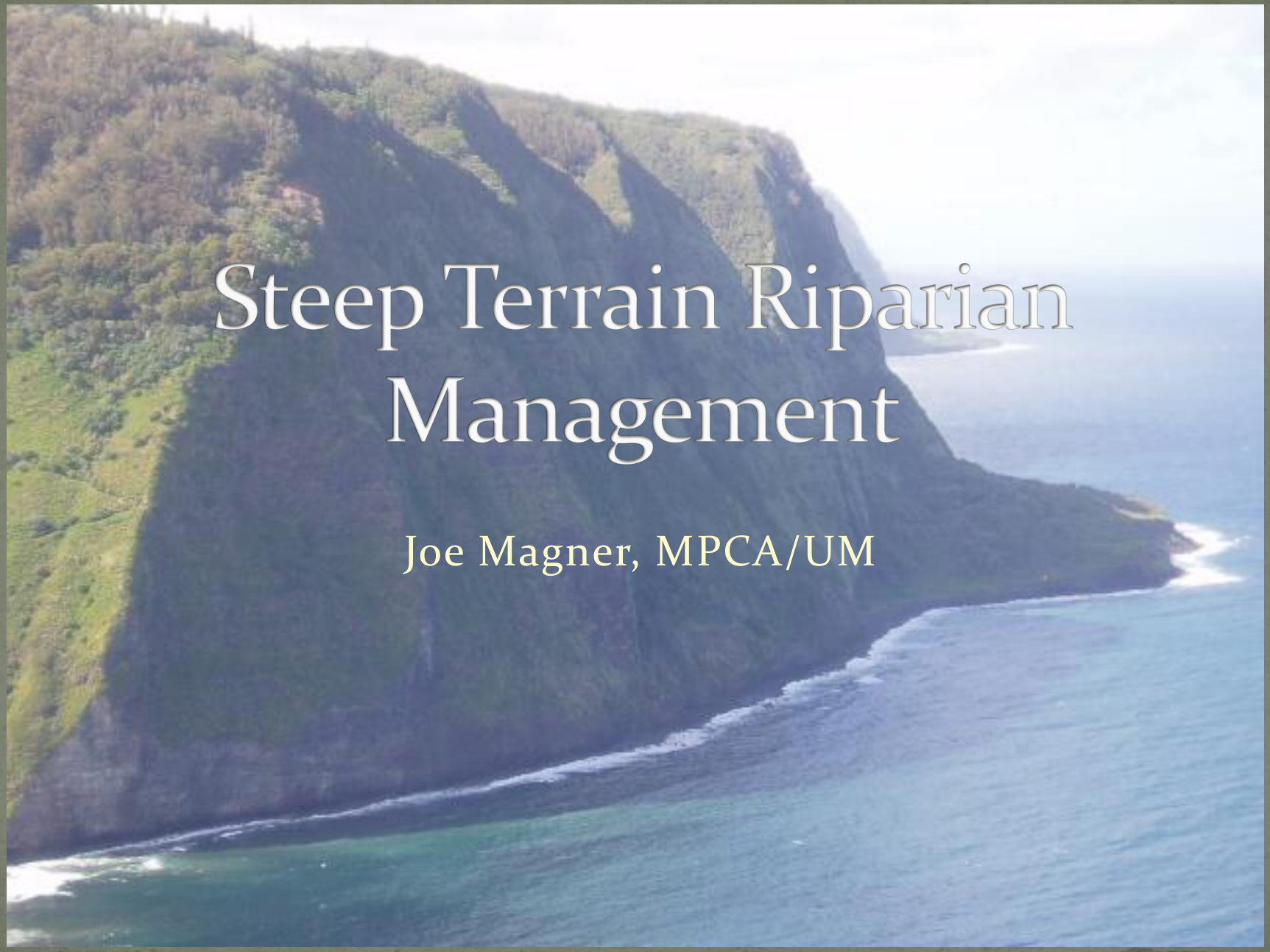
