The background features abstract, overlapping geometric shapes in various shades of green, ranging from light lime to dark forest green. The shapes are primarily triangles and polygons, creating a dynamic, layered effect. The overall composition is clean and modern, with the text centered on a white background.

# Geomorphic Resilience: An Argument for a Modified Definition

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# About Me

- ▶ MSc in Fluvial Geomorphology
- ▶ Urban river large woody debris
- ▶ Characterizing and comparing
- ▶ Study reaches in Toronto's Wilket Creek
- ▶ Restoration for erosion control



# What is Geomorphic Resilience?

- ▶ No singular definition
- ▶ Most are vague or too specific

Generally:

- ▶ The ability to recover after a disturbance or stress (Naylor *et al.*, 2017; Wohl, 2013)

# Objectives

- ▶ Outline the need for a stronger definition
- ▶ Explore temporal and anthropogenic elements
- ▶ Define resilience



# Why a singular definition?

- ▶ Frame of reference for context and evaluation (Lave *et al*, 2014)
- ▶ Unification of various interests
- ▶ Management, research, restoration



# Are Rivers Resilient?

- ▶ By nature, are geomorphic systems resilient?
- ▶ Water always flows down slopes
- ▶ Water will always shape sediment
- ▶ The path by which it travels changes

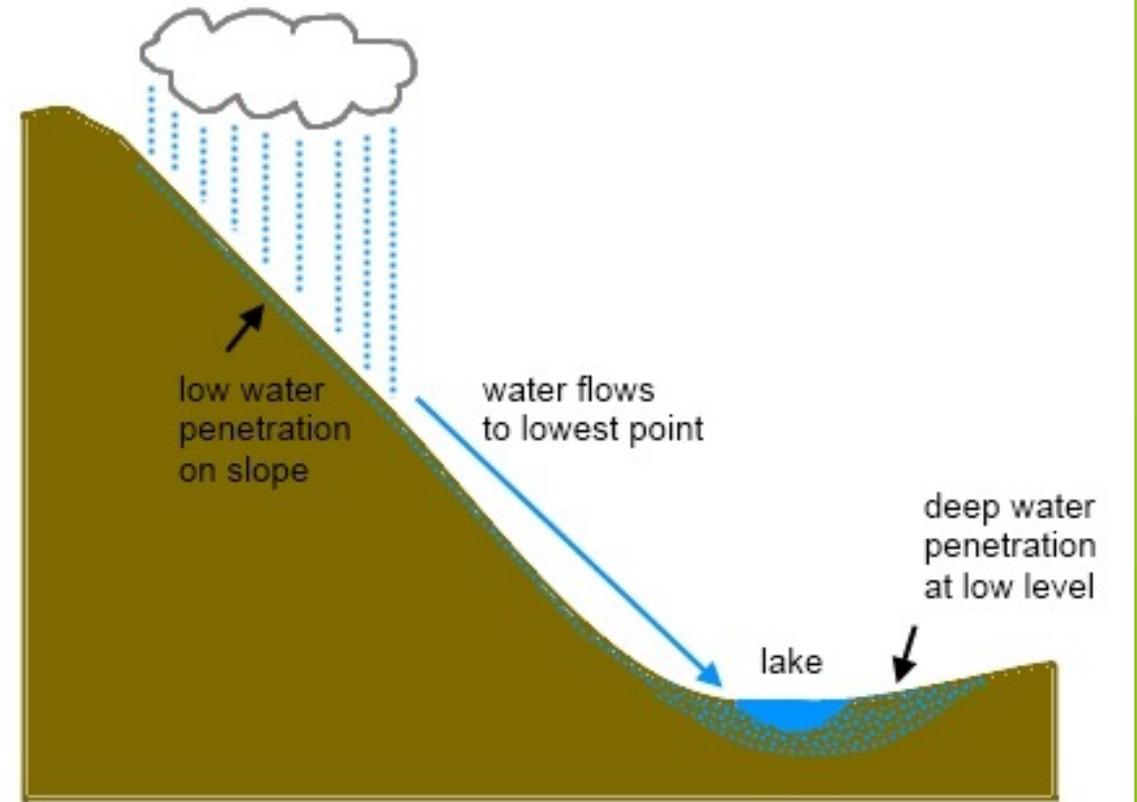


Image: [Deep Green Permaculture](#)

# Current Shortcomings

## Scale:

- ▶ Time
- ▶ Space

## Change:

- ▶ Size
- ▶ Duration/Frequency

## Outcome:

- ▶ Stable state
- ▶ Alternate state

## Human Bias:

- ▶ Cost/Profit
- ▶ User defined



# Temporal Influences

- ▶ “(...) a resilient river recovers channel geometry and sediment fluxes following a large flood (Wohl, 2013, P. 7).”
- ▶ Threshold change
- ▶ Long term stressors

# Wilket Creek's Temporal Stress

- ▶ Urbanization
- ▶ Unrelenting stress
- ▶ Never to return
  
- ▶ Channel Design
- ▶ Alternative stable state



Bottom: Aryn Cain

# Alternative States

## Benefits:

- ▶ Resistance to stress
- ▶ Recovery post stress
- ▶ Threshold state changes

(Naylor *et al.*, 2017)

## Going Further:

- ▶ Is stable state even the goal?
- ▶ Variation in state
- ▶ Flexibility to further stress

(Lave *et al.*, 2014)

