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POAMA for WA farming

Peter McIntosh, Senthold Asseng, Dean Thomas, Guomin Wang and Nirav Khimashia

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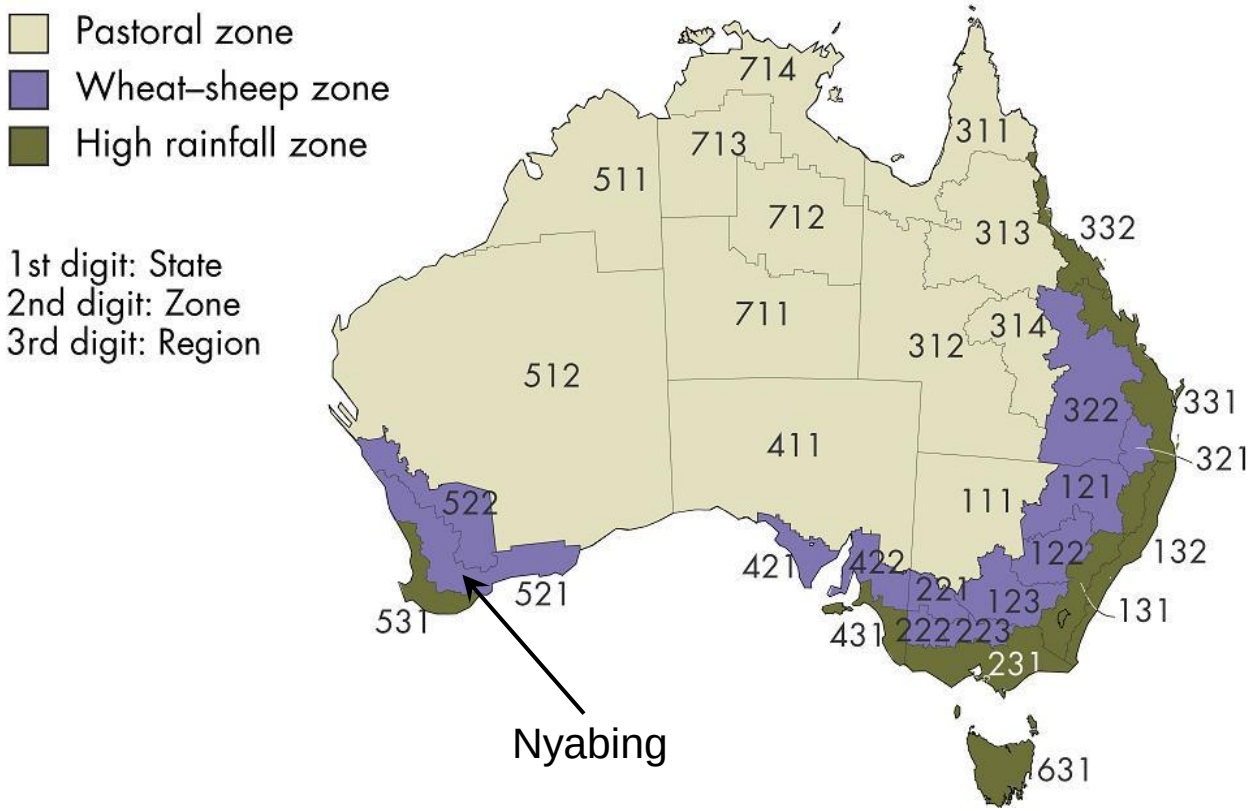
Overview

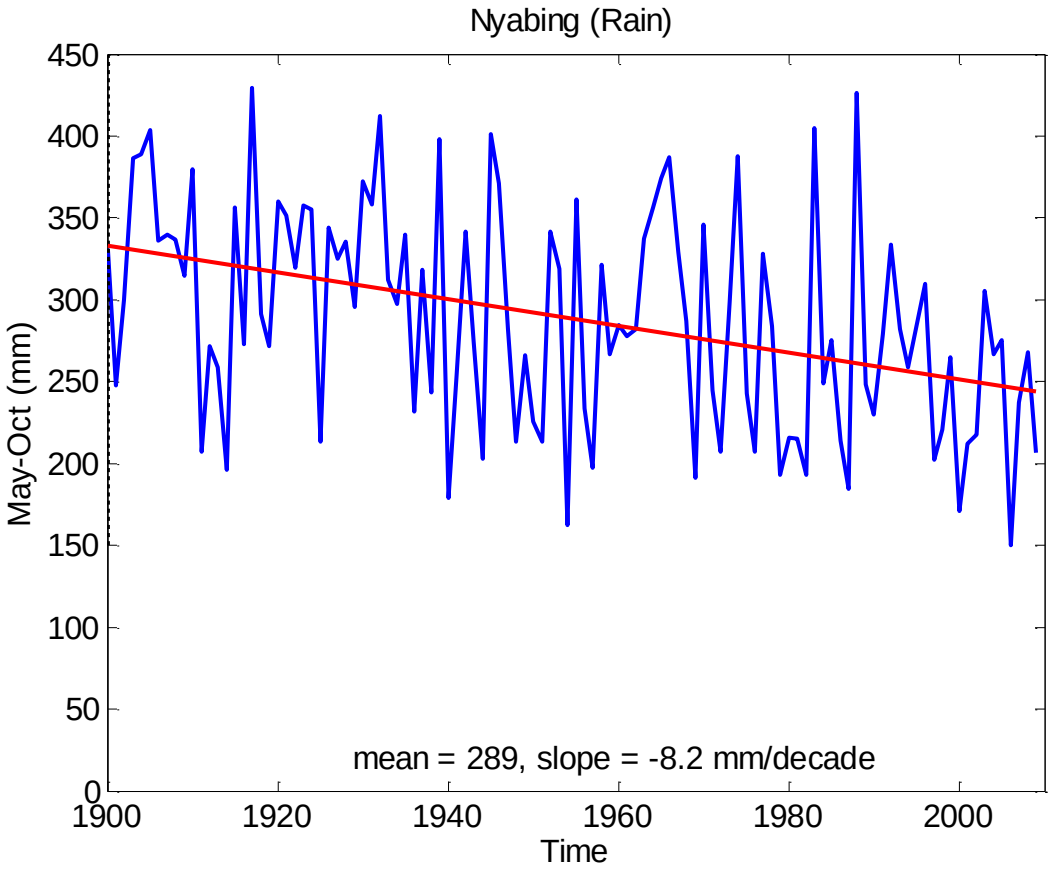
- Simulate growing wheat crop in southwest WA using APSIM
- Explore two different N application strategies
  - maximise income (risky)
  - $1 N must return $2 (risk averse, realistic)
- Vary N rate using seasonal forecast from POAMA
  - May-Oct rainfall forecast (above/below median)
- Show that the forecast
  - is much more valuable for the realistic N management strategy
  - requires fewer good years for greater returns (climate change)
- Explore risk and payoff time for forecast

Asseng, S., P.C. McIntosh, G. Wang and N. Khimashia, 2012: Optimal N fertiliser management based on a seasonal forecast. *Europ. J. Agronomy,* **38,** 66-73.

