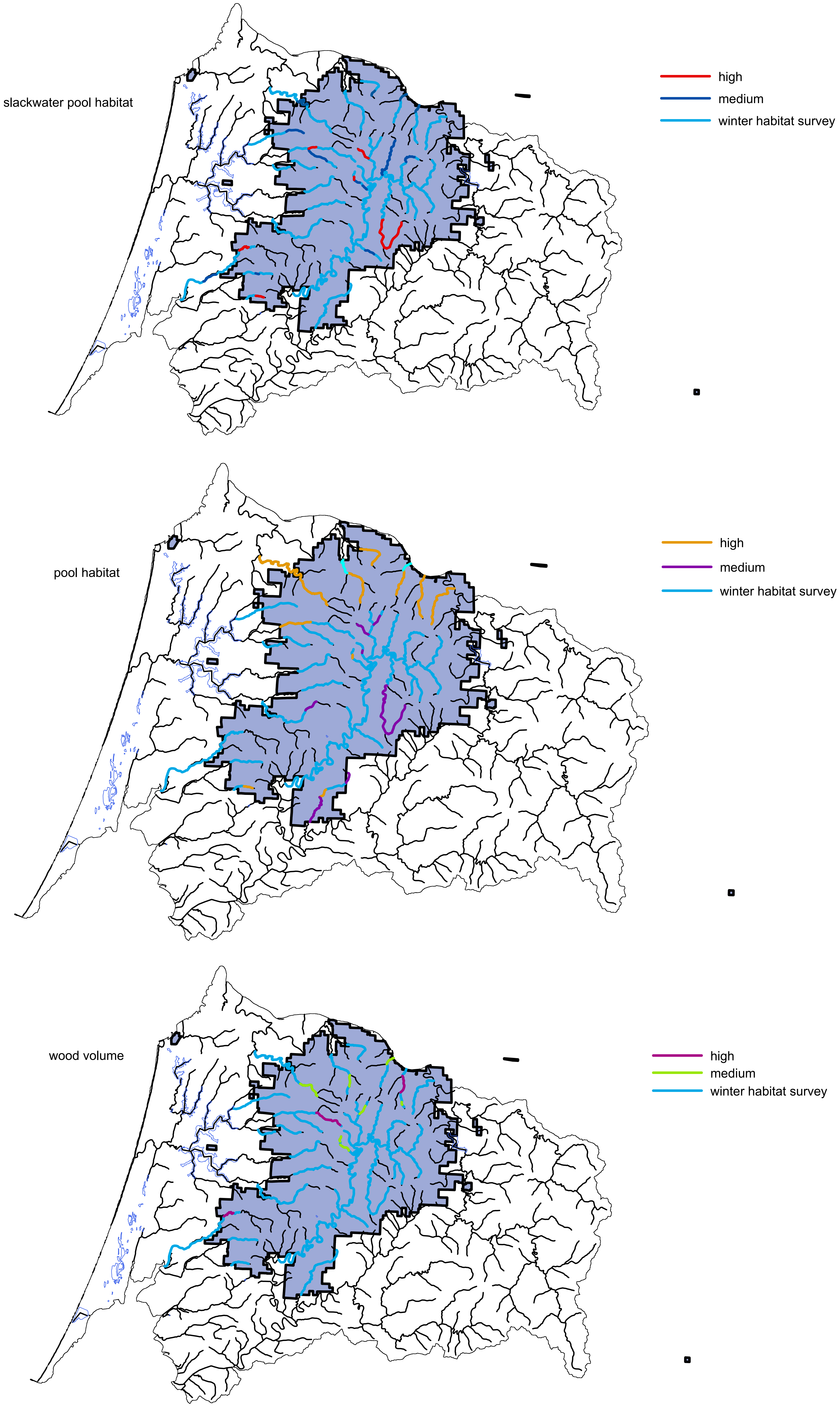
Map 20. Key habitat characteristics - percent shade and pools, number of deep pools, large woody debris pieces and volume, and key pieces of wood - which meet or exceed high benchmark levels in the Elliott study area.



