Building catchment resilience: A strategy, methodology and tool to meet future challenges

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The global call to action is building to create positive, multi-objective improvement for people, land and water

Global, National, Regional and Local Pressures include:

- UN 2030 Climate Targets
- UN Decade on Ecosystem Restoration (2021-2030)
- DCCEEW 2022 State of the Environment Report
- DAFF Carbon Neutral Target by 2030
- Natural capital investment (e.g., nutrient markets)
- Biodiversity loss, water supply issues
- Loss of valuable farmland
- Flood damage to infrastructure
- Climate impacts

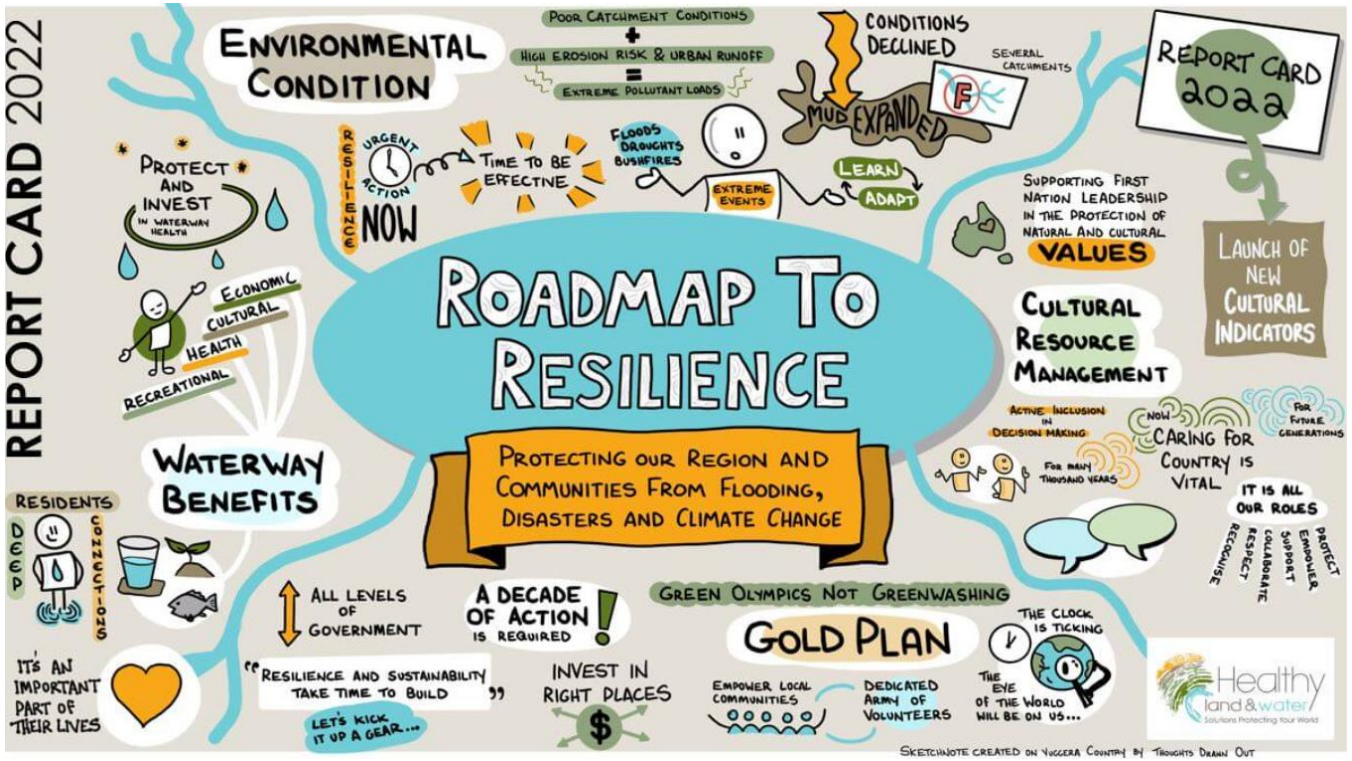
Sat 26 Feb, 2022
Bruce Highway to Brisbane
Gympie

Mulgowie farms rehabilitation area
Laidley Creek
April 2022

We understand the problem well

Diffuse pollution threatens our waterways, biodiversity and water security. Without an integrated approach, there are likely to be significant ongoing environmental, economic and social costs

- Most catchment are in poor condition with high erosion risks and pollutant loads
- Environmental condition is declining
- Building climate resilience for catchments and waterways is urgent to protect people, environment and cultural resources; *it will take time to be effective, so action must be taken now for the future*