# Updated Definition

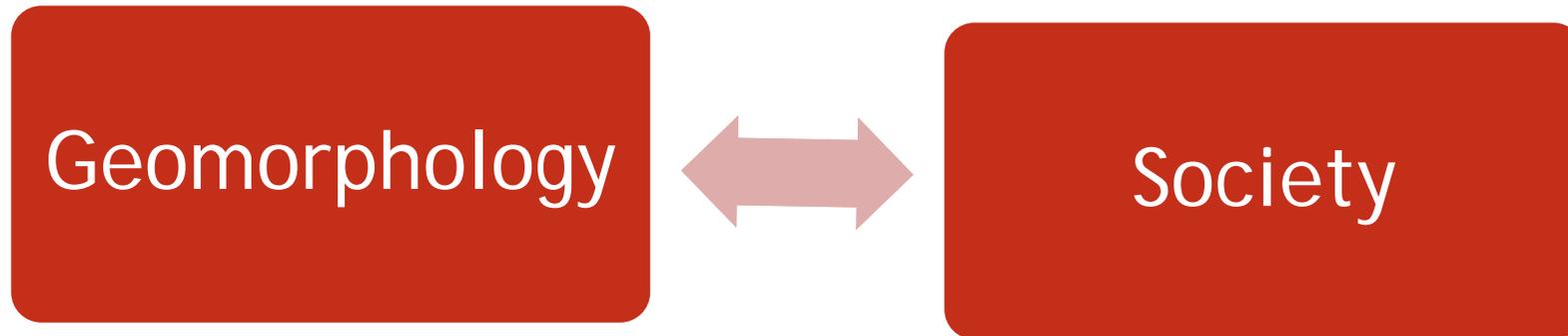
## General:

- ▶ The ability to recover after a disturbance or stress (Naylor *et al.*, 2017; Wohl, 2013)

## First Take:

- ▶ The ability of the channel to adjust form and sediment transport to discrete and ongoing stresses

# Anthropogenic Influences



- ▶ Society as a stressor
- ▶ Social resilience
- ▶ Management vacuum

# Socio-Geomorphology

- ▶ More-than-Physical-Geography
- ▶ Spectrum of human impact
- ▶ Absorb or adapt
- ▶ Ecosystem services approach



# Value of Wilket Creek

## Cultural Values:

- ▶ Recreation
- ▶ Urban Nature

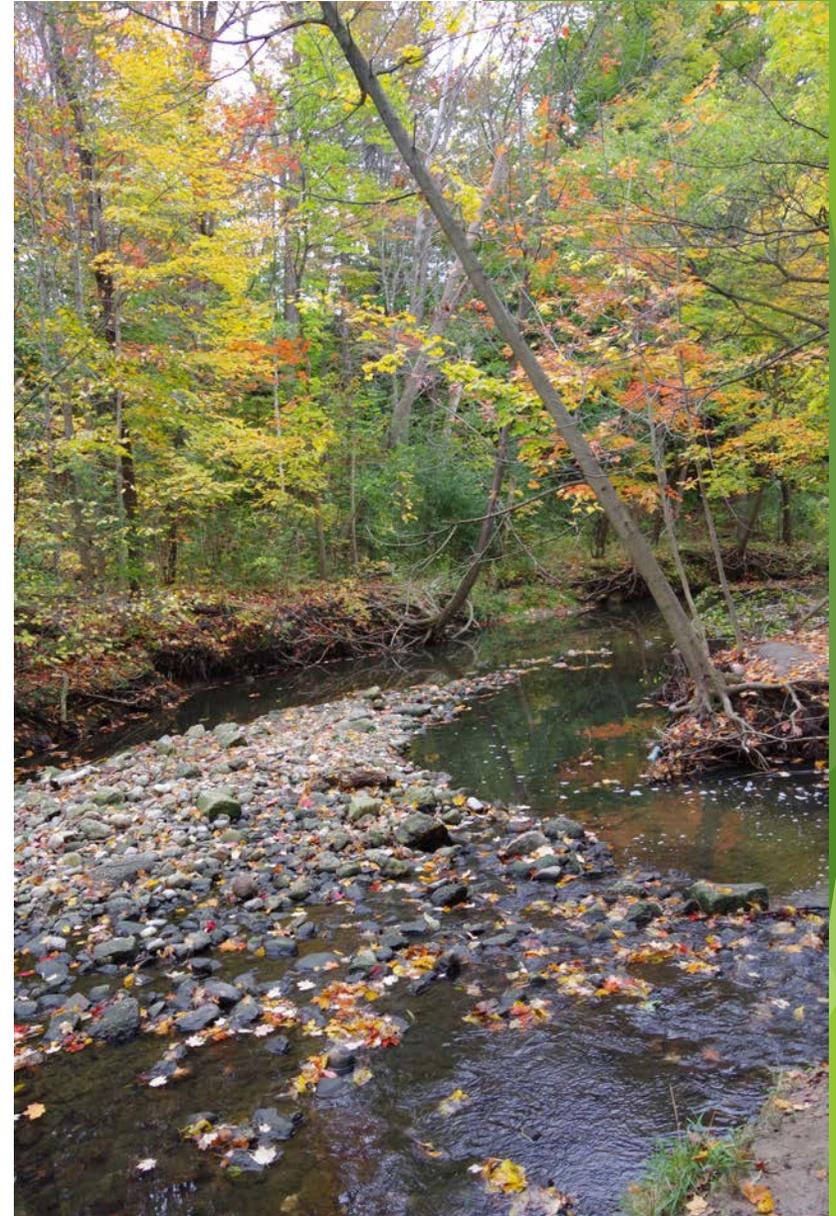
## Structural Values:

- ▶ Storm Water
- ▶ Sewer Protection



# Co-Evolution

- ▶ 'Natural' and 'human' systems
- ▶ Balance
- ▶ Compromises to achieve resilience
- ▶ Consider past, present, and future  
(Ashmore, 2015)



# Proposed Definition

Proposed:

- ▶ The ability of the channel to adjust channel form and sediment transport to discrete and ongoing stresses while preserving aspects of social and cultural value

