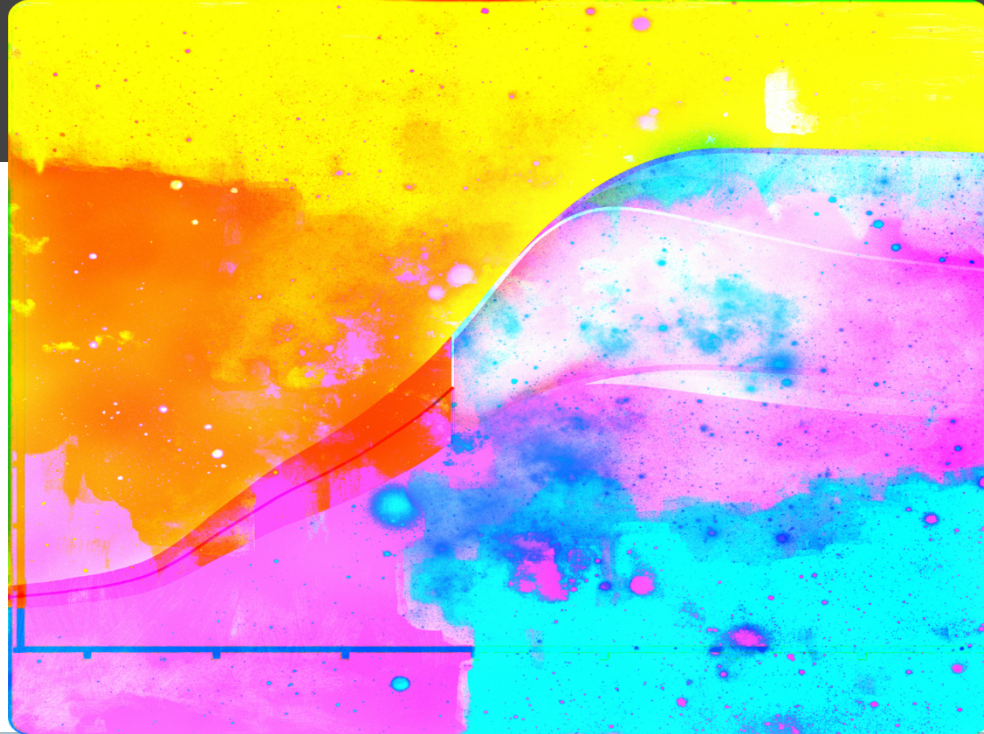




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# The IPCC Special Report on 1.5°C of global warming and climate adaptation



Professor Mark Howden

@ProfMarkHowden

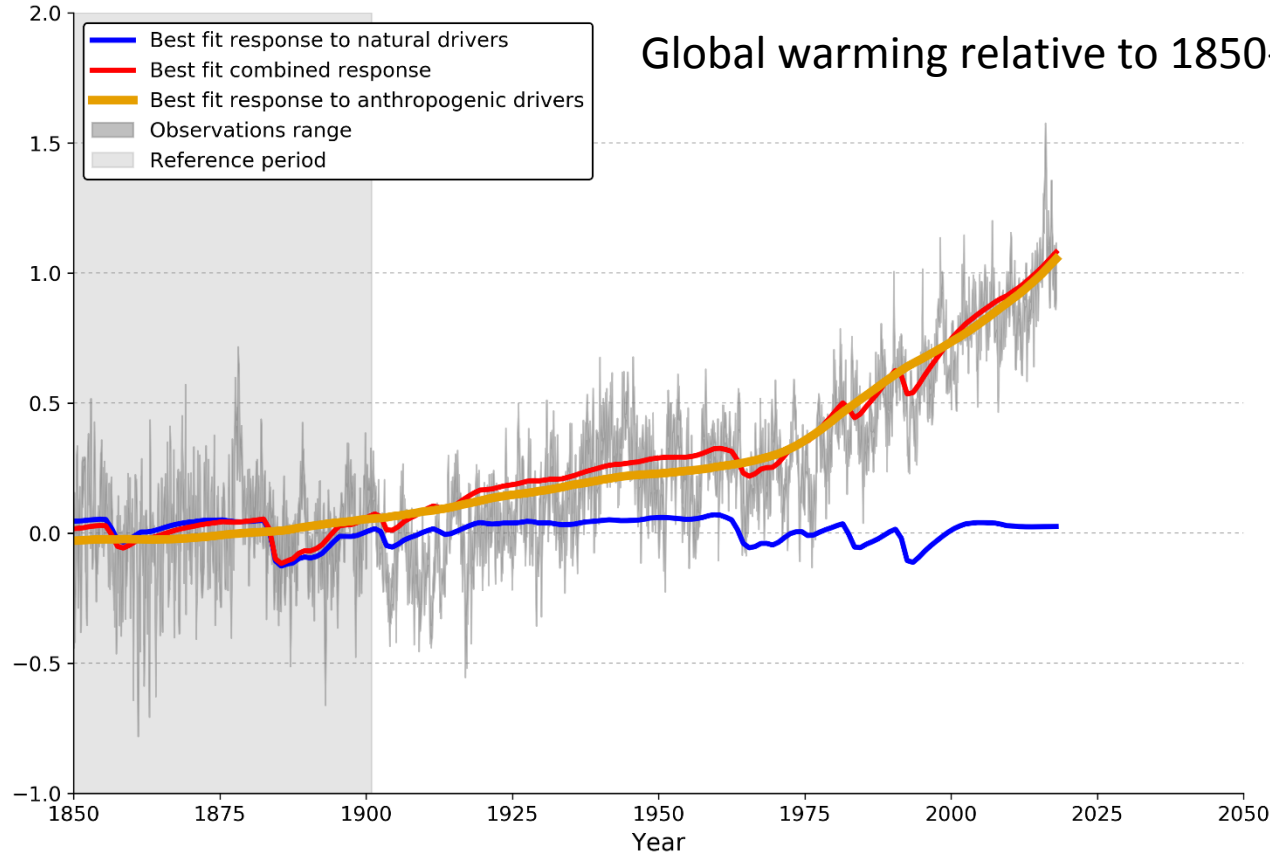
ANU Climate Change Institute

Vice Chair, IPCC Working Group II

# The IPCC Special Report

- *‘An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty’*
- Global scale, policy-informing
- 91 Authors, 133 Contributing Authors, 17 Review Editors
- 6 000 studies
- 42 001 comments

