



# FS & BLM Large Scale Monitoring Efforts



# Goal: Assess Effects of Current Mgmt Direction

- ✱ Use 6<sup>th</sup> field watershed as sample unit
- ✱ 5 year rotating panel design
- ✱ Sample stream reaches
- ✱ Biological and physical variables similar to EMAP
- ✱ Just beginning analyses



# Upper Columbia River Basin Effort

- ✴ Rick Henderson
- ✴ Eric Archer
- ✴ Jeff Kershner
- ✴ Brett Roper



# Charges as Land Management and Regulatory Agencies.

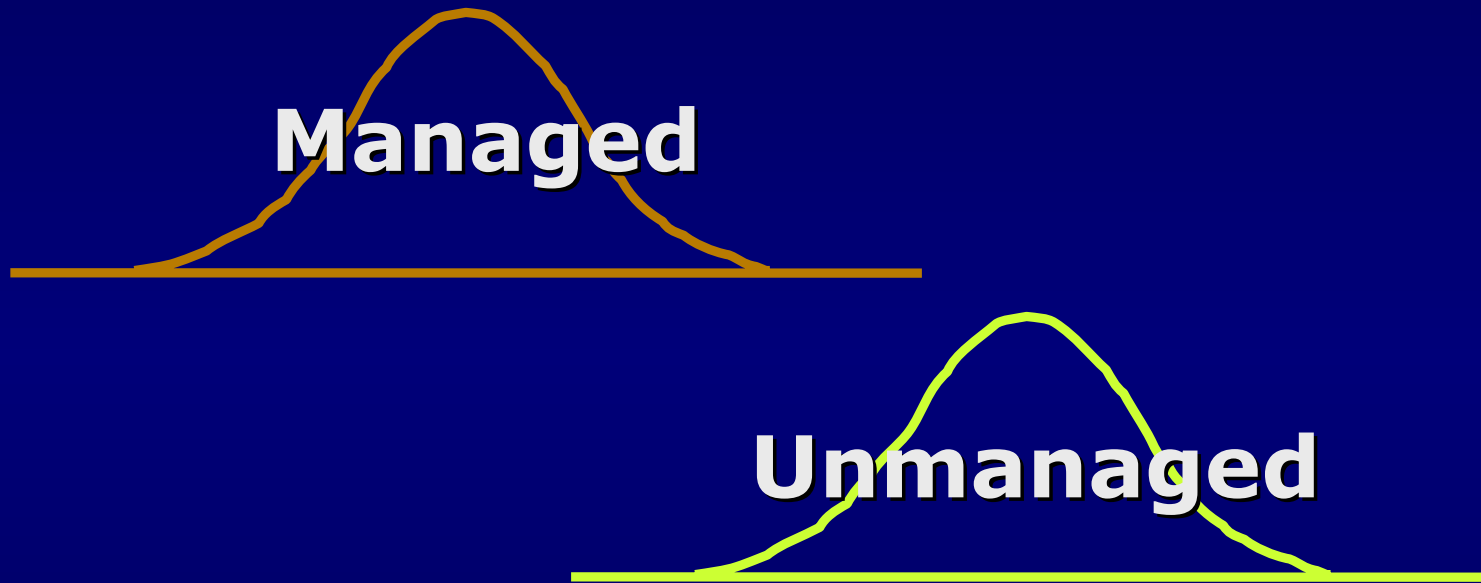
- ★ To describe the complexity of streams and their watersheds.
- ★ To understand the relationship between management activities and the conditions of basins, watershed, and streams.
- ★ To recommend management changes that address and protect short and long-term public desires/federal laws.



# Study Design

- ✱ 4000 6<sup>th</sup> field HUC's
- ✱ Stratified into Managed and Reference
- ✱ Sample 1250 in 5 years
- ✱ Sample Integrator Reach
- ✱ Reference =
  - ✱ Minimally managed
  - ✱ Watershed vs reach
  - ✱ Don't use best available

