Doing Things Differently: Recalibrating Farm Business Management and Risk Management in a Changing and Uncertain World

By

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1/ Farm Business Management

2/Big Picture: History, Population and Food, Climate, Sustainability

3/Agriculture in Australia

4/Things the most successful farmers and their advisors do

5/Changing Climate – what to do?

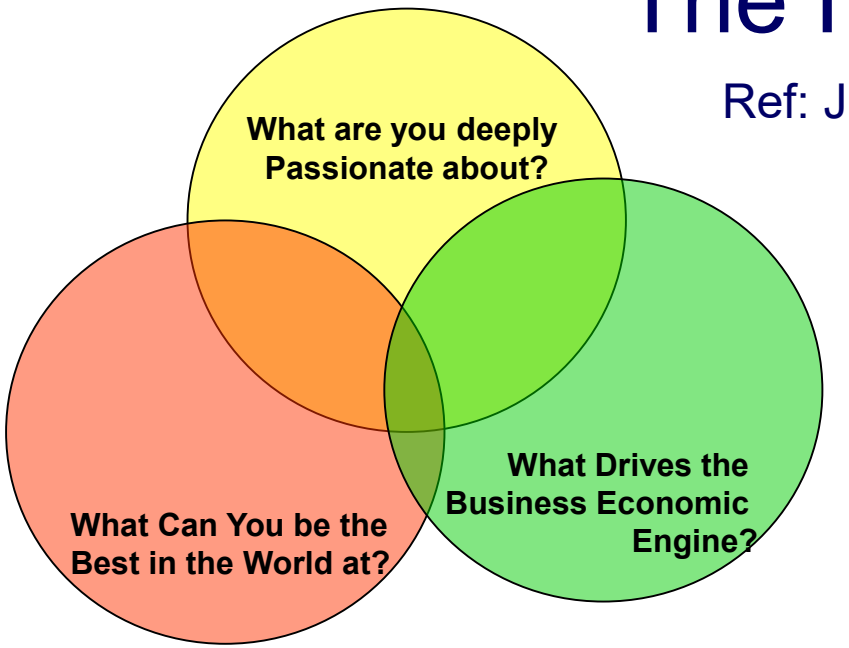
Slide Notes accompanying the Presentation to Nuffield Contemporary Scholars Conference,Conversations Down Under, Queensland March 2020

1. INTRODUCTION: FARM BUSINESS MANAGEMENT

Farm management is ‘a process by which resources and situations are manipulated by farm managers in trying, with less than full information, to achieve their goals’ (Dillon, 1980,p.258).

The Hedgehog Concept

Ref: Jim Collins “Good to Great”



The Hedgehog Concept –
Simplicity can Master a Complex World

Components of Success in Business

- High Quality Leadership
- First Who, then What (Right people on the bus - right values, good skills/trainable)
- Confront the Brutal Facts
- Hedgehog Concept
- Culture of Discipline – maintain focus
- Technology Accelerators – productivity, key innovations

Whole Farm Approach

Central premise of farming management is that the whole phenomenon cannot be understood or explained from the behaviour of its parts in isolation.

Solutions to problems of parts are not solutions to problems of the whole.

Cannot understand or solve problems of whole by analysing part of it.

The common mistake of thinking ‘This is a good answer to part of the problem, it must be a good answer to the whole of the problem’.

Better to solve whole of problem roughly than part of the problem precisely. i.e. Better to be roughly right than precisely wrong

- ***The Whole Farm Approach*** *to management advice 'refers to advice which has been budgeted to ensure that it really does result in an improved farm plan, from the farmer's point of view'.*
- *Budgeting allows the best proposal from a number of alternatives to be selected.*
- *Occasionally one hears a rather peculiar phrase 'the whole farm approach to farm management'. I say peculiar because this statement implies there is another approach to farm management'.*

The whole farm approach:

Computation as a form of reasoning

Sophisticated Thinking, Simple Sums is the Whole Farm Approach

Managing for farm business survival and growth depends on:

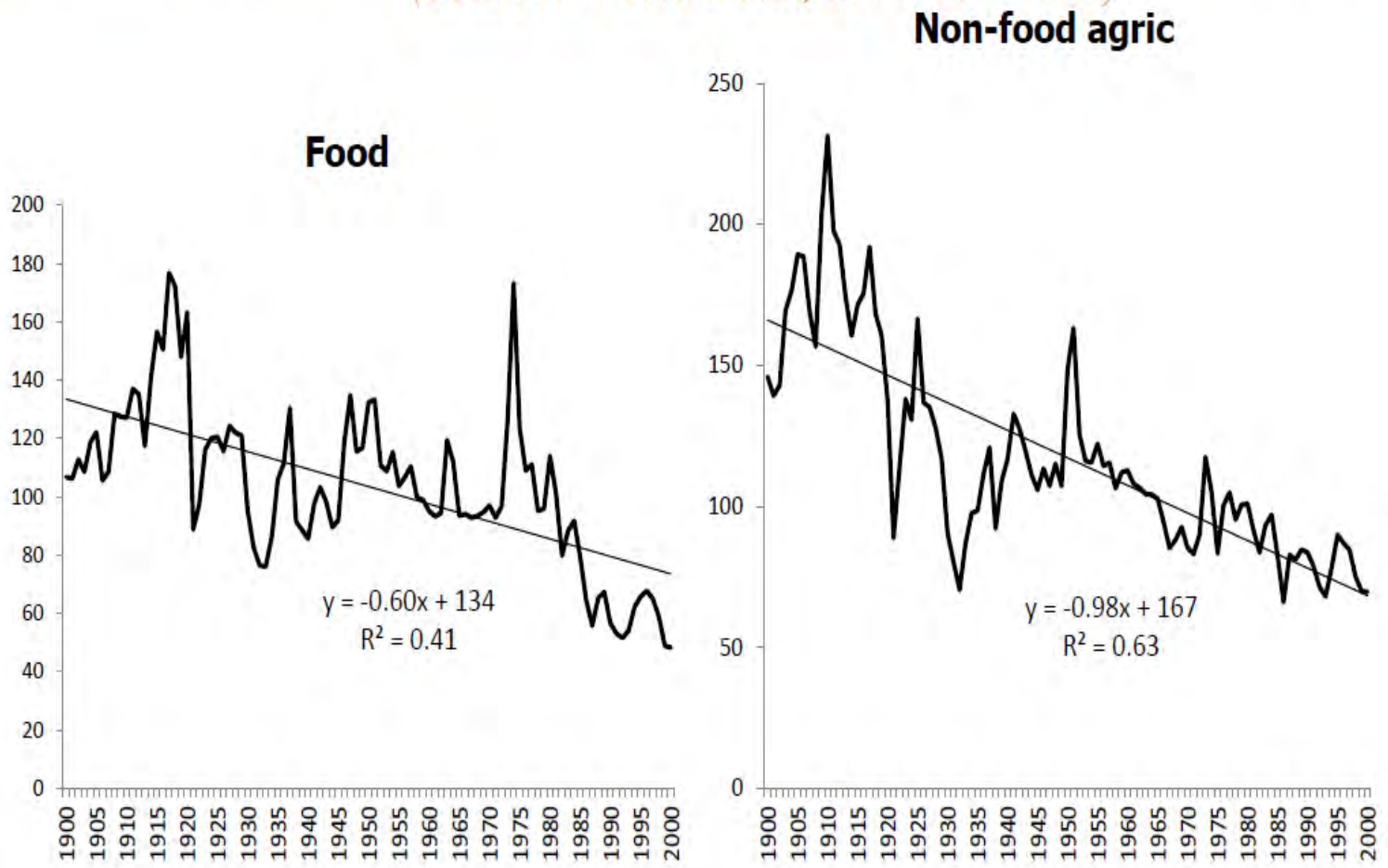
- Good decisions about change
- Good decisions require
  - Good Information,
  - Good Analysis, and
  - Sound Advice

  Theoretical Foundations of Analysis and Advice based on the Whole Farm Principles of Farm Management Analysis
- Profit (Efficiency), Cash (Liquidity), Wealth (Growth) – all are Means to the end of creating Choices (Farmer Goals)
- Risk: Volatility of returns, risk creates returns, difference between good decision and right decision

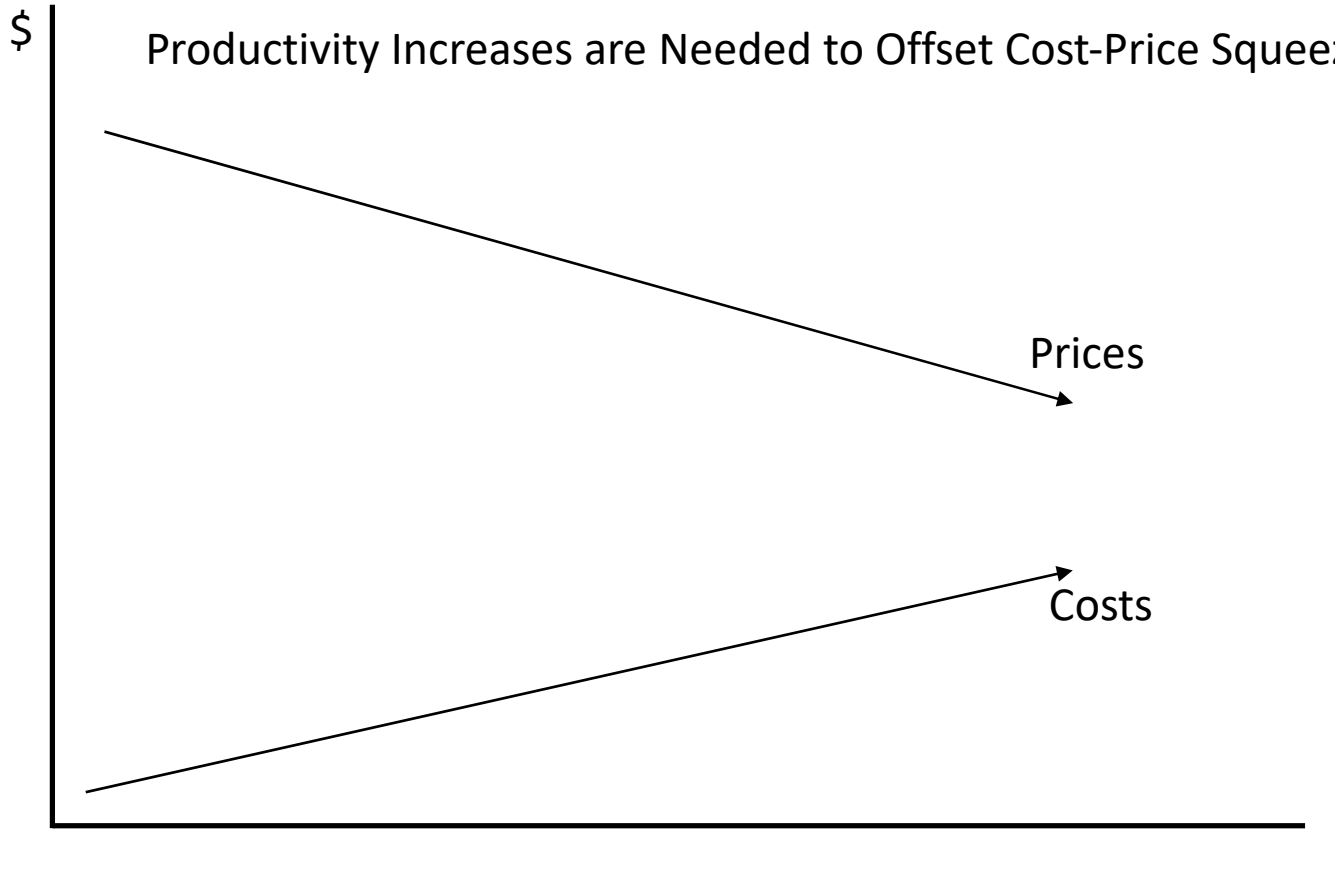
Context of Farm Management Decision-making is ‘Clouds of Vagueness’

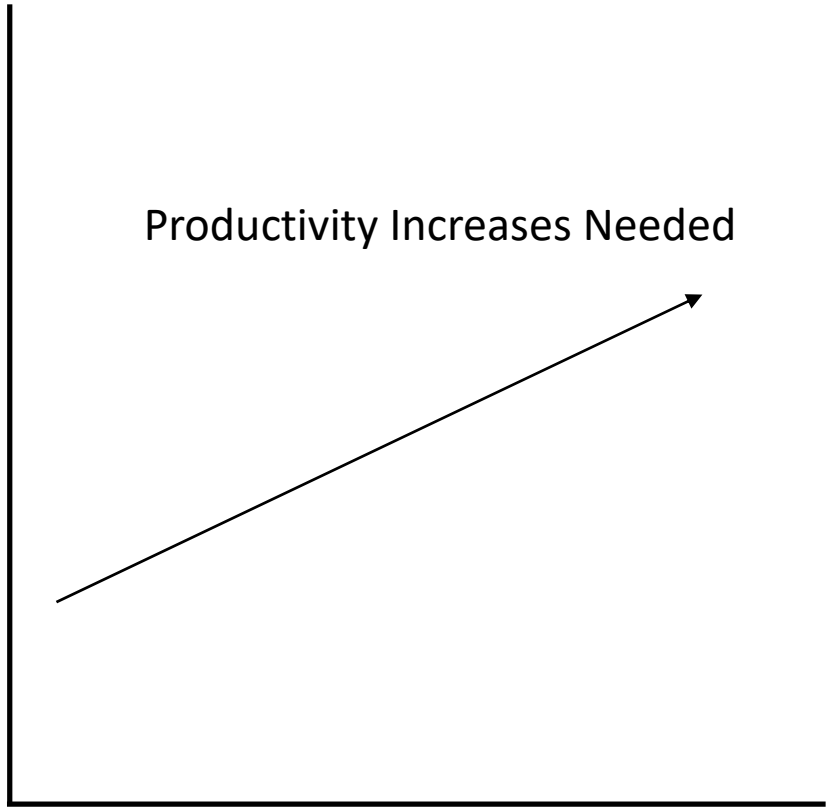
Real International Food and Agricultural Prices

(Source: World Bank, 1977-79 = 100)



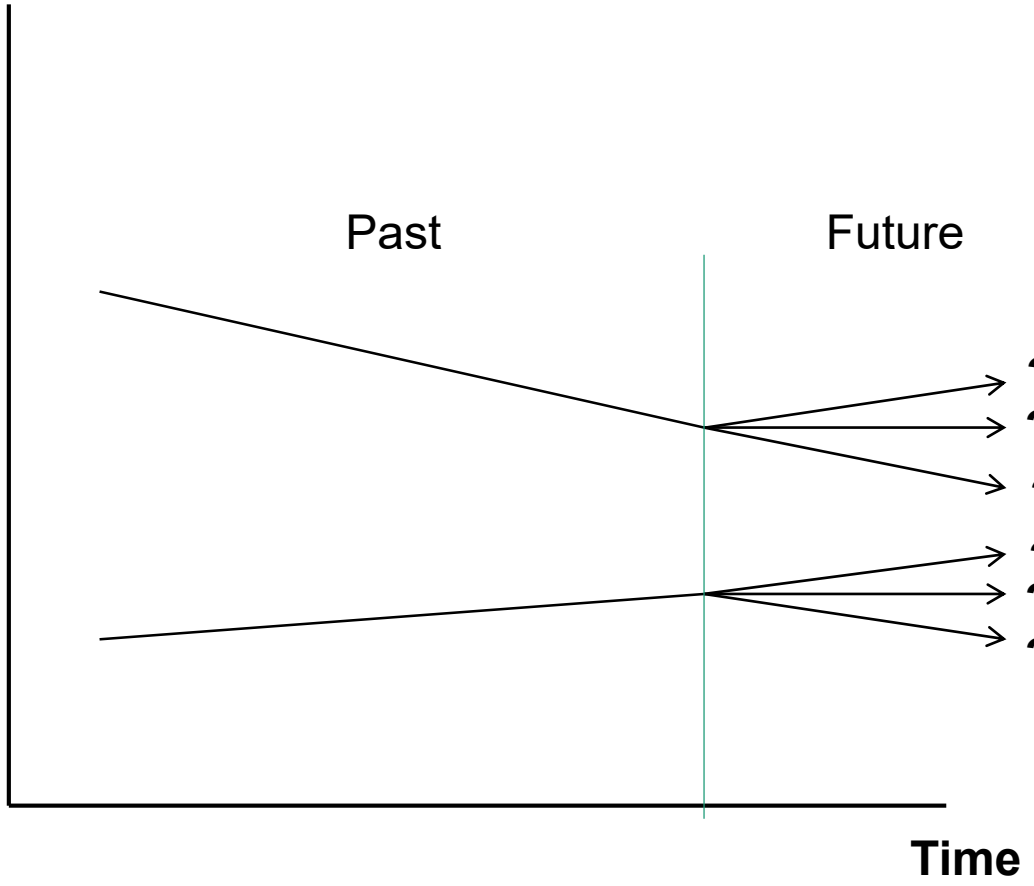
Cost Price Squeeze of Agriculture





Farm Prices and Farm Costs

Regression to the mean
Is a handy notion

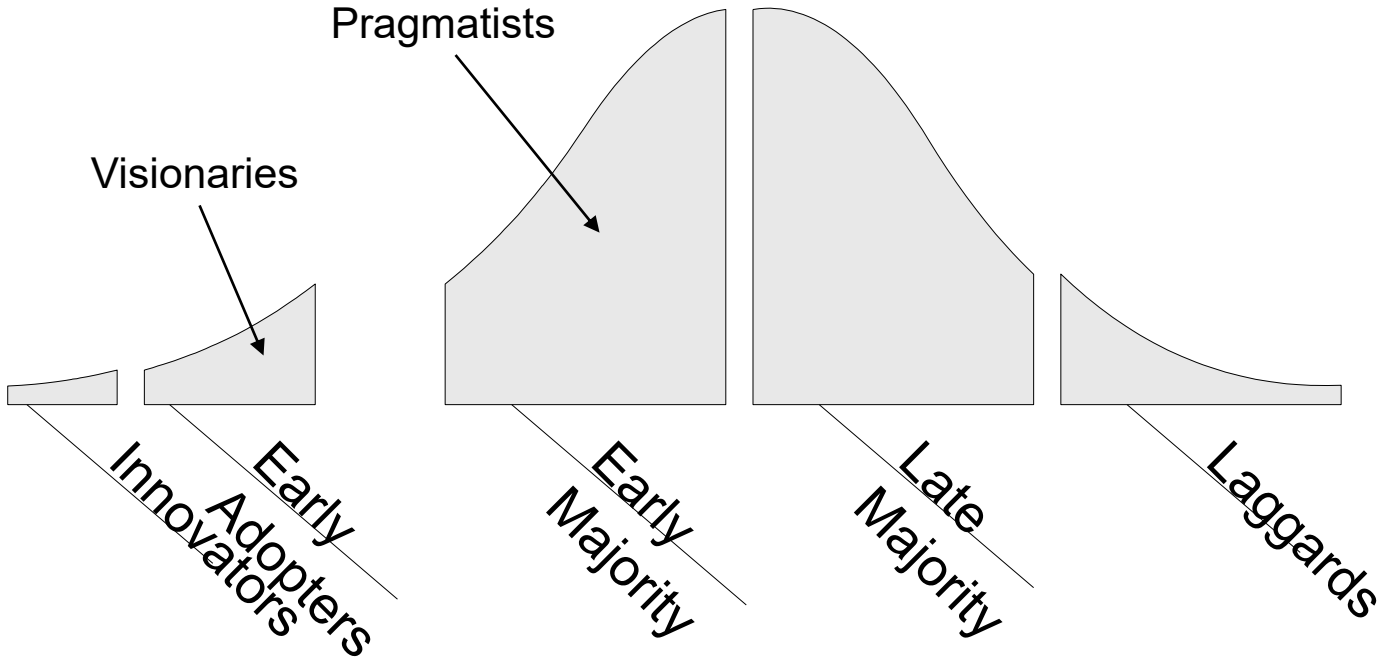


Cannot know but reasonable probability of declining or flat real price trend as world supply grows

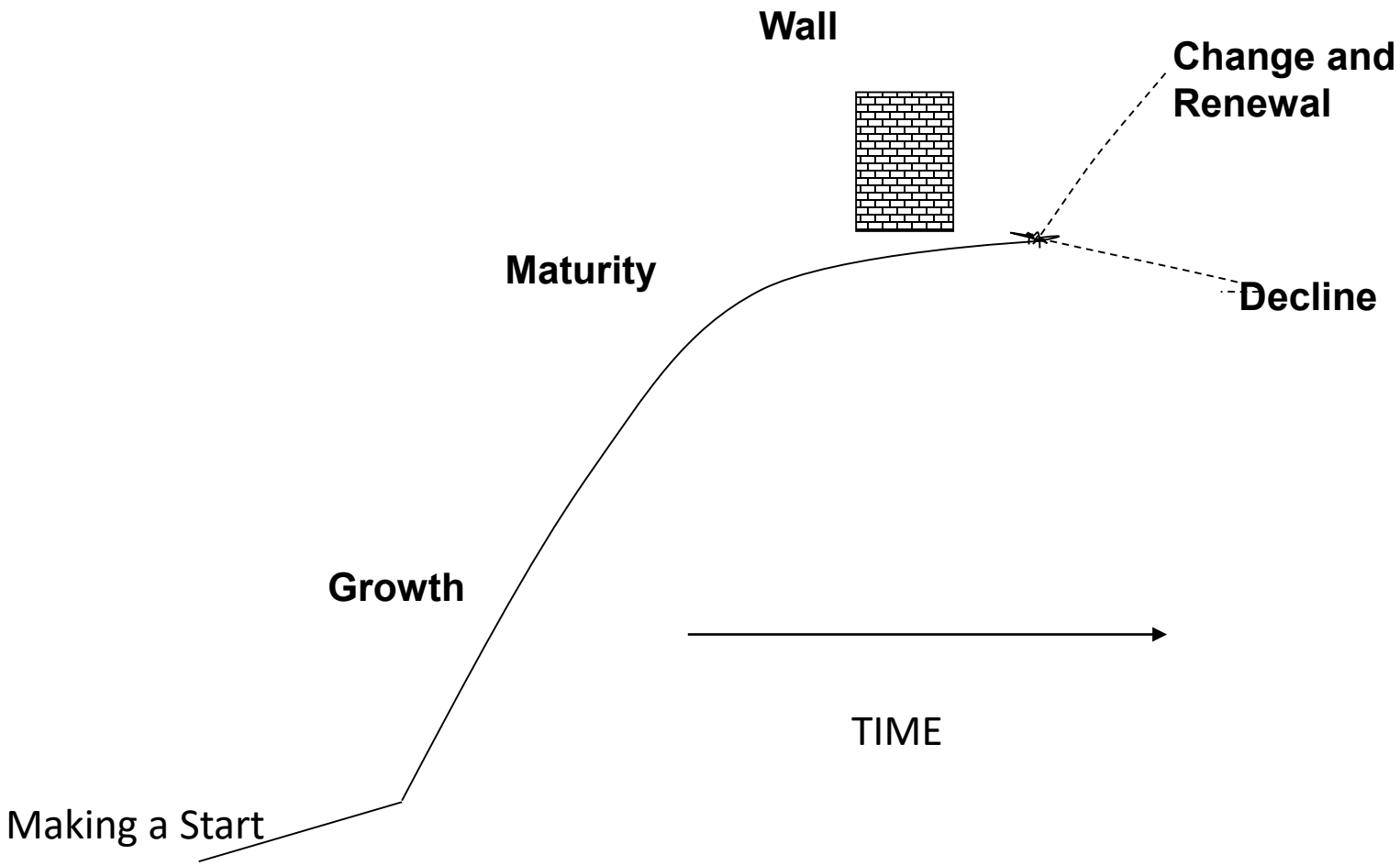
Cannot know but reasonable probability of rising real farm cost trend as economy grows

To Increase Productivity and Grow, Adopt Change

Stand still, go backwards

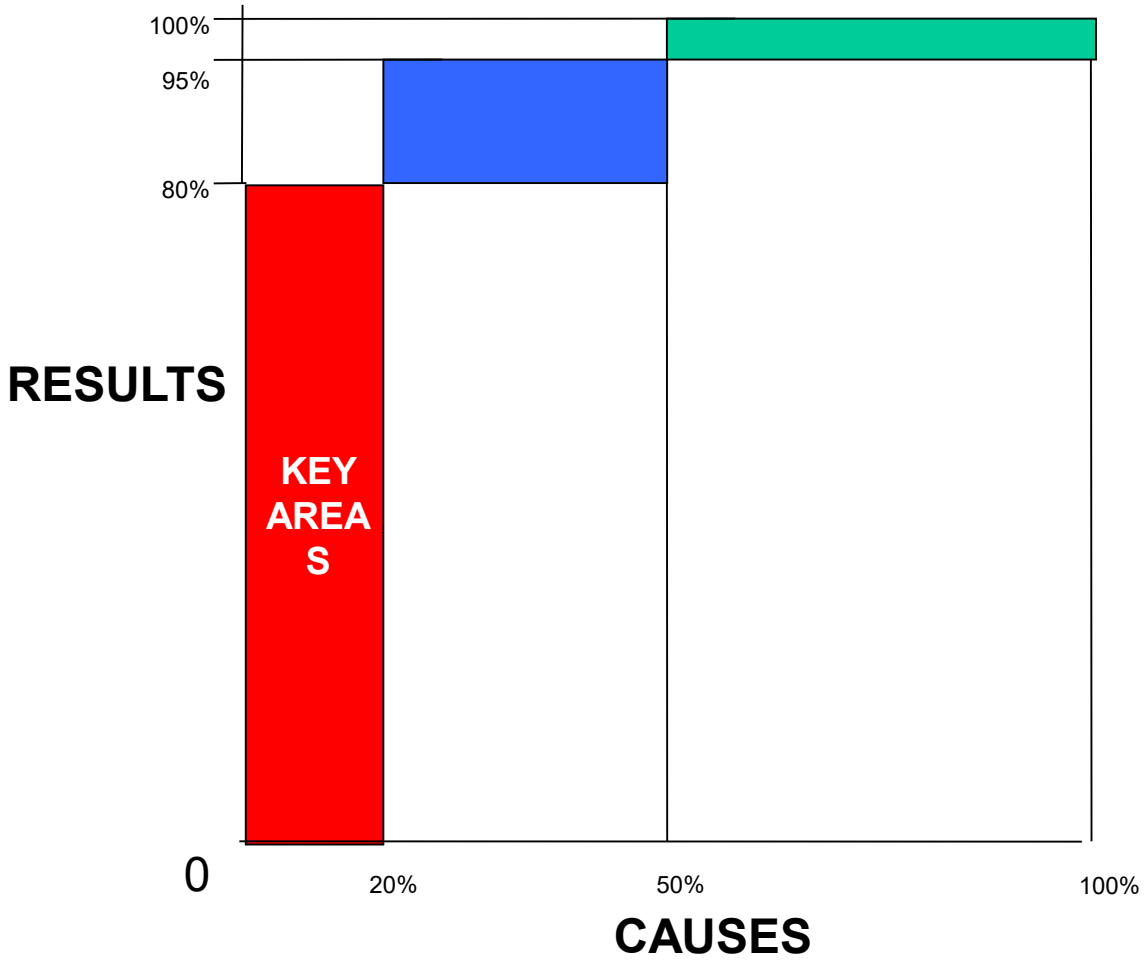


Where Is The Company On The S Curve

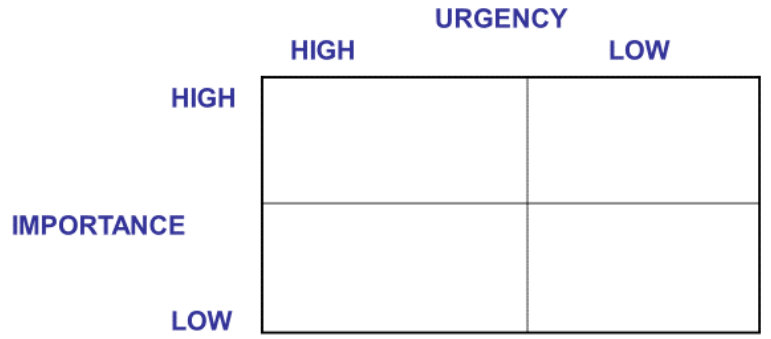


PARETO ANALYSIS (80/20)

Identify Key Result Areas



Know What Matters: The **important/urgent matrix**



Imagine Alternative Futures
What is (Status Quo) and What could be?
Strategic Planning

- what do we want to do
- what have we got to work with
- where should we focus our effort and why
- what do we need to do to compete, survive and achieve our goals

‘Planning is useful – but surprises happen’

Prepare don’t predict

Imagine Alternative Futures

What is?

- What do we know? What can we know? What can we do about it?

When?

- Very short term
- Short term
- Medium term
- Long term

The longer the time out, around the corner and over the hill less is knowable, more is uncertain. Look in the future as far as the eye can see.

Our knowledge of the way things work, in society or in nature, comes trailing clouds of vagueness (Kenneth Arrow).
More things could happen than will happen. Some things that we cannot even imagine will happen. Imagine the future. Run your business as though the future you expect is already here.

The future's already arrived. It's just not evenly distributed yet.

Where?

Implications for running the business? If don't know where want to go any road will take you there.

How?

The widespread flaw of looking at problems in pieces-the whole is product of intersection and combination all of the parts. Solutions to parts are not solutions to wholes.

The Logicians Trap- PAST IS PROLOGUE
It isn't, so LOOK BACKWARDS, FORWARDS, ALL AROUND

The future is neither a blank sheet nor a replay of the recent past.

It is not that we know nothing about how the world currently works.

To an extent, we are prisoners of the future because we are captives our past.

Look Back Twice as Far as You Look Forward

Theory, Cycles and Fundamentals

- We have understandings about how the world works – technical, economic, social – theory and practical experience of the world.
- We know about economic phenomena, how these phenomena (fundamentals) affect each other, combine, reinforce or counteract each other.
- There are some patterns in the randomness: Nature repeats itself - but only for the most part.
- We know about regression to the mean in if short to medium time as long as worldly fundamentals (e.g. technology) haven't changed too much too quickly. i.e. if things are good they can only get worse, if things are bad they can only get better. We know Booms bust.
- We know market prices reflect a lot about what we know at the time and we expect at this time to happen at a future time. The theory of efficient markets holds that all information is in current prices, and as new information comes along randomly, price movements too must be random (This is the strong theory of efficient markets).

Analysis and Planning

Einstein- everything that can be counted does not necessarily count- everything that counts cannot necessarily be counted.

That's not a plan, that's an idea- and not a very good idea at that.

The information you have is not the information you want. The information you want is not the information you need. The information you need is not the information you can obtain. The information you can obtain costs more than you want to pay.

If what we end up knowing after an event, was known before the event, we would have made a some-ways different decision before the event.

Even in periods of dramatic, rapid transformation, there are vastly more elements that do not change than new things that emerge.

Face the brutal facts.

Prepare don't predict.

Planning useful, plans useless.

Guard against the future as if it were the present.

There is a word for simple answers to complex questions: Wrong.

Solving problems by making the solution more complex than the problem!

Change requires Good Farm Management Analysis and Advice:

- applies the whole farm approach (solutions to parts not solutions to whole, better to be approximately right about the whole system than precisely wrong about a part of the whole system)
- asking the right question is the key to solving problems
- starts with the farm people and builds on sound technology
- assesses both returns and risk
- economics and finance analysis is different: both important
- applies principle of diminishing marginal returns
- uses total and marginal values, not averages

The approach is: Sophisticated Thinking and Simple (not simplistic) Sums

Imagine the Future:

A crisis takes longer to arrive than you thought it would and arrives more quickly than you have expected.

Q: How healthy is this business?

A: balance sheet, profit budget and cash budget - to estimate efficiency, liquidity and growth

Measures: few key numbers and ratios

Wealth, Efficiency, Liquidity, Other

- **percentage growth in equity**
- **operating profit and return to total capital**
- **net cash flow after debt servicing**

Risk –can put odds on. Uncertainty has no odds.

- Managing a farm is about managing risk and uncertainty (Risk is volatility of annual profit, ncf)
- No risk, no management . Minimize risk minimize return
- Managing a risky business is about gathering relevant information; weighing it judiciously; and acting accordingly
- Combined risky events, runs of risky events – major challenges

To understand risk in farm systems, and to manage it, it is useful to distinguish two types of risk :

Business risk (prices, yields, rain, pest, disease) and Financial risk (gearing)

Risk sometimes categorized as: production, market, financial, institutional, personal

Uncertainty – no odds on it happening

Uncertainty has the challenges of dealing with unforeseen threats and solving unanticipated problems, while raising the chance of benefiting from opportunities unexpected.

Five Principles about Risk:

Principle #1 is that risk creates return.

