Turning Cobble into Functional Floodplain along the Klickitat River

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Yakama Nation Fisheries Program

Salmon Habitat Project Conference

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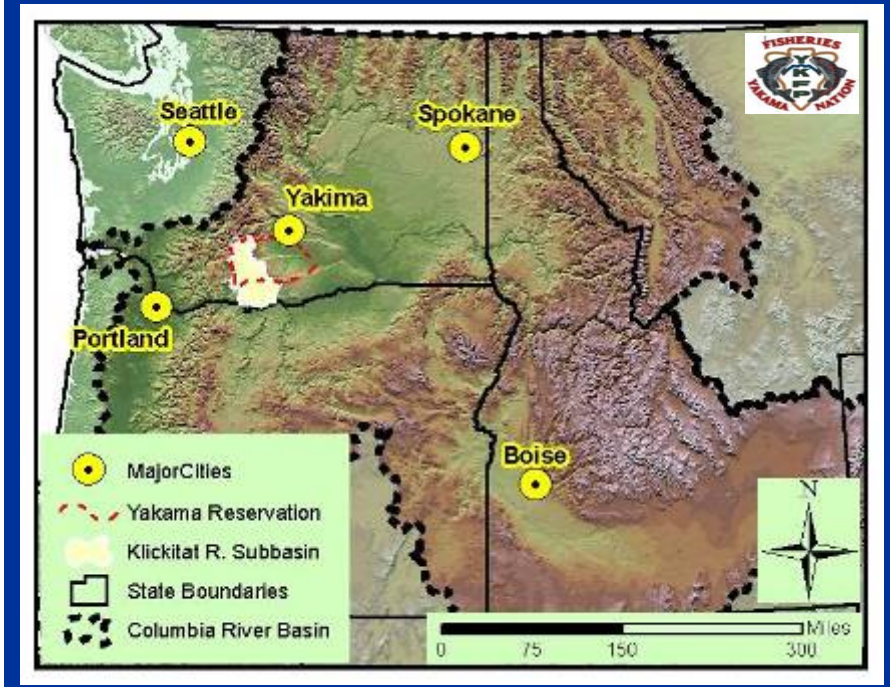
Project Team

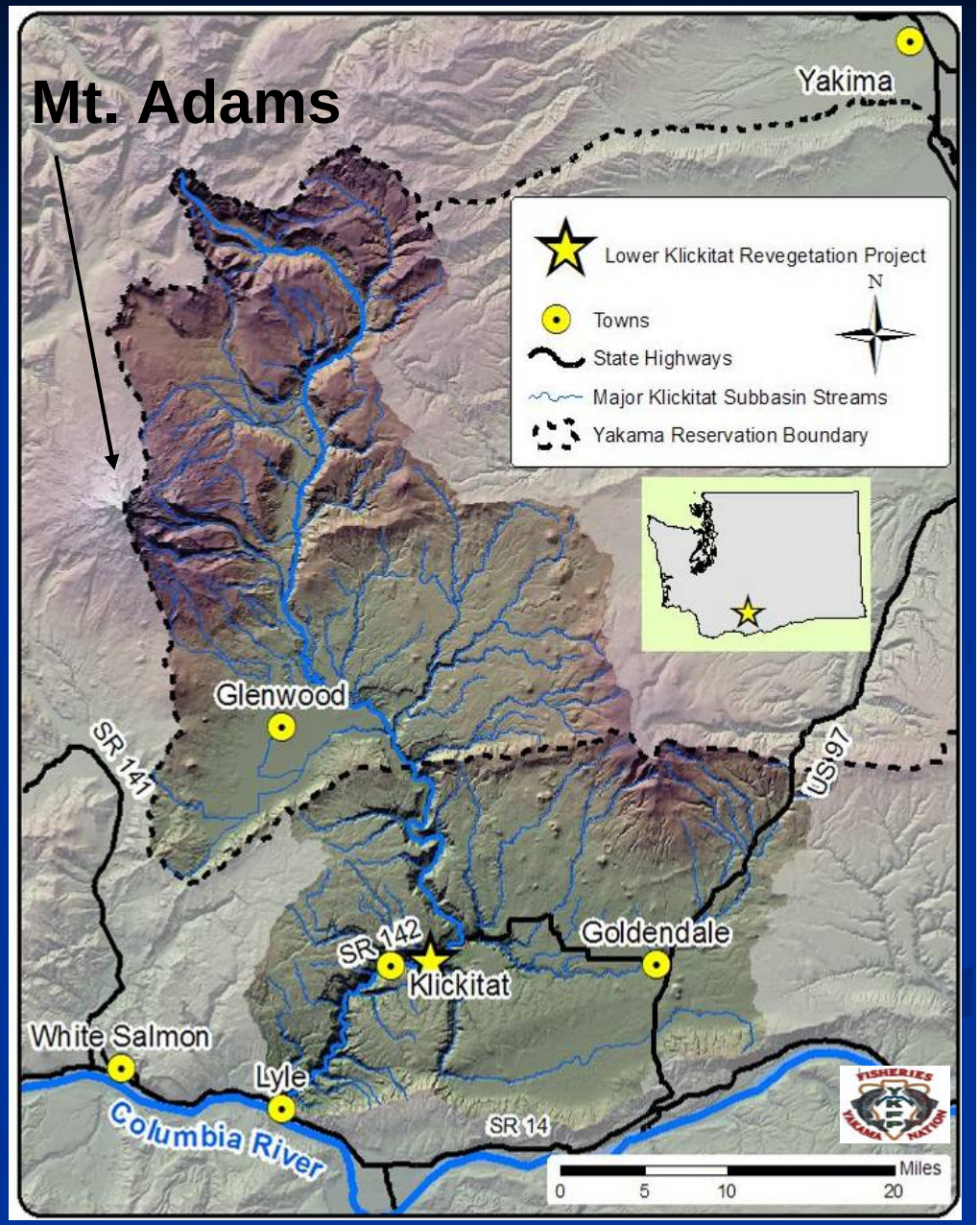
Partnership between the **Mid-Columbia Fisheries Enhancement Group** (sponsor) and **Yakama Nation Fisheries Program** (technical lead)