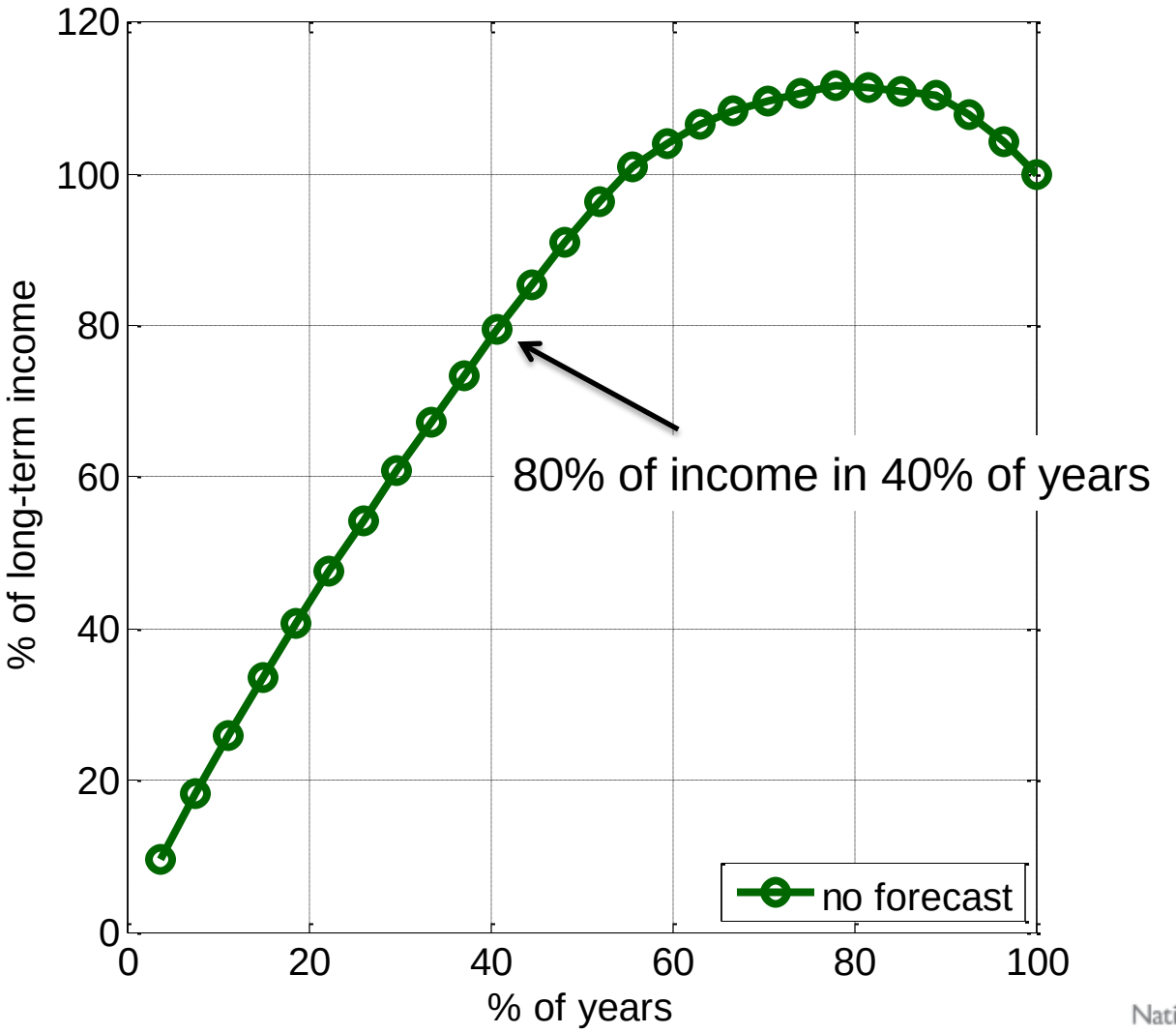
Australian broadacre zones and regions



Good years decreasing



The importance of good years



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Simulated wheat crop 1980-2006

