Regional Vegetation Types and Shade Curves

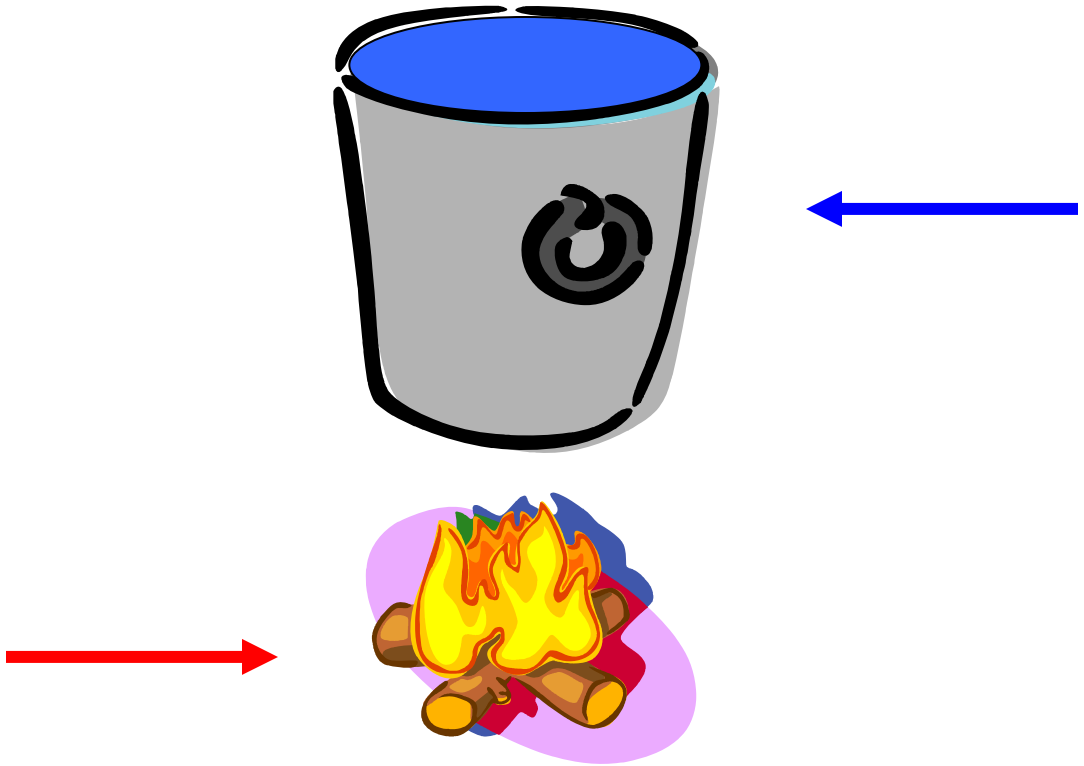
Pend Oreille Tributary Workgroup Meeting

Peter Leinenbach – USEPA

Stream Heating Processes

Stream Heating Processes

$$\Delta T_w \propto \frac{\Delta Heat \quad Energy}{Volume}$$



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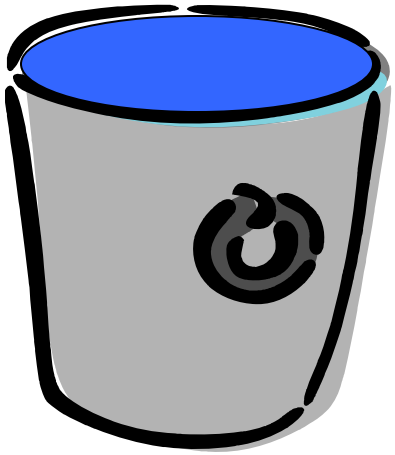

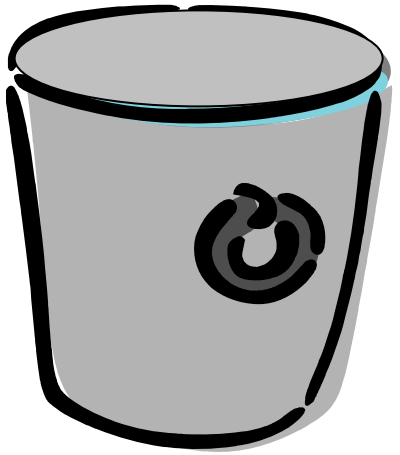

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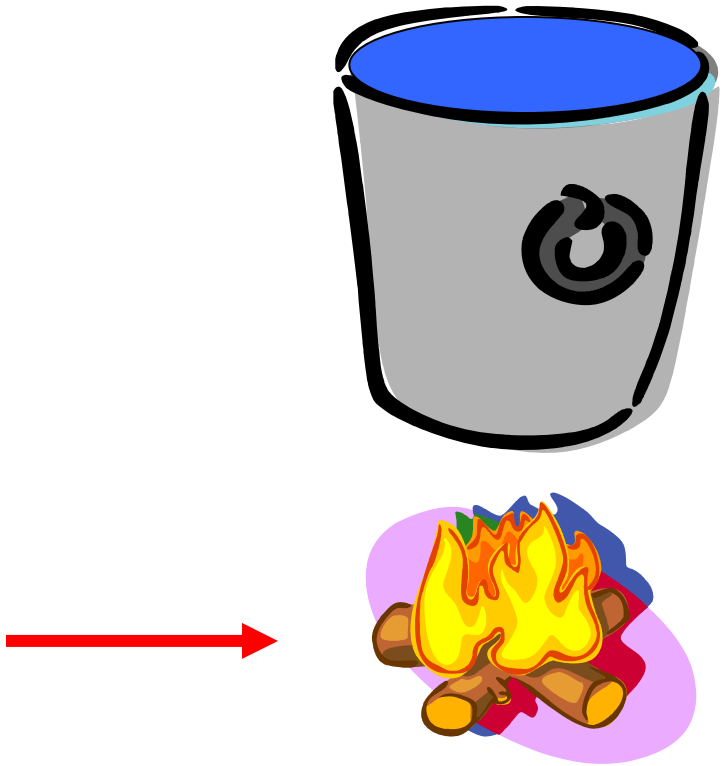
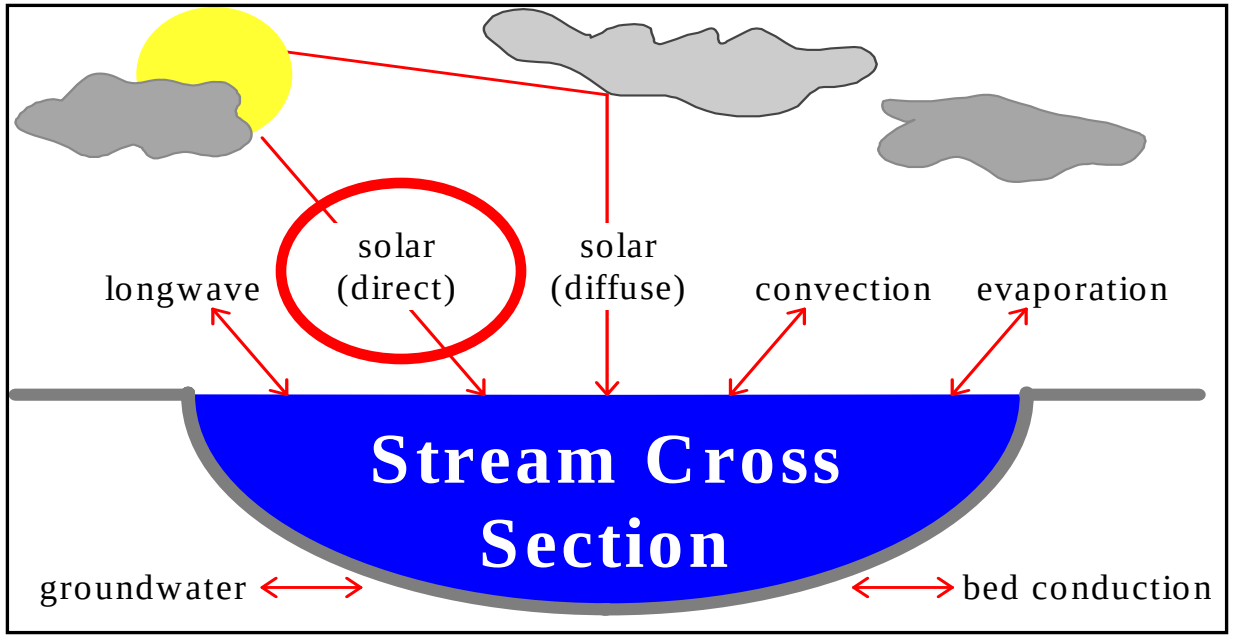


