

# Lesson's Learned and the Future of Riparian Forest Management

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Washington Hardwood Commission

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Puyallup, WA

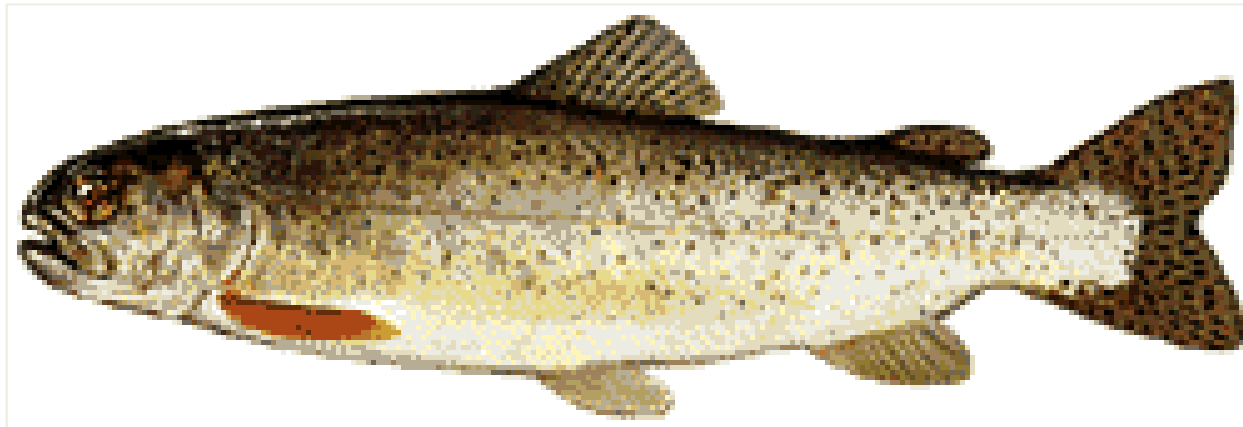
# Confessions of a Hardwood Killer

- Brown and burn conversion of alder stands to Douglas-fir (fell, desiccate, burn, plant)
- Favoring conifers over hardwoods in riparian areas for large wood recruitment (persistence of large wood)



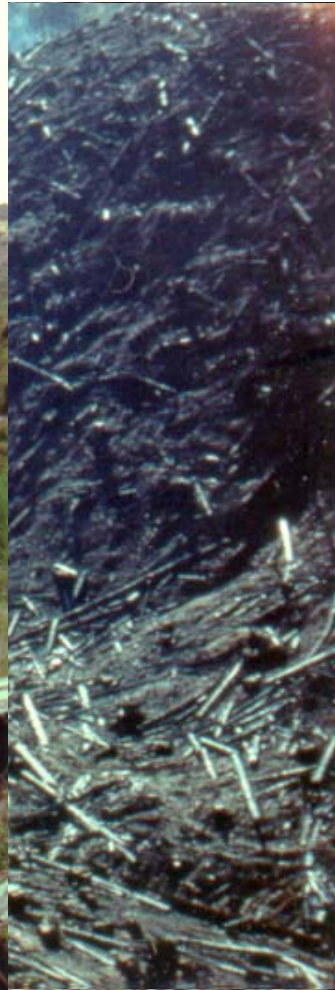
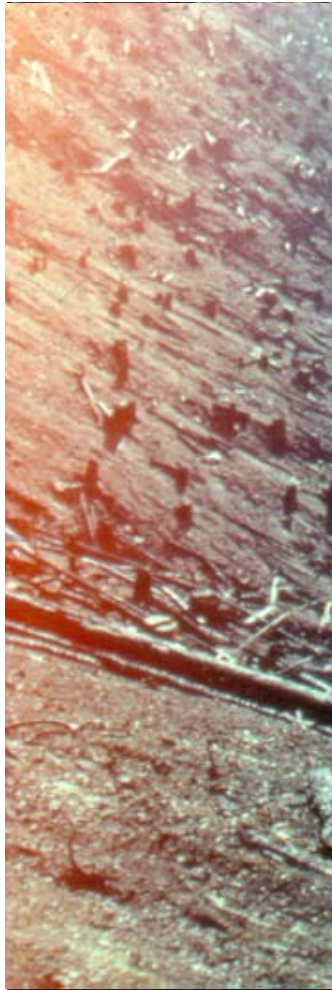
# Cutthroat Trout Patterns in COPE Study

“... biomass of 1+ and older cutthroat trout was generally higher in streams that had riparian zones with low levels of conifer (<35%) in the riparian canopy and high levels (<15 pieces per 100 m) of LWD...”

