A photograph of a river flowing through a forest. The water is white with rapids. Several large logs are fallen across the river, creating a natural dam. The surrounding trees are green and dense.

In-Stream Wood:

Thoughts from a recreational rafter
and restoration practitioner

Presented To:
Salmon Habitat Conference
April 27, 2011

Presented By:
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Presentation Objectives

- Provide a context for human interactions with river hazards (focus on Large Woody Debris -LWD)
- Inform stream restoration practitioners and river managers:
 - Background on river hazards
 - Boater perspectives and LWD
 - Design considerations



Disclaimers:

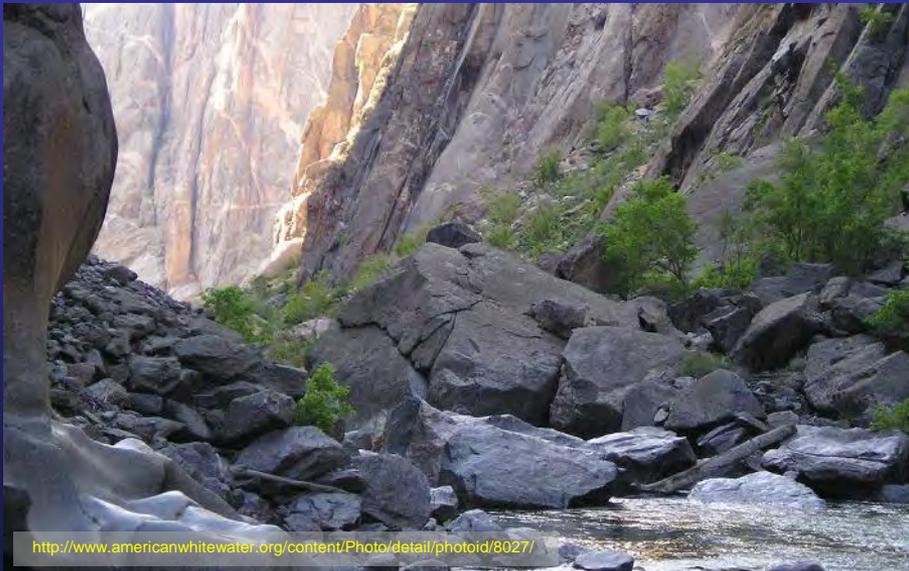
- Presentation is strictly for informational purposes
- Ecological functions of LWD are well-established and covered by other speakers in this session
- Material is not presented as a policy position of the Yakama Nation

Speaker Background

- Recreational Boater
 - approximately 400 river-days over the last 10 years
 - over 3,300 miles on 60 different rivers/streams in 8 states
 - Class I to Class V+
 - conducted / participated in ~60 rescues / recoveries
- Stream Restoration Practitioner
 - 11 years professionally as a project manager and designer
 - placed ~ 2000 pieces of LWD in rivers & streams
- Volunteer firefighter
- Husband
- Father



Rivers Present a Variety of Hazards: Some Natural...