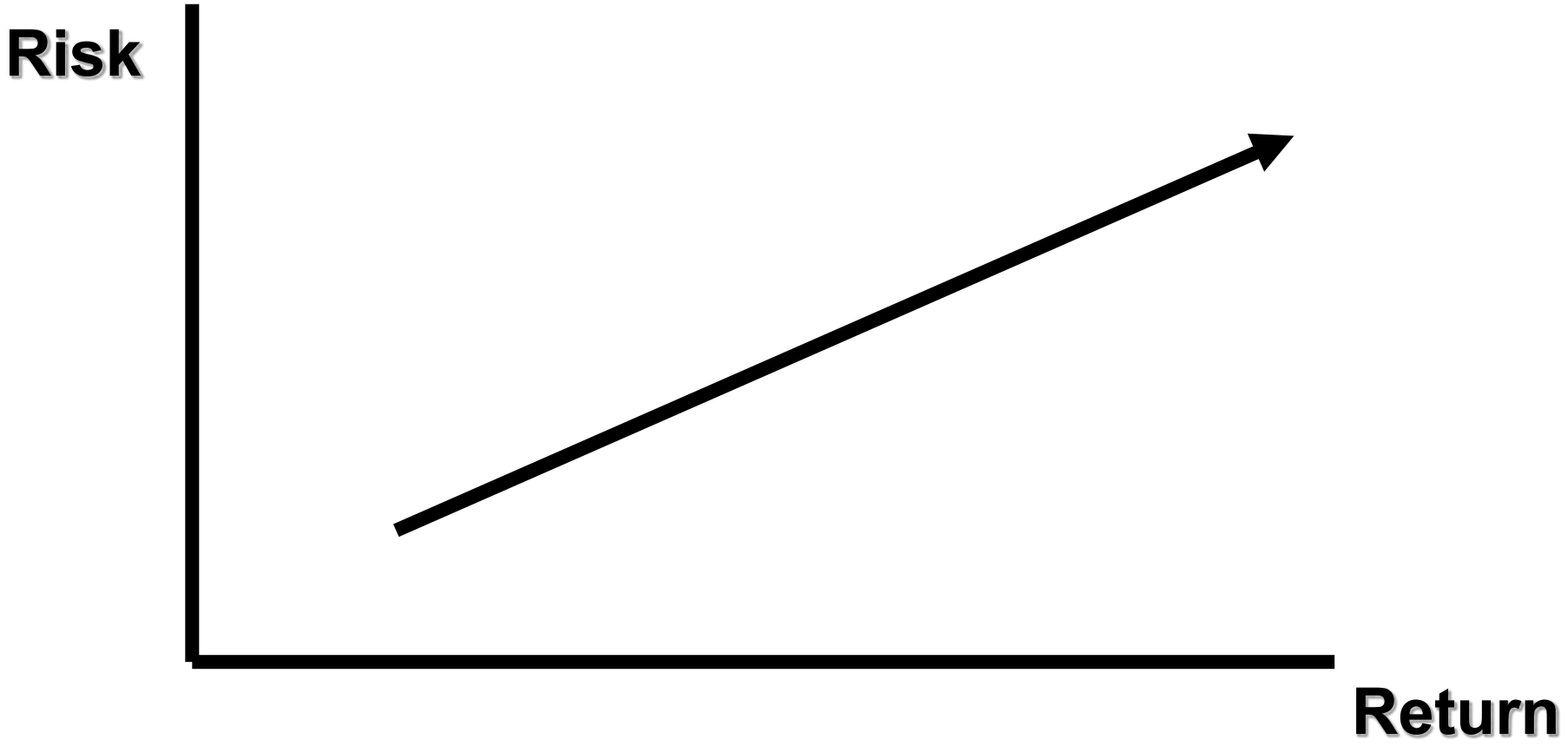
Principle #2 is the portfolio principle.

Principle #3 is increasing financial risk

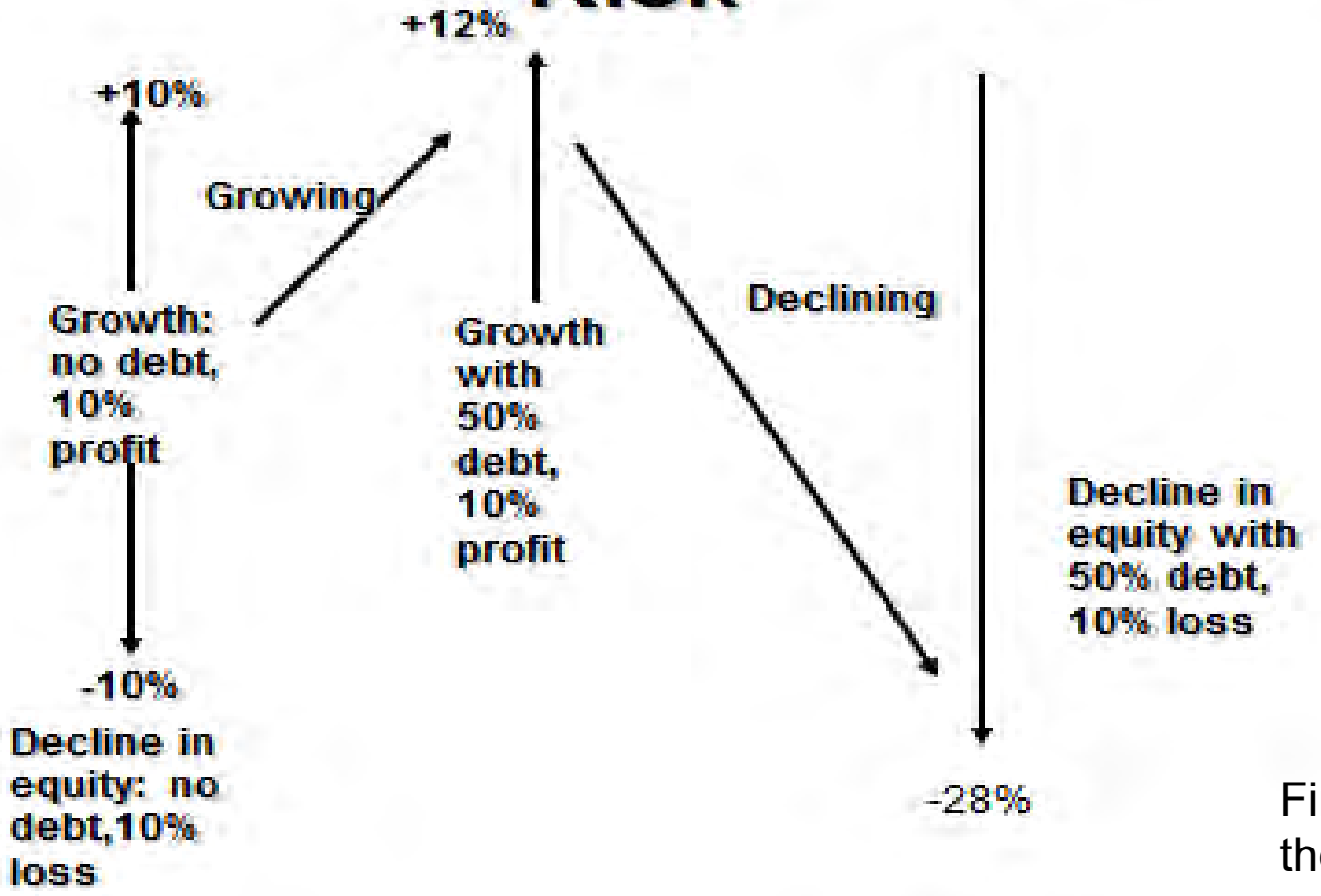
Principle #4: sell risk you don't want to someone who is prepared to bear it, for a price.

Principle #5: manage well the risks over which you have control, and set the business up to withstand whatever may happen (uncertainty)

Risk Creates Return – it's the risk of farming that makes it worthwhile doing

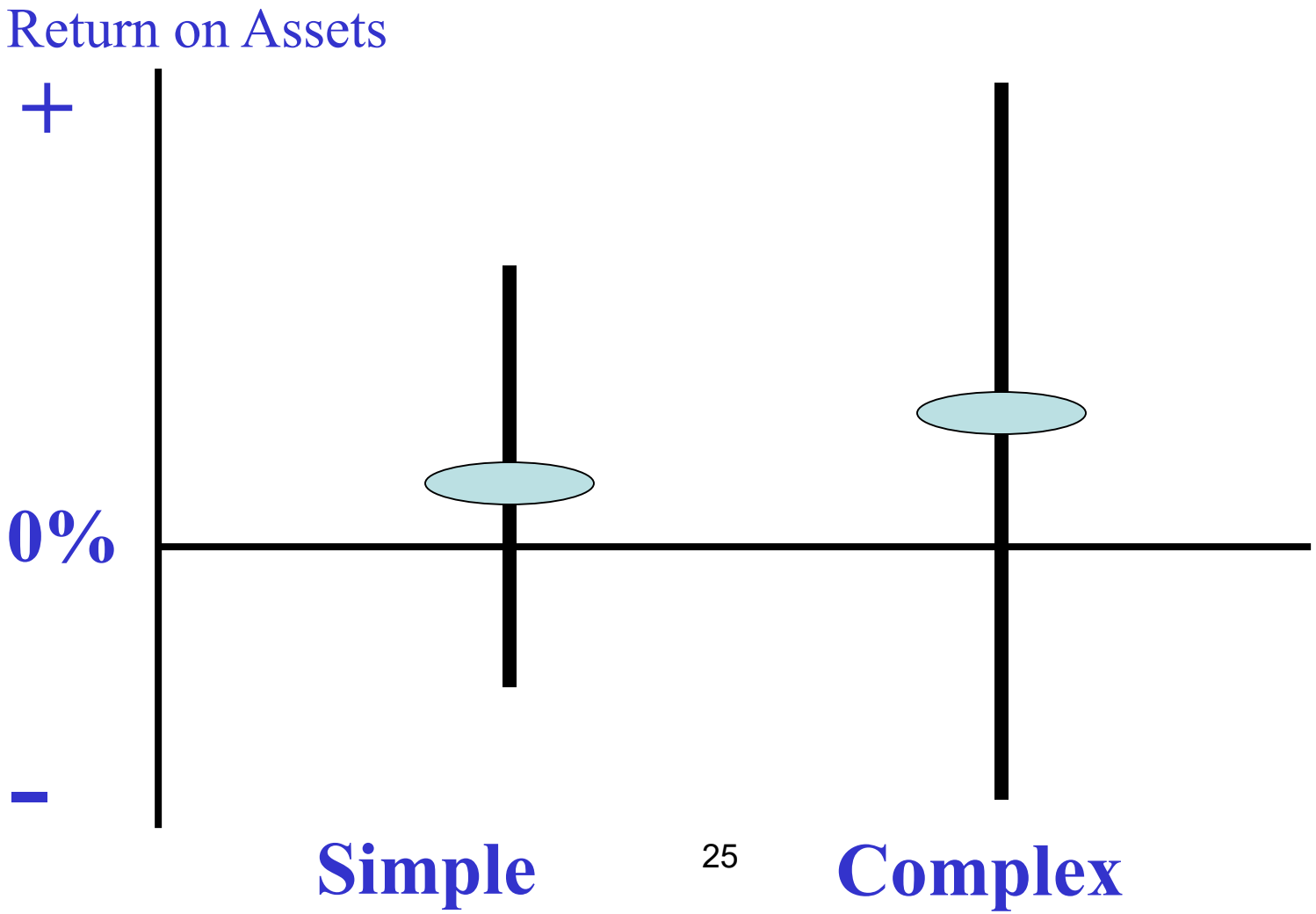


Principle of Increasing Financial Risk

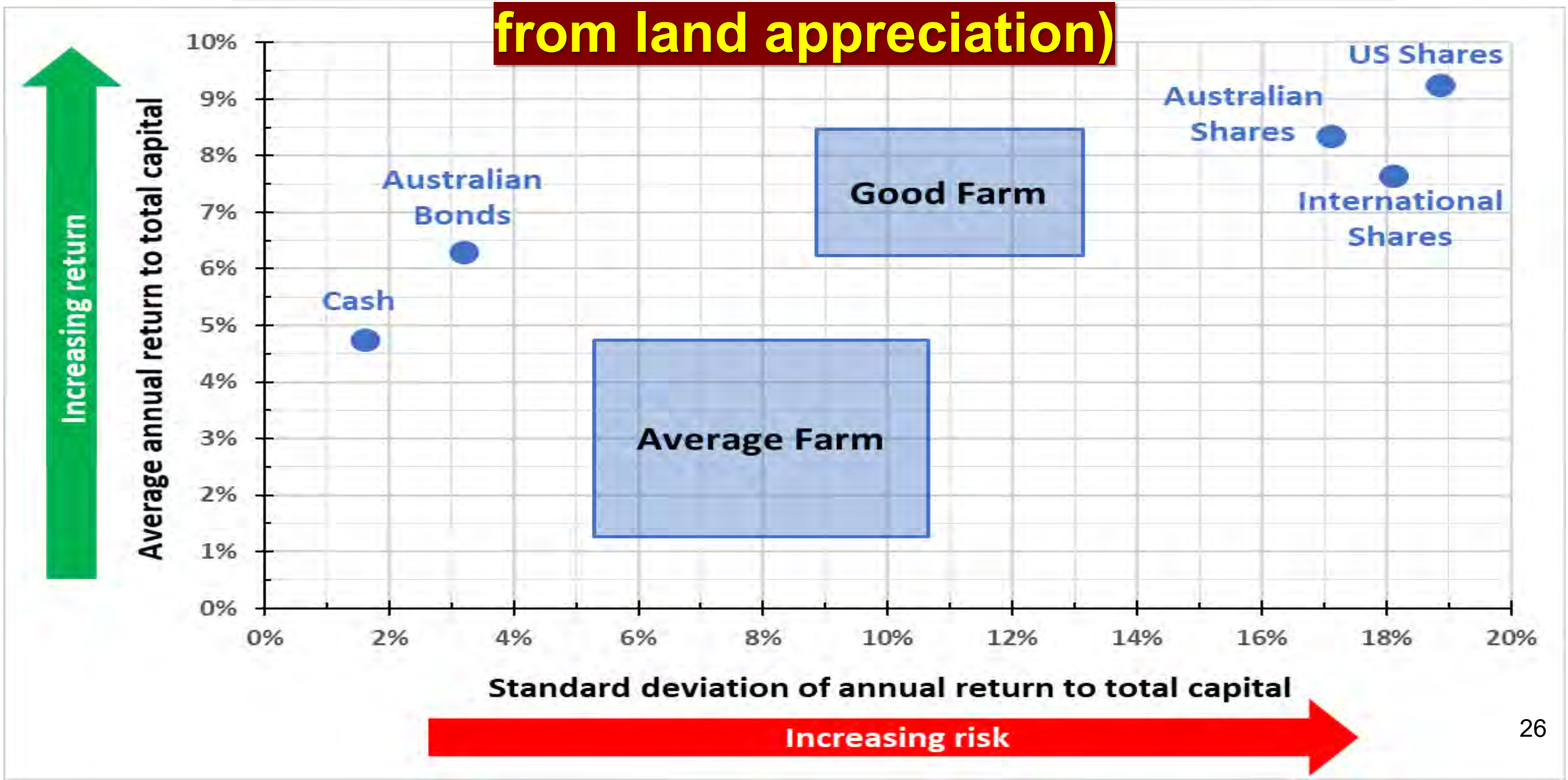


Financial risk exacerbates the business risk faced by operators of farm businesses

Systems, Risk and Return on Assets



Returns to capital relative to non-agricultural investments (excluding returns from land appreciation)



RISK and UNCERTAINTY in analysing, planning, managing business

- Uncertain, unknowable future – what's it mean for managing our business?
- What matters is the quality of decisions in the face of uncertainty.
- Eliminate risk, eliminate return. Don't be afraid to go out on a limb- that's where the fruit is.
- Be technically good. Risk comes from not knowing what you are doing (Buffet).
- Good decisions vs right decisions
- First step in risk management is to acknowledge the reality.
- In the middle of difficulty lies opportunity.
- It is ok to take risks, provided you manage them well.
- Even a correct decision is wrong when taken too late.
- Delay sets thing to rights.
- If don't do risk management - no matter what business you are in - it's a risky business.
- If treat managing risk as a part-time job, soon looking for one.

RISK and UNCERTAINTY in analysing, planning, managing business (Cont..)

- Volatility vs consequence.
- Risk does not mean danger-it just means not knowing what the future holds.
- Take no more risk than you need to get the return you want.
- Probability-based guesses about the future – go from helplessness to informed choice.
- One of the biggest mistakes a forecaster—or a decision maker—can make is to over-rely on one piece of seemingly strong information because it happens to reinforce the conclusion he or she has already reached.
- What if I am wrong?
- Things that baffle probability. Rare events with big impacts.
- Maximize the areas we have some control over the outcome and minimize the areas we have absolutely no control over the outcome.
- Hope deceives (All that glisters isn't gold: Even donkey droppings glisten).
- Recklessly optimistic vs recklessly conservative.

Implications of Change and Growth of Farm Businesses:

- More risk; risk creates return and increases mean and variance of profits
- More challenge – this can be rewarding
- More complexity, bigger implications
- Less ‘hands on work’, more staff to manage
- More work ‘on the business’ instead of ‘in the business’
- Greater business skills needed: negotiation, buying, selling, timing
- Intensification increases risk

The best *Managers* of farm risk:

- are masters of information and technically very good
- understand business risk and financial risk
- use a mix of debt and equity that can be serviced with confidence
- manage the good times to set up to exploit the bad times
- buy and sell in counter-cyclical ways
- apply the portfolio principle; spread risks with range of types of investment

The best farm decision-makers:

- **Ask the right questions (the question is the answer)**
- **Face the brutal facts**
- **Understand system (whole farm approach)**
- **Know there are only are only 2 or 3 key factors thar are decisive in a decision**
- **Use experience, keen observation, comprehensive ‘world view’**
- **Listen to ‘experts’ but know experts only ever see part of big picture.**

Best Farm Managers:

- Do not over-analyse, act quickly, decisively, good options disappear
- Can say no to an opportunity – be another one the next day
- Know it takes longer than planned to reach potential
- Know knowledge is incomplete; some things just aren't knowable; unexpected things happen all the time
- Know Nature varies unpredictably, recognize uncertainty
- Know people misunderstand one another and make mistakes
- Know we cannot predict the future accurately so have to imagine it instead.

2. THE BIG PICTURE

How are things in the world?

- Rapidly growing global population (7bn now, soon 9bn-10bn 2050)
- Rapidly growing need for more for food all over the world
- Widespread poverty and hunger (1bn people underfed)
- Rapidly growing large emerging economies (China, India, Brazil, Indonesia, Eastern Europe)
- Rapidly growing incomes of people all over the world
- Warming climate: hotter, rougher weather, more extreme events

Note:

- **Food shortage** is because of **Income shortage**, i.e. world food problem is world income problem

Agriculture in Australia: What's happening and what's around the corner.

World population growing in size and wealth:

Current 7bn people, 9+bn people in 30 years time, 1bn currently hungry

Climate changing: Hotter, drier, rougher weather, volatile yields, prices, incomes

Challenge: Feeding the growing, wealthier world population in a climate that is hotter and with less rainfall and more extreme weather events

- Can do this by:
  i. economic growth in poor countries so people can buy the food they need,
  ii. increasing farm production
    - more output from the same inputs (increasing productivity)
    - more and better inputs (increasing production)
    - managing the increased volatility of yields, prices, incomes.

Next 30 years the challenge of increasing farm output to feed the growing, wealthier world population in a warming climate will dominate the professional lives of farmers and of agricultural scientists who are starting their careers in 2020.

Agriculture's Contribution to Economic Growth

- Food and Fibre
- Labour
- Export earnings
- Capital from profits and savings
- Market for non-agricultural sector
- Natural resource management

Economic Growth is increase in annual Gross Domestic Product (market value of all goods and services produced in the economy in a year)

Further changes and challenges for farmers and agricultural scientists and agribusiness people

- Economic growth: this requires liberalizing international trade, yet globally restrictions on international trade are becoming more not less
- Increasing productivity and maintaining profit of farming and managing the risks as farming – always a hard way to make a living – gets harder, not only because of climate change but also because:
  - Competition from the best farmers from all over the world
  - Consumers preferences are changing:
    - concerned about protecting and improving the natural environment
    - impacts of farming on the environment
    - welfare and use of animals
    - treatment of workers
- Investment in agricultural research, development and extension is necessary to increase productivity in agriculture, yet such investment is increasing only slowly and the growth in agricultural productivity is declining.
- Managing the flood of data and information that increasingly becoming available

2.1 Some History: Agricultural Revolutions

Beginnings of Agriculture

First Agricultural Revolution

In many places around the world farming started around 12,000 years ago (10,000 years before CE – the Common Era)

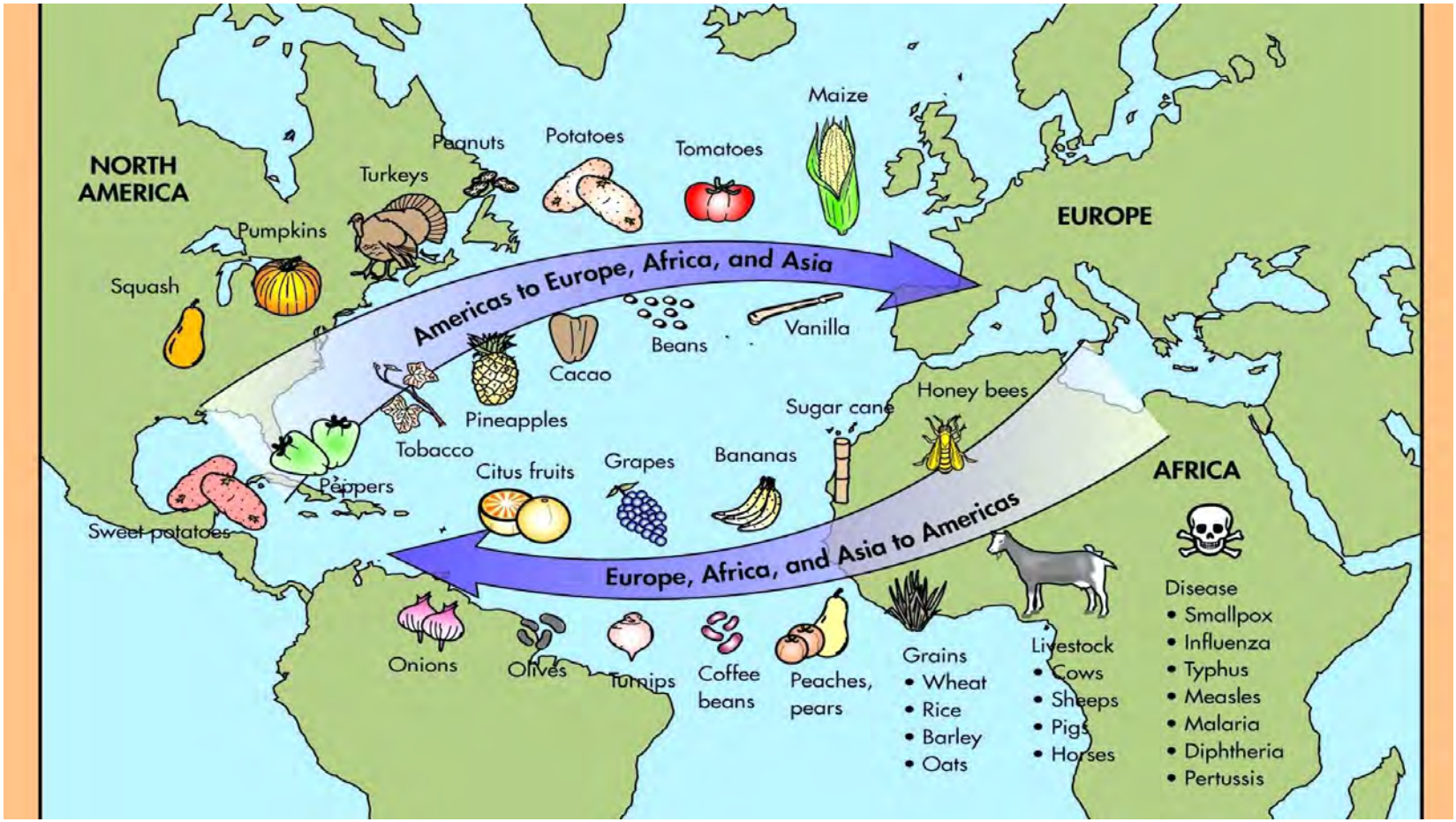
Farming developed and grew markedly in the ‘Fertile Crescent’ of the (now) Middle East.

A crescent-shaped area of fertile land in the Middle East extending from the eastern Mediterranean coast through the valley of the Tigris and Euphrates Rivers to the Persian Gulf. It was the centre of the Neolithic development of agriculture (from 7000 BCE), and where the Assyrian, Sumerian, and Babylonian civilizations started.

In different parts of the world all the main crops grown and animals used today were grown and used.

By 9500 BCE the eight basic crops were grown:
wheat, barley, rye, peas, lentils, vetch, chick peas, flax
Oxen and horse ploughing by 2000 BCE, sheep, goats, cattle

- Evidence of selection and cultivation of seeds in the Fertile Crescent (Middle East) by 9500 BC
- The eight basic crops appear by 9500 BCE: wheat, barley, rye, peas, lentils, vetch, chick peas, flax
- Aztec and Maya agriculture 8000-2000BCE (Domesticated Maize, which was storable)
- 7000 BCE sowing and harvesting in fertile soil of Mesopotamia (Fertile Crescent)
- 5500 BCE Sumerians farming along the Nile; large scale, intensive use of cultivation, specialized labour-can claim to be the ‘inventors of agriculture’
- 6000 BCE agriculture underway in China, growing rice
- 3000 BCE Maize being grown in the Americas – later potatoes, tomato, pepper, squash, beans in the Andes
- Agriculture developed very early and independently in New Guinea


NORTH AMERICA
EUROPE
AFRICA
Americas to Europe, Africa, and Asia
Europe, Africa, and Asia to Americas
Maize
Peanuts
Potatoes
Tomatoes
Turkeys
Pumpkins
Squash
Vanilla
Beans
Cacao
Pineapples
Tobacco
Sugar cane
Honey bees
Citus fruits
Grapes
Bananas
Peppers
Sweet potatoes
Onions
Olives
Turnips
Coffee beans
Peaches, pears
Grains
• Wheat
• Rice
• Barley
• Oats
Livestock
• Cows
• Sheeps
• Pigs
• Horses
Disease
• Smallpox
• Influenza
• Typhus
• Measles
• Malaria
• Diphtheria
• Pertussis

Second Agricultural Revolution: Industrial Revolution and Industrial agriculture

- Mechanization
- Steam power
- Speed and scale hitherto impossible
- Great increases in output/land
- Rail, refrigeration, shipping long distance
- Nitrogen and Phosphorus identified as key elements to plant growth
- Synthetic fertilizers
- 1900-1920s –animal nutrition advances, vitamins, indoor animal raising
- Antibiotics and vaccines post WW2
- Chemical-pesticides

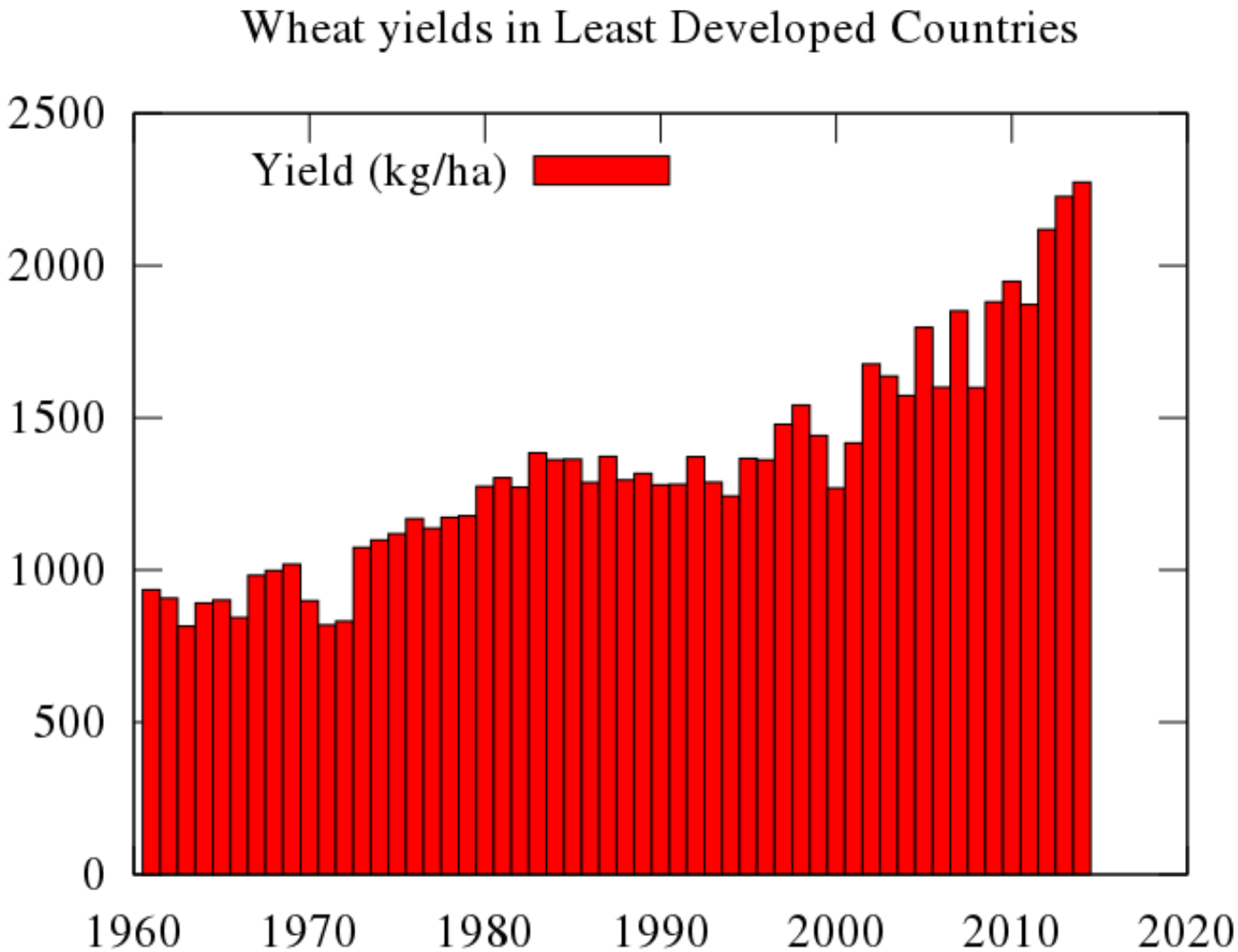
Third Agricultural Revolution: Green Revolution

- The Green Revolution doubled cereal-grains production in Mexico, India, Pakistan, the Philippines in the 1960s and 1970s.

- The Green Revolution exported the technologies (including pesticides and synthetic nitrogen, high yielding wheat and rice, irrigation) of the developed world to the developing world.

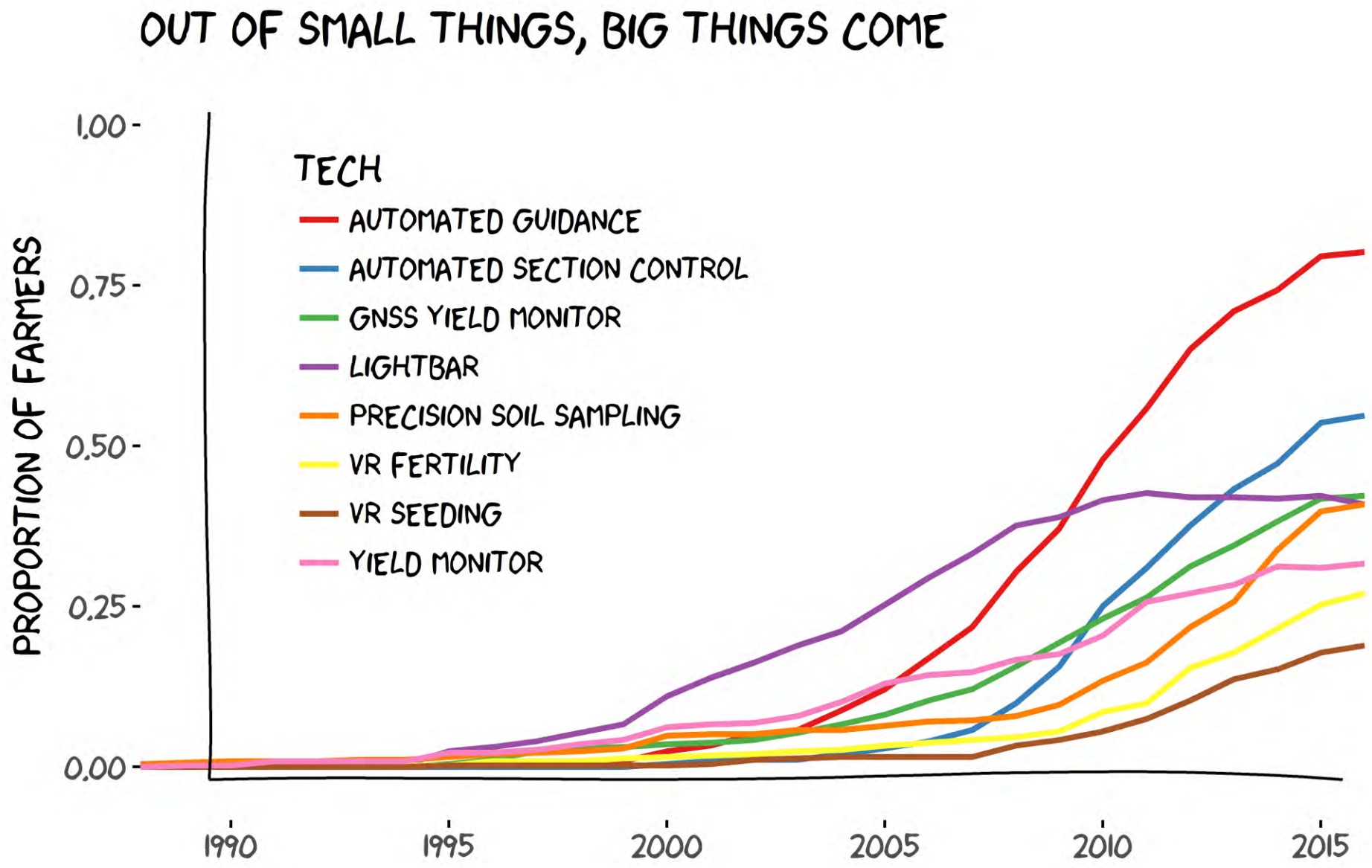
- Averted famine in India and Pakistan, allowed many developing countries to keep up with the population growth that had been expected to outstrip food production.

