



Toolbox for refining monitoring and reporting

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Landcare Research
Manaaki Whenua

Challenges

Reporting.....

- 🌀 Clearly defined goals
- 🌀 Difficult to interpret results
- 🌀 Confidence in results

Monitoring

- 🌀 Can be expensive
- 🌀 Can be time consuming
- 🌀 Difficult to evaluate trade-offs in design



Survey design

- 🌀 Is it fit-for-purpose?

- 🌀 If not, should you monitor:
 - For a longer period?
 - More farms?
 - More intensively within farms?

- 🌀 Stop sampling altogether?



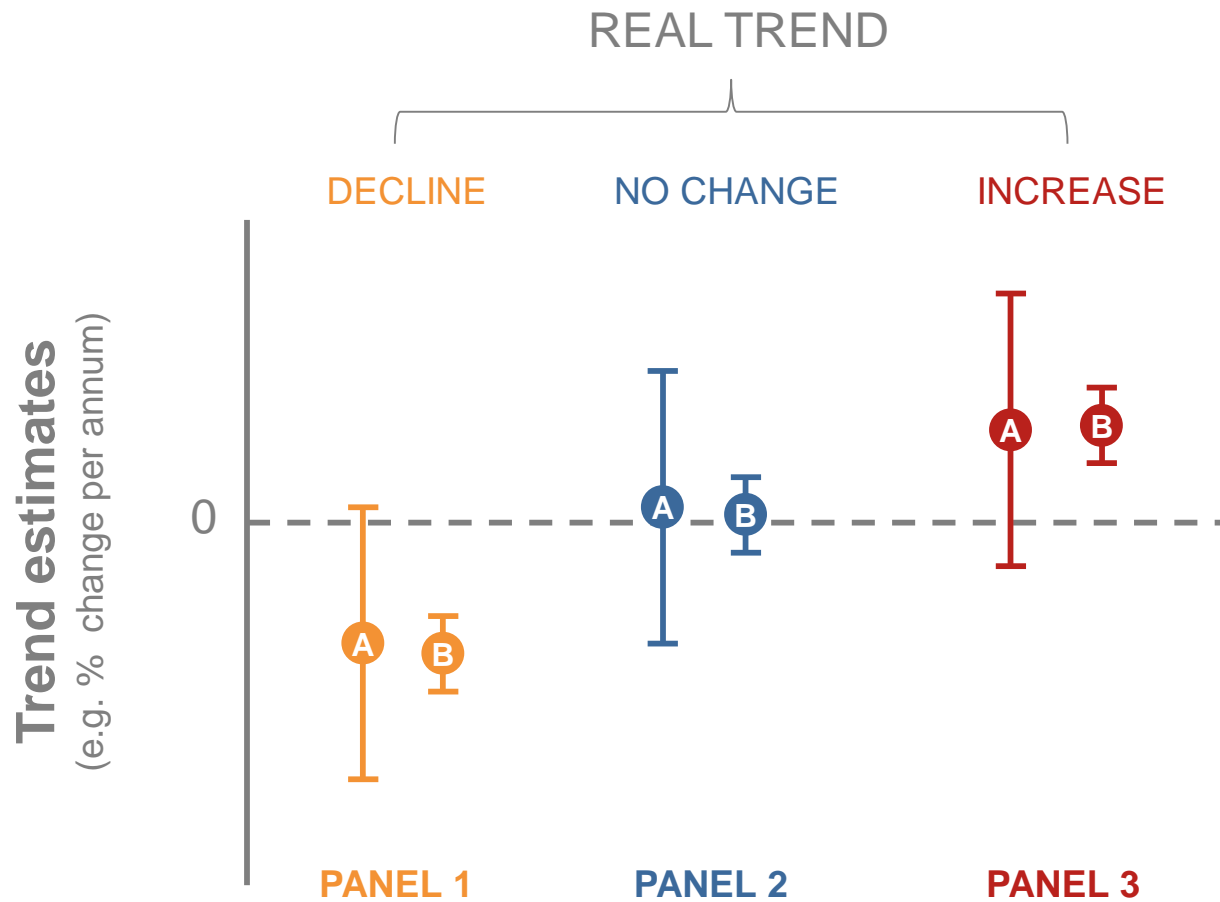


Confidence in results

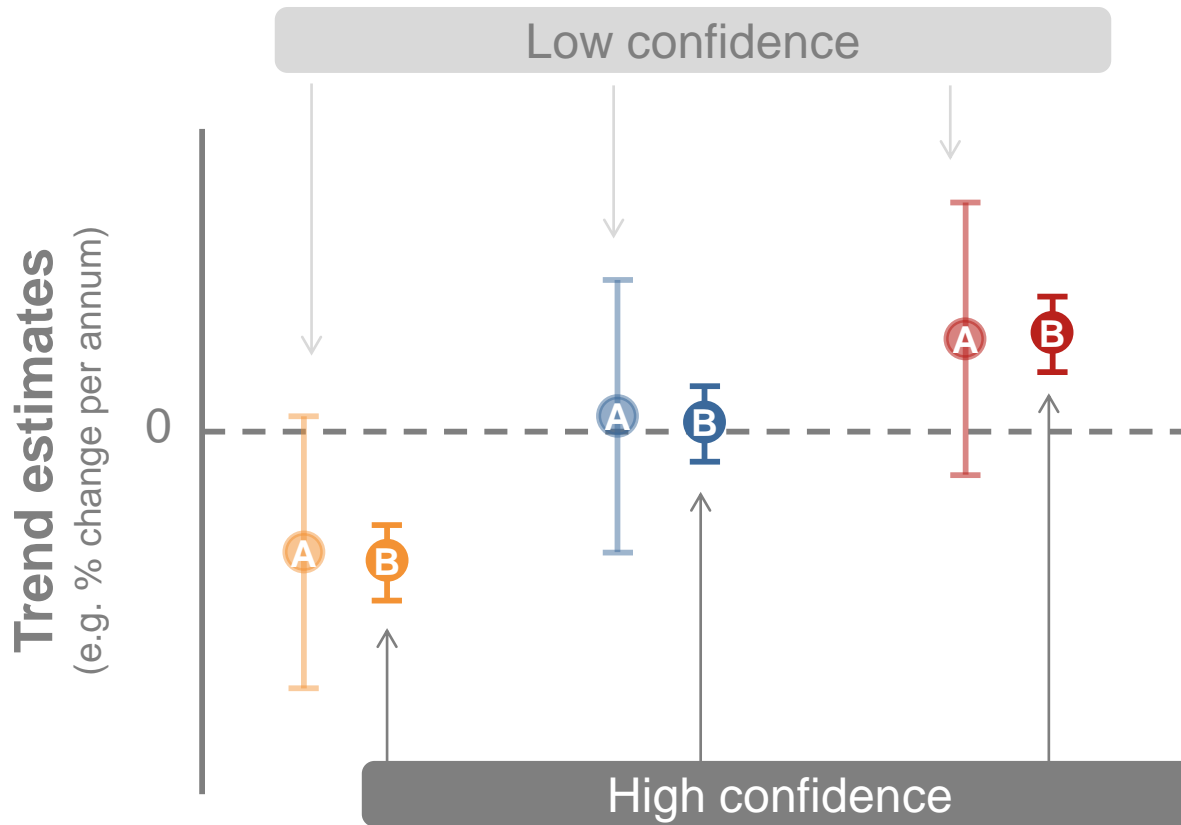
EARLY WARNINGS & SAFETY



Evidence of trend?

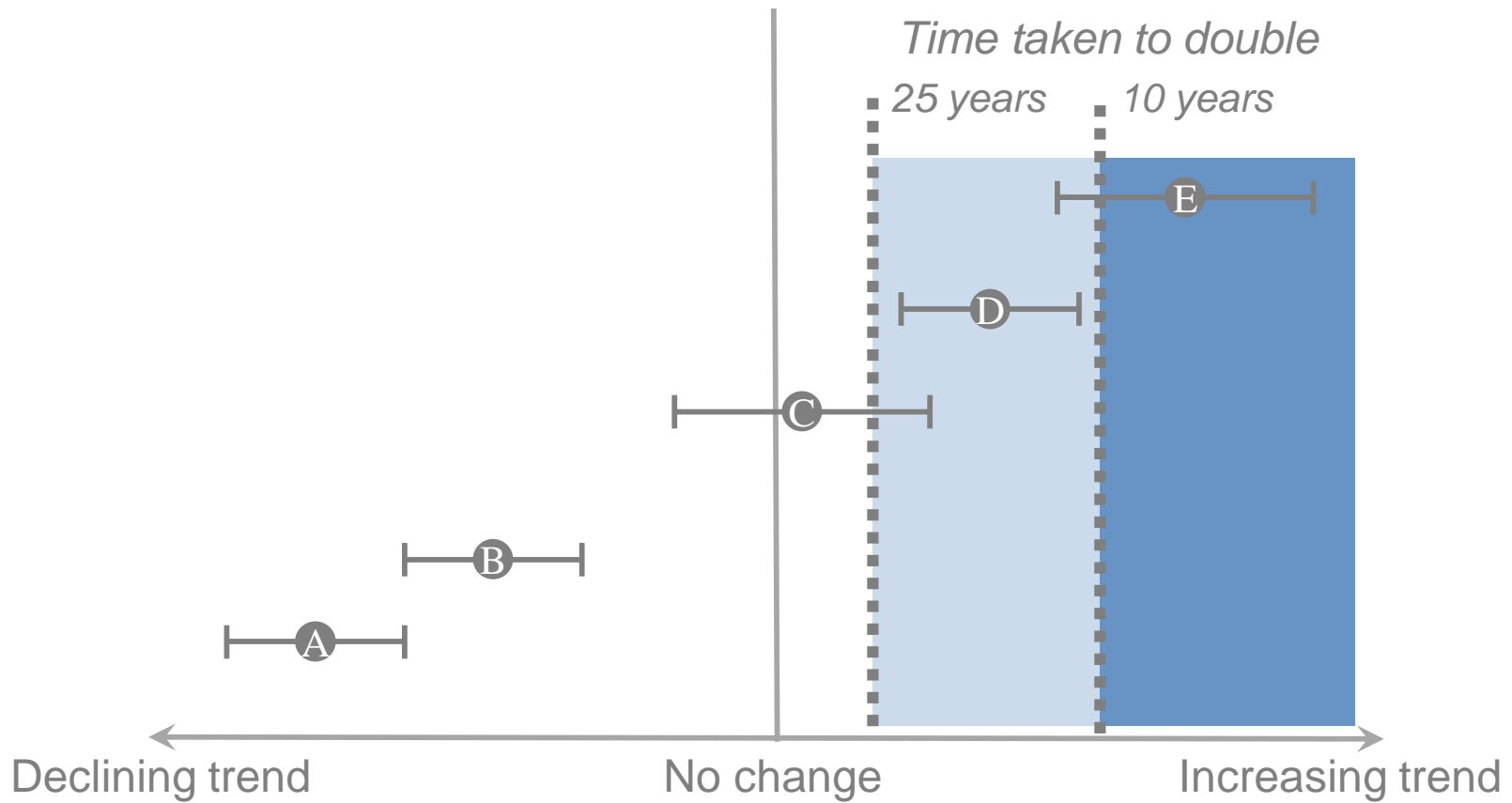


Evidence of trend?

