Australia's National Science Agency

Northern Australian rangelands under climate change: threats and adaptation strategies

RSPCA Seminar - Animal welfare in a changing climate

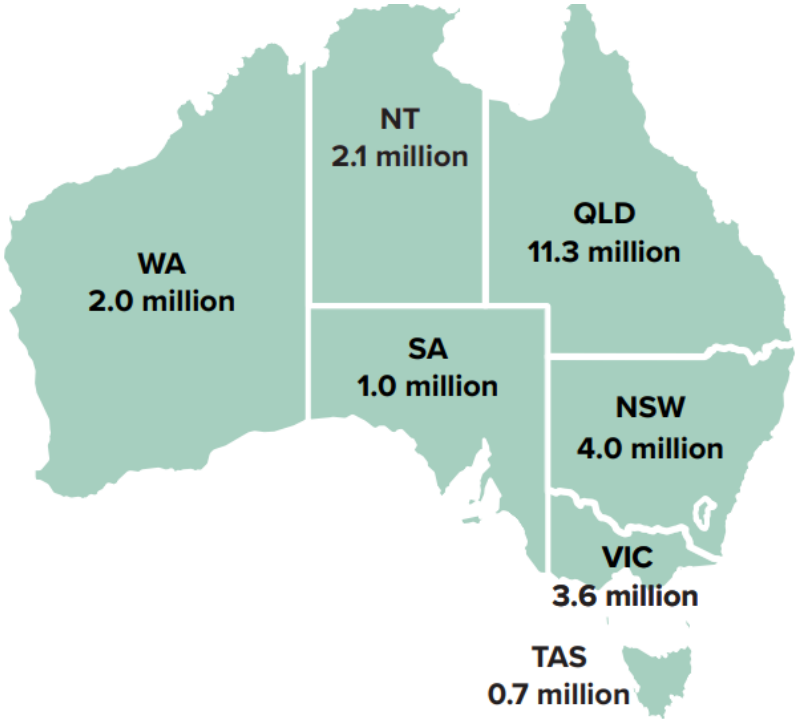
Dr. Cecile Godde| 17th February 2022

Brahman cattle, northern Queensland – Australia. Photo credits: C. Godde

Northern Australian rangelands

Australian rangelands

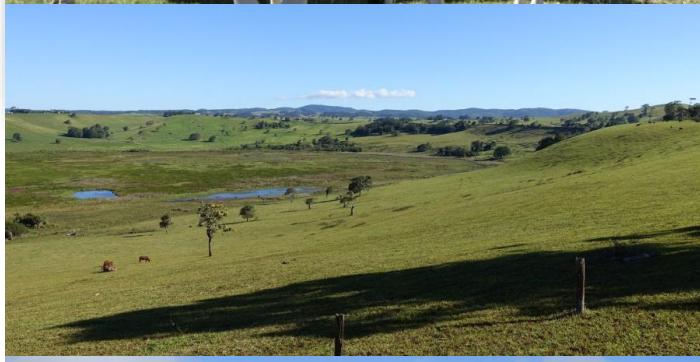
(Bastin and the ACRIS Management Committee, 2008)



Cattle numbers – as at June 2019

(MLA, 2020. Source Australian Bureau of Statistics and Australian Government Land and Coasts)

Other cited data from Chilcott et al. (2020) & Gleeson et al. (2012)



Brahman and Brahman cross cattle, northern Queensland – Australia. Photo credits: C. Godde

1. Impacts of climate change
2. Adaptation strategies
3. Concluding remarks

A complex dynamic system

Climate hazards

Climate change hazards

Changes in mean climate trends, overall variability and extreme events

- Atmospheric CO_2
- Tropospheric O_3
- Temperature
- Precipitation, sea level rise, storm surges

(Godde et al. 2021)

Climate hazards

Northern Australia - projected changes over the course of this century:

- Increases in **temperatures**
- Hotter and more frequent **hot days**
- Increased intensity of **heavy rainfall** events
- Increased **evaporation rates**
- Reduced **soil moisture**
- Harsher **fire**-weather climate

