Climate-change impacted extreme events: are we unknowingly forcing a game-of-chicken between primary industry and rivers?

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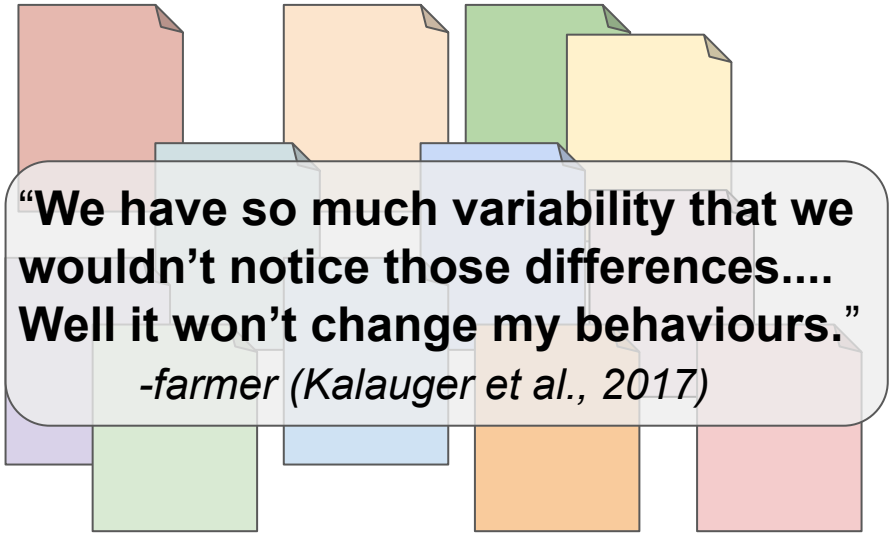
PRIMARY INSIGHT

KSL Kōmanawa Solutions Ltd

What do you do with a problem like Climate Change*

Near to long term variability under climate change AUS/NZ:

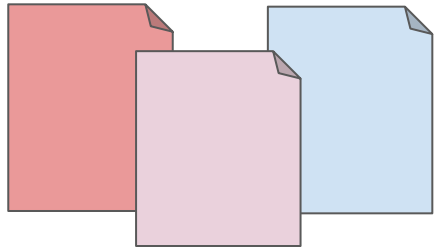
*We know it's important but **did not** address it in this study instead focusing on **mean change** at 2050, 2100, etc.*



"We have so much variability that we wouldn't notice those differences.... Well it won't change my behaviours."

-farmer (Kalauger et al., 2017)