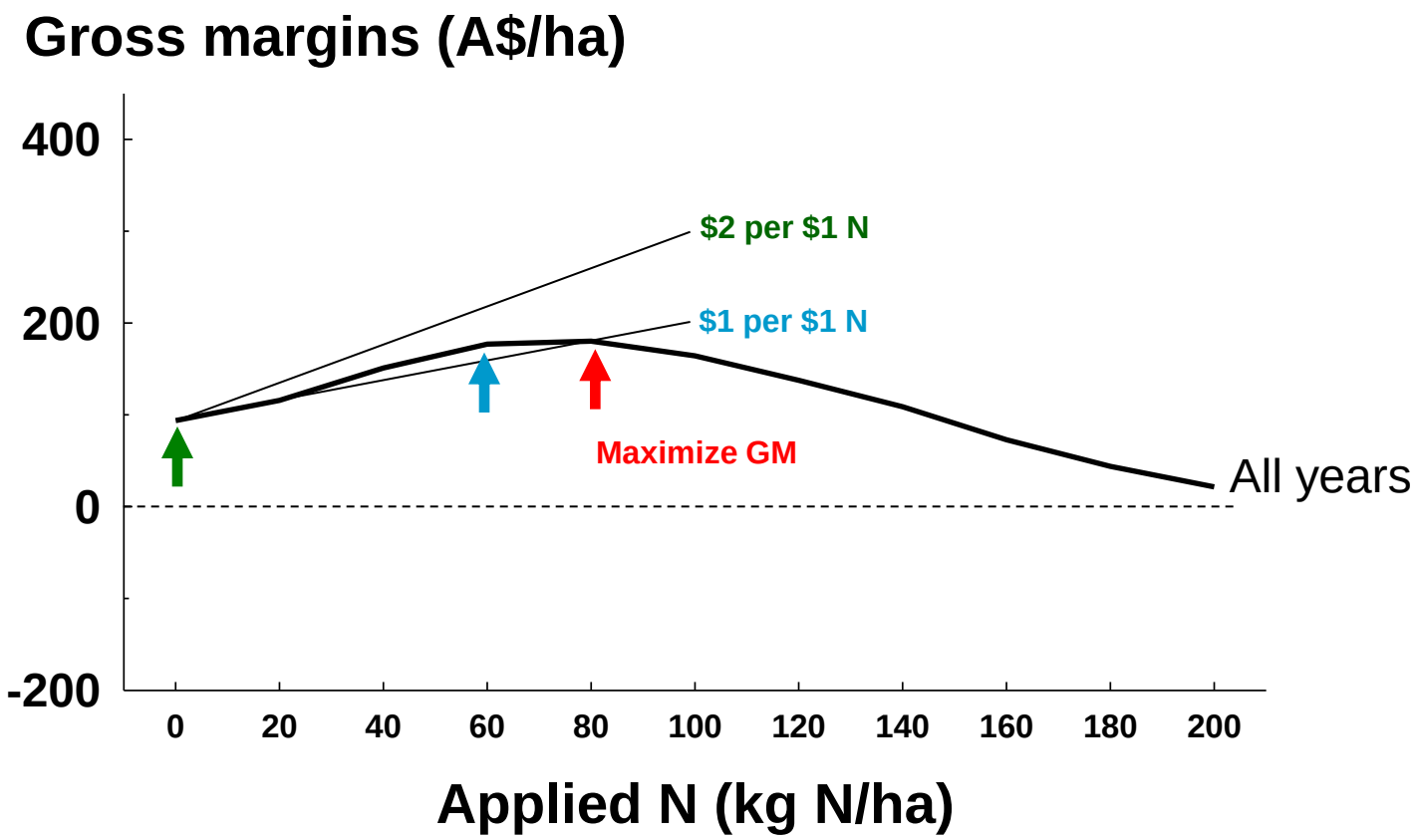
- Crop simulation model APSIM-Nwheat
- Local variety, clay soil
- Reset soil moisture to no plant-available stored soil water each year
- Reset to 50 kg mineral N per ha each year
- Plant after enough rain (10mm over 10 days)
- Apply nitrogen (N) at sowing (>80kg applied 4 weeks later)

- Gross Margin (GM) = income – operating cost – N cost

- Wheat price $200/t (± protein premium/penalty)
- Operating = seed, sprays, diesel, insurance, interest etc ($150/ha)
