		Unscaled								Scaled (% / km)		
Geographic Area / Assessment Unit	DI	Prod.	N(eq)	Sum	Total Cumu -lative	Within Basin Cumu-lative	Rank	Cate-gory		Sum	Rank	Cate-gory
Out of Subbasin	89%	248%	723%	1060%			1	A		0.1%	14	C
Lower Twisp	21%	38%	54%	113%	7%	23%	2	A		2.0%	1	A
Lower Methow	27%	23%	44%	94%	13%	42%	3	A		1.8%	2	A
Middle Methow	17%	15%	26%	58%	17%	54%	4	B		1.4%	3	A
Beaver Ck/ Bear Ck	15%	10%	20%	46%	20%	63%	5	B		1.4%	4	A
Upper Chewuch	9%	13%	23%	45%	23%	72%	6	B		0.6%	10	C
Gold / Libby Ck	16%	9%	15%	40%	25%	80%	7	B		0.9%	7	B
Upper Methow / Early Winters Ck / Lost R.	1%	9%	16%	26%	27%	85%	8	C		0.4%	12	C
Upper Twisp	1%	9%	14%	24%	29%	90%	9	C		0.9%	8	B
Lower Chewuch	7%	6%	11%	24%	30%	95%	10	C		1.1%	6	B
Wolf / Hancock Ck	4%	3%	6%	13%	31%	97%	11	D		1.2%	5	B
Upper-Middle Methow	1%	1%	2%	5%	31%	98%	12	D		0.4%	13	C
Black Canyon/Squaw Ck	3%	1%	1%	5%	32%	99%	13	D		0.7%	9	C
Goat / Little Boulder Ck	2%	1%	1%	4%	32%	100%	14	D		0.5%	11	C

Table 45 Priority assessment units (AUs) and priority survival factors in the Methow subbasin, Washington.

Geographic Area / Assessment Unit	Integrated Priority Restoration Category	Habitat Diversity	Key habitat quantity	Sediment load	Obstructions	Channel Stability	Flow	Food	Temperature	Predation	Chemicals	Competition (hatchery fish)	Competition (other species)	Harassment/Poaching	Oxygen	Pathogens	Withdrawals
Middle Methow	A	1	2	2	1	1	2			2							
Lower Twisp	A	1	1	1	1	1	2	2	1								
Lower Chewuch	A	1	2	1	1	2	2	2	1								
Upper-Middle Methow	A	1	2			1	2	2									
Lower Methow	A	1		2					2	1							
Beaver Ck./ Bear Ck.	A	1	1	1	1	2	1	2									
Upper Twisp	B	1	1		1		2	2									
Wolf Ck / Hancock Ck	B	1	1	1	1	2	2	2	2								
Upper Chewuch	B	1	1	1	2	2		2	2								
Gold Ck/Libby Ck	B	1	1	1	1	2	2		2								
Upper Methow / Early Winters Ck / Lost R.	B	1	1			2	2	2									
Goat Ck / Little Boulder Ck	C	1	1	1		2		2									
Black Canyon/Squaw Ck	C	1		1	1		2										

Priorities were determined using the EDT model for steelhead and Chinook, and the QHA method for bull trout and cutthroat trout. For survival factors, 1=primary limiting factor, 2= secondary limiting factor, and blank cells were minor or not considered limiting factors.

3.23 EDT Species Results

3.23.1 Summer Steelhead

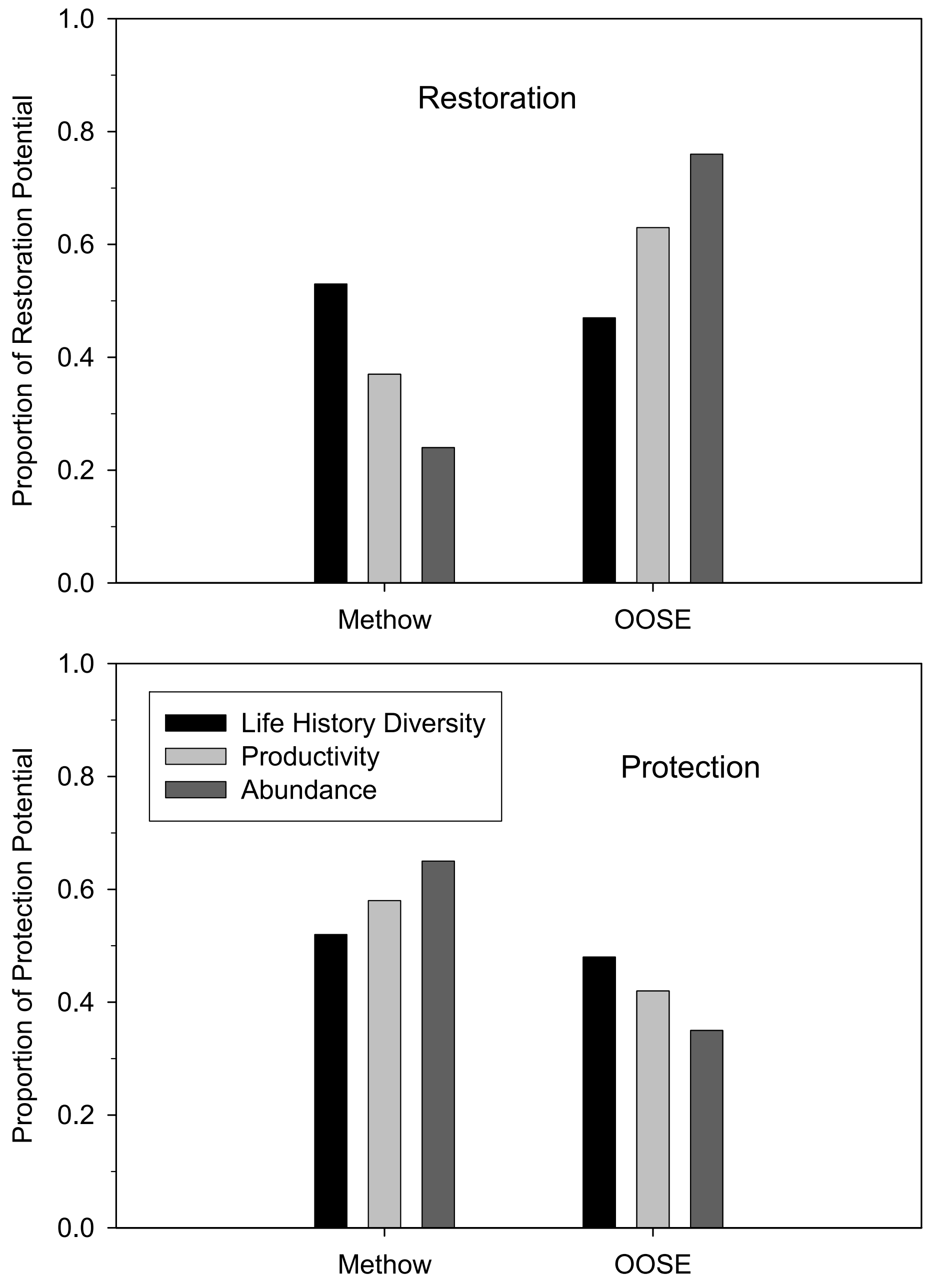
The restoration potential for summer steelhead within the Methow watershed was 59% for life history diversity, 35% for productivity, and 24% for abundance; therefore, increasing performance of summer steelhead in the Methow basin will be strongly tied to actions in the mainstem Columbia River. Additionally, when restoration actions are implemented in the Methow basin, we can expect to see the most gain in life history diversity, with smaller benefits to productivity and abundance.