We included variability in our study

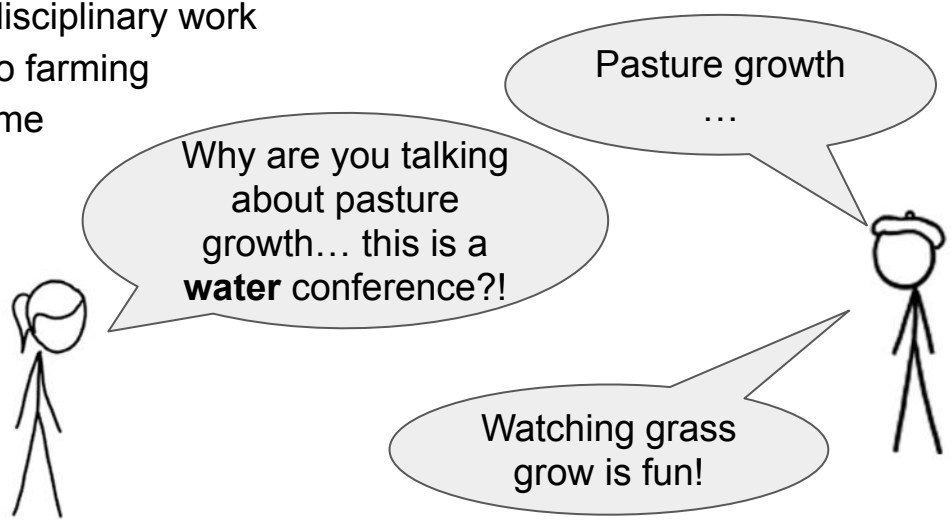


Different Regional Climate Models ≠ variability

** I promise there are no singing Nazis in this presentation*

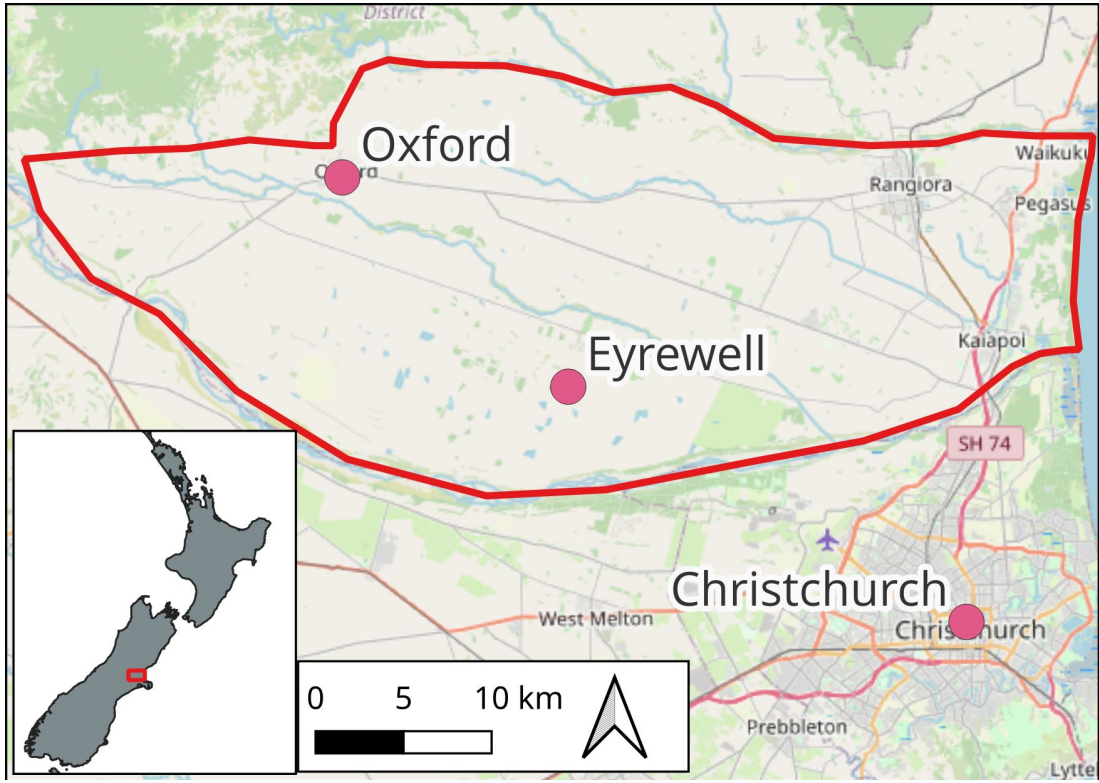
Climate Shock and Resilience Adaptation Project

- 2 Hypotheses + 1 bonus
  - Severe weather/climate events will impact farm financial resilience
  - Severe weather/climate events will increase confrontation between rivers and agriculture
  - Bonus: knowing about climate variability will change our outcomes
- Why am I talking about farm systems at a water conference?
  - We need system wide thinking – cross disciplinary work
  - The approach taken here is not limited to farming
  - Trade-off analysis is the name of the game
- “Current Climate” = c. 2020
  - We’re here, but we haven’t been here long enough to know what current climate looks like



Where are We?

- 2 Sites - Oxford and Eyrewell
- 2 systems - Dry-land, & Irrigated
- Strong Precip + Temp gradient from E-W
- Run of river irrigation scheme from Waimakariri River – relatively unreliable scheme



What do you do with a problem like Climate Change*

Near to long term variability under climate change AUS/NZ:

*We know it's important but **did not** address it in this study instead focusing on **mean** change (SST, pH, etc.)*

We included variability in our study

WHY Not?

It's hard!

"We have so much variability that we wouldn't notice those differences.... Well it won't change my behaviours."

-farmer (Kalauger et al., 2017)

