

# **Stream Restoration with Large Wood -Context Matters-**

**Workshop on Stream Restoration using Large Wood  
Materials**

**Klawock, Prince of Wales Island, ALASKA**

- **ANDY DOLLOFF, RETIRED FROM  
FOREST WATERSHED  
SCIENCE, USDA USFS SRS  
& CNRE, VIRGINIA TECH**

*In spite of and in coordination with*  
**Noel Kalinity  
Lotta Sulfaight  
Roxanne Mudd  
L. Woody d' Brie**

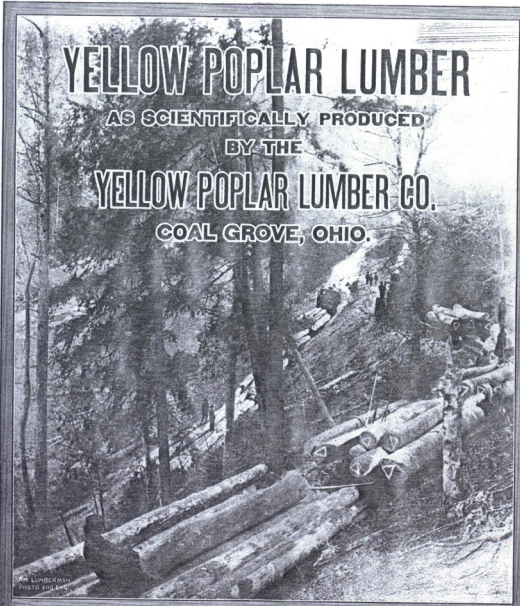
# Process For Watershed Restoration

## - Know What You're Restoring! -

Explore history of land use:

- journals, diaries, trade journals
- municipal records, historical societies, newspaper archives,
- senior citizens recollections,
- previous studies, inventories.

May 21, 1908. AMERICAN LUMBERMAN. 6



**YELLOW POPLAR LUMBER**  
AS SCIENTIFICALLY PRODUCED  
BY THE  
**YELLOW POPLAR LUMBER CO.**  
COAL GROVE, OHIO.

**ORIGIN OF POPLAR.**

In the days of King Khikhi, ruler of the tree makers, a poor youth  
desired far up in the bare mountains of a great country. This youth  
was the son of a prince who had been banished by royal decree for  
holding original ideas. The youth inherited the task which brought his  
father into disrepute in most circles but by other inheritance had he  
not even a hair and came to prefer himself from the will toward one  
a spear with which to reach his, though his name was king.

Now King Khikhi died of consumption, a fatal disease in those  
days and Plogron was made king. Originally again came into vogue  
at the court of the ruler. The King caused his scribe to write upon  
the back of a bark a great proclamation and it was read from the  
hillsides and in the valleys, even from the far distant hills where  
dwelt the lonely youth. The will of the king banished by the scribe  
proclaimed a great invention, and in those days all inventors had  
to do with the making of something new in trees or elsewhere.

Already these inventors had produced trees bearing cones, trees  
bearing fruits of all description, trees that bore nuts and the bark  
bearing and these groves. It was proclaimed and made manifest that

# Process For Watershed Restoration

Develop Proposals, solicit input

- Citizens, interest groups
- Resource professionals



# Process For Watershed Restoration

Design/conduct inventory

- Chemical, physical, biological
- Whole basin (establish context)



# Process For Watershed Restoration

- Work from "bottom up"



Lead, follow, or  
get out of the road



# Context (history) matters

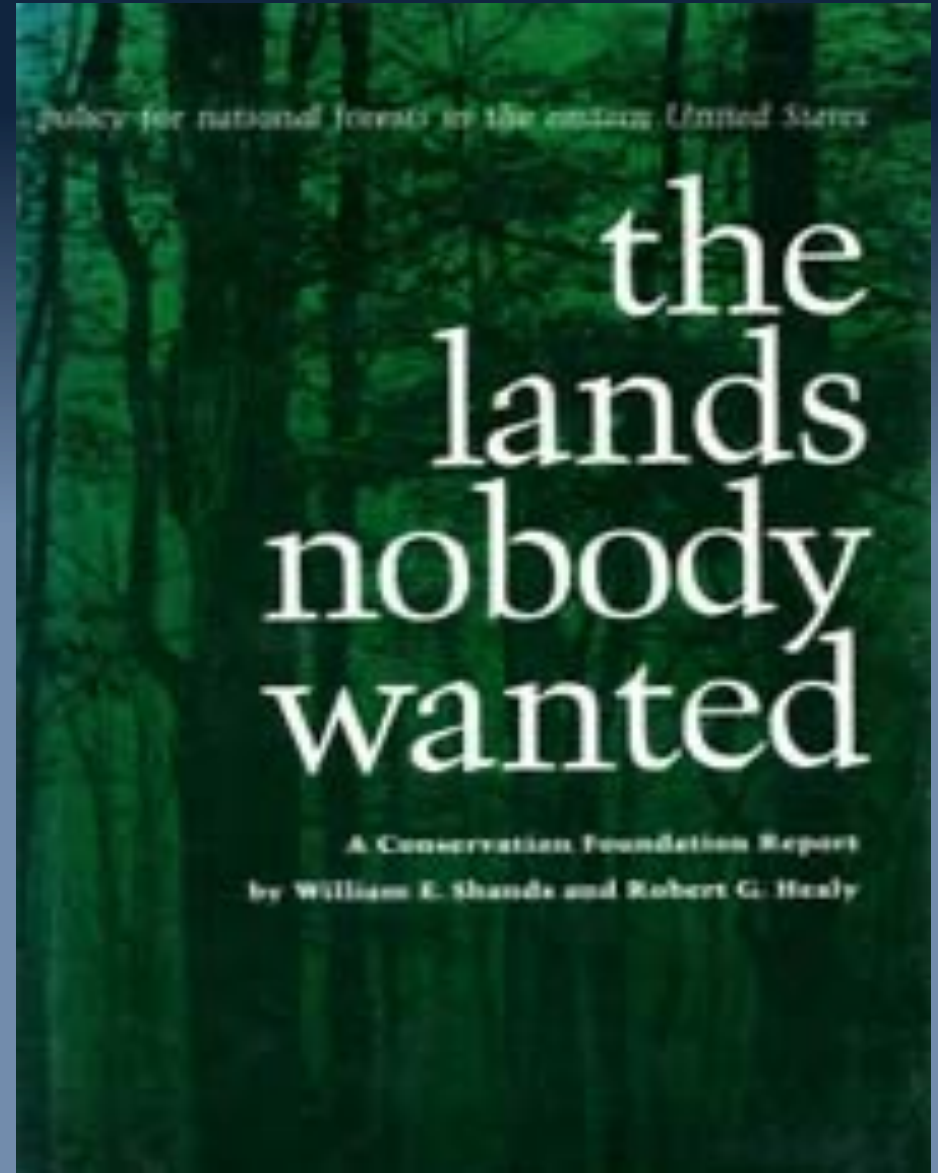
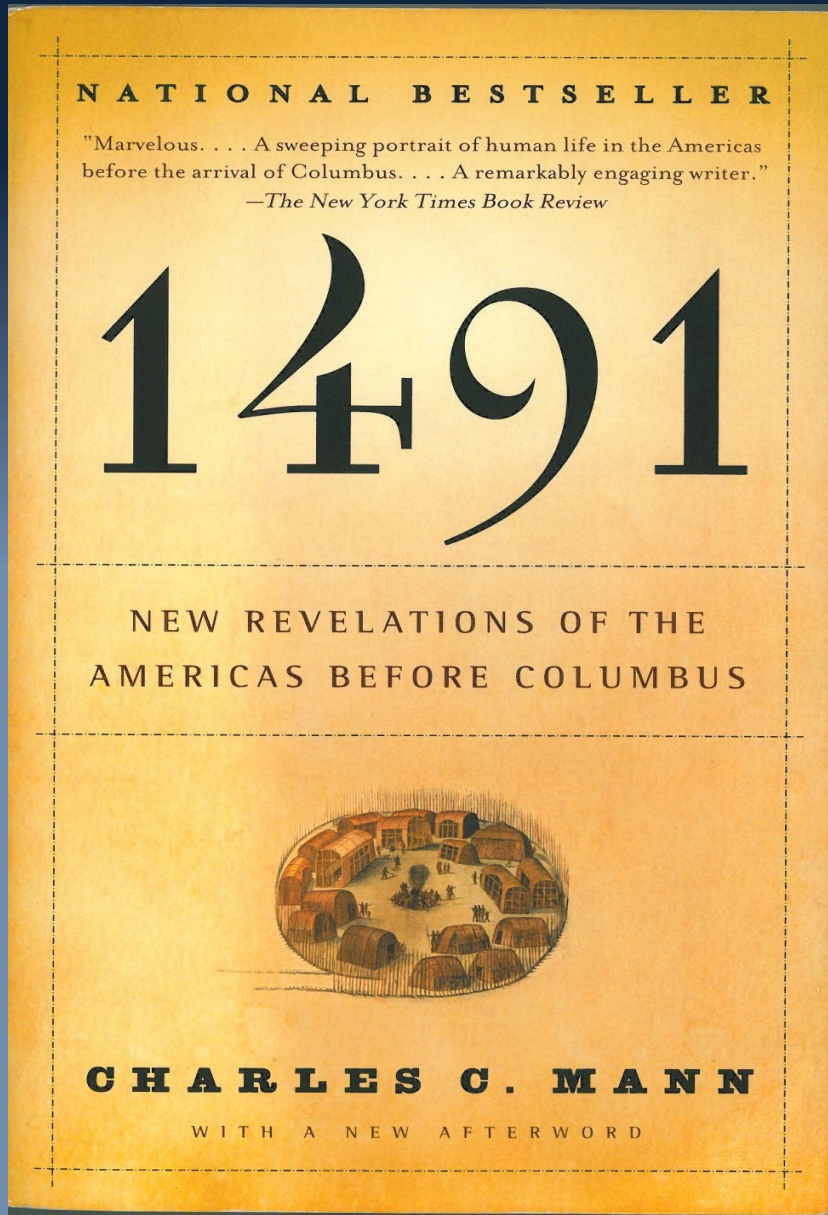
**\*Because the fishin' (along with most everything else) ain't what it used to be**



**\*Perceptions vs reality**



# Highly Modified Landscape





# American Lumberman

**NORTHWESTERN LUMBERMAN**  
ESTABLISHED 1873.

**CONSOLIDATED**  
JAN. 1, 1899.

**THE TIMBERMAN**  
ESTABLISHED 1886.

WHOLE NUMBER 2559

CHICAGO, MAY 31, 1924

YEARLY SUBSCRIPTION \$4

The Exponent of the American Lumber Industry

## American Lumberman

Published Weekly by  
**THE AMERICAN LUMBERMAN**  
C. W. DEFEBAUGH, President. E. C. HOLE, Secretary and Manager.

