Milton Creek

Limiting Factors Analysis (LFA)

Executive Summary

Purpose

This document identifies the dominant processes and habitat characteristics that currently limit the production of coho salmon smolts in Milton Creek, historically a direct tributary to the Columbia River, and currently a watershed draining into Scappoose Bay.

The concept of this plan is an analysis of limiting factors (Limiting Factors Analysis - LFA), identifying habitat conditions that restrict the success of one or more coho life history stages. The plan proposes restoration actions that address these limitations based on the following guiding principals:

- Protect remnant (core) populations against extinction.
- Protect the refuge areas that support core populations.
- Protect life history and genetic diversity.
- Emphasize protection of intact habitats over restoration of degraded habitats.
- Emphasize restoration of ecosystem function over site-specific habitat enhancement.
- Ensure that the habitat needs of all life history phases are supported.
- Ensure connectivity (accessibility) among the habitats needed for all life history stages.
- Ensure that habitat enhancement actions support the natural recovery of the system.

The scale of effort is confined to a single target species (coho) within a restricted geographic zone, in this case a single 6th field HUC. The primary attributes evaluated are fish distribution, the abundance and distribution of aquatic habitats, spatial differences in thermal water quality, and historical upslope management activities.

The assessment process relies on responses to a structured set of questions that progressively reveal the status and needs of stream channels in relation to coho habitat use. The end product of the analysis is a list of specific needs and actions (prescriptions) prioritized according to their effectiveness at addressing the identified seasonal limitation, urgency, cost, and practicality.

The prescriptions include a mix of strategies involving the recovery of riparian canopies, passage barrier removal, supporting beaver dam building activity, instream structure placement, sediment reduction, water quality monitoring and community education strategies.

System overview

The Milton Creek sub-basin comprises 21,561 acres and contains 17.8 miles of mainstem stream corridor and 6.6 miles within five tributary corridors utilized by coho salmon. Current stream habitat function is greatly reduced below that of historical levels due to interactions between natural forces and man-produced changes. These changes have created a trajectory of channel simplification that will continue without the intervention of restoration.

Management practices and flood events

The Milton Cr subbasin currently functions in response to a long legacy of historical impacts that have shaped its current condition and consequently its future trajectory.

Extremely low mainstem wood complexity is indicative of the long-term events that have caused channel simplification. It is important to note that the process of simplification began in the mid-19th century when splash damming and flumes were used to transport logs to mill sites, and continued into the 1970's when management agencies directed the removal of log jams to improve salmonid access to spawning and rearing habitats.

The majority of the upper watershed's stream valleys are managed for timber production and are primarily under private industrial ownership. For the most part, management appears to follow the minimum requirements of the Oregon Forest Practices Act, which do not preserve riparian buffers on Type N (non-fish bearing) streams. The potential therefore exists for upslope harvest activities to create thermal impacts on non-fish bearing perennial streams that are inextricably linked to the maintenance of summer water quality in fish bearing segments of the system.

The lower gradient reaches outside the City of St Helens are managed for multiple uses including residential, farm, pasture, nursery and woodlot. Management of riparian corridors varies from mature closed riparian canopy to fully open farm pastures with extensive solar exposure. These uses have also created thermal impacts on fish bearing streams that continue to accrue in a downstream progression until portions of the mainstem of Milton Cr are not capable of rearing salmonid juveniles in the summer because of temperatures that exceed their threshold for survival.

Beaver colonies

The role of beaver in the Milton Cr basin is critical to the expansion of summer ponded surface area and the storage of nutrient rich sediments that support food webs within the upper watershed. Beaver are currently active in the watershed, but with the exception of Salmon Cr, legacy beaver flats are not currently fully utilized and dams are not sufficiently winter stable to impound large surface areas capable of storing winter rains on floodplain terraces for extended delivery into the summer.

Status of Coho

No data are available that document adult coho escapement into the Milton Cr basin. However, it is possible to make a usable estimate using the 2008 summer pool densities of juvenile coho. Based on a basin-wide 20% snorkel sample of all pool habitats, the estimate was 6,840 juvenile coho. From this, escapement by 2007 brood year adult coho is estimated to have been a total of 55-69 fish for the basin (assuming a 1:1 male / female ratio).

This estimate agrees with information developed by the ODFW Salmonid Life-Cycle Monitoring study for North Fork Scappoose Creek, which shows that escapement has been extremely low in adjacent watersheds within the Scappoose Bay complex.

Concepts and approach

This document evaluates the relationships between the physical and biological attributes of the Milton Creek subbasin that drive system function in the basin. The goal is to identify the dominant processes and habitat characteristics that currently limit the production of coho salmon smolts in the basin.

The primary product of the analysis is a prioritized list of actions (prescriptions) for removing the limitations in ways that normalize landscape and stream channel function. This analysis is designed to be coho centric, with the assumption that most restoration prescriptions that serve the needs of coho will positively affect other salmonid species.

