Supplement to The Imnaha Subbasin Plan

Introduction

This document has been written by Craig Rabe, Anne Davidson and Darin Saul of Ecovista to summarize and clarify the information presented in the May 2004 draft Imnaha Subbasin Assessment and Imnaha Subbasin Management Plan (available at www.nwppc.org). Information that provides context, additional detail, supporting data and references can be found in these documents. This supplement was reviewed by the Imnaha Technical and Planning Teams during the fall of 2004.

This supplement is presented in four sections that correspond to information requested by the Northwest Power and Conservation Council. Section I summarizes factors limiting aquatic and terrestrial species in the Imnaha subbasin. Section II summarizes the prioritization of these limiting factors. Section III identifies objectives and strategies from the Imnaha Subbasin Management Plan. Section IV describes the prioritization of strategies.

I. Explanation of key factors limiting the biological potential of selected focal species in the subbasin

In general, the Imnaha subbasin is in good condition relative to other subbasins in the Columbia Basin. A high percentage of its area is protected and, compared to other subbasins, habitat are in relatively good shape, with conditions generally improving over the past 20 to 30 years with better land management practices and reduced levels of road construction, logging, and grazing. Like other Snake River subbasins, though, it has suffered disproportionately severe impacts from the Columbia River hydropower system. During the assessment process, a number of issues emerged as having a significant impact on focal wildlife and fish species in the subbasin. These issues were identified as limiting factors in the assessment and are discussed below. Some of these limiting factors are influenced primarily by events outside of the subbasin (out of subbasin impacts), while others are influenced by activities within the subbasin (in-subbasin limiting factors).

Out-of-Basin Limiting Factors – Aquatics (Assessment section 1.3.1)

Out-of-subbasin factors are the primary factors limiting abundance and productivity of anadromous populations in the Imnaha subbasin: these include changes to mainstem and estuary habitats, downstream harvest, impacts to fish passage, water quality, and Snake/Columbia river water quantity conditions. These factors limit in-basin productivity, keep yearly effective population size low, and increase genetic and demographic risk of localized extinction.

Imnaha chinook production, based on smolt-to-adult return rates (SARs) and smolt per spawner observations, has been severely reduced following development of the Federal Columbia River Power System (FCRPS). An evaluation of 25 years of juvenile survival statistics estimates that around 13 to 14% of emigrating smolts are lost annually at each lower Snake and Columbia River dam, which has contributed to Imnaha SARs below the 2-6% level needed for recovery. The SAR data for Imnaha chinook indicate that the overall survival decline, as compared to survival from a ‘healthy’ time period (pre 1980), is consistent primarily with hydropower system impacts and poorer ocean conditions (out-of-subbasin factors), rather than large-scale impacts within the subbasin.

Post-dam declines in Imnaha SARs have contributed to reductions in population viability and an increased extinction risk (compared to pre-1980 conditions). Research shows that the current viability of all Snake River spring/summer chinook salmon ESUs and populations (including the Imnaha) was significantly poorer, compared to that from the healthy (pre-1980 conditions) time period, and that the Big Sheep Creek and Imnaha River mainstem spring/summer chinook salmon populations are currently at risk of extinction. These results may differ when data from 2002 and 2003 are included.

Out of Basin Limiting Factors – Wildlife (Assessment section 1.3.2)

Many of the wildlife species present in the Imnaha subbasin spend a portion of their life cycle outside the Imnaha subbasin boundaries. This complicates and potentially reduces the effectiveness of wildlife management actions in the subbasin. Depending on the extent, location, and timing of seasonal movements, out of subbasin effects may range from limited to substantial.

Migratory birds travel the greatest distance outside of the subbasin. Three of the focal species in the subbasin are neotropical migrants that breed in the subbasin and winter in Mexico or Central America. Flammulated owls are the most migratory of all North American owls, migrating to Mexico or Central America during the fall and winter. Grasshopper sparrows winter in the southern United States to as far south as Central America. The olive-sided flycatcher is migratory and winters in Central and South America. Environmental toxins, and habitat degradation in these species' winter habitats potentially impact the populations of these species in the Imnaha subbasin.

Many other species in the subbasin move smaller distances out of the subbasin. Large game species including bighorn sheep, mountain goat, elk, and mule deer may migrate into and out of the subbasin. This commonly results in crossing wildlife management units, and potentially state boundaries, and can complicate the setting of appropriate hunting seasons and harvest limits. Game species may experience greater hunting pressure when they move out of the subbasin into more populated surrounding areas. Other potential out of subbasin impacts to game species include increased potential for disease transmission between bighorn sheep and domestic sheep.

Species may migrate out of the subbasin in search of habitat and forage. Finding high quality habitat may allow for increased populations in the subbasin, while use of unsuitable habitats may result in reduced populations. The neighboring Snake Hells Canyon subbasin has been recognized as having some of the most crucial big game winter habitat in the region. These winter range areas may help support deer and elk populations throughout the region, including those in the Imnaha subbasin. Use of habitat outside the subbasin may also have negative impacts on game species in the subbasin. Agricultural areas are very limited in the subbasin, but elk and, particularly mule deer, may migrate outside of the subbasin and forage on private agricultural lands. This results in reduced social carrying capacity and public pressure to reduce population management objectives. Grasshopper sparrows are also documented to use agricultural areas and hayfields, which are not as suitable for breeding grasshopper sparrows and may serve as population sinks.

Species with very large home ranges that occur in low densities may migrate into and out of the subbasin in search of prey and mates. Fisher, marten, and particularly lynx and wolverine, are species with large home range sizes. Suitable habitat for all these species exists within the Imnaha subbasin, and wolverines have been documented as subbasin inhabitants. Maintaining and enhancing the integrity of movement corridors may prove critical to maintaining genetic diversity and healthy populations of these species in the region.

In-Basin Limiting Factors - Aquatics[1]

While out of subbasin factors are the primary limiting factors for aquatic focal species in the Imnaha subbasin, substantial improvement can be gained through work in the subbasin. Habitats within the subbasin have been limited by modified hydrologic regime, channel modification, stream temperatures, increased fine sediments, and migration barriers.

Modified Hydrologic Regime

Excessively low and high flows are among the factors considered to be limiting habitat quality and quantity, and limiting the biological potential of aquatic focal species within the Imnaha subbasin. Base flow and runoff regimes are most notably altered in the Big Sheep Creek watershed, and may affect populations of spring/summer chinook, steelhead, and bull trout.

Sources

Over-bank flows, combined with snow avalanches and debris flows, occur frequently in the geomorphologically young Big Sheep and Little Sheep Creek systems, and are often accompanied by excessively low flows during summer months. Changes to flow patterns likely have resulted primarily from modifications to upland vegetation from the Canal Fire (1989), the Twin Lake Fire (1994), timber harvest, grazing, agricultural clearing, windstorms, and insect outbreaks.

Low flows are also attributed to irrigation withdrawals, which are most prevalent in the Sheep Creek system. Operation of the Wallowa Valley Improvement Canal (WVIC) and other diversions cause annual dewatering, habitat fragmentation, and stream temperature heating, which has been most problematic to spring chinook, summer steelhead, and bull trout.

