Figure 1. Normalizing scores for watershed characteristics. A. In order to compare differing amounts of physical units (e.g. riparian area, escapement numbers, old growth area), we performed log transformation, then calculated a standard z-score (see Equation 1) for each watershed. This converts physical units into normalized units that are directly comparable and have meaningful units. For example, a z-score of "1" indicates that the value for that watershed is 1 standard deviation greater than the mean (which is zero).

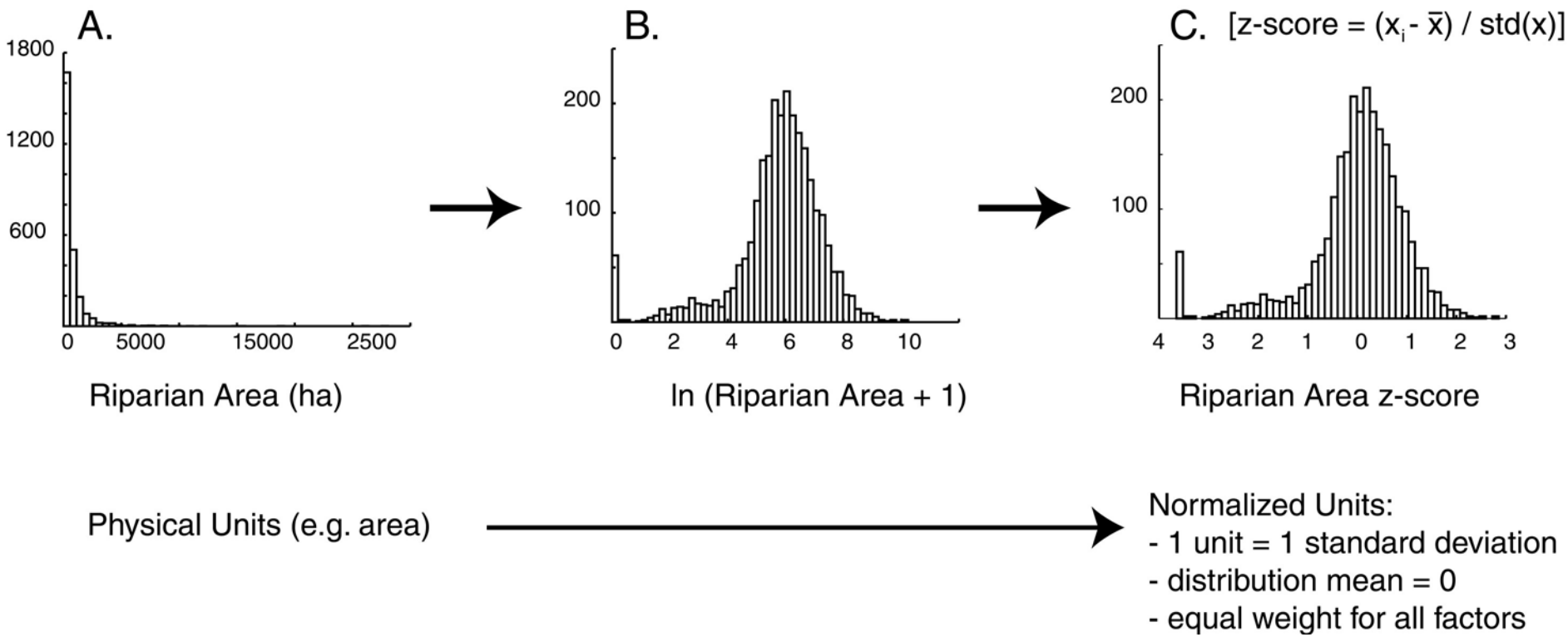


Figure 2. Old Growth index calculation

$$OGI_{ws} = \sum_{1}^{n} \text{z-score}(\ln(\text{area}_{n}^{ws} + 1))$$

where:

ws = watershed code

n = species group defined as:

species group	height class	age class	inventory type group
cedars	>37.5m	>250 years	9,10,11,12,14
sitka spruce	>37.5m	>250 years	16,20,21,22,23,24,26
douglas fir	>20m	>141 years	1,2,3,4,5,8
all species	>37.5m	>250 years	all

Table 1. Core Intact Area identification criteria

Watershed attribute	Definition
< 10% of forested area logged	BC MOF forestry database (1:250,000 generalized from 1:20,000 forest cover data and 1:20,000 forest cover data). Forested area was defined as basic class = 0 (productive forest) in the database. Logging data was taken from Sierra Club B.C. satellite imagery analysis (2001) and from digitized forest development plans.
< 0.2 km/km2 road density	1:20,000 TRIM roads
< 1/2 AT/CWH biogeoclimatic zone area ratio (to eliminate areas that are primarily rock and ice)	BC biogeoclimatic zone classification
Presence of intact forest with old growth structure	BC MOF forestry database (1:250,000 generalized from 1:20,000 forest cover data and 1:20,000 forest cover data). Forests with old growth structure were defined as having large and old trees (height class > 37.5 m tall and age class > 250 years old). In addition douglas fir polygons of height class > 30m age class > 200 years old were also included (our criteria for delineating Douglas fir old-growth is more inclusive than for other tree species because of disproportionate historic human impact). This forestry data was updated using logging data was taken from Sierra Club B.C. satellite imagery analysis (1993, 1998 and 2001) and from digitized forest development plans.