OFFICES: EIGHTH FLOOR, MANHATTAN BUILDING  
431 South Dearborn St.  
CHICAGO, ILLINOIS, U. S. A.  
Cable Address, "Lumberman, Chicago."

**TERMS OF ANNUAL SUBSCRIPTION, POSTAGE PAID:**  
IN THE UNITED STATES AND MEXICO, \$4; CANADA, \$6; IN THE UNITED KINGDOM AND ALL OTHER COUNTRIES IN THE UNIVERSAL POSTAL UNION, \$8.

Subscriptions for less than a year are taken at the yearly rate if paid in advance. Remittance upon yearly subscriptions is expected within the first sixty days; after that time they are subject to sight draft with exchange upon due notice.

Orders to discontinue should be accompanied by payment to date. In requesting change in address, please give old as well as new address. Single copies, 25 cents.

ENTERED AS SECOND CLASS MATTER JANUARY 27, 1899, AT THE POSTOFFICE AT CHICAGO, ILLINOIS, UNDER ACT OF MARCH 3, 1879.

Copy for new advertisements should be in this office not later than Monday, changes in current advertisements not later than Tuesday of the week previous.

MEMBER AUDIT BUREAU OF CIRCULATIONS



READ WHEREVER LUMBER IS CUT OR SOLD AND REGARDED BY THE TRADE AS AUTHORITY IN LUMBER MATTERS

Published Weekly—  
In Its Fifty-first Year

### Where You Will Find It This Week

Editorial	Of Special Interest
Editorials ..... 27-29	The Lumber Retailer and His Show Window ..... 35
Query and Comment ..... 30	Lumber Retailers Tell of Trade Conditions ..... 36-37
Review of Current Lumber Trade Conditions ..... 31	What the Banker Told "Mr. Jones" ..... 37
Departments	Conducts Hardwood Operation in Ohio City ..... 39
Book Reviews ..... 56	Develops Economies in Belting Department ..... 39-40
Building, Notes from the Realm of ..... 38	The Northwest Is Making Steady Recovery ..... 43
Business Changes, Incorporations, etc. .... 62-63	Center for Timber Production in Willamette Valley ..... 44
Foreign Fields for Industrial Endeavor ..... 88-89	Old Farm Rich in Burl Black Walnuts ..... 47
Forestry News ..... 56	Aerial Tramway Used in Coast Operation ..... 55
Live Topics ..... 29, 42, 43, 57	Fixture Industry and Lumber Supply ..... 64, 87-88
Local and Personal ..... 76-77	
Lumber Statistics ..... 40-41	Index to Advertisers
Markets, The ..... 78-87	Lumber ..... 98
Motor Truck Department ..... 61	Machinery ..... 99
Obituary ..... 45-63	Miscellaneous ..... 99
Poet, The Lumberman ..... 54	
Realm of the Retailer ..... 32-33	News from the Lumber World
Retailers, News and Business Ideas for ..... 34-35	Aberdeen-Hoquiam, Macon, Ga. .... 71
Sash, Doors and Millwork ..... 67	Wash. .... 73
Timber Land Sales ..... 63	Atlanta, Ga. .... 65, 70
Trouble and Litigation ..... 63	Baltimore, Md. .... 72
Transportation, Lumber ..... 58	Bellingham, Wash. .... 68
Washington, Notes from ..... 59	Boston, Mass. .... 75
Association Activities	Buffalo, N. Y. .... 66
Coming Conventions ..... 50	Cincinnati, Ohio. .... 67
Northern Wholesale Hardwood Lumber Association ..... 46-47	Columbus, Ohio. .... 65
Northern Hemlock & Hardwood Manufacturers' Association ..... 47	Detroit, Mich. .... 66
Hoo-Hoo Doings ..... 48	Duluth, Minn. .... 69
Southwestern Hardwood Manufacturers' Club ..... 49	Elkins, W. Va. .... 67
National Lumber Exporters' Association ..... 49	Evansville, Ind. .... 65
What the Associations Have in Prospect ..... 50-51	Everett, Wash. .... 72
Jackson (Miss.) Lumbermen's Club ..... 52	Houston, Tex. .... 90
Central Illinois Lumbermen's Club ..... 52	Indianapolis, Ind. .... 66
Lumber Clubs and Exchanges ..... 53	Jacksonville, Fla. .... 66, 75
Outings ..... 91	Kansas City, Mo. .... 90
	Lake Charles, La. .... 90
	Laurel, Miss. .... 71
	Los Angeles, Calif. .... 73
	Louisville, Ky. .... 65
	Lufkin, Tex. .... 70
	Macon, Ga. .... 71
	Marquette, Wis. .... 66
	Memphis, Tenn. .... 67
	Merrill, Wis. .... 66
	Milwaukee, Wis. .... 65
	Minneapolis, Minn. .... 74
	New Orleans, La. .... 90
	New York, N. Y. .... 71
	Norfolk, Va. .... 70
	Omaha, Neb. .... 69
	Philadelphia, Pa. .... 71
	Pittsburgh, Pa. .... 71
	Portland, Ore. .... 72
	Sacramento, Calif. .... 74
	San Francisco, Calif. .... 73
	Seattle, Wash. .... 69
	Shreveport, La. .... 70
	Spokane, Wash. .... 72
	Tacoma, Wash. .... 68
	Vancouver, B. C. .... 74
	Warren, Ark. .... 69
	Winnipeg, Man. .... 75

## America Will Use Her Waterways for Transportation

EXPLORATION OF THE INTERIOR of the American continent was owing principally to the existence of numerous lakes and rivers. The Indians and the French explorers habitually used these waterways in traversing the Mississippi Valley region in all directions; and before the coming of the whites the native red men knew and used numerous "portages" where by carrying their light canoes for short distances they could pass from the headwaters of one stream to another and from one drainage basin to another. Beginning in this way, water transportation became and continued until long after the railroads were in existence to be an important

that water has played in American development may not be able to visualize the part that it must play when the present population is doubled or trebled. The United States today has several agencies of transportation, each in a measure competing with the others but all together serving to carry the nation's goods between producers and consumers. No method of transport ever used in the history of mankind has been wholly abandoned; the most crude still has a place to fill where special conditions make it the only or the most practicable method. This is the history of all the means and agencies that man has used in struggling forward.

# What's wood got to do, got to do, with it?

Wood influences physical and biological processes including:

- channel morphology
- sediment storage & delivery
- water quality
- streamflow patterns
- stream biota (Fish! ...and other stuff)
- habitat





Maine

*Brook Drive—Carding the Ledges*

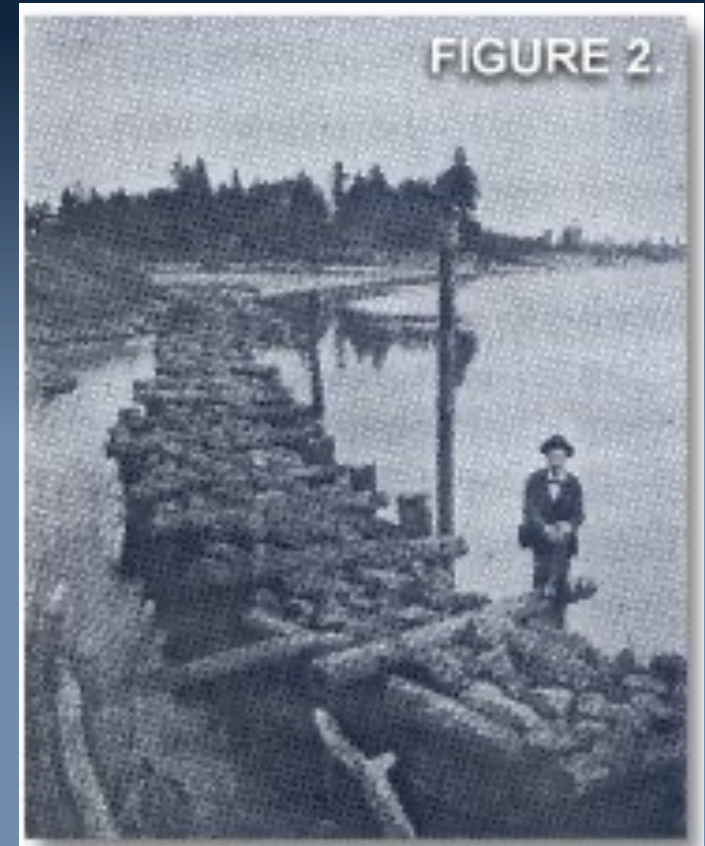
Larson Collection, University of New Brunswick