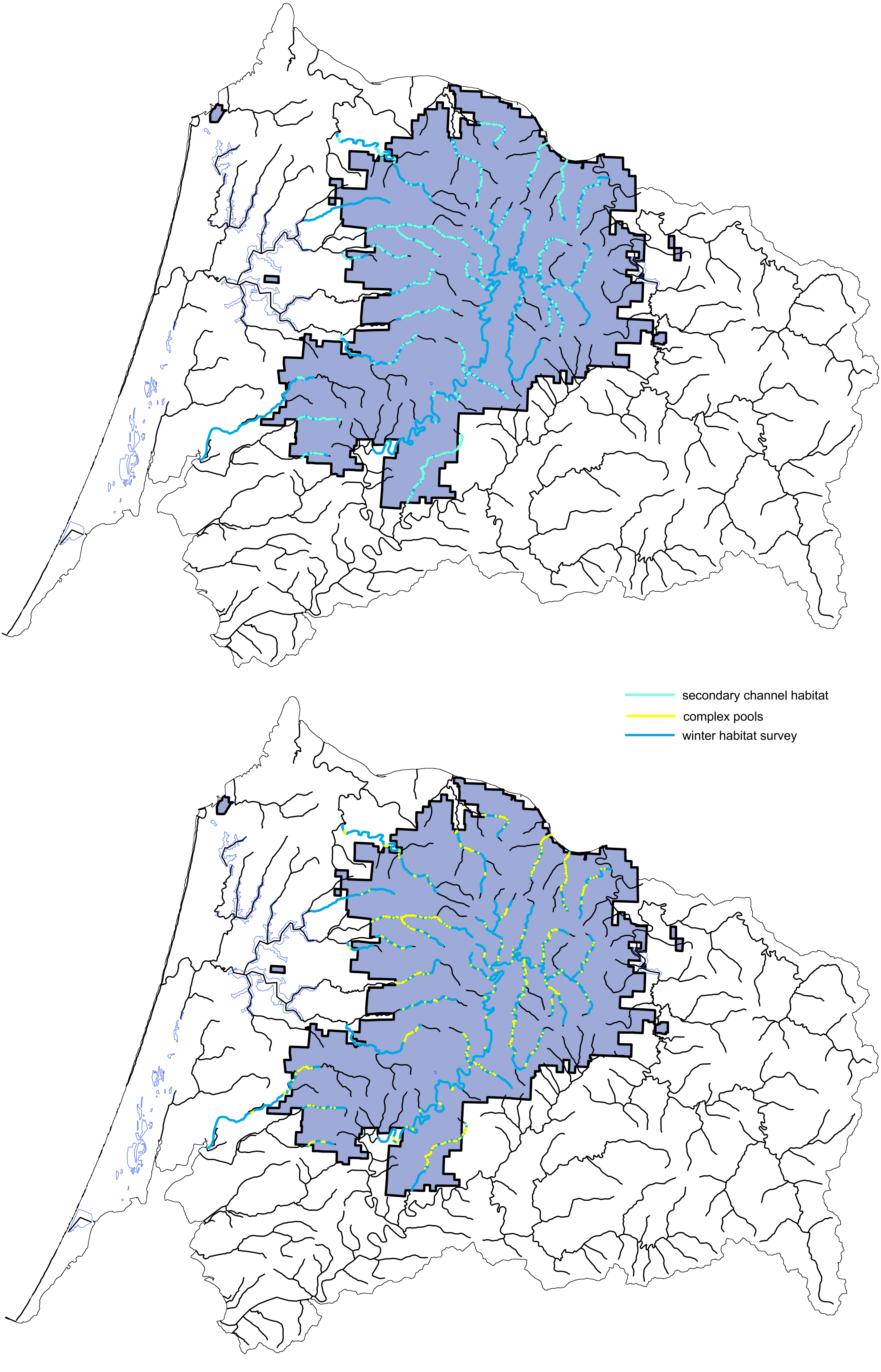
Map 21. Important habitat characteristics on the unit level scale within the Elliott project area.