Table 2. Grizzly Bear Index Components

Watershed attribute	Definition
Estuary	Presence on field surveys, provincial data sets and identification by local experts.
Salmon Abundance and Diversity	We averaged data in the AFS database to reduce sampling artifacts (i.e. bias towards more heavily sampled areas). For each watershed, we calculated a salmon index which is the normalized (z-score) mean abundance (calculated by mean escapements for each stock over the last 40 years) by stock (identifiable run that is counted separately). Thus the salmon index accounts for both abundance and stocks (five species and separate runs). Steelhead and coastal cutthroat trout were omitted because of lack of data.
Riparian Area	Riparian index based on the normalized (z-score) riparian area within each watershed (sum of the area within 100 m of any stream detectable using the 1:50,000 BC watershed atlas). Although the actual width of the riparian zone varies considerably, we assume that more linear stream area is correlated with riparian area.
Old growth area	Old Growth Index (see *Core Intact Areas* methods (above) for description)
Grizzly bear distribution range	Provincial grizzly bear population units

Figure 3. Components of the Grizzly Bear/Salmon Watershed Index. A. Riparian area. We calculated area within 100m of a river as a surrogate for riparian area. B. Salmon Index, calculated as the sum z-score escapement for 5 species of salmon. Most watersheds (2000 out of 2599) in did not have recorded salmon escapement, and a few watersheds had high escapement numbers. C. Old Growth Index.