Stream Heating Processes

Stream Heating Processes

$$\Delta T_w \propto \frac{\Delta Heat\ \ Energy}{Volume}$$

Stream Processes that Involve the Transfer of Heat Energy

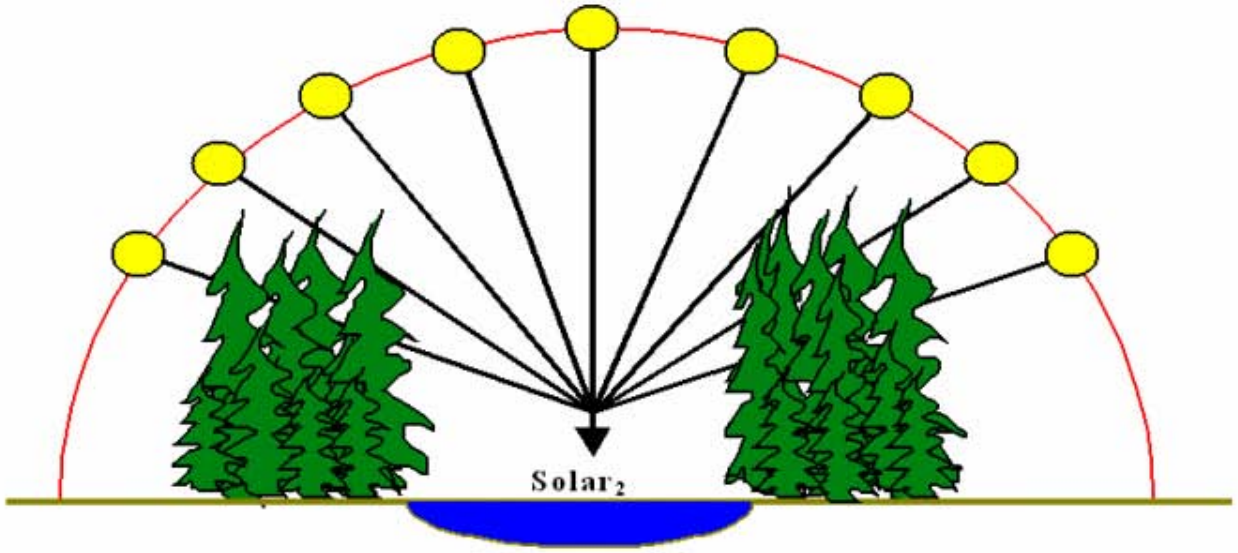


Net Heat Energy Continuity

$$\Phi_{total} = \Phi_{solar} + \Phi_{longwave} + \Phi_{convection} + \Phi_{evaporation} + \Phi_{streambed} + \Phi_{groundwater}$$

Solar Energy Load Defined As Effective Shade

$Solar_1$ – Potential Daily Solar Radiation Load
(Adjusted for Solar Altitude and Solar Azimuth)



Effective Shade Defined:

$$\text{Effective Shade} = \frac{(\text{Solar}_1 - \text{Solar}_2)}{\text{Solar}_1}$$

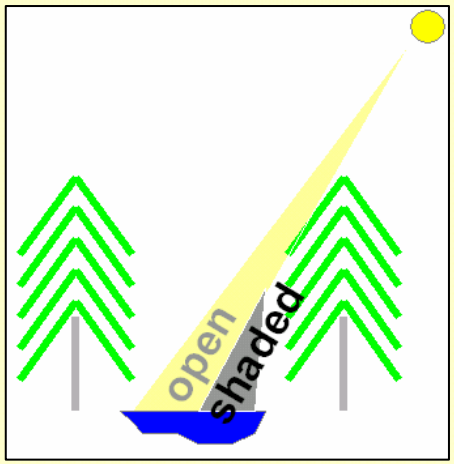
Where,

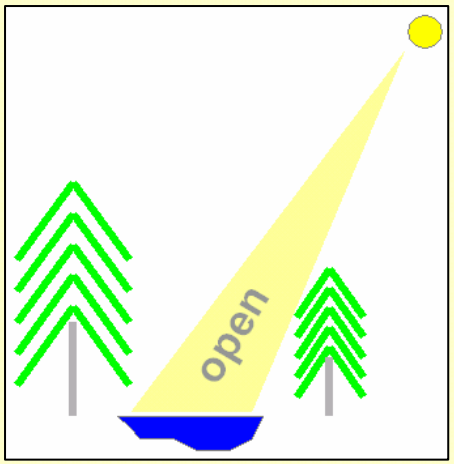
$Solar_1$: Potential Daily Solar Radiation Load
$Solar_2$: Measured Daily Solar Radiation Load at Stream Surface

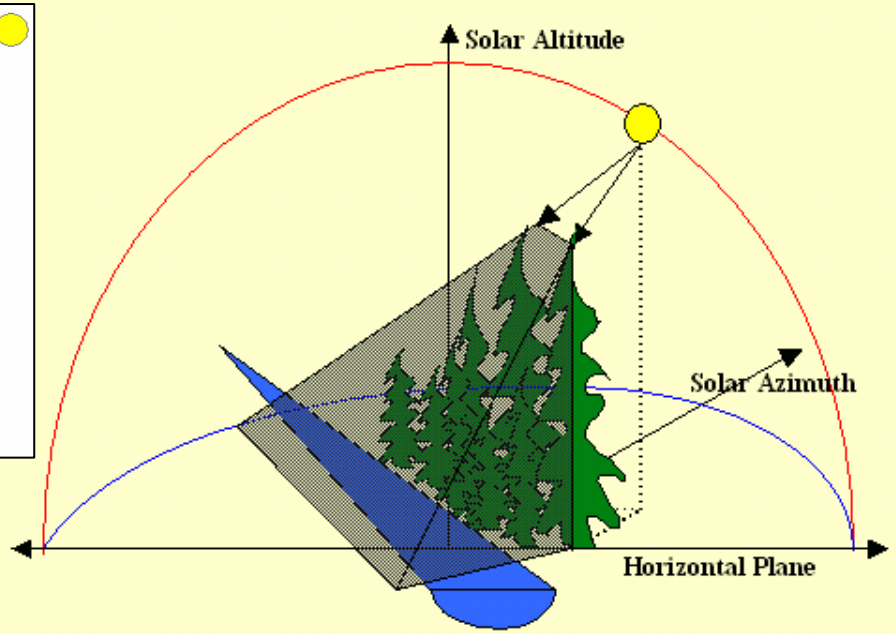
Stream Heating Processes

Factors that Influence Stream Surface Shade

Description	*Parameter* *Blue – Not Influenced by Human Activities* *Red - Influenced by Human Activities*
Season/Time	Date/Time
Stream Characteristics	Aspect, Channel Width
Geographic Position	Latitude, Longitude
Vegetative Characteristics	Near Stream Vegetation Height, Width, Density
Solar Position	Solar Altitude, Solar Azimuth







Stream Heating Processes

System Potential Shade - *Defined*

Regional Vegetation Types

Stream Heating Processes

The maximum level of shade practical at a particular site is termed the "**system potential**" effective shade level.

System Potential Effective Shade occurs when:

1 - Near stream vegetation is at a mature life stage

- Vegetation community is mature and **undisturbed from anthropogenic** sources;
- Vegetation **height** and **density** is at or near the potential for the given community;
- Vegetation is sufficiently wide to maximize solar attenuation; and
- Vegetation width should accommodate channel migrations.

2 - Channel width reflects a suitable range for hydrologic process given that near stream vegetation is at a mature life stage

System Potential Shade - *Defined*

Regional Vegetation Types

Stream Heating Processes

In other words, "**System Potential Landcover**" (or "PNV") is necessary to achieve "**System Potential Effective Shade**", and is defined in the TMDL process as -

"the potential near stream land cover condition that can grow and reproduce on a site, give: climate, elevation, soil properties, plant biology, and hydrologic processes."