# The Great Raft—1830s



Source: Noel Memorial Library Archives

# “River Improvements”

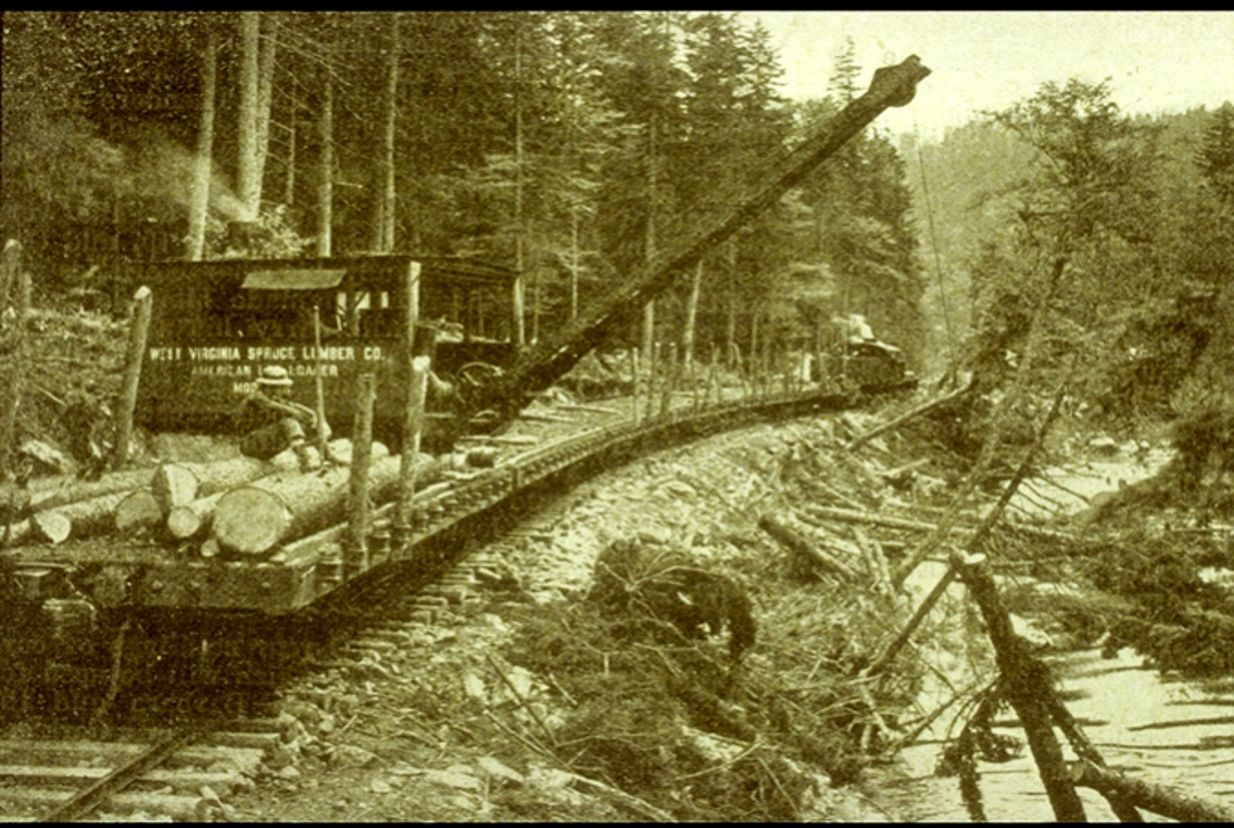


Source: Patricia Benner <http://gessphoto.com/river-history.html>



West Virginia red spruce





North Carolina





# Legacy of Logging



# Big Creek dam – Cradle of Forestry

Pinchot's 'success,'  
Schenk's 'failure'



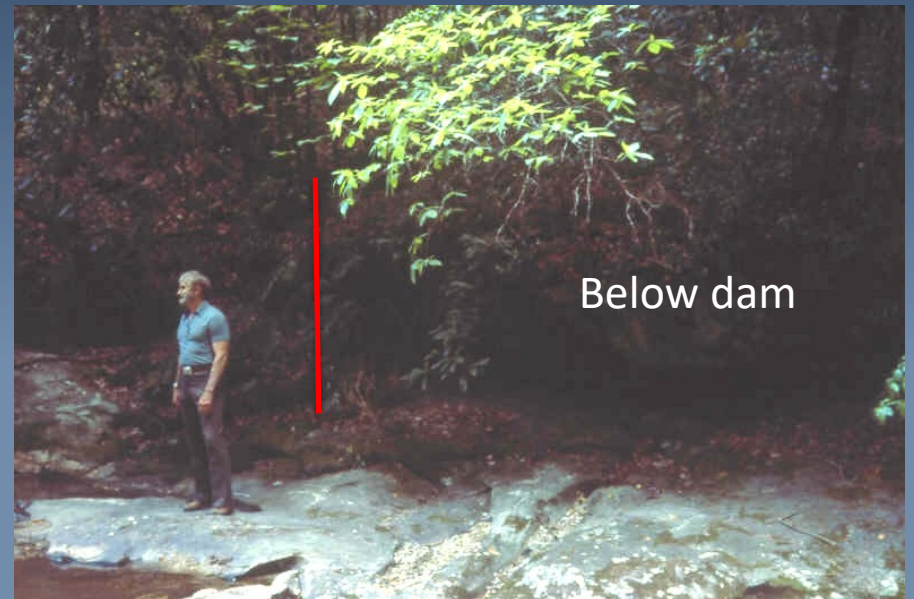
# Chattooga River



Holcomb  
Splash dam

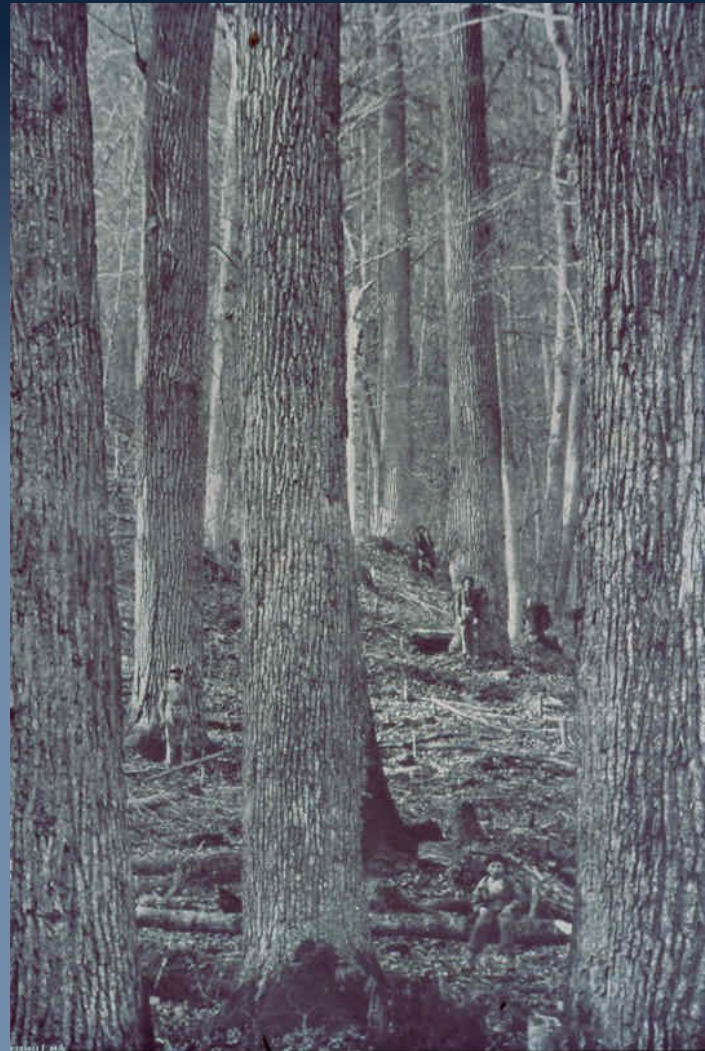


Above dam



Below dam

# Russel Fork – Big Sandy



Large structural roughness elements were an issue



First splash – 30K pieces mean diameter 28””



30,000 pieces Yellow Poplar





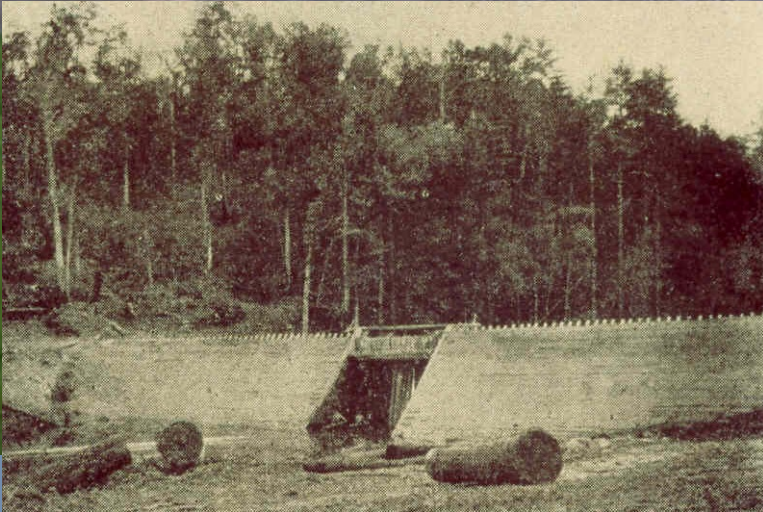
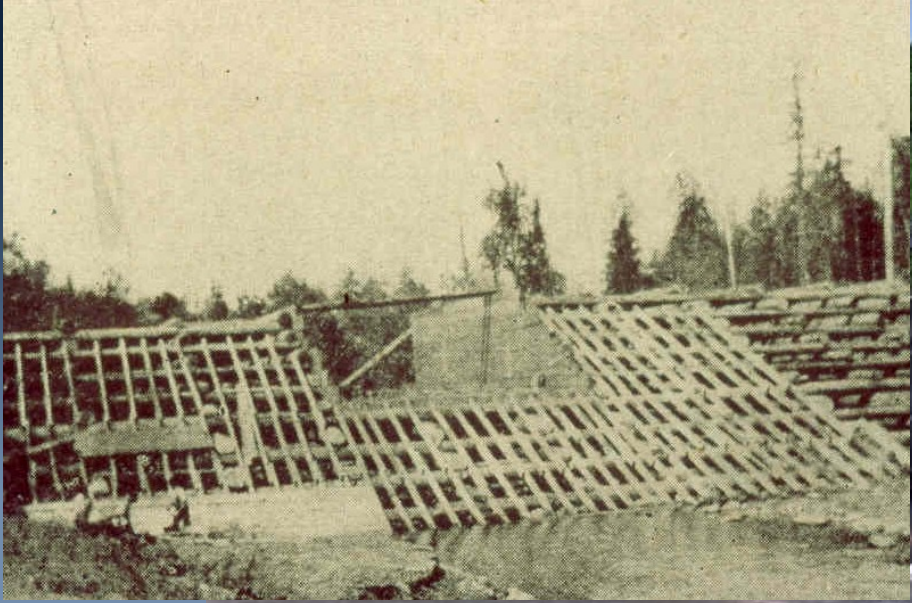


