Current Ecological Conditions and Restoration Needs in Forests of the Clearwater Basin, Idaho

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Executive Summary

Background

Within the Clearwater Basin of northern Idaho, a diverse group of conservation, business, government, and tribal leaders have been working together through the Clearwater Basin Collaborative (CBC) since 2008 to resolve longstanding land management conflicts. The CBC sees great potential in the synergy between forest restoration and the forest industry to benefit the health of the basin's forests, rivers, and its communities. Yet, due to a lack of comprehensive information on current ecological conditions across the entire Basin, it has not been possible to clearly define forest restoration needs or identify the long-term ecological, economic, and social outcomes of different forest management strategies. Without this information, it has been difficult for the CBC to reach shared understandings, articulate a clear vision, and speak with a unified voice on issues of forest management.

Working from available data sources, we have **documented current vegetation conditions and identified restoration needs in forests throughout the Clearwater Basin.** Our assessment considers all forest ownerships, including federal, state, private, and tribal. Ultimately, this information is intended to facilitate the CBC in developing and articulating a "shared vision" for where, how much, and what types of forest management activities the CBC advocates. More immediately, this assessment will help define current forest restoration/management needs and provide ecological context for CBC conversations on forest management.

Key Findings

- **Sixty one percent of coniferous forests across the Clearwater Basin assessment area (4,204,000 acres) are moderately to severely departed from historic conditions.** Departure is a measure of how different the structure (tree size, density, canopy cover) of present day forests is from pre-European settlement conditions.

- **Historic mixed severity fire regime forests are the most common and most consistently departed forest type.** Across the assessment area there are 3,659,000 acres of mixed severity forests, of which 75% are moderately to severely departed. Largely dominated by Douglas-fir, grand fir and/or western red cedar, these forests constitute over 70% of general forest lands on the Nez Perce – Clearwater National forest. Departure in mixed-severity forests is likely the result of the extensive wildfires in the late 19th and early 20th century followed by wildfire suppression and extensive harvesting in the mid-20th century.

- **Historic low severity fire regime forests are less abundant than mixed severity forests but also have substantial levels of departure.** Of the 1,262,000 acres of low severity forests across the assessment area, 55% are moderately to severely departed. Characterized by ponderosa pine, low severity forests make up 74% of tribal forest lands. Departure is consistent with past harvests and wildfire suppression that has led to more crowded stands with fewer large/old trees and more grand-fir and Douglas-fir than were found historically.

- **Historic high severity fire regime forests have the lowest departure levels.** Across the assessment area there are 1,934,000 acres of high severity forests, of which 40% are moderately to severely departed. These forests are often in wet, higher elevation locations and may be dominated by Engleman spruce, subalpine fir, or lodgepole pine. 20th century fire suppression has not had a significant influence on high severity forests and the specific causes of departure are uncertain.

Executive Summary

- **Nineteen percent of coniferous forests across the Clearwater Basin assessment area (1,322,000 acres) are in need of active restoration.** Either through mechanical harvests, prescribed fire, or wildfire, active restoration in these stands would reduce departure and put today's forests landscapes on a trajectory toward a more resilient state reflecting their natural conditions.

- **Twenty six percent of general forest lands on the Nez Perce – Clearwater National Forest (309,000 acres) are in need of active restoration.** Across our assessment area, general forests on the Nez Perce - Clearwater National Forest had the highest proportion of forest lands in need of active restoration.

- **Active restoration alone often cannot eliminate departure. Twenty eight percent of forests would remain moderately to severely departed, even if all active restoration needs were hypothetically implemented immediately.** To reduce departure many forests require passive restoration (e.g., growth) in order to recover from past disturbances and rebuild structure.

- **On non-federal forests, passive restoration needs are nearly equivalent to active restoration needs (272,000 versus 274,000 acres respectively).**

Other Considerations

Climate Change: While this analysis provides a static view of past and current conditions, research indicates that restoring forests to closely reflect historic conditions will increase their resilience in a warming climate. Additional work is needed to integrate climate adaptation into the planning of on-the-ground restoration projects.

Spatial patterns: The data used in this assessment was not suitable to directly assess the spatial patterns of clumps and gaps within individual stands or of the size, shape and configuration of forest patches across the landscape. Yet critical ecological processes such as fire spread, insect dispersal, and wildlife movement are controlled by the spatial patterns of forests. **To restore resilient forested landscapes, on-the-ground restoration projects must consider spatial patterns at the stand and landscape scales.**

Western White Pine: Western white pine was historically an important component of forests in the northern half of the Clearwater Basin. This species has today largely been lost due to the introduction of white pine blister rust and extensive 20th century harvesting. The data and methods used in this assessment do not explicitly address questions of western white pine reestablishment.

Old Growth: The identification and conservation of old-growth forest stands is a critical land management issue across the Clearwater Basin. However, the data and methods used in this assessment are not sufficient to map old growth following accepted definitions.

Table of Contents

Sections

Figures

Tables

Appendices

Clearwater Forest Conditions and Restoration Needs

Overview and Objectives

As a result of past management practices, forests across western North America are at risk of uncharacteristic fire and insect/disease outbreaks (1-5). Such disturbances threaten the pristine waters, productive fisheries and diverse wildlife for which these landscapes are renowned, and equally the many rural communities which depend upon the forest and recreation industries. The need for ecological restoration through active management in order to achieve more resilient natural and human communities in these western landscapes is widely acknowledged (6-8).

Within the Clearwater Basin of northern Idaho, a diverse group of conservation, business, government, and tribal leaders have been working together through the Clearwater Basin Collaborative (CBC) since 2008 to resolve longstanding land management conflicts. The CBC sees great potential in the synergy between forest restoration and the forest industry to improve the health of the Basin's forests and its communities. Yet, due to the lack of comprehensive information on current ecological conditions across the Clearwater Basin, it has not been possible to clearly define forest restoration needs or identify the long-term ecological, economic, and social outcomes of different forest management strategies. Without such information, it has been difficult for the CBC to reach shared understandings and speak with a unified voice on issues of forest management.

Working from available data sources, *we have* ***documented current vegetation conditions and identified restoration needs in forests throughout the Clearwater Basin,*** across all forest ownerships and management designations. Ultimately, this information is intended to facilitate the CBC in developing and articulating a shared vision ***for where, how much and what types of forest management activities the CBC advocates***. More immediately, this assessment will help define forest restoration/management needs and provide ecological context for CBC conversations on forest management.

Through the CBC Landscape Health Subcommittee, The Nature Conservancy has led the collection, analysis, and summarization of data for all forested lands in subbasins (4th-level or 8-digit hydrologic units) or portions of subbasins in Idaho that intersect the Clearwater Basin or the Nez Perce – Clearwater National Forest (Figure 1).

Core Concepts

Much of this assessment is based on data products from the Landfire program (www.landfire.gov), which we determined to be the best source for consistent and continuous data on both current and reference conditions across the entire Clearwater Basin assessment area (Fig. 1). As with any data source, Landfire data have certain key assumptions and limitations. "Core concepts" critical to interpreting and understanding the output of this assessment are described below.

Appropriate Spatial Scales: The data and methods used in this assessment are intended for use at the subbasin scale (~100,000 to 900,000+ acres; 4th level hydrologic units). They are not appropriate at the scale of individual project areas (e.g, 10,000 – 50,000 ac. subwatersheds) and cannot be used to describe the condition of a precise location on the landscape (e.g., a particular hillside).

BioPhysical Setting: BioPhysical Settings represent the different types of forest found across the Clearwater Basin, based on factors including soils, climate, topography, species, and historic disturbance

regimes (Fig. 1; 9, 10). Complete descriptions for each of the 16 forest BioPhyscial Settings found in the Clearwater Basin are included in Appendix A.

Forest Structure: In this assessment, forest structure refers to tree size, density, and canopy cover. It does not explicitly consider tree species identity. However, tree species composition is described for each successional class within each BioPhysical Setting (*see below*).

Successional Classes: All forests are in a continuous state of change. The forests we see today are shaped by many factors including but not limited to tree growth, fire, insects, disease, wind, and human management. To capture the influence of these processes, Landfire organizes each BioPhysical setting into 5 different successional classes: A) Early Development, B) Mid-Development Closed Canopy, C) Mid-Development Open Canopy, D) Late Development Open Canopy, E) Late Development Closed canopy. While all BioPhysical Settings share a common set of successional classes, the definition of each class in terms of structure, species composition, and stand age is unique for each BioPhysical Setting. Similarly, the influence of the various growth/disturbance processes on the transitions between classes is also unique for each BioPhysical Setting. ***Ecological condition (either current or historic) is based on the percentage of a BioPhysical Setting in each successional class for a given landscape.***

Natural Range of Variability (NRV): The Landfire Natural Range of Variability data represent how forested landscapes were shaped by succession and disturbance prior to European settlement. These data cannot be applied to any particular acre/pixel, but instead provide the expected distribution of successional classes across a landscape. Natural Range of Variability reference conditions are developed through state and transition models for each BioPhysical Setting that incorporate the five successional classes and pre-European settlement rates of succession and disturbance determined from intensive literature and expert review (9)**.** The resulting distribution of development states for each BpS does not represent a specific historical date, but instead approximates an equilibrium condition based upon the "natural" biological and physical processes. ***Natural Range of Variability provides a reference point to which we can compare today's forests. This does not mean that we must recreate NRV conditions across today's landscapes or that NRV represents Desired Future Conditions.*** Desired future conditions must also account for a range of other ecological, social, and economic considerations. However, we are assuming that moving toward NRV conditions will result in increased forest health and resilience in the context of a changing climate (11-13).

Fire Regimes: Fire has always been a dominant force shaping the forests of the northern Rockies (14, 15). We can broadly classify the different forest BioPhysical Settings within the Clearwater Basin based on their natural/historic relationships with fire (16). Both the ecology and management varies dramatically between these different "Historic Fire Regime Groups".

- **Low Severity Forests (Fire Regime Group 1):** Forests where frequent (<35 yr return interval) surface fire was dominant, usually resulting in limited mortality of overstory trees. These forests are typically found in dry, lower elevations and are often dominated by ponderosa pine.
- **Mixed Severity Forests (Fire Regime Group 3)**: Forests where fires exhibited a mix of frequencies (~35 – 200 yr return interval) and severities, ranging from low to high. These forests are found across a variety of middle elevations and somewhat dry to somewhat wet locations. Dominant trees today are often Douglas-fir, grand fir, and/or western red cedar.
- **High Severity Forests (Fire Regime Groups 4 and 5):** Forests where fires were infrequent and usually severe, resulting in high mortality of overstory trees. These forests are often in wet, higher elevation locations and may be dominated by Engelmann spruce, subalpine fir, or lodgepole pine.

Clearwater Forest Conditions and Restoration Needs

Forest Structure Departure: Forest structure departure is a measure of how different present day forests are from Natural Range of Variability reference conditions. 0% departure means that the present day distribution of successional classes for a particular BioPhysical Setting – Landscape combination is identical to the Nature Range of Variability reference. 100% departure means that the current distribution of Successional Classes is completely different from the Natural Range of Variability reference. See the *Methods* section for more information on how departure is calculated.

Forest Restoration Needs: Simply assessing levels of forest structure departure does not describe WHY a forest is departed from historic conditions or what can be done to reduce departure. Not every acre of departed forest needs to be actively treated in order to restore historic forest structure. Similarly, active treatment is not always the correct tool to reduce departure, sometimes forests just need time to grow. Building upon the departure analysis, our restoration needs analysis uses the same reference and current distribution of successional classes for BioPhysical Setting – Landscape combinations to ***estimate how many acres could be moved between successional classes by "active restoration" (either through mechanical treatment, prescribed fire, or wildfire) or "passive restoration" (growth only) in order to reduce forest structure departure.*** See the *Methods* section for more information on how restoration needs are calculated. While mechanical harvests / thinning, prescribed fire, and wildfire can all be used to alter forest structure, they have significantly different ecological, economic, and social outcomes. However, the Landfire based analyses in this assessment do not distinguish between these different "tools" (*see also Appropriate Spatial Scales above)*.