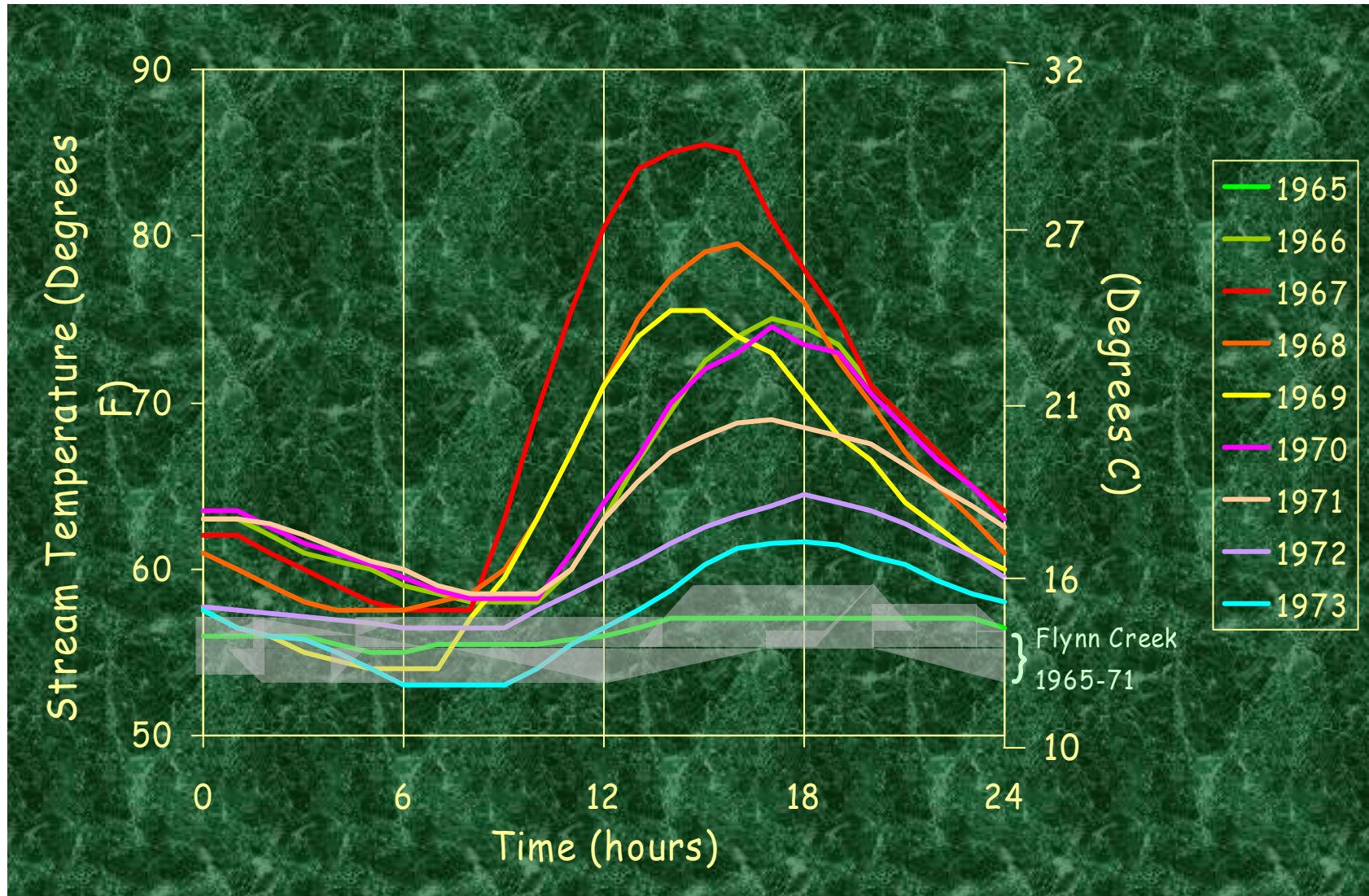


Connolly and Hall 1994

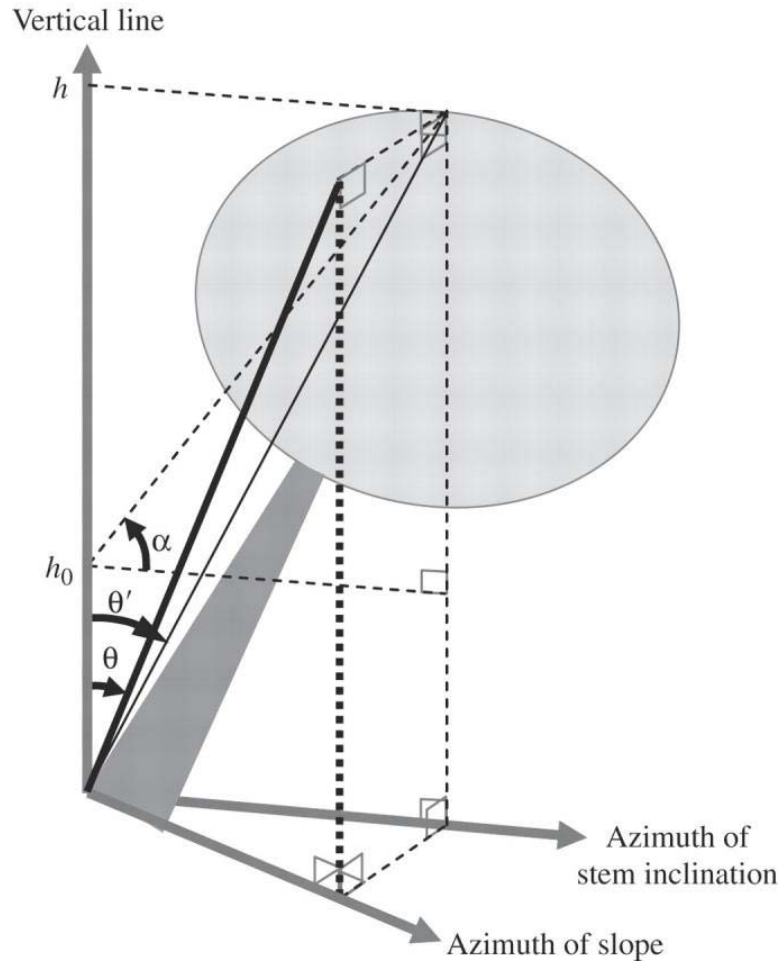
# Riparian Alder and Needle Branch



# Temperature - Needle Branch



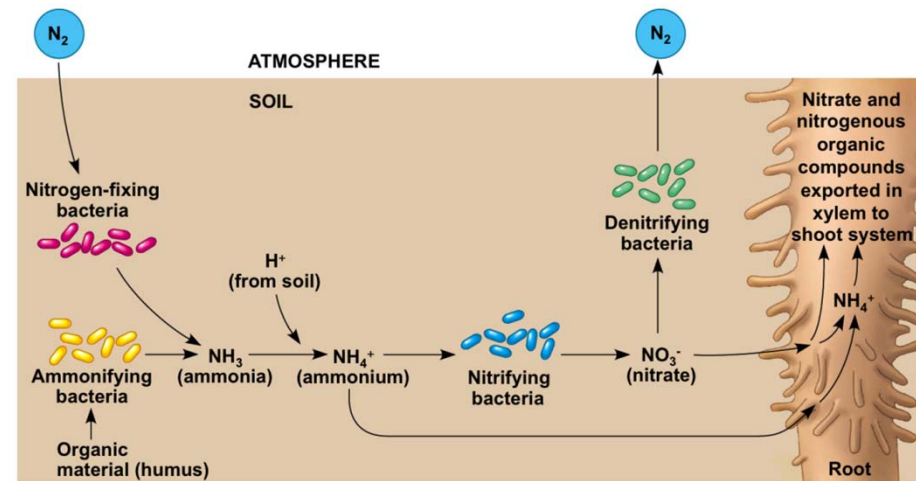
# Stem Phototropism, Nitrogen Fixing, and Deciduous



<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2803559/>



[https://en.wikipedia.org/wiki/Alder#/media/File:An\\_alder\\_root\\_nodule\\_gall.JPG](https://en.wikipedia.org/wiki/Alder#/media/File:An_alder_root_nodule_gall.JPG)



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# Forest Water Quality and Riparian Forests

- How, where, and when you manage are equally important as how much you manage
- Riparian forest protection is best defined in three dimensions (width, extent of stream network, management restrictions)
- There is a law of diminishing returns
- Water quality recovers over time and downstream following disturbance
- Water quality criteria are sometimes unattainable; disturbance is essential

# How, Where, and When You Do Practices Are Equally as Important as How Much

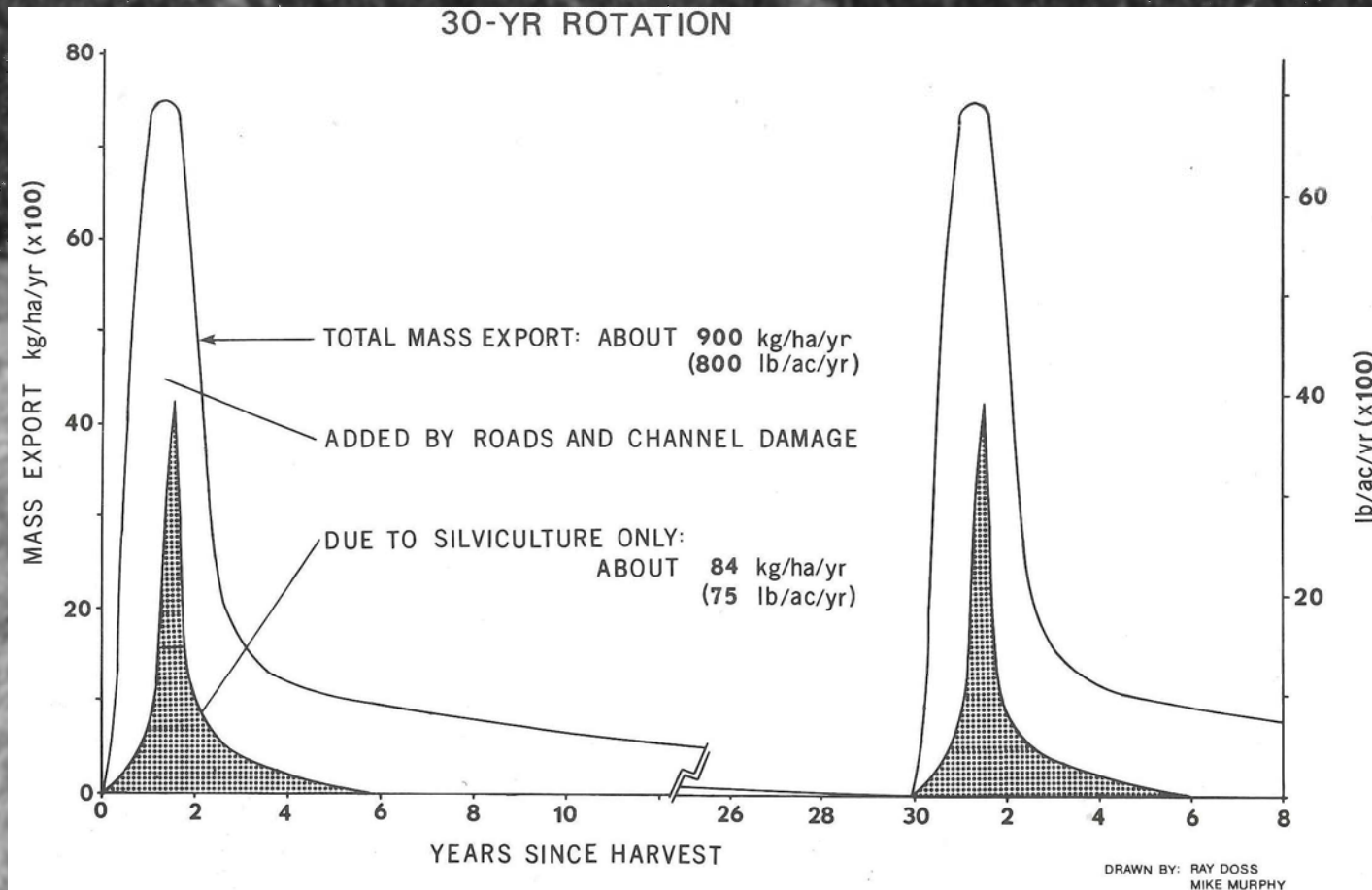


← No erosion control



With mulch and seeding →

# 1979 Grant Forest Study by John Hewlett

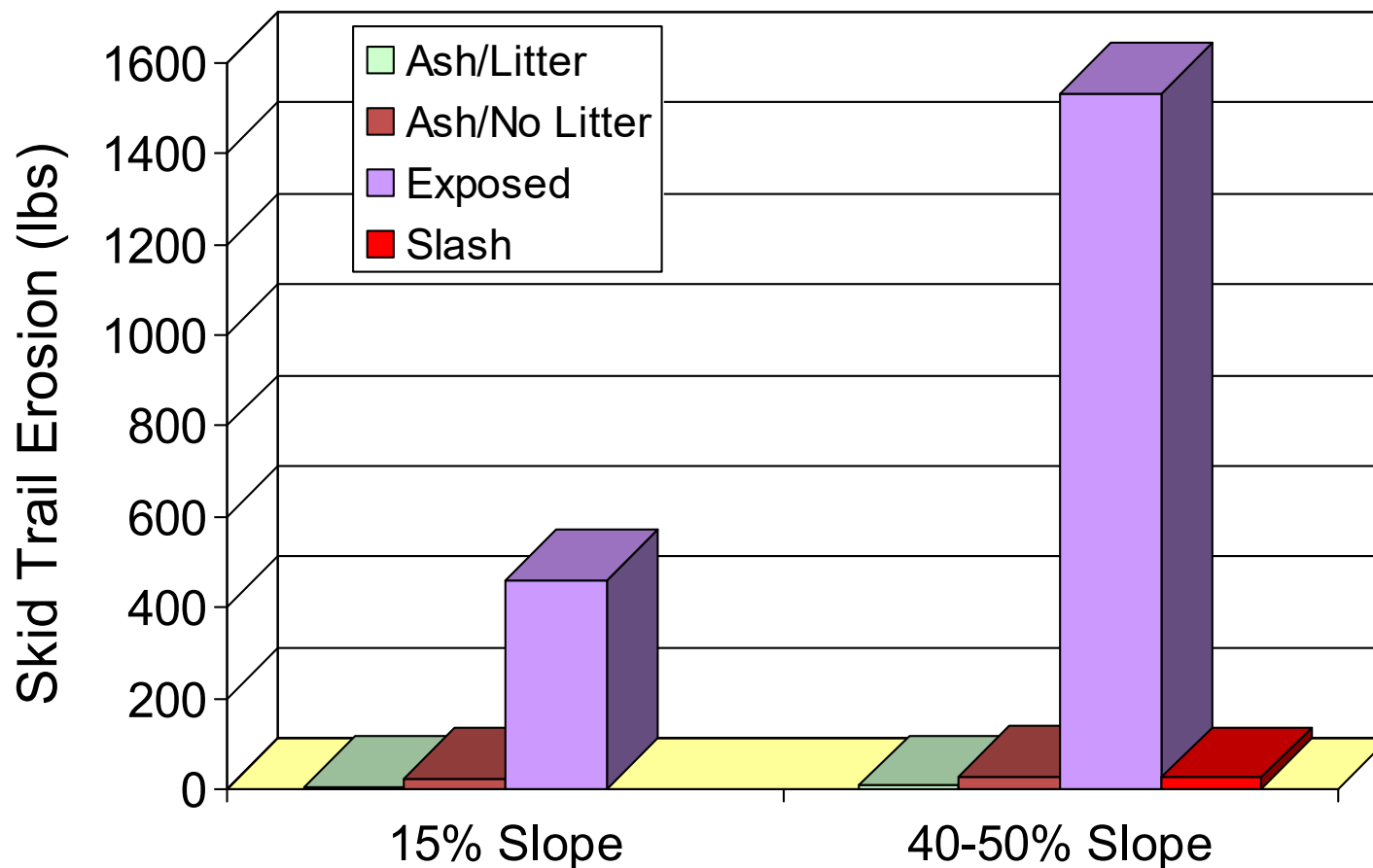


Hewlett predicted that there would have been a 10-fold reduction in sediment losses if there had been adequate riparian buffers and well constructed and maintained roads, and if machine planting had not been carried out through gullies

