Tucannon Subbasin Plan

May 2004 Version

Submitted by: **Columbia Conservation District**

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Prepared for

Northwest Power and Conservation Council

Submitted by

Columbia Conservation District

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PREFACE

This subbasin plan represents the hard work of numerous individuals and organizations to produce a watershed-based approach for protection and restoration of the terrestrial and aquatic habitats found in this subbasin. It complies with the requirements set out by the Northwest Power and Conservation Council for this product and is the best product that could be produced under the required conditions and timeline, and available resources. It is not “perfect,” but it does represent a reasonable first-step. It is a snapshot in time. As a living document, it will be improved and refined through implementation and review.

This plan contains considerable, significant areas where the participants in the process (subbasin planners and public) find agreement. This will provide focus for implementation activities in the near future. The plan also identifies areas where issues remain to be addressed. It is expected that over time these issues will be resolved in a manner that is appropriate.

Additional information, and related time and budget for analysis, would have resulted in increased technical support for findings, hypotheses, biological objectives and strategies (the management plan elements) in this subbasin plan. Within the time and resource constraints provided, the best available information and analysis approaches have been used to reach the conclusions in the plan. As noted above, and as outlined in the Research, Monitoring and Evaluation (RM&E) section of the plan, additional information and refined analysis techniques are expected to become available during plan implementation that will add to the technical foundation for this subbasin management plan.

It needs to be recognized that this plan is the product of a process that, with the exception of developing Subbasin summaries, had lain dormant for over 10 years. Most of the participants in the Council’s original subbasin planning process were not available for this process for various reasons. In addition, this process was implemented with far more local involvement than earlier subbasin planning efforts. For this reason, this process has required a significant learning curve for all Columbia River subbasins; and this learning curve has occurred simultaneously in all the subbasins with very little opportunity for cross-subbasin sharing of good ideas and approaches during plan development. In addition, necessary work at the state and regional level that has been occurring simultaneous to the subbasin level planning has not always been available for inclusion in individual subbasin plans in a manner that could meet the Council’s May 28, 2004 deadline. Finally, it is important to note that the planners involved in this subbasin have not regularly worked together on watershed-based planning. Relationships as well as planning approaches had to be developed to produce a plan. These relationships and approaches will now serve as a solid foundation for the subbasin in ensuring that the plan is effectively implemented, reviewed and revised over time.

The following recommendations address what we learned in putting together this subbasin plan in a coordinated approach with all the southeastern Washington (and part of northwestern Oregon) subbasin plans (Asotin, Lower Snake, Tucannon, Walla Walla subbasin plans). Addressing these recommendations should improve future efforts to update and implement the plans:

PREFACE (Continued)

- **Plan updates should be staggered in time –** Participation was limited by the need for some planners to be involved in more than one subbasin planning effort simultaneously. This especially affected fish and wildlife co-manager staff with state, federal and tribal agencies.
- **Expectations need to be consistent with schedules and funding –** The current subbasin planning effort was on a fast track. The product of this process was limited by the time and funding available to complete the effort. This does not mean that the time and funding were not appropriate for a subbasin planning effort, merely that the expectations for the plans needed to be consistent with these factors. We believe the expectations for the current subbasin plans were ambitious considering the schedule and funding available.
- **Deliberately coordinate implementation and revision of subbasin plans with other planning efforts –** Many planning efforts are occurring, and will occur, around the region that are or should be directly coordinated with the subbasin plans. We have coordinated with several of these efforts in producing the Asotin, Lower Snake, Tucannon, and Walla Walla subbasin plans. These include the Snake River Salmon Recovery Board, watershed resource inventory area, Walla Walla habitat conservation plan for steelhead and bull trout, comprehensive irrigation district management, federal bull trout and salmon recovery, Wy-Kan-Ush-Mi- Wa-Kish-Wit Tribal Recovery, Hatchery Genetic Management and US vs. OR planning efforts. We believe that the content and implementability of our plans have benefited and will continue to benefit significantly from this coordination.
- **Provide appropriate regional direction and assistance –** We agree that the subbasin plans must be locally generated and implemented, but this must occur in an appropriate regional context. The current process could have used more direction in this regard. Likewise, implementation and revision of the subbasin plans will benefit from appropriate regional guidance on expectations that is provided in a timely manner. For instance, we expect that regional guidance will assist us in refining our RM&E plan to be as cost-effective and scientifically-based as possible while meeting the combined needs of all subbasins and avoiding redundancy.
- **Implementation and Revision of Subbasin Plans will require ongoing involvement from subbasin interests –** The subbasin planning effort resulted in more than just plans. It resulted in relationships and processes that allow for technical, policy and public participation in developing and implementing appropriate, agreed-to on-the-ground efforts to restore and maintain fish and wildlife habitat. This will result in the good investments of tribal, local, state, regional and federal funds in watersheds. If these relationships and processes are not maintained, there is a distinct risk that the intent to maintain living plans will be defeated. We highly recommend that the appropriate level of resources (people and funding) continue to be provided to ensure that an adequate subbasin planning and implementation process is maintained.

EXECUTIVE SUMMARY

In 1980, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act which authorized creation of the Northwest Power and Conservation Council by the states of Washington, Oregon, Idaho, and Montana. The Act directed the Council to develop a program "to protect, mitigate and enhance fish and wildlife…in the Columbia River and its tributaries…affected by the development, operation and management of (hydroelectric projects) while assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply." The Council has established four primary objectives for the Columbia River Fish and Wildlife Program.

- A Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife.
- Mitigation across the Columbia River Basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem.
- Sufficient populations of fish and wildlife for abundant opportunities for tribal trust and treaty rights harvest and for non-tribal harvest.
- Recovery of the fish and wildlife which are affected by the development and operation of the hydrosystem and are listed under the Endangered Species Act.

The Columbia River Basin was divided into 62 subbasins based on Columbia River tributaries. Each subbasin is developing its own plan which will establish locally defined biological objectives to meet the four primary objectives defined by the Council. Plans developed at the subbasin level will be combined into the fourteen province-level plans and will form the framework within which the Bonneville Power Administration will fund proposed fish and wildlife projects. The subbasin planning process is viewed as an on-going effort and is anticipated to occur on a three year cycle. The plans are considered "living documents" which will incorporate new information during their periodic updates.

The subbasin plans will also play a significant role in addressing the requirements of the Endangered Species Act; NOAA-Fisheries and USFWS intend to use the plans to help in recovery of ESA-listed species. In addition, the Council, Bonneville Power Administration, NOAA-Fisheries, and USFWS will use the adopted subbasin plans to help meet subbasin and province requirements under the 2000 Federal Columbia River System Biological Opinion. Other regulatory standards and planning efforts, including the Clean Water Act and various state requirements affect, and are affected by, the subbasin plans. In particular, an interactive relationship is expected to be developed between subbasin planning, watershed plans, and State of Washington salmon recovery plans.

Tucannon Subbasin Plan

This plan concerns the Tucannon Subbasin in southeastern Washington. The Tucannon Subbasin encompasses 503 square miles in Garfield and Columbia counties drained by the Tucannon River and its tributaries. Pataha Creek is the Tucannon's major tributary. The Tucannon arises in the Blue Mountains and enters the Snake River at River Mile 62.2 near the mouth of the Palouse River. The area has an average annual rainfall of 23 inches which includes winter snowfall. Melting snow from the Blue Mountains provides much of the annual runoff to the streams and rivers in the subbasin; the water level in many streams diminishes greatly during the summer months. Vegetation in the subbasin is characterized by grasslands and agricultural lands at lower elevations and evergreen forests at higher elevations.

Major land uses in the subbasin are related to agriculture; cropland, forest, rangeland, pasture, and hay production account for more than 90 percent of the land within the watershed. Approximately 75 percent of the Tucannon subbasin is in private ownership; most of this land is in the lower portion of the watershed.

The planning process in the Tucannon subbasin involved a number of organizations, agencies, and interested parties including the Columbia Conservation District, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Washington Department of Fish and Wildlife, private landowners and others. The lead entity for the planning effort was the Columbia Conservation District with the Nez Perce Tribe and Confederated Tribes of the Umatilla Indian Reservation as the co-leads. The technical components of the assessment were developed by the Washington Department of Fish and Wildlife. The planning effort was guided by the Asotin, Lower Snake, and Tucannon Subbasin Planning Team which included representation from the lead entity, co-leads, local resource managers, conservation districts, agencies, private landowners, and other interested parties. The vision statement and guiding principles for the management plan were formulated by the Subbasin Planning Team through a collaborative and public process. The vision statement is as follows.

The vision for the Tucannon Subbasin is a healthy ecosystem with abundant, productive, and diverse populations of aquatic and terrestrial species that supports the social, cultural and economic well-being of the communities within the Subbasin and the Pacific Northwest.

Together with the guiding principles, the vision statement provided guidance regarding the assumptions and trade-offs inherent in natural resource planning.

Aquatic Focal Species and Species of Interest

To guide the assessment and management plan, focal species were selected for aquatic and terrestrial habitats within the Tucannon Subbasin. Aquatic focal species are steelhead/rainbow trout, spring Chinook and fall Chinook salmon, and bull trout. These species were chosen based on the following considerations:

- Selection of species with life histories representative of the Tucannon Subbasin
- ESA status
- Cultural importance of the species
- Level of information available about species' life histories allowing an effective assessment

In addition, Pacific lamprey, coho salmon, freshwater mussels, and mountain whitefish were designated as aquatic "species of interest" for this planning effort. These species are of cultural and ecological significance to stakeholders, but not enough information was available to warrant their selection as focal species.

Terrestrial Focal Species and Priority Habitats

Focal terrestrial species are white-headed woodpecker, flammulated owl, Rocky Mountain elk, yellow warbler, American beaver, great blue heron, grasshopper sparrow, sharp-tailed grouse, and mule deer. The criteria for selection of these species are:

- Primary association with focal habitats for breeding
- Specialist species that are obligate or highly associated with key habitat elements or conditions important in functioning ecosystems
- Declining population trends or reduction in historic breeding range
- Special management concerns or conservation status (threatened, endangered, species of concern, indicator species)
- Professional knowledge of species of local interest

Within the Tucannon Subbasin, four priority habitats were selected for detailed analyses: ponderosa pine, eastside interior grasslands, interior riparian wetlands, and shrub-steppe. These were selected based upon determination of key habitat needs by local resource managers, the ability of these habitats to track ecosystem health, and cultural factors.

Within this subbasin plan, the role of aquatic focal species differed from the role of terrestrial focal species. Aquatic focal species were used to inform decisions regarding the relative level of enhancement effort required to achieve an ecological response. Due to data limitations, terrestrial focal species did not inform the majority of the management plan, but instead will be used to guide monitoring the functionality of priority habitats. Terrestrial priority habitats were used to guide development of the management plan for terrestrial habitats and species.

Aquatic Habitat Assessment

Assessment of aquatic habitats for steelhead and salmon within the Tucannon subbasin was accomplished with the Ecosystem Diagnostic and Treatment (EDT) model. Bull trout were not assessed using EDT as its methodology does not yet include information pertinent to that species.

EDT is a system for analyzing aquatic habitat quality, quantity, and diversity relative to the needs of a focal species. The purpose of the analysis is to identify stream reaches that can provide the greatest biological benefit based upon potential improvement in habitat conditions. This is accomplished by comparing historic aquatic habitat conditions in the watershed to those currently existing relative to life history needs of the focal species. The result of the analysis is identification of stream reaches that have high potential restoration and protection values. These values allow prioritization of corrective actions to gain the greatest benefit with the lowest risk for the focal species.

For Tucannon River summer steelhead and spring/fall Chinook salmon, the EDT analysis identified areas that currently have high production and should be protected (High Protection Value) and areas with the greatest potential for restoring life stages critical to increasing production (High Restoration Value). These initial EDT results were then reviewed in light of the following four considerations: 1) results of related assessment and planning documents (Limiting Factors Analysis, Tucannon Subbasin Summary, Tucannon Model Watershed Plan, etc.); 2) the necessary trade-offs between the biological benefits provided by enhancement potential of one geographic area versus another to achieve geographic prioritization; 3) balancing the needs of all aquatic focal species; and 4) physical and socioeconomic limitations. This type of review was necessary given the data gaps currently present in the EDT model and the fact that EDT is an ecologically-based model that does not incorporate factors such as limited access to wilderness areas. Through this review, the initial EDT results were modified in a limited number of instances to develop a group of priority restoration geographic areas and a group of priority protection geographic areas. These geographic areas include the stream reaches themselves and the upland areas that drain to these reaches.

The areas with the highest restoration value in the Tucannon Subbasin are: Tucannon River from Pataha-Marengo, Tucannon River from Marengo-Tumalum, Tucannon River from Tumalum-Hatchery,Tucannon River from Hatchery-Little Tucannon, and Mountain Tucannon. Within these priority areas, the most negatively impacted life stages were identified for steelhead and spring Chinook. In each of these areas, the key environmental factors that contribute to losses in focal species performance, i.e. limiting factors, were also identified. Key limiting factors for steelhead and spring/fall Chinook included the following: sediment, large woody debris, key habitat (pools), riparian function, stream confinement, summer water temperature, and flow. Decreasing the effect of these limiting factors through habitat enhancement is expected to benefit bull trout as well as steelhead, spring Chinook, and fall Chinook.

Priority protection geographic areas for aquatic focal species include the five areas identified for restoration plus Panjab Creek, Cummings Creek, the lower Tucannon River, and the Tucannon River headwaters. Protecting current habitat conditions in these geographic areas is expected to achieve no loss of function, and to allow for natural attenuation of limiting factors over time to benefit aquatic habitat.

Terrestrial Habitat Assessment

The terrestrial assessment occurred at two levels: Southeast Washington Ecoregion and subbasin level. Several key databases, i.e. Ecosystem Conservation Assessment (ECA), the Interactive Biodiversity Information System (IBIS), and the GAP analyses, containing information on historic and current conditions were used in the assessment. The ECA data identified areas that would provide ecological value if protected and are under various levels of development pressure. The IBIS database provided habitat descriptions and historic and current habitat maps. GAP data classifies terrestrial habitats by protection status based primarily on the presence or absence of a wildlife habitat and species management program for specific land parcels. The classification ranges from 1 (highest protection) to 4 (little or unknown amount of protection).

The nature and extent of the focal habitats were described as well as their protection status and threats to the habitat type. Shrub-steppe habitats, though common on the Columbia Plateau, do not occur in the Tucannon Subbasin, nor is it considered to have occurred here historically. From historic to current times, there has been an estimated 43 percent decrease in riparian wetland habitat, 40 percent decrease in interior grassland habitat, and a 69 percent decrease in ponderosa pine habitat within the subbasin. Little information was available regarding the functionality of remaining habitats. Most ponderosa pine forest and eastside grassland habitats in the subbasin are afforded “low” protection status, while most interior wetlands receive no protection. In total, 4 percent of the subbasin is considered to be in high protection status (primarily the Wenaha-Tucannon Wilderness Area), 3 percent is in medium protection status, 24 percent in low protection status, and 69 percent has no protection status or is area for which this information was not available.

Inventory

Complementing the aquatic and terrestrial assessments, information on programmatic and project-specific implementation activities within the subbasin is provided. A wide variety of agencies and entities are involved in habitat protection and enhancement efforts within the Tucannon Subbasin, including the Columbia Conservation District, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, U.S. Fish and Wildlife Service (USFWS), NOAA-Fisheries, Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology, cities, counties, and others. Key aquatic and terrestrial programs include the following:

- USDA Programs (e.g. Conservation Reserve Enhancement Program, Conservation Reserve Program)
- Total Maximum Daily Load water quality enhancement program
- Hatchery programs
- Harvest regulations (tribal and sport fishing)
- Blue Mountains Elk Management Plan (WDFW)
- Priority Habitats and Species Program (WDFW)

Project-specific information was only available for aquatic habitats. Since 1996, projects implemented within the subbasin focused on several key attributes:

- upland issues (10%)
- riparian restoration (36%)
- instream (42%)
- Conservation Reserve Program/Conservation Reserve Enhancement Program (12%)

Management Plan

The management plan consists of three components: working hypotheses, biological objectives, and strategies. Working hypotheses are statements about the identified limiting factors for aquatic species and terrestrial habitats. The hypotheses are intended to be testable, allowing future research to evaluate their accuracy. Biological objectives are measurable objectives for selected habitat components based upon what could reasonably be achieved over the 10 to 15 year planning horizon. Quantitative biological objectives were identified where supporting data was available. Where such data was not present, qualitative biological objectives based on desired trends were proposed. Strategies identify the types of actions that can be implemented to achieve the biological objectives.

For terrestrial species and habitats, the limited information available precluded development of biological objectives and strategies for individual focal species. Instead, terrestrial strategies focus on enhancement of priority habitat types, under the general assumption that improvements to terrestrial habitats will benefit terrestrial species. Both protection and enhancement strategies were developed.

Aquatic strategies focus on methods to achieve improvements in aquatic habitat. Both restoration and protection strategies were developed. Restoration strategies focus on enhancing the current habitat conditions while protection strategies focus on maintenance of current conditions. Although local stakeholders desired to achieve the greatest coordination possible among various planning efforts, the draft Bull Trout Recovery Plan being developed by the U.S. Fish and Wildlife Service was not directly incorporated because it is still in draft form. However, the draft strategies it contains were considered and incorporated in general form during development of aquatic management strategies in the subbasin plan. The subbasin intends to consider incorporation of selected Bull Trout Recovery Plan strategies into the subbasin plan once the recovery plan is finalized.

For each priority restoration geographic area within the subbasin, working hypotheses were developed for each limiting factor, causes of negative impacts were listed, biological objectives were delineated, and strategies were proposed. For example, in the Pataha-Marengo area, Working Hypothesis 4 states that an increase in riparian function and a decrease in stream confinement will increase the survival of steelhead, spring Chinook, and bull trout in various life stages. Biological objectives in this geographic area are as follows:

- Sediment – achieve less than 20% mean embeddedness
- Large Woody Debris – at least 2 pieces per channel width should be present
- Pools – 15% or more of the stream surface area should be pools
- Riparian Function – the riparian function should be at least 75% of maximum
- Confinement – no more than 25% of the stream bank length should be confined
- Summer Maximum Water Temperature – the water temperature should exceed 75°F on fewer than 4 days per year
- Instream Flow – flow should be increased where possible

Strategies were identified specific to each biological objective and include limiting firewood cutting in riparian areas, upholding existing land use regulations, implementing conservation easements, and decommissioning/paving roads near the river. These and similar strategies were applicable across all priority restoration geographic areas. Achieving the biological objectives in the priority restoration areas is considered a priority within the subbasin.

Aquatic strategies were also developed for two additional categories: 1) priority protection areasand 2) imminent threats. Priority protection geographic areas are those areas that EDT analysis or empirical data suggest would have the most negative impacts on the focal species if they were allowed to degrade further. Because all priority restoration areas are also considered priority protection areas, these strategies would apply to both types of geographic areas. Priority protection area strategies include but are not limited to implementation of riparian buffers, upland enhancement, alternative water development, conservation easements, expanding participation in the Conservation Reserve Program and similar efforts, and water conservation.

Imminent threats are those factors likely to cause immediate mortality to the aquatic focal species and include the following three categories: fish passage obstructions, inadequate fish screens, and stream reaches that are dewatered due directly to man-caused activities. Implementing the identified strategies in priority protection areas and addressing imminent threats throughout the subbasin are also considered priorities within this subbasin plan.

Working hypotheses for terrestrial habitats are based on factors that affect (limit) focal habitats. Hypotheses were defined for riparian/riverine wetlands, ponderosa pine habitats, and interior grasslands. Factors affecting the habitats were identified and biological objectives reflecting habitat protection as well as enhancement and maintenance of habitat function were formulated. Terrestrial habitat biological objectives are focused on protecting and enhancing functionality in areas that are have a high or medium protection status, and private lands that meet one or more of the following conditions:

- directly contribute to the restoration of aquatic focal species
- have high ecological function
- are adjacent to public lands

- contain rare or unique plant communities
- support threatened or endangered species/habitats
- provide connectivity between high quality habitat areas
- have high potential for re-establishment of functional habitats

Terrestrial strategies are based on a flexible approach which takes into account a variety of conservation “tools” such as leases and easements and cooperative projects/programs. The efficacy of focusing future protection efforts on large blocks of public and adjacent lands is recognized.

The specific strategies are focused entirely on improvements in functional habitat. Strategies for achieving the biological objectives include upholding existing land use and environmental regulations, , completing a more detailed assessment of the focal species, providing outreach opportunities, and identifying functional habitat areas.

Agriculture is considered a “cover type of interest” due to its predominance in the subbasin and its potential to both positively and negatively impact terrestrial wildlife. Proposed enhancement efforts in this area focus on limiting elk and deer damage on private agricultural lands.

Additional components of the management plan include the following:

- Comparison of the relative ecological benefit of achieving the restoration biological objectives only, protection biological objectives only, versus achieving all of the proposed biological objectives.
- Preliminary numeric fish population goals from other planning efforts (Biological objectives in this plan are habitat-based. Objectives with specific fish population numbers were not established in this subbasin plan).
- Research, monitoring, and evaluation priorities for aquatic and terrestrial species and habitats.

Integration of the aquatic and terrestrial strategies and integration of the subbasin strategies with those of the Endangered Species Act and the Clean Water Act are addressed in the plan. These aspects are expected to develop further as the plan is implemented and related efforts such as the Snake River Salmon Recovery Plan are developed. This plan will evolve over time through use of an adaptive management strategy that will allow funding to consistently be applied to those projects that can achieve the greatest benefits.

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APPENDICES

ACRONYM LIST

BiOp	2000 Federal Columbia River System Biological Opinion
BMP	Best Management Practice
BPA	Bonneville Power Administration
CRITFC	Columbia River Inter-tribal Fish Commission
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CW	Channel width
CWA	Clean Water Act
ECA	Ecoregion Conservation Assessment
EDT	Ecosystem Diagnosis and Treatment
EQIP	Environmental Quality Improvement Program
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FSA	Farm Services Agency
IBIS	Interactive Biodiversity Information System
ISRP	Independent Scientific Review Panel
LWD	Large woody debris
MBI	Mobrand Biometrics, Inc.
N(eq)	Equilibrium abundance of returning adult spawners
NF	North Fork
NGO	Non-Governmental Organization
NOAA	National Oceanographic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NPT	Nez Perce Tribe
NWPCC	Northwest Power and Conservation Council
OOSE	Out of Subbasin Effects
PFC	Properly Functioning Conditions
PHS	Priority Habitats and Species
SF	South Fork
SH	Steelhead

ACRONYM LIST (Continued)

SOI	Species of Interest
SPCK	Spring Chinook
SPT	Subbasin Planning Team
TMDL	Total Maximum Daily Load
TOAST	Oregon Technical Outreach and Assistance Team
TRT	Technical Recovery Team
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VSP	Viable Salmonid Population
WDFW	Washington Department of Fish and Wildlife
WLRIS	Washington Lakes and Rivers Information System
WQMA	Water Quality Management Area
WRIA	Water Resource Inventory Area

GLOSSARY

Active Restoration: Active restoration is the use of a structural improvement or direct instream work for the benefit of instream habitat. Examples include installation of large woody debris, rock weirs, and J-hook vanes. Activities such as riparian planting and upland infiltration enhancement are not considered active restoration actions. Note that this is the definition of active restoration for this subbasin plan, and may not be consistent with typical definitions of active restoration.

Adult Abundance: Adult abundance is the number of adult fish that the EDT model predicts would be present, given a set of habitat conditions and incorporating a factor for calculating out of subbasin effects.

Capacity: Capacity is the number of juvenile and adult fish that could potentially be supported by a stream under a defined set of habitat conditions (e.g. historic or current).

Concentrated Recreational Uses: Includes campgrounds, ORV trails, trailheads, day use areas, parking lots and similar practices.

Hard Stabilization: Hard stabilization includes the use of rip rap, concrete, and similar structures to stabilize streambanks. Use of such structures is discouraged throughout the subbasin. Methods such as vegetation planting, fascines, instream structures (e.g. J-hook vanes, vortex rock weirs), and similar bio-engineered structures, are the preferred methods of bank stabilization.

Large Woody Debris (LWD): Woody debris of significant size, enough to generate pools, provide rearing habitat, control sediment, and manage stream hydrology.

Life History Diversity: Life history diversity refers to the numerous potential paths a fish can use to move through its life cycle, including geographic options for habitat to support egg incubation, emergence, rearing, downstream migration, maturation, upstream migration, and spawning. Habitat degradation can limit the number of potential paths available, and as such leave population at-risk if a catastrophic event were to occur affecting the remaining life history pathways.

Managed Grazing: A grazing regime that includes consideration of the appropriate number of livestock for a particular area, alternative water sources and conveyance systems, timing, intensity, limited stream access (water gaps) and other practices combined in a manner that helps maintain the health and vigor of livestock, range and riparian vegetation, and water resources.

Overgrazing: Historic and/or current grazing by livestock and/or wild ungulates that is inconsistent with desired ecological conditions through its timing, intensity, duration, and utilization.

Passive Restoration: Passive restoration takes advantage of natural processes and out-of-stream actions to achieve instream habitat enhancement. Examples includes planting riparian vegetation, implementing conservation easements, increasing upland infiltration (e.g. direct seed/no-till), use of sediment basins, developing alternative livestock watering facilities, and water conservation. Note that this is the definition of passive restoration for this subbasin plan, and may not be consistent with typical definitions of passive restoration.

Primary Pools: Large, stable pools that provide critical habitat for several salmonid life stages, including adult pre-spawn holding. Primary pools include log or rock plunge pool or pools at meander bends that are at least 50 percent the width of the stream.

Productivity: Productivity refers to the number of adults that return to a stream per spawning fish.

Riparian Function: The riparian corridor provides a variety of ecological functions, which generally can be grouped into energy, nutrients, and habitat as they affect salmonid performance. Some aspects of these functions are expressed through specific environmental attributes within EDT, such as wood debris, flow characteristics (several attributes), temperature characteristics (several attributes), benthos, pollutant conditions, and habitat type characteristics (e.g., pool-riffle units). Not all functions are identified and treated as separate environmental attributes. Functions specifically not covered include the following:

- Terrestrial insect input (affects fish food abundance)
- Shade (provides a form of cover, temperature covered by specific attributes)
- Source of fine detritus (affects fish food abundance, large wood covered by specific attribute)
- Bank and channel stability (affects suitability of fish habitat, as well as micro-habitat)
- Bank cover (affects suitability of fish habitat, as well as micro-habitat)
- Secondary channel development (affects channel stability, flow velocities, and habitat suitability)
- Groundwater recharge and hyporheic flow characteristics (affects fish food abundance, strength of upwelling, and micro temperature spatial variation)
- Flow velocity along stream margins (affects suitability of fish habitat)
- Connectivity to off-channel habitat (affects likelihood of finding off-channel sites)

Summer Flows: typically July-October

1. Introduction

The Tucannon Subbasin Plan was developed through cooperation of a multitude of stakeholders including the Columbia Conservation District, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, local landowners, Washington Department of Fish and Wildlife, United State Forest Service, United State Fish and Wildlife Service, and others. The vision guiding the development of this plan was defined as follows:

> *The vision for the Tucannon Subbasin is a healthy ecosystem with abundant, productive, and diverse populations of aquatic and terrestrial species that supports the social, cultural and economic well-being of the communities within the Subbasin and the Pacific Northwest.*

This plan was developed to meet requirements of the Norhtwest Power and Conservation Council (formerly Northwest Power and Planning Council), created across the states of Idaho, Montana, Oregon and Washington when Congress passed the 1980 Pacific Northwest Electric Power Planning and Conservation Act. The Act directs the Council to develop a program to "protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries affected by the development, operation and management of [hydroelectric projects] while assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply" (NPPC 2000).

The Council has stated the following four overarching objectives for the Columbia River Fish and Wildlife Program (Program):

- A Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife.
- Mitigation across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem.
- Sufficient populations of fish and wildlife for abundant opportunities for tribal trust and treaty right harvest and for non-tribal harvest.
- Recovery of the fish and wildlife affected by the development and operation of the hydrosystem that are listed under the Endangered Species Act (ESA).

To achieve these program-level objectives, the Council intends to establish specific biological objectives at the subbasin level that will then be combined into objectives at the province level. The Council will integrate locally developed plans for the 62 tributary subbasins of the Columbia River and a plan for the mainstem into the Program. Plans developed at the subbasin level will provide a framework within which fish and wildlife projects are proposed for Bonneville Power Administration (BPA) funding to implement the Program. Subbasin plans will be the context, for review of proposals for BPA funding by the fish and wildlife agencies and tribes, the Independent Scientific Review Panel (ISRP), and the Council. The projects funded by BPA will be reviewed through the Council's Rolling Provincial Review Process once every three years.

The following is taken from NWPCC, 2001, and describes the rolling review process:

> "An adopted subbasin plan is intended to be a living document that increases analytical, predictive, and prescriptive ability to restore fish and wildlife. At each three-year cycle of planning, the updated information will guide revision of the biological objectives, strategies and implementation plan. The Council views the assessment development as an ongoing process of evaluation and refinement of the region's efforts through adaptive management, research and evaluation. It will need maintenance over time that will need to be coordinated with other agencies and stakeholders. In addition, as relationships are made at a larger scale such as a province or ESU, adaptive management practices may be warranted to reflect priorities at the larger scale."

The Tucannon Subbasin Plan is a local response to this regional directive. Components of this plan will be integrated with those of the Yakima, Crab, Palouse, Deschutes, John Day, Lower Middle Columbia, Umatilla, Walla Walla and Lower Snake Mainstem subbasins in the Columbia Plateau Province. The key components of this subbasin plan include the introduction, subbasin overview, aquatic species and habitat assessment, terrestrial species and habitat assessment, inventory of existing projects, integration of aquatic and terrestrial components, and the management plan. This plan is based upon the best available science, and its various components explicitly identify the data, hypotheses, and assumptions used during its development.

Following are the key components of the Tucannon Subbasin Plan by chapter:

- Chapter 1: Introduction, planning context, approach, and participants
- Chapter 2: Overview of current conditions in the subbasin.
- Chapter 3: Discussion of the Ecosystem Diagnosis and Treatment modeling method used for the aquatic assessment, and results of this effort.
- Chapter 4: Discussion of the methods used for the terrestrial assessment, and results of this effort.
- Chapter 5: Integration of aquatic and terrestrial components
- Chapter 6: Identification of programmatic activities and recent habitat enhancement projects
- Chapter 7: Discussion of subbasin priorities in terms of the vision, working hypotheses, biological objectives, and strategies. This includes identification of topics that required special treatment outside of the standard assessment approach and an implementation plan.

Through this planning process, the technical staff and the public worked together to identify working hypotheses regarding limiting factors for fish, wildlife, and habitat, define objectives that measure progress toward those goals, and develop strategies to meet those objectives. See Section 1.2 for a list of planning participants.

1.1 Planning Context

1.1.1 Relationship to Applicable Federal and State Regulations

The Tucannon Subbasin Plan is one piece of a larger effort to achieve de-listing and/or recovery of species currently listed under the Endangered Species Act (ESA). ESA requirements for aquatic species in the subbasin will be met primarily through development and implementation of the Snake River Salmon Recovery Plan. As a mechanism to obtain funding for habitat enhancement projects, the Tucannon Subbasin Plan will play a key role in this process. The National Oceanographic and Atmospheric Administration-Fisheries (NOAA-Fisheries) and the U.S. Fish and Wildlife Service (USFWS) intend to use adopted subbasin plans as one component leading toward recovery of ESA-listed species. This includes integration with NOAA-Fisheries Technical Recovery Team (TRT) goals. In addition, the Council, BPA, NOAA-Fisheries and USFWS will use adopted subbasin plans to help meet requirements under the 2000 Federal Columbia River System Biological Opinion (BiOp) at the subbasin and/or province level.

Within the Tucannon Subbasin four primary aquatic species are listed as threatened: Steelhead, Bull Trout, Spring Chinook and Fall Chinook. Threatened status means that the listed group is likely to become endangered (in danger of extinction) within the foreseeable future throughout all or a significant portion of its range.

- The Snake River Basin steelhead ESU, which includes Tucannon River summer steelhead, was listed as threatened under the federal Endangered Species Act (ESA) by NOAA Fisheries in August, 1997 (62 FR 43937).
- The Snake River spring/summer Chinook evolutionarily significant unit (ESU), which includes Tucannon River spring Chinook, was listed as threatened under the ESA in 1992 (57 FR 14653).
- The Snake River fall Chinook evolutionarily significant unit (ESU), which includes fall chinook in the Tucannon River, was listed as threatened under the federal Endangered Species Act (ESA) in 1992 (NMFS 1992).
- Bull Trout in the Columbia Basin (including the Tucannon River) were listed as threatened under the ESA in 1998.

The 1972 Clean Water Act (CWA) requires states to establish and administer standards for specific pollutants in water bodies. The CWA requires states to identify those water bodies that do not meet state standards, i.e. the 303(d) list. Although the State of Washington is currently revising their water quality regulatory system, Total Maximum Daily Loads (TMDLs) will still be required for each water body and water quality parameter that caused it to be placed on the 303(d) list. In Washington, TMDLs are developed on a five-year rotating watershed schedule, where in which watersheds are divided into Water Quality Management Areas (WQMAs). Specific strategies outlined in the management plan (Chapter 7) will provide direction for water quality enhancement (addressing primarily turbidity and temperature).

1.1.2 Integration with Related Planning Efforts

The Tucannon Subbasin Summary was completed in 2001 (Gephart & Nordheim 2001). This summary was comprehensive with regard to the existing conditions, programs, projects, and management activities. Information contained in the subbasin summary was used in development of this plan to the greatest extent possible. During plan development, three key departures from the subbasin summary occurred: 1) development of a more solid scientific basis within the assessment; 2) development of the management plan section where hypotheses, objectives and strategies are developed and identified for a 10 to 15 year planning horizon (Chapter 7 of this subbasin plan); and 3) attempted integration and agreement by diverse stakeholders on the management plan.

Table 1-1 identifies other assessments and plans that subbasin technical staff and planners used to develop the current plan. Empirical data and local knowledge of the subbasin also played a key role in development of this plan. These assessments and plans are referenced in this subbasin plan, as appropriate.

Table 1-1 Primary Pre-Existing Assessments and Plans used for Subbasin Plan Development

Assessment/Plan	Sponsor
Limiting Factors Analysis	Washington Conservation Commission
Tucannon Subbasin Summary	Northwest Power and Conservation Council
Tucannon River Model Watershed Plan	Northwest Power and Conservation Council
Bull Trout Recovery Plan (draft)	U.S. Fish and Wildlife Service
Spirit of Salmon; Wy-Dan-Ush-Mi-Wa_Kish-Wit	Columbia River Inter-tribal Fish Commission

1.1.3 Integration with Future Planning Efforts

In addition to integration with federal obligations under the Northwest Power Act, ESA, CWA, and tribal trust and treaty-based responsibilities, subbasin plans need to look more broadly toward other federal, state, and local activities. Inclusion of such elements will enable coordination of activities to eliminate duplication, enhance cost-effectiveness, and allow pursuit of funding in addition to that provided by the BPA.

One such planning activity is the Water Resource Inventory Area (WRIA) 35 watershed planning process. In 1998, the Washington legislature passed HB 2514, codified into RCW 90.82, to set a framework for addressing water quantity and quality issues including establishing instream flows and addressing salmon habitat needs. This process in WRIA 35, which includes the Tucannon Subbasin is currently in the assessment phase. It is expected to incorporate the management plans of the Asotin, Lower Snake, and Tucannon subbasins as its approach for assessing and managing fish habitat.

The Snake River Salmon Recovery Plan is another local planning effort that will incorporate the information provided by several subbasin plans, including the Tucannon. The Snake River Salmon Recovery Board will play an integral role in implementation and progress evaluation of habitat improvement projects for the Tucannon Subbasin Plan. Snake River Salmon Recovery is a regional effort to identify a strategy for salmon recovery that is science-based and supported by the community and Tribes. Representatives from Asotin, Columbia, Garfield, Walla Walla, and Whitman counties, and the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), are guiding the recovery planning process by serving as representatives of the region's stakeholders in building a plan that puts effective and endorsed salmon recovery actions "on the ground." The Snake River Salmon Recovery Board will play an integral role in implementation and progress evaluation for the Tucannon Subbasin Plan.

1.2 Planning Process and Participants

The planning process in the Tucannon Subbasin involved numerous entities, including the Columbia Conservation District, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, Washington Department of Fish and Wildlife (WDFW), WRIA 35 Planning Unit, Snake River Salmon Recovery Board, and others. Figure 1-1 shows the general relationship between the various groups.

The lead entity for development of the Tucannon Subbasin Plan was the Columbia Conservation District. The Nez Perce Tribe and Confederated Tribes of the Umatilla Indian Reservation served as co-leads.

The WDFW developed all technical assessment components, both aquatic and terrestrial. Their work was accomplished with the assistance of Mobrand Biometrics, Inc., who provided assessment data using the Ecosystem Diagnosis and Treatment model (see Chapter 3), compiled the inventory information (see Chapter 6), and completed the objectives analysis (see Chapter 7). Organizational support, policy development, facilitation, writing and document editing services were provided by the consultant team of Parametrix and Economic and Engineering Services, Inc.