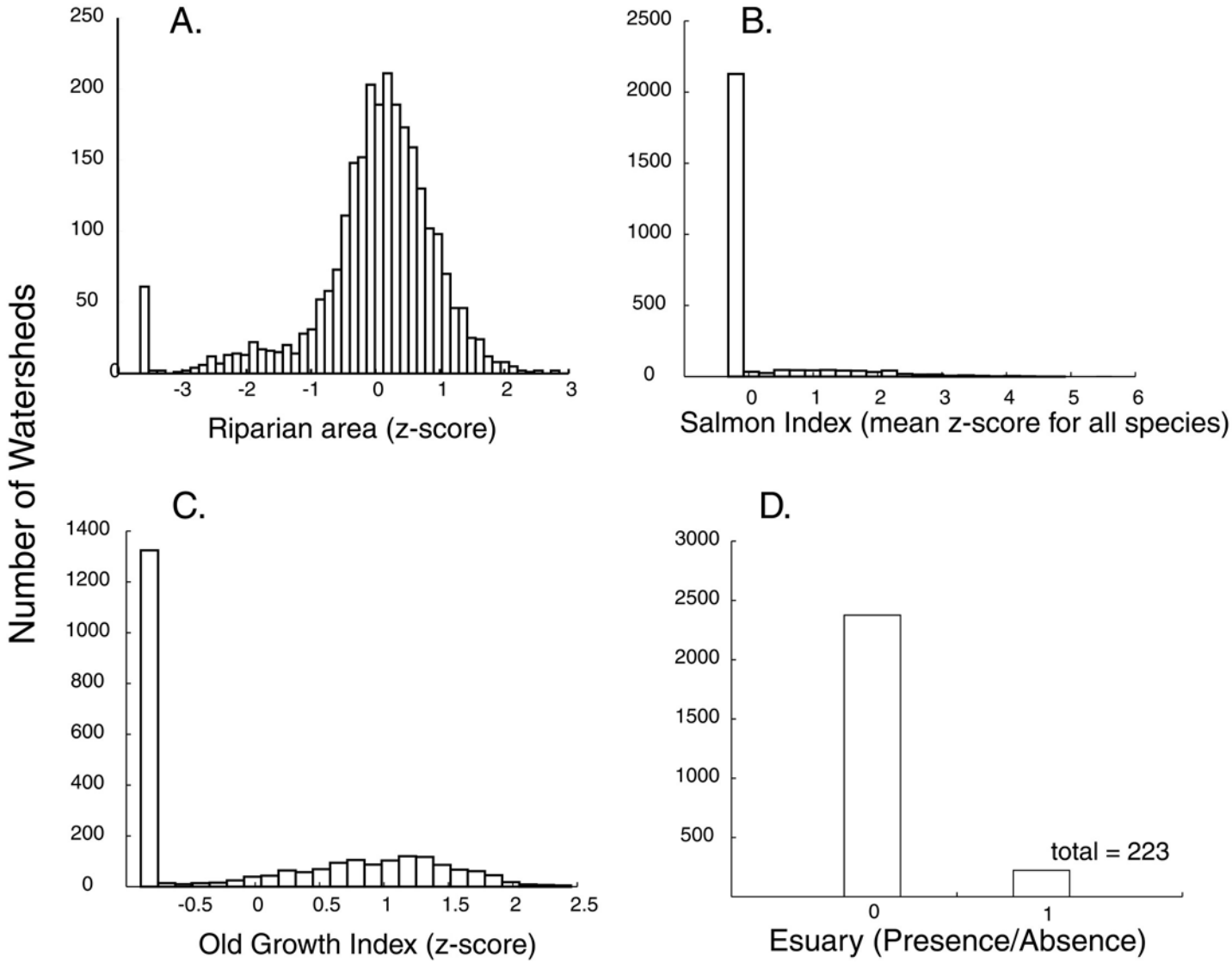


Figure 4. Setting thresholds for grizzly bear/salmon watersheds

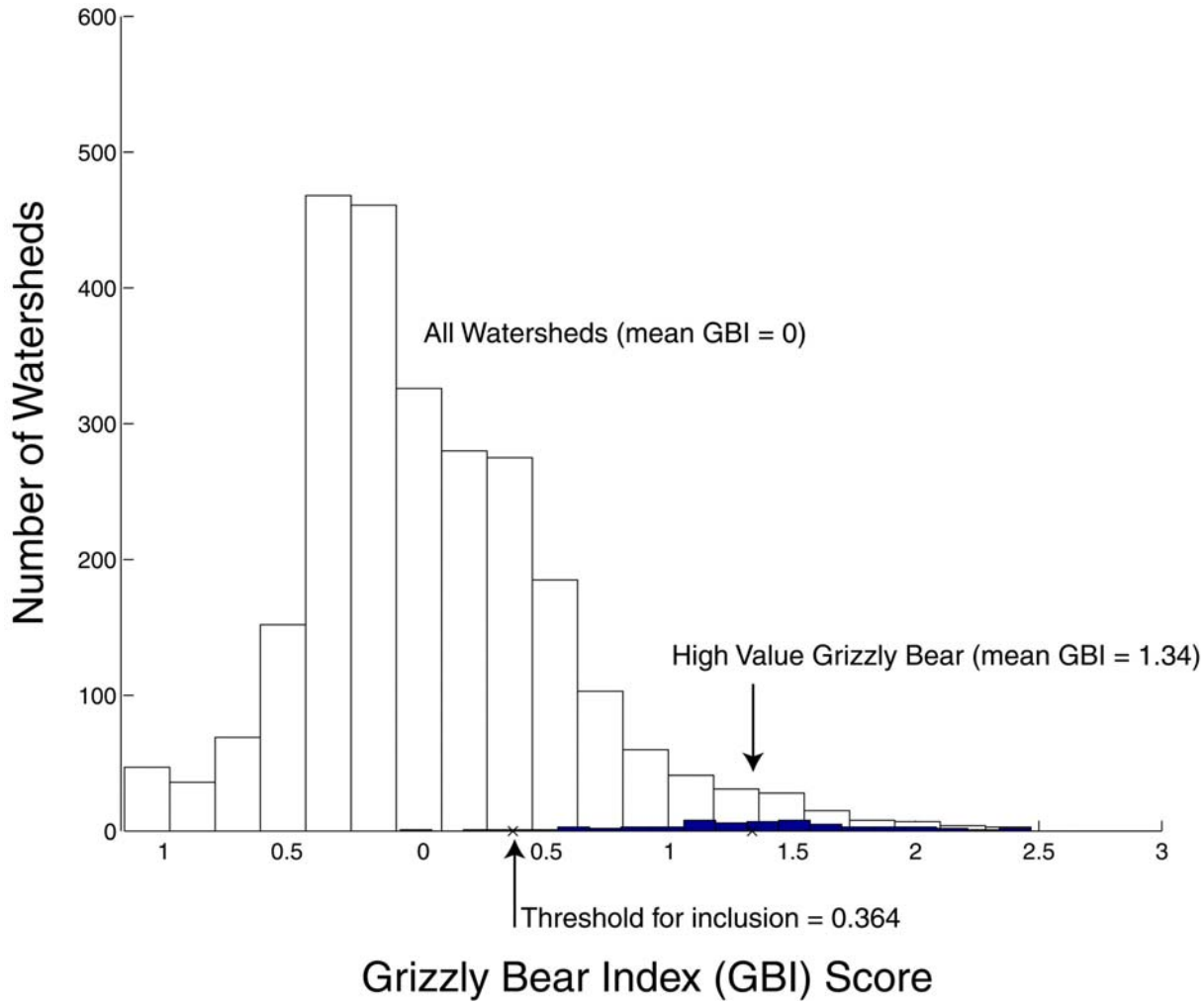


Figure 5. Distribution of human impacts by watershed

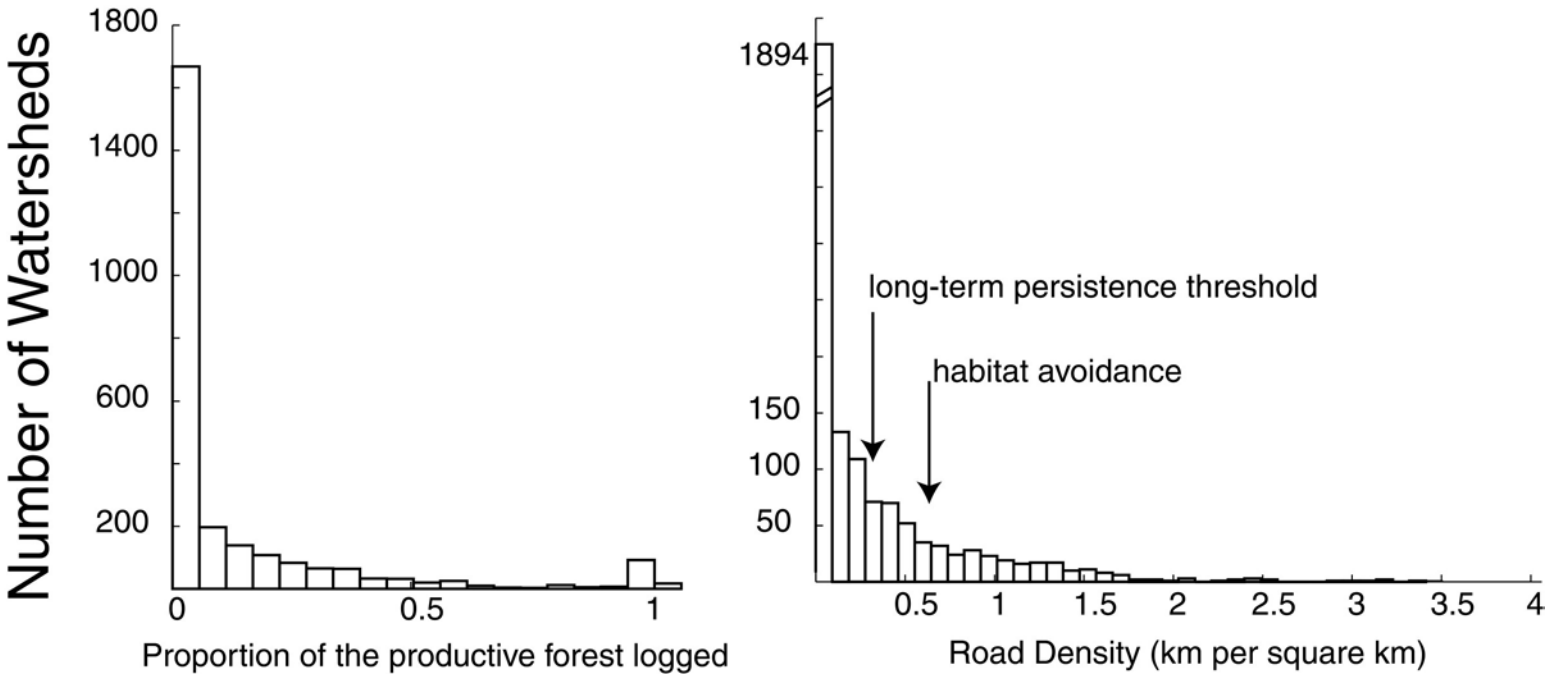


Figure 6. Defining Grizzly Bear/Salmon conservation areas. We initially used the grizzly bear index and road density to identify high value watersheds. Winner-take-all methods were then applied to delineate primary watersheds, which were further sub-divided by watershed according to human impact and habitat characteristics.