Conversely, the largest potential losses to summer steelhead performance, because of degradation of habitat conditions, are within the Methow basin, with 68% for life history diversity, 74% for productivity, and 75% for abundance (**Table 46**). Therefore, it is most important to protect the pristine habitat in the Methow basin and prevent further degradation to current functional habitats.

Within the Methow basin, the Lower Twisp, Lower Methow Mainstem, Middle Methow Mainstem, and Beaver Creek/Bear Creek assessment units were the top priority for both scaled and unscaled restoration benefits (**Table 46**). These four assessment units comprised 63% (unscaled results) of the combined restoration potential for summer steelhead within the Methow basin and 20% of the overall restoration potential when including OOSE (**Figure 61**, **Table 46**).

For protection value, the Upper Twisp, Upper Methow (including Early Winters Creek and the Lost River), Lower Methow, and Upper Chewuch where the most important assessment units when considering both scaled and unscaled output. These four assessment units comprised 70% (unscaled results) of the combined protection benefit for summer steelhead within the Methow basin, and 51 % of the overall restoration potential when including OOSE The scaled rank adjusted the unscaled rank by dividing by the length of stream in the geographic area to evaluate restoration potential on a per kilometre basis. N(eq) was the equilibrium abundance of returning adult spawners (**Table 47**).

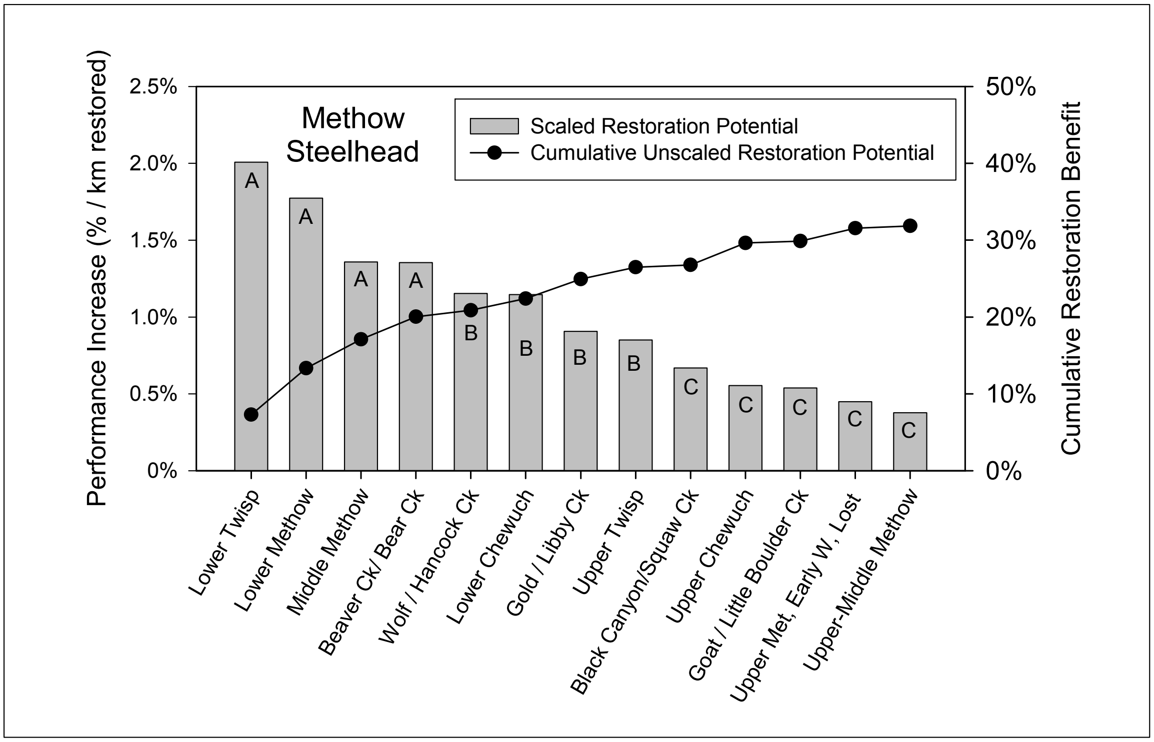
A summary of limiting habitat attributes and survival factors for each assessment unit and species specific life stage generated in the reach analysis of EDT can be found on the assessment unit summary sheets in the "synthesis of key findings" section of this report. The reach specific analysis reports that were generated in EDT and used to formulate the working hypothesis and limiting factors can be found at www.mobrand.com/edt/NWPCC/index.htm.



Source: Mobrand Biometrics Inc. 2004

Figure 60 Contribution of reaches inside and outside* the Methow River subbasin, Washington, to the total restoration and protection potential of summer steelhead

* Out-of-subbasin-effects (OOSE) include the Columbia River mainstem and estuary.



Source: Mobrand Biometrics Inc. 2004

Figure 61 Ecosystem Diagnosis and Treatment Model predictions of potential increased steelhead performance in the Methow basin, Washington, due to restoration actions in specific assessment units

Table 46 Ecosystem Diagnosis and Treatment (EDT) Model predictions of restoration potential for summer steelhead in Geographic Areas of the Methow basin, Washington

		Unscaled								Scaled (% / km)		
Geographic Area / Assessment Unit	**DI**	**Prod.**	**N(eq)**	**Sum**	**Total Cumu -lative**	**Within Basin Cumu- lative**	**Rank**	**Cate- gory**		**Sum**	**Rank**	**Cate- gory**
Out of Subbasin	89%	248%	723%	1060%			1	A		0.1%	14	C
Lower Twisp	21%	38%	54%	113%	7%	23%	2	A		2.0%	1	A
Lower Methow	27%	23%	44%	94%	13%	42%	3	A		1.8%	2	A
Middle Methow	17%	15%	26%	58%	17%	54%	4	B		1.4%	3	A
Beaver Ck/ Bear Ck	15%	10%	20%	46%	20%	63%	5	B		1.4%	4	A
Upper Chewuch	9%	13%	23%	45%	23%	72%	6	B		0.6%	10	C
Gold / Libby Ck	16%	9%	15%	40%	25%	80%	7	B		0.9%	7	B
Upper Methow / Early Winters Ck / Lost R.	1%	9%	16%	26%	27%	85%	8	C		0.4%	12	C
Upper Twisp	1%	9%	14%	24%	29%	90%	9	C		0.9%	8	B
Lower Chewuch	7%	6%	11%	24%	30%	95%	10	C		1.1%	6	B