Species Affected

Low flows for late migrating spring/summer chinook into the Big Sheep Creek watershed (IRBSH population) have been identified as a potential problem, especially when factoring in stream temperatures. Flows (high and low) combined with sediment transport processes are also considered to negatively influence spring/summer chinook spawning and incubation success in the upper half of Big Sheep Creek (refer to Assessment, Section 1.5.1.1). Flows capable of exporting spawning substrate are problematic to spring/summer chinook spawning and egg incubation success in the middle portions and upper reaches of the Imnaha (up to RM 67), and in areas downstream of artificially constricted or armored streambanks.

Low flows, caused in part by diversions associated with the WVIC, have resulted in habitat fragmentation for focal species, including spring chinook, summer steelhead, and bull trout. Potential habitat for steelhead spawning, colonization and summer rearing life history stages is reduced by low flows in the lower-elevation reaches of the Big Sheep Creek watershed, as is habitat used for spring chinook rearing life history stages.

Insufficient flows in the Big Sheep Creek watershed are a primary factor contributing to the loss of connectivity between bull trout populations. This loss of connectivity limits refounding potential, genetic interchange, access to spawning and rearing habitats, and availability of thermal refugia. Flow reductions in Big Sheep Creek have also been cited as factors responsible for causing bull trout to experience spawning delays (due to increased temperatures), loss of foraging opportunities, and/or stranding of

---

[1] Although the following summaries were derived from information provided in the Imnaha Assessment (pp. 273-302), they lack important details, which limit their utility for planning. The reader is encouraged to review the Assessment for additional resolution regarding in-basin limiting factors.

juvenile fish in dry channel beds. A delay in spawning may result in late emergence of fry from the gravel, which would result in juveniles being smaller than fish that had emerged earlier, which may ultimately confer a survival disadvantage during later life history stages (i.e., the smaller fish would be more susceptible to predation and may not successfully overwinter).

Channel Modification

Stream channel alteration limits the biological potential of spring/summer chinook and summer steelhead. Modification of stream channels has occurred in a number of places in the subbasin and acts cumulatively to affect streamflow regime, riparian development, and habitat diversity.

Sources

The primary source of channel modification in the subbasin is roading. Channel modification is also caused through irrigation diversions, bank armoring (e.g., rip-rapping), levees, dredging, and/or riparian alteration. Channel modification is most pronounced along reaches constrained by roadbeds (e.g., mainstem Imnaha), and/or reaches that have been constrained by development. The lack of interaction between the stream channel and its floodplain combine to negatively influence pool frequency, pool quality, side channel formation, flow regime, accrual of large organic matter, and development and maintenance of spawning and rearing habitats.

Species Affected

Spring/summer chinook rearing life history stages are those most susceptible to deleterious effects of channel modification. Loss of access to side channel or floodplain habitats limits fall redistribution and overwintering success, and reduces useable summer rearing habitats. Incubation and spawning success of spring/summer chinook may also be compromised by indirect effects of channel modification in the middle portions and upper reaches of the Imnaha. Portions of the lower mainstem Imnaha and lower-elevation reaches of Little Sheep Creek have experienced considerable channel modification and have reduced habitat quantity and quality for summer steelhead winter and summer rearing life history stages.

Sedimentation

Alteration of sedimentation processes (e.g., accrual and transport) is considered to represent a factor limiting the biological potential of spring/summer chinook, fall chinook, summer steelhead, and bull trout. Sedimentation is most problematic to spawning and incubation life history stages and occurs in localized depositional reaches throughout portions of the subbasin. The largest sediment input in recent years has come from landslides in the wilderness and the 1997 flood.

Sources

Landslides (including debris torrents) are the most common source of fine sediment to aquatic habitats in the Imnaha. Changes to upland vegetation due to impacts of wildfire, insects, or pathogens, may increase the incidence of slope instability, especially in geologically unstable areas. Sediment is also delivered to Imnaha stream channels via streambank cutting, gully erosion, sheet erosion, and rill erosion.

Roads represent the primary source of sediment in the subbasin, and specifically within the mainstem Imnaha. Livestock grazing, rural home sites, pasture creation, and other activities that have modified soil and vegetation characteristics are secondary land use activities causing alterations to sediment availability and routing. Operation of the WVIC on Big Sheep (RM 31.9–RM 33.7) has also led to a change in sediment availability and transport capacity due to decreased flows. The operation of this canal also causes seasonal and dramatically increased sediment transport into the Wallowa valley (out-of-basin).

Species Affected

Fine sediment in the lower mainstem Imnaha may be limiting substrate availability and subsequently reducing spawning success for fall chinook. That fall chinook spawn in depositional reaches in the Imnaha lends credence to this concern, however supporting documentation is limited. In their biological assessment, the USFS defines fine sediment in the lower Imnaha to be "functioning at risk." Whether the concentrations are detrimental to fall chinook incubation success is unknown (i.e., comprising 20–25% of the redd).

Although the quantity of spring/summer chinook spawning and incubation habitat in Big Sheep Creek is comparatively small, the biological potential of the IRBSH population is negatively impacted by flow regimes and sediment load. Success of fry colonization and summer rearing life history forms may similarly be compromised by excessive amounts of fine sediment, most notably in depositional habitats.

Excessive amounts of fines may compromise the integrity of steelhead redds and/or emergence success of steelhead fry in each of five subwatersheds within the Big Sheep Creek drainage. Similarly, some perennial headwater streams in the upper Imnaha may not be suitable for steelhead spawning and incubation due to high amounts of fine sediment from land management activities and natural erosion patterns; however, the majority of these streams are suitable to support spawning and rearing life history stages.

Bull trout spawning habitat between Owl and Lick Creeks, and in the lower several kilometers of Lick Creek (Big Sheep Creek watershed), has been impacted by excessive sediment. Similar to other salmonid species, excessive fine sediments in bull trout redds reduce incubation and emergence success. Excessive amounts of fine sediment also impact growth and feeding opportunities in Little Sheep Creek and McCully Creek (summer rearing occurs throughout the creek, particularly in National Forest and Wilderness areas (Buchanan et al. 1997).

Stream Temperatures and Riparian Function

Elevated stream temperatures are common in the lower-elevation portions of the subbasin and in areas with impacted riparian zones. All focal species are affected to some degree, especially those with narrow thermal tolerance limits. The year-round temperature criterion for bull trout spawning, rearing, and adult presence is 10.0 °C (50.0 °F), and applies to portions of the mainstem Imnaha River, Big Sheep Creek, and Little Sheep Creek watersheds. The §303(d)-listed streams within the Imnaha subbasin include the entire Imnaha River mainstem and reaches in the Big and Little Sheep Creek watersheds that exceed the numeric criteria of the water quality standard for temperature.

