

Climate change and sustainability

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3 September 2015

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and Livelihoods



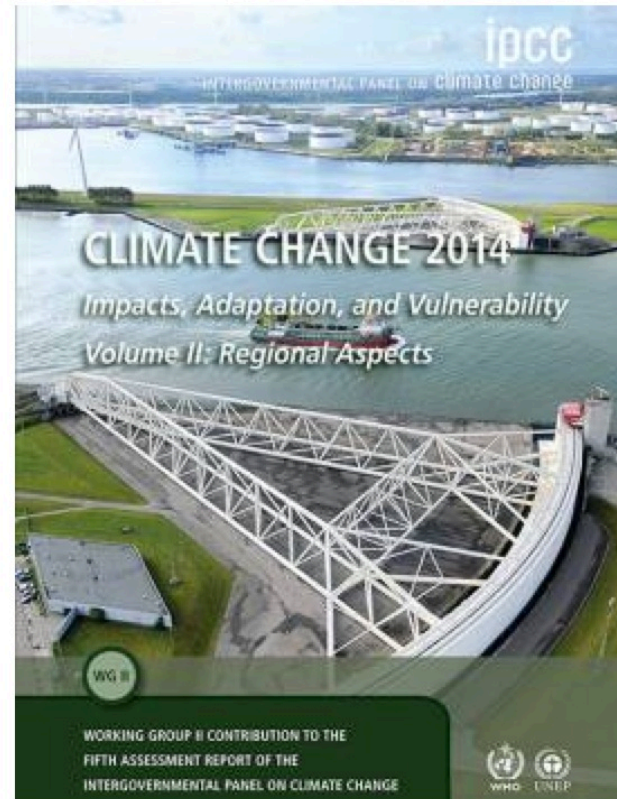
<http://riel.cdu.edu.au>

Key Points

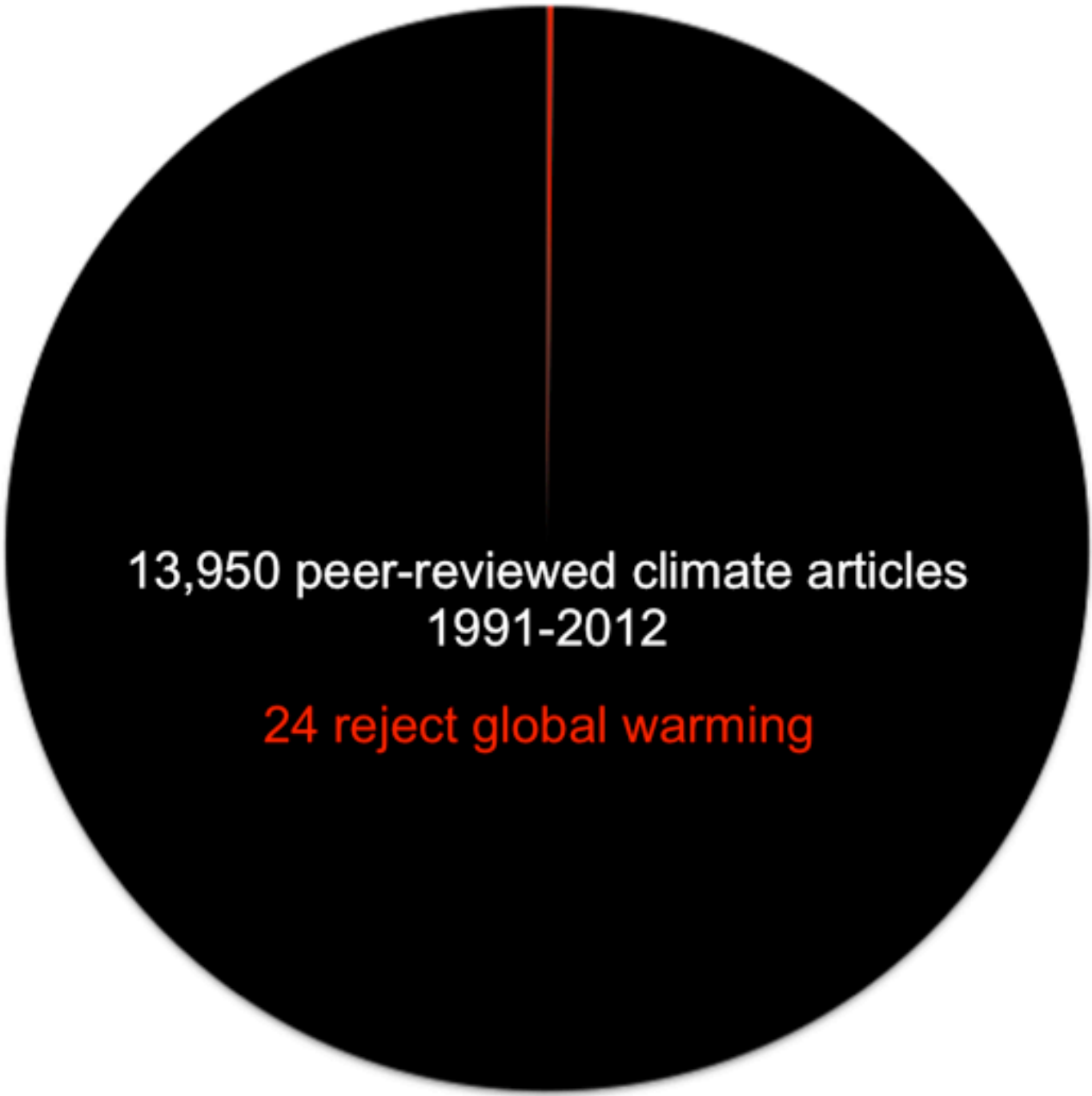
- Climate, water, energy and food systems are converging as major public policy challenges
- Each of these has their own imperatives, but their interactions are equally, if not more important
- All other challenges are amplified by climate change
- We deal with these issues separately in science and policy, but we should see them as connected
- **Technical solutions exist**, but successful implementation and policy integration will require better planning and governance
- Delivering such improvements is the challenge of our age

The climate is changing.....

