

OUR LAND
AND WATER

Toitū te Whenua,
Toiora te Wai

Cascade of Soil Erosion to River Sediment

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Landcare Research
Manaaki Whenua



MASSEY
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TE KUNENGA KI PŪREHURŌA

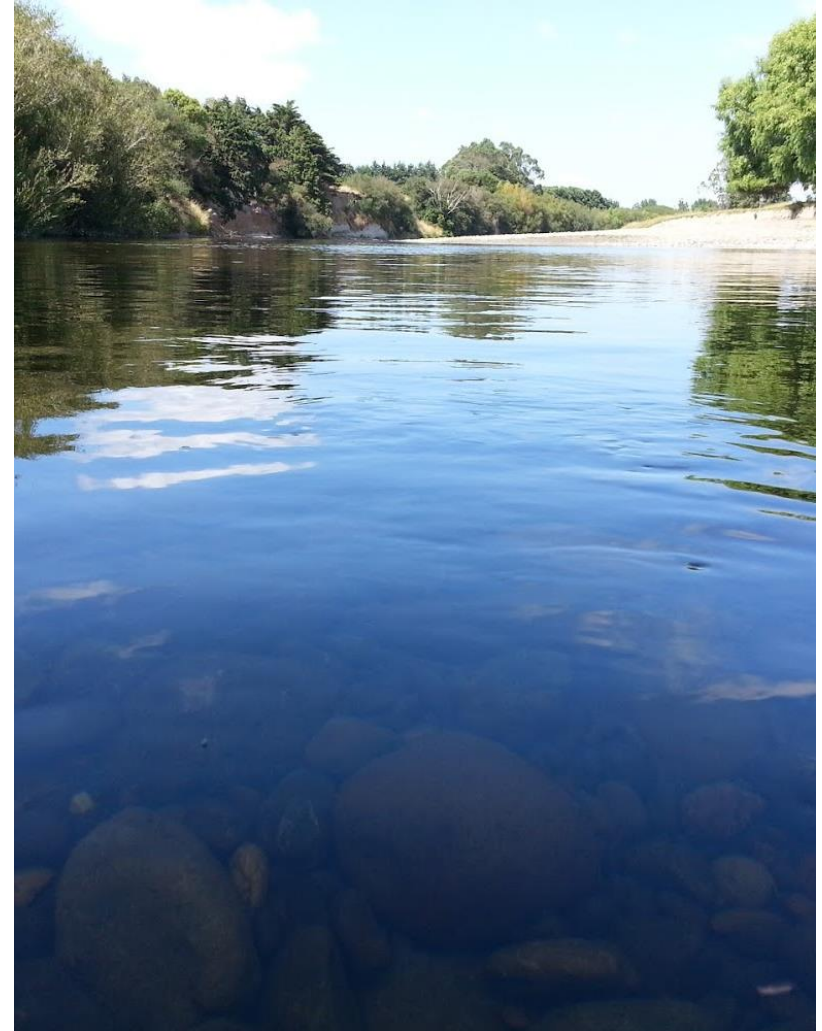
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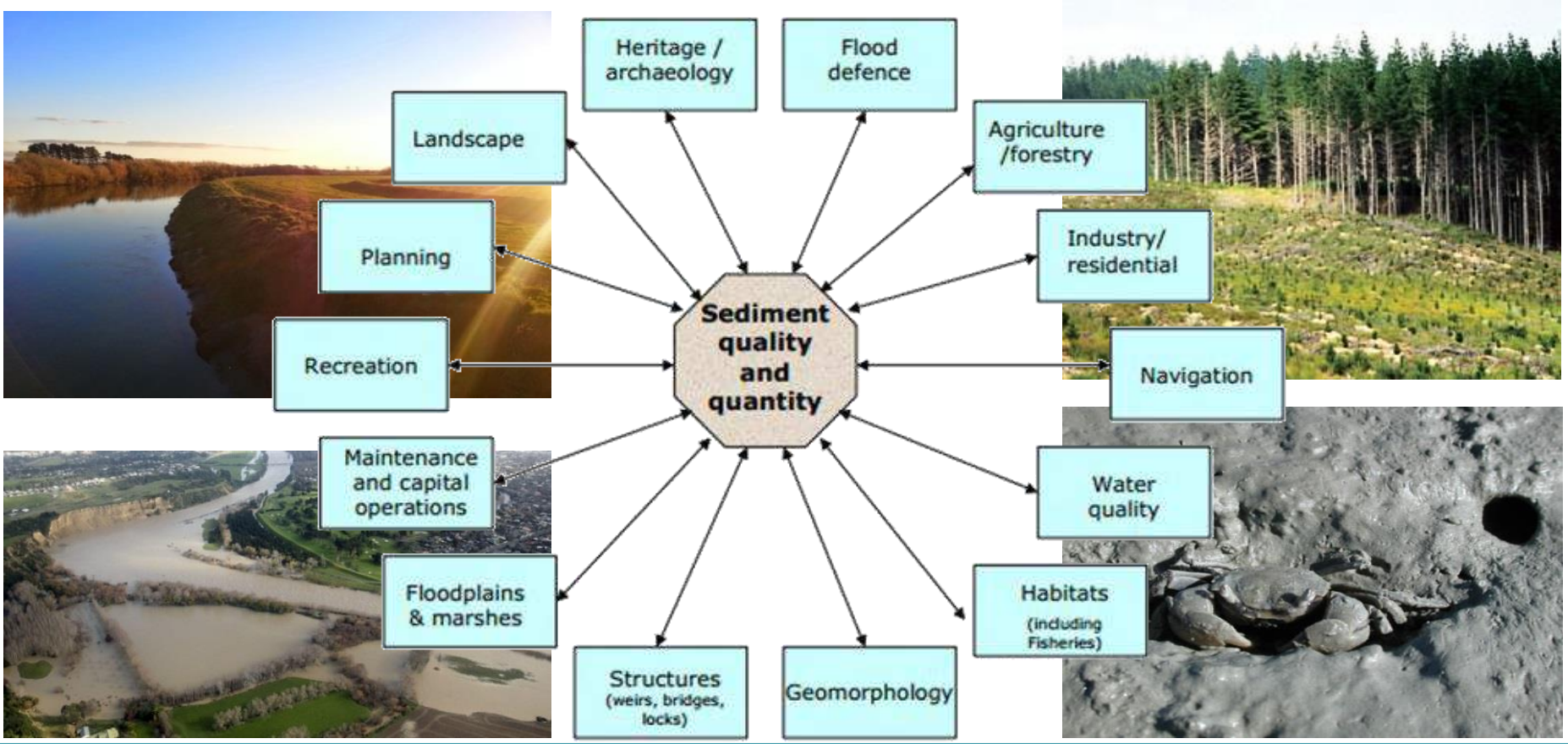
horizons
regional council

