



Arlington, VA Dept. of Environmental Resources

# Stream Restoration: An Evolving Practice

*Karen Gran  
UMD Geological Sciences*

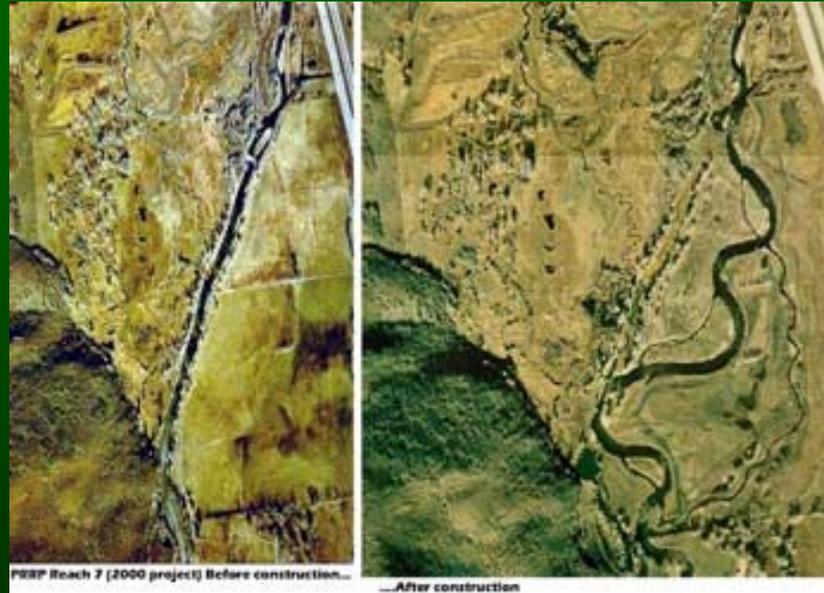
# What is stream restoration?

Small-scale bank stabilization or revegetation



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Complete channel realignment or redesign



FRSP Reach 7 (2000 project) Before construction...

...After construction

# Most restoration work is actually rehabilitation

Small-scale bank stabilization or revegetation



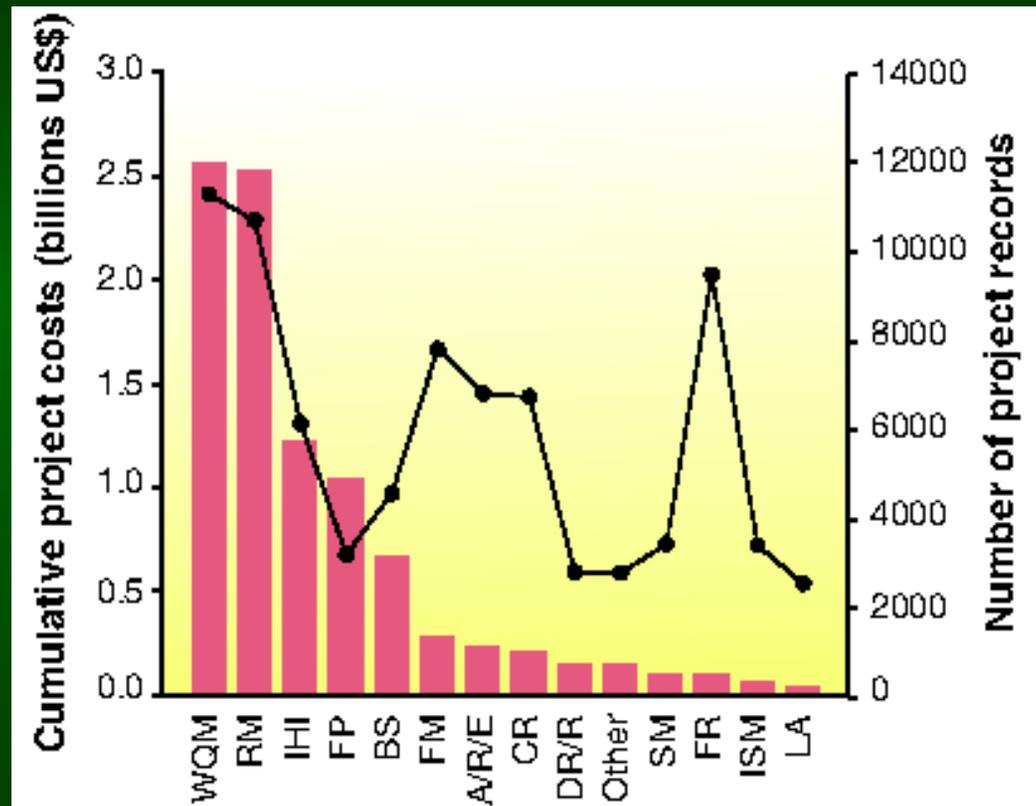
Complete channel realignment or redesign