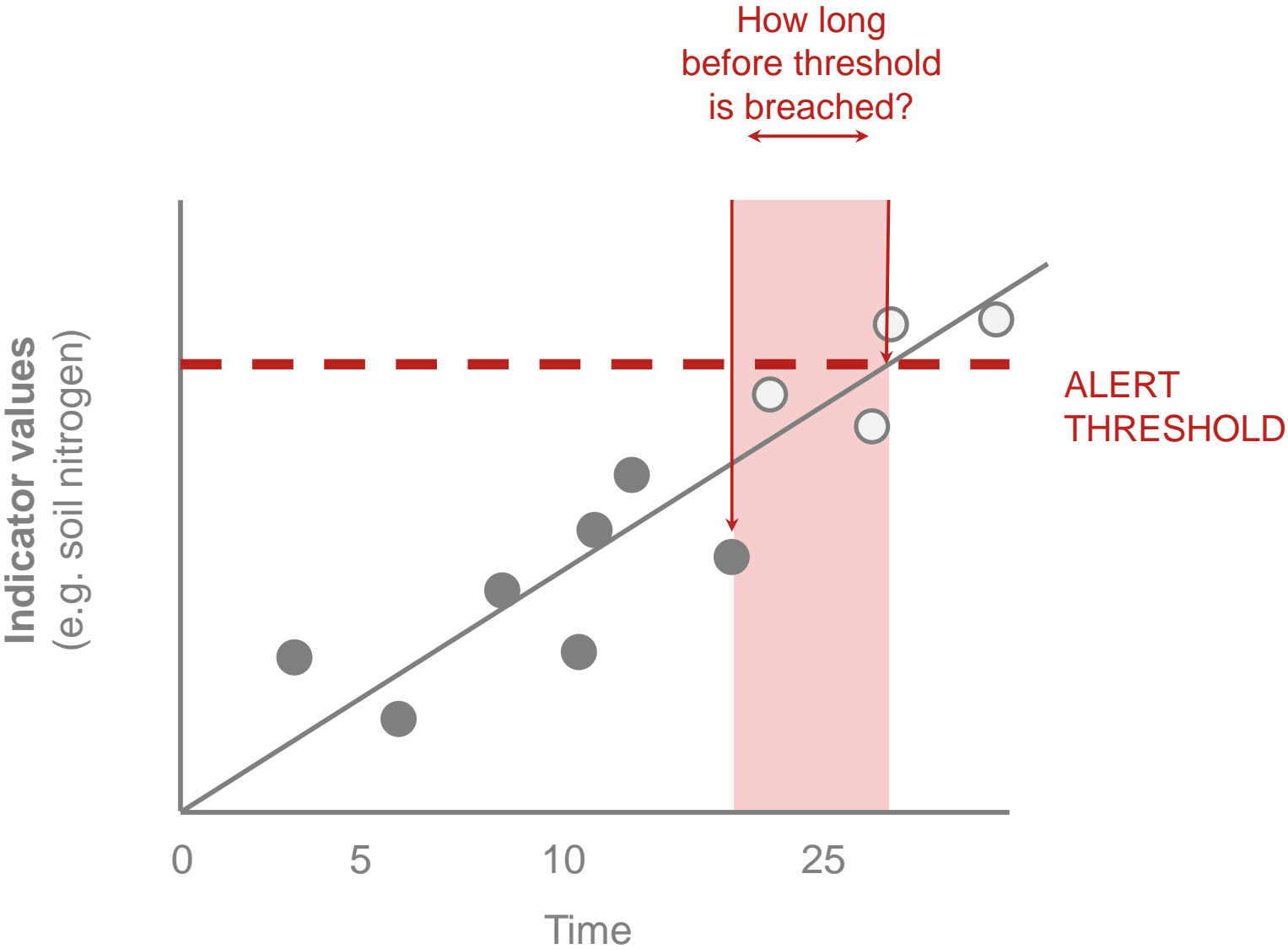


Breaching alert thresholds?

EXAMPLE: FALCON ABUNDANCE ON VINEYARDS



Time to cross alert threshold?