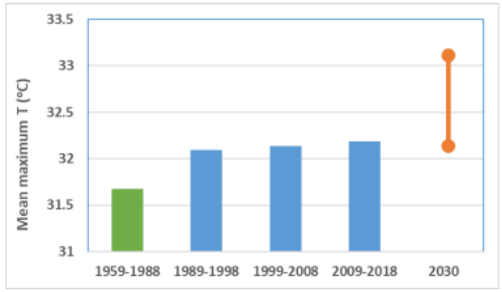
Less clear:

- Changes to **drought**
- Overall changes to **precipitation**

(CSIRO and Bureau of Meteorology Cluster reports - Dowdy et al., 2015; McInnes et al., 2015; Moise et al., 2015; Watterson et al., 2015)

Decadal mean maximum temperature

(a) Queensland



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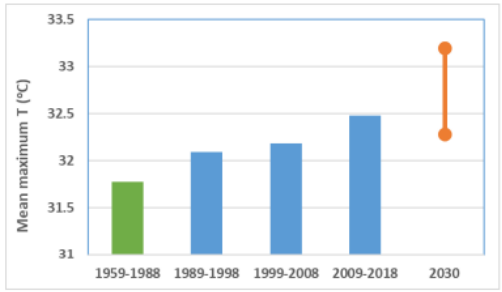

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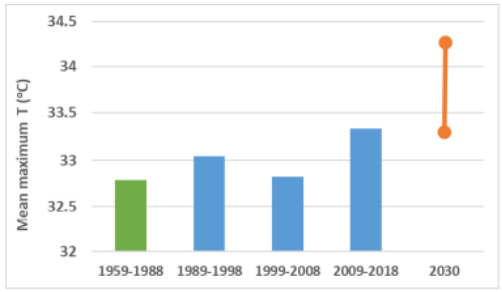

For 4 weather stations in QLD, 3 in NT, 3 in WA.
Chilcott et al. (2020) with projections based on Moise et al. (2015)

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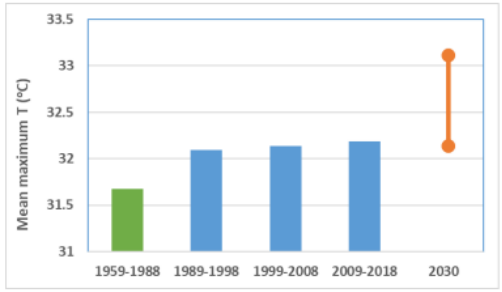

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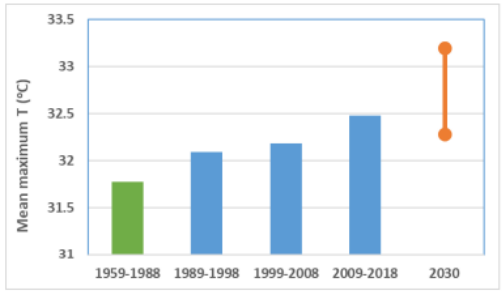