# Potlatch Skid Trail Erosion Study (McGreer 1981)



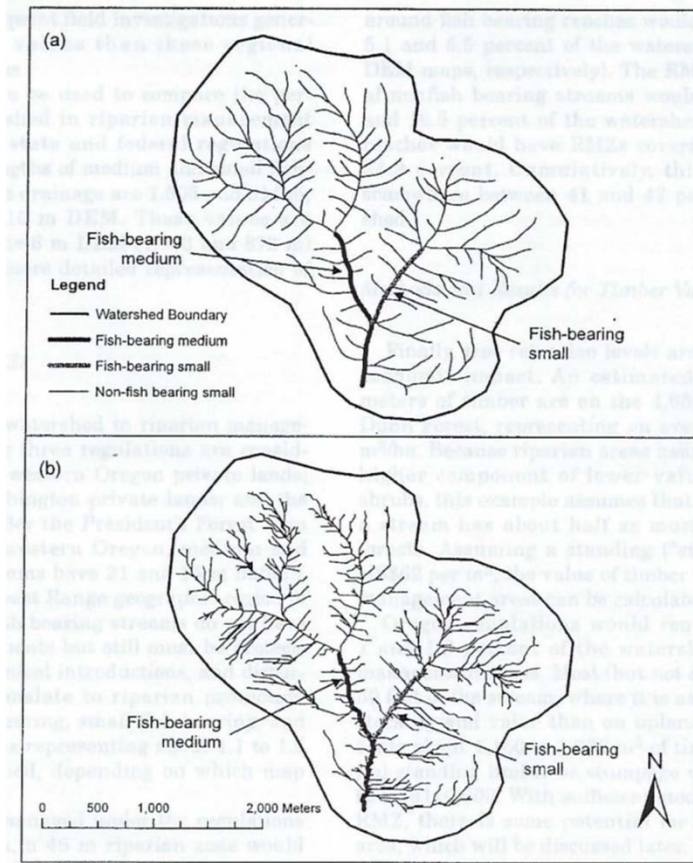
# Controlling Skid Trail Erosion (McGreer 1981)



Placing slash on skid trails is now a common practice following forest harvests

# Dimension of RMAs Defined by Width, Network Extent, and Restrictions

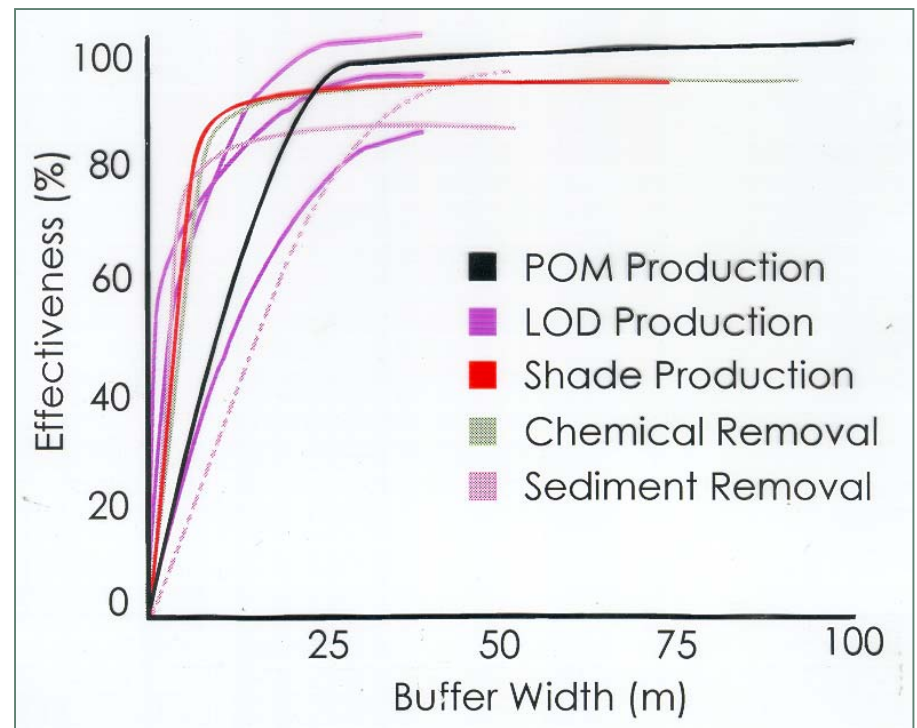
- Width
- Extent of network covered (fish, non-fish, perennial)
- Management restrictions
- Drainage density



From Ice, Skaugset, and Simmons 2006

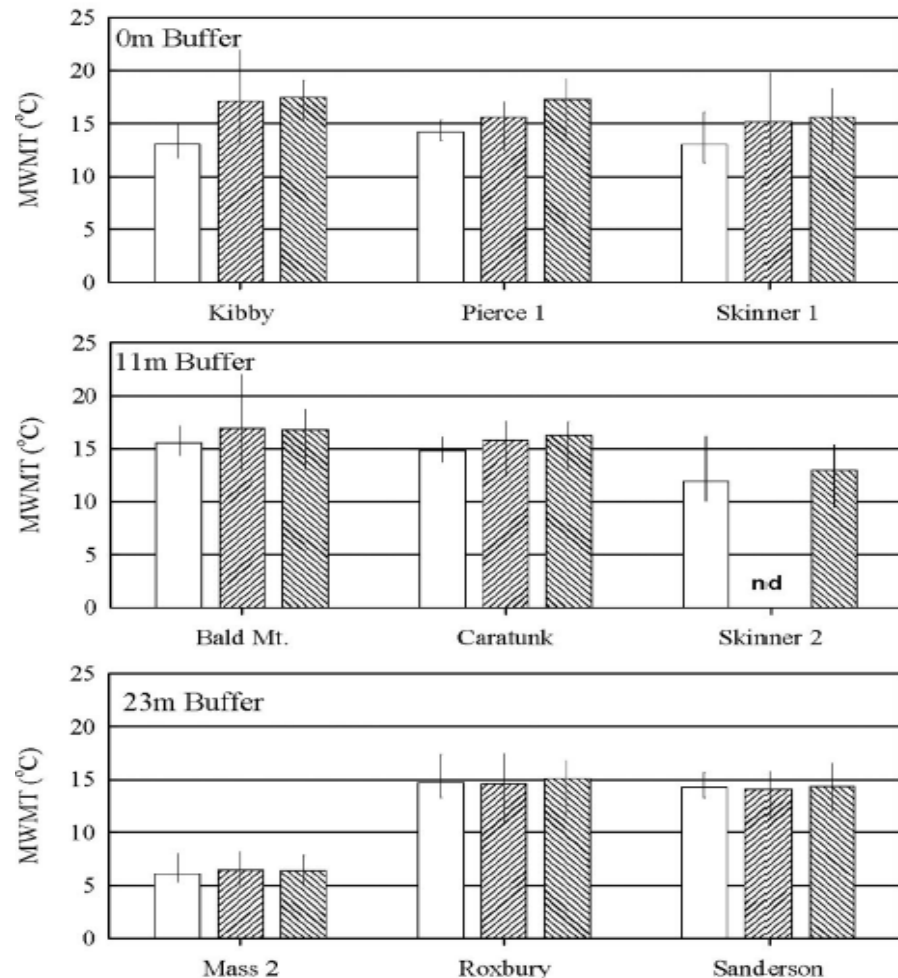
# Law of Diminishing Returns

- For equal additional BMP investments there is diminishing return in benefits
- Riparian function summary – NCASI TB 799
- Comprehensive Economic and Environmental Optimization Tool (CEEOT)