The key group involved in guiding the Tucannon Subbasin Plan was the Asotin, Lower Snake, and Tucannon Subbasin Planning Team (SPT). The SPT was established in fall 2003, and has representation from the lead entity, co-lead, local resource managers, and others (see Table 1-2 for membership list). Meetings of the SPT were held on November 20, 2003, January 27, 2004, March 23, 2004, and April 28, 2004. Significant communication via teleconference and email occurred among SPT members between these meeting dates. The SPT served multiple roles, including information clearinghouse, approving documents prior to public review. Most important, the SPT served as the forum in which significant policy-level issues were discussed and addressed. Given that all major groups involved in Subbasin planning in the Tucannon were involved on the SPT, it also served a key function coordinating the efforts of its members. The SPT operated by consensus. Decision memos were used to track approval of plan components and key decisions throughout plan development.

Table 1-2 Asotin, Lower Snake, and Tucannon Subbasin Planning Team Membership

Member	Affiliation
Bradley Johnson	Asotin County Conservation District
Terry Bruegman	Columbia Conservation District
Duane Bartels	Pomeroy Conservation District
Emmit Taylor	Nez Perce Tribe
Paul Kraynak	Nez Perce Tribe
Angela Sondenaa	Nez Perce Tribe
Del Groat	U.S. Forest Service
Carl Scheeler	Confederated Tribes of the Umatilla Indian Reservation
Mark Wachtel	Washington Department of Fish and Wildlife
Jason Flory	U.S. Fish and Wildlife Service
Paul Beaudoin	Landowner (Pomeroy Conservation District)
Chad Atkins	Washington Department of Ecology
Jed Volkman	Confederated Tribes of the Umatilla Indian Reservation
Keith Berglund	Garfield County Wheat Growers
Pat Fowler	Washington Department of Fish and Wildlife
Steve Martin	Snake River Salmon Recovery Board
Victoria Leuba	Washington Department of Ecology
Gary James	Confederated Tribes of the Umatilla Indian Reservation
Les Marois	Nez Perce Tribe

Informal technical work groups were also used throughout the process. These groups were comprised primarily of Conservation District, Nez Perce Tribe, United States Forest Service (USFS), CTUIR, USDFW, WDFW, Washington Department of Ecology and consultant team staff. The primary purpose of the technical work group was to review and evaluate WDFW work products before presentation to the public in order to identify inconsistencies and address technical issues. Figure 1-1 illustrates the information flow and decision-making framework used in this process.

The Tucannon Subbasin Plan will be a significant component of the WRIA 35 Watershed and Snake River Salmon Recovery planning efforts as they proceed. As such, these two groups were provided the opportunity to review plan components during development.

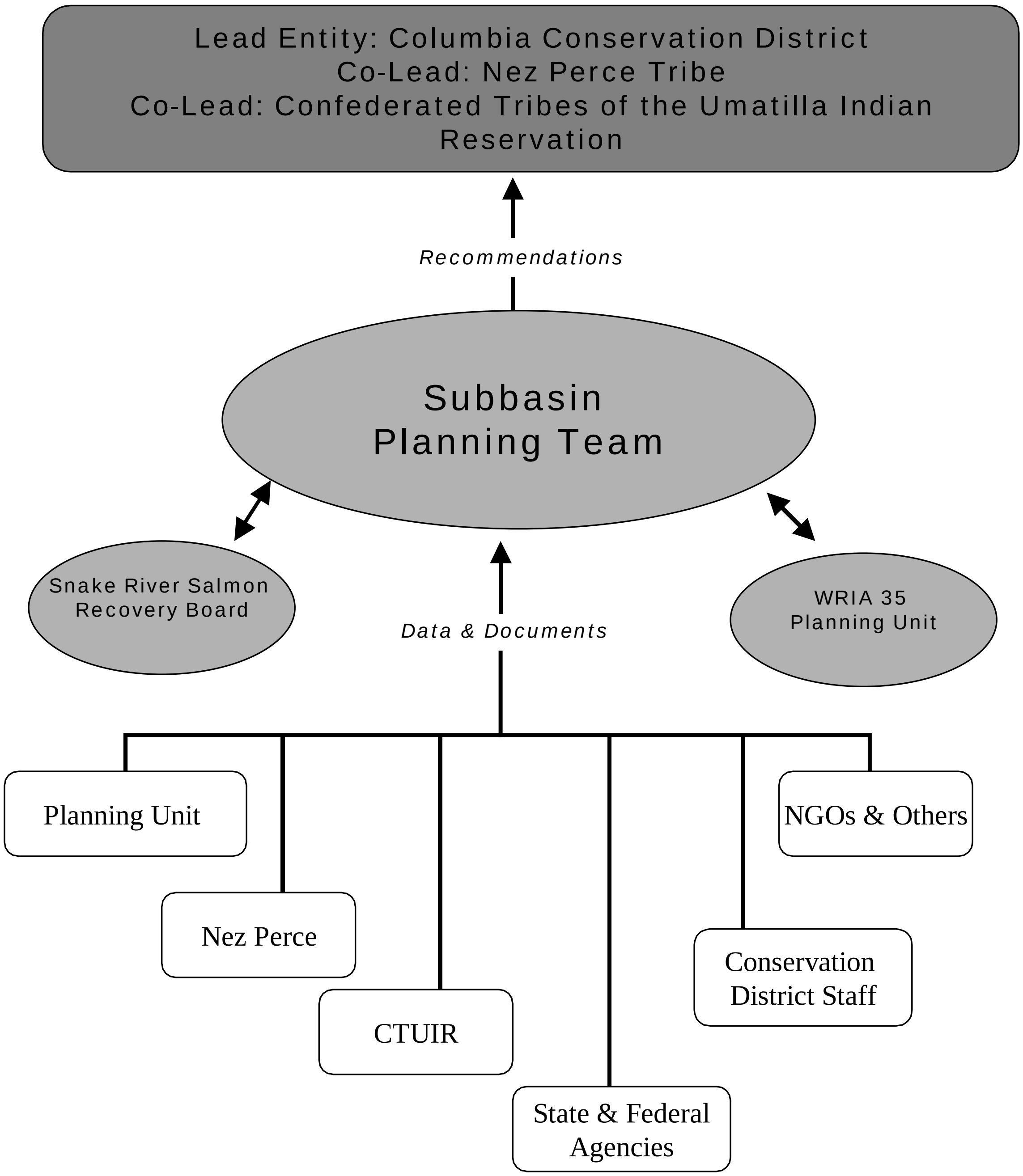

Figure 1-1 Tucannon Subbasin Information Flow and Decision-Making Framework

1.3 Public Involvement

1.3.1 Public Involvement During Plan Development

Public involvement was a key element of the subbasin planning process. Opportunities for public involvement were numerous, including the following:

- Subbasin Planning Scoping Public Meeting
- Subbasin Planning Assessment Public Meeting
- Management Plan Public Workshop #1
- Management Plan Public Workshop #2
- Information posted on the subbasin planning website (http://www.nwppc.org/fw/subbasinplanning/admin/upload/list.asp?id=54)
- Draft documents distributed to the WRIA 35 and Snake River Salmon Recovery Board mailing lists and interested parties, and discussed at their scheduled meetings.

The assessment and two management plan workshops listed above provided a significant opportunity for interface between the SPT, technical staff, and the public. Prior to each of these meetings, the technical work group met to review and revise information prepared by WDFW. At each public meeting, a subbasin planning overview and status update were provided, available information was presented, and the documents available were discussed and revised. Feedback received from the public was used to change the documents in real-time at the meetings. In addition, comment sheets and self-addressed stamped envelopes were distributed at each meeting for written comments, which were later incorporated into the plan. The public involvement plan for the Asotin, Lower Snake, Tucannon, and Walla Walla Subbasins can be found in Appendix A.

Outreach During Implementation

Over the long run, it is important to develop broad public understanding and commitment to fish and wildlife efforts in the Tucannon Subbasin. This effort needs to involve individuals as well as agencies. Information and resources from state agencies, Nez Perce Tribe and subbasin scale efforts need to be provided to local groups, while local data from conservation districts and others need to be integrated into the subbasin scale effort. A sustained, long-term effort to provide information to communities and residents of the subbasin needs to be maintained. Implementation of this subbasin plan will rely upon the cooperation of private landowners. Public outreach regarding the purpose, objectives, and benefits of this plan can play a large role in supporting successful implementation. Further, public outreach and education can reap additional benefits as individuals voluntarily modify their actions for the benefit of aquatic and terrestrial species and their habitats. Public outreach and education activities should occur with the cooperation of a wide variety of local stakeholders, including the Asotin County Conservation District, Nez Perce Tribe, state agencies, and others.

1.4 Plan Approval

On May 12, 2004, the Columbia Conservation District Board of Directors approved submittal of the Tucannon Subbasin Plan, May 2004 Version, to the Northwest Power and Conservation Council.

1.5 Plan Updates

The Tucannon Subbasin Plan was written with a 10 to 15 year planning horizon. All hypotheses, objectives, and strategies were established with this time frame in mind. Upon approval of the subbasin plan, it will be reviewed by the Council's Independent Science Review Panel (ISRP). The entities involved in development of this plan anticipate that they will be provided the resources and opportunity to address the ISRP's concerns through a subsequent plan finalization process at the subbasin-level with local stakeholders. Upon adoption into the Council's Fish and Wildlife Program, the entities involved in development of this plan further anticipate that they will be provided the resources and opportunity to lead future updates of this subbasin plan.

2. Subbasin Overview

2.1 Subbasin Description

2.1.1 Location and Climate

The Tucannon Subbasin is comprised of an area of 503 square miles located in Garfield and Columbia Counties in southeastern Washington (Northwest Power Planning Council 2001). The following description of the Subbasin drainage area and climate was excerpted from the Draft Tucannon Subbasin Summary completed by the Northwest Power Planning Council (NPPC 2001).

> "The Tucannon River has two major drainages, the mainstem and Pataha Creek. The mainstem drains 207,734 acres (318 mi^2) and flows into the Snake River at river mile (RM) 62.2, three miles upstream of Lyons Ferry State Park, near the mouth of the Palouse River (Figure 2-1). Besides Pataha Creek, the major tributaries to the mainstem include Willow Creek, Kellogg Creek, Cummings Creek, Little Tucannon River, Panjab Creek, Sheep Creek, and Bear Creek. Pataha Creek drains 114,166 acres (185 mi^2) and enters the Tucannon River at RM 11.2. Major tributaries of Pataha Creek are seasonal streams that include Dry Pataha Creek, Sweeney Gulch, Balmaier Gulch, Linville Creek, Tatman Gulch, and Dry Hollow."

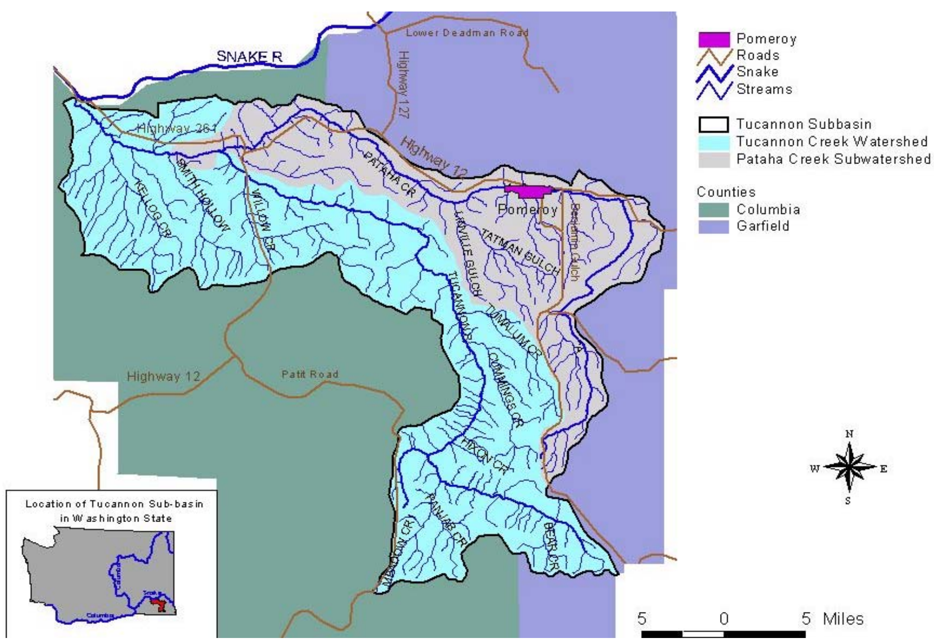

Figure 2-1 Location of Tucannon Subbasin
ICBEMP data source, Map by Ecopacific as shown in NPPC 2001, Figure 1.

"The Cascade Mountains to the west, the Pacific Ocean beyond the mountains, and the prevailing westerly winds, influences the climate of the region. The subbasin receives a mean annual precipitation of 23 inches including a mean annual snowfall of 65 inches (Figure 2-2)"

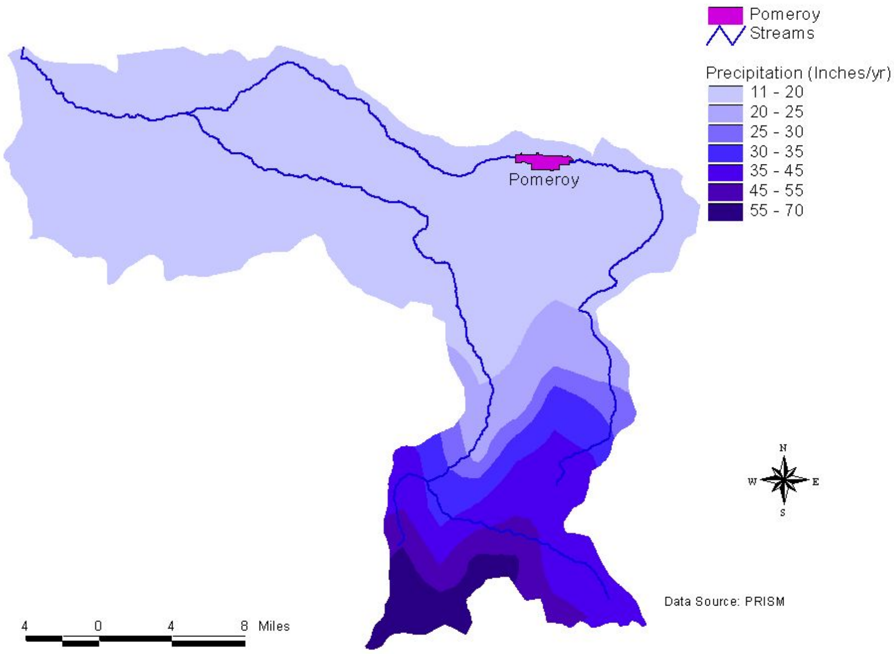

Figure 2-2 Precipitation Trends of the Tucannon Subbasin
Map by Ecopacific as shown in NPPC 2001, Figure 4.

"Rainfall ranges from more than 40 inches in the higher elevations to 10 to 15 inches in the lower elevations. Ninety percent of the precipitation occurs between September and May with 30 percent of the winter's precipitation in the form of snow. Snowfall at elevations less than 1,500 feet seldom lingers beyond three or four weeks, occasionally melting quickly enough to produce severe erosion (Kelley *et al.* 1982; Fuller 1986)."

2.1.2 Physical Environment

The following description of topography and geology in the Tucannon Subbasin was excerpted from the Draft Tucannon Subbasin Summary (NPPC 2001).

"Elevations in the subbasin range from 540 feet at the confluence of the Tucannon and Snake Rivers to 6,400 feet at Oregon Butte in the Wenaha-Tucannon Wilderness located in the Umatilla National Forest. Long slopes intersected by steep canyons characterize topography in the Tucannon Subbasin (Figure 2-3). Most of the non-forested land with slopes of 45 percent or less is under cultivation."

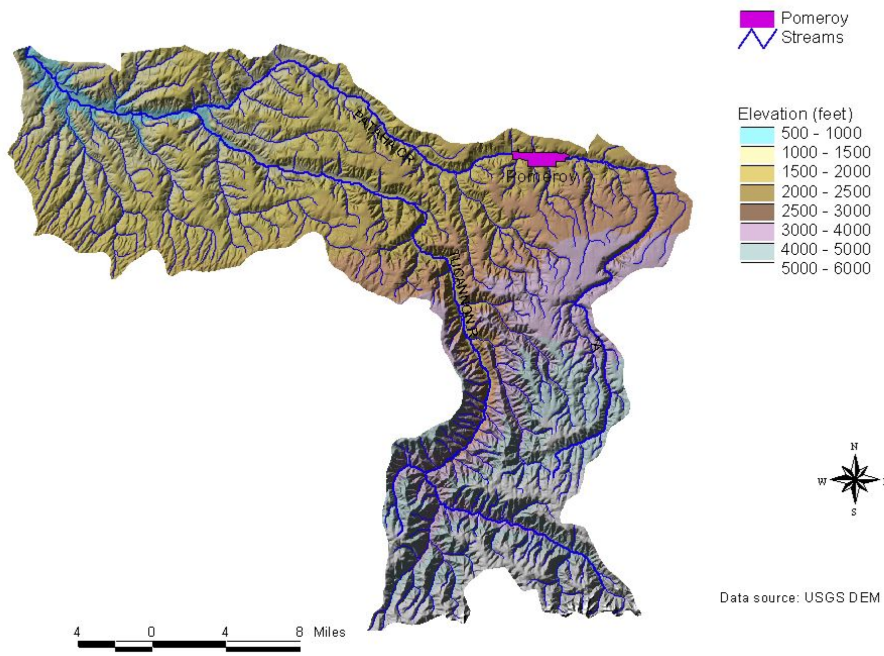

Figure 2-3 Elevations Within the Tucannon Subbasin
Source: NPPC 2001, Figure 3.

The Tucannon River drains the Blue Mountains, a broad anticline arch uplifted during the last 20 million years. The Blue Mountains are comprised of a core of Paleozoic and Mesozoic metamorphic rocks mantled by flows of the Columbia River Basalt Group. The bedrock of the Tucannon watershed consists nearly entirely of lava flows 6 to 16.5 million years old (Miocene) and belongs to the Grande Ronde and Wampum formations. The flows are composed of black to dark gray basalt of basaltic-andesine. Average flow thickness is about 90 to 120 feet (Columbia Basin System Planning 1990).

> "Once the Columbia River Basalts ceased to flow, the area climate became colder. Fine glacial and erosion material carried by wind was deposited as eolian (wind blown) silt and sand. This combination is commonly known as loess and covers much of eastern Washington State. This loess caps the basalts and ranges in thickness from 200 to 300 feet."

> "With the cold climate, glaciers in northeastern Washington dammed up drainages and formed large lakes. When these ice-dam lakes breached, the land was flooded, leaving a scoured landscape with deposits of slack water clays (rhythmites) and cobble to boulder-size material. These deposits occur in the lower reaches of both Pataha Creek and the Tucannon River. Landslide and gully wash deposits are evident at the mouths of canyons. This material eventually moves down slope into the major drainages.
>
> "One of the most notable geologic features in the Tucannon subbasin is the Hite Fault. This fault system forms the western margin of the Blue Mountains between Pomeroy, Washington and Pendleton, Oregon, and has been the focus of many historic earthquakes (U.S. Department of Energy 1988). This fault is 135 kilometers (83.9 miles) in length and crosses both the Tucannon River and Pataha Creek at right angles. The Hite Fault is still active and may be the cause of elevated ground water temperatures well above the standard geothermal gradient recorded in local wells (Covert *et al.* 1995)."

2.1.3 Water Resources and Hydrology

The following discussion of hydrology and water quality in the Subbasin was excerpted from the Draft Tucannon Subbasin Summary (NPPC 2001).

> "Precipitation and ground water augmentation (ground water that flows directly into the river) provide the only water sources that form the Tucannon River and associated tributaries. Measurements taken by Washington Department of Ecology (WDOE) in 1994 suggest that virtually all of the base flow in the Tucannon watershed comes from ground water discharge. Summer thundershowers elevate stream flow for only short periods of time. These measurements also indicate that the Tucannon River is a gaining stream throughout its length (Covert *et al.* 1995)."
>
> "Melting snow in the Blue Mountains of the Umatilla National Forest provides much of the annual runoff in the Pataha Creek watershed, producing peak flows in May or June. Severe runoff events lead to sediment problems in Pataha Creek and lower Tucannon River. On occasion, Bihmaier Springs provides approximately one half of the flow to Pataha Creek during the summer months if mountain snow pack is less than normal and drought conditions persist during May and June. Some sections of Pataha Creek have been known to go subsurface during periods of drought conditions."
>
> "… The area drained [by Pataha Creek] is approximately 431 mi^2. A maximum discharge of 7,980 cubic feet per second (cfs) was recorded on December 22, 1964, while the minimum stream flow recorded was 15 cfs on July 11 and 12, 1930. The 1990 water year was the lowest Snake River flow on record, and the maximum flow in the Tucannon River was 462 cfs on May 6, with a minimum of 38 cfs during August 14-16th. It appears that the mid-reach of the Tucannon River in 2000 was a losing reach…"
>
> "… The lowest mean monthly flow [measured in the Tucannon River] was during the month of August for all years, and the highest mean monthly flow was during the month of May (Table 2-1). The mean annual flow at the gauge was 166.3 cfs."

Table 2-1 Mean monthly flows in the Tucannon River (River Mile 7.9)

Month	January	February	March	April	May	June
Flow	218.6	270.6	248.9	275.0	298.0	200.6
Month	**July**	**August**	**September**	**October**	**November**	**December**
Flow	84.1	61.2	70.4	8223	108.3	163.7

(NPPC 2001, Table 2).

> "… the baseflow, summer low flow, of the Tucannon River comes primarily from groundwater… At river mile (RM) 9 in 2000, the Tucannon River had a base flow of 47 cfs (CEEd 2001). Between 1976 and 1984, the average flow at that point was 57 cfs… Currently, the long-term average flow at that location is 61 cfs; since 1935, there appears to be no significant long-term change in the amount of water in the Tucannon River."
>
> "Temperature and pH [in Pataha Creek] were significantly affected when flows were below 9 cfs. Flow augmentation through water storage in the upper portion of the watershed would increase summer flows and decrease water temperatures. Such low flows have adversely affected the fish and other aquatic habitat conditions in the watershed. While Pataha Creek itself is characterized as having fair to poor fisheries enhancement potential, it contributes significantly to the water quality of the Tucannon River (Mendel 1981)."
>
> "WDOE lists the Tucannon River, Pataha Creek, and their tributaries outside the Umatilla National Forest, as Class A (Excellent) surface waters. Waters within the National Forest are considered Class AA (Extraordinary). According to WDOE, both classes of water "shall meet or exceed requirements for all beneficial uses…"
>
> "The Tucannon River is on the current 1998 303(d) list of impaired water bodies for temperature for the segment that extends from the mouth at the Snake River to Tumalum Creek at river mile (RM) 32.7…"
>
> "The Tucannon River was previously listed on the 1996 303(d) list for fecal coliform exceedance based on one excursion at Powers Bridge station. The Tucannon River was not listed again in 1998 because the data (from WDOE samples taken between 1991 and 1996 at Powers Bridge) did not meet the criterion for listing."
>
> "Pataha Creek is on the 1998 and 1996 303(d) list of impaired waters for fecal coliform bacteria. WDOE is proposing a bacteria TMDL on the segment of Pataha Creek from the mouth at the Tucannon River (RM 11.2) to the headwaters for the 2001 watershed cycle."
>
> "Pataha Creek temperatures are well above the upper limits recommended for salmonid survival during the summer months, especially in the middle and lower reaches… While high temperatures may not be directly lethal to the fish, they do limit their available habitat in the upper watershed."

Additional water quality data for the Tucannon watershed can be found in NPPC, 2001.

2.1.4 Fish and Wildlife Species

A diverse variety of fish and wildlife are associated with the various habitat types within the Tucannon subbasin. The following discussion of fish and wildlife and species of concern in the Tucannon Subbasin was excerpted from the Draft Tucannon Subbasin Summary (NPPC 2001).

Fish

> "The Tucannon River supports a diverse collection of anadromous and resident fish species throughout the Subbasin (Table 2-2)."
>
> "Prior to the late 1800's there was an annual spawning return (escapement) of Snake River spring/summer chinook salmon that may have exceeded 1.5 million fish (Bevan *et al.* 1993). By 1975, escapement was down to only 122,500 in the Columbia River (WDW *et al*. 1990), or 8 percent of the historic run. The 1994 return of 1,822 fish, 0.12 percent of the historic run, was the lowest ever recorded, to that time. The estimated escapement into the Tucannon River was 140 fish that year. In 1995, the return to the Tucannon River was only 54 fish… Since then, returns have varied from 144 to about 250 each year (Bumgarner *et al*. 2000). All Snake River spring/summer and fall chinook were officially listed by the National Marine Fisheries Service (NMFS) as "threatened" species on April 22, 1992. A petition to further list them as endangered is pending based on the outcome of proposed changes to the Endangered Species Act (ESA) (Griffin 1995), even though the 2001 spring chinook return to the Snake River is expected to be the highest in many years (greater than 100,000 fish into the Snake River)."
>
> "In 1935, local residents told surveyors that until 1922-23, there was a run of chinook that entered the river in the fall, but this run had been "greatly depleted…" The WDF *et al.* (1990) documents counts made by NMFS that ranged from 20 to 200 redds between 1976 and 1980 near the mouth of the river..."

Table 2-2 Fish Species Present in the Tucannon Subbasin

Species	Origin	Status
Bull trout (*Salvelinus confluentus*)	N	C/I
Steelhead trout (*Oncorhynchus mykiss*)	N	C/D
Spring Chinook salmon (*Oncorhynchus tshawytscha)*	N	C/D
Fall Chinook salmon (*Oncorhynchus tshawytscha)*	N	O/S
Coho salmon (*Oncorhynchus kisutch)*	*	*
Mountain whitefish (*Prosopium williamsoni)*	N	O/U
Brook trout (*Salvelinus fontinalis)*	E	O/U
Pink salmon (*Oncorhynchus gorbuscha*)	E*	O/U
Northern pikeminnow (*Ptychocheilus oregonensis)*	N	C/S
Longnose dace (*Rhinichthys cataractae*)	N	C/U
Speckled dace (*Rhinichthys osculus)*	N	C/U
Redside shiner (*Richardsonius balteatus*)	N	C/U
Chiselmouth (*Acrocheilus alutaceus*)	N	O/U

Species	Origin	Status
Peamouth (*Mylocheilus caurinus*)	N	O/U
Largescale sucker (*Catostomas macrocheilus*)	N	O/U
Longnose sucker (*Catostomas catostomas*)	N	C/U
Bridgelip sucker (*Catostomas columbianus*)	N	C/U
Pacific lamprey (*Lampetra tridentata*)	N	O/S-D
River lamprey (*Lampetra ayresi*)	N	O/S-D
Torrent sculpin (*Cottus rhotheus*)	N	O/D
Margined sculpin (*Cottus marginatus*)	N	C/S
Paiute sculpin (*Cottus beldingi*)	N	C/S
Brown bullhead (*Ictalurus nebulosus*)	E	O/U
Smallmouth bass (*Micropterus dolomieui*)	E	O/S
Bluegill (*Lepomis macrochirus*)	E	O/U
Crappie (*Pomoxis spp.*)	E	O/S
Channel catfish (*Ictaluris punctatus*)	E	O/S
Grass pickerel (*Esox americanus vermiculatus*)	E	O/U
Pumpkinseed (*Lepomis gibbosus*)	E	O/U
Carp (Cyprinus carpio)	E	O/S

E=Exotic, N=Native, A=Abundant, C=Common, O=Occasional, U=Unknown, S=Stable, I=Increasing, D=Decreasing
Source: NPPC 2001, Table 13
* Coho salmon added per request from the Nez Perce Tribe.

"During the 1990-1993 surveys, 88 [fall Chinook] carcasses were found, of which only 21 were tagged hatchery fish (Bugert *et al.* 1991, Mendel *et al.* 1992 and 1994). Although many of these adult fish are natural, stray hatchery fall chinook from Lyons Ferry Hatchery and the Umatilla River have been documented in the river for several years (Mendel *et al*. 1996, Wargo *et al.* 1999)… Fall chinook have been seen spawning upstream of Starbuck Dam since 1992, when WDFW and BPA constructed a fish ladder (Mendel *et al.* 1994)."

"… according to local residents, the last run of silver (coho) salmon entered the river in October 1929, although a small number of these fish probably still appear. The Tucannon River coho may have become extinct by 1955 (Kelley *et al.* 1982), though coho were still found within the Snake River system until at least 1986 (Wortman 1993). Edson (1960) reported that sporadic returns of up to 100 adults were still occurring after the Snake River coho sport fishery had been closed during the 1950's. He thought the river could still support a sizeable run of coho. Stray hatchery origin fish, suspected to have originated from smolt releases into the Clearwater River in Idaho, or elsewhere, have recently been observed spawning in the river below RM 5.0 (Wargo *et al.* 1999). Juvenile coho smolts were identified at a WDFW outmigrant trap located on the lower Tucannon River, which may have been produced from redds identified the previous year."

"Pink salmon have been documented in the Columbia River since at least 1941, but only a few times in the Snake River, most recently in 1975 and 1991. During surveys for fall chinook in the fall of 1975, one male and four female carcasses were found in the Tucannon River, downstream of Starbuck Dam. They appeared to have spawned in the area where fall chinook had spawned (Basham and Gilbreath 1978). There are no records of hatchery releases of pink salmon into the Tucannon or Snake rivers."

"According to Parkhurst (1950) at the time of the 1935 survey, a considerable run of steelhead was believed to still enter the river, but not as abundantly as in the past. Unfortunately, they made no estimate of run size at the time, but other researchers estimate the steelhead run could have been between 3,400 and 4,000 adults (Eldred 1960; USACE 1975)."

"Prior to 1970, returns of native steelhead to the Tucannon River were estimated to average 3,400 or 3 percent of the total Snake River return (WDF *et al.* 1990). Using harvest report card data since 1947, Washington Department of Game (WDG) estimated "in-river" sport catches ranged from a high of 689 in 1957 down to 24 in 1973."

"Pacific lampreys have life histories and survival problems similar to salmon… As few as 40 adults were counted passing Ice Harbor Dam in 1993. Bumgarner (per. com., 1999) reported that juvenile lampreys had been captured in the smolt trap located at RM 1.9 every spring since 1986. A few adults have been seen each year in the smolt trap by WDFW staff since 1995. The NMFS lists the Pacific lamprey as a species of concern, and the CTUIR has begun investigations on the status of lamprey in the Snake River and Walla Walla systems. River and brook lamprey may also exist in the Tucannon River, but their presence is uncertain."

"Bull trout spawn and rear in the upper portions of the river and adults and subadults migrate to the lower Tucannon and Snake rivers in the winter months. They return to the upper river each spring to spawn... Bull trout were listed as threatened under the ESA in June 1998… the release of brook trout into the subbasin several decades ago resulted in the establishment of a self-sustaining population in upper Pataha Creek. These fish represent a potential threat to the population stability of bull trout and they may be a competitive population for food and space with native steelhead/rainbow."

Wildlife

"… The Tucannon subbasin contains 276 species of wildlife. The species list is continuously being revised to reflect the change in populations due to habitat loss, harvest numbers, updated wildlife surveys and introduction of exotic species."

"Population status varies by area and species. Some species are doing well, while others are listed as state threatened, candidate, or species of concern. State and federal agencies manage big game, upland birds, diversity species, furbearers, and waterfowl."

"WDFW maintains a list of Priority Species of fish and wildlife species that includes all animals presently listed in the Federal Register as *endangered, threatened, sensitive, or candidate* (Figure 2-4). It also includes wildlife species, which WDFW feels are vulnerable to future listing (*monitor* species) or important for recreation (*game* species).

WDFW also developed a list of Priority Habitats which support either unique or a wide diversity of wildlife species."

"State threatened species include the ferruginous hawk and sharp-tailed grouse (Table 2-3). State candidate species include the Washington ground squirrel, burrowing owl, and white-tailed jackrabbit. Mule deer populations are at management objective in the lowlands, and below management objective in the mountains. The elk population is below the management objective by approximately 250 animals. The bighorn sheep population has declined from a high of 60+ sheep to approximately 20-25 over the last two years (P. Fowler, WDFW, per. com., 2001)."

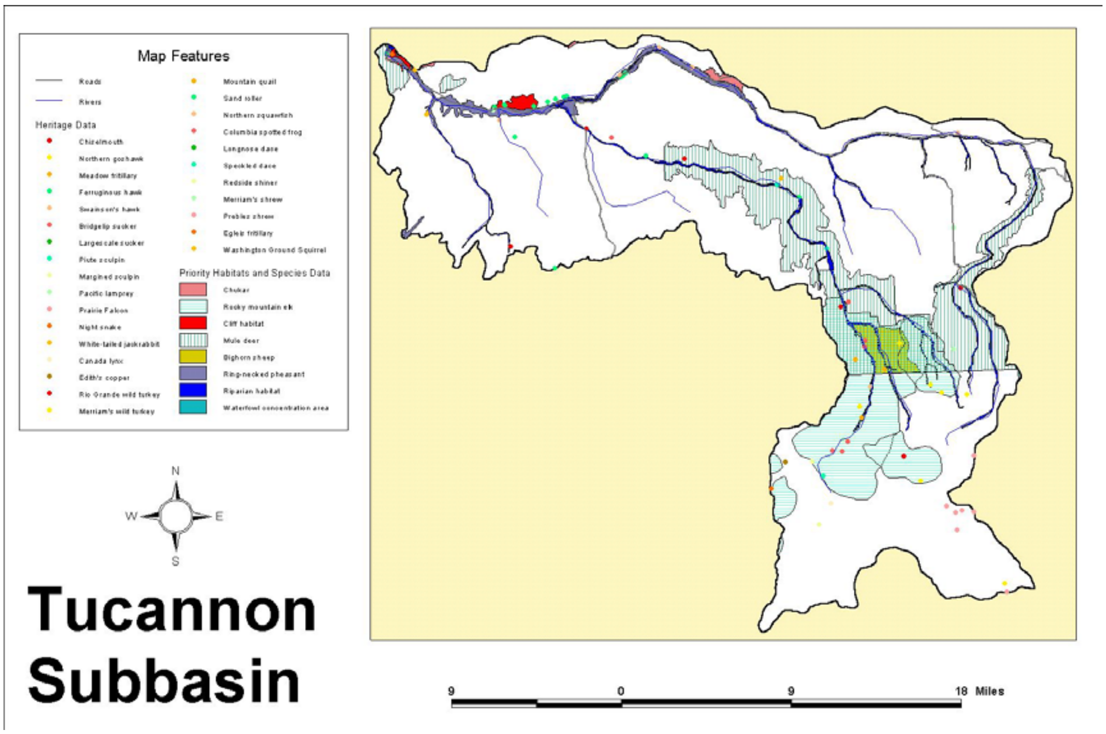

Figure 2-4 Priority Habitat Species in the Tucannon Subbasin

Source: NPPC 2001, Figure 23.

Table 2-3 Status of Priority Habitat Species in the Tucannon Subbasin

Species	State Status	Population
Bald eagle *(Haliaeetus leucocephalus*)	T	Wintering 4-5
Bighorn sheep (*Ovus Canadensis*)	PHS Species	Declining (20)
Blacktailed jackrabbit (*Lepus californicus*)	C	Very low
Burrowing owl (Athene cunicularia)	C	2 nesting pairs
Elk (Cerrvus elaphus)	PHS - Game	MO
Ferruginous hawk *(Buteo regalis)*		
Flammulated owl *(Otus flammeolus)*		
Goshawk *(Accipiter gentilis)*	C	Unknown
Lewis woodpecker *(Melanerpes lewis)*		unknown
Loggerhead shrike (*Lanius ludovicianus*)	C	unknown
Mule Deer (*Odocoileous hemionus)*	PHS - Game	MO lowlands
Pileated woodpecker *((Dryocopus pileatus)*		
Pine marten *(Martes Americana)*		unknown
Ringneck pheasant (*Phasianus colchicus)*	Game	declining
Sharp-tailed grouse (*Tympanuchus phasianellus)*	T	extirpated
Spotted frog *(Rana pretiosa*)	C	low
Vaux's swift *(Chaetura vauxi)*		
Washington ground squirrel (*Spermophilus washingtoni)*	C	unknown
Whitetail deer (*Odocoileous virginianus*)	G	MO
Whiteheaded woodpecker *(Picoides albolarvatus)*		unknown
Whitetailed jackrabbit (*Lepus townsendii*)	Candidate	unknown
Wild turkey (*Meleagris gallopavo*)	G	stable
Wolverine *(Gulo luscus)*		unknown

C=Candidate Species, G=Game Species, PHS=Priority Habitat Species, T=Threatened, MO=Management Objective
Source: WDFW 2001 as shown in NPPC 2001, Table 17.

2.1.5 Vegetation

The following discussion of vegetation in the Tucannon Subbasin was excerpted from the Draft Tucannon Subbasin Summary (NPPC 2001).

> "The vegetative regime in the Tucannon subbasin has changed markedly over the past 100 years. Cropland and pasture encompass 138,425 acres within the Tucannon Subbasin (Figure 2-5)."