1912

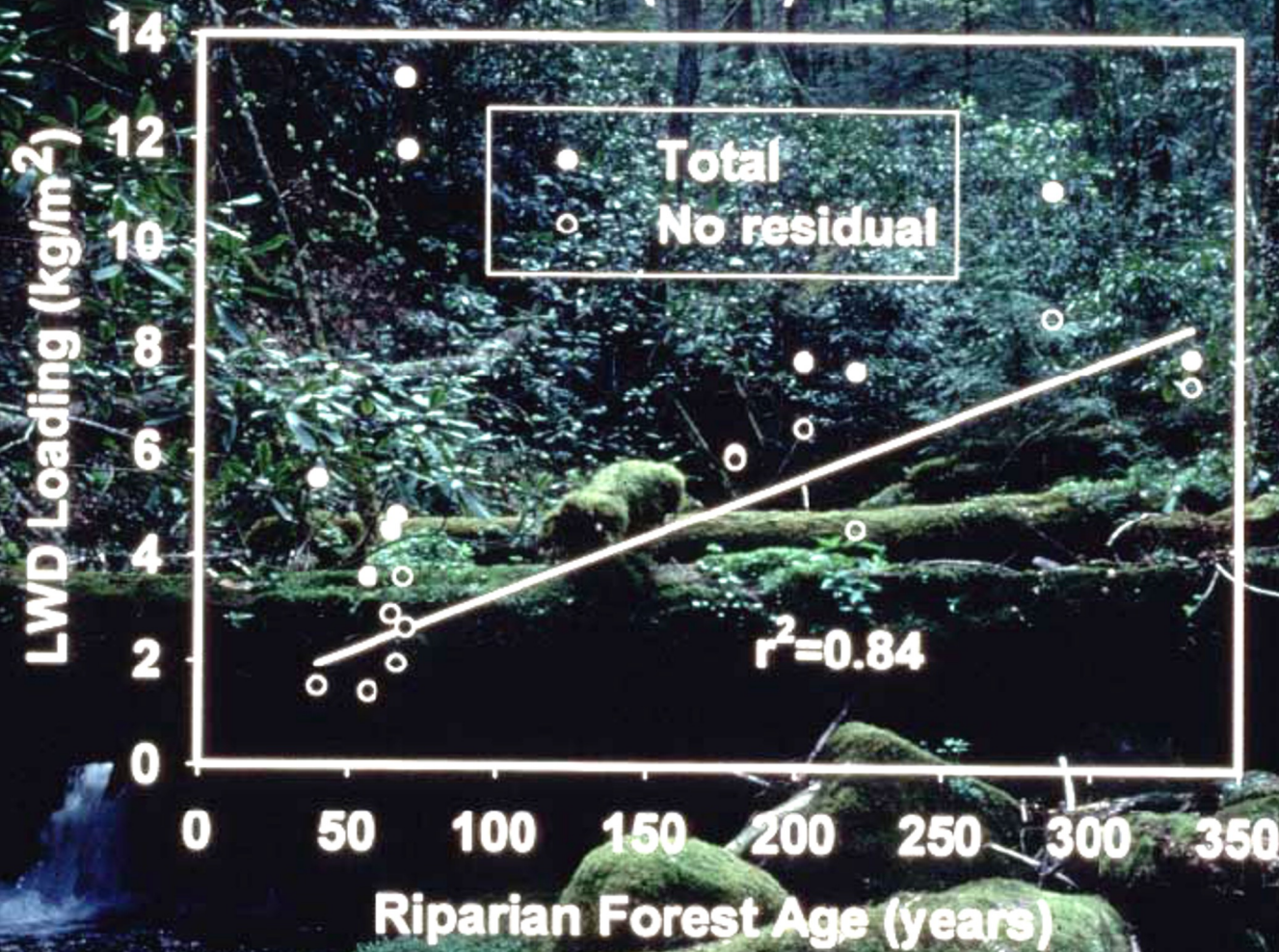
1989



# Tellico River



# Southern Appalachian Streams (N=11)

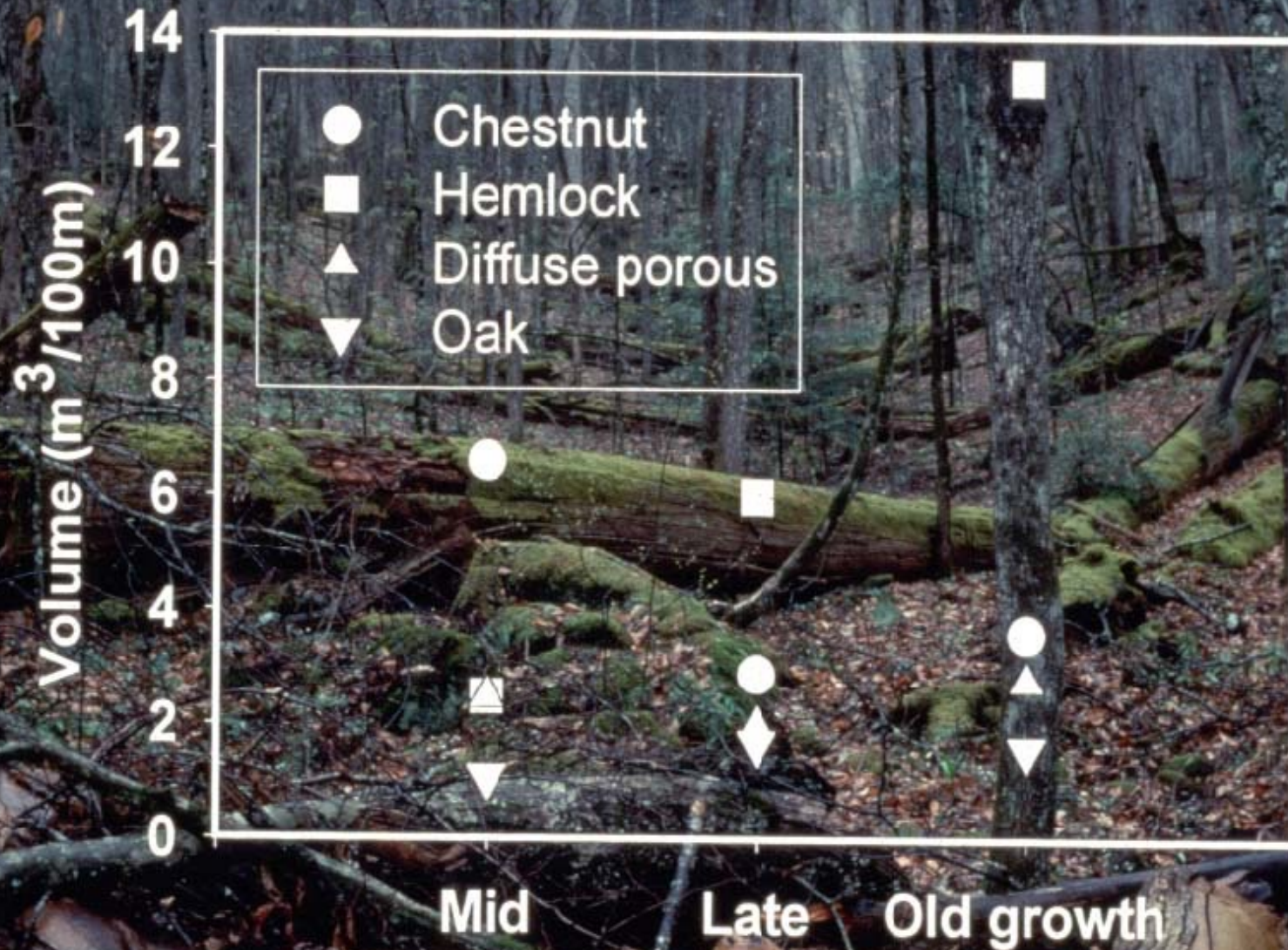


Source: Hedman, VanLear and Swank 1996



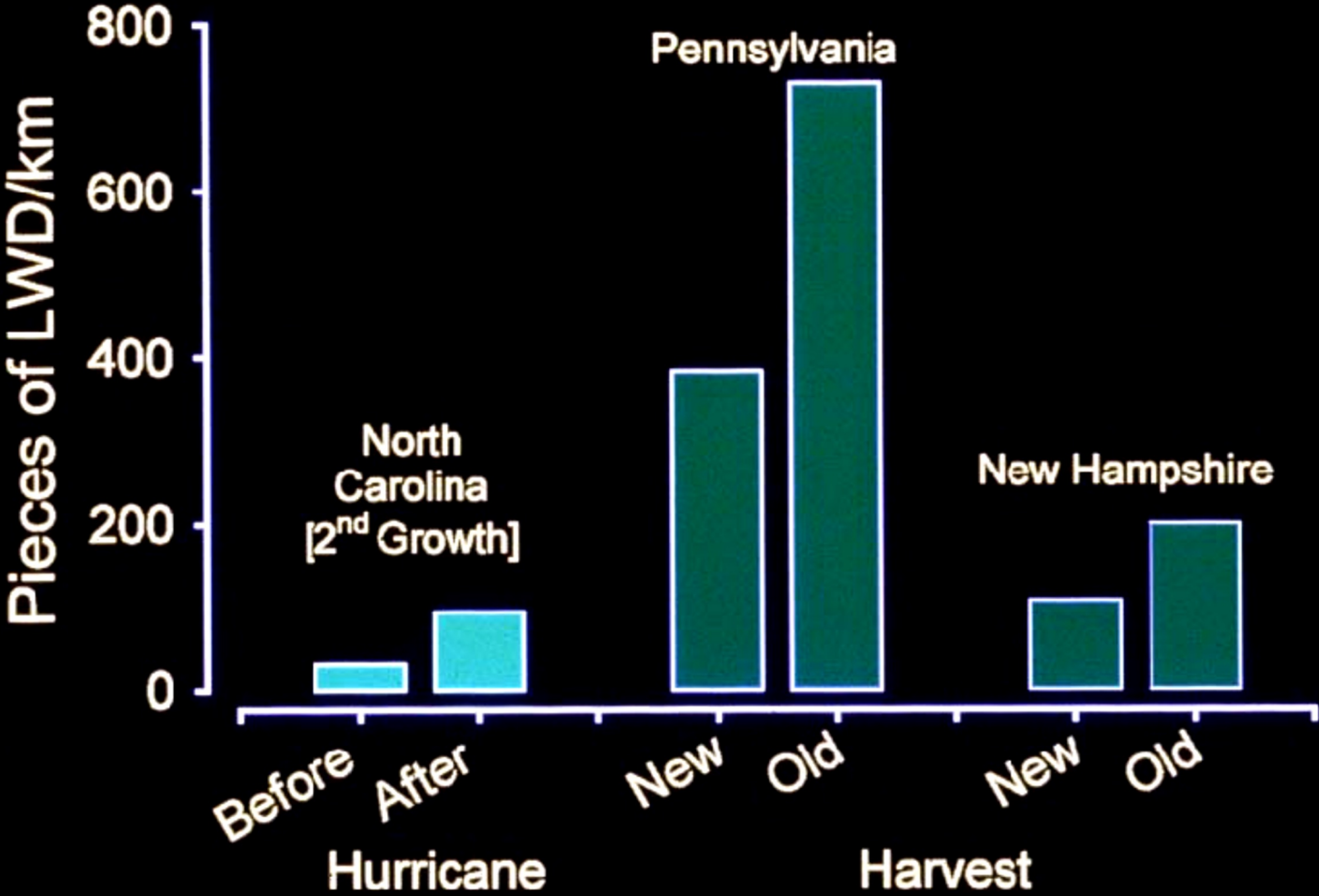
CHESTNUT WATER PIPES LAID IN BOSTON 125 YEARS  
AGO AND STILL IN SOUND CONDITION.