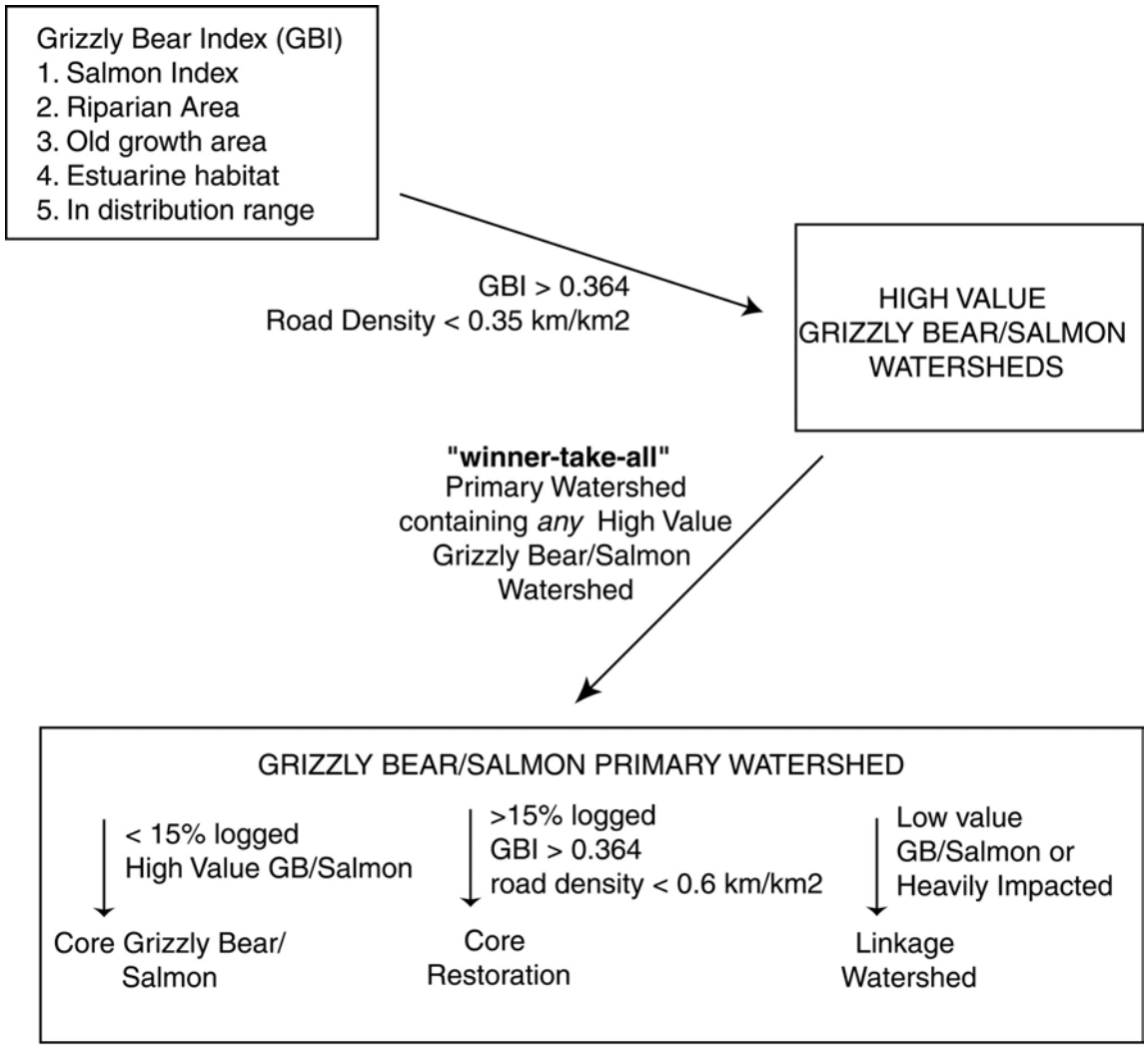


Figure 7. Example of a *GB/Salmon Primary Watershed* (The Kimsquit river) with different types of conservation areas delineated within the primary watershed boundary. The darker areas depict the low elevation forest (CWH biogeoclimatic zone) in core GB/Salmon and Core Restoration Areas. The watershed boundaries are shown with grey lines. The primary watershed is made up of all watersheds that share a common saltwater exit point. Although protection of entire primary watersheds is necessary for grizzly bear and salmon conservation, sub-watersheds receive differing management recommendations based on habitat characteristics.