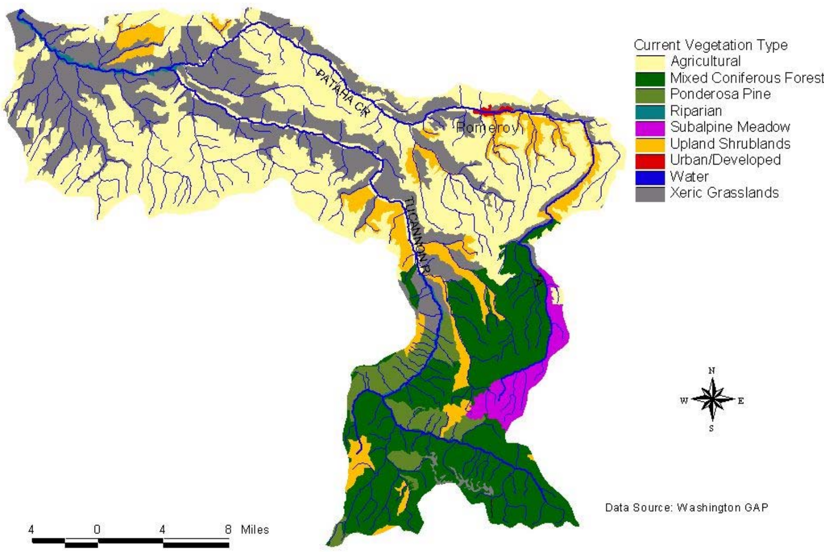

Figure 2-5 Current Vegetation Types Within the Tucannon Subbasin
Map by Ecopacific as shown in NPPC 2001, Figure 13.

"The dominant riparian plant species along 29 miles of streambank was [identified as] Reed canarygrass, *Phaluris urundinacea*. A mixture of Reed canarygrass and black cottonwood dominated 6.3 miles of streambank. White alder and Douglas fir dominated 5.5 miles and Douglas fir and grand fir dominated 4.1 miles. Inventory results also indicated that black cottonwood and white alder was dominant on 3.4 miles while white alder and Douglas hawthorn, *Crataegus douglasii*, dominated 2.8 miles of streambank and 2.5 miles was dominated by Engleman spruce, *Picea engelmannii*, and grand fir, *Abies grandis*. Common tree species in the riparian plant community include western larch, *Larix occidentalis*, ponderosa pine, *Pinus ponderosa*, golden willow, *Salix alba*, and locust, *Robinia psuedo-acacia*. Common shrub species include chokecherry, *Prunus virginiana*, coyote willow, *Salix exigua*, rose, *Rosa spp.*, sticky current, *Ribes spp.*, and snowberry, *Symphoricarpos albus*. Few-flowered spike rush, *Elaochris panciflora*, various sedge species, and a variety of weedy forbs are common. Conifer species were dominant in the higher elevations and deciduous species were dominant in the lower elevations."

"Percent canopy cover ranges from 1 percent to 85 percent and tends to increase with increased elevation. Agricultural land uses result in areas with less percent canopy cover.

"The grassland/forb age class is most common on 29 miles of the Tucannon River streambank. Large trees were most common on 13 miles of streambank. Small trees occupied 4.9 miles of streambank. Shrub/seedling age class was common on 4.2 miles of streambank. Small poles were most common on 2.5 miles of streambank. Height of vegetation tended to increase with elevation, as trees were more dominant in higher elevations."

> "… Approximately 20 percent of the riparian areas are infested with yellow starthistle, *Centaurea solstitialis*, and knapweeds (*Centaurea diffusa, Centaurea biebesteinii, Acroptilon repens*). Eighty percent of rangelands are infested with yellow starthistle."

2.1.6 Current and Historic Land Use

The Tucannon River valley has a long history of Native American usage and homesteading.

The Tucannon River Subbasin is within the treaty territory of the Nez Perce Tribe and is protected as a usual and accustomed area via the treaty of 1855 that states;

The exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians; as also the right of taking fish at all usual and accustomed places in common with citizens of the Territory; and of erecting temporary buildings for curing, together with the privileges of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land (12 Stats., 957-Article 3). Treaty of 1855.

The Nez Perce Tribe maintains a co-management authority with the State of Washington and the United States Government over the tribes' treaty reserved resources. The Tucannon River Subbasin is also part of the usual and accustomed area for the Confederated Tribes of the Umatilla Indian Reservation. Currently, the Tucannon River Subbasin provides hunting, fishing and gathering opportunities for tribal members.

The following description of land use in the Tucannon Subbasin was excerpted from the Draft Tucannon Subbasin Summary (NPPC 2001).

> "The Tucannon River valley, and associated valleys, provided natural pathways for traffic between Walla Walla and Lewiston. The existing road system was largely developed from these pathways. Homesteading settlement began in the 1860's near the confluence of the Tucannon and Panjab Creek. Diverse agriculture production, sheep and cattle management, and logging were the main means of living, along with low yield mining of gold, silver and copper ore."

> "[Today] The major land uses in the Tucannon River watershed are related to agricultural purposes (SCS 1991). Crop, forest, rangeland, pasture, and hay comprise over 90 percent of the watershed (Figures 2-6 and 2-7). Grazed rangeland includes approximately 40 percent of the Tucannon watershed (75,725 acres) and supports livestock production. Dry and irrigated cropland produces winter wheat, barley, peas, and bluegrass (SCS 1991)."

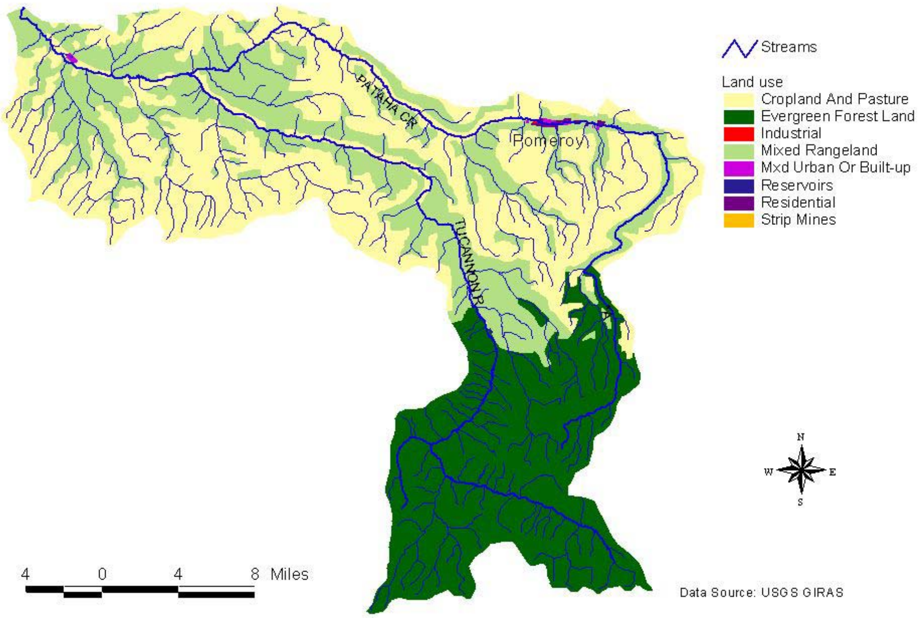

Figure 2-6 Land Use Within the Tucannon Subbasin
Source: NPPC 2001, Figure 15.

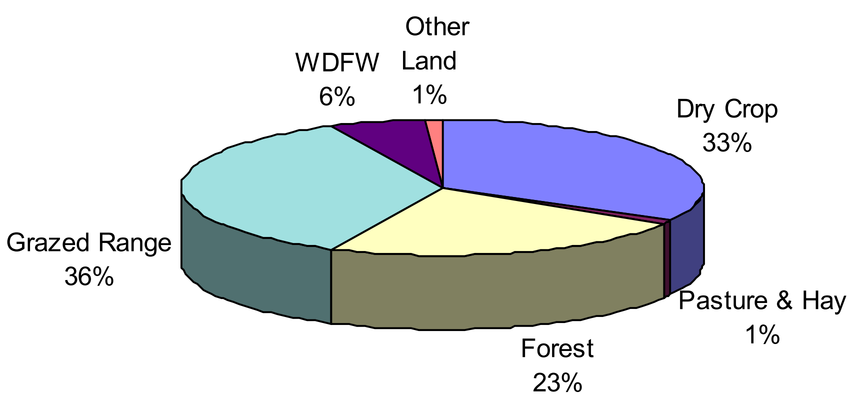

Figure 2-7 Land Uses in the Tucannon River Watershed, Washington.
Source: NPPC 2001, Figure 16.

2.1.7 Political Jurisdictions and Land Ownership

Approximately 75 percent of the Tucannon Subbasin is in private ownership, primarily in the lower reaches. Significant areas are managed by WDFW along the mid-reaches of the Tucannon River. This includes the Wooten Wildlife Area and WDFW fishing/rearing ponds. The headwaters of the Tucannon River is managed by the USFS (see Figure 2-8). The primary city is the City of Pomeroy, located on Pataha Creek in the northeastern portion of the subbasin.

> "There are 83 full-time farm and ranch operators that own or lease agricultural lands, and most are subbasin residents. The size of agricultural holdings varies from 160 acres to 5,000 acres, with the average landowner owning or leasing 1,400 acres. There are a number of smaller non-commercial farms located along the river corridor. These farms are often used for recreational purposes rather than agricultural production." (NPPC 2001)

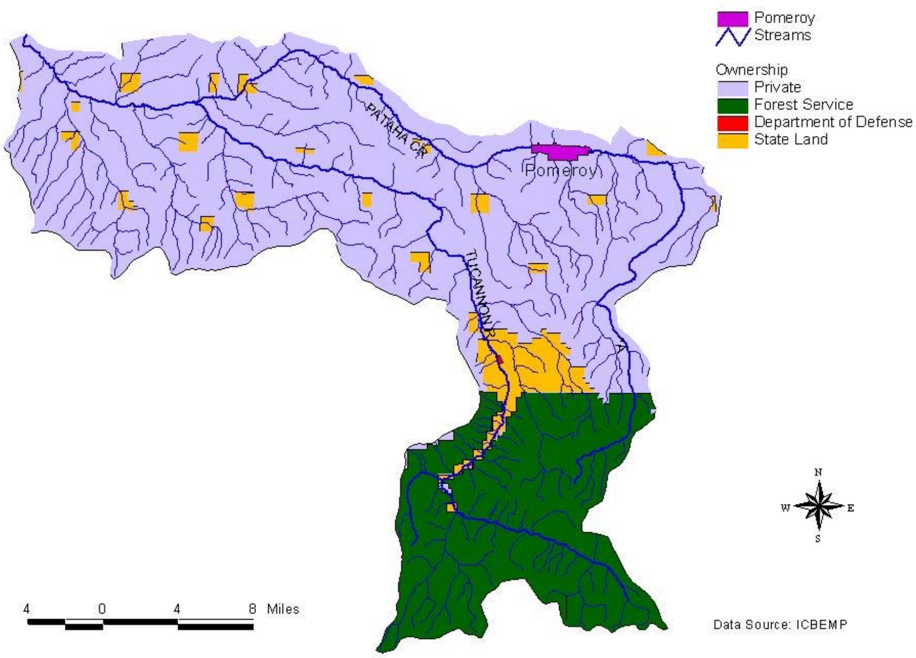

Figure 2-8 Land Ownership in the Tucannon Subbasin
Source: NPPC 2001, Figure 2.

The Tucannon Subbasin is within the treaty territory of the Nez Perce Tribe and is protected as a usual and accustomed area via the treaty of 1855 that states;

"The exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians; as also the right of taking fish at all

> usual and accustomed places in common with citizens of the Territory; and of erecting temporary buildings for curing, together with the privileges of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land (12 Stats., 957-Article 3). Treaty of 1855."

The tribe maintains a co-management authority with the State of Washington and the United States Government over the tribes' treaty reserved resources. Currently, the Tucannon Subbasin provides hunting, fishing and gathering opportunities for tribal members (refer to tribal harvest section).

2.2 Regional Context for Subbasin Plan

2.2.1 Relation to ESA Planning Units

The Tucannon Subbasin is only one portion of the larger ESUs that are the geographic basis for ESA listings. Given that it is only one subbasin within the Snake River Basin (which extends into parts of Idaho and Oregon) ESU if populations within the Tucannon Subbasin were enhanced to become healthy and productive, the species could remain threatened at the ESU scale. As such, although efforts accomplished within the Tucannon Subbasin will contribute to recovery at the ESU level, efforts across multiple subbasins will need to be coordinated to achieve enhancement of fish populations and eventual de-listing.

Figure 2-9 shows the relationship of the Tucannon Subbasin to the Snake River Basin steelhead ESU. Figure 2-10 shows the relationship of the Tucannon Subbasin to the Snake River Basin fall Chinook ESU. Figure 2-11 shows the relationship of the Tucannon Subbasin to the Snake River Basin spring/summer Chinook ESU. Figure 2-12 shows the relationship between the Tucannon Subbasin and the Snake River Recovery Unit for Bull Trout. These four are aquatic focal species in the Tucannon Subbasin.

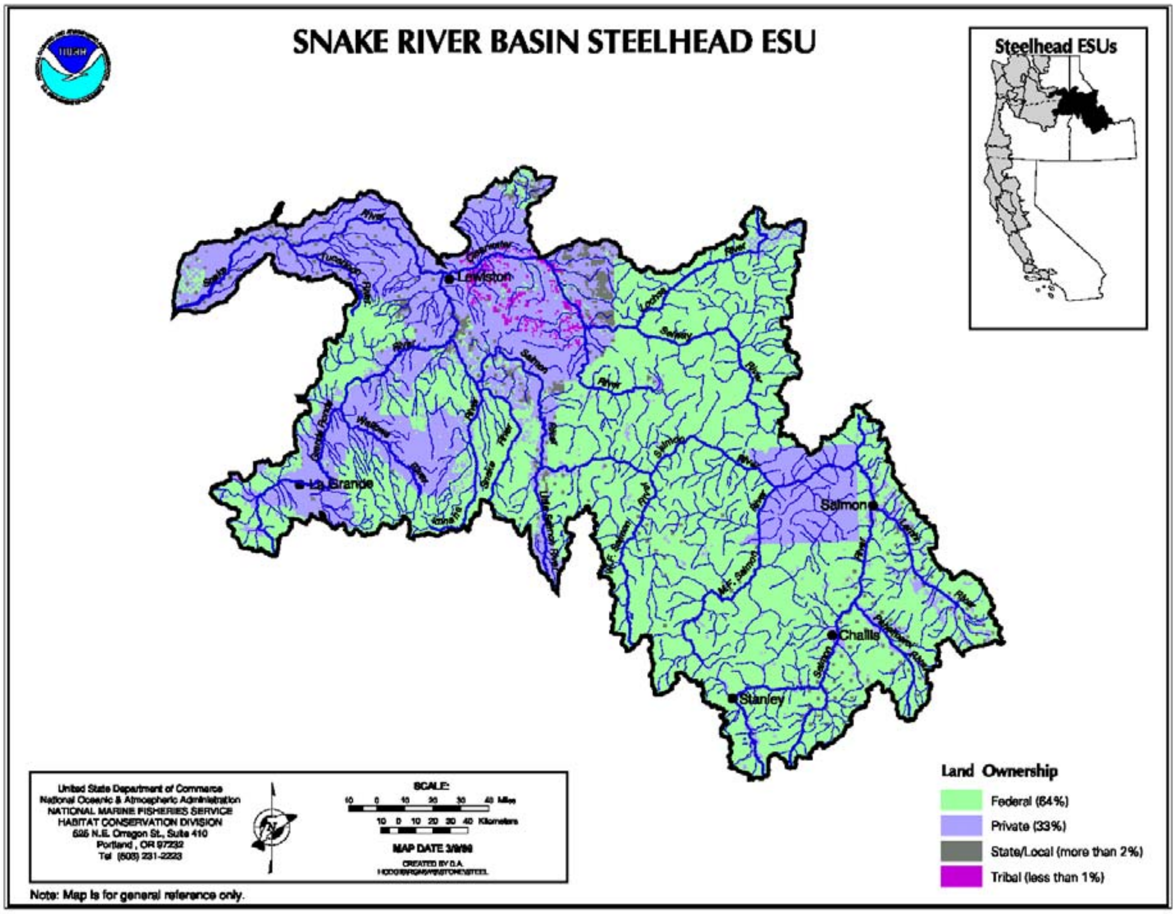

Figure 2-9 Relationship of Tucannon Subbasin to Snake River Steelhead ESU

Source: NOAA-Fisheries 2004

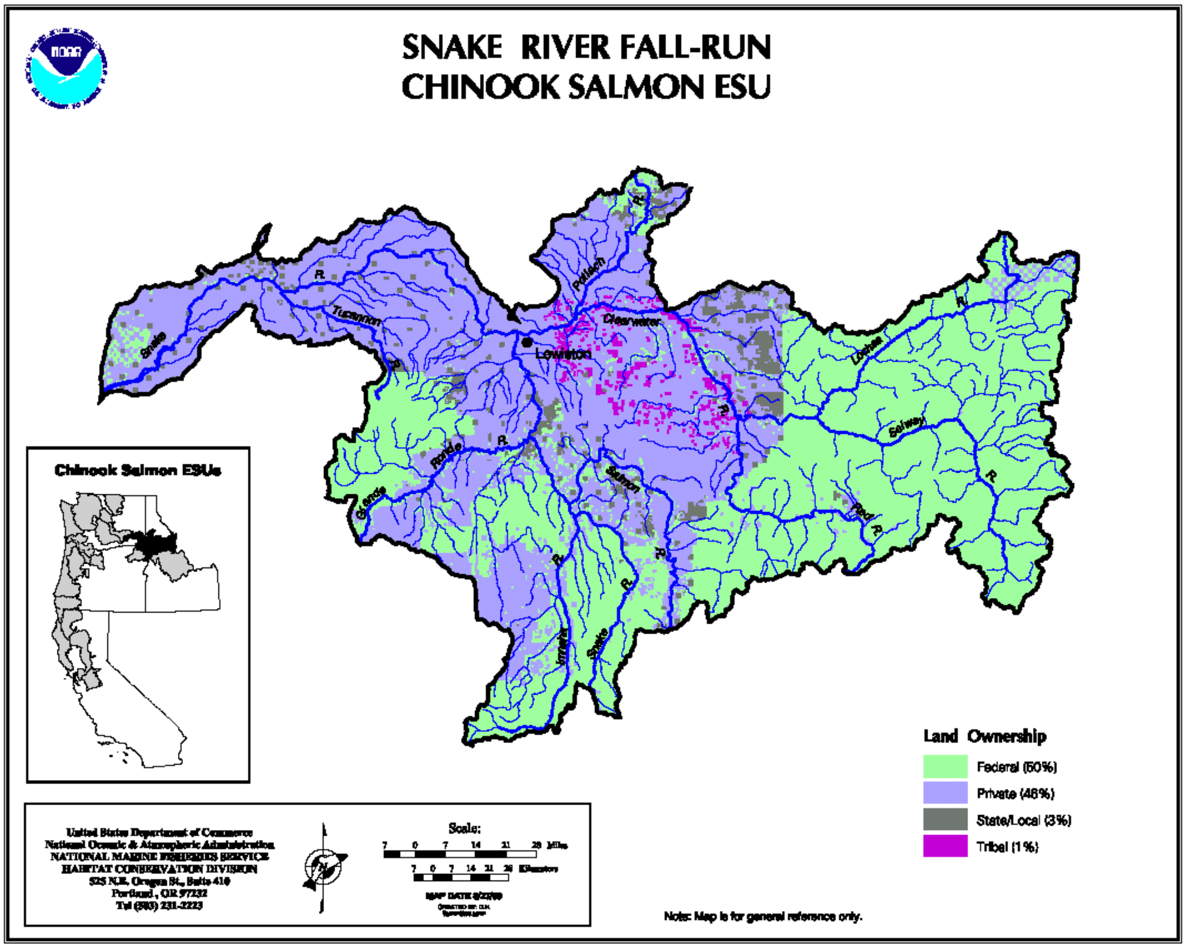

Figure 2-10 Relationship of Tucannon Subbasin to Snake River Fall Chinook Salmon
ESUSource: NOAA-Fisheries 2004

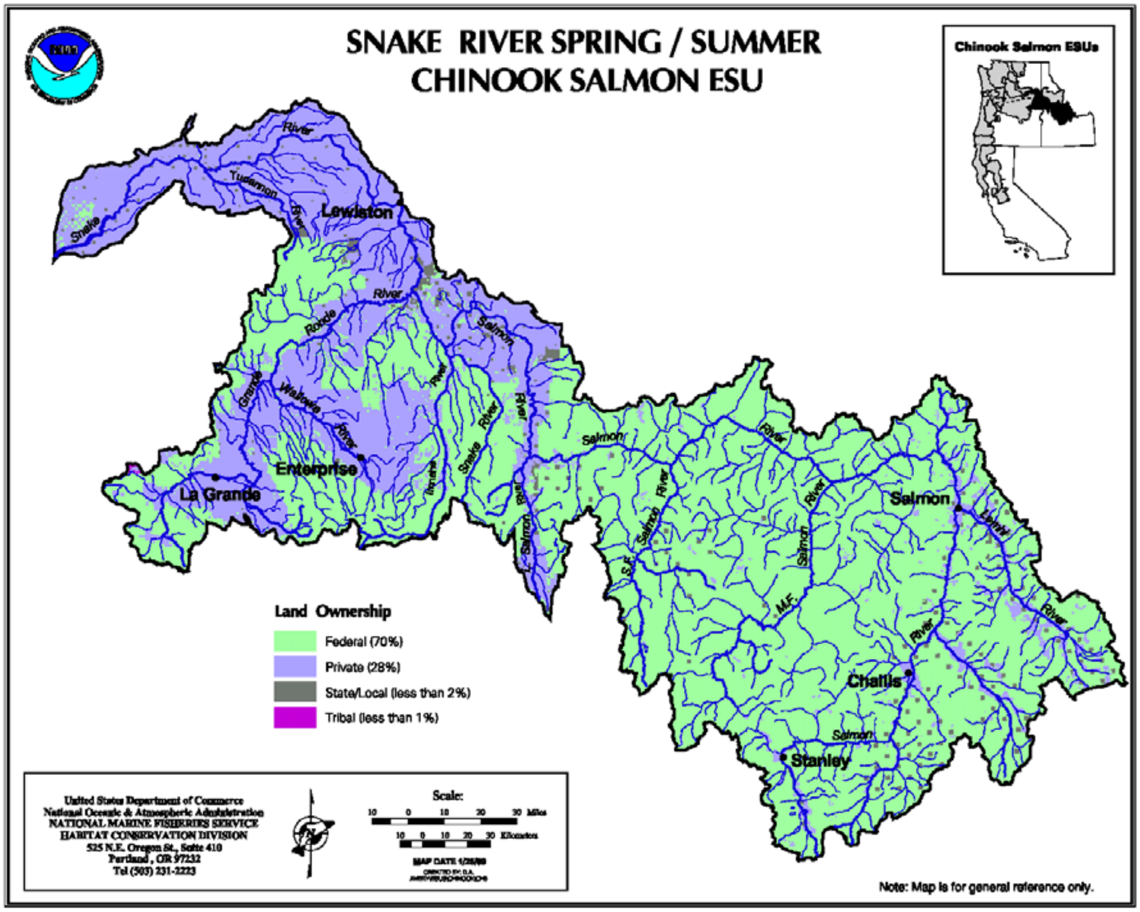

Figure 2-11 Relationship of Tucannon Subbasin to Snake River Spring/Summer Chinook Salmon ESU

Source: NOAA-Fisheries 2004.

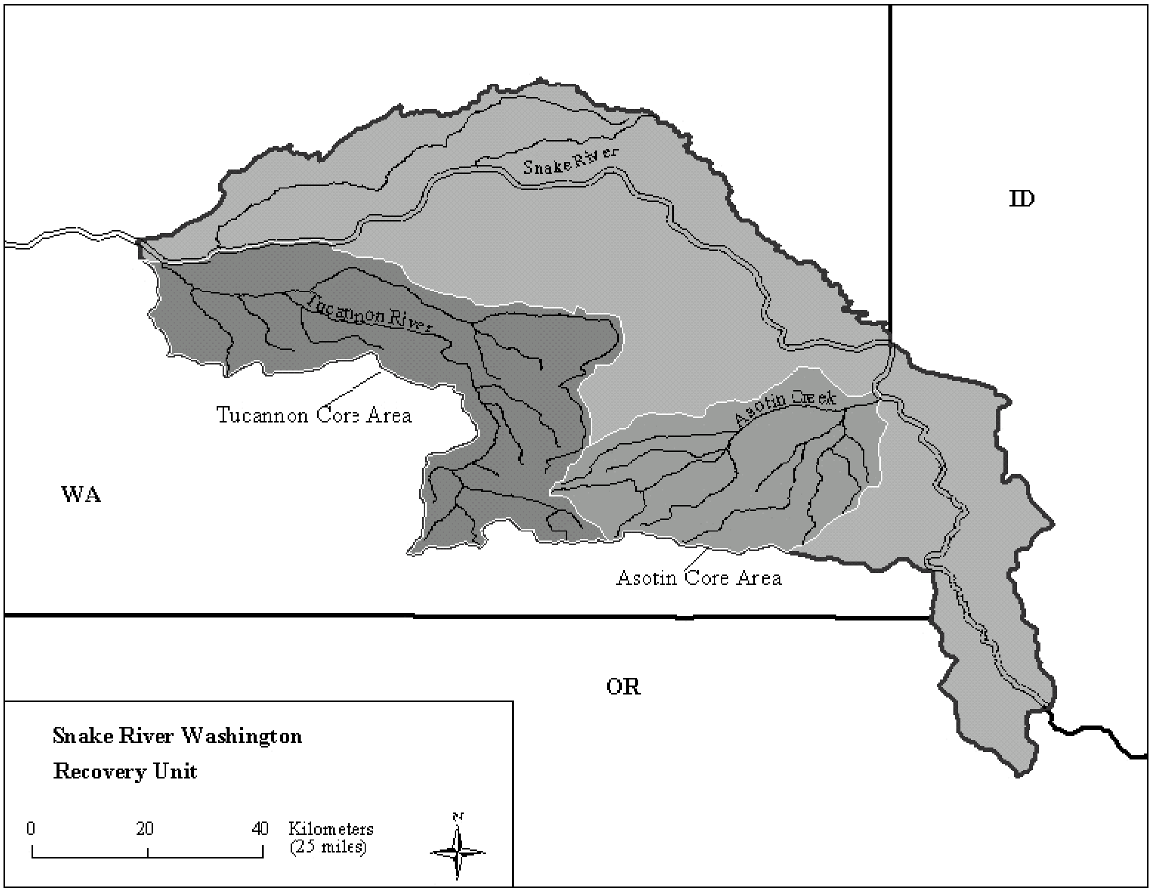

Figure 2-12 Relationship of Tucannon Bull Trout Core Area to Snake River Recovery Unit

Source: Figure2, Chapter 24, USFWS 2002.

2.2.2 Long-term Environmental Trends

Long-term environmental trends in climate have the ability to tremendously affect the baseline habitat conditions for salmonids. "Computer models generally agree that the climate in the Pacific Northwest will become, over the next half century, gradually warmer and wetter, with an increase of precipitation in winter and warmer, drier summers (USDA Forest Service 2004). These trends mostly agree with observed changes over the past century. Wetter winters would likely mean more flooding of certain rivers, and landslides on steep coastal bluffs (Mote et al. 1999) with higher levels of wood and grass fuels and increased wildland fire risk compared to previous disturbance regimes (USDA Forest Service 2004). The region's warm, dry summers may see slight increases in rainfall, according to the models, but the gains in rainfall will be more than offset by losses due to increased evaporation. Loss of moderate-elevation snowpack in response to warmer winter temperatures would have enormous and mostly negative impacts on the region's water resources, forests, and salmon (Mote et al. 1999). Among these impacts are a diminished ability to store water in reservoirs for summer use, and spawning and rearing difficulties for salmon…For the factors that climate models can simulate with some confidence, however, the prospects for many Pacific Northwest salmon stocks could worsen. The general picture of increased winter flooding and decreased summer and fall streamflows, along with elevated stream and estuary temperatures, would be especially problematic for in-stream and estuarine salmon habitat. For salmon runs that are already under stress from degraded freshwater and estuarine habitat, these changes may cause more severe problems than for more robust salmon runs that utilize healthy streams and estuaries." (TOAST 2004).

Locally, habitat within the Tucannon Subbasin continues to improve, particularly through implementation efforts from the model watershed plan. Further improvements that will be achieved through implementation of this and other habitat enhancement plans may serve to offset some of the anticipated climatic changes described above, especially if an adaptive management approach can be successfully implemented that allows these plans to evolve over time to meet changing ecological conditions.

3. Tucannon Subbasin Aquatic Assessment

3.1 Introduction

Summarized in this section is the aquatic assessment prepared by WDFW. Appendix B contains the complete WDFW assessment.

This section contains:

- A description of how focal species were selected and also identifies species of interest
- A description of the assessment methodology, including methodology limitations and qualifications, and instances in which the methodology was supplemented by previous assessment work and professional knowledge
- Assessment findings for the focal species
- A brief description of aquatic "species of interest."

3.2 Selection of Focal Species

Three aquatic species were identified as focal species for Tucannon Subbasin Planning: steelhead/rainbow trout *Oncorhynchus mykiss*, spring and fall Chinook *Onchorynchus tshawytcha*, and bull trout *Salvelinus confluentus (see Figures 3-1, 3-2, and 3-3, respectively)*. The subbasin planning parties (WDFW, Nez Perce Tribe, CTUIR, private citizens, and other interested agencies and entities) selected these species based on the following considerations:

- Selection of species with life histories representative of the Tucannon Subbasin ecosystem
- ESA status
- Cultural importance of the species and
- Level of information available/knowledge on species life history to conduct an effective assessment.

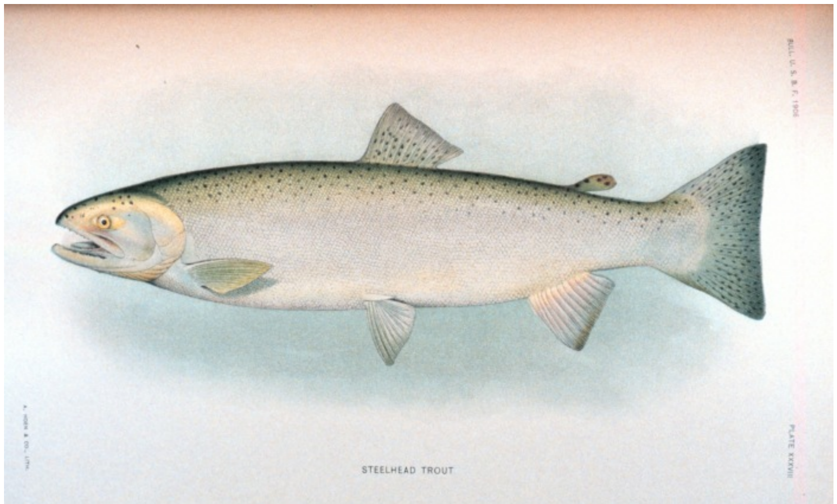

Figure 3-1 Steelhead trout (*Oncorhynchus mykiss)*

Source: NOAA Photo Library (http://www.photolib.noaa.gov/fish/fish3016.htm).

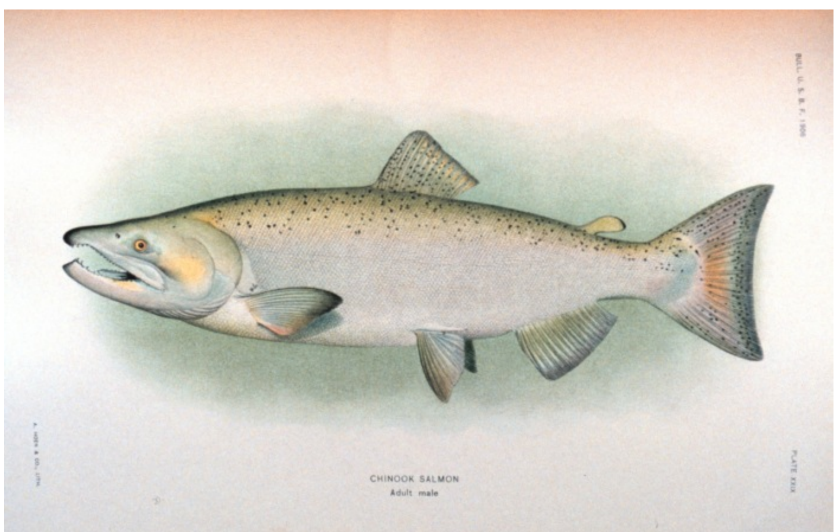

Figure 3-2 Chinook salmon (*Onchorynchus tshawytscha)*

Source: NOAA Photo Library (http://www.photolib.noaa.gov/fish/fish3007.htm).

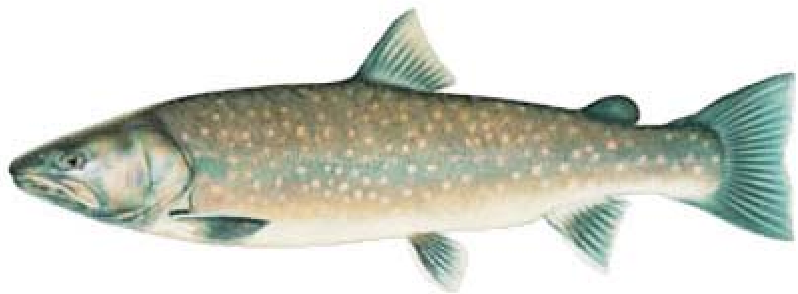

Figure 3-3 Bull trout (*Salvelinus confluentus)*
Source: USFWS (http://pacific.fws.gov/bulltrout/).

Tucannon summer steelhead, spring Chinook, fall Chinook, and bull trout life histories intersect a broad range of the aquatic ecosystem. Spatially, the life histories of these four species cover the entire subbasin from the mouth to the headwaters. These species also occupy all levels of the water column including slack water, swift water and the hyporheic zone. Not only are they present, but also the ability of these species to thrive is dependent on being able to successfully occupy these areas. Temporally, these species are present (or were assumed to be present in the past) at one lifestage or another throughout much of the watershed in all seasons. The ability of these species to be present at a particular time in a particular area is also key to the success of these species. Given the wide range of both the spatial and temporal aspects of these life histories, it can be assumed that having habitat conditions that are appropriate for these four species will also produce conditions that allow for the prosperity of other aquatic life in the Tucannon Subbasin.

The legal status of these species is important to the people of the Tucannon Subbasin. All four species are listed as threatened under the ESA. Currently the citizens, governments, state and federal agencies and tribes are engaged in planning for the recovery of each of the salmonids through different processes. The intention of subbasin planning to address listed species within the subbasin supports the inclusion of the only four federally listed aquatic species within the subbasin as focal species." (Appendix B)

Information and knowledge on known and present distribution of these species, population status and other characteristics varies, with the most information being available for steelhead and the least information available on bull trout.

Other species identified as "species of interest" are discussed at the end of this chapter.

3.2.1 Summer Steelhead Life History [1]

Tucannon summer steelhead are a typical Snake River "A"-run stock. A-run steelhead enter freshwater from June to August and generally pass Bonneville Dam before August 25. They begin passing Lower Monumental Dam in early June and can continue through the following spring (Glen Mendel, WDFW, personal communication). Adult summer steelhead appear to hold in the mainstem Snake River, rather than in the Tucannon, prior to spawning (Mark Schuck, WDFW, personal communication, cited in WDFW et al. 1990) possibly due to a lack of pools and cold water in the Tucannon during the summer and autumn. Entry into the Tucannon probably does not begin until September, when water temperatures drop (WDFW et al. 1990). Spawning begins in late February or early March. Spawning peaks in early to mid-April and continues through mid-May.

Most wild Tucannon steelhead (60 to 65 percent) return to spawn after one year in saltwater, and 35 to 40 percent return to spawn after two years in saltwater (Bumgarner et al. 2000). Three-salt age fish are extremely rare. The frequency of repeat spawners is probably less than 5 percent (Bumgarner et al 2002).

Juveniles emerge from spawning gravels in late May or June (WDFW et al. 1990). They typically rear in the Tucannon for one to two winters before migrating to the ocean. Smolt trapping conducted in the Tucannon River between 1998 and 2001 (Bumgarner et al. 2002) showed that emigrating steelhead were about 43 percent age 1, 52 percent age 2, and 5 percent age 3 or 4. Most outmigration occurs from December through June (WDFW et al. 1990) with a peak in April (Glen Mendel, WDFW, personal communication).

For the purposes of this assessment, assumptions were made regarding steelhead life history. These assumptions are summarized in Table 3-1.

Table 3-1 Life History Assumptions for Summer Steelhead in the Tucannon River

Stock Name:	Tucannon River Summer Steelhead	
Geographic Area (spawning reaches):	Tucannon: All reaches except Tuc1 (Tucannon River, mouth to fishing access site)	
River Entry Timing (Columbia):	Bonneville Dam: mostly July-August, but as late as November	
River Entry Timing (Tucannon):	Early January through mid-April; mean entry date in mid-February	
Adult Holding:	Adults begin holding in Lower Monumental Pool and the lower Tucannon (between September and February)	
Spawn Timing:	Begins week of March 1, ends 20th of May, with a peak in mid-April	
Spawner Ages:	60% 1-Salt, 39% 2-Salt, <1% 3-Salt	
Emergence Timing (dates):	Lasts 2 weeks beginning as early as mid April and as late as early July, with an average period of May 25 – June 8.	
Smolt Ages:	35% Age 1, 60% Age 2, 5% Age 3, <0.5% Age 4	
Juvenile Overwintering:	Snake River: Tucannon River	10% (late October – March) 90% (late October – March)
*Stock Genetic Fitness:	90% wild	
Harvest:	In-Basin: No Harvest	Out of basin: No Harvest

[1] Life history information in this section was taken from the WDFW Tucannon Subbasin Aquatic Assessment (2004).