Overview

- What is Sediment?
- The Sediment Cascade
- The Research
 - Sediment Rating Curves
 - Hysteresis Analysis
- Collaboration, co-development, Vision Mātauranga
- Summary

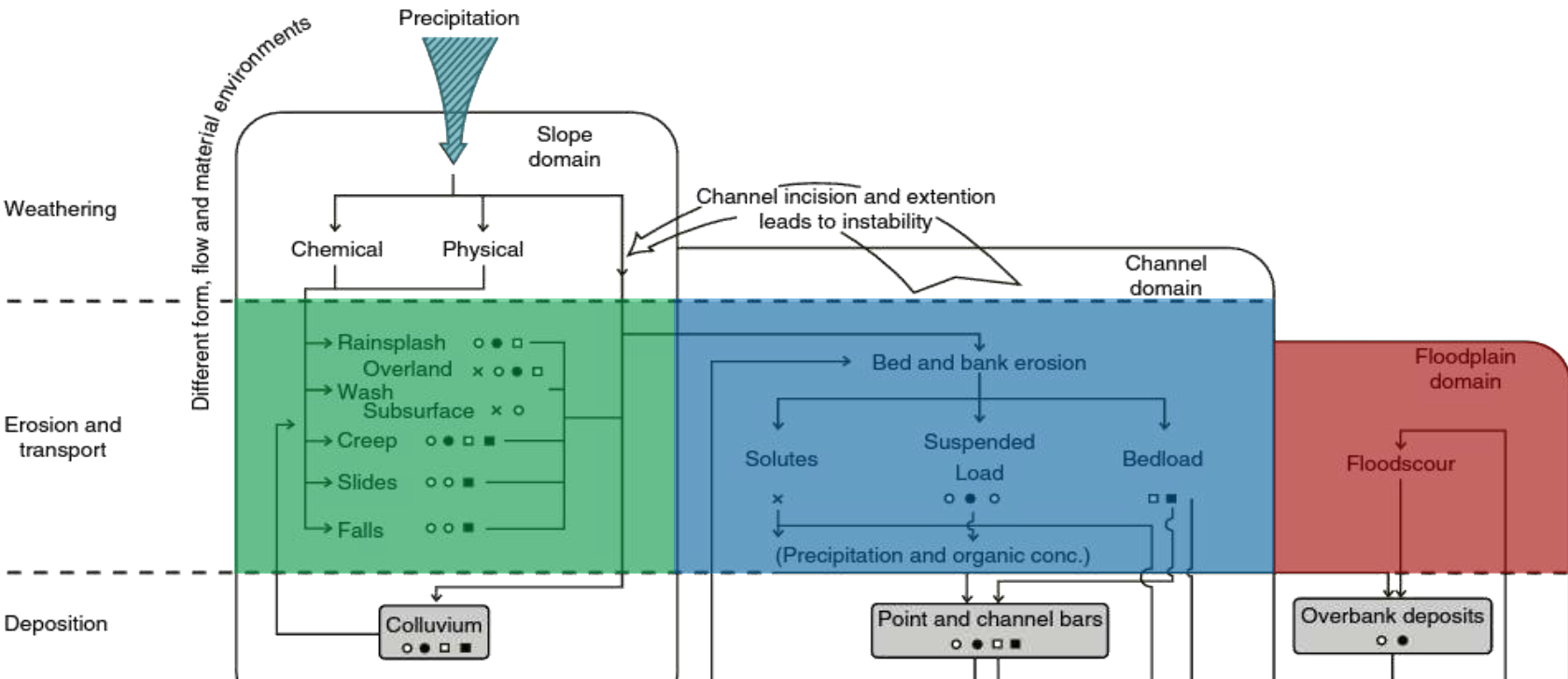


What is Sediment?



To prevent and reduce associated environmental problems it is necessary to understand mobilization, transfer and fate of fine sediment within catchments, to support the development and implementation of effective fine sediment control and management
(Walling, Golosov, & Olley, 2013)

Introduction: The Sediment Cascade

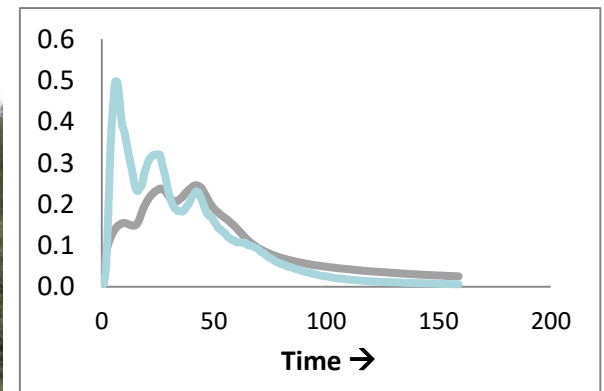


The Research

Aim: Spatial-temporal model of sediment sources and stores in a catchment and the transport of fine sediment through the river network



Hypothesis: Primary sediment sources and intermediate stores in the first-order catchments control the temporal supply of sediment to rivers



The Research

Soil Conservation

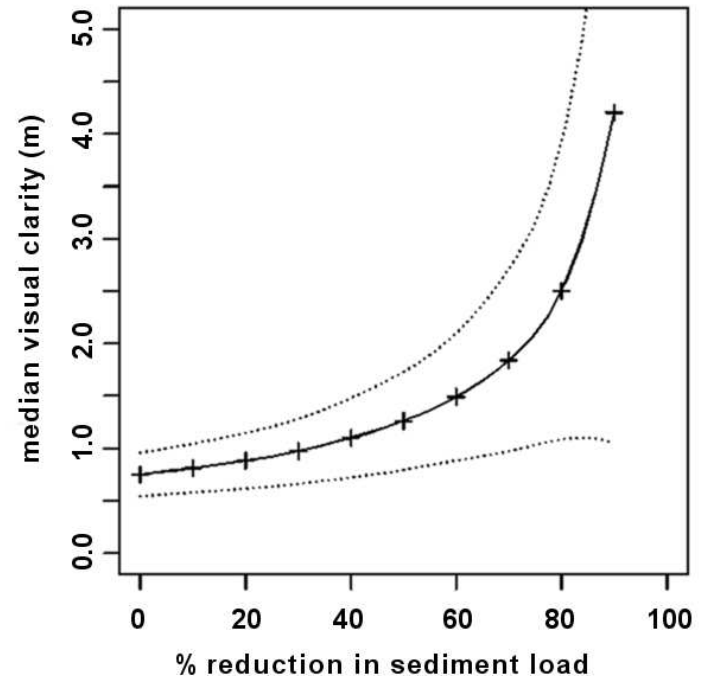
- Soil conservation or afforestation will reduce sediment delivered to rivers