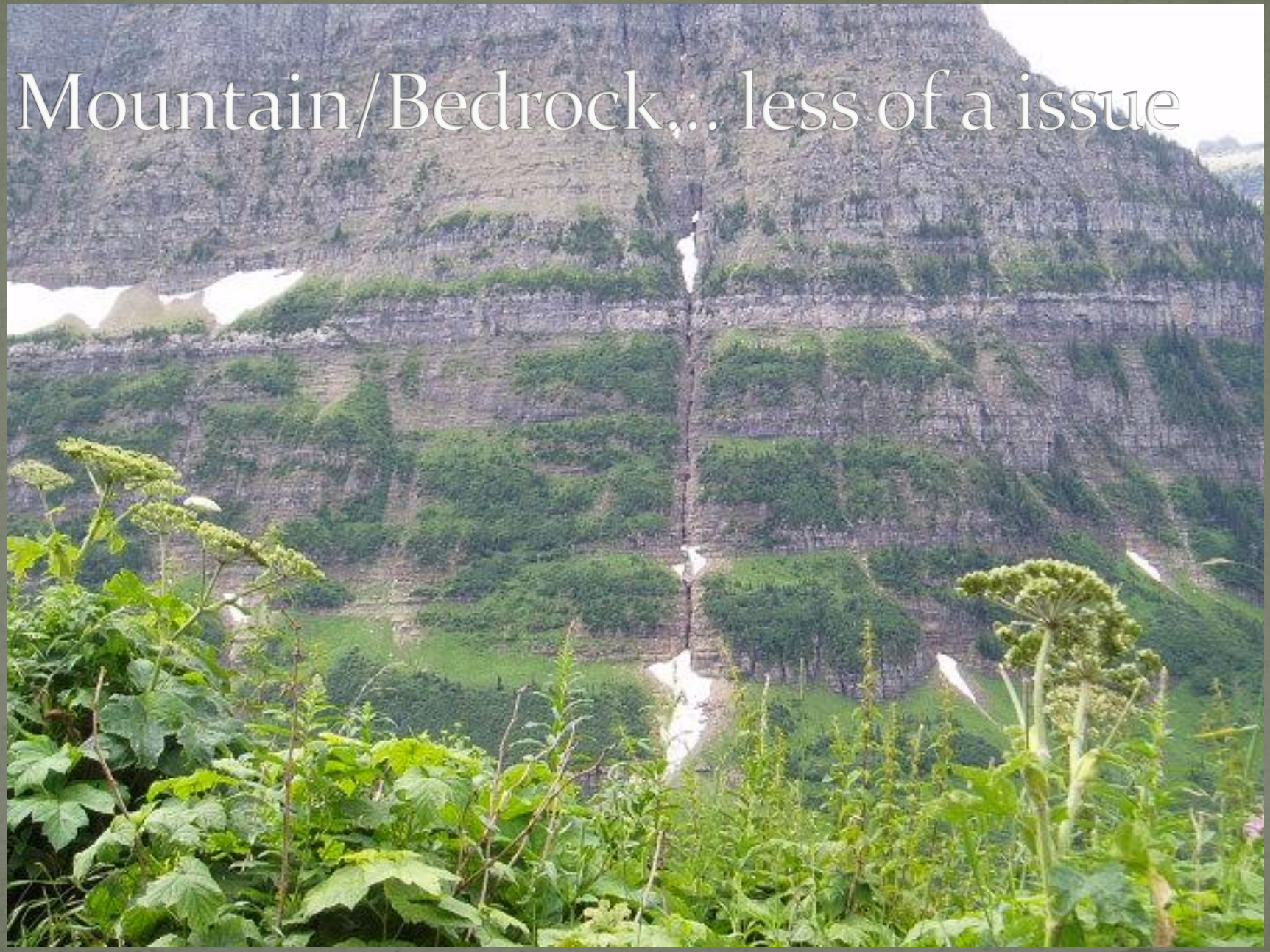