3.2.2 Spring Chinook Life History[2]

Spring Chinook spawners enter the Tucannon from late April or early May to late June or early July (WDFW 2003). Spawning generally occurs from late August to late September. The peak of spawning generally occurs from the last week of August to mid-September.

Most Tucannon spring Chinook spawn at age 4 (72%) or age 5 (26%), but a small percentage (3%) may spawn at age 3 (Glen Mendel and Mark Schuck, WDFW, personal communication).

Juvenile spring Chinook rear in the Tucannon system for 12 to 15 months prior to migrating to the ocean. Smolt age composition has not been summarized, however there appear to be more subyearling smolts than yearlings (c.f. Gallinat et al. 2001). Migration takes place from October to July and peaks from April to late May.

Life history assumptions made for the purposes of this assessment are summarized in Table 3-2.

Table 3-2 Life History Assumptions for Spring Chinook in the Tucannon River

Stock Name:	Tucannon River Spring Chinook	
Geographic Area (spawning reaches):	Tucannon: From Tuc 9 (Tucannon River, lower steelhead release site to King Grade) to Tuc 18 (Tucannon River, Sheep Cr to Bear Cr).	
River Entry Timing (Columbia):	Bonneville Dam: late March – late May	
River Entry Timing (Tucannon):	Late April – late June	
Adult Holding:	Tucannon: all in Tucannon above Einrich steelhead release site (between early May & mid September)	
Spawn Timing:	Between August 27 & October 7	
Spawner Ages:	2% jacks, 72% age-4, 26% age-5	
Emergence Timing (dates):	Late March – mid May	
Smolt Ages:	All age-1	
Juvenile Overwintering:	Snake River:	27% (late October – early March)
	Tucannon R.:	73% (late October – early March)
*Stock Genetic Fitness:	90% of wild fitness	
Harvest:	In-Basin: No Harvest	Out of Basin: 7% rate

3.2.3 Fall Chinook Life History

Fall Chinook in the Snake River, including the Tucannon are “bright” fall chinook, meaning that they enter freshwater with chrome bright skin and are not ready to spawn for several weeks to months after entering their spawning streams. Adult fall Chinook enter the Columbia River in July and August and the Snake River from mid-August through October (Waples et al. 1991). They enter the Tucannon River from early October to early December. Spawning generally

[2] Information in this section was taken from the WDFW Tucannon Subbasin Aquatic Assessment (2004).

occurs from mid-October to mid-December (WDFW 2003). The peak of spawning is from late October to mid-November.

Spawning takes place in the lower Tucannon mainstem, generally below the mouth of Pataha Creek, but a few redds have been observed upstream of Pataha Creek to near Enrich Bridge.

Most Tucannon fall chinook females are thought to at age four or five (Glen Mendel, WDFW, personal communication).

Juvenile fall Chinook in the Tucannon and in the Snake basin outmigrate as subyearlings. Summer water temperatures in the Lower Snake and Tucannon may be too high for juvenile Chinook rearing to yearling stage (Waples et al.1991, Gallinat et al. 2001). Smolt migration occurs in the Tucannon River from mid-April to July. The peak of migration is at the end of May. Juvenile migrants are from the mid-50 to upper 60 mm size range.

Life history assumptions made for the purposes of this assessment are summarized in Table 3-3.

Table 3-3 Life History Assumptions for Fall Chinook in the Tucannon River

Stock Name:	Tucannon River Fall Chinook	
Geographic Area (spawning reaches):	Tucannon mainstem, mouth to Pataha confluence.	
River Entry Timing (Columbia specify pool?):	At Bonneville Dam, early September – late October, mean September 22.	
River Entry Timing (Tucannon):	Late September – late November, mean October 24.	
Adult Holding:	Lower Tucannon mainstem, mid-October – early December	
Spawn Timing:	Mid-October – early December, mean November 13.	
Spawner Ages:	51% ocean age 2, 35% ocean age 3, 14% ocean age 4.	
Emergence Timing (dates):	Late March – late April, mean April 8.	
Smolt Ages:	All subyearling.	
Juvenile Overwintering:	Columbia River:	N.A.
	Tucannon R.:	N.A.
*Stock Genetic Fitness:	85%	
Harvest :	No harvest inside Tucannon	30% Harvest Rate out of subbasin

3.2.4 Bull Trout Life History

Bull trout are relatively common in the Tucannon River and are not known to exist in the Pataha watershed.

Bull trout are known to spawn in Hatchery-Little Tucannon River (Panjab Creek to the headwaters), Bear Creek, lower Cold and lower Sheep creeks, Panjab Creek, Meadow Creek, Turkey Creek and Little Turkey Tail Creek. The lower 6.5 miles of Cummings Creek was surveyed by WDFW for spawning bull trout in October 2003 but no redds or fish were observed. Therefore, spawning in Cummings Creek has not been confirmed, although juveniles have been documented there. Spawning occurs from late August through October (USFWS 2002). Juvenile rearing is generally in the spawning areas, but subadult and adult bull trout may wander or migrate to other areas of the drainage during winter, spring and summer.

Migratory and resident bull trout are known to exist in the Tucannon subbasin. Migratory forms include fluvial fish that overwinter in the mainstem Tucannon River and fish that overwinter in the Snake River (USFWS 2002). Over two hundred migratory bull trout have been captured during their upstream migration in the spring and early summer at the Tucannon Hatchery trap (Faler et al. 2003).

3.3 Status of Focal Species in the Subbasin

Focal species information on historic and current distribution, population, harvest and hatchery (as applicable), is provided in Appendix B, along with the available empirical data for steelhead and spring and fall Chinook. Figure 3-4 identifies steelhead distribution and use type. Figure 3-5 identifies spring Chinook distribution and use type. No information on historical fall Chinook distribution in the Tucannon is available. Spawning and juvenile rearing take place from just above slack water at the confluence with the Snake River up to about river mile 17 (Appendix B).

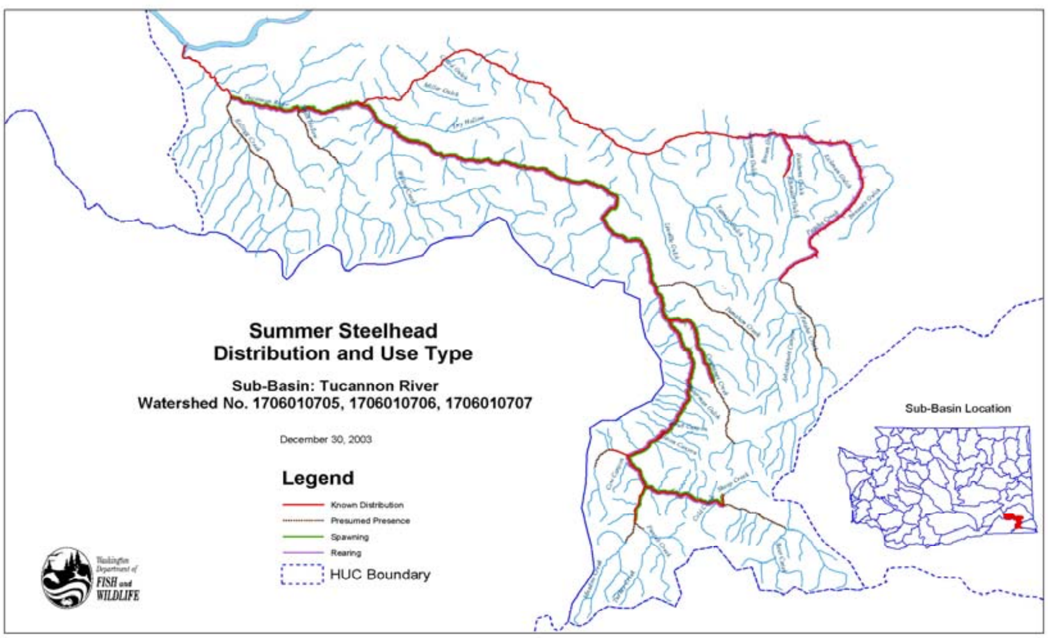

Figure 3-4 Current Known and Presumed Distribution of Summer Steelhead in the Tucannon Subbasin

Source: Data from the WDFW Washington Lakes and Rivers Information System (WLRIS) database (figure taken from WDFW 2004).

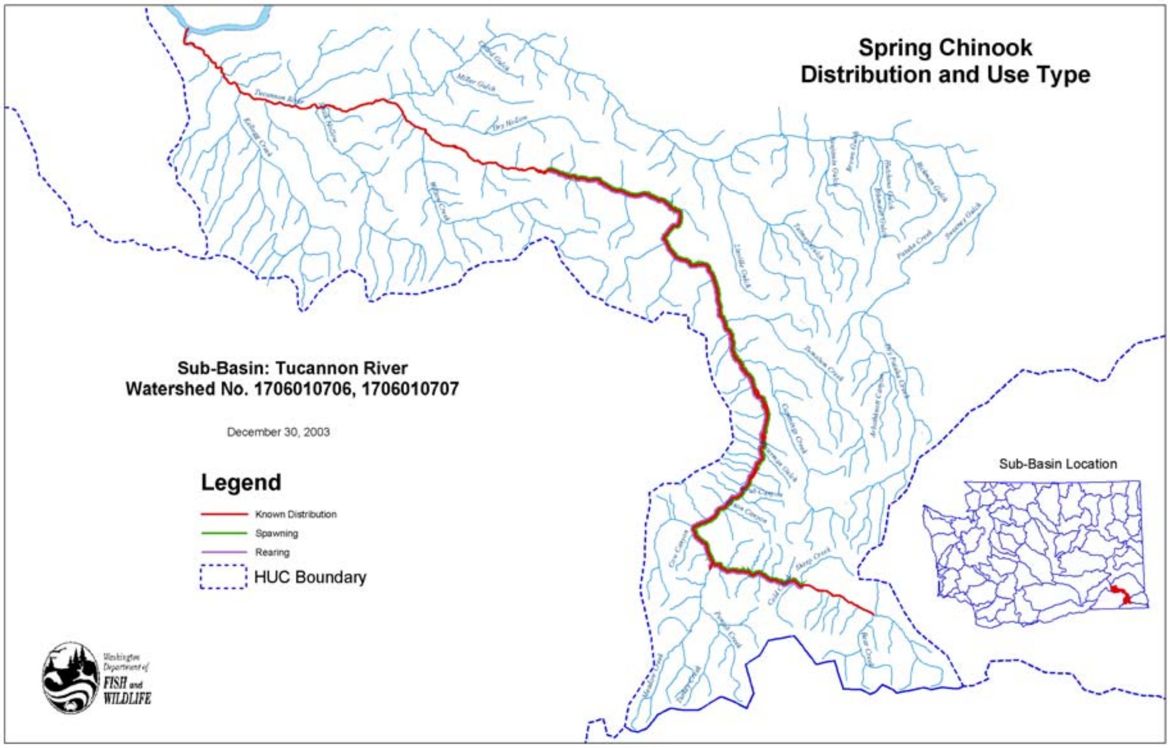

Figure 3-5 Current Known and Presumed Distribution of Spring Chinook in the Tucannon Subbasin.

Source: Data from the WDFW Washington Lakes and Rivers Information System (WLRIS) database (figure taken from WDFW 2004).

3.4 Tucannon Subbasin Habitat Assessment Methods

3.4.1 Introduction

Steelhead and spring and fall Chinook in the Tucannon subbasin were assessed by the WFDW using the Ecosystem Diagnosis and Treatment (EDT) method. EDT modeling was not possible for bull trout, as EDT rules for bull trout were not available for this assessment (WDFW 2004). Even without the EDT analysis, however, it is clear that suitable bull trout habitat is significantly less prevalent than in pre-development times (WDFW 2004).

Habitat conditions for bull trout were generally assessed in the USFWS Draft Bull Trout Recovery Plan[3]. The USFWS Draft Bull Trout Recovery Plan (2002) identified temperature as

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[3] See the Recovery Plan and Chapter 7 of this document, the Tucannon subbasin Management Plan, for additional information on bull trout.

the primary limiting factor in the Tucannon subbasin (WDFW 2004). Bull trout have a narrower tolerance range for certain attributes (i.e. temperature) than do steelhead and Chinook (pers. comm. J. Flory, USFWS, 2004).

Most of the habitat improvements recommended for steelhead trout and Chinook salmon also would benefit bull trout, particularly those that would reduce instream temperatures and protect the upper reaches of the subbasin (WDFW 2004).

3.4.2 Overview of EDT Methodology

EDT is an analytical model relating aquatic habitat features and biological (i.e., fish) health in an effort to support conservation and recovery planning (Lichatowich et al. 1995; Lestelle et al. 1996; Mobrand et al. 1997; Mobrand et al. 1998). Additional information on the EDT model can be found at www.edthome.org.

EDT is structured as an information pyramid in which each level builds on information from the lower level (Figure 3-6). Levels 1 and 2 characterize the condition of the ecosystem/environment. Level 3 analyzes the performance of a focal species (e.g., Chinook salmon) based on the condition (quality) of its environment as detailed by the Level 2 ecological attributes. Level 3 can be thought of as a characterization of the environment in the eyes of the fish (i.e., how a fish would rate environmental conditions based on our understanding of their requirements) (Mobrand et al. 1997).

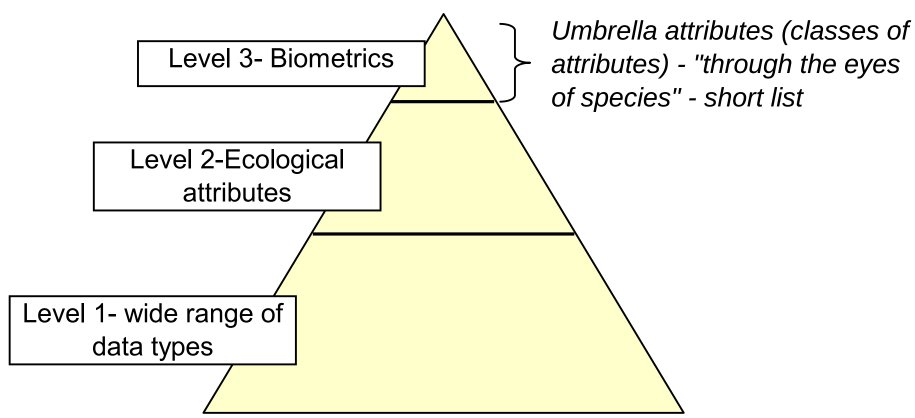

Figure 3-6 Data/Information Pyramid
Source: WDFW 2004.

The primary purpose of the EDT analysis is to compare historic conditions in the watershed to those that exist currently. Priority areas identified by EDT are those where historic conditions diverge the most from current conditions. WDFW began by gathering baseline information on aquatic habitat, human activities, and focal species life history to assess watershed conditions for the following three scenarios:

1. predevelopment (historic) conditions[4]
2. current conditions
3. properly functioning conditions (PFC)[5].

The comparison of these scenarios formed the basis of the analysis, from which conclusions were drawn regarding the reduction in habitat quality in the Tucannon subbasin and the associated reduction in focal species performance (WDFW 2004). The historic reference scenario also defined the natural limits to potential recovery within the basin (WDFW 2004).

WDFW tasked a technical workgroup to subdivide the subbasin into stream reaches based on similarity of habitat features, drainage connectivity, and land use patterns (WDFW 2004). For each of these stream reaches, the technical work group ranked 46 habitat parameters based on habitat quality using data/documentation when available and expert knowledge regarding fish biology, habitat processes, etc. when empirical data were not available (see Appendix B for data sources) (WDFW 2004). These habitat attributes were ranked for each of the three scenarios and input into the model.

WDFW then compiled life history information for steelhead and spring and fall Chinook[6] (e.g., life history stages, timing of each stage, and location/habitat required for each stage within an individual stream reach) (WDFW 2004). This life history information was input into the EDT model and "crossed" with habitat information from each of the three scenarios (WDFW 2004). This Stream Reach Analysis produced a set of limiting habitat attributes by stream reach, by species, and by life history stage. This analysis identifies the key factors contributing to the loss in species performance within individual stream reaches (WDFW 2004). The result of this analysis is a priority ranking of stream reaches to be considered for restoration. For ease of comparison and implementation, WDFW (2004) grouped contiguous reaches with similar limiting factors into the geographic areas. More specific findings from EDT analysis, and a description of the resulting geographic areas are provided later in this section. Appendix C describes the ways in which out-of-subbasin effects were incorporated into EDT. Out of subbasin effects are described in more detail in Section 3.5.6.

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[4] In general, the subbasin's historic conditions would have included undisturbed streamside forests that provide shade to the streams, less in-stream sediment, increased stream flow during summer months, greater number of pools (critical habitat during warm summer months), cooler water temperatures.

[5] Properly functioning conditions are a set of NOAA Fisheries standardized guidelines that are designed to facilitate and standardize determinations of the effect for Endangered Species Act (ESA) conferencing, consultations, and permits focusing on anadromous salmonids (Stelle 1996 as taken from WDFW 2004).

[6] Information on bull trout life history was not available in a format usable in the EDT model.

3.4.3 EDT Limitations

The EDT analysis used in this assessment has proved to be a valuable tool for conducting the steelhead and spring and fall Chinook assessment. As with all modeling tools, additional data collection and model calibration to further validate modeling conclusions would be desired. The time frame for developing the plan, combined with the shortage of data available for some key attributes suggests using caution with the results.

While conducting this assessment and particularly while performing the attribute ratings for EDT, it became quite clear that in many cases we were lacking even the most basic habitat information. This made the assessment work quite difficult, particularly outside of the Forest Service lands where at least some basic surveys had been conducted. In order to properly assess the subbasin and provide better information for the management strategy process it is vital that additional habitat and life history surveys be conducted. There were some reaches for which we had no empirical data on habitat types (pools/riffles/glides, etc.), embeddedness, LWD density, winter temperature or percent fines. The entire subbasin is lacking in bedscour, bankfull widths, flow and riparian function[7] data. Gradient measurements for individual reaches were also a concern. Gradients were measured using Terrain Navigator; the accuracy of these gradients is unknown and needs to be groundtruthed. Gradients for EDT input were derived using Terrain Navigator software. These gradients have not been ground truthed and some doubt remains as to whether any of the reaches actually exceed 3 percent. This could lead to habitat diversity appearing to be a higher magnitude problem than it actually is. It is the strong finding of this assessment that the above information begin to be acquired as soon as possible in order to better inform the land managers, public and private, during future planning efforts.

It is our determination that the current data set used for this EDT assessment should be re-examined and revised between each rolling provincial review, and/or before it is used for other planning efforts. Use in its present state for this Subbasin Plan was necessary, however, with more time and better data the model results can certainly be improved upon. Perhaps in the future, the EDT model can also be used to develop a detailed bull trout habitat assessment.

With the limitations of EDT, information and findings from other assessment and planning processes were also used as discussed in Section 3.6.4.

3.5 EDT Analysis

3.5.1 Introduction

A technical work group was formed for the Tucannon basin for the purpose of rating the Level 2 habitat attributes for the freshwater stream reaches. The work group drew upon published and

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[7] The riparian corridor provides a variety of ecological functions that generally can be grouped into energy, nutrients, and habitat as they affect salmonid performance. Some aspects of these functions are expressed through specific environmental attributes within EDT, such as woody debris, flow characteristics, temperature characteristics, benthos, pollutant conditions, and habitat types (e.g., pool riffle units).

unpublished data and information for the basin to complete the task. Expert knowledge about habitat identification, habitat processes, hydrology, water quality, and fish biology was incorporated into the process where data was not available. Attribute rating for EDT was coordinated by WDFW using state, federal and tribal resources. The WDFW watershed steward served as coordinator for the attribute rating process. The sources used for rating the individual attributes are outlined in Table 4-4 of Appendix B. The patient (current) condition attribute ratings represent a variety of sources and levels of proof. Levels of proof (or confidence levels) assigned to ratings are directly from developed rating methods by MBI specifically for the EDT process. The attributes assigned to each reach are assigned a numerical value from 1 to 5 where: 1 is empirical observation; 2 is expansion of empirical observation; 3 is derived information; 4 is expert opinion; 5 is hypothetical. Table 4-5 of Appendix B includes template attributes.

Three baseline reference scenarios were developed for the Tucannon Subbasin; predevelopment (historic or template as described above) conditions, current conditions, and properly functioning conditions (PFC). The comparison of these scenarios formed the basis for diagnostic conclusions about how the Tucannon and associated summer steelhead performance have been altered by human development. The historic reference scenario also served to define the natural limits to potential recovery actions within the basin. Properly functioning conditions were a set of standardized guidelines that NOAA Fisheries provided that were designed to facilitate and standardize determinations of the effect for Endangered Species Act (ESA) conferencing, consultations, and permits focusing on anadromous salmonids (Stelle 1996). The objective of the diagnosis then became identifying the relative contributions of environmental factors to the losses in summer steelhead performance. To accomplish this, two types of analyses, each at a different scale of overall effect: 1) individual stream reaches, and 2) geographic area analysis.

The Stream Reach Analysis identified the factors that, if appropriately moderated or corrected, would produce the most significant improvements in overall fish population performance. It identified the factors that should be considered in planning habitat restoration projects.

The Geographic Area Analysis identified the relative importance of each area for either restoration or protection actions. In this case, the effect of either restoring or further altering environmental conditions on population performance was analyzed. These results will be discussed in the management plan (Chapter 7).

Table 3-4 describes the Geographic Areas used for Tucannon subbasin assessment 2003 (WDFW 2004).

Table 3-4 Geographic Areas Used for Tucannon Subbasin

Geographic Area (Map Code)	Location	Length (Miles)	EDT Reaches included
Mouth Tucannon (MT)	Mouth to End of Backwater	.72	Tuc1
Lower Tucannon (LT)	Backwater to Pataha Creek	11.24	Tuc2, Tuc3, Tuc4, Tuc5, Tuc6
Kellogg Creek (KC)	Mouth to Steelhead Access Limit	1.29	Kel,
Smith Hollow (SH)	Mouth to Steelhead Access Limit	1.05	Smith
Lower Pataha (LP)	Mouth to Pomeroy	25.75	Pat1, Pat2, Pat3, Pat4, Pat5, Pat6, Pat7, Pat8

Geographic Area (Map Code)	Location	Length (Miles)	EDT Reaches included
Bihmaier (BIH)	Mouth to Steelhead Access Limit	1.94	Bih1, Bih2, Bih3, Bih4, Hutch
Upper Pataha (UP)	Pomeroy to Dry Pataha Creek	16.91	Pat9, Pat10, Pat11, Pat12
Dry Pataha (DP)	Dry Pataha Drainage	3.45	DryPat1, DryPat2, DryPat3
Mountain Pataha (MN)	Dry Pataha to Access Limit	6.88	Pat13, Pat14
Iron Springs (IS)	Iron Springs Creek Drainage	.06	IronSpr
Pataha-Marengo Tucannon (P-M-T)	Pataha Creek to Marengo	14.02	Tuc7, Tuc8A, Tuc9, Tuc9A, Tuc9B
Marengo-Tumalum Tucannon (M-TUM-T)	Marengo to Tumalum Creek	8.37	Tuc10
Tumalum (TUM)	Mouth to Steelhead Access Limit	5.87	Tumalum
Tumalum-Hatchery Tucannon (TUM-HAT)	Tumalum Cr to Hatchery Dam	4.06	Tuc11, Tuc12, Tuc13
Cummings (CUM)	Mouth to Steelhead Access Limit	6.78	Cummings
Hatchery-Little Tucannon (HAT-LT)	Hatchery Dam to Little Tucannon	7.85	Tuc14, Tuc14A, Tuc14B, Tuc15
Hixon (HIX)	Mouth to Steelhead Access Limit	.93	Hix
Little Tucannon (LT)	Mouth to Steelhead Access Limit	1.90	Ltuc
Panjab (PAN)	Mouth to Steelhead Access Limit	5.49	Pan1, Pan2, Meadow
Mountain Tucannon (MN-T)	Little Tucannon River to Bear Creek	10.28	Tuc16, Tuc17, Tuc18

Source: WDFW 2004.

3.5.2 Scaled and Unscaled Results

Results from this analysis are provided in two forms, scaled and unscaled. Unscaled results present the potential habitat benefits that could be achieved through protection and/or restoration of an entire geographic area. However, each geographic area is different in size, and habitat projects would be unlikely to occur throughout an entire geographic area. To provide a better understanding of the potential habitat benefits to be achieved through implementation of projects in specific portions of the geographic areas, scaled results were calculated that take into account the length of each geographic area by taking the original output from EDT (i.e. percent productivity change, etc.) and dividing it by the length of the stream in kilometers. This gives a value of the condition being measured per kilometer, which represents the most efficient areas to apply restoration or protection measures. Both results are presented, though the scaled version was given more weight in the conclusions portion of the assessment.

A Reach Analysis identifies the life stages most severely impacted (relative to historical performance) on a reach-by-reach basis, as well as the environmental conditions most responsible for the impacts. This three-part diagnosis can then be used to develop a plan designed to protect areas critical to current production, and to implement effective restoration actions in reaches with the greatest production potential.

3.5.3 Tucannon River - Steelhead and Chinook EDT Assessment

Tucannon River summer steelhead and spring and fall Chinook were assessed in two basic ways:

1. By identifying areas that currently have high production and therefore should be protected (i.e., high "Protection Value")[8].

2. By identifying areas with the greatest potential for restoring a life stage that is critical to increasing production (i.e., high "Restoration Potential")[9].

Table 3-5 contains a ranked list of the priority geographic areas for restoration and a summary of potential performance increase for steelhead, spring Chinook, and fall Chinook by geographic area in the Tucannon Subbasin. Table 3-6 contains a ranked list of the priority geographic areas for protection and a summary of potential performance increase for steelhead, spring Chinook, and fall Chinook by geographic area in the Tucannon Subbasin. Potential performance increase was the sum of the model predicted increases in life history diversity, productivity, and abundance for the scaled (% benefit/ km) EDT output. Results are sorted by steelhead ranking and do not represent an integrated priority list for all species. Integration across focal species occurred during the integrated assessment analysis discussed below.

The "restoration potential" of a geographic area is the is the production benefit to a specific population if that area were to be restored to historical environmental conditions. Restoration potential is measured in tems of life history diversity, productivity, and average adult abundance, and is expressed as the percent increase in each of these variables relative to current values. In other words, restoration potential is a measure of the maximum fisheries benefit that could be achieved by restoring a particular geographic area. "Protection value" is essentially the inverse of "restoration potential": a measure of the decrease in fish performance to be expected if a specific geographic area were to be degraded in a standardized way. Relative protection values over a number of geographic areas can be used to prioritize the areas in terms of their importance to preserving current production. Both restoration potential and protection value can be scaled to control for the impact of geographic areas that differ in size by dividing the absolute value by the length of the geographic area. Thus, scaled values represent, for instance, restoration potential per kilometer of stream.

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[8] Protection value describes stream reaches or geographic areas that currently are providing valuable habitat to support one or more life history stages and therefore should be protected from negative impacts.

[9] Protection value describes stream reaches or geographic areas that currently are providing valuable habitat to support one or more life history stages and therefore should be protected from negative impacts.

Table 3-5 Ranked List of Geographic Areas Based upon EDT Restoration Priority Potential

	EDT Restoration Priority Rank			Potential Performance Increase (% / km)		
Geographic Area	**Stlhd**	**Spr Chk**	**Fal Chk**	**Stlhd**	**Spr Chk**	**Fal Chk**
Tumalum-Hatchery Tucannon	1	1		5.6%	13.5%	
Marengo-Tumalum Tucannon	2	3		5.0%	9.8%	
Hatchery-Little Tucannon	3	5		4.1%	7.6%	
Pataha-Marengo Tucannon	4	2		3.0%	11.4%	
Lower Tucannon	5	6	2	2.3%	5.7%	14.6%
Iron Springs	6			2.0%		
Mountain Tucannon	7	7		1.8%	2.5%	
Tumalum	8			1.7%		
Mouth Tucannon	9	4	1	1.6%	8.6%	38.6%
Lower Pataha	10			1.5%		
Bihmaier	11			1.5%		
Hixon	12			1.4%		
Mountain Pataha	13			1.2%		
Upper Pataha	14			1.2%		
Panjab	15	8		1.1%	0.4%	
Smith Hollow	16			1.0%		
Little Tucannon	17			0.9%		
Dry Pataha	18			0.7%		
Cummings	19			0.5%		
Columbia River	20	9	3	0.3%	0.4%	0.30%
Kellogg	21			0.2%		
Snake River	22	10	4	0.1%	0.1%	0.20%

Source: Table 4-35, Appendix B (WDFW 2004)
Key: Spring Chinook (Spr Chk); Summer steelhead (Stlhd); Fall Chinook (Fal Chk).

Table 3-6 Ranked List of Geographic Areas Based upon EDT Protection Priority Potential

	EDT Protection Priority Rank			Potential Performance Increase (% / km)		
Geographic Area	**Stlhd**	**Spr Chk**	**Fal Chk**	**Stlhd**	**Spr Chk**	**Fal Chk**
Tumalum-Hatchery Tucannon	1	3		-6.4%	-4.1%	
Marengo-Tumalum Tucannon	2	2		-5.6%	-4.3%	
Mountain Tucannon	3	6		-4.9%	-3.2%	
Hatchery-Little Tucannon	4	4		-4.4%	-4.0%	
Panjab	5	8		-3.5%	-1.2%	
Cummings	6			-3.1%		
Pataha-Marengo Tucannon	7	1		-3.0%	-9.0%	
Hixon	8			-3.0%		

Geographic Area	EDT Protection Priority Rank Stlhd	Spr Chk	Fal Chk	Potential Performance Increase (% / km) Stlhd	Spr Chk	Fal Chk
Tumalum	9			-2.0%		
Little Tucannon	10			-1.6%		
Bihmaier	11			-0.7%		
Mouth Tucannon	12	7	1	-0.6%	-2.7%	-14.3%
Lower Tucannon	13	5	2	-0.5%	-3.7%	-6.1%
Iron Springs	14			-0.5%		
Snake River	15	9	3	-0.4%	-0.2%	0.20%
Upper Pataha	16			-0.1%		
Mountain Pataha	17			-0.1%		
Columbia River	18	10	4	-0.1%	-0.1%	0.20%
Dry Pataha	19			-0.1%		
Smith Hollow	20			-0.1%		
Kellog	21			0.0%		
Lower Pataha	22			0.0%		

Source: Table 4-35, Appendix B (WDFW 2004)
Key: Spring Chinook (Spr Chk); Summer steelhead (Stlhd); Fall Chinook (Fal Chk).

Summer steelhead summary of limiting habitat attributes

The EDT analysis identified the following most common limiting factors for summer steelhead in the Tucannon subbasin (WDFW 2004):

- habitat diversity (as influenced by gradient, confinement, hydromodifications [e.g., roads, dikes], degraded riparian function, and instream large wood)
- sediment load
- key habitat quantity (e.g., pre-spawn holding pool habitat)
- obstructions (i.e., fish passage barriers)

Spring Chinook summary of limiting habitat attributes

Habitat diversity and key habitat quantity were the most common limiting factors for spring Chinook in the Tucannon River, with flow, channel stability, and temperature being secondary limiting factors (WDFW 2004).

Fall Chinook summary of limiting habitat attributes

In both Tucannon River geographic areas, sediment load and key habitat quantity were the primary limiting factors for fall Chinook, with habitat diversity and channel stability following as secondary limiting factors (WDFW 2004). Sediment load moderately to highly impacts egg incubation and fry colonization in most reaches (WDFW 2004). Most life stages experienced small to moderate losses in key habitat quantity; however, the fry colonization and juveniles less than one year old active rearing life stages experienced high losses in some stream reaches (WDFW 2004).

Restoration efforts should focus on reducing the limiting factors identified for summer steelhead and spring and fall Chinook. Protection efforts should focus on protecting habitats (or stream reaches and geographic areas that contain these habitats) that provide one or more of these limiting attributes. Recommendations regarding locations of specific restoration and protection activities are outlined in Figure 3-8. See the Management Plan and Appendix B for additional clarification regarding limiting habitat attributes and a detailed discussion of restoration and protection activities recommended in individual geographic areas.

3.5.4 Tucannon Subbasin – Population Performance

The primary purpose of the EDT analysis is to provide a comparison of current, historical, and PFC habitat conditions. Results of this comparison help identify limiting habitat attributes and priority restoration and protection areas. Although not its primary purpose, the EDT model also estimates productivity, adult abundance, and capacity of focal species populations[10] for each baseline habitat condition. These values are not concrete population estimates, but rather are used to calibrate the EDT model (i.e., compare model results to available empirical data) and for comparative purposes (e.g., current vs. historic vs. predicted fish returns after implementation of the management plan) to ensure habitat goals will translate to desired population numbers.

Tucannon River Summer Steelhead

The EDT analysis and empirical data estimates vary slightly. WDFW (2004) summarizes the EDT model results for the Tucannon subbasin as follows

> "The EDT model estimated the average spawning population size of the current Tucannon River summer steelhead to be 636 fish, with a carrying capacity of 1397 fish and a productivity of just 1.8 adult returns per spawner (Table 3-7). The life history diversity value indicates only 34 % of the historic life history pathways can be successfully used under current conditions. The analysis also suggests that the Tucannon Subbasin has a much greater production potential for summer steelhead than it now displays, as historical abundance was estimated at 12,953 spawners, with a productivity of 18.9 returning adults per spawner and a life history diversity of 100%."
>
> "The EDT estimate (636 adults) and empirical adult abundance estimate (438-458 adults) for the Tucannon River are similar, especially considering there are some stream reaches that were excluded from the empirical estimate. However, the number of naturally produced steelhead has been estimated to be only 122 adults when hatchery fish are excluded from fish spawning in the river (from Bumgarner et al. 2002). Therefore, the EDT estimate is higher than the empirical data for naturally produced fish. The EDT estimated capacity for the Tucannon subbasin at PFC is 1,213 and that estimate is similar to the WDFW parr production estimate of 1,210 for the basin. Current EDT abundance is

[10] Estimates of productivity, adult abundance, and capacity were not made for fall Chinook.

estimated at 636 adult, naturally produced steelhead, with a current carrying capacity of 1,213 adults in the Tucannon Subbasin."

In developing the EDT analysis, Mobrand Biometrics brought each of the EDT 46 habitat attributes in each reach up to a level that was no longer harmful to fish, but is not necessarily beneficial. This represents properly functioning conditions (PFC). PFC can be thought of as habitat conditions able to support populations sufficient for a self-sustaining population, but not necessarily populations that would be considered abundant. A comparision of the model results under current conditions, PFC conditions, and historic conditions can be found in Tables 3-7, 3-8, and 3-9.

Table 3-7 EDT Summer Steelhead Spawner Population Performance Estimates.

Scenario	Diversity Index	Productivity	Capacity	Adult Abundance
Patient (Current)	34 %	1.8	1,397	636
PFC (Properly Functioning Conditions)	79 %	2.7	1,941	1,213
Template (Reference/Historic)	100 %	18.9	13,677	12,953

Source: Table 4-7, Appendix B.

Although the EDT results do not exactly match empirical data and historical data are unavailable for comparison, the EDT estimates indicate that current abundance, productivity, and life history pathways are substantially less than in the past. This finding is consistent with the results of other analyses and is in-line with planning efforts in the basin (WDFW 2004). EDT results also provide an evaluation of the habitat attributes (and their relative importance) that limit steelhead production.

Tucannon River Spring Chinook

WDFW (2004) summarizes their EDT analysis for spring Chinook as follows:

"….The EDT model estimated the average spawning population size of the current spring Chinook to be 506 fish, with a carrying capacity of 998 fish and a productivity of 2.0 adult returns per spawner (Table 3-9). The life history diversity value indicates 86 percent of the historic life history pathways can be successfully used under current conditions. The analysis also suggests that the Tucannon Subbasin had a much greater production potential for spring Chinook than it now displays, as historical abundance was estimated at 9,317 spawners, with a productivity of 19.4 returning adults per spawner and a life history diversity of 100 percent. Under Properly Functioning Conditions (PFC), the EDT model predicted an abundance of 2,665 spawners with a capacity of 3,345 spawners, a productivity of 4.9 returning adults per spawner, and a life history diversity of 97 percent (Table 3-8)."

"The EDT model estimates adult abundance for naturally produced spring Chinook in the Tucannon River at 506 fish when using 90 percent genetic fitness, and 681 adults when using 100 percent genetic fitness. The 506 adult EDT estimate is similar to the 498 adults (Table 3-9) based on using average redds/mile and 2.8 fish per redd (from Gallinat et al. 2003). However, the estimated numbers of adults spawning in the river include hatchery produced fish. Only 241 naturally produced fish on average have returned to the Tucannon over the past 7 years (from Gallinat et al. 2003)."

Note: Debate exists regarding whether redd counts are reliable predictors of the number of fish (Faurot & Kucera 2002; Faurot & Kucera 2003).

Table 3-8 EDT Spring Chinook Spawner Population Performance Estimates

Scenario	Diversity Index	Productivity	Capacity	Adult Abundance
Patient (Current) (90 % genetic fitness)	86%	2.0	998	506
PFC (90% genetic fitness)	97%	4.9	3,345	2,665
Template (Reference)	100%	19.4	9,823	9,317
Patient (Current) (100% genetic fitness)	91%	2.4	1,161	681
Patient (Current) (100 % genetic fitness)	98%	5.5	3,631	2,966

Note: Assumes 7% harvest out of subbasin
Source: Table 4-18 WDFW (2004) .