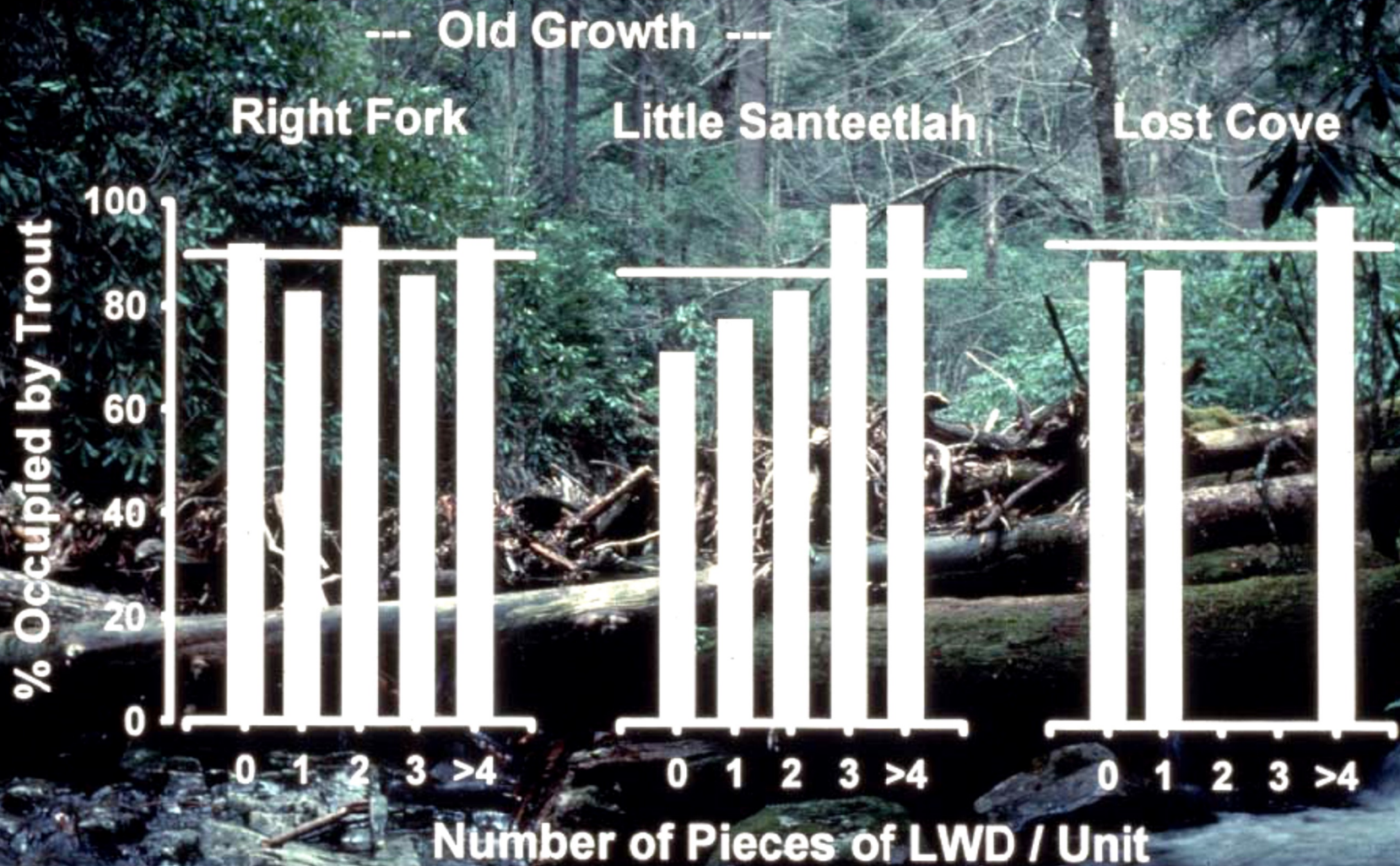
## Mean Volume - LWD



Source: Hedman, VanLear and Swank 1996

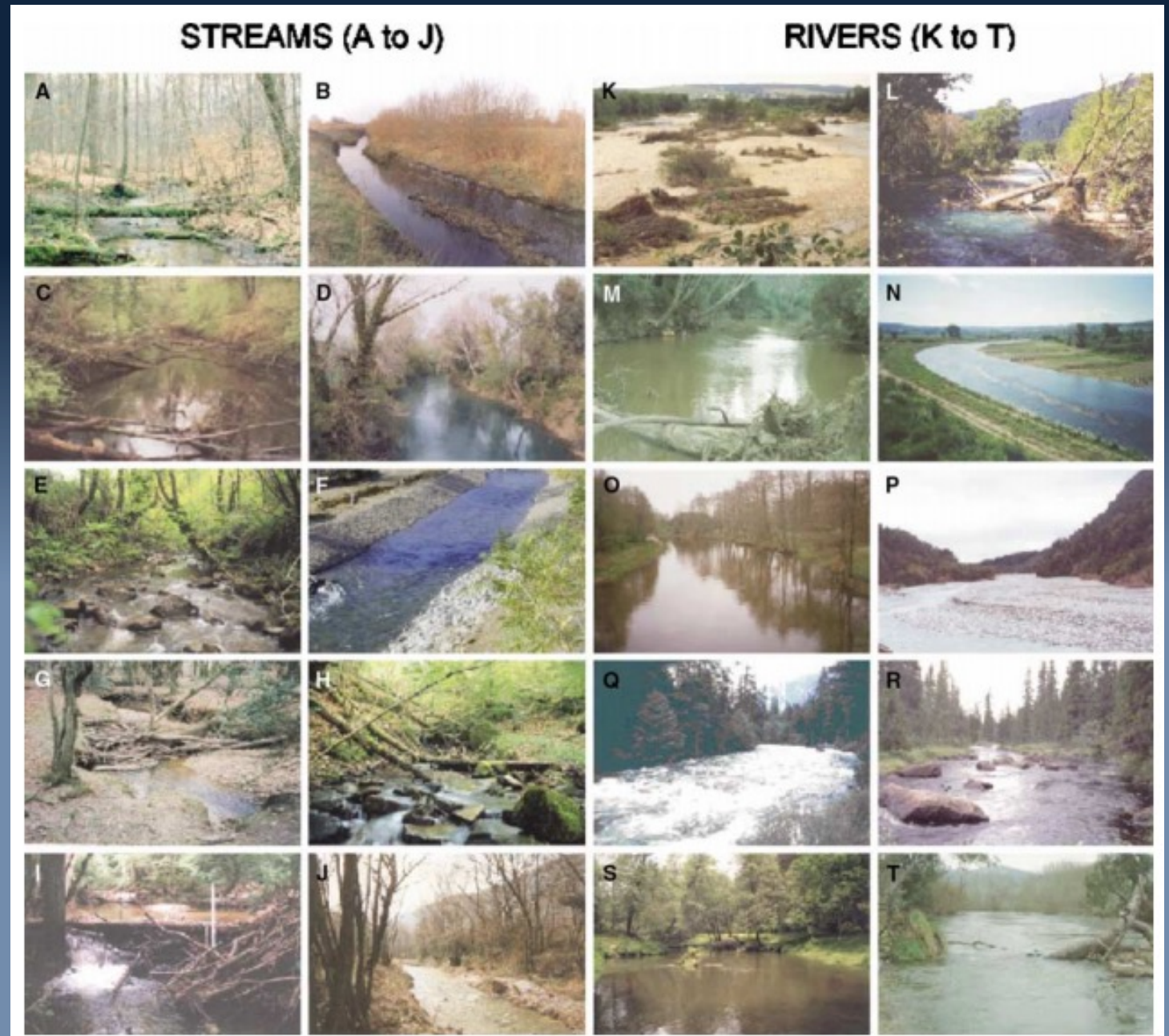
# Effect of Disturbances on LWD in Wilderness Areas



