

Leakiness, resilience and system transformations



environment
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Te Taiao Tonga

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The complex linkages between social and ecological systems (socio-ecology) are increasingly being acknowledged in environmental management and decision-making.

Resilience thinking is one approach to understanding the complexity within systems and transformational changes. Resilience thinking recognises that there can be multiple possible stable states or 'pathways' for socio-ecological systems, some desirable, others not. For example, a system may reach a critical rate of decline that is stable and resistant to remediation efforts (undesirable). For a system to transform between pathways it must cross a threshold or tipping point.

The image below depicts a representation of the relationships between resilience, thresholds, 'leakiness' and pathways through time for Southland.

Leakiness describes the tendency not to retain water, soil and nutrients. That is, the higher the leakiness, the quicker water, soil and nutrients will move through the landscape. Current levels of leakiness were 'designed' for a desirable pathway for stable climatic conditions – but our climate is changing.

► Moving through time

The image below shows an abstract time-leakiness surface for considering some historic and potential future resilient pathways.

The 'valley' through which the system (green ball) travels represents progress through time. It shows that leakiness has progressively increased in Southland (moved from left to right on image) via three key historic system transformations:

1. Landscape changes following Polynesian settlement
2. Landscape changes following European settlement
3. Agricultural deregulation in the 1980s - changes from low input extensive farming to high input intensive systems

We are currently entering a period where a transformation could occur to a pathway to reduced leakiness.

► Moving from one pathway to another

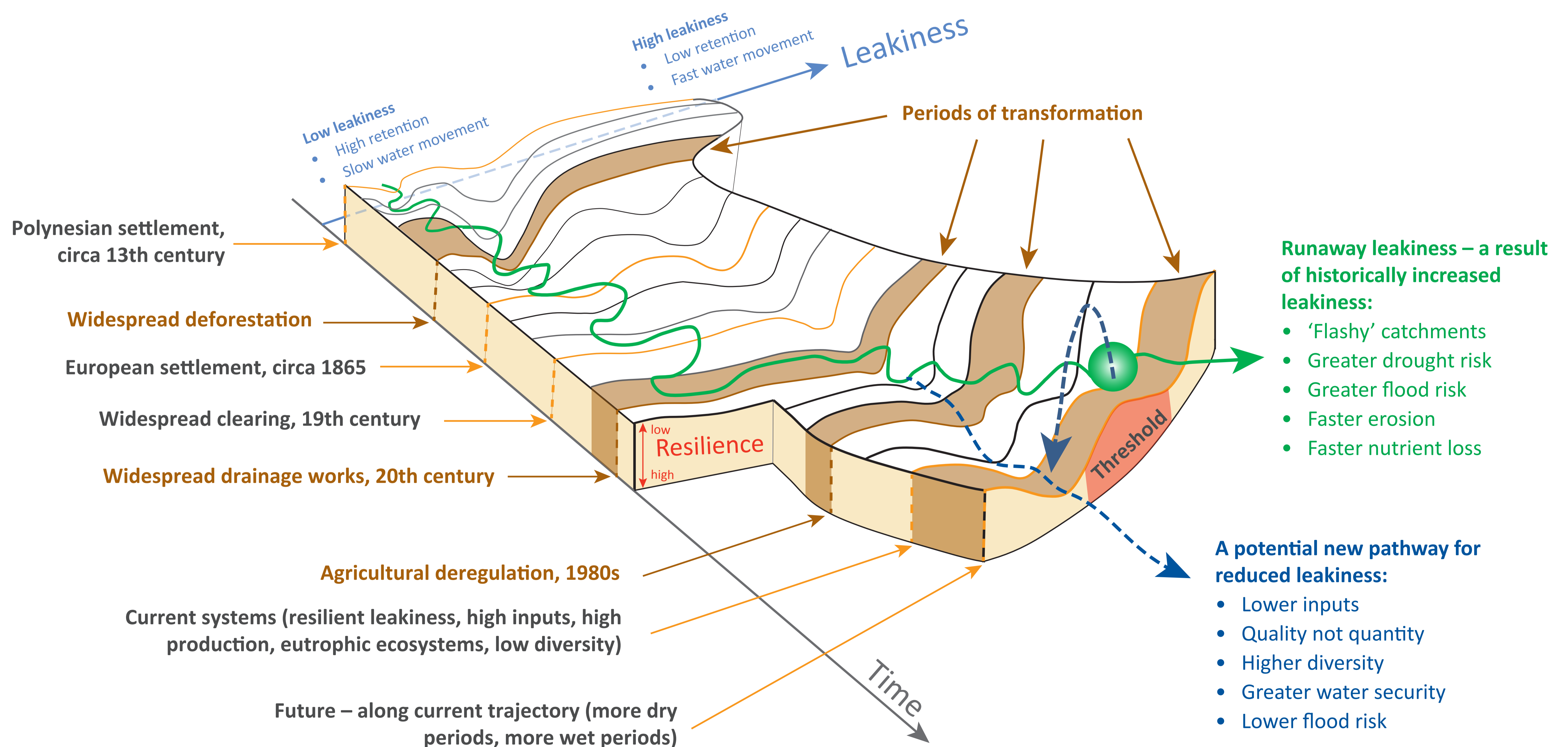
The 'valleys' represent different possible system pathways through time. Resilience is represented on the diagram as depth of the pathway. That is, the deeper the pathway in the time-leakiness surface, the greater the resilience of the system to change. The 'ridges' between pathways represent thresholds separating different pathways. Crossing a threshold represents a transformational change to a system that behaves in a different way.

► Where next?

We are at a point in time where our current pathway could lead to more resilient, undesirable leakiness, or our choices could cause a transformation to systems that are less leaky, more diverse and resilient to climate change (dashed arrows). Because of the resilience of our current pathway, crossing to a less leaky pathway will take effort to breach a threshold of transformational change. Subsequently, if a certain level of leakiness is not maintained, the system could transform again to 'runaway waterlogging'.

MAKING CHOICES

Current system versus a new pathway for reduced leakiness – one example of demonstrating resilience thinking



► Further information

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