# Why do we do stream restoration?

Stated goals vary widely

WQM – Improve Water Quality  
RM – Manage Riparian Zones  
IHI – Improve instream habitat  
FP – Fish Passage  
BS – Bank stabilization  
FM – Flow modification  
A/R/E – Aesthetics/recreation/education  
CR – Channel reconfiguration  
DR/R – Dam removal/retrofit  
SM – Stormwater mgmt.  
FR – Floodplain reconnection  
ISM – Instream species mgmt.  
LA – Land acquisition



*NRRSS Survey From Bernhardt et al., 2005*

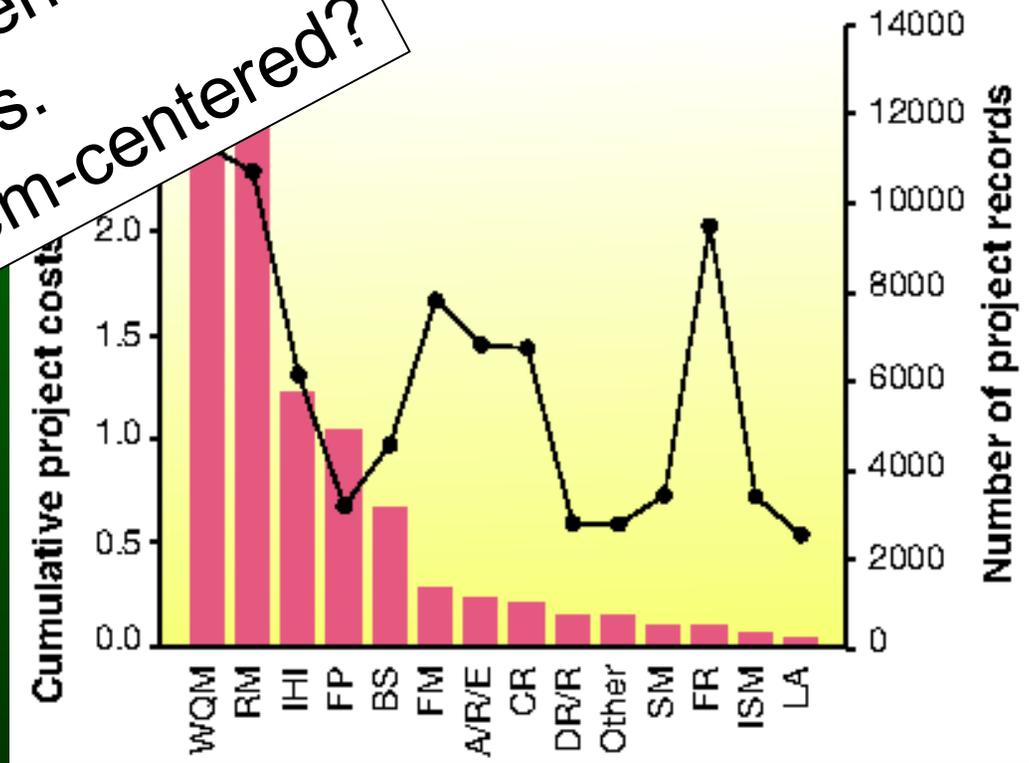
# Why do we do stream restoration?

Ultimate goal: Restoring a functional ecosystem

Conflicting goals: Restoration vs. Control

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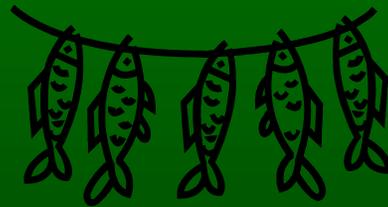
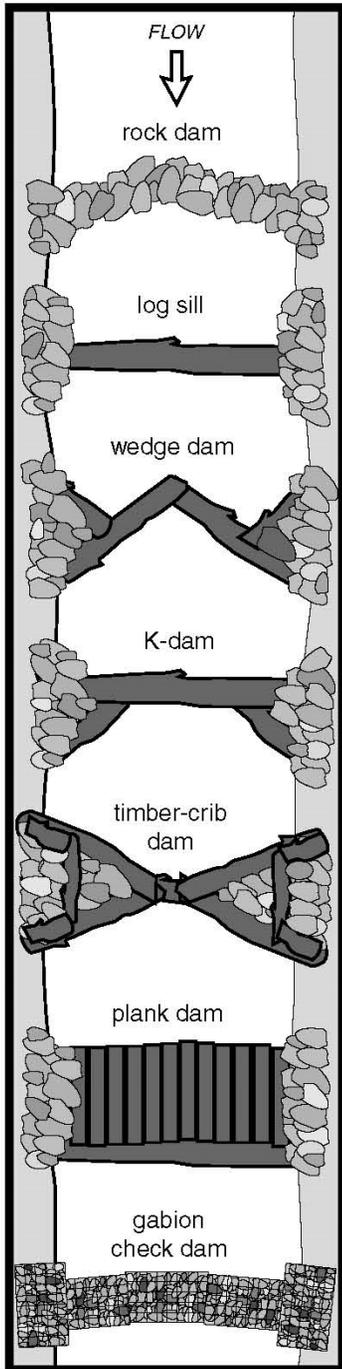
Human-centered  
vs.  
Ecosystem-centered?