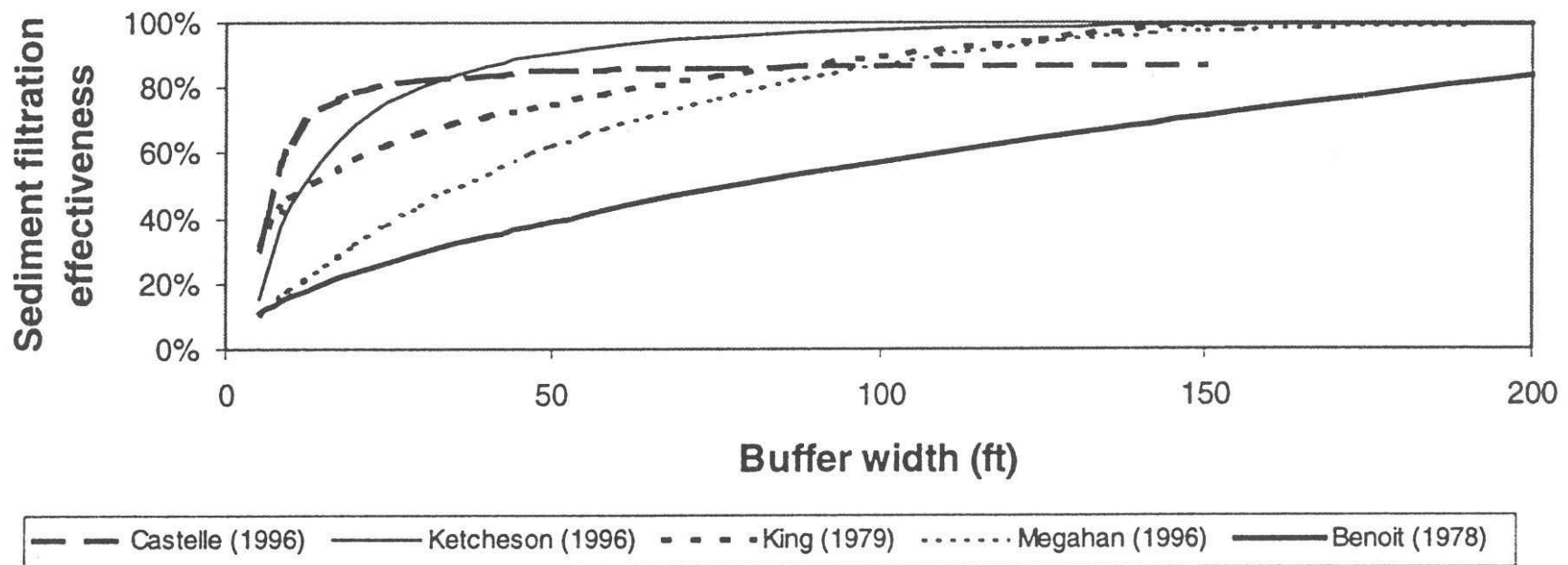
# Manomet Temp. Study in Maine

- Large increase with no buffer
- Not statistically different than the no harvest control for 36 ft buffer (60 ft<sup>2</sup>/acre RBA)
- No evidence of temp response at 75 ft (60 ft<sup>2</sup>/acre RBA)

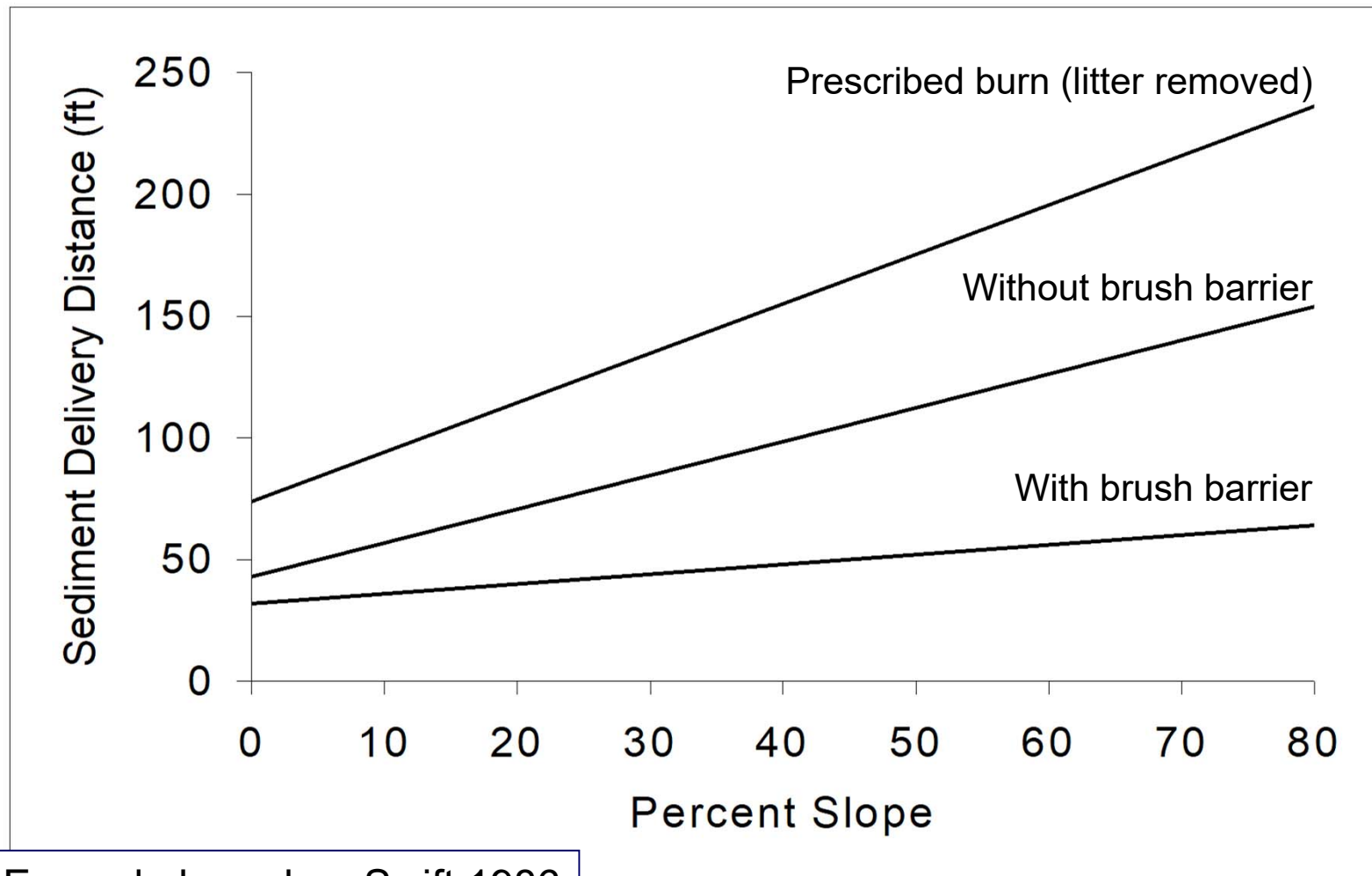


Wilkerson et al. 2006

# Synthesis of Effectiveness Studies



# Options to Achieve Environmental Goals



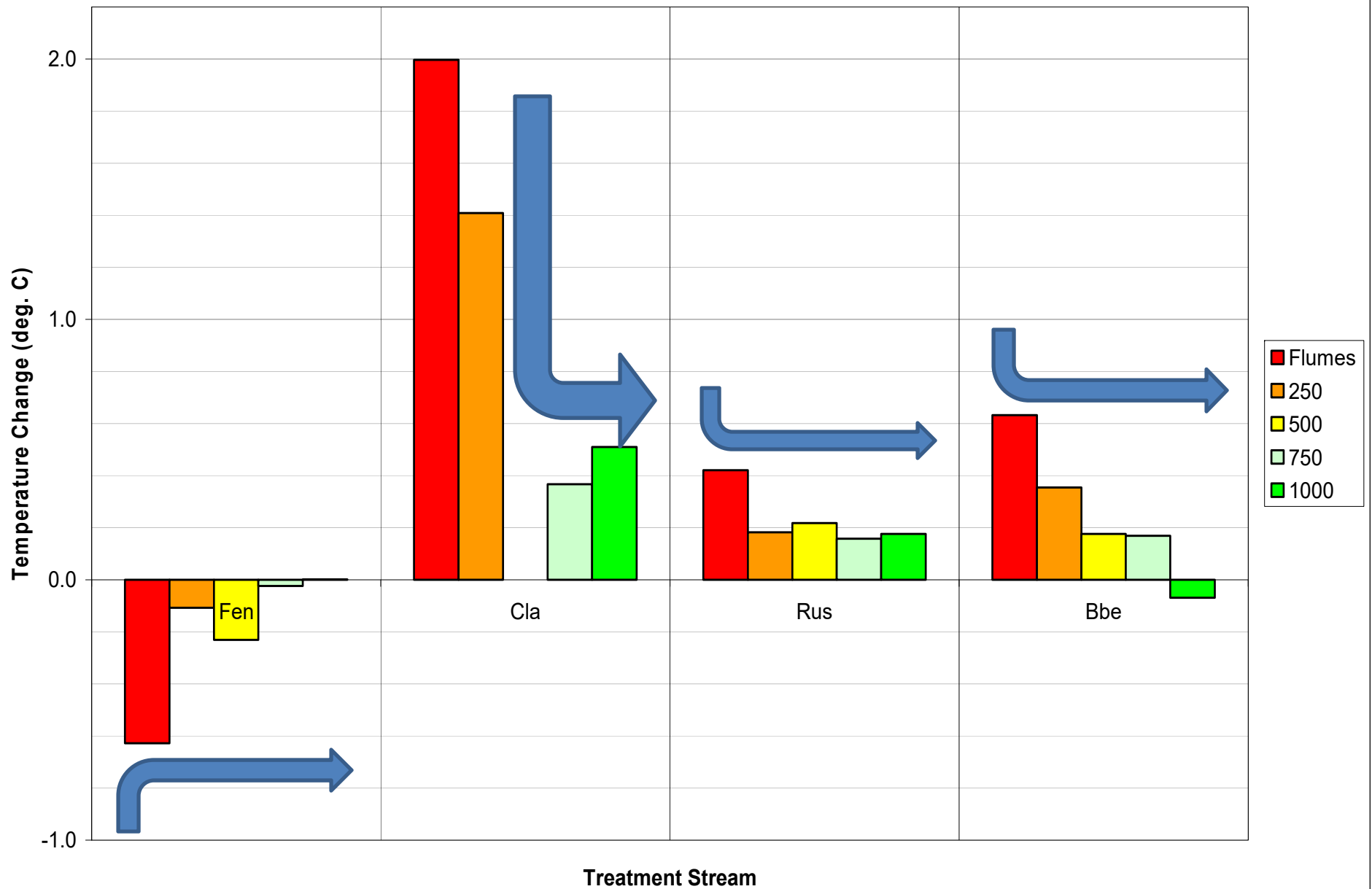
Example based on Swift 1986

# Recovery Over Time and Downstream

- All water quality parameters are partially non-conservative, so they recover downstream
- Forest are managed in a cycle so that any changes that occur tend to recover over time