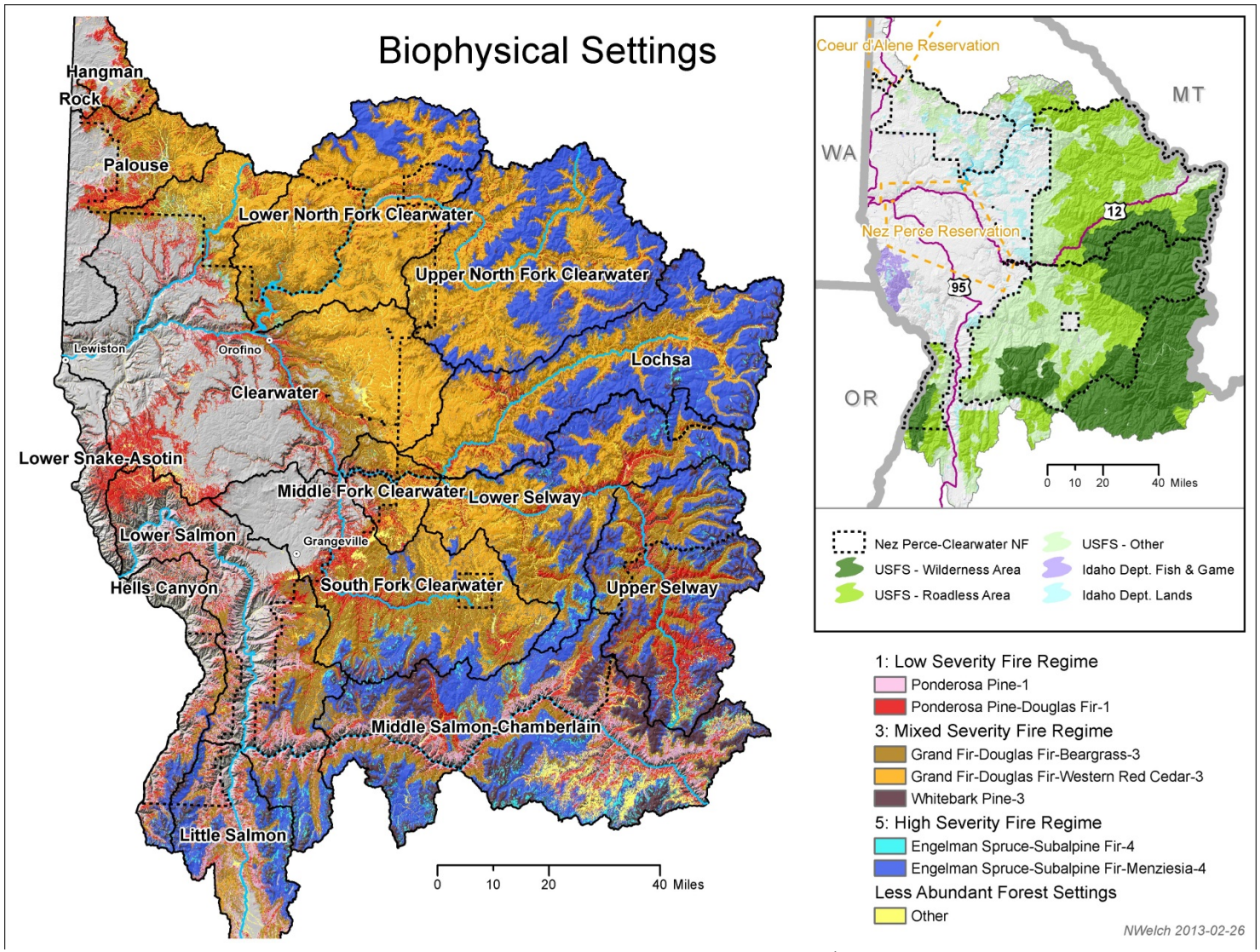

Figure 1. Forest BioPhysical Settings (see *Core Concepts* section) and Subbasins (4th level hydrologic unit) in the Clearwater Basin Collaborative assessment area. Inset map: Forest ownership – management categories.

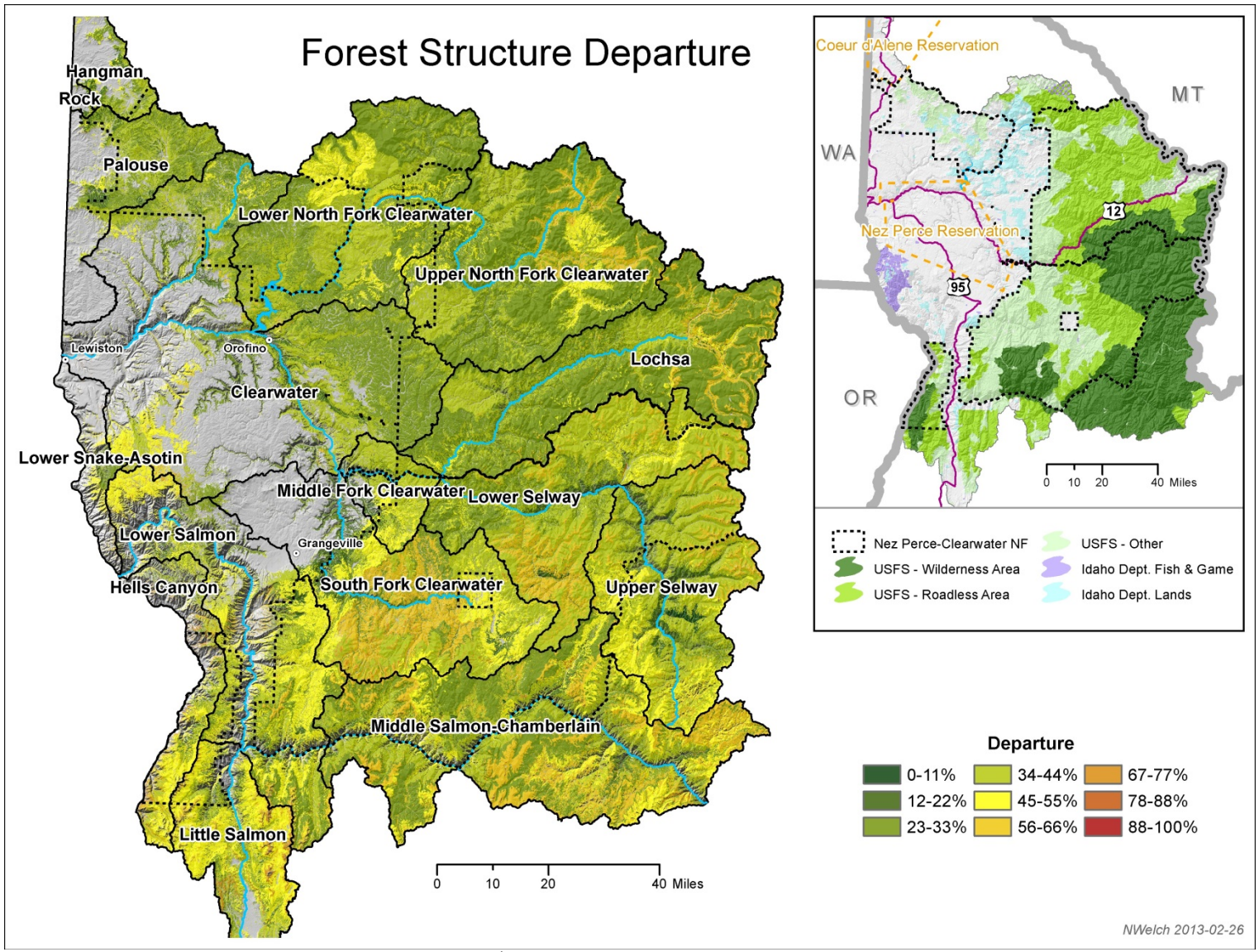

Figure 2. Current forest structure departure and 4th level subbasins within the Clearwater Basin Collaborative assessment area.

Clearwater Forest Conditions and Restoration Needs

Results and Discussion

Table 1. Distribution of forest fire regime groups, forest structure departure, and restoration needs by ownership-management in the assessment area.

		Fire Regimes			Moderate / Severe Departure	Active Restoration Needs	Passive Restoration Needs
	Total	Low	Mixed	High			
Non-Federal Forests	**ac.**	**ac.**	**ac.**	**ac.**	**ac.**	**ac.**	**ac.**
Private	1,199,000	431,000	716,000	51,000	704,000	188,000	188,000
Tribal	47,000	35,000	11,000	1,000	30,000	6,000	9,000
Idaho Fish and Game	41,000	27,000	7,000	6,000	26,000	4,000	8,000
Idaho Dept. of Lands	333,000	40,000	280,000	12,000	202,000	55,000	52,000
Other	116,000	52,000	47,000	17,000	74,000	21,000	15,000
Federal Forests							
NP-CLW* General	1,212,000	156,000	850,000	205,000	727,000	309,000	100,000
NP-CLW* Roadless	1,428,000	92,000	729,000	607,000	683,000	250,000	104,000
NP-CLW* Wilderness	1,112,000	220,000	365,000	270,000	778,000	209,000	65,000
Other General	163,000	31,000	62,000	70,000	98,000	28,000	14,000
Other Roadless	349,000	39,000	141,000	169,000	224,000	65,000	30,000
Other Wilderness	855,000	138,000	450,000	524,000	659,000	187,000	68,000
Total	6,855,000	1,262,000	3,659,000	1,934,000	4,204,000	1,322,000	653,000

*NP-CLW= Nez Perce - Clearwater National Forest

Table 2. Distribution of forest fire regime groups, forest structure departure, and restoration needs by subbasin (4th level hydrologic unit) in assessment area. Note: “t” denotes values < 500 acres.

		Fire Regimes			Moderate / Severe Departure	Active Restoration Needs	Passive Restoration Needs
	Total	Low	Mid	High			
Subbasin	**ac.**	**ac.**	**ac.**	**ac.**	**ac.**	**ac.**	**ac.**
Clearwater	690,000	206,000	466,000	18,000	319,000	107,000	102,000
Hangman	59,000	36,000	23,000	1,000	34,000	7,000	10,000
Hells Canyon	117,000	62,000	31,000	24,000	101,000	9,000	24,000
Little Salmon	292,000	101,000	93,000	97,000	262,000	50,000	34,000
Lochsa	728,000	28,000	340,000	361,000	244,000	111,000	37,000
Lower North Fork Clearwater	677,000	23,000	546,000	107,000	338,000	93,000	112,000
Lower Salmon	451,000	219,000	157,000	74,000	335,000	89,000	62,000
Lower Selway	629,000	42,000	341,000	246,000	504,000	140,000	34,000
Lower Snake-Asotin	19,000	18,000	1,000	t	10,000	t	5,000
Middle Fork Clearwater	114,000	22,000	88,000	5,000	98,000	33,000	5,000
Middle Salmon-Chamberlain	989,000	241,000	388,000	360,000	629,000	213,000	69,000
Palouse	167,000	46,000	118,000	3,000	82,000	28,000	23,000
Rock	4,000	3,000	1,000	t	1,000	t	t
South Fork Clearwater	540,000	89,000	353,000	98,000	421,000	213,000	16,000
Upper North Fork Clearwater	793,000	21,000	437,000	336,000	325,000	107,000	78,000
Upper Selway	587,000	106,000	277,000	204,000	500,000	120,000	43,000
Total	6,855,000	1,262,000	3,659,000	1,934,000	4,204,000	1,322,000	653,000

Clearwater Forest Conditions and Restoration Needs

Forest Structure Departure

Approximately 61% of the 6,855,000 acres of coniferous forest across the Clearwater Basin assessment area have structure that is moderately to severity departed (>33% departure) from their Natural Range of Variability. Of these departed forests, 1,036,000 acres are found in non-federal and 4,204,000 acres in federal ownership (Tables 1, 2). Departure levels tended to be higher in the southern half of the assessment area (Fig. 2), with the highest overall proportion in the Little Salmon subbasin (90% of forests moderate to severely departed). In contrast, we found the lowest levels in the Lochsa subbasin (34% of forests moderately to severely departed). However, our measure of forest structure departure does not account for the loss of western white pine which is thought to have been historically prevalent in the mixed severity forests north of the Lochsa River (Art Zack, personal communication; 17, 18).

Both the overall levels of forest structure departure and the underlying causes of departure varied greatly between fire regimes. Low severity forests account for 1,262,000 acres and make up over 74% of tribal forests in the assessment area. Departure within low severity forests (55% moderately to severely departed; Fig. 3) was characterized by an overabundance of mid and late development closed-canopy stands and a deficit of mid and late development open-canopy stands (Fig. 4). These trends are consistent with the effects of wildfire suppression and past harvests which removed large, old early seral trees (19). Mixed severity forests are the most common (3,659,000 ac.) and the most consistently departed (75% moderately to severely departed) forest type in the Clearwater Basin Collaborative assessment area (Fig. 3). Nearly 85% of Idaho Department of Lands forests and over 70% of general forests in the Nez Perce - Clearwater National Forest are mixed severity.