- N cost = $1 per kg

- Experiment designed to isolate the climate effect
- In practice, need to consider multiple management decisions that may interact in a non-linear way

How much N (nitrogen fertiliser) to add?



Nyabing, clay soil, average for 1980-2006, same N applied every year

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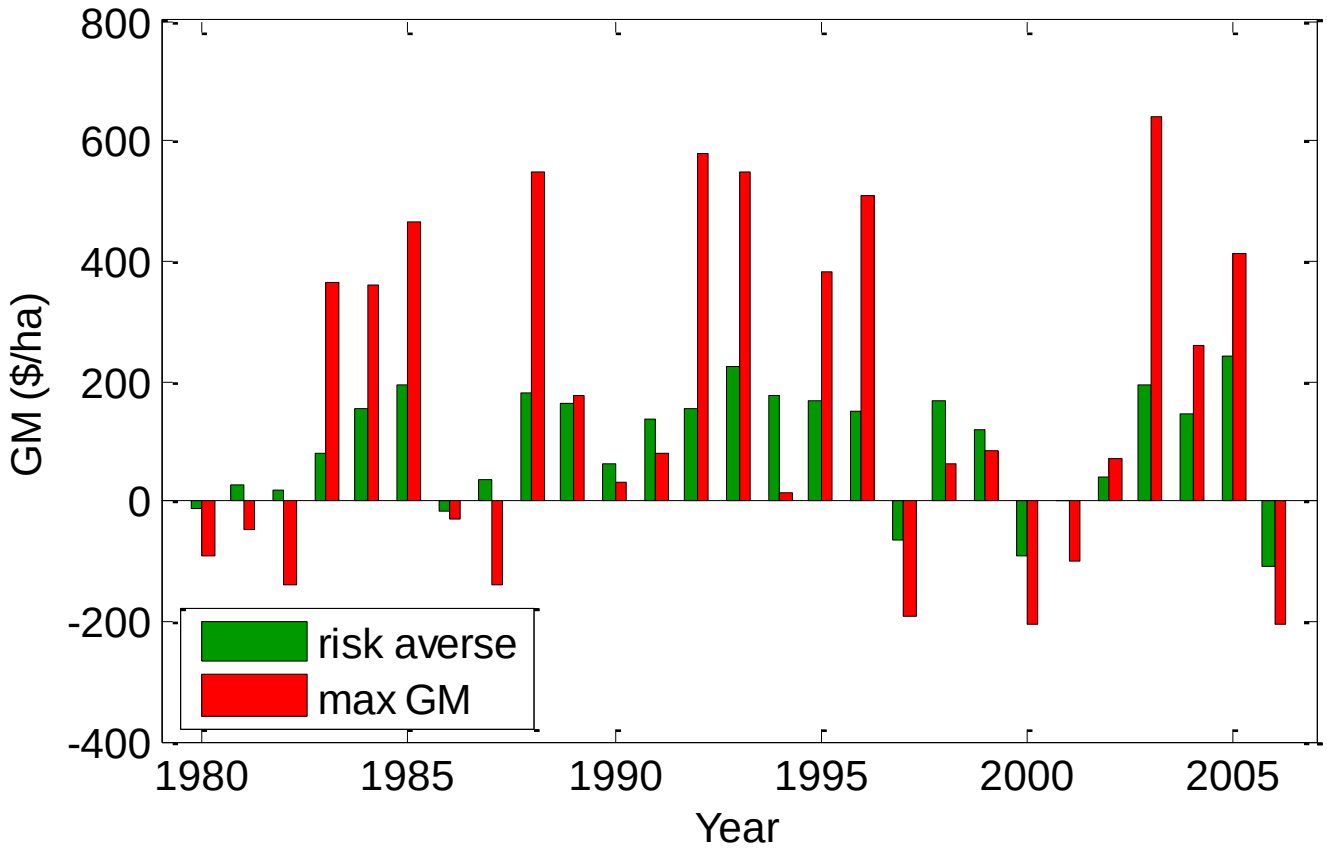
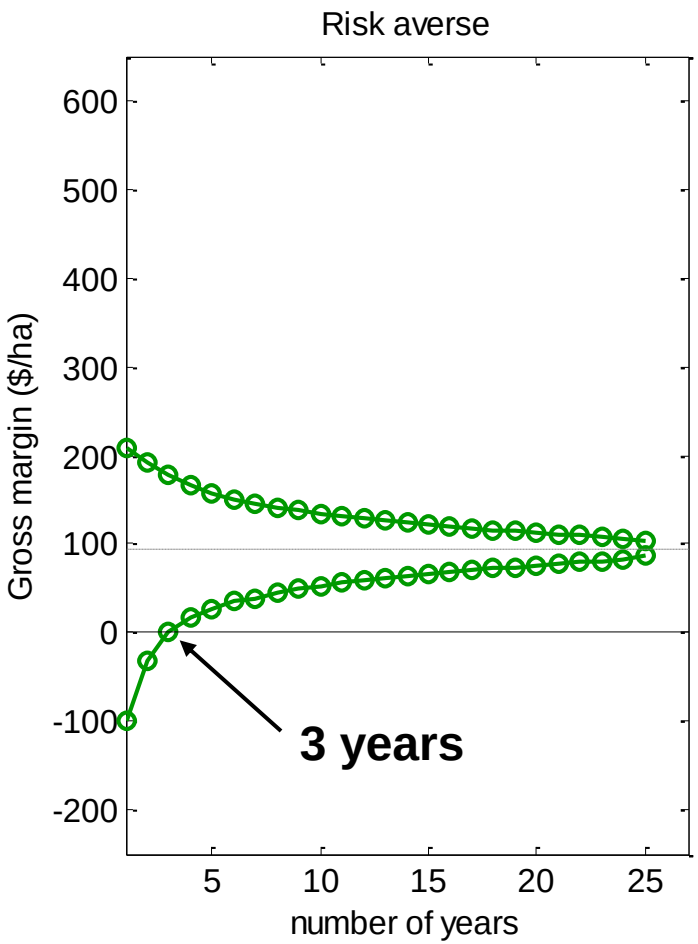
Why be risk averse?