Climate Change 2014: Impacts, Adaptation, and Vulnerability



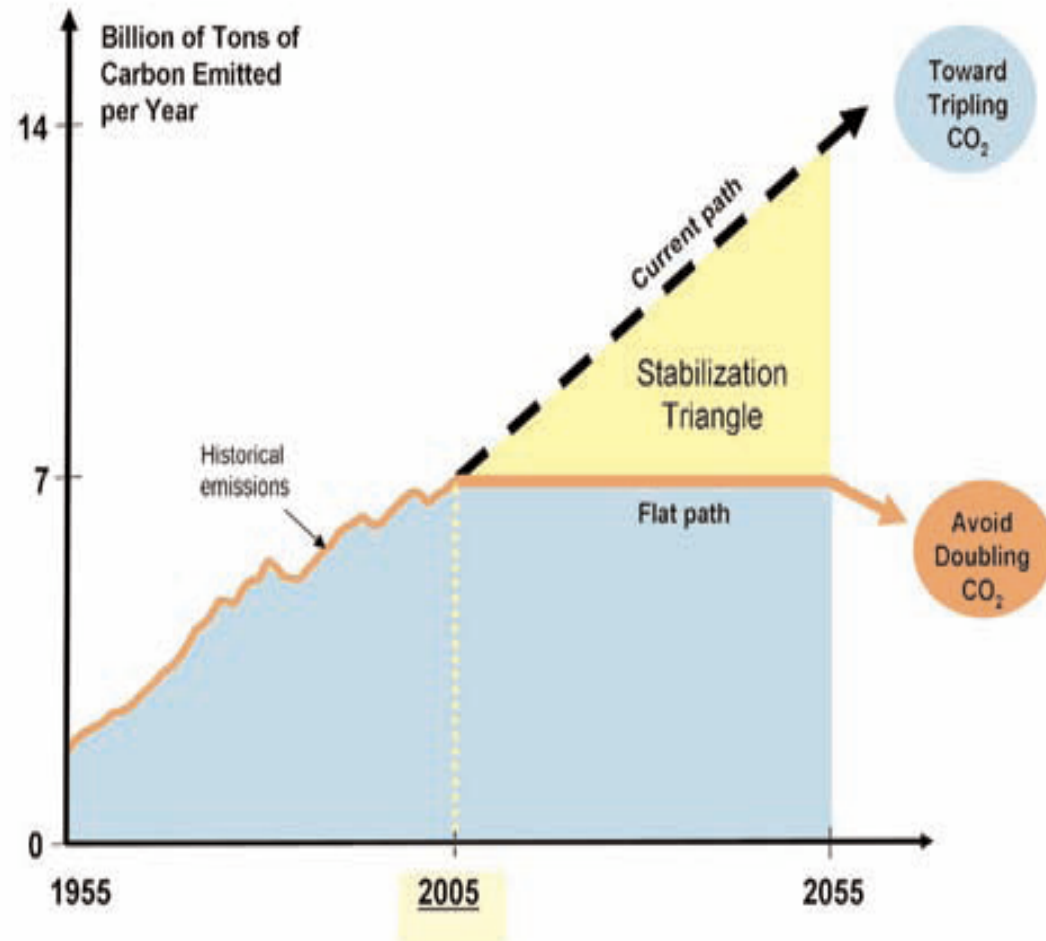
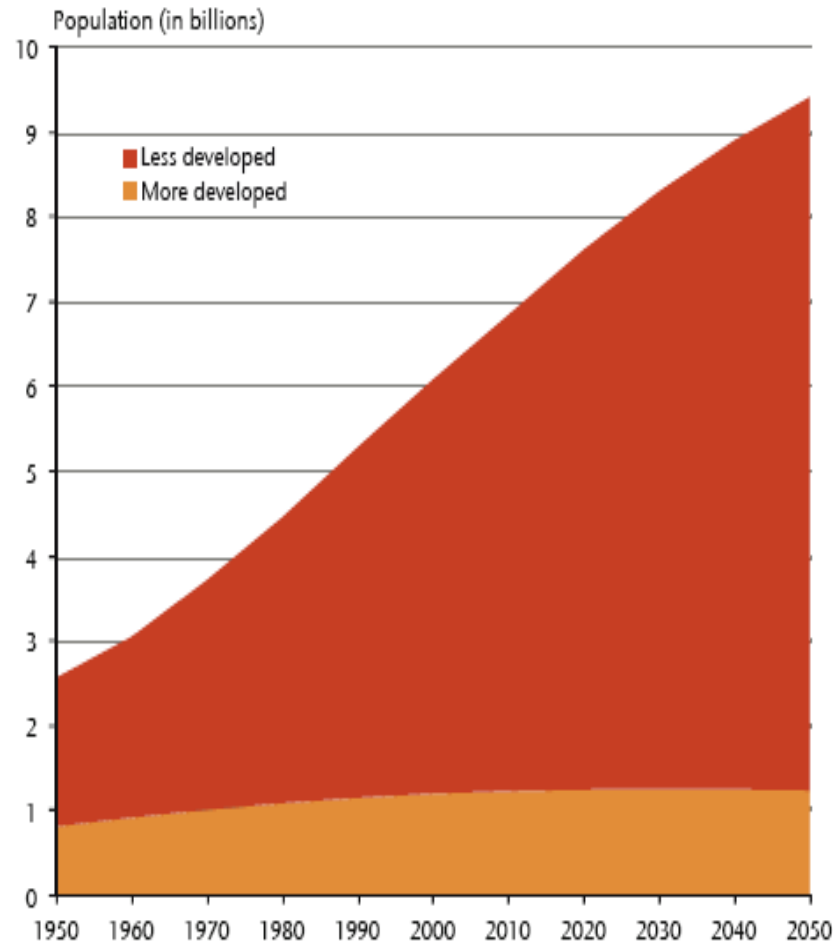
<http://ipcc-wg2.gov/AR5/report/>



13,950 peer-reviewed climate articles
1991-2012

24 reject global warming

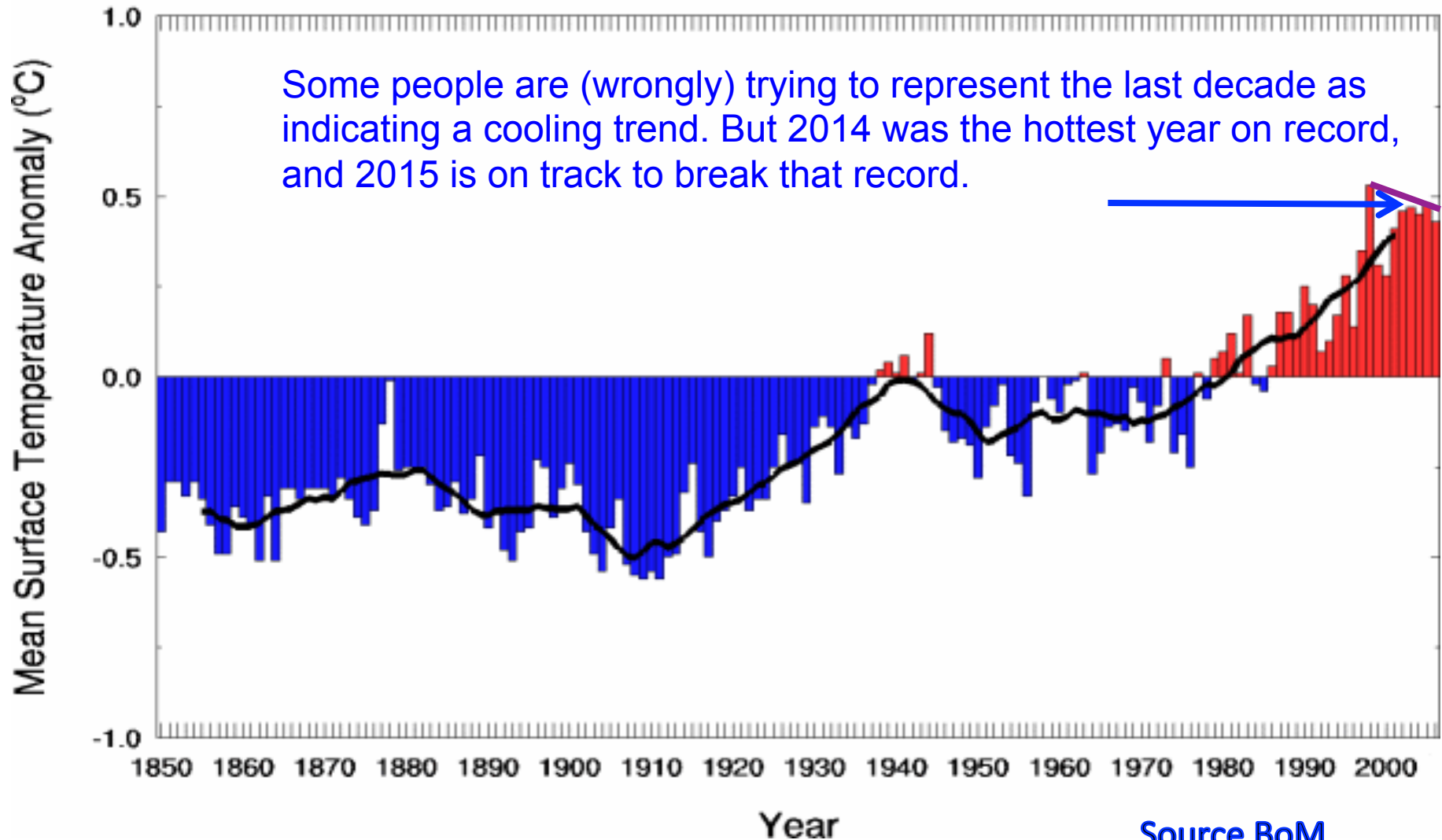
The core problem: population & carbon emissions