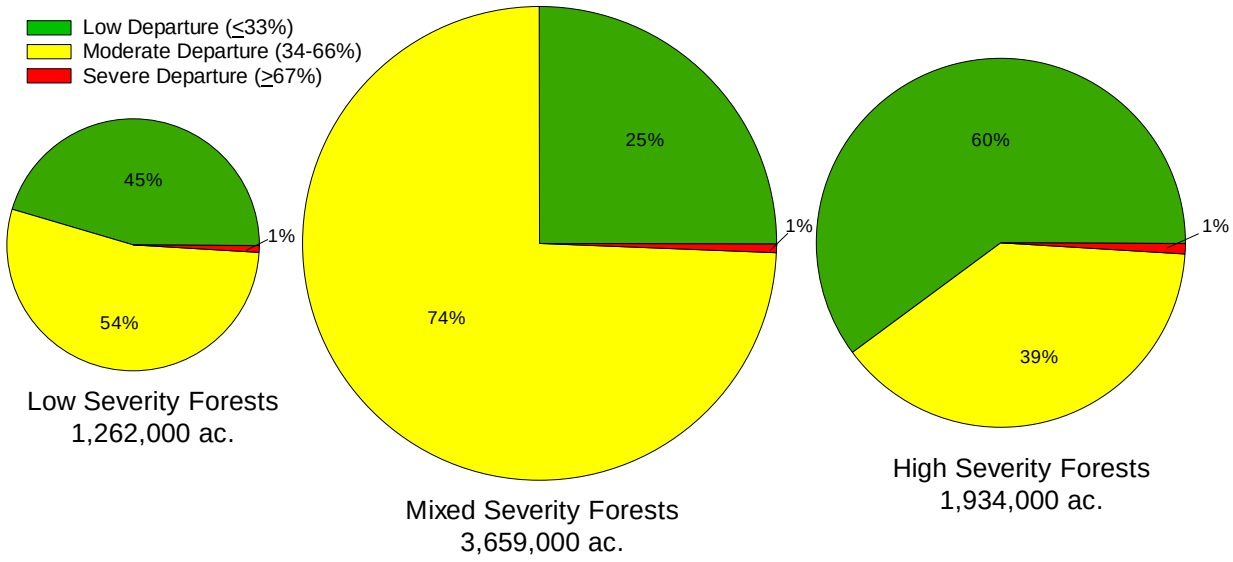

Figure 3. Forest structure departure by fire regime group in the Clearwater Basin Collaborative Assessment area

Clearwater Forest Conditions and Restoration Needs

Departure in mixed severity forests are characterized by overabundance in the late open and late closed and a deficit in the mid closed successional classes (Fig 4). At first these trends might seem contradictory to the typical understanding that wildfire suppression, extensive 20th century harvesting and pervasive root rot has left moist forests across north Idaho with a severe overabundance of mid-seral forests (20, 21). However, this is simply a difference in terminology with the Landfire BioPhysical Setting models. The "Late Development" successional classes for the most common mixed severity BioPhysical settings begin at 65-70 years post disturbance (Appendix A). Consequently, many of the forests established following early to mid-20th century disturbances, which constitute the commonly referred to "mid-seral bulge", have now grown into the "Late Development" Landfire successional classes. In addition, the lack of wildfire and reduced harvest levels over the past 20-30 years, has resulted in very few stands recruiting into the mid development closed canopy successional class.

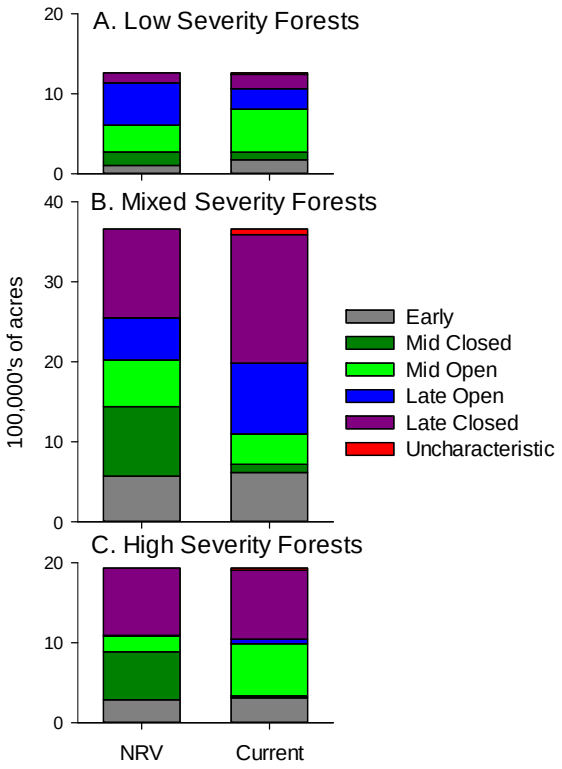

Figure 4. Natural Range of Variability (NRV) reference and current distribution of successional classes for low (a), mixed (b), and high (c) severity forests. Successional classes with greater current acreage compared to NRV are considered overabundant while successional classes with less current acres current compared to NRV are in deficit.

High severity forests (1,934,000 ac.), which account for 42% of forests in roadless and wilderness areas, had the lowest overall departure levels (40% moderately to highly departed; Fig. 3). Departure in high severity forests is characterized by an overabundance of mid development open canopy stands and a deficit of mid development closed canopy stands (Fig. 4), predominately in the "Engelmann Spruce-Subalpine Fir-Menziesia-4" BioPhysical Setting. While the specific causes of departure is uncertain, Landfire notes for this model state that mid development open canopy stands "primarily occur after insects, disease or weather stress thins denser stands" (Appendix A).

Active Restoration Needs

We have identified 19% (1,322,000 ac.) of forests across the Clearwater Basin Collaborative assessment area where active restoration, either through mechanical treatment, prescribed fire, or wildfire, would help put today's forests on a trajectory back toward the natural range of variability reference condition (Table 1). With 309,000 acres identified in need of active restoration, general forest lands on the Nez Perce - Clearwater National Forest had the highest proportion of treatment acres to total acres (26%). Amongst subbasins, the South Fork Clearwater had the highest proportion (39%) of forests in need of active restoration.

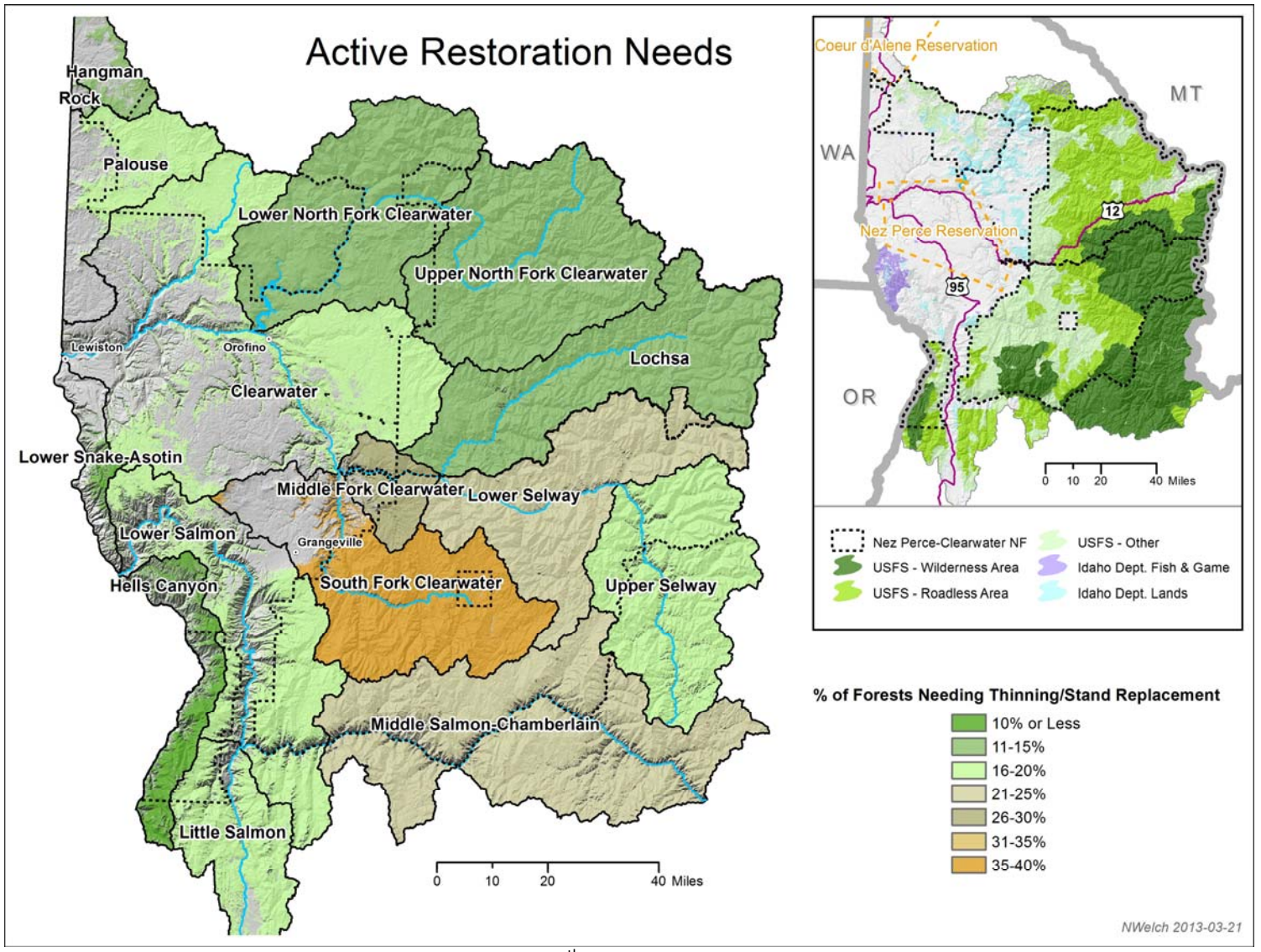

Figure 5. Percent of total forests within each subbasin (4th level hydrologic unit) identified in need of active restoration across the assessment area.

Clearwater Forest Conditions and Restoration Needs

Similar to the levels and causes of structural departure, active restoration needs vary substantially among forests in the fire regime groups. Surprising given over a century of fire suppression, only 9% of low severity forests were identified as in need of active restoration (Fig. 6). A much higher percentage of mixed severity forests (29%) were in need of active restoration, with the vast majority categorized as "other thinning" (Fig. 6), which captures all treatments that reduce tree density / canopy cover but do not meet the definition of "thinning from below" or "stand replacement". See the *Methods* section for specific definitions of the active restoration categories. Other thinning was also the most common treatment for high severity forests where 7% were identified for active restoration.

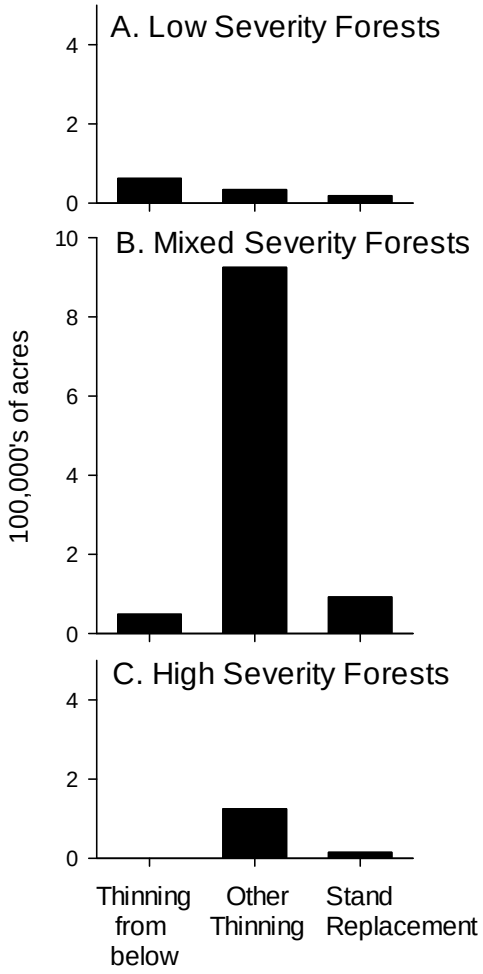

Figure 6. Active restoration treatments for low (a), mixed (b), and high (c) severity forests. See *Methods* for specific definitions of each treatment.

Residual Departure and Passive Restoration Needs

Active restoration alone, however, cannot eliminate all the forest structure departure. Recovery from current departure levels also involves "passive restoration"; time for forests to grow and recover from past disturbances. Even if all active restoration needs were hypothetically implemented immediately across our assessment area, 28% of forests would remain moderately to severely departed (Fig. 7). Residual departure levels were greatest in the Hells Canyon and Upper Selway with 69% and 56% percent of forests, respectively, remaining moderately to severely departed following hypothetical active restoration. In contrast, the Middle Fork Clearwater declined from 86% to 3% moderately to severely departed with active restoration. Across the Clearwater Basin assessment area we identified 10% of forests (653,000 ac) where non-action, or passive restoration is needed to reduce departure. On non-federal forests passive restoration needs are generally equivalent to active restoration needs (Table 1). Amongst forest types, passive restoration needs were highest in low severity forests (19%). The passive restoration needs for low severity forests are dominated by "growth with low severity fire" (Fig. 8), defining transitions from early to mid-development open or from mid-development open to late development open successional classes (see Methods). As a percentage of total forest lands, passive restoration needs are similarly greatest in subbasins characterized by low severity forests. Mixed and high severity forests had lower passive restoration needs (10% and 2% respectively)