# History of stream restoration

Late 1800s, Catskills – decline in fish stocks led to  
A) privatization of streams, B) stocking, and C)  
reach-scale modifications

First widespread use of in-stream structures in US  
Idea that humans could improve upon natural  
streams by in-stream modifications

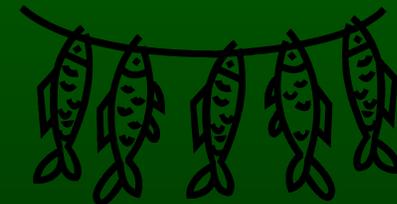
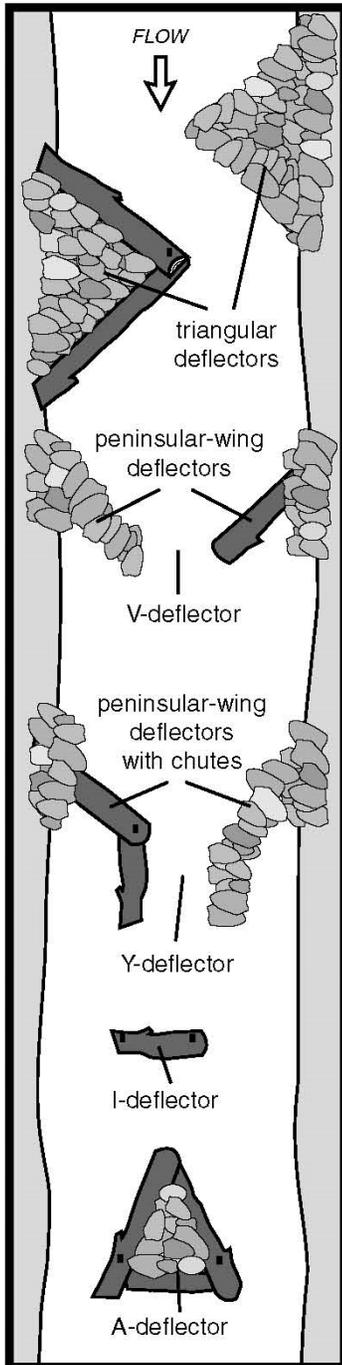


# History of stream restoration

Hewitt (NY) produced influential books on instream structures

Hubbs (MI) spread the work nationwide

“In view of the fact that our lakes and streams were formed by natural processes and were not created or especially designed for the species of fish which we desire, it is logical to believe that with adequate knowledge and a definite design or purpose in mind, we can improve on nature and make some of our waters more favorable for the desired species.”  
(Tarzwell, 1935)



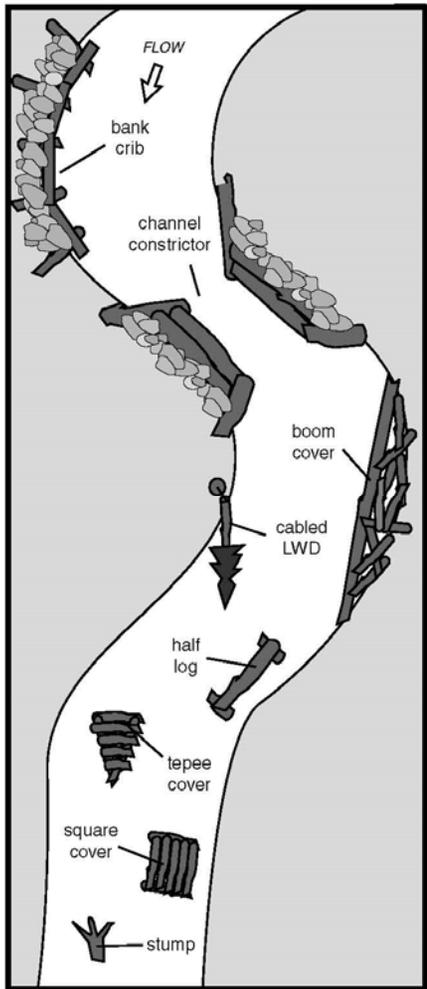
Thompson 2005

# History of stream restoration

1930s: CCC & USFS joined in, adopting structures used by Michigan group

CCC “improved” 7,950 km of stream & installed over 31,000 in-stream structures in mountain streams in mid-1930s