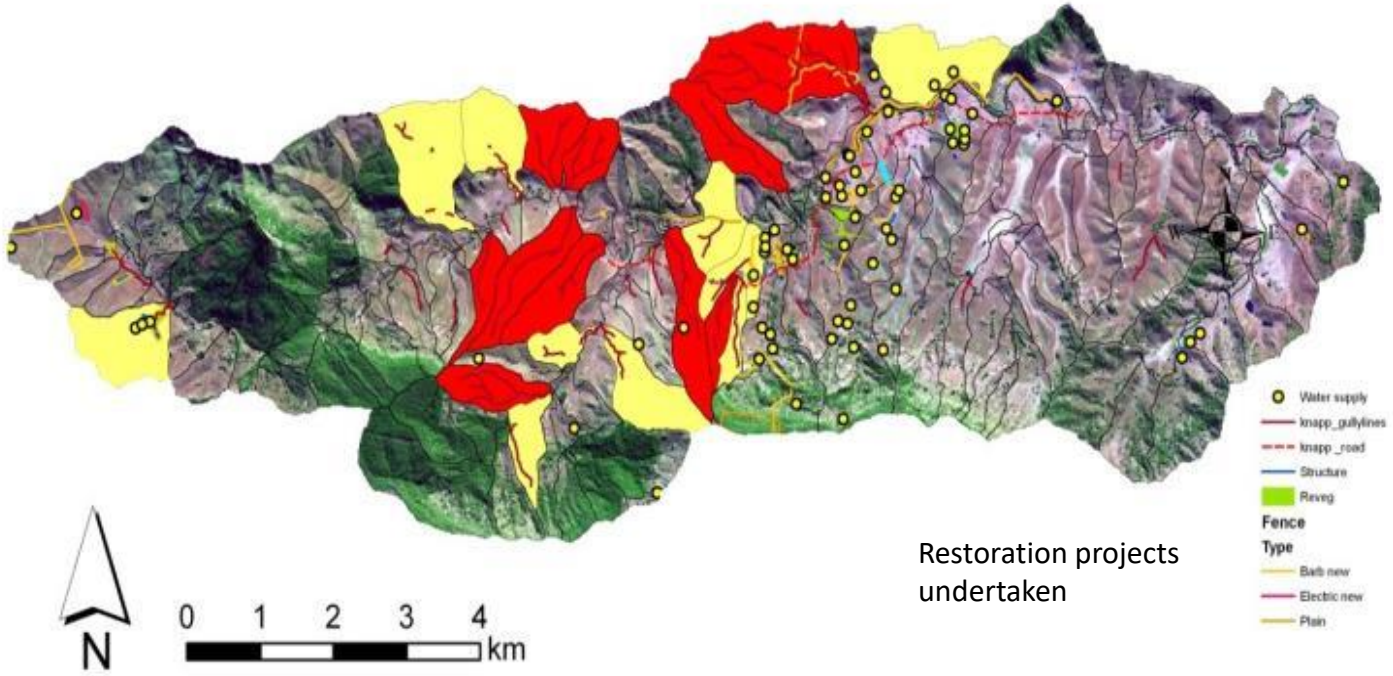
https://reportcard.hlw.org.au/

Solutions are found upstream for impacts experienced downstream

We need targeted investment

To date, we have not had the tools to target investment in an optimised way, and the benefits have not been fully realised

We often find most of the pollution comes from a small proportion of the channel network



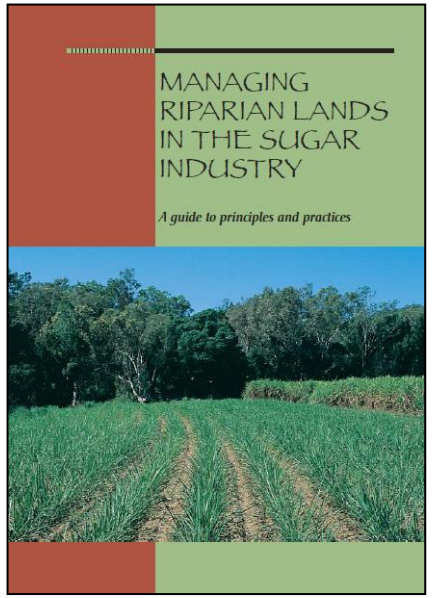
Restoration projects undertaken

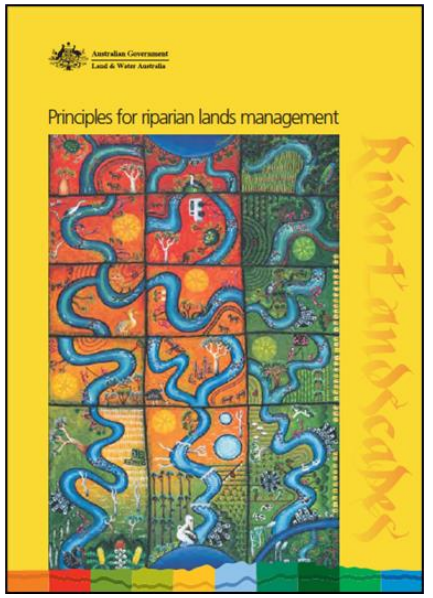
Example from the Logan-Albert catchment, Queensland:

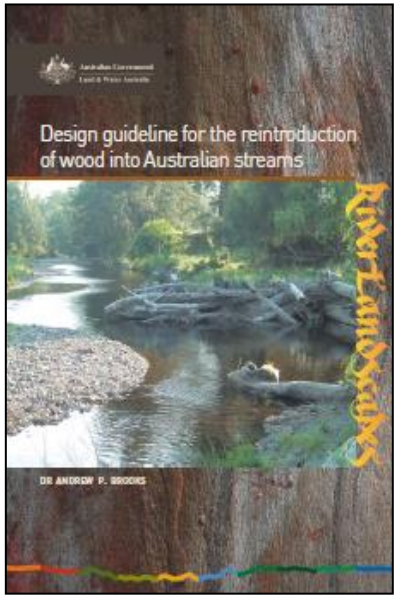
- Red areas represent approx. 10% catchment area, and approx. *60% of sediment supply*
- Yellow areas represent approx. 10% catchment area and approx. *20% of sediment supply*
- Coloured lines and dots represent areas where *investments have been made*

Actions aimed to slow the rate of flow, reduce erosion, and trap and transform nutrients and other pollutants; ultimately to improve catchment resilience

1. Riparian and riverbank rehabilitation (including revegetation, constructed pylon fields, to increase channel roughness)
2. Hillslope revegetation – including replanting, improved grazing and fire management
3. Gully remediation
4. Wetlands – reconnection; creation







The key challenges…

How to:

- choose what actions where?
- optimise investment for multiple outcomes?

} multi-objective investment tool

- reach consensus?
- build confidence?