# General model of stream habitat change.

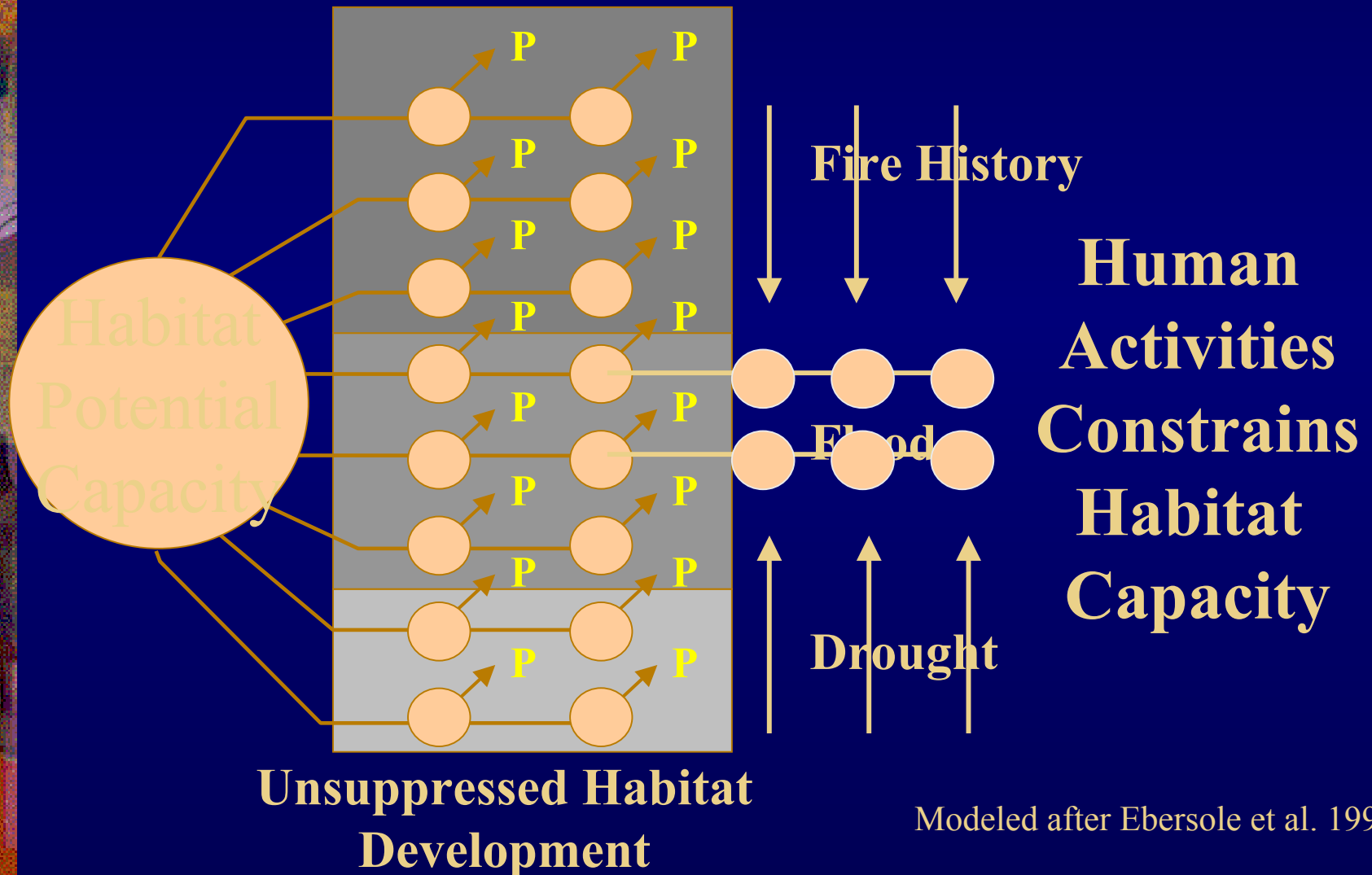


**Different Mean**

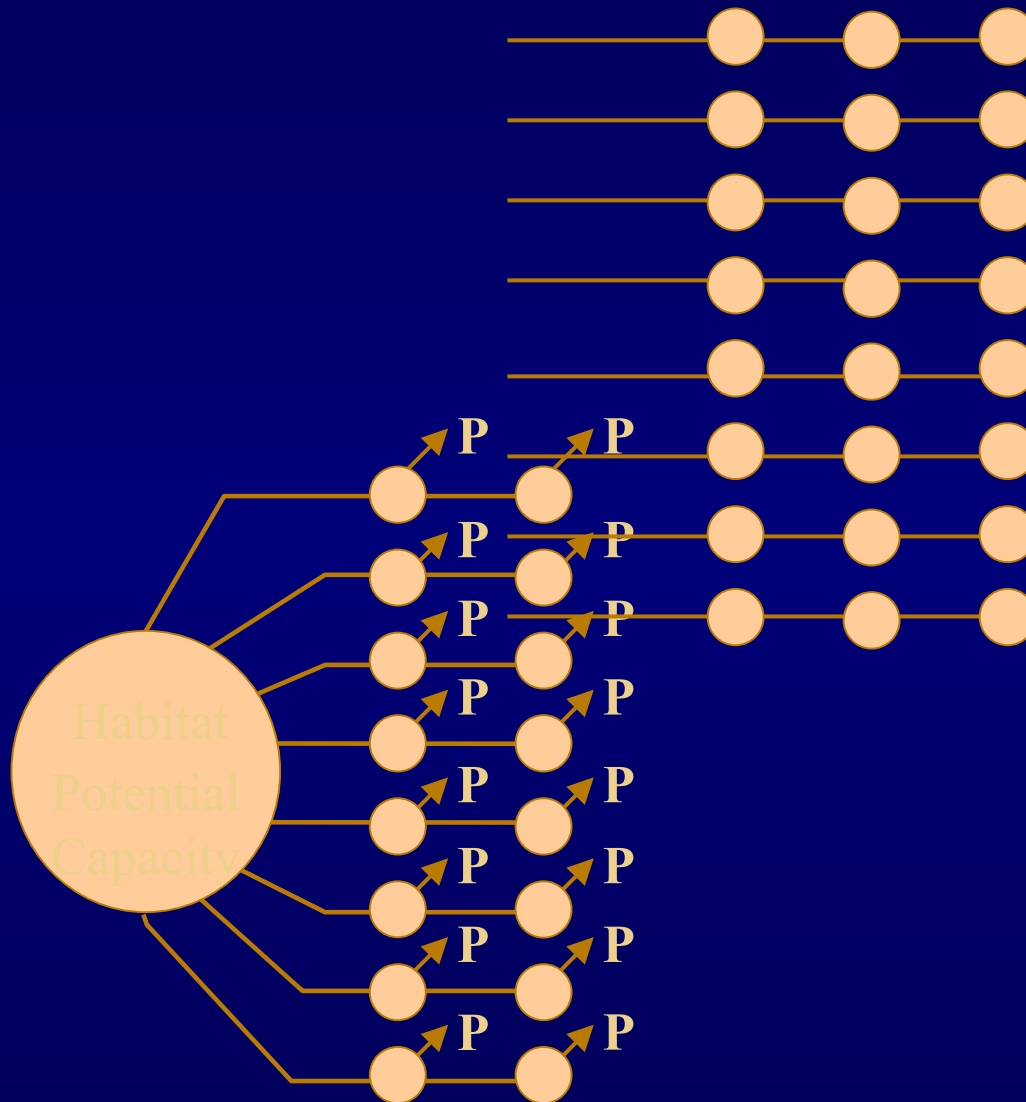
**Same Variance**

**Likely changes biota**

# Understanding the Relationship Between Management Activities and the Conditions of Basins, Watershed, and Streams.



# Alternative Response

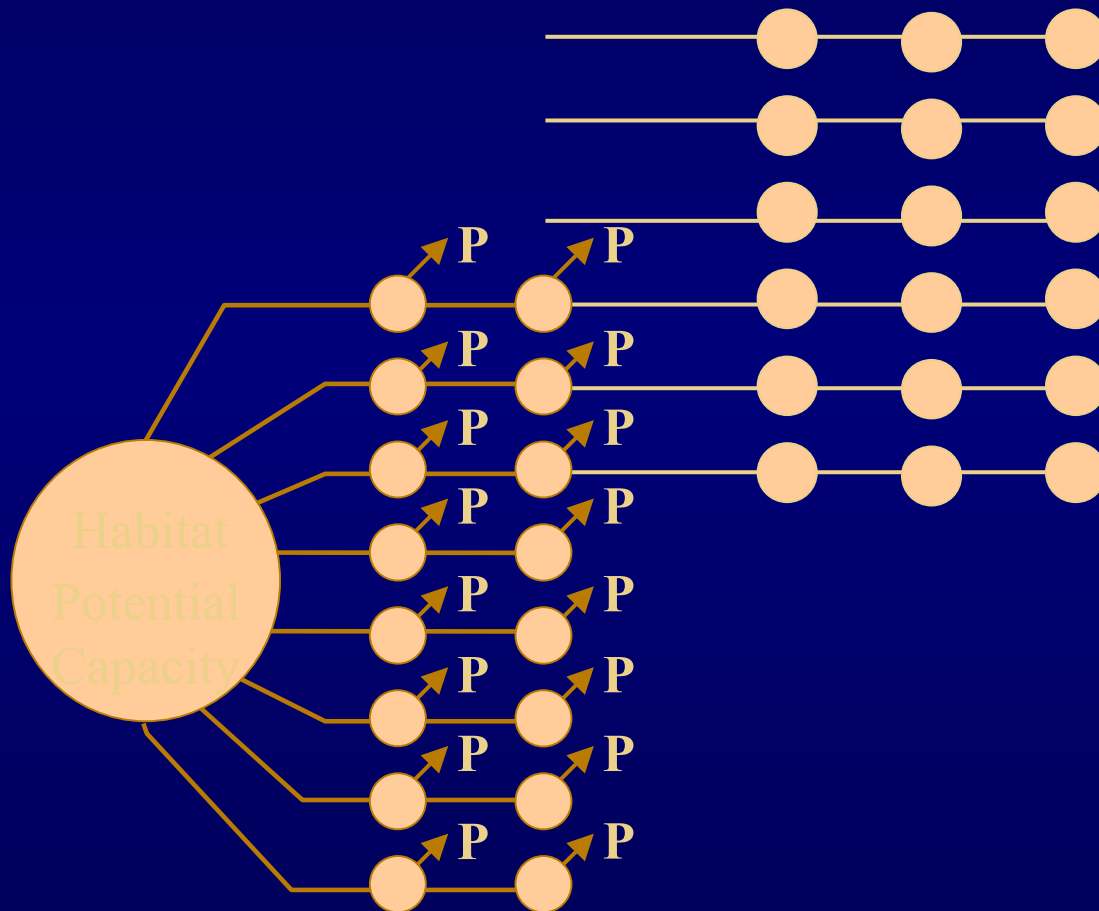


Human  
Activities  
Alters  
Habitat  
Capacity

**Unsuppressed Habitat Development**



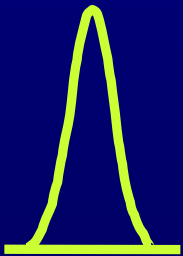