...Some Not



W. Conley - 2011



W. Conley - 2007



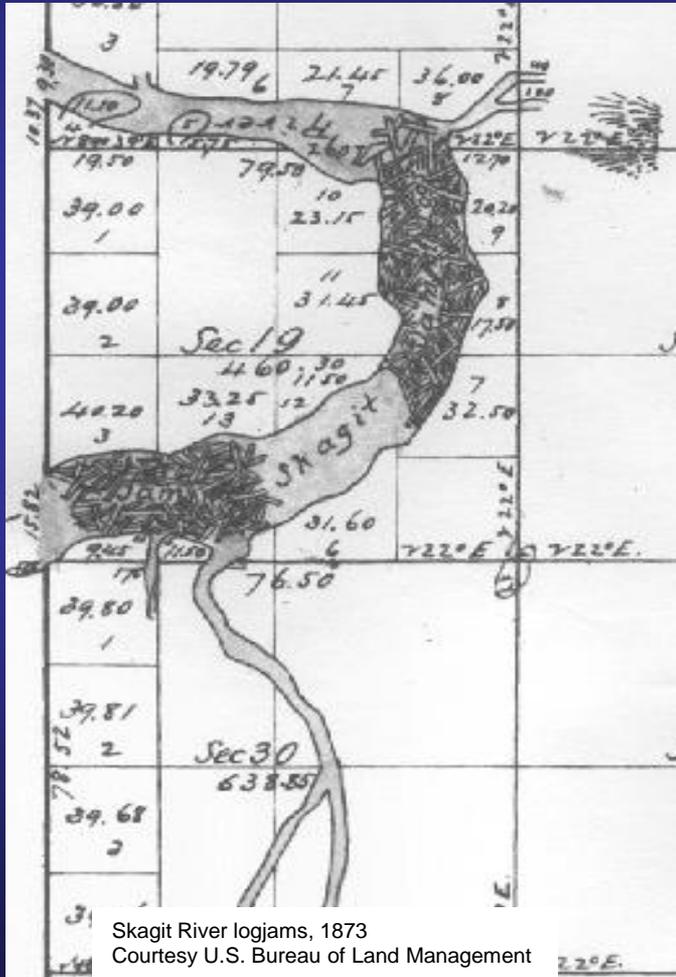
W. Conley - 2011



W. Conley - 2011

Historic Prevalence of LWD

Logs and log jams commonly blocked navigation



- Two large jams on the Skagit River appear on the GLO maps in 1873
- One jam had been in place sufficient to block river traffic for nearly 100 years
- A second, younger jam was “rapidly increasing in size at the rate of a quarter mile every three years.”
- The only way around the jam was “A rude skid road built by Upper Skagit Indians to haul their canoes...”
- Removal of “five to eight tiers of logs three to eight feet in diameter, totaling 30 feet deep” between 1876 and 1879.

A Tale of Two Log Jams - Part 1: The Value of Persistence & Patience...



Paul Kuthe - 2009

- LWD jam formed on Canyon Cr (WA) after upstream landslide (1/9/09)
- flooding cleared the jam naturally (1/16/11)

A Tale of Two Log Jams – Part 2: ...or not



<http://ph.groups.yahoo.com/group/idahowhitewater/photos/view/9fae?b=3&m=f&o=0>

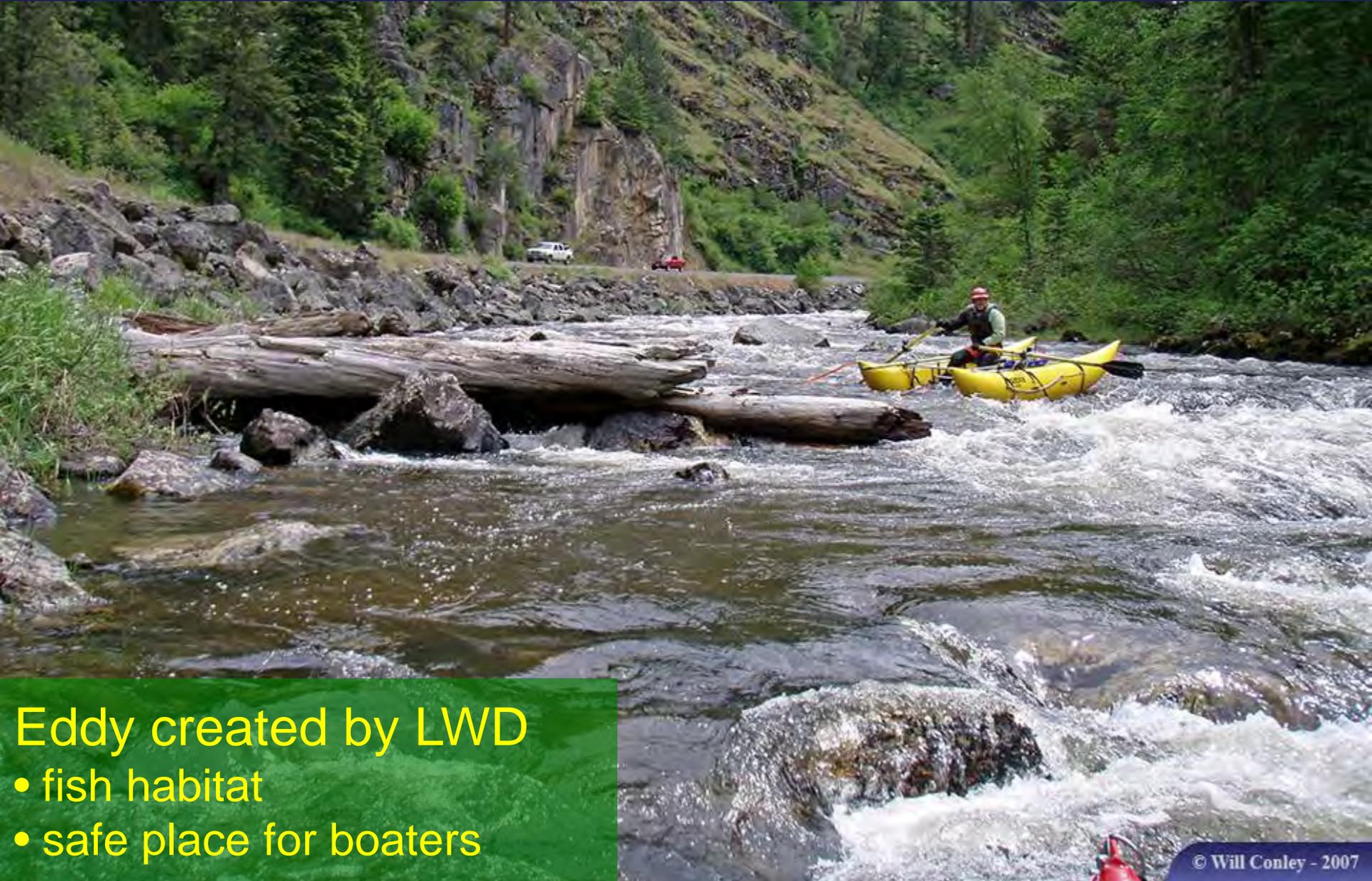
- LWD jam formed by a (tributary) debris flow on “Wild & Scenic” M.F. Salmon River (ID)
- USFS used explosives to clear 2 days after occurrence (July 2006)