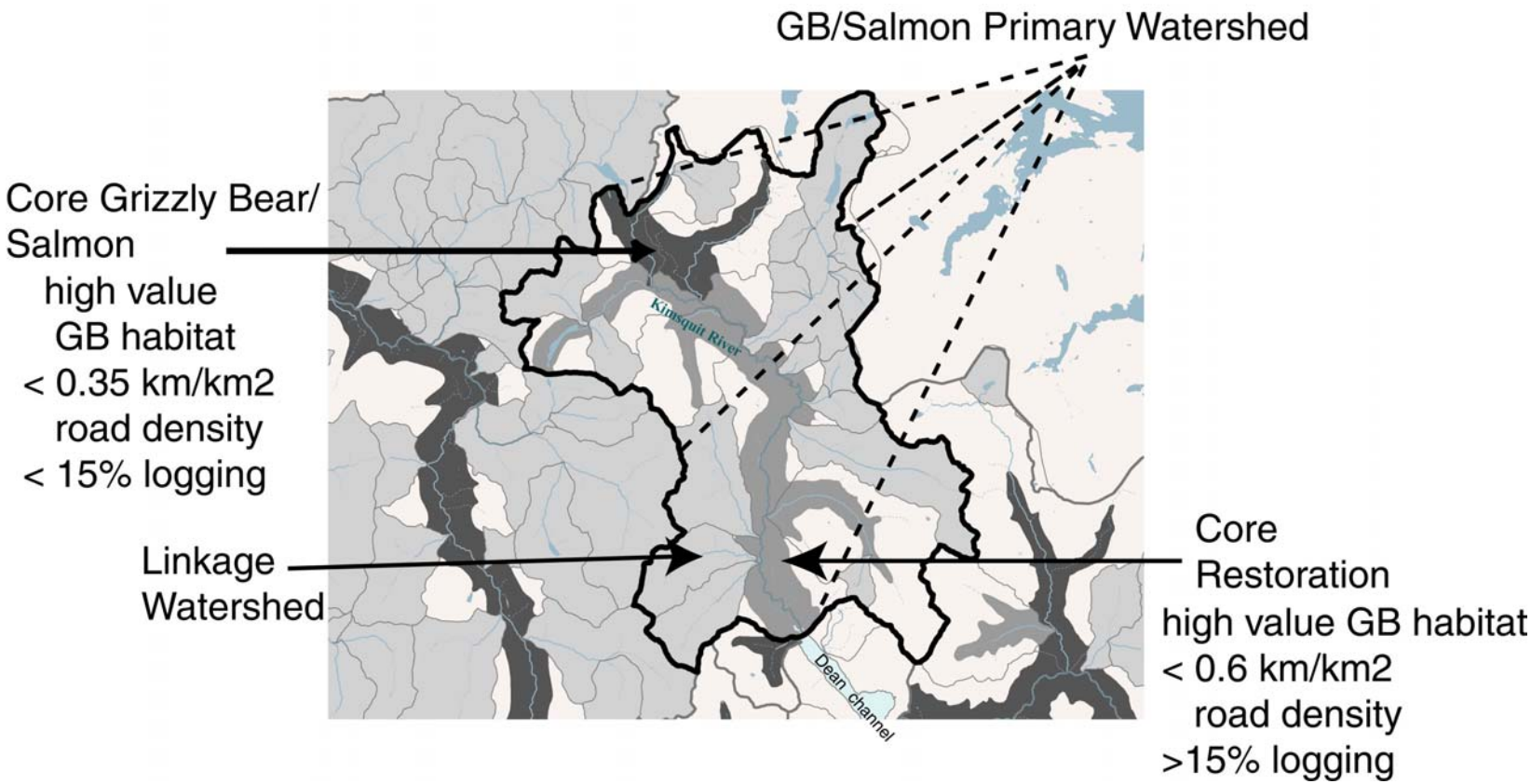
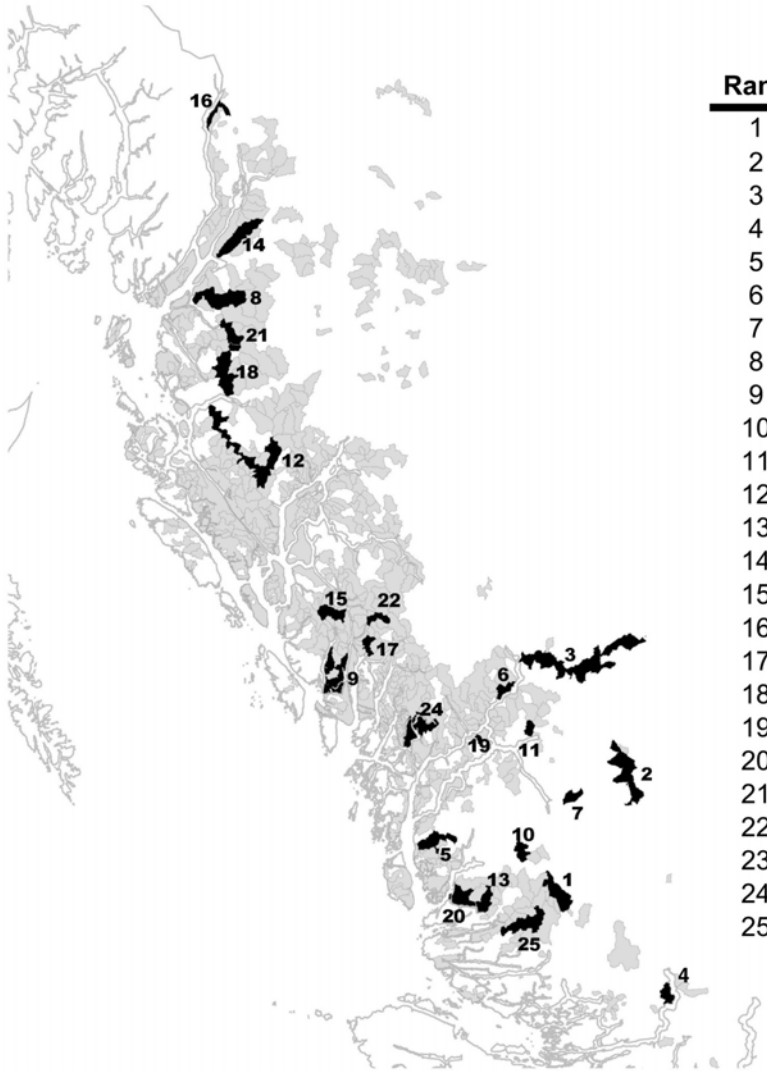