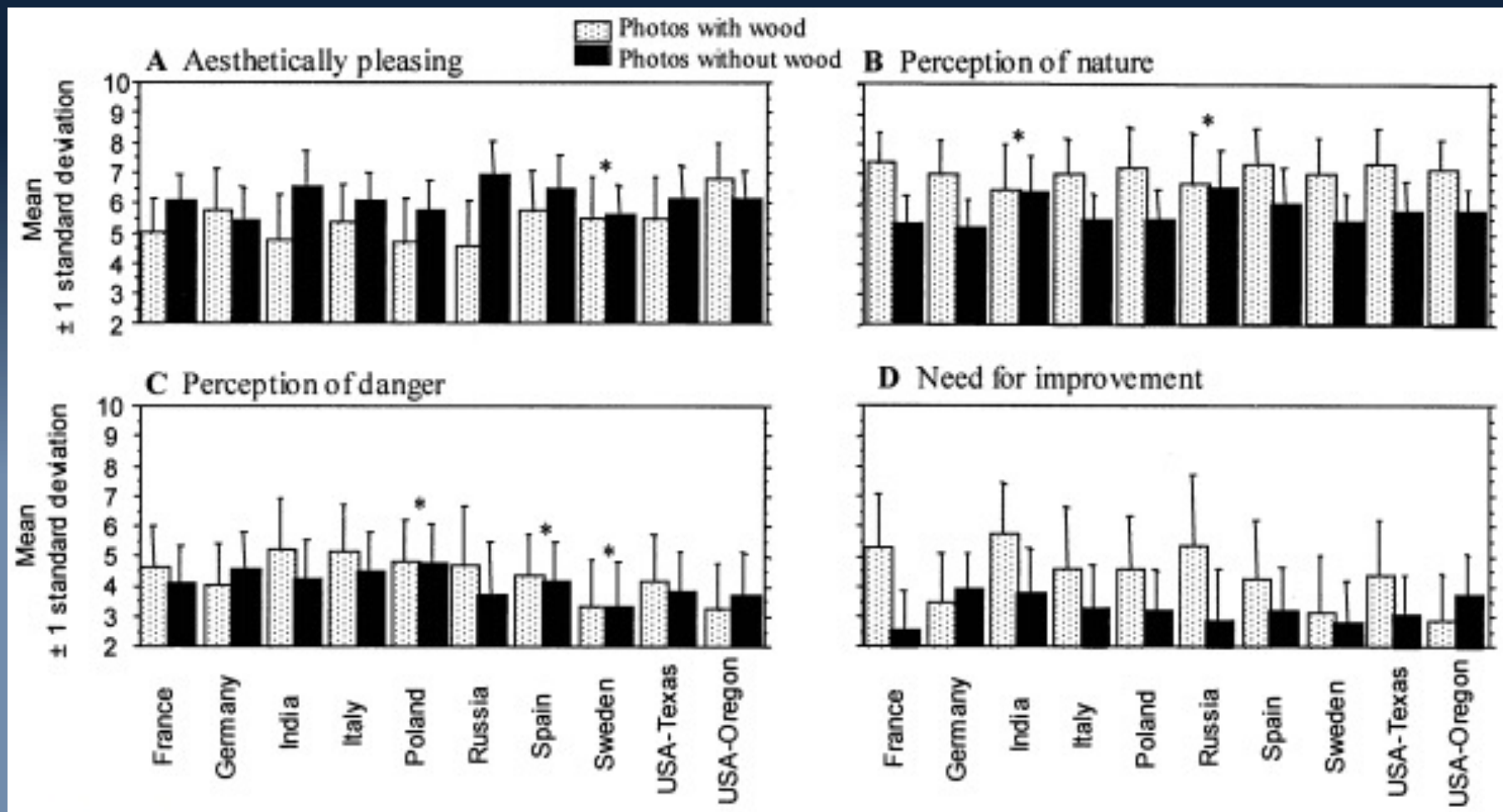


Source: Flebbe & Dolloff 1995

Perception:  
'Looks' bad,  
must be bad







# Large Wood

- AKA: LWD, CWD
- Varies, but generally pieces of wood:
  - minimum length
    - 1.0 – 1.5 m
  - minimum diameter
    - 5-10 cm



# Physical Role

- Water
  - Storage
  - Quality
- Substrate
  - Storage
  - Quality
- Channel shape
  - Width, depth
  - Habitat type





Crunch time: winter

Kadashan River,  
Chicagoff Island  
1984

A photograph of a stream in a forest. The stream flows over a bed of smooth, dark rocks. Several large, weathered logs are scattered across the stream, some partially submerged. The surrounding forest is dense with green foliage, and sunlight filters through the trees, creating dappled light on the water and rocks. The overall scene is a natural, undisturbed stream in a forest.

Crunch time: summer

Low flow refugia

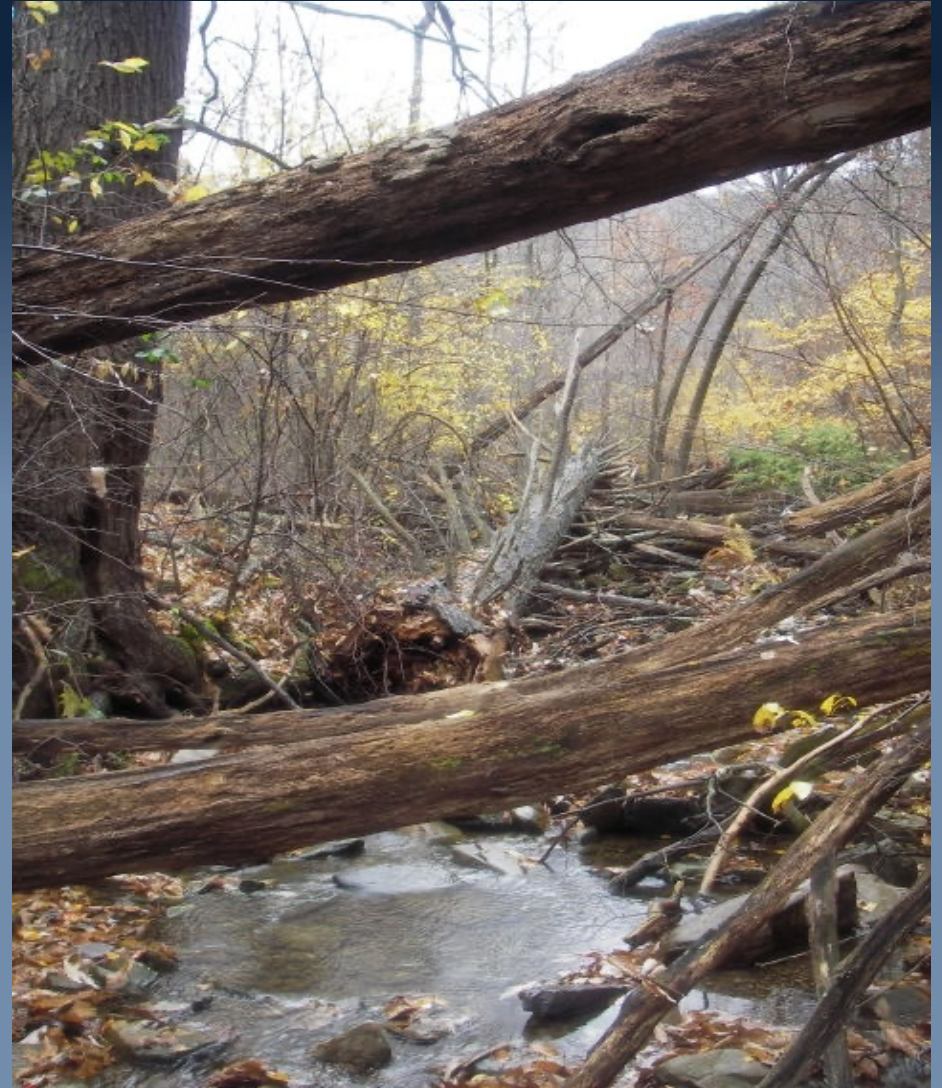
Central Appalachians



Two people, two days, and a skidder = low flow refugia

# Biological Role

- Pools
  - Low velocity, high depth
  - Low water refugia
- Cover
  - From high flows, predators
  - From predators
- Spawning
  - Nest sites
  - Egg attachment
- Roughness element
  - Coastal plain
- Food Source
  - Macroinvertebrates
  - algae