Tucannon River Fall Chinook

WDFW (2004) summarizes their EDT analysis for fall Chinook as follows:

"Model results for Tucannon Fall Chinook are based on life history assumptions summarized in Table 4-25 The EDT model estimated the average spawning population size of the fall Chinook population to be 52 fish, after impacts of reduced genetic fitness and harvest. The model predicted a carrying capacity 1,745 fish and productivity of 1.1 adult returns per spawner (Table 4-26). The life history diversity value indicates 21% of the historic life history pathways can be successfully used under current conditions. The analysis also suggests that the Tucannon Subbasin had a much greater production potential for fall Chinook than it now displays, as historical abundance was estimated at 7,882 spawners, with a productivity of 19.9 returning adults per spawner and a life history diversity of 100%. Under Properly Functioning Conditions (PFC), the EDT model predicted an abundance of 1,745 spawners with a capacity of 2,263 spawners, a productivity of 4.4 returning adults per spawner, and a life history diversity of 78%."

Table 3-9 Baseline spawner population performance parameters for Tucannon River fall Chinook.

Scenario	Diversity Index	Productivity	Capacity	Adult Abundance
Current	21%	1.1	1,745	52
PFC	78%	4.4	2,263	1,745
Template (Reference/Historic)	100%	19.9	8,299	7,882

Source: Table 4-26, Appendix B.

3.5.5 Population characteristics consistent with VSP.

The NOAA Fisheries Viable Salmonid Population (VSP) document (McElhany 2000) identified four parameters that are key in determining the long-term viability of a population: abundance, population growth rate, population spatial structure and diversity. Specific targets for these parameters have not been developed by the TRT for summer steelhead or spring Chinook; consequently, quantitative goals for the four parameters cannot be established at this time. However, the interim spawner abundance target for steelhead in the Tucannon River has been set at 1,300 adults (Lohn 2002; as cited in WDFW 2004). An interim goal of 1,000 wild spawning adults has been set for the Tucannon River spring Chinook population (Lohn 2002; as cited in WDFW 2004). Subbasin specific interim goals have not been set for fall Chinook.

A WDFW (2004) discussion of the four VSP parameters as they relate to the Tucannon subbasin EDT results for summer steelhead and spring and fall Chinook is provided in Appendix B, Sections 4.3.4.2 (steelhead), 4.4.4.2 (spring Chinook), 4.5.4.2 (fall Chinook).

3.5.6 Out of Subbasin Effects

Out of Subbasin Effects - General

Given that this subbasin plan focuses heavily upon anadromous species, out-of-subbasin environmental conditions can play a large role in determining the actual populations of such species. Out-of-subbasin effects were described effectively by TOAST (2004):

> "Subbasin planning, by definition, is focused on the major tributaries to the mainstem Columbia and Snake rivers. However, many focal species migrate, spending varying amounts of time and traveling sometimes extensively outside of the subbasins. Salmon populations typically spend most of their lives outside the subbasin. Unhindered, sturgeon will spend short periods in the ocean. Lamprey typically spend most of their life as juveniles in freshwater, but gain most of their growth in the ocean. Planning for such focal species requires accounting for conditions during the time these populations exist away from their natal subbasin. Out-of-subbasin effects encompasses all mortality factors from the time a population leaves a subbasin to the time it returns to the subbasin. These effects can vary greatly from year to year, especially for wide ranging species such as salmon.)." (TOAST 2004)

Primary out of subbasin effects include factors that can be natural in origin (ocean productivity, climate, and estuary conditions), human-caused (harvest), or a combination (mainstem flows / dam operations).

Out of Subbasin Effects – Tucannon Subbasin Empirical Data

The information in this section was written by Becky Ashe, Nez Perce Tribe.

Anadromous fish focal species in the Tucannon subbasin are limited primarily by out-of-subbasin factors involving hydropower development, ocean productivity, predation and harvest. Hydropower development and operation increases mortality in Snake River stocks of spring/summer and fall chinook. Fluctuations of ocean productivity in combination with the hydrosystem have caused severe declines in productivity and survival rates. Predation, especially within reservoirs, is also a potential limiting factor to salmonid smolts. Out of subbasin harvest is also a potential limiting factor for naturally produced chinook and steelhead stocks within the subbasin.

It is generally accepted that hydropower development on the Lower Snake River and Columbia River is the primary cause of decline and continued suppression of Snake River salmon and steelhead (WDF et al. 1990; CBFWA 1991; NPPC 1992; NMFS 1995, 1997; NRC 1995; IDFG 1998; Williams et al. 1998). However, less agreement exists about whether the hydropower system is the primary factor limiting recovery (Mamorek et al. 1998).

Adult escapement of anadromous species to the Snake River basin remains relatively low despite significant hatchery production/reintroduction efforts. Smolt-to-adult return rates (SAR), from smolts at the uppermost dam to adults returning to the Columbia River mouth, averaged 5.2% in the 1960s before hydrosystem completion and only 1.2% from 1977-1994 (Petrosky et al. 2001) (Figure 3-7). This is below the 2%-6% needed for recovery (Mamorek et al. 1998).

In contrast to the decline in SAR, numbers of smolts per spawner from Snake River tributaries did not decrease during this period, averaging 62 smolts per spawner before hydrosystem completion and 100 smolts per spawner afterward (Petrosky et al. 2001) (Figure 3-7). In this summary both spawner escapement and smolt yield are measured at the uppermost mainstem dam (currently Lower Granite). The increase in smolts per spawner was due to a reduction in density dependent mortality as spawner abundance declined. Accounting for density dependence, a modest decrease occurred in smolts per spawner from Snake River tributaries over this period, but not of a magnitude to explain the severe decline in life-cycle survival (Petrosky et al. 2001).

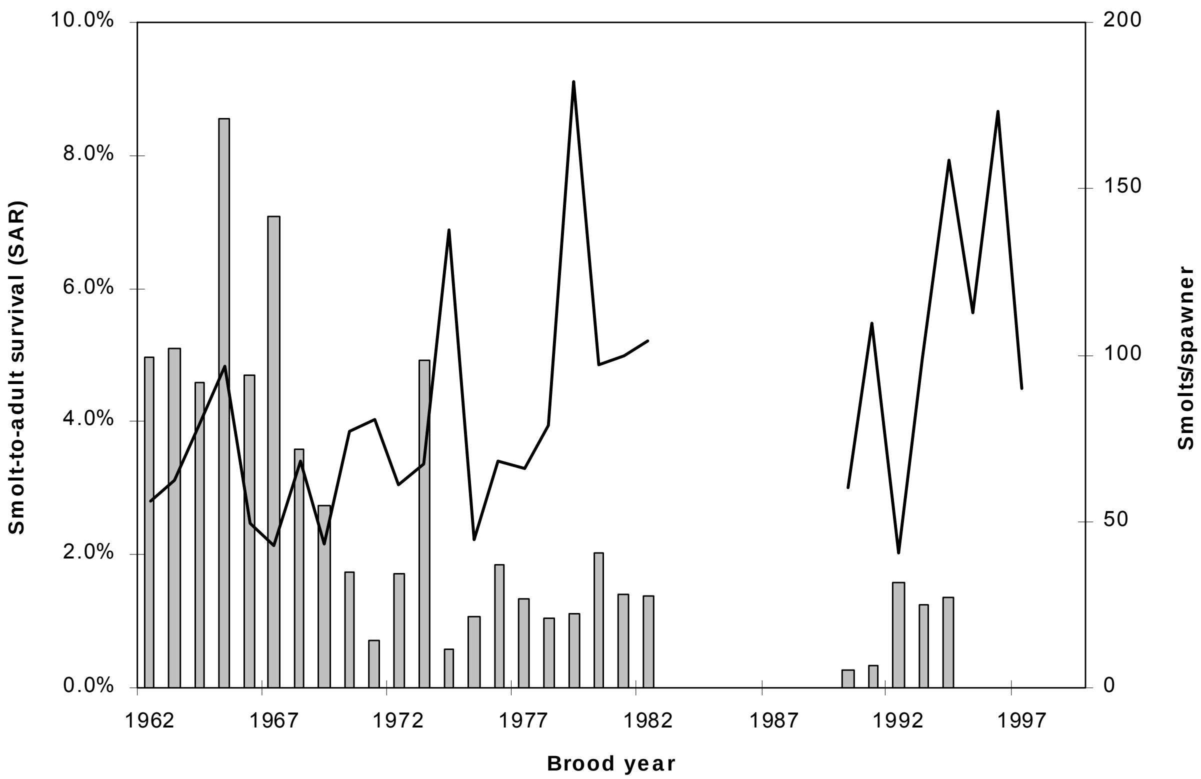

Figure 3-7 Smolt-to-Adult Survival Rates and Smolts/Spawner for Wild Snake River Spring and Summer Chinook

The SAR (Bars) describes survival during mainstem downstream migration to adult returns whereas the number of smolts per spawner (Line) describes freshwater productivity in upstream freshwater spawning and rearing areas

Source: Petrosky et al. 2001.

The dams cause direct, indirect, or delayed mortality, mainly to emigrating juveniles (IDFG 1998, Nemeth and Kiefer 1999). As a result of this increased mortality, Snake River spring and summer chinook declined at a greater rate than downriver stocks, coincident with completion of the federal hydropower system (Schaller et al. 1999). Schaller et al. (1999) concluded that factors other than hydropower development have not played a significant role in the differential decline in performance between upriver and downriver stocks. The Snake River stocks above eight dams survived one-third as well as downriver stocks migrating through 3 dams for this time period after taking into account factors common to both groups (Schaller et al. 1999; Deriso 2002). The additional decline in productivity of upriver stocks relative to downriver stocks indicates this portion of the mortality is related to factors unique to upriver stocks.

Patterns of Pacific Decadal Oscillation and salmon production would indicate that poor ocean conditions existed for Columbia River salmon after the late 1970s (Hare et al. 1999). However, the natural fluctuations of ocean productivity affecting all Columbia River stocks, in combination with mortality as a result of the hydrosystem, appear to have caused the severe declines in productivity and survival rates for the Snake River stocks. Temporal and spatial patterns of hatchery release numbers did not coincide with the differential changes in survival rates between upriver and downriver stocks (Schaller et al. 1999). Harvest rates were drastically reduced in the early 1970s, in response to declines in upriver stream-type chinook abundance. Given that changes in smolts per spawner cannot explain the decreases in SAR or overall survival rates for Snake River stocks, it appears the altered migration corridor has had a strong influence on the mortality that causes these differences in stock performance.

The SAR and smolt per spawner observations (Figure X) indicate that the overall survival decline is consistent primarily with hydrosystem impacts and poorer ocean (out-of-subbasin factors), rather than large-scale impacts within the subbasins between the 1960s and present (Schaller et al. 1999; Petrosky et al. 2001). Because the smolt/spawner data represent aggregate populations from a mix of habitat qualities throughout the Snake River basin, and are from a period after hydropower development, they do not imply there is no room for survival improvement within the Snake River subbasins. However, because of limiting factors outside the subbasins, and critically reduced life-cycle survival for populations even in pristine watersheds, it is unlikely that potential survival improvements within the Snake River subbasins alone can increase survival to a level that ensures recovery of anadromous fish populations

TOAST (2004) provides a regional overview of out of subbasin factors impacting anadromous fish in the Columbia Basin, including the Snake River.

The TOAST (2004) utilized the most current studies and information reviewing mainstem passage effects on juvenile and adult salmonids to model hydrosystem effects on survival of anadromous fish. Juvenile survival through the mainstem Columbia and Snake rivers depends upon habitat quality and quantity, river flow, juvenile travel time, juvenile migration timing, dam survival, transportation survival, survival of naturally migrating fish, and competitive interactions with hatchery fish.

For example, survival of yearling chinook migrating in-river from above Lower Granite Dam (past eight hydroelectric projects) averages 36% (88% per project) and subyearling chinook in-river survival averages 29% (~85% per project). For juveniles that are transported, TOAST (2004) assumed 98% of the juveniles survive to the point of release (NMFS 2000 White Paper Transportation). However, once transported Snake River yearling and subyearling chinook are released from the barges survival is 50% for yearlings (Bouwes et al. 1999) and 35% for subyearlings (PATH 1999 as cited by TOAST 2004) compared to that of juveniles migrating in-river, respectively.

Adult chinook survival past each mainstem dam under current conditions was assumed to average 93% (PATH 2000 as cited by TOAST 2004). Thus, total adult survival through mainstem river reaches is highly dependent on the number of dams each adult must pass. For example, adult chinook returning to the Tucannon River would have to pass six mainstem dams, and thus their overall survival rate would be 65%. Historically, adult chinook survival through the mainstem Columbia and Snake Rivers was assumed to average 92% (TOAST 2004).

TOAST (2004) also incorporated impacts to survival in the estuary and ocean and through mainstem fisheries.

Table 5 in TOAST (2004) reports Smolt-to-Adult (SAR) survival rates of juvenile fish from the mouth of the subbasin to their return to the subbasin as adults. They were calculated from intermediate EDT results. Results of SAR rates calculated for fish produced in the Tucannon River (those that originate above Lower Monumental Dam were):

- yearling chinook juveniles – 1.1% with a range of 0.36% to 3.63%.
- subyearling chinook - 0.5% with a range of 0.16% to 1.65%.
- steelhead juveniles – 2.07% with a range of 1.27% to 5.72%

It would be great to insert a table with actual observed SAR's from the Tucannon – brood year 85 to 93 only had SAR above 1 two years. Mean smolt to adult for wild fish during this period was 0.64 percent and for hatchery was 0.17 percent.

Out of Subbasin Effects and EDT

Although the subbasin planning process is designed to focus on restoration and protection opportunities within the subbasin, the EDT analysis also summarizes the proportion of the total restoration and protection potential that exists within the subbasin versus the portion that would be realized exclusively from improvements made outside of the basin (i.e., restoration and protection activities downstream in the Snake and Columbia rivers). Appendix C provides further detail regarding how out-of-subbasin effects were integrated into the EDT analysis.

Analysis of the maximum in-basin and out-of-basin changes in life history diversity, productivity, and abundance that could potentially be observed for steelhead and spring Chinook has been summarized in Table 3-10 below. The Tucannon River fall Chinook population is not an independent population (i.e., it is strongly dependent on the parent population in the Snake River mainstem). Consequently, it is not valid to compare in basin versus out of basin effects for fall Chinook. The relative contribution of within-subbasin efforts versus out-of-subbasin efforts was determined by identifying areas critical to preserving current production (e.g. by identifying areas with high "Protection Value"), and by identifying areas with the greatest potential for restoring a significant measure of historical production (e.g. by identifying areas with high "Restoration Potential").

Table 3-10 Within Subbasin and Out of Subbasin Steelhead and Spring Chinook Restoration and Protection Potential

	Life history diversity		Productivity		Abundance	
	Within Subbasin	Out of Subbasin*	Within Subbasin	Out of Subbasin*	Within Subbasin	Out of Subbasin*
Steelhead						
Restoration Potential	75%	25%	64%	36%	46%	54%
Protection Potential	64%	36%	65%	35%	63%	37%
Spring Chinook						
Restoration Potential	57%	43%	72%	28%	64%	36%
Protection Potential	84%	16%	69%	31%	67%	33%

* Out of subbasin refers to impacts and benefits from restoration and protection in the mainstem Snake and Columbia Rivers.
Source: Section 4.3.4.6 of Appendix B.

These results show that for steelhead, 25 to 54 percent of potential improvements for the Tucannon subbasin are tied to actions outside of the subbasin (i.e., restoration and protection in the mainstem Columbia and Snake rivers). For spring Chinook, 16 to 43 percent of potential improvements for the Tucannon subbasin are tied to actions outside of the subbasin. These represent a significant impact of out-of-subbasin environmental conditions upon subbasin fish populations. Discussion of the need for activities outside of the subbasin in addition to those actions proposed in this plan is provided in Section 7.3.7.

3.6 Integrated Assessment Analysis and Conditions

3.6.1 Introduction

The information presented in this section was taken from Appendix B (WDFW 2004), and includes the results from integrating the steelhead and Chinook assessments into one combined approach, setting the stage for the management plan (Chapter 7). Divergences from EDT are identified, along with a description of the priority restoration and protection areas, and a summary of the basis for these. Note that this subbasin plan is focused on in-basin improvements, and does not address activities that would need to occur out of the subbasin at the same level of detail as those that are proposed in-basin. As such, this section does not discuss efforts in the Snake River and Columbia River mainstems, although such efforts may be significant in terms of fish population benefit and cost.

3.6.2 Spring Chinook, Fall Chinook and Summer Steelhead EDT Analysis Limiting Attributes

Within the Tucannon Subbasin, the EDT analysis identified habitat quantity and habitat diversity as the most common limiting habitat attributes for both steelhead and spring Chinook. Additionally, sediment load was a primary limiting factor for steelhead and fall Chinook. Channel stability, flow, temperature, and obstructions were common secondary limiting factors, with obstructions more commonly affecting steelhead and warm summer temperatures having a bigger impact on spring Chinook.

Sediment load and channel stability were common limiting factors for egg incubation and early life history stages of summer steelhead throughout much of the Tucannon watershed. Restoration efforts for reaches upstream of steelhead distribution should also be evaluated and considered for restoration, if they are determined to be major contributors of sediment to the system. These efforts will also directly benefit bull trout, which could not be evaluated using EDT. Food (reduced benthic productivity) was not a major limiting factor in any one reach, but the cumulative effect of small losses for juvenile life history stages throughout the watershed could make it an important factor for all salmonids.

Warm summer temperatures were a common problem for spawning (pre-spawn holding) and egg incubation for spring Chinook, but appeared to have little effect on steelhead probably due to differences in spawn timing. However, other assessments have indicated that marginal summer temperatures would likely adversely affect juvenile rearing for spring Chinook and steelhead. Increased peak flows, reduced low flows, and food (salmon carcasses and benthic productivity) were consistently low to moderate limiting factors for fry colonization and juvenile rearing life stages. The cumulative impact of these low-level limiting attributes could be important to the overall reduced productivity in the Tucannon River Subbasin.

EDT analyses indicate that restoration efforts should focus on restoring riparian function (connection to the floodplain, riparian vegetation and possibly offchannel habitat), minimizing man-made confinement (roads and dikes), increasing LWD density, decreasing summer temperatures, addressing fish passage obstructions, and reducing sediment load throughout the watershed. Addressing these habitat attributes will benefit steelhead and spring Chinook, as well as bull trout and possibly fall Chinook.

3.6.3 Priority Areas for Protection from EDT Analysis

An initial set of recommended geographic areas for protection for both steelhead and spring Chinook was derived from the EDT analysis (see Table 3-11). Protection here is defined as "protection of these areas in such a way as to prevent further degradation of the habitat attributes that are important to the focal species" (MBI products refer to this as "preservation"; for the purposes of this assessment the terms are synonymous). EDT predicted some overlap of priority geographic areas for protection of steelhead, fall Chinook and spring Chinook in the Tucannon River Subbasin. Merengo-Tumalum Tucannon, Tumalum-Hatchery Tucannon and Hatchery-Little Tucannon all ranked in the top five for protection for steelhead and spring Chinook. Pataha-Marengo Tucannon was the top ranked area for protection for spring Chinook but was only seventh for steelhead.

Priority geographic areas for habitat protection for spring Chinook (Spr Chk), summer steelhead (Stlhd), and fall Chinook (Fal Chk) in the Tucannon River Subbasin, Washington, were developed from the EDT analysis based upon potential performance increase and decrease. Potential performance decrease was the sum of the model predicted degradation in life history diversity, productivity, and abundance for the scaled (% benefit/ km) EDT output. Results are sorted by steelhead ranking and do not represent an integrated priority list for all species.

Table 3-11 Priority Geographic Areas for Habitat Protection for Spring Chinook, Summer Steelhead, and Fall Chinook in the Tucannon River Subbasin

	EDT Protection Priority Rank			Potential Performance Increase (% / km)		
Geographic Area	**Stlhd**	**Spr Chk**	**Fal Chk**	**Stlhd**	**Spr Chk**	**Fal Chk**
Tumalum-Hatchery Tucannon	1	3		-6.4%	-4.1%	
Marengo-Tumalum Tucannon	2	2		-5.6%	-4.3%	
Mountain Tucannon	3	6		-4.9%	-3.2%	
Hatchery-Little Tucannon	4	4		-4.4%	-4.0%	
Panjab	5	8		-3.5%	-1.2%	
Cummings	6			-3.1%		
Pataha-Marengo Tucannon	7	1		-3.0%	-9.0%	
Hixon	8			-3.0%		
Tumalum	9			-2.0%		

Geographic Area	EDT Protection Priority Rank			Potential Performance Increase (% / km)		
	Stlhd	Spr Chk	Fal Chk	Stlhd	Spr Chk	Fal Chk
Little Tucannon	10			-1.6%		
Bihmaier	11			-0.7%		
Mouth Tucannon	12	7	1	-0.6%	-2.7%	-14.3%
Lower Tucannon	13	5	2	-0.5%	-3.7%	-6.1%
Iron Springs	14			-0.5%		
Snake River	15	9	3	-0.4%	-0.2%	0.20%
Upper Pataha	16			-0.1%		
Mountain Pataha	17			-0.1%		
Columbia River	18	10	4	-0.1%	-0.1%	0.20%
Dry Pataha	19			-0.1%		
Smith Hollow	20			-0.1%		
Kellog	21			0.0%		
Lower Pataha	22			0.0%		

Note: Potential performance decrease was the sum of the model predicted degradation in life history diversity, productivity, and abundance for the scaled (% benefit/ km) EDT output. Results are sorted by steelhead ranking and do not represent an integrated priority list for all species.Restoration Priority Areas from EDT Analysis.

Source: Table 4-35b, Appendix B (WDFW 2004).

3.6.4 Restoration Priority Areas from EDT Analysis

EDT predicted substantial overlap of priority geographic areas for restoration for steelhead and spring Chinook in the Tucannon River Subbasin (Table 3-12). One exception was that the fourth priority for spring Chinook (Mouth Tucannon) and first priority for fall Chinook was the ninth priority for steelhead. Potential benefits of restoration work were two to four fold greater for spring Chinook (5.7 to 13.5% / km) than for steelhead (2.3 to 5.6 % / km).

Priority geographic areas for restoration of spring Chinook (Spr Chk), summer steelhead (Stlhd), and fall Chinook (Fal Chk) in the Tucannon River Subbasin, Washington. Potential performance increase was the sum of the model predicted increases in life history diversity, productivity, and abundance for the scaled (% benefit/ km) EDT output. Results are sorted by steelhead ranking and do not represent an integrated priority list for all species.

Table 3-12 Priority Goegraphic Areas for Restoration of Spring Chinook, Summer Steelhead, and Fall Chinook in the Tucannon River Subbasin

Geographic Area	EDT Restoration Priority Rank			Potential Performance Increase (% / km)		
	Stlhd	Spr Chk	Fal Chk	Stlhd	Spr Chk	Fal Chk
Tumalum-Hatchery Tucannon	1	1		5.6%	13.5%	
Marengo-Tumalum Tucannon	2	3		5.0%	9.8%	
Hatchery-Little Tucannon	3	5		4.1%	7.6%	
Pataha-Marengo Tucannon	4	2		3.0%	11.4%	
Lower Tucannon	5	6	2	2.3%	5.7%	14.6%
Iron Springs	6			2.0%		

Geographic Area	EDT Restoration Priority Rank			Potential Performance Increase (% / km)		
	Stlhd	Spr Chk	Fal Chk	Stlhd	Spr Chk	Fal Chk
Mountain Tucannon	7	7		1.8%	2.5%	
Tumalum	8			1.7%		
Mouth Tucannon	9	4	1	1.6%	8.6%	38.6%
Lower Pataha	10			1.5%		
Bihmaier	11			1.5%		
Hixon	12			1.4%		
Mountain Pataha	13			1.2%		
Upper Pataha	14			1.2%		
Panjab	15	8		1.1%	0.4%	
Smith Hollow	16			1.0%		
Little Tucannon	17			0.9%		
Dry Pataha	18			0.7%		
Cummings	19			0.5%		
Columbia River	20	9	3	0.3%	0.4%	0.30%
Kellogg	21			0.2%		
Snake River	22	10	4	0.1%	0.1%	0.20%

Source: Table 4-35a, Appendix B (WDFW 2004).

3.6.5 Analysis Discussion

The subbasin assessment has many findings that are comparable to other recent assessments and planning efforts. Riparian function, LWD, pools, confinement; sediment and temperature were the most common limiting attributes identified with the assessment. These same habitat attributes were identified by virtually all the assessments performed on the Tucannon in the last seven years (Table 3-13). Particularly pronounced in these assessments is the mention of attributes having to do with floodplain connectivity, riparian health (both of which are related to the EDT attribute Riparian Function) and LWD. These limiting factors are mentioned in all the assessments reviewed and figure prominently in nearly every reach in the Tucannon analyzed with EDT.

Table 3-13 Assessments Performed in the Tucannon Subbasin and the Key Limiting Factors Identified

Assessment	Key Limiting Factors Identified
EDT	Habitat Diversity (Includes: riparian Function, confinement, gradient, LWD density for most life stages); Key Habitat (pools, pool tail-outs and small cobble riffles); Temperature; Low-Flows; Sediment; Channel Stability (); hatchery competition
LFA	LWD; pools (quality & frequency); embeddedness (Pataha); floodplain connectivity; temperature; streambank condition; riparian condition; reduced salmon carcasses
Subbasin Summary	temperature; geomorphic instability (pools, floodplain access); riparian function; sedimentation; instream habitat (inc. pools and LWD); passage; hatchery effects; exotic species; harvest; ecologic productivity; flows
Model Watershed Plan	temperature; turbidity, sediment, lack of pools; streambank and geomorphic stability (stream complexity and floodplain accessability)
Bull Trout Recovery Plan (draft)	LWD; temperatures; sediment; bank stability; loss of riparian, barrier removal

The Limiting Factors Analysis (LFA) performed for WRIA 35 (Kuttle, 2002) identified many of the same habitat problems as EDT or the other documents (such as sediment; confinement; lack of primary pools and temperature). In addition to these limiting habitat attributes the LFA identified the "upper" Tucannon, particularly state and federal land, as areas to protect from further degradation. This was in addition to land already protected within the Wenaha-Tucannon Wilderness.

The Subbasin Summary (Stovall 2001) identified many of the same habitat issues as the EDT or Limiting factors reports, but it was not reach specific. The Summary identified key factors that occur at the local and regional level limiting fish production. These included water quality, geomorphic instability, riparian function, sedimentation, insufficient instream habitat, out-of-basin effects, the introduction and proliferation of non-native species, and ecological productivity.

The draft Bull Trout Recovery Plan (Chaper 24, USFWS 2002) lists many of the same habitat issues, but as with the Summary it is not reach specific. Because bull trout are remaining in the headwater areas, the report tends to emphasize those areas. Proposed Critical habitat included the Tucannon River mainstem, Cummings Creek, Hixon Canyon, Cold Creek, Sheep Creek, Turkey Creek, Little Turkey Creek, Bear Creek, Panjab and Meadow Creek. Pataha Creek and the Little Tucannon River were included in the draft critical areas, but WDFW recommended deleting these areas in their response to the draft critical habitat designations. Grub Creek was not included in the original draft critical areas but has been recommended for inclusion by USFS. Results from EDT and the above works appear to generally compliment the results of the Recovery Plan when complete.

The Model Watershed Plan (CCD 1997) identified major watershed problems. These included: sediment deposition in spawning gravels, lack of resting and rearing pools, lack of large woody debris, high stream temperatures and diminished riparian vegetation.

In short, if we examine EDT in light of other planning reports and our empirical data results we find a very similar story with a few slight differences. Most age one and older steelhead production overlaps with primary spring Chinook spawning and rearing areas in the mainstem

Tucannon River. Bull trout spawn and rear in areas in the upper reaches of the mainstem Tucannon River and upper tributaries that are important for steelhead production (Cummings Creek) or for protection (mostly in Wilderness designation). Bull trout migration and overwintering uses the geographic areas of the mainstem Tucannon that are important for spring Chinook, steelhead and even the lower river that is the primary area for fall Chinook. Other than the bull trout overwintering and fall Chinook production areas, the areas of highest value for steelhead and spring Chinook rearing, as well as the bull trout spawning or rearing areas in, or near the Wilderness are consistent among all the planning documents and most of the EDT results.

Restoration Priority Geographic Areas

The following geographic areas have the highest restoration value in Tucannon River according to the EDT analysis of steelhead and spring chinook and taking into account other factors, such as previous planning efforts and empirical data:

- Pataha-Marengo Tucannon
- Marengo-Tumalum Tucannon
- Tumalum-Hatchery Tucannon
- Hatchery-Little Tucannon
- Mountain Tucannon

These are not in ranked order. These five areas are, as a group, considered a priority for restoration. The assessment team did not believe that the information available was at a fine enough detail to rank the areas beyond the top five. The priority geographic areas were identified by considering first their rankings by the EDT analysis for restoration for steelhead, fall Chinook and spring Chinook from Tables 3-11 and 3-12. Then these were considered in the light of past planning efforts and empirical data within the subbasin.

3.6.6 Divergence from EDT

The EDT model provided ranking of geographic areas based solely upon their potential to provide habitat for fish species from a biological perspective, comparing historic conditions to current conditions. However, the Subbasin Planning Team reevaluated these EDT results in light of several additional considerations.

- Prioritization of geographic areas was required. This necessitated comparison of trade-offs between the biological benefits provided by enhancement potential of one geographic area versus another.
- The needs of all aquatic focal species needed to be balanced. This again required balancing between geographic areas that would provide significant benefit to one focal species, but lesser benefit to others.
- Socioeconomic factors may limit restoration opportunities in selected geographic areas. Given the lack of time and resources to develop a comprehensive socioeconomic analysis for the subbasin, limitations due to this factor were based upon best professional

judgment of the Subbasin Planning Team and technical staff. Clearly there are value judgments involved in determining what is considered feasible and not feasible, and differences in such value judgments do exist within the subbasin. A comprehensive socioeconomic study within the subbasin should be developed with the cooperation of local stakeholders. This analysis would provide a solid foundation upon which socioeconomic conditions could be factored into consideration of project priorities.

This section describes where the Subbasin Planning Team chose to diverge from EDT, based upon these and other considerations. This does not preclude projects from being implemented in non-priority areas. If opportunities present themselves in non-priority areas, project sponsors could use the initial EDT modeling results to support the need for such a project. The full EDT modeling results are provided in Appendix B. However, such a project would be a lower priority than projects proposed in a priority geographic area or a project that addresses imminent threats.

Lower Tucannon and Iron Springs ranked higher than Mountain Tucannon in EDT restoration value. Iron Springs was not selected as a priority area because of its small size (0.6 mile) and correspondingly low potential to contribute to the overall abundance of the only focal species to spawn there, steelhead. Lower Tucannon and Mountain Tucannon were very close in scaled potential performance increase. This assessment placed the Mountain Tucannon in the priority restoration area based on the amount and varied use of the area by the three focal species that are currently having the most resources put to recovery.

The empirical evidence indicates that steelhead, bull trout and spring Chinook use all or part of this geographic area during all life stages that occur within the subbasin. For this reason restoration projects here (especially from the Little Tucannon to Panjab Creek) will have the greater benefit to salmonids in the near term than activities in the Lower Tucannon. WDFW considers the Lower Tucannon to currently support only adult/smolt passage of steelhead and spring Chinook, and possibly bull trout passage, and over-wintering of these three species. WDFW also does not consider spawning to occur in this area for any of these three focal species and current summer temperatures preclude summer rearing. However, uncertainty exists among co-managers regarding usage of this area for migration, rearing, and spawning. The assessment team does recognize the importance of the area for fall Chinook, passage and over-wintering of the other three focal species, and as a winter rearing area. Though this area is also not listed as a priority for protection it does deserve attention given that all four focal species do use it at one stage or another in the life histories.

Impacted Life Stages

Within the priority restoration geographic areas above the following life stages are the most impacted according to the EDT analysis (STS = steelhead; CHS = spring Chinook):

- Pataha-Marengo Tucannon
    - Incubation (STS)
    - Fry (STS & CHS)
    - Subyearling rearing (STS & CHS)
    - Overwintering (CHS)

- Yearling rearing (STS)
- Pre-spawning (CHS)

- Marengo-Tumalum Tucannon
    - Fry (STS & CHS)
    - Subyearling rearing (STS & CHS)
    - Overwintering (STS & CHS)
    - Yearling Rearing (STS)
    - Pre-spawning (CHS)
- Tumalum-Hatchery Tucannon
    - Fry (STS & CHS)
    - Subyearling rearing (STS & CHS)
    - Overwintering (STS & CHS)
    - Yearling Rearing (STS)
    - Pre-Spawning (CHS)
- Hatchery-Little Tucannon
    - Fry (STS & CHS)
    - Subyearling rearing (STS & CHS)
    - Overwintering (STS & CHS)
    - Yearling (STS)
    - Pre-Spawning (CHS)
- Mountain Tucannon
    - Fry (STS & CHS)
    - Sub-yearling rearing (STS & CHS)
    - Overwintering (STS & CHS)
    - Yearling (STS)
    - Pre-Spawning (CHS)

The impacted life stages are strictly from the EDT analysis. Although EDT did not address bull trout, in certain areas bull trout life history stages are likely impacted as well by similar limiting factors (pers. comm.., J. Flory, USFWS, 2004). These represent the top four by life stage rank for the geographic areas as determined from the reach analysis. Life stage ranks are determined through EDT for each reach by considering all three EDT population performance measures (life history diversity, abundance and production). The individual reach analysis that make up the geographic areas were then considered in determining the top four life stages. Those life stages that were ranked in the top four within the reaches most often by the EDT reach analysis were determined to be the four most impacted life stages for the geographic areas. It should be noted that in order to develop a well targeted subbasin plan we determined to make this distinction in life stage impacts. However, throughout the system the habitat factors that were identified as most limiting to these life stages actually impact all life stages of salmonids to one degree or another. The previous assessment and planning documents did not usually go into this level of detail, in that limited life stages were not clearly defined within specific reaches. These results are not inconsistent with previous assessments given that there appears to be general agreement on the limiting factors for the Tucannon Subbasin and that the affected life stages are determined for the EDT analysis using the latest literature.

Limiting Habitat Attributes

The following habitat attributes are considered to have the most impact within the above Tucannon River geographic areas and key life stages listed above (LWD = Large Woody Debris):

- Pataha-Marengo Tucannon
  - LWD
  - Confinement
  - Riparian Function
  - Sediment (embeddedness, turbidity and % fines)
  - Key Habitat (pools)
  - Temperature
  - Flow
- Marengo –Tumalum Tucannon
  - LWD
  - Confinement
  - Riparian Function
  - Key Habitat (pools)
  - Temperature
  - Flow
- Tumalum-Hatchery Tucannon
  - LWD
  - Confinement
  - Riparian Function
  - Key Habitat (pools)
  - Temperature
  - Flow
- Hatchery-Little Tucannon
  - LWD
  - Confinement
  - Riparian Function
  - Key Habitat (pools)
- Mountain Tucannon
  - LWD

- Confinement
- Riparian Function
- Key Habitat (pools & glides)

These habitat attributes were taken from the EDT analysis. The limiting attributes identified appeared to be consistent with what is known about the subbasin..

Divergence from EDT- Competition with Hatchery Fish

The output from EDT identified impacts from hatchery fish on subyearling and yearling steelhead and spring Chinook. While this assessment recognizes that there are likely still impacts from hatchery fish within the subbasin, the recent reductions in fish stocking and the changes in the way steelhead are managed (endemic stock development see section 4.3.4.5) has addressed this limiting factor. The spring Chinook broodstock and hatchery program uses both hatchery origin and wild (unmarked) fish in its supplementation program (see section 4.4.4.5); there is no evidence of negative interaction between hatchery and wild spring Chinook.

Flow

Flow showed up as a limiting factor within the priority geographic areas. It is not well understood by the assessment team how the interaction between the ratings we gave for flow and the EDT model run gave us poor ratings for flow. Lack of time and resources did not allow us to re-examine this attribute and re-run the model. What is generally understood is that summer flows within the Tucannon are likely reduced from historical levels, and that all previous planning documents mentioned flow as being limiting for salmonid production. This probably has to do with a lessened ability of the watershed to retain water in the system into the summer months. Reduced upland canopy and ground cover and compromised riparian areas are a couple reasons why this may be happening. Since flow affects many attributes; amount of rearing space, temperature and stream hydraulics to name a few, any opportunities to lease or purchase water that is now being diverted from the Tucannon should be a high priority. In addition to low flow conditions, the rate at which water comes out of the watershed also has impacts to salmonids according to the analysis. This was reflected in the EDT analysis for the flow attributes: where flow-flashy and flow high actually had a greater affect on production than flow low. The causes of this condition are likely the same as for low flow: upland canopy removal, poor riparian conditions and loss of ground cover in uplands.

Protection Priority Geographic Areas

The following geographic areas have the highest protection value in the Tucannon River (Figure 3-8), according to the EDT analysis, empirical data and taking into account other assessment work and empirical data:

- Pataha-Marengo Tucannon
- Marengo-Tumalum Tucannon
- Tumalum-Hatchery Tucannon

- Hatchery-Little Tucannon
- Mountain Tucannon
- Panjab
- Cummings
- Lower Tucannon
- Headwaters*

*Headwaters is an assemblage of reaches covering the Bull Trout bearing (present or potential) waters upstream of the present reaches designated through the EDT process (see discussion in below).

As can be seen the five areas high for restoration also show up here as priorities for protection. This emphasizes the importance of these areas to the focal species identified for this plan. This is not a contradiction but spells out here clearly the importance of protecting these areas from degradation while doing restorative work.