- The initiatives, led by Norman Borlaug and credited with saving over a billion people from starvation, enabled rate of growth of world agricultural supply to outstrip rate of growth of population.


Wheat yields in Least Developed Countries
Yield (kg/ha)
2500
2000
1500
1000
500
0
1960
1970
1980
1990
2000
2010
2020

Fourth Agricultural Revolution

Data, GPS, Artificial Intelligence, Robotics



Slide courtesy of Terry Griffin KSU

More Information – added to existing information farmers use and already make decisions

Ability to generate data versus ability to use data. More precision in an increasingly uncertain world. Does increasing uncertainty make increased precision less important, or more important? Both-it depends!

Has potential value on farm – micro

- Information about farm system plus information about management actions, precise inputs, finer scales, micro-climates etc, more information only useful if usable. The DSS Dilemma. Flat responses? year to year variations
- Efficiencies – labour, capital, management, data collection and assembly, better informed decisions, diagnosis analysis, planning, control
- Implications for size economies: many ways depending – favour smaller than now, favour larger than now, suit some activities not others
- Danger of 'have data will travel' leading to more mindless farm benchmarking

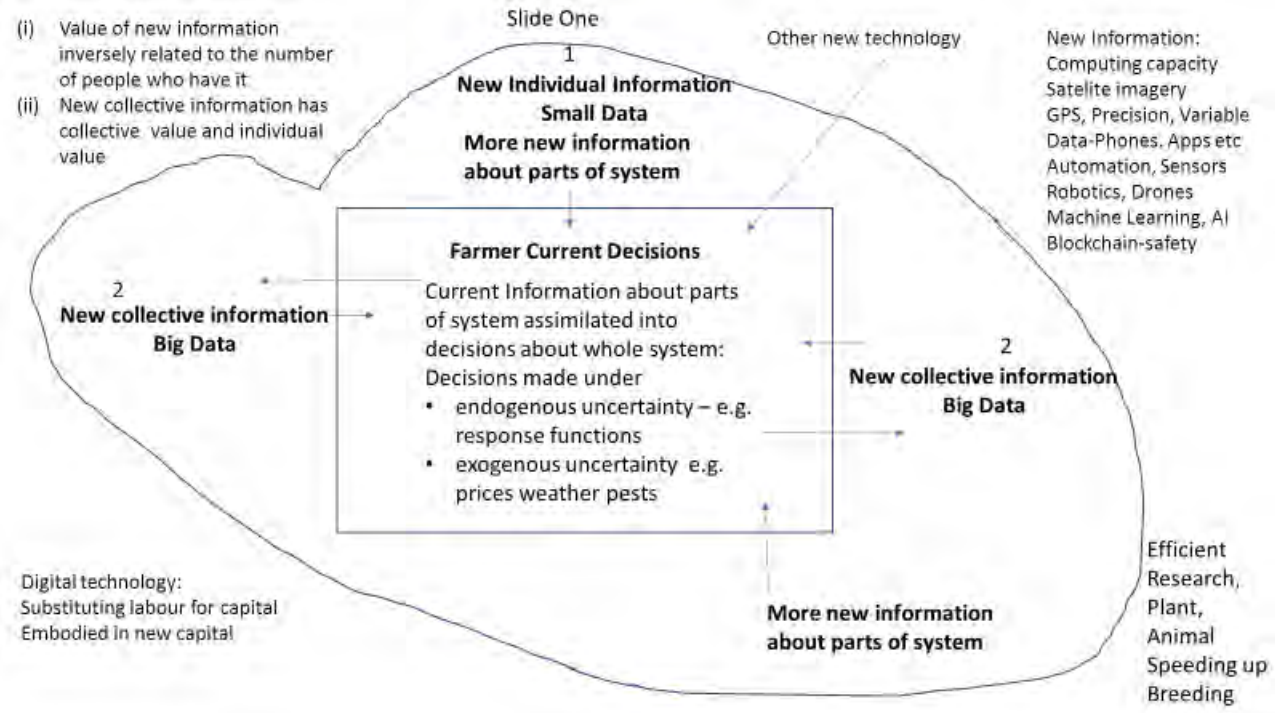
Has value off farm for agribusiness sector - macro

Issues:

- Efficient research
- Who owns the information? Giving up control. bargaining power
- Governance? Privacy
- Connectivity in region, paddock.
- Pooling data sets, networks to collectivize data?
- natural monopoly?

Has value off farm for public sector – macro

- What is the true state of affairs? Early alerts
- Efficient agricultural R,D&E
- Monitoring compliance. Documenting outcomes from policy interventions
- Value chain integration, alliances, tracability, consumer connection
- Insurances
- The Marginal Farmer and farm structural adjustment? Ever thus.

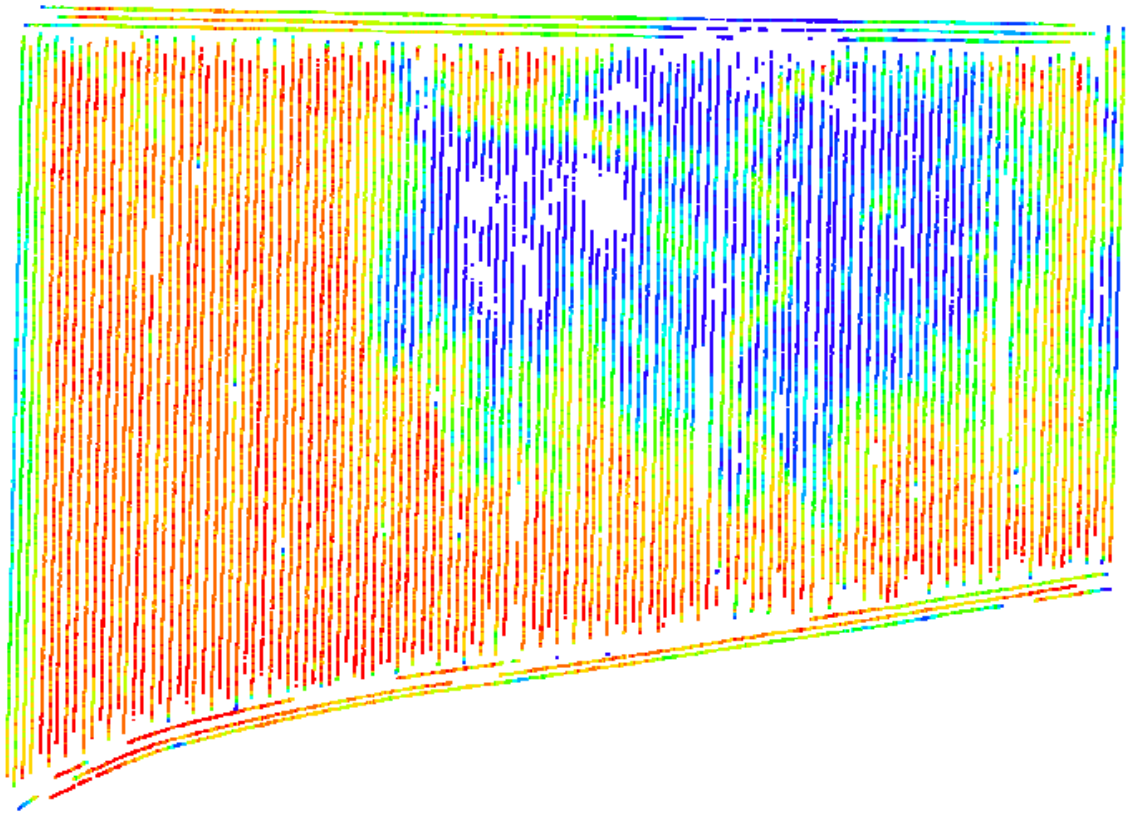


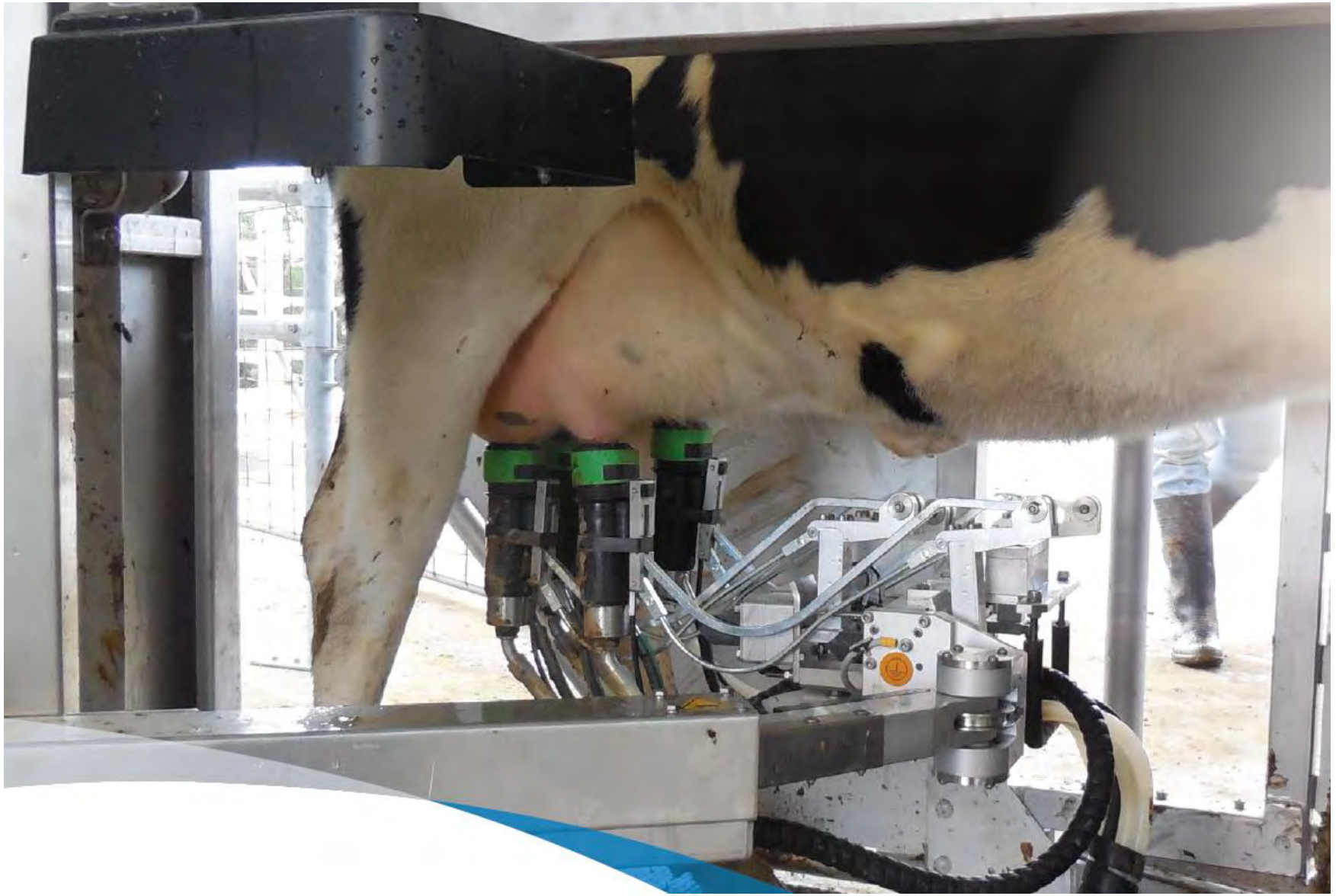
Data

- More Information – added to existing information farmers use and already make decisions
- Ability to generate data versus ability to use data.
- Has potential value on farm – micro
- Has value off farm for agribusiness sector - macro
- Has value off farm for public sector – macro

Yield monitor data can be useful, but has to be good quality and

tell you something you don’t already know





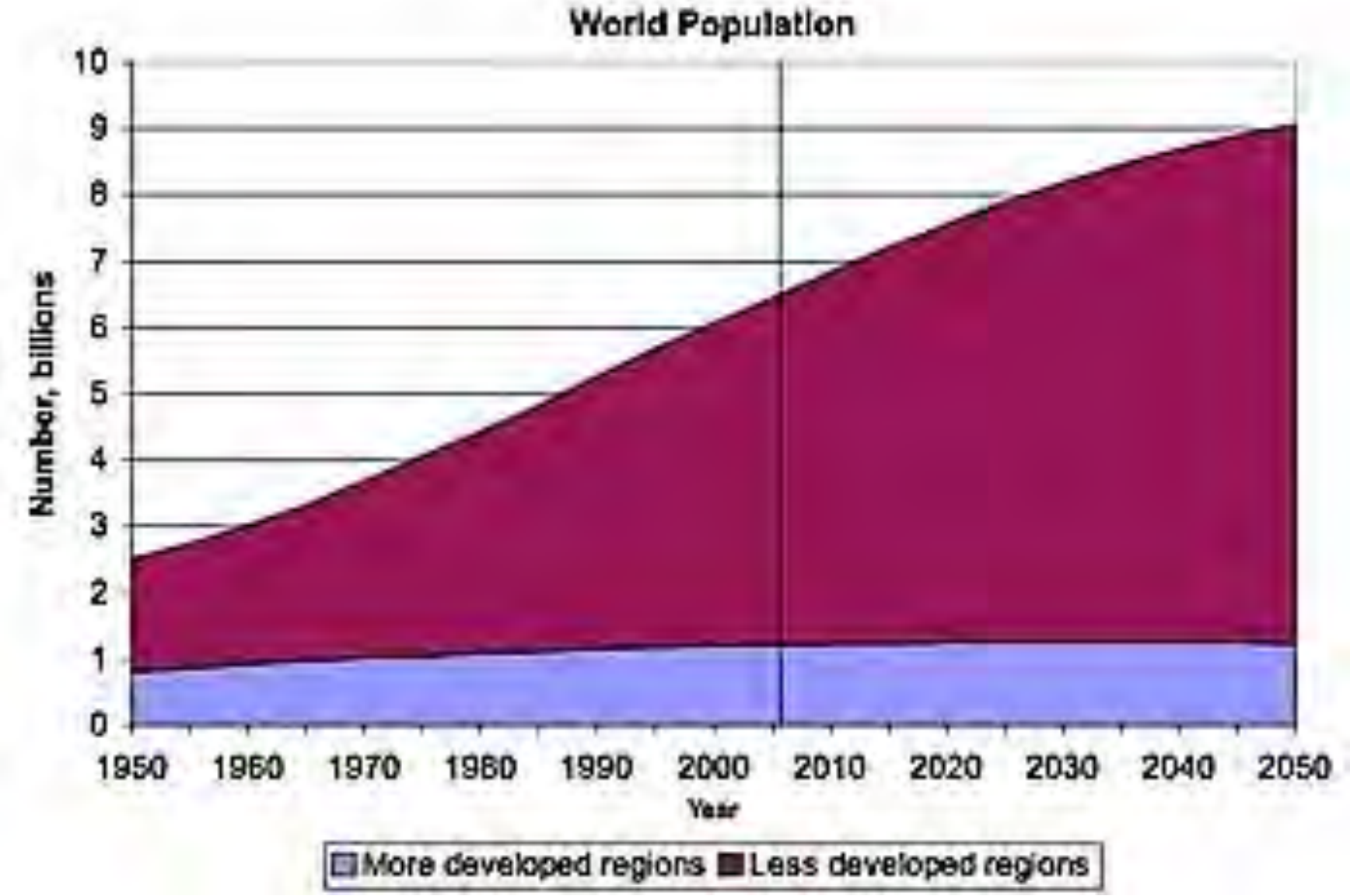
5th AGRICULTURAL REVOLUTION?

A Micro-organism Revolution

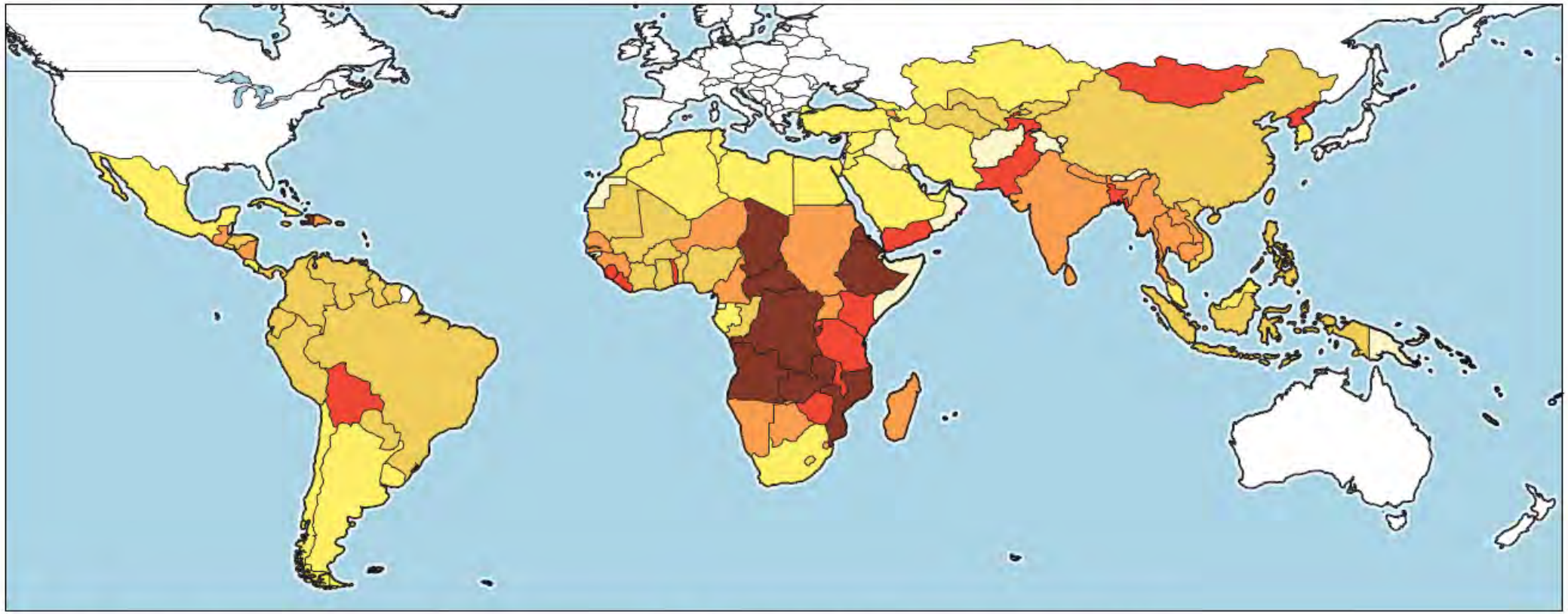
Molecular biology, biotechnology, single molecules, proteins, genetic engineering, precision fermentation etc etc

2.2 Population Growth and Food


he 9 billion-people question
ecial report on feeding the world | February 26th 2011


World Population
Number, billions
10
9
8
7
6
5
4
3
2
1
0
1950
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
Year
More developed regions
Less developed regions

map **1** Prevalence of undernourishment in total population (%), 2005–07



very high (undernourishment 35% and above)
high (undernourishment 25-34%)
moderately high (undernourishment 15-24%)
moderately low (undernourishment 5-14%)
very low (undernourishment below 5%)
missing or insufficient data

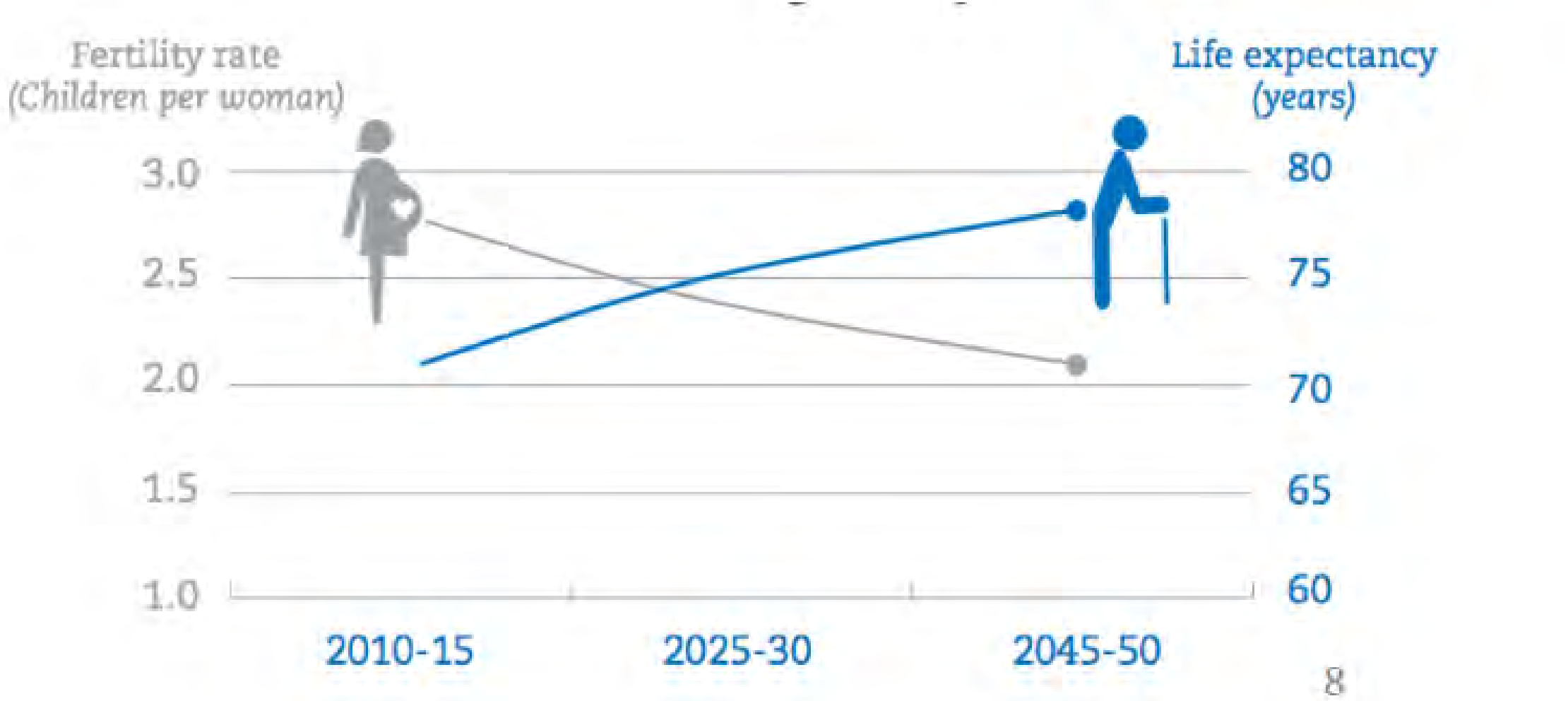
Food Security

(A term you will hear a lot)

What does the term food security mean?

1996 (World Food Summit) and then 2002 –

"Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO 2002)


Fertility rate
(Children per woman)
Life expectancy
(years)
3.0
2.5
2.0
1.5
1.0
80
75
70
65
60
2010-15
2025-30
2045-50

- The ‘food problem’ is an income problem.
- Increasingly productive agriculture is the key.
- Good science and economics are necessary.

- Solving world food shortages:
  - economic growth (increase in goods and services in an economy per head of population)
  - invest in agricultural R,D&E
  - liberalize world trade
  - educate people, particularly women in the poorest countries

Sustainability, Sustainable Ways of Doing Things

What does it mean?

There are at least two ways that we can think about Sustainable Agriculture

- One relates to the quality of land and water resources available on Australian farms And how they can be maintained or improved so that agricultural production and profitable farm businesses can be maintained (sustained) over time
- The other way takes a broader view of agriculture in our local, national and global societies
  - Including environmental impacts and improved environmental conditions
  - For present and future generations

Brundtland 1987

The United Nations World Commission on Environment and Development (WCED) in 1987 produced the Brundtland Report definition

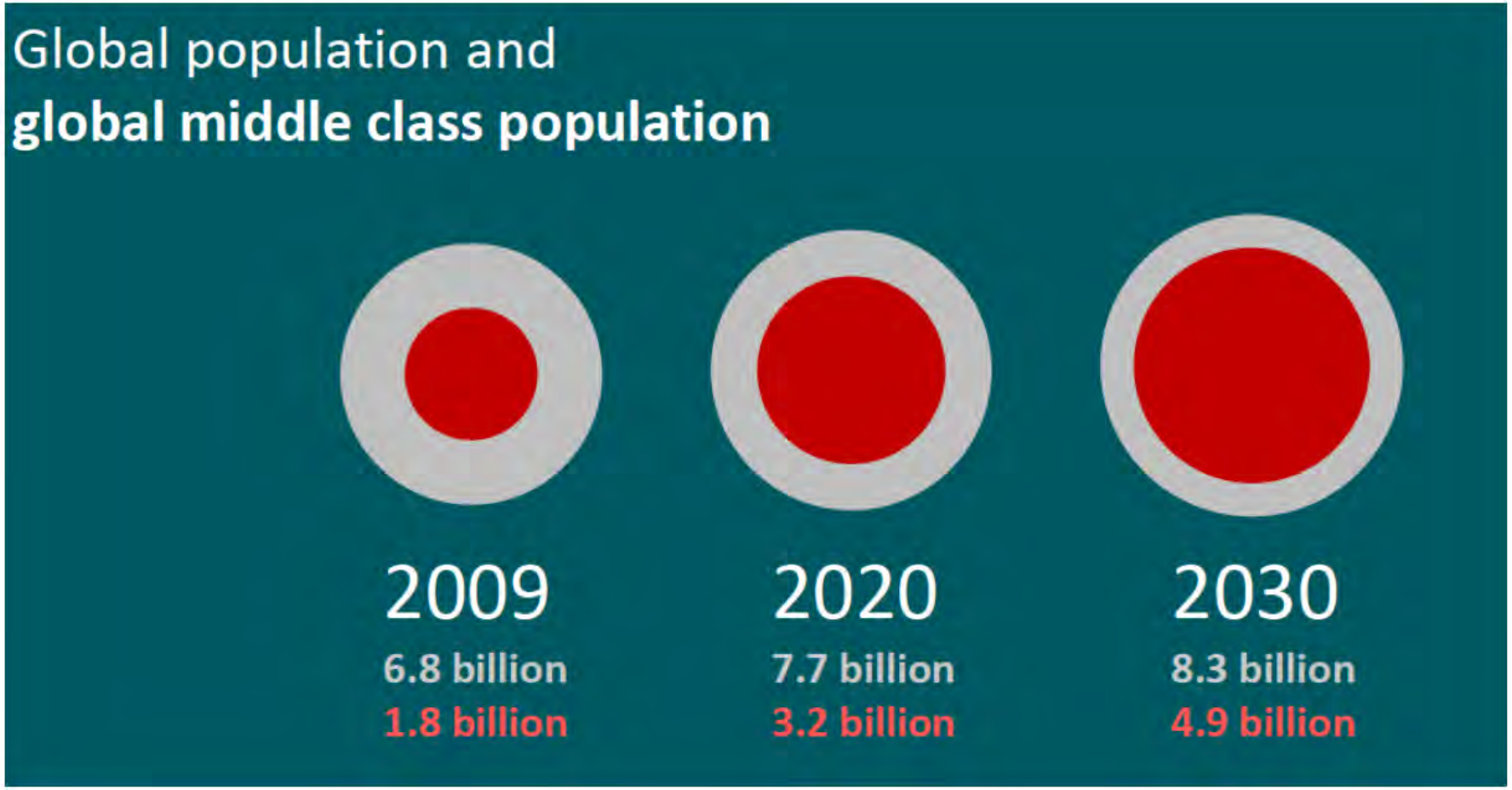
Sustainable development is:

‘*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*’

Some principles for sustainable agriculture are:

1. Farm productivity is sustained or enhanced over the long term
2. Adverse impacts on the natural resource base of agriculture and associated ecosystems are ameliorated, minimised or avoided
3. Residues resulting from the use of chemicals in agriculture are minimised
4. The net social benefit from agriculture is maximised
5. Farming systems are sufficiently flexible to manage risks associated with the vagaries of climate and markets

Richer population



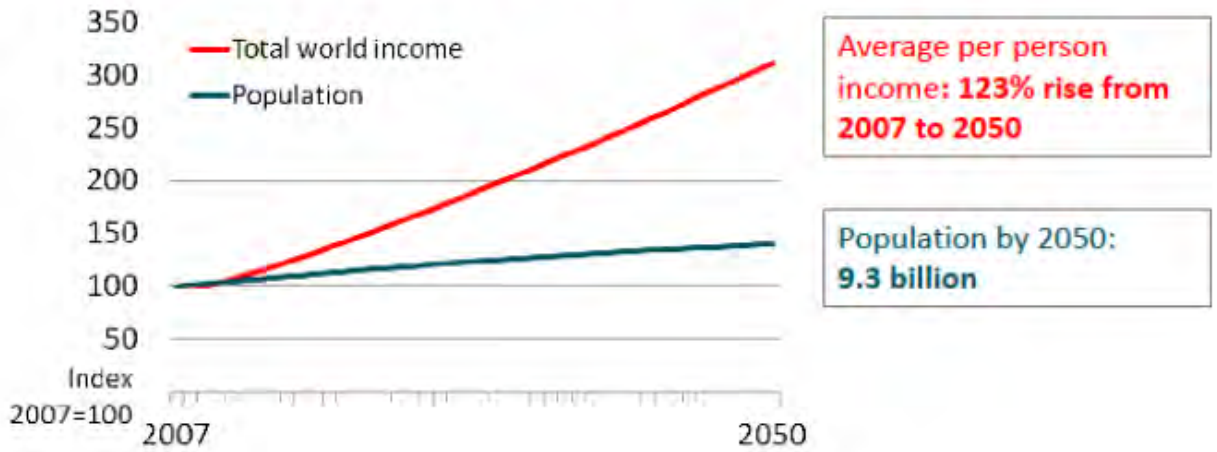
Rapidly changing Asian markets

Rising middle class	From 500 million today to 1.75 billion by 2020 – one estimate
	Mostly in China and India, also Indonesia
Changing Tastes	Increasing demand for protein (more meat), shifting from rice to wheat (Indonesia)
Niche Markets	EG - Increasing demand for high quality fruit
Concerns about health and safety	High prices paid for verifiably safe food.

ITS global

Combining expected population growth with income growth means food consumption will increase by 68 per cent between 2000 and 2050. This implies an annual growth rate of 1.04 per cent, compared with growth of 2.2 per cent annually between 1970 and 2000.

Global food demand is expected to rise strongly to 2050



People's demand for food: Rules of Behaviour

Higher price people buy less

High income people spend low proportion of *total* income on food and low proportion of an *increase* in income on food

Low income people spend high proportion of *total* income on food and high proportion of an *increase* in income on food

Engels Law: as people become wealthier they spend a declining proportion of extra income on food.

Combining expected population growth with income growth means food consumption will increase by 68 per cent between 2000 and 2050. This implies an annual growth rate of 1.04 per cent, compared with growth of 2.2 per cent annually between 1970 and 2000.

With global food consumption growing at decreasing rates to 2050, agricultural production can also expand at a slower rate than in the past without prices rising.