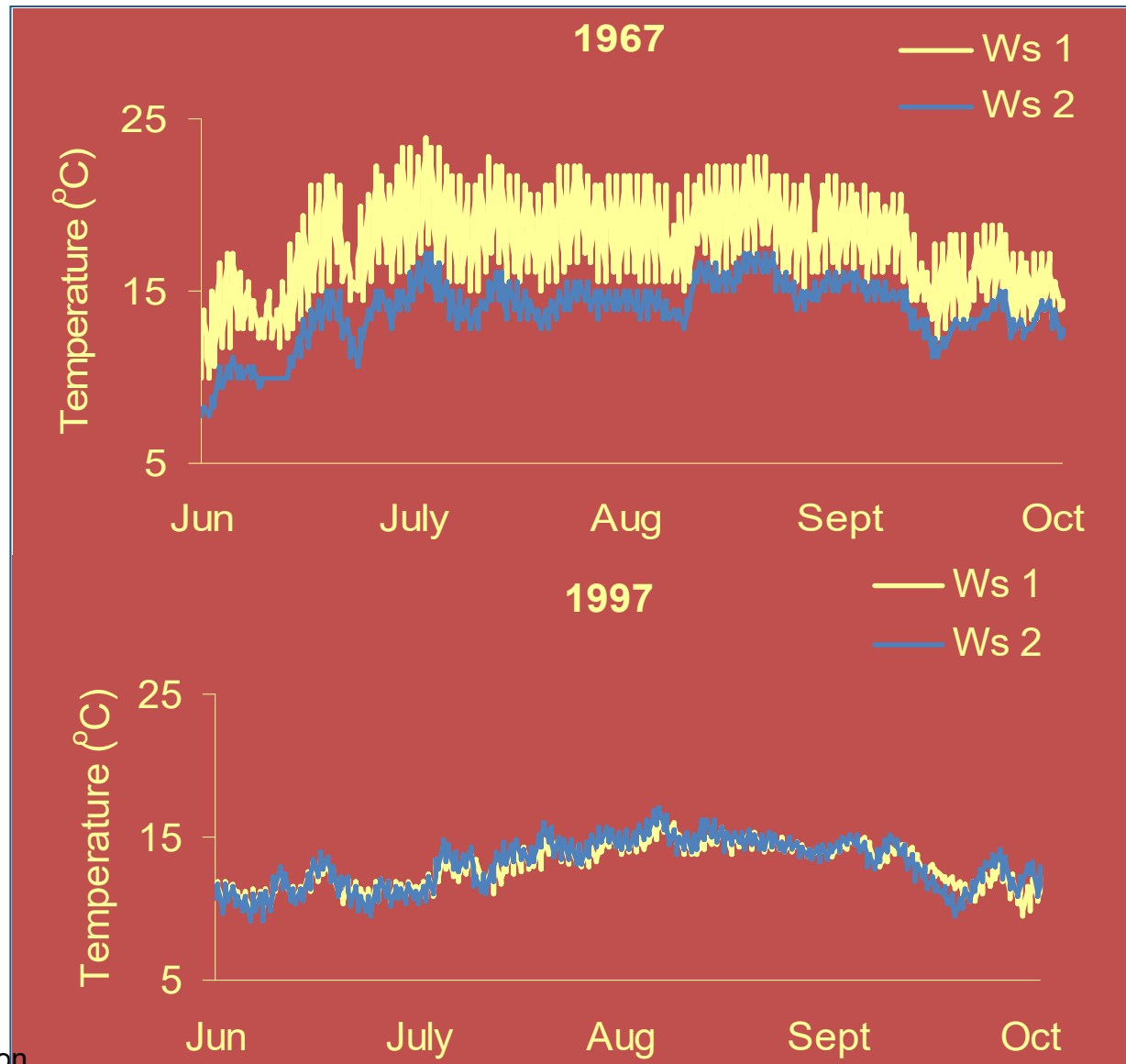
Mean Maximum Daily Temp. Change - 2005 to 2006, Myers control