The concepts of Core Area and Anchor Site are used to specify project goals and focus effort. This process identifies specific sites and conditions within the aquatic system that support the remnant population by determining how these sites function together to allow completion of the coho freshwater life history.

The Core Area is the contiguous section of stream channel or channel system where juveniles rear on a consistent (year to year) basis. Anchor Sites are those portions of the Core Area that provide all the essential habitat features necessary to support the complete coho freshwater life history, from egg to smolt. The required attributes of an Anchor Site designation include optimal gradient (1-2%), potential for floodplain

interaction, and presence of spawning gravels. Such sites typically provide the greatest opportunity for boosting or restoring channel conditions that support all of the habitats required for producing coho to the smolt stage.

The prioritization process thus relies on identifying the Core Area where the remnant population is sustained, and then identifying the habitats within the Core Area that function as Anchor Sites. The overarching goal is to conserve and expand the population within the Core Area, and to do this in ways that contribute to normalized landscape and stream function.

Subbasin history and current function

The Milton Creek subbasin has long been the host of resource extraction activities that have impacted many aspects of watershed function. European settlement and exploitation of the watershed over the past 150 years has drastically altered historical habitats in the watershed for fish and wildlife. These land use changes are at least partially responsible for the decline in salmon and trout populations. Dating as far back as 1846-49 and until 1916, splash damming and flumes in the lower 8 miles of mainstem Milton Cr were used to transport logs downstream, resulting today in a highly simplified, scoured channel.

In 1861, the lower two miles of Milton Creek was relocated from Jackass Canyon to its present location, permanently modifying the basin's relationship to the Columbia River, and providing juvenile salmonids access to extensive slough habitat in Scappoose Bay. In 1920, the City of St. Helens constructed the dam on Salmonberry Creek to procure a water supply for its residents. The prairies on the gravel plain between the hills and the floodplain were altered for farming, residential and commercial development. The dike along Multnomah Channel was built in 1925-28 to control flooding of the lowland floodplain to expand developable and farmable land.

Contemporary management practices have combined with these historical activities to create a highly dysfunctional stream system that is characterized by extremely low channel complexity and floodplain interaction, as well as elevated stream temperatures. The result is aquatic habitats that are nearly incapable of supporting a viable coho population.

Results

Core Area

Field and topographic work identified the Core Area as extending from Milton Creek's confluence with the Scappoose Bay to the end point of coho distribution in the mainstem at RM 17.8. In addition, the Core includes 6.6 miles of tributary habitat. This describes the full extent of the summer distribution of juvenile coho.

Anchor Sites

Nine Anchor Sites were identified within the Core Area, four of which are in the mainstem. The remaining five Anchor Sites are located in Cox Creek (4) and Smith Cr (1). The map in Appendix 13 shows the locations of these Anchor Sites.

Basin-wide limiting factors

The Nickelson Limiting Habitat Model identified summer habitat as the seasonal habitat resource that currently most limits smolt production in the overall Milton Cr basin. Temperatures in summer pool habitats of the lower 7 miles of mainstem Milton Cr exceed ODEQ standards for juvenile salmonids. Model inputs were therefore modified to remove the rearing potential provided by these pools. With these changes made, model results make it overwhelmingly clear that it is functional summer pool habitat that most limits the production potential of the system.

Habitat inventories by ODFW and RBA and LFA inventories by Bio- Surveys, LLC have identified three primary causes for summer habitat deficiencies:

1) The lower 7-10 miles of mainstem Milton Cr are temperature impaired due to extensive solar exposure.
2) The aquatic corridor is deficient in large woody debris.
3) Stable beaver pond habitat is not at fully functional levels.

Large woody debris (LWD) and beaver dams are the primary mechanisms for trapping, storing, sorting and pulsing gravel resources through a stream network and for building and retaining floodplain interaction. The floodplain storage of winter flows from the channel aggradation initiated by wood and beaver dams extends late season flows, contributing to cooler summer stream temperatures. Gravel bedload and increased channel roughness created by LWD increases hyporheic exchanges that dissipate heat through groundwater mixing. Currently, most beaver dams in the basin lack the winter stability to achieve significant pool surface area. Large wood provides the foundation for increased channel complexity and results in reduced stream power that supports stable beaver dams.

The extremely low levels of instream wood are the legacy of extensive upslope harvest that included riparian corridors. The riparian corridors of many important salmonid producing tributaries were lost before 1971, when changes in Oregon Forest Practices provided for the retention of riparian buffers.

Site-specific limiting factors

While the model identifies summer rearing habitat as the primary seasonal limitation for the Milton Cr basin as a whole, this limitation does not apply to every stream segment. It is therefore necessary to assess needs and to define restoration actions for individual sites.