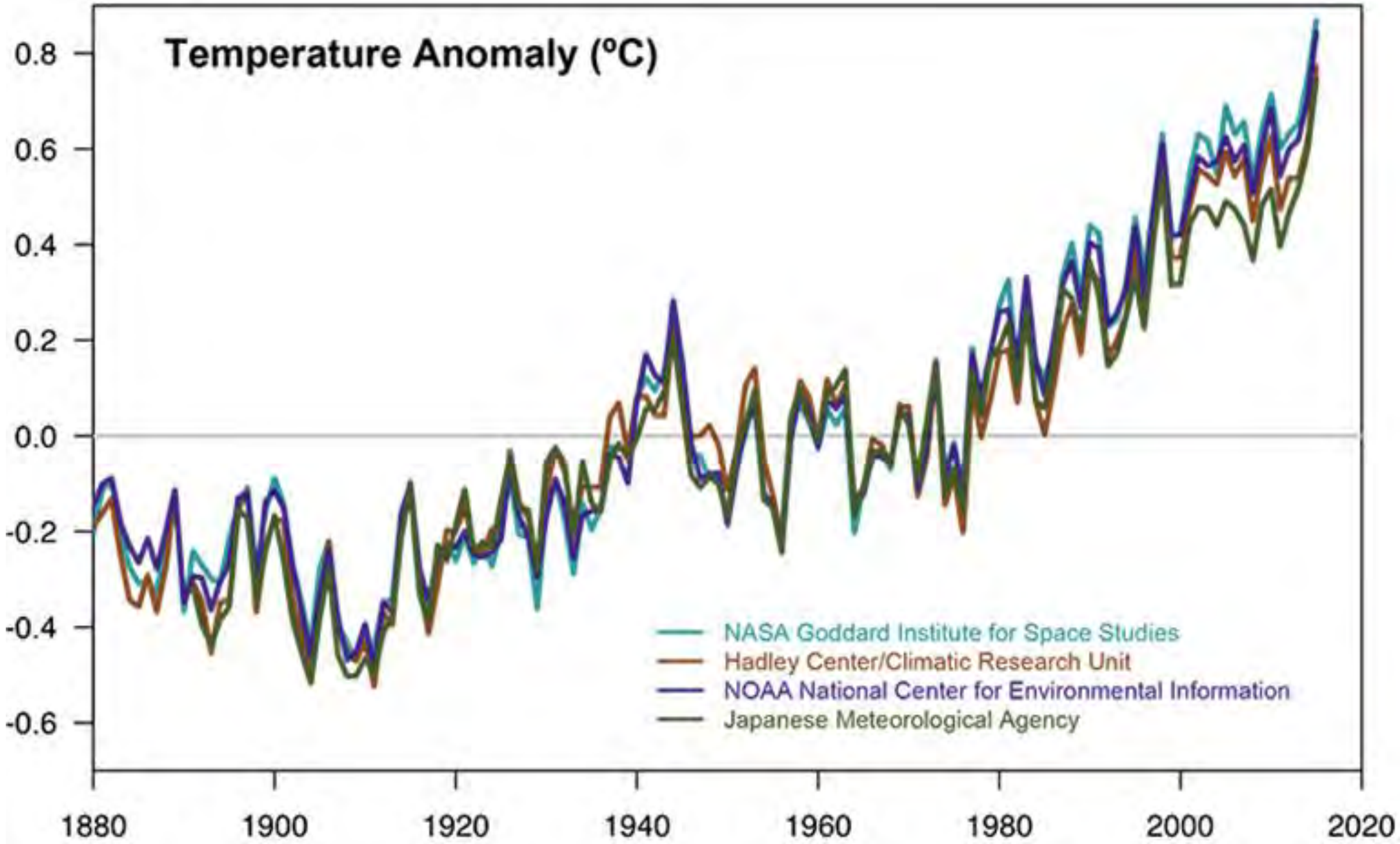
Policy Agreement

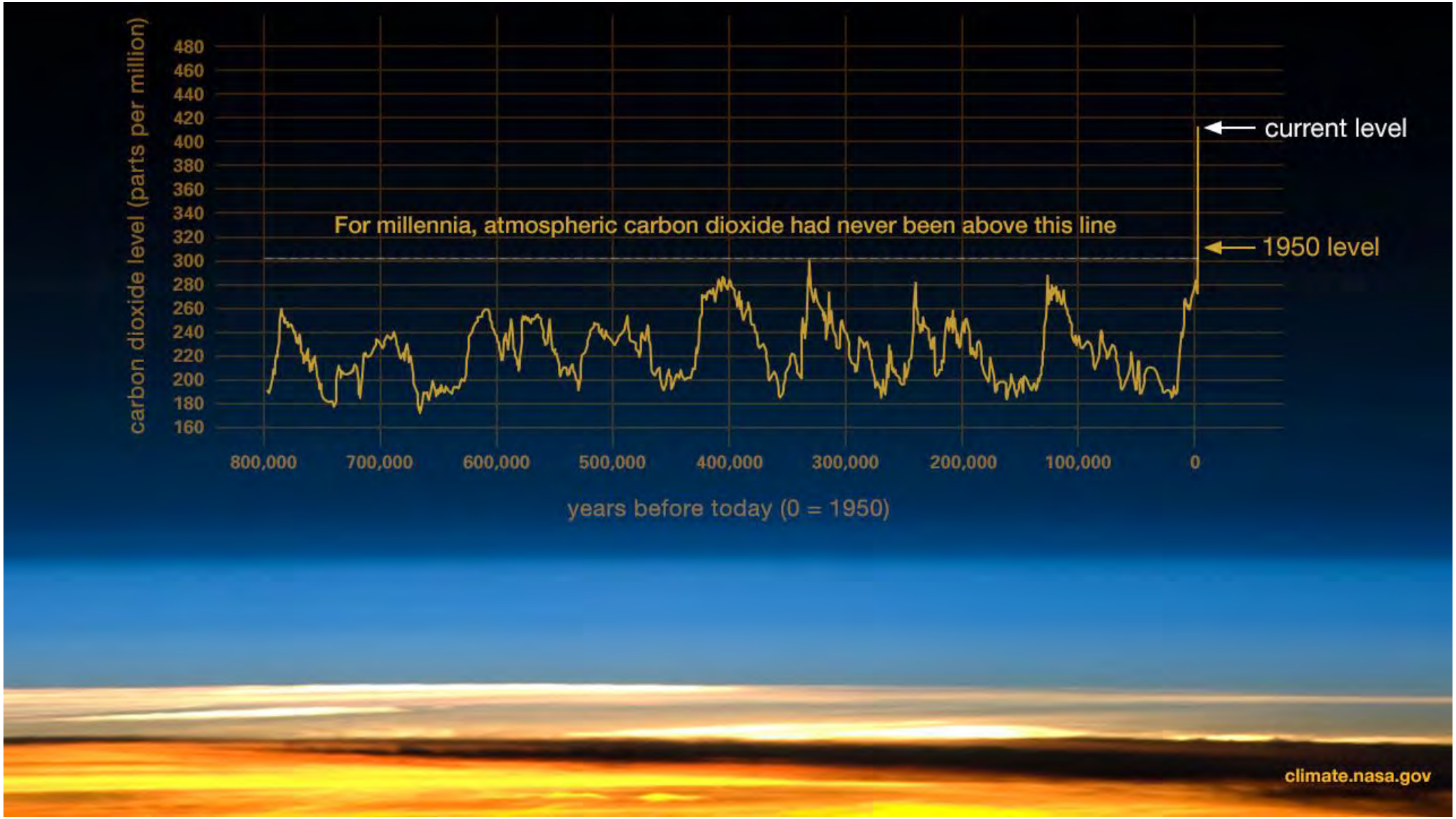
Farmer, Zambia

http://www.fao.org/News/2001/img/zambia.jpg

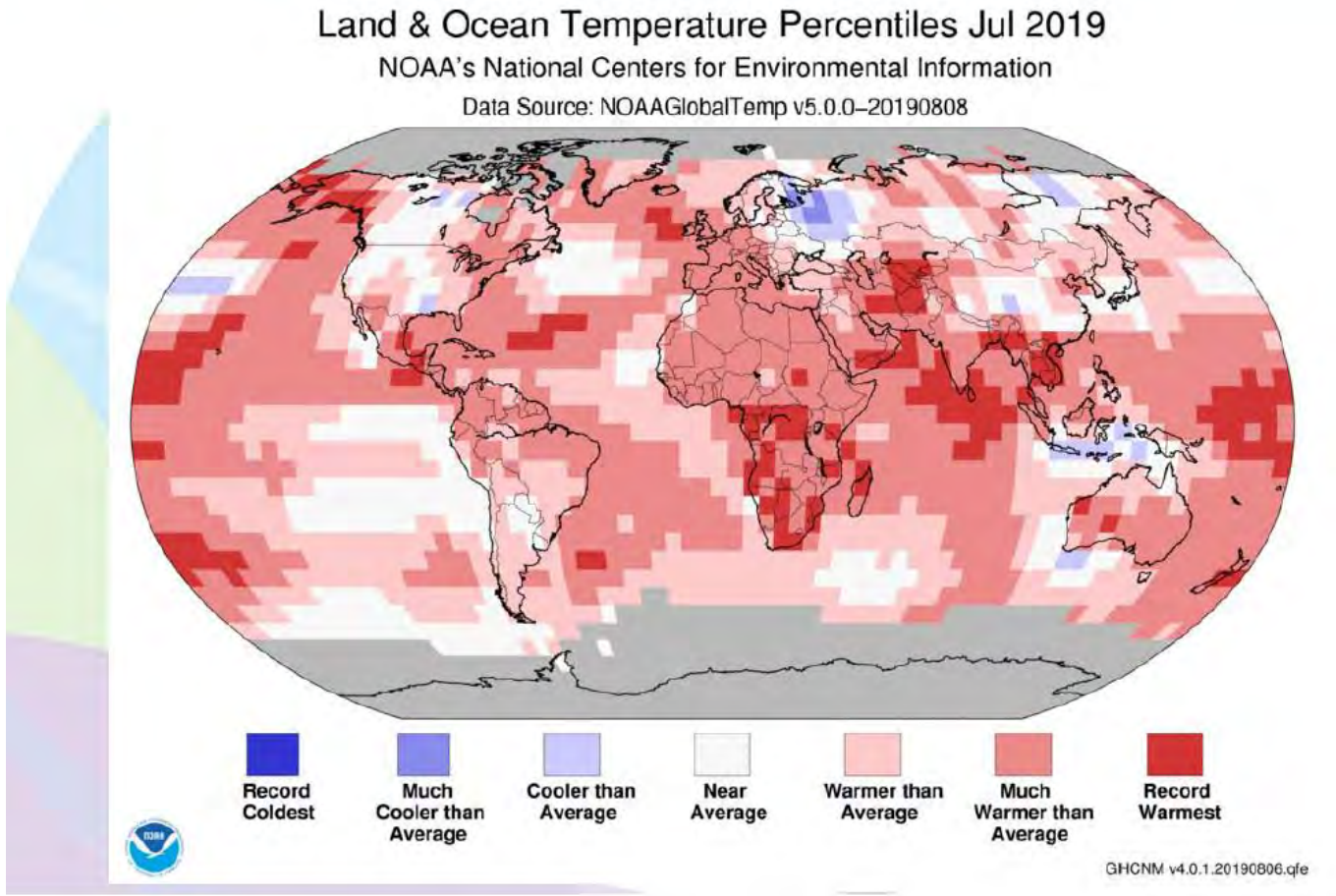
- Reduce population growth rate
  - **Promote** economic prosperity, health, and education
- Invest in agricultural productivity
  - Research, extension, credit, markets
- Protect soil and water resources
  - Assign property rights
    - Gives resource owners a stake in environmental protection
- Encourage economic growth among the poorest
  - Macroeconomic policies, competitive markets, human capital

2.3 Changing Climate

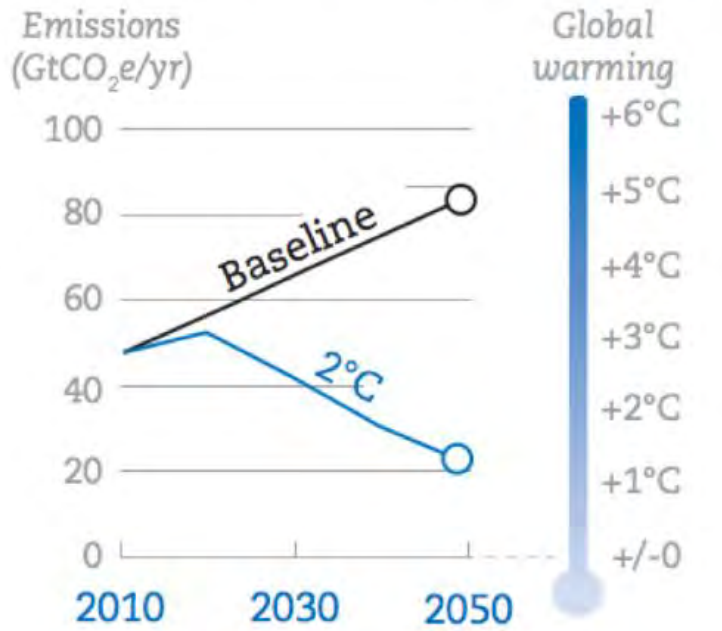

Temperature Anomaly (°C)
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1880
1900
1920
1940
1960
1980
2000
2020
NASA Goddard Institute for Space Studies
Hadley Center/Climatic Research Unit
NOAA National Center for Environmental Information
Japanese Meteorological Agency

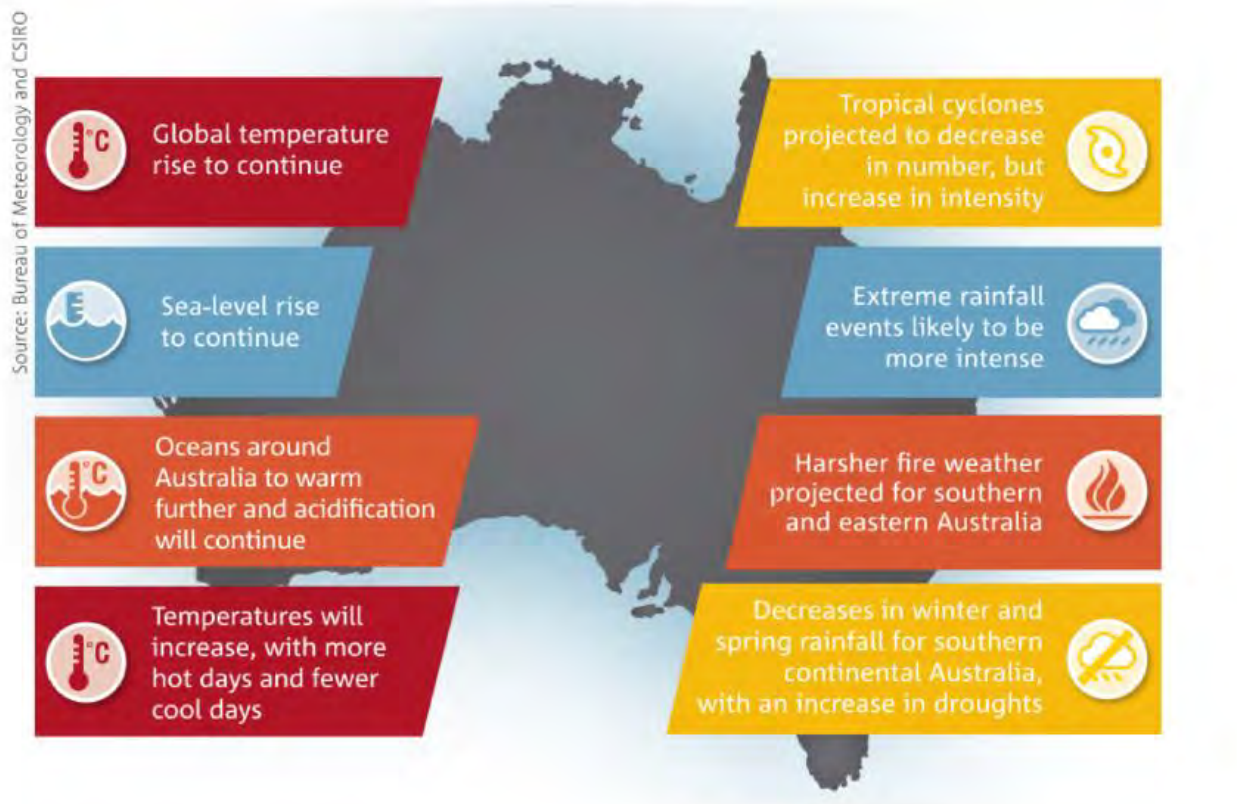

carbon dioxide level (parts per million)
480
460
440
420
400
380
360
340
320
300
280
260
240
220
200
180
160
For millennia, atmospheric carbon dioxide had never been above this line
current level
1950 level
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
years before today (0 = 1950)
climate.nasa.gov

What has already changed?



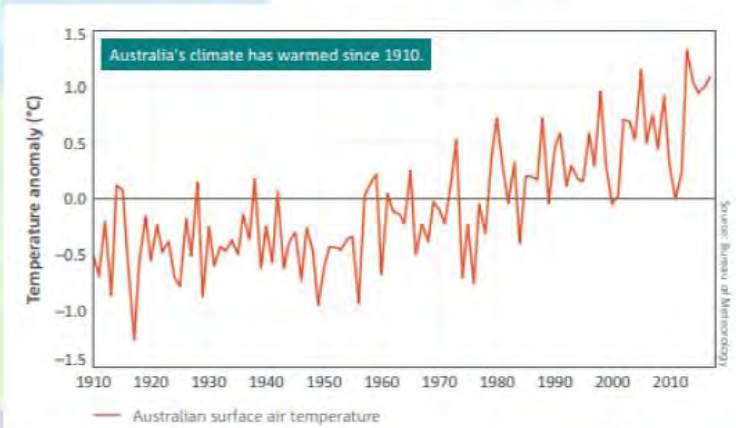
Global emissions and the 2°C target[2]

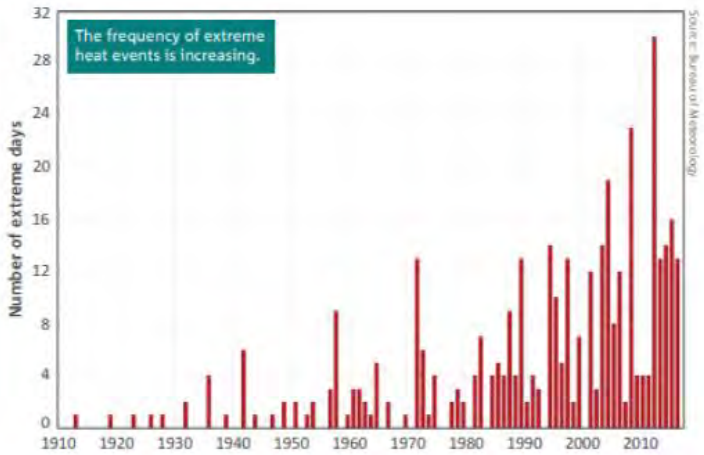


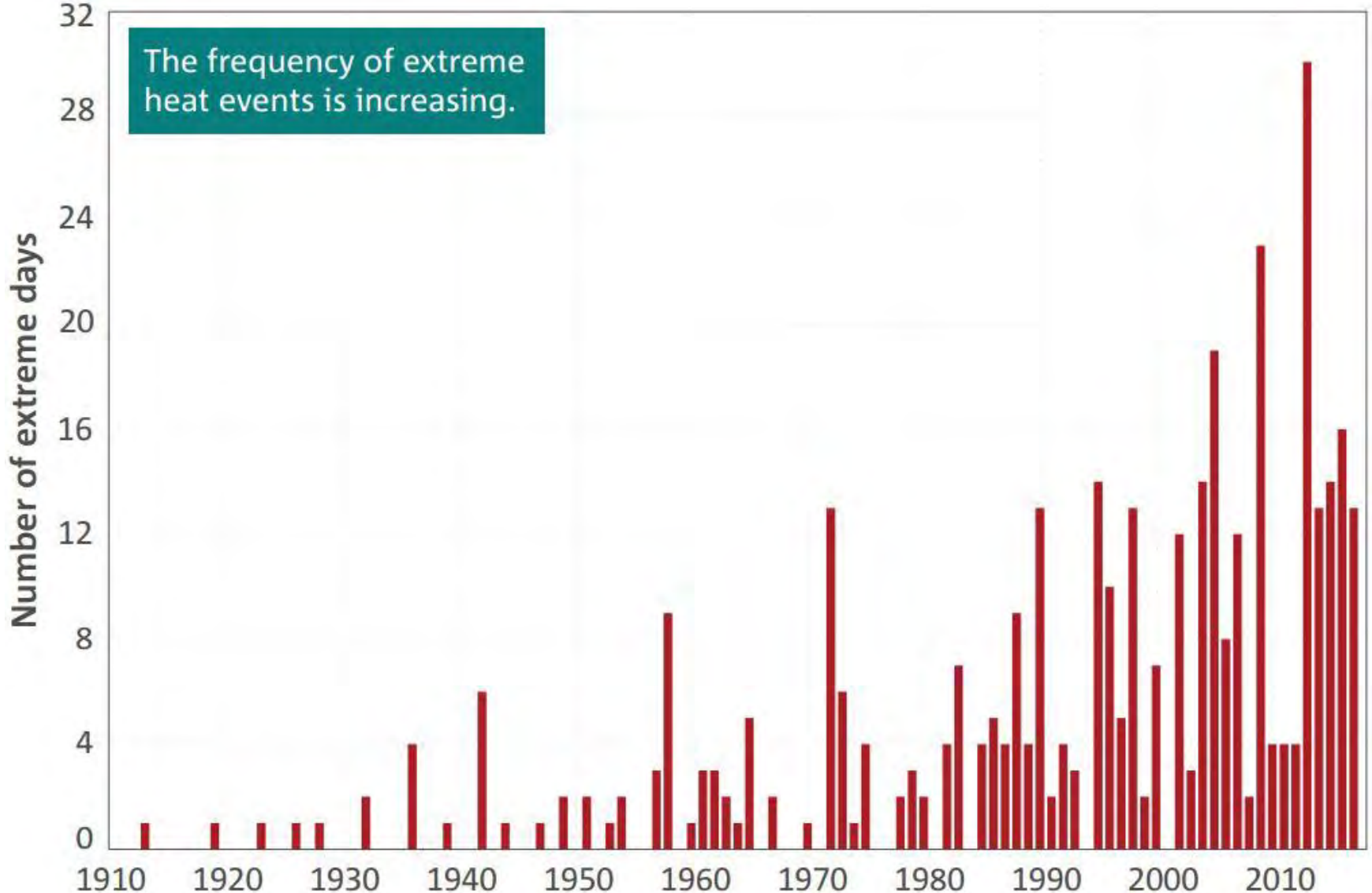


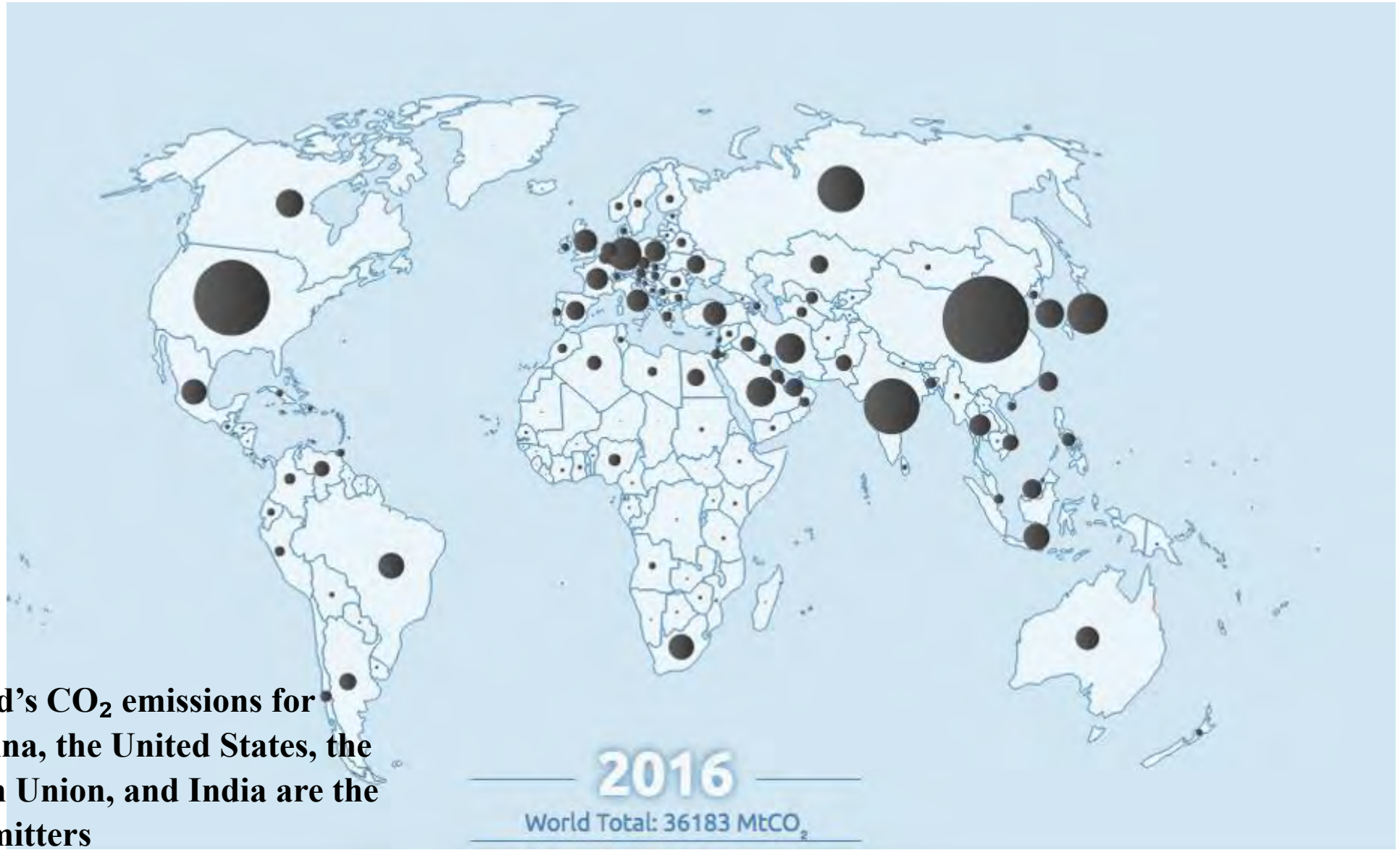
What has already changed?

- Average temperatures continue to increase
  - As is the frequency of extreme heat events
- Global average temperature is now 1.1 ˚C above pre-industrial





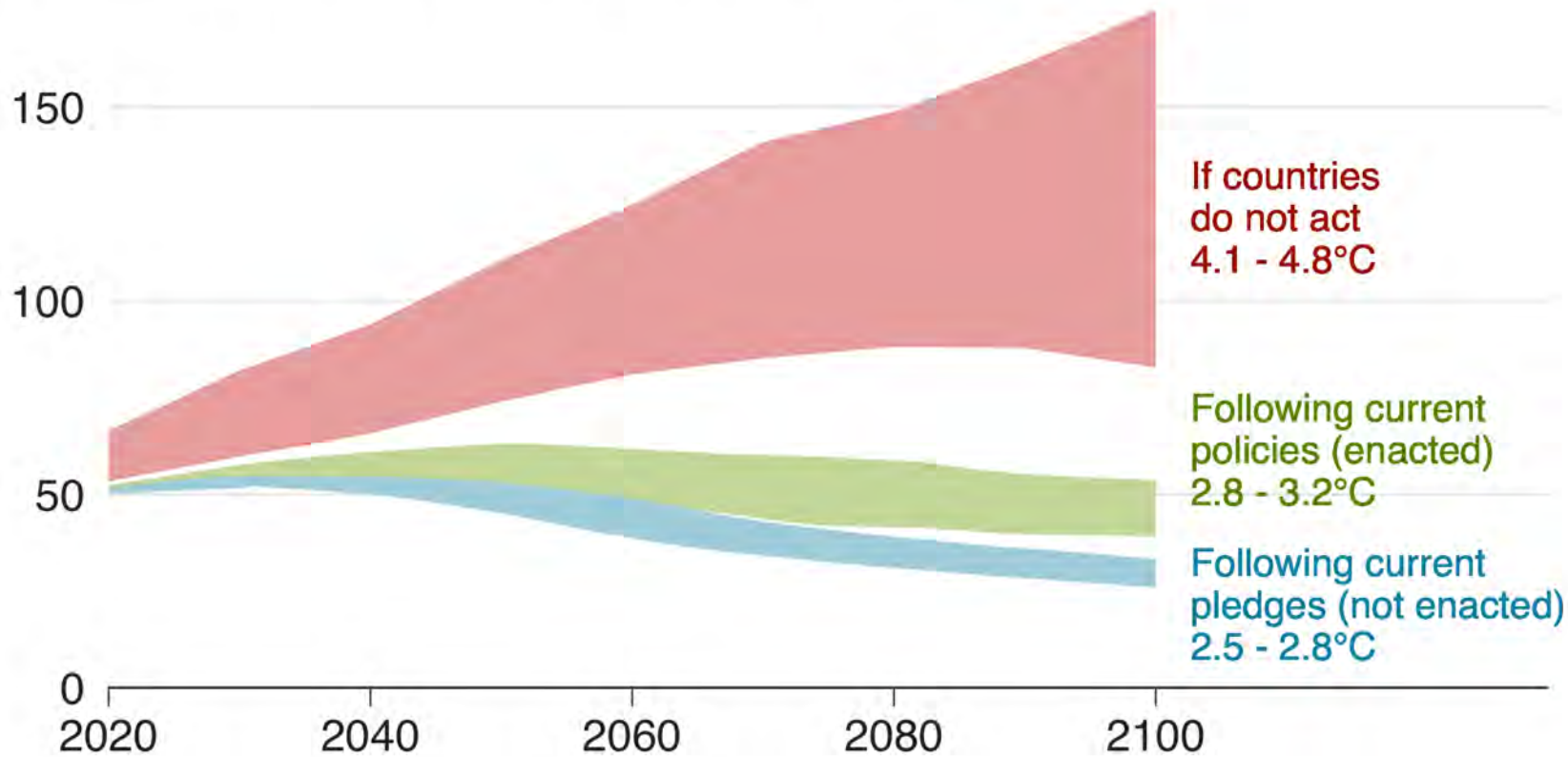

The frequency of extreme heat events is increasing.
Number of extreme days
0
4
8
12
16
20
24
28
32
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010



The world's CO_2 emissions for 2016. China, the United States, the European Union, and India are the largest emitters

How much worse will the problem get?