Many problems and often a lack of understanding of stream geomorphology & dynamics



Hunter 1991; Thompson 2005

# *History of stream restoration*

Post-WWII, federal policy shift towards economic over environmental river management

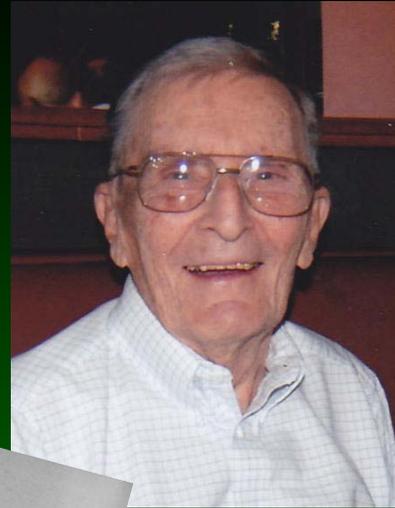
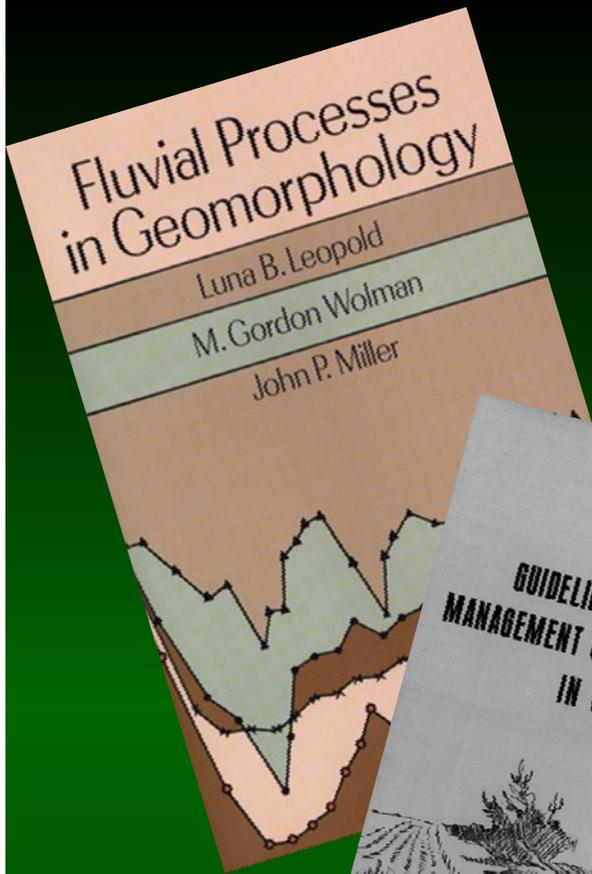
## **Channelization, levees, dams**

By 1970s, 33,353 km river channelized; 9,490km levees built by USACE & NRCS; Over 600 dams built by Bureau of Reclamation