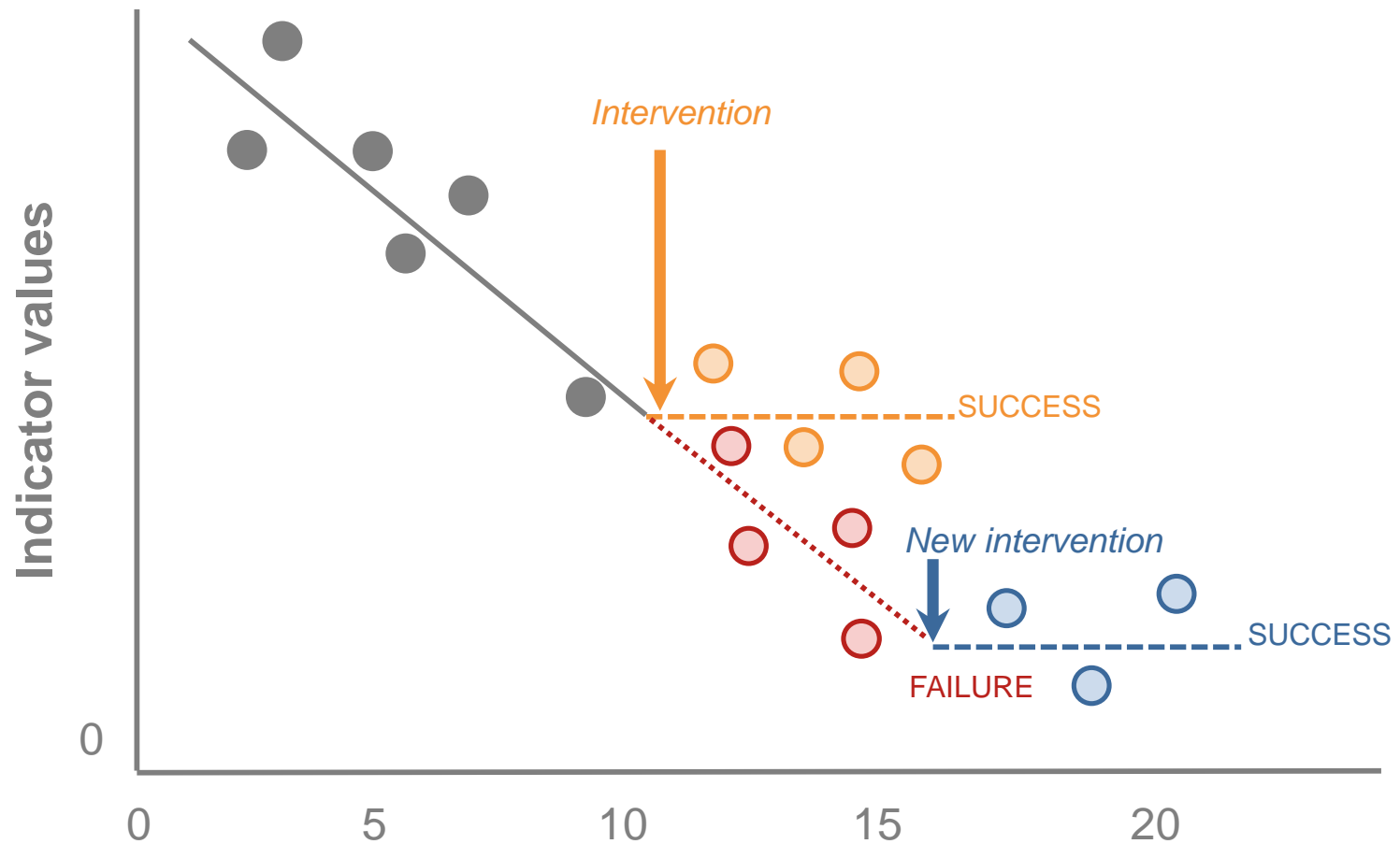
Informing management

LEARNING FOR SUSTAINABILITY



Impact of a management intervention?

Goal: Halt the decline (e.g. in soil quality)