Emissions* and expected warming by 2100

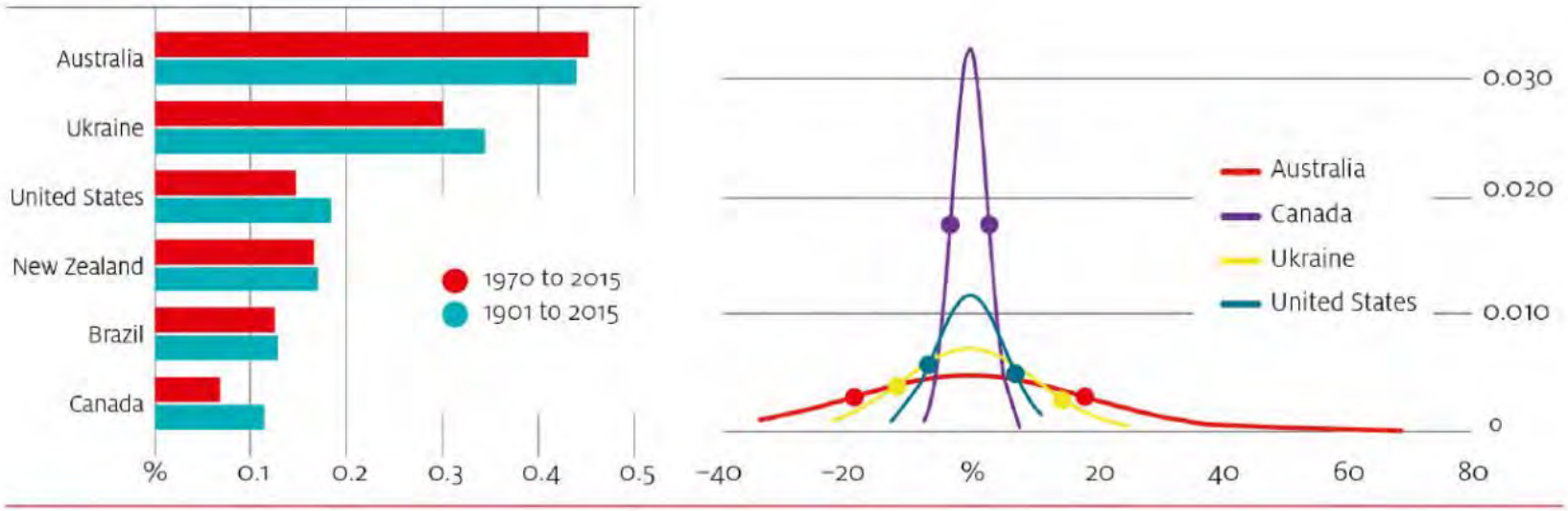


*Emissions are in Gigatonnes of CO2 equivalent

Source: Climate Action Tracker

BBC

Australian farmers manage highly variable climate,
with low producer support



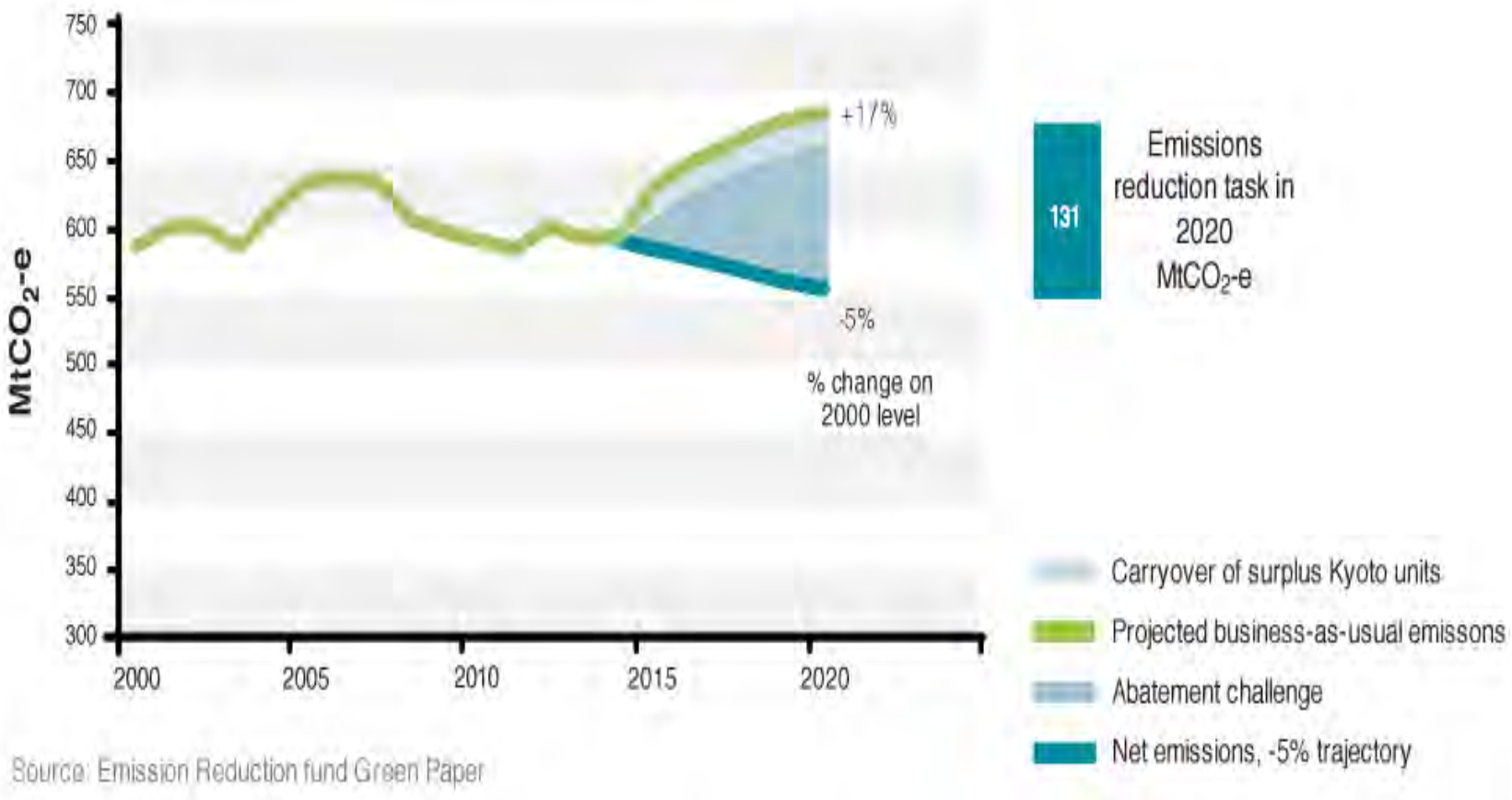
Rainfall variability index

Departure from mean rainfall (%), 1970-2015

Note: Departure from mean rainfall calculated as a probability density function, which shows the spread of possible values around the mean. Source: The World Bank Group – Climate Change Knowledge Portal

Carbon Emissions: Australia's target

Figure 1: Australia's emissions reduction tasks to 2020



Source: Emission Reduction fund Green Paper

Australian Government
Department of Agriculture
ABARES

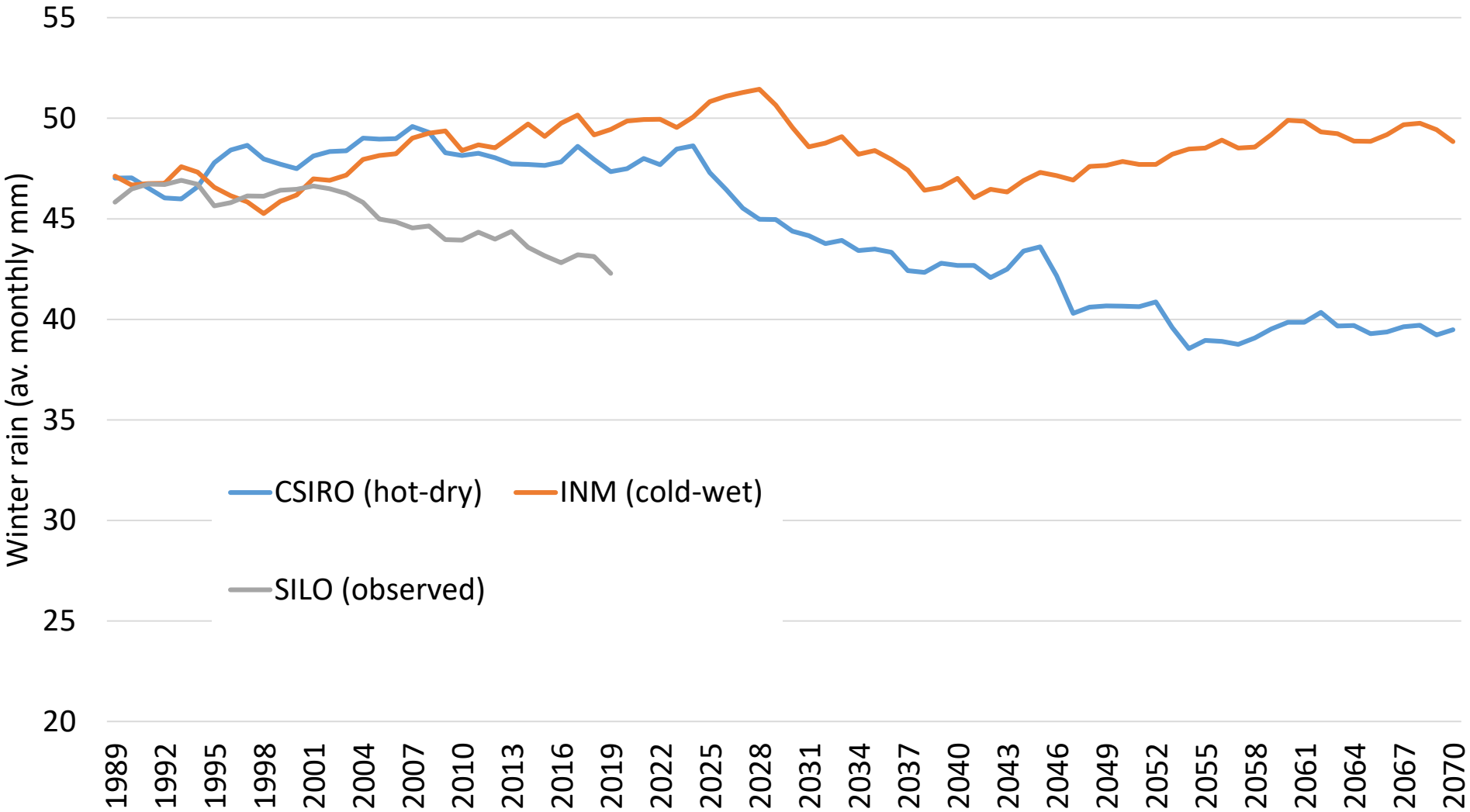
The effects of drought and climate change on Australian farms

Neal Hughes

Australian Bureau of Agricultural and Resource Economics and Sciences

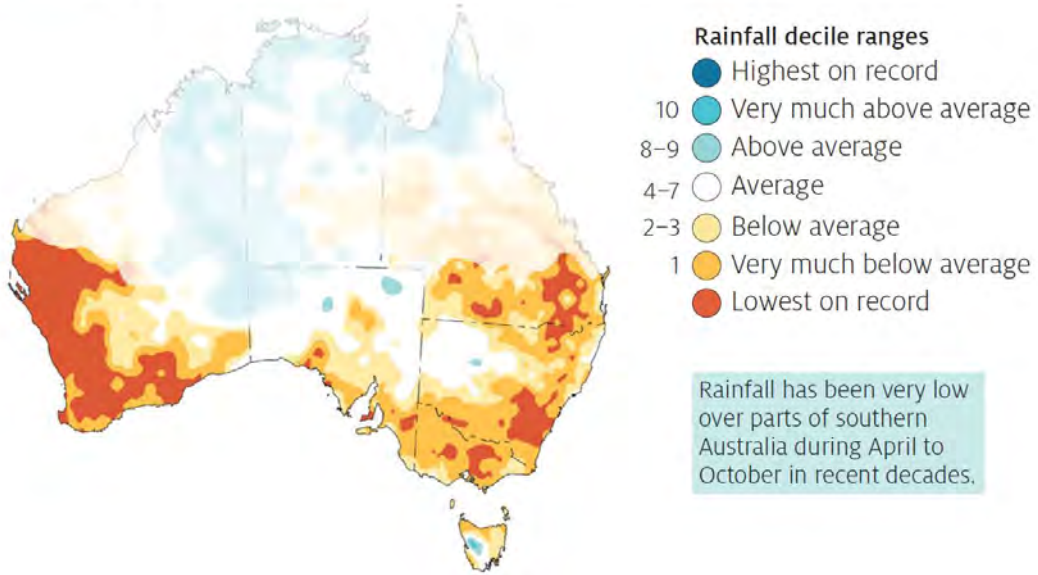
Future climate is uncertain

Average winter rainfall in Australian broadacre farming regions (30 year moving average)



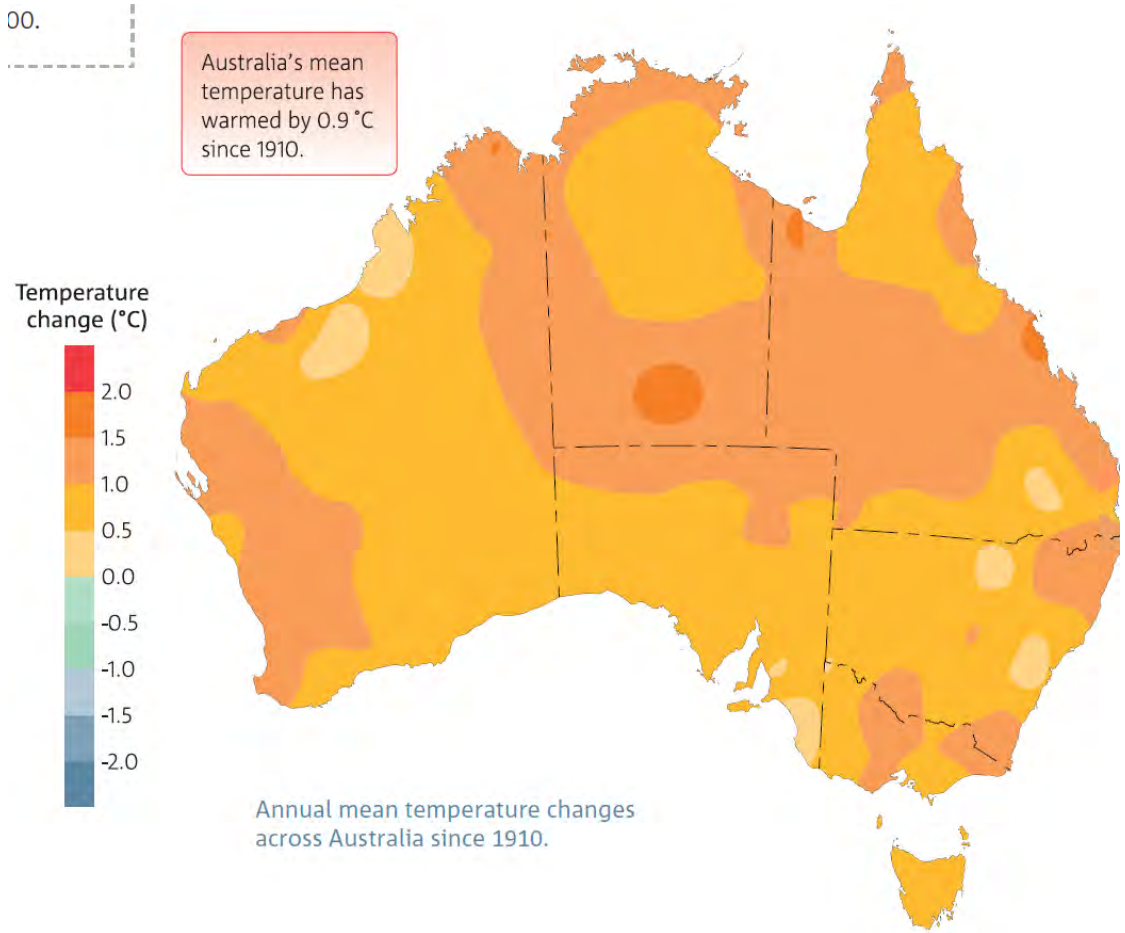
Rainfall – Last 15 years

FIGURE 5 Changes in Australian April to October rainfall, 1999–2018 relative to 1900–2018



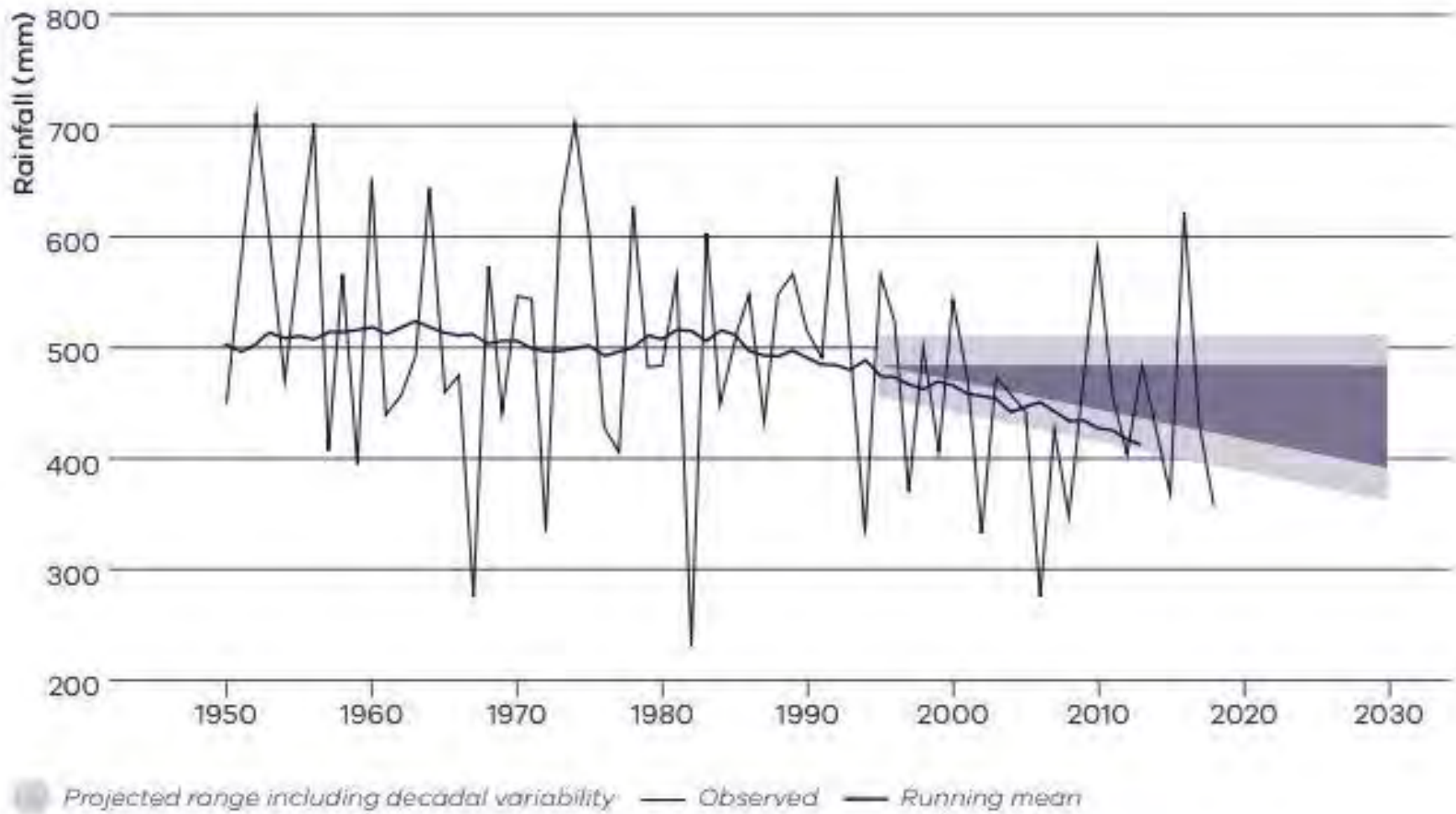
Note: April to October rainfall deciles for the last 20 years (1999–2018). A decile map shows where the rainfall is above average, average or below average for the most recent period, in comparison with entire rainfall record from 1900. Areas across northern and central Australia that receive less than 40 per cent of their annual rainfall during April to October have been faded.
Source: Bureau of Meteorology 2018

00.



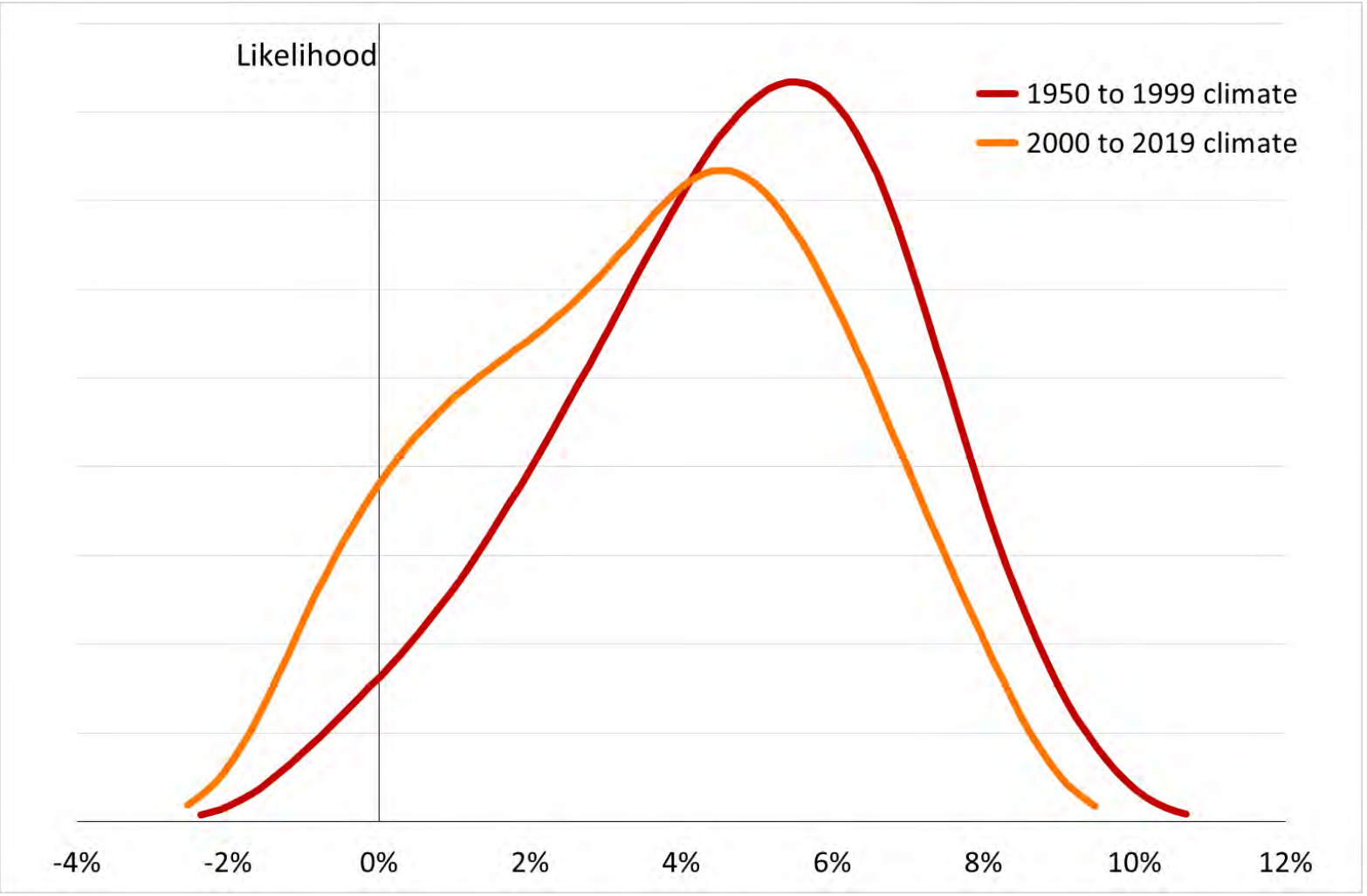
Annual mean temperature changes across Australia since 1910.

Observed winter rainfall in Victoria is tracking towards the drier end of projections



The climate is changing

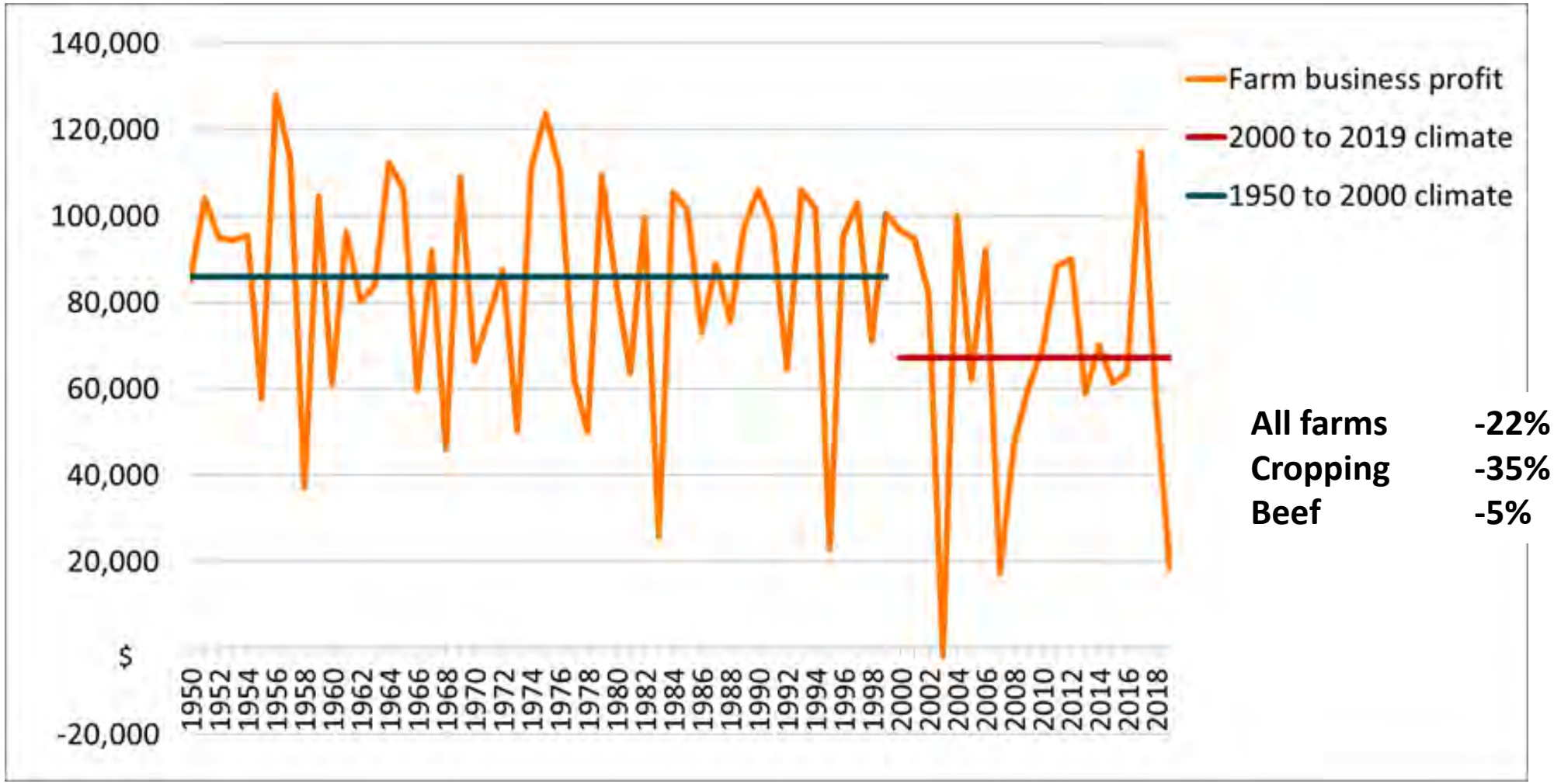
Effect of climate variability on rate-of-return for a typical Australian cropping farm



Notes: Distributions of simulated rate-of-return (with current farms and commodity prices 2015-16 to 2017-18) under both 1949-50 to 1998-99 climate conditions and 1999-2000 to 2018-19 conditions. (Hughes et al. 2019).

The climate is changing

Effect of climate variability on average broadacre farm business profit 1950 to 2019



All farms	**-22% (-$18,631)**
Cropping	**-35%**
Beef	**-5%**

Notes: Simulated weighted average farm business profit for broadacre farms, for current farms and commodity prices (2015-16 to 2017-18) and historical climate conditions (1949-50 to 2018-19) (Hughes et al. 2019).

Farm risk management

- Farmers absorb risk with assets and off-farm income
    - Farms hold higher equity than other businesses
    - Small farms hold higher than large farms
    - Small farms have lots of off-farm income (50 per cent on average)
    - Farm business have high survival rates
- Farmers mitigate risk with farm management practices
    - Conservative cropping / livestock decisions
    - Diversification, new technology
- Insurance available for some risks, but typically not drought

Policy implications

- Long-term investments (infra. / R&D) need to be mindful of climate trends
- Drought policy: subsidies have side-effects
    - Gradual shift away from drought support to self-reliance
    - Drought support can slow structural adjustment and adaptation
    - …but drought risk is still a problem
- Index-based insurance could provide a way forward
    - Insurance provides drought protection without side-effects
    - Index-based insurance addresses information problems (AS, MH)
    - Instead we have a technical problem (basis risk)
    - In future better data / models may solve this

Natural Resource Management

Water supplies for urban and rural uses. Murray Darling Basin Plan.

Soil conservation and improvement

Native vegetation and forests

Feral animals and weeds

Biodiversity of plants, animals and other species

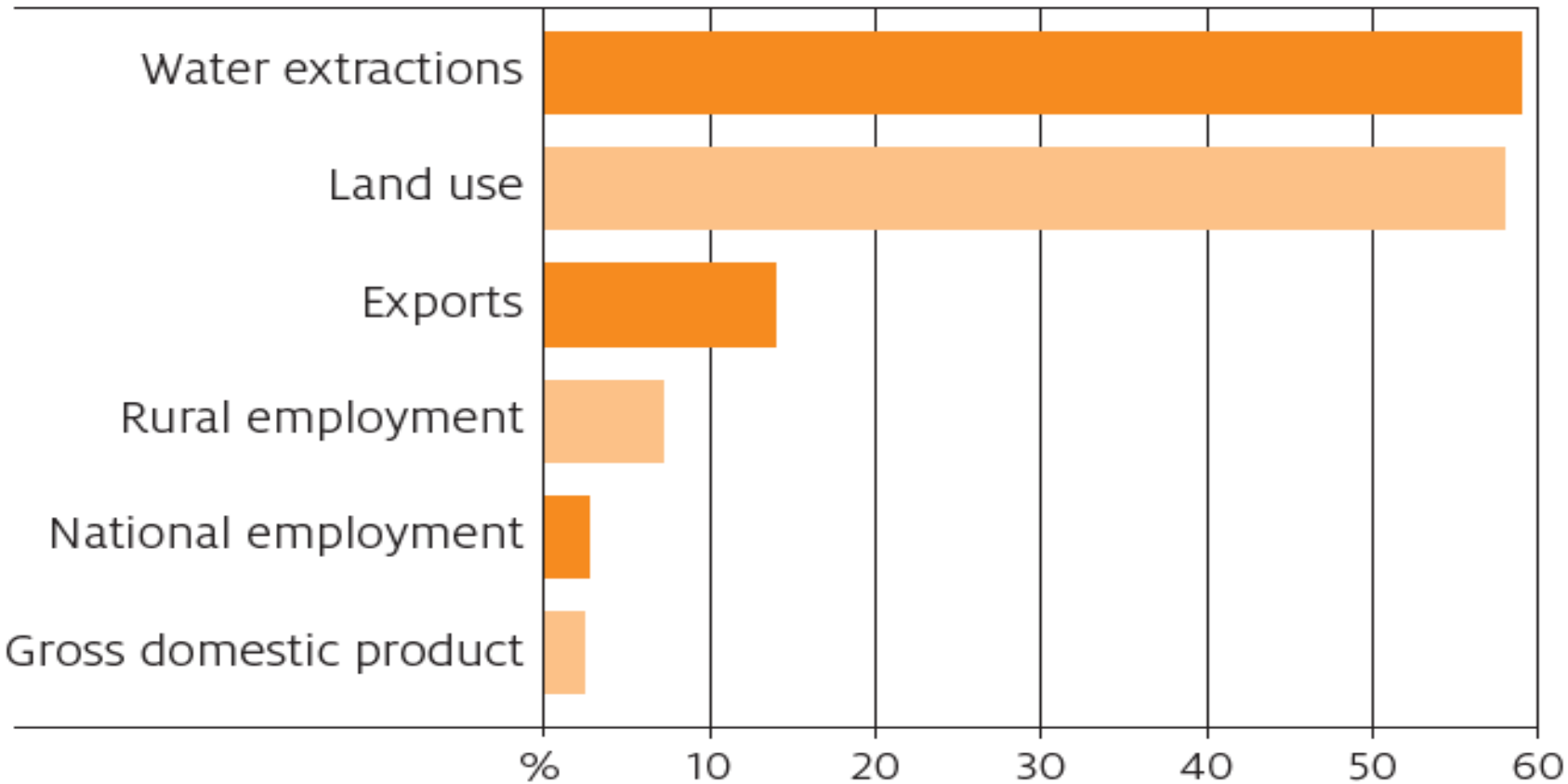
Fisheries

3. AGRICULTURE IN AUSTRALIA

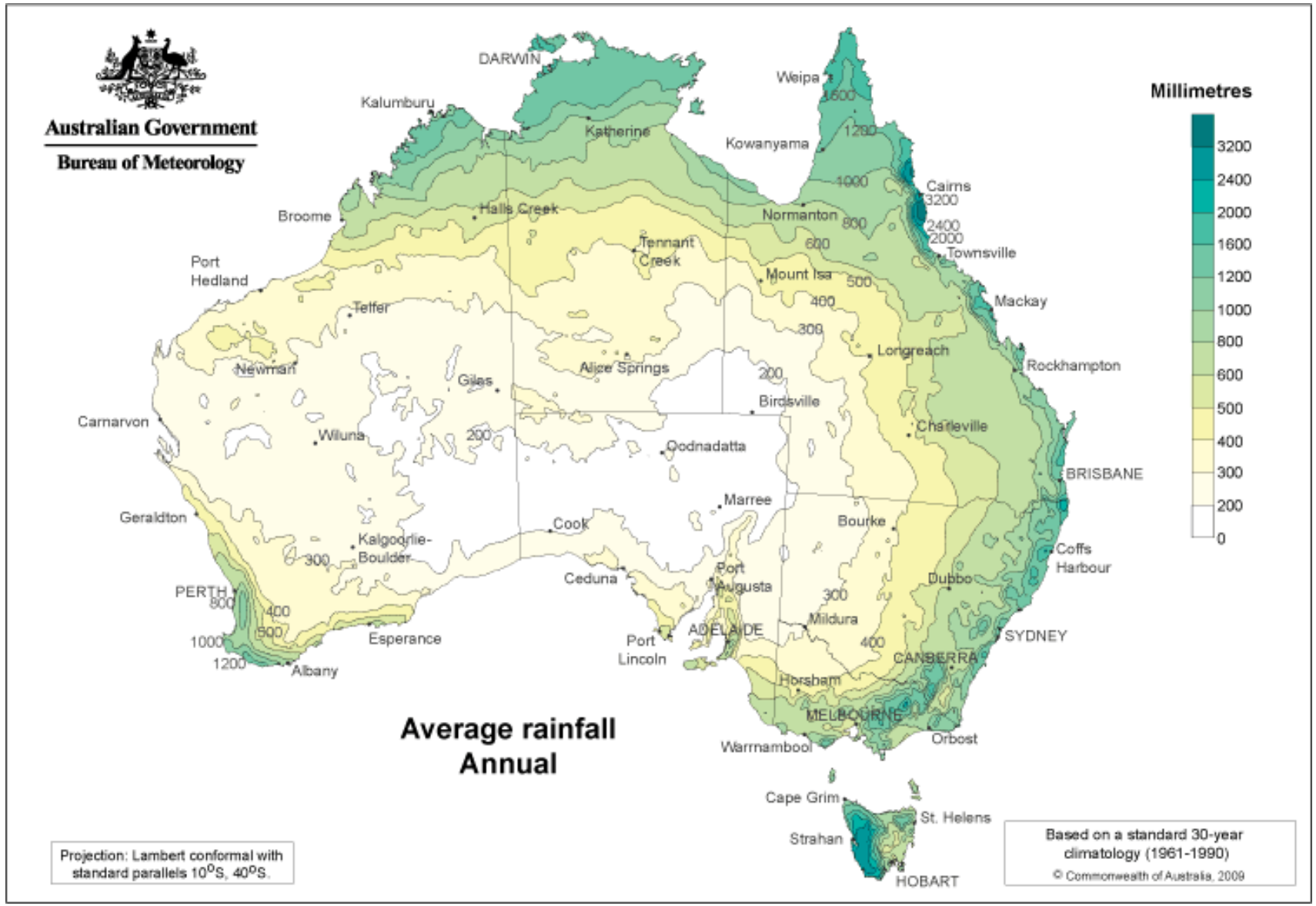
Role of Agricultural Technology and Agricultural Production

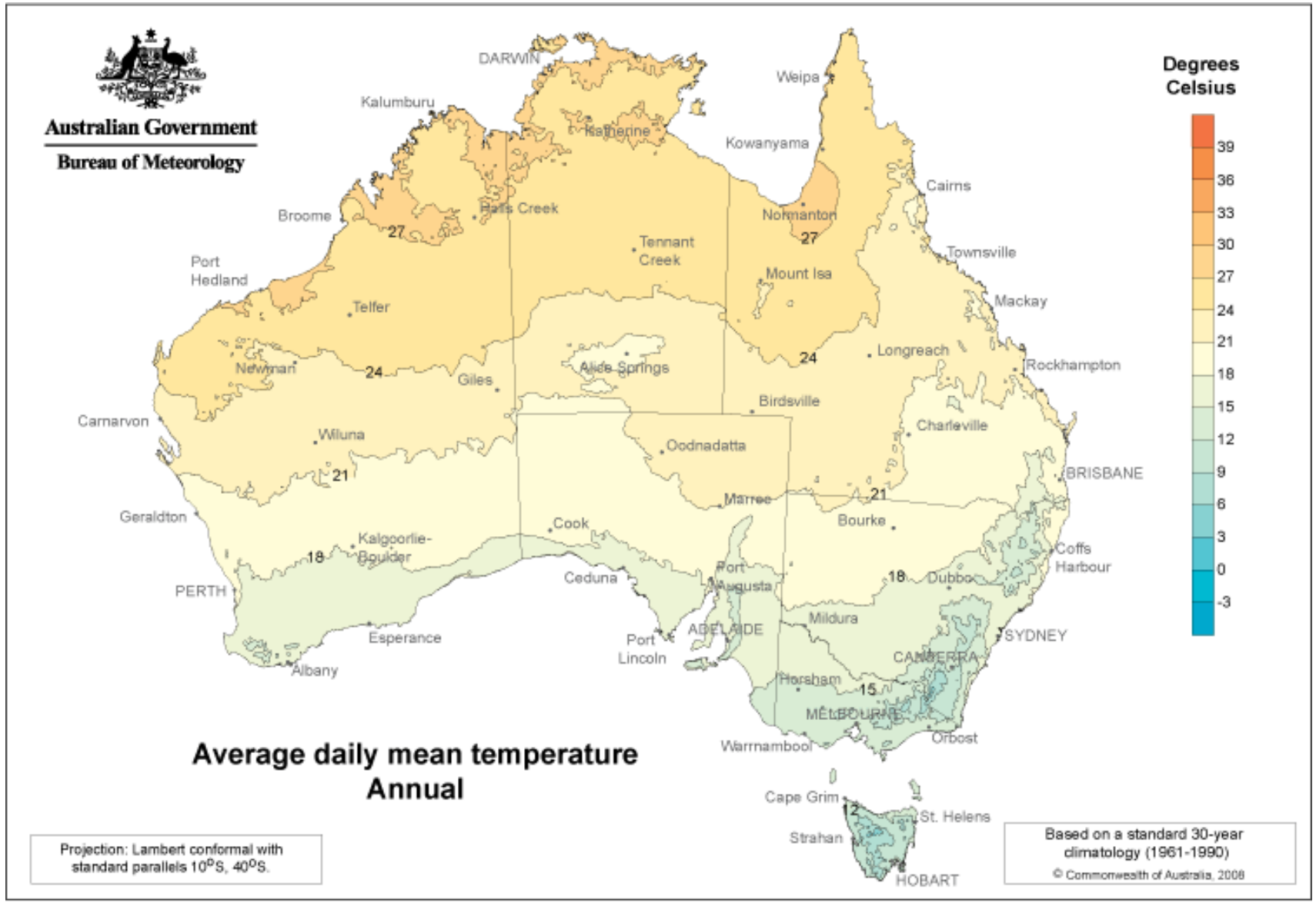
- Agricultural production is 2.5% of total production of goods and services in Australia
- Agricultural production is 15% of Australia's total exports
- Agricultural productivity (output produced/inputs used) increases around 2% p.a.