Rocks cause wraps & entrapments too...



...but, we've managed to (mostly) move past altering them for convenience sake

Some LWD Is Useful To Boaters



Eddy created by LWD

- fish habitat
- safe place for boaters

Floaters' / Boaters' Responsibilities

- Be a **Competent swimmer**
- Wear proper **personal protective equipment** (life jacket, etc)
- Boat **in control**. Able to stop or reach shore before reaching danger.
- Boat with **companions**. (≥ 2 two craft recommended)
- Have a **frank knowledge** of their boating **ability**
- Be trained in rescue and **self-rescue**, **CPR**, & first aid.
- Carry equipment needed for unexpected emergencies
- **Knowledge of river conditions**

Adapted from AW's Safety Code <http://www.americanwhitewater.org/content/Wiki/safety:start>



Putting the Risk in Perspective

Rivers are dynamic and inherently dangerous, yet fatality rates are comparable to or lower than many common activities

Activity	Annual Fatality Rate ^A
Passenger Automobile	15.2
Falls at home	4.0
Pedestrians	2.2
Fires at home	1.2
Drowning in public places	0.9
Firearms (accidental)	0.1
Lightning	0.02

^A per 100,000 population

Activity	Annual Fatality Rate ^B
Climbing / Mountaineering	3.2
Kayaking	2.9
Swimming	2.6
Bicycling	1.6
Whitewater boating	0.86
Hunting	0.7
Skiing and snowboarding	0.4

^B per 100,000 participants

Tables adapted from:
Kayaking is Safer Than You Might Think (really!) By Laura Wittmann
American Whitewater Journal Sep/Oct 2000

Common Denominators of River Incidents

Environmental

- High Water
- Cold
- Strainers, Sweepers, and Sieves
 - Rock sieves
 - Undercut rocks
 - Pilings / Abutments
 - Overhanging Limbs
 - Brush
 - LWD
- Dams, weirs, holes, etc.