Reductions or lack of functional riparian vegetation is problematic to key ecological processes, including sedimentation, water quality, and habitat formation, each of which influences the success of Imnaha focal species. The condition of riparian vegetation is least favorable on private lands, areas that have always had a riparian community dominated by grasses, or in portions of the subbasin that have burned, been subjected to insect infestations, or have had extensive wind throw damage.

Sources

Temperature extremes in the subbasin result from habitat modification and some are likely to exist naturally, especially in lower elevation reaches. The two most common contributing factors to excessive stream temperatures in the Imnaha subbasin are reduction in stream flows and the lack of functional riparian areas. The reduction in stream flows are clearly related to climatic variation, but also result from irrigation withdrawals. Current and legacy effects from the overutilization of riparian areas by livestock occur throughout portions of the subbasin, and represent a primary contributing factor to temperature and habitat problems. Fires, grazing, pathogens, wind throw, agricultural clearing, roads, and timber harvest have contributed to the decline in riparian function.

Species Affected

High stream temperatures in the lower Imnaha are a potential concern for the success and timing of upstream migrating adult spring/summer chinook salmon. Temperatures have increased from historical levels in the lower river corridor (below Freezeout Creek, RM 29.4), but have not specifically been identified as a factor limiting productivity. Spring/summer chinook smolts that outmigrate later than April are more likely to encounter elevated temperatures, such as in the lower Imnaha and in lower Big Sheep Creek, which may delay or postpone emigration. However, smolt emigration may not be limiting the productivity of the population as a whole. Spring/summer chinook fry colonization and summer rearing life history stages have been reduced from historical levels throughout all but the upper portion of the subbasin, due in part to excessive stream temperatures. Temperature-related growth and feeding issues for spring/summer chinook are most common in the lower 20 miles (below Coyote Creek) of Big Sheep Creek.

Excessively low winter temperatures may limit embryonic development of Imnaha fall chinook and consequently reduce production, although supporting data are limited. Fall chinook embryos also may be limited by severe and massive ice floes common to the Imnaha, which could potentially disrupt redds and dislodge eggs.

Water temperatures, along with other factors, are considered to be either at risk or not properly functioning within portions of Little Sheep Creek, and may limit steelhead spawning and incubation life history stages.

Although not well established, bull trout spawning and incubation life history stages in the Big Sheep Creek watershed may be delayed due to excessive stream temperatures, which may confer a survival disadvantage to certain subpopulations. Growth and feeding life history stages for juveniles occurring in Big (above RM 31 near Owl Creek) and Little (at approximately RM 25.5) Sheep Creeks are limited by high stream temperatures, among other factors.

Migration Barriers

Irrigation diversions, culverts, and low flow conditions currently represent a key factor limiting the potential biological productivity of bull trout populations. Based on an inventory of known, fish-bearing streams on Forest Service lands, the USFS rated a total of ten subwatersheds as “functioning at risk” due to culverts, and one subwatershed as “functioning at unacceptable risk” due to two irrigation diversions. The Nez Perce Tribe, DFRM-Watershed Division is currently inventorying *all* stream road crossings within Wallowa County, which will be complete in 2005.

Sources

A diversion ditch for the Wallowa Valley Improvement District canal currently impedes upstream migration of steelhead and bull trout into the upper Little Sheep Creek subwatershed and into creeks such as Big Sheep, McCully, Ferguson, Canal, Redmont, and Salt. Irrigation diversions obstructing migration were also identified in lower Camp Creek and in lower Grouse Creek (during low flow periods). Stock ponds in the upper Camp Creek subwatershed and in the Lightning Creek subwatershed were also considered to impede the migration of salmonids into otherwise usable habitat areas. And, while fish are commonly observed inhabiting the canal network, poor water quality conditions seasonally limit their residence period within the ditch. Fish that may occasionally “spill” downstream of the barriers are prohibited from returning to their natal habitats, as upstream migration is prohibited due to structural or hydrologic impediments.

Based on Forest Service inventories, culverts on streams within the middle Little Sheep Creek, McCully Creek, Carrol Creek, Big Sheep Creek (RM 25), Lick Creek, Big Sheep (RM 34), Imnaha River (RM 51), Gumboot Creek, Imnaha River (RM 55), and Imnaha River (RM 58) subwatersheds act as barriers to juveniles only (USFS 2003a). Based on the ongoing inventory efforts by the NPT, DFRM-Watershed Division, at least a portion of the barrier culverts listed above are barriers to juveniles and adults (NPT unpublished data, 2004), and will be identified as such following completion of the survey in 2005. These obstructions are currently considered to represent fish passage barriers at least part of the year and are being evaluated for replacement or removal by the USFS.

Low flows caused through irrigation withdrawals, drought, and/or through coarse alluvium also restrict bull trout, chinook, and steelhead movement into otherwise useable habitats. Based on the ongoing inventory efforts by the NPT, DFRM-Watershed Division, the cement diversion structures associated with the WVIC in the Big and Little Sheep Creek drainages, represent complete, year-round barriers to all upstream migrants (based on NPT stream crossing methodology, revised from USDA-FS protocol, 2003).

Species Affected

The biological potential of some steelhead and bull trout populations that utilize habitat in the upper Little Sheep Creek subwatershed and portions of Big Sheep, McCully, Ferguson, Canal, Redmont, and Salt creeks is thought to be limited based on low population size. Obstructions to migration and loss of connectivity are commonly cited as primary factors contributing to small population size, as the barriers limit genetic interchange, growth and feeding opportunities, and population refounding.

In-Basin Limiting Factors – Wildlife (Assessment section 1.5.2)

Loss of Ponderosa Pine Communities

Data from the Northwest Habitat Institute indicate that the distribution of the Ponderosa Pine Wildlife Habitat Type (WHT) has declined by 47% in the Imnaha subbasin between historical and current, which reflects similar losses at the scale of the Columbia Basin. Fire suppression and selective timber harvest are most responsible for losses of ponderosa pine habitat both at the scale of the Imnaha subbasin and the Columbia Basin. Twenty-one of the subbasin’s wildlife species (12 birds and 9 mammals) are closely associated with ponderosa pine habitat types.

Degradation of Grassland Habitats

Relative to other parts of the Columbia Basin, the grassland habitats of the Imnaha subbasin are in good condition. Most are in mid-late seral stages and dominated by native vegetation; however, areas exist where overgrazing has damaged the subbasin’s grasslands and allowed annual grasses and noxious weeds to establish. Reduced grassland habitat quality has limited the subbasin’s ability to support grassland dependent wildlife species.

Degradation of Riparian Habitats

Riparian habitats in the Imnaha subbasin have been altered through various human activities, including livestock grazing, timber harvest, flow modification and road construction. Alterations in vegetative structure and disturbance regimes have increased the intensity of fire, flood and insects outbreaks, resulting in decreased riparian quality. Wildlife species closely associated with wetland and riparian WHTs have been limited by these changes.