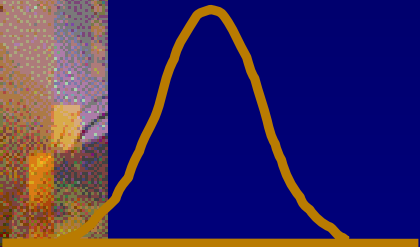
# Alternative Response



Human  
Activities  
Alters and  
Constrains  
Habitat  
Capacity

**Unsuppressed Habitat Development**

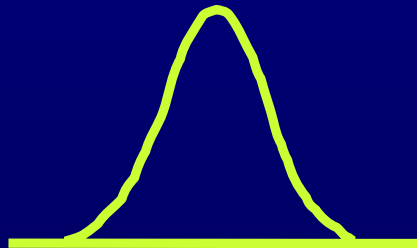
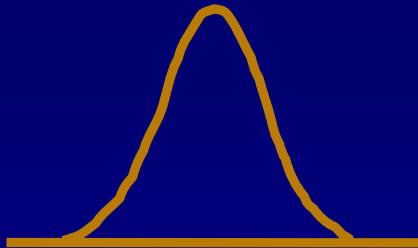
# Effects of These Three Realities On Statistical Test



**Same Mean**

**Different Variance**

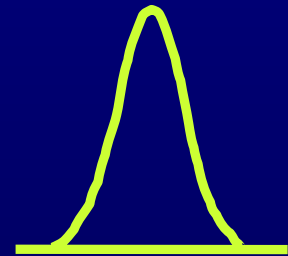
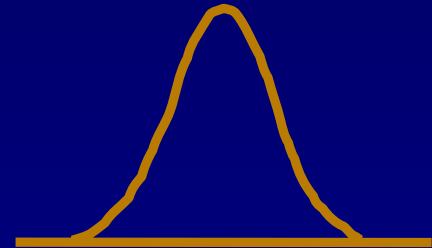
**Likely changes biota**