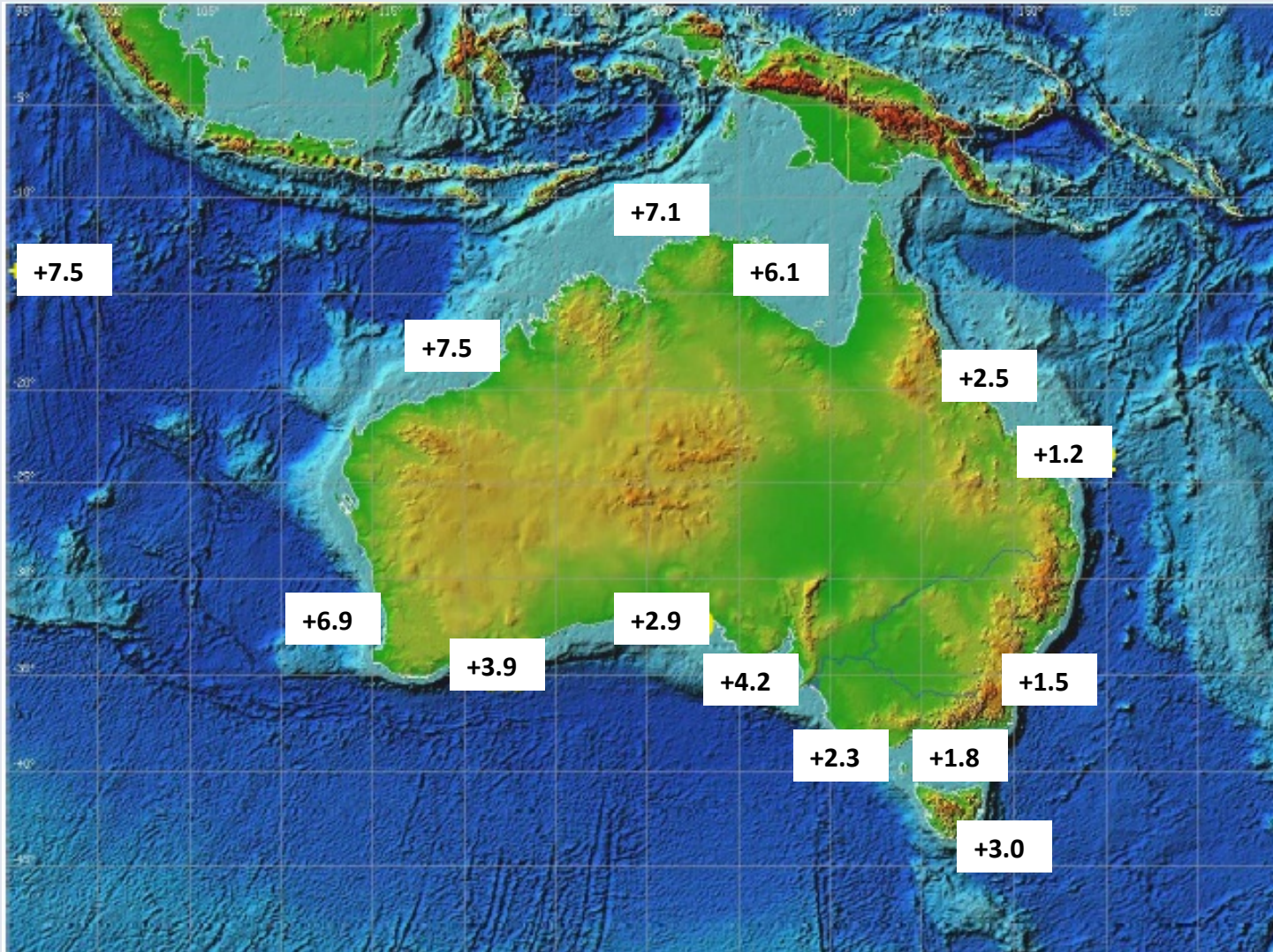
Source: WBCSD & IUCN 2008; Harvard Medical School 2008

Warming of the climate system is *unequivocal* (IPCC 2007)

Global Annual Mean Surface Temperature Anomaly (base 1961-90)