Impacts

- Reduction of sediment in rivers improves freshwater sediment attributes, such as visual clarity and depth of light penetration

Assumptions

- The estimated improvement is based on “**sediment rating curves**”, which assume average change and cannot be used with confidence over a range of flows

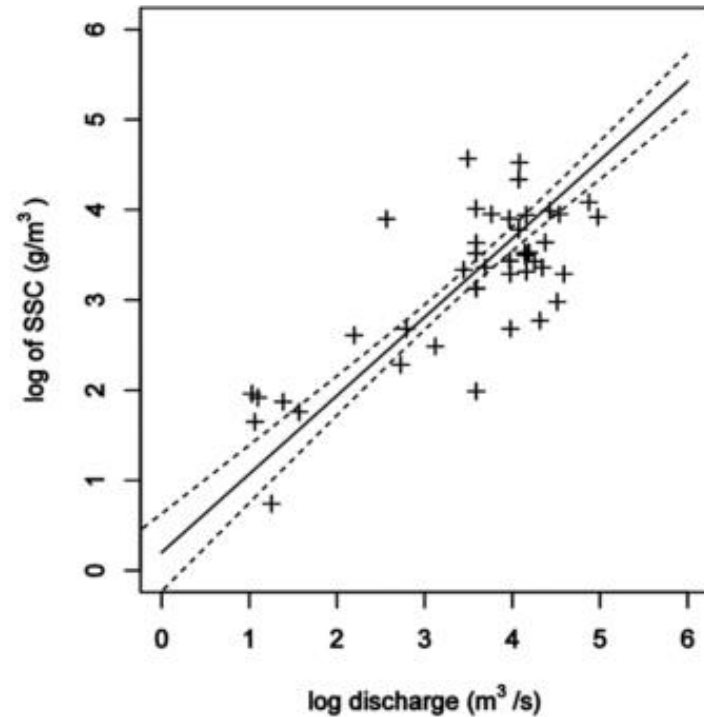


Dymond et al., (In Press) determined the increase in median visual clarity based on the % reduction of sediment load

A 50 % reduction in sediment load would increase median visual clarity from 0.75 m to 1.25 m.

Sediment Rating Curves

“A **sediment rating curve** describes the relation between discharge and suspended **sediment concentration**”