**Different Mean**

**Same Variance**

**Likely changes biota**



**Different Mean**

**Different Variance**

**Likely changes biota**

# What should we manage stream conditions towards?

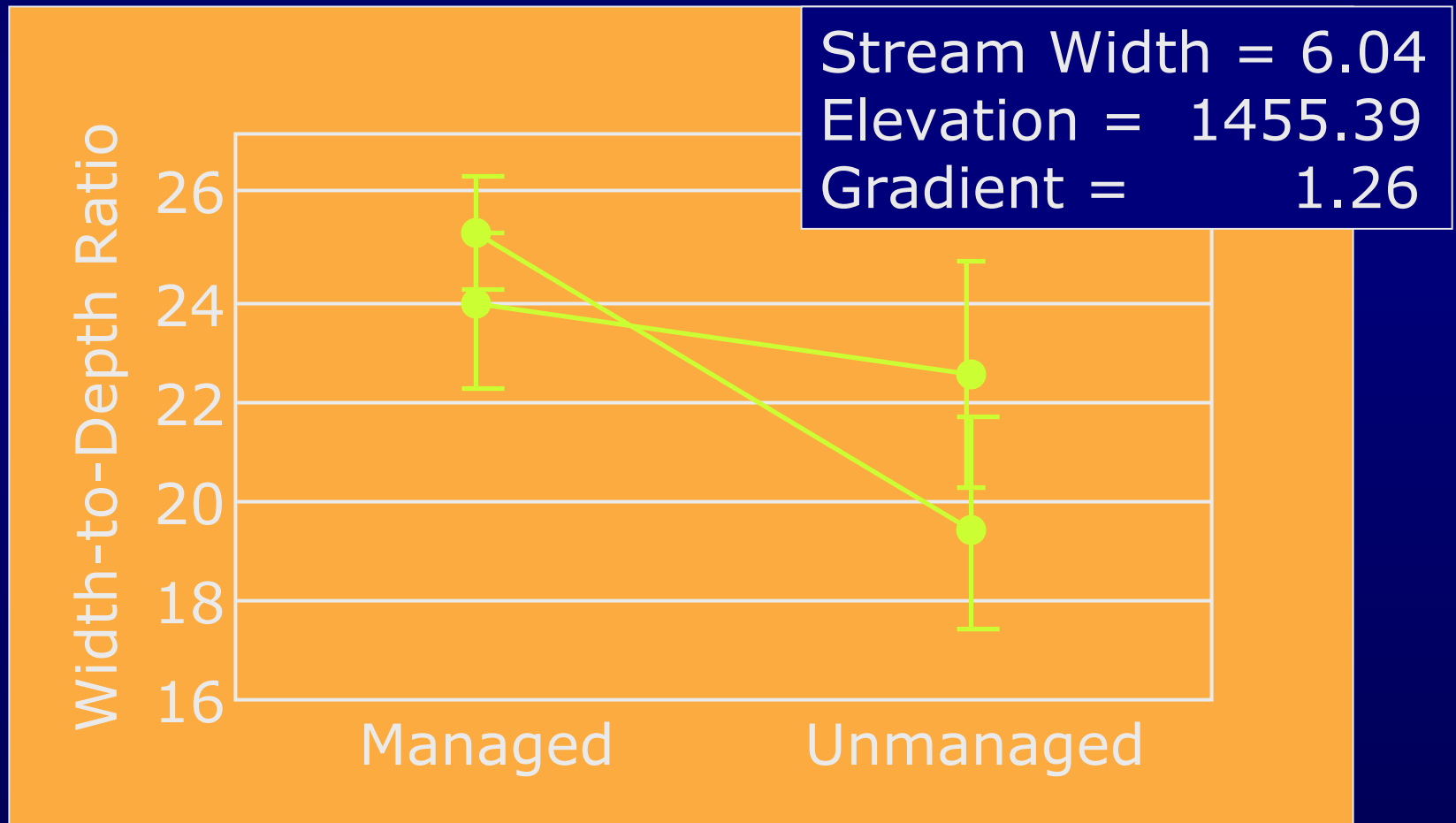
## Characteristics of Minimally Managed and Unmanaged Watersheds Within the Upper Columbia River Basin

Variable	Managed Mean (STD)	Unmanaged Mean (STD)	p-value Mean (STD)
Elevation	4576.70 (1333.4)	5443.99 (1384.9)	<0.001 (0.679)
Gradient	1.27 (0.702)	1.20 (0.718)	0.526 (0.798)
Sinuosity	1.34 (0.314)	1.42 (0.384)	0.106 (0.370)
Area	39.87 (28.57)	31.32 (25.69)	0.304 (0.316)
Stream width	5.67 (2.943)	6.69 (4.088)	0.004 (0.001)
Stream Density	1.58 (0.654)	1.57 (0.936)	0.871 (<0.001)
Road Density	1.60 (1.109)	0.15 (0.392)	<0.001 (<0.001)
% Federal	95.40 (7.74)	99.84 (0.665)	<0.001 (<0.001)
Precipitation	810.26 (302.6)	1013.63 (284.3)	<0.001 (0.561)

**n=203**

**n=67**

So how are we evaluate departure from those conditions?





## The next frontier – The real need for large scale monitoring programs

- Predict rates attributes change under unmanaged and managed conditions.
- Be able to discern between natural changes and the accelerated or decelerated rates of change due to anthropogenic effects.
- Provide context for the endpoints towards which society wants individual streams, watersheds, and basins be managed towards.