Changes in Disturbance Regime and Vegetative Structure

Fire suppression has resulted in increased accumulation of fuels, higher tree densities, and the accumulation of duff. Under these conditions, even light severity fires can be damaging due to the concentrated heating of the tree bole. The accumulation of ground fuels along with denser, multi-storied stand conditions have created “fuel ladders” that cart fire into the tree canopy, resulting in high intensity crown fires. Unlike the moderate severity fires that burned historically, many wildfires now have the potential to impact soil productivity and increase erosion through the consumption of organic matter and higher temperatures, resulting in wildfires that are more severe and more difficult to control. Over the past 100-plus years, the percentage of higher burn intensities in Blue Mountain forests has increased. Focal species threatened by large stand-replacing fires include the boreal owl, olive-sided flycatcher and American marten.

Fire suppression also has resulted in a shift to more shade tolerant tree species and contributed to the development of dense, multi-layered stands. Forests with these conditions are more susceptible to insects and disease than forests developed in more natural disturbance regimes.

Roads and Habitat Fragmentation

More than 65 species of terrestrial vertebrates in the interior Columbia River Basin have been identified as being negatively affected by road-associated factors. Road-associated factors can negatively affect habitats and populations of terrestrial vertebrates both directly and indirectly. The Wallowa-Whitman National Forest uses the following classes to quantify in general terms the impact of roads on wildlife sensitive to open roads: low impacts can be expected in areas with a density less than 1.0 mi./sq. mi, a moderate impact at densities between 1.0-2.5 mi./sq. mi., and a high impact when densities are greater than 2.5 mi./sq. mi. of open road.

Noxious Weeds and Other Invasive Plants

The introduction of nonnative plants to the Imnaha subbasin has reduced its ability to support native wildlife and plant species. Introduced plants in the subbasin often outcompete native plant species and alter ecological processes, thereby reducing habitat suitability. Many invasive are not palatable to either livestock or wildlife, nor do they provide suitable habitat for wildlife species.

Weed problems in the subbasin are less severe than in many areas of the Columbia Basin, but are most severe in the grassland habitats. The naturally open structure of the subbasin’s grassland vegetation, its soils, and climate have predisposed it to invasion by weeds, especially by species of Mediterranean origin.

Loss of Marine-Derived Nutrients

Salmon runs input organic matter and nutrients to the trophic system through multiple levels and pathways including direct consumption, excretion, decomposition, and primary production. Direct consumption occurs in the form of predation, parasitism, or scavenging of the live spawner, carcass, egg, or fry life stages. Carcass decomposition and the particulate and dissolved organic matter released by spawning fish deliver nutrients to primary producers. Sixty-seven birds, twenty-three mammals, three reptiles and one amphibian species thought to inhabit the Blue Mountain Province consume salmon during one or more of salmon’s lifestages. Twenty-five of the ninety-four total species in the province with a relationship to salmon are concern or focal species. Reductions in anadromous populations have reduced nutrient availability in the subbasin.

II. Prioritization of limiting factors

Aquatics

Limiting factors (e.g., out of basin effects, species interactions, genetic effects, fisheries management issues, research uncertainties) that were not included in the Qualitative Habitat Assessment (QHA) model were *not* prioritized in the Imnaha subbasin planning process. Increasing anadromous species’ SAR however, is recognized by planners as one of the highest priorities in the subbasin, as the attainment of objectives set forth in the subbasin Plan (*see Imnaha Management Plan, Table 5*) would by default help address other problems. Further, planners felt strongly about the need to address research uncertainties (i.e. data gaps/monitoring and evaluation), as our current lack of understanding limits our ability to effectively manage imperiled focal species.

Qualitative Habitat Assessment (QHA) was used to spatially evaluate and prioritize habitat factors within the subbasin that limit the biological productivity of (1) individual focal species (*see Assessment Section 1.5.1.5; Plan Section 3.2.1.2*), and (2) aggregates of focal species (*see Plan Section 6.1.1*). Priority limiting factors within and between sixth field HUCs for spring chinook (*see Assessment, Table 92*), fall chinook (*see Assessment, Table 95*), steelhead (*see Assessment, Table 98*), and bull trout (*see Assessment, Table* 101) can be generalized into groupings of those that are spatially common and those that are spatially unique. Spatially common limiting factors (Tier 1) include, in order of importance,

1. excessive summer stream temperatures,
2. low flow problems,
3. excessive amounts of fine sediment.

Spatially unique limiting factors (Tier 2) include, in order of importance,

4. population connectivity,
5. legacy effects from land use activities impacting channel form and stability,
6. thermal and organic pollutants.

A multi-species prioritization was developed based on the previous, species-specific QHA information (*see Plan Section 6.1.1*) that identified priority areas only in HUCs where species overlap occurs, and with common management. The overlap of habitat use by the four focal species was ranked based on the number of life history stages occurring in the specific HUC.

At the subbasin scale, the Big Sheep Creek watershed (including Little Sheep Creek) represents the area in the subbasin where habitat-based factors are most limiting to multiple focal species and where restoration activities would be most beneficial (*see Plan, Figure 2*). Lower mainstem reaches of Big and Little Sheep Creeks, starting at the confluence of Big and Little Sheep Creek, are inhabited by spring/summer chinook and summer steelhead while mid- upper-elevation reaches of Little Sheep Creek are used by summer steelhead and bull trout.

Species residing in these areas are limited by excessive stream temperatures and low flows. Riparian improvement is a common restoration activity that would benefit multiple species in the Big Sheep Creek watershed. In the mid- and upper-elevation reaches of Little Sheep Creek, steelhead and bull trout would benefit through restoration of connectivity (*e.g.,* addressing structural and low flow barriers).

Terrestrial (see Assessment section 1.5.2, Management Plan section 6.1.2)

Because each of the seven terrestrial limiting factors identified in the assessment impact numerous terrestrial species in the subbasin, the Technical Team found it impossible to place them in a simple list by priority. However, a few issues emerged as particularly important in the development of the plan. The key issues and the associated limiting factors are described below.

Priority- Reduce the risk of catastrophic fire

Associated limiting factors- changes in disturbance regime/ vegetative structure

Priority- Reduce the risk of noxious weed invasion into grassland habitats

Associated limiting factors- degradation of grassland habitats, noxious weeds and other invasive plants

Priority- Restore degraded riparian areas

Associated limiting factors- degradation of riparian habitats

Priority- Increase baseline data collection and monitoring

> **Associated limiting factors-** more data is needed to assess all limiting factors

Priority- Protect existing good quality habitat

> **Associated limiting factors-** degradation of riparian habitats, degradation of grassland habitats, loss of ponderosa pine communities, noxious weeds and other invasive plants

III. Identification of objectives and strategies explaining links between strategies and limiting factors

The information in this section draws from the more comprehensive information in the *Imnaha Subbasin Management* Plan (*see Section 3.2*).

Aquatics – Non QHA

The limiting factors that were not addressed by the QHA model are presented separately in the Imnaha Plan (*Biological Components Section 3.2.1.1*), as are the associated suite of eleven objectives and 42 strategy statements that were developed by the technical team. For summary purposes in this supplement, we grouped these statements under a Recruitment or Data Gaps header, as most of the non-QHA problems and their proposed solutions fall under either of these two categories, or are treated in the subsequent *Environmental Components Section (3.2.1.2).* The reader is encouraged, however, to review Section 3.2.1.1 of the Plan for a more comprehensive review of the information presented below.