# Global warming: human and natural



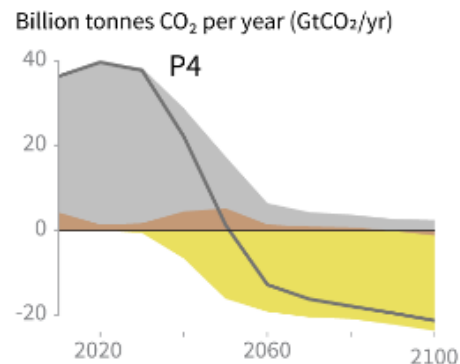
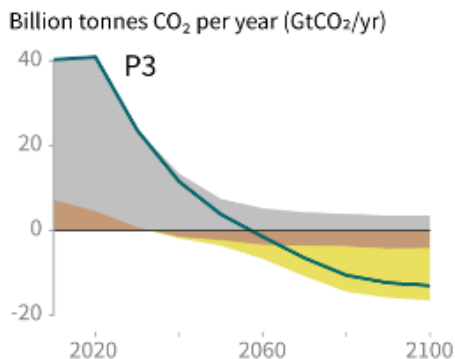
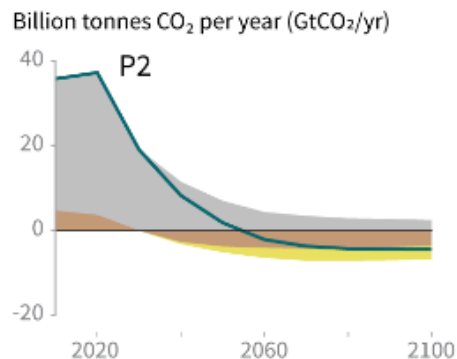
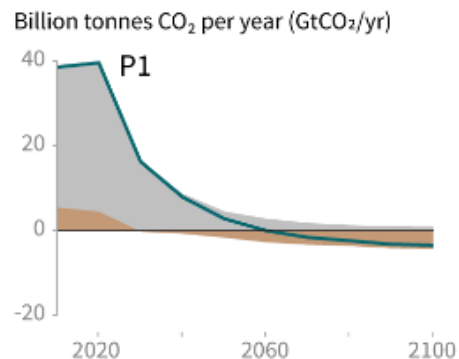
Likely to  
reach 1.5°C  
by 2040

# Carbon budget and urgency

- Currently emitting about 42 billion tonnes of CO<sub>2</sub> per year
- In 10 to 14 years we will use up our C budget for a 2/3rds chance of staying below 1.5°C
- To stay within 1.5°C CO<sub>2</sub> emissions decline 45% by 2030 and reach net zero by around 2050
  - still need some negative emissions
- For 2°C target – decline by 20% by 2030 and net zero by 2075
- Reducing emissions would have direct and immediate health benefits in many situations

# Illustrative 1.5°C compatible pathways

● Fossil fuel and industry ● AFOLU ● BECCS



**P1:** A scenario in which social, business, and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A down-sized energy system enables rapid decarbonisation of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

**P2:** A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

**P3:** A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

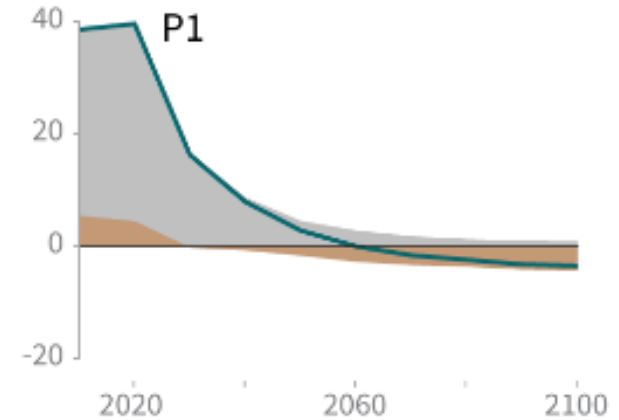
**P4:** A resource and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

# Illustrative 1.5°C compatible pathways

● Fossil fuel and industry ● AFOLU ● BECCS

Indicator	
CO <sub>2</sub> emissions in 2050 (% change)	-93
Renewable share of electricity (%)	77
Primary energy from coal (% change)	-97
Primary energy from oil (% change)	-87
Primary energy from gas (% change)	-74
Cumulative CCS/BECCS to 2100 (GtCO <sub>2</sub> )	0
Land for bio-energy (Mha)	22
Agricultural methane (% change)	-33

Billion tonnes CO<sub>2</sub> per year (GtCO<sub>2</sub>/yr)



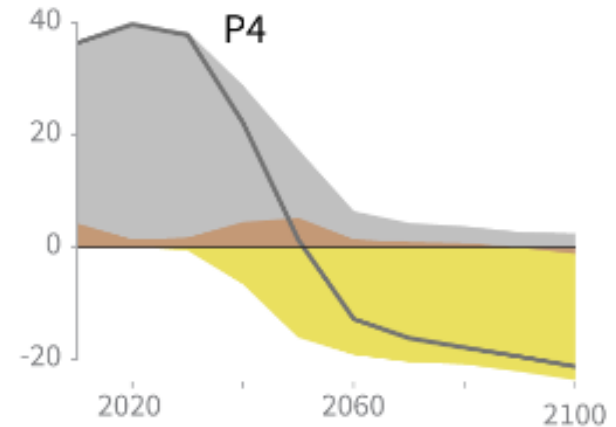
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# Illustrative 1.5°C compatible pathways