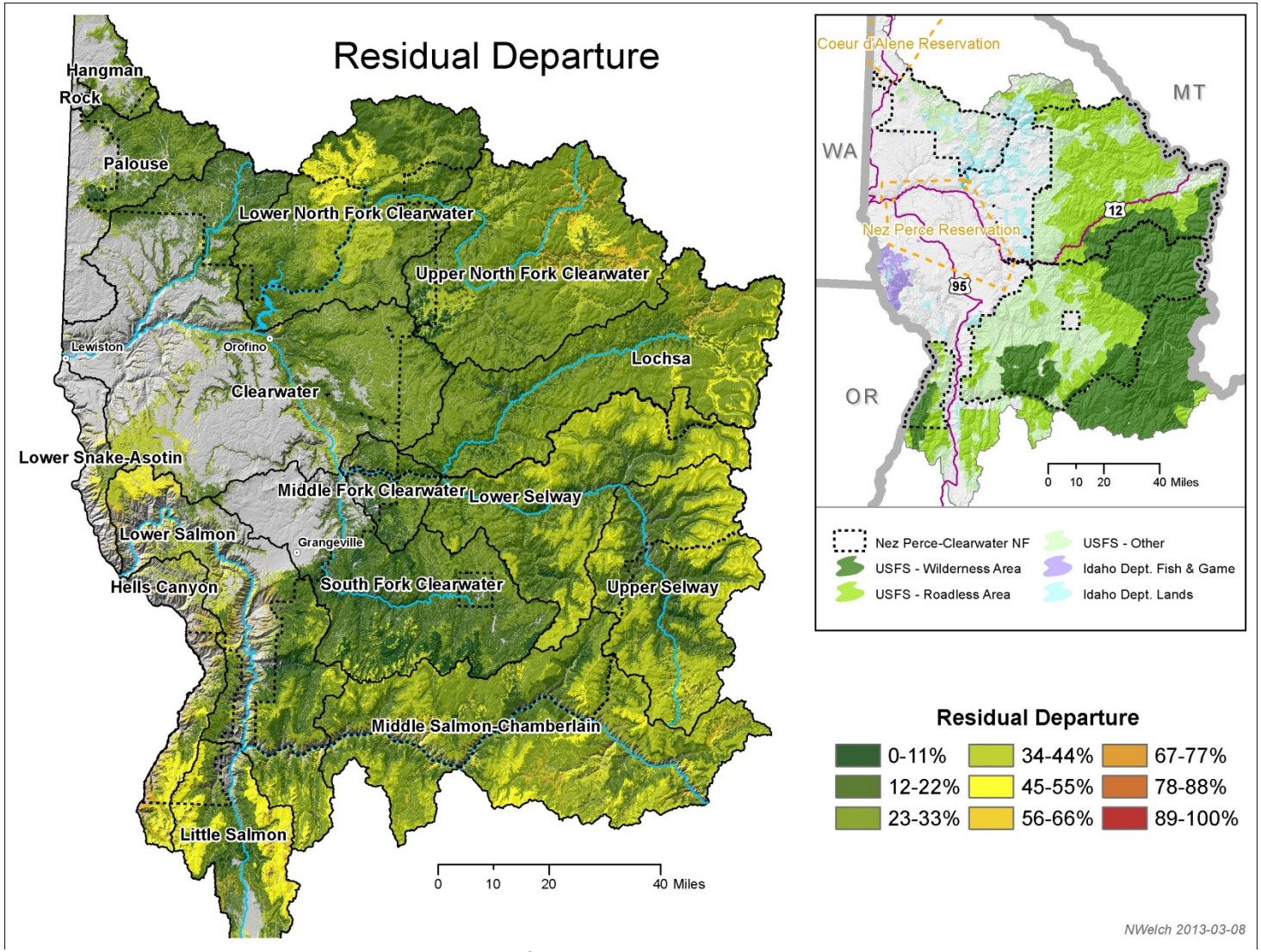

Figure 7. Residual forest structure departure and 4th level subbasins the Clearwater Basin Collaborative assessment area. Residual departure represents hypothetical conditions if all active restoration needs were to be immediately implemented and indicates the additional need for "passive" restoration.

Other Considerations

Climate Change: Climate change has and will continue to bring significant changes to forests across the Northern Rockies, including increased drought stress and more frequent and severe fire (e.g., 5, 22, 23, 24). The increased density and changes in species composition that we have observed in today's low and mixed severity fire regime forests indicate reduced fire and drought tolerance. Consequently, moving today's forests toward "natural" reference conditions will increase their resilience to a warming climate. Yet, much additional work is needed to integrate climate adaptation into on-the-ground restoration projects.

Spatial patterns: This assessment considers forest conditions and restoration needs based upon the relative abundance of different successional classes. But critical ecological processes such as fire spread, insect dispersal, and wildlife movement are also controlled by the spatial patterns of forests (4, 25-27). At the scale of individual forest stands (10's – 100's of acres) spatial pattern includes the size of clumps / gaps and the spacing of trees. At the landscape scales (1,000's to 10,000's of acres) spatial patterns includes the size, shape and configuration of individual forest patches or stands. Due to the quality of the data available for this assessment, we are unable to directly assess the spatial patterns of forests across the Clearwater Basin below the level of 4th level subbasins. Results from the regional scale analyses in this assessment provide coarse estimates of current forest conditions and restoration needs. ***To restore functioning forested landscapes, on-the-ground restoration projects must additionally incorporate spatial patterns at the stand and landscape scales*** (28-30).

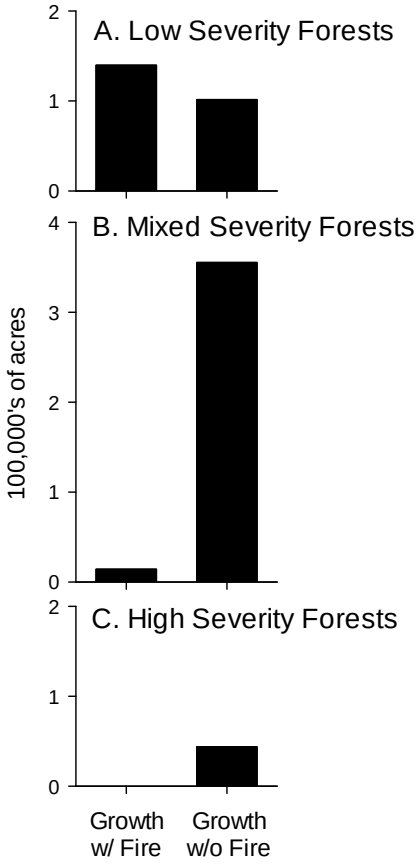

Figure 8. Passive restoration needs for low (a), mixed (b), and high (c) severity forests. See *Methods* for specific definitions of each growth category.

Western White Pine: Historically, western white pine (*Pinus monticola*) was an important component of many forests in the northern half of the Clearwater Basin, particularly within in the grand fir – Douglas fir - western red cedar BioPhysical setting (Fig. 1; 17, 18). Following the introduction of white pine blister rust (*Cronartium ribicola)* and extensive harvesting during the 20th century, western white pine has largely been lost from the forests of the Clearwater Basin. A fast growing fire and disease resistant species, western white pine historically played an important ecological role in these forests. However, the ***Landfire data used in this assessment is based upon forest structure only, and does not measure the presence or absence of western white pine*** from present day forests. Consequently, the data and methods used in this assessment do not explicitly address questions of western white pine reestablishment. But it is also important to note that the active treatment needs that we have identified in historic white pine forests (typically "other thinning") are likely compatible with re-establishment of rust resistant western white pine (17, 31, 32).

Old Growth: The identification and conservation of old-growth forest stands is a critical land management issue across the Clearwater Basin. However, the ***Landfire "Late Development" successional classes do not represent old growth stands and the Landfire current condition data cannot be used to map old growth following accepted definitions*** (33).

Assessment and Modeling Methods

Forest Structure Departure

Departure of current forest structure from the natural range of variability reference conditions was assessed using Landfire 1.1.0 (Refresh 2008) data (www.landfire.gov). A joint product of the US Forest Service, the US Geological Society, the Bureau of Land Management, and The Nature Conservancy, Landfire data is based on LANDSAT satellite imagery, an extensive field plot network (including FIA and CVS plots), and detailed biophysical modeling that incorporate topographic, edaphic, and climatic layers (9). Current conditions are derived from circa year 2000 Landsat imagery but have been updated with known disturbances (e.g. fire, insects, etc.) and management activities (e.g. harvests) through year 2008.

During the update process for Landfire 1.1.0 (Refresh 2008), many of the original BpS types from the previous "Landfire National" version were lumped, resulting in new "grouped BioPhysical Settings" that provide a more parsimonious representation of natural vegetation conditions (10). "Exemplar models" from Landfire National were selected to represent each of the Landfire 1.1.0 grouped BioPhysical Settings. As part of this assessment, we reviewed, modified, and updated the exemplar models for the forested BioPhysical settings within the assessment area based upon documentation from the original BioPhysical Setting modelers and feedback from local experts (Dr. Terrie Jain - Rocky Mountain Research Station, Dr. Art Zack - Idaho Panhandle National Forest, Dr. Penelope Morgan - University of Idaho). See Appendix A and the companion document "CBC_BpSModels.pdf" for complete descriptions of BioPhysical Setting models used in this assessment. Following revision of the BioPhysical Setting exemplar models, we re-mapped the distribution of forest successional classes across the Clearwater Basin based on Landfire 1.1.0 BioPhysical Setting, Existing Vegetation Type, Existing Vegetation Height, and Existing Vegetation Cover layers. Only forested BioPhysical Setting types were included in the analysis (Landfire 1.1.0 BpS, GROUPVEG = Conifer, Hardwoond-Conifer), all other BioPhysical Settings were removed. Similarly, historically forested lands that have been developed or converted to agriculture (Landfire 1.1.0 EVT, SYSTMGRPPH = Agricultural, Developed) were also excluded from the analyses.

Forest structure departure compares the current distribution of successional classes for each BioPhysical Setting within a landscape unit to each BioPhysical Settings' Natural Range of Variability reference successional class distribution (16):

$$Departure = 100 - \sum min(Prcnt_{ai}, Prcnt_{bi})$$

Where ai and bi are the percent of the landscape of successional class "i" in the Reference condition "a" or Current condition "b" for a BpS-Landscape combination.

In order to fully contain the estimated extent of historic disturbances, the size of the landscape units used in the departure calculations varied based upon each BioPhysical Settings historic fire regime group (16). Departure within BioPhysical settings with a historic low severity fire regime (FRG 1) was calculated based upon subwatersheds (12-digit / 6th level hydrologic units). Within historic mixed severity BioPhysical Settings (FRG 3) we calculated departure using watersheds (10-digit / 5th level hydrologic units). Finally, departure within high severity BioPhysical settings (FRG 4&5) was calculated within subbasins (8-digit / 4th level hydrologic units). Departure calculations were conducting using the

FRCC Mapping Tool v3.0 (34) and custom R scripts (35). We summarized departure results by subbasins, BioPhysical Setting, historic fire regime groups, and current land ownership and management allocations. Ownership-management data was obtained from the US Forest Service Region 1 geospatial library (Inventoried Roadless Areas and other special designations) and US Bureau of Land Management INSIDE Idaho (all other ownerships – management). Analysis considered 12 ownership-management classes:

1 = IDFG (Idaho Department of Fish & Game)
2 = IDL (Idaho Department of Lands)
3 = IR (Indian Reservation)
4 = OTHER (all other classes)
5 = PRIVATE
6 = NpClw(Nez Perce – Clearwater National Forest, neither IRA nor WA)
7 = NpClw-IRA (Nez Perce – Clearwater National Forest Inventoried Roadless Areas)
8 = NpClw -WA (Nez Perce – Clearwater National Forest Wilderness Areas)
9 = USFS (Other US Forest Service, neither IRA nor WA)
10 = USFS-IRA (Other US Forest Service Inventoried Roadless Areas)
11 = USFS -WA (Other US Forest Service Wilderness Areas)

Forest Vegetation Restoration Needs

The Restoration Needs analysis is based upon the same Landfire 1.1.0 (Refresh 2008) BioPhysical Setting NRV reference condition and current condition successional class data, revised for the Clearwater Basin, as the forest structure departure calculations. By comparing the NRV to the current successional class distributions, it is possible to calculate how many acres theoretically "need" to be transitioned between successional classes in order to reduce or eliminate forest structure departure for each BioPhysical Setting and landscape unit. These transitions can be categorized as different forms of "active restoration" or "passive restoration" based upon the donating and receiving successional classes. Our restoration needs analysis considers the following active and passive restoration categories:

- **Thinning from below (Active):** Transitions between various middle and late development S-Classes through the removal of small and medium sized trees, generally to achieve canopy covers <70%. May be accomplished through fire or mechanical treatment.
- **Stand replacement (Active):** Transition from any mid or late development S-Class to "Early Development". May be accomplished through fire or mechanical treatment.
- **Other thinning (Active):** All other transitions that reduce tree density / canopy cover but do NOT result in transition all the way back to "Early Development". May be accomplished through fire or mechanical treatment.
- **Growth with low severity fire (Passive):** Transitions from "Early Development" to "Mid Development Open Canopy" or from "Mid Development Open Canopy" to "Late Development Open Canopy" in low and mixed severity fire regime BioPhysical settings.
- **Growth without fire (Passive):** All other transitions from earlier to later development successional classes, typically maintaining or resulting in a closed canopy.

All possible transitions between successional classes within each BioPhysical Setting were defined based on the above categories (Figure 9). However, we varied these definitions based on the unique characteristics of each BioPhysical Setting. All transition definitions for each BioPhysical Setting were captured in a "rules table" used during the restoration needs calculations (Tables 3, 4).