Recruitment

Aquatic Objective 1A: Achieve escapement objectives within 24 years (represents 4-5 generations; timeline is consistent with the NPCC's Fish and Wildlife Program) that would restore and maintain in-basin treaty-reserved tribal harvest, and recreational fisheries. Criteria will involve both a time element (persistence) and an abundance element, both of which are currently under review.

> **Strategies 1A1-1A5** improve focal species recruitment by addressing out of basin limiting factors, improving basin-wide coordination of management efforts, implementing a common (basin-wide) monitoring and evaluation program, ensuring adequate enforcement of conservation practices, laws, and regulations, and promoting the use of a mix of hatchery and natural production strategies.

Aquatic Objective 2B: Increase anadromous fish productivity and production, as well as life stage-specific survival, through artificial production. Achieving Objective 1A will undoubtedly work towards the attainment of Objective 2B.

> **Strategies 2B1-2B5** incorporate the use of artificial production to improve anadromous production/productivity. Specifically, the strategies address the maximization of hatchery effectiveness in the subbasin through the continued implementation of the LSRCP and NEOH programs, and support the continuation of existing natural production strategies via artificial production programs.

Data Gaps (Monitoring and Evaluation)

Aquatic Objective 3A. By fifth code HUC, carry out focused activities designed to improve our understanding and definition of small populations, while protecting the genetic integrity of wild populations that are below historical levels.

Strategies 3A1-3A6 address the problem of small population size by first ensuring that the genetic integrity of existing wild stocks are protected and monitored by supporting the TRTs ongoing effort of defining populations for recovery purposes and by supporting ODFWs management actions that will have the effect of homogenizing areas of the subbasin through outplanting of hatchery-origin fish. Use knowledge gained through monitoring to better define instances where genetic preservation techniques such as captive brood stock, cryopreservation, or supplementation (e.g. LSRCP/NEOH), are needed and/or where selective application of artificial propagation programs could provide extinction safety nets. Continue the collection of wild adult steelhead abundance data and evaluate the effectiveness and potential positive and negative consequences of supplementation of natural production with hatchery fish. An associated monitoring and evaluation program and feedback loop is built into the strategies.

Aquatic Objective 4A: Establish the abundance and productivity of anadromous stocks and how they compare to other Snake River stocks.

Strategies 4A1-4A2 address the problem of better defining abundance and productivity of anadromous stocks and include the adherence to a basin-wide RM&E program which incorporates the evaluation of Imnaha subbasin-specific adult abundance, life history characteristics, and spawn–recruit relationships (as a measure of productivity), the maintenance of historic (e.g., run reconstruction) data and long-term evaluation protocols for spring chinook, and development of appropriate protocols for assessing steelhead and fall chinook (in order to provide for comparisons with Snake River and other downriver stocks).

Aquatic Objective 5A: Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats (associated strategies for achieving this objective are presented in Section 4 of the subbasin Plan).

Aquatic Objective 5B: Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

Strategies 5B1-5B4 address the need for bull trout monitoring and research through specific data collection actions, including conducting additional watershed assessments, spatially assessing whether differences exist in temperature tolerance limits, determining the seasonal movement patterns of adult and sub-adult migratory bull trout, and by evaluating food web interactions.

Aquatic Objective 5C: Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

The lack of knowledge regarding the effects of diseases and parasites on bull trout is addressed through **Strategies 5C1-5C3**, which promote the maintenance of fish health screening and transplant protocols, the dissemination of information to the public, and the implementation of a monitoring and evaluation program which allows for the assessment of pathogen effects on Oregon bull trout populations.

Aquatic Objective 5D: Develop and conduct research and monitoring to improve information concerning the distribution and status of bull trout.

Strategies 5D1-5D4 address the data gaps relative to the distribution and status of Imnaha bull trout, and include assessing whether local resident and migratory populations have different life history requirements, refining our knowledge regarding relationships between bull trout and anadromous species (e.g., predator/prey), continuing and expanding bull trout surveys, and assessing differences between strong and weak populations.

Aquatic Objective 5E: Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

> **Strategies 5E1-5E5** identify the information needed to better define whether local populations in select core areas are genetically independent or function collectively and require connectivity within and between subgroups. Steps needed to address these data gaps include investigating bull trout use of the mainstem Snake River, assessing whether the recovery unit consists of one large population or multiple populations and whether there appears to be any metapopulation structure, evaluating basic life history characteristics (e.g., age- and size- specific fecundity of fluvial and resident bull trout, age at first spawning, size at first spawning, longevity, and the number of spawns during a lifetime), and evaluating life-stage specific survival rates.

Aquatics – Environmental Components

The first environmental objective and associated strategies addresses habitat and species interactions at a general level and does not address a specific limiting factor. The other environmental objectives and strategies address specific limiting factors, which were analyzed based on QHA habitat metrics and apply to both anadromous and resident focal species. The metrics defined as most limiting are listed below in order of importance and include high temperatures, low flow, fine sediment, connectivity (migration barriers), channel form/stability, and pollutants.

Aquatic Objective 2A: Increase anadromous fish productivity and production, as well as life stage-specific survival, through habitat improvement.

> **Strategies 2A1-2A5** address habitat factors limiting anadromous species in general, rather than focusing on specific limiting factors. Strategy 2A1 calls for implementation of strategies addressing each of the specifically identified limiting factors outlined under the other environmental objectives in the plan. Strategy 2A2-2A5 develop research, habitat response indices and monitoring and evaluation programs that focus on habitat quality and quantity for multiple anadromous species. These should look at multiple habitat variables and at cumulative impacts and results, rather than single variable, or single limiting factors in isolation. These strategies aim to understand how species react to the total effort directed at improving habitat, rather than efforts aimed at a specific limiting factor.

High Temperatures

Aquatic Objective 7A: Using ODEQ's guidelines, reduce stream temperatures in listed segments so cold water biota beneficial uses are restored.

> **Strategies 7A1-7A7** address the limiting factor of high stream temperatures through the restoration of non-functional riparian zones, maintenance/protection of functional riparian zones, ameliorating grazing impacts, reduction of consumptive water uses, restoration of natural floodplain processes, restoration of channel form, and associated monitoring and evaluation of restoration activities.

Low Flows

Aquatic Objective 8A: Improve efficiency of irrigation withdrawal delivery and application to reduce volume of water needed for consumptive purposes.

> **Strategies 8A1-8A2** develop cooperative agreements between irrigation districts and OWRD, and improve water delivery and transfer to achieve a reduction in the volume of water needed for consumptive purposes.

Aquatic Objective 8B: Restore flows to support resident and anadromous fish needs.