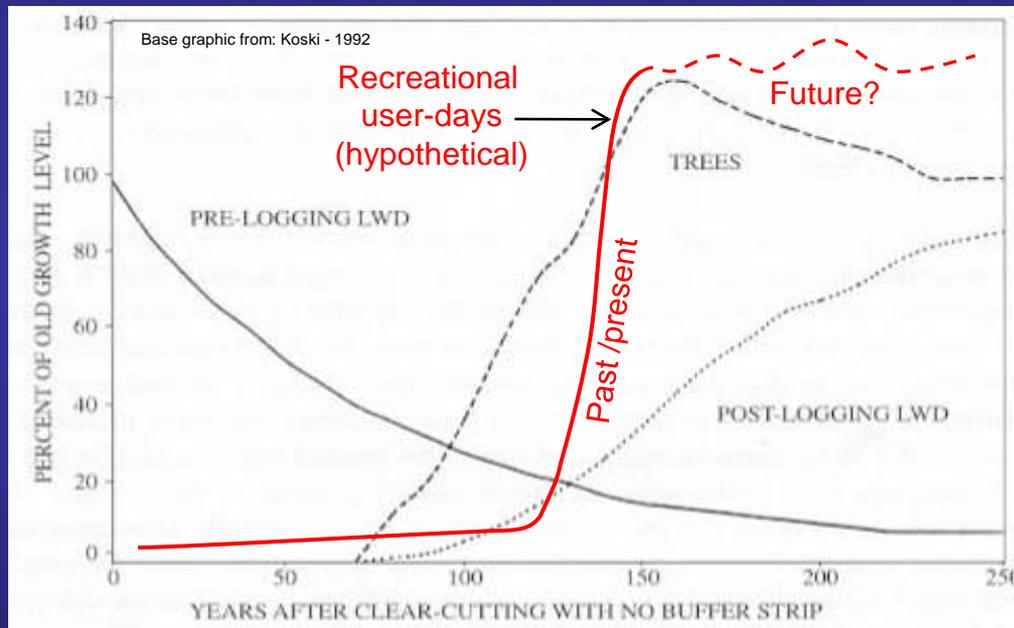
Human Factor

- Lack of preparedness
- Drugs / alcohol
- Bad judgment



Boaters and LWD Through Time

Though original instream LWD declines were generally caused by commerce and industry...



...river recreationists today enjoy and, in some cases, help maintain historically-low levels of LWD

Boater Antipathy Toward LWD

“Logs are the predators of paddlers and we treat them how our ancestors in this country treated wolves and mountain lions. They are generally disliked, their importance to the ecosystem is completely misunderstood, they are removed whenever possible, and if one is ever implicated in the injury or death of a human it is ceremoniously destroyed.”

*From: How Much Wood Does a Paddler Chuck? By Kevin Colburn
American Whitewater Journal Mar/Apr 2001*

Design Vehicle Concept?

Tempting, but not appropriate in the traditional sense

- Rivers / streams are not highways, roads, or trails
- The range of user-ability is very broad...selecting the slowest or least-mobile shortchanges habitat
- Who decides?
- Use of pool-toys or other equipment not explicitly designed for rivers is hazardous in and of itself



S. Conley - 2011



Mike Reid - 2009

If You Really Need a "Design Vehicle"



CRITFC / Les Brown - 2003



YNFP / W. Conley - 2008



YNFP / P. Luke - 2011



YNFP / W. Conley - 2004



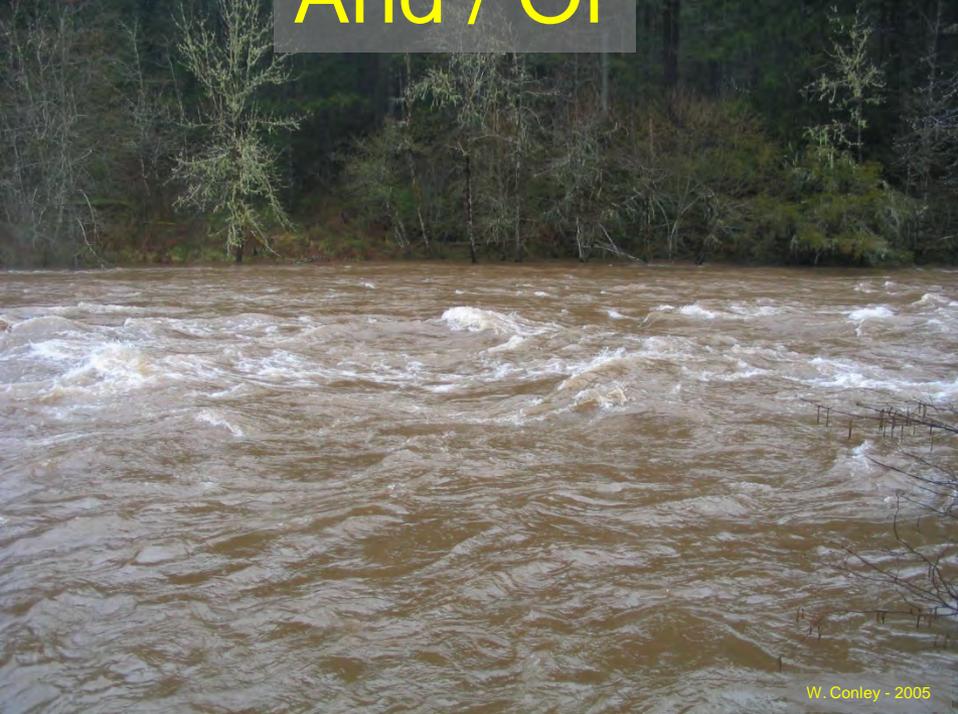
YNFP / P. Luke - 2011

Design Flows?



W. Conley - 2006

And / Or



W. Conley - 2005



Does anyone design for this?