Regional Vegetation Types

- **Step One –**

  Define Spatial Distribution of Potential Natural Vegetation (PNV) Zones.

  - Vegetation Response Unit (VRU) – Forested Areas
  - Aquatic Vegetation Unit Filter (ARU Filter) - Non Forested Areas

- **Step Two –**

  Populate PNV Zones (**Estimate System Potential Landcover**).

  - Vegetation Composition
  - Size Class, Vegetation Height and Density

Vegetation Response Unit (VRU)

Regional Vegetation Types

- Provides a mechanism to interpret existing vegetation in the context of natural disturbance processes and enables a projection of future landscape conditions.

- As mapped polygons these units have similar patterns in:

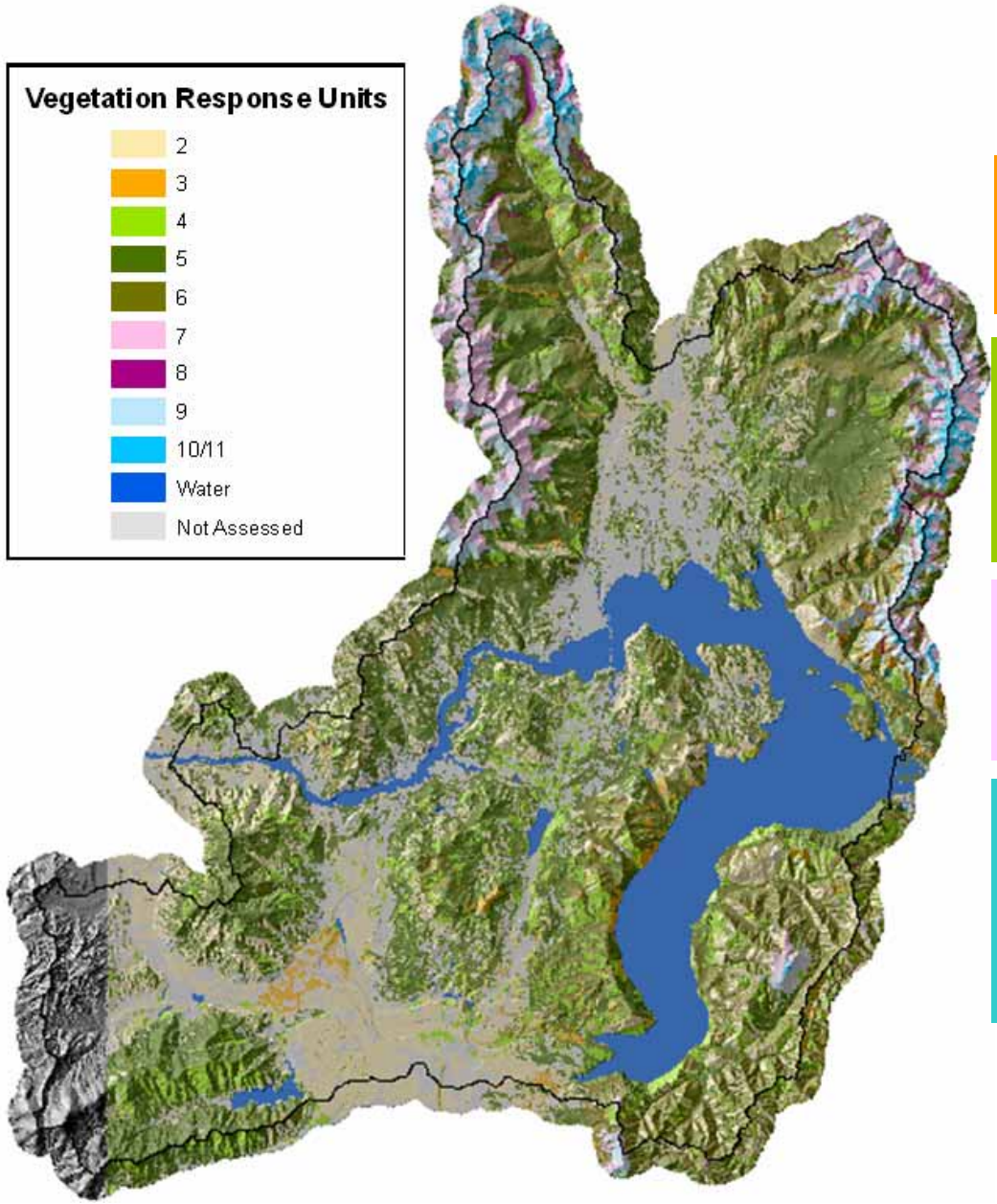
  - Potential Natural Communities (Habitat Types)

  Natural Disturbance Processes
  - Fire Regimes
  - Succession
  - Productivity
  - Nutrient Cycling

(Also Soils, Hydrologic Function, Landform and Topography, Lithology, Climate, Air quality)

Vegetation Response Unit (VRU)

Regional Vegetation Types



VRU/HTG Assessment Groups

Group A – Warm/Dry

- VRU 2/HTG 2 (Moderately Warm/Dry)
- VRU 3/HTG 3 (Moderately Warm/ Moderately Dry)

Group B – Moist

- VRU 4/HTG 4 (Moderately Warm/Moist)
- VRU 5/HTG 5 (Moderately Cool/Moist)
- VRU 6/HTG 6 (Moderately Cool/Wet)

Group C – Cool/Moist

- VRU 7/HTG 7 (Cool/Moist)
- VRU 8/HTG 8 (Cool/Wet)

Group D – Cool/Dry

- VRU 9/HTG 9 (Cool/ Moderately Dry)
- VRU 10/HTG 10 (Cold/Moderately Dry)
- VRU11/HTG 11 (Cold)

Vegetation Response Unit (VRU)

Regional Vegetation Types

- "Historical Range of Variability" (HRV) was the method which the IPNF incorporated the concept of historical/natural conditions and processes as reference for understanding ecosystem potential.

  - Developed for VRU/HTG Assessment Groups

VRU/HTG Assessment Groups - Composition

Regional Vegetation Types

Table X-3. Pend Oreille Basin Historical Forest Vegetation Composition Estimates

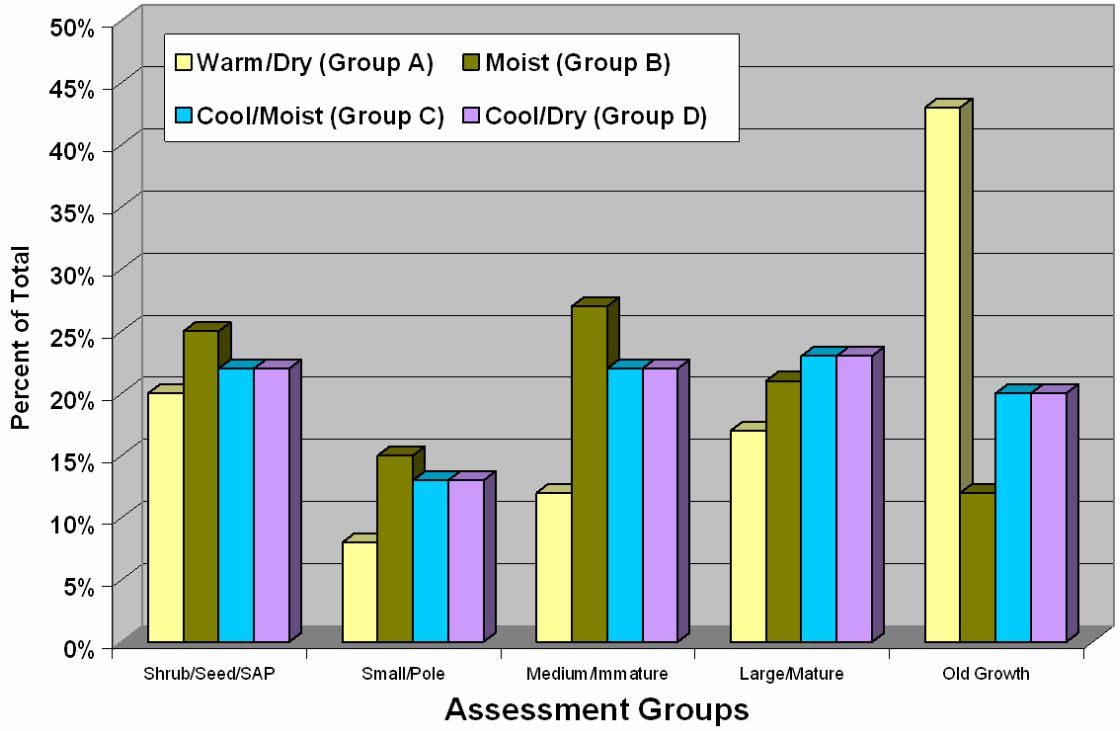
Assessment Group	PP	WP	WL	DF	GF/WH	WRC	LP	SAF	WBP
Warm/Dry (Group A)	60%	- -	10%	20%	- -	- -	10%	- -	- -
Moist (Group B)	1%	40%	25%	20%	5%	5%	3%	1%	- -
Cool/Moist (Group C)	- -	12%	15%	1%	- -	- -	12%	60%	- -
Cool/Dry (Group D)	- -	- -	- -	- -	- -	- -	20%	65%	15%