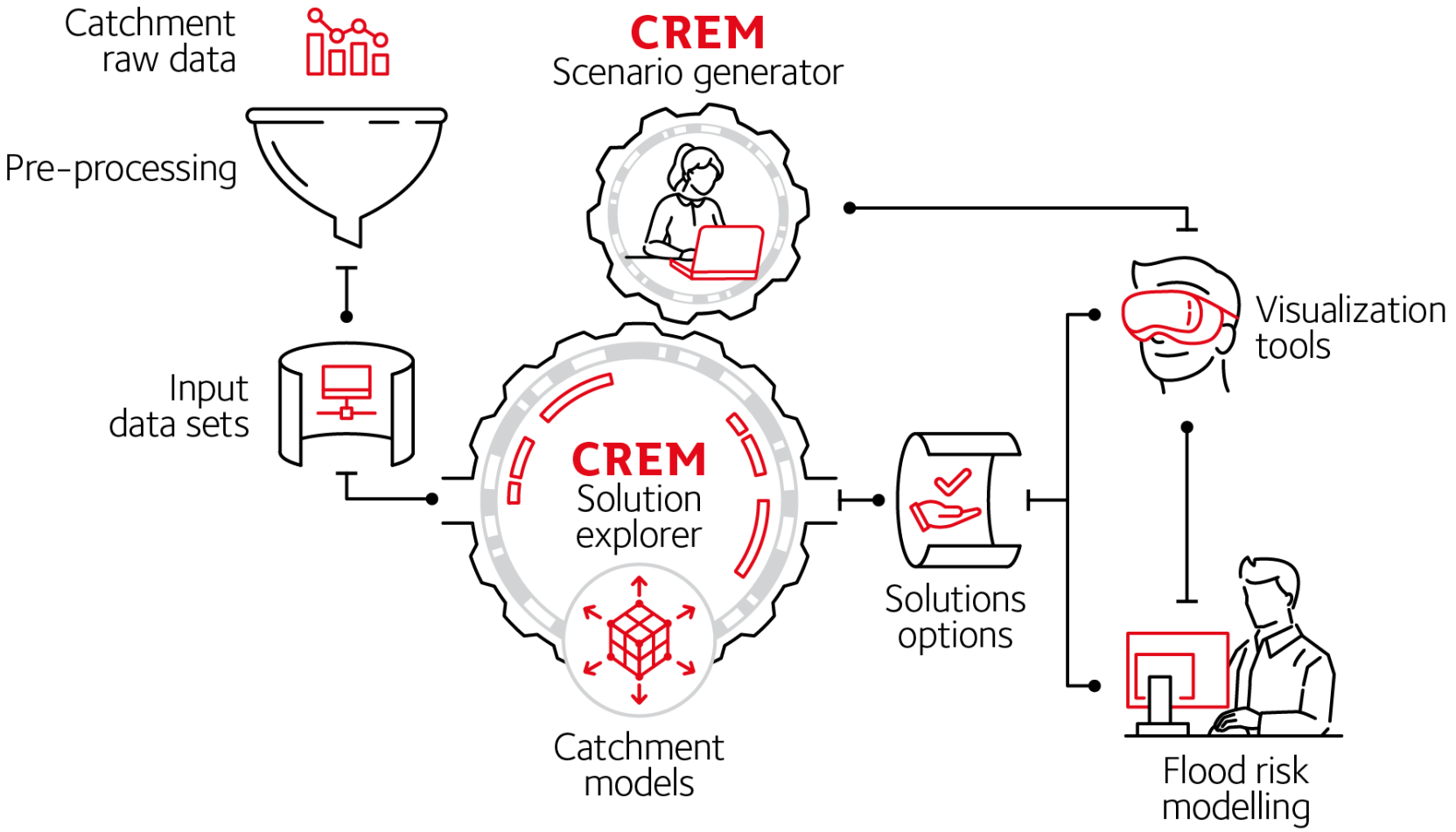
} visualisation interface

Engage communities and explore the scenarios

Quantify costs/benefits, e.g.:

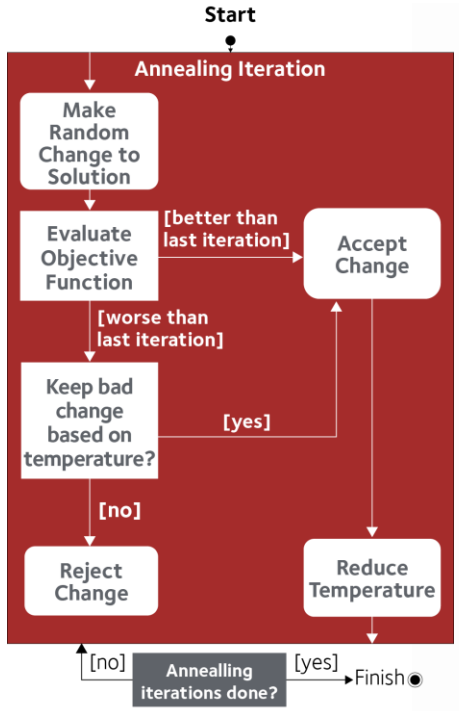
- Reduce flood impact
- Improve water quality (sediment, nitrogen)
- Improve stream health
- Carbon sequestration

Design of the catchment resilience tool to optimise investment in catchment restoration

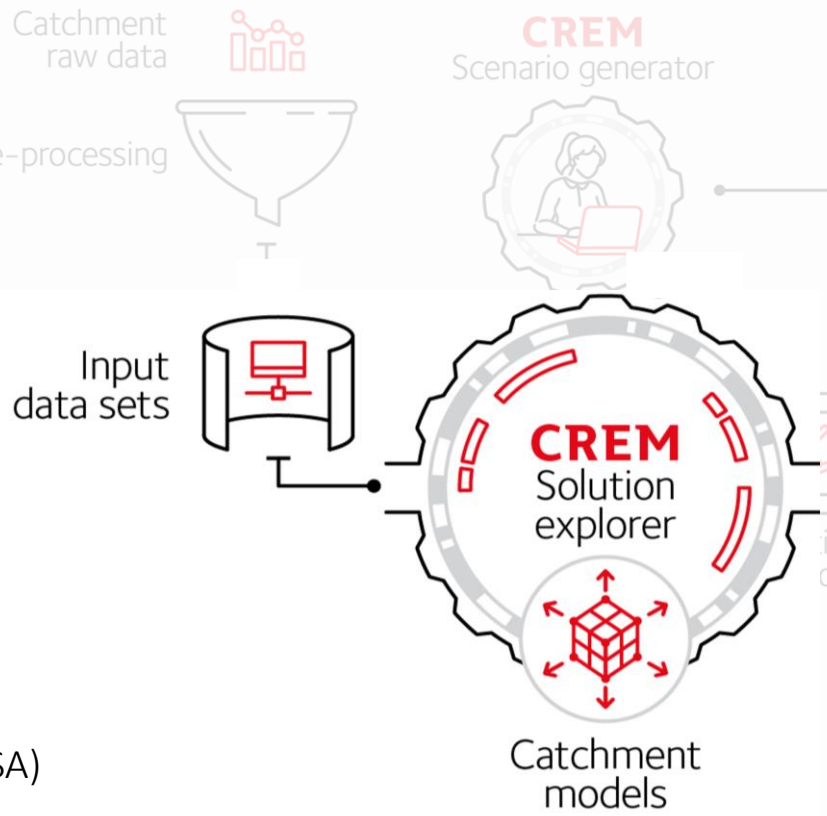


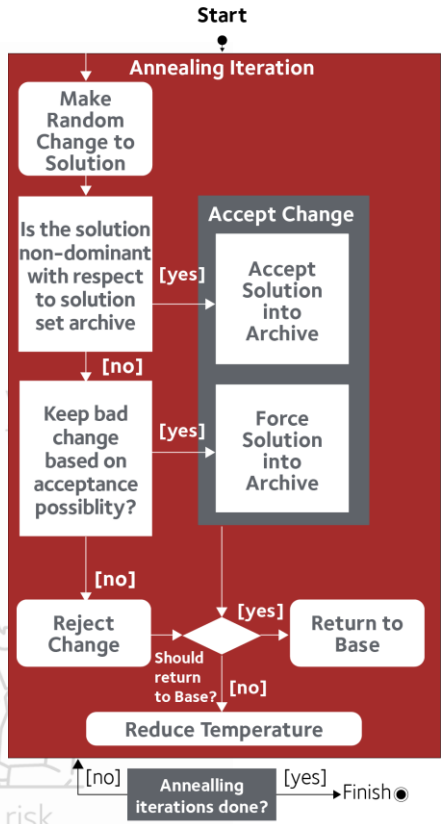
The Solution Explorer houses the catchment models used to simulate the effect of various management actions