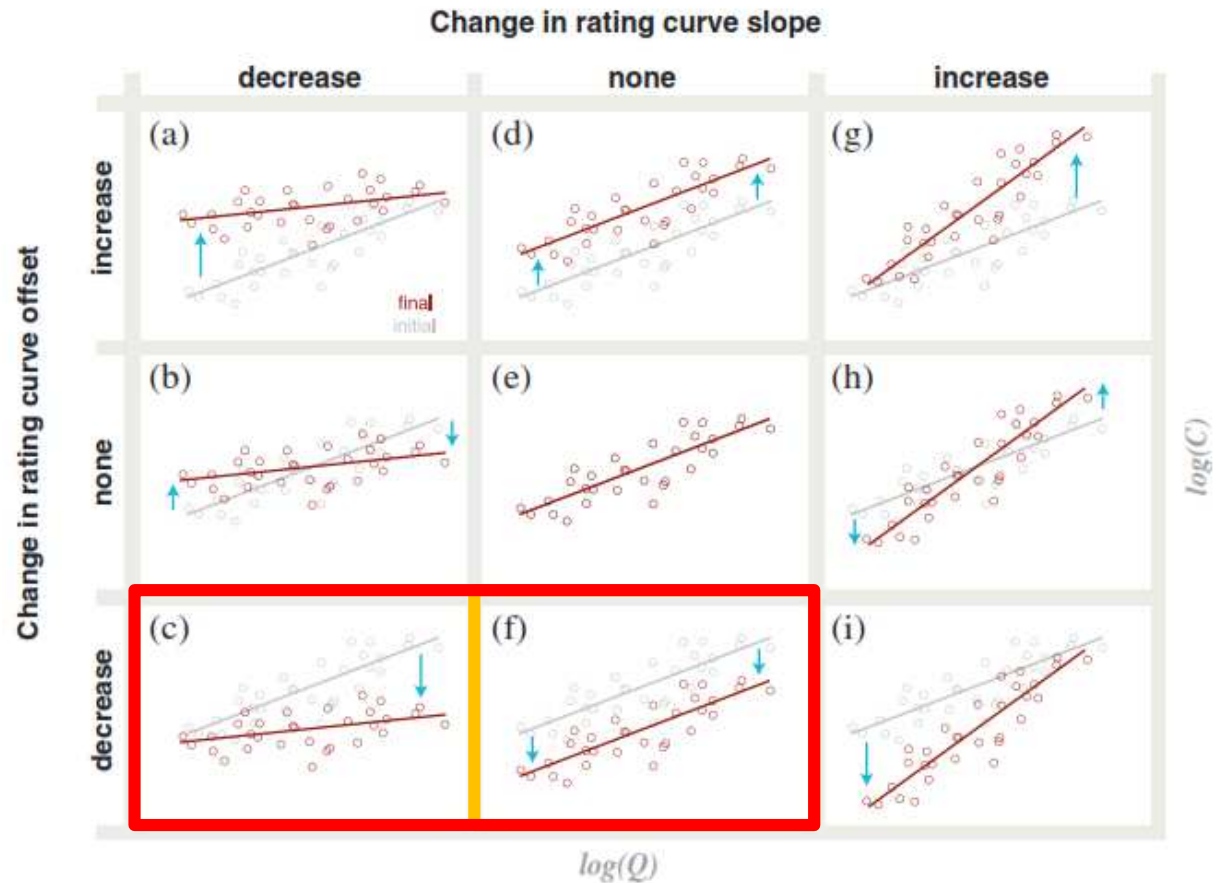


$$\text{Log}(C) = b \log(Q) + \log(a)$$

Dashed lines show plus or minus one standard error of

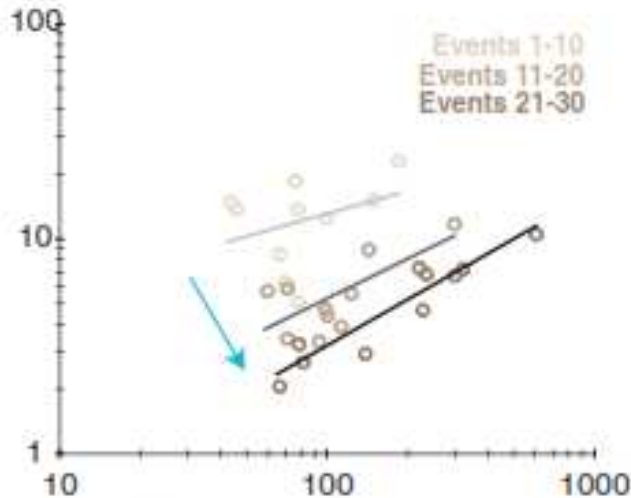
Sediment Rating Curves

Conceptual trends between suspended-sediment concentrations and discharge



Sediment Rating Curves

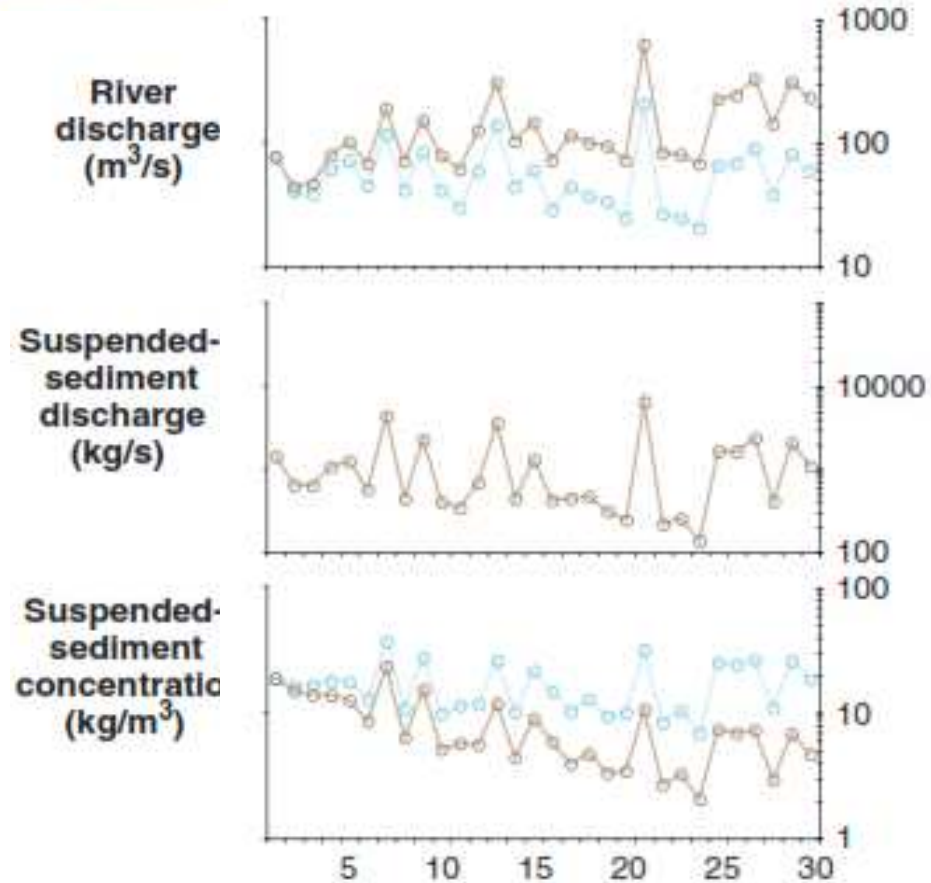
- Land management changes Sediment Rating Curves