FIGURE 1 Selected contributions of agriculture



Sources: ABS Water Account (cat. 4610), ABS Land Management and Farming (cat. 4627), ABS Balance of Payments (cat. 5302), ABS Labour Survey (cat. 6202), ABS National Accounts (cat. 5206)


Australian Government
Bureau of Meteorology
Average rainfall
Annual
Millimetres
3200
2400
2000
1600
1200
1000
800
600
500
400
300
200
0
DARWIN
Kalumburu
Katherine
Weipa
1600
1200
Kowanyama
1000
Cairns
3200
2400
2000
Townsville
Normanton
800
600
Broome
Halls Creek
Tennant Creek
Mount Isa
500
400
300
Port Hedland
Telfer
Mackay
Longreach
Rockhampton
Newman
Alice Springs
200
Gilas
Birdsville
Carnarvon
Wiluna
Charleville
Oodnadatta
BRISBANE
Marree
Geraldton
Cook
Bourke
Kalgoorlie-Boulder
300
Coffs Harbour
Ceduna
Port Augusta
Dubbo
PERTH
800
400
500
1000
1200
Esperance
Albany
Port Lincoln
ADELAIDE
Mildura
SYDNEY
CANBERRA
Horsham
MELBOURNE
Warrnambool
Orbost
Cape Grim
St. Helens
Strahan
HOBART
Projection: Lambert conformal with standard parallels 10°S, 40°S.
Based on a standard 30-year climatology (1961-1990)
© Commonwealth of Australia, 2009

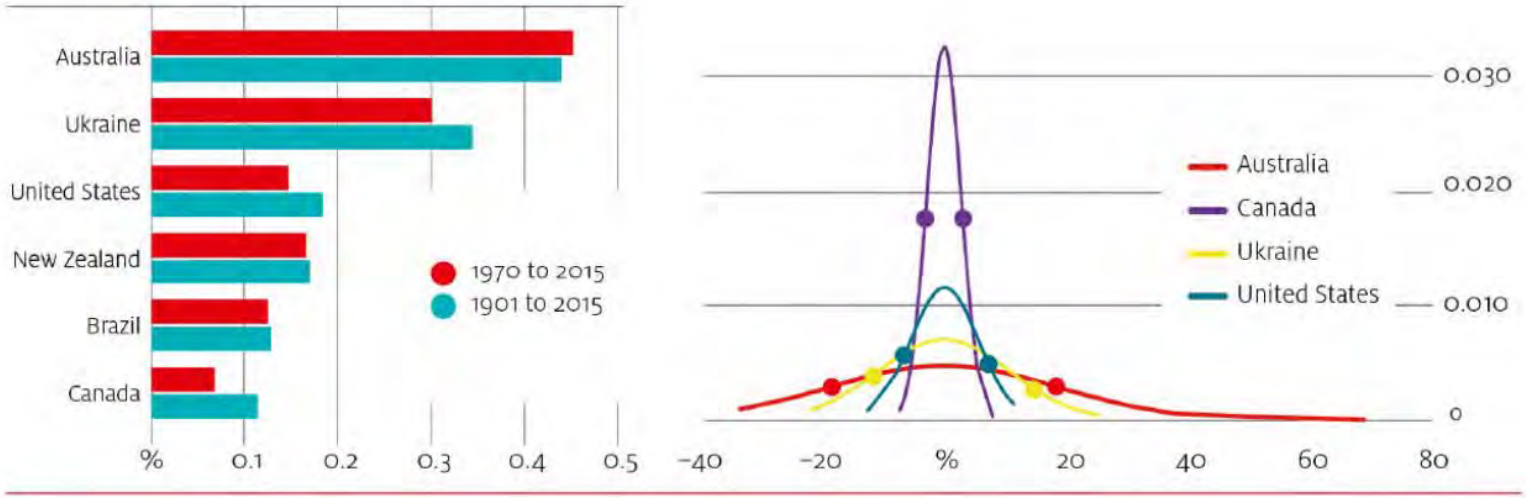

Australian Government
Bureau of Meteorology
DARWIN
Kalumburu
Katherine
Weipa
Kowanyama
Cairns
Broome
Halls Creek
Normanton
27
Tennant Creek
Townsville
Port Hedland
Mount Isa
Mackay
Telfer
Longreach
Newman
24
Giles
Alice Springs
Rockhampton
Birdsville
Carnarvon
Charleville
Wiluna
Oodnadatta
BRISBANE
21
Marree
Geraldton
Bourke
Cook
Kalgoorlie-Boulder
Coffs Harbour
18
Ceduna
Port Augusta
Dubbo
PERTH
Mildura
ADELAIDE
SYDNEY
Esperance
Port Lincoln
CANBERRA
Horsham
15
Albany
MELBOURNE
Warrnambool
Orbost
Cape Grim
12
St. Helens
Strahan
HOBART
Degrees Celsius
39
36
33
30
27
24
21
18
15
12
9
6
3
0
-3
Average daily mean temperature
Annual
Projection: Lambert conformal with standard parallels 10°S, 40°S.
Based on a standard 30-year climatology (1961-1990)
© Commonwealth of Australia, 2008


Mediterranean Climate
MEDITERRANEAN BASIN
CALIFORNIA AND NORTHERN BAJA CALIFORNIA
CENTRAL CHILE
WESTERN CAPE, SOUTH AFRICA
SOUTHWEST AND SOUTH AUSTRALIA

Agricultural Zones


Darling River
Murray-Darling Basin
Murray River
news.com.au

Australian farmers manage highly variable climate,
with low producer support

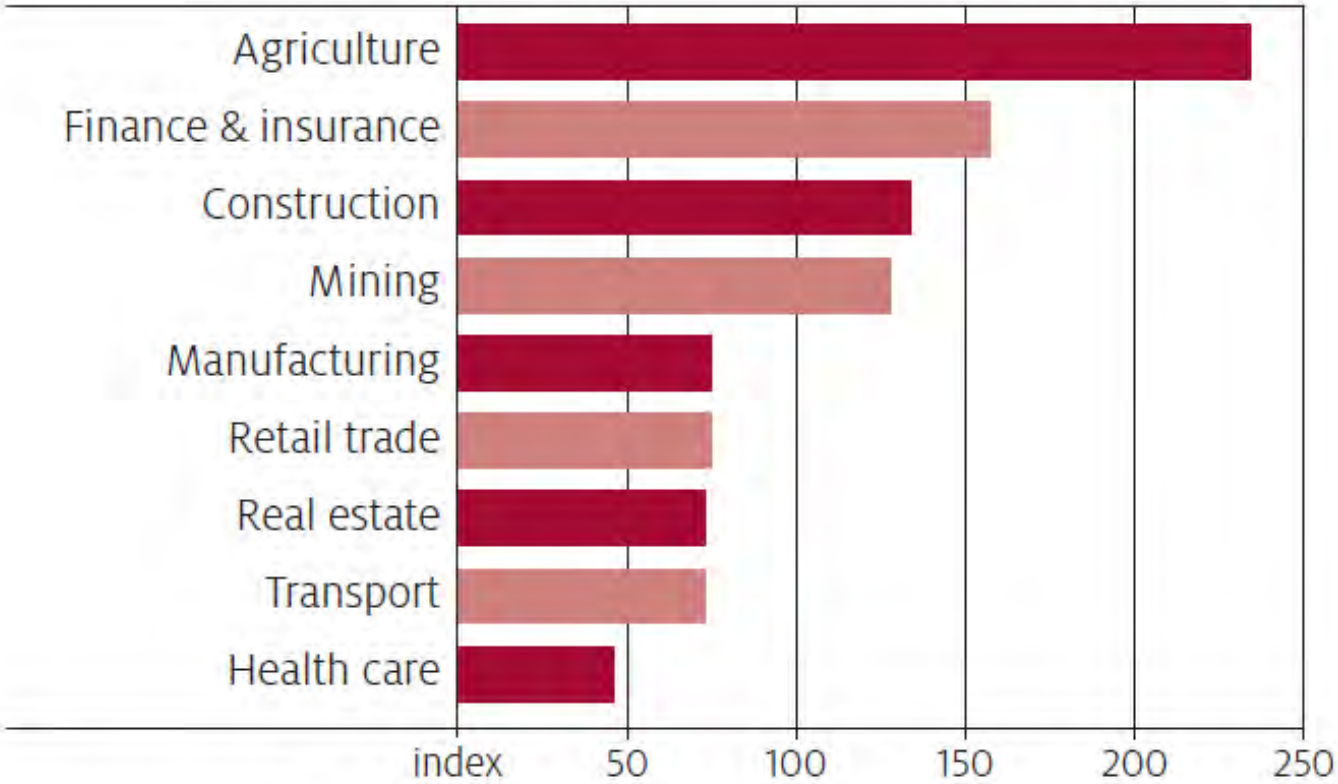


Rainfall variability index

Departure from mean rainfall (%), 1970-2015

Note: Departure from mean rainfall calculated as a probability density function, which shows the spread of possible values around the mean. Source: The World Bank Group – Climate Change Knowledge Portal

Index of relative volatility in annual value of output for selected Australian economic sectors



Note: average volatility of agricultural output across 15 countries (not all shown) = 100; average volatility of industry output across all sectors (not all shown) = 100.
Source: adapted from Keogh (2012) Including risk in enterprise decisions in Australia's riskiest businesses.

FIGURE 11 Australian agriculture is highly variable internationally and domestically

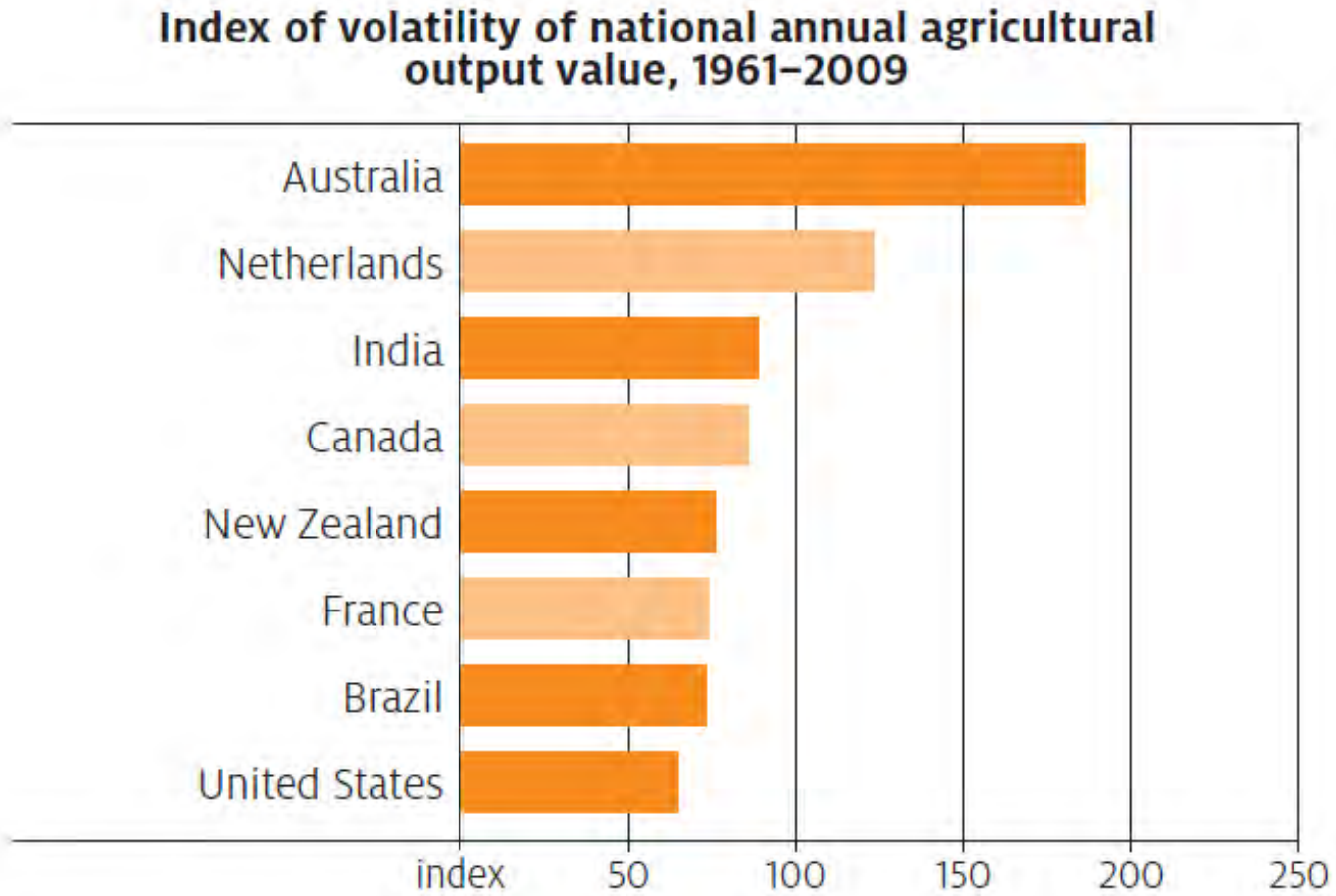
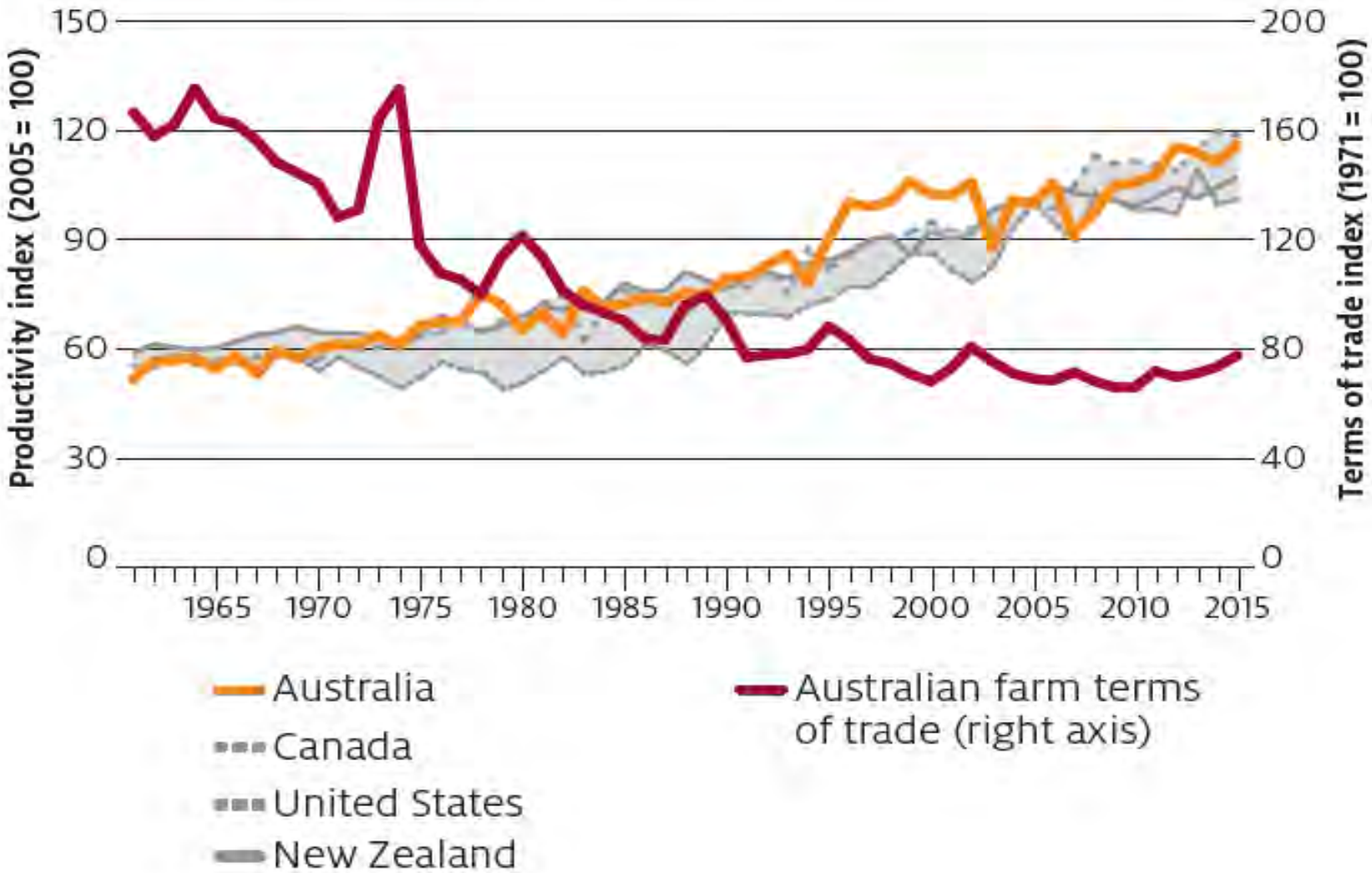


FIGURE 9 Agriculture productivity growth and terms of trade, 1961 to 2015



Increasing Agricultural Productivity is the Key

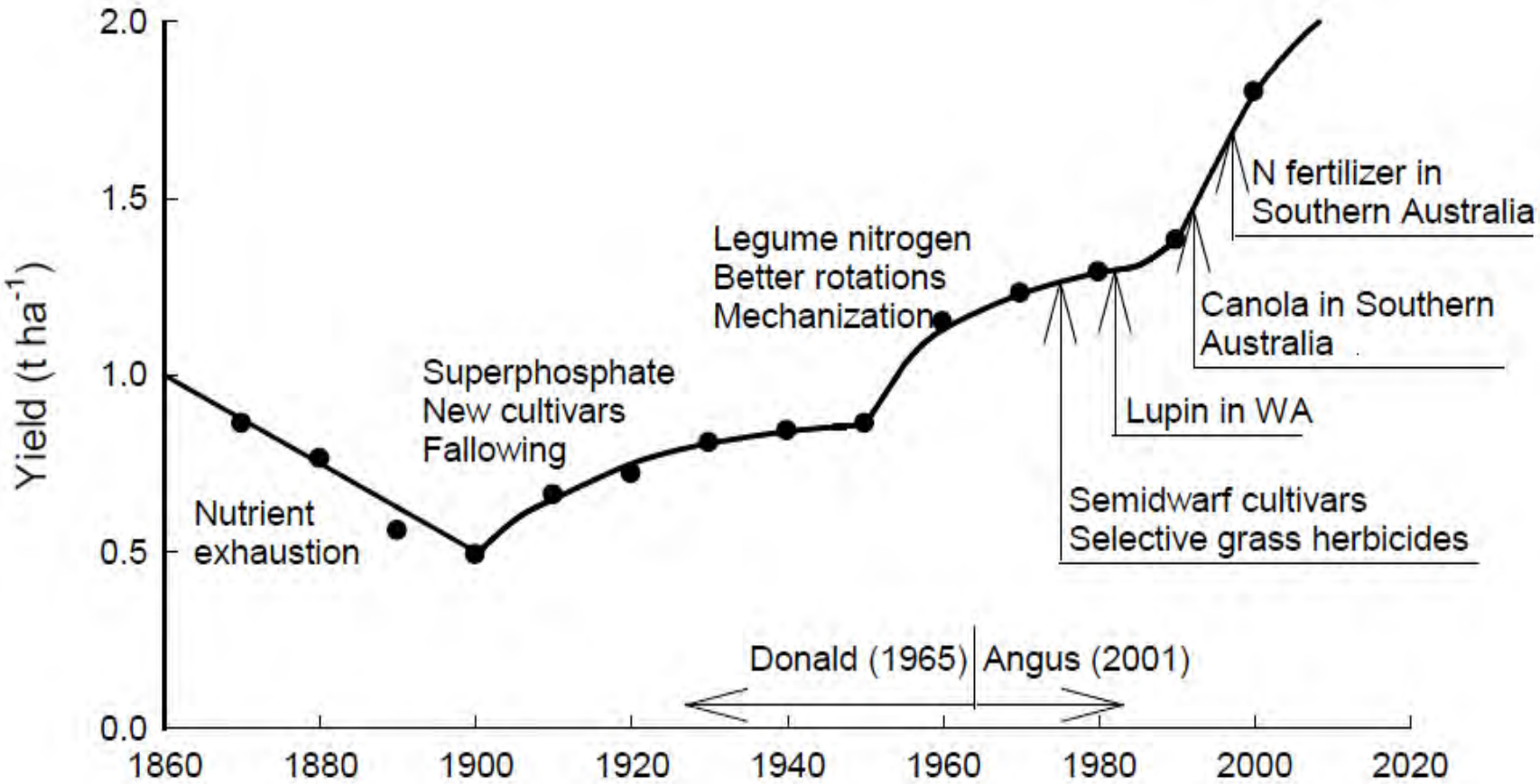
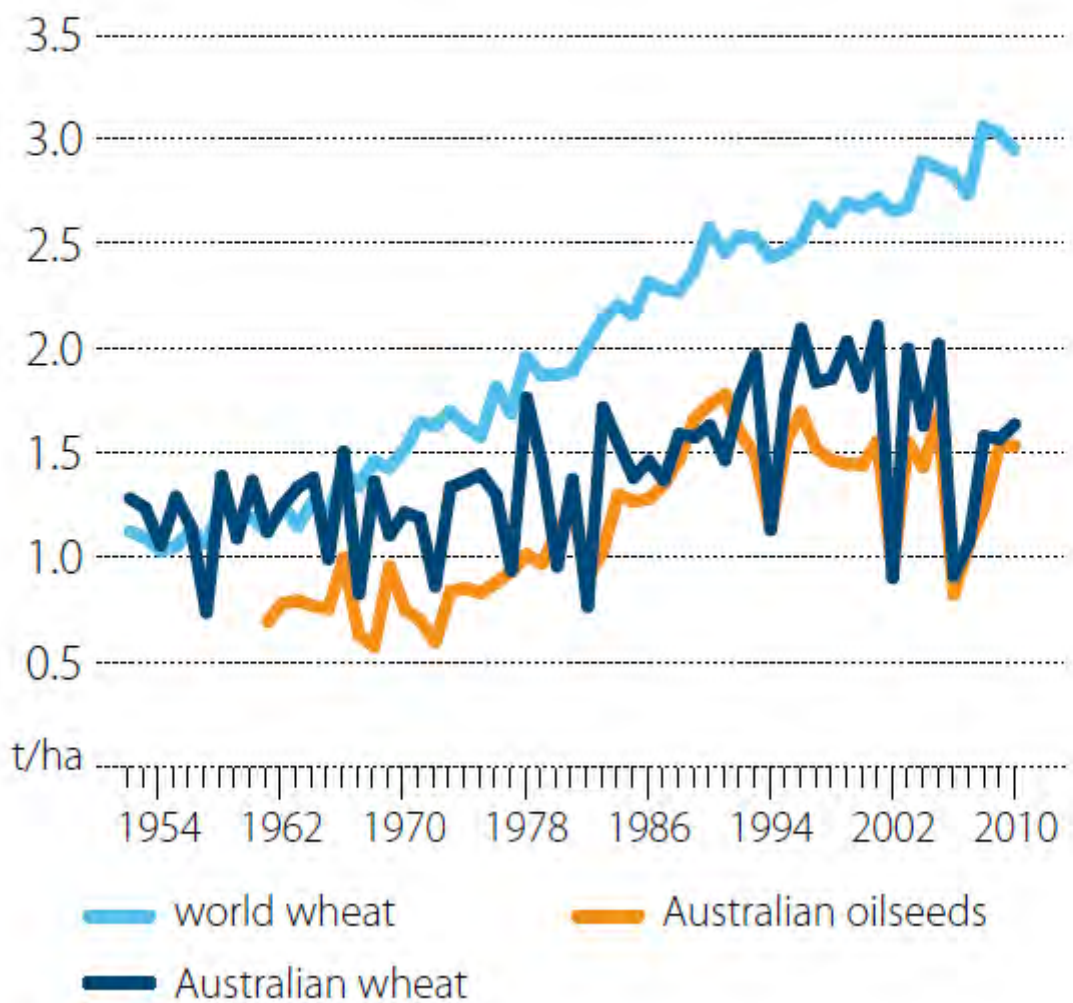


Figure 6: Decadal growth in Australian wheat yields and technologies driving changes.
Source: Donald (1965) modified by Angus (2001).

10 Crop yields



Australia's role in meeting global food needs

- Australia's exports contribute to the supply of food available to food-deficit countries. However, Australia is a relatively small producer in global terms, and exports are likely to be directed to markets of the highest value rather than to countries with the greatest food need
- Australia has the capacity to feed farm more people internationally through technical assistance in the agricultural sectors of the world's food-deficit countries than through the export of food produced in Australia.

4. THINGS THE MOST SUCCESSFUL FARMERS AND THEIR ADVISORS GET RIGHT

Things the most successful farmers and their advisors get right

1. They think big
2. They have well considered goals
3. They use the whole farm approach
4. They distinguish between cash, profit and wealth to judge business performance
5. They understand growth, gearing and the principle of increasing financial risk
6. They know costs
7. They know how to sensibly value farm assets
8. They understand that risk creates return
9. They appreciate that uncertainty is trumps
10. They pursue continual improvement: the Status Quo is not an option
11. They know that the quality of management is the key
12. They recognize that growth and intensification increases mean and variance of profits
13. They reject unsound advice based on average technical ratios
14. They compare themselves with themselves
15. They make good decisions
16. They keep their business afloat

1. They think big

The big challenges for people in agriculture are remaining profitable in the face of:

- downward trending farm product prices;
- upward trending farm input costs;
- hotter and rougher weather;
- rising protectionism world-wide;
- slowing increases in productivity as a result of slowing in the size of public investment in R,D&E;
- a plague of farm economic illiteracy;
- the growth of pseudo-science and anti-science and anti-economics, evident in parts of agricultural service sectors and in modern society;
- the biggest threat to the family farm business is the family farmer next door who can do it better

2. They have well-considered goals

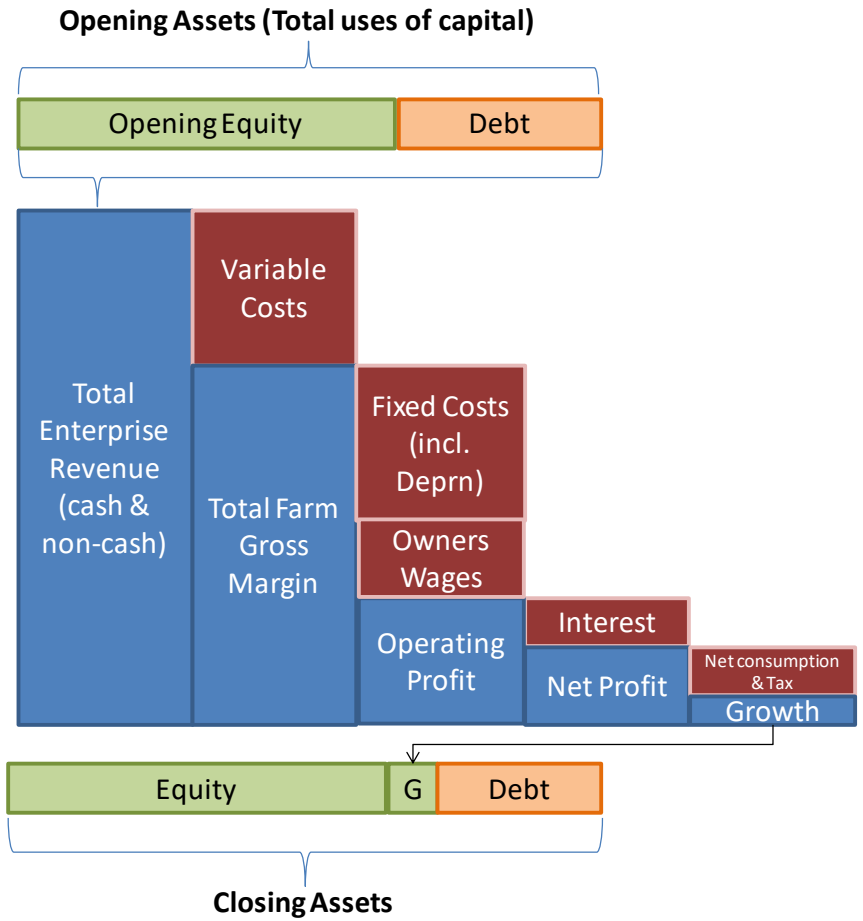
Goals refers to imagining alternative futures and identifying which future is the one for the farm family and the farm business. If you don't know where you want to go then any road will get you there.