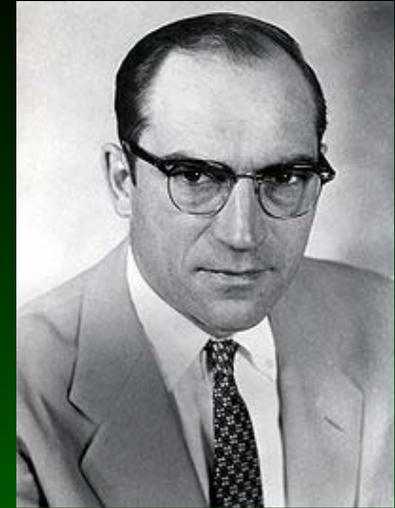


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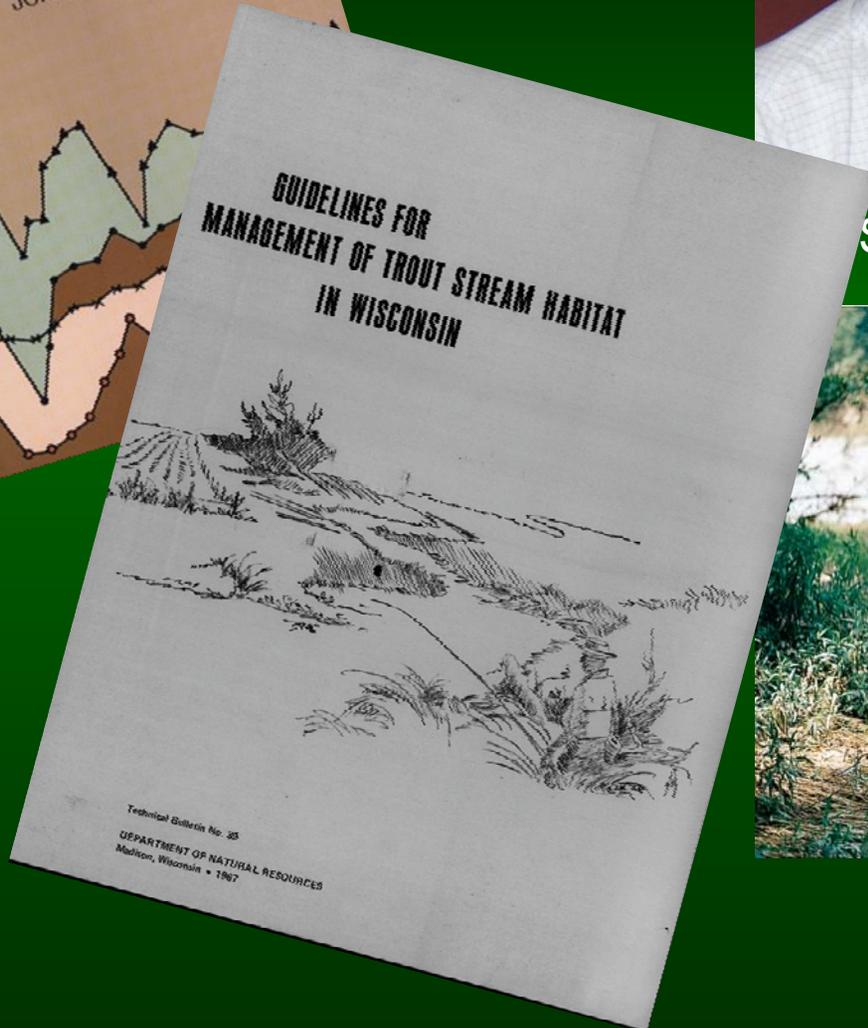
Rebecca Lave, 2012; Riley 1998



Stan Schumm



Luna Leopold



Reds Wolman

# *History of stream restoration*

Wild & Scenic Rivers Act, 1968:

If you are going to dam some rivers, you need to leave others alone

National Environmental Protection Act (1969)

Clean Water Act (1972)

Endangered Species Act (1973)