VRU/HTG Assessment Groups - Structure

Regional Vegetation Types

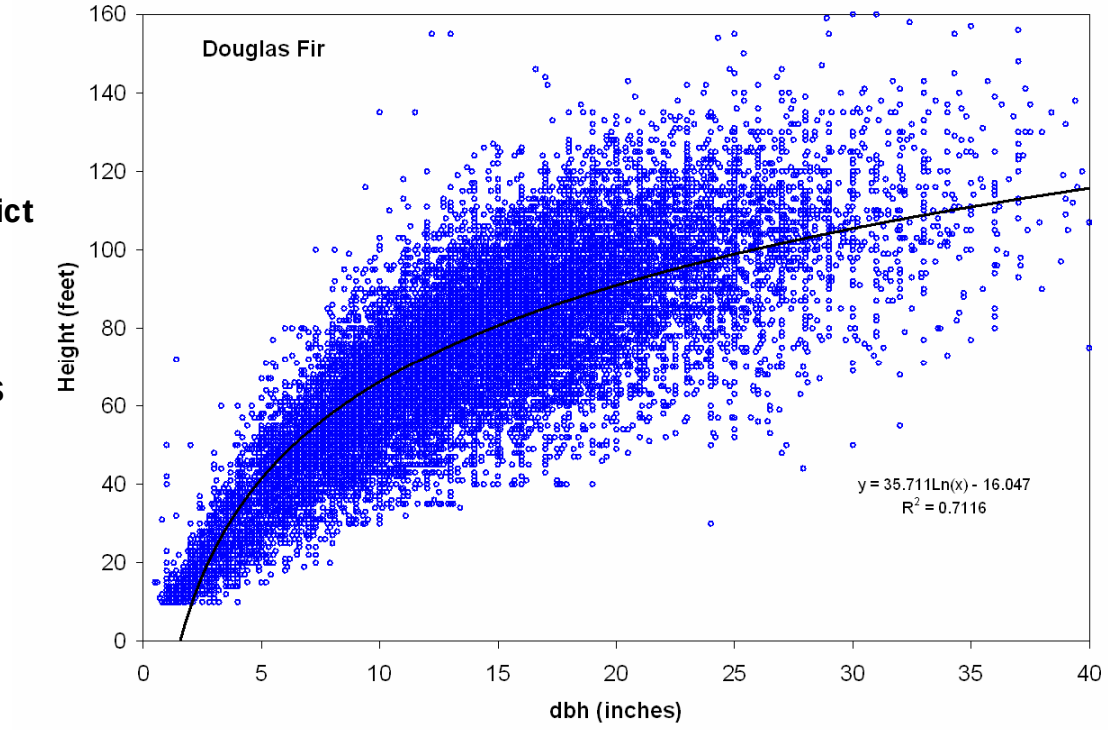
Table X-2. Pend Oreille Basin Historical Forest Vegetation Structure Estimates

Assessment Group	Shrub/Seed/ SAP	Small/ Pole	Medium/ Immature	Large/ Mature	Old Growth
Warm/Dry (Group A)	20%	8%	12%	17%	43%
Moist (Group B)	25%	15%	27%	21%	12%
Cool/Moist (Group C)	22%	13%	22%	23%	20%
Cool/Dry (Group D)	22%	13%	22%	23%	20%



Douglas Fir

- FSVeg Database - **Sandpoint Ranger District**
- 150,000 Individual Trees
- Only Live Trees Included in Calculations



Measured Douglas Fir Height (feet) by Size Classification Groups.

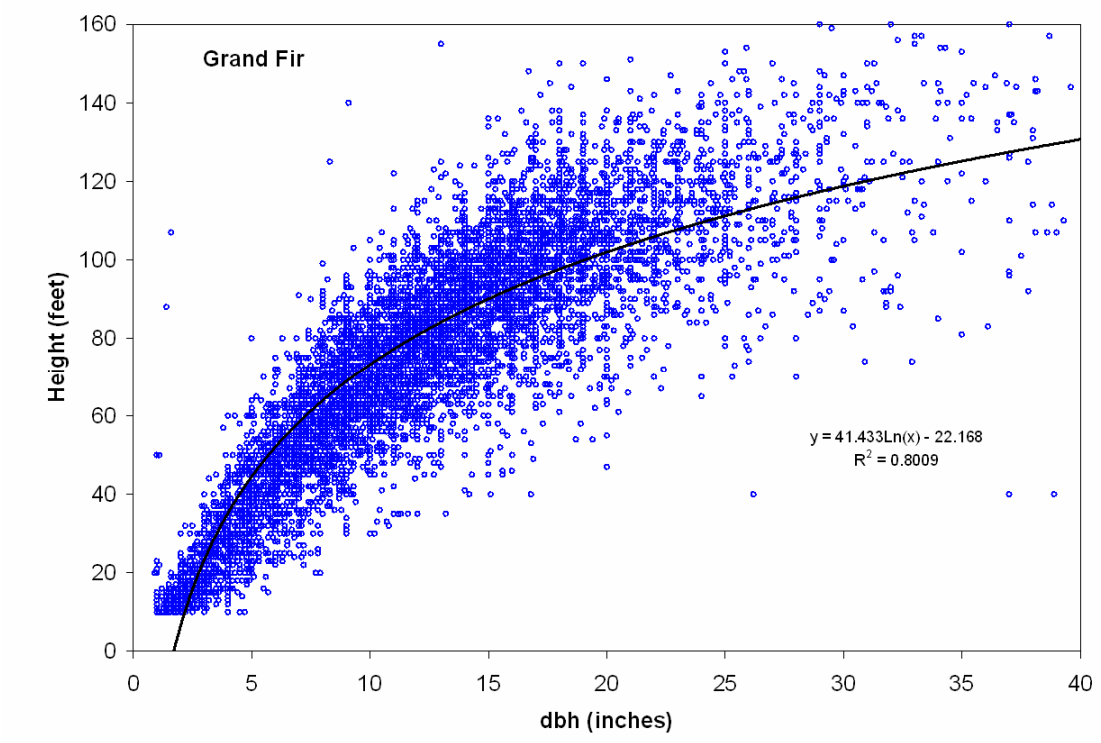
Size Class (Group Name and Year Range)

Percentile	**Seed/Sap** Less than 35	**Small** 35 through 59	**Medium** 60 through 99	**Large** 100 through 149	**Oldest** Greater than 150
90th	40	78	101	115	123
75th	25	67	91	103	110
50th	13	55	80	91	96
25th	7	41	67	78	83
10th	6	25	54	64	70
Number of Measurements	1866	6323	15983	3029	1600