Strategies 8B1-8B7 incorporate both a planning and implementation component to achieve Objective 8B. The planning component involves obtaining a better understanding of life history specific needs of affected focal species so that a prioritization of problems and activities for protection and restoration can be developed and minimum flow requirements can be set. The implementation phase involves restoring a natural hydrograph to affected areas through riparian, floodplain, and wetland enhancements, working with user groups to improve water conservation and decrease water withdrawals, and securing water rights designated to meet flows (where necessary and possible). An integrated feedback loop is included in the suite of strategies to provide a gage of progress towards attainment of the objective.

Fine Sediment

Aquatic Objective 9A: Establish a subbasin-wide database to facilitate monitoring and evaluation of sedimentation trends and provide information relative to its effect on salmonid production.

Strategies 9A1-9A3 complete a sediment source assessment to provide an indication of sediment effects upon focal populations. This will provide focus for sediment reduction efforts.

Aquatic Objective 9B: In problem areas, reduce sedimentation impacts to aquatic focal species.

Identification and treatment of known sediment source areas are outlined in **Strategies 9B1-9B3.** Known sediment source areas are defined, by species, in the Imnaha Plan, Strategy 9B1. Treatment options for these areas include riparian management, upland vegetation management, access management, floodplain restoration, and hydro-modification. An evaluative feedback loop is included in the suite of strategies.

Connectivity (migration barriers)

Aquatic Objective 6A: To achieve bull trout distribution criteria, as defined in USFWS (2002), maintain or expand current distribution of bull trout throughout the Imnaha-Snake Rivers Recovery Unit until bull trout are distributed among at least six local populations.

Strategies 6A1-6A3 reestablish connectivity to provide for the distribution of bull trout among at least six local populations. Actions designed to achieve the objective include the protection and/or expansion of bull trout habitat, restoration of migration corridors, and biological monitoring and evaluation of restoration actions.

Aquatic Objective 10A: Identify and prioritize for modification, structural barriers that limit connectivity.

Strategies 10A1-10A6 provide a list of known areas containing structural barriers, and propose that additional work be done to inventory suspected, or unknown barriers. Upon development of a subbasin-wide inventory of structural barriers, prioritization for removal/modification can occur. Guidelines for barrier removal/modification are provided in the suite of strategies, as is an adaptive monitoring and evaluation strategy.

Channel form/stability

Aquatic Objective 11A:. Within the next 15 years improve channel form and stability in portions of the subbasin where low flow, temperature, and sediment problems also exist.

Strategies 11A1-11A6 describe specific methods needed to improve channel form and stability, including retarding downcutting, improving floodplain interaction, implementation of bioengineering approaches, implementation of passive restoration approaches, and treatment of headcuts. A regionally accepted effectiveness monitoring and evaluation component is built into the suite of strategies.

Pollutants

Aquatic Objective 12A:. Conduct research, monitoring, and evaluation to identify and address point and non-point pollutant sources and to determine associated impacts upon various life history stages of aquatic focal species.

Strategies 12A1-12A7 identify approaches needed to obtain sufficient information to make determinations regarding the effects of pollutants on Imnaha focal species, and possible restoration actions. Steps defined in the strategies include the identification of study sites, data collection, research, development of a nutrient budget, assessing groundwater and/or hyporheic influence, and finally the implementation of restoration actions. An adaptive management approach is proposed, including a feedback loop to evaluate fish distribution, reproductive success, and life history-specific habitat utilization following restoration.

Terrestrial

Data Gaps

Terrestrial Objective 13A: Increase knowledge of the composition, population trends, and habitat requirements of the terrestrial communities of the Imnaha.

These strategies attempt to fill terrestrial data gaps and research needs. Strategies1-3 focus on increasing the understanding of the biology, populations and habitat use of the wildlife species in the subbasin. Strategies 4 and 5 expand understandings of ecosystem processes and community dynamics in the subbasin. Strategy 6 provides a mechanism for reevaluating data collection and research efforts over time and applying collected information to management.

Degradation of Grassland Habitats

Terrestrial Objective 14A: Maintain grassland quality, condition, and composition.

Strategy 1 addresses data gaps associated with location and condition of grassland communities. Information collected through these two strategies will be used to further prioritize restoration and protection efforts. Strategies 2-4 strive to protect high quality grassland areas and rare plant populations in the subbasin. Strategy 5 evaluates the effort.

Terrestrial Objective 14B: Restore or rehabilitate areas where grasslands have been degraded.

Strategy 1 addresses the need for continuing research into methods for restoring degraded grassland habitats. Strategies 2-4 work toward restoration of degraded grassland communities in the subbasin. Strategy 5 evaluates the effort.

Loss of Ponderosa Pine Communities

Terrestrial Objective 15A: Maintain and enhance mature ponderosa pine habitats.

Strategy 1 seeks to increase efforts to inventory and characterize mature ponderosa pine habitats in the subbasin. Strategy 2 identifies methods for protecting mature ponderosa pine habitats in the subbasin. Strategy 3-5 identifies methods for encouraging the development of additional ponderosa pine habitats in appropriate habitat types and promoting succession in these stands. Strategy 6 evaluates the effort.

Degradation of Riparian Habitats

Terrestrial Objective 16A: Maintain currently functioning wetlands and restore degraded wetlands.

Strategy 1 seeks to increase efforts to inventory and characterize wetland and spring habitats in the subbasin and identify those with the greatest need for protection and restoration activities. Strategy 2 and 3 identify methods for protecting and restoring wetland habitats in the subbasin. Strategy 4 evaluates the effort.

Terrestrial Objective 16B: Maintain currently functioning riparian areas and restore degraded riparian areas.

Strategy 1 identifies programs and grazing management practices to protect riparian condition in the subbasin. Strategy 2 increases education efforts on the importance of riparian habitats. Strategy 3 restores structural diversity, species composition, and the abundance of KECs in the riparian habitats of the subbasin. Strategy 4 addresses winter feeding operations that may be impacting water quality in the subbasin. Strategy 5 seeks to ensure funding to existing and new programs focused on riparian restoration. Strategy 6 evaluates the effort.

Noxious Weeds and Other Invasive Plants

Terrestrial Objective 17A: Maintain and enhance the existing quality, quantity and diversity of native plant communities providing habitat to native wildlife species by preventing the introduction, reproduction, and spread of noxious weeds and invasive exotic plants into and within the subbasin.

Strategy 1 prioritizes noxious weed eradication, containment and control efforts in the subbasin based on the Wallowa County Noxious Weed List. Strategies 2-6 attempt to reduce the spread of noxious weeds into high quality habitats in the subbasin. Strategies 7 and 8 seek to reduce the extent of existing noxious weed infestations in the subbasin. Strategy 9 attempts to increase the role of the public in noxious weed prevention and treatment. Strategy 10 evaluates the effort.

Changes in Disturbance Regime and Vegetative Structure

Terrestrial Objective 18A: Restore the composition, structure, and density of forests to within the historic range of variability (HRV).

Strategy 1 and 2 seek to increase efforts to inventory and characterize forest structure in the subbasin. Strategy 3- 6 identify methods for restoring forest structure, composition, and density in the subbasin. Strategy 7 evaluates the effort.

Roads and Habitat Fragmentation

Terrestrial Objective 19A: Reduce the impact of the transportation system on wildlife and fish populations and habitats.