W. Conley - 2009

Design to the “General Character”

(from a navigability perspective)

- Can be categorized by greatest degree of difficulty
 - for example, International Scale of River Difficulty
 - subjective, but loosely defined
- Applied to 1) individual rapids and 2) “runs”
- A “run” is like a “reach” with the endpoints defined by access
 - Access points are called “put-in” and “take-out”
 - **The majority of a “run” (by length) is usually easier than rating**
 - e.g. a class II run has multiple class II rapids (and none harder) but may be mostly class I in between rapids
- Ratings usually increase with discharge
 - A class I or II river could easily be class IV or V during high water
- A single channel-spanning log can turn a class III into class V

Class I *

Moving water with riffles and small waves. **Few obstructions, all obvious and easily missed with little training.**

Class II *

Straightforward rapids with wide, clear channels evident without scouting. **Occasional maneuvering required, objects easily missed by trained paddlers.**

Class III*

Complex maneuvers in fast current and good boat control in tight passages often required; **large waves or strainers may be present but are easily avoided.** Strong eddies and powerful current effects can be found.

Class IV*

Intense, powerful but predictable rapids **requiring precise boat handling in turbulent water.** Large, unavoidable waves, holes & **constricted passages** demanding fast maneuvers under pressure. “Must” moves above dangerous hazards.

Class V*

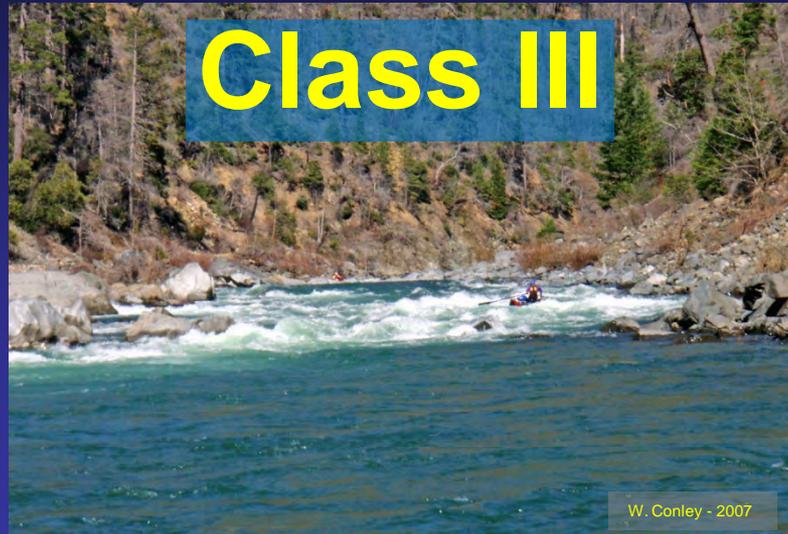
Extremely long, obstructed, or very violent rapids. Large, unavoidable waves, holes & **steep, congested chutes with complex, demanding routes. Eddies small, turbulent, or difficult to reach.** Rescue difficult, even for experts.

Increasing importance of LWD for fish habitat & channel morphology

Class II



Class III



Class IV



Class V



Increasing boater skill / rapid difficulty

Note: Class I (flatwater) and Class VI intentionally excluded

Can Boaters be Avoided Geographically?

The short answer is “no”

Class I to II Runs

- typically <30 ft/mi (0.006 ft/ft), w/exceptions (e.g. Grand Canyon)
- Probably good benefit to fisheries
- Probably some recreational conflict (but slower water)

Class III to IV Runs

- typically <80 ft/mi (0.015 ft/ft), w/exceptions
- Probably good benefit to fisheries (for non-“continuous” runs)
- Probably greatest potential for recreational conflict

Class V to VI Runs

- Typically 80-300 ft/mi (0.019 - 0.057 ft/ft)
- Generally steeper than most restoration project reaches
- Palouse Falls (~180') has been run; kayakers have run 600-800 fpm

Degree of Hazard is a Function of:

- Approach velocity (speed and angle)
- Porosity
- Position in the water column
- Percent of cross-section obstructed
- Juxtaposition of elements



LWD Porosity

- Is it well-sealed and acting as a deflector?
 - Less-likely to be hazardous
 - More likely to create hydraulic features like eddies
- Is it porous and acting like a sieve?
 - Flow is entrained into or underneath
 - More likely to cause vessel and/or human entrapment

Poorly-sealed and channel-spanning



Courtesy of Idaho Public Television

Well-sealed and obstructing <50% W_{wet}



W. Dorley - 2010

From a Practical Perspective (cont'd) the Hazard is Mitigated if:

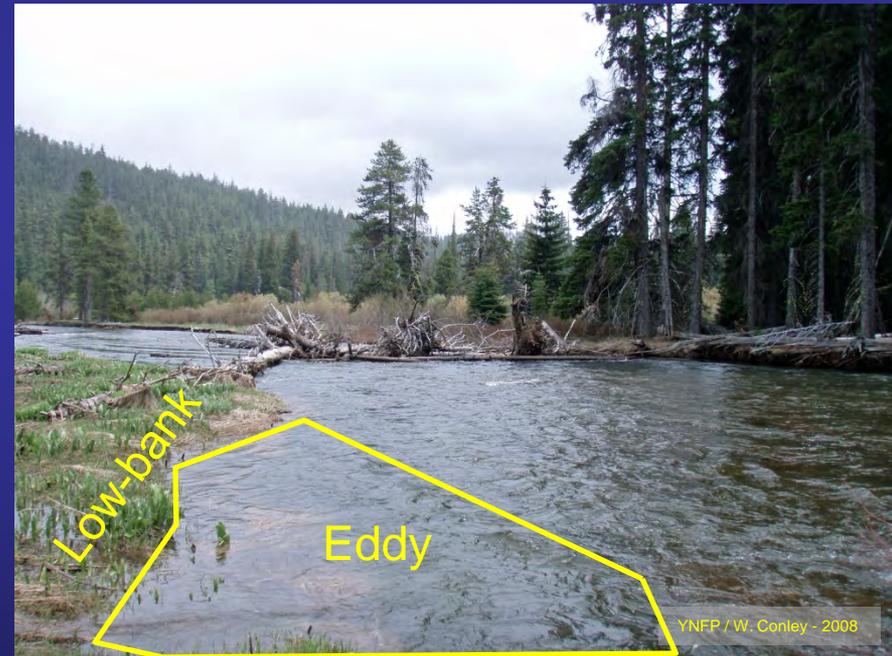
1) It can be avoided with a degree of skill consistent with the character of the reach & discharge

Or

2) It's visible from upstream, *and* opportunity exists to stop and get to bank

Or

3) It's signed upstream, *and* opportunity exists to stop and get to bank



In the case of constructed LWD, it should be probably be portageable if it presents a navigation impediment during some established period of use

Signage

- Appropriate in some instances, particularly if:

- Human-constructed, and
- Out of geomorphic context
- Channel-spanning



- Problematic in many instances:

- LWD moves...naturally / rivers move...naturally
- Once you start, you can't stop
 - creates expectations
 - requires maintenance
- Expectations may be problematic when folks travel to other rivers where expectations are different

Getting the Word Out...

Technology facilitates rapid hazard awareness:

Cell phones, satellite phones and the internet have made same-day notification possible from very remote places (e.g. the Lake Creek blow-out)

Boater forums on the web (hazards & other subjects):

- Yahoogroups.com
 - [PNWWhitewater](#) (OR/WA; rafting)
 - [PDXKayaker](#) (Portland-based; kayaking)
 - [IdahoWhitewater](#) (ID/NW; rafting and kayaking)
- KayakIdaho.com (ID; kayaking)
- Professorpaddle.com (Seattle-based; kayaking)
- BoaterTalk.com (~national; rafting and kayaking)
- MountainBuzz.com (CO/WY/MT/UT/NM; mostly kayaking)
- Boof.com (CA; kayaking)
- ifish.net (fishing & drift boats)
- Meanchicken.net (ID/WA/OR; jet boating)