← Draft KIPZ CER Report

Regional Vegetation Types

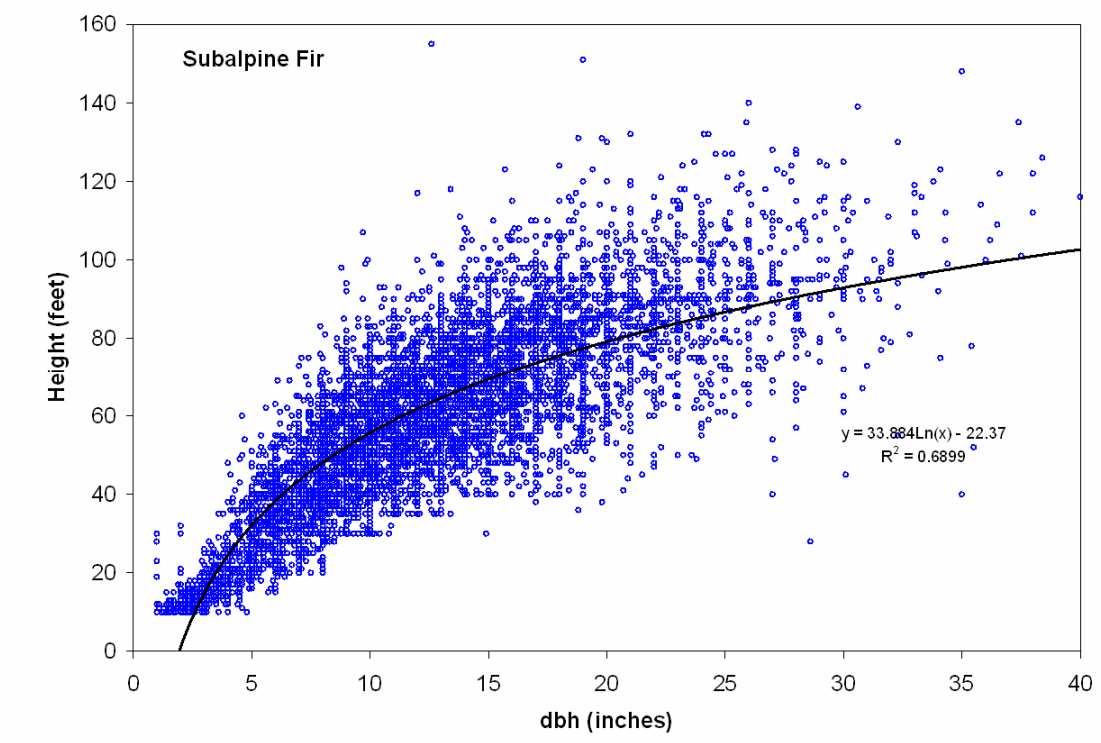
Grand Fir



Measured Grand Fir Height (feet) by Size Classification Groups. **Size Class** (Group Name and Year Range)					
Percentile	**Seed/Sap** Less than 35	**Small** 35 through 59	**Medium** 60 through 99	**Large** 100 through 149	**Oldest** Greater than 150
90th	22	84	110	128	145
75th	15	70	97	115	130
50th	9	47	81	100	114
25th	6	25	65	85	97
10th	5	13	46	69	87
Number of Measurements	1267	2288	6861	1384	342

Regional Vegetation Types

Subalpine Fir



Measured Subalpine Fir Height (feet) by Size Classification Groups.

Size Class (Group Name and Year Range)

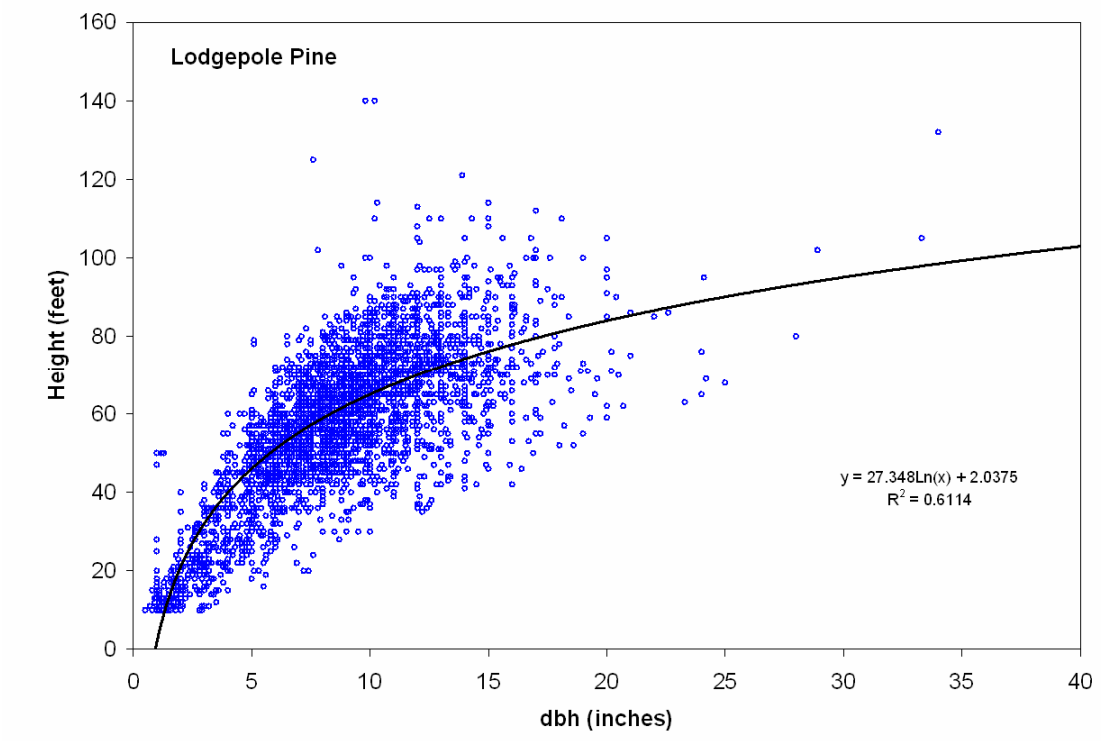
Percentile	**Seed/Sap** Less than 35	**Small** 35 through 59	**Medium** 60 through 99	**Large** 100 through 149	**Oldest** Greater than 150
90th	21	61	82	90	104
75th	13	47	71	77	91
50th	8	30	58	63	78
25th	6	11	44	51	63
10th	5	6	30	40	52
Number of Measurements	768	1515	3707	2770	1222

Regional Vegetation Types

Lodgepole Pine

Also Developed for

- Western Larch
- Ponderosa Pine
- Western White Pine
- Western Hemlock
- Western Red Cedar
- Subalpine Fir
- Whitebark Pine



Measured Lodgepole Pine Height (feet) by Size Classification Groups.

Percentile	**Size Class** (Group Name and Year Range)				
	Seed/Sap Less than 35	**Small** 35 through 59	**Medium** 60 through 99	**Large** 100 through 149	**Oldest** Greater than 150
90th	32	67	83	90	100
75th	24	60	74	82	88
50th	15	52	67	74	77
25th	10	44	59	65	66
10th	6	36	52	57	55
Number of Measurements	560	1297	1830	136	102

Regional Vegetation Types

Regional Vegetation Types

Regional Vegetation Types

The following parameters were used to develop "system potential land cover conditions":

- "System Potential Land Cover" conditions were defined for the four (4) VRU/HTG "Assessment Groups" (see Table X-1)

- Forest Vegetation Structure for each of the "Assessment Groups" were assigned as weighted average historical level (see Table X-2)

- Forest Vegetation Composition for each of the "Assessment Groups" were assigned as weighted average historical level (see Table X-3)

- Vegetation height conditions were assigned to the 50th percentile (median) of measured vegetation conditions within the Sand Point Ranger District for each of the size class groups (see Figure X-5)

- Vegetation Canopy Cover Conditions was assigned to 80%.