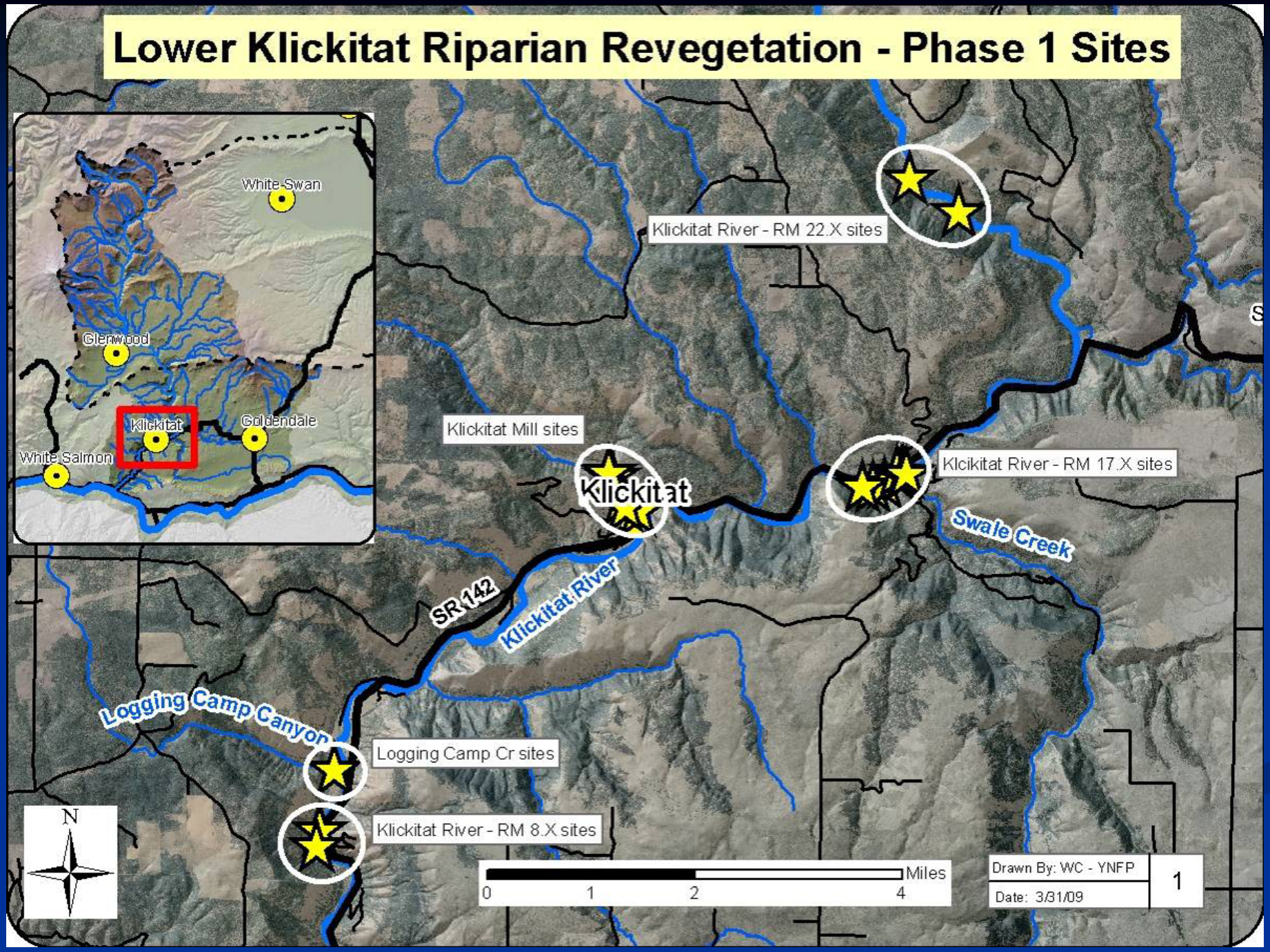
- Margaret Neuman – MCFEG
  - Project Management & Oversight
- Will Conley – YNFP
  - Design & Construction Oversight