● Fossil fuel and industry ● AFOLU ● BECCS

Indicator	
CO <sub>2</sub> emissions in 2050 (% change)	-97
Renewable share of electricity (%)	70
Primary energy from coal (% change)	-97
Primary energy from oil (% change)	-32
Primary energy from gas (% change)	-48
Cumulative CCS/BECCS to 2100 (GtCO <sub>2</sub> )	1218
Land for bio-energy (Mha)	724
Agricultural methane (% change)	2

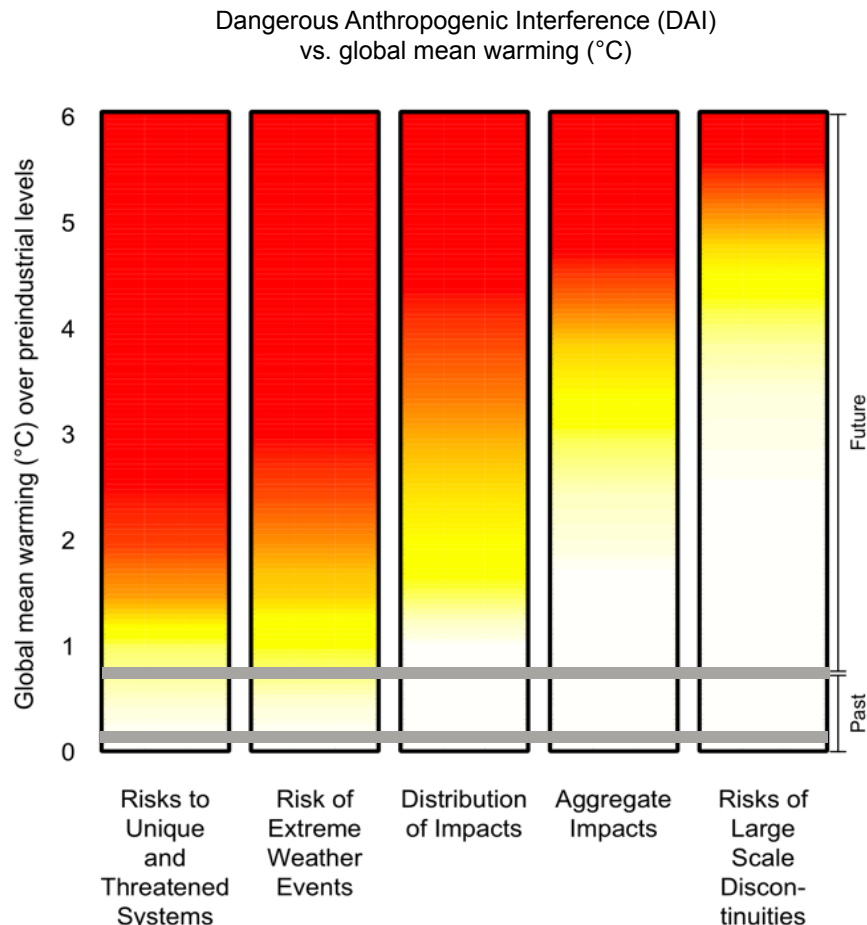
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# Reasons for Concern: 2001