Coho

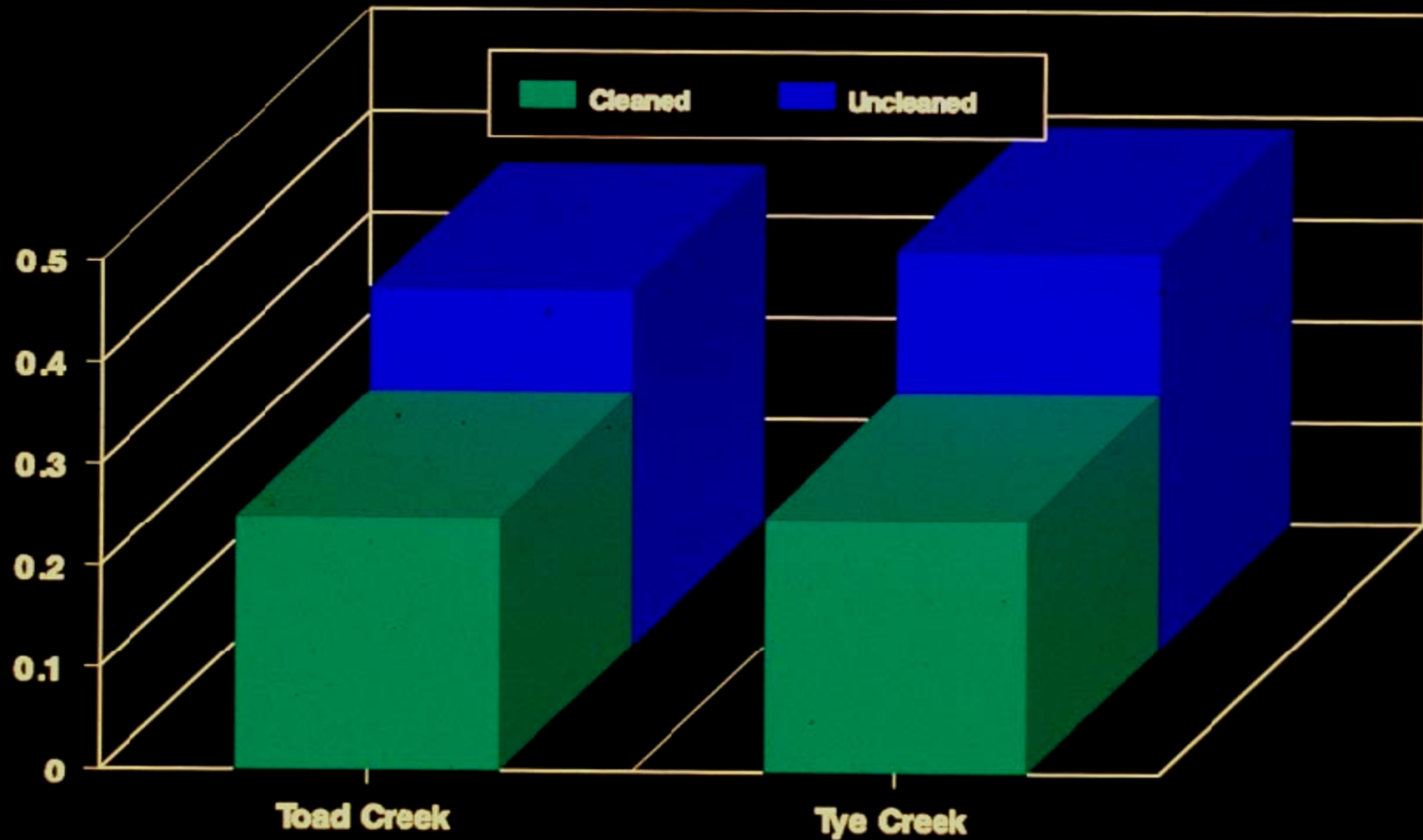
Large wood

Kadashan River DJ



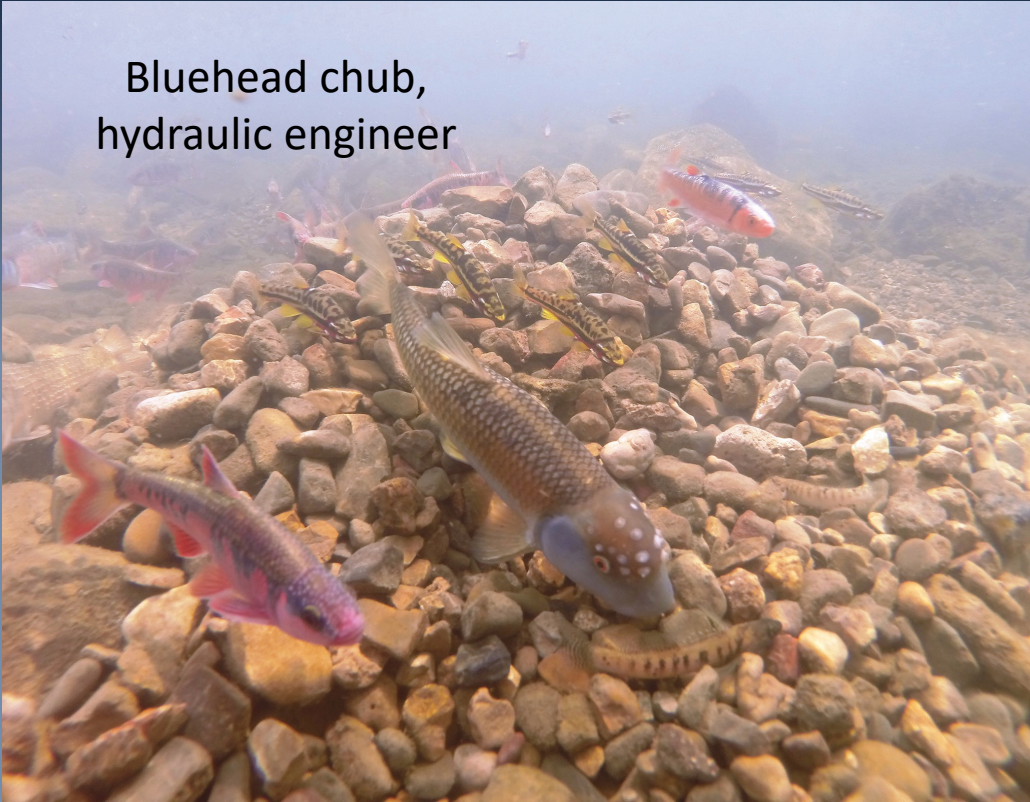
# Production ( $\text{g}/\text{m}^3$ )

## Age 1 + Coho Salmon in Alaska



**At least: 85 southern fishes  
associated with LW**

Bluehead chub,  
hydraulic engineer

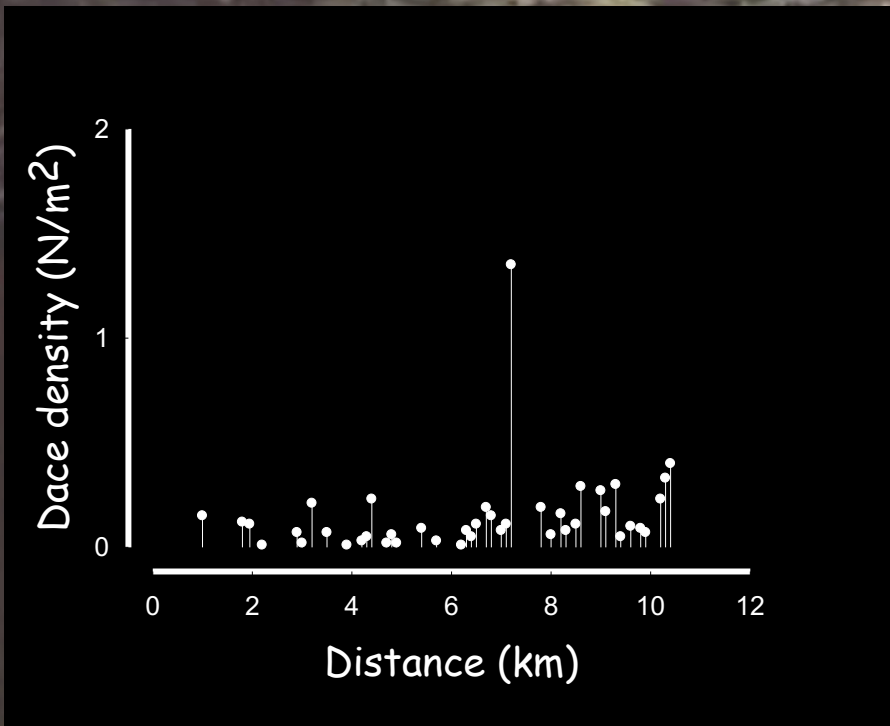


Tangerine darter



# Kentucky

Blackside dace  
*Chrosomus cumberlandensis*



*Cyprinella* southern U.S. coastal plain  
Spawning substrate: Bark and rough surfaces  
of coarse woody debris in sand-bed streams.





Mississippi - Upper Coastal Plain  
channelized

CWD - sunfishes, darters, madtoms


## 269 freshwater mussels

13% extinct

60% jeopardized

Other fauna at risk:  
-crayfishes  
-gastropods  
-insects  
-amphibians, reptiles



A photograph of a river with a large fallen log in the foreground and dense forest in the background. The water is brown and murky. The log is large and dark, with some green moss or algae on it. The forest is dense with green leaves, and the ground is covered in fallen branches and leaves. The overall scene is a natural, unchannelized river environment.

Mississippi - Upper Coastal Plain  
unchannelized

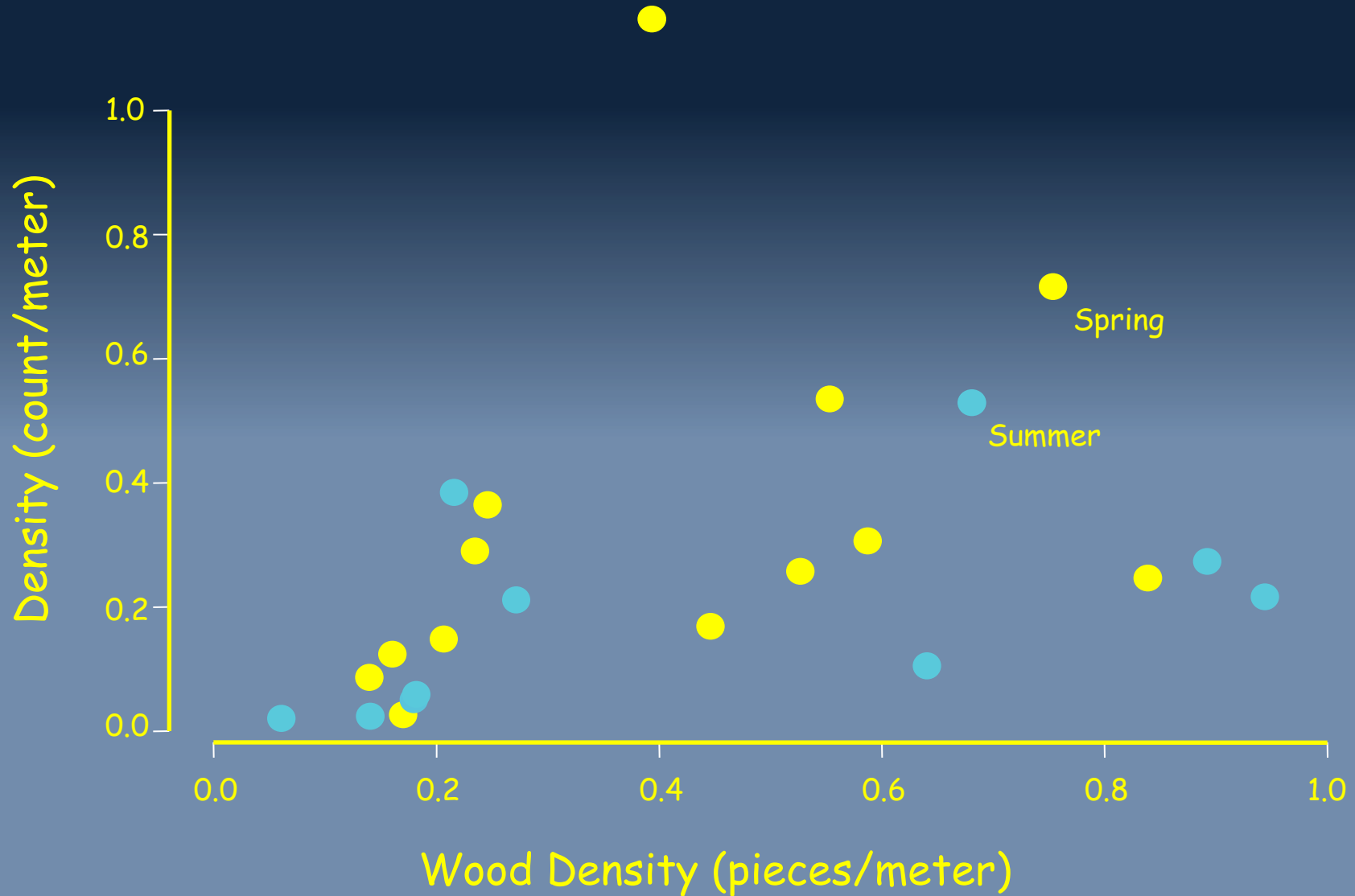
9 mussel  
species

Source: Warren, Hagg, and Adams 2000





# Pacific Giant Salamander and Wood: Headwater Streams





## Tasmanian Giant Crayfish *Astacopsis gouldi*

Habitat: submerged LW

Diet: CPOM

Black River - juvenile habitat  
giant man ferns and eucalyptus

Source: Robert DiStefano and Todd Walsh



# Complexity

## Without LW

- Reduced complexity
  - = lower species diversity
  - = lower productivity
    - fewer fish
    - smaller size
    - lower biomass
  - = lower resiliency