		Unscaled								Scaled (% / km)		
Geographic Area / Assessment Unit	DI	Prod.	N(eq)	Sum	Total Cumu -lative	Within Basin Cumu-lative	Rank	Cate-gory		Sum	Rank	Cate-gory
Wolf / Hancock Ck	4%	3%	6%	13%	31%	97%	11	D		1.2%	5	B
Upper-Middle Methow	1%	1%	2%	5%	31%	98%	12	D		0.4%	13	C
Black Canyon/Squaw Ck	3%	1%	1%	5%	32%	99%	13	D		0.7%	9	C
Goat / Little Boulder Ck	2%	1%	1%	4%	32%	100%	14	D		0.5%	11	C

The scaled rank adjusted the unscaled rank by dividing by the length of stream in the geographic area to evaluate restoration potential on a per kilometre basis. N(eq) was the equilibrium abundance of returning adult spawners.

Table 47 Ecosystem Diagnosis and Treatment Model (EDT) predictions of degradation potential (protection benefit) for summer steelhead in Geographic Areas of the Methow Basin, Washington

				Unscaled						Scaled (% / km)		
Geographic Area / Assessment Unit	**DI**	**Prod.**	**N(eq)**	**Sum**	**Total Cumu -lative**	**Within Basin Cumu-lative**	**Rank**	**Cate-gory**		**Sum**	**Rank**	**Cate-gory**
Out of Subbasin	-60%	-44%	-100%	-204%			1	A		0.0%	14	D
Upper Methow / Early Winters Ck / Lost R.	-26%	-29%	-69%	-124%	16%	22%	2	A		-2.1%	2	A
Lower Methow	-21%	-24%	-63%	-108%	30%	42%	3	A		-2.0%	3	A
Upper Chewuch	-21%	-17%	-42%	-80%	41%	56%	4	A		-1.0%	6	B
Upper Twisp	-13%	-20%	-44%	-77%	51%	70%	5	A		-2.7%	1	A
Lower Twisp	-12%	-11%	-28%	-50%	58%	79%	6	B		-0.9%	8	B
Middle Methow	-10%	-9%	-22%	-41%	63%	86%	7	B		-1.0%	7	B
Gold / Libby Ck	-6%	-4%	-11%	-21%	66%	90%	8	C		-0.5%	11	C
Upper-Middle Methow	-9%	-2%	-5%	-16%	68%	92%	9	C		-1.3%	4	B
Lower Chewuch	-4%	-3%	-9%	-15%	70%	95%	10	C		-0.7%	9	C
Beaver CS[k./ Bear Ck.	-1%	-2%	-7%	-11%	71%	97%	11	C		-0.3%	12	C
Goat / Little Boulder Ck	-5%	-1%	-2%	-8%	72%	99%	12	D		-1.2%	5	B
Wolf / Hancock Ck	-1%	-2%	-4%	-7%	73%	100%	13	D		-0.7%	10	C
Black Canyon/Squaw Ck	0%	0%	0%	0%	73%	100%	14	D		-0.1%	13	D

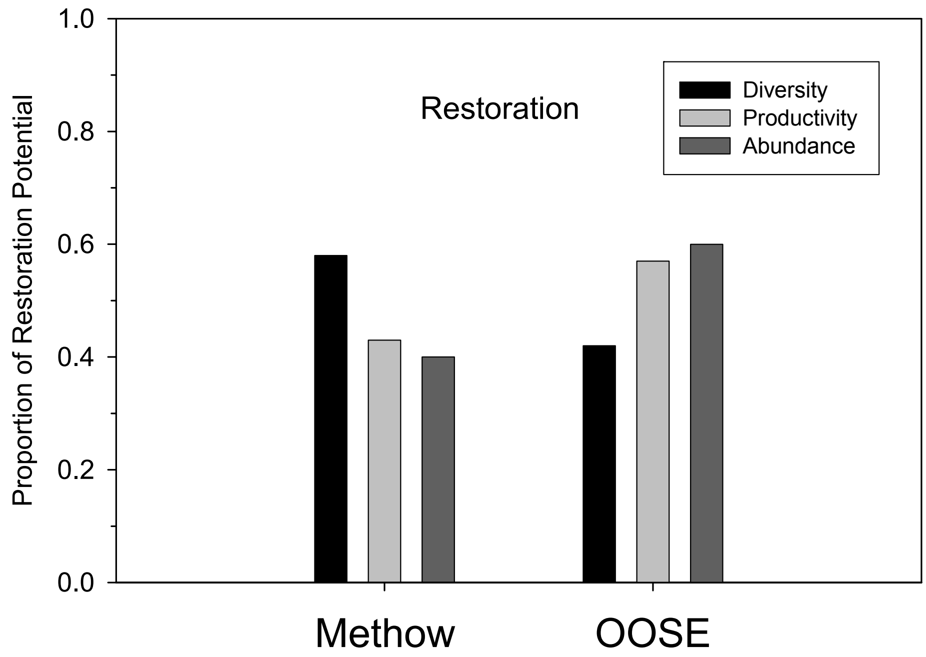
The scaled rank adjusted the unscaled rank by dividing by the length of stream in the Geographic Area to evaluate restoration potential on a per kilometre basis. N(eq) was the equilibrium abundance of returning adult spawners.

3.23.2 Spring Chinook

The restoration potential for spring Chinook within the Methow watershed was 58% for life history diversity, 43% for productivity, and 40% for abundance (**Figure 62**). Therefore, increasing performance of spring Chinook in the Methow basin will be strongly tied to actions in the mainstem Columbia River. Additionally, when restoration actions are implemented in the Methow basin, we can expect to see the most gain in life history diversity, with smaller benefits to productivity and abundance. Conversely, the largest potential losses to spring Chinook performance because of degradation of habitat conditions were within the Methow basin, with 94% for life history diversity, 89% for productivity, and 89% for abundance. It is most important, therefore, to protect the pristine habitat in the Methow basin and prevent further degradation to current functional habitats.

Within the Methow basin, the Middle Methow mainstem, Lower Chewuch, and Lower Twisp were high priority for both scaled and unscaled restoration benefits (Table 48). Additionally, the Upper-Middle Methow (Weeman Bridge to Robinson Creek) was high priority for scaled output, and the Upper Chewuch was high priority for unscaled output (**Table 49**). These five AUs comprised 83% (sum of unscaled totals for life history diversity, productivity, and abundance) of the restoration potential for spring Chinook in the Methow basin.