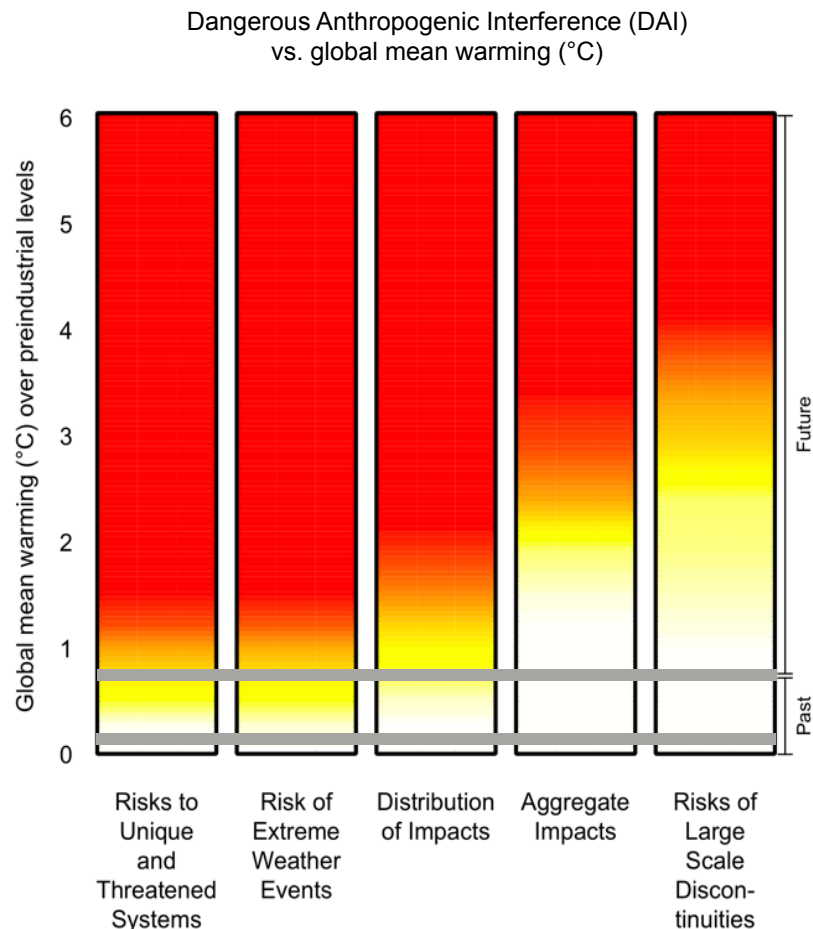
Knowledge  
**AR3**  
**2001**





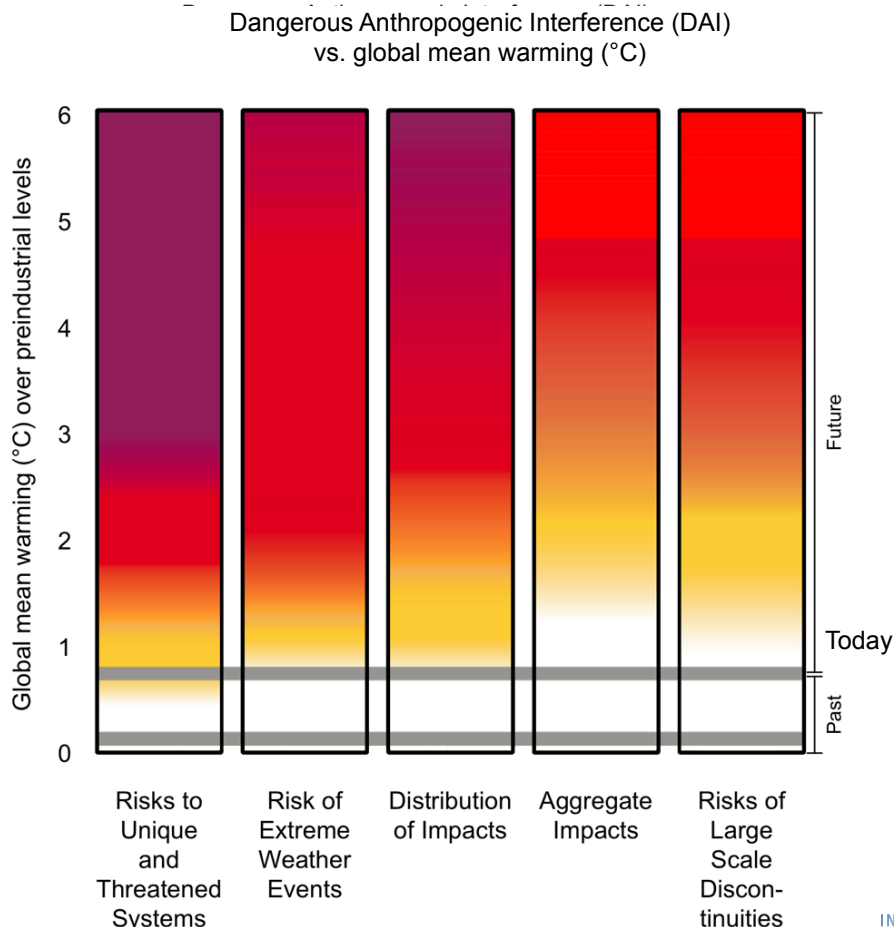
# Reasons for Concern: 2007

Knowledge  
**AR4**  
**2007**

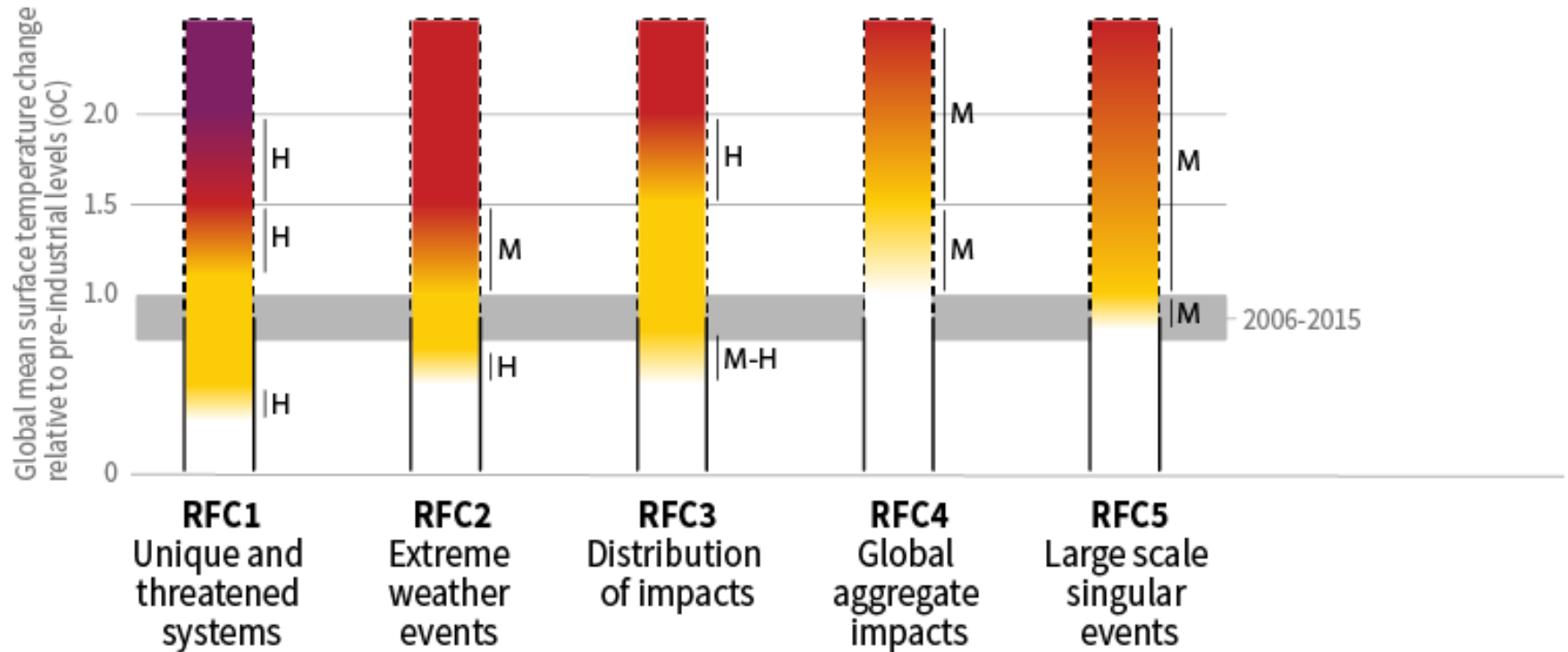


# Reasons for Concern: 2014

Knowledge  
**AR5**  
**2014**



# Reasons for Concern: 2018

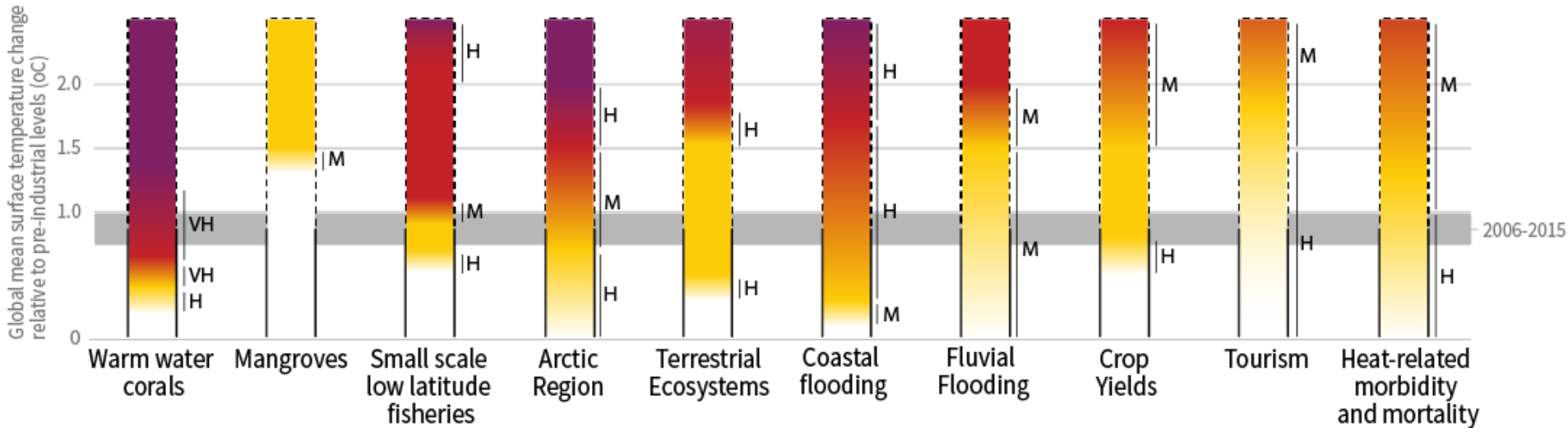


Confidence level for transition: L=Low, M=Medium,



# Reasons for Concern: 2018 sectoral

## Impacts and risks for selected natural, managed and human systems



Confidence level for transition: L=Low, M=Medium,



# Coral Reefs

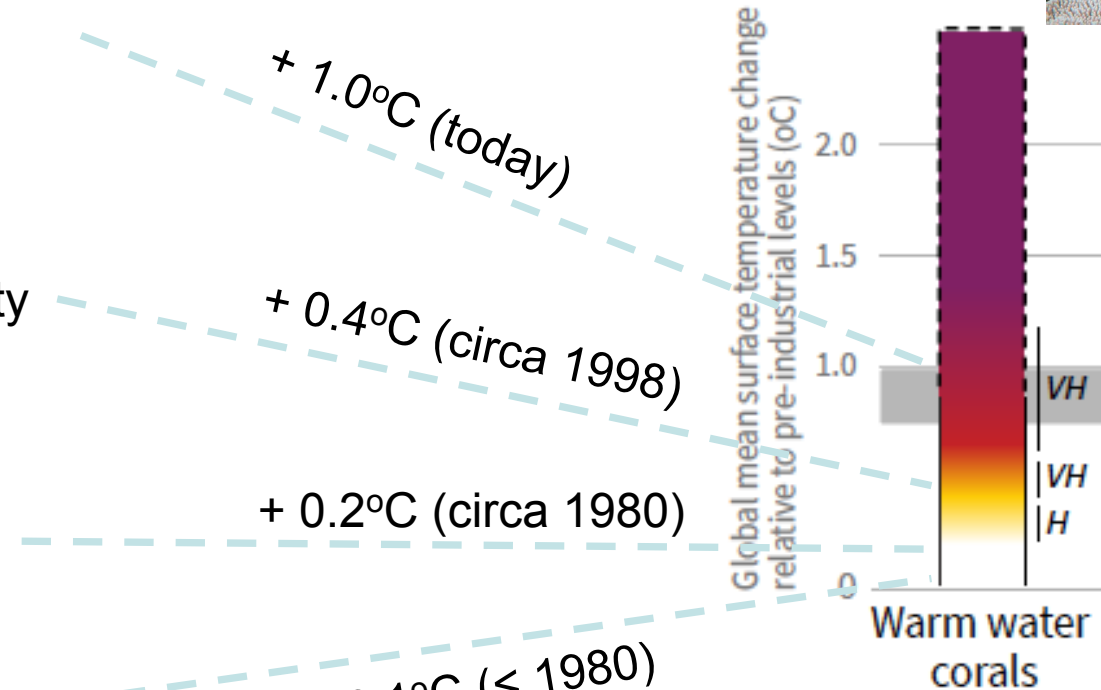


First back-to-back global  
mass bleaching and  
mortality events

First global mass  
bleaching and mortality  
event

Localised mass coral  
bleaching reported

No reports of mass  
coral bleaching



# Benefits of 1.5°C vs 2°C

- Fewer and less severe droughts, floods, fires, weather extremes especially in the sub-tropics and mid-latitudes
- Lower sea level rise (10cm by 2100) with 10M+ fewer people affected
- Halving the exposure to water shortages
- Up to several hundred million fewer people exposed to climate-related risk and susceptible to poverty by 2050
- Reduced food insecurity
- Reductions in impacts on biodiversity and the natural resource base