Strategy 1 implements the transportation planning efforts already conducted by the Forest Service in the subbasin. Strategy 2 and 3 develop and implement a subbasin wide transportation plan. Strategy 4 evaluates the effort.

Loss of Marine Derived Nutrients

Terrestrial Objective 20A: Restore natural nutrient input cycles and mitigate for damages to aquatic and terrestrial populations due to the loss of these nutrients.

Strategy 1-3 assess the nutrient cycle in the Imnaha subbasin and look for innovative approaches to restoring these cycles. Strategy 4 evaluates the effort.

Socioeconomic

Socioeconomic Objective 21A: Consider impacts and benefits of fish and wildlife activities to surrounding communities and their economies.

> Strategies 1-5 minimize negative impacts on communities and maximizes benefits to surrounding communities and recreation.

Socioeconomic Objective 22A: Protect and foster both Indian and non-Indian cultural uses of natural resources in the Imnaha subbasin.

> Strategy 1 integrates information on Indian and non-Indian cultural practices into project selection. Strategy 2 provides information and education on these cultural practices to land managers, regulatory agencies and policy makers.

Socioeconomic Objective 23A: Coordinate with groups and the public when developing and implementing fish and wildlife management activities in the subbasin.

> Strategy 1 identifies a coordinator for implementation of plan activities. Strategies 2 and 5 involve user groups and entities with vested interests in the subbasin in planning activities. Strategy 3 coordinates implementation of the Imnaha Subbasin Management Plan with federal agencies. Strategy 4 makes recommendations to funding sources. Strategies 6 and 7 promote stewardship of natural resources through involvement and education. Strategies 8 and 9 disseminate and collect information through meetings, newsletters, websites and other public outreach and involvement activities.

IV. Prioritization of strategies

The scale of the limiting factors impacting species and habitats in the Imnaha subbasin dwarfs the financial resources available over the short-term for protection and restoration efforts. Clearly, as not all problems can be fixed immediately with existing and potential resources, the resources available must be used as efficiently and effectively as possible. The number of issues and diversity of species and habitats impacted make prioritization a major task that must be periodically repeated and fine-tuned based on new information. Filling key data gaps (as outlined in the Management Plan) will further improve the accuracy of prioritization processes.

Successful implementation of prioritized strategies often require simultaneous implementation of a suite of other strategies, such as planning or monitoring and evaluation strategies as described in the Management Plan. Research, monitoring and evaluation strategies are examples of strategies that need to be implemented before, during and after implementation strategies to guide success, increase efficiency and to learn from implementation activities. These types of strategies were not individually prioritized because they are generally intended to be included as part of a suite of strategies and many of them would have little value as stand alone activities. The social economic strategies (Strategies 21A1-5, 22A1-2, 23A1-9) provide an operational framework for successful implementing programs and projects in the subbasin and are not meant to be optional, but need to be a part of implementing aquatic and terrestrial strategies in the subbasin. The successful management of fish and wildlife in the subbasin is partially dependent on simultaneous implementation of the social and economic strategies.

Aquatics

Aquatic strategies were prioritized by groups rather than into a simple list because the Technical Team felt that the flexibility needed for concurrent execution of diverse restoration and protection actions of equal importance would be lost with a rigid prioritization scheme. The first group of strategies includes those that address out of basin factors limiting anadromous recruitment. Implementation of strategies that focus on treating out of basin limiting factors (e.g., improving connectivity, passage, and water quality) is a high priority for Imnaha anadromous focal species, but must be coordinated at the province or regional level (Strategies 1A1-1A3).

While these strategies are important, no one believes that implementing them in isolation will have much impact on the limiting factors, for the Imnaha subbasin in only one of many areas impacted by these factors, and representatives for the Imnaha subbasin will only be a few among the many who will need to agree and coordinate efforts. These factors also impact wide geographic areas (such as the Pacific Ocean) and addressing them will involve an intensive, long-term political effort in which representatives for the Imnaha need to participate, but have little ability to lead. As a result of this dilemma, artificial production of anadromous species (Strategies 1A4-1A5, 2B1-2B5) has served and will continue to serve to mitigate for these out of subbasin impacts, including the expected continued shortfalls in achieving the SARs called for in Table 5 (p. 19 of the Imnaha Plan) and for the cultural needs and treaty rights outlined in Objective 22A (p. 54 of the Imnaha Plan).

Over the long-term, the success of implementing strategies that concentrate on the problem of recruitment requires concurrent implementation of strategies that improve our understanding of population demographics and environmental relationships. Strategies 3A1-3A6, and 4A1-4A2 are designed to provide co-managers needed information to define small populations, production and productivity, all of which are critical for focal species restoration/protection but are currently unknown. Similarly, it is a high priority to improve our understanding of factors limiting bull trout and measures to take for their recovery tasks (Strategies 5B1-5B4; 5C1-5C4; 5D1-5D4; 5E1-5E5).

The ranking of strategies addressing in-subbasin limiting factors mirrors the ranking of limiting factors, as presented in Section III (above) and as presented in Assessment Tables 92, 95, 98, and 101. Strategies that deal with in-basin limiting factors are subdivided by those that are spatially common (Tier 1) and those that are spatially specific (Tier 2). Tier 1 strategies address the most common problems in the subbasin: these include those that address (1) excessive stream temperatures (Strategies 7A1-7A7), (2) low flows (implement Strategies 8A1-8A2 and 8B1-8B7), and (3) fine sediment (implement Strategies 9A1-9A3 and 9B1-9B3). Among these strategies, 7A1-7A3 are designed to improve or protect riparian areas and are most likely to be the most cost efficient to fully or partly address the Tier 1 limiting factors. While these strategies are common to a number of areas in the subbasin, they are not ubiquitous. The particular subwatersheds where these factors are a problem have been identified and prioritized using the QHA model presented in the Assessment. The output of this model identifies and prioritizes impacts to specific 6th field HUCs (see Tables 92, 95, 98, and 101 and Figures 68-71). These tables and figures provide specific importance and spatial ranking of problems, which provide a basis for directing the relative emphasis of implementation strategies. It is important to remember that the QHA identifies the area of the impact, but not necessarily the source of the impact. To improve an area suffering from limiting factors such as temperature, flow and sediment, the strategies may need to be implemented upstream of the prioritized HUC in subwatersheds that are not themselves prioritized because the limiting factors are most severe downstream.

Although, in general, the Tier 1 strategies are the highest priority because they address the most common limiting factors, a number of other limiting factors cause significant impacts in spatially specific areas and are high priorities for those areas. The QHA model captures this distinction by enabling the prioritization of a limiting factor, even if it only impacts a single HUC. Implementation of the Tier 2 strategies is important to address the localized limiting factors that affect key focal species. Addressing structural barriers that limit connectivity are considered by many to represent one of the best restoration opportunities available, and could show tangible results through the implementation of a suite of strategies (6A1-6A3; 10A1-10A6). Areas defined by unstable, eroding, or otherwise unsuitable channel geometries are not widespread throughout the subbasin, however their treatment (Strategies 11A1-11A6) would increase useable habitat considerably. The effects of pollutants on focal species are not well defined, making the implementation of Strategies 12A1-12A7 all that more important. Prioritization of these strategies mirrors the prioritization of the corresponding limiting factors ranked in Section III (above) and as presented in Assessment Tables 92, 95, 98, and 101, and Figures 68-71.