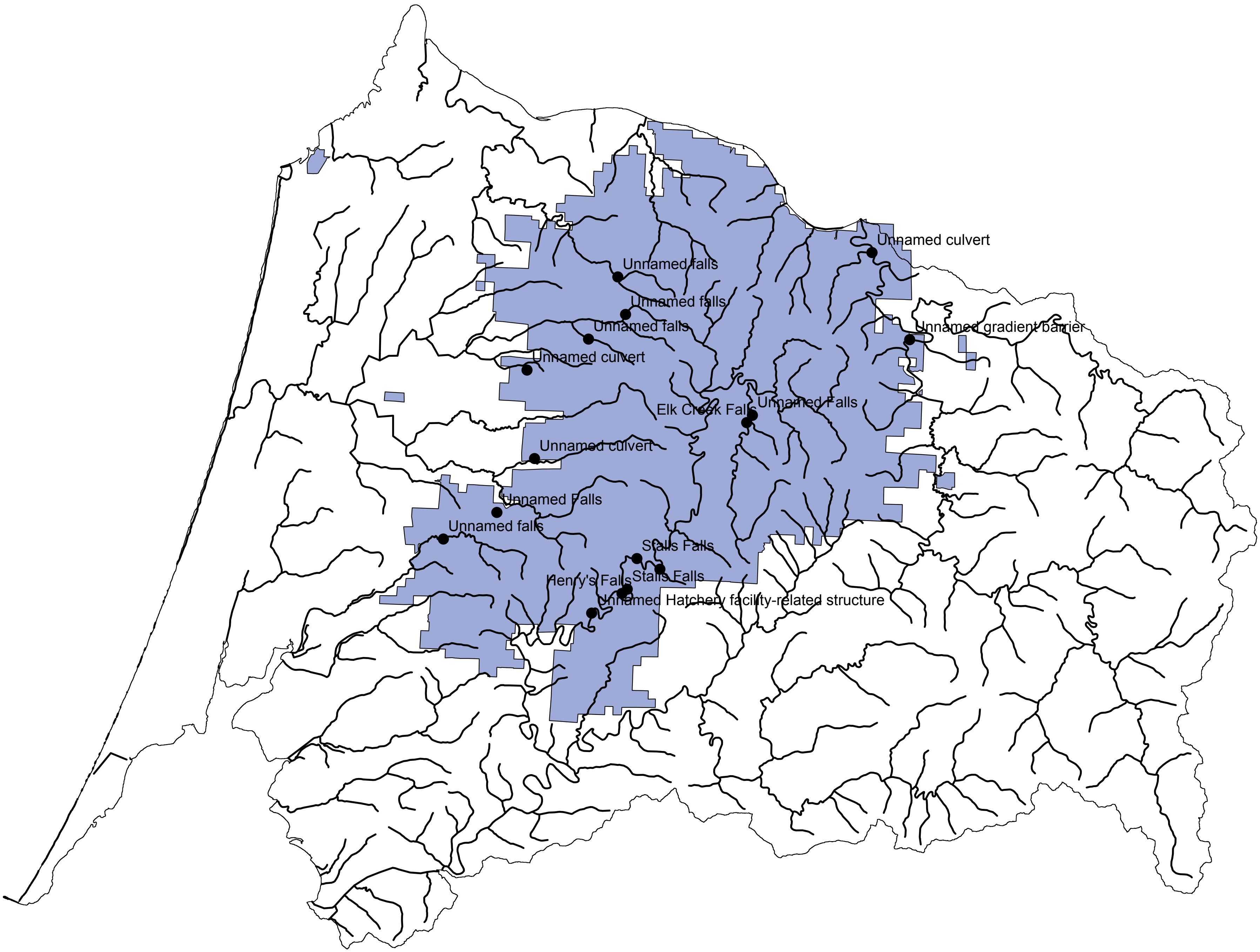
Map 22. Important habitat characteristics on the unit level scale within the Elliott project area.