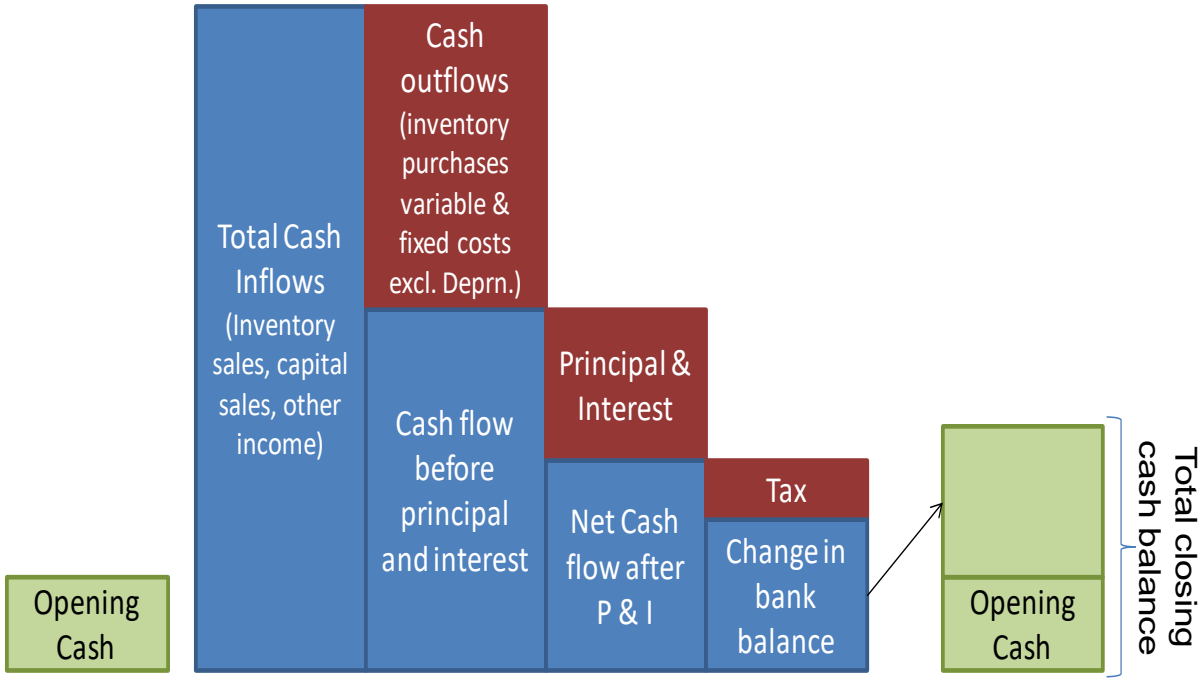
3. They use the whole farm approach

The whole farm approach is based on several key steps, which draw upon an understanding of several key principles. The key steps are:

- Start with the farm family and their values.
- Understand the internal operating environment in terms of available resources (including biophysical, financial and people); the quality of resources and the way and how well resources are being combined.
- Understand the external operating environment in terms of external influences on decision making and resource allocation.

4. They distinguish between cash, profit and wealth to judge business performance

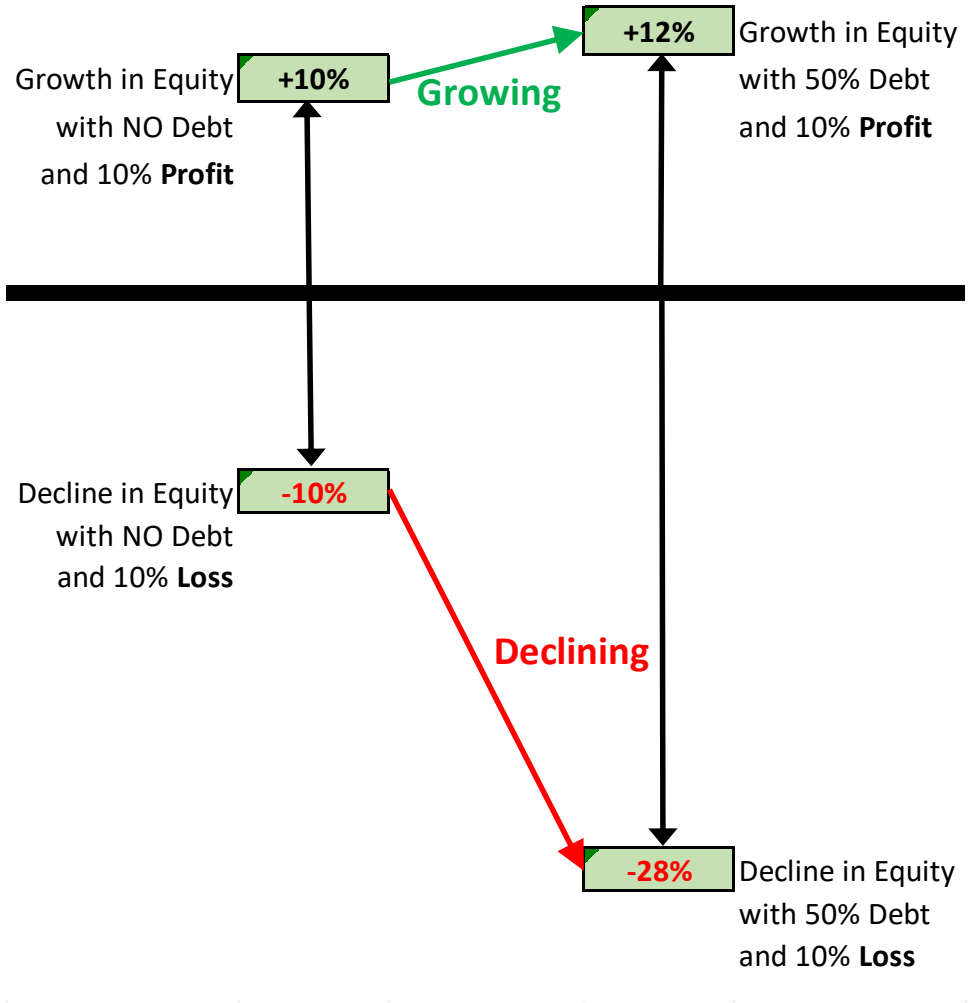




5. They understand growth, gearing and the principle of increasing financial risk

Principle of increasing financial risk

		Case A	Case B
	Assets	**$ 10,000,000**	**$ 10,000,000**
	Equity	**$ 10,000,000**	**$ 5,000,000**
	Debt	**$ 0**	**$ 5,000,000**
Growth Rate when there is +10% (PROFIT) Return on Capital	Operating Profit	$ 1,000,000	$ 1,000,000
	Return on Capital	**10.0 %**	**10.0 %**
	Interest on Debt at **8.0%**	$ 0	$ 400,000
	Net Profit	$ 1,000,000	$ 600,000
	Return on Equity	**10.0 %**	**12.0 %**
	Tax	$ 0	$ 0
	Consumption	$ 0	$ 0
	Growth	$ 1,000,000	$ 600,000
	Growth Rate	**10.0 %**	**12.0 %**
Growth Rate when there is -10% (LOSS) Return on Capital	Operating Profit	-$ 1,000,000	-$ 1,000,000
	Return on Capital	**-10.0 %**	**-10.0 %**
	Interest on Debt at **8.0%**	$ 0	$ 400,000
	Net Profit	-$ 1,000,000	-$ 1,400,000
	Return on Equity	**-10.0 %**	**-28.0 %**
	Tax	$ 0	$ 0
	Consumption	$ 0	$ 0
	Growth	-$ 1,000,000	-$ 1,400,000
	Growth Rate	**-10.0 %**	**-28.0 %**

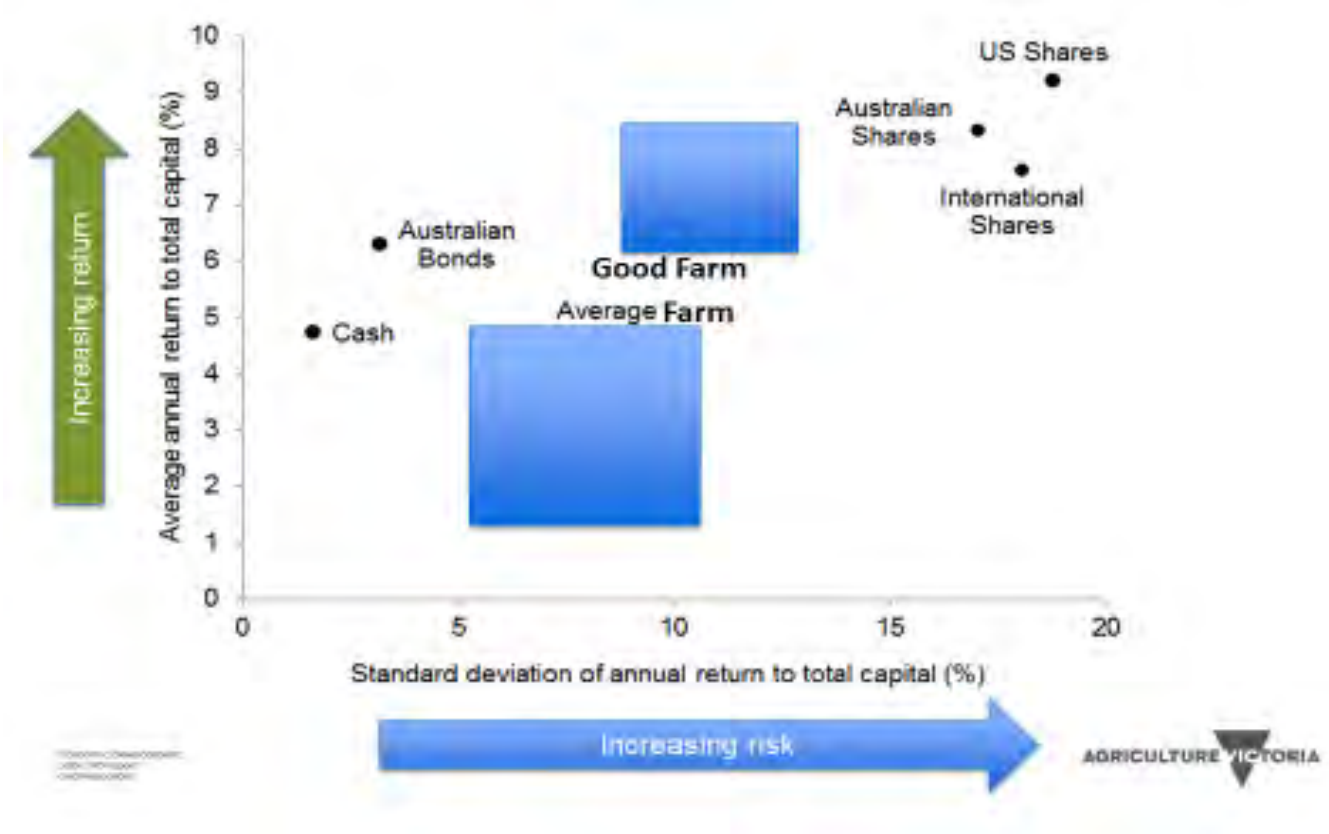


6. They know Costs

- All costs are measures of opportunities given up
- Another form of cost are the hidden costs of depreciation of assets
- The relevant costs are marginal costs, not average cost of production

7. They know how to sensibly value farm assets

Value= Profit/Investment



8. They understand that risk creates return

RETURNS AND RISKS FROM INVESTMENT

A preferable to B, same profit BUT B has more risk

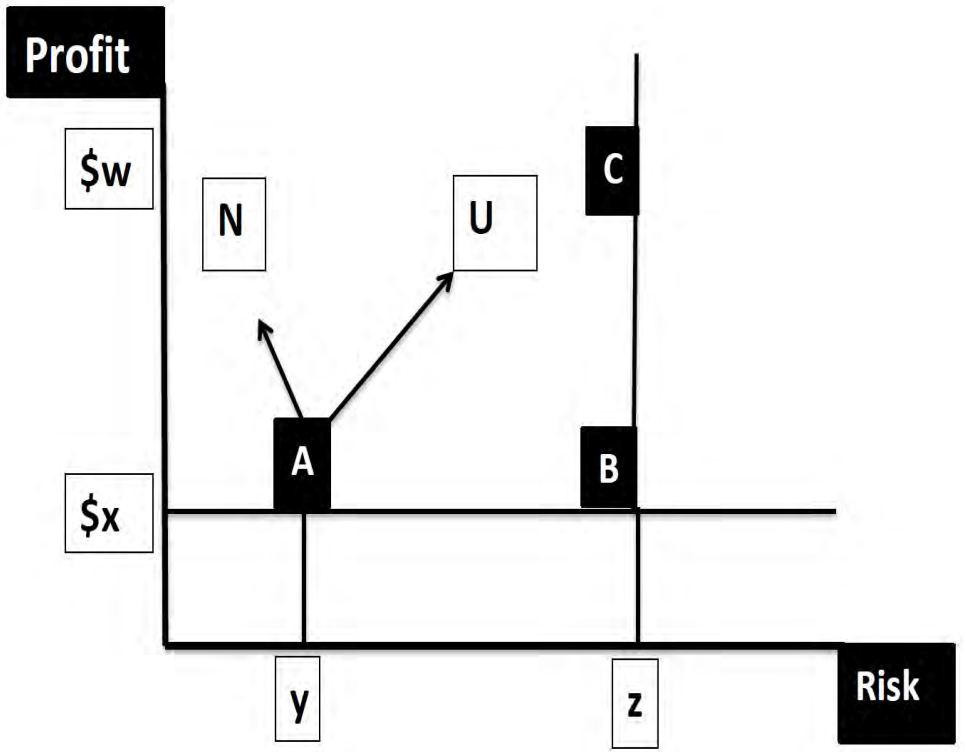
C preferable to B, same risk BUT C more profitable

A vs C depends on attitude to risk and return

N Higher profit, lower risk: not usual

U Higher profit but higher risk: the usual case

The key is the farm decision-maker weighing up the return:risk combination/trade-off that they are prepared to be exposed to



9. They appreciate well that uncertainty is trumps

While risky events, such as a drought, should entail no surprise, uncertainties, unpredictable rare events with big impacts, are replete with surprise

Uncertainty requires having a buffer of plenty of equity, which means having a reserve of borrowing capacity and having a range of assets of varying degrees of liquidity for when things go awry

10. They pursue continual improvement: the Status Quo is not an option

In 1968 in ‘Farm Management Economics’ Makeham (1968) wrote there were two major challenges facing farmers. These were:

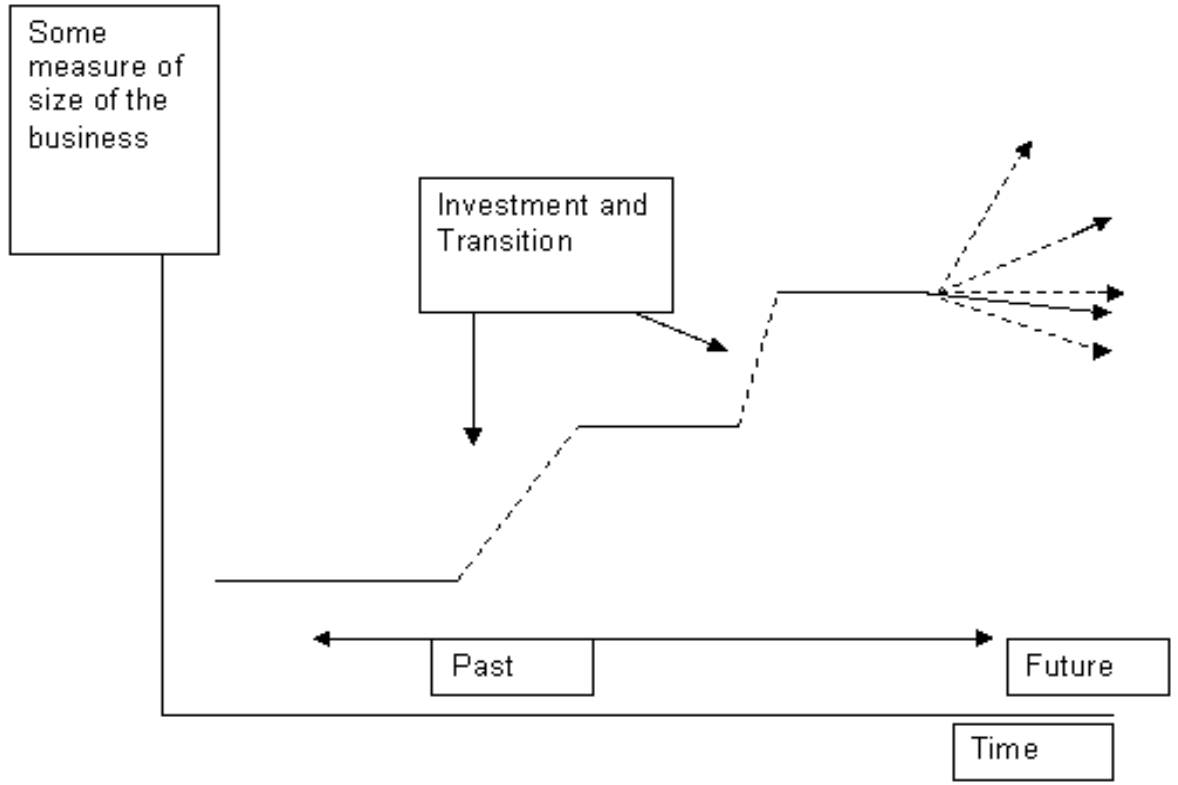
- how to incorporate new technology profitably into the existing business organization; and
- how to be sufficiently flexible, mentally and financially, to adjust resource management to meet both changed economic circumstances and widely varying climatic conditions

11. They know that the quality of their management is the key

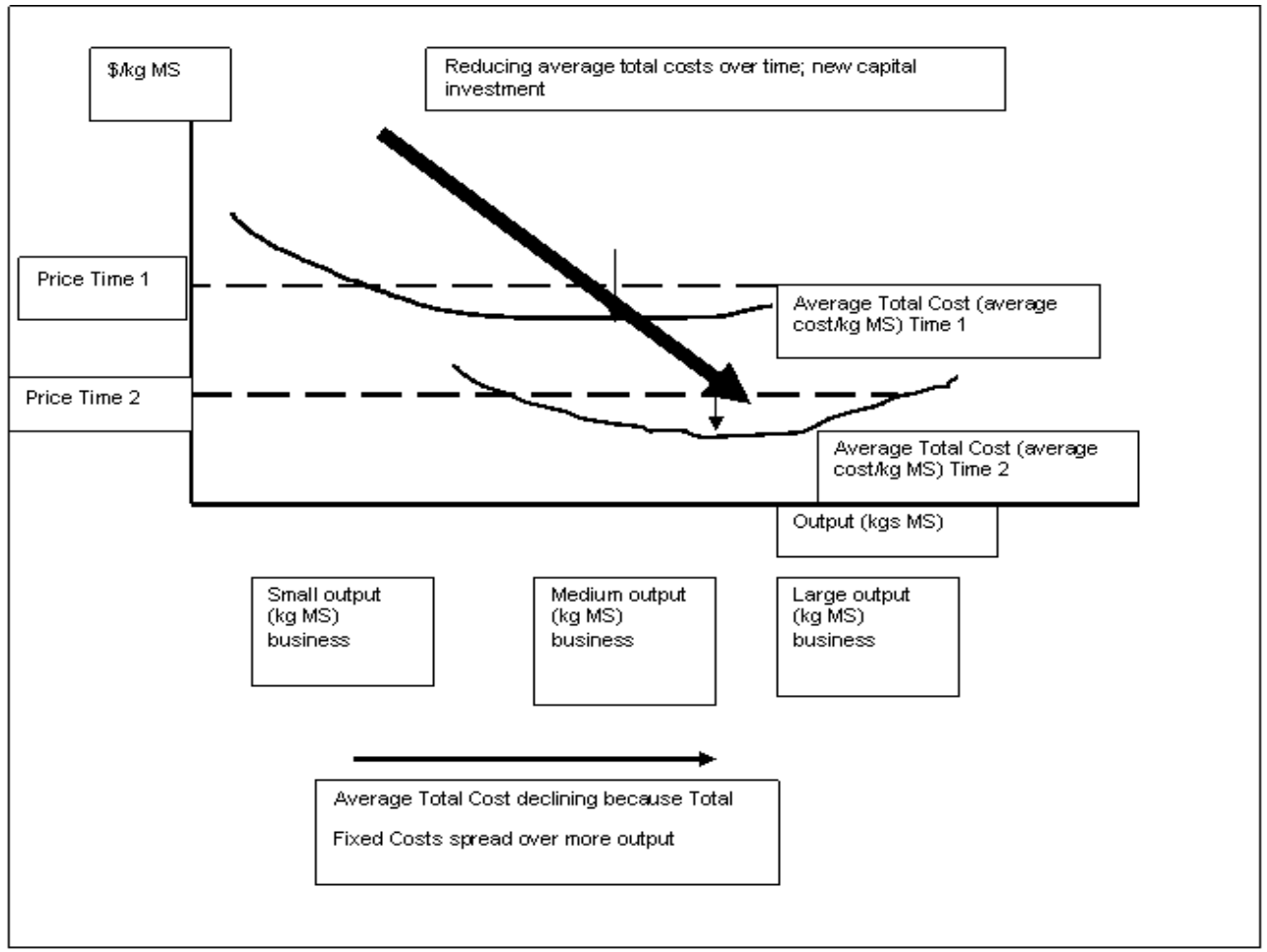
The common characteristics of good managers are:

- they are passionate about farming;
- they want to be the best at what they do;
- they look forward (management economics) not backward (accounting) (we can do better than hoping the past will continue in the future);
- they minimize the risk of family discord by managing family partners and succession with care, consideration and generosity of spirit;
- they manage surpluses of the good times to set them up to exploit the bad times;
- they expand their business by strategically building up and running down equity percentage over time;
- they live and breathe the principle of comparative advantage; that is, do what they are relatively best at;
- they do not change activities to chase short term price fluctuations;
- they do change activities in response to significant medium-term changes in markets and seasons;
- they periodically step aside from the business and take a dispassionate view of what is going on;
- they keep in close touch with the detail of what is happening on the ground at all times, even whilst delegating for efficiency;
- they screw the overhead costs down as tight as can be done;
- they have an eye for the main chance; that is, they are abreast of market and technological developments, without necessarily being the first movers, the leading innovators; and
- they know their system comprehensively and especially what in their system makes the profit.

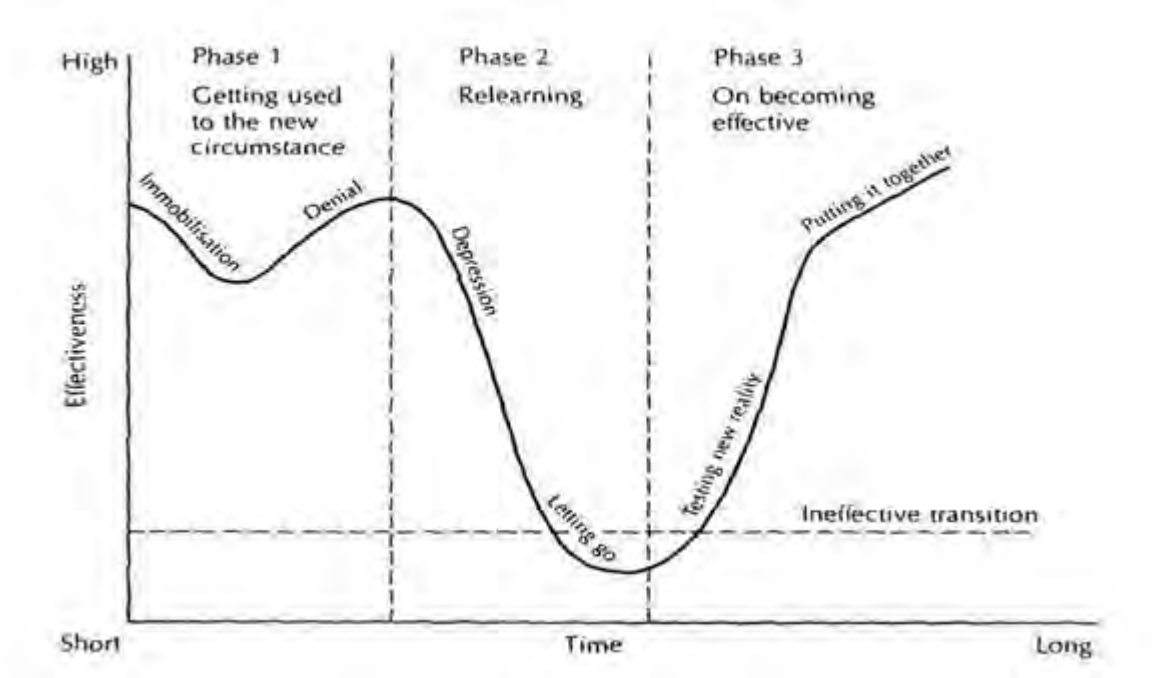
12. They recognize that growth and intensification increases the mean and variance of profits



Changing costs with changing size of business over time

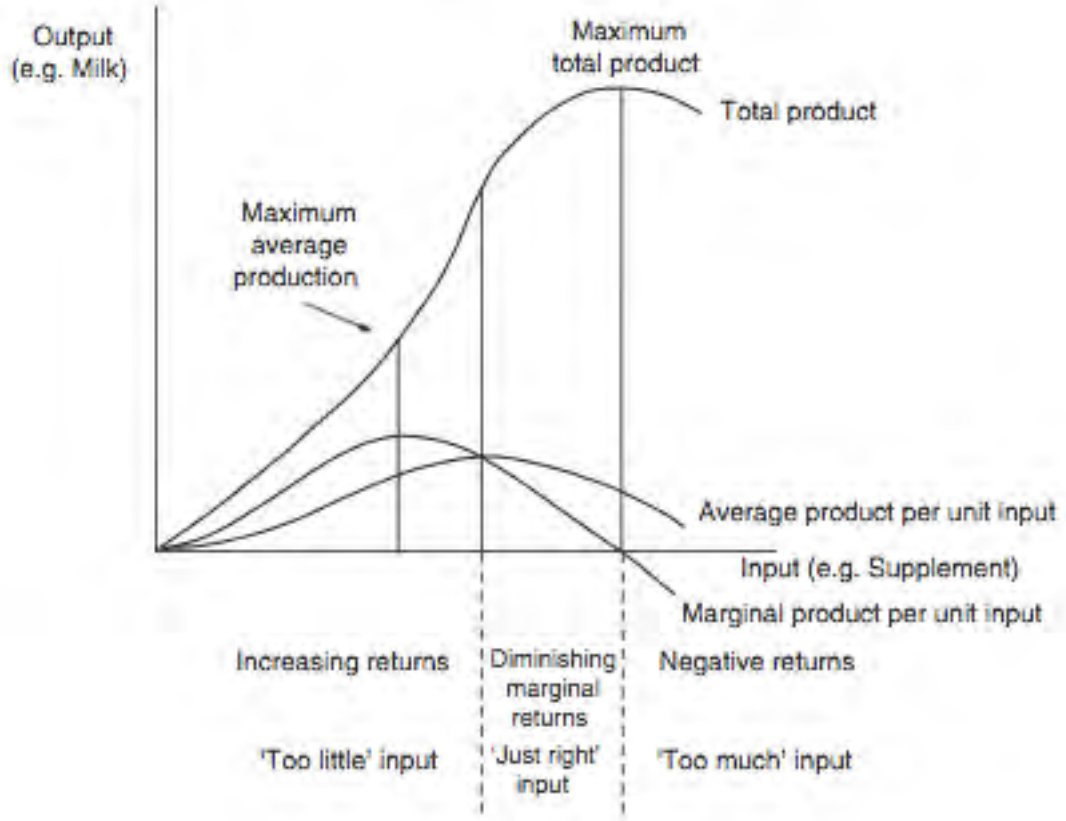


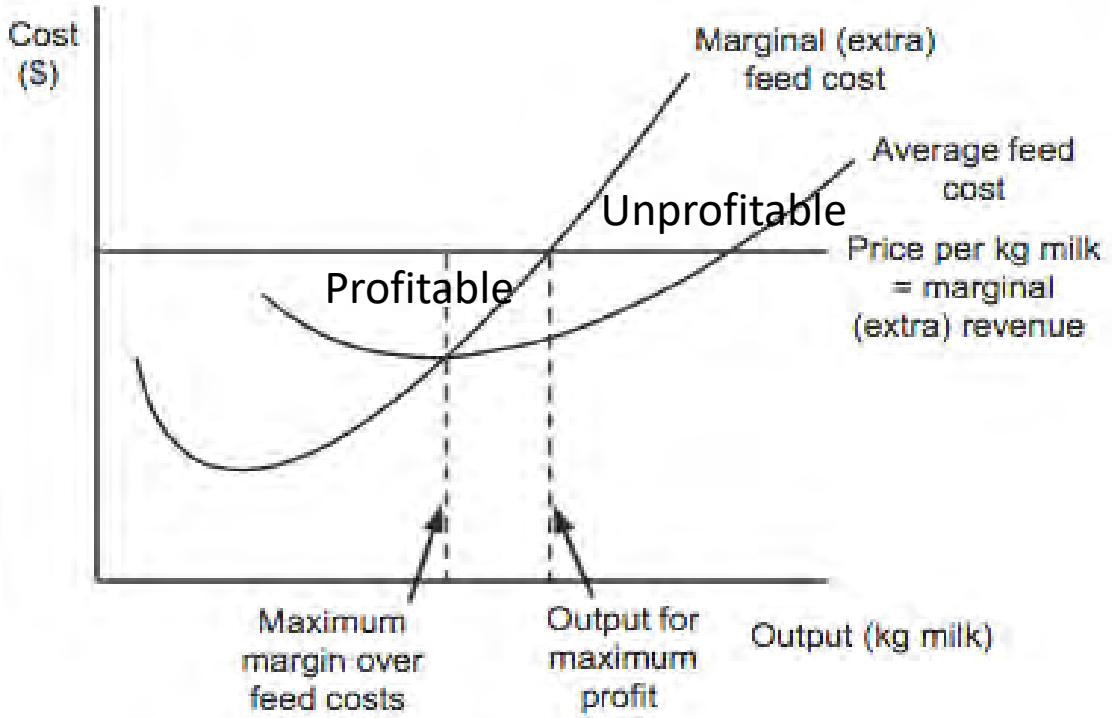
Work effectiveness during transition



13. They reject unsound advice based on average technical ratios

Marginal revenue equals marginal cost maximizes profit





Diminishing marginal returns to inputs means there are no maximums in maximising profit!

Yet we talk like there is:

- Maximum pasture growth
- Maximum pasture harvest
- Fully feeding cows
- Maximum milk production

14. THEY COMPARE THEMSELVES WITH THEMSELVES BECAUSE THEY ARE DIFFERENT, AND ALSO, WHEN MAKING COMPARISONS ABOUT THEIR BUSINESS THEY KNOW THAT …

Partial 'Benchmark' numbers in isolation CANNOT tell the true story

Partial benchmark data is often used to compare the performance of farms – it is not meaningful or helpful to do so.

Check out these comparative analysis numbers for a group of farms

Benchmark Parameter	Best Result per Parameter		Parameters of 'Best' Farm	
	Result	Farm ID #	Result	Farm ID #
Stocking Rate (cows/ha*)	3.74	37	2.08	2
Pasture Harvest (tDM/ha)	12.4	38	8.4	2
Milk per Cow (litres)	10,730	22	6,022	2
Milk per Ha (litres)	21,033	37	12,555	2
Cows per Staff Unit	74	16	67	2
Debt per Cow	$125	58	$1,859	2
Pasture Cost ($/tDM consumed)	$68	38	$107	2
Concentrate Cost ($/tDM consumed)	$166	9	$248	2
Milk Price (c/litre)	46.0	42	41.4	2
Cost of Production (c/litre)	29.8	11	35.8	2
Return on Capital	**10%**	**2**	**10%**	**2**

Farming is like a decathlon…not individual 'events'… but overall system performance!
(The Sum of Many Parts) – And the Winner is Farm Number 2

15. They make good decisions

In practice, this means using approaches to forming judgements and making decisions that explicitly incorporate good understanding of the following:

- the clouds of uncertainty surround decisions; this means the least, and best, we can do is undertake serious decision analysis, using a structured, formal and well-documented approaches.
- economics is the discipline of choice and risk applies the correct perspective; place the organization for which the decision is being made at the centre of the environment and consider the many directions and forms of connection with the world
- the folly of focussing much on past while recognizing that the past has created the constraints and possibilities of the present and future
- it is useful to explicitly imagine a small number of futures – we do this implicitly anyway, so make it explicit, and even though this does not tell us much about likelihoods, what else can we do?
- compare alternative futures, not a future compared with the current situation
- the creative enterprise of individuals in the organization as well as the 'innards' of the organization are the keys the knowledge needed for growth of organizations
- economic analysis (efficiency, opportunity cost, equi-marginal returns, is it worth doing) and financial analysis (cash flow, who funds it) growth in wealth (net worth, balance sheet structure) are different, necessary parts of analyses
- understanding about the key elements of systems and the basic sources of net benefits, and implications of changes to systems

15. They make good decisions (continued)

- understanding of what the organization can be best at, in some domain
- doing what the people in the organization are passionate about
- being mindful of the dictates of the principle of increasing financial risk that constrains size (Kalecki 1937)
- it is important to focus on distributions not averages, and especially on events in tails and middles of distributions
- that ‘errors compound’ in budgeting; variance around the means of two variables (e.g. price and quantity) combine into wider variance around the sum of the two variables (Income)
- the nature of main benefits and costs have to be defined well, even if we cannot measure them
- benefits and costs should be valued if can be done; remembering that putting a number on something may create an impression of precision, but ‘it isn’t necessarily so’
- thinking hard about benefits and costs we cannot measure is worthwhile
- when costs are knowable and benefits are unknowable, use the threshold/breakeven approach. For these costs and this required return on investment, the benefits would have to be of this size. Benefits of this size could/could not be achieved in the following manner.
- Compile a plausible story about the investment in question, with a few angles, exploring a few futures, and encompassing a few calculations.