# Northwest Forest Plan

C. Moyer, K. Gallo, S. Lanigan

Aquatic and Riparian Effectiveness Monitoring Program

USDA Forest Service

Bureau of Land Management



# Overview

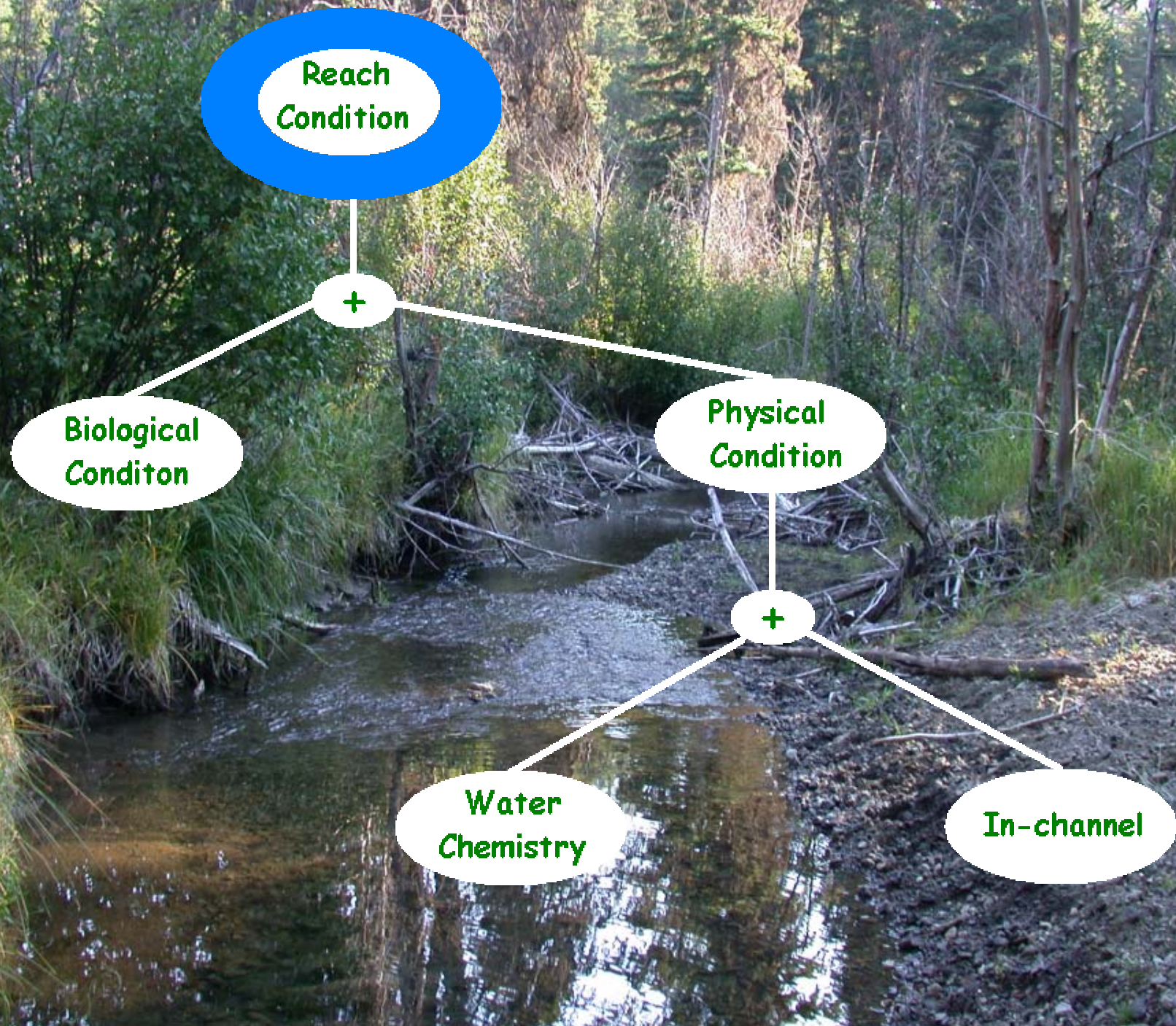
- ★ 3500 6<sup>th</sup> field HUC's
- ★ Sample 250 within 5 years
- ★ Sample 6-8 random reaches within each HUC
- ★ Decision Support Model
  - ★ Structure
  - ★ Evaluation Criteria
  - ★ Operators
- ★ Ecosystem Management Decision Support



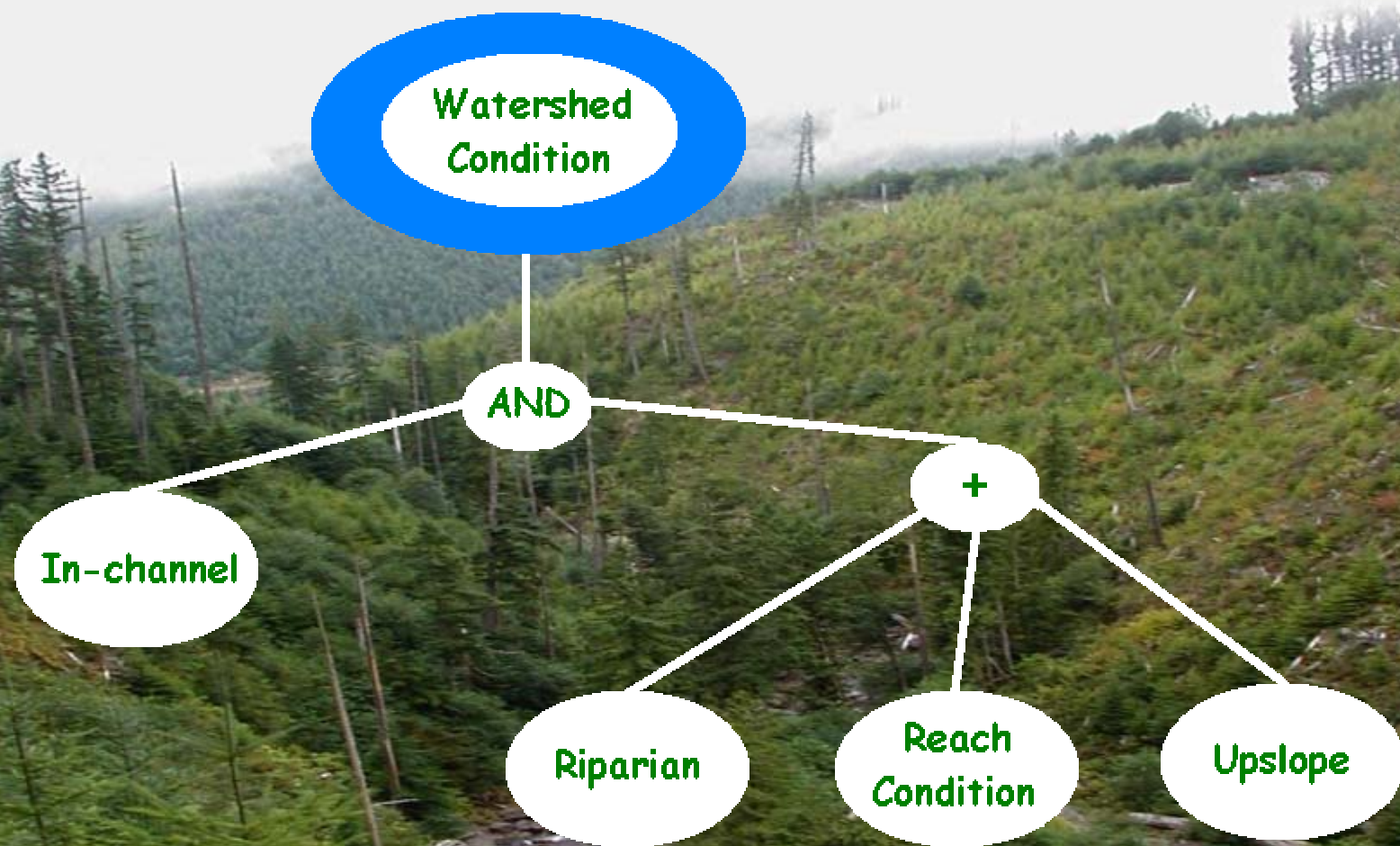
# Decision Support Model (DSM)