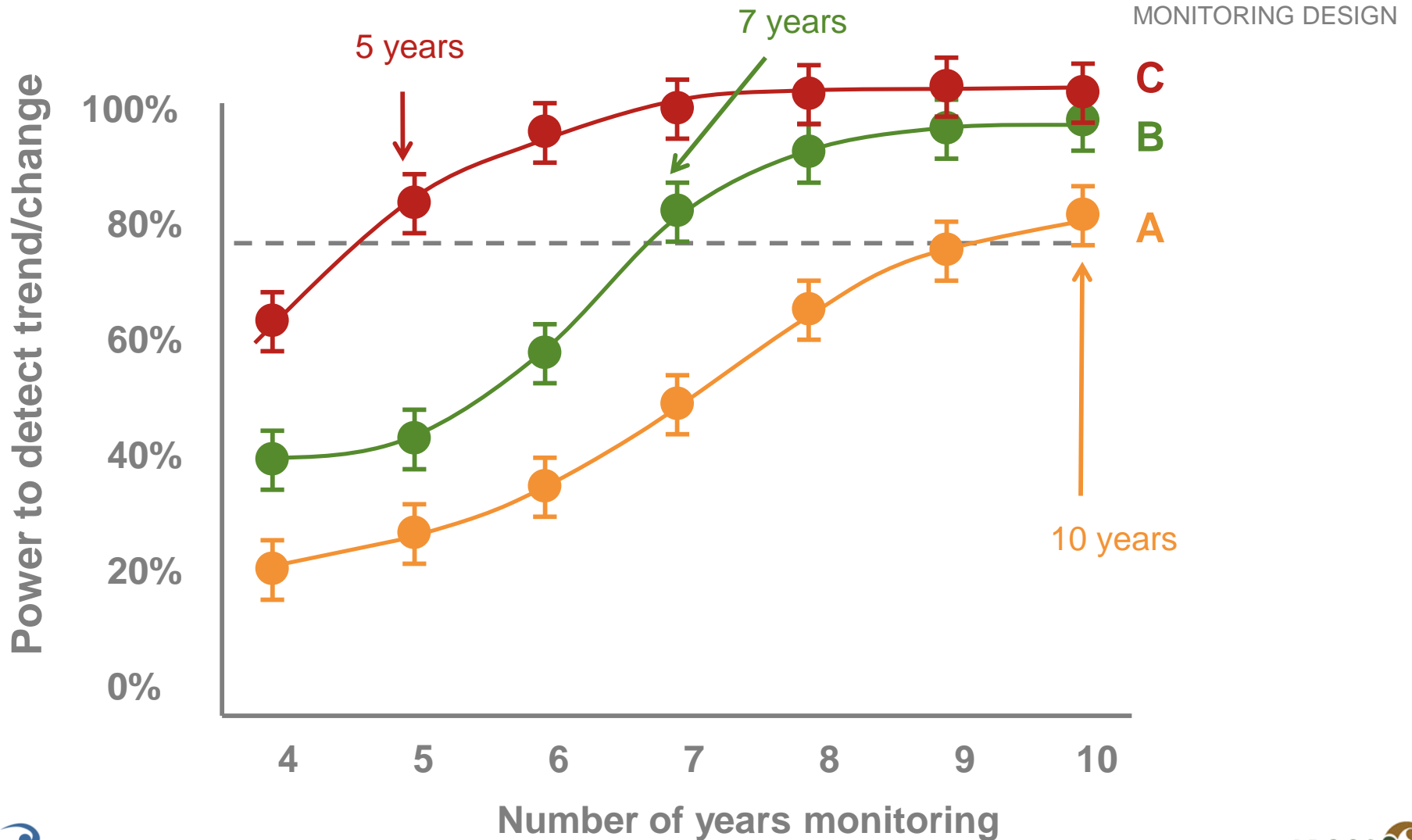




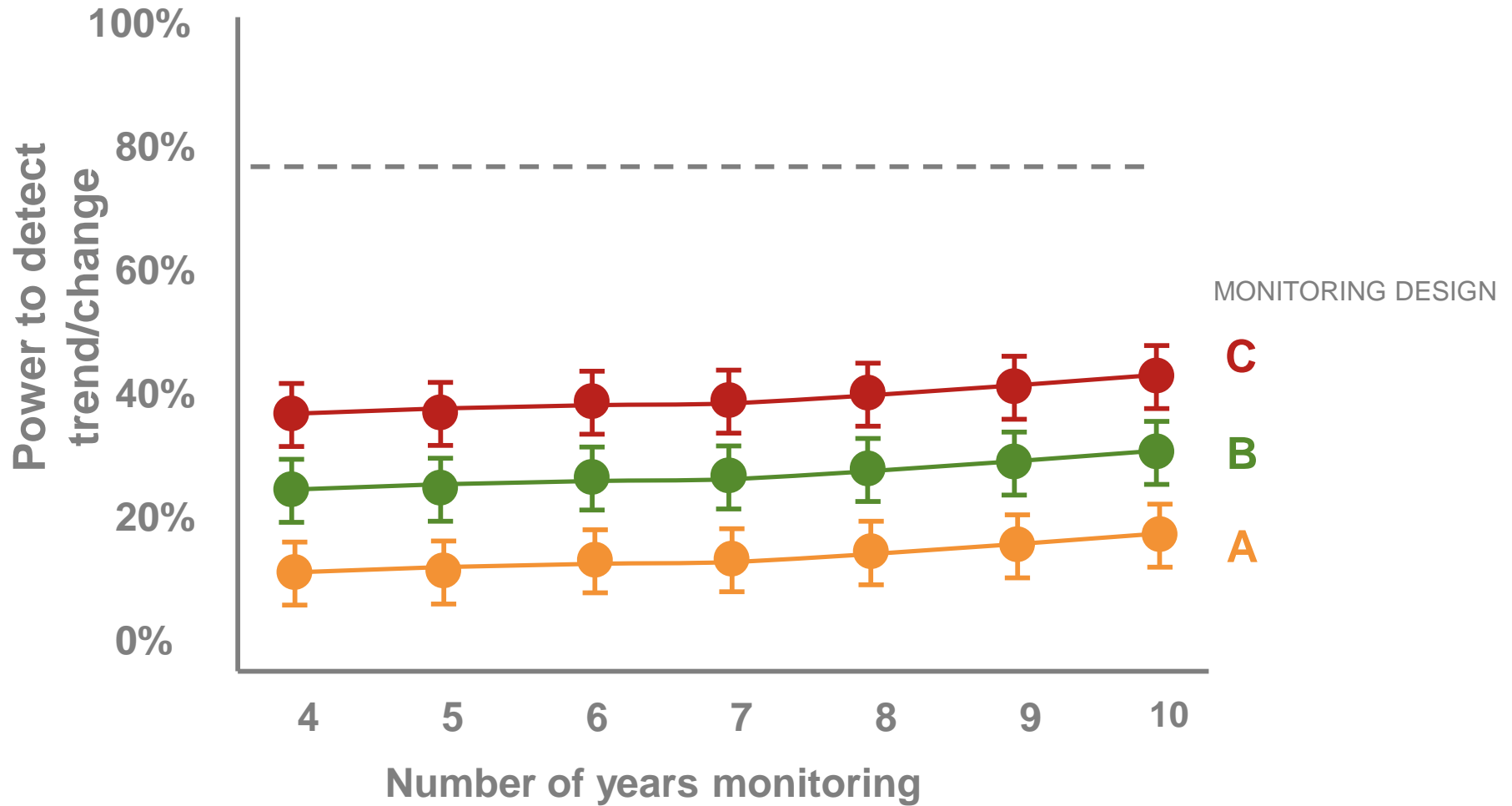
Minimum investment for reliable knowledge

FINE-TUNING MONITORING

How long before detect trend/change?



How long before detect trend/change?