Location

- south-central Washington State
- east-slope of Cascade Mountains
- Klickitat Lead Entity







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Fisheries Significance

- Project reach is a migration and rearing corridor for nearly 100 percent of all migratory fish in the Klickitat watershed
- Primary target species is Mid-Columbia River steelhead (ESA- “threatened”; summer and winter runs)
  - on average, 10% of observed basin-wide steelhead spawning occurs within reach
- Other beneficiary species include Chinook salmon (spring and fall runs), coho salmon, and resident trout
- Reach occurs within a top-tier geographic priority in the Klickitat Lead Entity Region Salmon Recovery Strategy

Pre-Project Conditions

- Extensive areas unvegetated since 1996 floods
- In some cases, site perimeters colonized by woody spp
  - Function of depth to water in August / September (5’ - 8’)
  - Generally along margins of (August) wetted-channel
    - OK short-term strategy, but hydraulically risky
    - Will not persist in long-term (due to scour and/or abrasion)
- Interior of bars generally bare (except weeds)
- Substrate not mobilized since initial deposition

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Project Goals

- **Increase bank cover**
- **Increase woody debris recruitment potential**
- **Increase floodplain roughness to trap fine sediment.**

Note: Temperature reduction was not a project goal given position in watershed (6th order stream)

Conceptual Approach

Basically: Jump-start succession

- Get plant cover established that can increase site suitability for other vegetation by:
  - trapping fine sediment
  - providing organic inputs to substrate
  - providing shade

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Species Selection Criteria

- All:
  - Adapted to coarse textured, well-drained substrate
  - Adapted to low-nutrient substrate
- Most
  - Early seral species
  - Disturbance-adapted (root crowns not sensitive to burial)
  - Ability to re-sprout
- Range of moisture & disturbance tolerance
- Range of horizontal and vertical canopy structure
- Low Maintenance Requirements
  - no irrigation, fertilization, mulching, etc

Species Selection

	Height at Maturity	Drought Tolerance	Fertility Requirement	Indicator Status	Growth Form	Shade Tolerance	Vegetative Spread	N-fixation
Scouler's willow	20'	Med	Low	FAC	Mult. stem	Intermediate	N	N
Coyote willow	10'	Med	Low	OBL	Rhizomat.	Intermediate	Mod	N
Geyer's willow	15'	No	Low	FACW+	Thicket	Tol.	Rapid	N
Sitka willow	20'	Med	Med	FACW	Mult. Stem	Intol.	Slow	N
Black cottonwood	80'	Low	Med	FAC	Single stem	Intol.	Mod	N
Red alder	50'	Med	Med	FAC	Single Stem	Intol.	Mod	High

Also planted: red osier dogwood, ponderosa pine

Mechanical Site Prep.: Ripping

(a.k.a. “decompaction”)

General specifications:

- Ripped trenches oriented normal to flood flows (not necessarily parallel to low-flow channel)
- 5' spacing and 4' minimum depth
- not to occur within dripline of existing shrubs and trees
- at least one trench parallel to orientation of prevailing flood flow and that intersects all other trenches

Mechanical Planting: Stinging

General specifications:

- cuttings and containerized hardwoods planted at least 36 inches below ground level
- Ponderosa pines to a depth such that the root crown (base of the stem) is at or slightly (no more than ½ inch) below ground level.
- All cuttings planted RIGHT SIDE UP (have provision for docking contractor's pay in contract)

Excavator Specs

Minimum: 200-series (20-ton) with quick-connect system

Attachment	Hydraulic Fittings	Pins		Operating Pressure	
		Size	Spacing	Minimum	Maximum
Stinger	Pioneer Quick-Coupler: -one 3010-3 -one 3050-3	80 mm	458 mm	1500 psi	2000 psi
Ripper	none	80 mm	458 mm	n/a	