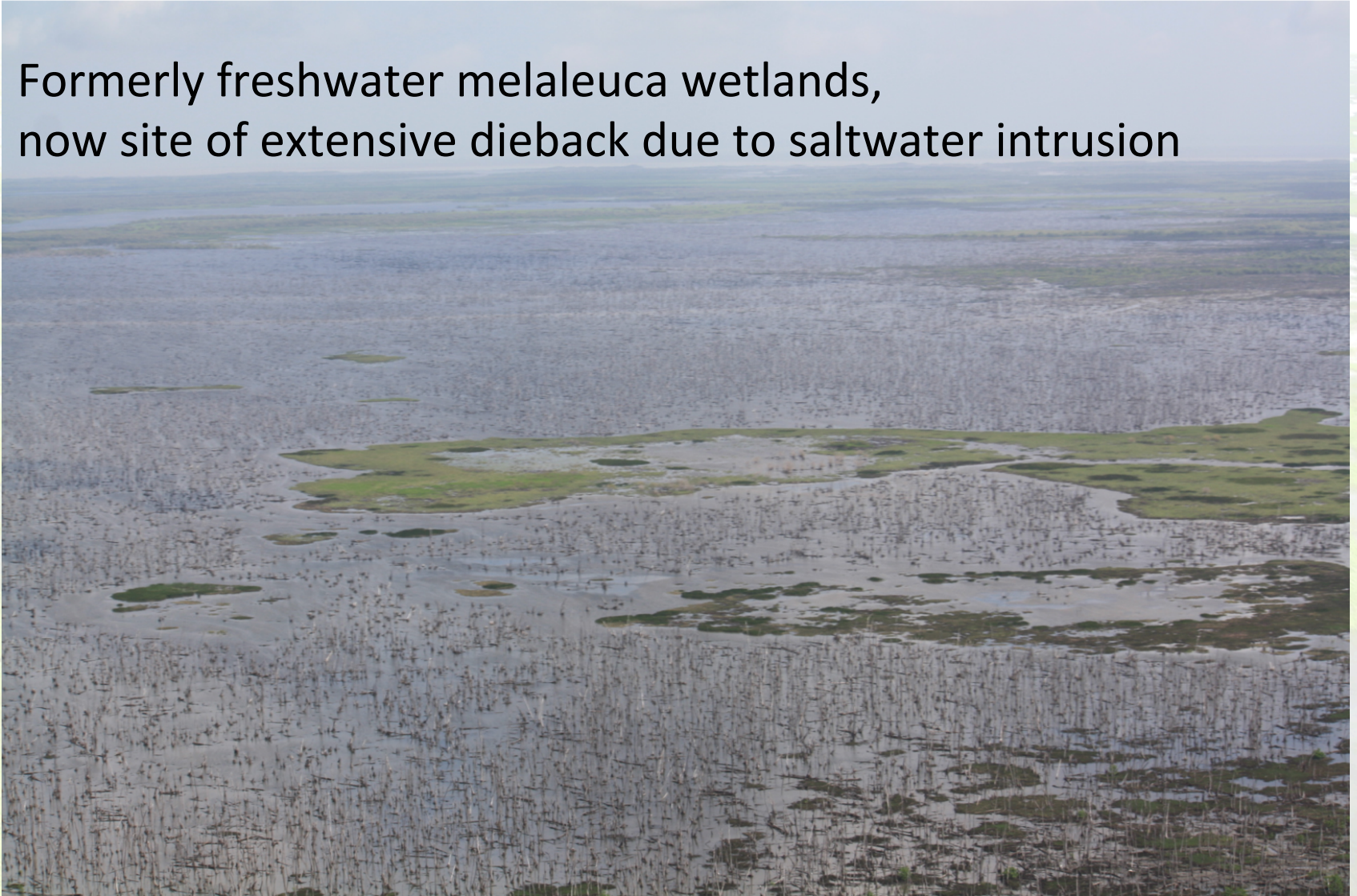


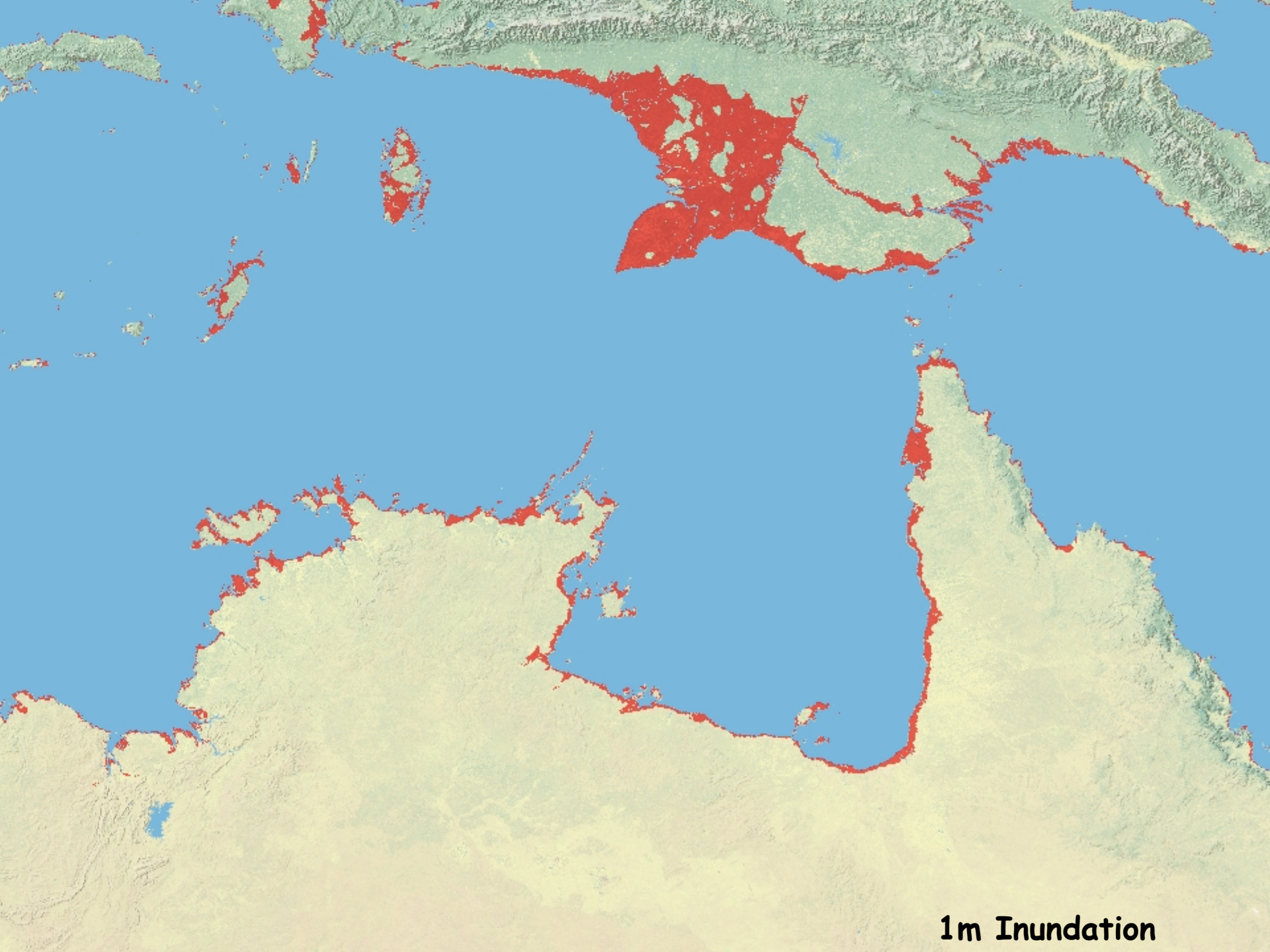
Observed rates of relative mean sea level rise (mm/year) over last 18 years



The Mary River

Formerly freshwater melaleuca wetlands,
now site of extensive dieback due to saltwater intrusion