# HJ Andrews Watershed 1 After Burn

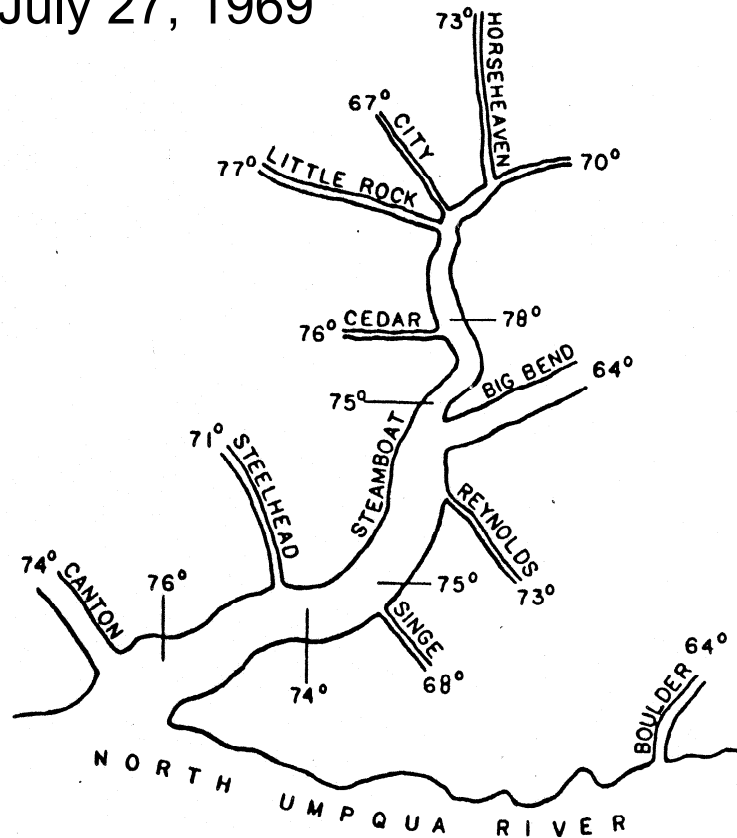


# Recovery of HJ Andrews Watershed 1

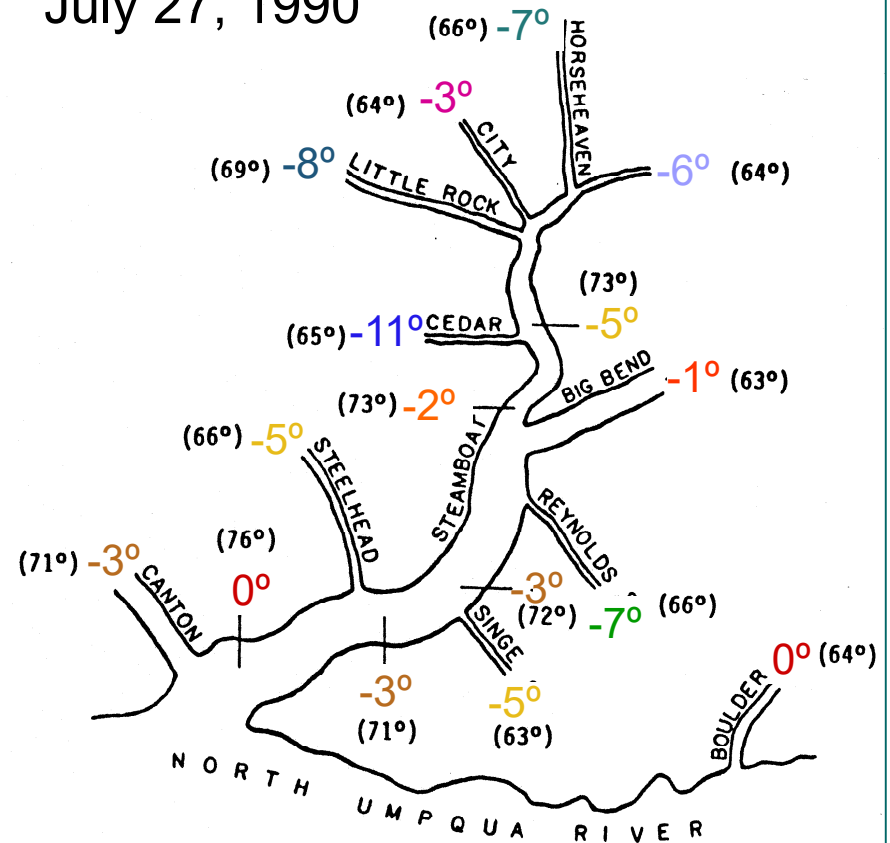


# Maximum Stream Temperatures Steamboat Creek (Holaday 1992)

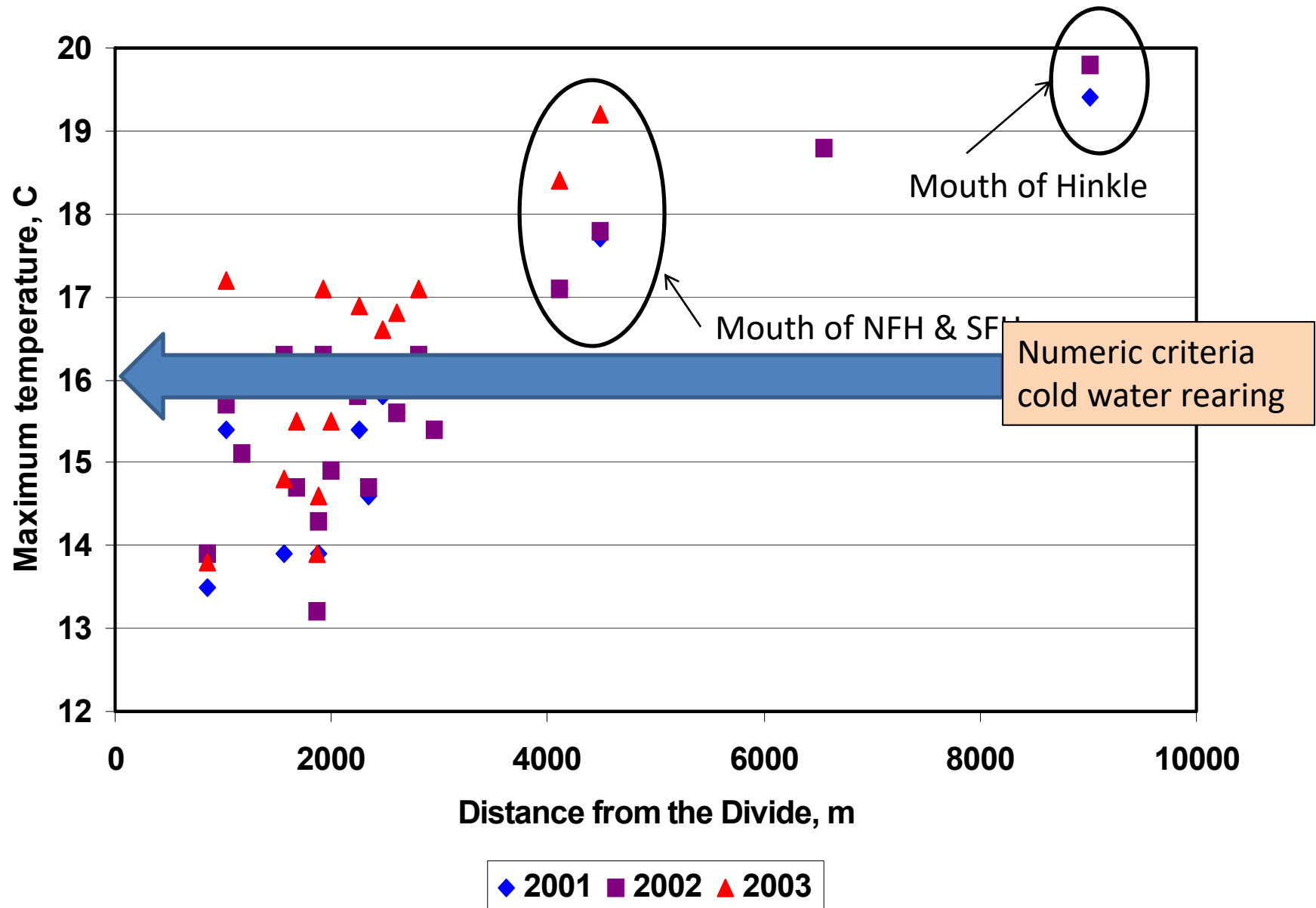
July 27, 1969



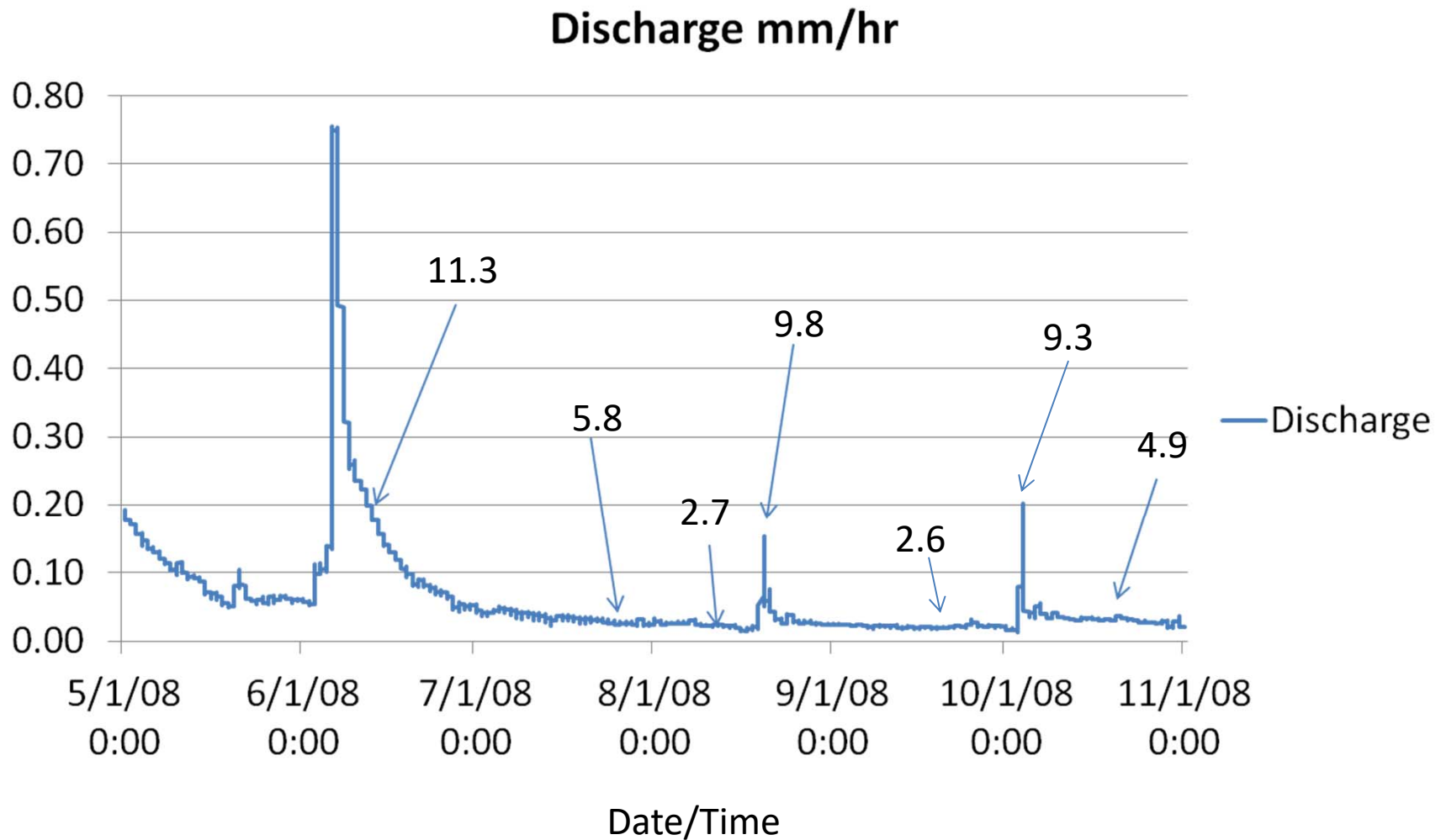
July 27, 1990



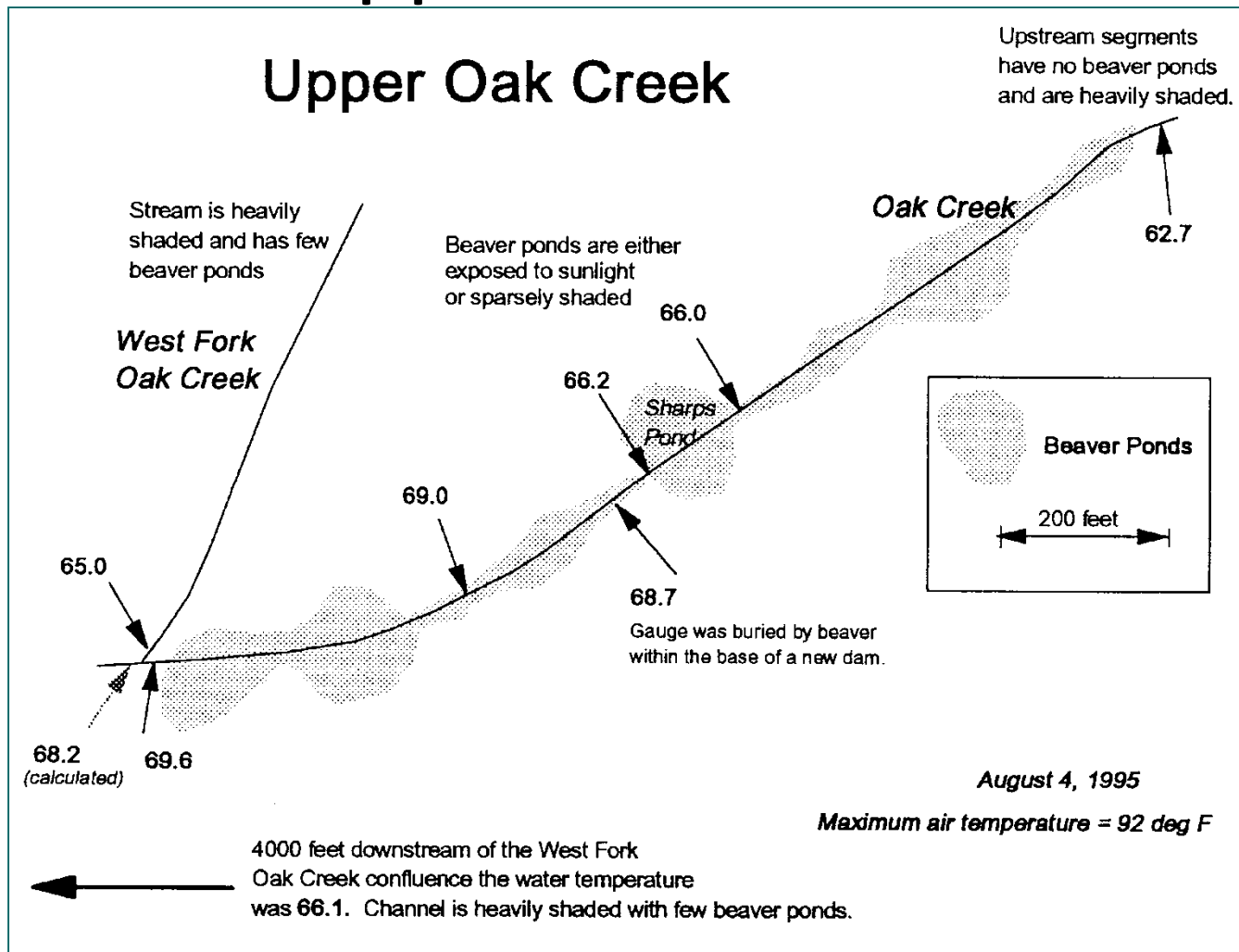
# Water Quality Criteria Sometimes Unattainable for Forest Watersheds