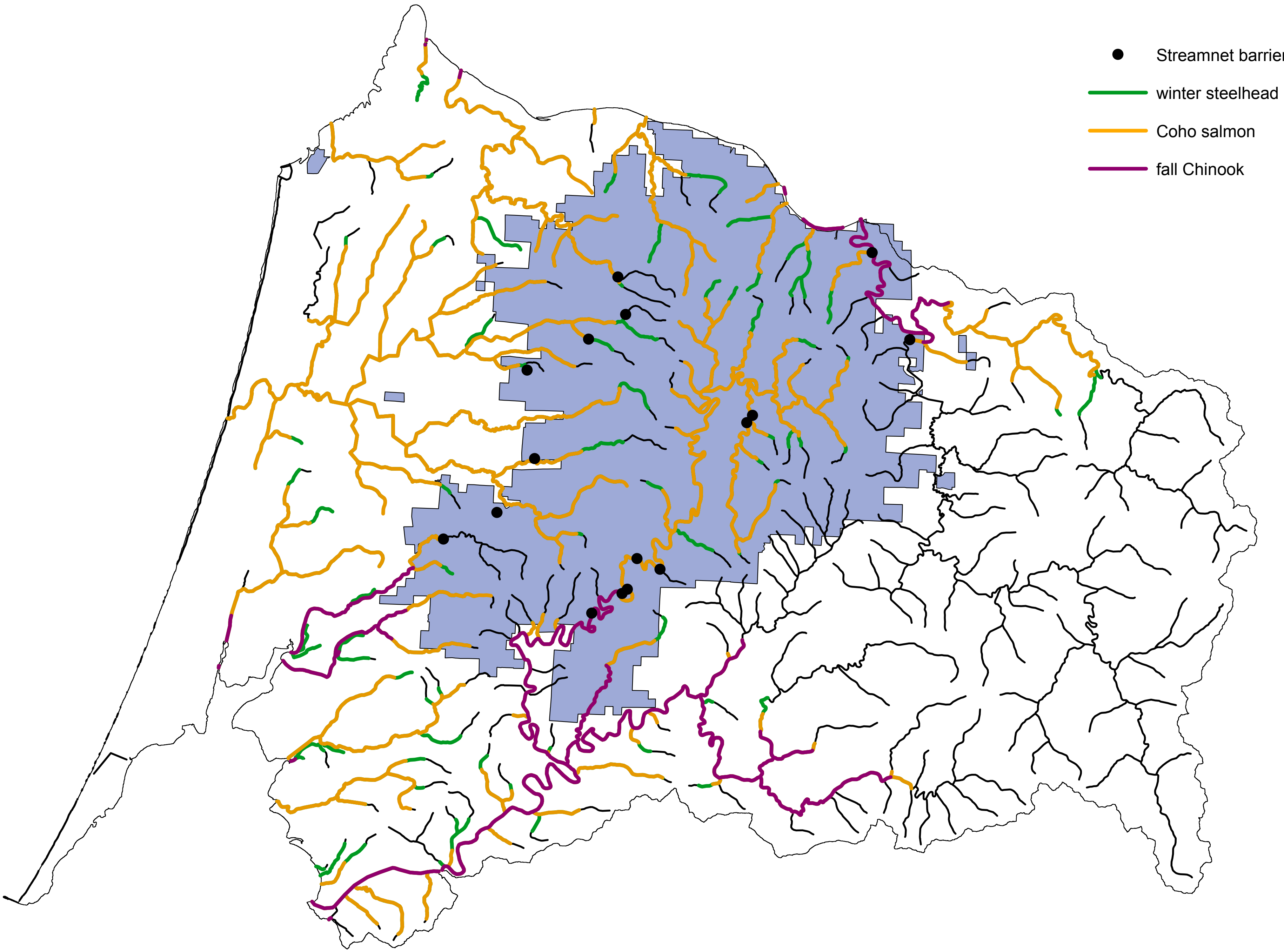
Map 23. Key winter habitat characteristics on the reach scale - percent slackwater habitat (includes beaver ponds, backwaters, alcoves, and isolated pools), percent pool habitat, and large woody debris volume per kilometer. The high and medium levels correspond to the summer benchmarks.