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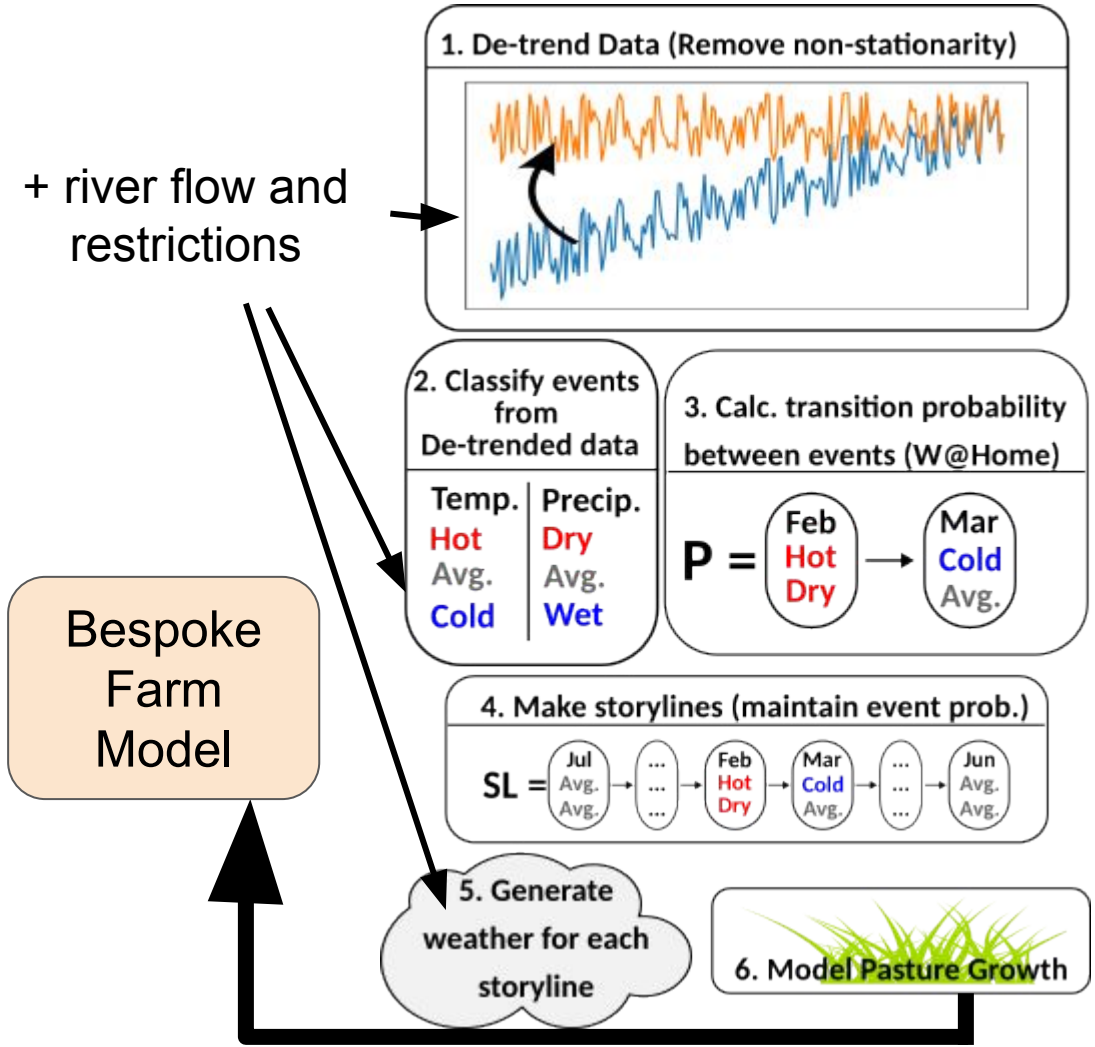
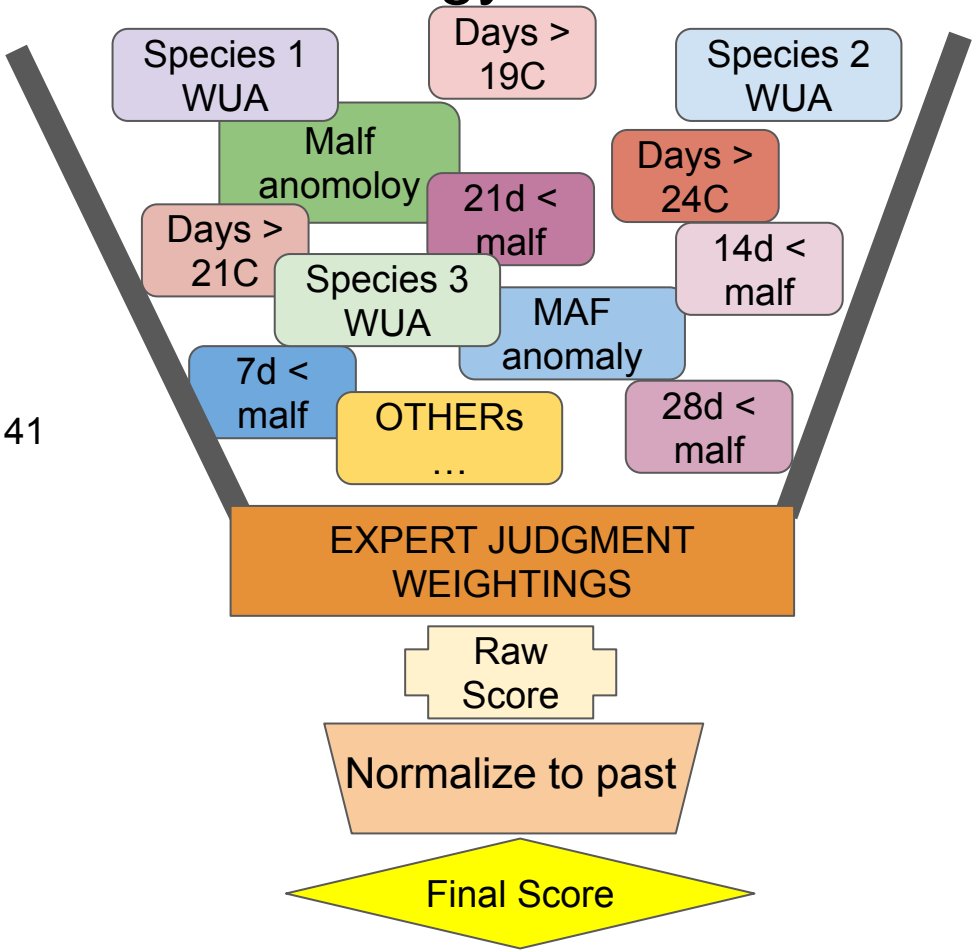
Methods: Weather to Farm Economics

- Storyline suite approach
- Probability from Weather@home
- Stochastic weather from SWG seeded with local climate data
- Bespoke farm model, which does a good job of replicating published trials
- Decisions made from an omniscient Cost vs. Benefit point of view



Methods: Alternative Allocation and Ecology

- Built an Expert Judgment ecological model
- 2 alternate allocation options
  - Rivers +: Minimum flow increased from 41 - 50 m^3/s
  - Farms +: Halve restrictions when farms will have 1 ton pasture deficit or higher (typically Dry Jan/Feb)