These are implemented with a view to optimise a management objective, or to identify useful trade-offs between several, possibly competing, objectives.



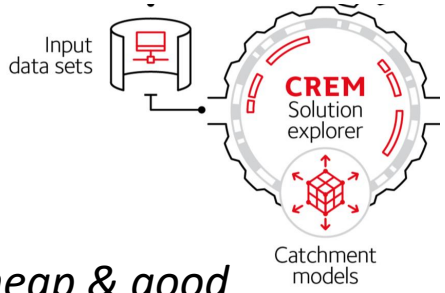
Single objective simulated annealing (SOSA)

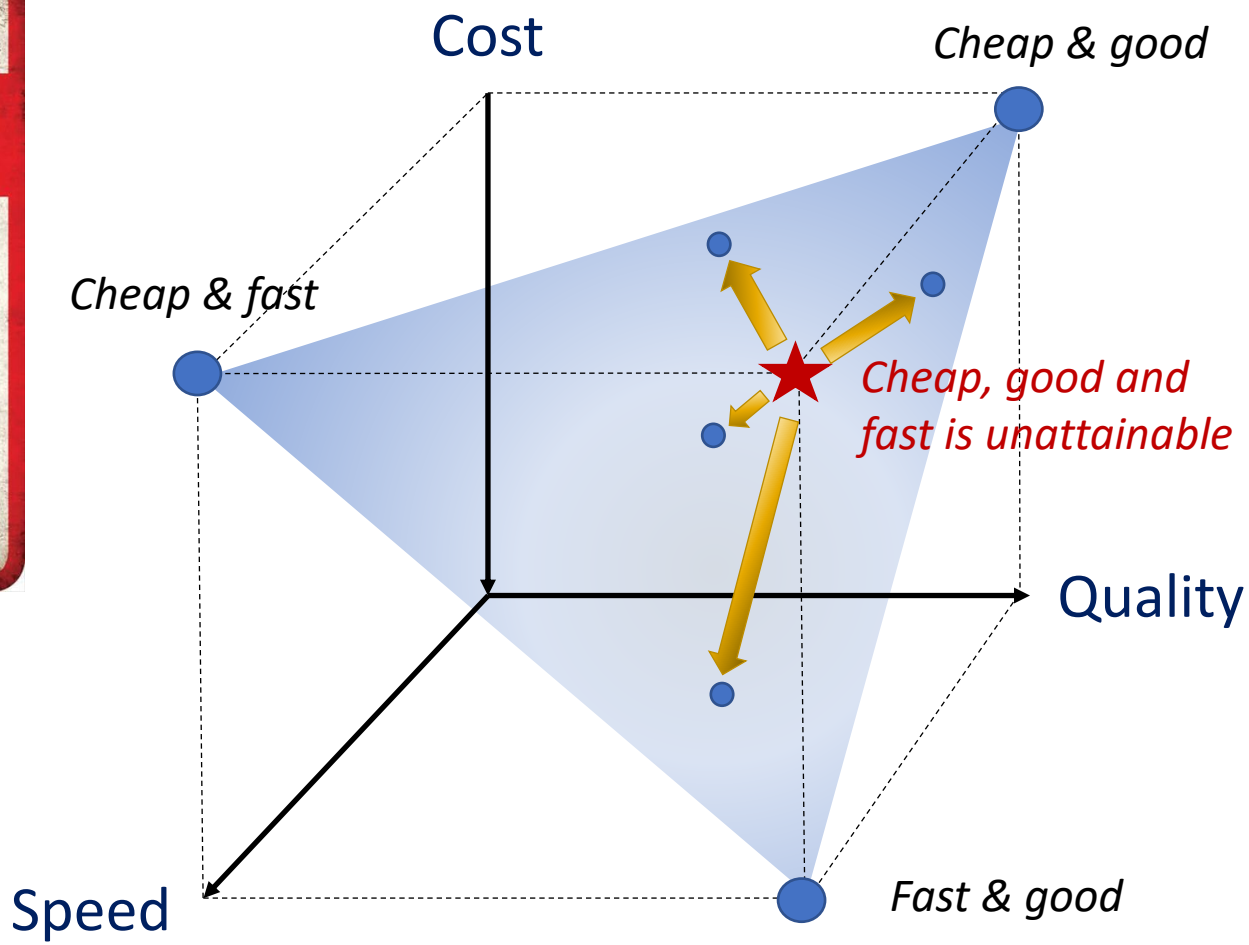




Multi-objective simulated annealing (MOSA)