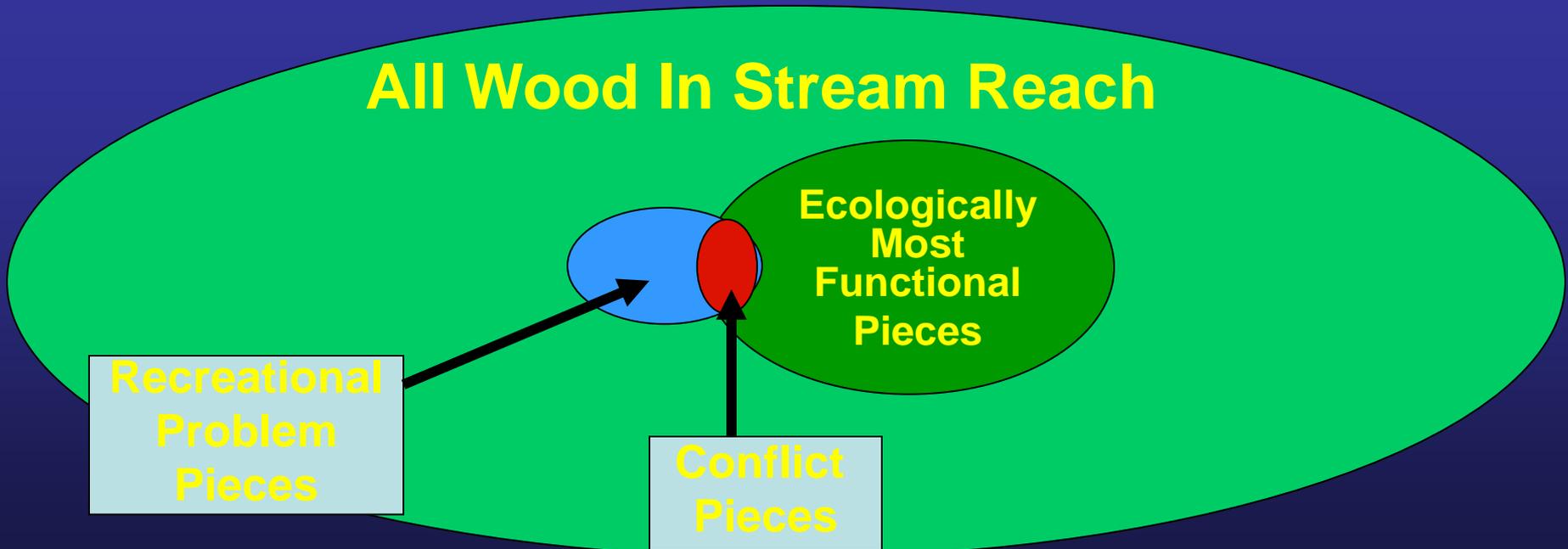
Everyone's an Expert On the Internet

Technology also expedites distribution of ignorance and misinformation with equally fast speed:

“It's legal to manually manipulate woody debris on rivers--that doesn't include chain saws, but does allow crosscut saws, z-drags, ropes or however you can move something via pure muscle or mechanical advantage. So, if managing agencies say ‘NO’ to manually manipulating woody debris, it's BS and simple intimidation. Besides, studies have shown that cross-river tree falls do not improve the fish & wildlife habitat, but tree falls along the banks do improve fish and wildlife habitat--even on the Metolius.”

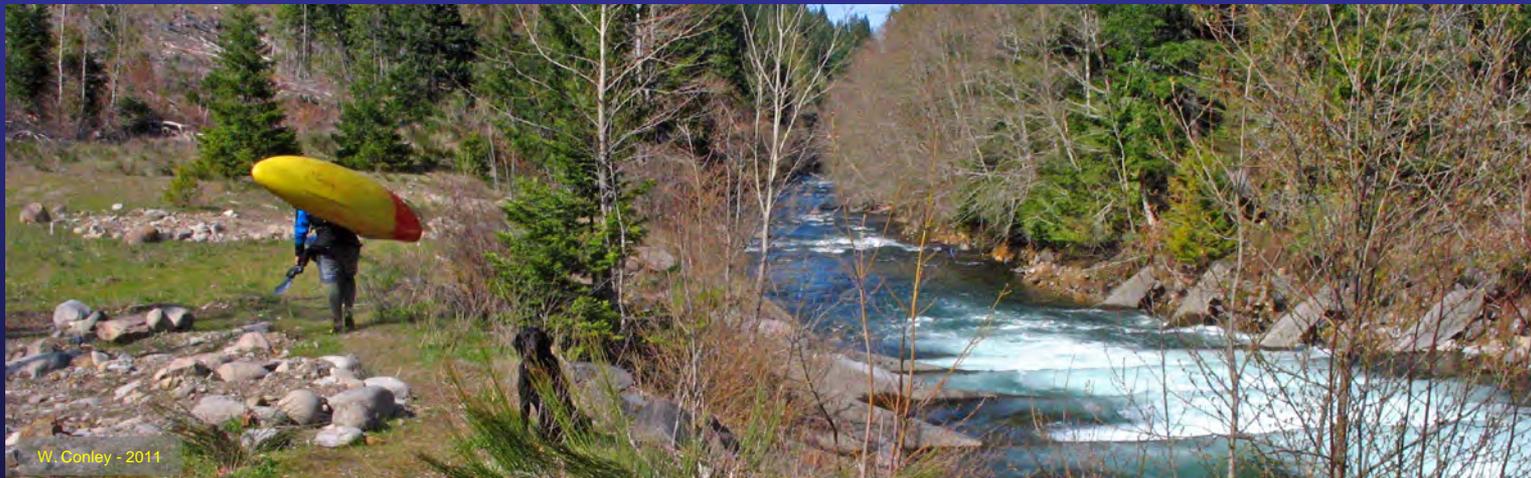
Take-Home Points:

- ***There is no guarantee of safety in any natural environment***
- There is a knee-jerk tendency to label LWD as “dangerous” or “hazardous”...most is neither
- Most “hazardous” LWD is really just inconvenient
- LWD facilitates physical and biological processes 24 hrs/day, 365 days/yr; inconvenience to boaters is minutes or hours