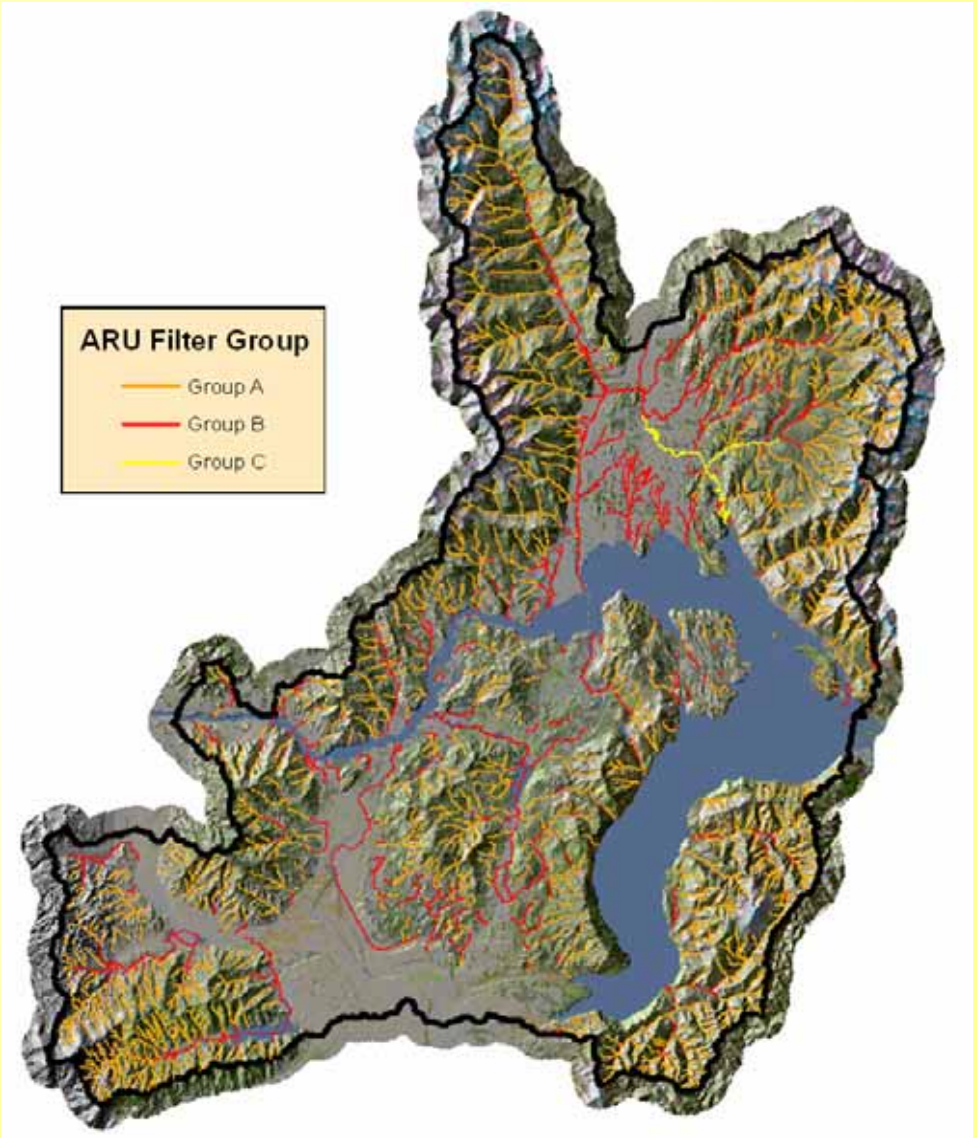
Aquatic Responce Unit - Filter Units

Regional Vegetation Types

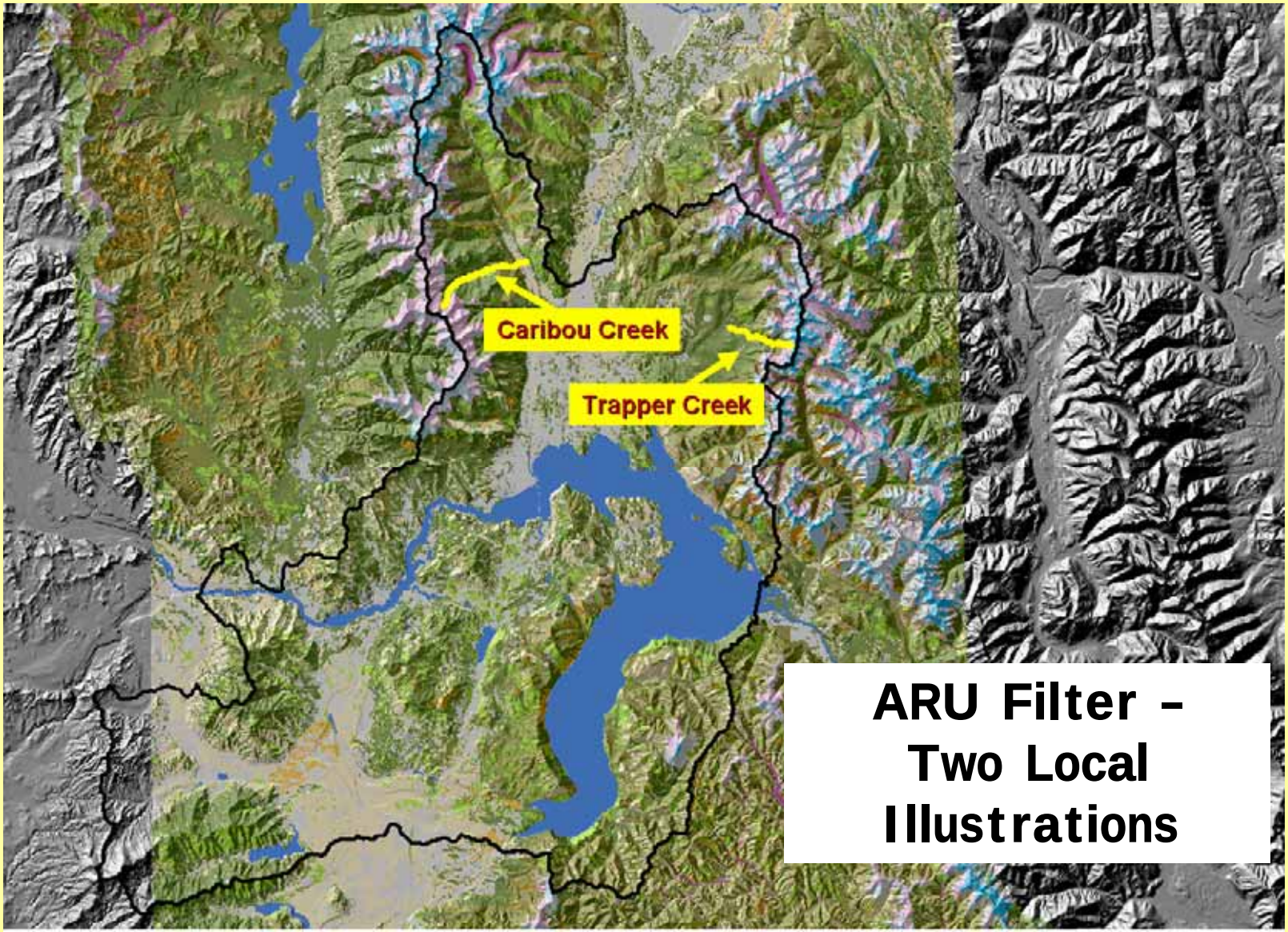
Table X-3. Summary ARU filter Group Characteristics
ARU filter Group A - Forest Riparian Group • Stream Order – 1st, 2nd, 3rd and 4th • Stream gradient ≥ 3 percent
ARU filter Group B - Non-Forest Riparian Group 1 • Stream Order – 1st, 2nd, 3rd and 4th • Stream gradient < 3 percent
ARU filter Group C - Non-Forest Riparian Group 2 • Stream Order – 5th and 6th

Group B - Late-successional cedar-hemlock, black cottonwood, mixed conifer and riparian shrubs.

Group C – More subject to Flooding Disturbance - black cottonwood and riparian shrubs and grass.