These models identify the optimal solutions for multiple factors



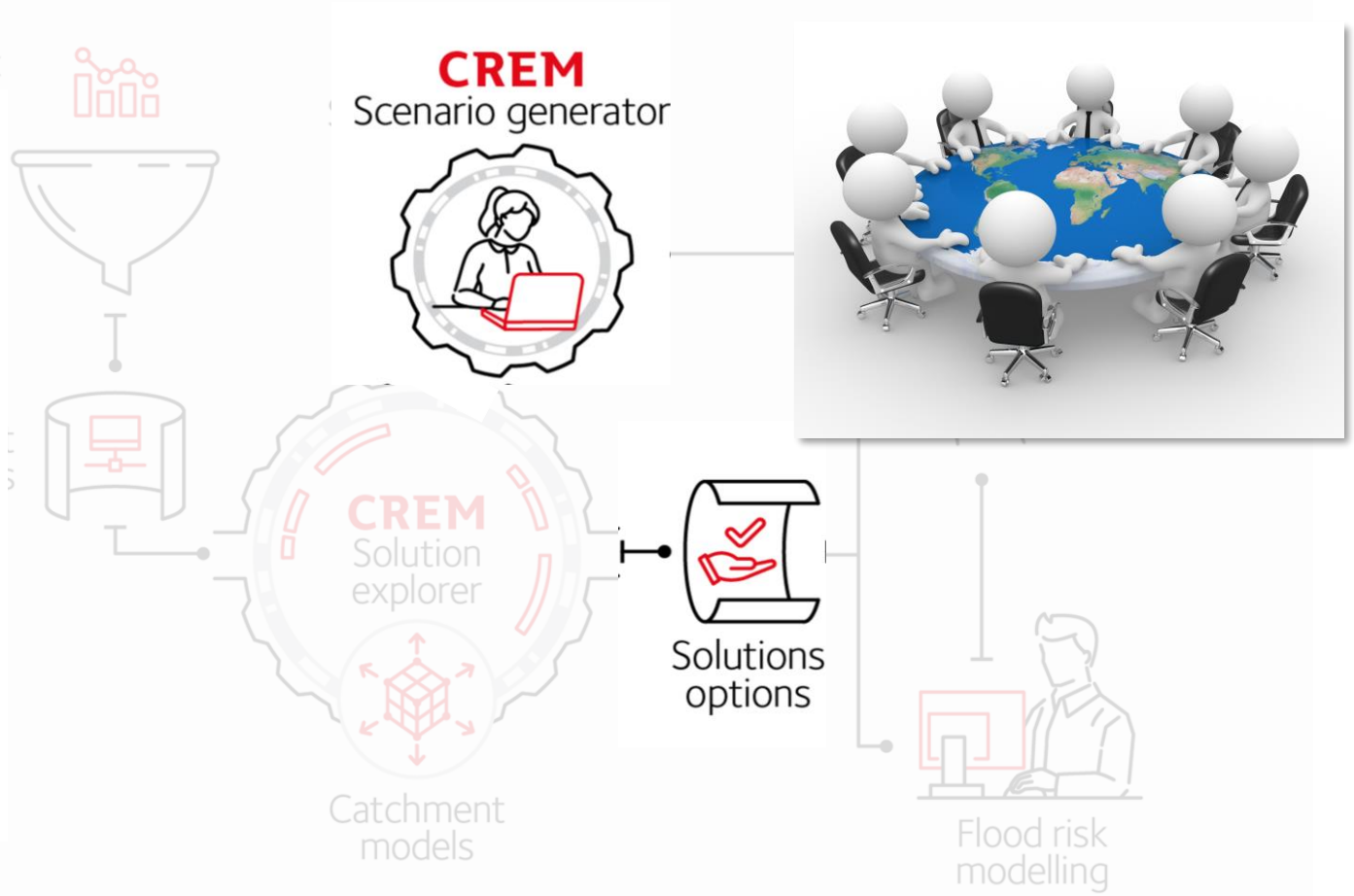


There is a range of options you could choose, depending on how you wish to trade off cost, speed or quality.

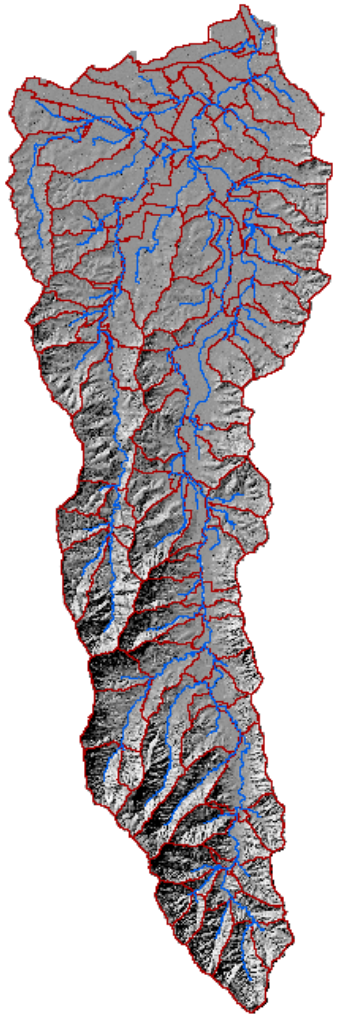
The Scenario Generator allows stakeholders to deliberate, build and load different catchment planning scenarios

Designed for deliberative and iterative scenario exploration, the tools can consider scenarios such as:

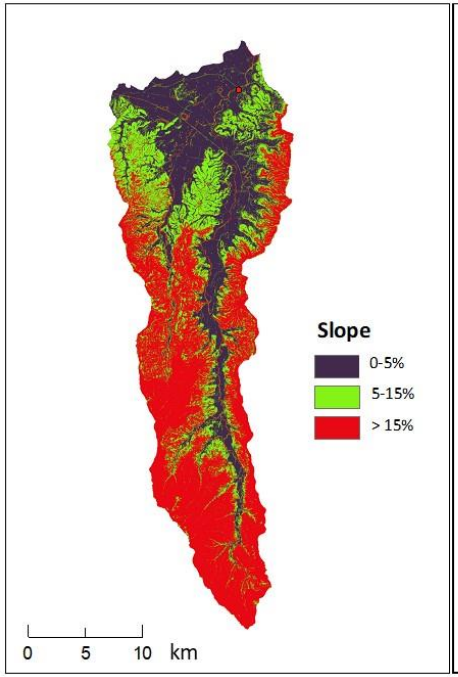
- What trade-offs between implementation and opportunity cost will we find aim to halve sediment production?
- What trade-offs amongst pollutant production will we find with an implementation cost budget of $20M?