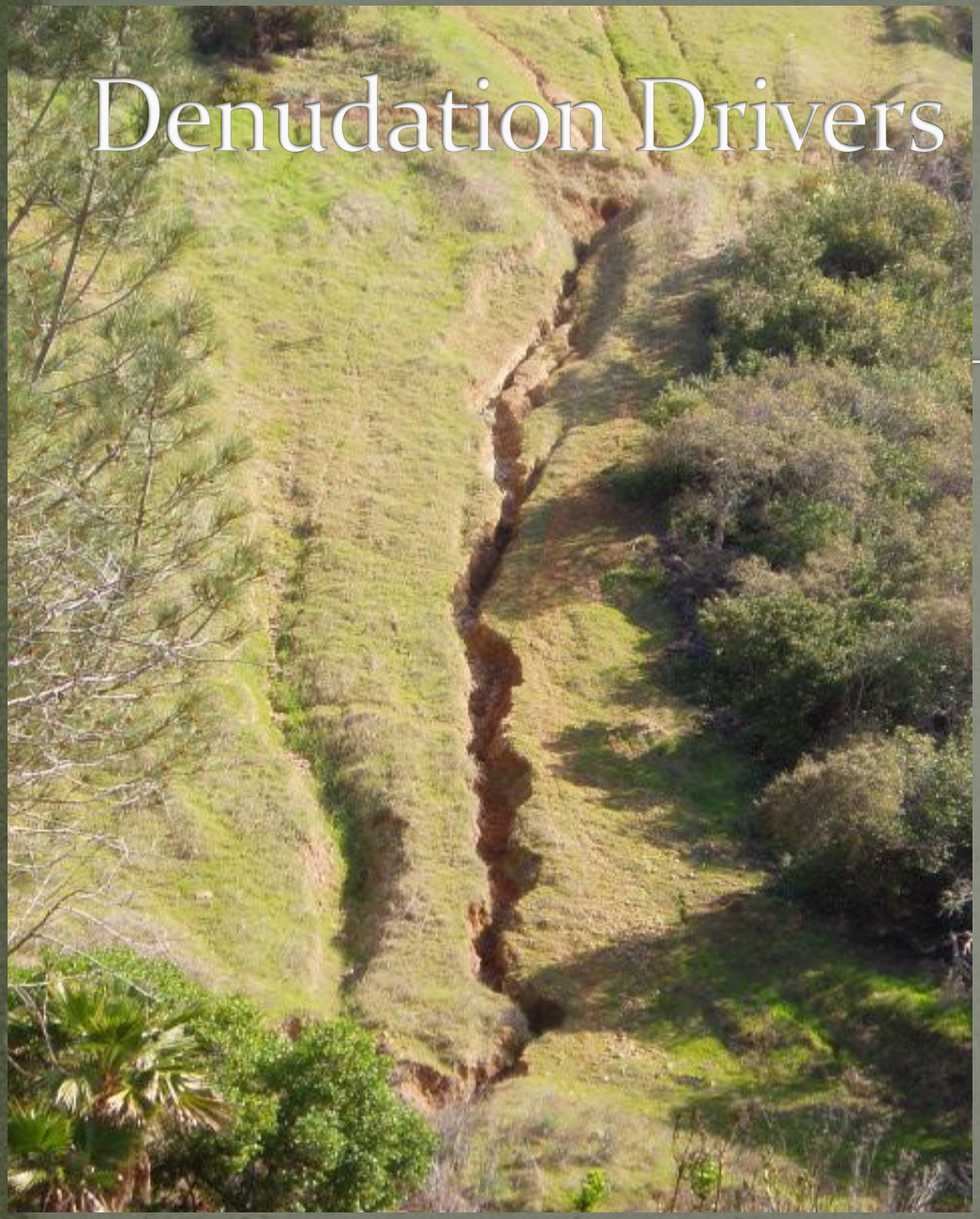
Steep Terrain Riparian Management

Joe Magner, MPCA/UM

Mountain/Bedrock… less of a issue



Denudation Drivers



How Dynamic:

- Climate,
- Vegetative Regime,
- Immediate and Systemic Land use activity,
- Flow & Resistance Factors

Eco-Stability Concepts

- Fragility of the Landscape and when a threshold is exceeded – What Responds?
- Resistance – the ability of an ecosystem to resist changes to external factors.
- Resilience – is the ability of an ecosystem to return "to normal" after perturbations. (Recovery Potential)