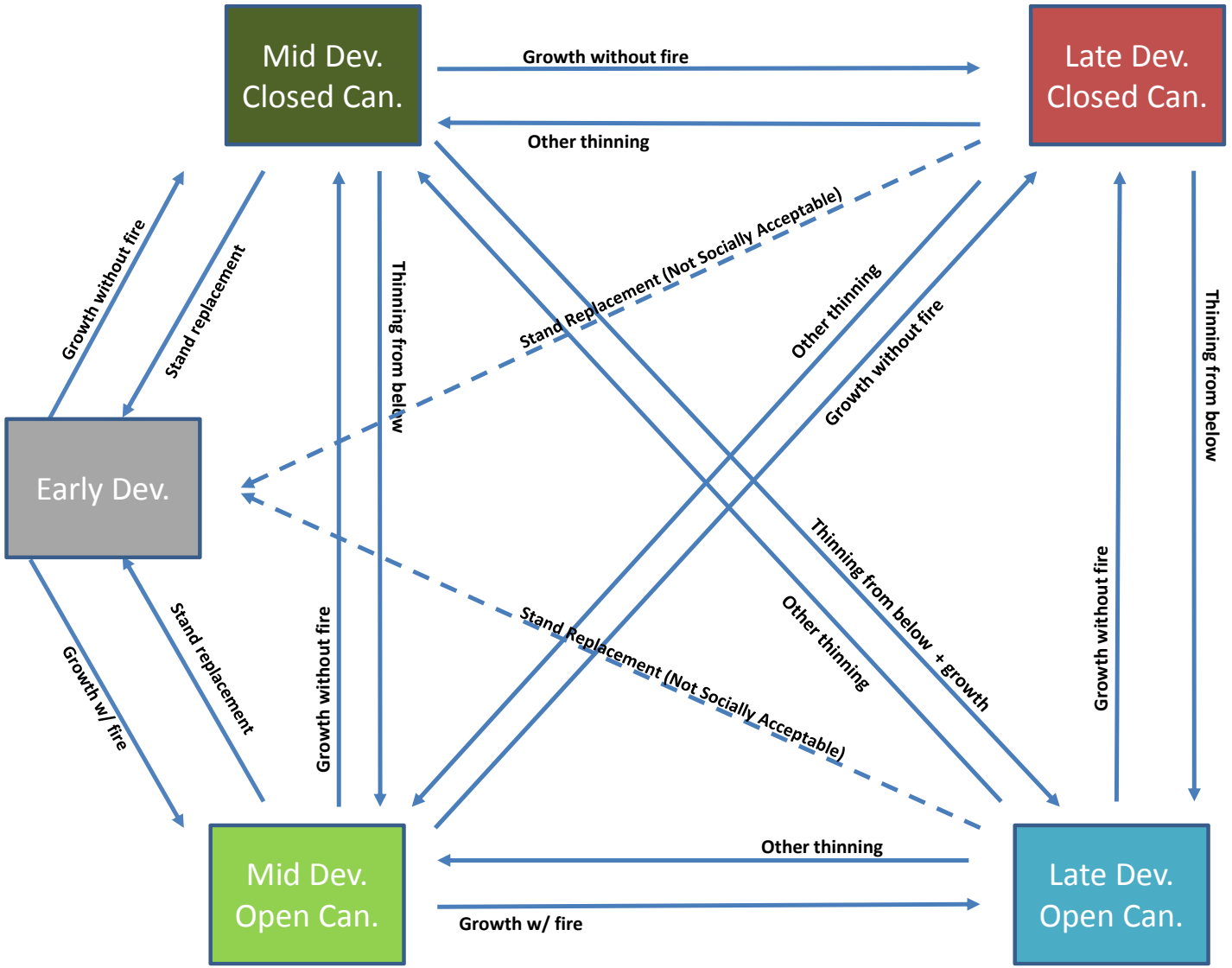

Figure 9. Default active and passive restoration transitions for low and mixed severity fire regime BioPhysical settings.

Clearwater Forest Conditions and Restoration Needs

The Restoration Needs calculations were conducted in a stepwise fashion for each BioPhysical Setting within each analysis unit. Following the same criteria as our analysis of Forest Structure Departure, all non-forest BioPhysical Settings and permanently converted forest BioPhysical Settings (agriculture, developed) were masked from the analysis. Analyses for low severity BioPhysical Settings were calculated within subwatersheds (6^{th}-level hydrologic units), mixed severity within watersheds (5^{th}-level hydrologic units) and high severity within subbasins (4^{th} level hydrologic units). We first calculated for each BioPhysical Setting within each analysis unit the excess or deficit abundance of each successional class when compared to that BioPhysical Settings historic reference condition. Based upon the top priority transition (e.g. row 1) in that BioPhysical Settings rules table (Tables 2 and 3), we determined if there was an excess of acres in the "donating" S-Class and a deficit in the "receiving" S-Class. If no, we skipped this transition step. If yes, we "moved" acres from the donating to the receiving S-Class, such that the receiving S-Class does not become in excess and the donating S-Class does not become in deficit relative to the reference condition. These "moved" acres are then considered "change acres" and part of the tally for that particular management category. We then recalculated the excess or deficit abundance of each S-Class following the hypothetical redistribution of acres between S-Classes in the previous step. Based upon the second priority transition in that BioPhysical Settings rules table (row 2), we determined if there was an excess in the "donor" S-Class and a deficit in the "receiving" S-Class. If yes, we "moved" acres following the same procedure as for the first priority transition. If no, we skipped this transition step. This process was then repeated for all transition steps for all BioPhysical Setting'-analysis unit combinations. Calculations were bulk processed using a custom script in Microsoft Access 2012.

To assess the extent to which eliminating forest structural departure requires passive restoration (e.g., growth only), we also recalculated forest structure departure following the hypothetical redistribution of S-Classes during the Restoration Needs analysis. This "Residual Departure" was calculated using the same algorithm as Forest Structure Departure in R (R Core Development Team, 2012). Comparison of the original Forest Structure Departure and the Residual Departure demonstrates the maximum possible immediate reduction in departure through active restoration.

Table 3. Default active change calculation rules table for low and mixed severity fire regime BioPhysical Settings. Early/Mid/Late refer to development status and Open/Closed refer to canopy cover as defined within Landfire Refresh 2008 BioPhysical Setting descriptions (Appendix A).

Priority	Donating State	Receiving State	Transition Category
1	Mid Closed	Mid Open	Thinning from below
2	Late Closed	Late Open	Thinning from below
3	Mid Closed	Late Open	Thinning from below + growth
4	Late Open	Mid Open	Other thinning
5	Late Closed	Mid Open	Other thinning
6	Late Open	Mid Closed	Other thinning + growth
7	Late Closed	Mid Closed	Other thinning + growth
8	Mid Closed	Early	Stand replacement
9	Mid Open	Early	Stand replacement
10	Late Closed	Early	Stand replacement
11	Early	Mid Open	Growth + low severity fire
12	Mid Open	Late Open	Growth + low severity fire
13	Early	Mid Closed	Growth without fire
14	Mid Closed	Late Closed	Growth without fire
15	Mid Open	Mid Closed	Growth without fire
16	Late Open	Late Closed	Growth without fire
17	Mid Open	Late Closed	Growth without fire
NA	Early	Late Open	Not applicable - time
NA	Early	Late Closed	Not applicable - time
NA	Late Open	Early	Not applicable - social

Table 4. Default active change calculation rules table for high severity fire regime BioPhysical Settings. Early/Mid/Late refer to development status and Open/Closed refer to canopy cover as defined within Landfire Refresh 2008 BioPhysical Setting descriptions.

Priority	Donating State	Receiving State	Transition Category
1	Mid Closed	Early	Stand replacement
2	Mid Open	Early	Stand replacement
3	Late Closed	Early	Stand replacement
4	Late Open	Mid Open	Other thinning
5	Late Open	Mid Closed	Other thinning
6	Late Closed	Mid Open	Other thinning
7	Mid Closed	Mid Open	Thinning from below
8	Late Closed	Late Open	Thinning from below
9	Mid Closed	Late Open	Other thinning + growth
10	Late Closed	Mid Closed	Other thinning + growth
11	Early	Mid Closed	Growth without fire
12	Mid Closed	Late Closed	Growth without fire
13	Mid Open	Mid Closed	Growth without fire
14	Late Open	Late Closed	Growth without fire
15	Mid Open	Late Closed	Growth without fire
NA	Early	Mid Open	Not applicable - succession
NA	Early	Late Open	Not applicable - time
NA	Early	Late Closed	Not applicable - time
NA	Mid Open	Late Open	Not applicable - succession
NA	Late Open	Early	Not applicable - social

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Appendix A: Clearwater Basin Forest BioPhysical Settings and Landfire National Exemplar Models

Table A.1. Landfire Refresh 2008 Forest BioPhysical Settings used in this analysis and the Landfire National exemplar models that have been modified through subsequent literature and expert review. See also the companion document "CBC_BpSModels.pdf" for complete descriptions of each exemplar model.

Clearwater Basin Assessment - Conifer BioPhysical Settings	Landfire National BioPhysical Setting ID	Landfire National - BioPhysical Setting Name
Low Severity Fire Regimes		
Ponderosa Pine-1	1010530	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna
Ponderosa Pine-3	0910532	Northern Rocky Mountain Ponderosa Pine Woodland and Savanna - Xeric
Ponderosa Pine-Douglas Fir-1	1010451	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Ponderosa Pine-Douglas-fir
Mixed Severity Fire Regimes		
Grand Fir-Douglas Fir-Beargrass-3	1010453	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Grand Fir
Grand Fir-Douglas Fir-Western Red Cedar-3	1010471	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest
Whitebark Pine-3	1010460	Northern Rocky Mountain Subalpine Woodland and Parkland
Western Larch-Douglas Fir-3	1010452	Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Larch
Grand Fir-Douglas Fir-Pacific Yew-3	0910470	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest
Douglas Fir-Ninebark-3	1011660	Middle Rocky Mountain Montane Douglas-fir Forest and Woodland
Quaking Aspen-Subalpine Fir-Douglas Fir-3	0910610	Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland
High Severity Fire Regimes		
Western Red Cedar-5	1010472	Northern Rocky Mountain Mesic Montane Mixed Conifer Forest - Cedar Groves
Engelmann Spruce-Subalpine Fir-4	1010550	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
Engelmann Spruce-Subalpine Fir-Menziesia-4	1010560	Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland
Engelmann Spruce-Ladyfern-5	1011610	Northern Rocky Mountain Conifer Swamp
Lodgepole Pine-Kinnikinnick-5	1011670	Rocky Mountain Poor-Site Lodgepole Pine Forest

Appendix A: Clearwater Basin Forest BioPhysical Settings and Landfire National Exemplar Models

Table A.2. Natural Range of Variability reference distribution of successional classes by BioPhysical Settings based upon the revised exemplar models (Table A.1). Typically, Successional Class A = Early Development, B = Mid Development Closed Canopy, C = Mid Development Open Canopy, D = Late Development Open Canopy, E = Late Development Closed Canopy

	Successional Classes				
BioPhysical Setting	**A**	**B**	**C**	**D**	**E**
Ponderosa Pine-1	5	10	20	55	10
Ponderosa Pine-3	25	5	25	40	5
Ponderosa Pine-Douglas Fir-1	10	15	30	35	10
Grand Fir-Douglas Fir-Beargrass-3	15	15	25	20	25
Grand Fir-Douglas Fir-Western Red Cedar-3	15	30	5	10	40
Whitebark Pine-3	20	40	15	5	20
Western Larch-Douglas Fir-3	10	15	25	30	20
Grand Fir-Douglas Fir-Pacific Yew-3	15	40	10	10	25
Douglas Fir-Ninebark-3	20	15	30	20	15
Quaking Aspen-Subalpine Fir-Douglas Fir-3*	14	40	35	10	1
Western Red Cedar-5	10	40	5	5	40
Engelmann Spruce-Subalpine Fir-4	15	45	15	5	20
Engelmann Spruce-Subalpine Fir-Menziesia-4*	15	30	10	45	na
Engelmann Spruce-Ladyfern-5*	10	20	70	na	na
Lodgepole Pine-Kinnikinnick-5*	15	25	15	45	na

*= BioPhysical Setting models with non-standard successional class assignments.

Appendix B: Clearwater Basin Forest BioPhysical Settings – Successional Classes

Table B.1. Current abundance (acres) of successional classes by BioPhysical Settings and Subbasins across the Clearwater Basin Collaborative assessment area. Only BioPhysical settings with greater than 500 acres per subbasin are displayed. Fire Regime Groups 1 = Low Severity, 3 = Mixed Severity, 4&5 = High Severity. Typically, Successional Class A = Early Development, B = Mid Development Closed Canopy, C = Mid Development Open Canopy, D = Late Development Open Canopy, E = Late Development Closed Canopy, and U = Uncharacteristic. However, certain BioPhysical Settings have alternative successional class definitions (Appendix A).