For protection value, the Upper Methow (including Early Winters Creek and Lost River), Upper Twisp, Upper-Middle Methow, Middle Methow, and Upper Chewuch were the most important AUs when considering both scaled and unscaled output (**Table 49**). These five AUs comprised 81% (sum of unscaled totals for life history diversity, productivity, and abundance) of the protection benefit for spring Chinook in the Methow basin.



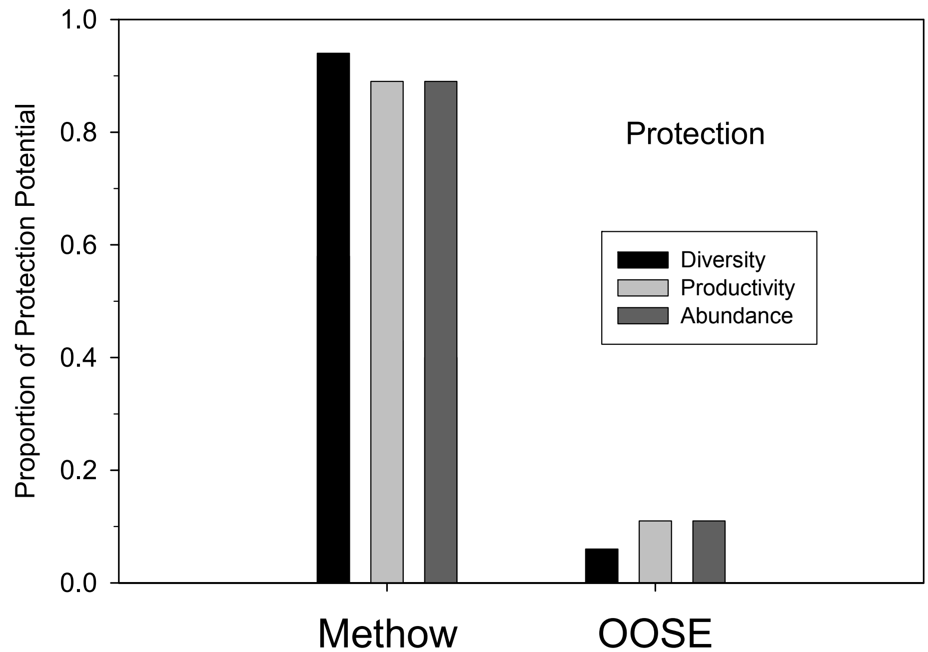


Figure 62 Contribution of reaches inside and outside* the Methow River subbasin, Washington to the total restoration and protection potential of spring Chinook

* Out-of-subbasin-effects (OOSE) include the Columbia River mainstem and estuary.

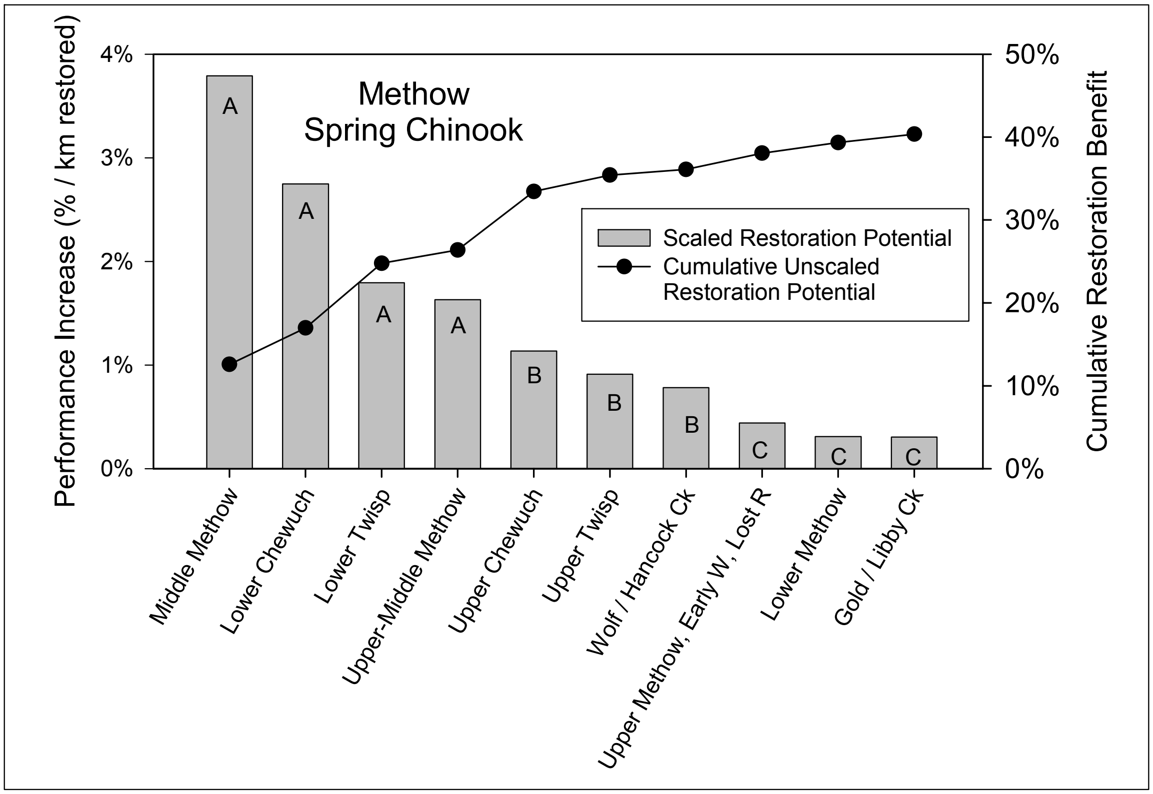


Figure 63 Ecosystem Diagnosis and Treatment Model predictions of potential increased spring chinook performance in the Methow basin, Washington, due to restoration actions in specific assessment units

Table 48 Ecosystem Diagnosis and Treatment Model (EDT) predictions of restoration potential for spring Chinook in Geographic Areas of the Methow basin, Washington

				Unscaled						Scaled (% / km)		
Geographic Area / Assessment Unit	**DI**	**Prod.**	**N(eq)**	**Sum**	**Total Cumu-lative**	**Within Basin Cumu-lative**	**Rank**	**Cate-gory**		**Sum**	**Rank**	**Cate-gory**
Out of Subbasin	31%	257%	485%	773%			1	A		0.1%	11	C
Middle Methow	10%	63%	91%	163%	13%	31%	2	A		3.8%	1	A
Lower Twisp	13%	36%	53%	101%	20%	51%	3	A		1.8%	3	A
Upper Chewuch	4%	34%	53%	92%	27%	68%	4	A		1.1%	5	B
Lower Chewuch	6%	19%	31%	57%	32%	79%	5	A		2.7%	2	A
Upper Methow / Early Winters Ck / Lost R.	0%	10%	15%	26%	34%	84%	6	B		0.4%	8	C
Upper Twisp	0%	11%	15%	26%	36%	89%	7	B		0.9%	6	B
Upper-Middle Methow	0%	10%	11%	21%	37%	93%	8	B		1.6%	4	A
Lower Methow	2%	4%	10%	16%	39%	96%	9	C		0.3%	9	C
Gold / Libby Ck	4%	3%	6%	13%	40%	98%	10	C		0.3%	10	C
Wolf / Hancock Ck	4%	2%	3%	9%	40%	100%	11	C		0.8%	7	B

The scaled rank adjusted the unscaled rank by dividing by the length of stream in the geographic area to evaluate restoration potential on a per kilometre basis. N(eq) was the equilibrium abundance of returning adult spawners.