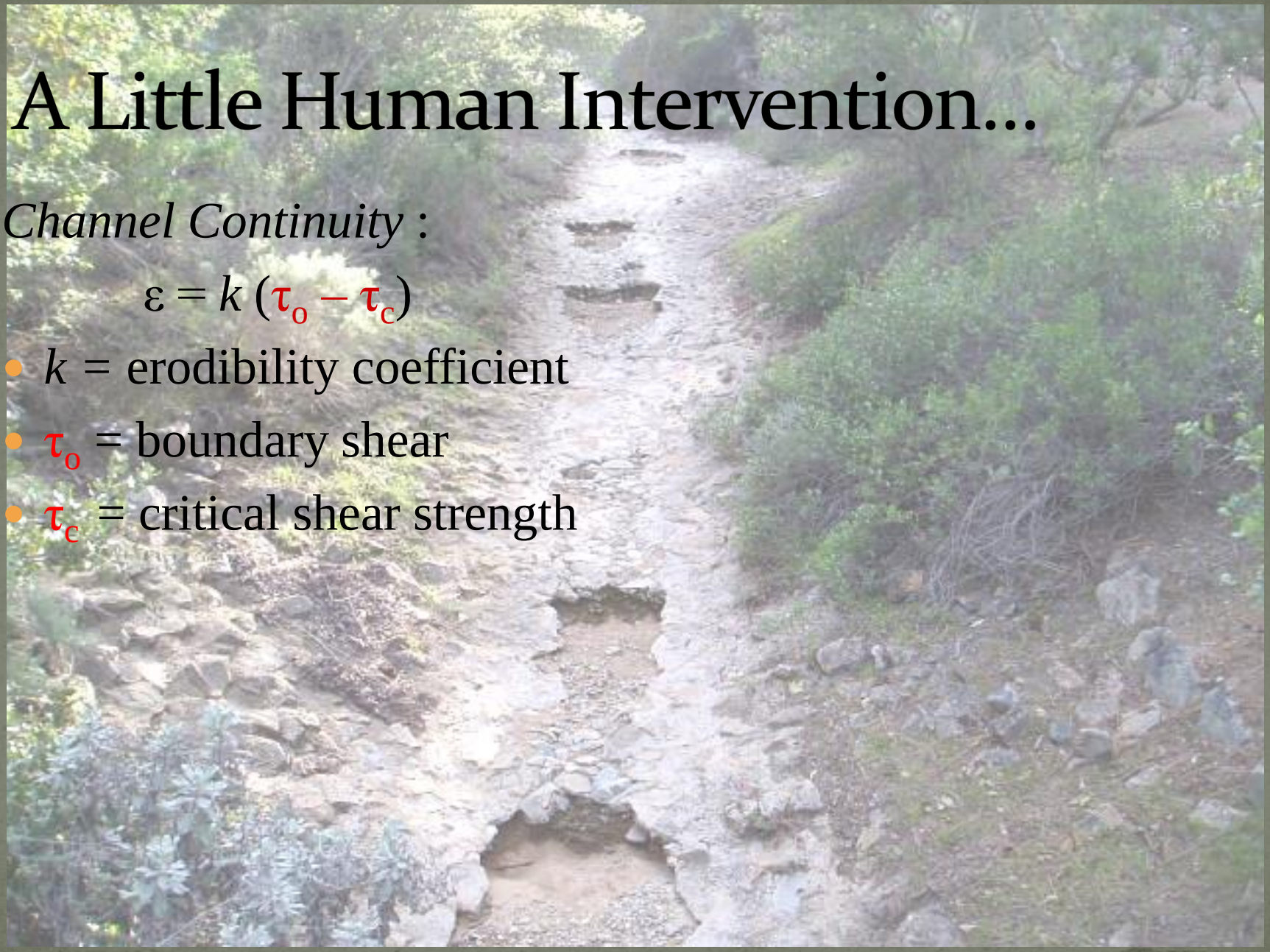
(Normal is not equal to the same exact pre-disturbance condition.)

A Little Human Intervention…

Channel Continuity :

$$\varepsilon = k\,(\tau_o - \tau_c)$$

- k = erodibility coefficient
- τ_o = boundary shear
- τ_c = critical shear strength




No Human Intervention...
$\tau_o < \tau_c$


$\tau_o > \tau_c$

Jørgensen's (2002) Buffer Capacity (β)

$\beta = \Delta(\text{forcing functions}) / \Delta(\text{state variables})$

Forcing functions (Ff) are the external variables that are driving an ecosystem.

i.e., Logging

Disturbance: Eco-System Recovery?

State variables (Sv) are internal variables intrinsic to the definition of the described ecosystem,

i.e., a Ravine in the MN River Valley.

The Ravine has been present and stable ~ 8000 years?

Steep yet Stable

Steep Terrain Mgt Perspective:

- β is the resultant ecological condition reflective of System dynamic s over some defined time period.

- What can be managed?
- What is logistically and economically beyond our ability to manage?