Plant Materials:

Type: livestakes and containerized (0.8 gal “Tall-one” pots)

Sources: mostly local collection for livestakes

3 nurseries (Milestone Nursery; Wildlands, Inc.; YNFP nursery at Klickitat Field Office)

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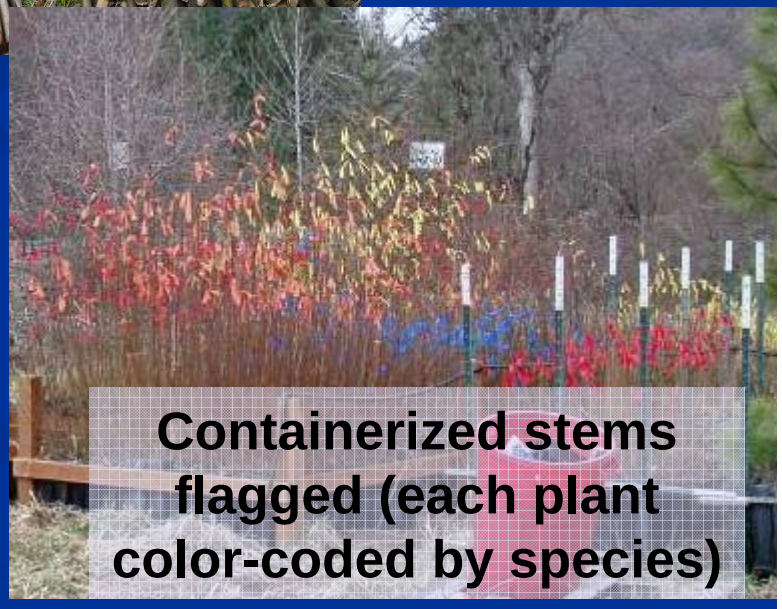
Livestake Preparation

- Collect locally, if possible
- Make angular cut at base when collecting
- Cold storage (avoid freeze-drying)
  - Wrap in plastic
  - About 30° F
- Pre-installation preparation
  - Soak in water 1-2 days before installation
  - Keep out of direct sunlight

Plant Materials: Marking



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Plant Materials: Organizing

Site 22.68 Summary		
Sum of # of Plants		
Plant Species	Type	Total
	Tall-one	235
coyote willow	cuttings	974
	Tall-one	58
Geyers willow	Tall-one	84
ponderosa pine	Tall-one	305
red alder	Tall-one	207
Scouler's willow	cuttings	123
	Tall-one	90
Grand Total		2733

- Total tally by species and stock provided to crew
- Contractor organized / packaged into fruit boxes by site for quick transport from materials staging area

Sequencing

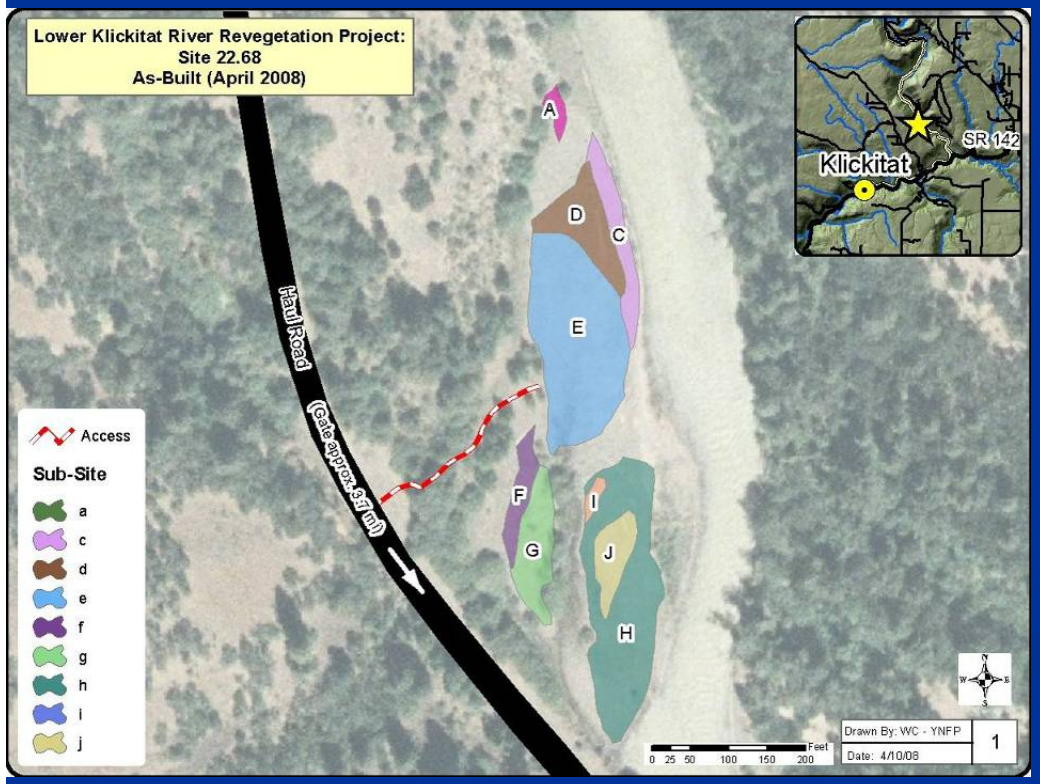
Implemented over two field seasons:

- March* 2006
  - Planted 6.63 ac
  - Used a general contractor
    - Excellent operator (required 4-5 hours to gain proficiency)
    - Crew needed to be watched continuously
- March* 2008
  - Planted 4.0 ac
  - Used a contractor that specializes in revegetation (Wildlands, Inc)
    - Excellent operator and crew
    - Required about half of the supervision
    - Allowed implementation of more site-specific designs

* March was selected based on concurrence of 1) dormancy, 2) low likelihood of inundation, and 3) elevated water table

Specifications for Work Crews

Site 22.68			
This site has nine planting areas:			
Name	**Description**	**Site Preparation**	**Priority**
A	highest surface; medium gravels to medium cobbles; 3' - 5' to g.w.	rip, then sting	1
C	medium gravels to large cobbles with sand infill; 1' - 3' to g.w.	rip, then sting	3
D	highest surface; medium gravels to medium cobbles; 3' - 5' to g.w.	rip, then sting	2
E	surfical sand deposits; 1' - 3' to g.w.	test sting, rip if necess., then sting	4
F	medium gravels to large cobbles with sand infill; 2' - 4' to g.w.	rip, then sting	9
G	sand; 4' to 7' to g.w.	sting only	5
H	gravs and cobbs w/sand infill (upstream) to sand (downstream); 2' - 3'	test sting, rip if necess., then sting	8
I	gravs & cobbs w/sand infill; 3' - 4' to g.w.	rip, then sting	6
J	gravs & cobbs w/sand infill; 3' - 4' to g.w.	rip, then sting	7



Detailed maps compliment good field lay-out and a pre-con walk-through (not a substitute)

Specs for Work Crews (cont'd)

drier/higher/ less disturb

moister/lower/ more disturb

G	area (sf) =	7175	avg spacing (ft) =	8	total holes =	112
Plant Species	Type	Percentage of holes	s.f./hole	# of holes	plants/hole	# of Plants
ponderosa pine	Tall-one	100.0%	64	112	1	112
		100%		**112**		**112**

H	area (sf) =	23012	avg spacing (ft) =	6	total holes =	639
Plant Species		Percentage of holes	s.f./hole	# of holes	plants/hole	# of Plants
Scouler's willow	cuttings	2.5%	36	16	2	32
Scouler's willow	Tall-one	4.0%	36	26	1	26
black cottonwood	cuttings					198
black cottonwood	Tall-on					96
Geyers willow	Tall-on					32
red alder	Tall-on					112
coyote willow	cuttings	20.00%	36	128	2	256
coyote willow	Tall-one	5.00%	36	32	1	32
		100.0%		**640**		**784**

Species order follows moisture/ topographic/disturbance gradient

I	area (sf) =	728	avg spacing (ft) =	6.5	total holes =	17
Plant Species		Percentage of holes	s.f./hole	# of holes	plants/hole	# of Plants
ponderosa pine	Tall-one	40.0%	42.25	7	1	7
Scouler's willow	cuttings	10.0%	42.25	2	2	4
Scouler's willow	Tall-one	10.0%	42.25	2	1	2
black cottonwood	cuttings	20.0%	42.25	3	1	3
black cottonwood	Tall-one	20.0%	42.25	3	1	3
		100%		**17**		**19**