Table 49 Ecosystem Diagnosis and Treatment (EDT) Model predictions of degradation potential (protection benefit) for spring Chinook in Geographic Areas of the Methow Basin, Washington

			Unscaled							Scaled (% / km)		
Geographic Area / Assessment Unit	**DI**	**Prod.**	**N(eq)**	**Sum**	**Total Cumu -lative**	**Within Basin Cumu-lative**	**Rank**	**Cate-gory**		**Sum**	**Rank**	**Cate-gory**
Upper Methow / Early Winters Ck / Lost R.	-32%	-24%	-27%	-83%	18%	20%	1	A		-1.4%	4	B
Upper Chewuch	-24%	-18%	-33%	-75%	35%	39%	2	A		-0.9%	6	B
Middle Methow	-14%	-22%	-34%	-70%	50%	56%	3	A		-1.6%	3	B
Upper Twisp	-14%	-23%	-22%	-59%	64%	70%	4	A		-2.1%	2	A
Upper-Middle Methow	-12%	-16%	-17%	-45%	73%	81%	5	B		-3.5%	1	A
Out of Subbasin	-7%	-15%	-22%	-44%			6	B		0.0%	11	C
Lower Twisp	-6%	-13%	-19%	-38%	82%	91%	7	B		-0.7%	7	B
Lower Chewuch	-8%	-5%	-14%	-27%	88%	97%	8	B		-1.3%	5	B
Lower Methow	-2%	-1%	-3%	-6%	89%	99%	9	C		-0.1%	9	C
Gold / Libby Ck	-1%	0%	-2%	-4%	90%	99%	10	C		-0.1%	10	C
Wolf / Hancock Ck	0%	0%	-2%	-2%	90%	100%	11	C		-0.2%	8	C

The scaled rank adjusted the unscaled rank by dividing by the length of stream in the Geographic Area to evaluate restoration potential on a per kilometre basis. N(eq) was the equilibrium abundance of returning adult spawners.

3.23.3 Summer Chinook

The restoration potential for summer/fall Chinook within the Methow watershed was 53% for life history diversity, 37% for productivity, and 24% for abundance (**Figure 64**); therefore, increasing performance of spring Chinook in the Methow basin will be strongly tied to actions in the mainstem Columbia River. Additionally, when restoration actions are implemented in the Methow basin, we can expect to see the most gain in life history diversity, with smaller benefits to productivity and abundance. Conversely, the largest potential losses to summer/fall Chinook performance because of degradation of habitat conditions were within the Methow basin, with 52% for life history diversity, 58% for productivity, and 65% for abundance. Therefore, it is most important to prevent further degradation to current functional habitats.

Summer/fall Chinook only occur in the lower 55 miles of the Methow River mainstem, which only spans two of the AUs delineated in our EDT model run. It does not make sense to prioritize at this course scale, so we gave primary importance to both the Lower and Middle Methow AUs. Prioritizing individual reaches within these AUs for summer/fall Chinook in a separate EDT model run was beyond the scope of this subbasin plan.

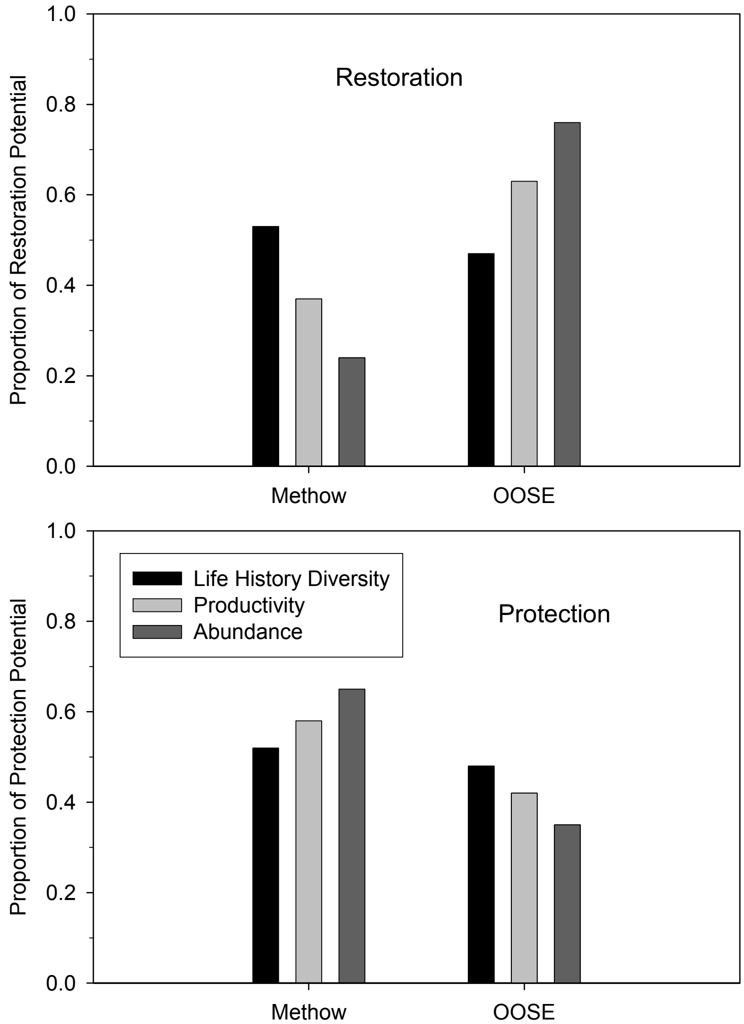


Figure 64 Contribution of reaches inside and outside* the Methow River subbasin, Washington to the total restoration and protection potential of summer/fall Chinook

* Out-of-subbasin-effects (OOSE) include the Columbia River mainstem and estuary.