Table 3. Area totals and coarse representation

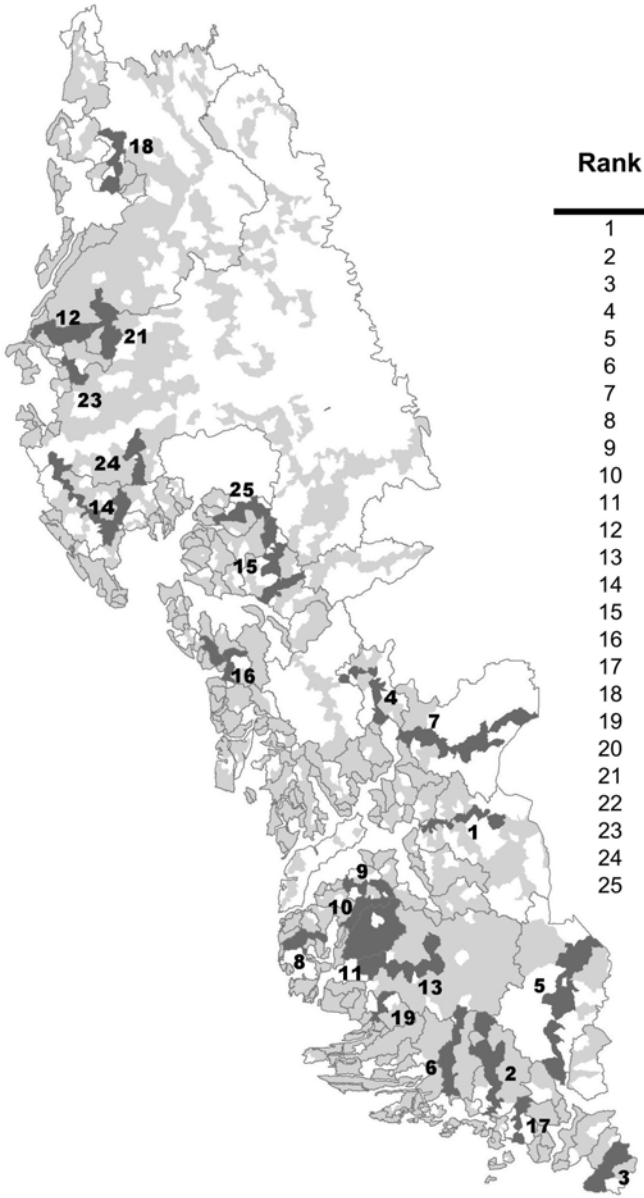
	Land Area	Productive Forest	Old Growth Area	# salmon stocks	# watersheds
Area (hectares)					
Overall total	11,133,955	6,675,801	345,153	1,744	2,599
All core areas	6,083,230	3,465,166	288,394	1,125	882
Intact Core Watersheds	3,215,848	1,875,426	185,141	721	682
GB/Salmon Core Watersheds	4,844,219	2,698,180	224,224	887	443
Percentage					
All Core Watersheds	54.6%	51.9%	83.6%	64.5%	33.9%
Intact Core Watersheds	28.9%	28.1%	53.6%	41.3%	26.2%
GB/Salmon Core Watersheds	43.5%	40.4%	65.0%	50.9%	17.0%