- Changes in discharge and sediment concentration
 - Increase river discharge - reduction in sediment concentration



Suspended-sediment concentration (kg/m³)

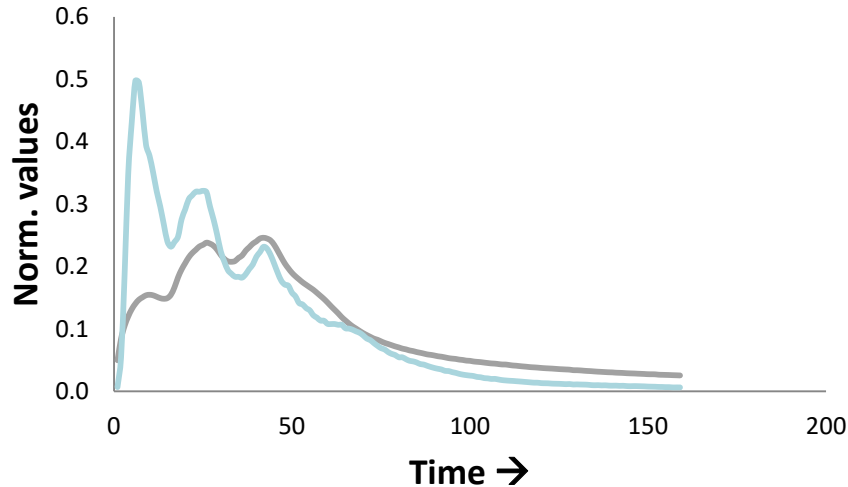
with modification
without modification

Scenario 2: Increase in river discharge

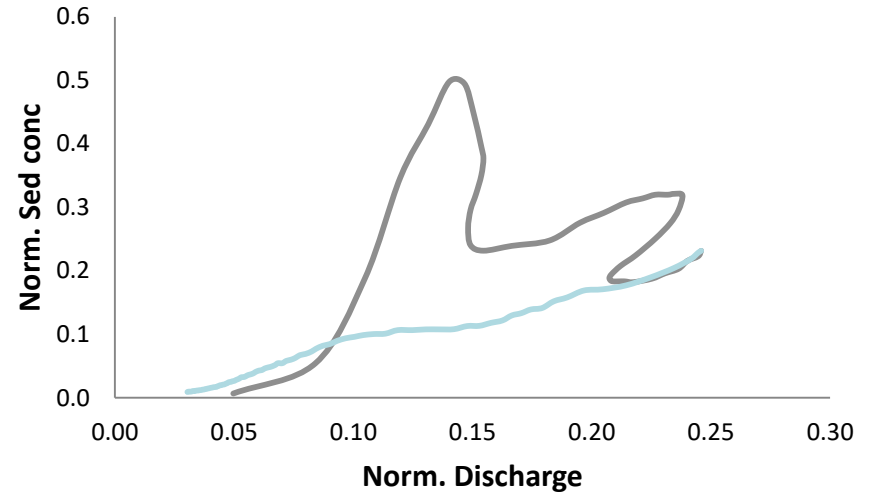


A linear increase in water discharge without modification of the suspended-sediment discharge.