Divergence from EDT - The priority areas above are consistent with the EDT output priorities for steelhead and to a lesser degree for spring Chinook. Hixon Creek was removed from the list of Priority Protection areas due to its small size and limited ability to contribute to the steelhead population as a whole. Lower Tucannon was included as an area that is priority for protection despite the fact that it ranked 13th when evaluated for steelhead. It did, however rank in the top five for protection in terms of spring Chinook, even though spawning and summer rearing do not occur there, and it is one of only two geographic areas that support fall Chinook. Bull trout also overwinter here. For these reasons the focal species as a whole will benefit more from protecting this area than Tumalum and Little Tucannon which ranked higher, but support only steelhead (and possibly bull trout in the Little Tucannon). Protecting the Lower Tucannon from further degradation may require more effort than areas higher in the watershed and should be addressed in the Management Plan section.

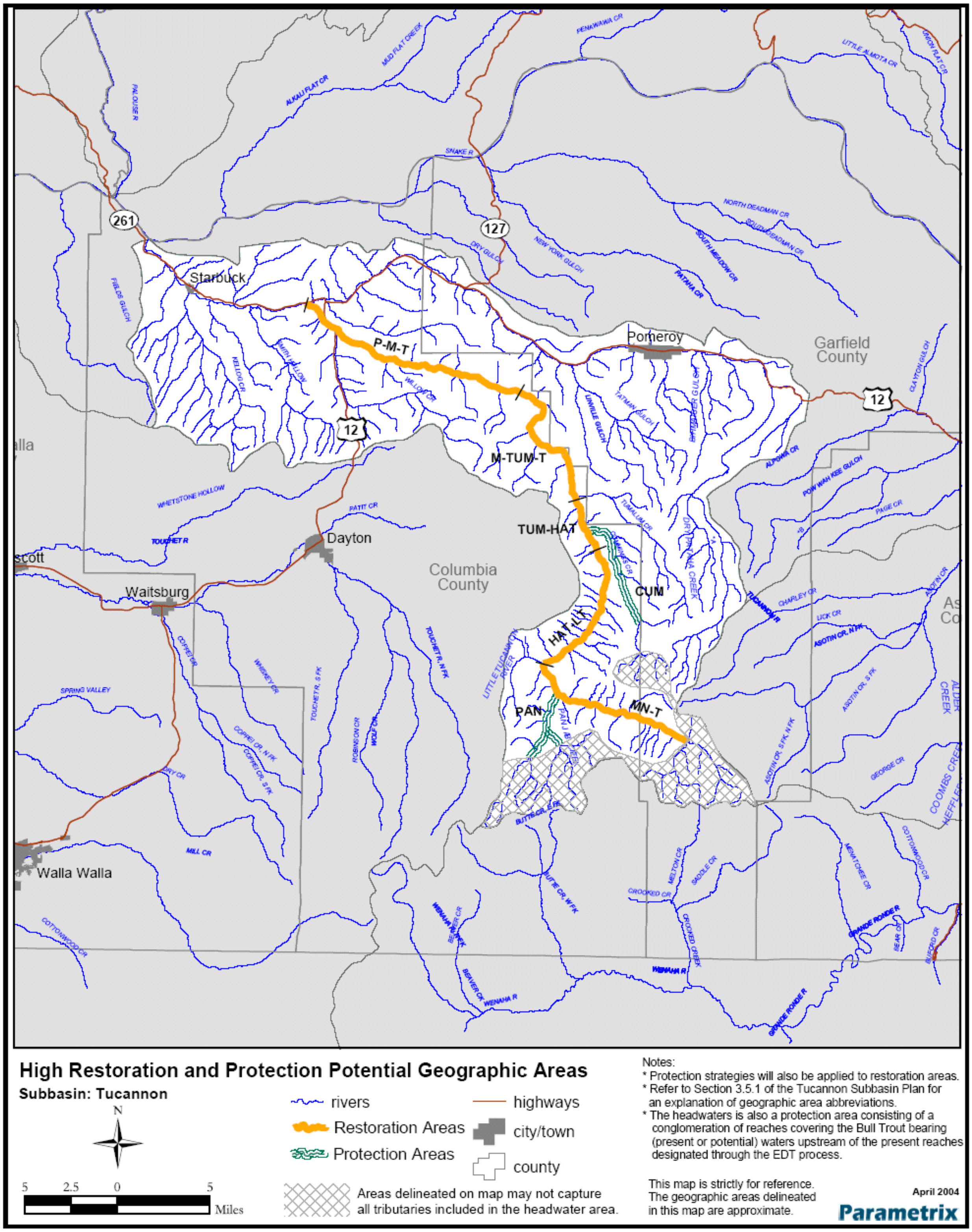

Figure 3-8 Priority Protection and Restoration Geographic Areas

Key: MN-T=Mountain Tucannon, PAN=Panjab, CUM=Cummings, HAT-LT=Tucannon River, Hatchery to Little Tucannon, TUM-HAT= Tucannon River, Tumalum to Hatchery, M-TUM-T= Tucannon River, Marengo to Tumalum, P-M-T= Tucannon River, Pataha to Marengo.

Bull Trout

The assessment of Bull Trout and its habitat presented some difficulty in the Tucannon Subbasin. Rules for Bull Trout in EDT had not been developed in time for this assessment. This coupled with a lack of knowledge of even the basic life history of Bull Trout in the Tucannon River put the fish at a distinct disadvantage when it came to naming priority habitats for protection and restoration. EDT reaches and the geographic areas described thus far in the document were developed based on the distribution of steelhead, fall Chinook and spring Chinook, not Bull Trout. Given that, and to be consistent with other assessments such as the list of priority streams from the Bull Trout Recovery Plan, the following reaches are to be considered as priority for protection under the geographic area named "Headwaters":

- Tucannon above Bear Cr (which is above current EDT reaches)
- Panjab above EDT reaches (Including Turkey, Little Turkey and Meadow Creeks)
- Bear Cr
- Sheep Cr
- Cold Cr
- Hixon Cr (above EDT reaches)
- Cummings Cr (above EDT reaches)

These reaches do not reflect the extent of Bull Trout habitat. Many of the reaches defined for EDT should also take into account Bull Trout needs when formulating management plans. In addition it is assumed by this assessment team that actions within those reaches that benefit the other focal species will also benefit Bull Trout.

EDT Analysis

The EDT analysis used in this assessment has proved to be a valuable tool. While conducting this assessment we have tried to use this tool in a responsible manner. We believe that the most value from EDT is in the future. The time frame that we operated under and the shortage of data available for some key attributes (see below) encouraged us to use caution with the results. It is our determination that the current data set used for this EDT run should be re-examined and revised between each rolling provincial review. This should also occur before it is used for other planning efforts. We believe that its use in its present state for this Subbasin Plan was necessary, however, with more time and better data the model results can certainly be improved upon.

Habitat Data

While conducting this assessment and particularly while performing the attribute ratings for EDT, it became quite clear that in many cases we were lacking even the most basic habitat information. This made the assessment work quite difficult, particularly outside of the Forest Service lands where at least some basic surveys had been conducted. In order to properly assess the subbasin and provide better information for the management strategy process it is vital that additional habitat and life history surveys be conducted. There were some reaches for which we had no empirical data on habitat types (pools/riffles/glides, etc.), embeddedness, LWD density, winter temperature or percent fines. The entire subbasin is lacking in, bedscour, bankfull widths, flow and riparian function data. Gradient measurements for individual reaches was also a concern. Gradients were measured using Terrain Navigator; the accuracy of these gradients is unknown and needs to be ground-truthed.

3.7 Aquatic Species of Interest

Species of Interest (SOI) were approved by the subbasin planning team for inclusion, because they may have ecological and/or cultural significance to the subbasin (WDFW 2004). In order to determine whether or not they should be classified as a focal species, more information is required regarding their subbasin specific life histories and conditions that may be limiting their productivity and abundance (WDFW 2004). WDFW (2004) has a established a section within the research, monitoring, and evaluation section that includes either a research plan for the SOI or a place-holder with the intention of inserting a plan in the future.

Pacific lamprey (Lampetra tridentate) and Coho salmon (Oncorhynchus kisutch) were suggested as a species of interest by the Nez Perce Tribe, who providedthe species write-ups summarized in Sections 3.7.1 and 3.7.2 (see Appendix D for full information). Freshwater Mussels (Mollusca: Unionoida) were suggested as a focal species by CTUIR, who provided the write-up in Section 3.7.3. Mountain whitefish was suggested as a species of interest by WDFW, and a write-up is included in Section 3.7.4. Note that Sections 3.7.3 and 3.7.4 were not reviewed by the Subbasin Planning Team or public.

3.7.1 Species of Interest: Pacific Lamprey (*Lampetra tridentata*)

History

Pacific lamprey (*Lampetra tridentata*) numbers have been in great decline since the installation of numerous dams and habitat degradation in the Columbia Basin. The Nez Perce Tribe regards Pacific lamprey as a highly valued resource harvested to this day as a subsistence food and is highly regarded for its cultural value.Pacific Lampreys historically were common in the Tucannon Subbasin (Mendel, 1997)

Life History

The life cycle of the Pacific Lamprey is similar to that of salmonids. Pacific Lamprey reach the spawning grounds in mid-summer (Kan 1975; Beamish 1980) and generally spawn the following spring. Thus, adult lamprey spend approximately 1 year in freshwater. Spawning generally occurs in small tributary streams, where both sexes construct a crude redd (Scott and Crossman 1973), generally located in the center of the stream near the tailout of a pool, and immediately upstream of shoreline depositional areas (Beamish 1980). Mating is repeated several times in the redd, with each mating followed by actions that move substrate over newly laid eggs. Water temperatures of 10-15oC have been measured in Clear Creek, a tributary of the John Day River, during spawning (Kan 1975). Adults die soon afterward and provide valuable nutrients to small tributaries where salmon fry rear (Kan 1975).

Eggs typically hatch into ammocoetes in less than 2 weeks; these newly hatched larvae, which are filter feeders, then drift downstream and bury themselves in silt, mud, or fine gravel along the margins and backwaters of streams and rivers (Scott and Crossman 1973; Hammond 1979). Ammocoetes generally spend 5-6 years in freshwater (Scott and Crossman 1973). In the fall of their last year, they metamorphose into macrophthalmia, which resemble the adult form. This transformation process is generally completed by early winter.

Downstream migration of macrophthalmia appears to be stimulated by and dependent on late winter and early spring floods (Hammond 1979). Because they are not strong swimmers, lampreys appear to be dependent on spring flows to carry them to the ocean (Kan 1975; Beamish 1980). The upstream, spawning migration of adults generally begins in early spring. Adult lamprey use the mainstem in returning to their spawning grounds, but do not feed during this period. They were once an important food source for juvenile and adult sturgeon in the mainstem (Kan 1975).

Pacific lampreys appear to travel directly into the open ocean, rather than feed in the estuary of nearby coastal waters (Kan 1975; Beamish 1980), as do some other lamprey species.

Pacific lampreys rear in the ocean habitat for up to 3.5 years (Beamish 1980), and range in excess of 100 km offshore, often in areas of considerable depth (up to 800 m) (Kan 1975; Beamish 1980;). Adult lampreys in the ocean are parasitic on many fish species, including salmon. They attach themselves to fish and other animals and feed on blood and body fluids through a hole rasped in the flesh of the host (Wy-Kan-Ush-Mi Wa-Kish-Wit, (Spirit of the Salmon): The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes, Volume I, CRITFC 1996).

Evidence suggests that Pacific Lamprey was well integrated into the native freshwater fish community, and as such had positive effects on the system. It was in all probability, a big contributor to the nutrient supply in oligotrophic streams of the basin as adults died after spawning (Beamish 1980). We suspect that it was an important buffer for upstream migrating adult salmon from predation by marine mammals. Juvenile lampreys migrating downstream may have buffered salmonid juveniles from predation by predacious fishes and sea gulls (Close et al. 1995).

Pacific Lamprey ammocoetes provide Snake River basin white sturgeon Acispenser transmontanus populations with an important food source (Galbreath 1979), which potentially contributed to Snake River white sturgeon historical productivity, (Cochnauer, Claire 2001). Pfeiffer and Pletcher (1964) found that coho fry ate emergent larval lamprey (Close et al. 1995).

Reference Data

Pacific Lampreys historically were common in the Tucannon Subbasin (Mendel, 1997). In 1995, two Pacific Lamprey adults were captured at the smolt trap at RM 12.5. In 1997, Washington Department of Fish and Wildlife sampled 94 Pacific Lamprey ammocoetes, and one dead adult Pacific lamprey in smolt trap operations, (Jackson et al., 1997). Incidental observations or catch on the Tucannon River subbasin for 1998 were 130 larvae and 8 adults were captured in the rotary screw trap at RK 3 (Close, 1998).

Counts of this species of interest for the Tucannon Subbasin for the last few years have been relatively low as demonstrated by the numbers observed at the smolt trap, (Gallinat, pers. comm. 2004). A summary of the numbers for the last four years are listed below in Table 3-14.

Table 3-14 Summary of Lamprey Over the Last Four Years

Season	Lamprey Ammocoetes	Lamprey Macropthalmia	Adults
99/00	626 (w/out eyes)	148 (w/eyes)	7
00/01	595 (w/out eyes)	195 (w/eyes)	31
01/02	203(w/out eyes)	44 (w/eyes)	1
02/03	307 (w/out eyes)	78 (w/eyes)	12

Need

This is the proposed placeholder for Lamprey for the Tucannon Subbasin. Since the completion of the hydropower system in the Columbia Basin, the numbers of Pacific lamprey have declined dramatically compared with historical levels of abundance and distribution.

Counts at Bonneville Dam have exceeded 300,000 lampreys in the past (Starke and Dalen 1995). These counts include only those fish that passed the counting station during the 18 hours of counting, i.e., they do not include lamprey that passed through navigation locks or at night. Counts of Pacific lamprey returning over Lower Snake River dams were in the thousands in 1969, but declined to hundreds by 1978 (Hammond 1979) and numbered only 40 individuals total in 1993 (L. Basham, Fish Passage Center, Portland, personal communication 1994) (Wy-Kan-Ush-Mi Wa-Kish-Wit, (Spirit of the Salmon): The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes, Volume I, CRITFC 1996).

Currently there is no empirical data on the numbers of Pacific Lamprey that may still be returning to this watershed. Basic life history, distribution, and remaining population status are urgently needed to fully understand this species and to begin intensive management before populations decline to unrecoverable thresholds. Additional research is required to establish current numbers, limiting factors, available habitat and rehabilitation potential.

On going efforts to determine the current status of Pacific Lamprey have largely been focused from the mouth to the Lower and Mid Columbia regions with the exception of the Idaho Department of Fish and Game study in the Clearwater River Basin above the confluence of the Lower Snake River.

To enhance information sharing and to eliminate duplication of development of research methodology proposed efforts should adopt methods such as those that are currently being utilized by other Columbia River Intertribal Fish Commission tribes. The Nez Perce Tribe’s goal relating to lamprey is to create a sustainable annual subsistence harvest and re-establish the lamprey’s role in the Tucannon subbasin.

3.7.2 Species of Interest: Coho Salmon (*Oncorhynchus Kisutch*)

The Nez Perce tribe regards coho salmon as a highly valued resource that was historically harvested as a subsistence food and is highly regarded for its cultural value.

Life History

Coho salmon (*Oncorhynchus kisutch*) spawn in small coastal streams and the tributaries of larger rivers. They prefer areas of mid-velocity water with small to medium sized gravels. Because they use small streams with limited space, they must use many such streams to successfully reproduce, which is why Coho can be found in virtually every small coastal stream with a year-round flow.

Returning Coho salmon often gather at the mouths of streams and wait for the water flow to rise, such as after a rain storm, before heading upstream. The higher flows and deeper water enable the fish to pass obstacles, such as logs across the stream or beaver dams that would otherwise be impassable.

Coho salmon deposit their eggs in the gravel in the fall, emerge from the gravel the next spring, and in their second spring go to sea, about 18 months after being deposited. Coho fry are usually found in the pools of small coastal streams and the tributaries of larger rivers.

Data

Coho salmon are presently dispersing/straying into the Tucannon Subbasin since 2000 due to releases from up-river hatchery operations (pers. comm. Milks, 2004). In 2002 there were 7 coho adults that were captured at the Tucannon Fish Weir. Five of these had coded wire tags (CWT's) (05 series) and are presumed to be pioneers of 2001/2002 brood stock Nez Perce Tribal Fisheries releases from upstream.

A summary of the numbers for the last four years are listed below in Tables 3-15 and 3-16.

Table 3-15 Summary of Coho Salmon over Last Four Years

Juvenile Smolt Trap	
Season	**Parr**
99/00	33
00/01	32
01/02	408
02/03	135

Table 3-16 Summary of Coho Salmon Adult Weir over Last Four Years

Season	Adults	CWT's/Series/Location
99/00	None	N/A
00/01	08	6 CWT's 612609 (Willard) 2 CWT's 612612 (Dworshak)
01/02	07	4 CWT's 054847 (Eagle Ck.) 2 CWT's None 1 CWT 054338 (Willard)
02/03	10	CWT's None

Need

Coho salmon were historically present in the Tucannon River and are now listed as extinct (Jackson et al., 1997). Parkhurst (1950) noted that, according to local residents, the last run of silver (Coho) salmon entered the river in October 1929, although "a small number of these fish probably still appear. The Tucannon River Coho may have become extinct by 1955 (Kelley et al. 1982), though Coho were still found within the Snake River system until at least 1986 (Wortman 1993). Edson (1960) reported that sporadic returns of up to 100 adults were still occurring after the Snake River Coho sport fishery had been closed during the 1950's. He thought the river could still support a sizeable run of Coho. Stray hatchery origin fish, suspected to have originated from smolt releases into the Clearwater River in Idaho, or elsewhere, have recently been observed spawning in the Tucannon River below RM 5.0 (Wargo et al. 1999)." (Gephart, Laura, Nordheim Debra, Bruegman, Terry, et al. 2001).

This is the proposed placeholder for the Coho Salmon for the Tucannon subbasin. It has been demonstrated that Coho Salmon were quite common in the Columbia and Snake River basins to include the Tucannon tributary until recent years, (since the development of the hydroelectric system).

The Nez Perce Tribe has an ongoing Coho reintroduction program for the Clearwater River Subbasin that could easily be expanded to other ceded territories, i.e. the Tucannon subbasin. It is evident that strays are dispersing to this subbasin. The Tucannon subbasin has been identified as an alternative stream for potential supplementation using the rotating supplementation schedule proposed in the NPT Coho Master Plan, (Nez Perce Tribe, Coho Master Plan for the Clearwater River Basin, March 2004, DRAFT). It is important that we learn the how's and whys regarding the run that is now occurring within the Tucannon watershed.

3.7.3 Species of Interest: Freshwater Mussels *(Mollusca: Unionoida)*

CTUIR proposed the addition of freshwater mussels as an aquatic species of interest. Information in this section was developed by CTUIR and was not reviewed nor approved by the lead entities, Subbasin Planning Team, or the public.

Freshwater mussels (Mollusca: Unionoida) are vital components of intact salmonid ecosystems and are culturally important to Native Americans. However, in part because freshwater mussels are sensitive to a myriad of pollutants and ecosystem alterations, these animals are now one of the most endangered faunal groups in North America.

Although the greatest diversity of freshwater mollusks occurs in the southeastern United States, the western states contain at least six endemic mussel species, and many endemic snail species. Historically, at least seven mussel species occurred in Oregon and Washington: the western pearlshell, *Margaritifera falcata* (Gould, 1850); western ridged mussel, *Gonidea angulata* (I. Lea, 1838); Yukon floater, *Anodonta beringiana* Middendorff, 1851; California floater, *Anodonta californiensis* I. Lea, 1852; western floater, *Anodonta kennerlyi* I. Lea, 1860; winged floater, *Anodonta nuttalliana* I. Lea, 1838; and Oregon floater, *Anodonta oregonensis* I. Lea, 1838 (USFS Mollusk Database 2004, Williams et al. 1993, Frest and Johannes 1995).

In the Tucannon River Subbasin, little is known about the historical or current occurrence and abundance of freshwater mussels, although mussels historically and currently occur in surrounding drainages, including the Snake River. In addition, we know of no historical or recent systematic surveys for freshwater mussels in the Tucannon River Subbasin.

Freshwater Mussel Life History

Freshwater mussels are unique among bivalves in that they require a host fish to complete their life cycle. Unlike male and female marine bivalves, which release sperm and eggs into the water column where fertilization takes place, fertilization of freshwater mussels takes place within the brood chambers of the female mussel. The female mussel carries the fertilized eggs in the gills until they develop into a parasitic stage called glochidia. Female mussels then release the glochidia into the water column where they must come into contact with a suitable host fish species. Once the glochidia are released they will survive for only a few days if they do not successfully attach to a host fish (O'Brien and Brim Box 1999, O'Brien and Williams 2002). Glochidia may attach to a non-host fish, but the glochidium will fail to encyst and will eventually be sloughed off. After successfully attaching to the host fish, glochidia metamorphose and drop to the substrate to become free-living juveniles (Jones 1950, Howard 1951). The time required for glochidial metamorphosis varies with water temperature and among mussel species.

The mussel/fish relationship is usually species-specific (Lefevre and Curtis 1912); only certain species of fish can serve as suitable hosts for a particular mussel species. The number of host fish utilized by a mussel species varies. Some mussel species have a very restricted number of host fish species (Watters 1994, Michaelson and Neves 1995) while other mussels parasitize a wide range of fish species (Watters 1994, Haag and Warren 1997). To increase their chances of coming into contact with a suitable host fish, some mussel species lure potential host fish by extending brightly colored portions of their mantles that mimic minnows, insects, or other prey (Coker et al. 1921, Kraemer 1970). In addition, some mussels release glochidia into the water column when light sensitive spots are stimulated by the shadow of a passing fish (Kraemer 1970, Jansen 1990). Other mussel species have evolved elaborate lures resembling fish food as mechanisms to attract specific host fishes (Haag et al. 1995, Hartfield and Butler 1997, O'Brien and Brim Box 1999). Knowledge of the reproductive biology of many mussels is incomplete (Jansen 1990), and the host fishes are known for only about a quarter of the mussel species in North America (Watters 1994).

The duration of the parasitic stage varies from about a week to several months (Fuller 1974, Oesch 1984, Williams et al. 1992), depending on mussel species and as a function of water temperature (higher temperatures causing shorter durations) (O'Brien and Brim Box 1999). After metamorphosis, juvenile mussels drop off from their host fish, and must fall to substrate suitable for their adult life requirements or they will not survive. Suitable substrates include those that are firm but yielding and stable (Fuller 1974). In general, shifting sands and suspended fine mud, clays and silt are considered harmful to both juvenile and mature mussels (Fuller 1974, Williams et al. 1992, Brim Box and Mossa 1999, Brim Box et al. 2002).

Mussels orient themselves on the bottom of a stream with their anterior ends buried in the substrate, usually with the two valves slightly open, which allows the intake of water through an incurrent siphon (and food and oxygen) while allowing waste materials to leave the body through an excurrent siphon (Oesch 1984). Food items include organic detritus, algae and diatoms (Coker et al. 1921, Matteson 1955, Fuller 1974). Increases in fine sediment, whether deposited or suspended, may impact mussels by interfering with feeding and/or respiration (Fuller 1974, Brim Box and Mossa 1999).

Although considered fairly sedentary, adult mussels may move in response to abnormal or transient ecological events. For example, water level fluctuations may cause some mussel species to seek deeper water (Coker et al. 1921, Oesch 1984). Often in late summer, mussel trails are visible as the water recedes. However, mussels colonize upstream areas mainly through the use of the parasitic glochidial life stage. Without this stage, freshwater mussel populations would, over generations, slowly shift downstream.

Freshwater Mussel Ecological Importance

The richest mollusk fauna in the world is found in North America north of Mexico, and is represented by about 600 species of gastropods and 340 species of bivalves. Freshwater mussels are also considered the most endangered faunal group in North America, with over 70% of species either imperiled or extinct (Neves et al. 1997). Extinction rates for freshwater mussels are an order of magnitude higher than expected background levels (Nott et al. 1995), and mussels are imperiled disproportionately relative to terrestrial species (e.g., birds and mammals) (Williams et al. 1993). Given that freshwater mussels are an endangered global resource, they are assigned tremendous ecological importance by many freshwater biologists (Corn 1994).

Freshwater mussels are ecologically important because they are primary consumers, detritivores and act as nutrient sinks (McMahon and Bogan 2001). In addition, freshwater mussels filter and clarify large amounts of waters and therefore contribute to maintaining water clarity (McMahon and Bogan 2001). Freshwater mussels can also be important food items for fish, mink, otters and raccoon (Dillon, Jr. 2000).

Freshwater Mussel Historic Distribution and Abundance

Over 300 records of historical mussel occurrences in Oregon and Washington, dating back to 1838, were obtained from the US Forest Service Freshwater Mollusk Database. Accounts from the Columbia River drainage comprise over half of these records. These records from the Columbia Basin include seven of the eight species known to currently occur in the western United States: *Anodonta beringiana*, *Anodonta californiensis*, *Anodonta kennerlyi*, *Anodonta nuttalliana*, *Anodonta oregonensis*, *Gonidea angulata* and *Margaritifera falcata.* No records, however, were found from the Tucannon River Subbasin, although numerous records were found from other Columbia River tributaries.   A total of 81 historical records of freshwater mussels from the western United States (i.e., shell material reposited in museum collections) were found at the United States National Museum (Smithsonian Institution) and California Academy of Sciences. Over half of these records of freshwater mussels were from the Columbia River drainage. However, none was from the Tucannon River Subbasin.

Freshwater Mussel Current Distribution and Abundance

Little is know about the current distribution and abundance of freshwater mussels in the Tucannon River Subbasin, mainly because systematic surveys for mussels have not been conducted in the basin. However, freshwater mussels were found recently in other drainages near the Tucannon (e.g., Umatilla, Walla Walla, John Day). A systematic survey of the entire Tucannon River Subbasin for freshwater mussels is needed in order to determine the current distribution of all three genera of western freshwater mussels (*Anodonta*, *Gonidea*, and *Margaritifera*) known from the western United States, in that drainage.

Freshwater Mussel Cultural Significance to Tribes

Historically freshwater mussels were an important food for tribal peoples of the Columbia River Basin. Native Americans in the interior Columbia River Basin harvested freshwater mussels for at least 10,000 years (Lyman 1984). Ethnographic surveys of Columbia Basin tribes reported that Native Americans collected mussels in late summer and in late winter through early spring during salmon fishing (Spinden 1908, Ray 1933, Post 1938). A few tribal elders from the Columbia and Snake River basins recalled that mussels were collected whenever conditions of the rivers were favorable (Hunn 1990, Chatters 1995). Tribal harvesters collected mussels by hand. When wading was not possible they used forked sticks (Post 1938). They prepared mussels for consumption by baking, broiling, steaming, and drying (Spinden 1908, Post 1938). The Umatilla Tribe preferred to boil freshwater mussels for consumption (Ray 1942).

Native American use of freshwater mussels decreased during the last 200 years, probably due to declines in native populations and assimilation following Euro-American settlement (Chatters 1987). A Umatilla tribal elder, however, remembered his parents trading fish for dried mussels as late as the 1930s (Eli Quaempts, per. com., 1996, CTUIR tribal member). In addition, shell middens found at village sites near the mouth of the Umatilla River, as well as the presence of mussels at burial sites in the same area, suggest that historically freshwater mussels were important to the indigenous peoples of the mid-Columbia River Plateau for multiple reasons.

3.7.4 Mountain Whitefish

Mountain Whitefish (Prosopium williamsoni) were proposed as a species of interest by WDFW., who provided the following write-up:

Mountain Whitefish (Prosopium williamsoni) are often a forgotten member of the salmonidae family in southeast Washington. A popular winter fishery used to exist for whitefish in parts of southeast Washington. Few anglers target whitefish now days.

Extensive sampling for salmon and steelhead by WDFW in the Tucannon River during the past two decades suggests that whitefish are not very common or well distributed in the Tucannon subbasin. When whitefish are found, WDFW tends to observe occasional clusters of adult whitefish in pools, and occasional juveniles scattered in the Tucannon River. The age classes between adult whitefish and subyearlings are uncommonly captured or observed.

WDFW has concerns that mountain whitefish in southeast Washington are not maintaining themselves and may vanish in the next decade or two. WDFW intends to propose a project to compile the literature about whitefish life history and habitat use and compare that with a compilation of WDFW sampling efforts and observations of whitefish for southeast Washington. The compilation of information would form the basis to help determine what additional sampling efforts and methods are needed to develop a more complete understanding of whitefish ecology, distribution and abundance in the Tucannon River and other southeast Washington streams.

4. Subbasin Terrestrial Assessment

4.1 Introduction

The terrestrial assessment occurred at two spatial scales. First was the Southeast Washington Ecoregion Scale, which incorporated the Asotin, Lower Snake, Palouse, Tucannon, and Walla Walla Subbasins. Note that the ecoregion also includes portions of Idaho and Oregon. The ecoregion-scale assessment, completed by WDFW, is located in Appendix E. The subbasin-scale assessment, incorporating portions of the ecoregion document and information unique to the subbasin, can be found in Appendix E.

This section includes descriptions of the:

- data available that was used for the terrestrial assessment (Section 4.2),
- selection process used to identify priority terrestrial habitats (Section 4.3.1)
- four priority terrestrial habitats – Ponderosa Pine Forest, Eastside Grassland, Eastside Riparian Wetlands, Shrub-Steppe (Section 4.3.2)
- one cover type of interest – Agriculture (Section 4.3.3)
- status of terrestrial habitat (Section 4.3.4)
- focal terrestrial species (Section 4.4)

4.2 Data used for Terrestrial Assessment

This assessment at both scales was completed through review of several key databases that summarize current and historic conditions for terrestrial wildlife and their habitats. These include the Ecosystem Conservation Assessment (ECA), Interactive Biodiversity Information System (IBIS), and GAP analyses.

The following description of the ECA database was taken directly from Appendix E (Ashley and Stovall 2004):

"Ecoregion Conservation Assessments are conducted at the ecoregional scale and provide information for decisions and activities that:

- establish regional priorities for conservation action
- coordinate programs for species or habitats that cross state, county, or other political boundaries
- judge the regional importance of any particular site in the ecoregion
- measure progress in protecting the full biodiversity of the ecoregion.

ECA brings diverse data sources together into a single system. Terrestrial species and habitat information are brought together as an integrated planning resource to identify which areas contribute the most to the conservation of existing biodiversity.

ECA has no regulatory authority. It is simply a guide for conservation action across the Ecoregion that is intrinsically flexible that should not constrain decision makers in how they address local land use and conservation issues. Since many types of land use are compatible with biodiversity conservation, the large number and size of conservation areas creates numerous options for local conservation of biodiversity. Ultimately, the management or protection of the conservation priority areas will be based on the policies and values of local governments, organizations, and citizens.

Ecoregion/subbasin planners prioritized ECA data into three conservation priority classes. The primary distinction between ECA classes is the amount of risk potential associated with those habitats. Ecoregional Conservation Assessment classifications include:

- Class 1: Key habitats mostly under private ownership (high risk potential)
- Class 2: Key habitats primarily on public lands (low to medium risk depending on ownership)
- Class 3: Unclassified/unspecified land elements (mainly agricultural lands)

ECA data included in the subbasin assessment provided subbasin planners with a logical path to initially determine how many acres of each focal habitat to protect and where protection should occur. An integral part of this land protection process is to identify lands already under public ownership within ECA identified areas (Figure 3). Public ownership, key aquatic areas, vegetation zones, and rare plant communities are fine filters subbasin planners will use to support and/or guide protection and enhancement objective efforts within the subbasin (Figure 4). This “fine filter” concept is applicable to all protection and enhancement objectives.”

The IBIS database provided habitat descriptions, historic habitat maps, and current habitat maps. GAP data was used to identify the protection status of IBIS defined habitat types. “The “GAP status” is the classification scheme or category that describes the relative degree of management or protection of specific geographic areas for the purpose of maintaining biodiversity. The goal is to assign each mapped land unit with categories of management or protection status, ranging from 1 (highest protection for maintenance of biodiversity) to 4 (no or unknown amount of protection).

Status 1 (High Protection): An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events of natural type are allowed to proceed without interference or are mimicked through management. Wilderness areas garner this status. Approximately 0.6 percent of the Ecoregion is within this category. The Tucannon-Wenaha Wilderness is an area of high protection status.

Status 2 (Medium Protection): An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive use or management practices that degrade the quality of the existing natural state. An estimated 0.8 percent of the lands within the Ecoregion are in this category. In the Tucannon Subbasin, the Wooten Wildlife Area falls under the medium protection category.

Status 3 (Low Protection): An area having permanent protection from conversion of natural land cover for the majority of the area, but subjective to uses of either a broad, low intensity type or localized intense type. It also confers protection to federally listed endangered and threatened species throughout the area. Lands owned by WDFW within the Ecoregion fall within medium and low protection status. Ten percent of the lands within the Ecoregion are in this category. Land managed by the Washington Department of Natural Resources and United States Forest Service within the Tucannon Subbasin would fall under low protection status.

Status 4 (No or Unknown Protection): Lack of irrevocable easement or mandate to prevent conversion of natural habitat types to anthropogenic habitat types and allow for intensive use throughout the tract, or existence of such activity is unknown. This category includes the majority (88 percent) of the land base within the Ecoregion" (Appendix E).

The relative protection status of land in the Ecoregion can be found in Table 4-1.

Table 4-1 Protection Status of Lands in the Southeast Washington Subbasin Planning Ecoregion

Subbasin	Palouse (acres)	Lower Snake (acres)	Tucannon (acres)	Asotin (acres)	Walla Walla (acres)	Total (Ecoregion)
Status 1: High Protection	49	7,383	13,793	0	8,211	29,436
Status 2: Medium Protection	15,014	8,443	10,298	4,976	8,500	47,231
Status 3: Low Protection	159,032	61,194	77,157	80,690	124,645	502,717
Status 4: No Protection	1,951,648	982,905	224,938	160,334	993,342	4,313,167
Total(Subbasin)	2,125,841	1,059,935	326,185	246,001	1,126,198	4,892,552

Source: Table 6 of Appendix E.

4.3 Terrestrial Priority Habitats

4.3.1 Selection of Terrestrial Priority Habitats

The Tucannon subbasin consists of 14 wildlife habitat types. These habitat types are briefly described in Table 4-2. Their historic and current abundance in the Tucannon subbasin are illustrated in Figures 4-1 and 4-2 respectively, and the percent change between the two time periods is detailed in Table 4-3.

Table 4-2 Wildlife Habitat Types Within the Tucannon Subbasin

Habitat Type	Brief Description
Montane Mixed Conifer Forest	Coniferous forest of mid-to upper montane sites with persistent snowpack; several species of conifer; understory typically shrub-dominated.
Eastside (Interior) Mixed Conifer Forest	Coniferous forests and woodlands; Douglas-fir commonly present, up to 8 other conifer species present; understory shrub and grass/forb layers typical; mid-montane.
Lodgepole Pine Forest and Woodlands	Lodgepole pine dominated woodlands and forests; understory various; mid- to high elevations.
Ponderosa Pine and Interior White Oak Forest and Woodland	Ponderosa pine dominated woodland or savannah, often with Douglas-fir; shrub, forb, or grass understory; lower elevation forest above steppe, shrubsteppe.
Subalpine Parkland	Elevation >4,500 feet; tree layer between 10% and 30% canopy, low to matted evergreen dwarf shrubs, sod/bunch grasses, sedges, forbs, moss or lichen covered soils.
Alpine Grasslands and Shrublands	Grassland, dwarf-shrubland, or forb dominated, occasionally with patches of dwarfed trees.
Eastside (Interior) Canyon Shrublands	A mix of tall to medium deciduous shrublands in a mosaic with bunchgrass or annual grasslands.
Eastside (Interior) Grasslands	Dominated by short to medium height native bunchgrass with forbs, cryptogam crust.
Montane Coniferous Wetlands	Forested wetlands or floodplains with a persistent winter snow pack; >30% tree canopy dominated by conifers; shrubs include goose berry, salmon berry, spirea, dogwood, alder, currant, snowberry.
Shrub-steppe (not present)	Sagebrush and/or bitterbrush dominated; bunchgrass understory with forbs, cryptogam crust.
Agriculture, Pasture, and Mixed Environs	Cropland, orchards, vineyards, nurseries, pastures, and grasslands modified by heavy grazing; associated structures.
Urban and Mixed Environs	High, medium, and low (10-29 percent impervious ground) density development.
Herbaceous Wetlands	Emergent herbaceous wetlands with grasses, sedges, bulrushes, or forbs; aquatic beds with pondweeds, pond lily, other aquatic plants
Open Water – Lakes, Rivers, and Streams	Lakes, are typically adjacent to Herbaceous Wetlands, while rivers and streams typically adjoin Eastside Riparian Wetlands and Herbaceous Wetlands
Eastside (Interior) Riparian Wetlands	Shrublands, woodlands and forest, less commonly grasslands; often multilayered canopy with shrubs, graminoids, forbs below.

Source: IBIS 2003; as cited in Ashley and Stovall 2004.