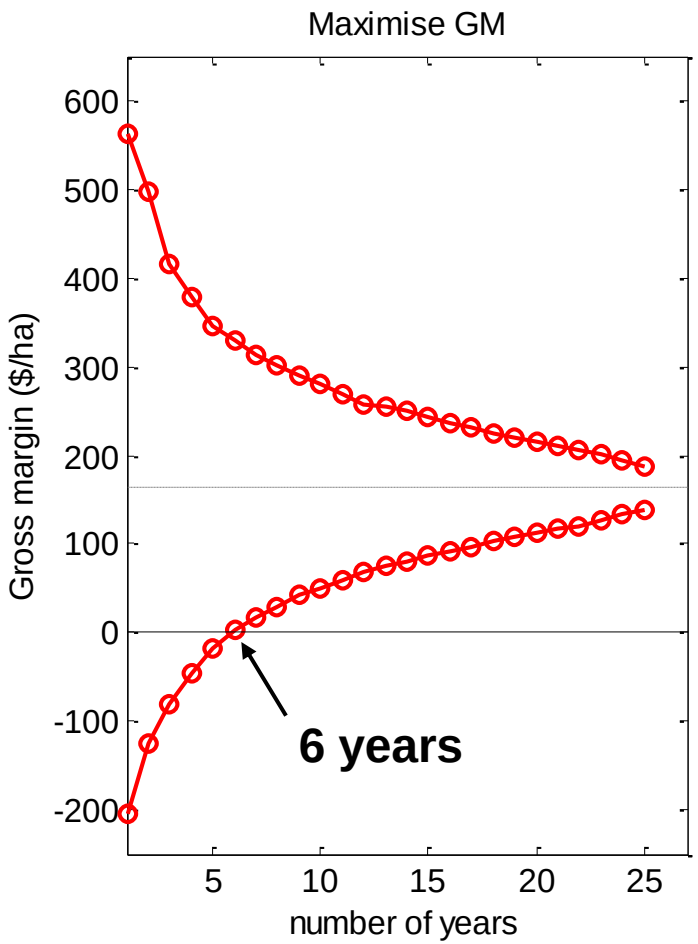


3 bad years in a row can lose the farm

1 really bad year can compromise the next 2-3

Number of years to be 95% sure of breaking even





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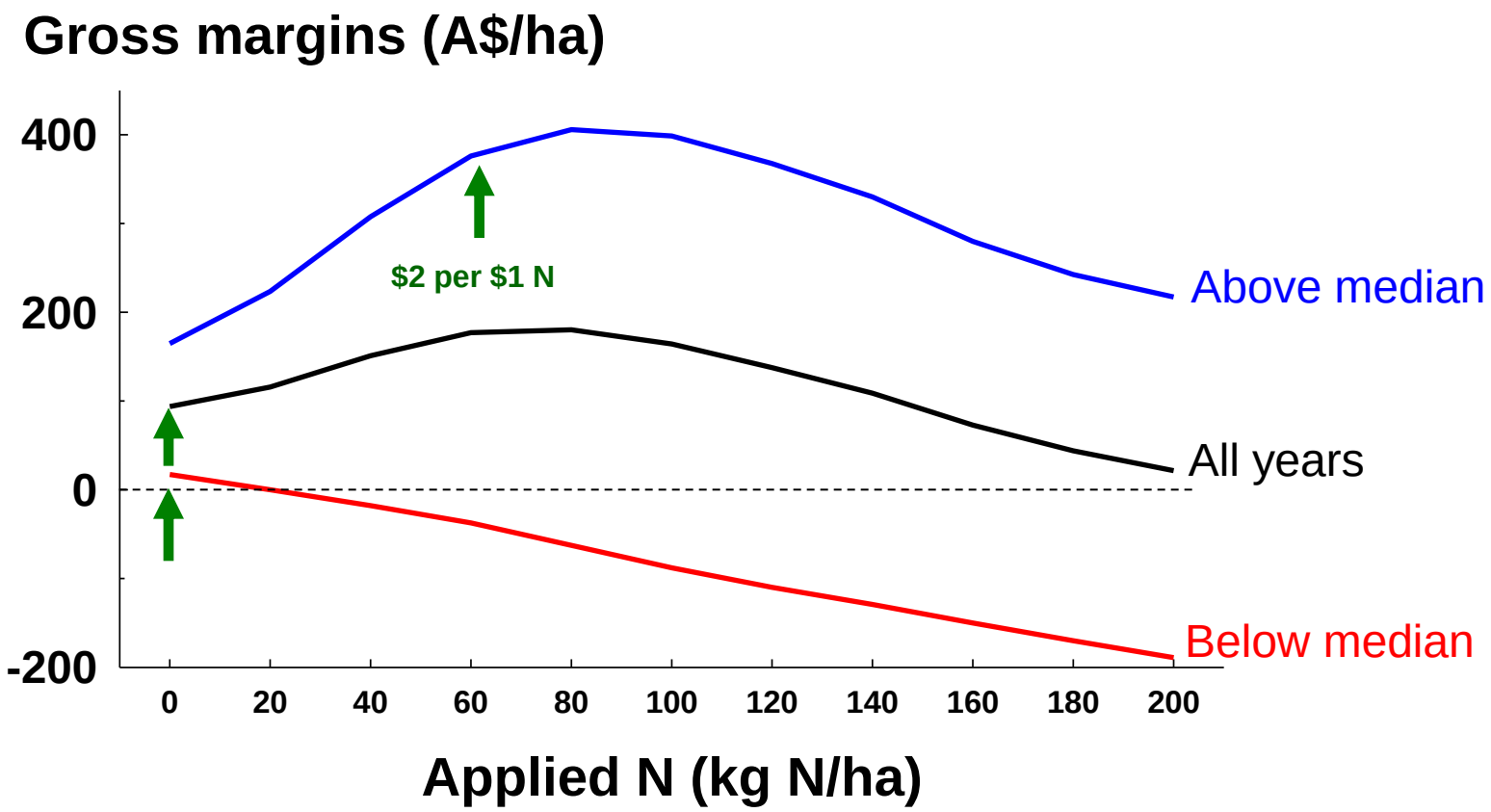
How much N in wet vs. dry years?



Nyabing, clay soil, 1980-2006

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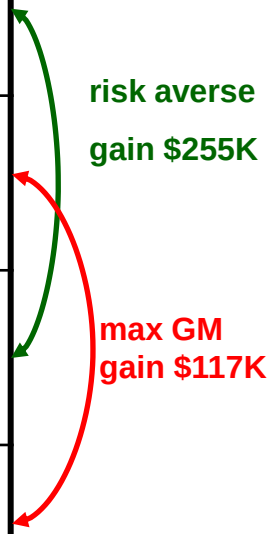
Potential value of a forecast

Strategy	N (kg/ha) above/below	GM ($/ha) above/below ave	Farm Income ($/2500ha)
Climatology (risk averse)	0 / 0	166 / 27 94	235,000
Climatology (maximise GM)	77 / 77	376 / -32 164	410,000
Correct 2 category (risk averse)	60 / 0	378 / 27 196	490,000
Correct 2 category (maximise GM)	80 / 0	410 / 27 211	527,500



Risk averse strategy gains more from a perfect forecast

Seasonal forecast model - POAMA

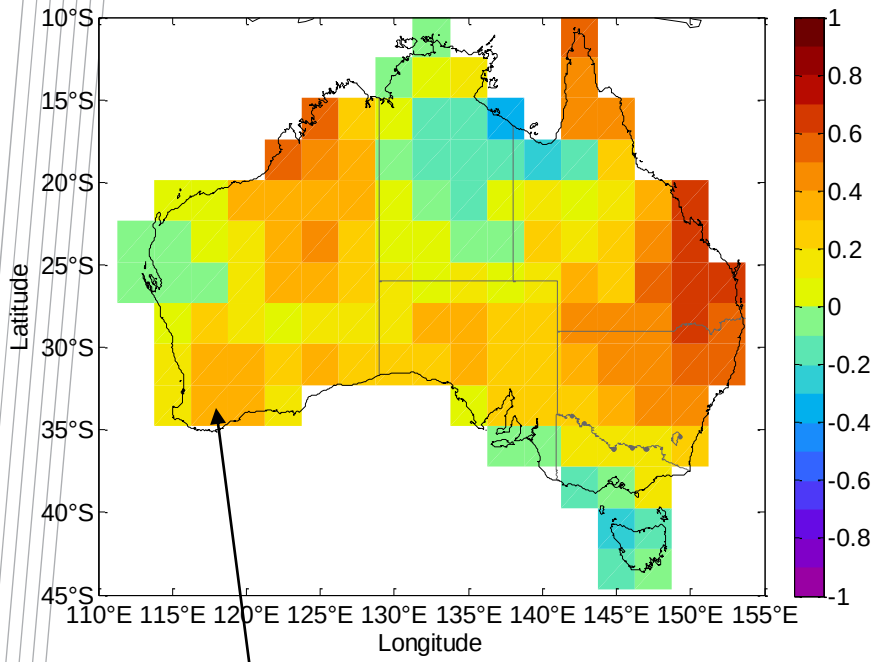
- Predictive Ocean Atmosphere Model for Australia

- Models the earth system (atmosphere, ocean, ice, land)
- Based on dynamics of fluids, range of physical processes
- Start from measured state of the ocean and atmosphere
- Step forward every 15 minutes for 9 months on global 250km grid
- Predicts wind, temperature, rainfall
- Climate change built-in

- Start 1 May, predict May-Oct rainfall
- 1980-2006
- Version 1.5 (now up to 2.4)