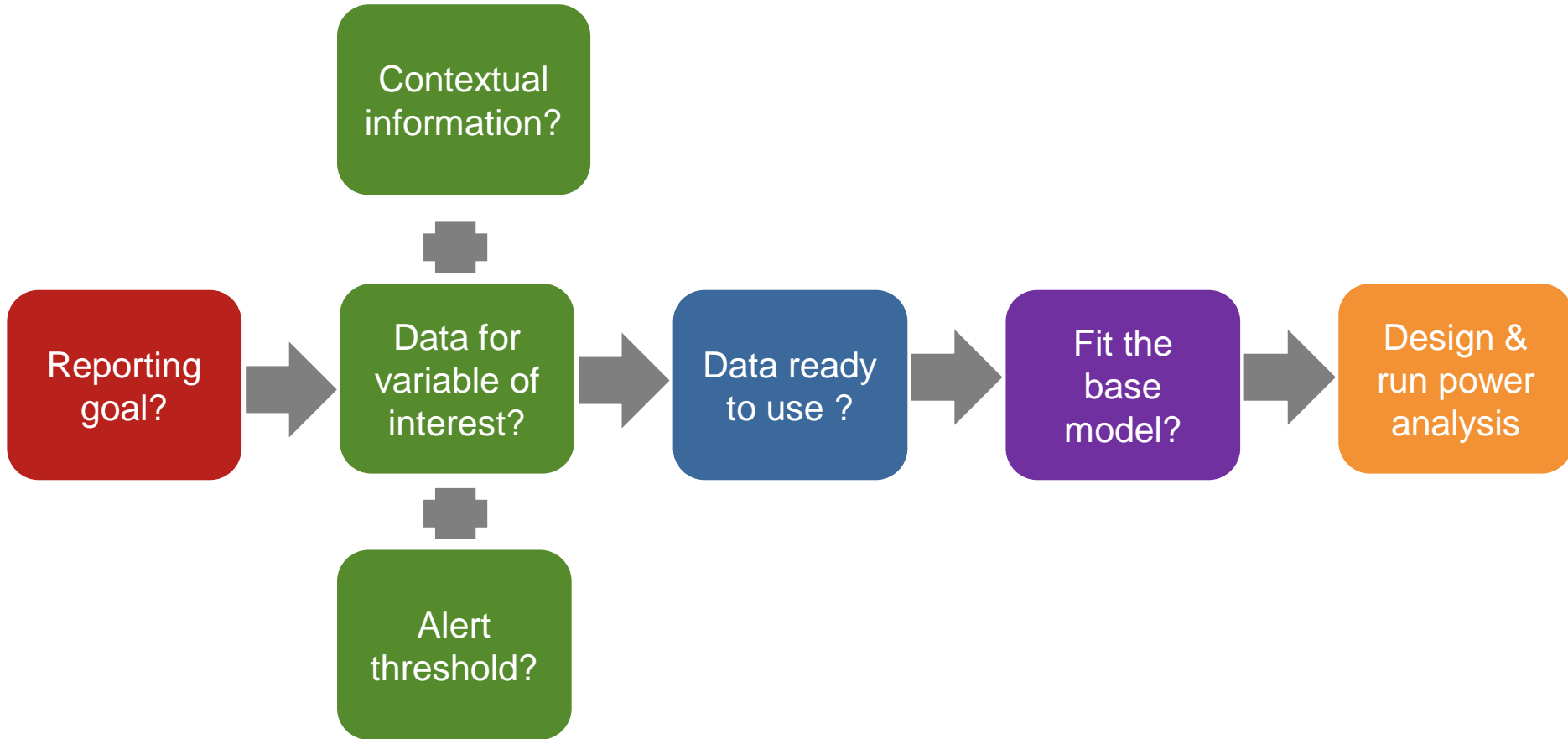


Refining monitoring and reporting designs

KEY STEPS AND SKILLS REQUIRED



Key steps?



Key skills?

Understanding the system and data

Framing and refining the question

Data analysis skills





Building flexible infrastructure

simr - **POWER ANALYSIS PACKAGE**



simr - power analysis package

- Software to assess the power of different monitoring designs to detect trends or changes in monitoring data



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simr – Handles a range of data types

SCORECARD QUESTIONS ASKED

DATA GATHERED

DATA TYPE

Did you use pesticide?

Yes / No

BINARY

What area did you spray with pesticide?

XXX ha

CONTINUOUS

How many times did you spray with pesticide?