Hysteresis Analysis



— Discharge — Sediment Conc.



— Rising — Falling

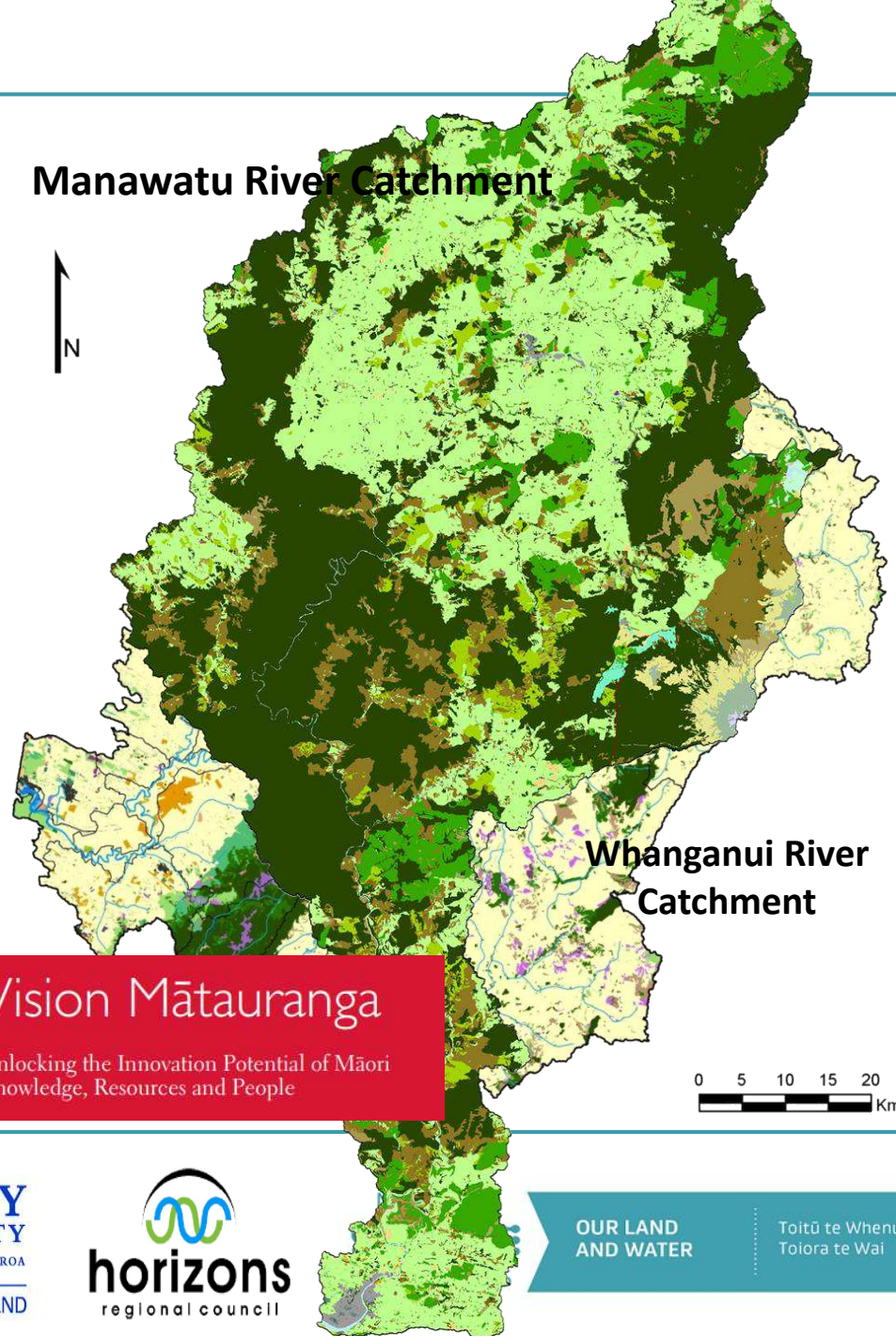
- SRC assume stationarity and we have evidence this is not always the case
- Hysteresis effects are not often factored in to SRCs
- Patterns of hysteresis will provide information on sediment source variation

To improve this understanding for New Zealand catchments we can analyse how the sediment rating curves relate to the timing and location of individual rainfall events, and infer the status of sediment sources and stores.