# Rise of modern stream restoration movement

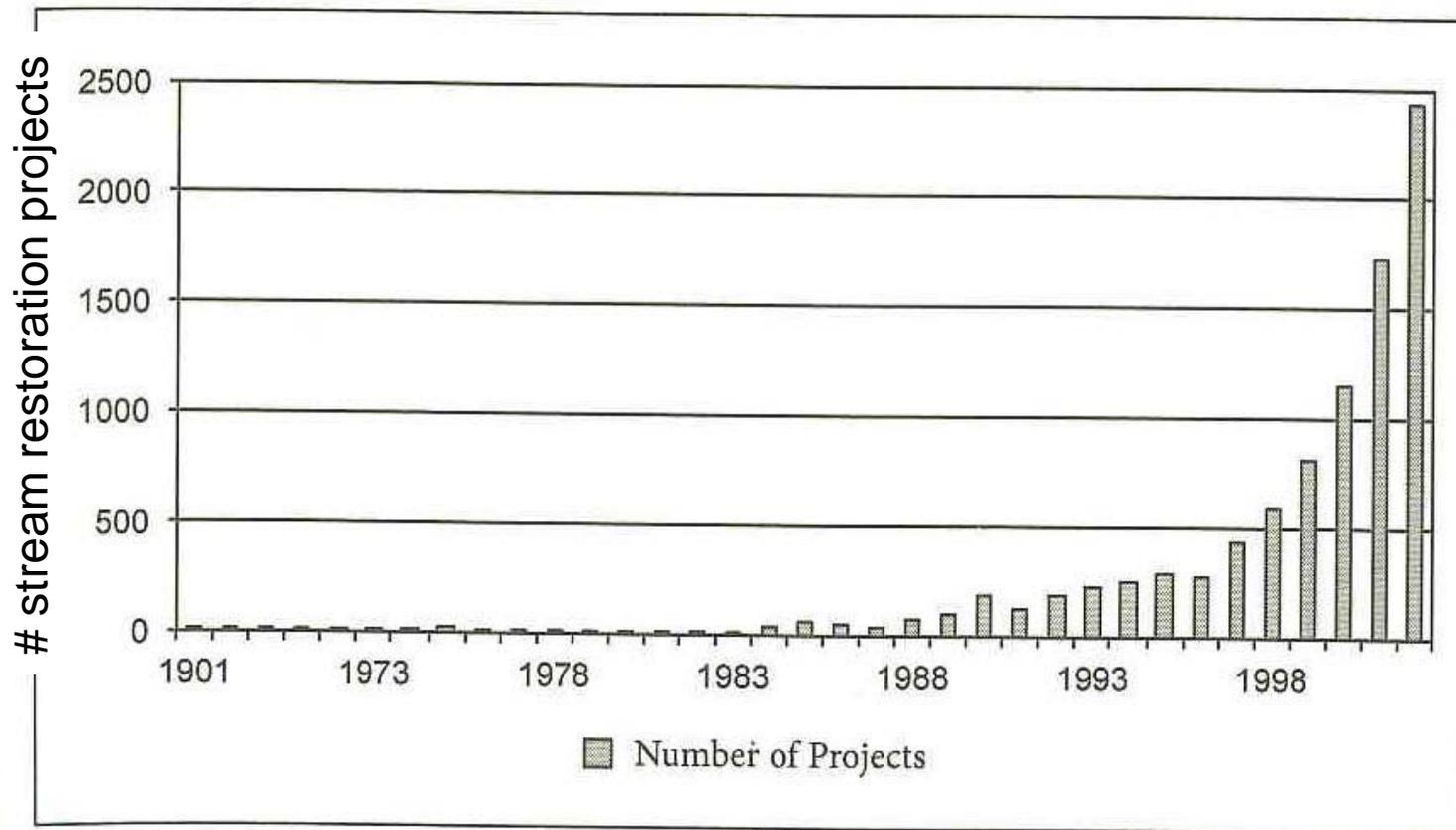


Figure 3.1 Number of stream restoration projects in the United States per year based on the NRRSS database.<sup>7</sup>