	Successional Classes					
BioPhysical Setting	**A**	**B**	**C**	**D**	**E**	**U**
Clearwater						
Ponderosa Pine-1	2,337	5,150	15,614	5,276	5,663	1,162
Ponderosa Pine-Douglas Fir-1	15,026	2,750	95,869	47,439	8,682	1,372
Douglas Fir-Ninebark-3	0	1	10	2,590	1,560	195
Grand Fir-Douglas Fir-Beargrass-3	42,770	833	1,715	46,436	83,772	17,549
Grand Fir-Douglas Fir-Pacific Yew-3	97	71	777	268	286	94
Grand Fir-Douglas Fir-Western Red Cedar-3	34,286	15,431	52,416	53,334	107,588	2,171
Western Larch-Douglas Fir-3	146	174	285	127	722	0
Engelmann Spruce-Subalpine Fir-4	2,242	39	60	721	654	48
Engelmann Spruce-Subalpine Fir-Menziesia-4	265	2	969	2,589	0	0
Engelmann Spruce-Ladyfern-5	1,142	1,757	4,916	0	0	184
Lodgepole Pine-Kinnikinnick-5	14	2	1,717	169	0	1
Hangman						
Ponderosa Pine-1	790	1,613	3,018	442	1,507	219
Ponderosa Pine-Douglas Fir-1	5,026	1,469	12,390	6,087	2,365	705
Grand Fir-Douglas Fir-Beargrass-3	3,793	13	102	4,419	8,202	880
Grand Fir-Douglas Fir-Western Red Cedar-3	799	243	1,245	1,415	1,077	17
Western Larch-Douglas Fir-3	76	169	144	30	157	3
Engelmann Spruce-Ladyfern-5	87	216	421	0	0	33
Hells Canyon						
Ponderosa Pine-1	10,867	2,772	16,003	2,272	2,202	927
Ponderosa Pine-Douglas Fir-1	5,660	420	14,127	5,579	1,039	318
Douglas Fir-Ninebark-3	0	8	33	434	363	263
Grand Fir-Douglas Fir-Beargrass-3	3,734	81	522	7,042	6,321	1,496
Grand Fir-Douglas Fir-Western Red Cedar-3	185	44	501	266	90	48
Whitebark Pine-3	3,699	148	1,080	2,877	969	5
Engelmann Spruce-Subalpine Fir-4	552	27	89	725	262	31
Engelmann Spruce-Subalpine Fir-Menziesia-4	5,603	238	11,963	4,223	0	296
Little Salmon						
Ponderosa Pine-1	9,135	11,736	23,561	9,333	15,672	1,974
Ponderosa Pine-Douglas Fir-1	1,847	963	12,773	8,249	5,911	156
Douglas Fir-Ninebark-3	0	3	19	563	1,405	151
Grand Fir-Douglas Fir-Beargrass-3	7,541	51	474	26,010	24,500	3,047
Grand Fir-Douglas Fir-Western Red Cedar-3	934	239	3,547	2,518	859	863
Whitebark Pine-3	10,839	122	672	7,374	1,736	6
Engelmann Spruce-Subalpine Fir-4	3,998	24	371	4,279	2,106	202
Engelmann Spruce-Subalpine Fir-Menziesia-4	23,975	340	37,085	22,372	0	995
Engelmann Spruce-Ladyfern-5	170	299	825	0	0	27
Lochsa						
Ponderosa Pine-Douglas Fir-1	2,556	2,154	8,378	5,212	9,102	12

Appendix B: Clearwater Basin Forest BioPhysical Settings – Successional Classes

Table B.1 continued.

BioPhysical Setting	Successional Classes A	B	C	D	E	U
Lochsa, continued						
Douglas Fir-Ninebark-3	0	0	18	262	249	144
Grand Fir-Douglas Fir-Beargrass-3	15,413	332	1,249	27,038	65,518	1,703
Grand Fir-Douglas Fir-Western Red Cedar-3	21,268	6,791	45,534	47,579	69,182	457
Western Larch-Douglas Fir-3	539	1,320	1,733	440	2,469	2
Whitebark Pine-3	12,044	99	680	14,130	3,575	5
Engelmann Spruce-Subalpine Fir-4	2,182	33	147	4,049	2,526	854
Engelmann Spruce-Subalpine Fir-Menziesia-4	47,656	426	146,990	149,214	0	4,142
Engelmann Spruce-Ladyfern-5	50	349	1,318	0	0	22
Western Red Cedar-5	64	20	43	70	511	2
Lower North Fork Clearwater						
Ponderosa Pine-1	263	187	95	28	775	19
Ponderosa Pine-Douglas Fir-1	5,577	1,955	5,036	3,058	5,802	75
Grand Fir-Douglas Fir-Beargrass-3	48,352	3,053	2,869	27,609	100,778	2,355
Grand Fir-Douglas Fir-Western Red Cedar-3	81,094	29,600	80,917	58,245	109,601	874
Western Larch-Douglas Fir-3	100	156	82	24	234	0
Engelmann Spruce-Subalpine Fir-4	484	24	39	331	705	9
Engelmann Spruce-Subalpine Fir-Menziesia-4	16,555	2,321	25,497	53,579	0	878
Engelmann Spruce-Ladyfern-5	761	1,046	4,975	0	0	106
Lower Salmon						
Ponderosa Pine-1	18,335	12,163	49,755	13,561	19,055	2,992
Ponderosa Pine-Douglas Fir-1	8,654	3,542	57,242	23,105	10,270	548
Douglas Fir-Ninebark-3	0	0	43	658	983	101
Grand Fir-Douglas Fir-Beargrass-3	11,358	275	1,210	33,907	68,589	2,480
Grand Fir-Douglas Fir-Pacific Yew-3	652	47	707	97	56	363
Grand Fir-Douglas Fir-Western Red Cedar-3	1,023	1,387	6,094	1,845	2,977	103
Ponderosa Pine-3	301	39	151	59	32	0
Western Larch-Douglas Fir-3	172	832	934	253	1,577	10
Whitebark Pine-3	5,031	113	561	8,783	3,447	4
Engelmann Spruce-Subalpine Fir-4	1,832	22	567	4,145	4,498	81
Engelmann Spruce-Subalpine Fir-Menziesia-4	8,114	82	22,994	28,630	0	381
Engelmann Spruce-Ladyfern-5	125	970	292	0	0	31
Lodgepole Pine-Kinnikinnick-5	21	0	1,374	163	0	1
Lower Selway						
Ponderosa Pine-Douglas Fir-1	3,781	1,915	9,580	10,822	14,781	183
Douglas Fir-Ninebark-3	0	0	3	133	318	115
Grand Fir-Douglas Fir-Beargrass-3	13,364	230	767	21,911	103,651	2,220
Grand Fir-Douglas Fir-Western Red Cedar-3	17,141	4,848	36,512	34,805	71,971	547
Western Larch-Douglas Fir-3	70	352	226	41	890	0
Whitebark Pine-3	12,500	54	345	13,359	4,635	3
Engelmann Spruce-Subalpine Fir-4	5,023	14	144	5,502	8,093	894
Engelmann Spruce-Subalpine Fir-Menziesia-4	35,160	169	86,796	81,974	0	5,784
Engelmannn Spruce-Ladyfern-5	89	379	3,805	0	0	23
Western Red Cedar-5	757	283	490	989	9,906	1
Lower Snake-Asotin						
Ponderosa Pine-1	73	131	537	72	21	341
Ponderosa Pine-Douglas Fir-1	5,275	38	8,213	3,302	21	148
Middle Fork Clearwater						
Ponderosa Pine-1	241	167	595	430	277	12

Appendix B: Clearwater Basin Forest BioPhysical Settings – Successional Classes

Table B.1 continued

BioPhysical Setting	Successional Classes A	B	C	D	E	U
Middle Fork Clearwater, continued						
Ponderosa Pine-Douglas Fir-1	1,984	1,521	7,097	4,027	5,413	181
Grand Fir-Douglas Fir-Beargrass-3	7,008	145	493	12,032	27,770	3,024
Grand Fir-Douglas Fir-Western Red Cedar-3	1,991	1,731	6,888	5,926	16,900	199
Western Larch-Douglas Fir-3	75	1,102	443	78	1,618	0
Engelmannn Spruce-Subalpine Fir-Menziesia-4	8	0	146	451	0	0
Engelmannn Spruce-Ladyfern-5	66	196	1,604	0	0	3
Western Red Cedar-5	33	44	64	103	1,595	0
Middle Salmon-Chamberlain						
Ponderosa Pine-1	30,457	21,456	47,450	18,895	21,341	5,390
Ponderosa Pine-Douglas Fir-1	12,992	5,528	50,258	20,531	6,834	109
Douglas Fir-Ninebark-3	0	49	1,141	23,889	19,791	8,748
Grand Fir-Douglas Fir-Beargrass-3	22,428	180	2,218	47,680	74,417	1,763
Grand Fir-Douglas Fir-Western Red Cedar-3	1,516	287	3,341	2,926	1,521	334
Whitebark Pine-3	46,573	563	5,092	85,047	37,738	16
Engelmannn Spruce-Subalpine Fir-4	12,499	50	2,266	24,637	16,626	316
Engelmannn Spruce-Subalpine Fir-Menziesia-4	41,196	193	111,580	135,693	0	1,629
Engelmannn Spruce-Ladyfern-5	1,340	6,256	457	0	0	336
Lodgepole Pine-Kinnikinnick-5	1,428	1	2,377	554	0	278
Palouse						
Ponderosa Pine-1	898	950	3,692	477	1,165	360
Ponderosa Pine-Douglas Fir-1	7,442	2,528	13,471	8,531	5,511	1,022
Grand Fir-Douglas Fir-Beargrass-3	15,989	259	611	15,207	37,227	2,386
Grand Fir-Douglas Fir-Western Red Cedar-3	7,193	3,346	11,657	9,089	14,156	107
Western Larch-Douglas Fir-3	158	266	86	36	421	0
Engelmannn Spruce-Subalpine Fir-4	477	3	12	138	187	26
Engelmann Spruce-Ladyfern-5	399	529	1,341	0	0	63
Rock						
Ponderosa Pine-Douglas Fir-1	262	58	862	996	288	53
Grand Fir-Douglas Fir-Beargrass-3	168	1	2	191	332	72
South Fork Clearwater						
Ponderosa Pine-1	325	821	3,165	1,915	654	22
Ponderosa Pine-Douglas Fir-1	6,164	4,338	25,924	25,160	19,918	449
Grand Fir-Douglas Fir-Beargrass-3	16,382	538	1,257	30,758	187,383	1,497
Grand Fir-Douglas Fir-Western Red Cedar-3	5,678	4,947	22,275	16,926	43,478	113
Western Larch-Douglas Fir-3	185	1,722	1,215	359	4,600	3
Whitebark Pine-3	2,713	53	106	5,160	4,688	8
Engelmann Spruce-Subalpine Fir-4	614	40	58	2,156	11,098	113
Engelmann Spruce-Subalpine Fir-Menziesia-4	4,453	185	11,880	64,414	0	348
Engelmann Spruce-Ladyfern-5	72	831	1,630	0	0	10
Upper North Fork Clearwater						
Ponderosa Pine-Douglas Fir-1	4,457	1,697	6,776	3,669	4,174	50
Grand Fir-Douglas Fir-Beargrass-3	35,790	3,343	2,067	31,057	87,392	2,737
Grand Fir-Douglas Fir-Western Red Cedar-3	45,575	14,547	65,655	61,831	78,428	1,694
Western Larch-Douglas Fir-3	179	258	176	14	118	1
Whitebark Pine-3	2,710	87	119	1,998	569	1
Engelmann Spruce-Subalpine Fir-4	857	85	120	1,216	1,206	34
Engelmann Spruce-Subalpine Fir-Menziesia-4	53,284	4,870	110,028	157,158	0	5,137
Engelmann Spruce-Ladyfern-5	115	196	1,052	0	0	6

Appendix B: Clearwater Basin Forest BioPhysical Settings – Successional Classes

Table B.1 continued.

BioPhysical Setting	Successional Classes					
	A	B	C	D	E	U
Upper Selway						
Ponderosa Pine-Douglas Fir-1	15,113	5,013	46,465	27,825	10,027	910
Douglas Fir-Ninebark-3	0	3	284	3,961	2,908	2,254
Grand Fir-Douglas Fir-Beargrass-3	19,024	80	1,379	39,953	93,583	5,043
Grand Fir-Douglas Fir-Western Red Cedar-3	2,800	1,434	7,413	5,939	7,547	155
Whitebark Pine-3	30,696	276	3,359	35,307	13,712	8
Engelmann Spruce-Subalpine Fir-4	4,281	9	367	6,733	5,636	517
Engelmann Spruce-Subalpine Fir-Menziesia-4	32,940	205	75,627	69,167	0	5,874
Engelmann Spruce-Ladyfern-5	136	899	870	0	0	29
Western Red Cedar-5	55	6	21	67	464	0

Appendix C: Clearwater Basin Forest BioPhysical Settings – Forest Ownership

Table C.1. Forest ownership – management (acres) by BioPhysical Settings and Subbasins across the Clearwater Basin Collaborative assessment area. Note: Only BioPhysical settings with greater than 500 acres per subbasin are displayed. IDFG = Idaho Fish and Game, IDL = Idaho Department of Lands, NF = National Forests, IRA = Inventoried Roadless Areas, Wild. = Wilderness Areas.