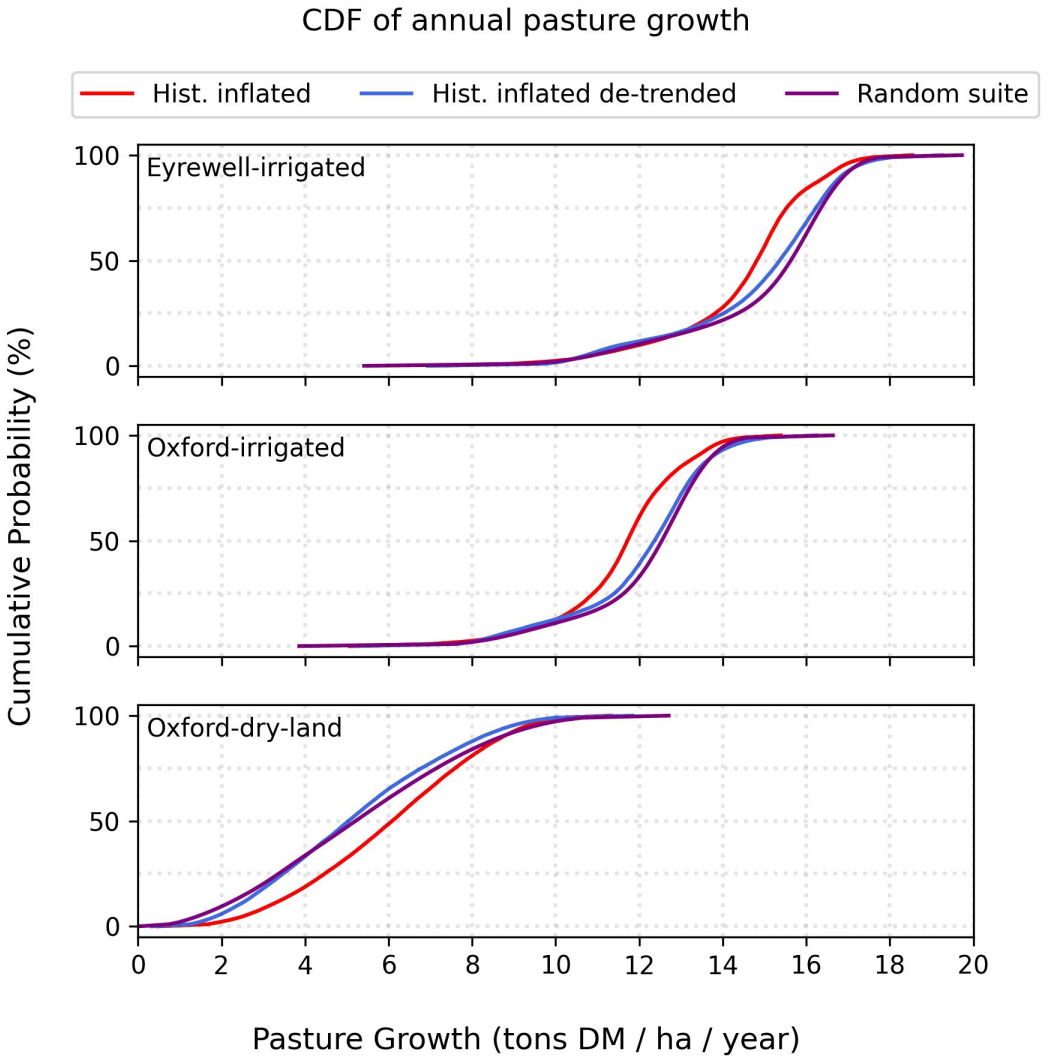
What did we learn about pasture growth?

Mean/median pasture yield

- Previous (mean) studies:
  - 5.6-6% by 2050 (Keller et al., 2014)
  - 10.1 % by 2100 (Keller et al., 2014)
  - -2% by 2050 (Kalaugher et al., 2017)
- Irr. sites 50th: 3.7 - 5.5%
- Dry. site 50th: -17%

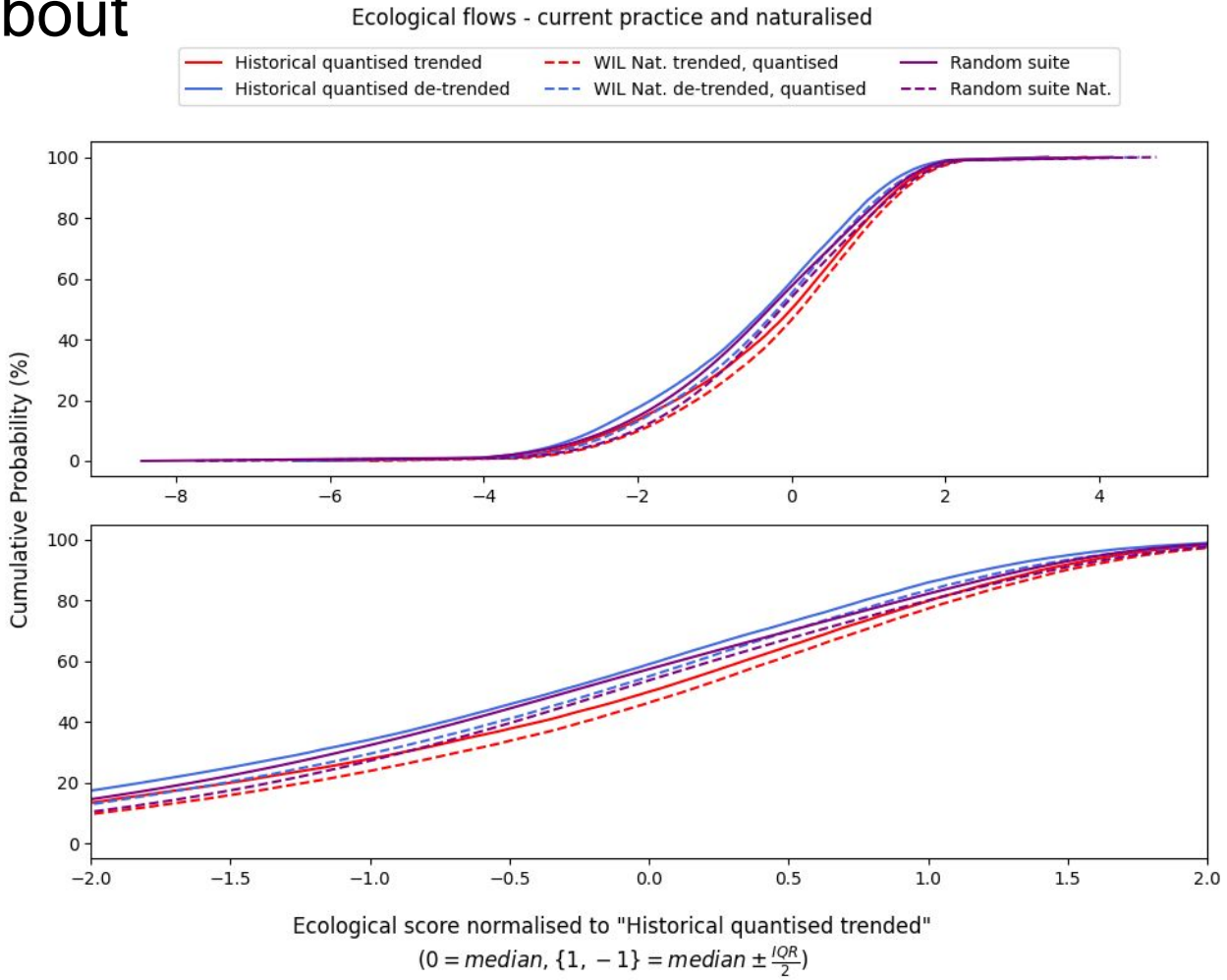
Variability:

- Irr. sites 25th-75th: 7-30%
- Irr. sites 5th - 95th: 9-12%
- Dry site 25th-75th: 6%
- Dry site 5th-95th: 4%



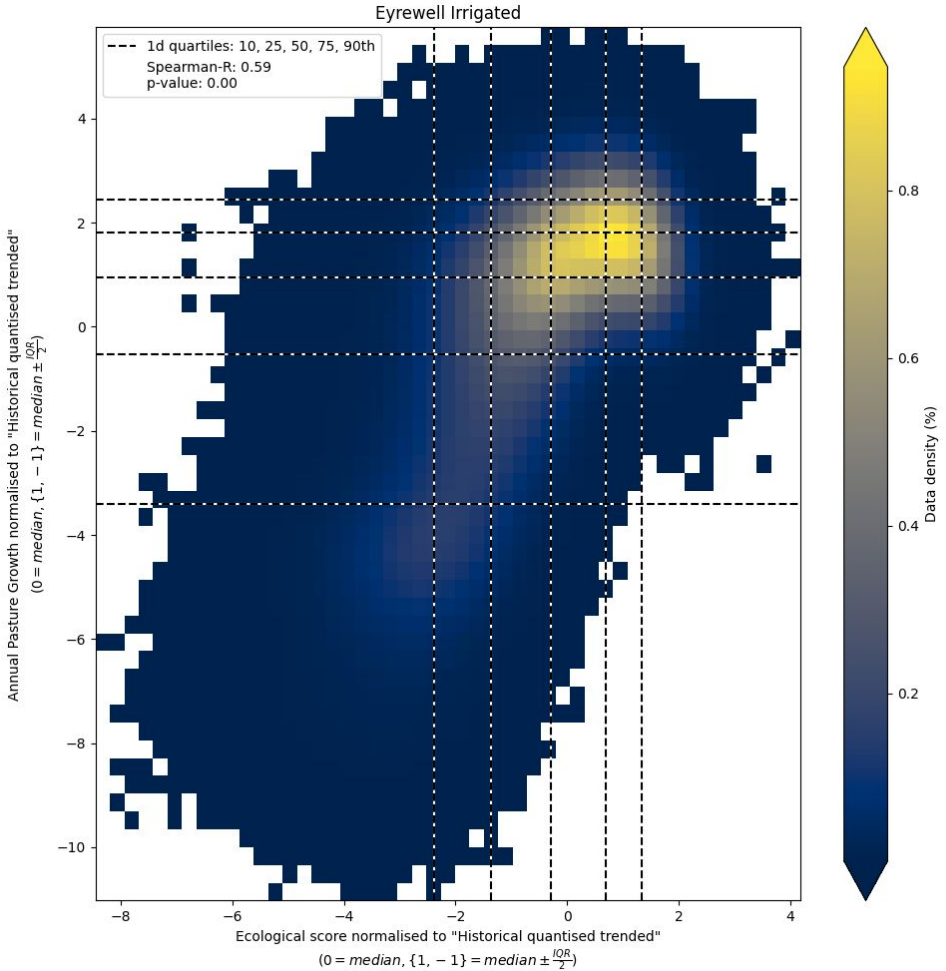
What did we learn about river health?

- River health score has gone down.
- We'd have to remove the WIL consent to make it like it use to be…