- ★ Logic based modeling
- ★ Gives each reach a Score
- ★ Reach evaluations are passed up to the watershed model
- ★ Switches
- ★ Weighting Factors

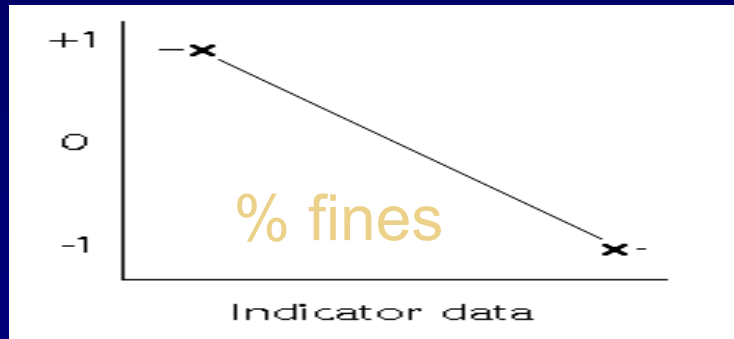




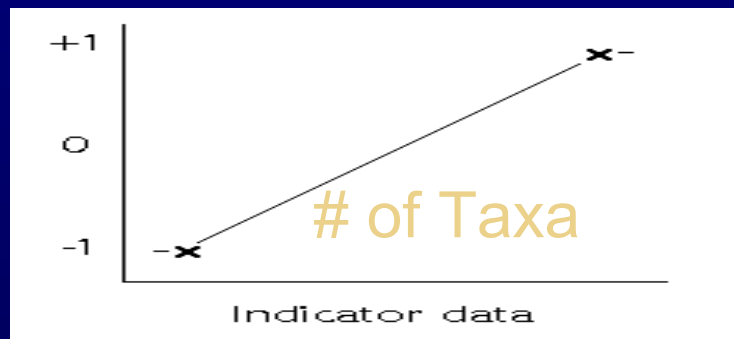




# Two-Criteria Evaluation

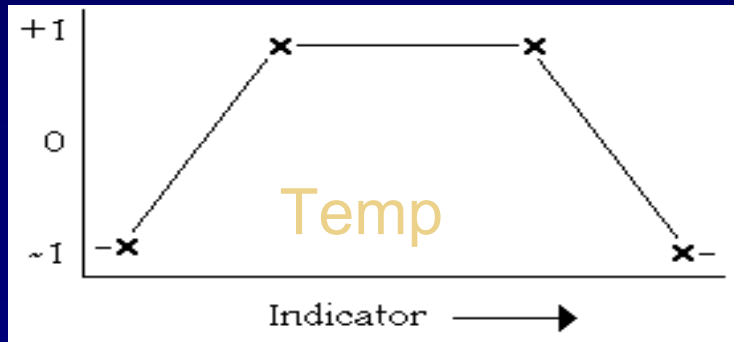


- ☀ Data that fall between the “poor” and “good” criteria are assigned a value between  $-1$  and  $+1$

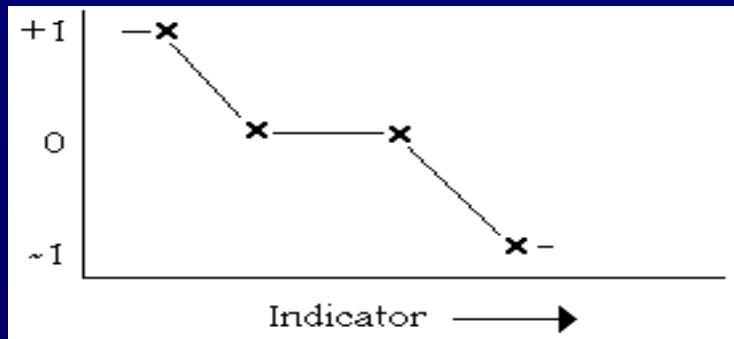


- ☀ Relationship may have a positive or negative slope

# Four-Criteria Evaluation

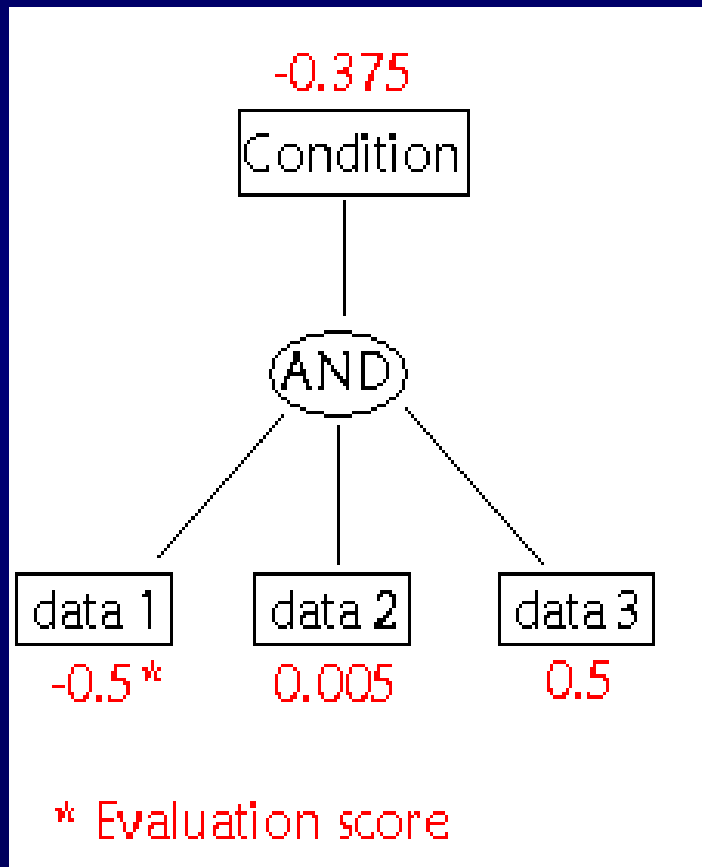


- Indicator data that fall within range of “good” criteria are assigned value of +1