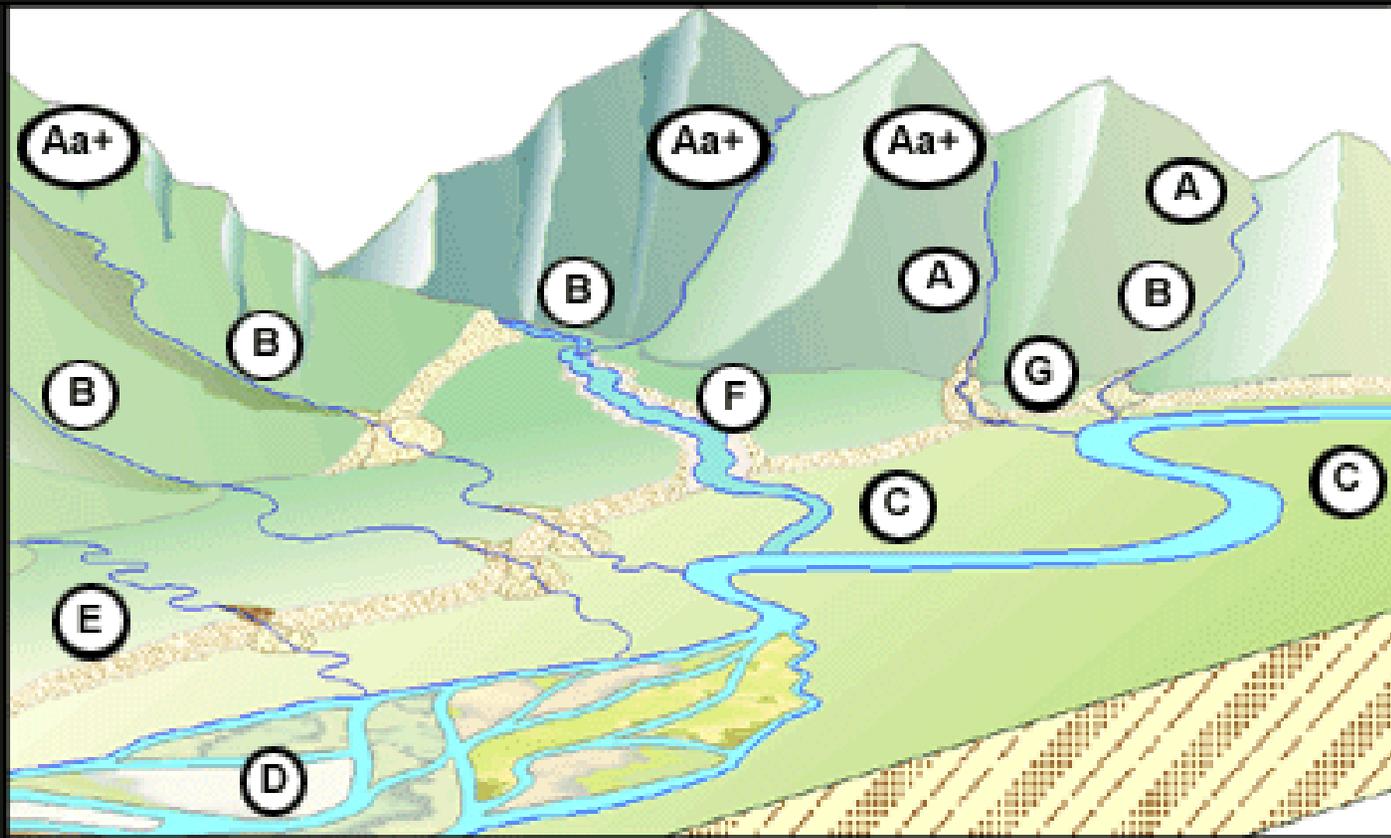
# Enter Dave Rosgen



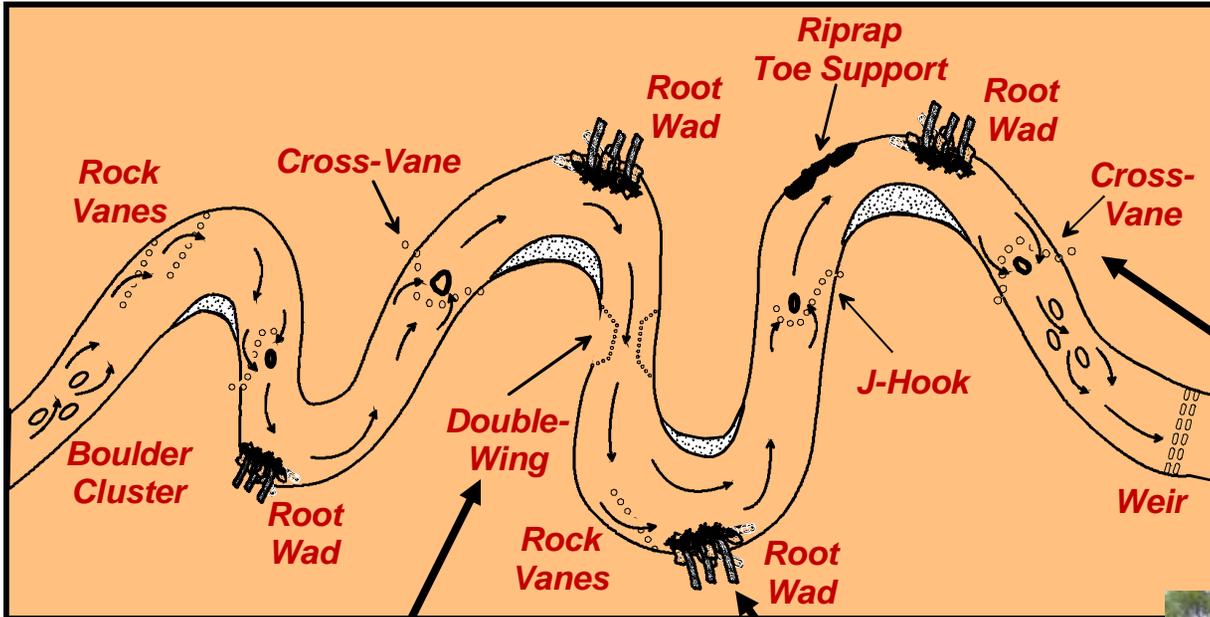
Time Magazine, 2004

# Natural Channel Design

Natural channel design uses natural materials to create stable streams that maintain their dimension, pattern, and profile through time without aggrading or degrading.