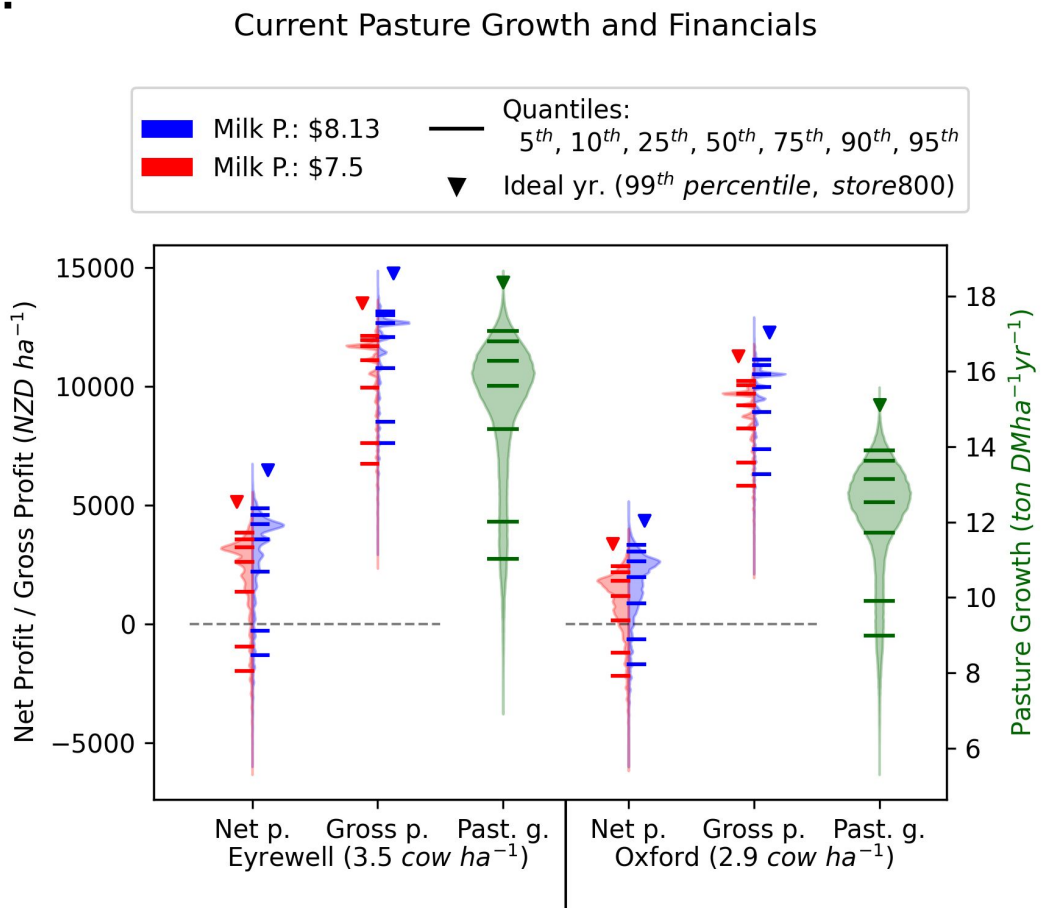
What did we learn about pasture growth and river health?

- River health score and pasture yield are covariant
- When it's bad for the river it's bad for the pasture and more water is needed on farm

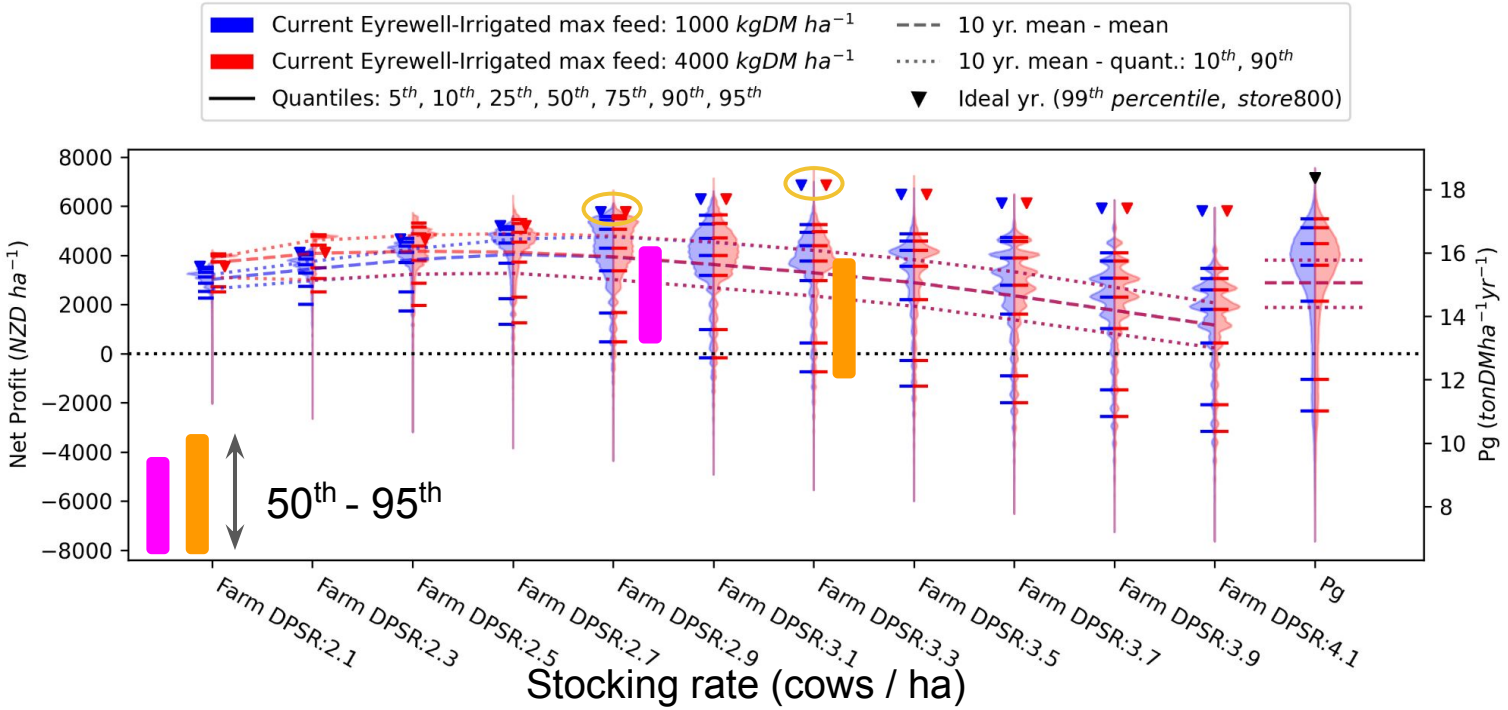


Can Farm Systems cope? – It depends

- Bad years can cause a significant loss even before debt servicing is considered.
- If you have low debt rates you can probably endure but otherwise…



What can we do…Change stocking rate?