1m Inundation

Tommycut hypersaline mud flats were once fresh water







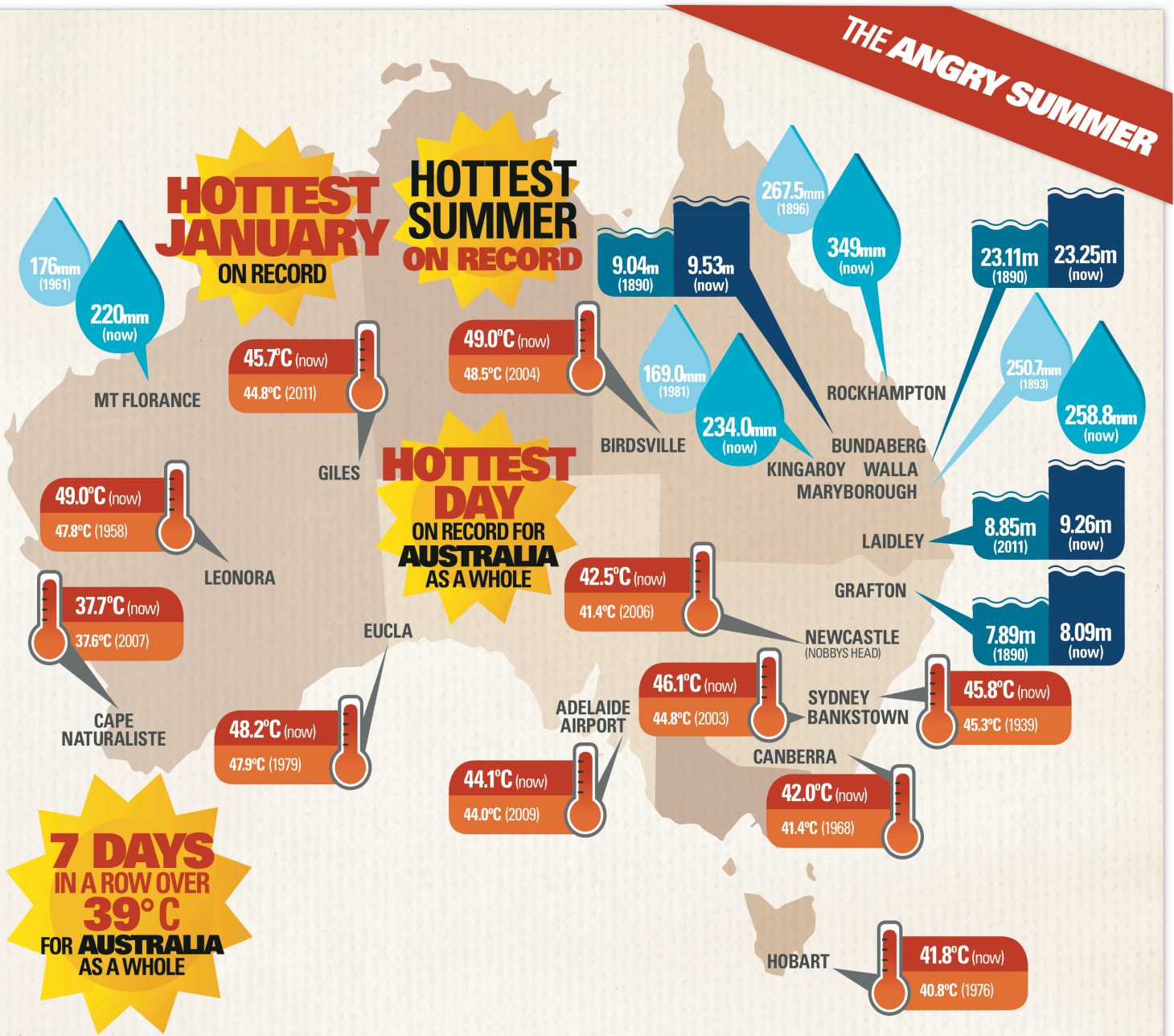
17,000 Hectares



IN JUST
90 DAYS:
123 RECORDS
 BROKEN
 THROUGHOUT
 AUSTRALIA

HERE ARE JUST
24 OF THE 123
 RECORDS FROM SUMMER 2012/2013

- 
MAXIMUM TEMPERATURE RECORDS
- 
FLOOD RECORDS
- 
DAILY RAINFALL RECORDS
- 
HEATWAVE RECORDS



THE ANGRY SUMMER

DATA SOURCES: BoM. (2013a). Special Climate Statement 43 – extreme heat in January 2013. DATA SOURCE: BoM. (2013b). Special Climate Statement 44 – extreme rainfall and flooding in coastal Queensland and New South Wales.



Expectations from former planning decisions





Mortlock Islands Papua New Guinea – surge

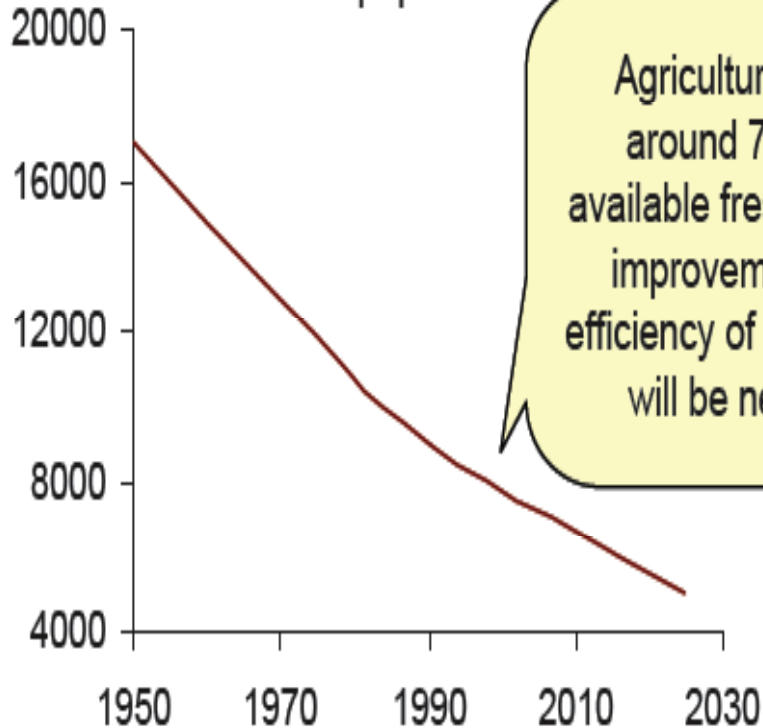
The world needs 70% more food

A photograph of a man and a young boy walking on a dirt path in a rural village. The man is carrying two large woven baskets filled with green corn cobs, one in each hand. The boy is walking alongside him, also carrying a basket. In the background, there are simple houses, trees, and a person on a motorcycle.

- The world needs to increase food production by about 70% by 2050, & improve distribution
- We have done this in the past, mainly through clearing, cultivating and irrigating more land
 - and intensification, better varieties, more fertiliser, pesticides
- Climate change and oil depletion is narrowing those options, with limits to water, land, energy & nutrients. We need to grow more food, more sustainably:
 - Using less land, water & energy and emitting less carbon
 - Improving nutrition, distribution, animal welfare, reducing pollution
 - Looking after rural landscapes, biodiversity & communities

Water availability per capita is declining

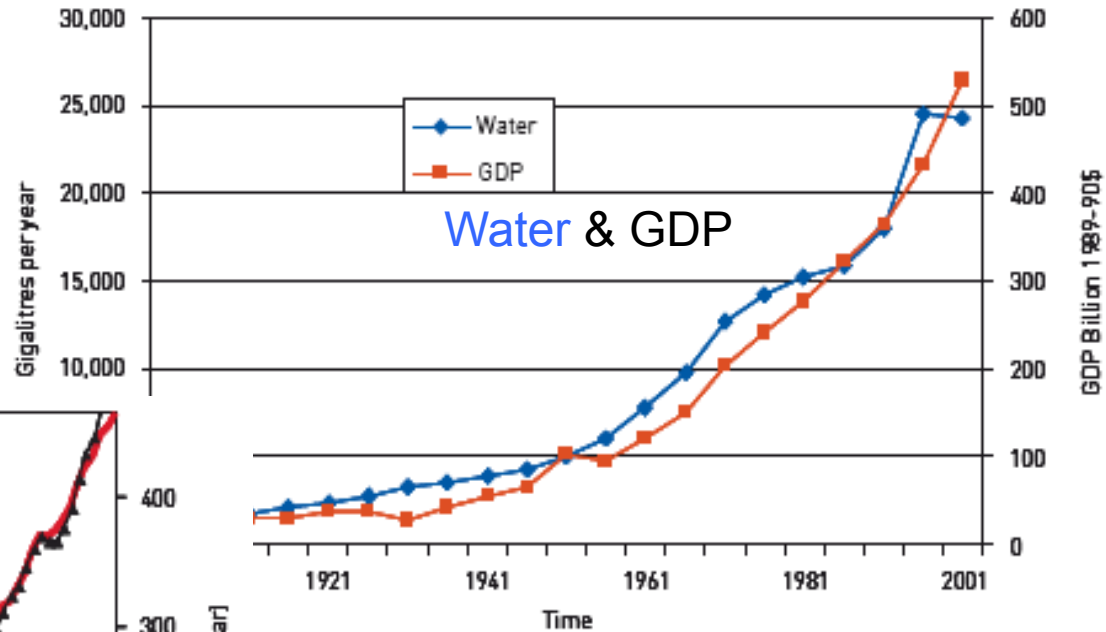
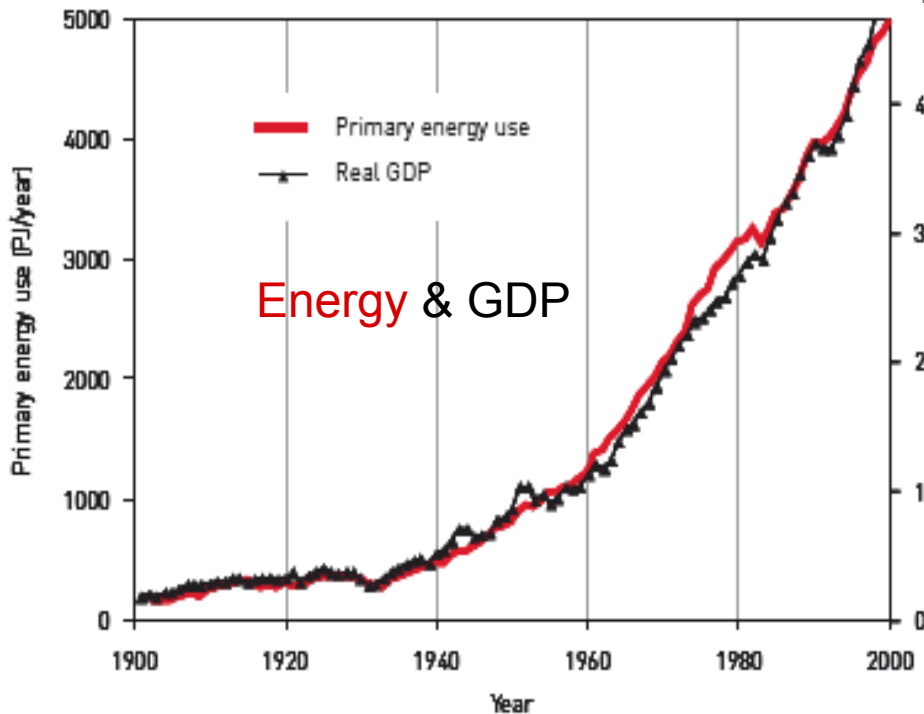
Actual and projected freshwater availability, cubic metres per head of total world population¹