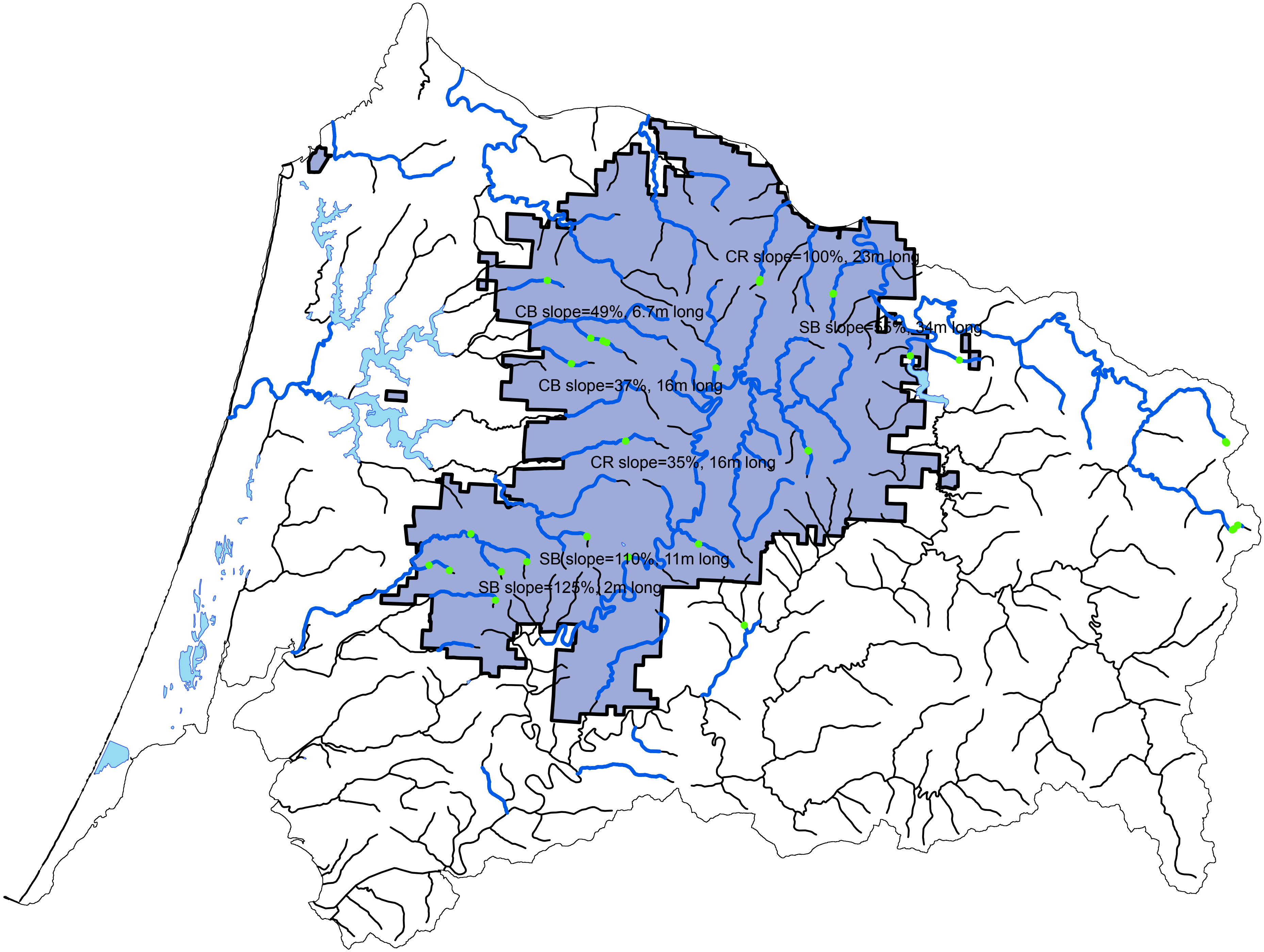
Map 24. Key winter habitat characteristics on the unit scale - secondary channels and complex pools (>1 meter deep and 3+ pieces of wood) - in the Elliott study area.