Table 4-3 Changes in Wildlife Habitat Types in the Tucannon Subbasin - circa 1850 (historic) to 1999 (current)

Status	Montane Mixed Conifer Forest	Interior Mixed Conifer Forest	Lodgepole Pine Forest & Woodlands	Ponderosa Pine	Subalpine parkland	Alpine Grasslands and Shrublands	Interior Canyon Shrublands	Eastside (Interior) Grasslands	Agriculture, Pasture, and Mixed Environs	Urban and Mixed Environs	Lakes, Rivers, Ponds, and Reservoirs	Herbaceous Wetlands (1)	Montane Coniferous Wetlands	Eastside (Interior) Riparian Wetlands
Historic	5,428	43,919	0	32,322	247	0	0	188,013	0	0	247	51,074	0	7,881
Current	20,395	41,085	1,128	9,918	0	1,027	175	114,263	132,246	1,174	93	154	9	4,512
Change (acres)	+14,967	-2,834	1,128	-22,404	-247	+1,027	+175	-73,750	+132,246	+1,174	-154	-50,920	9	-3,369
Change (%)	+73	-6	999	-69	-100	999	999	-40	999	999	-62	-99	999	-43

Note: Values of 999 indicate a positive change from historically 0 (habitat not present or mapped in historic data. (1). No confidence in data.

Historic Eastside (Interior) Riparian Wetlands estimates in IBIS (2003) were not considered accurate. As such, estimates of historic wetland acres were developed separately.

Source: IBIS 2003; as cited in Ashley and Stovall 2004.

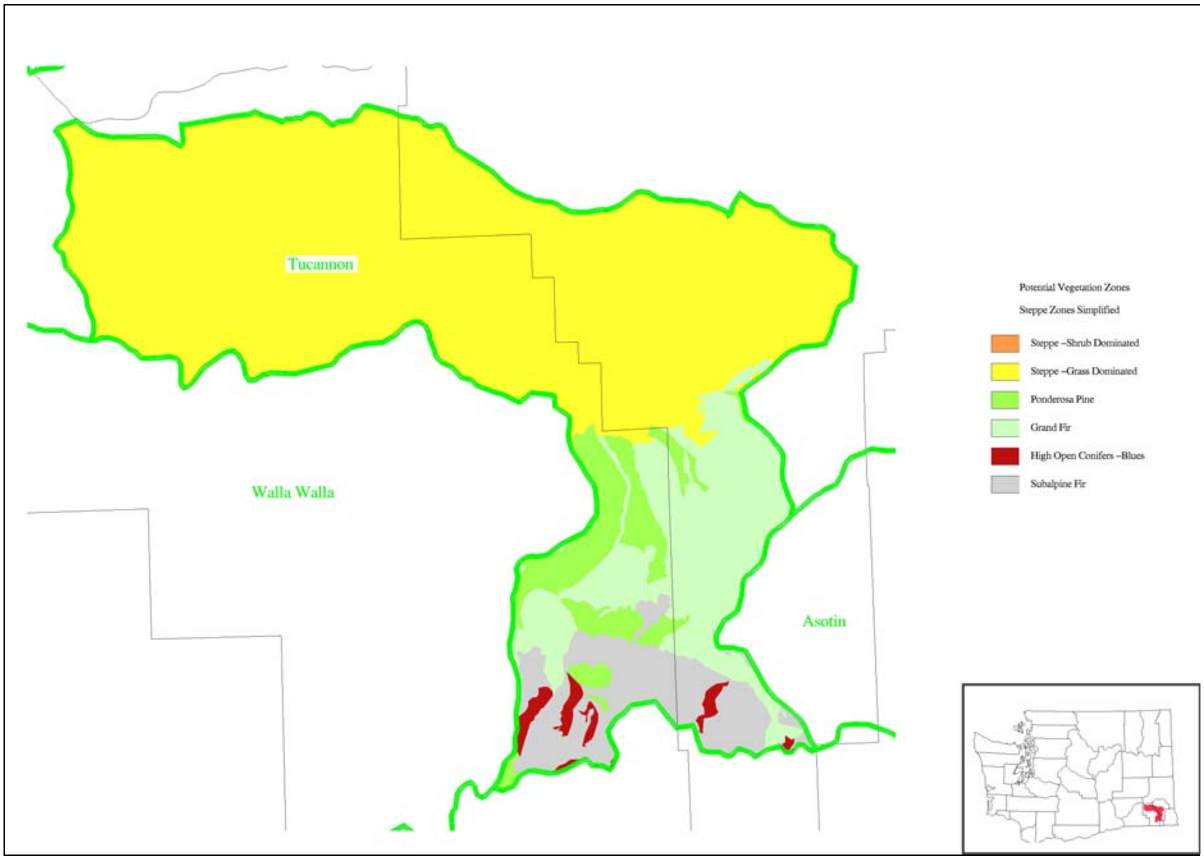

Figure 4-1 Historic Wildlife Habitat Types of the Tucannon Subbasin

IBIS 2003, as cited in Ashley and Stovall 2004.

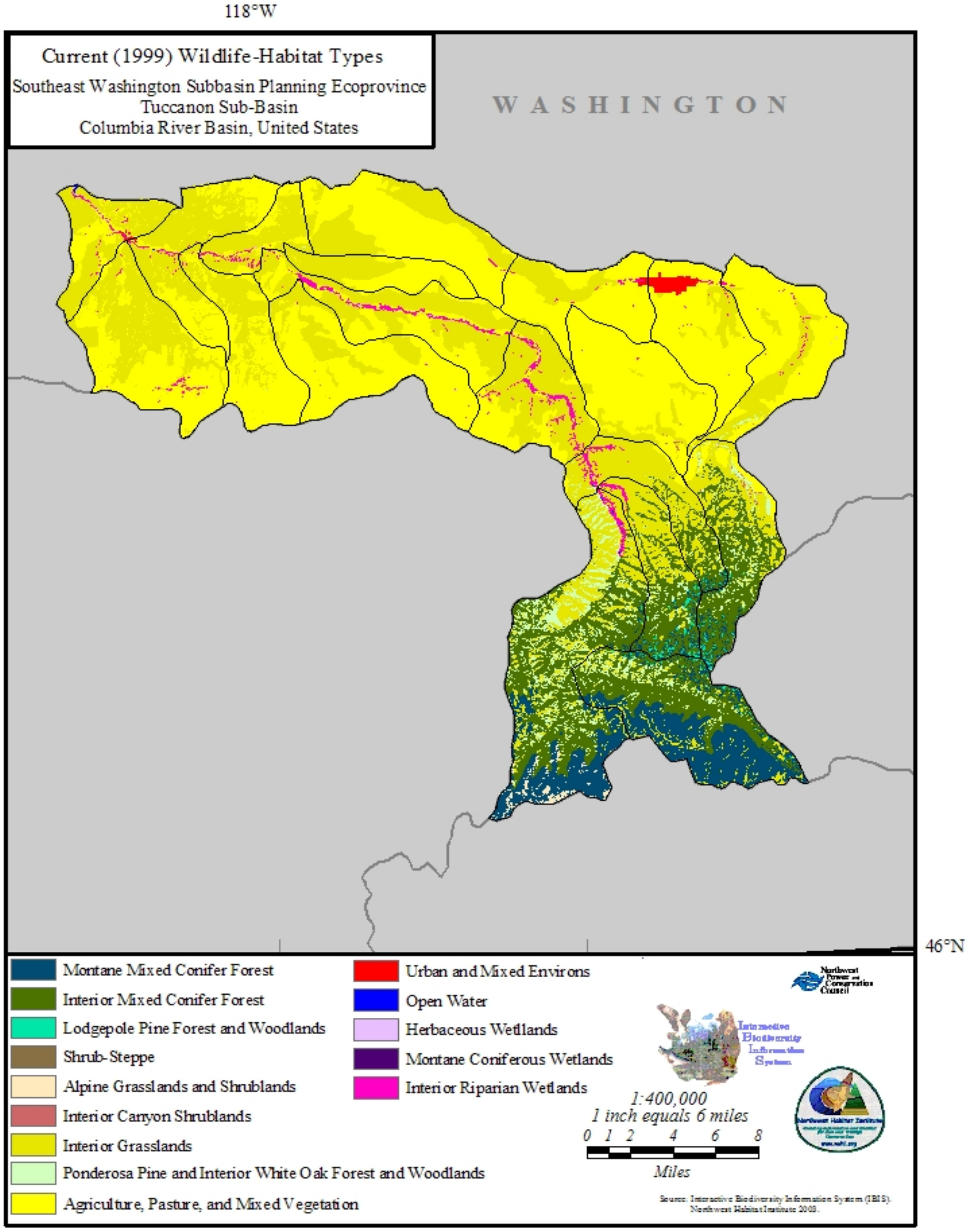

Figure 4-2 Current Wildlife Habitat Types of the Tucannon Subbasin

IBIS 2003, as cited in Ashley and Stovall 2004.

The following four key principles were used to guide selection of focal habitats (see Section 4.1.3 in Appendix E for more detail):

- Focal habitats were identified by WDFW at the Ecoregion level and reviewed/modified at the subbasin level.
- Focal habitats can be used to evaluate ecosystem health and establish management priorities at the Ecoregion level.
- To identify focal macro habitat types within the Ecoregion, Ecoregion planners used the assessment tools to develop a habitat selection matrix based on various criteria, including ecological, spatial, and cultural factors.

Of the 11 habitat types that are present within the subbasin, the following four were selected as focal habitats for detailed analysis within this subbasin plan (notethe same habitats were selected as focal habitat types in all subbasins within the Southeast Washington Ecoregion):

- ponderosa pine
- eastside interior grasslands
- interior riparian wetlands
- shrub-steppe.

The number of extant acres occupied by each focal habitat type within the ecoregion is illustrated by subbasin in Table 4-4 (IBIS 2003, as cited in Ashley and Stovall 2004). There is little, if any, shrub-steppe habitat within the Tucannon subbasin[11] (Table 3).

Table 4-4 Comparison of the Amount of Current Focal Habitat Types for Each Subbasin in the Ecoregion

Subbasin	Focal Habitats			
	Ponderosa Pine	Shrubsteppe	Interior Grassland	Riparian Wetlands
Asotin	14,997	0	134,789	1,687
Palouse	48,343	159,305	356,638	7,923
Lower Snake	1,014	6,505	416,207	3,181
Tucannon	9,918	0	114,263	4,512
Walla Walla	49,904	29,252	154,619	15,217

Source: IBIS 2003; as cited in Ashley and Stovall 2004.

Ponderosa pine and eastside (interior) grassland focal habitat types are detailed graphically in Figure 3. Steppe vegetation zones are combined to form the grassland habitat type. Current and historic riparian wetland habitat information is a significant data gap, therefore, riparian wetland habitat is not included in the habitat distribution maps for the Tucannon subbasin.

[11] Additionally, both IBIS (2003) and Washington GAP data do not recognize it as a historical or current habitat type in the Tucannon subbasin.

A brief description of each focal habitat type is presented in following sections. Detailed descriptions of the focal habitat types are presented in Appendix E (Ashley and Stovall 2004). Subbasin-specific focal habitat type anomalies and differences are described in detail in the following sections.

4.3.2 Description of Terrestrial Priority Habitats

Ponderosa Pine (*Pinus ponderosa*)

This habitat type occurs in much of eastern Washington and Oregon including the eastern slopes of the Cascades and the Blue Mountains (Johnson and O'Neil 2001). It typically occurs on the driest sites supporting conifers in the Pacific Northwest, and elevation ranges from just above sea level to over 6,000 feet in dry, warm areas (Johnson and O'Neil 2001). Typically a woodland or savanna with tree canopy coverage of 10 to 60 percent, ponderosa pines and Douglas fir (*Pseudotsuga menziesii*) dominate the conifer community (Johnson and O'Neil 2001).

Within the subbasin, ponderosa pine habitat currently covers a wide range of seral conditions (Ashley and Stovall 2004). Forest management and fire suppression in the subbasin have resulted in the replacement of old-growth ponderosa pine forests with younger mixed forests (greater proportion of Douglas-fir [*Pseudotsuga menziesii*] than ponderosa pine) (Habeck 1990, as cited in Ashley and Stovall 2004). Silviculture practices (particularly clear-cut logging) and subsequent reforestation have converted these older, diverse, ponderosa dominated stands into younger stands that are less diverse and less complex structurally (Wright and Bailey 1982, as cited in Ashley and Stovall 2004).

Much of the ponderosa pine habitat has a younger tree cohort composed of more shade-tolerant species that form a more closed, multi-layered canopy (Ashley and Stovall 2004). For example, this habitat previously included natural fire-maintained stands in which grand fir (*Abies grandis*) often became the dominant canopy species (Ashley and Stovall 2004). Currently, most management regimes prescribe the harvest of large ponderosa pine and Douglas fir (Ashley and Stovall 2004). This decreases average tree size and increases stand density, thereby preventing the establishment of grand fir in the canopy (Ashley and Stovall 2004). In some portions of the subbasin, new woodlands have been created by patchy tree establishment at forest-steppe ecotones (Ashley and Stovall 2004).

Other impacts to this habitat type within the subbasin include

- Introduced annuals (especially cheatgrass) and invading shrubs under heavy grazing pressure (Agee 1993, as cited in Ashley and Stovall 2004) – these exotics have replaced the native herbaceous species in the habitat's understory.
- Four exotic knapweed species (*Centaurea* spp.) are spreading rapidly through the ponderosa pine habitat type and are threatening to replace cheatgrass as the dominant invader after grazing (Roche and Roche 1988, as cited in Ashley and Stovall 2004).
- Dense cheatgrass stands eventually alter the fire regime by reducing the frequency of low-intensity fires. This leads to catastrophic fires that kill, and lead to the replacement of, the existing stand (Ashley and Stovall 2004).

- Bark beetles (primarily of the genus Dendroctonus and Ips) kill large numbers of ponderosa pines annually and are the major mortality factor in stands of commercial saw timber (Schmid 1988 in Howard 2001, as cited in Ashley and Stovall 2004).

Remaining ponderosa pine habitats in the Tucannon subbasin fall primarily in the "low" to "no protection" categories. Consequently, this habitat type "will likely suffer further degradation, disturbance, and/or loss" in the subbasin. Table 4-5 details the protection status of remaining ponderosa pine habitat within the Tucannon subbasin (Ashley and Stovall 2004).

Table 4-5 Ponderosa Pine Habitat GAP Protection Status/Acres in the Tucannon Subbasin

GAP Protection Status	Acres
High Protection	771
Medium Protection	1,013
Low Protection	6,971
No Protection	1,185

Source: IBIS 2003; as cited in Ashley and Stovall 2004.

The number of acres protected by CRP (compared by county) are listed in Table 4-6 (FSA 2004, as cited in Ashley and Stovall 2004). The number of acres protected through the CREP program (also by county) are presented in Table 4-7 (FSA 2003, as cited in Ashley and Stovall 2004). Land in these two programs was considered to have short-term high protection status.

Table 4-6 CRP Protected Acres by County Within the Southeast Washington Subbasin Planning Ecoregion

County	Introduced Grasses (CP1)	Native Grasses (CP2)	Tree Plantings (CP3)	Wildlife Habitat (CP4)	Established Grass (CP10)	Established Trees (CP11)	Contour Grass (CP15)	Total Acres
Asotin	7,812	9,591	35	7,450	3,367	19	0	28,274
Columbia	5,991	20,162	581	5,929	10,839	355	28	43,885
Garfield	4,545	13,328	0	19,911	7,428	0	2,414	47,626
Walla Walla	44,955	95,555	129	0	11,735	166	0	152,540
Whitman	67,804	142,625	1,522	34,509	36,645	925	2,442	286,472

Source: FSA 2003.

Table 4-7 Number of Acres Protected Through the CREP/Continuous CRP Program by County (FSA CP-22 2003)

County	CP-22 Acres
Asotin	1,339
Columbia [1]	2,087
Garfield [2]	2,535
Umatilla	52
Walla Walla	1,922
Whitman [3]	1,052

Source: FSA 2003.

[1] Columbia County CP-22 acreage was modified from FSA values and of the 2,087 acres listed above for Columbia County, 1,519 are CREP (pers. comm. T. Bruegman, May 2004).

[2] Of the 2,535 acres listed above for Garfield County, 1,005 are CREP (pers. comm. D. Bartels, May 2004).

[3] Whitman County has no CREP acres (pers. comm. D. Bartels, May 2004).

Eastside (Interior) Grassland

Developing in hot, dry climates in the Pacific Northwest, this habitat type is found primarily at mid- to low elevations (Johnson and O'Neil 2001). In general, it is an open and irregular arrangement of short to medium-tall grass clumps (<1 meter) (Johnson and O'Neil 2001). Dominant native perennial grasses, on undisturbed sites, include Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and Sandberg bluegrass (*Poa secunda*) (Johnson and O'Neil 2001). A large number of forbs are also present; balsamroot (*Balsamorhiza sagittata*), cinquefoil (*Potentilla recta*), and old man's whiskers (*Geum triflorum*) are among the most common (Daubenmire 1970; Franklin and Dyrness 1973; both as cited in Ashley and Stovall 2004). The eastside (interior) grassland habitat type is detailed in Appendix E (Ashley and Stovall 2004).

The Canyon Grassland and Wheatgrass/Fescue vegetation zones comprise the grassland habitat within the Tucannon subbasin (Ashley and Stovall 2004). Throughout most of the subbasin, native grasslands have been replaced by agricultural crops, or severely altered by introduction of, and subsequent competition from, introduced weeds including cheatgrass (*Bromus tectorum*), knapweed (*Centaurea* spp.), and yellow starthistle(*Centaurea solstitialis*) (Ashley and Stovall 2004). Over-grazing results in the replacement of native vegetation with invasive species, especially cheatgrass and yellow starthistle (Mack 1986; Roche and Roche 1988; both as cited in Ashley and Stovall 2004). Currently, "native perennial bunchgrass/shrub communities are found only on a few 'eyebrows' on steep slopes surrounded by wheat fields, or in non-farmed canyon slopes and bottoms within agricultural areas" (Ashley and Stovall 2004).

The protection status of remaining eastside (interior) grassland habitat in the Tucannon subbasin is presented in Table 4-8. The vast majority of the subbasin's grassland habitat is either not protected or is afforded only low-protection status; a very small percentage is included in the high-protection category (Ashley and Stovall 2004). Furthermore, the vast majority of grassland habitat throughout the Ecoregion is not protected and is at risk for further degradation and/or conversion to other land uses (Ashley and Stovall 2004).

Table 4-8 Eastside (Interior) Grassland Habitat GAP Protection Status/Acres in the Tucannon Subbasin

GAP Protection Status	Acres
High Protection	1,005
Medium Protection	6,617
Low Protection	17,692
No Protection	88,970

Source: IBIS 2003; as cited in Ashley and Stovall 2004.

Grassland habitats established through implementation of the Conservation Reserve Program receive short-term/high protection (Ashley and Stovall 2004). The number of acres protected by CRP (compared by county) are listed in Table 5 (FSA 2004, as cited in Ashley and Stovall 2004). The number of acres protected through the CREP program (also by county) are presented in Table 4-7 (FSA 2003, as cited in Ashley and Stovall 2004).

Eastside (Interior) Riparian Wetlands

Eastside (interior) riparian wetlands[12] occur along the interface between aquatic and terrestrial ecosystems, most often as linear strips that closely follow perennial or intermittent streams and rivers (Johnson and O'Neil 2001). Wetland hydrology or soils, periodic riverine flooding, or perennial flowing freshwater characterizes them (Johnson and O'Neil 2001). They are composed of a mosaic of shrublands, woodlands, and forest communities and have a tree layer that can be dominated by deciduous, coniferous, or mixed canopies (Johnson and O'Neil 2001). The undergrowth consists of low shrubs or dense patches of grasses, sedges, or forbs (Johnson and O'Neil 2001). The eastside (interior) grassland habitat type is detailed in Appendix E.

Ashley and Stovall (2004) summarize the current and historical condition of eastside riparian wetlands in eastern Washington as follows:

> "Historically, riparian wetland habitat was characterized by a mosaic of plant communities occurring at irregular intervals along streams and dominated singularly, or in some combination by grass-forbs, shrub thickets, and mature forests with tall deciduous trees. Beaver activity and natural flooding are two ecological processes that affected the quality and distribution of riparian wetlands."
>
> "Today, agricultural conversion, livestock grazing, altered stream channel morphology, and water withdrawal have played significant roles in changing the character and function of streams and associated riparian areas throughout the subbasin. Riparian zones along the Tucannon River have been lost and/or fragmented by agricultural development (NPCC 2001). Moreover, grazing has suppressed woody vegetation while introduction

[12] In Ashley and Stovall's (2004) analysis, the eastside (interior) riparian wetlands habitat type refers only to riverine and adjacent wetland habitats. Although significant, other wetland habitat types that occur within the subbasins were not included as focal habitat types due to their limited extent.

of Kentucky bluegrass, reed canarygrass, and other weed species has significantly altered native plant communities in most riparian areas."

Within the Tucannon subbasin, 53.3 miles of riparian and riverine habitat were inventoried in 1994 to assess habitat conditions (Ashley and Stovall 2004). Additionally, the USFS conducted a modified Hankin and Reeves (1988) inventory along 6.8 miles of stream within the Umatilla National Forest (Ashley and Stovall 2004). Results from the two inventories were combined and are summarized by Ashley and Stovall (2004):

> "Survey results show that Reed canarygrass was the dominant riparian plant species along 29 miles of streambank surveyed. Few-flowered spike rush, various sedge species, and a variety of weedy forbs were common as well. Shrub species included chokecherry, coyote willow, rose, sticky currant, hawthorn, and snowberry. Trees found in riparian/riverine habitats included western larch, ponderosa pine, golden willow, black cottonwood, white alder, and locust. Conifer species were dominant in the higher elevations and deciduous species were prevalent at lower elevations. Percent canopy cover ranged from 1% to 85% and increased with elevation (NPCC 2001)."

The protection status of remaining eastside (interior) riparian wetland habitat in the Tucannon subbasin is presented in Table 4-9. The vast majority of the subbasin's riparian/wetland habitat is either not protected or is afforded only low-protection status; none is included in the high-protection category (Ashley and Stovall 2004). Furthermore, the vast majority of riparian habitat throughout the ecoregion is not protected and is at risk for further degradation and/or conversion to other land uses (Ashley and Stovall 2004).

Table 4-9 Eastside (Interior) Riparian Wetlands GAP Protection Status/Acres in the Tucannon Subbasin

GAP Protection Status	Acres
High Protection	0
Medium Protection	707
Low Protection	179
No Protection	3,629

Source: IBIS 2003; as cited in Ashley and Stovall 2004.

Riparian habitats are provided additional short-term high protection by USDA's CREP program (Ashley and Stovall 2004). The number of acres enrolled in the CREP program by county is listed in Table 4-7 (Ashley and Stovall 2004). Bruegman (Columbia CD, pers. comm. 2004; as cited in Ashley and Stovall 2004) reports there are 15 CREP projects in the Tucannon Subbasin totaling nearly 300 acres.

Shrub-steppe

Shrub-steppe habitats are common on the Columbia Plateau and extend onto the dry surrounding mountains (Johnson and O'Neil 2001). Widely scattered shrubs are mixed with perennial grasses (Johnson and O'Neil 2001). Elevation range is 300-9,000 feet, mostly between 2,000 and 6,000 feet (Johnson and O'Neil 2001). Shrub-steppe occurs on deep soils, stony flats, and lake beds with ash or pumice soils (Johnson and O'Neil 2001). Livestock grazing is the primary land use although much shrub-steppe has been converted to irrigation or dry-land agriculture (Johnson and O'Neil 2001).

The shrub-steppe habitat type is not reported to occur currently or historically within the Tucannon subbasin (Ashley and Stovall 2004).

4.3.3 Agriculture (Cover type of interest)

Tucannon subbasin agriculture operations include dryland/irrigated crops, fruit orchards, and irrigated and non-irrigated pasture (alfalfa and hay) (Ashley and Stovall 2004). Annual grains such as wheat, oats, barley, and rye are the primary cultivated crops (Ashley and Stovall 2004). They typically are produced on upland, rolling terrain without irrigation on non-forested areas of the subbasin (Ashley and Stovall 2004). Pastures adjacent to streams and riparian areas may be irrigated (Ashley and Stovall 2004). Hay pastures typically are composed of several species, while grass seed fields are composed of only one species (Ashley and Stovall 2004).

Agricultural lands concentrated in deep soiled upland areas and valley bottoms have significantly affected grasslands, shrublands, and riparian zones in those areas (Ashley and Stovall 2004). Conversion of native habitats to agriculture altered, destroyed, and fragmented much of the riparian/floodplain habitat along the Tucannon River and Pataha Creek (Ashley and Stovall 2004). Increased sediment loads, the introduction of herbicides and pesticides into streams, and the invasion of exotic plants also are a result of agricultural operations (Ashley and Stovall 2004).

The conversion of agricultural land has had some beneficial wildlife impacts, especially for introduced game species. Ashley and Stovall (2004) discuss the pros and cons of agriculture conversion of native and introduced game species.

> "Although the conversion of native habitats to agriculture severely affected native wildlife species such as the sharp-tailed grouse, agriculture did provide new habitat niches quickly filled by introduced wildlife species including the ring-necked pheasant, chukar, and gray partridge. Introduced parasitic wildlife species such as European starlings also thrived as more land was converted to agriculture."
>
> "Native ungulate and waterfowl populations took advantage of new food sources provided by croplands and either expanded their range or increased in number (J. Benson, WDFW, personal communication, 1999). Indigenous wildlife species and populations that adapted to and/or thrived on "edge" habitats increased with the introduction of agriculture except in areas where "clean farming" practices and crop monocultures dominated the landscape."
>
> "In addition to crops, agricultural lands provide and support hunting and wildlife viewing opportunities, which promotes local economic growth. Conversely, crop depredation by elk and deer is an issue in some areas of the subbasin with a number of landowners desiring reductions in ungulate herds…."

IBIS (2003) reports that nearly all of the agriculture habitat type in the Tucannon subbasin and across the Ecoregion is not protected. However, low and medium protection is provided for lands enrolled in conservation easements or protected under other development restrictions (e.g., county planning ordinances) (Ashley and Stovall 2004). The GAP protection status of agricultural habitat in the Tucannon subbasin is illustrated in Table 4-10.

Table 4-10 GAP Protection Status/Acres of Agriculture and Mixed Environments in the Tucannon Subbasin

GAP Protection Status	Acres
High Protection	0
Medium Protection	26
Low Protection	4,983
No Protection	127,232

Source: IBIS 2003; as cited in Ashley and Stovall 2004.

Primarily due to steep topography and shallow soils, the Tucannon subbasin has the second lowest percentage of agriculture land within the Ecoregion (Figure 4-3) (Ashley and Stovall 2004). Agricultural production generally occurs wherever it is not precluded by unsuitable soils or topography or public land ownership (Ashley and Stovall 2004).

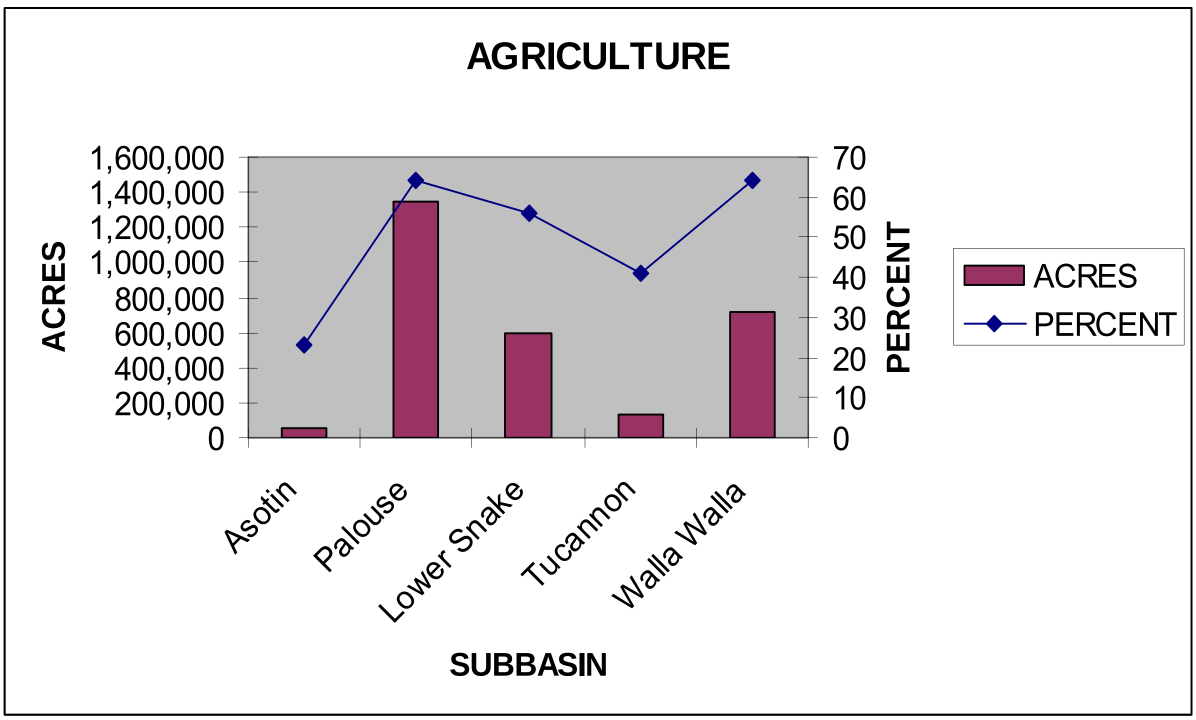

Figure 4-3 Agricultural Land Use Within the Ecoregion

Source: IBIS 2003.

4.3.4 Terrestrial Habitat and Protection Status Summary

Table 4-11 summarizes changes in the extent of focal habitats within the Tucannon subbasin (Ashley and Stovall 2004). All Tucannon subbasin focal habitats have decreased substantially since 1850. Only agriculture (a cover type of interest) has increased.

Table 4-11 Changes in Focal Wildlife Habitat Type Acreage in the Tucannon Subbasin From Circa 1850 (Historic) to 1999 (Current)

Focal Habitat Type	Historic Acres	Current Acres	Acre Change	Percent Change
Ponderosa Pine	32,322	9,918	-22,404	-69
Shrub-steppe	0	0	0	0
Eastside (Interior) Grassland	188,013	114,263	-73,755	-40
Eastside (Interior) Riparian Wetlands	7,881	4,512	-3,369	-43
Agriculture	0	132,246	+132,246	----

Source: M. Hudson, WDFW, personal communication, 2003; IBIS 2003; both as cited in Ashley and Stovall 2004.

Ashley and Stovall (2004) summarize these habitat losses as follows.

> "All focal habitats within the subbasin have decreased significantly from circa 1850….Agricultural conversion accounts for nearly 100% of the total change (loss) in Eastside (Interior) Grassland habitats in the Tucannon Subbasin and throughout the Ecoregion (IBIS 2003). Riparian/riverine wetland habitat data are incomplete and limited in value.….Subbasin wildlife managers, however, believe that significant physical and functional losses have occurred to these important riparian habitats from…agricultural development, and livestock grazing."

Located in the south central portion of the subbasin, the Wenaha-Tucannon Wilderness Area, is the only GAP priority 1 status area (Ashley and Stovall 2004). It constitutes approximately 4 percent (13,793 acres) of the subbasin (Ashley and Stovall 2004). An estimated 3 percent (10,298 acres) of the Tucannon subbasin is protected by GAP priority 2 status, 24 percent (77,157 acres) is under GAP priority 3 status, and the remainder (69 percent; 224,938 acres) has no degree of protection (GAP priority status 4) (Figure 4-4) (Ashley and Stovall 2004). Definitions of various levels of GAP protection status can be found in the introduction of this section.

Subbasin ECA priorities, public land ownership, and focal habitat types are shown in Figures 4-5 and 4-6. As illustrated, the majority of ECA lands overlap lands owned by WDFW and the USFS. All ECA designated lands in the Tucannon Subbasin are Class 2 priority; there are no ECA Class 1 priority lands (Ashley and Stovall 2004). ECA is described in detail at the beginning of Section 4.

The protection status of an area is significant, because a higher level of protection is assumed to enable planners and resource managers greater opportunities for long-term habitat enhancement (i.e., they are assured that habitat enhancement efforts will be protected in the future). Subbasin planners can use a combination of ECA, StreamNet, GAP, and IBIS data to identify areas in which to focus protection strategies and conservation efforts (Ashley and Stovall 2004). Ashley and Stovall (2004) identify “protection of critical habitats on private lands, located adjacent to existing public lands, within ECA designated areas” as a high conservation priority within the subbasin and Ecoregion”.

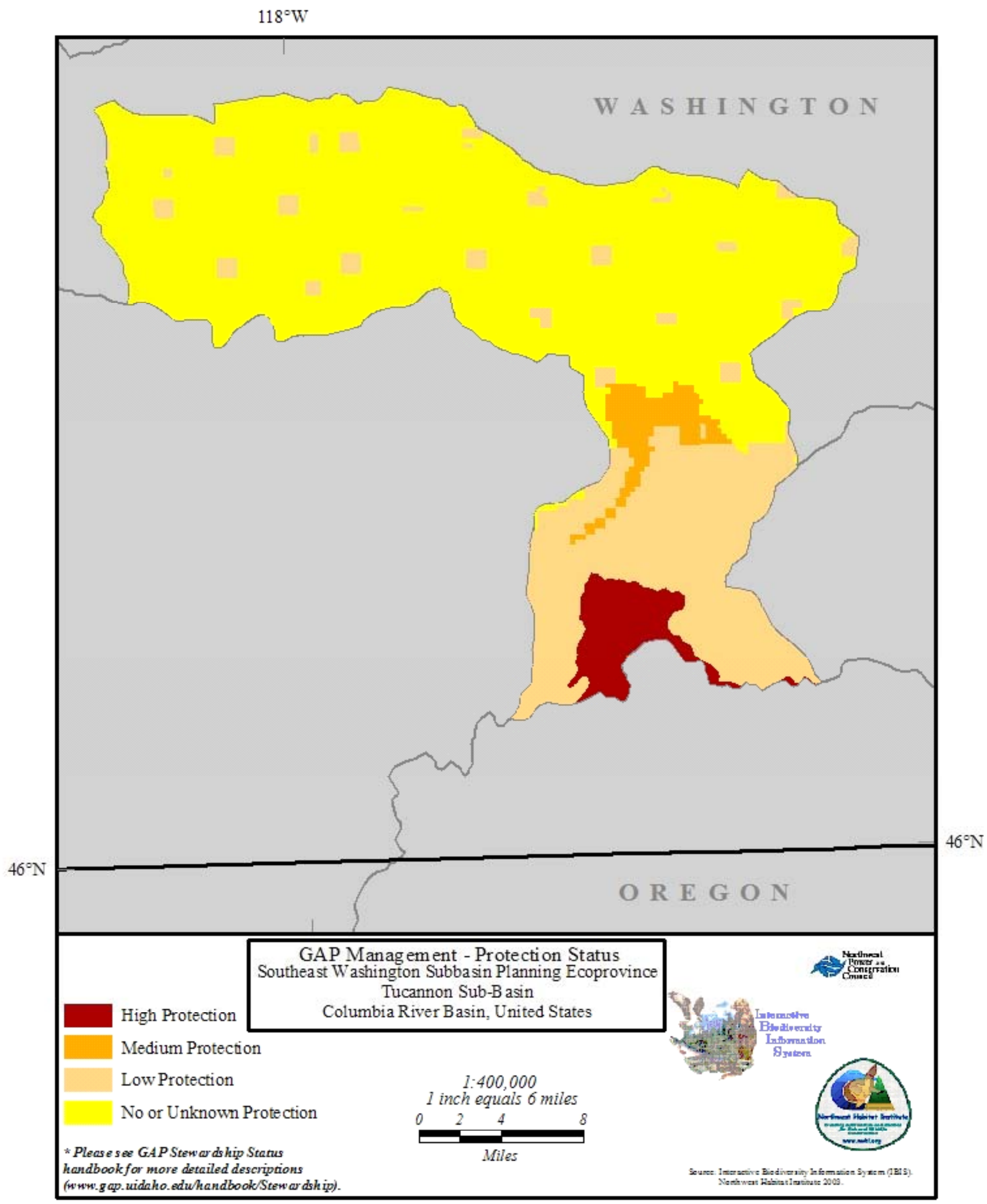

Figure 4-4 GAP Protection Status for the Tucannon Subbasin

Source: Cassidy 1997, as cited in Ashley and Stovall 2004.