Priority strategies, as they pertain to addressing limiting factors affecting multiple species, include primarily the Tier 1 group (Strategies 7A1-7A7). The Big Sheep Creek watershed (including Little Sheep Creek) represents the area in the subbasin where restoration activities would be most beneficial to multiple focal species. Lower mainstem reaches of Big and Little Sheep Creeks, starting at the confluence of Big and Little Sheep Creek, are inhabited by spring/summer chinook and summer steelhead, while mid- upper-elevation reaches of Little Sheep Creek are used by summer steelhead and bull trout. Species residing in these areas, as discussed in the limiting factors section of the Assessment (refer to Section 1.5.1.5), are all limited by excessive stream temperatures and low flows. It is therefore reasonable to assume that riparian improvement actions would be a common restoration activity that would benefit multiple species in the Big Sheep Creek watershed. In the mid- upper elevation reaches of Little Sheep Creek, steelhead and bull trout will benefit through restoration of connectivity (*e.g.*, addressing structural barriers).

Top terrestrial priorities (see Management Plan section 6.1.2)

Prioritization for the Terrestrial components of the *Imnaha Subbasin Plan* was carried out collaboratively by the Terrestrial Technical Team as part of the subbasin planning process. Any projects that work to implement the terrestrial strategies developed in the *Imnaha Subbasin Management Plan* will reduce the impact of the limiting factors and benefit the wildlife, plants and terrestrial communities of the subbasin. However, during technical team discussions of protection and restoration priorities for the subbasin, five items emerged as the top priority terrestrial issues for the subbasin. Reasons for selection as a top priority issue included potential for severe irreversible damage to the ecosystem as a result of inaction or disproportionate importance of the habitat affected. These issues are summarized below along with the priority strategies developed to address them

- **Reduce the risk of catastrophic fire**
  Altered fire regimes and other disturbance processes have changed the stand density and vegetative composition of the subbasin's forests. Fuel loads have accumulated and more of the subbasin's forests exhibit fuel model 9 or 10 characteristics than did historically. Fires burning in these fuel models can have much higher intensities, are more difficult to suppress, and have longer and more severe ecological impacts than other fires. For example, numerous negative effects were documented after the 1989 Canal Creek fire, including a reduction in shade-providing riparian vegetation, accelerated sheet, rill and gully erosion hazards and reduced hydrologic storage capacity.

  The Imnaha Subbasin Terrestrial Technical Team identified two areas where the risk of catastrophic fire in the subbasin is very high due to forest structural conditions, the Lick Creek (O7Q) and Gumboot (09K) subwatersheds. Large intense fires in these areas could have serious impacts on both wildlife and fish species in the subbasin. Reducing the potential for catastrophic fire in these areas should be a priority. Potential methods for achieving this include precommercial thinning, mechanical treatment, underburn, and prescribed fire.

  Implementation of strategies 15A3, 15A4, 18A1, 18A3, 18A6, 18A7 should be prioritized to help reduce the risk of catastrophic fire.

- **Reduce the risk of noxious weed invasion into grassland habitats**
  The grassland habitats of the Imnaha subbasin are still in good condition relative to other grassland habitats in the Columbia Basin. Preventing the further establishment and spread of noxious weeds into these habitats is a priority for maintaining these high quality areas.

  Implementation of strategies 14A4, 17A1, 17A2, 17A3, 17A4, 17A5, 17A6, 17A7, 17A8, 17A9, and 17A10 should be prioritized to help prevent the spread of noxious weeds into grassland habitats. Noxious weed efforts should be focused to follow the priorities set by Wallowa County (see assessment section 1.5.2).

- **Restore degraded riparian areas**
  Riparian areas are very important to both the aquatic and terrestrial wildlife populations of the Imnaha subbasin. The Imnaha subbasin Multi-species Biological Assessment (USFS 2003a) identified 17 subwatersheds in the subbasin where riparian conditions are functioning at risk (7A,7D,7E,7H,7J,7K,7M,7O,7P,7Q, 8D, 9A,9D,9E,9F,9H,9K; see Appendix C of the Management Plan for a map of subwatershed locations). Maintaining and enhancing riparian conditions should improve habitat for fish and riparian dependent wildlife and improve connectivity between habitats and populations. Other finer scale areas of the subbasin may be identified as needing riparian restoration in the future.

  Strategies focused on the restoration of degraded riparian areas include 16B1, 16B2, 16B3, 16B4, 16B5, 16B6.

- **Increase baseline data collection and monitoring**
  Increased information on terrestrial populations in the subbasin, their interactions and ecosystem function is vital to effective management of the subbasin's terrestrial resources. Increased levels of baseline data collection and monitoring during and after project implementation will increase the ability for effective adaptive management.

  The strategies focused on data collection and monitoring are 13A1, 13A2, 13A3, 13A4, 13A5, 14A1, 15A1, 16A1, 18A1, 20A1, 20A2, 20A3.

- **Protect existing good quality habitat**
  Many areas of the subbasin contain terrestrial habitats in good condition, particularly when compared to the rest of the Columbia Basin. For example, the native bunchgrass habitats of the subbasin are among the best remaining examples in the region. Protecting these should be a top priority as they provide habitat for species that have lost habitat across much of their historic range, support ESA listed plant populations, and provide reference conditions that may be useful to restoration efforts in other areas. Protection of areas while they are in good condition is far more cost effective than restoring degraded areas, if restoration is even feasible.

  The strategies focused on protecting good quality habitats are 14A2, 14A3, 14A4, 15A2, 16A2, 16B1, 17A4, 17A5, 17A6.

V. References

Buchanan, D. V.; Hanson, M. L. and Hooton, R. M. 1997. Status of Oregon's Bull Trout: Distribution, Life History, Limiting Factors, Management Considerations, and Status. Portland: Oregon Department of Fish and Wildlife.

Nez Perce Tribe (NPT). 2004. Unpublished data currently on file at the Enterprise, OR Field Office.

U.S. Fish and Wildlife Service (USFWS). 2002b. Chapter 12, Imnaha-Snake Rivers Recovery Unit, Oregon. 86 p. *In*: U.S. Fish and Wildlife Service. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

U. S. Forest Service (USFS). 1995. Big Sheep Creek Watershed Analysis. Wallowa-Whitman National Forest.

U.S. Forest Service (USFS). 2003a. Imnaha Subbasin Multi-Species Biological Assessment (2003-2005). Wallowa-Whitman National Forest.

U.S. Forest Service (USFS). 2003b. Hells Canyon National Recreation Area Comprehensive Management Plan Final Environmental Impact Statement, Volume 1. U.S. Department of Agriculture, USFS, Pacific Northwest Region.