- Each calorie takes one litre of water to produce, on average
- Like the Murray Darling Basin, all the world's major food producing basins are effectively 'closed' or already over-committed

Water, energy, and GDP

Water and energy have historically been closely coupled with GDP in Australia



Our challenge now is to radically reduce the energy, carbon and water-intensity of our economy

Climate-energy-water feedbacks



knowledge for managing Australian landscapes

(c) Deviation of weather pattern from 'normal'

Climate, energy and water
Accounting for the links

May 2007

Katrina Proust, Stephen Dovers, Barney Foran, Barry Newell,
Will Steffen and Patrick Troy

The Fenner School of Environment and Society
College of Science
The Australian National University

Use of tra-somatic (f) energy

- Saving water often uses more energy, and vice-versa
- Efforts to moderate climate often use more energy +/or water
 - E.g. coal-fired power stations with Carbon Capture & Storage will be 25-33% more water-intensive
- Using more fossil energy exacerbates climate chaos



Converging Insecurities

- Climate change
 - Direct impacts
 - Impacts of responses to climate change – e.g. carbon markets, migration
- Energy
 - the era of cheap, energetically efficient fossil fuels is ending
- Water
 - Every calorie we consume uses one litre in its production
 - Every litre weighs one kilogram — energy intensive to distribute it
 - Per capita freshwater availability declining steeply (globally)
- Food — must increase world production by 70% by 2050
 - Using less land, water, fossil energy and nutrients

Profound technical challenges

- To decouple economic growth from carbon emissions
- To adapt to an increasingly difficult climate
- To increase water productivity
 - Decoupling the 1 litre per calorie relationship
- To increase energy productivity
 - more food energy out per unit of energy input
 - while shifting from fossil fuels to renewable energy
- To develop more sustainable food systems
 - while conserving biodiversity and human livelihoods
 - improving landscape amenity, soil health, animal welfare & human health
- **TO DO ALL OF THIS SIMULTANEOUSLY!**
 - **improving sustainability and resilience**

Sustainability and Resilience

- Complementary concepts
- Sustainability remains relevant and desirable
 - Living within our means
 - Thinking long term (inter-generational equity)
 - Distinguishing between depletable and renewable resources
 - Avoiding or limiting actions that degrade, pollute, over-use or compromise ecosystem function
 - Keeping options open for future generations
- **BUT:** Sustainability is less instructive around:
 - Social and cultural dimensions
 - Operating in contexts with inherent variability

Resilience

– the cool new kid in town?

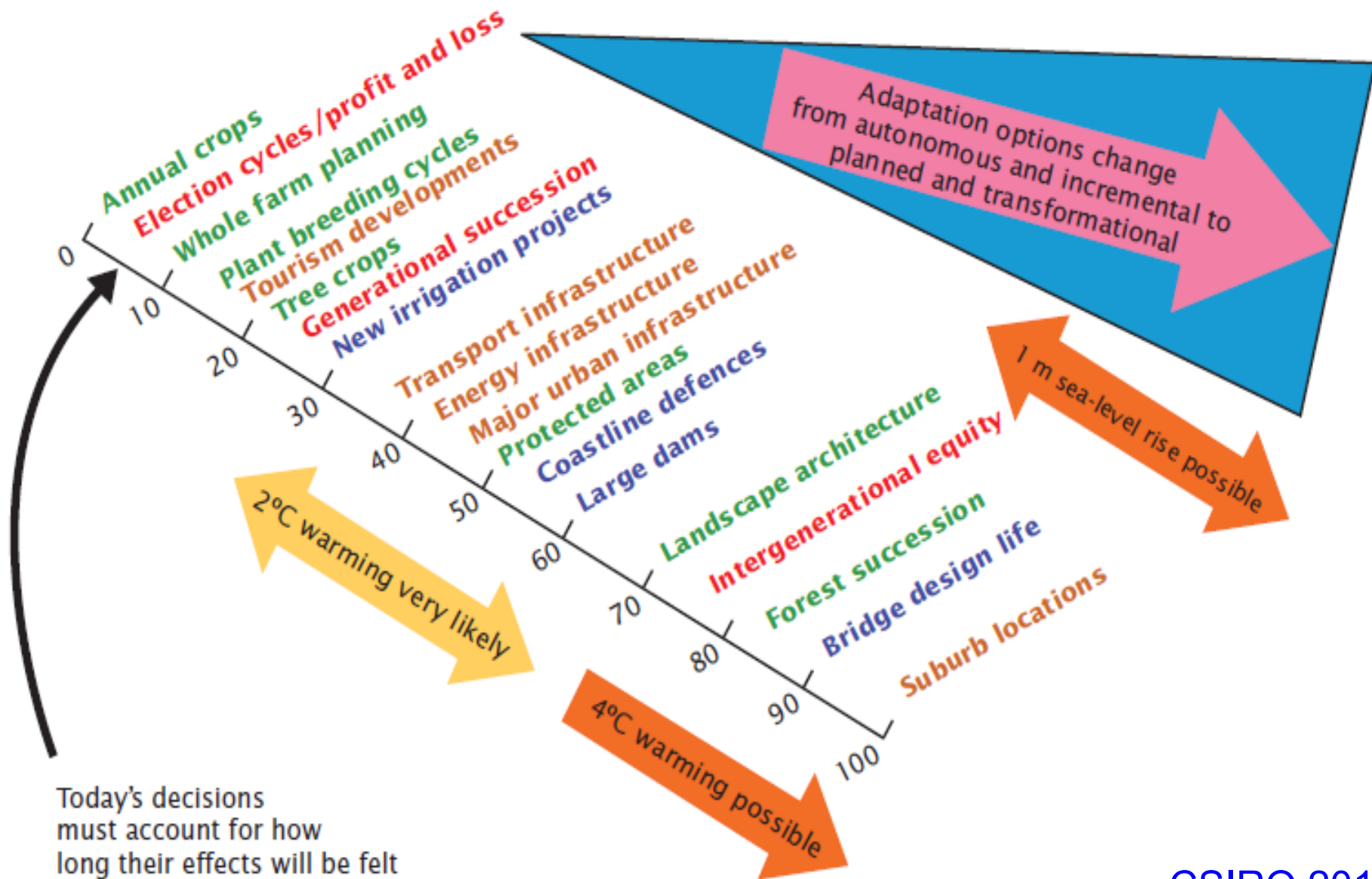
- The capacity of a system to absorb shocks, reorganise and retain the same functions
 - As resilience declines, it takes a progressively smaller shock to push a system across a threshold
- Adds value in explicitly embracing change and variability
- Introduces the useful concept of thresholds or tipping points
- Explicitly embraces scale
 - Resilience at a given scale requires an understanding of at least one scale up & one scale down