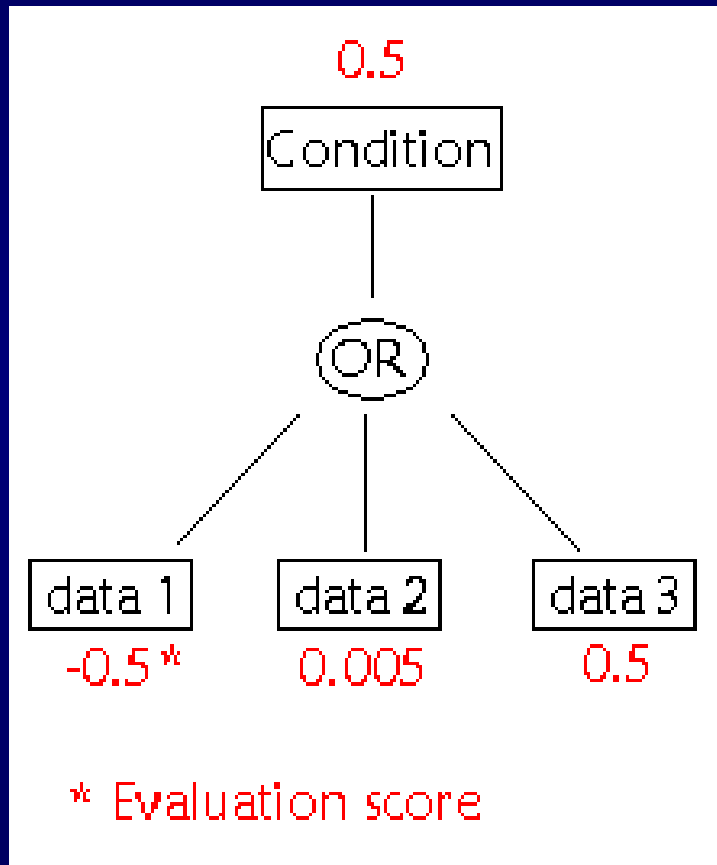
- Data outside range of “good” criteria are assigned value between -1 & +1

# AND Operator



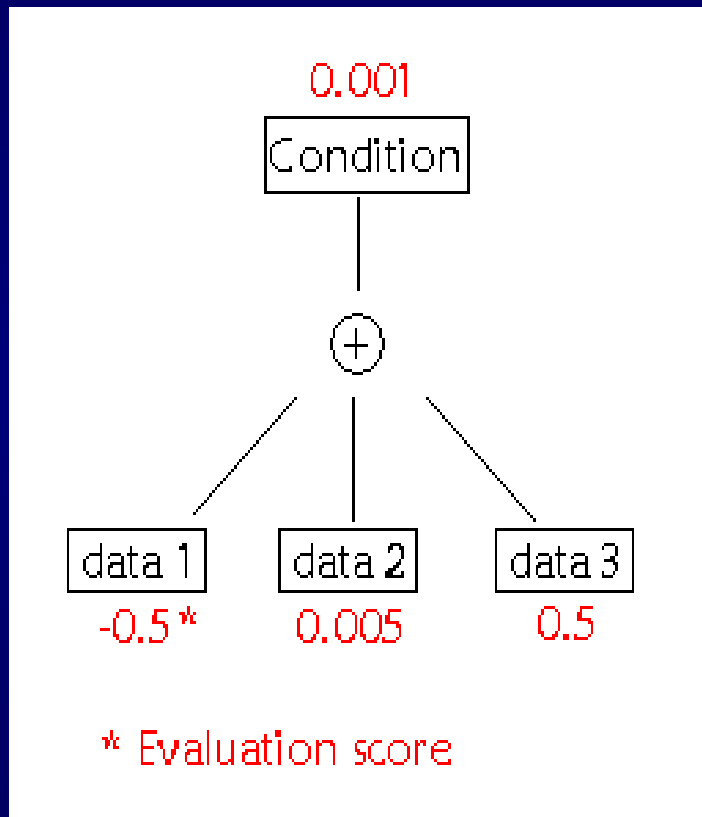
- ★ AND operators pass a score weighted towards the lowest evaluation score
- ★ AND is used primarily if one indicator is more important than others (e.g., temperature)

# OR Operator



- ✦ OR operators pass the highest evaluation score
- ✦ Presents an optimistic view of condition

# + (Union) Operator



- ✦ + operators pass the average evaluation score
- ✦ + is used so that indicators in good and poor condition balance each other out