Model w/Trigger Mechanism

$$\beta = [\Delta(Ff)/\ \Delta(Sv)][\varepsilon^{+/-\lambda t}]$$

Trigger Mechanism

ε is the *Channel Continuity* defined above as

$$k\,(\tau_o - \tau_c)$$

- k is an erodibility coefficient and the Tau values's are the counter balancing shear factors; when equal to each other, the system is considered balanced.
- $+/-\lambda t$ is a dimensionless exponent indicating rate and direction of sediment balance change;

  where + = aggradation, - = degradation

Age-Old Practice


Is this going WORK?


Whipps Ravine

Interpret Action Steps for a given Setting!


What is τ_c?

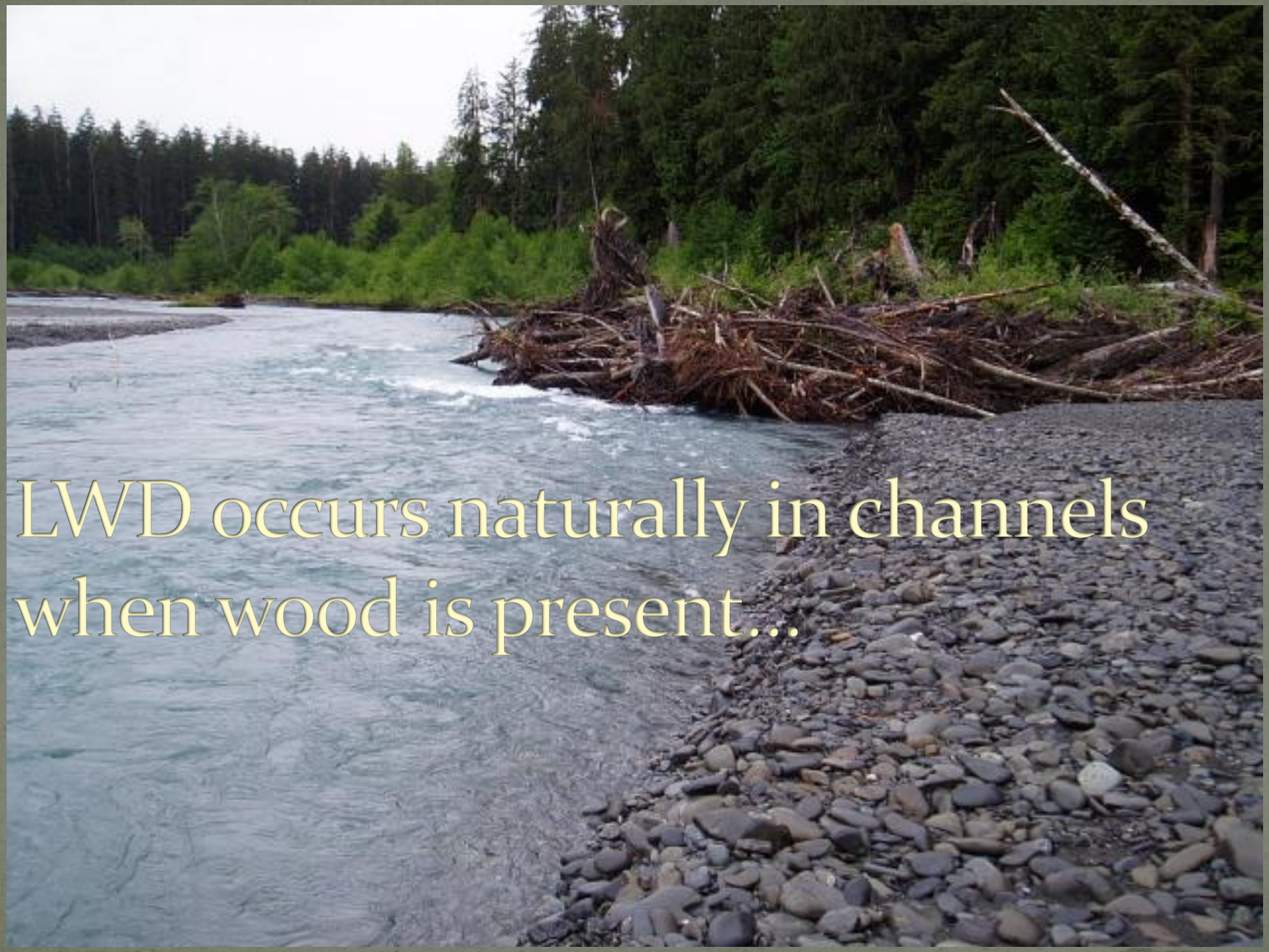

Measure τ_c

Type of Failure?

