

QUANTIFYING RESILIENCE TO DROUGHT & FLOODING IN REGENERATIVE AGRICULTURAL SYSTEMS

Mitchell Donovan¹, Kate Orwin², Pierre Roudier², Stella Belliss²

¹AgResearch, ²Manaaki Whenua – Landcare Research

What is resilience?

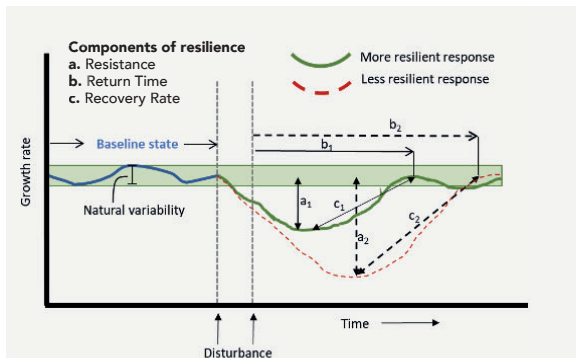


FIGURE 1: WHAT IS RESILIENCE?

(e.g., drought or flooding). Example of possible responses in two systems (denoted by subscript 1 and 2 and red/dashed and green/solid lines) with differing resilience.

1

Priority research questions:

- 1) Do practices under RA alter resilience to drought and flood compared to current management practices at field, farm and landscape scales?
- 2) What mechanisms underpin any observed differences in resilience between RA and current systems?

Considerations for choosing indicators of resilience and study sites

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Time-scale: multiple years to discern annual 'noise' from long-term resilience

Spatial-scale: plot-, field-, farm-, and landscape-scales (catchment, regional)

Study design: Pairwise comparison through time of practices unique to RA and mainstream systems

Study locations aim to cover a range of systems with different levels of prior exposure to drought and/or flooding, and include:

- 1) Sites within regions that are known to be particularly impacted by drought and/or flooding (e.g., Hawkes Bay, Gisborne, Southland)
- 2) Sites that have recently experienced an extreme event (to monitor recovery from extreme event)
- 3) Sites that have less extreme disturbance regimes.

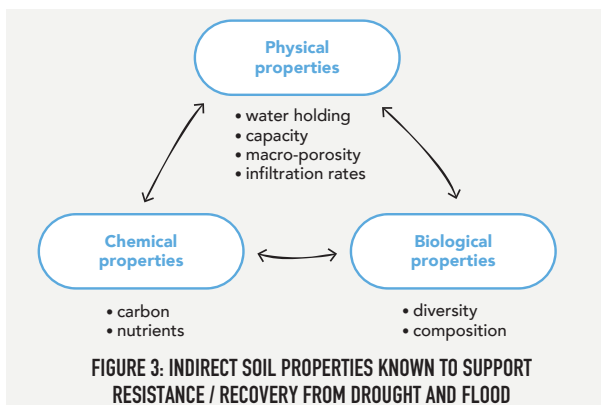


FIGURE 3: INDIRECT SOIL PROPERTIES KNOWN TO SUPPORT RESISTANCE / RECOVERY FROM DROUGHT AND FLOOD

Recommended approach to quantifying resilience:

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- 1) Direct measurements of productivity, farm produce quality and changes in composition / diversity of vegetation throughout periods of disturbance
- 2) Indirect measurements of soil properties (e.g., infiltration, macroporosity, aggregate stability, carbon (C), and composition / diversity of soil biotic communities) that are known to support resistance to, or recovery from, drought and flood
- 3) Remote-sensing measurements of vegetation quality (e.g., NDVI, SAVI, etc.) across regional scales to test whether farm-scale results are applicable across a broader New Zealand context.

Ground-truthing of links of remote sensing and indirect measurements to directly measured resilience is also required.

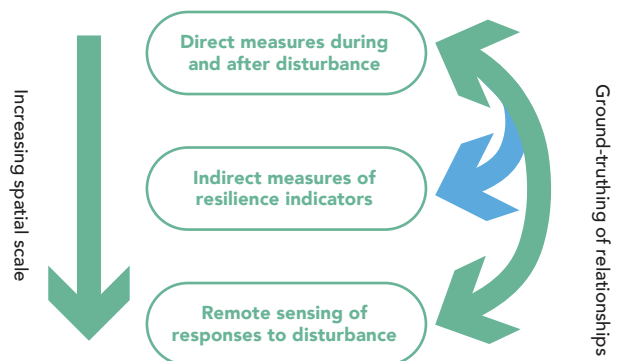


FIGURE 2: PROPOSED METHODOLOGICAL WORKFLOW TO QUANTIFY RESILIENCE

Source:

Donovan M, Orwin K, Roudier P, Belliss S 2021. Quantifying resilience to drought and flooding in agricultural systems. Manaaki Whenua – Landcare Research Contract Report LC3954-14 for Our Land and Water National Science Challenge & The NEXT Foundation.