*From Rosgen, 1996*



**Cross Vane**



**Double Wing**

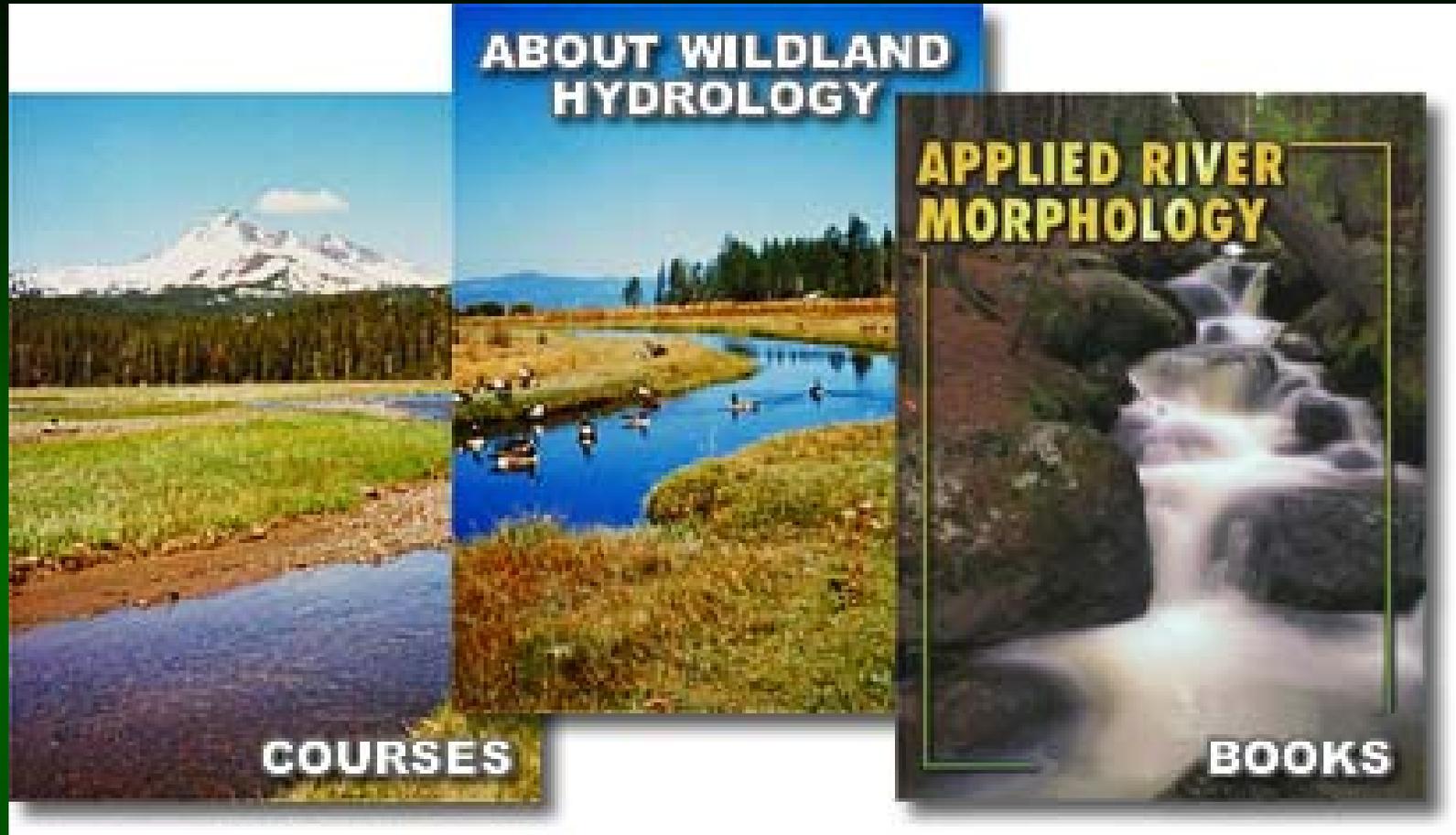


**Root Wads**



**Rock Vane**





In part by default, NCD has become the standard of practice in many states; with Rosgen short courses the standard training.

# “Rosgen Wars”



# Gist of arguments

## Science of NCD

- stability
- predictability
- bankfull

Dissemination  
& Peer-review

Exclusive use of NCD

Ignorance of NCD  
Non-practitioners  
NCD is not the enemy

*Fields and Streams: Stream Restoration, Neoliberalism, and the Future of Environmental Science by Lave, 2012*

# Fundamentally...

(We don't know if NCD works better or not!)



(But there isn't a widespread easily transferable alternative)

# But there are many alternatives...

- Watershed assessments and plans
- Watershed Modeling
- Diagnostic geomorphology
- Connectivity
- Peak-flow reduction
- Focus on climate change adaptation
- Resiliency

# No conclusions, just questions

- What is the role of science in stream restoration?
- Is restoration driven more by societal demands than scientific understanding?
- Is it right to spend billions of dollars on restoration projects without a better understanding of their effectiveness?