15. They make good decisions (continued)

Good decision-makers make their good decisions by doing the following things:

- Using as much information as can obtained at the time the decision is made.
- They use information, experience, intuition, judgement to develop rules of thumb that work (quick, efficient decision making).
- They use marginal thinking: a bit more of this, a bit less of that.
- Ask the right questions (the question is the answer).
- Face the brutal facts.
- Understand system (whole farm approach)
- Know there are only are only 2 or 3 key factors
- Use experience, keen observation, and have a comprehensive ‘world view’
- Listen to ‘experts’ but know experts only ever see part of big picture.
- Do not over-analyse, act quickly, decisively, good options disappear
- Can say no to an opportunity – be another one the next day
- Know it takes longer than planned to reach potential
- Know knowledge is incomplete; some things just aren’t knowable; unexpected things happen all the time
- Know Nature varies unpredictably, recognize uncertainty
- Know people misunderstand one another and make mistakes
- Know we cannot predict the future accurately so have to imagine it instead.

16 They keep their business afloat

To stay in business over a medium or long time it is necessary to:

- preserve and improve the productive capacity of the resources of land, labour and capital;
- have returns to capital that are equal to or better than alternative uses of the resources involved.
- It helps a lot to have more good luck than bad luck.

We cannot predict the future accurately so have to imagine it instead.

Our understandings and best explanations of current phenomena are partial.

The things we do now as our best bets for the future will be different to things we would have done if we knew then what we will know when the future has arrived and we know how it looks and how it works.

This does not mean that we should not try hard to imagine the future – to the contrary

5 Changing climate: What to do?

What to do about managing the risk of changing climate?

- The usual: be better technically
- Just another increase in costs and risks, higher costs of production, so increase size to get size economies and remain competitive
- Risk management but more so: higher equity, portfolio, diversification of investments, activities and spatial
- Etc etc

And

- Take advantage of new opportunities

Current Policy: Emissions Reduction Fund

What is carbon farming? Producing ACCUs (Australian Carbon Credit Units)

- Avoiding emissions from agricultural activities
- Sequestering emissions from the atmosphere
- Not just ‘carbon’: coverage includes CO2, methane, nitrous oxide.

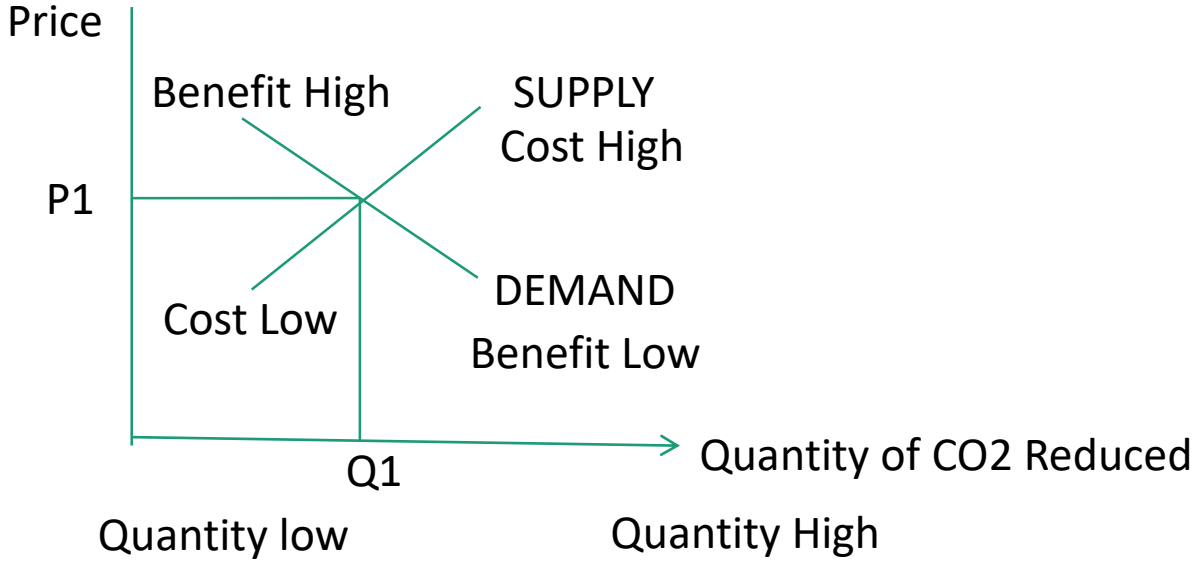
Carbon Farming: add cost of abatement (tonnes/$ costs)

- Ensuring abatement is real: the integrity standards make the markets work (the bureaucracy and paperwork is the buyer and sellers friend)

Market for ACCUs

- The ‘Product’ of Carbon Farming is Reduced Carbon Emissions
- Producer/Seller is Farmer **(Supply)**
- Consumer/Buyer is Federal Government/Public **(Demand)**

Market in Carbon dioxide equivalents emissions



Sequestration

- Removing carbon dioxide from the atmosphere by absorbing and then storing it permanently.
- Absorption of carbon by plants as they grow and increase organic matter in the soil.
- Avoiding emissions from living or dead plants or soils.
- Sequestration activities include reforestation, revegetation, restoring rangelands and protecting native forests or vegetation that was otherwise planned to be cleared. Soil carbon.

Avoiding emissions

- **Enteric fermentation** — methane emissions a by-product of the digestive processes of cattle, sheep, pigs and other animals.
- **Manure management** — the emission of methane (and in some cases nitrous oxide) from the decomposition of organic matter in animal manure.

Avoiding emissions

- **Rice cultivation** — methane generated during rice growing from the decomposition of residues and organic carbon in the soil as a consequence of flooding of the rice crop.
- **Agricultural soils** — the emission of nitrous oxide from soils as a result of microbial and chemical transformations, due in part to the application of nitrogen fertilisers.
- **Field burning of agricultural residues** — emission of a range of greenhouse gases largely as a result of stubble burning (for crops such as wheat) or burning of a sugar cane crop before harvest.
- **Savannah burning** — releases methane and nitrous oxide into the atmosphere.

What is the Emission Reduction Fund?

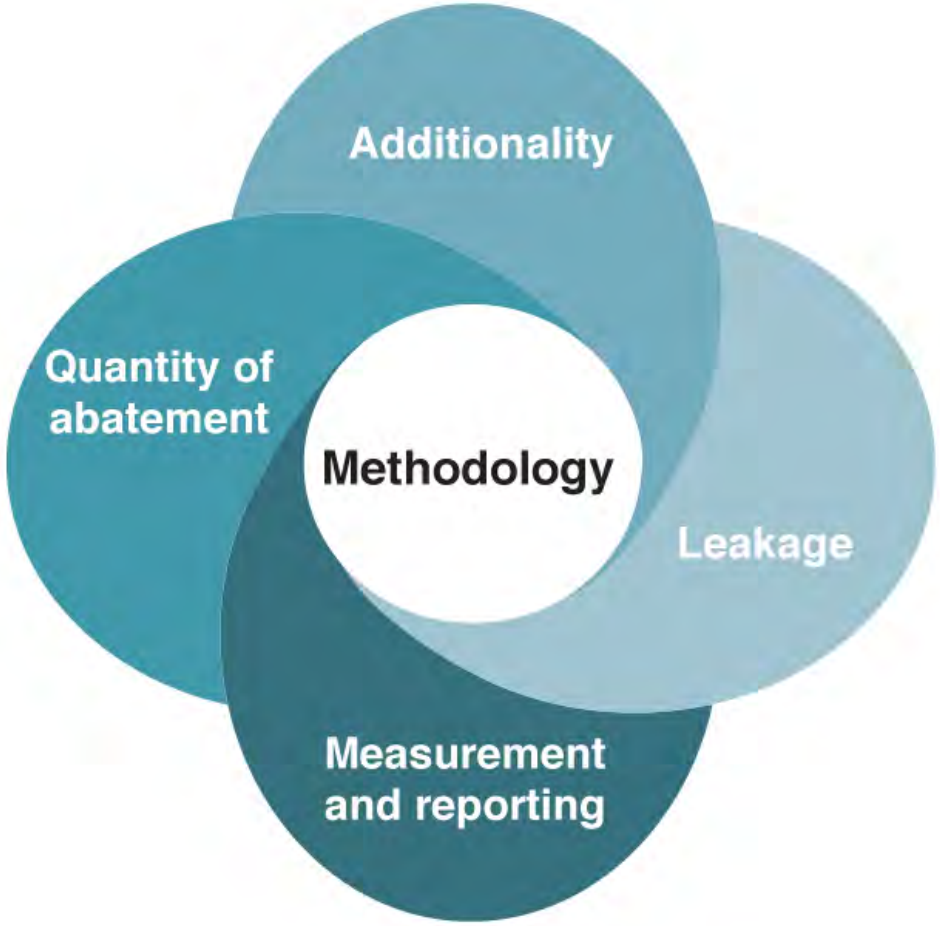
Reducing emissions by:

- Crediting: run a project and apply for ACCUs
- Purchasing: CER purchases ACCUs through auction process
- Safeguarding: applies to largest carbon emitters; keeps emissions below baseline; start 2016

The integrity standard for carbon removed from the atmosphere

- **additional**
- abatement **measurable and verifiable**.
- based on good **science**
- account for **leakage.**, variability and cyclical variations
- use **conservative** assumptions.
- Sequestration must be **permanent**.

The method is central



The method sets out…

- a description of the activity and how it reduces emissions or stores carbon
- a list of sources and sinks affected by a project
- instructions for determining the baseline that represents what would occur in the absence of the project
- procedures for measuring or estimating project abatement relative to the baseline
- identification of the greenhouse gas assessment boundary
- some accounting for leakage
- project specific data collection, monitoring, reporting and record keeping requirements

Costs

Cost item
Compliance costs: *those costs related to complying with the rules that establish the CFI*
Planning costs*: those costs related to planning and preparing for the project*.
Capital cost*: costs associated with the purchase of infrastructure of land to undertake the project.*
Transactions costs*: these are the various third party costs and fees that may be incurred during the course of the project, depending on the business structure chosen*.
Operational cost*: involved in the day to day operations of the project*
Post closure costs*: these are costs that continue to be incurred even once the project has formally been closed.*
Opportunity cost*: the cost of opportunities foregone as a results of devoting resources to the CFI project*.

Recent CO2 prices

Trading scheme	Recent price (August 2014)	Highest price in two years prior to August 2014	Lowest price in two years prior to August 2014
	A$/t	A$/t	A$/t
European Union	9.23	10.08	3.96
California	12.72	24.08	12.47
New Zealand	3.59	7.28	1.82
Clean Development Mechanism [a]	0.23	1.08	0.04

Sequestration rates: Cumulative Abatement from 1 Ha Environmental Planting

Number of years	Kyogle, NSW	Leongatha, Victoria	Gold Coast Hinterland, QLD	Central Tasmania	Geraldton, WA
	t of CO2-e	t of CO2-e	t of CO2-e	t of CO2-e	t of CO2-e
0	0	0	0	0	0
1	1.5	1.5	1.39	1.43	1.28
5	43.34	43.3	26.23	36.49	9.96
10	155.36	155.1	92.4	130.18	33.38
20	328.46	327.69	194.52	274.91	71.52

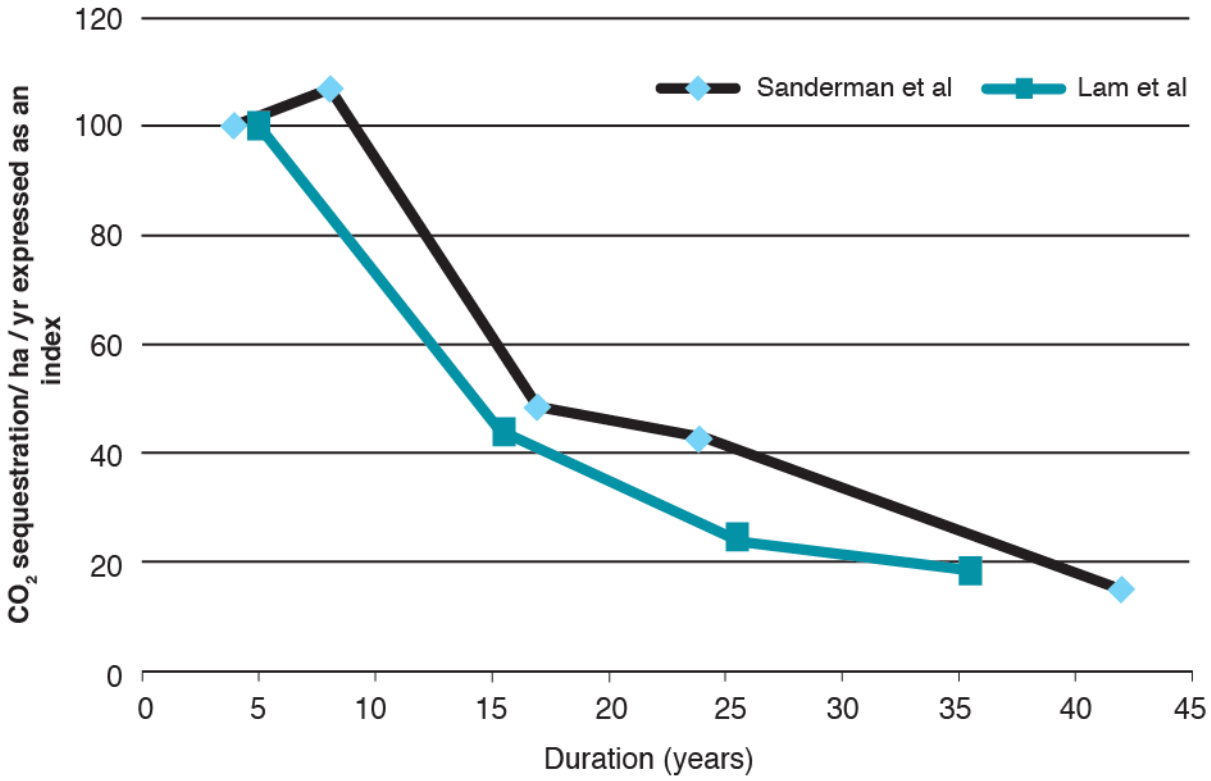
Indicative costs tree planting

Cost element	Range from case studies
	A$
Start-up fixed costs ($)	
Start-up, accreditation and registration	3000
Legal advice	2000
Initial verification report	1500
Project start-up variable costs ($/ha)	
Establishing tree lots	800 to 3000
Ongoing fixed costs ($/yr)	
Reporting and auditing	800 to 1000
Ongoing variable costs ($/ha/yr)	
Weed control, other	5 to 67

Soil carbon sequestration – Ave. kg C02/ha/yr

Method	Average sequestration	Lower bound of 95% confidence interval	Upper bound of 95% confidence interval
	kg CO_2/ha/yr	kg CO_2/ha/yr	kg CO_2/ha/yr
Reported by Sanderman et al			
Crop rotation	733	446	1021
Stubble management	697	122	1272
Improved tillage	1247	815	1678
Reported by Lam et al			
Conservation tillage	550	356	770
Residue retention	539	147	1012
Use of pasture	484	154	950
Fertiliser (N) application	246	73	411

Soil carbon sequestration and time



Soil carbon related project costs

Item	Cost
General soil test	$75 per sample
Leco soil carbon test	$28 per sample
Initial accreditation	$3 000 one off cost
Legal advice (contract)	$2 000 one off cost
Annual statement preparation	$1000 per year
Annual insurance	$500 per year
Soil sampling	$780 per day labour costs, operator collecting four samples per hour and working 6.5 hours per day $30 per sample

Nitrogen cost to stabilise soil carbon (1N:10C)

1 tonne of N gives 10t C and about 40t CO_2 (36.6)

N cost $1000/t (46%N in Urea)

N cost per tonne of CO_2 is $25/t ($1000 N/40t CO_2)

Need CO_2 price of $25/t to cover cost of N

Project	Nitrogen cost
	$/ha/yr
Conservation tillage	19.6
Residue retention	19.1
Use of pasture	17.2
Nitrogen fertiliser application	8.8

Carbon farming risks

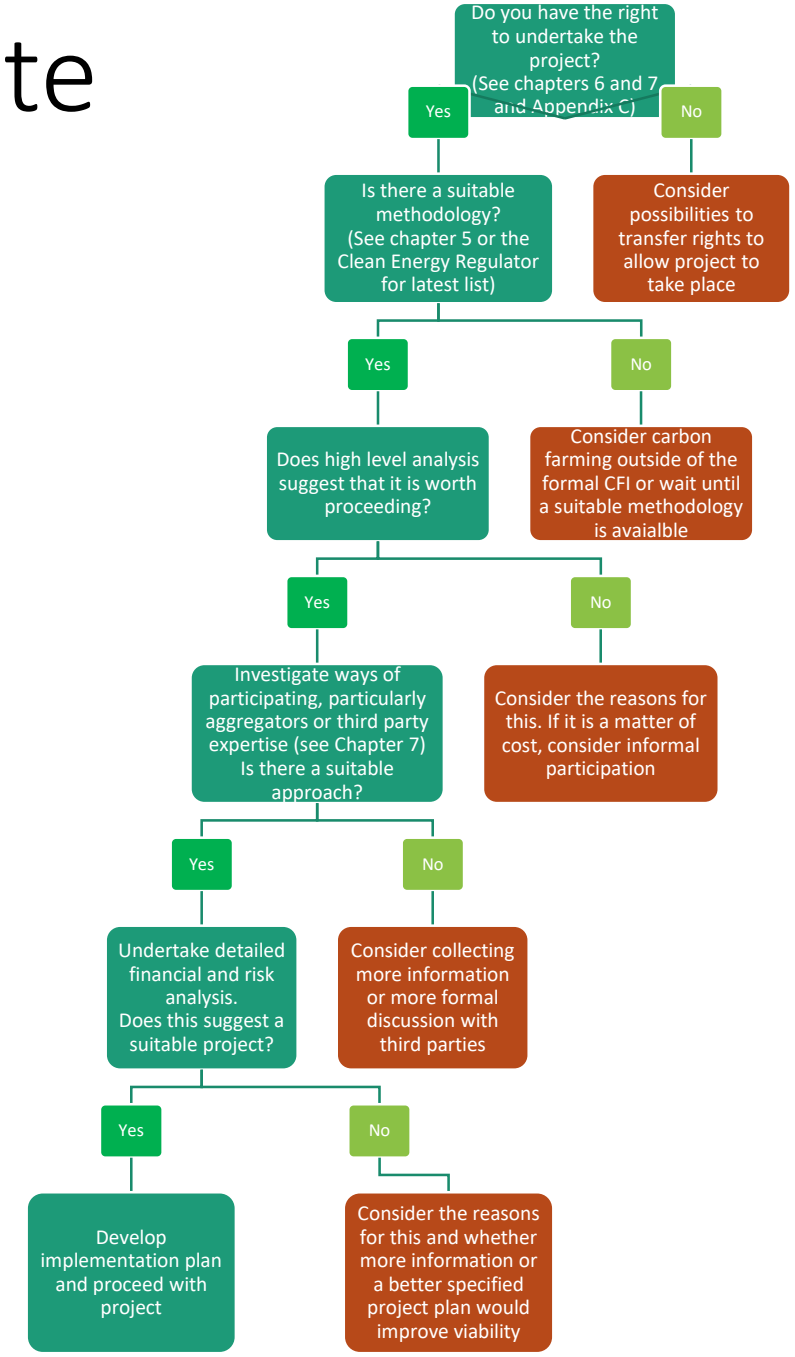
- Policy – national and international
- Market -
- Technical – rates of abatement, new cheaper technologies
- Project – performance, risky events

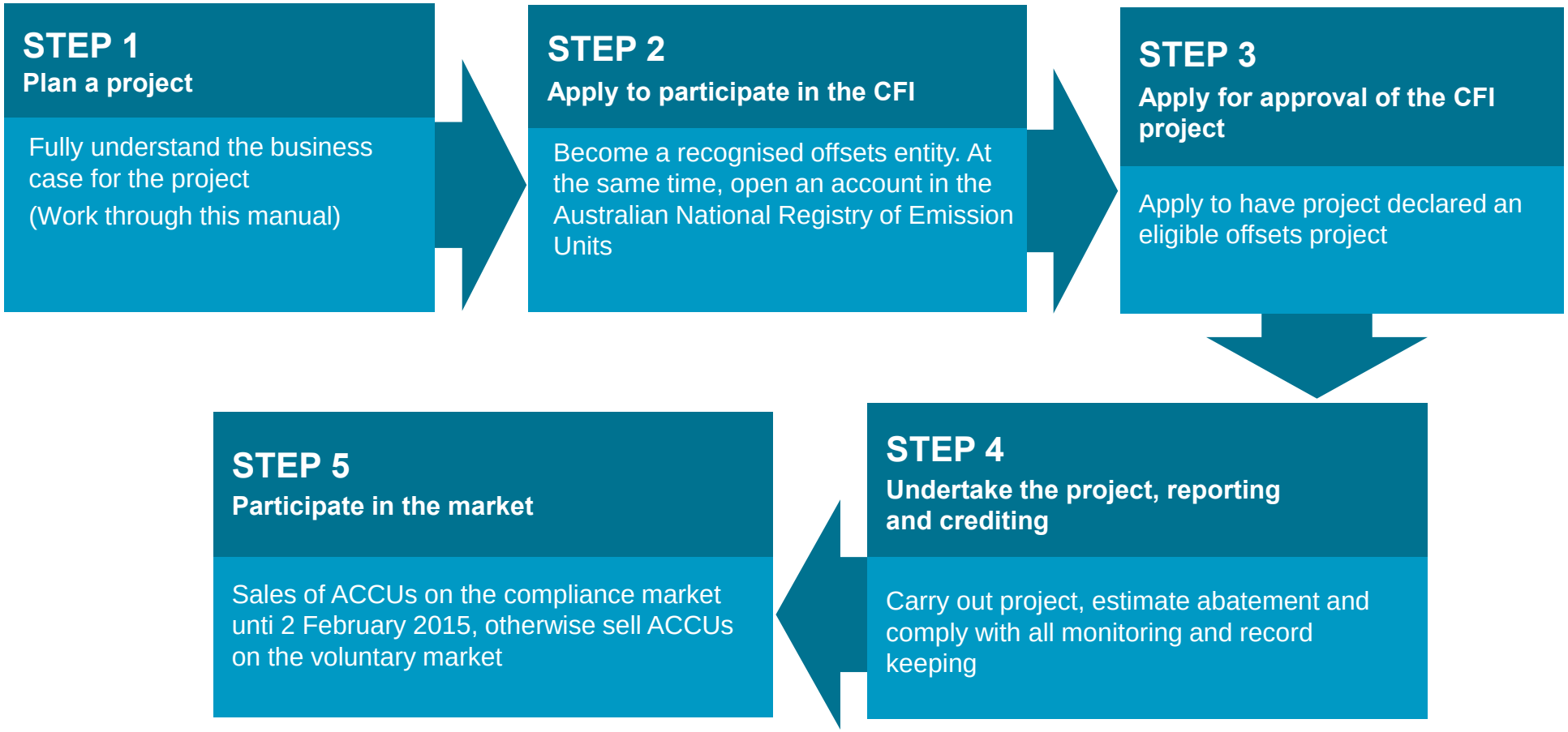
- Quantity of ACCUs
- Price of ACCUs
- Project costs

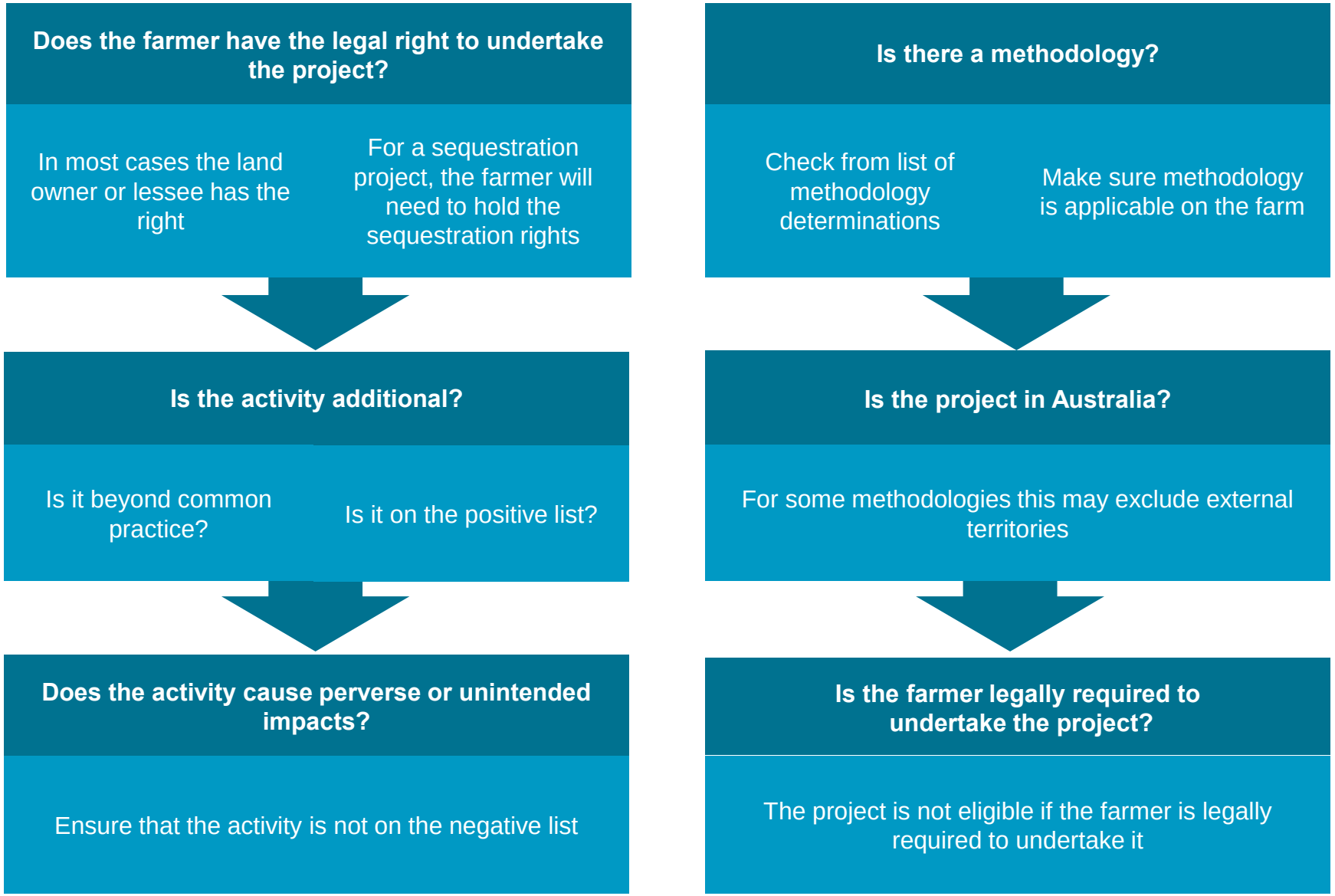
Risk in the context of the farm enterprise

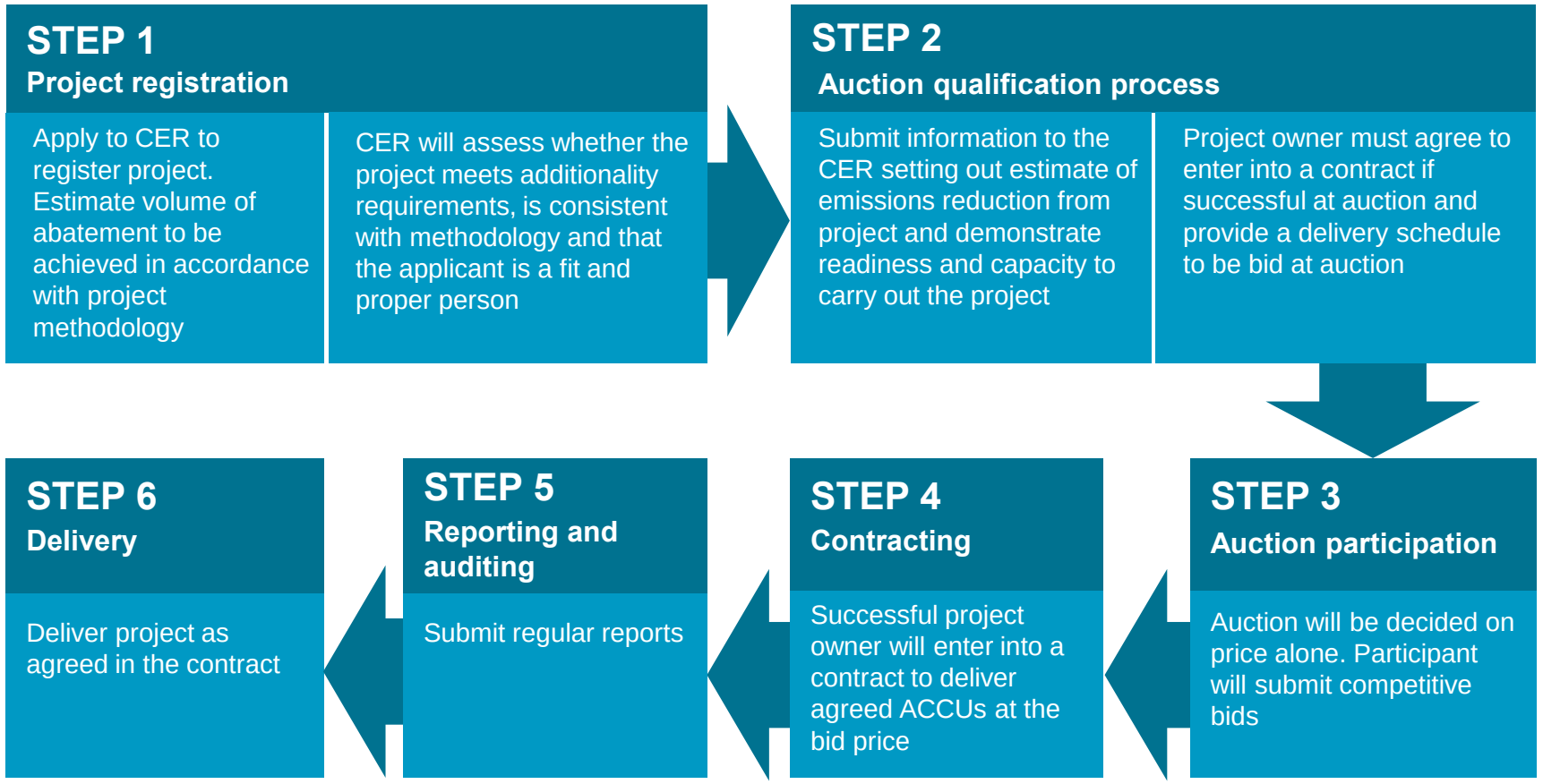
- Does the carbon project increase or reduce risks faced by the enterprise?
- Will increase risk if:-
  - Carbon risks **perfectly** correlated with other risks
  - e.g. drought
- Will reduce risk if:-
  - Carbon risk offsets other enterprise risks
  - e.g. salinity
- Threshold and sensitivity analysis

A decision template




STEP 1
Plan a project
Fully understand the business case for the project
(Work through this manual)
STEP 2
Apply to participate in the CFI
Become a recognised offsets entity. At the same time, open an account in the Australian National Registry of Emission Units
STEP 3
Apply for approval of the CFI project
Apply to have project declared an eligible offsets project
STEP 4
Undertake the project, reporting and crediting
Carry out project, estimate abatement and comply with all monitoring and record keeping
STEP 5
Participate in the market
Sales of ACCUs on the compliance market unti 2 February 2015, otherwise sell ACCUs on the voluntary market


Does the farmer have the legal right to undertake the project?
In most cases the land owner or lessee has the right
For a sequestration project, the farmer will need to hold the sequestration rights
Is there a methodology?
Check from list of methodology determinations
Make sure methodology is applicable on the farm
Is the activity additional?
Is it beyond common practice?
Is it on the positive list?
Is the project in Australia?
For some methodologies this may exclude external territories
Does the activity cause perverse or unintended impacts?
Ensure that the activity is not on the negative list
Is the farmer legally required to undertake the project?
The project is not eligible if the farmer is legally required to undertake it


STEP 1
Project registration
Apply to CER to register project. Estimate volume of abatement to be achieved in accordance with project methodology
CER will assess whether the project meets additionality requirements, is consistent with methodology and that the applicant is a fit and proper person
STEP 2
Auction qualification process
Submit information to the CER setting out estimate of emissions reduction from project and demonstrate readiness and capacity to carry out the project
Project owner must agree to enter into a contract if successful at auction and provide a delivery schedule to be bid at auction
STEP 3
Auction participation
Auction will be decided on price alone. Participant will submit competitive bids
STEP 4
Contracting
Successful project owner will enter into a contract to deliver agreed ACCUs at the bid price
STEP 5
Reporting and auditing
Submit regular reports
STEP 6
Delivery
Deliver project as agreed in the contract