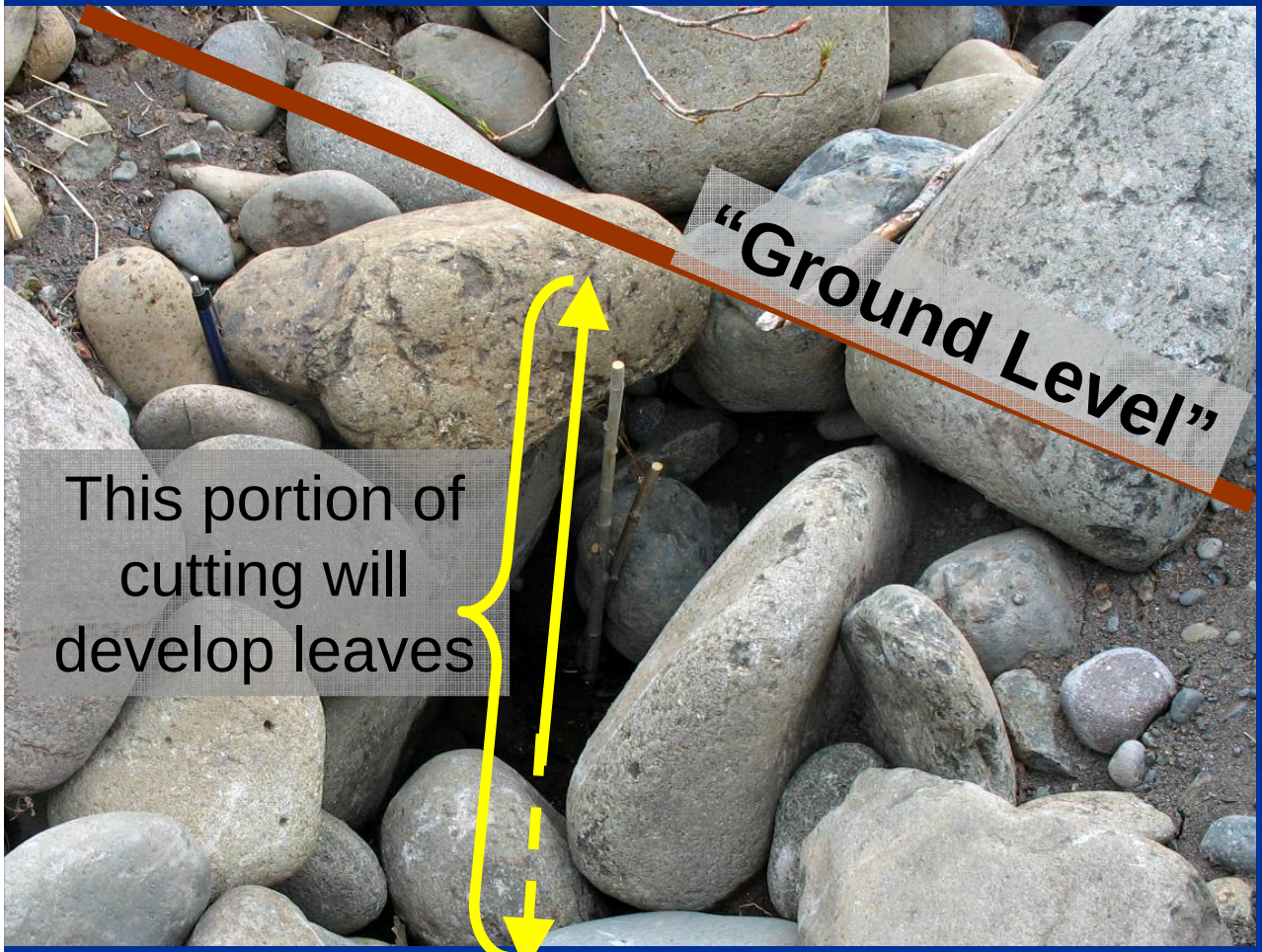
Taylor species selection to site's ecology as much as possible

Installing for Long-term Survival

- Plant hardwoods as deep as possible
  - For containerized stock (especially willow and cottonwood)
    - DO worry about depth of the bottom of the root mass
    - DON'T worry about having root crown at ground level
- **HIGH ROOT-TO-SHOOT RATIOS create success**
  - think about the plant's physiology
  - anybody can get them to leaf-out
  - prune the heck out of hardwoods (initially and, if necessary and resources available, mid-summer)
  - Foliage is a LIABILITY when there's no roots to support it
  - be careful of dogma like, "cut-off 4 inches above ground"…

“Ground Level” is Irrelevant

- livestake doesn’t care about “ground level”
- livestake does care about continuous mineral contact and RH
  - vegetative growth above / adventitious roots below