# How do we adapt well ?



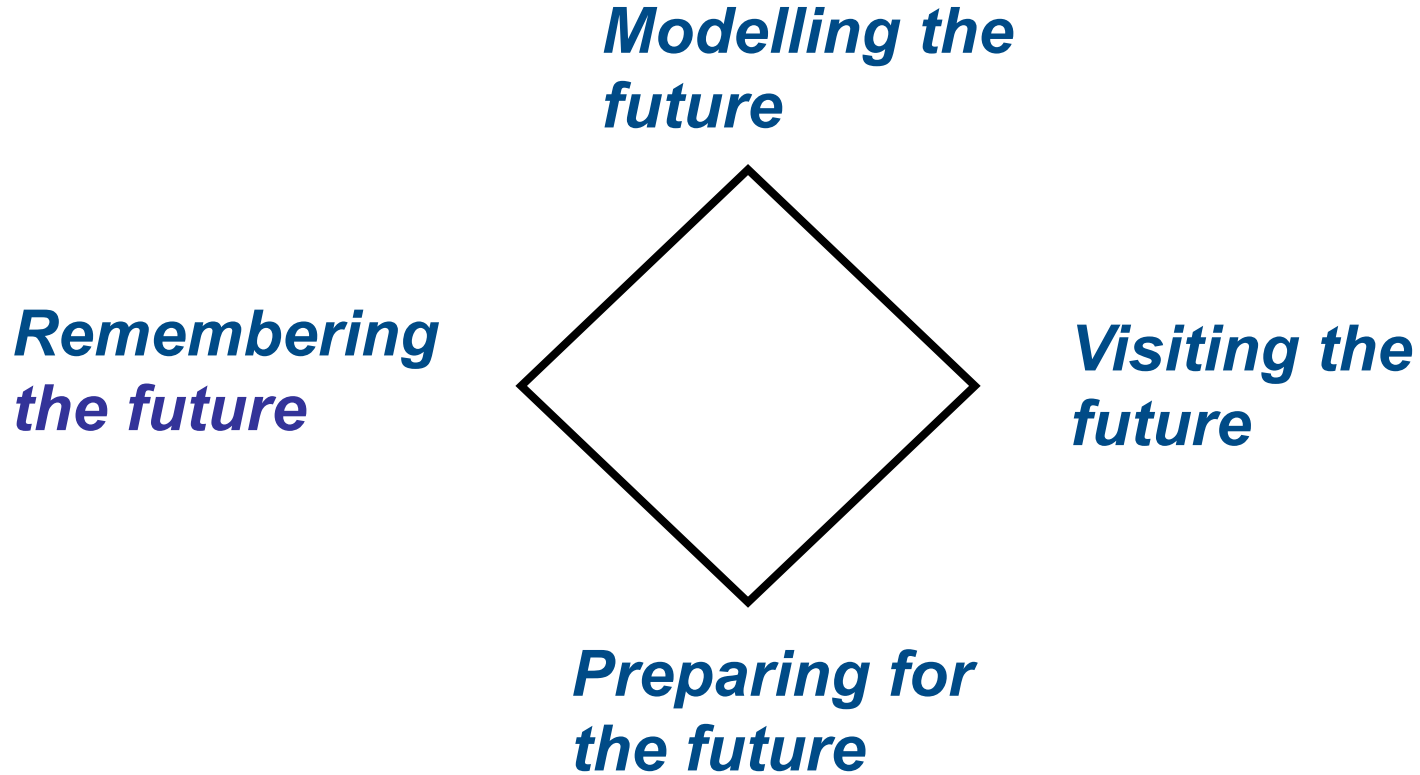
- Adaptation: *‘Changing what we do to get what we want’*
- Highly contextual - values
- Huge diversity of options
  - on farm and off farm, diversification
  - tactical and strategic
  - incremental to transformational
  - institutional, regional, value chain etc
- All involve costs, require some change in knowledge as well as action
- Always in anticipation of net benefits
- Empowers, reduces stress

# The climate adaptation journey: technical to strategic

2007	2009	2011	2012
<ul style="list-style-type: none"> <li>• no cultivation, no-till and stubble retention</li> <li>• guidance systems</li> <li>• press wheels for water harvesting</li> <li>• inter-row sowing</li> <li>• opportunity cropping</li> <li>• less canola and pulses</li> <li>• hay</li> <li>• soil testing for N and water</li> <li>• sowing by the calendar not on moisture (dry sowing)</li> </ul>	<ul style="list-style-type: none"> <li>• containment areas for livestock</li> <li>• low P rates and N only just in time</li> <li>• postpone machinery purchases</li> <li>• no burning of stubbles</li> <li>• shorter season and heat tolerant varieties</li> <li>• variable sowing rate</li> <li>• improve sheep production</li> </ul>	<ul style="list-style-type: none"> <li>• canola only on soil moisture</li> <li>• bought and leased more light (sandy) country</li> <li>• concentrate on marketing (futures and foreign exchange rates)</li> <li>• decrease debt</li> <li>• off-farm income</li> <li>• reduce costs</li> <li>• improve harvest efficiency</li> </ul>	<ul style="list-style-type: none"> <li>• simplify all operations</li> <li>• larger paddocks – easier management</li> <li>• improve labour efficiency</li> <li>• improve financial management</li> <li>• requirement for more information and knowledge</li> </ul>