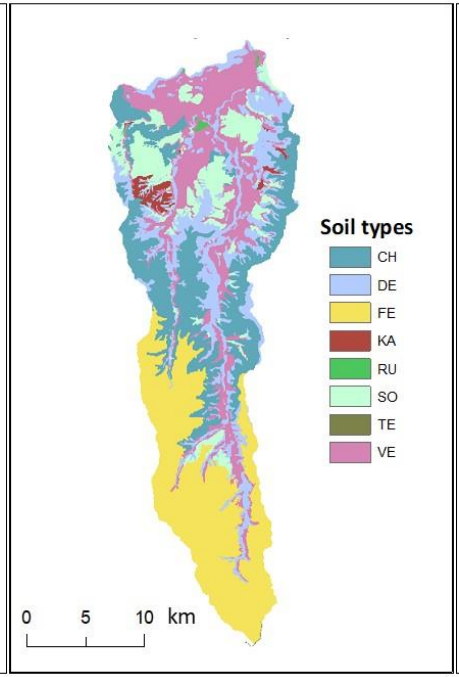


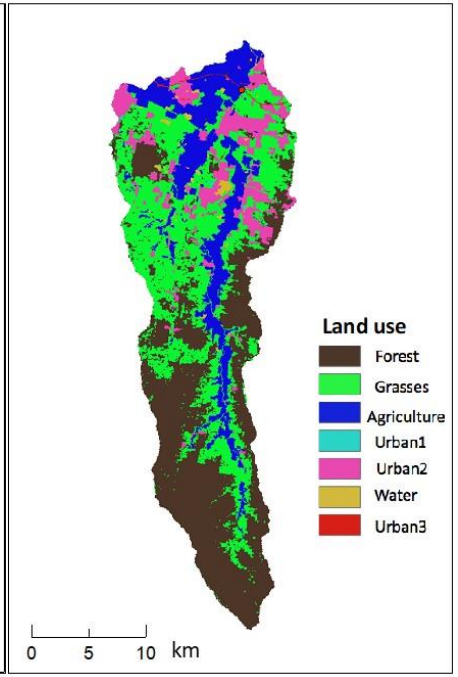
Inputs to the catchment resilience tool are readily accessible georeferenced data



1. Ground cover
2. Hillslope delivery ratio
3. Rainfall
4. Slope length
5. Soil erodibility
6. Slope





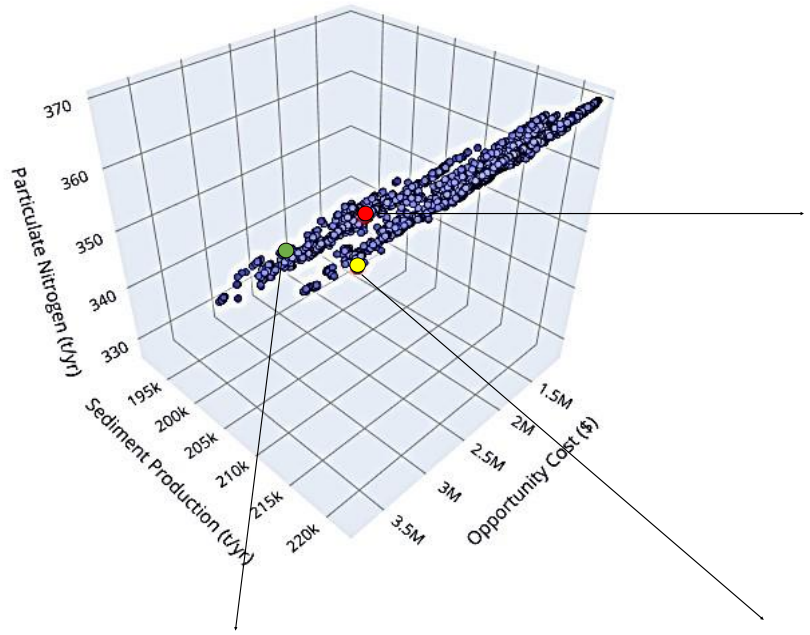


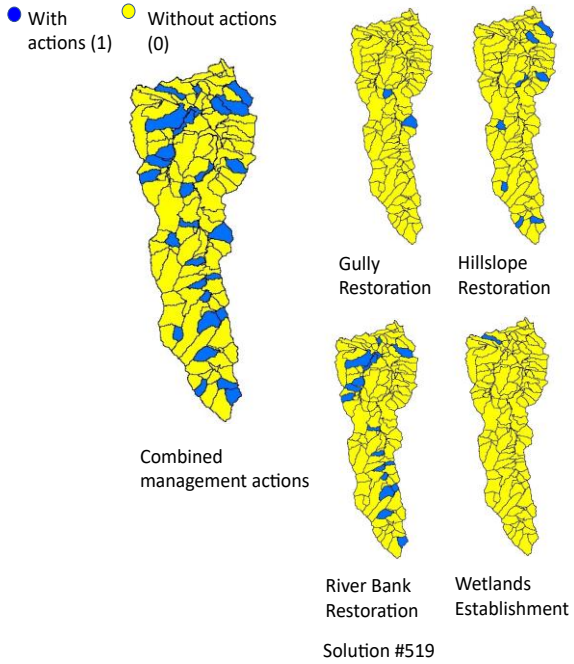
For any scenario, a range of optimal solutions can be considered

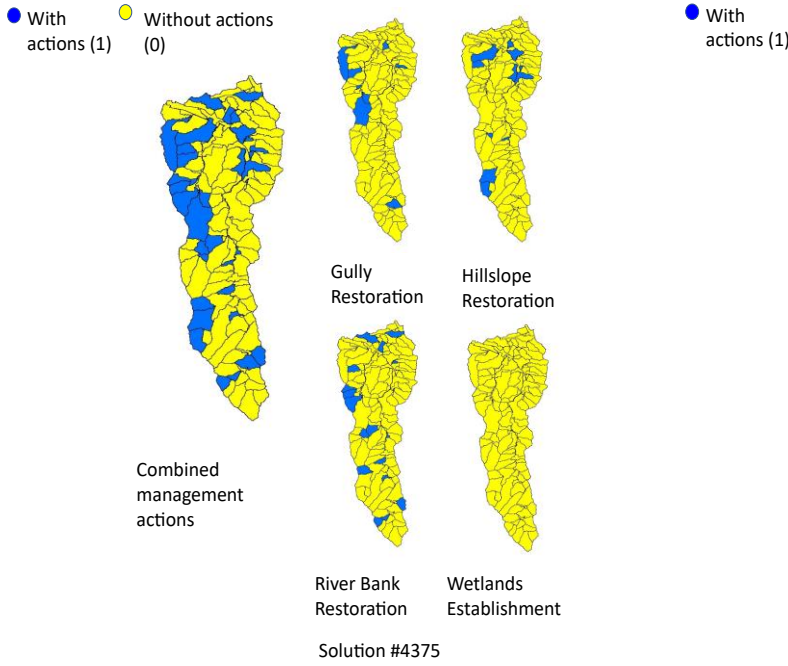
Scenario: $ 20 million implementation cost