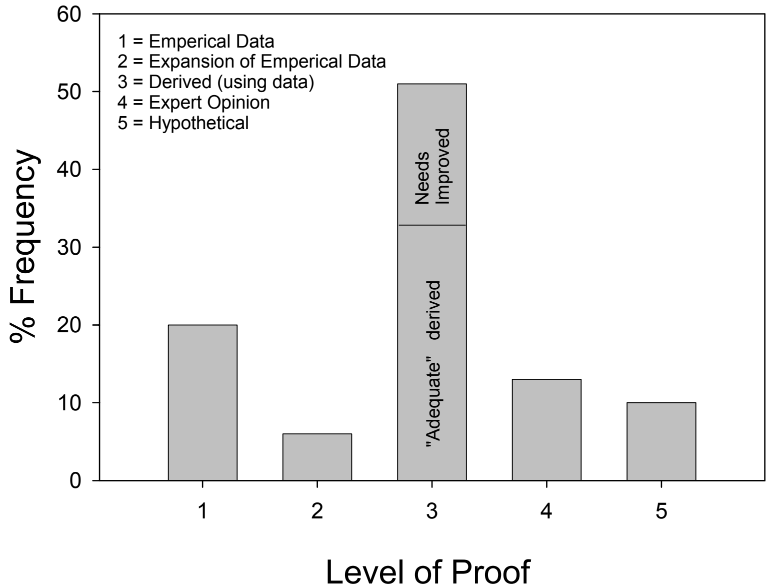


Figure 65 Summary of basin-wide level of proof used to rate EDT input data for current environmental conditions in the Methow subbasin, Washington

Table 50 Integrated priority geographic areas for habitat restoration for summer steelhead (Stlhd), spring Chinook (SprChk), summer/fall Chinook (S/FChk), bull trout (Bull Tr.), and westslope cutthroat trout (WSCT) in the Methow River subbasin, Washington

	EDT Restoration Priorities				QHA Restoration Priorities					
Geographic Area / Assessment Unit	**Steel-head**	**Spr-Chk**	**Sum-Fal-Chk**		**Bull Tr.**	**WSCT**		**Endangered Fish Sum**	**All Fish Sum**	**Cate-gory**
Middle Methow	1	1	1		1	2		2	6	A
Lower Twisp	1	1	4		2	2		2	10	A
Lower Chewuch	2	1	4		2	2		3	11	A
Upper-Middle Methow	3	1	4		1	1		4	10	A
Lower Methow	1	3	1		3	3		4	11	A
Beaver Ck / Bear Ck.	1	4	4		3	4		5	16	A
Upper Twisp	2	2	4		1	1		4	10	B
Wolf Creek / Hancock Ck	2	2	4		1	1		4	10	B
Upper Chewuch	3	2	4		1	1		5	11	B
Gold Ck / Libby Ck	2	3	4		1	2		5	12	B
Upper Methow / Early Winters Ck / Lost R.	3	3	4		1	1		6	12	B
Goat / Little Boulder Ck	3	4	4		2	2		7	15	B
Black Canyon / Squaw Ck	3	4	4		4	4		7	19	C

For each focal species-AU combination, categorical ranks (A,B,C) were converted to numerical values (1,2,3) and a value of 4 was assigned to the assessment unit if a particular species was absent. Intra-specific priorities were generated using the Ecosystem Diagnosis and Treatment model scaled (% potential benefit / km) for anadromous fish and qualitative habitat assessment method for resident fish. Inter-specific (integrated) priorities were generated by giving preference to Endangered fish first, then Threatened, then all focal species. Categories (A,B,C) represents groups of assessment units with the highest, intermediate, and lowest potential for benefit to focal species.

Table 51 Integrated priority geographic areas for habitat protection for summer steelhead, spring Chinook (Spr-Chk), summer/fall Chinook (Sum-Fal-Chk), bull trout (Bull Tr.), and westslope cutthroat trout (WSCT) in the Methow River Subbasin, Washington

	EDT Restoration Priorities			QHA Restoration Priorities				
Geographic Area / Assessment Unit	**Steel-head**	**Spr-Chk**	**Sum-Fal-Chk**	**Bull Tr.**	**WSCT**	**Endangered Fish Sum**	**All Fish Sum**	**Cate-gory**
Upper Twisp	1	1	4	1	1	2	8	A
Upper Methow / Early Winters Ck / Lost R.	1	2	4	1	1	3	9	A
Upper-Middle Methow	2	1	4	1	1	3	9	A
Lower Methow	1	3	1	3	3	4	11	A
Upper Chewuch	2	2	4	1	1	4	10	B
Wolf Ck / Hancock Ck	3	3	4	1	1	6	12	B
Gold Ck/Libby Ck	3	3	4	1	1	6	12	B
Middle Methow	2	2	1	2	2	4	9	B
Goat Ck / Little Boulder Ck	2	4	4	2	2	6	14	B
Lower Twisp	2	2	4	3	3	4	14	B
Lower Chewuch	3	2	4	3	3	5	15	B
Beaver Ck./ Bear Ck.	3	4	4	3	3	7	17	C
Black Canyon/Squaw Ck	4	4	4	3	3	8	18	C

For each focal species-AU combination, categorical ranks (A,B,C) were converted to numerical values (1,2,3) and a value of 4 was assigned to the assessment unit if a particular species was absent. Intra-specific priorities were generated using the Ecosystem Diagnosis and Treatment model scaled (% potential benefit / km) for anadromous fish and qualitative habitat assessment method for resident fish. Inter-specific (integrated) priorities were generated by giving preference to endangered fish first, then threatened, then all focal species. Categories (A,B,C) represents groups of assessment units with the highest, intermediate, and lowest potential for benefit to focal species.

Table 52 Priority assessment units and priority survival factors in the Methow subbasin, Washington

Geographic Area / Assessment Unit	Integrated Priority Restoration Category	Habitat Diversity	Key habitat quantity	Sediment load	Obstructions	Channel Stability	Flow	Food	Temperature	Predation	Chemicals	Competition (hatchery fish)	Competition (other species)	Harassment/Poaching	Oxygen	Pathogens	Withdrawals
Middle Methow	A	1	2	2	1	1	2			2							
Lower Twisp	A	1	1	1	1	1	2	2	1								
Lower Chewuch	A	1	2	1	1	2	2	2	1								
Upper-Middle Methow	A	1	2			1	2	2									
Lower Methow	A	1		2					2	1							
Beaver Ck./ Bear Ck.	A	1	1	1	1	2	1	2									
Upper Twisp	B	1	1		1		2	2									
Wolf Ck / Hancock Ck	B	1	1	1	1	2	2	2	2								
Upper Chewuch	B	1	1	1	2	2		2	2								
Gold Ck/Libby Ck	B	1	1	1	1	2	2		2								
Upper Methow / Early Winters Ck / Lost R.	B	1	1			2	2	2									
Goat Ck / Little Boulder Ck	C	1	1	1		2		2									
Black Canyon/Squaw Ck	C	1		1	1		2										

Priorities were determined using the EDT model for steelhead and Chinook, and the QHA method for bull trout and cutthroat trout. For survival factors, 1=primary limiting factor, 2= secondary limiting factor, blank cells were minor or not considered limiting factors.