Forecast skill

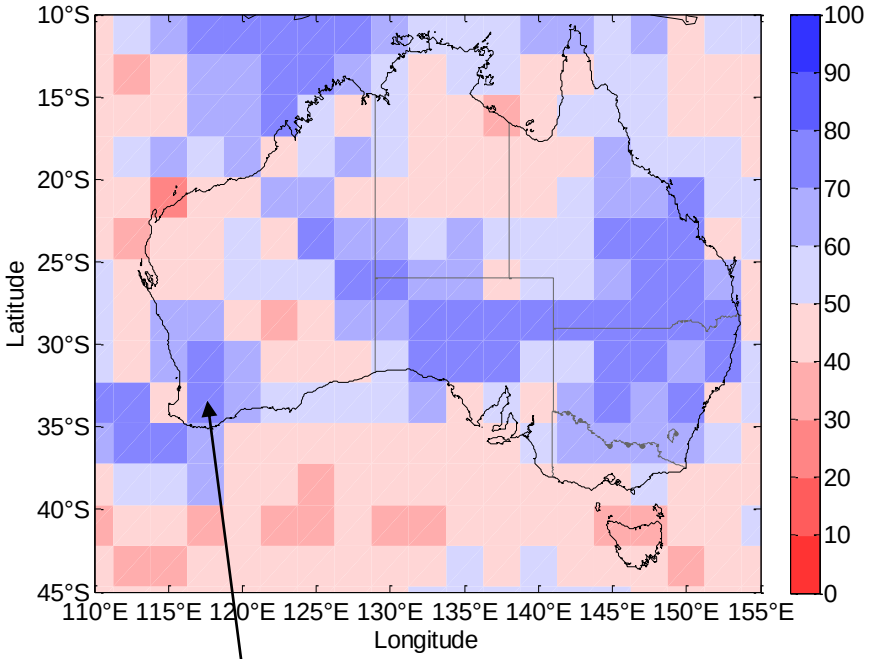
correlation (r)



r=0.32 at Nyabing

(significant at 90% but not 95%)

two-category hit rate



70% at Nyabing

(significant at 95%)

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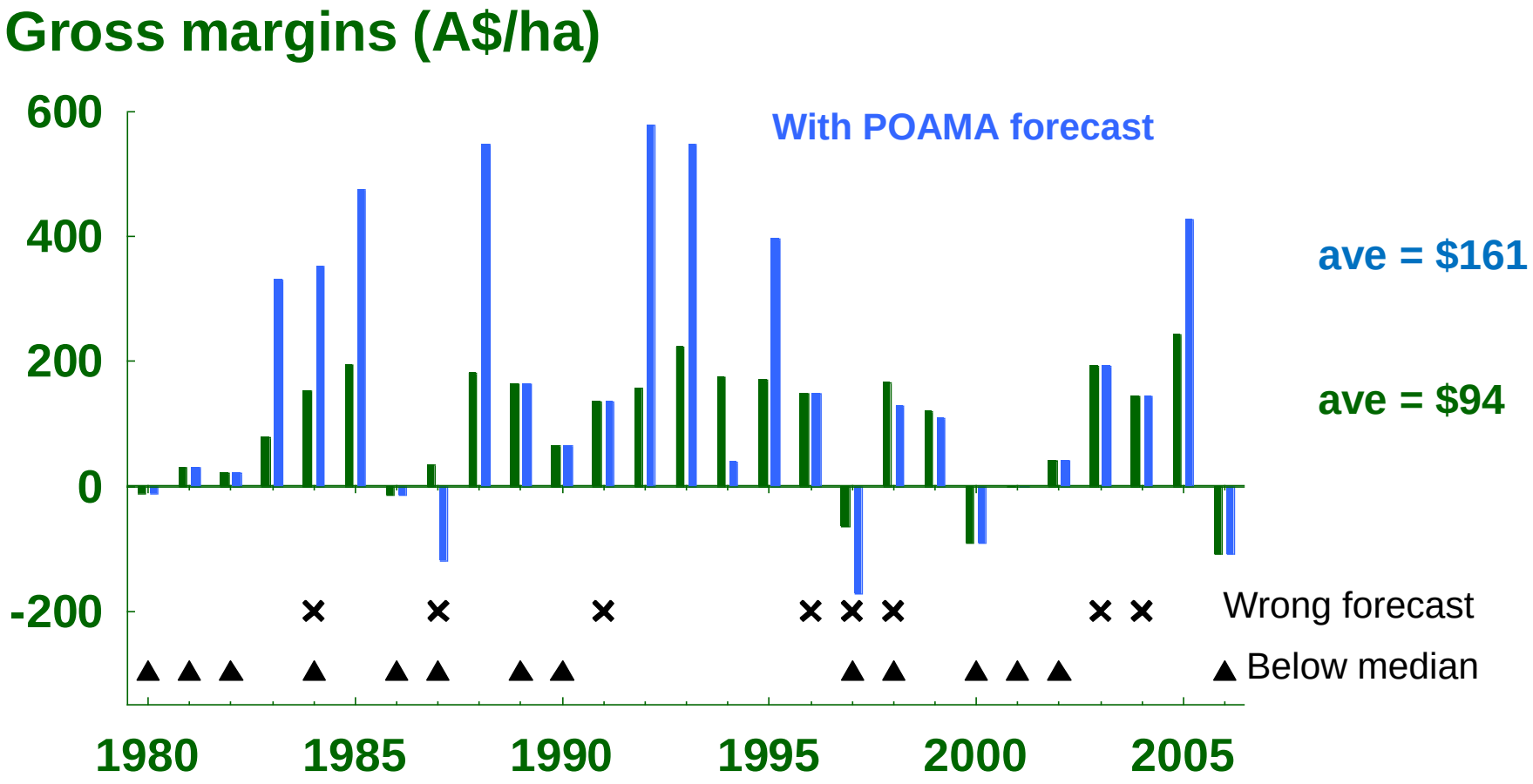
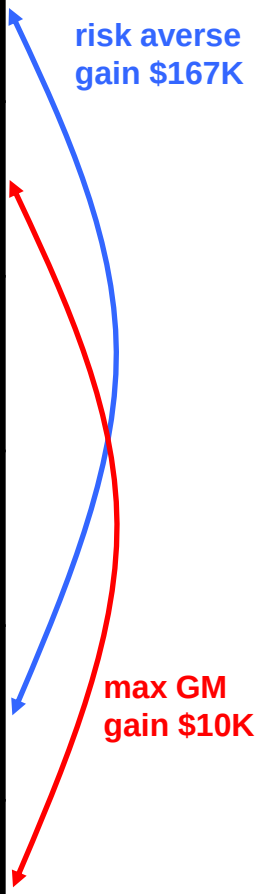
Use POAMA forecast to determine N



Risk averse strategy

Strategy	N (kg/ha) above/below	GM ($/ha) above/below ave	Farm Income ($/2500ha)
Climatology (risk averse)	0 / 0	166 / 27 94	235,000
Climatology (maximise GM)	77 / 77	376 / -32 164	410,000
Correct 2 category (risk averse)	60 / 0	378 / 27 196	490,000
Correct 2 category (maximise GM)	80 / 0	410 / 27 211	527,500
POAMA 2 category (risk averse)	60 / 0	313 / 20 161	402,500
POAMA 2 category (maximise GM)	80 / 0	335 / 13 168	420,000