		Non-Federal				Nez Perce-Clearwater NF			Other NF		
BioPhysical Setting	**Private**	**Tribal**	**IDFG**	**IDL**	**Other**	**General**	**IRA**	**Wild.**	**General**	**IRA**	**Wild.**
Clearwater											
Ponderosa Pine-1	31,256	3,194	127	435	172	15					
Ponderosa Pine-Douglas Fir-1	133,790	20,545	3,797	4,840	3,757	4,405					
Douglas Fir-Ninebark-3	3,142	978	165	22		48					
Grand Fir-Douglas Fir-Beargrass-3	127,778	6,473	184	29,995	3,546	23,941	1,148				
Grand Fir-Douglas Fir-Pacific Yew-3	1,401	83	24	77	8						
Grand Fir-Douglas Fir-Western Red Cedar-3	115,933	610		56,996	644	85,928	5,104				
Western Larch-Douglas Fir-3	905	128		338	19	64					
Engelmann Spruce-Subalpine Fir-4	3,428	205		129		1					
Engelmann Spruce-Subalpine Fir-Menziesia-4	8			11		3,535	272				
Engelmann Spruce-Ladyfern-5	4,941	206	50	1,548	241	1,012					
Lodgepole Pine-Kinnikinnick-5	1,484	282	137								
Hangman											
Ponderosa Pine-1	3,090	4,386		100					7		
Ponderosa Pine-Douglas Fir-1	21,576	3,956		868	921	609			92		
Grand Fir-Douglas Fir-Beargrass-3	13,959	1,539		353	482	1,064			1		
Grand Fir-Douglas Fir-Western Red Cedar-3	3,923	233		64	75	482			14		
Western Larch-Douglas Fir-3	521	39		13	2	4					
Engelmann Spruce-Ladyfern-5	465	248		20	3	18			2		
Hells Canyon											
Ponderosa Pine-1	11,700			2,302	1,027	1,389	5,623	9,698	248	1,589	1,341
Ponderosa Pine-Douglas Fir-1	8,809			1,469	819	1,357	4,269	8,249	31	1,143	994
Douglas Fir-Ninebark-3	1			1	2	2	104	522	5	169	295
Grand Fir-Douglas Fir-Beargrass-3	3,301			754	297	3,398	2,113	6,536	68	1,334	1,394
Grand Fir-Douglas Fir-Western Red Cedar-3	56			13	10	215	7	616	2	102	111
Whitebark Pine-3	30					145	7	5,139	93	653	2,709

Appendix C: Clearwater Basin Forest BioPhysical Settings – Forest Ownership

Table C.1 continued.

	Non-Federal					Nez Perce-Clearwater NF			Other NF		
BioPhysical Setting	**Private**	**Tribal**	**IDFG**	**IDL**	**Other**	**General**	**IRA**	**Wild.**	**General**	**IRA**	**Wild.**
Hells Canyon continued											
Engelmann Spruce-Subalpine Fir-4	59			24	2	140	8	570	37	242	606
Engelmann Spruce-Subalpine Fir-Menziesia-4	208			50	24	1,421	31	11,509	470	1,638	6,968
Little Salmon											
Ponderosa Pine-1	25,979		2	2,145	5,701	4,175	5,303	71	16,326	11,672	12
Ponderosa Pine-Douglas Fir-1	9,167		3	1,242	3,899	1,640	2,611	16	5,881	5,422	19
Douglas Fir-Ninebark-3	232			48	379	325	360	6	122	611	58
Grand Fir-Douglas Fir-Beargrass-3	22,224			3,104	2,564	1,886	3,837	35	16,597	11,299	67
Grand Fir-Douglas Fir-Western Red Cedar-3	3,842		2	797	293	337	688		1,735	1,266	
Whitebark Pine-3	166			198	30	59	1,592	1,740	1,252	14,094	1,611
Engelmann Spruce-Subalpine Fir-4	130			309	96	39	481	31	1,759	7,971	165
Engelmann Spruce-Subalpine Fir-Menziesia-4	842			3,420	885	1,615	6,765	2,882	17,187	48,366	2,781
Engelmann Spruce-Ladyfern-5	605		0	46	69	18	26	5	353	199	
Lochsa											
Ponderosa Pine-Douglas Fir-1	1,292					4,106	18,203	3,811			
Douglas Fir-Ninebark-3	119					135	266	152			
Grand Fir-Douglas Fir-Beargrass-3	6,666			1	12	31,514	59,425	13,633			
Grand Fir-Douglas Fir-Western Red Cedar-3	8,068				167	50,263	106,092	26,221			
Western Larch-Douglas Fir-3	1,411					1,399	2,278	1,416			
Whitebark Pine-3	1,192				2	908	5,779	22,458			
Engelmann Spruce-Subalpine Fir-4	318					781	3,507	5,173			
Engelmann Spruce-Subalpine Fir-Menziesia-4	19,146				83	44,558	125,137	159,352			
Engelmann Spruce-Ladyfern-5	64				22	467	995	192			
Western Red Cedar-5	22				7	189	480	11			
Lower North Fork Clearwater											
Ponderosa Pine-1	417			339	542	46	22		2		
Ponderosa Pine-Douglas Fir-1	8,168	37	397	3,492	1,262	3,289	1,267		1,169	2,425	
Grand Fir-Douglas Fir-Beargrass-3	85,146	215	2,874	49,331	5,662	13,650	5,751		9,277	13,102	
Grand Fir-Douglas Fir-Western Red Cedar-3	166,195	57	2,657	101,908	7,286	34,214	9,598		14,183	24,229	

Appendix C: Clearwater Basin Forest BioPhysical Settings – Forest Ownership

Table C.1 continued.

	Non-Federal					Nez Perce-Clearwater NF			Other NF		
BioPhysical Setting	**Private**	**Tribal**	**IDFG**	**IDL**	**Other**	**General**	**IRA**	**Wild.**	**General**	**IRA**	**Wild.**
Lower North Fork Clearwater continued											
Western Larch-Douglas Fir-3	237	7	30	100	18	45	37		43	79	
Engelmann Spruce-Subalpine Fir-4	1,136	3	1	208	10	35	93		5	100	
Engelmann Spruce-Subalpine Fir-Menziesia-4	6,562		5,842	2,770	9,501	1,484	11,309		25,625	35,666	
Engelmann Spruce-Ladyfern-5	2,989	7	2	1,897	1,163	703	56		7	64	
Lower Salmon											
Ponderosa Pine-1	51,497		792	6,941	13,956	30,748	8,014		530	3,381	
Ponderosa Pine-Douglas Fir-1	44,118		12,991	11,717	7,082	19,838	4,232	430	592	2,364	
Douglas Fir-Ninebark-3	582		110	77	30	413	397	18	7	151	
Grand Fir-Douglas Fir-Beargrass-3	8,418		178	8,137	4,806	62,416	13,922	1,416	1,811	16,715	
Grand Fir-Douglas Fir-Pacific Yew-3	1,442		312	159	10						
Grand Fir-Douglas Fir-Western Red Cedar-3	392		4	185	200	11,097	894	11	46	598	
Ponderosa Pine-3	372		158	17	35						
Western Larch-Douglas Fir-3	1,340		39	359	239	1,565	230		1	5	
Whitebark Pine-3	1			59	22	1,343	3,169	1,922	264	11,148	
Engelmann Spruce-Subalpine Fir-4	108			58	47	2,339	752	1,097	1,229	5,516	
Engelmann Spruce-Subalpine Fir-Menziesia-4	338		0	533	347	16,777	7,549	1,697	4,657	28,301	
Engelmann Spruce-Ladyfern-5	69		3	49	38	410	40	29	119	663	
Lodgepole Pine-Kinnikinnick-5	1,009		402	139	10						
Lower Selway											
Ponderosa Pine-Douglas Fir-1	154			30	44	3,881	11,643	25,313			
Douglas Fir-Ninebark-3						3	181	385			
Grand Fir-Douglas Fir-Beargrass-3	141			50	77	6,529	71,293	64,054			
Grand Fir-Douglas Fir-Western Red Cedar-3	180			84	25	31,202	66,682	67,650			
Western Larch-Douglas Fir-3					4	339	509	728			
Whitebark Pine-3						22	2,852	27,973			
Engelmann Spruce-Subalpine Fir-4						223	10,582	8,865			
Engelmann Spruce-Subalpine Fir-Menziesia-4						4,419	46,622	158,840			
Engelmann Spruce-Ladyfern-5	62			27	146	589	2,060	1,413			

Appendix C: Clearwater Basin Forest BioPhysical Settings – Forest Ownership

Table C.1 continued.

	Non-Federal					Nez Perce-Clearwater NF			Other NF		
BioPhysical Setting	**Private**	**Tribal**	**IDFG**	**IDL**	**Other**	**General**	**IRA**	**Wild.**	**General**	**IRA**	**Wild.**
Lower Selway continued											
Western Red Cedar-5	73			43	9	2,401	6,485	3,416			
Lower Snake-Asotin											
Ponderosa Pine-1	647		348	11	140				5		
Ponderosa Pine-Douglas Fir-1	2,598		8,589	686	5,050				10		
Middle Fork Clearwater											
Ponderosa Pine-1	1,348	51	0	255	5	62					
Ponderosa Pine-Douglas Fir-1	8,210	575	0	944	236	7,670	2,587				
Grand Fir-Douglas Fir-Beargrass-3	20,368	447		10,043	87	16,401	3,128				
Grand Fir-Douglas Fir-Western Red Cedar-3	1,725	6		4,579	22	25,232	2,071				
Western Larch-Douglas Fir-3	101	4		46		2,829	336				
Engelmann Spruce-Subalpine Fir-Menziesia-4	0					604	1				
Engelmann Spruce-Ladyfern-5	524	8		338	26	832	141				
Western Red Cedar-5	142			116	30	1,502	50				
Middle Salmon-Chamberlain											
Ponderosa Pine-1	483			17	432	6,670	4,262	43,608	3,140	7,315	79,064
Ponderosa Pine-Douglas Fir-1	212			53	237	3,937	5,830	25,262	1,878	4,142	54,700
Douglas Fir-Ninebark-3	161				48	75	596	2,947	459	2,834	46,493
Grand Fir-Douglas Fir-Beargrass-3	722			328	2,798	9,727	18,255	31,647	5,536	18,372	61,298
Grand Fir-Douglas Fir-Western Red Cedar-3	43				32	1,119	1,698	4,579	276	311	1,867
Whitebark Pine-3	988			12	2,875	5,912	2,507	41,233	8,773	23,628	89,028
Engelmann Spruce-Subalpine Fir-4	335			75	501	2,761	5,960	4,161	3,108	6,420	33,051
Engelmann Spruce-Subalpine Fir-Menziesia-4	1,738			144	2,836	28,360	53,175	52,625	14,764	32,717	103,914
Engelmann Spruce-Ladyfern-5	649				15	1,031	1,278	599	826	779	3,212
Lodgepole Pine-Kinnikinnick-5	57					91	151	1	23	12	4,302
Palouse											
Ponderosa Pine-1	7,193		3	328	10	7					
Ponderosa Pine-Douglas Fir-1	29,270	6	1	760	4,398	4,065					
Grand Fir-Douglas Fir-Beargrass-3	46,651			1,610	1,604	21,802					

Appendix C: Clearwater Basin Forest BioPhysical Settings – Forest Ownership

Table C.1 Continued

	Non-Federal					Nez Perce-Clearwater NF			Other NF		
BioPhysical Setting	**Private**	**Tribal**	**IDFG**	**IDL**	**Other**	**General**	**IRA**	**Wild.**	**General**	**IRA**	**Wild.**
Palouse continued											
Grand Fir-Douglas Fir-Western Red Cedar-3	20,103			815	924	23,693					
Western Larch-Douglas Fir-3	642			13	29	281					
Engelmann Spruce-Subalpine Fir-4	836					6					
Engelmann Spruce-Ladyfern-5	1,647			22	192	472					
Rock											
Ponderosa Pine-Douglas Fir-1	1,379			1	1,075	63					
Grand Fir-Douglas Fir-Beargrass-3	402				363	1					
South Fork Clearwater											
Ponderosa Pine-1	5,546	824	0	100	26	404	1				
Ponderosa Pine-Douglas Fir-1	22,535	1,174	284	1,180	1,006	52,122	939	2,713			
Grand Fir-Douglas Fir-Beargrass-3	12,280		54	291	8,521	183,042	17,455	16,172			
Grand Fir-Douglas Fir-Western Red Cedar-3	1,578		0	107	2,317	67,848	20,714	854			
Western Larch-Douglas Fir-3	1,331		7	54	2	6,494	161	33			
Whitebark Pine-3	54					1,246	653	10,775			
Engelmann Spruce-Subalpine Fir-4	46		1		26	6,808	1,887	5,310			
Engelmann Spruce-Subalpine Fir-Menziesia-4	456		0		62	34,162	18,454	28,147			
Engelmann Spruce-Ladyfern-5	126		2	6	99	1,973	96	241			
Upper North Fork Clearwater											
Ponderosa Pine-Douglas Fir-1	373			69	4	5,398	14,980				
Grand Fir-Douglas Fir-Beargrass-3	14,894			4,971	47	42,828	99,646				
Grand Fir-Douglas Fir-Western Red Cedar-3	13,329			4,092	163	76,320	173,827				
Western Larch-Douglas Fir-3	69			20		129	527				
Whitebark Pine-3						25	5,431			0	
Engelmann Spruce-Subalpine Fir-4	1					543	2,974				
Engelmann Spruce-Subalpine Fir-Menziesia-4	267			57	8	41,663	288,268			12	
Engelmann Spruce-Ladyfern-5	0				145	729	496				
Upper Selway											
Ponderosa Pine-Douglas Fir-1	64				63	1	2,142	18,226	918		83,937

Appendix C: Clearwater Basin Forest BioPhysical Settings – Forest Ownership

Table C.1 continued.