# 2008 NBU Hydrograph (May-October) and DO Response (mg/L)

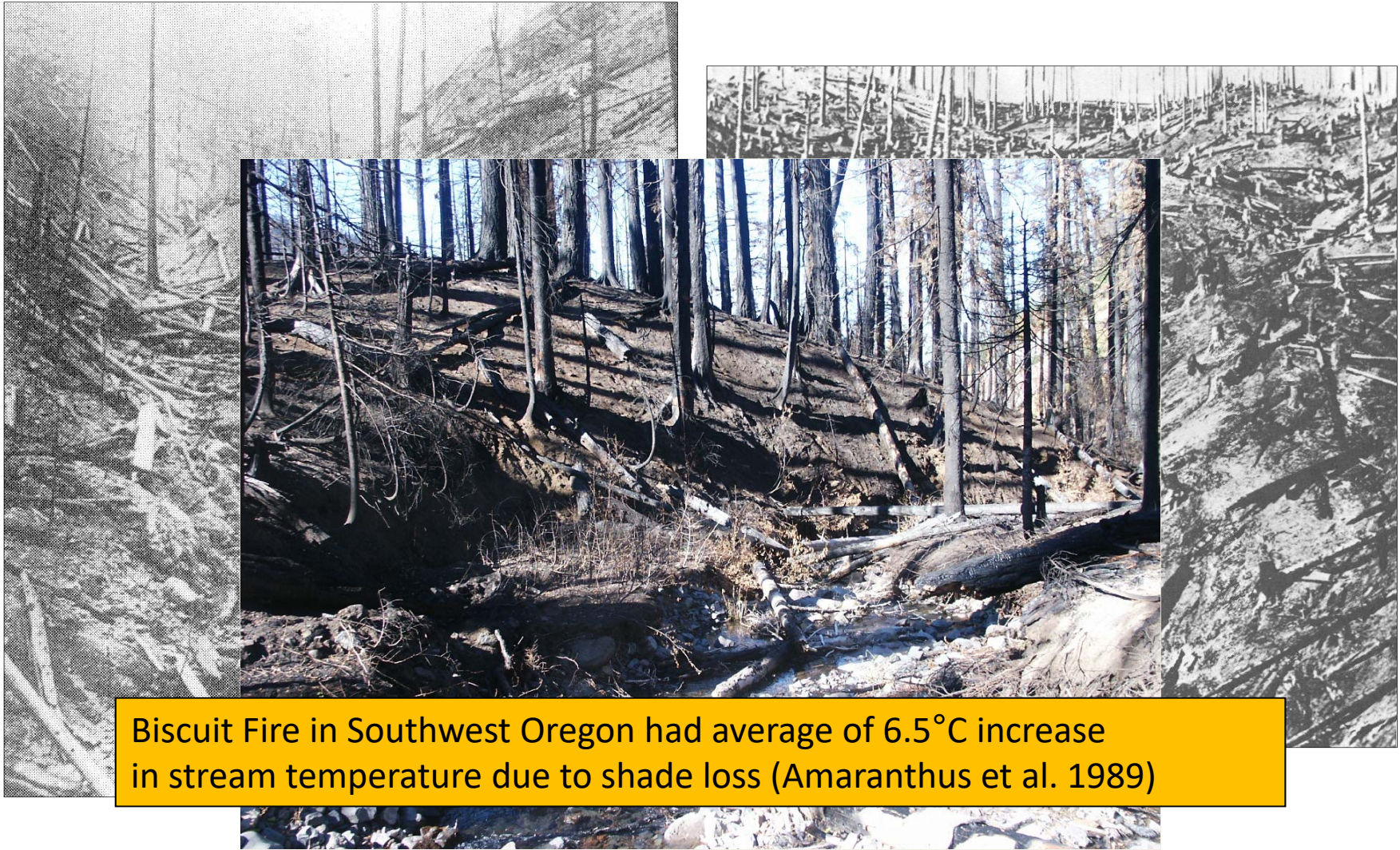


# Role of Beaver Ponds in Upper Oak Creek



From Unpublished Report by Chip Andrus

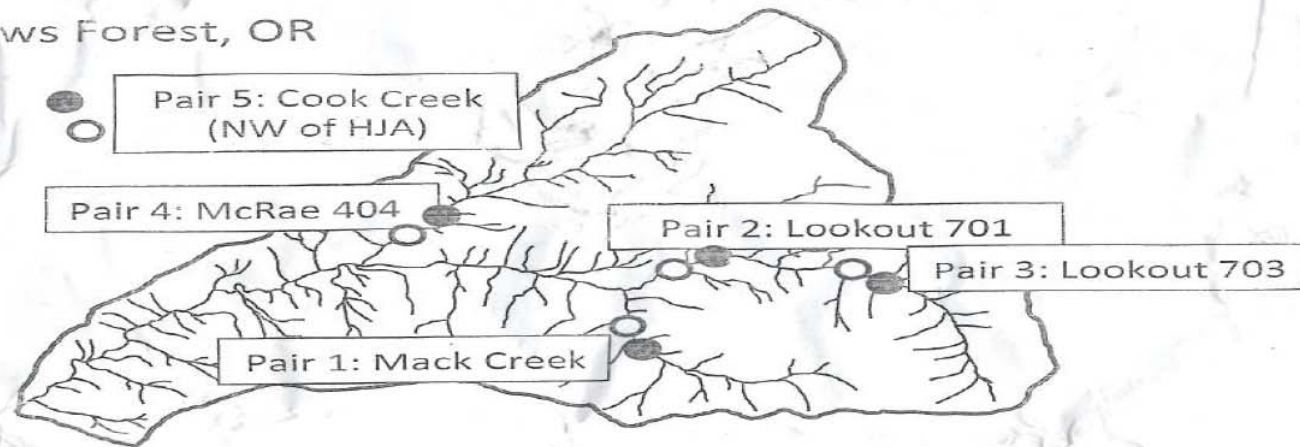
# Streamwater Temperature



### Premise for study

In the late 1970's paired reaches flowing through old-growth riparian forests and recent clear-cuts (see map 1) were surveyed to assess predator populations (Murphy and Hall 1981). In every pair with fish, greater fish biomass was observed in the clear-cut reach (figure 2). In 2014 we returned to 5 of these sites to explore how fish populations have responded to riparian stand development.

### HJ Andrews Forest, OR



Map 1: Study site locations within and near the HJ Andrews Experimental Forest, OR. Sites were surveyed in 1977 following recent harvesting and again in 2014.

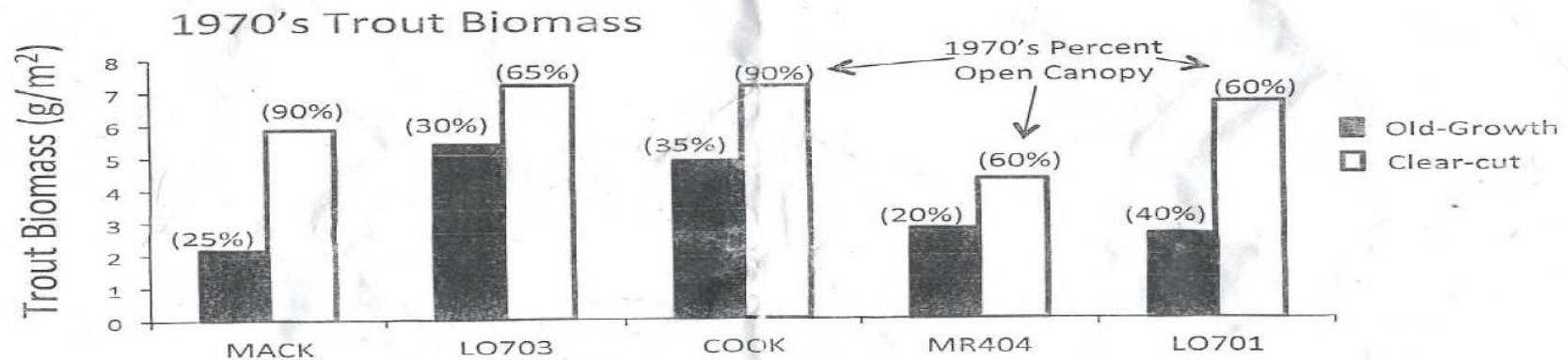


Figure 2: Cutthroat Trout biomass in paired reaches flowing through old-growth (black) and recent clear-cut (white) riparian forests. Values in parentheses represent the percentage of open canopy above streams. At Mack Creek and Cook Creek, clear-cut harvesting occurred on both sides of the stream. In LO703, MR404 and LO701, clear-cut harvesting only occurred on one bank of the stream. Where harvesting did occur, no riparian buffers were left.