Take-Home Points (cont'd):

- ***Design to the character of the reach / “run”***
- Character of the run may be generally categorized (e.g. International Scale of River Difficulty)
- Elements beyond the run’s present character may be OK, but should probably have more outreach & some form of mitigation
- Awareness + Opportunity to stop & portage (or line) = Mitigation
- Awareness may = visibility and/or signage

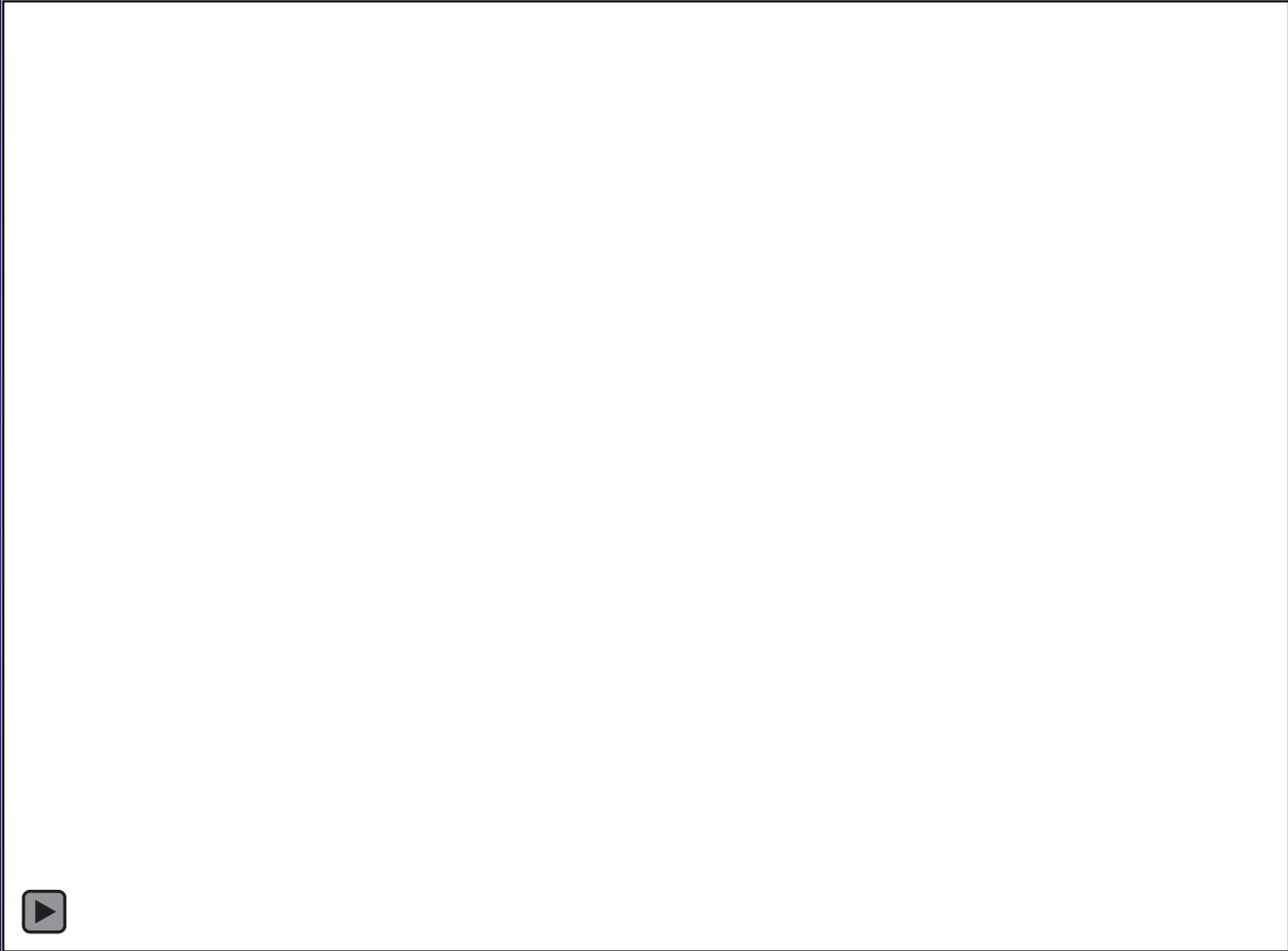


Take-Home Points (cont'd):

- ***Be concerned about “hazards” and “safety” issues, but not intimidated by them***
- Be cautious of channel-spanning and porous designs
- Be particularly mindful of elements that become more hazardous at low flows / during warm weather



LWD can be fun!!!



Wind River (Washington)
Surf /play wave created by natural LWD