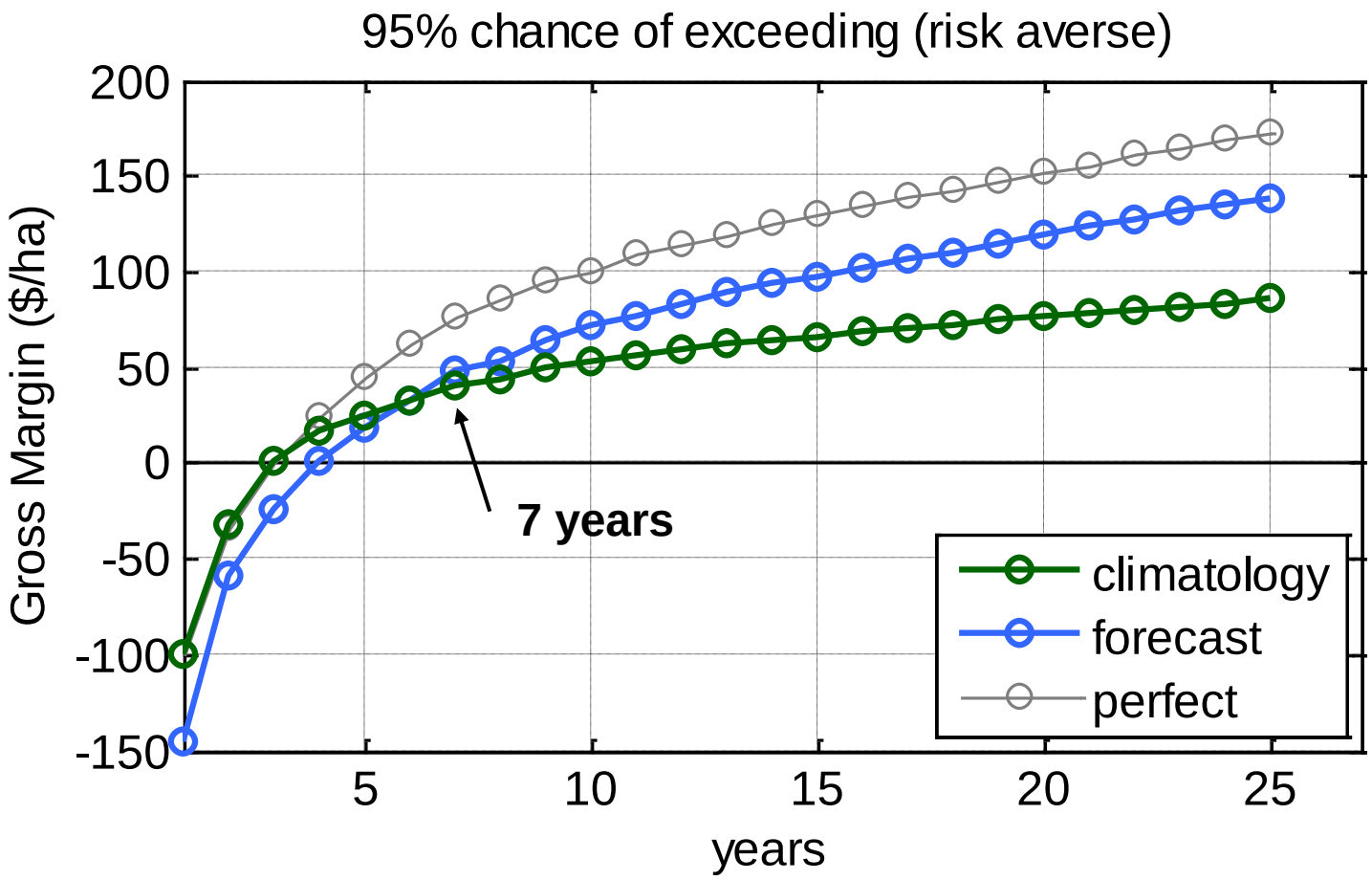


Forecast value

	Climatology	POAMA forecast	Correct forecast	Forecast efficacy
Risk averse	$235,000	$402,500	$490,000	66%
Maximise GM	$410,000	$420,000	$527,500	9%

Planted area 2500 ha

How long for a forecast to pay off?