Measure What Changed


Tree Cores: Time Frame of Change


Observe what is working…


LWD occurs naturally in channels when wood is present....

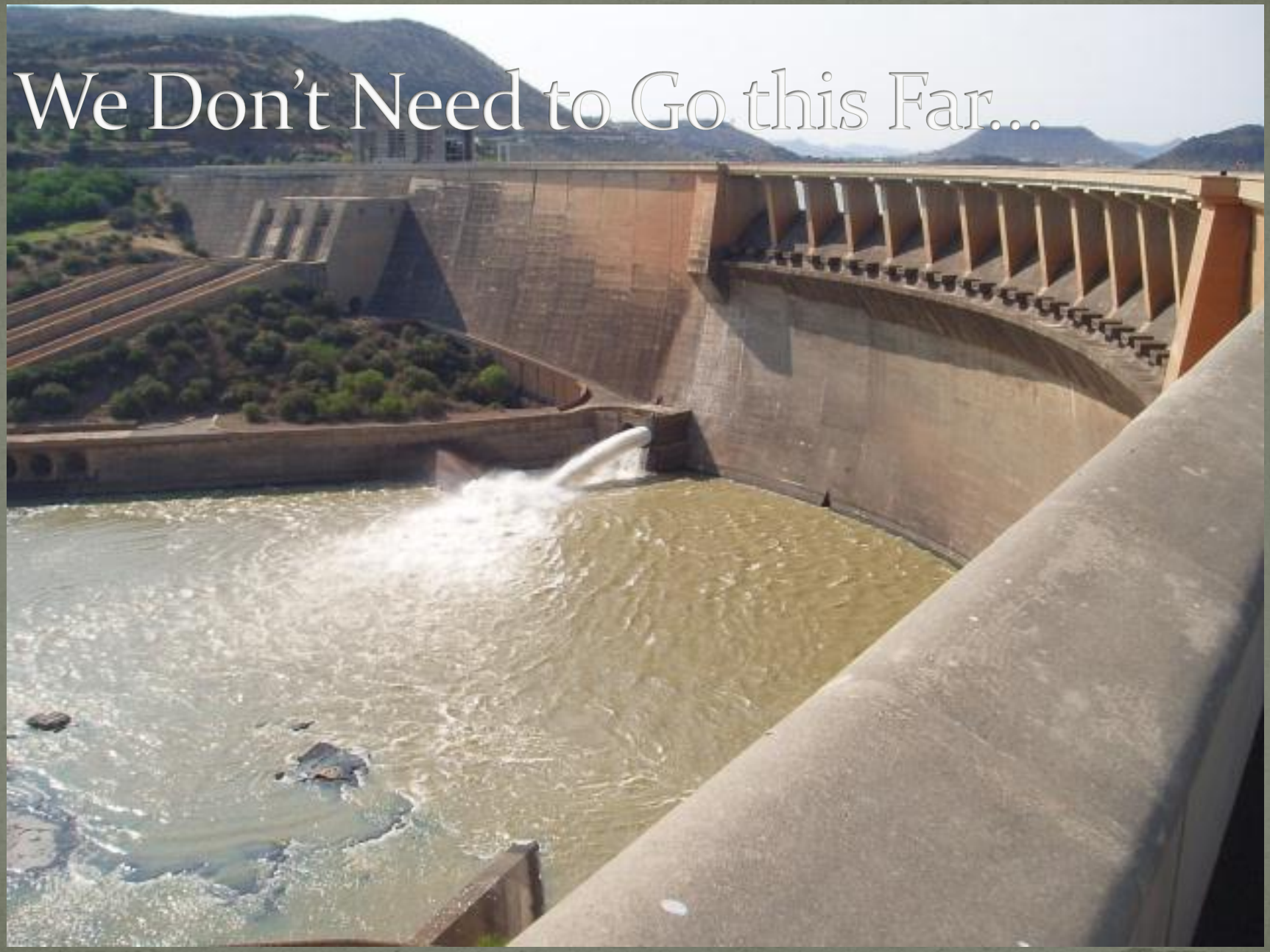
Priority Management Zone (PMZ)

Manage Resistance via LWD

Labor Intensive…


conservation
corps

We Don't Need to Go this Far…



Questions...