Factors affecting resilience*

- Diversity: biological, economic (e.g. energy sources), social
- Modularity (connectedness, engagement)
- Tightness of feedbacks
- Openness – immigration, inflows, outflows
- Reserves and other reservoirs (e.g. seedbanks, nutrient pools, soil moisture, memory, knowledge, young people, women)
- Overlapping institutions
- Polycentric governance & leadership
- **Useful diagnostics for food systems analysis?**

Scales for response to climate change



We need a third agricultural revolution

- High level goals: e.g. doubling food & fibre production while doubling water productivity, and producing renewable energy from farming lands
- How to get there?
 - Farming/agroforestry systems that make more efficient use of and conserve water, energy, nutrients, carbon and biodiversity (natural and cultivated)
 - Smart metering, sensing, telemetry, robotics, guidance, biotechnology
 - Better understanding of soil carbon & microbial activity
 - Radically reducing waste in all parts of the food chain
 - Farming systems producing renewable (2nd generation) bioenergy
 - Attracting talented young people into agricultural careers

Climate change and biodiversity

- **Natural biodiversity**

- Climate change amplifies existing pressures on nature
- It increases threats and risks, underlining the need for conservation of natural areas
- Species at the edge of their bioclimatic niche basically have 3 options: move, adapt, or die

- **Cultivated biodiversity**

- Genetic diversity **within** species becomes even more important as climates are changing and becoming more difficult for agriculture
- Farming systems need diversity among and within crops
- Farming communities need diverse sources of income & livelihood

Planning landscapes & infrastructure

- How can this all 'fit' at a landscape and regional scale?
- The landscape needs to be re-plumbed and re-wired
- We need new planning approaches that:
 - work under a range of climate change & demographic scenarios
 - build in resilience thinking
(conserve natural areas, improve habitat connectivity & buffering)
 - Integrate ways to reduce carbon pollution (energy, transport, food)
 - safeguard productive soil and allow for increased food production
 - facilitate recycling of water, nutrients and energy
- ★ **Leading, educating and bringing the community on the journey**

Governance

“How society shares power, benefit and risk”

- Vertical and horizontal distribution of benefits, costs and risks, in space and time
- Need to honour the past and respect local values, without being tied by them
- Lowest common denominator consensus rarely makes big advances
- Local institutions are essential, but not sufficient
- As everything becomes more interconnected, better governance becomes more vital, and more difficult

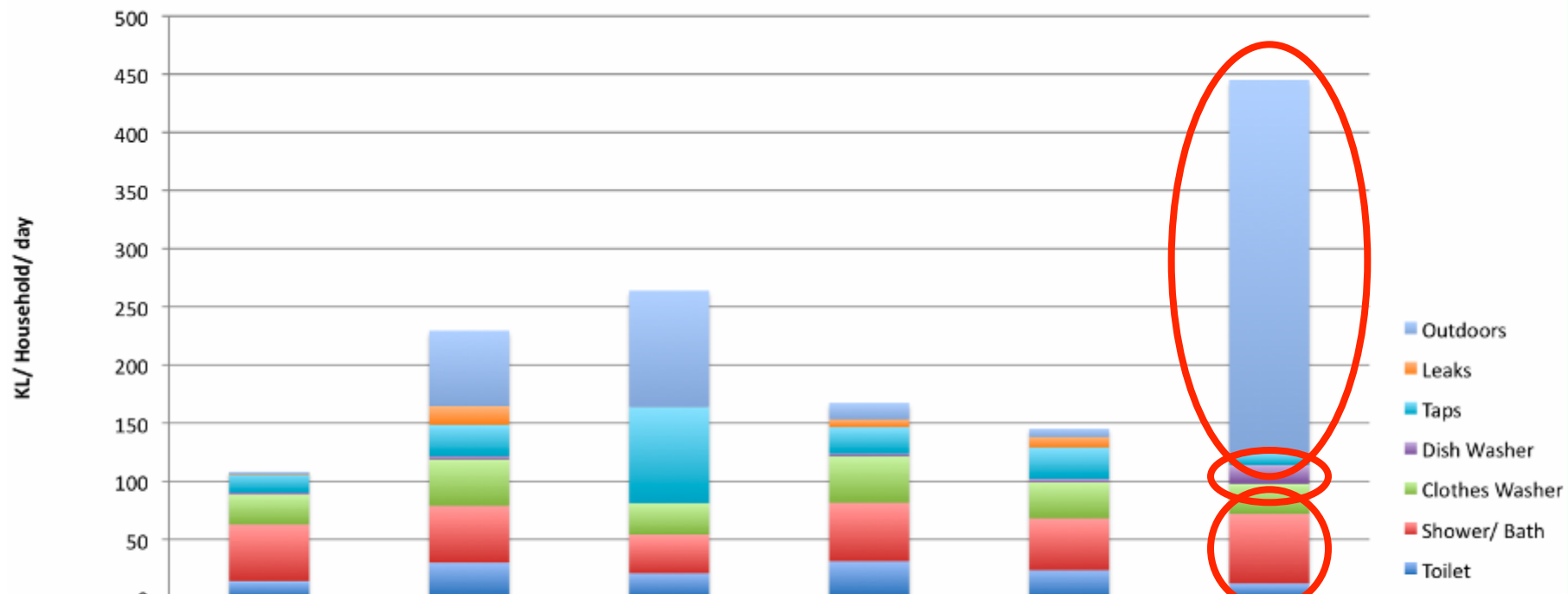


Regions around cities are fertile ground for **innovation**

- Cities suck in water, energy and nutrients from their hinterland
- Much of which becomes waste
- Replumbing, rewiring and recladding is required on a massive scale, to transform waste back into food, energy and water
- Cities also attract people, and are part of the sustainability solution, not the problem

How do Households Compare?