Limiting Environmental Attributes

The Methow Basin is a naturally harsh environment for fish, with high peak flows, low base flows, warm summers, extremely cold winters, natural dewatering areas, and intense fire regimes. Our assessment was not designed nor intended to evaluate the conditions that naturally limit salmonid production. We determined limiting factors from EDT output that identified the survival factors that deviated the most from template conditions. If low base flow and cold winter temperatures are the natural limitations to salmonid production in the Methow Basin, then our assessment would not identify those factors, unless it was determined that current flow is lower and current temperatures are colder. This is an important distinction because the goal of this assessment was to identify the greatest opportunities for improvement within the Methow basin. The goal was not to identify the natural limits of the watershed, nor to compare and contrast cost-benefit tradeoffs of improving survival inside the Methow basin versus in the mainstem Columbia River or other area outside the basin.

Throughout the Methow Subbasin, habitat diversity was the most common limiting factor to focal fish species (Table 8). Habitat diversity was a function of gradient, natural confinement, man-made confinement, floodplain connection, off-channel habitat, LWD, and riparian vegetation. The effect of man-made confinement, riparian function, and template LWD were driving these results, but there was no way to validate our assumptions about template conditions. Losses to habitat diversity affected most life stages from moderate to high degrees, depending on the AU and species. See the working hypothesis in Appendix E for predictions of life stages most affected by losses of habitat diversity.

Other critical limiting factors included key habitat quantity (which was primarily a function of reduced quality pools for rearing and holding and reduced pool tailouts for spawning), sediment load (turbidity, embeddedness, and % fines), obstructions, and channel stability (bed scour, icing, riparian function, wood, man-made confinement, flashy flow, change in annual peak flow). We assumed that man-made confinement, recent and historic removal of LWD, increased bed scour, and degraded riparian zone vegetation had reduced the number of quality pools, pool tailouts, and LWD in most of the lower reaches of the Methow River and its tributaries. The difference between current and template values for these assumptions were driving the results that these survival factors were primary limiting factors in the Methow Basin, and there was no way to validate our assumptions about template conditions. Channel stability (bed scour) and sediment load were particularly problematic for fry colonization and incubation life stages, whereas obstructions and key habitat quantity varied by AU depending on localized conditions within the AU. See the working hypothesis in Appendix E for predictions of life stages and assessment units most affected by these habitat attributes.

Common secondary limiting factors included flow (reduced base flow, increased peak flow), food (reduced salmon carcasses and benthic invertebrate productivity), and temperature (high summer temperatures) (Table 8). Although there was a slight increase to peak flow and flashy flow because of road density, the majority of flow-related problems in the Methow basin were related to water withdrawals during summer low flows, impacting juvenile rearing life stages and pre-spawn holding and spawning spring Chinook. There are studies underway, and a draft watershed plan, that deals extensively with irrigation withdrawals, groundwater recharge, IFIM, and other flow-related issues. We did not attempt a scientifically defensible analysis of base flow in relation to salmonid performance; however, the EDT model is capable of evaluating the benefit of alteration to flow regimes. This tool could be used in the future to predict benefits and tradeoffs, once options are identified for improving flow conditions in the Methow basin. Our assessment identified flow as a secondary limiting factor to salmonid performance; therefore, opportunities to fill data gaps regarding flow or increase flow during base flow conditions should be pursued, but not at the expense of other primary limiting factors. See the working hypothesis in Appendix E for predictions of life stages and assessment units most affected by increased peak flows and reduced base flows.

Fewer salmon carcasses were the primary reason for food being identified as a secondary limiting factor. The EDT model predicted that small to moderate increases could be gained for juvenile life stages, but potential increases were very minor compared to factors such as riparian function, channel stability, and habitat diversity.

Warm summer temperatures were identified as a primary problem in the two key tributaries, the Twisp and Chewuch Rivers, at a time when migration, pre-spawn holding and spawning was critical to spring Chinook. Although temperature was identified as secondary in other tributaries, it rarely got above 18 ^{o}C (64 F)and the majority of the effect was because of multiple days over 16 ^{o}C (61 F). In the lower Twisp and Chewuch Rivers, however, the majority of daytime high temperatures were over 18 ^{o}C from mid-July to early September, based on USFS data collected in 2001 and 2002. We had access to very good temperature data for this analysis, and have high confidence that cooler temperatures in these key tributaries need to be restored.

See section 2.5 for a qualitative description of potential causal mechanisms for each of these limiting factors, relevant to each assessment unit.

Integrated Priority Assessment Units (AUs)

We incorporated EDT output for anadromous fishes, and QHA output for resident fishes and generated an integrated list of priority AUs. Categorical ranks (A,B,C) for each species were converted to numerical values (1,2,3), and a value of 4 was assigned to the AU if a particular species was absent. We then summed across all focal species and ordered the list by prioritizing Endangered fish first, Threatened fish second, and non-listed focal species last.

All AUs with a primary benefit to an Endangered species (steelhead, spring Chinook) were in the integrated category “A,” and were then ordered within category “A” based on their score (lowest sum across focal species with Endangered fish first, all fish second) (**Table 42**). All remaining AUs with a primary benefit to a Threatened species (bull trout) were in the category “B,” and were then ordered within category “B” based on their score (lowest sum across focal species with Endangered fish first, all fish second) (**Table 42**). Remaining AUs were considered category “C” and were ordered in the same fashion as previously described. The integrated priority list for restoration and protection can be seen in **Table 50** and **Table 51**, respectively.

We also integrated the inter-species priority list with the AU limiting habitat attribute summary analysis to provide a matrix to describe “where” and “what” needs restoration in the Methow subbasin.

Note: In the Management Plan section of this plan we outline the limitations of assigning priorities across multiple subbasin scales, programs and all “H” sectors. Readers are encouraged to use caution during qualitative prioritization exercises and to examine this plan in sum and in context before adopting or ascribing priorities based upon restricted use of independent sections.

3.24 Synthesis of Key Findings – Fish Habitat

Four course-scale filters, noted below, were used to guide us in developing strategies and to ensure that actions are balanced and rational. They were then used to gauge if the actions will be ultimately implementable. In taking this step, we found that trade-off analysis and multiple iterations of planning was reduced by focusing actions in areas and on habitat attributes that fell within the "realm of the do-able and effectual."

9. Is the strategy supported by science?
10. Is the strategy cost-effective?
11. Does the strategy have (or is it likely to win) public support?
12. Are resources available to implement the strategy and monitor the outcomes—including enforcement where relevant?