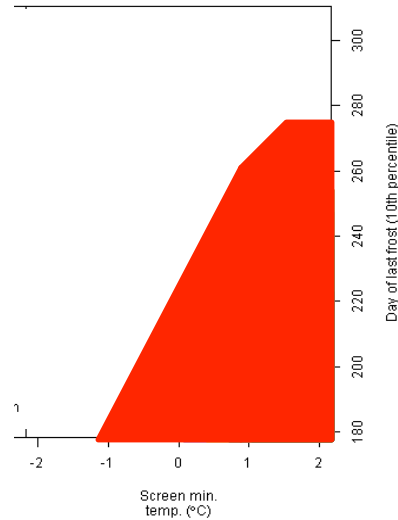
# Thinking about future climates



Strategy	Method or Action
Remembering the future	Temporal analogues e.g. learn from past droughts
Visiting the future	Spatial analogues e.g. learn from warmer & drier sites
Modelling the future	Climate trend analysis, climate projections from GCMS, systems analyses
Preparing for the future	Develop adaptation technologies and management, adaptive capacity and adoption systems



# Increasing variability: frost risk

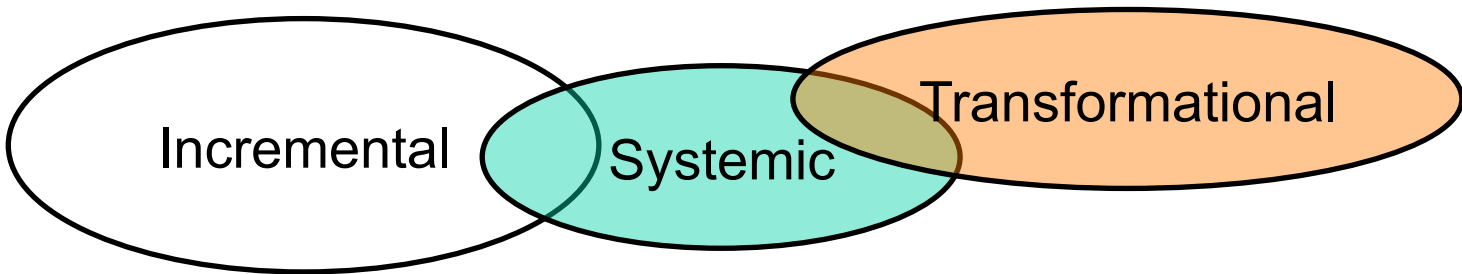


	Ignore	100-year	Decadal - Adaptive
Mean gross margin (Wagga)	\$119/ha	+\$8/ha	+\$17/ha
Mean gross margin (Emerald)	\$34/ha	-\$5/ha	+\$18/ha

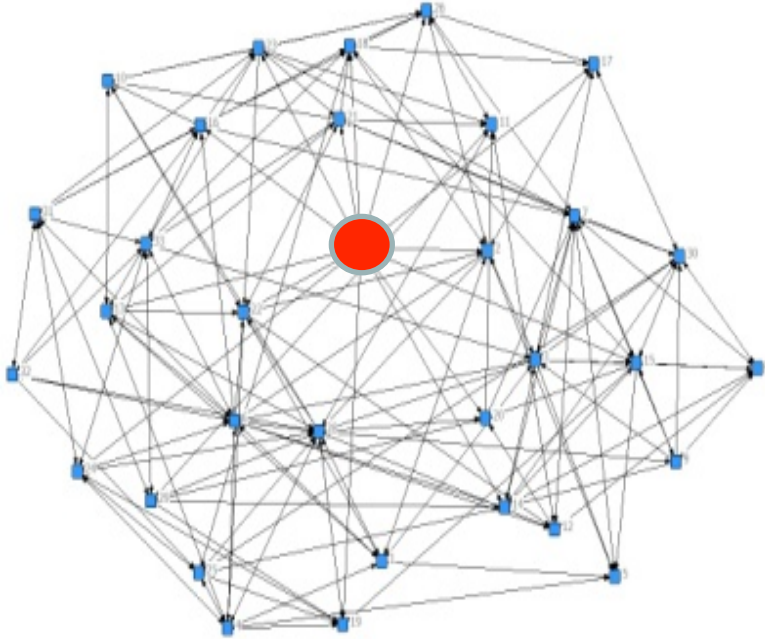
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# Comprehensiveness: more than incremental

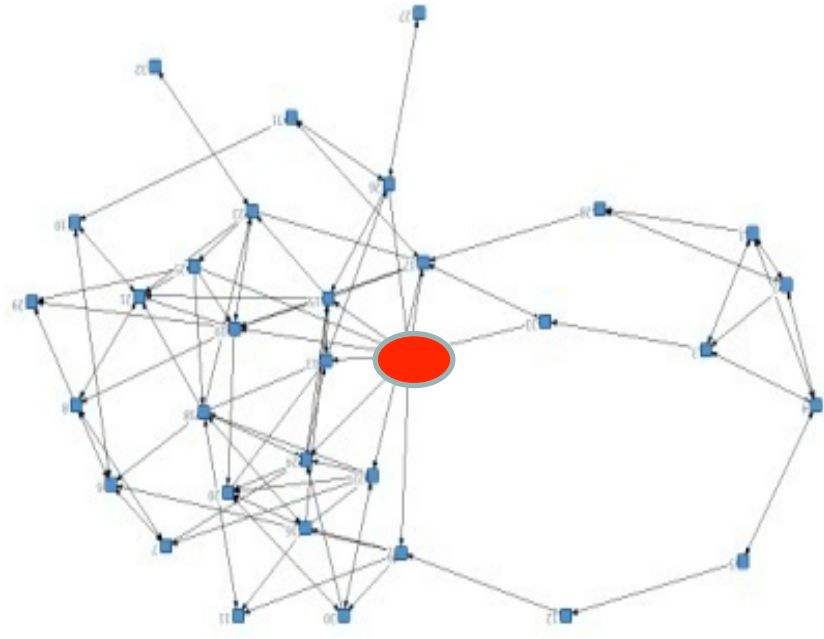
- Focus on existing systems only may result in maladaptation
  - and in missed opportunities
- Need to consider more systemic and transformational adaptations
  - increasingly so as changes continue