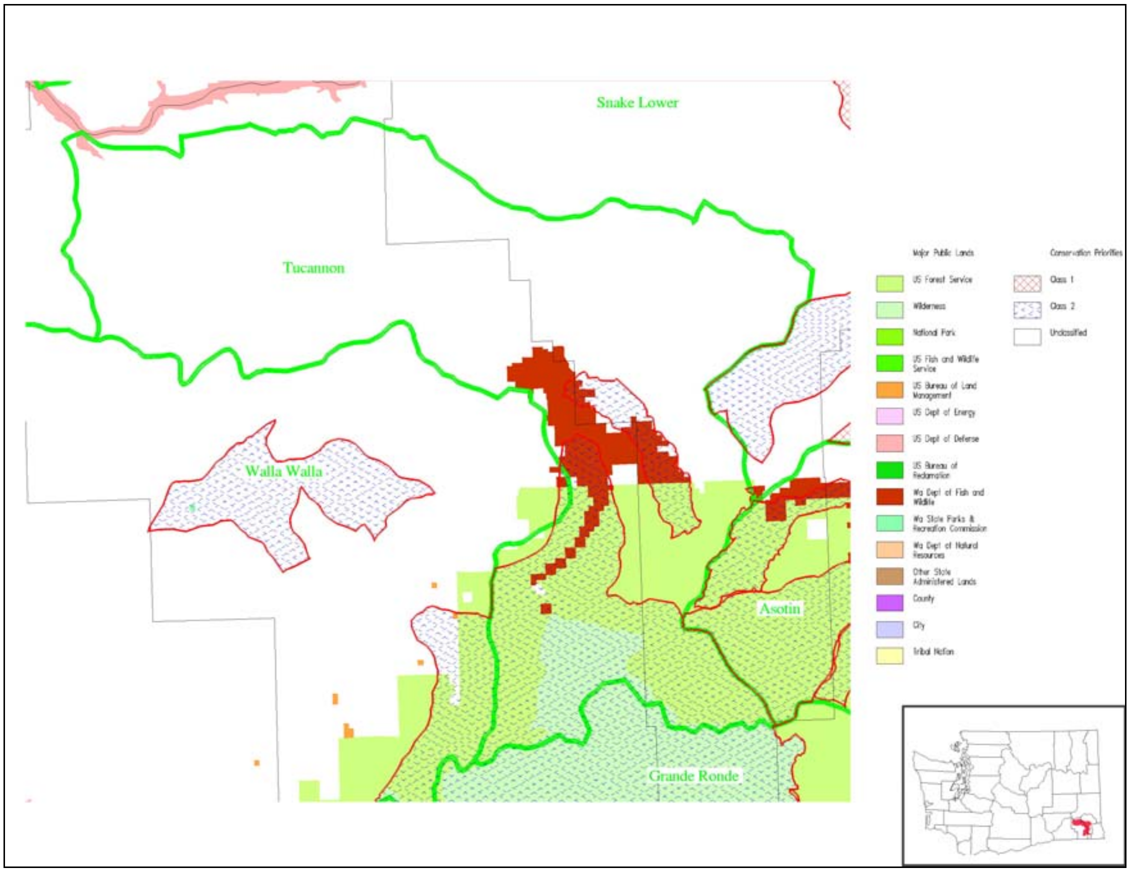

Figure 4-5 ECA and Publicly Owned Lands in the Tucannon Subbasin

Source: ECA 2003, as cited in Ashley and Stovall 2004.

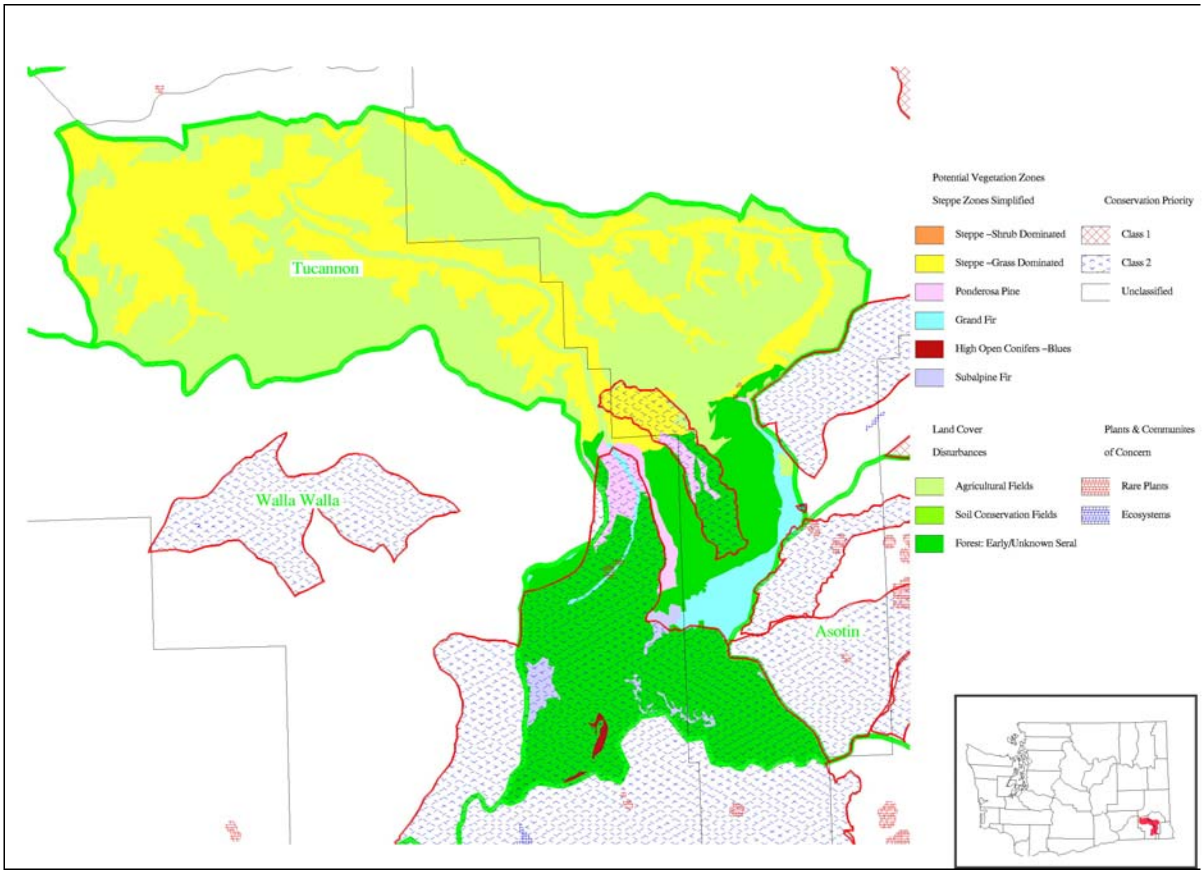

Figure 4-6 ECA Priority Areas and Focal Habitat Types in the Tucannon Subbasin
(ECA 2003, as cited in Ashley and Stovall 2004).

4.4 Focal Species

4.4.1 Introduction

This section reviews the process for selecting focal species, which species were chosen, and general information regarding their life history, status, and environmental relationships.

4.4.2 Focal Wildlife Species Assemblage Selection and Rationale

Subbasin planners selected focal wildlife species using a combination of several factors including:

- primary association with focal habitats for breeding;
- specialist species that are obligate or highly associated with key habitat elements/conditions important in functioning ecosystems;

- declining population trends or reduction in their historic breeding range (may include extirpated species);
- special management concern or conservation status such as threatened, endangered, species of concern and management indicator species; and
- professional knowledge on species of local interest.

There are an estimated 269 wildlife species that occur in the Tucannon subbasin (Table 25 in Appendix E). Of these species, 101 are closely associated with wetland habitat and 57 consume salmonids during some portion of their life cycle (Ashley and Stovall 2004). Eleven species in the Tucannon subbasin are non-native (Ashley and Stovall 2004). Eight wildlife species that occur in the Subbasin are listed federally and 41 species are listed in Washington as Threatened, Endangered, or Candidate species (Ashley and Stovall 2004). Both bird species and mammalian species were chosen as focal or indicator species to represent the four priority habitats in the Tucannon Subbasin (see Table 4-12). Focal species selection rationale and important habitat attributes are described in further detail in Table 31 of Appendix E.

Table 4-12 Focal species selection matrix for the Tucannon subbasin

Common Name	Focal Habitat[1]	Status[2]		Native Species	PHS	Partners in Flight	Game Species
		Federal	State				
White-headed woodpecker	Ponderosa Pine	n/a	C	Yes	Yes	Yes	No
Flammulated owl		n/a	C	Yes	Yes	Yes	No
Rocky Mountain elk		n/a	n/a	Yes	Yes	No	Yes
Yellow warbler	Eastside (Interior) Riparian Wetland	n/a	n/a	Yes	No	Yes	No
American beaver		n/a	n/a	Yes	No	No	Yes
Great blue heron		n/a	n/a	Yes	Yes	No	No
Grasshopper sparrow	Eastside (Interior) Grassland	n/a	n/a	Yes	No	Yes	No
Sharp-tailed grouse		SC	T	Yes	Yes	Yes	No
Mule Deer		n/a	n/a	Yes	n/a	n/a	Yes

Source: Ashley and Stovall 2004.

Figures 4-7 through 4-15 depict photos of the terrestrial focal species.

Figure 4-7 White-Headed Woodpecker

Source: http://www.birdphotography.com/species/whwo.html.

Figure 4-8 Flammulated Owl

Source: http://www.mbr-pwrc.usgs.gov/id/framlst/i3740id.html.

Figure 4-9 Rocky Mountain Elk

Source: http://www.rmef.org/pages/fallphoto10.html.

Figure 4-10 Yellow Warbler

Source: http://www.mbr-pwrc.usgs.gov/id/framlst/i6520id.html.

Figure 4-11 American Beaver
Source: www.enature.com.

Figure 4-12 Great Blue Heron
Source: http://www.mbr-pwrc.usgs.gov/id/framlst/i1940id.html.

Figure 4-13 Grasshopper Sparrow
Source: http://www.mbr-pwrc.usgs.gov/id/framlst/i5460id.html.

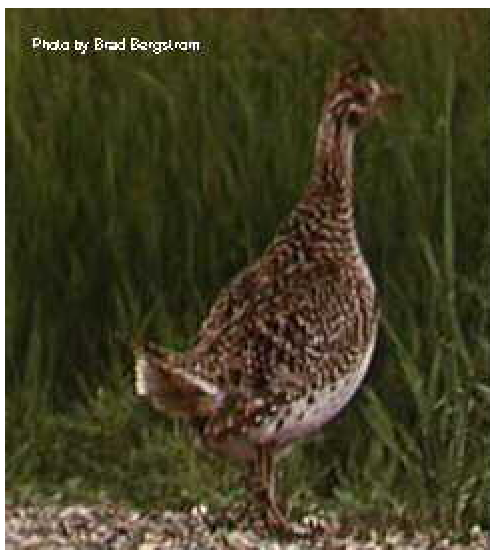

Figure 4-14 Sharp-Tailed Grouse
Source: http://www.mbr-pwrc.usgs.gov/id/framlst/i3080id.html.

Figure 4-15 Mule Deer
Source: http://www.mule-deer.com/

Information regarding management of specific species, where applicable, can be found in Chapter 6. Figures 4-16 through 4-20 provide distribution maps for selected terrestrial focal species. Detailed information regarding the life history, status, environment/species relationships, distribution, and key ecological functions of terrestrial focal species can be found in Appendix E.

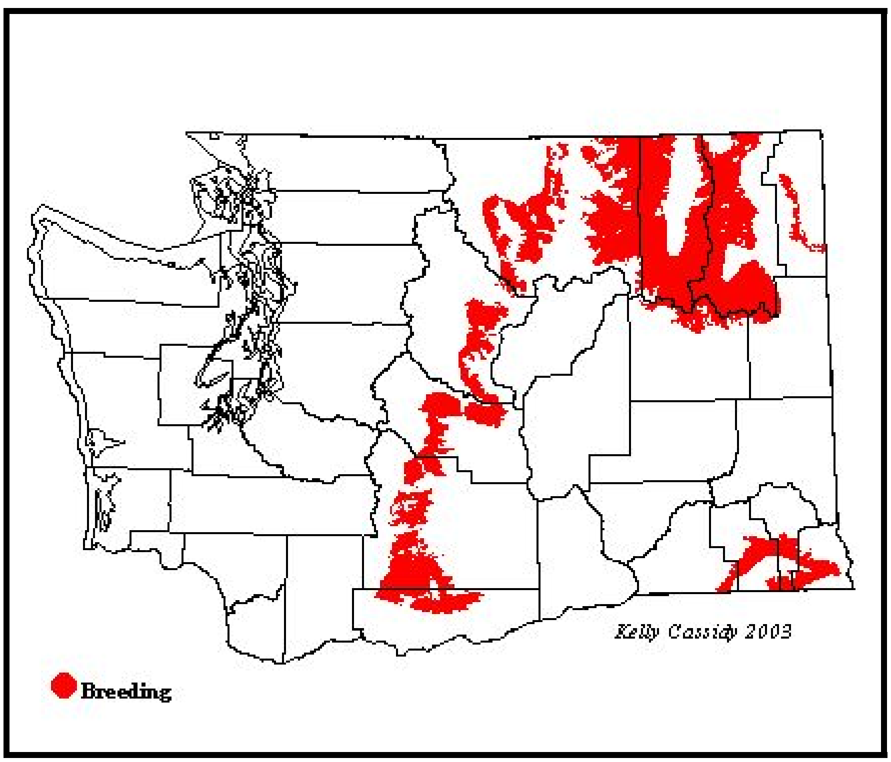

Figure 4-16 Flammulated Owl Distribution, Washington
Source: Kaufman 1996; as cited in Appendix E.

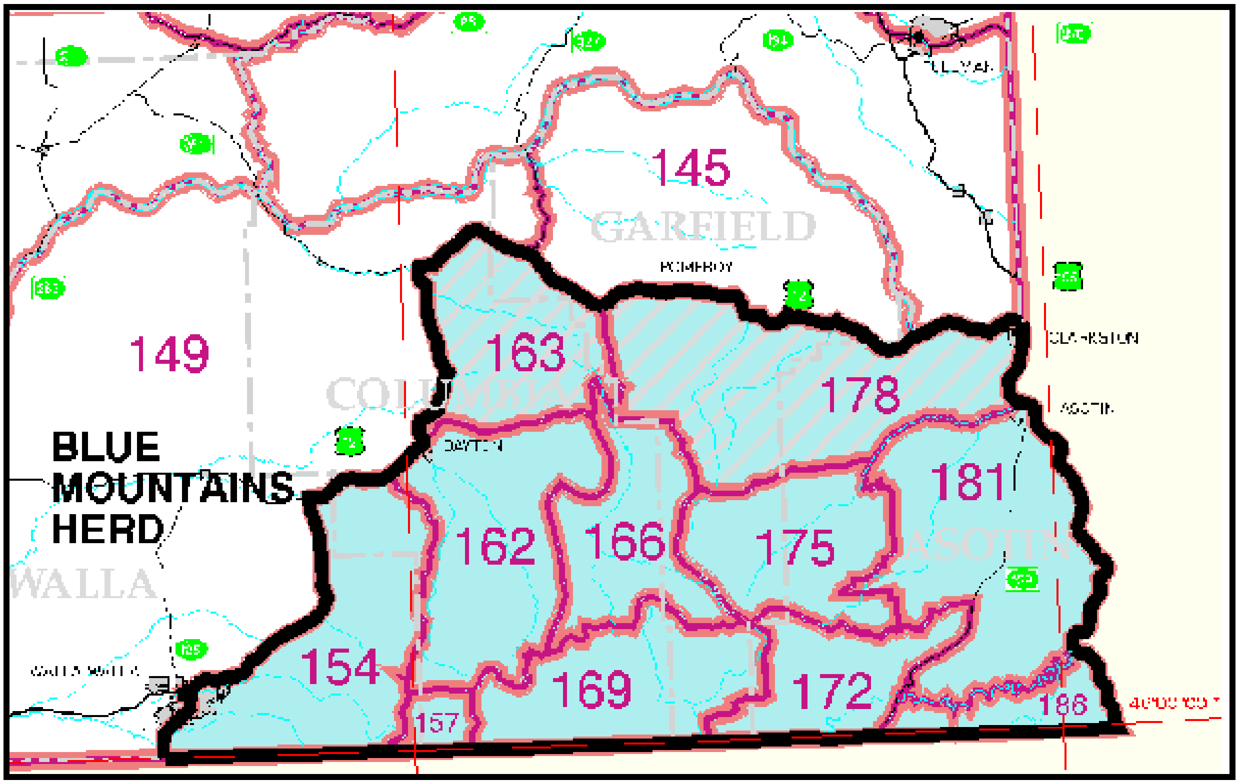

Figure 4-17 Elk Game Management Units in the Southeast Washington Subbasin Planning Ecoregion, Washington

(Fowler 2001, as cited in Ashley and Stovall 2004).

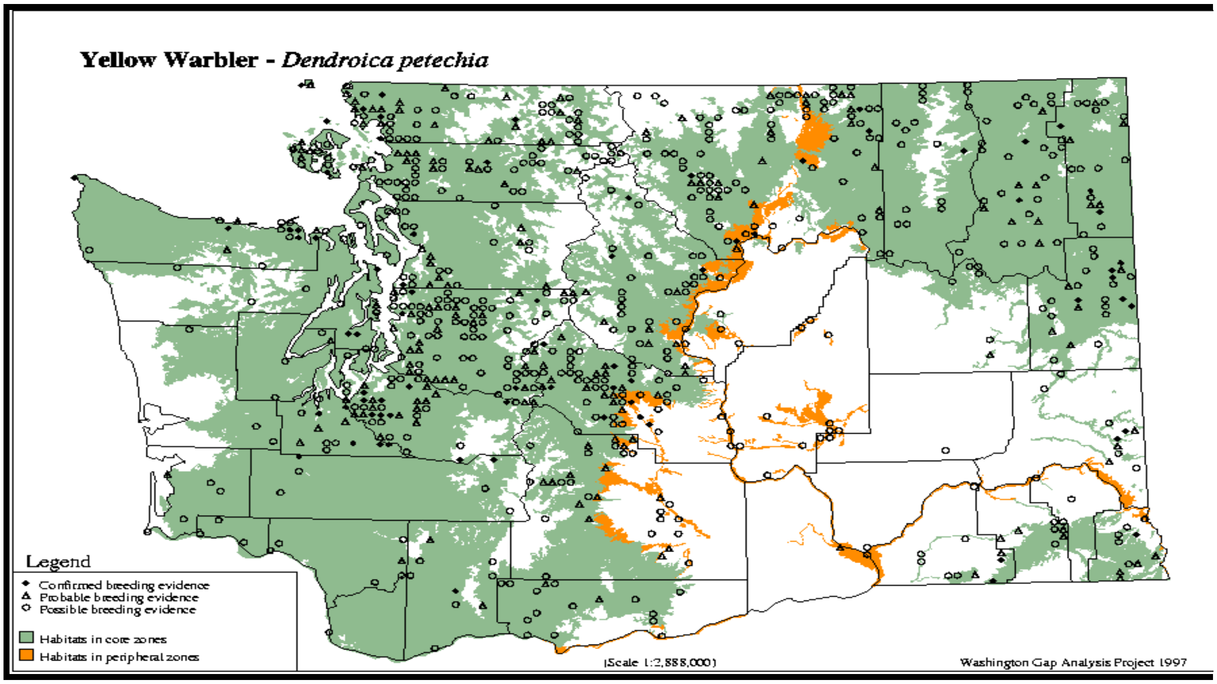

Figure 4-18 Breeding Bird Atlas Data (1987-1995) and Species Distribution for Yellow Warbler

(Washington GAP Analysis Project 1997, as cited in Ashley and Stovall 2004).

Figure 4-19 Geographic Distribution of American Beaver

Source: Linzey and Brecht 2002, as cited in Ashley and Stovall 2004.

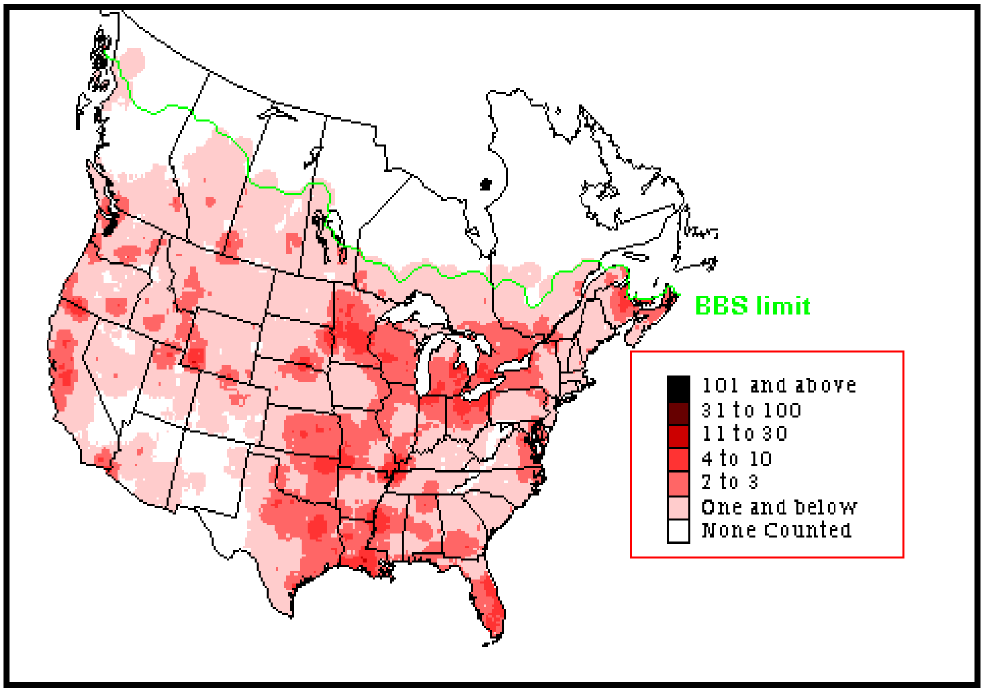

Figure 4-20 Great blue heron summer distribution

Source: Sauer et al. 2003, as cited in Ashley and Stovall 2004.

5. Integration of Aquatic and Terrestrial Components

This section of the subbasin plan addresses integration of the aquatic and terrestrial parts of the plan. These parts of the plan were developed independent of each other. The assessments for each were conducted using different methodologies and approaches. The working hypotheses, biological objectives, and strategies address the findings of the respective assessments. No attempt was made to integrate the aquatic and terrestrial aspects in other sections of this plan.

Recognizing the above, this section attempts to integrate these two aspects of the plan. The integration that is possible within the constraints of schedule and resources is very preliminary. A methodology to more fully integrate the aquatic and terrestrial aspects of the subbasin plan is under development at this time. When available later this year, it is expected that a full integration of aquatic and terrestrial aspects could be done and would be a desirable addition to this plan.

The following information is addressed in this section. First, a suggested methodology for integration that is based on the best available science is discussed. Next, a description of the process that is underway to refine this methodology, and how it could be used to provide an integration of fish and wildlife for this plan, is addressed. Finally, a preliminary integration of the aquatic and terrestrial aspects of the subbasin plan is provided.

5.1 Suggested Methodology

Work has been performed in this subbasin plan to identify appropriate aquatic and terrestrial biological objectives and strategies. A clear demonstration of how these aquatic and terrestrial aspects can be and are integrated will ensure that actions taken to improve the habitat for one biological objective does not prove counter-productive to another desired biological objective. Importantly, it will also demonstrate where implementation of a strategy or strategies will positively address two or more biological objectives whether aquatic and/or terrestrial. This will provide a better basis for selecting priorities and for most effectively implementing the subbasin plan.

In order to address integration, it is valuable to consider the relationships between land management actions and habitat impacts. The species influence diagram presented below is excerpted from *Wildlife Habitat Relationships in Oregon and Washington* (Figure5-1). The diagram displays the relationships between land management actions and the anticipated influence upon habitats, species, and wildlife functions.

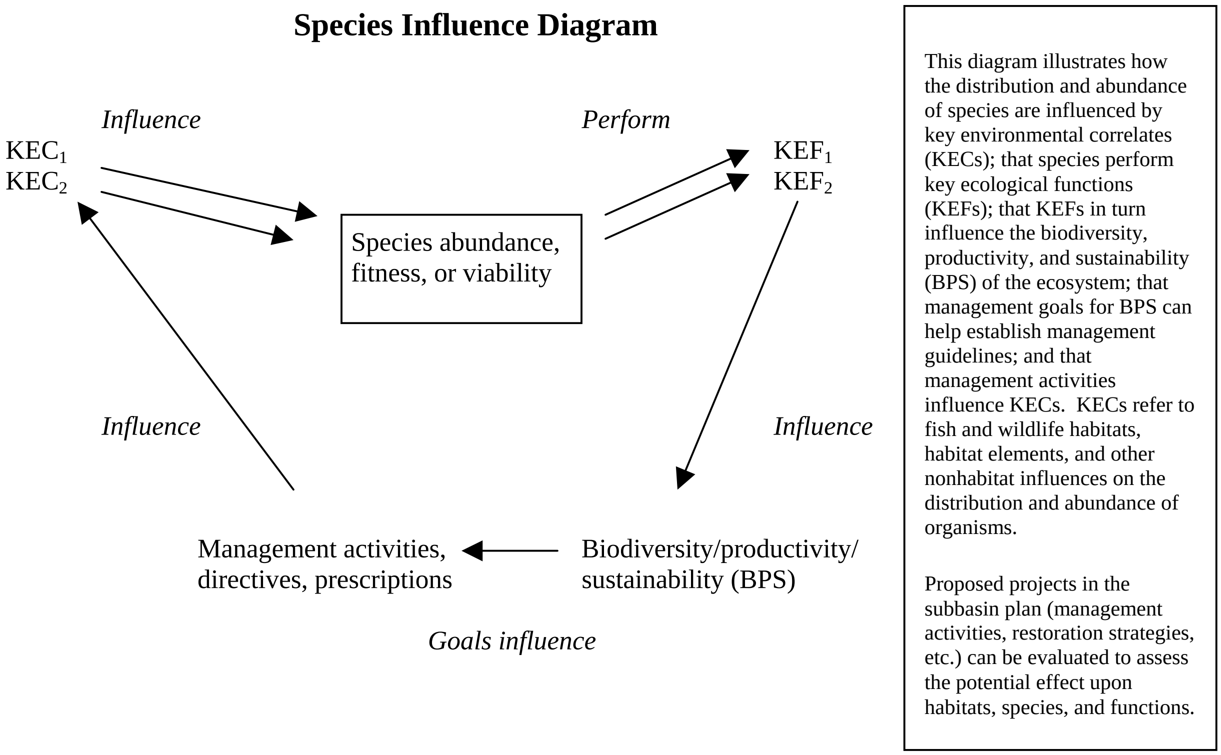

Figure 5-1 Species Influence Diagram

Source: Johnson and O'Neil, 2001.

The framework depicted above is relevant to the subbasin planning process in terms of its potential utility for integrating the aquatic and terrestrial components of the plan. Rather than viewing baseline conditions, impacts, and improvements to one system (aquatic vs. terrestrial), the status of the entire system becomes the subject of study.

As an example, the effects of land management activities upon upland and riparian habitats can be evaluated by linking specific activities to those Key Environmental Correlates (KECs), or habitat features, that are likely to be affected by the action. Based on the anticipated impacts to the habitat, one can infer how fish and wildlife species may be affected. In turn, it then becomes possible to evaluate how the functions performed by those species may be influenced – and thus gain additional insight into the effect of the proposed action on the biodiversity and sustainability of the system as a whole. For example, if planting of vegetation is proposed to occur within a riparian area, it becomes possible to quantify (based on footprint of "alteration" and the use of GIS) the anticipated effect to KECs. Once the effect to KECs is understood, it becomes possible to assess the effects to species that may result from the positive or negative alteration of existing habitats. Based on the changes to the diversity, abundance and fitness of species that may use the site, it becomes possible to understand how Key Ecological Functions (KEFs), or the functions performed by wildlife (e.g. seed dispersal), may change as a result of the proposed activities.

This assessment technique bridges the gap between terrestrial and aquatic systems. In the previous example, if vegetative planting actions are proposed to occur in a riparian area, the footprint of effect can be assessed to determine if changes to KECs (e.g. the growth of woody vegetation to a certain size) may influence the ability of the system to provide KECs that are of importance to aquatic species (e.g. large woody debris). This provides an opportunity to evaluate the relationship between management activities and habitat, from the abiotic and/or habitat forming processes perspective.

5.2 Future Efforts

Currently, efforts are underway to refine the relationships depicted in Figure 5-1 to reflect the contribution of abiotic functions (e.g. habitat forming processes) to the system. An Oregon Department of Transportation group known as the Comprehensive Mitigation/Conservation Strategy team (CMCS)[13] is working through development of this aspect, as it relates to the above diagram and the concept of ecosystem services. The relationships currently being explored between management activities, abiotic processes, and habitats are depicted in Figure 5-2. Further refinement of the specific relationships between management activities and abiotic processes will occur in association with the CMCS throughout the 2004 calendar year.

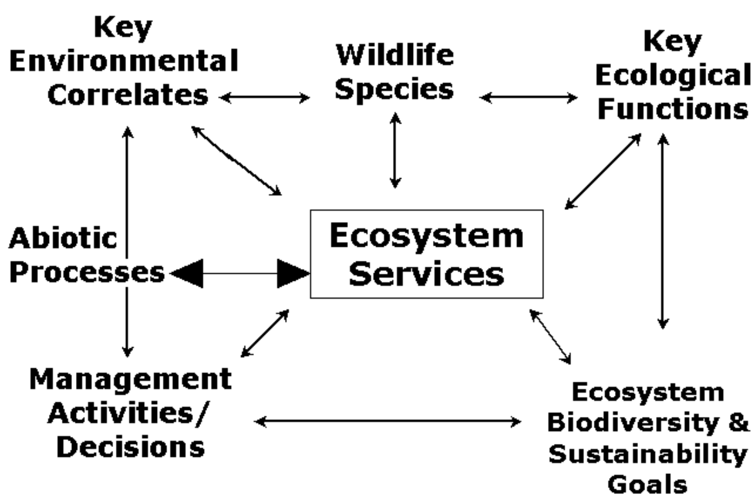

Figure 5-2   Integration of Abiotic Processes (Habitat Forming Processes)
Source: T.A. O'Neil and B. Marcot (2004).

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[13] CMCS team members include representatives from ODOT, US Environmental Protection Agency, US Fish and Wildlife Service, US Army Corps of Engineers, NOAA Fisheries, Oregon Department of State Lands, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, Federal Highways Administration, Oregon Watershed Enhancement Board, and the Oregon Governor's Office. The CMCS is staffed by a team comprised of the Northwest Habitat Institute (Tom O'Neil), USDA Forest Service (Bruce Marcot), and Parametrix (Michelle Wilson).

An additional opportunity for integration of the aquatic and terrestrial components of the plan is provided when one examines the relationships between individual species of fish and wildlife. The Northwest Habitat Institute has identified those wildlife species in the region that have a relationship to salmon (pers. com. T.A. O'Neil, 2004). These relationships are based primarily on predator-prey interactions between the wildlife and salmon. A total of sixty-five wildlife species were preliminarily identified as having some relationship to salmonids. Of those species, six have a strong and consistent relationship with salmon; twenty-four have a recurrent relationship with salmon, and seventeen species have an indirect relationship to salmon (Johnson and O'Neil, 2001).

Of the nine focal wildlife species identified in this subbasin plan, the great blue heron is the only one that is identified as having a relationship to salmonids using the above analysis. This analysis will need to be tailored to extend to east-side watersheds, and to model salmon relationships to wildlife, to be useful for this subbasin plan. Regardless, this approach provides an example of how to develop information that can be used to identify benefits accrued to terrestrial habitat-related species through enhancement of aquatic habitat and related species.

The application of this technique can occur on a broad regional scale. It can also be utilized as part of an intense site-specific review, where one considers the impacts of various land management strategies as they apply to the specific site, as well as the entire ecoprovince in which they occur. Future revisions of the subbasin plan could more fully address the integration of the aquatic and terrestrial components by:

- Step 1. Regional Perspective
    - Assessing changes in fish and wildlife habitat (Partially complete)
    - Assessing changes in fish and wildlife species over time (Partially complete)
    - Assessing changes in fish and wildlife functions over time; identification of functional specialists or critical functional link species that need to be addressed (This information would need to be derived from changes in habitat types and changes in species)
- Step 2. Project or Program Tool
    - Assess specific study areas (potential areas of impact/benefit) utilizing field method designed to document KECs (captures habitat elements related to species needs) (Parametrix and NHI, 2004)
    - Identify relationships between specific management/activity proposals and KECs; identify whether proposed activities have a positive, negative, or neutral effect upon the habitats and habitat features of interest
    - Assess the effect of proposed impacts/improvements upon the species of interest
    - Assess the influence of changes to species (resulting from changes to habitat), upon the functions performed by those species; identify whether the changes in function support system goals for biodiversity/sustainability; identify whether the needs of critical functional link species or functional specialists are addressed
    - Assess how the proposed program or project activities relate to the broad-scale regional assessment performed in Step 1; determine how the anticipated

project/program effects relate to what is happening on a regional basis; determine if the proposed activities support the objectives of the sub-basin plan

While this analysis is currently outside the scope of this document, the approach may provide a potential future step for combining terrestrial and aquatic components of the plan. The true benefit comes in terms of monitoring and adaptive management, as the framework provides a feedback loop for continuous learning and improvement, based on measurable and reproducible results. Incorporation of the compatible EDT information, which can be included as a component of this integrated approach, would provide valuable depth and robustness to the management component of the framework.

5.3 Preliminary Integration

This section describes a very preliminary integration approach for the subbasin plan by identifying preliminary integrated working hypotheses. It is expected that these preliminary integrated working hypotheses will be used to add justification for proposed projects that address aquatic and terrestrial biological objectives identified in Section 7 of this subbasin plan. Simple stated, we anticipate that these hypotheses will be referenced, as appropriate, in project proposals.

The preliminary integrated working hypotheses that follow have been identified by screening the aquatic and terrestrial biological objectives and strategies. This screening looked for areas where benefits potentially will accrue to fish and wildlife species associated with habitats other than those being addressed by the specific aquatic or terrestrial habitat type biological objective and associated strategy. For example, management objective and strategies in terrestrial focal habitat types may also play a direct role in affecting aquatic priority habitats:

- Shading provided by ponderosa pine may keep streams cool
- Ponderosa pine near streams and rivers may ultimately provide large woody debris
- Fully functioning grassland and shrub-steppe habitat may benefit aquatic habitat by decreasing erosion and sedimentation.

In addition, indirect effects from terrestrial management objectives and strategies include the addition of KEFs that may also impact aquatic habitats and aquatic species. For example, as ponderosa pines grow in diameter from saplings (under one inch in diameter) to large trees (20 to 29 inches in diameter) the number of bird species associated with the habitat types increase from one species to 52. Moreover, the species compositions change during this process. Large trees are more likely to support piscivorous birds than smaller trees. The larger trees provide more suitable habitat for great blue herons, osprey, bald eagles, common mergansers, and hooded mergansers. Depending on the bird species, their presence may be detrimental to the focal fish species by directly preying on these fish or by competing for the same food sources. Conversely, the piscivorous birds may be beneficial to the focal fish species by consuming competitor and predatory species.

It is much more likely that terrestrial habitat improvements will have a direct effect on salmonid focal species and habitat than it is that aquatic habitat improvements will have a direct effect in terrestrial habitats and species. Except for increased riparian vegetation identified in the aquatic habitat objectives and strategies, these objectives and strategies tend to be focused on in-water structural conditions that do not directly impact many terrestrial habitat and species. However, many indirect, secondary impacts to terrestrial species may occur as a result of better aquatic habitat. For example, increased numbers of salmonids translates to increased numbers of terrestrial predators and scavengers, such as the great blue heron, bald eagle, and black bear. In addition, more properly functioning substrate and nutrient loads may increase aquatic insect populations, resulting in more food for terrestrial insectivores such as the yellow warbler. Effects on other wildlife species including most of the focal terrestrial wildlife species would be from tertiary relationships. For example, increased nutrient cycling may increase prey items for flammulated owls and great blue herons and browse for mule deer and elk. The effects of these structural improvements will likely decrease to a greater extent as the distance from enhanced streams increases.

Preliminary integrated working hypotheses are presented below that integrate terrestrial and aquatic biological objectives and strategies.

Preliminary Integrated Working Hypotheses

Hypotheses based on Aquatic Biological Objectives that Influence Terrestrial Habitat and Related Wildlife:

- Biological objectives and associated strategies that address “riparian function” for aquatic species will provide benefits for terrestrial species in the “riparian/riverine wetlands” terrestrial habitat type.
- Biological objectives and associated strategies that result in increased returns of adult salmonids will positively influence wildlife species because of the increased food resources for scavengers and predators such as bald eagles, osprey, and black bear.
- Biological objectives and associated strategies that result in increased returns of adult salmonids will positively influence wildlife species because increased nutrient cycling benefits aquatic macroinvertebrates that are preyed on by wildlife species.
- Biological objectives and associated strategies that reduce turbidity, percent fines, and embeddedness will benefit wildlife species by increasing survivorship of their prey species (fish and invertebrates). Decreased turbidity will also increase the visibility of prey species to terrestrial predators
- Biological objectives and associated strategies that limit access to streamside campgrounds will benefit wildlife by limiting disturbance to riparian-associated terrestrial species.
- Biological objectives and associated strategies that increase riparian vegetation quality will benefit wildlife by providing habitat for nesting, foraging, and cover.
- Biological objectives and associated strategies that result in setback of roads from streams to help improve water quality and stream stability will benefit riparian-associated species by decreasing disturbance from passing vehicles.

Hypotheses based on Terrestrial Biological Objectives that Influence Aquatic Habitat and Related Fish Species:

- Biological objectives and associated strategies that result in taller, larger trees that will increase shading of streams will create better habitat for salmonids.
- Biological objectives and associated strategies that increase the number of medium trees or larger (15+ inches in diameter) will increase the amount of large woody debris in streams, which positively influence salmonids.
- Biological objectives and associated strategies that decrease spraying for detrimental insects will result in increased survival of beneficial adult insects that complete their larval stage in streams, e.g., mayflies and caddisflies, and of aquatic macroinvertebrates in general. Increased survivorship of adult and larval insects will positively influence insectivorous fish species.
- Biological objectives and associated strategies that address overgrazing and destruction of cryptogrammic crusts will decrease erosion and resulting sediment loading in streams, which will benefit salmonids.
- Biological objectives and associated strategies that enhance upland habitat through programs such as CRP or techniques such as construction of sediment basins and upland terraces will benefit aquatic species by decreasing sedimentation, turbidity, and embeddedness.