These AU Summaries are, therefore, not intended to be prescriptive; rather, they focus on a logical series of actionable measures for use and consideration in developing future programs and projects. The prioritizations are relative and qualitative in nature. The question asked was "Where and when do we focus efforts to support the subbasin plan goals, and what is the range of possible and reasonable actions?"

We took a four-step approach to answering this question: 1) estimate status of habitat processes historically and currently; 2) evaluate current and historic fish population use of these habitats; 3) characterize actions and strategies through the use of working hypothesis statements, and 4) identify a list of measurable objectives (see Monitoring and Evaluation Program), and identify strategies to guide the development of projects, programs and actions for the next 15 years.

The assessment focused on identification of limiting factors, specific habitat and ecosystem attributes relative to survival and/or mortality, and location and spatial extent of the habitats themselves. Our analytical method and tool (EDT) allowed us to do this "through the eyes of the fish."

The Goals and Species Objective sections of this plan describe the future desired condition for fish populations in terms of long-term viability, sustainability and opportunities for ceremonial, subsistence, and recreational harvest. These are tied directly to the assessment findings, with subsequent and derived guidance provided in this section.

In summary, the ecosystem diagnosis method used (the assessment) was intended primarily to address the question: "*Is there potential to improve anadromous salmonid population status through improvements to habitat conditions in tributary environments?*"

3.25 Synthesis and Interpretation of Assessment for Terrestrial / Wildlife Ecosystems

Subbasin assessment conclusions are identical to those found at the Ecoprovince level for focal habitat types and species. An assessment synthesis is included in section 6 in Ashley and Stovall (unpublished report 2004).

The process used to develop wildlife assessments and management plan objectives and strategies is based on the need for a landscape-level, holistic approach to protecting the full range of biological diversity at the Ecoregion scale, with attention to size and condition of core areas (subbasin scale), physical connections between core areas, and buffer zones surrounding core areas to ameliorate impacts from incompatible land uses. As most wildlife populations extend beyond subbasin or other political boundaries, this "conservation network" must contain habitat of sufficient extent, quality, and connectivity to ensure long-term viability of obligate/focal wildlife species. Subbasin planners recognized the need for large-scale planning that would lead to effective and efficient conservation of wildlife resources.

In response to this need, Ecoregion planners approached subbasin planning at two scales. The landscape-level scale emphasizes focal habitats and associated species assemblages that are important to Ecoregion wildlife managers, while specific focal habitat and/or species needs are identified at the subbasin-level scale.

Ecoregion and subbasin planners agreed with Lambeck (1997) who proposed that species requirements ("umbrella species concept") could be used to guide ecosystem management. The main premise is that the requirements of a demanding species assemblage encapsulate those of many co-occurring, less demanding species. By directing management efforts towards the requirements of the most exigent species, the requirements of many cohabitants that use the same habitat type are met; therefore, managing habitat conditions for a species assemblage should provide life requisite needs for most other focal habitat obligate species.

Ecoregion/subbasin planners also assumed that by focusing resources primarily on riparian wetland, Ponderosa pine, and shrubsteppe habitats, the needs of most listed and managed terrestrial species, dependent on these habitats, would be addressed during this planning period. While other listed and managed species occur within the subbasin, primarily forested habitat obligates, needs of these species are addressed primarily through the existing land management frameworks of the federal agencies within whose jurisdiction the overwhelming majority of these habitats occur (Okanogan/Wenatchee National Forest and Washington Department of Natural Resources).

Ecoprovince/subbasin planners identified a focal species assemblage for each focal habitat type and combined life-requisite habitat attributes for each species assemblage to form a "recommended range of management conditions," that, when achieved, should result in functional habitats.

The rationale for using focal species assemblages is to draw immediate attention to habitat features and conditions most in need of conservation or most important in a functioning ecosystem. The corollary is that factors that affect habitat quality and integrity within the Ecoregion and subbasins also impact wildlife species. As a result, identifying and addressing "factors that affect focal habitats" should support the needs of obligate wildlife populations as well. Planners recognize, however, that addressing factors that limit habitat does not necessarily address some anthropogenic-induced limiting factors such as affects of human presence on wildlife species.

Emphasis in this management plan is placed on the selected focal habitats and wildlife species described in the inventory and assessment. It is clear from the inventory and assessment that reliable quantification of most subbasin level impacts is lacking; however, many anthropogenic changes have occurred and clearly impact the focal habitats: riparian wetlands, shrubsteppe and Ponderosa pine forest habitats.

While all habitats are important, focal habitats were selected in part because they are disproportionately vulnerable to anthropogenic impacts, and likely to have received the greatest degree of existing impacts within the subbasin. In particular, the majority of shrubsteppe and Ponderosa pine habitats fall within the “low” or “no” protection status categories defined above. Some of the identified impacts are, for all practical purposes, irreversible (conversion to urban and residential development, primary transportation systems); others are already being mitigated through ongoing management (ie, USFS adjustments to grazing management).

It is impractical to address goals for future conditions within the subbasin without consideration of existing conditions; not all impacts are reversible. The context within which this plan was drafted recognizes that human uses do occur, and will continue into the future. Recommendations are made within this presumptive framework.

Subbasin assessment conclusions are identical to those found at the Ecoprovince level for focal habitat types and species. An assessment synthesis is included in section 6 in Ashley and Stovall (unpublished report 2004).

Riparian Wetlands Working Hypothesis Statement

The proximate or major factors affecting riparian wetlands are direct loss of habitat, due primarily to urban/agricultural development, reduction of habitat diversity and function resulting from exotic vegetation, livestock overgrazing, fragmentation, and recreational activities. The principal habitat diversity stressor is the spread and proliferation of invasive exotics. That stressor, coupled with poor habitat quality of existing vegetation, has resulted in extirpation and/or significant reductions in riparian habitat obligate wildlife species.

Ponderosa Pine Working Hypothesis Statement

The near-term or major factors affecting Ponderosa Pine stands are direct loss of habitat due primarily to timber harvesting, fire reduction/wildfires, mixed forest encroachment, development, recreational activities, and reduction of habitat diversity and function resulting from invasion by exotic species and vegetation and overgrazing. The principal habitat diversity stressors are the spread and proliferation of mixed-forest conifer species within Ponderosa pine communities, due primarily to fire reduction and intense, stand-replacing wildfires, and invasive exotic weeds. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation), coupled with poor habitat quality of existing vegetation (i.e., lack of old growth forest and associated large-diameter trees and snags), have resulted in significant reductions in Ponderosa pine habitat obligate wildlife species.

Shrubsteppe Working Hypothesis Statement

The near-term or major factors affecting shrubsteppe areas are direct loss of habitat, due primarily to conversion to agriculture, residential development, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires, and livestock grazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and knapweeds that either supplant and/or radically alter entire native bunchgrass communities, significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation), coupled with poor habitat quality of extant vegetation, have resulted in extirpation and/or significant reductions in shrubsteppe obligate wildlife species.