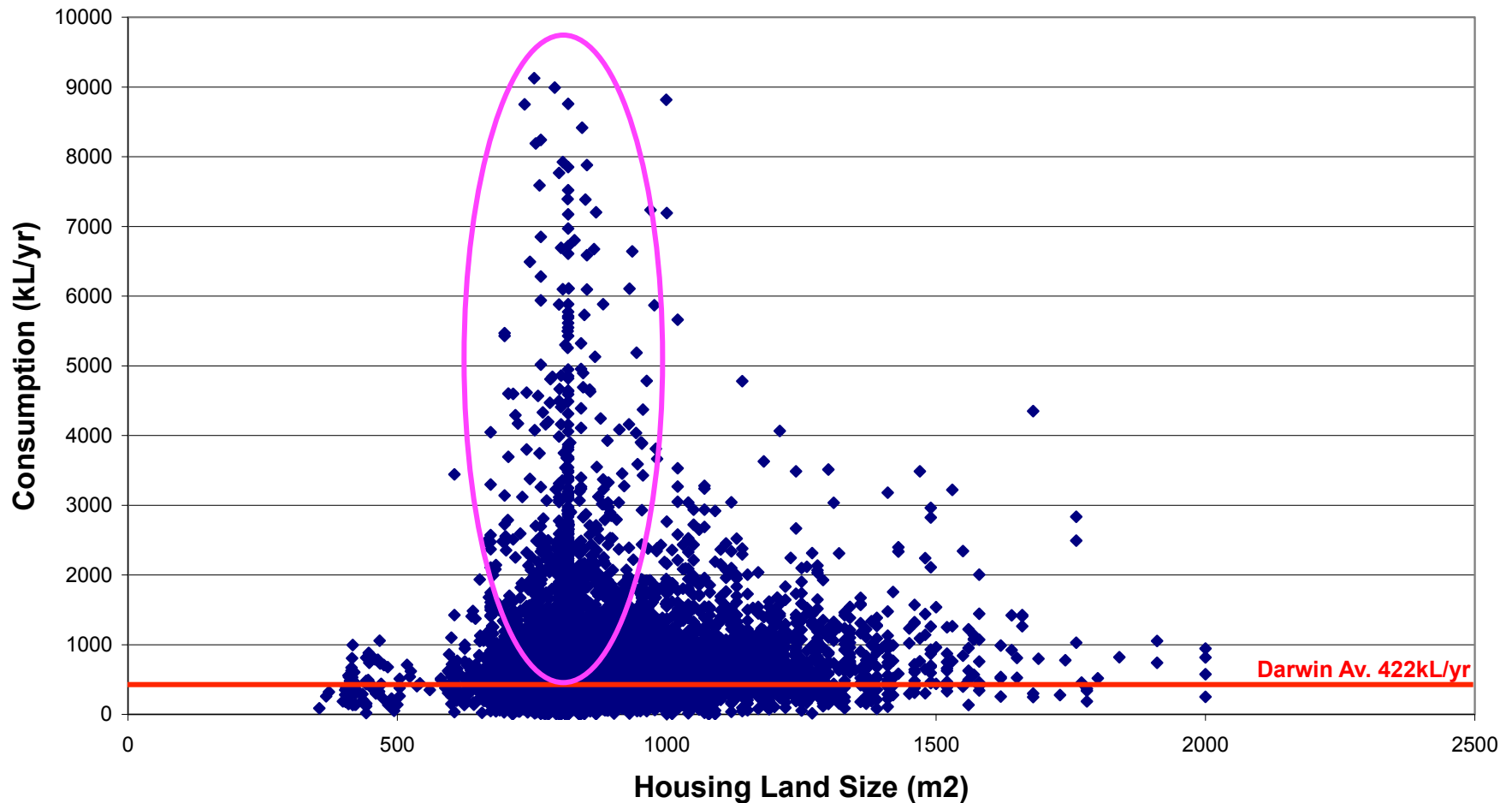
Household End Water Use in Australia



	Toowomba (n=10)	Melbourne (n=100)	Perth (n=120)	Auckland (n=50)	SEQREUS (n=252)	Darwin Average
Outdoors	0.5	65	100	13.9	7	321
Leaks	0.5	15.9	0	7	9	0
Taps	16.8	27	83	22.7	27.5	10
Dish Washer	2	2.7	0	2.1	2.5	16
Clothes Washer	25.4	40	27	39.9	31	26
Shower/ Bath	48.7	49	33	50.4	44.5	60
Toilet	14.2	30	21	31.3	23.7	12

Our Garden Water Habits

2009 Darwin Water Consumption v's House Lot Size (<2000m²)



Reflections on Darwin & the NT

- Long, vulnerable food supply chains
- Real energy, nutrient and chemical prices (& hence local food prices) will increase over time
- Plenty of scope to increase local food production
 - at household, urban and peri-urban scales
 - integration with local markets minimises food miles
- And to better utilise waste streams & waste water
- We currently dump nutrient-rich waste in the harbour
- Renewable energy (especially solar PV) is a no-brainer
- **House energy rating systems need to be tuned for the tropics!**

Northern Territory Climate Change Policy 2009

(<http://www.greeningnt.nt.gov.au/climate/policy.html>)

- **Ambitious targets**

- 60% emissions reduction by 2050
- NTG carbon neutral in its own operations by 2018
- 20% energy from renewables by 2020
- Replace diesel in remote communities by 2020

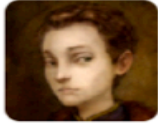
- **Comprehensive strategy**

- 9 elements including towns, industry, workforce, waste, communities and living with change
- Detailed adaptation action plans for each sector, led by whole of government task force

- **THIS POLICY WAS ABANDONED by a new government (Leadership, resources & community buy-in critical)**

Reform is getting harder

Retweeted by Andrew Campbell



Scott Westerfeld @ScottWesterfeld · Mar 21

Plot idea: 97% of the world's scientists contrive an environmental crisis, but are exposed by a plucky band of billionaires & oil companies.

[Collapse](#)

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RETWEETS

10,545

FAVORITES

6,568



9:57 AM - 21 Mar 2014 · [Details](#)

In the Anglosphere, we are seeing systematic attacks on environmental policy of unprecedented intensity, sophistication and comprehensiveness, supported/reinforced by a loose ‘coalition of the willing’:

- The fossil fuel sector and some energy-intensive industries
- Older white males who feel their values & achievements are threatened
- Contrarian denialists & genuine skeptics (a much smaller group)
- Media interests aligned with any or all of the above (e.g. Rupert Murdoch)

Assume all wins are temporary

In the last two years in Australia, under a narrative of removing '*red and green tape*' & being '*open for business*', we have seen many environmental policy achievements of the last thirty years reversed, wound back, defunded or undermined, including:

- Abolish price on carbon and all associated agencies, advice and incentives
- Abolish Mineral Resources Rent tax
- Create a 'one stop shop' for development approvals between Feds & States
- Cut funding for Environmental Defenders' Offices
- Amend legislation to exempt the Environment Minister from his own Act
- unpicking the Tasmanian Forests Agreement
- approving the dumping of dredge spoil into the Great Barrier Reef catchment
- relaxing restrictions on land clearing
- 'State Significant Project' status to large scale expansions of CSG & fracking
- reintroducing hunting and grazing in National Parks
- renegeing on promises to monitor the Japanese whaling fleet

Environment professionals



- Will continue to be in great demand
- Can shape remarkable careers
- Career mobility and flexibility crucial, BUT FIRST;
 - Build on a solid base of skills and expertise
 - Understand yourself, how you relate to others, how others see you
 - Take time out to sharpen the saw (several times)
 - Cultivate mentors, patrons, exemplars
- **Don't forget to have a life!**

In Summary

- Sustainability is the challenge of our age
- You are key players in the biggest game of all
- The Australian environment, and sustainability industries, are critical to national identity and competitiveness
- There are rich and diverse opportunities for environmental professionals in every aspect of economy and society
- Work out what you want and what you have to offer
- Be opportunistic, but don't lose sight of long-term goals

GO FOR IT!

For more information

Including:

Paddock to Plate

Managing Australian Soils

Managing Australian Landscapes in a Changing Climate

Powerful Choices

The Getting of Knowledge

Designing environmental research for impact

www.riel.cdu.edu.au

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