Collaboration, co-development, Vision Mātauranga

- Co-development with Ngati Hau and Nga Hononga Marae Trust
 - Tools to guide land-use decisions for achieving economic and social aspirations
 - Active role with land management agencies
- Development of Maori potential in science
 - Supervision of Maori PhD candidate in sediment tracing work in the Whanganui Catchment

Manawatu River Catchment



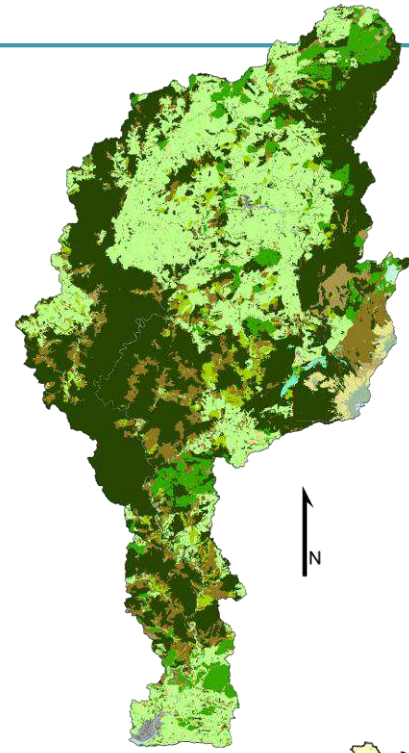
Vision Mātauranga

Unlocking the Innovation Potential of Māori Knowledge, Resources and People

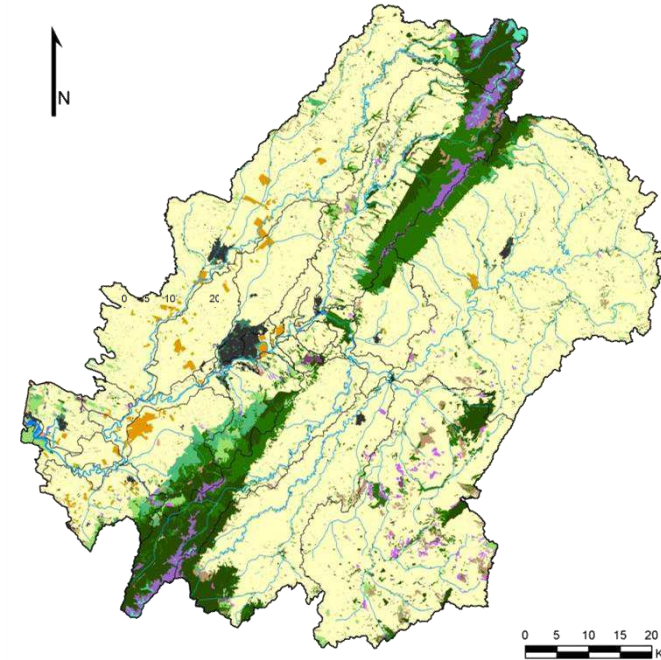
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Collaboration, co-development, Vision Mātauranga

- Aligns with NSC Sources and Flows and Land Use suitability programmes
 - Important process understanding
- Supports Landcare Research SSIF through SedNetNZ
 - Temporal & Spatial
- Management and Government
 - Inform understanding for RC's, targeted on-farm and land management practice
 -



Whanganui River Catchment



Manawatu River Catchment

Summary

- The sediment cascade is a fundamental component of our environment
- Predicated effects of soil conservation on freshwater sediment attributes rely on Sediment Rating Curve assumptions
- Analysis of Sediment Rating Curve and Hysteresis patterns can improve our understanding of soil erosion and sediment delivery at spatial and temporal scales
- This informs national understanding and quantification of sediment risk and enables targeted on-farm and land management practice change
- Aligns with and supports NSC: Sources and Flows, Land Use suitability and Vision Mātauranga



Thank you