# Model Development

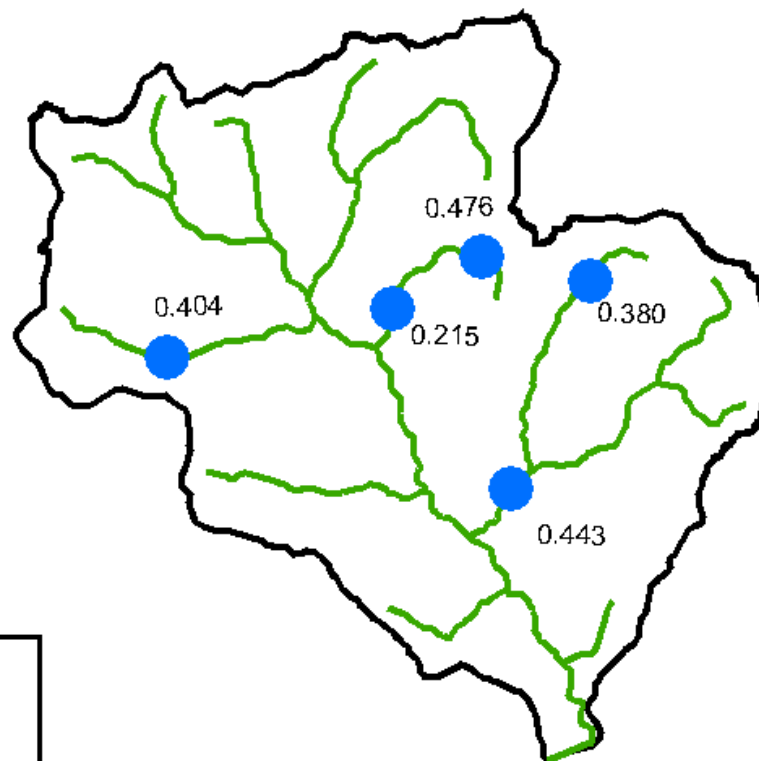
## ☀ To date:

- ☀ Extensive literature review
- ☀ Input from outside sources

## ☀ Future:

- ☀ Provincial Review Teams
- ☀ Local area input





#### Reach Condition

0.501 - 1.000

0.001 - 0.500

0

-0.001 - -0.500

-0.501 - -1.000

Streams

Watershed Boundary

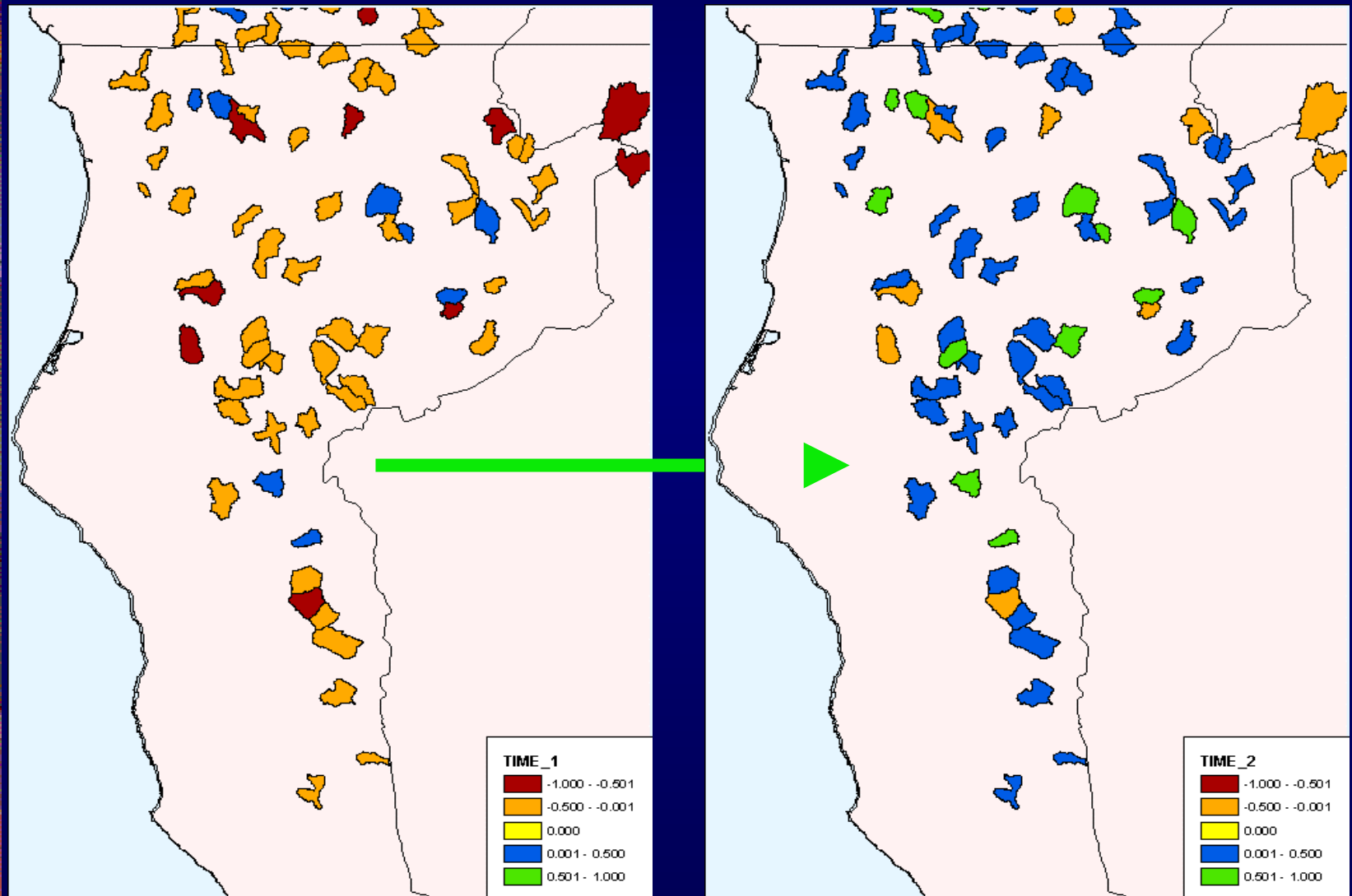
USDA Forest Service  
Aquatic & Riparian Effectiveness Monitoring Program  
4077 Research Way  
Corvallis, Oregon 97333  
February, 2002

1:100,000

1 0.5 0 1 2 3 4 5  
Kilometers

N

# Watersheds - Spatial



# Conclusions

- ✱ Changes in evaluation score distributions through time (across Northwest Forest Plan)
- ✱ Changes in individual indicator values through time (within watershed)
- ✱ DSM/EMDS tools for aggregating different information types
- ✱ Real Evaluation criteria are challenging to get
- ✱ Rule sets (operators) are challenging to determine