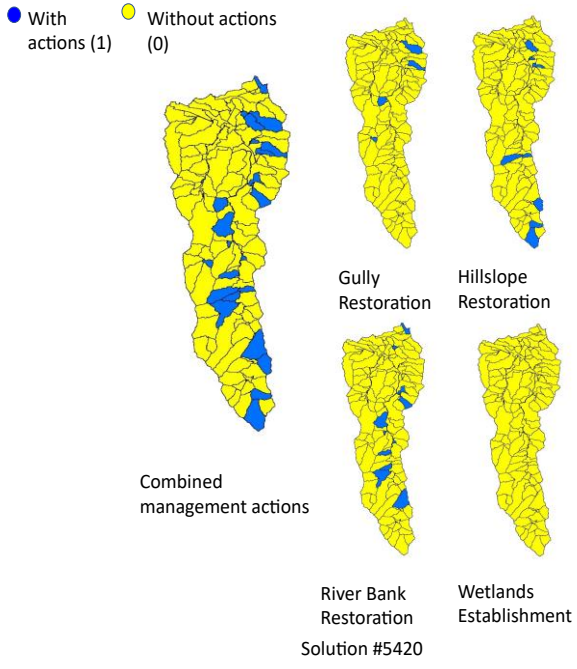
What range of outcomes for sediment and nitrogen reduction can we achieve with an implementation cost budget = $20 million?

* Opportunity cost = income foregone by not using that land for its current purposes and reflects a minimum amount of compensation required to implement a management option in a location

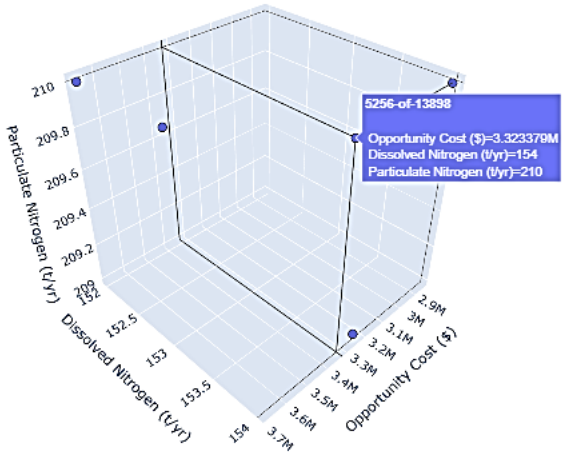








Dashboard: Visualizing Restoration Trade-Offs for Informed Decision-Making

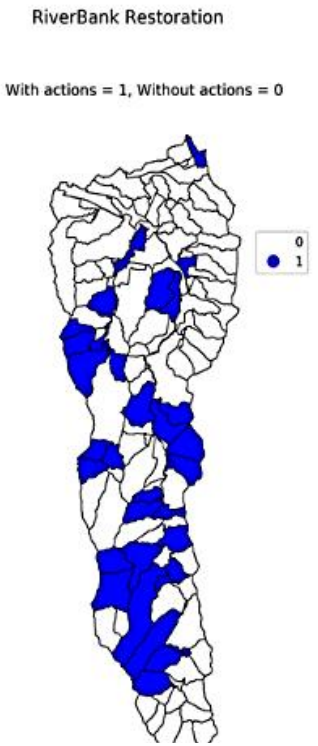


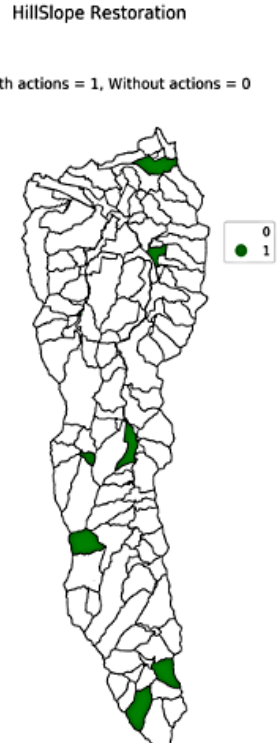
Associated information

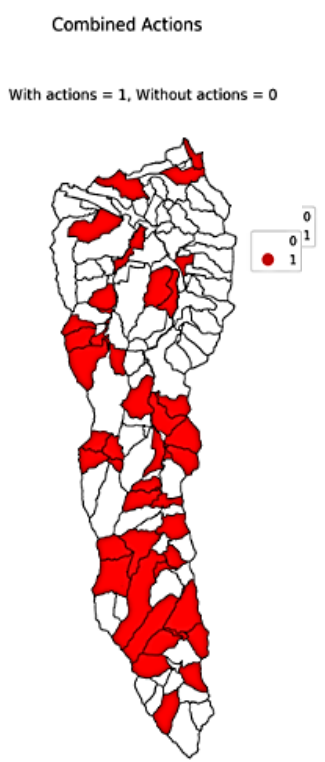
Opportunity Cost ($): 3323378.59

Dissolved Nitrogen (t/yr): 154

Particulate Nitrogen (t/yr): 210







Combined Actions
HillSlope Restoration
RiverBank Restoration
Wetlands Establishment
Gully Restoration

Implementation Cost ($):

23M 24M 30M

Dissolved Nitrogen (t/yr):

141 144 148 152 156 162

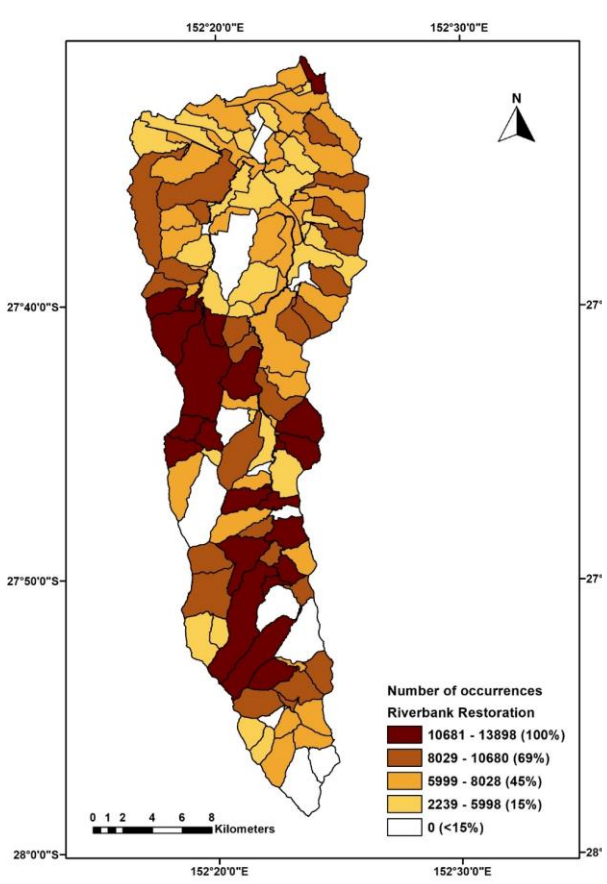
Particulate Nitrogen (t/yr):