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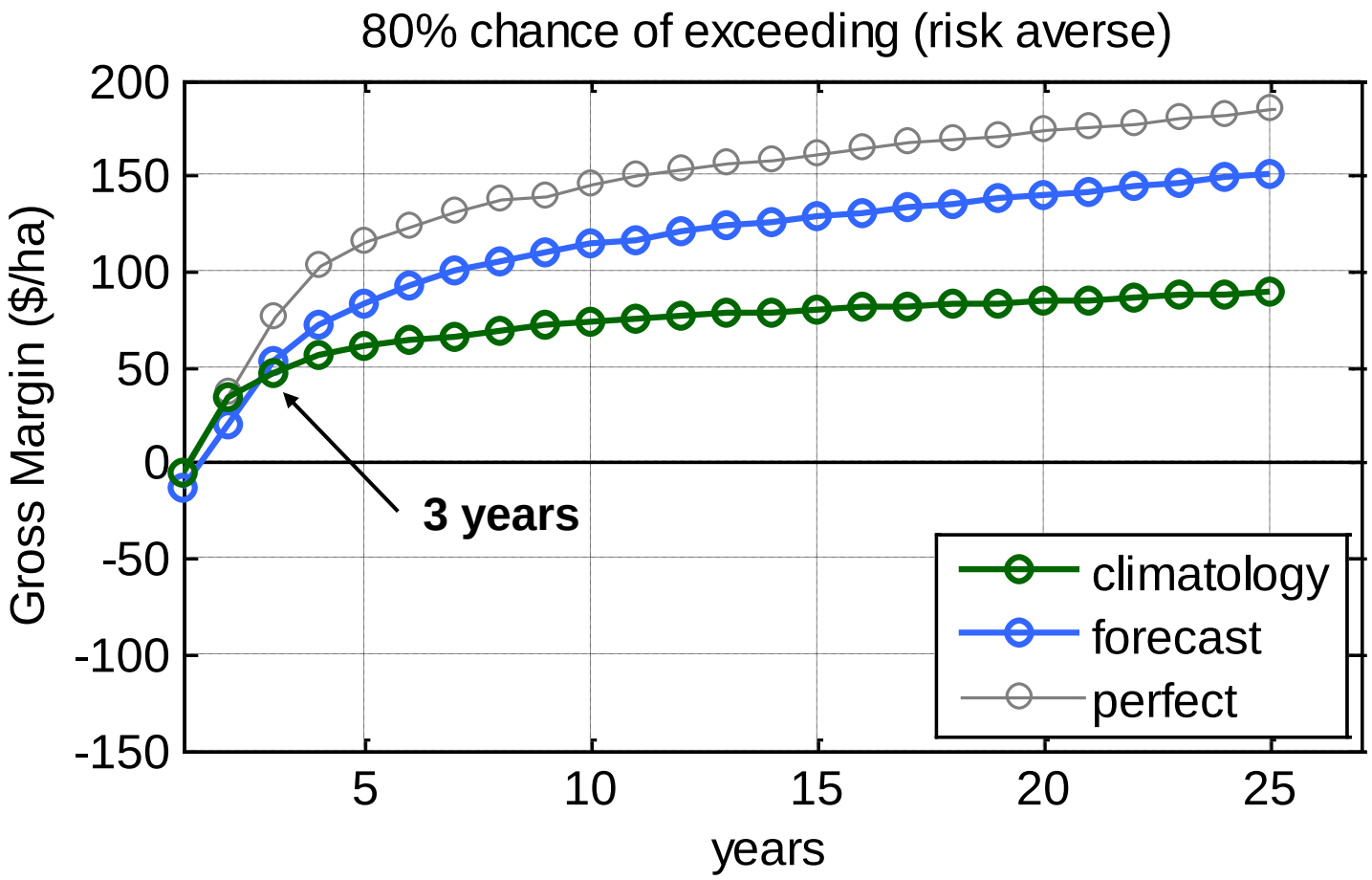
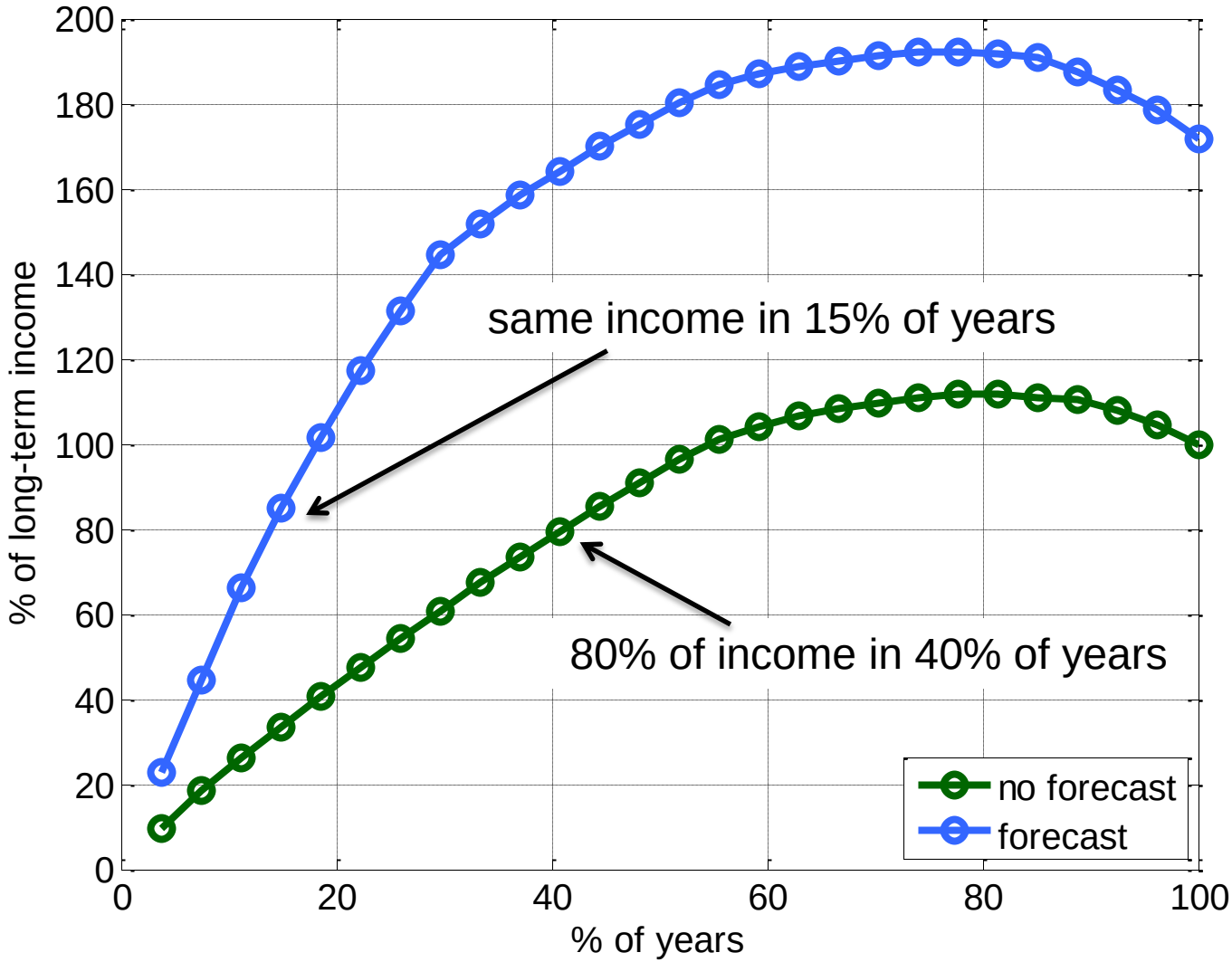


Forecast makes the most of good years



Summary

- Get much better value from a seasonal forecast using a realistic conservative management strategy
- A moderately skilful forecast (19 out of 27 years correct) can increase farm profit from $235K to $402K
- Using such a forecast pays off in
  - 7 years (at 95% certainty)
  - 3 years (at 80% certainty)

MANAGING CLIMATE VARIABILITY
R & D PROGRAM

GRDC
Grains Research & Development Corporation

CAWCR
(The Centre for Australian Weather and Climate Research - A partnership between CSIRO and BoM)
Peter McIntosh
Principal Research Scientist

Phone: +61 3 6232 5390
Email: peter.mcintosh@csiro.au
Web: www.csiro.au/cmar

www.csiro.au

Thank you

Contact Us
Phone: 1300 363 400 **or** +61 3 9545 2176
Email: Enquiries@csiro.au **Web:** www.csiro.au

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