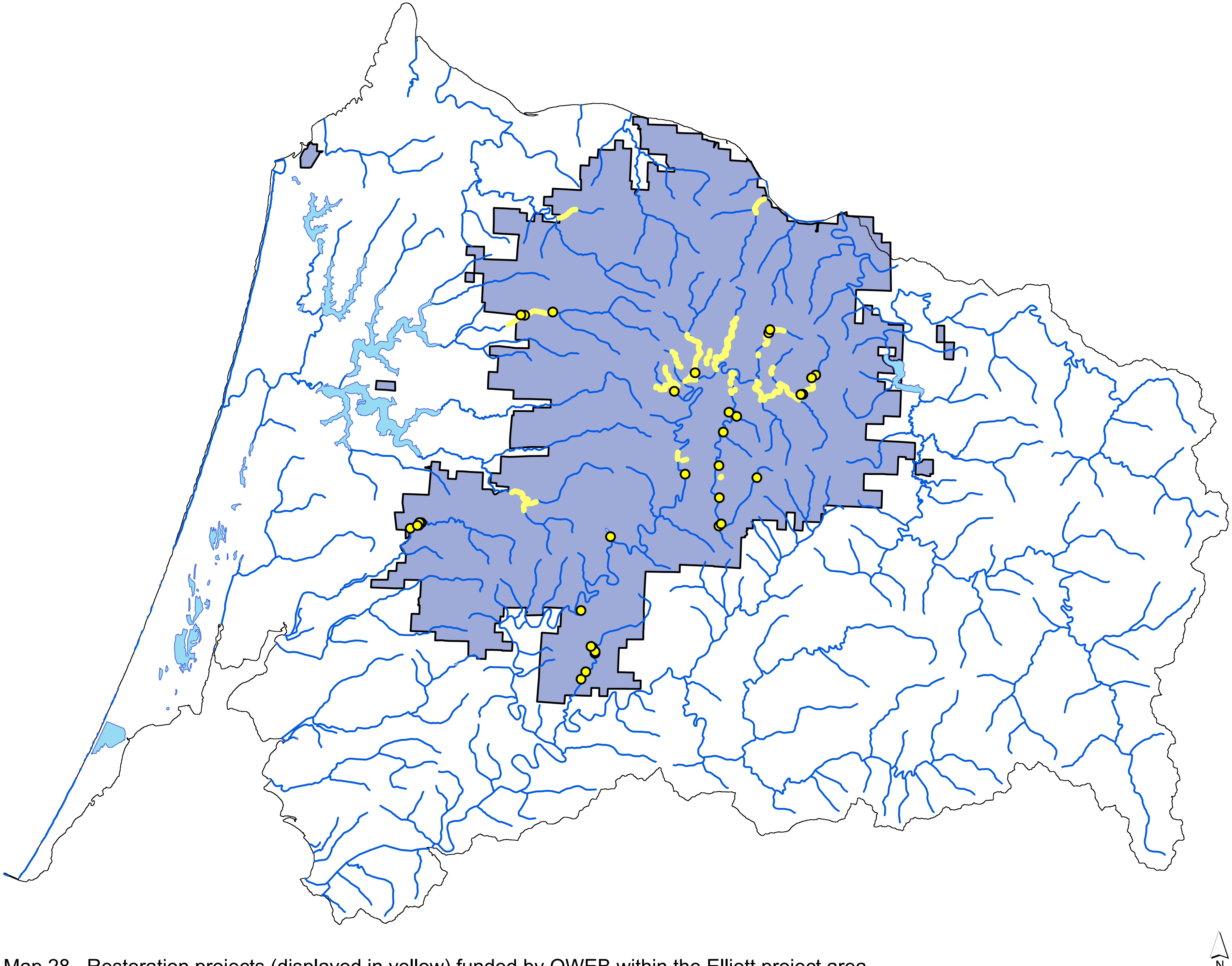
Map 25. Streamnet barriers identified by Record Id in the Elliott study area.



Map 26. Streamnet barriers and fish distribution in the Elliott study area.



Map 27. Potential barriers (green dots) to fish distribution within the Elliott study area. The selected habitat units are either cascade-over-bedrock (CR), cascade-over-boulder (CB, step-over-boulder (SB), or step-over-bedrock (SR) habitat types with at least 35% slope. A selection of these are labled with unit type, percent slope and unit length.



Map 28. Restoration projects (displayed in yellow) funded by OWEB within the Elliott project area.