Regional Vegetation Types



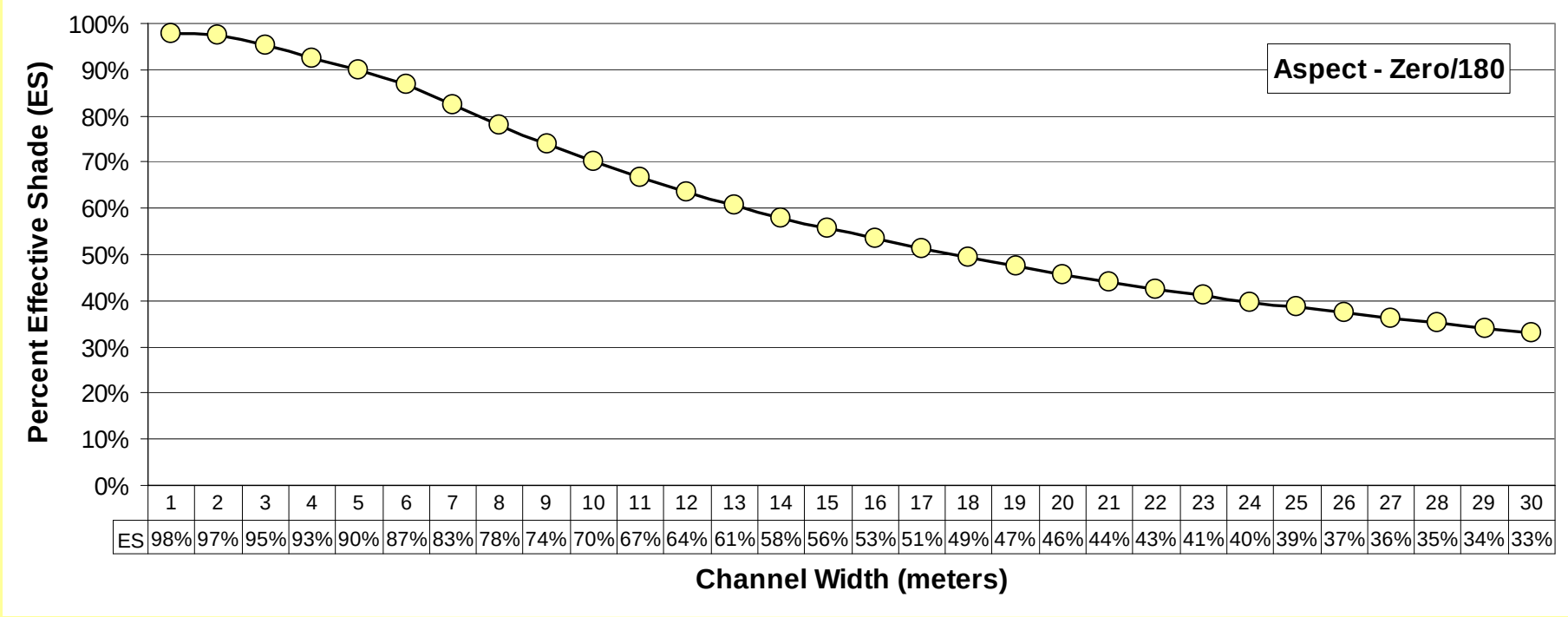
ARU Filter – Two Local Illustrations

Regional Vegetation Types

Regional Vegetation Types

Example Shade Curve – Assessment Group B

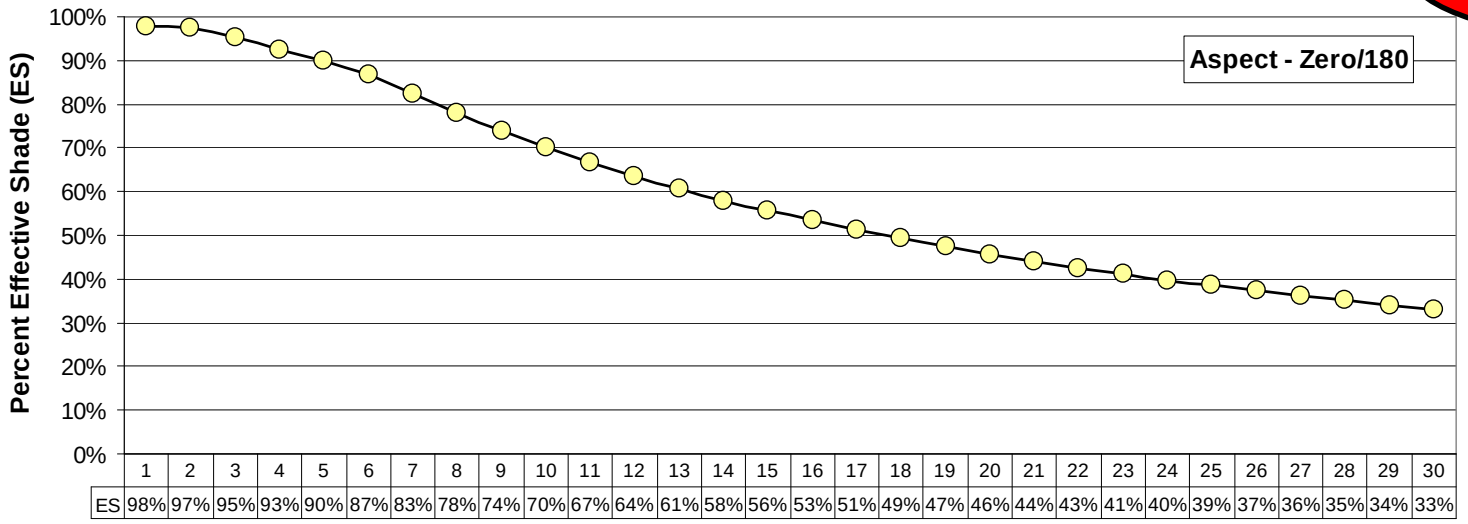
Shade Curves



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ES	98%	97%	95%	93%	90%	87%	83%	78%	74%	70%	67%	64%	61%	58%	56%	53%	51%	49%	47%	46%	44%	43%	41%	40%	39%	37%	36%	35%	34%	33%

Example Shade Curve – Assessment Group B

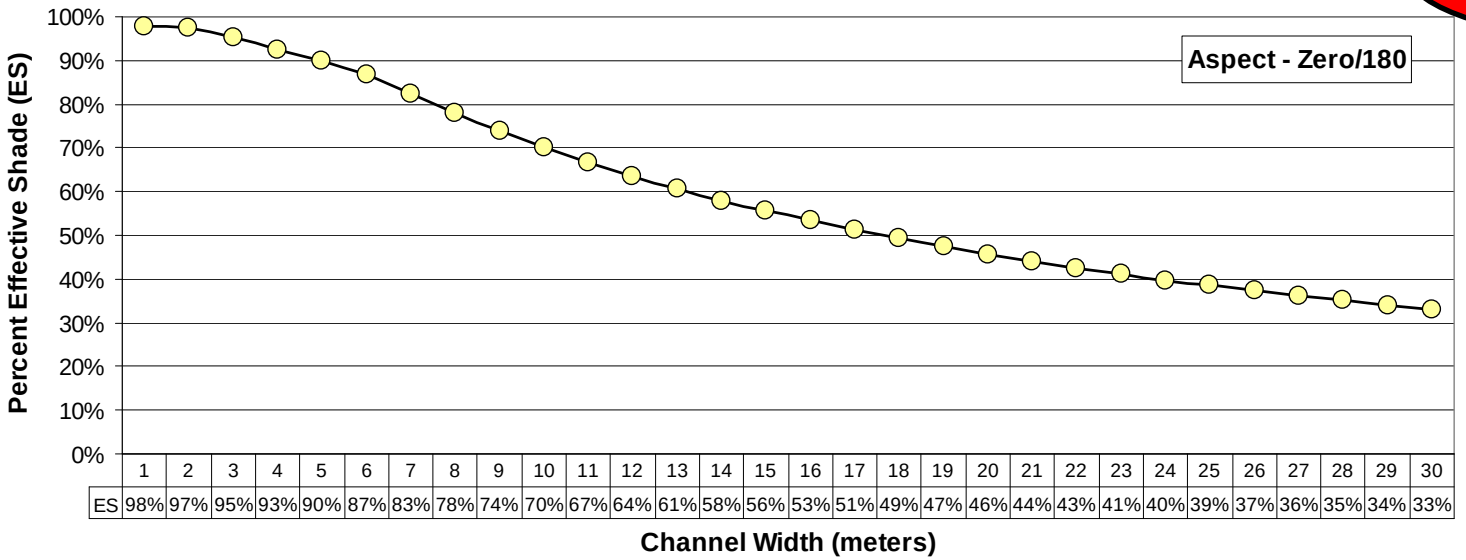
Shade Curves



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ES	98%	97%	95%	93%	90%	87%	83%	78%	74%	70%	67%	64%	61%	58%	56%	53%	51%	49%	47%	46%	44%	43%	41%	40%	39%	37%	36%	35%	34%	33%