Figure 8. Top 25 Intact Core Watersheds based on old growth index



Rank	Watershed Name	OGI	%logged
1	NEECHANZ R	3.001	6.10%
2	UPPER BELLA COOLA R	2.675	1.40%
3	DEAN R	2.281	4.90%
4	Knight Inlet	2.117	8.30%
5	KOEYE R	2.066	2.10%
6	Between Sutslem and Skowquiltz	2.028	3.30%
7	TALEOMEY R	1.977	7.50%
8	KWINAMASS R	1.911	2.70%
9	Princess Royal Island	1.888	0.10%
10	ASHLULM C	1.851	0.90%
11	NIEUMIAMUS C	1.838	10.00%
12	ECSTALL R	1.824	2.80%
13	LOCKHART GORDON C	1.812	4.70%
14	KINCOLITH R	1.793	0.00%
15	Princess Royal Island: CANOONA R	1.781	1.10%
16	KSHWAN RIVER	1.771	3.60%
17	CARTER R	1.752	0.00%
18	KHYEX R	1.742	7.00%
19	King Island	1.734	0.10%
20	JOHNSTON C	1.727	1.60%
21	KHUTZEYMATEEN R	1.722	0.00%
22	GREEN R (1)	1.683	0.00%
23	NASCALL R: UNNAMED C	1.679	1.30%
24	RAINBOW C	1.671	3.90%
25	SMOKEHOUSE C	1.656	0.00%

Figure 9. Top 25 core restoration or core grizzly bear/salmon watersheds based on grizzly bear index. These watersheds all had road density of < 0.6 km/km2. Many of the impacted watersheds still harbor substantial grizzly bear habitat characteristics (top 4 watersheds are core restoration).



Rank	Watershed Name	GBI	Area Type	Road Density (km/km2)
1	BELLA COOLA R	2.468	Core Restoration	0.555
2	KINGCOME R	2.408	Core Restoration	0.198
3	PHILLIPS R	2.356	Core Restoration	0.385
4	KIMSQUIT R	2.269	Core Restoration	0.505
5	KLINAKLINI R	2.241	Core GB/Salmon	0
6	WAKEMAN R	2.181	Core Restoration	0.278
7	DEAN R	2.143	Core GB/Salmon	0.083
8	KOEYE R	2.015	Core GB/Salmon	0
9	KWATNA R	1.979	Core Restoration	0.484
10	KILBELLA R	1.96	Core Restoration	0.236
11	CHUCKWALLA R	1.947	Core Restoration	0.23
12	KWINAMASS R	1.938	Core GB/Salmon	0.055
13	OWIKENO LAKE	1.927	Core GB/Salmon	0.094
14	ECSTALL R	1.896	Core GB/Salmon	0.019
15	KEMANO R	1.879	Core GB/Salmon	0.258
16	KHUTZE R (1)	1.766	Core GB/Salmon	0
17	KAKWEIKEN R	1.738	Core GB/Salmon	0.171
18	KITSAULT	1.737	Core GB/Salmon	0.192
19	NEKITE R	1.7	Core Restoration	0.357
20	CLYAK R	1.699	Core Restoration	0.363
21	ISHKHEENICKH R	1.69	Core GB/Salmon	0.163
22	AALTANHASH R	1.672	Core GB/Salmon	0
23	KHUTZEYMATEEN R	1.66	Core GB/Salmon	0
24	GITNADOIX R	1.659	Core GB/Salmon	0
25	DALA R	1.641	Core GB/Salmon	0.034

Figure 10. Area analysis for Grizzly Bear Population Units.

Grizzly Bear Population Unit	Area	Total Core	Core GB/Salmon	Core Restoration	Vulnerabilty
Area					
Stewart	516,375	301,986	262,165	39,821	0
Cranberry	1,346,198	423,150	202,408	220,742	299,262
Bulkley-Lakes	2,089,213	558,480	432,834	125,646	258,397
Khutzeymateen	806,283	539,809	361,466	178,343	91,195
North Coast	716,780	338,849	303,131	35,718	106,681
Tweedsmuir *	1,905,811	515,654	264,212	251,442	8,397
Kitlope-Fjordland	1,116,631	554,466	520,064	34,402	1,620
Klinaklini-Homathko *	1,583,941	208,481	207,954	527	0
Kwatna-Owikeno	1,246,300	801,798	512,355	289,443	4,950
Kingcome-Wakeman	838,477	463,653	140,242	323,411	10,818
Knight-Bute	372,191	105,471	46,982	58,489	71,507
Percentage of Unit					
Stewart		58.5%	50.8%	7.7%	0.0%
Cranberry		31.4%	15.0%	16.4%	22.2%
Bulkley-Lakes		26.7%	20.7%	6.0%	12.4%
Khutzeymateen		67.0%	44.8%	22.1%	11.3%
North Coast		47.3%	42.3%	5.0%	14.9%
Tweedsmuir *		27.1%	13.9%	13.2%	0.4%
Kitlope-Fjordland		49.7%	46.6%	3.1%	0.1%
Klinaklini-Homathko *		13.2%	13.1%	0.0%	0.0%
Kwatna-Owikeno		64.3%	41.1%	23.2%	0.4%
Kingcome-Wakeman		55.3%	16.7%	38.6%	1.3%
Knight-Bute		28.3%	12.6%	15.7%	19.2%

** partial population unit*