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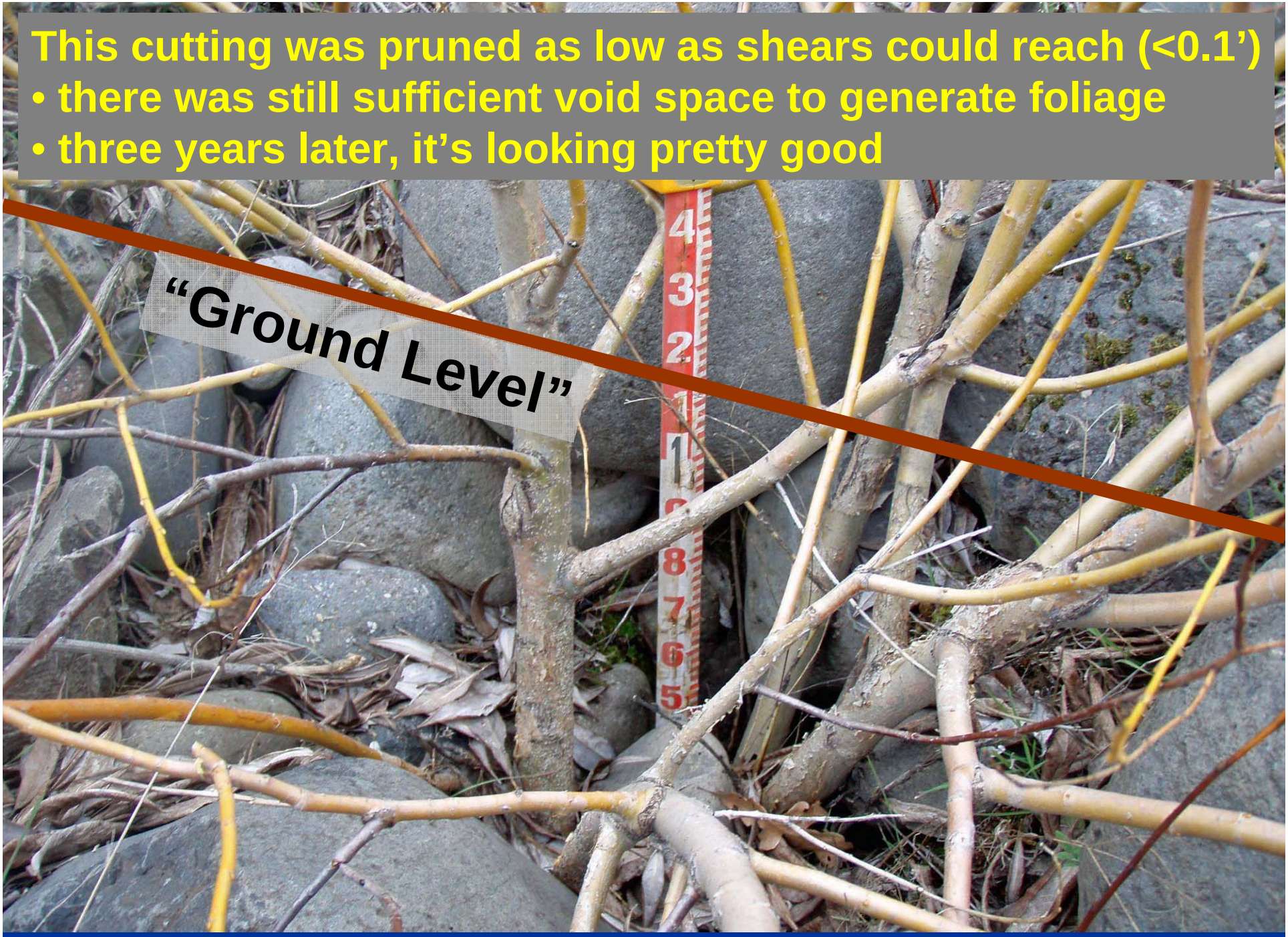
- Mechanical action causes fines to settle
- Stinger leaves a “cone” / “dimple” at surface with very high void ratios
- cut as low as a pair of shears will reach
- don’t handicap your plants by leaving too much effective stem