X times

COUNT

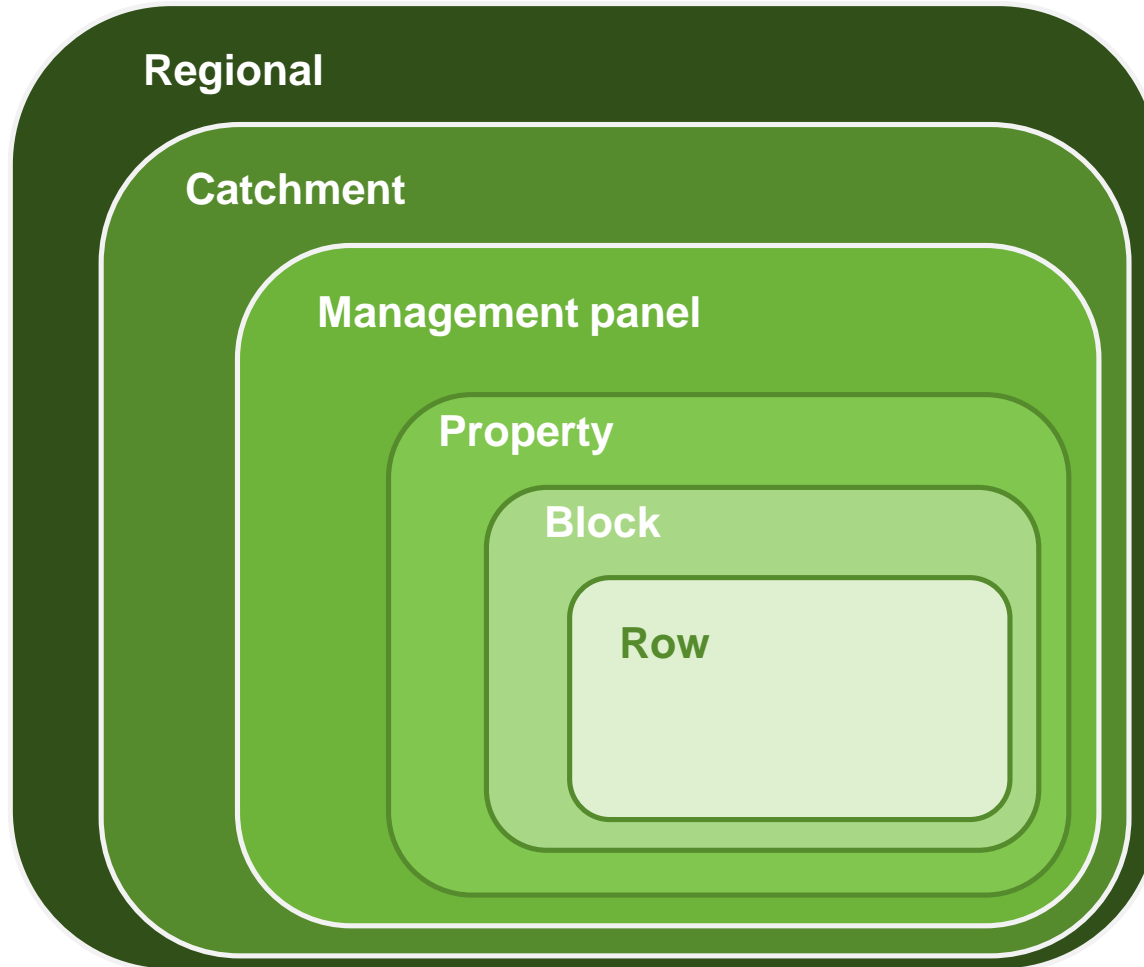
How often did you use pesticide?

1= often
2= occasionally
3 = rarely
4 = never

(ORDINAL)