Important examples of site-specific limiting factors are the following:

1) Spawning gravels are very low in the upper mainstem of Milton Cr, suggesting that restoration prescriptions for this important segment of the Core Area should focus on improving trapping and sorting activities that boost gravel retention and functionality. These changes would allow currently functional summer and winter habitats to be adequately seeded.
2) Elevated temperatures in the lower mainstem Milton Cr make this otherwise high-quality habitat unusable during the summer. Coho juveniles attempting to migrate upstream to cooler tributary systems (principally Cox Cr) encounter multiple physical barriers (low-head dams and bedrock intrusions). Those that migrate downstream face temperature limitations beyond their physiological threshold and must move or perish. The fate of those that end up in Scappoose Bay is unknown. From a restoration standpoint, the most effective approach to deal with this highly important habitat disconnection is to work simultaneously in both the mainstem and Cox Cr.

Adult escapement and juvenile seeding

Our review of the amount, quality and distribution of spawning gravels, summer habitat and winter habitat makes it clear that the basin currently provides more viable habitat than is being utilized. This conclusion holds even when the detrimental effects of elevated mainstem summer temperatures are considered.

Adult coho escapement is insufficient to fully seed any of Milton Creek's seasonal habitats – spawning gravels, summer rearing, or winter rearing. Specifically, adult escapement is far below the 375 pairs that currently available spawning gravels are able to support.

Addressing the constraints

We can summarize the status and needs of the Milton Creek coho population as the following:

1) Coho production in the Milton Cr basin is primarily limited by the lack of adequate adult escapement. Spawning gravels are under seeded.
2) Protection of the few returning adults is essential.
3) Restoration efforts should also emphasize increasing the survival rates of the limited number of fry currently emerging within the system.
4) Population stability requires genetic diversity. Recognizing and enabling variable life histories (survival strategies) is critical for supporting this teetering population.

These are the paramount guidelines of a successful recovery plan designed to stabilize the fragile population as long-term restoration work is pursued. Under such a coordinated program, improved smolt production would build a basin-wide coho population that sustains itself generation to generation.

Using this report

Implementing the prescriptions

Utilizing a basin scale perspective, the report steps through the conditions and constraints that control channel functionality at each anchor site. It then establishes what actions will relieve these constraints in ways that contribute to the expansion of the Core Area and to improvements in whole-system health and functionality.

The prescribed actions are collated into a table of prioritized prescriptions presented in Appendix 15. Locations of the proposed actions are presented in map form in Appendix 14. As more specific information is needed about a prescription, refer to the text that describes the Anchor Site, its problems, and how they may be addressed.

Note that the Appendix 15 table can be copied to MS Excel, where sort and filter operations can be used to create organized short-lists of prescriptions.

Complexity and localization of issues

This report examines the physical and biological interactions that form a complex stream system. It assumes that a high level of inter-dependence exists among habitats that extend from the low gradient mainstem to the high gradient headwater reaches. Emphasis is placed on how current and historical conditions have broadly reduced coho habitat throughout the system.

It should also be understood that limitations defined for the whole sub-basin are not always those operating at the individual tributary or reach level. Both scales of concern have been considered in defining the prescriptions and their order of implementation. It is the localized conditions that occupied most of the field and analytic work, and which the report documents. The reader should refer to the body of the report to access information about specific sites and prescriptions.

Order of restoration actions

A limiting factor analysis establishes an ordered progression of actions, not a single-effort solution. Once significant progress has been made toward resolving the seasonal limitations addressed by Priority 1 prescriptions, attention to Priority 2 prescriptions should then logically begin. However, it is understood that the orderly process that this suggests may not occur. The realities of landowner cooperation, funds acquisition, and physical constraints may prevent an entirely orderly process. It is also true that the effects of implementing the Priority 1 actions may create responses from the system that lead to re-prioritizing or modifying the remaining prescriptions. Priority levels should be thought of as a strong set of guidelines, and not as a rigid set of directions.

Presentation of data, maps and photographs

All of the data summaries, charts, maps, and photographs are presented as appendices. Please refer to the appendices listed in the Table of Contents as they are referenced in the text of the report.

Note: In the electronic version of the report, it is possible to use the Table of Contents as a hot link to a topic. Hold the Control key down and left-click the heading listed in the Table of Contents.

Acronyms used

- AQI – Aquatic Habitat Inventory (Oregon Dept of Fish and Wildlife)
- AWS – Alsea Watershed Studies (Seasonal survival rates for coho)
- BMP – Best Management Practices
- DEQ – Department of Environmental Quality
- DO – Dissolved Oxygen
- ESU – Evolutionarily Significant Unit
- HUC – Hydrologic Unit Code
- LCM – Life Cycle Monitoring
- LFA – Limiting Factor Analysis
- LWD – Large Woody Debris
- nd – no data
- OCN – Oregon Coast Natural
- ODF – Oregon Department of Forestry
- ODFW – Oregon Department of Fish and Wildlife
- OFP – Oregon Forest Practices
- RBA – Rapid Bio-Assessment Inventory
- RM – River Mile
- SBWC – Scappoose Bay Watershed Council
- SRS – Stratified Random Sample
- USFS – United States Forest Service