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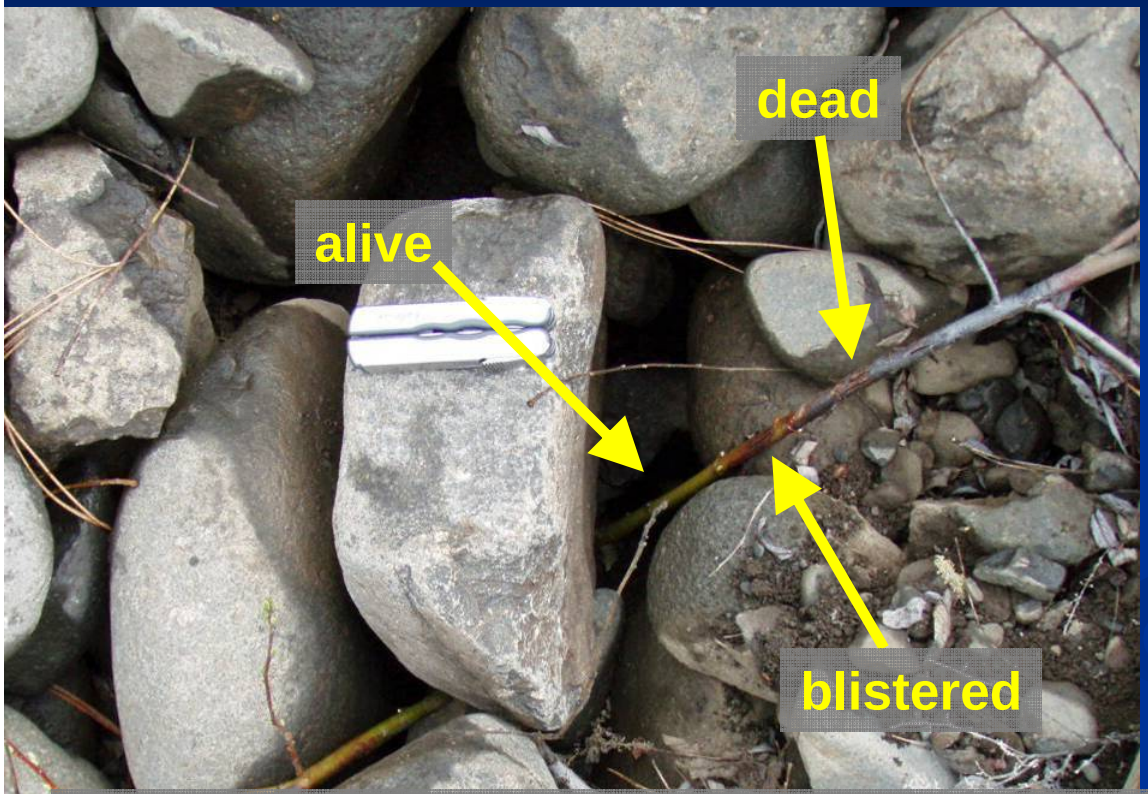
Blistering / Die-Back



- Not uncommon
- Happens at/near ground level during first summer
- Seems to result from refraction and/or re-radiation of solar energy by rocks

Shading the Root Crown (pines)

Specified in installation sub-contract

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Weeds

- bull thistle
- diffuse knapweed
- spotted knapweed
- houndstongue
- Dalmatian toadflax

- Present, but not competing with native vegetation
- Pulled manually to reduce seed source/spread

Livestock Exclusion

Single-strand barbed-wire electrified with 12V charger installed seasonally at sites 22.06 and 22.68

Costs

(approximate)

Materials (14.6%)	
plant materials	$14,500
fencing materials	$ 800
Installation (64.7%)	
2006*	$28,610
2008*	$33,245
Weed control & Fencing	$ 2,500
Planning, Design, and Oversight (16.8%)	
2005-2006	$ 9,100
2007-2008	$ 7,600
Monitoring (3.1%)	$ 3,100
TOTAL	**$99,455**

* hourly sub-contract

Unit Costs
(approximate)

- Average installation **cost per hole** (inclusive of mobilization, ripping, and plant materials handling)
  - 2006 (using a general contractor) $8.32/hole
  - 2008 (using a revegetation contractor) $7.42/hole

- Average **total cost per acre** (inclusive of materials, installation, design, and maintenance costs, but not monitoring, on the 10.08 acres planted)

$9,560

Acknowledgements

- Salmon Recovery Funding Board (materials and installation)
  - Lower Klickitat River Riparian Re-vegetation Project $46,402
  - Logging Camp Creek Acquisition Project $ 2,800
- BPA (Klickitat Watershed Enhancement Project)
  - materials, planning, design, oversight, & monitoring ~$26,000
- Mid-Columbia Fisheries Enhancement Group
  - materials, planning, design, oversight ~$21,650
- Fish America Foundation
  - installation at Klickitat Mill sites $ 2,600
- Volunteers

Effectiveness Monitoring

Ponderosa Pine Survival

(worst case scenario* - as of 3/9/09)

	RM 17.24		RM 22.06		RM 22.68	
Total Planted March and/or April 2008	206		347		305	
# Alive & Unbrowsed	**139**	**67%**	**311**	**90%**	**200**	**66%**
# Alive & Browsed	2	1%	24	7%	61	20%
# Dead & Unbrowsed	11	5%	1	0%	7	2%
# Dead & Browsed	0	0%	0	0%	6	2%

* initial planted count is from April 2008. Follow-up count was a census of plants that could be relocated, some survivors were likely missed.

Effectiveness Monitoring

Site RM 17.16	6/20/06 (year 1)	7/1/08 (year 3)
Hardwood Survival	92.7	85.4
Average height (cm)	57	150
Avg % woody cover	11.6	29.2

Data courtesy of Jennifer O'Neal, TetraTech

Know your site!!!!

http://www.ykfp.org/klickitat/KWEP_sites.htm

(Under development)

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