# Wilzbach et al. Study of Fish Response to Carcass Inputs and Light



**Fish productivity responded most to increased light**

**Mechanism could include:**

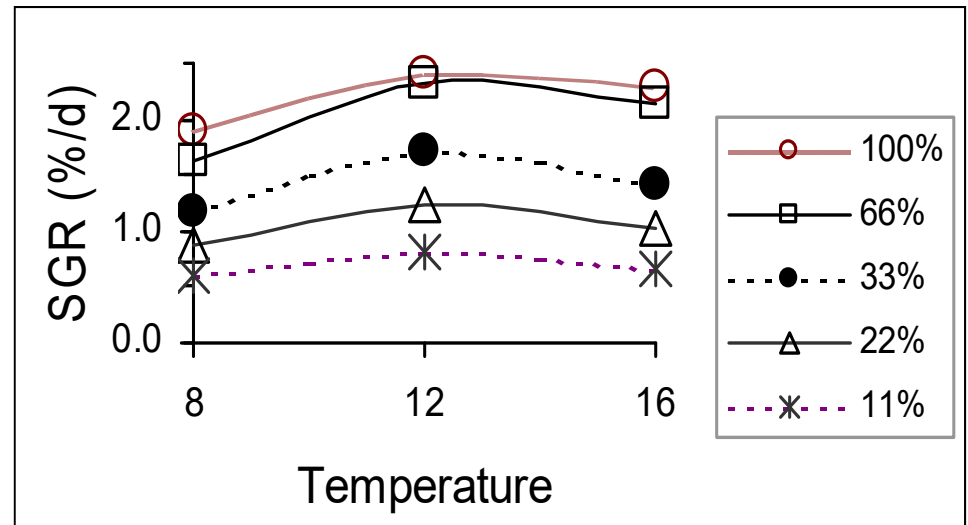
**Increased primary production and more macroinvertebrates**

**More favorable temperatures for metabolic activity/growth**

**Better visibility with more light to allow easier feeding**

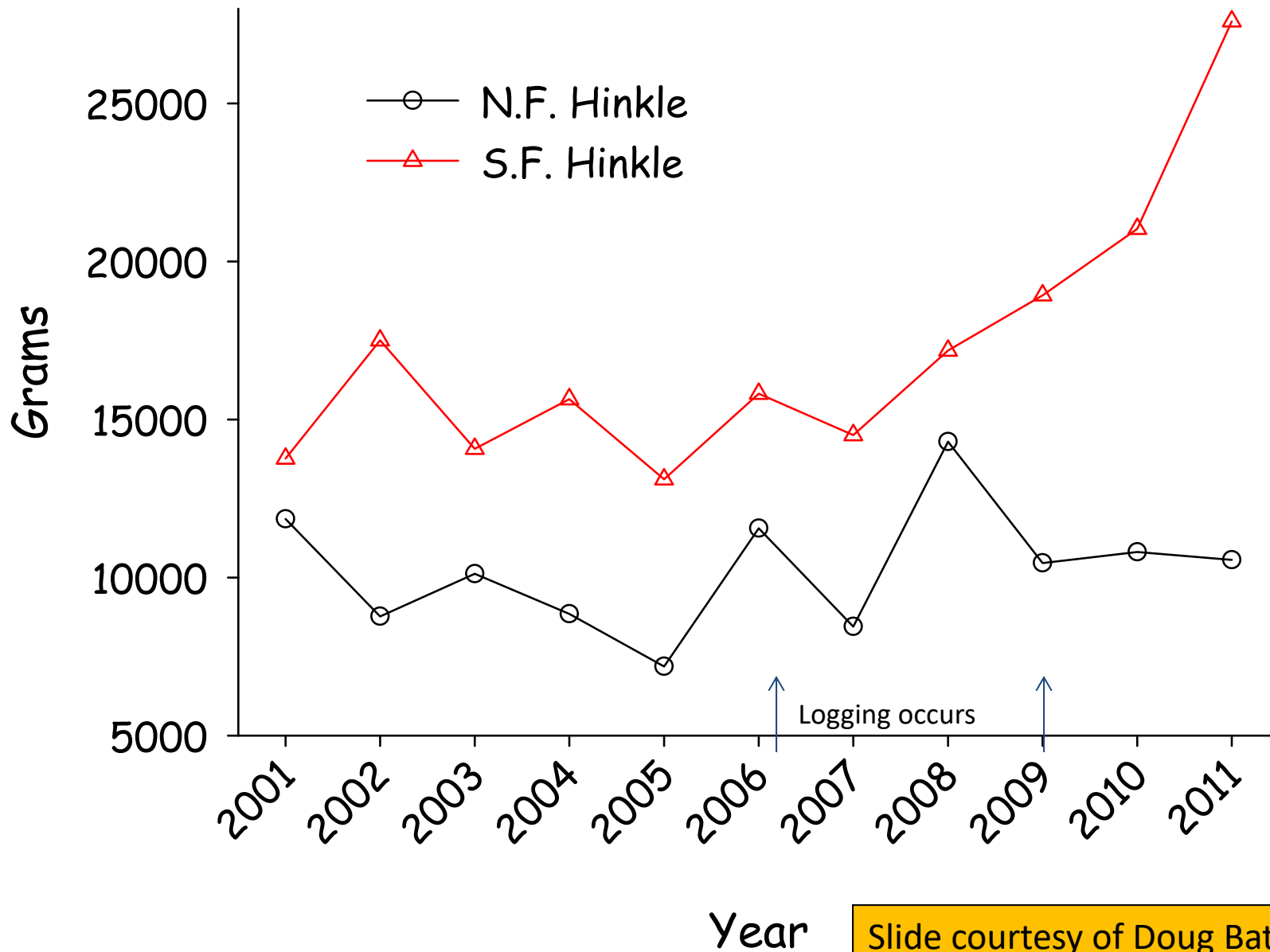
# Food, Food, Food

- Meta analysis of 25 studies with clearcutting without RMAs (Mellina and Hinch 2007)
- “The majority of the 25 studies reporting negative effects on [large wood] and pool habitat but positive ones for salmonid density and biomass.”

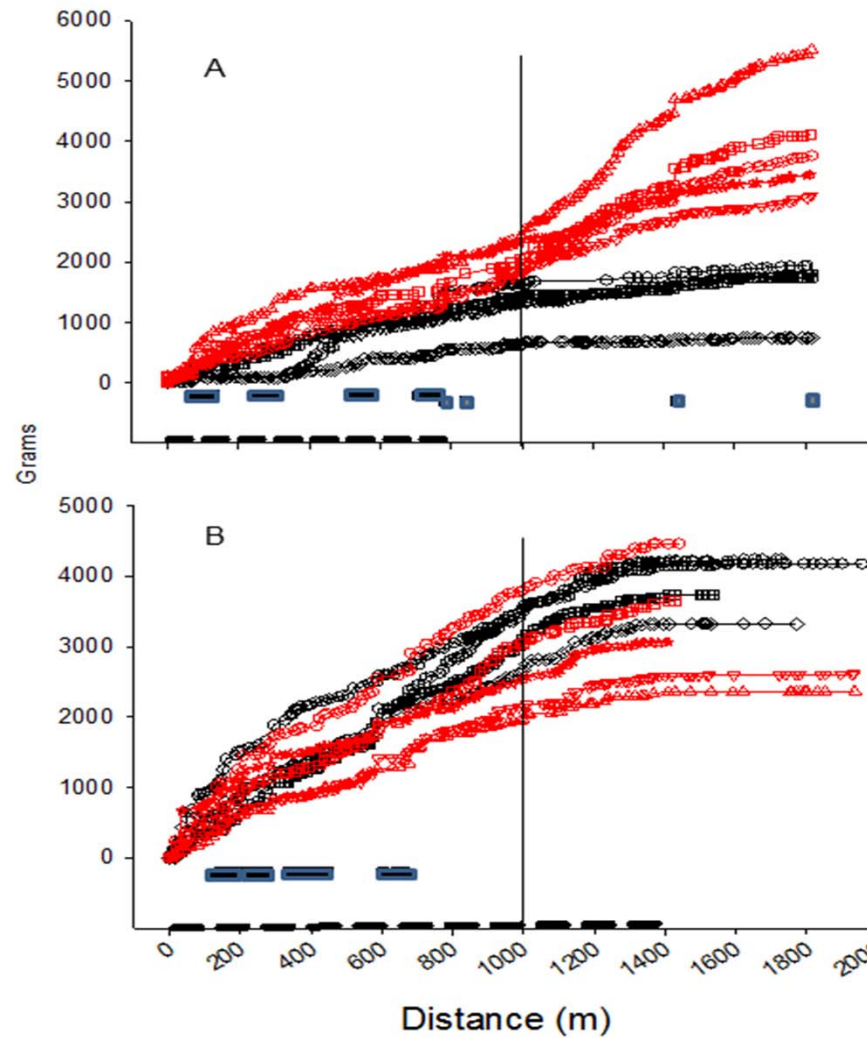


McMahon et al. 2001  
Bull Trout

# Total Grams All Salmonids by Year and Stream



# Alsea Watershed Study Revisited



Needle Branch  
(Clearcut Upper)

Flynn Creek  
(Control)

# Regulating riparian forests for aquatic productivity in the Pacific Northwest, USA: addressing a paradox

Michael Newton & George Ice

*Environmental Science Pollution Research* (2016) 23:1149–1157

**Abstract** Forested riparian buffers isolate streams from the influence of harvesting operations that can lead to water temperature increases. Only forest cover between the sun and stream limits stream warming, but that cover also reduces instream photosynthesis, aquatic insect production, and fish productivity. Water temperature increases that occur as streams flow through canopy openings decrease rapidly downstream, in as little as 150 m. Limiting management options in riparian forests restricts maintenance and optimization of various buffer contributions to beneficial uses, including forest products, fish, and their food supply. Some riparian disturbance, especially along cold streams, appears to benefit fish productivity. Options for enhancing environmental investments in buffers should include flexibility in application of water quality standards to address the general biological needs of fish and temporary nature of clearing induced warming. Local prescriptions for optimizing riparian buffers and practices that address long-term habitat needs deserve attention. Options and incentives are needed to entice landowners to actively manage for desirable riparian forest conditions.

# How can we do it better not bigger?

- Address few cases where largest water quality impacts observed with rule changes
- Allow harvests along streams that:
  - creates small opening for increased productivity
  - accelerates growth of functional LW sources
  - Provides for shade-intolerant species regeneration
- Encourage active placement of functional wood
- Optimize shade benefits by favoring tree retention on the South side of water
- Condition riparian buffers (RMAs) more closely to site conditions to account for factors like background stream temperature, existing stand structure and stream orientation, rate of riparian cover recovery, and recovery downstream

# Policy Steps to Positively Resolve Issues

- Adopt policies similar to other states where small, brief, infrequent, and spatially isolated water quality events do not trigger listing of streams as “impaired”
- Interpret water quality standards not just immediately after a harvest but over the full cycle of forest management
- Implement measured rules changes to address both risks and benefits