# LW Recruitment depends on...

- Age of riparian veg
- Species in riparian
- Size of stream
- Time since disturbance
  - Natural
    - Hurricane, debris torrents, fire
  - Anthropogenic
    - Logging, urbanization, agriculture, land use





1979

## Tye Creek, Tongass NF



2016



Saturday

# Tye Creek, Tongass NF



# Mechanisms of Recruitment

- Chronic
  - Litterfall, self-pruning
  - Mortality (including disease and insects)
  - Undercutting of stream banks
- Episodic
  - Bank failure
  - Windthrow
  - Snow and ice
  - Debris flows
  - Fire



# Managing for LW

- 1) Leave an undisturbed buffer strip
- 2) Leave enough trees to meet DFCs
- 3) Lengthen the harvest cycle
- 4) Manipulate riparian using silvicultural techniques
  - Maintain even delivery of LW
  - Mix of tree species
  - Leverage 'disasters'
  - Intentional introduction of LW



# Wood Additions



1993 Jefferson NF SRS partnership  
3 @ 250 m reaches two streams,  
'150 structures' 2-weeks





Minimize non-wood impacts  
\*(canopy and bank)

7 tree species  
Min 30 cm d small end  
1-1.5x channel width length  
30 m<sup>3</sup> of wood/stream  
No roots, limbs, anchors

Peaveys & log tongs  
Chain saw winch

Match tools & skill-set  
to the job!





Relocate and evaluate all pieces at least annually  
1993-2023 (so far...)

# Wood FAQs

- How much is enough?
- What sizes are appropriate?
- Should I (can I) control loading?
- What tree species should I manage for?

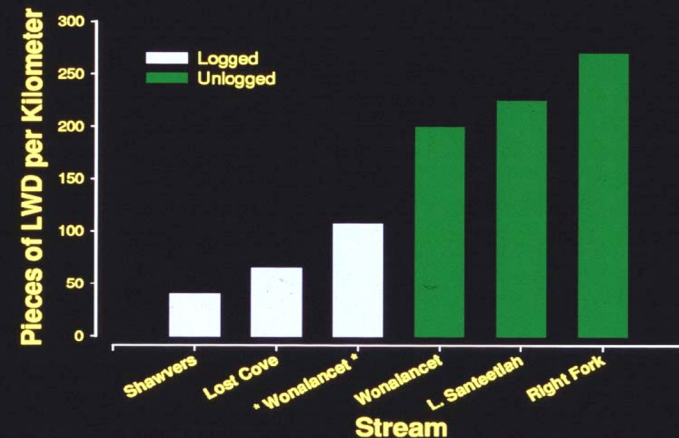


# How much large wood?

- There is no such thing as too much LW
  - “Researchers believe they have not seen an upper limit ” -Sedell
  - Pristine rivers jams > 5 miles
  - Limiting factors
    - Social
      - Recreation
      - Infrastructure

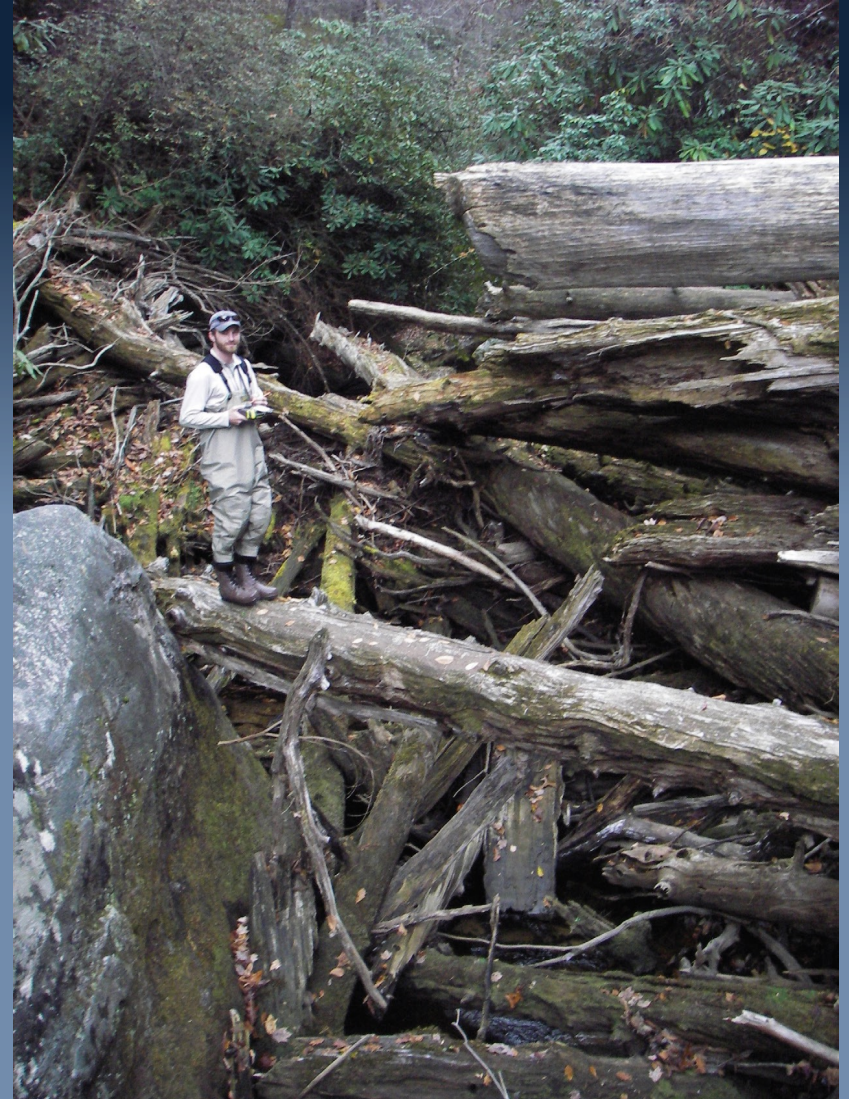


Wilderness Areas: Logged vs. Unlogged



# What sizes of large wood?

- All sizes are desirable
  - Large pieces anchor – stability and persistence
  - Small pieces trap fine particulates



Chattooga River  
(Deliverance)



Shaheen Creek 1987

# What species are best?

- Variety is good
- Emphasize *native* species typical of local riparian areas
  - Opportunity to develop specific silvicultural prescriptions
  - “designer” riparian areas



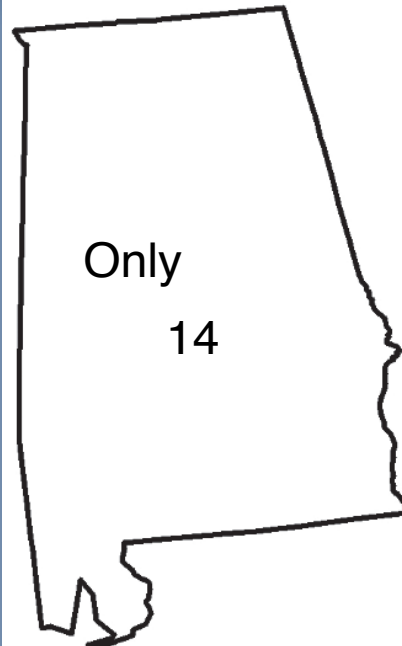
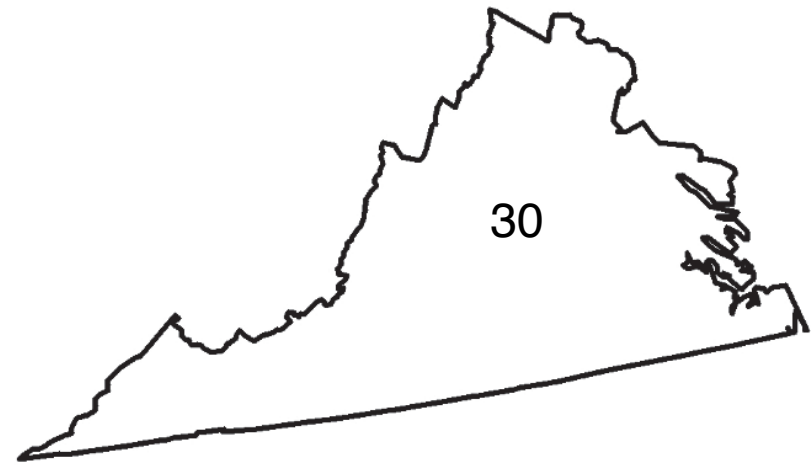
Number of tree species:

In common - 83

Alabama - 126

South Carolina 117

Virginia - 128





2016



Saturday

Black Cottonwood  
Staney Trib  
Transplanted ~1986

# Should I control LW?

- Loading (addition)
  - Riparian management
  - Manual additions
    - Directed
    - As part of harvest strategy
- Removal
  - Salvage after storms
    - Think carefully before doing this
    - A rare opportunity to dramatically increase loading





# Leveraging 'Disasters'

## The hemlock dilemma (Brantley et. al 2013)

- Hemlock Woolly Adelgid
  - Chattooga Wild & Scenic
  - 2013: Thousands of dead, standing hemlocks
  - Kayaks/rafts vs. Fish
- Catastrophe or once in a lifetime opportunity?



# Chattooga LW Project 2007-2014 (1996)