209 210 211.5 213 215

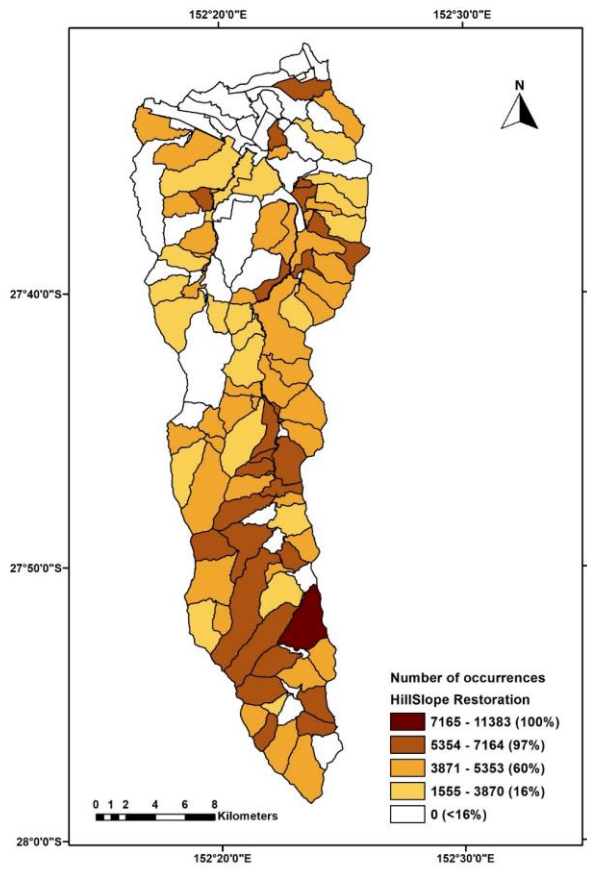
Opportunity Cost ($):

2M 2M 3M 4M 5M 6M

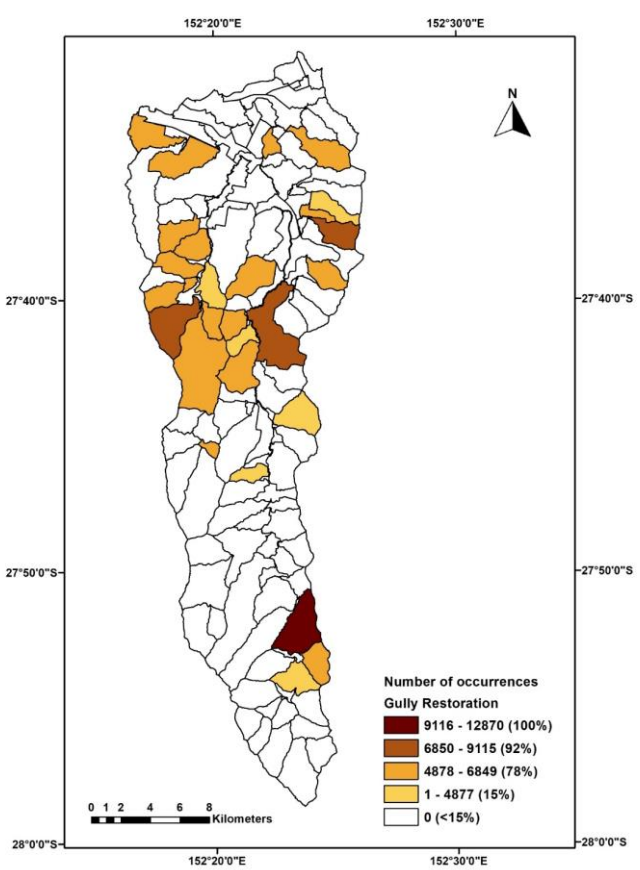
Prioritisation of planning units for restoration



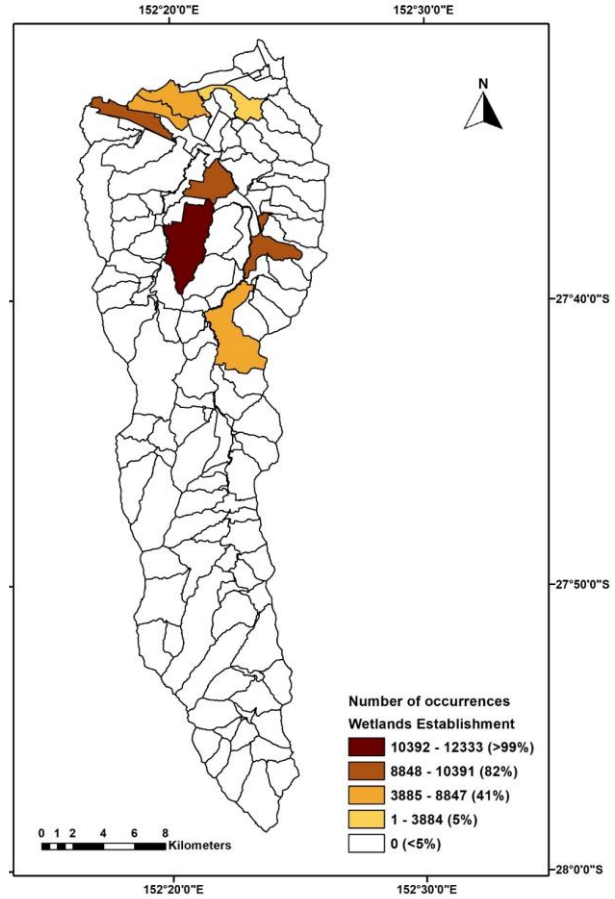
Riverbank Restoration



Hillslope Restoration



Gully Restoration



Wetland Establishment

Building Catchment RESILIENCE

Visualisation tools to support stakeholder engagement in catchment rehabilitation planning

Queensland University of Technology QUT

Acknowledgements

Stuart Bunn
Michele Burford
Jim Smart
Lindsay Bradford
Jagriti Tawiri
Sarah Cochrane

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