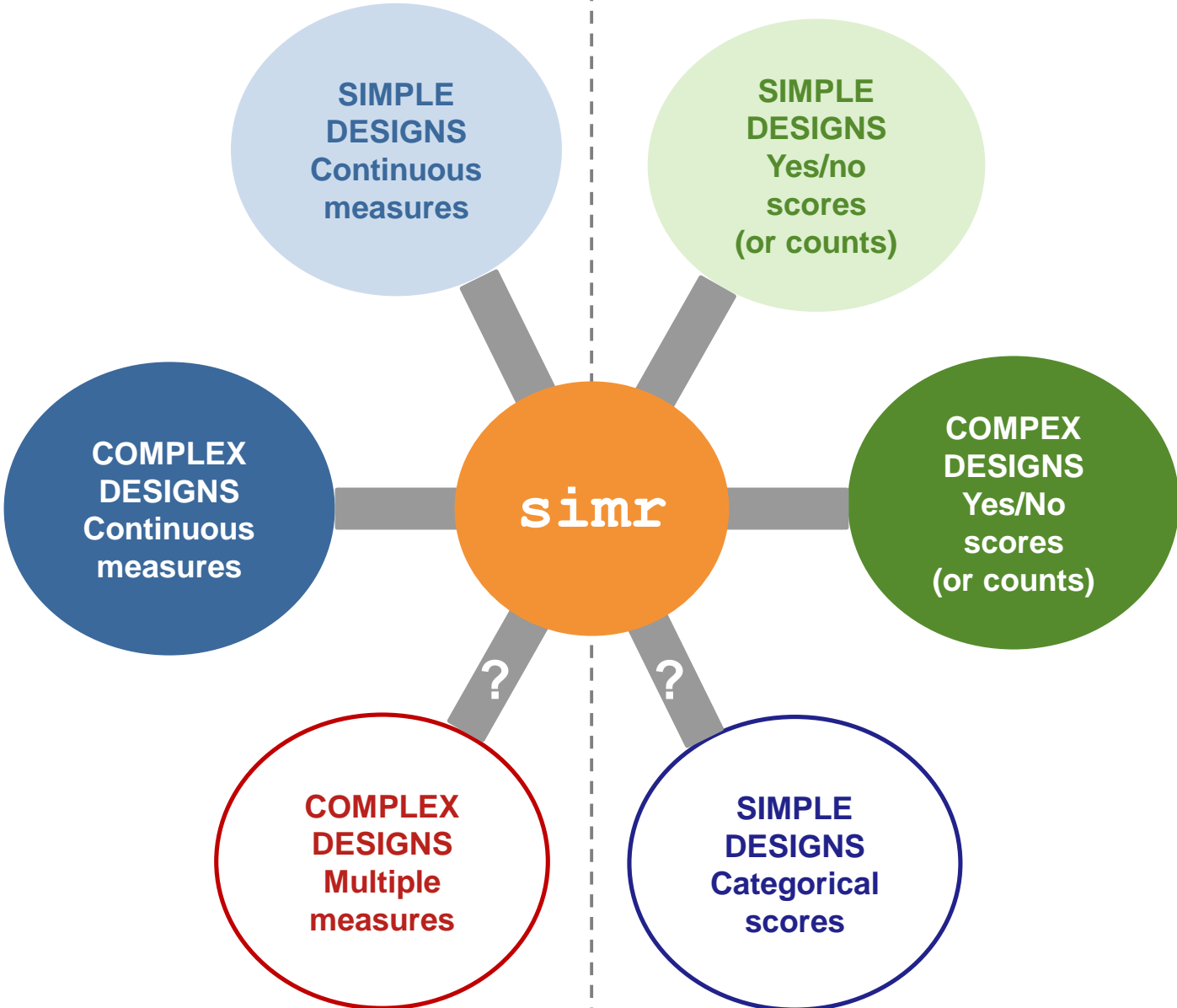


simr – Handles simple to complex designs



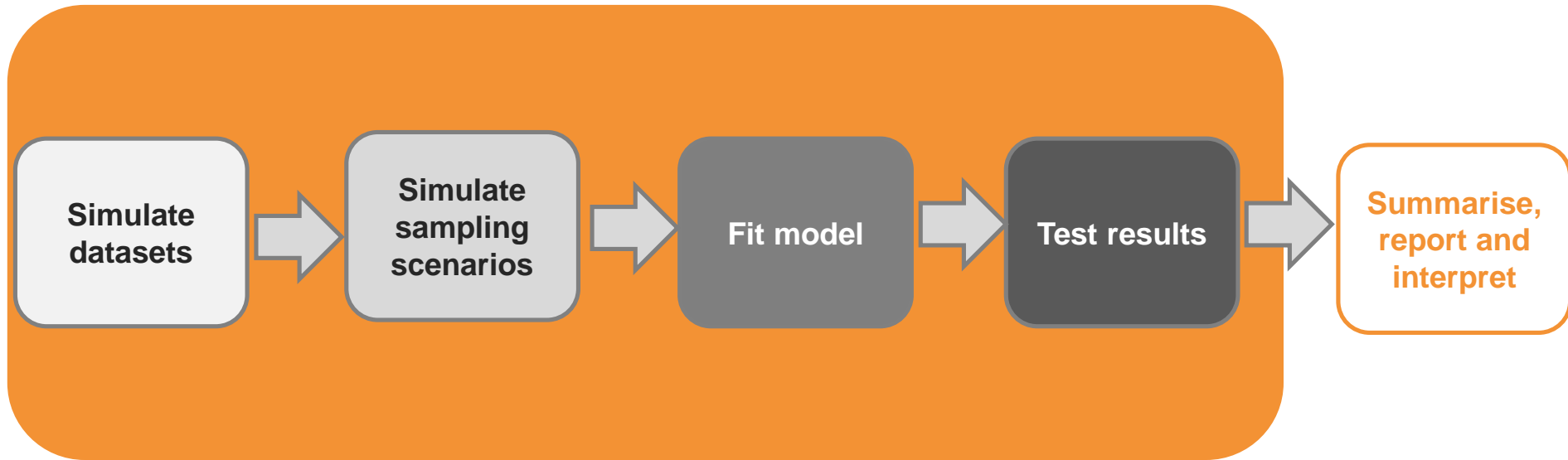
MOST PERFORMANCE-BASED MEASURES

MOST PRACTICE-BASED MEASURES



simr - power analysis package

User enters one or two lines of R-code and behind the scenes the package runs through these steps.....



simr – NZSD example of application

How much data is needed for effective monitoring?

The challenge

There is a trade-off between:

- The cost of monitoring.
- The risk of missing a problematic trend.

What's needed?

Based on the monitoring requirements, an adequate sampling design.

An understanding of the trade-off between the amount of sampling and how effective it will be.

The solution

Power analysis tells us how much data we need to collect.



With too little data we risk missing a trend



But collecting too much data might be expensive

Requirements

An understanding of what is being monitored and clearly defined questions.

Existing data to inform the analysis.

Analysis software and expertise.

Case study: Trends in nitrogen use on kiwifruit orchards

Nitrogen use and associated losses on kiwifruit orchards will be scrutinised, as councils implement fresh water management plans.

Given this, one question might be:

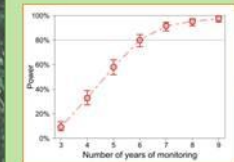
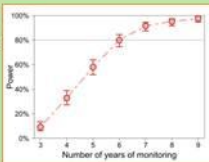
How much monitoring would be required to detect trends in fertiliser use?

To address this question, we used ARGOS data on fertiliser use:

- 30 ARGOS kiwifruit orchards in the Bay of Plenty.
- Orchards arranged in 10 clusters, each including one Green, one Green Organic, and one Gold.
- For the period 2007/8 to 2009/10.



Based on the ARGOS design, it would take 6 years before the risk of missing a 1 kg/ha/yr trend is less than 20%.



To detect a trend of 1 kg/ha/yr within 5 years, a minimum of four clusters would need to be added.



'Success stories' beyond the NZSD

NATIONAL



- Informing regional and national environmental reporting
- Interest from local researchers and academics for their own research and teaching students

INTERNATIONAL



Invitation to run workshop for ecologists and statisticians

Interest in adding new capability to the package