BioPhysical Setting	Non-Federal					Nez Perce-Clearwater NF			Other NF		
	Private	Tribal	IDFG	IDL	Other	General	IRA	Wild.	General	IRA	Wild.
Upper Selway continued											
Douglas Fir-Ninebark-3					1		19	255	51		9,081
Grand Fir-Douglas Fir-Beargrass-3	2				23	33	14,823	58,650	675		84,855
Grand Fir-Douglas Fir-Western Red Cedar-3						2	1,152	18,338	0		5,796
Whitebark Pine-3						4	1,435	21,323	656		59,662
Engelmann Spruce-Subalpine Fir-4						3	1,149	6,368	15		10,002
Engelmann Spruce-Subalpine Fir-Menziesia-4						21	9,275	70,448	238		103,765
Engelmann Spruce-Ladyfern-5					16		49	678	53		1,137
Western Red Cedar-5							1	600			12

Appendix D: Clearwater Basin BioPhysical Settings - Forest Restoration Needs

Table D.1. Active and passive forest restoration needs (acres) by BioPhysical Settings and Subbasins across the Clearwater Basin Collaborative assessment area. Note: Only BioPhysical settings with greater than 500 acres per subbasin are displayed.

		Active Restoration			Passive Restoration	
BioPhysical Setting - Fire Regime Group	Total	Thinning from Below	Other Thinning	Stand Replacement	Grow w/ Fire	Grow w/o Fire
Clearwater						
Ponderosa Pine-1	35,199	2,779	0	615	8,032	560
Ponderosa Pine-Douglas Fir-1	171,134	2,405	4,562	5,201	13,944	29,660
Douglas Fir-Ninebark-3	4,355	0	1,930	637	0	1
Grand Fir-Douglas Fir-Beargrass-3	193,065	938	43,749	425	4,851	9,394
Grand Fir-Douglas Fir-Pacific Yew-3	1,593	0	157	145	2	498
Grand Fir-Douglas Fir-Western Red Cedar-3	265,215	0	33,202	7,932	0	33,678
Western Larch-Douglas Fir-3	1,454	295	119	39	42	25
Engelmann Spruce-Subalpine Fir-4	3,763	0	531	0	0	1,630
Engelmann Spruce-Subalpine Fir-Menziesia-4	3,826	0	868	310	0	0
Lodgepole Pine-Kinnikinnick-5	1,903	0	0	272	0	0
Hangman						
Ponderosa Pine-1	7,583	781	0	16	1,501	32
Ponderosa Pine-Douglas Fir-1	28,022	65	0	22	2,701	3,004
Grand Fir-Douglas Fir-Beargrass-3	17,398	0	4,790	0	62	1,120
Grand Fir-Douglas Fir-Western Red Cedar-3	4,791	0	937	10	0	1,084
Western Larch-Douglas Fir-3	579	57	0	11	15	0
Hells Canyon						
Ponderosa Pine-1	34,917	149	0	0	8,988	1,793
Ponderosa Pine-Douglas Fir-1	27,140	0	59	175	3,288	4,442
Douglas Fir-Ninebark-3	1,101	0	412	0	0	0
Grand Fir-Douglas Fir-Beargrass-3	19,195	0	4,815	0	391	461
Grand Fir-Douglas Fir-Western Red Cedar-3	1,132	0	153	6	1	458
Whitebark Pine-3	8,776	0	2,441	0	0	1,159
Engelmann Spruce-Subalpine Fir-4	1,688	0	641	0	0	255
Engelmann Spruce-Subalpine Fir-Menziesia-4	22,319	0	0	0	0	2,255
Little Salmon						
Ponderosa Pine-1	71,386	8,872	0	41	9,272	351
Ponderosa Pine-Douglas Fir-1	29,900	1,060	2,253	1,267	1,378	2,166

Appendix D: Clearwater Basin BioPhysical Settings - Forest Restoration Needs

Table D.1 continued.

BioPhysical Setting - Fire Regime Group	Total	Active Restoration			Passive Restoration	
		Thinning from Below	Other Thinning	Stand Replacement	Grow w/ Fire	Grow w/o Fire
Little Salmon continued						
Douglas Fir-Ninebark-3	2,141	0	942	277	0	0
Grand Fir-Douglas Fir-Beargrass-3	61,613	0	22,053	1,082	0	291
Grand Fir-Douglas Fir-Western Red Cedar-3	8,960	0	1,621	412	0	2,689
Whitebark Pine-3	20,742	0	6,336	0	0	4,290
Engelmann Spruce-Subalpine Fir-4	10,981	0	3,734	0	0	2,350
Engelmann Spruce-Subalpine Fir-Menziesia-4	84,743	0	0	0	0	11,274
Lochsa						
Ponderosa Pine-Douglas Fir-1	27,412	3,495	2,610	667	862	1,045
Douglas Fir-Ninebark-3	672	6	257	19	0	0
Grand Fir-Douglas Fir-Beargrass-3	111,251	547	40,906	1,574	0	851
Grand Fir-Douglas Fir-Western Red Cedar-3	190,811	0	30,367	7,709	0	29,588
Western Larch-Douglas Fir-3	6,504	958	173	162	399	0
Whitebark Pine-3	30,339	0	12,780	0	0	3,240
Engelmann Spruce-Subalpine Fir-4	9,779	0	4,132	0	0	715
Engelmann Spruce-Subalpine Fir-Menziesia-4	348,276	0	0	4,530	0	0
Western Red Cedar-5	709	0	261	6	0	1
Lower North Fork Clearwater						
Ponderosa Pine-1	1,368	660	11	1	139	9
Ponderosa Pine-Douglas Fir-1	21,506	2,630	1,307	45	734	1,130
Grand Fir-Douglas Fir-Beargrass-3	185,008	10,409	45,097	0	6,063	14,550
Grand Fir-Douglas Fir-Western Red Cedar-3	360,327	0	22,236	252	0	87,467
Western Larch-Douglas Fir-3	596	116	34	3	9	10
Engelmann Spruce-Subalpine Fir-4	1,591	0	638	0	0	245
Engelmann Spruce-Subalpine Fir-Menziesia-4	98,759	0	9,092	0	0	1,779
Engelmann Spruce-Ladyfern-5	6,888	0	0	0	0	152
Lower Salmon						
Ponderosa Pine-1	115,859	8,821	14	85	26,272	3,325
Ponderosa Pine-Douglas Fir-1	103,364	2,924	2,880	3,177	11,491	14,531
Douglas Fir-Ninebark-3	1,785	40	750	271	0	0
Grand Fir-Douglas Fir-Beargrass-3	117,819	611	44,207	5,642	31	474
Grand Fir-Douglas Fir-Pacific Yew-3	1,923	0	0	0	95	718

Appendix D: Clearwater Basin BioPhysical Settings - Forest Restoration Needs

Table D.1 continued.

BioPhysical Setting - Fire Regime Group	Total	Active Restoration			Passive Restoration	
		Thinning from Below	Other Thinning	Stand Replacement	Grow w/ Fire	Grow w/o Fire
Lower Salmon continued						
Grand Fir-Douglas Fir-Western Red Cedar-3	13,427	0	563	1,175	53	4,291
Ponderosa Pine-3	582	16	0	21	42	12
Western Larch-Douglas Fir-3	3,778	691	78	196	58	2
Whitebark Pine-3	17,928	0	8,304	486	0	889
Engelmann Spruce-Subalpine Fir-4	11,146	0	5,862	0	0	156
Engelmann Spruce-Subalpine Fir-Menziesia-4	60,199	0	1,565	903	0	0
Lodgepole Pine-Kinnikinnick-5	1,560	0	0	214	0	0
Lower Selway						
Ponderosa Pine-Douglas Fir-1	41,065	3,804	6,393	1,086	292	919
Douglas Fir-Ninebark-3	569	13	237	15	0	0
Grand Fir-Douglas Fir-Beargrass-3	142,144	6,730	54,765	6,794	0	624
Grand Fir-Douglas Fir-Western Red Cedar-3	165,823	0	25,807	7,702	0	20,542
Western Larch-Douglas Fir-3	1,580	509	89	87	0	0
Whitebark Pine-3	30,847	0	11,806	0	0	4,794
Engelmann Spruce-Subalpine Fir-4	19,670	0	8,675	0	0	2,065
Engelmann Spruce-Subalpine Fir-Menziesia-4	209,881	0	0	0	0	3,778
Engelmann Spruce-Ladyfern-5	4,297	0	0	0	0	481
Western Red Cedar-5	12,427	0	4,822	485	0	0
Lower Snake-Asotin						
Ponderosa Pine-1	1,151	2	0	11	285	43
Ponderosa Pine-Douglas Fir-1	16,933	0	0	1	1,536	3,394
Middle Fork Clearwater						
Ponderosa Pine-1	1,721	110	1	3	252	22
Ponderosa Pine-Douglas Fir-1	20,222	2,457	665	571	532	1,148
Grand Fir-Douglas Fir-Beargrass-3	50,474	203	16,585	518	0	480
Grand Fir-Douglas Fir-Western Red Cedar-3	33,635	0	6,012	3,060	0	2,146
Western Larch-Douglas Fir-3	3,316	1,302	0	256	0	0
Engelmann Spruce-Subalpine Fir-Menziesia-4	605	0	179	84	0	0
Engelmann Spruce-Ladyfern-5	1,869	0	0	0	0	178
Western Red Cedar-5	1,840	0	719	151	0	0

Appendix D: Clearwater Basin BioPhysical Settings - Forest Restoration Needs

Table D.1 continued

BioPhysical Setting - Fire Regime Group	Total	Active Restoration			Passive Restoration	
		Thinning from Below	Other Thinning	Stand Replacement	Grow w/ Fire	Grow w/o Fire
Middle Salmon-Chamberlain						
Ponderosa Pine-1	144,991	9,262	123	34	19,633	1,793
Ponderosa Pine-Douglas Fir-1	96,251	1,083	873	1,694	12,275	12,739
Douglas Fir-Ninebark-3	53,613	75	22,644	2,272	0	0
Grand Fir-Douglas Fir-Beargrass-3	148,683	0	52,739	2,730	122	4,069
Grand Fir-Douglas Fir-Western Red Cedar-3	9,925	0	1,917	363	14	2,805
Whitebark Pine-3	174,956	0	80,361	2,450	0	10,993
Engelmann Spruce-Subalpine Fir-4	56,372	0	27,182	0	0	4,060
Engelmann Spruce-Subalpine Fir-Menziesia-4	290,273	0	4,935	2,322	0	0
Lodgepole Pine-Kinnikinnick-5	4,637	0	0	0	0	733
Palouse						
Ponderosa Pine-1	7,541	429	0	16	2,182	55
Ponderosa Pine-Douglas Fir-1	38,500	1,943	47	103	2,126	3,072
Grand Fir-Douglas Fir-Beargrass-3	71,667	0	20,195	22	0	5,325
Grand Fir-Douglas Fir-Western Red Cedar-3	45,535	0	4,523	10	0	9,737
Western Larch-Douglas Fir-3	965	348	1	0	34	0
Engelmann Spruce-Subalpine Fir-4	842	0	115	0	0	351
Rock						
Ponderosa Pine-Douglas Fir-1	2,518	0	179	9	16	101
Grand Fir-Douglas Fir-Beargrass-3	766	0	178	0	11	42
South Fork Clearwater						
Ponderosa Pine-1	6,901	118	1	126	1,554	228
Ponderosa Pine-Douglas Fir-1	81,953	4,546	8,264	2,222	555	2,955
Grand Fir-Douglas Fir-Beargrass-3	237,815	16,937	92,287	18,739	0	638
Grand Fir-Douglas Fir-Western Red Cedar-3	93,418	0	13,819	8,321	1	9,402
Western Larch-Douglas Fir-3	8,082	2,453	363	622	1	3
Whitebark Pine-3	12,728	0	6,469	202	0	372
Engelmann Spruce-Subalpine Fir-4	14,078	0	8,236	1,492	0	0
Engelmann Spruce-Subalpine Fir-Menziesia-4	81,281	0	23,815	3,739	0	0
Upper North Fork Clearwater						
Ponderosa Pine-Douglas Fir-1	20,824	1,692	736	16	1,470	1,497
Grand Fir-Douglas Fir-Beargrass-3	162,386	3,685	44,757	606	1,695	10,844

Appendix D: Clearwater Basin BioPhysical Settings - Forest Restoration Needs

Table D.1 continued.

BioPhysical Setting - Fire Regime Group	Total	Active Restoration			Passive Restoration	
		Thinning from Below	Other Thinning	Stand Replacement	Grow w/ Fire	Grow w/o Fire
Upper North Fork Clearwater						
Grand Fir-Douglas Fir-Western Red Cedar-3	267,731	0	39,935	3,501	0	57,630
Western Larch-Douglas Fir-3	745	56	1	3	37	42
Whitebark Pine-3	5,456	0	1,736	0	5	1,072
Engelmann Spruce-Subalpine Fir-4	3,518	0	1,545	0	0	331
Engelmann Spruce-Subalpine Fir-Menziesia-4	330,275	0	8,592	0	0	3,635
Engelmann Spruce-Ladyfern-5	1,370	0	0	0	0	78
Upper Selway						
Ponderosa Pine-Douglas Fir-1	105,351	2,272	3,305	1,337	8,305	11,413
Douglas Fir-Ninebark-3	9,407	15	3,285	289	0	0
Grand Fir-Douglas Fir-Beargrass-3	159,061	1,286	58,465	3,785	0	1,517
Grand Fir-Douglas Fir-Western Red Cedar-3	25,288	0	3,411	996	0	5,154
Whitebark Pine-3	83,080	0	32,681	88	0	9,509
Engelmann Spruce-Subalpine Fir-4	17,537	0	7,982	0	0	1,649
Engelmann Spruce-Subalpine Fir-Menziesia-4	183,747	0	0	0	0	5,331
Western Red Cedar-5	613	0	249	6	0	0