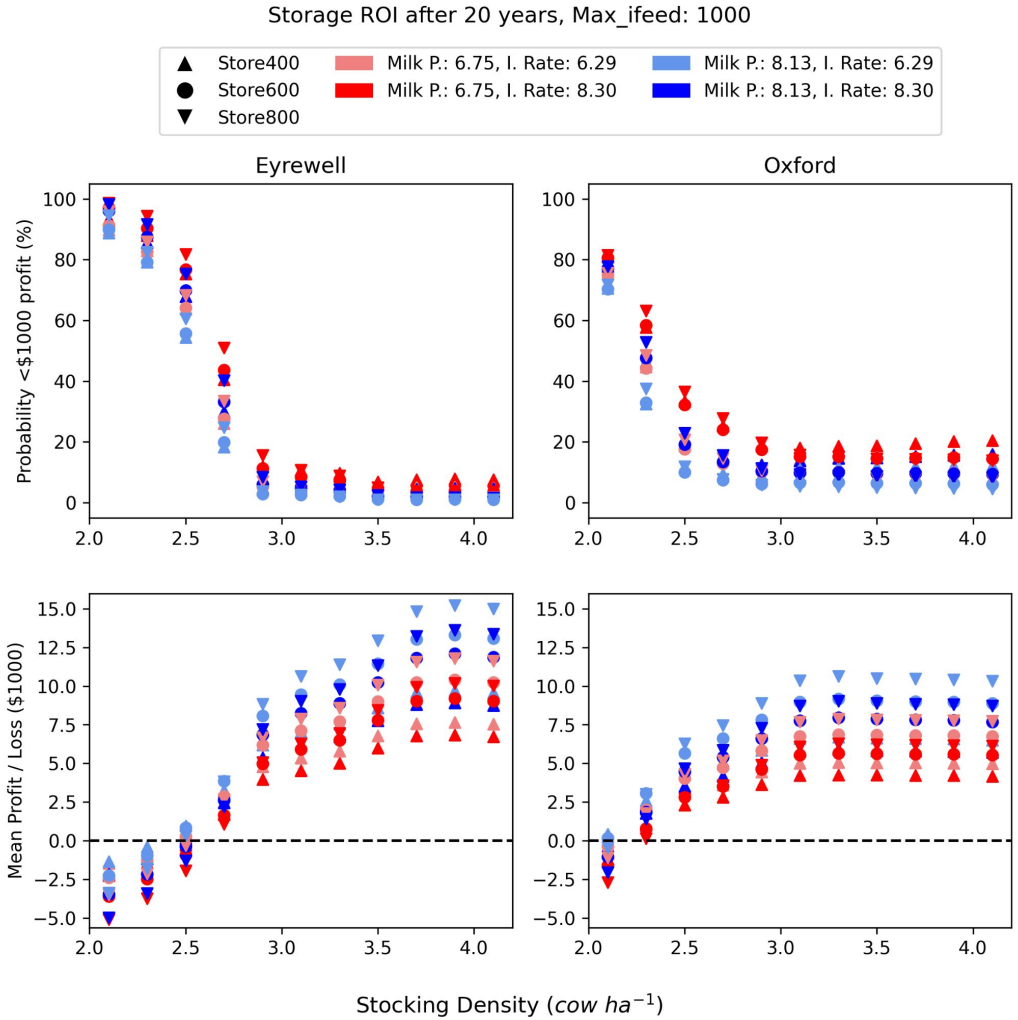
Reduced stocking rate from 3.5 to 2.9 cows/ha:

- -11% of ideal net profit
- 20% increase in 10-year mean net profit

PASTURE QUALITY is tricky!

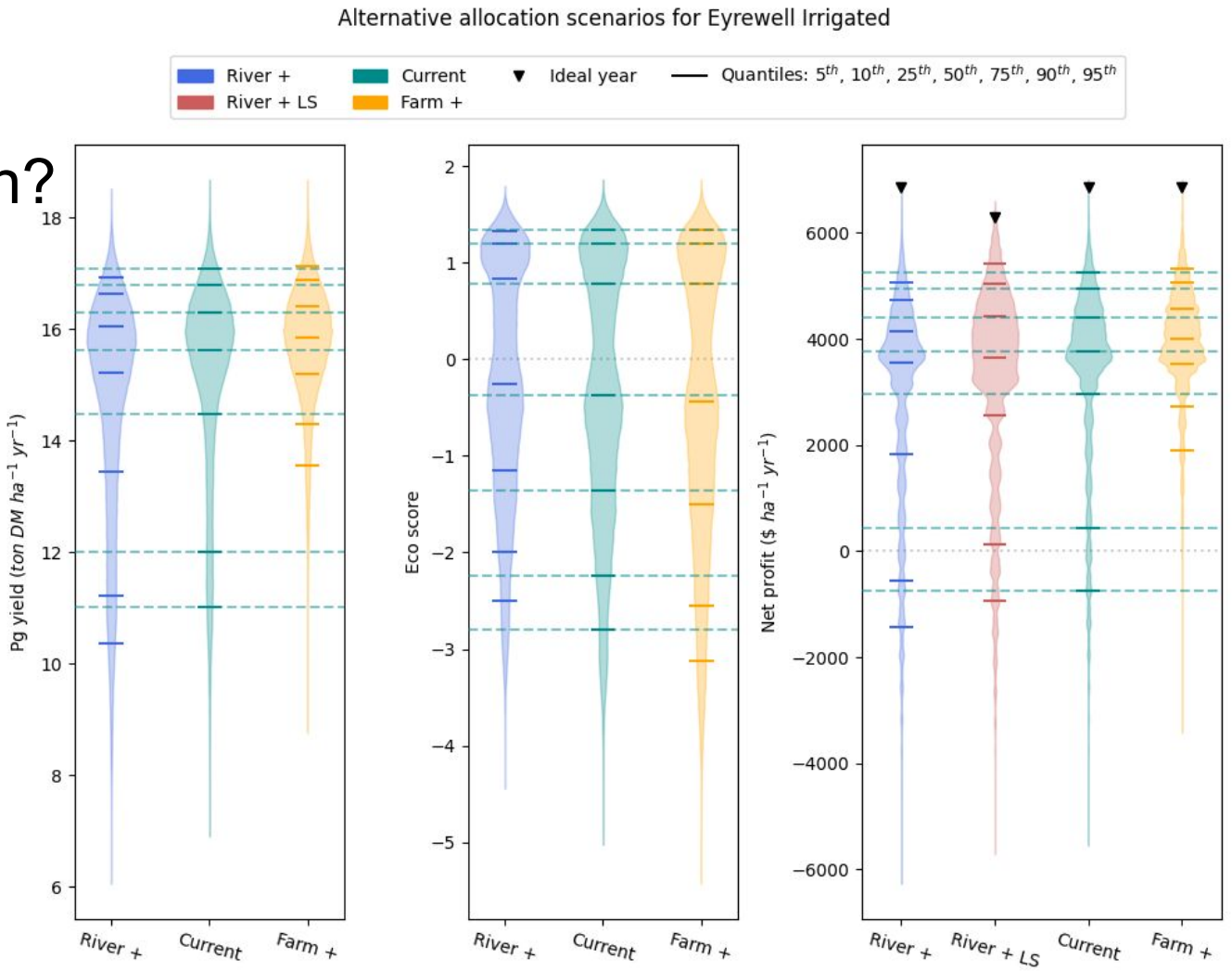
What can we do… Storage?