# Social support networks



A. Incremental adaptor



B. Transformational adaptor

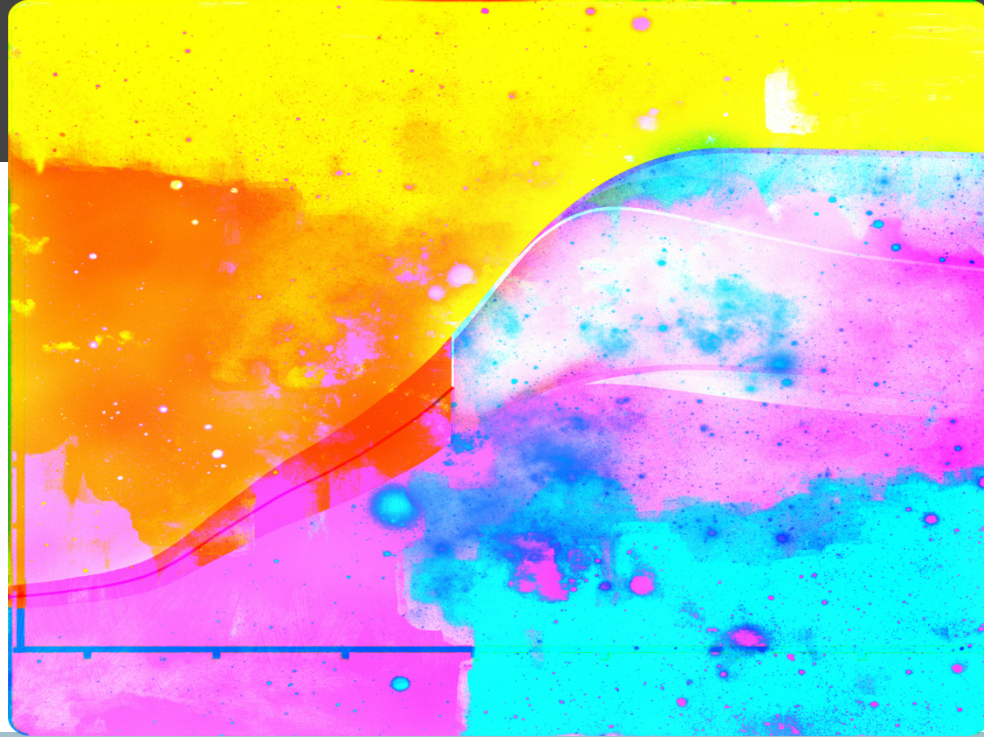


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*Thankyou*

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# Strategy for a changing climate

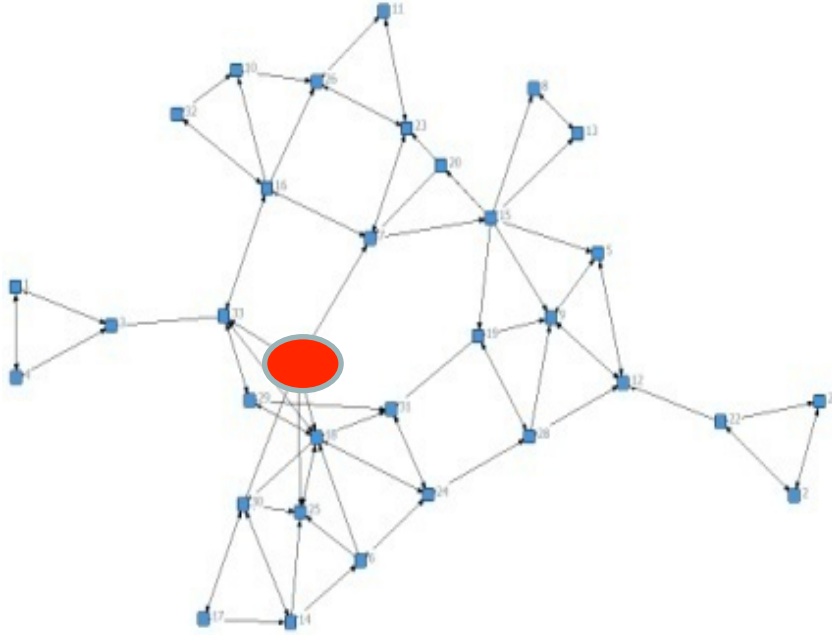
Solar farming is 'better money, safer money, easier money than farming' given climate changes.

*Peter Mailler*

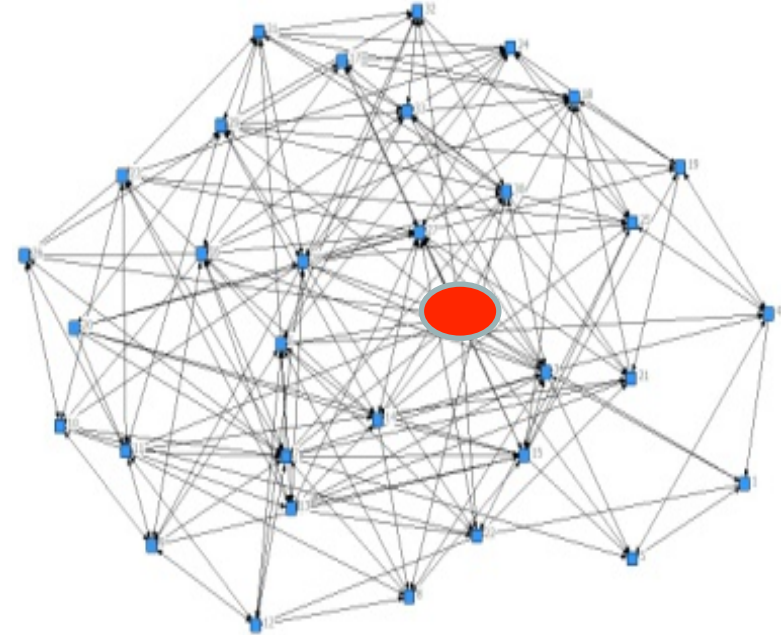




# Information networks



A. Incremental adaptor



B. Transformational adaptor