Shade Curves

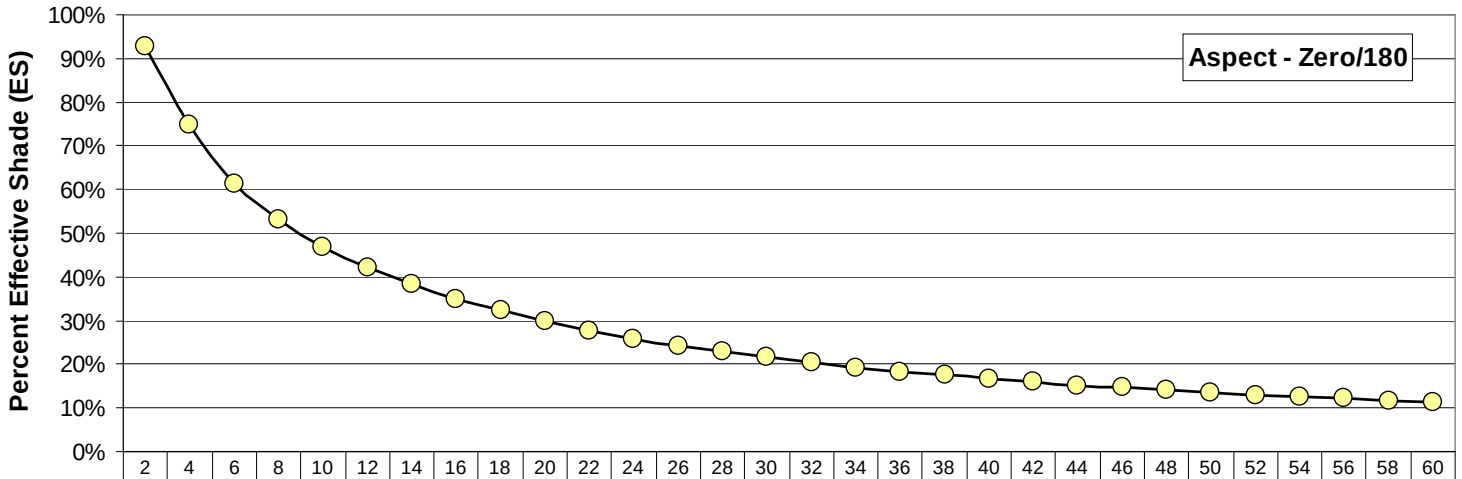
Example Shade Curve – Assessment Group B



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ES	98%	97%	95%	93%	90%	87%	83%	78%	74%	70%	67%	64%	61%	58%	56%	53%	51%	49%	47%	46%	44%	43%	41%	40%	39%	37%	36%	35%	34%	33%

Channel Width (meters)

Example Shade Curve – Non Forest Group 1

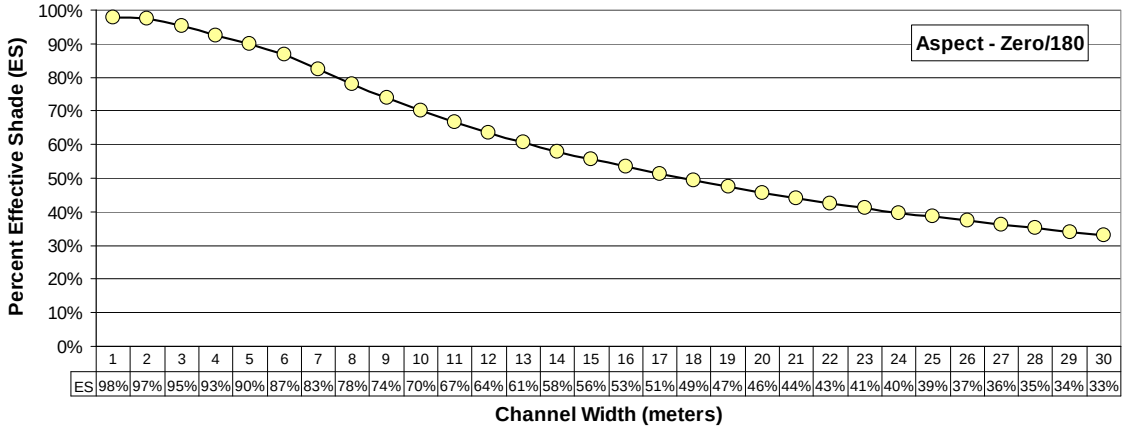


	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
ES	93%	75%	61%	53%	47%	42%	38%	35%	32%	30%	28%	26%	24%	23%	22%	20%	19%	18%	17%	17%	16%	15%	15%	14%	14%	13%	13%	12%	12%	11%

Channel Width (meters)

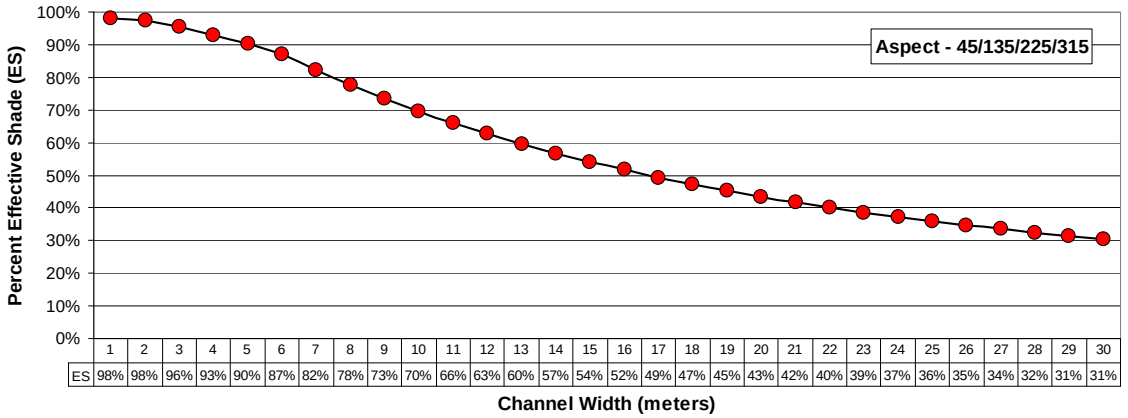
Example Shade Curve – Assessment Group B

Shade Curves



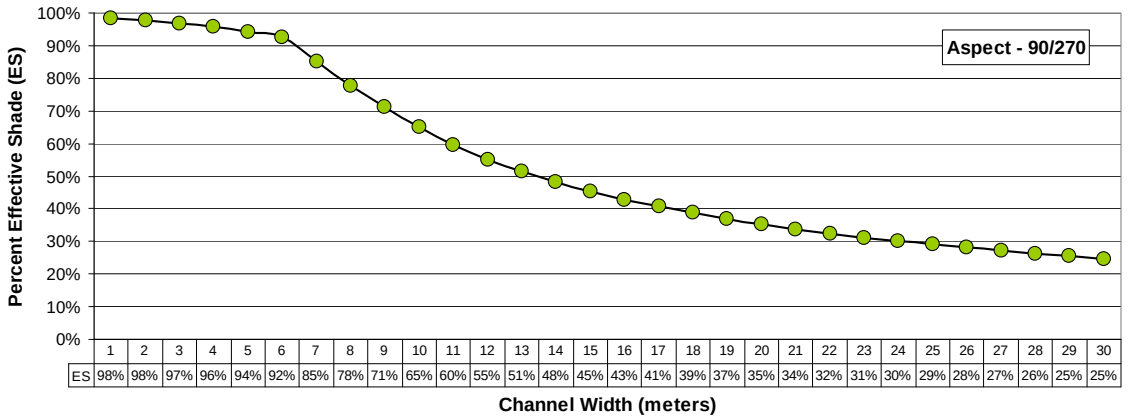
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ES	98%	97%	95%	93%	90%	87%	83%	78%	74%	70%	67%	64%	61%	58%	56%	53%	51%	49%	47%	46%	44%	43%	41%	40%	39%	37%	36%	35%	34%	33%

Channel Width (meters)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ES	98%	98%	96%	93%	90%	87%	82%	78%	73%	70%	66%	63%	60%	57%	54%	52%	49%	47%	45%	43%	42%	40%	39%	37%	36%	35%	34%	32%	31%	31%

Channel Width (meters)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
ES	98%	98%	97%	96%	94%	92%	85%	78%	71%	65%	60%	55%	51%	48%	45%	43%	41%	39%	37%	35%	34%	32%	31%	30%	29%	28%	27%	26%	25%	25%

Channel Width (meters)


Thank goodness that's over!