- Storage mitigates variability
- It is EXPENSIVE
- Debt loading makes farms more susceptible to change in milk price and interest rates
- Pushes to higher stocking density and intensification



What can we do…
Change allocation?

- Very little change in good years
- Significant change in bad years
- Fixing stocking rate fixes the outcomes



Now about that game of chicken

Option	Impact	
Get / give more Water	Good for farms; bad for rivers – straight up chicken.	
Invest in storage	Maybe good for farms (trade climate for debt risks); +- impact on rivers; incentivizes higher intensity to service debt -> increases in NO_3 & CH_4?	 Maladaptive?
Reduce stocking rate	Good for farms **IFF pasture quality** can be maintained; +- impact river flows, Lower stocking ≠ lower NO_3 but adds wiggle room to improve environmental effects.	

Cross disciplinary learnings

Climate change induced variability is happening now!

Ignore it at your peril

If you fix any variable in your assessment you have fixed your conclusion

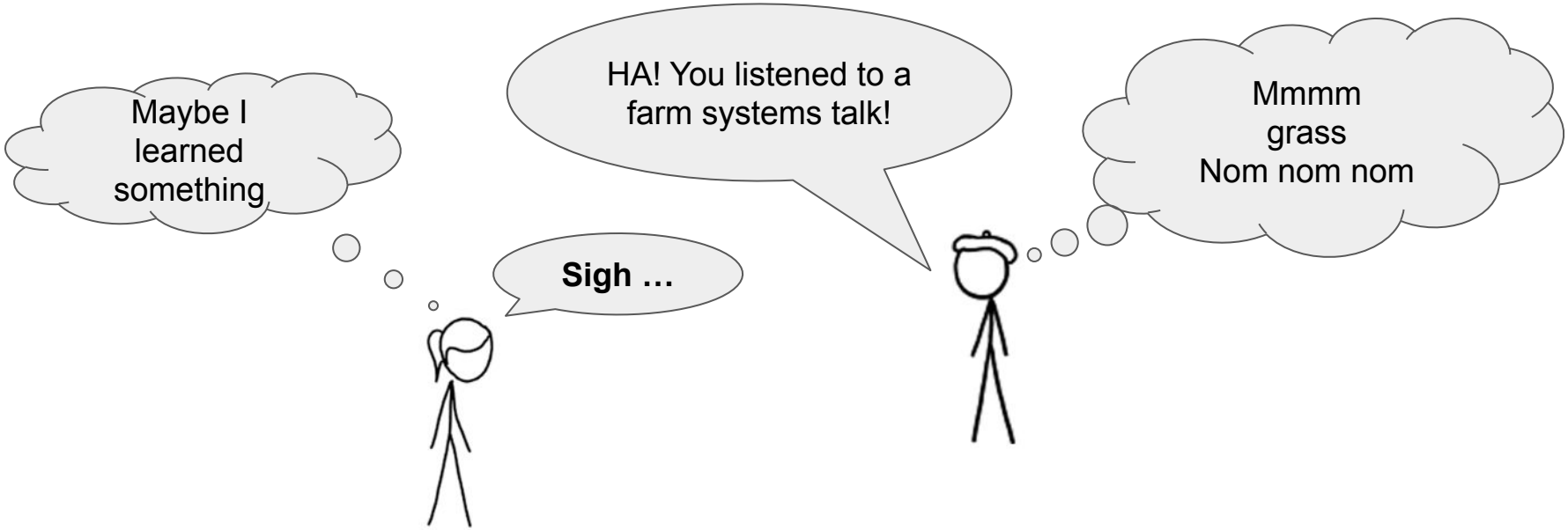
The impacts from **climate variability** are likely to be **much more consequential** than **long term mean change**

Addressing climate variability is tricky but necessary

Without it we risk maladapation

Climate adaptation is a highly localised process

Questions?


Maybe I learned something
Sigh …
HA! You listened to a farm systems talk!
Mmmm
grass
Nom nom nom