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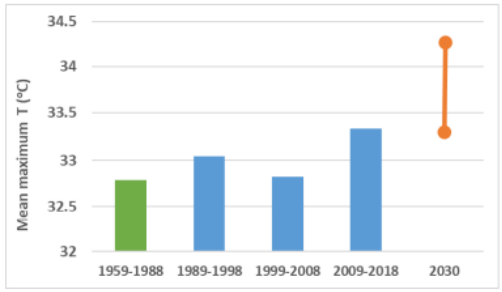
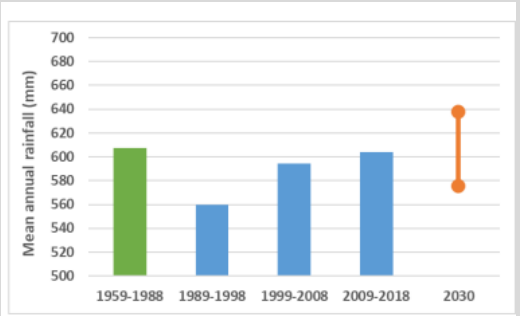
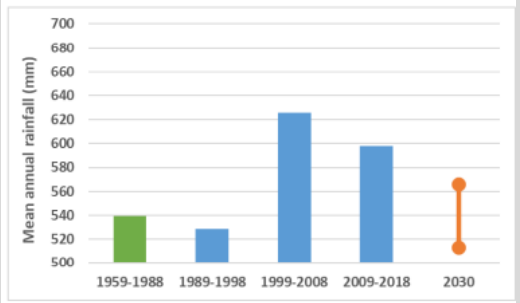
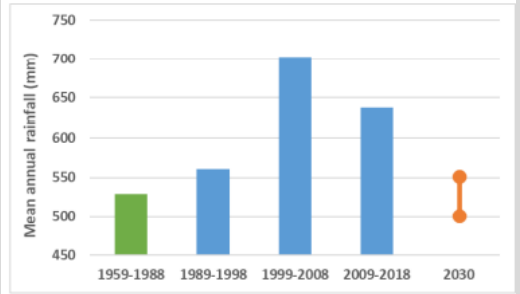


Decadal mean annual rainfall







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Decadal mean annual rainfall

No of days per year >40°C

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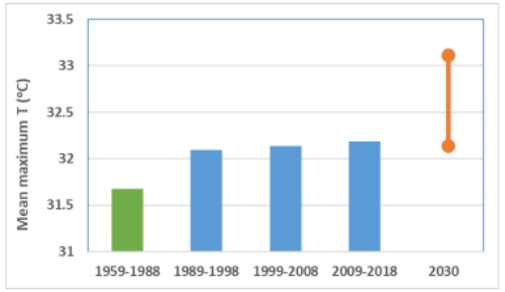

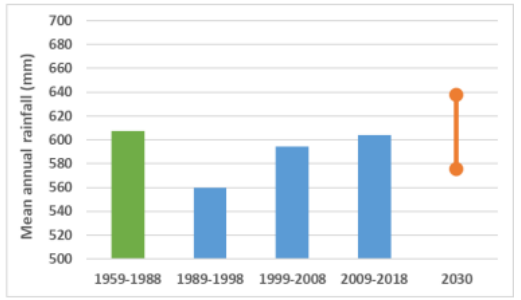

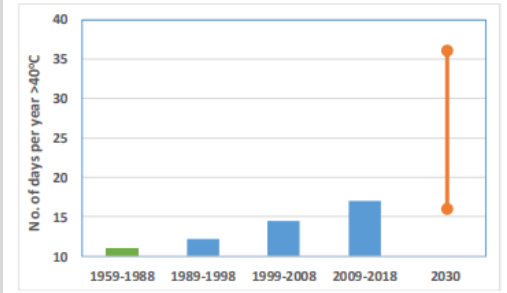

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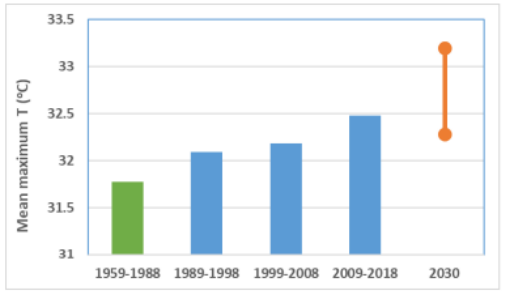

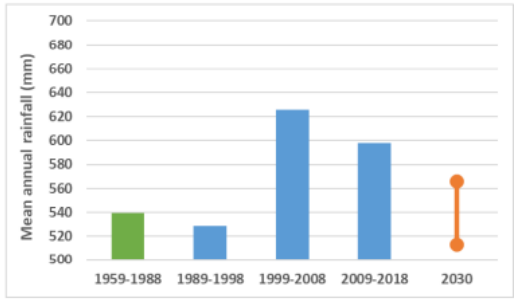

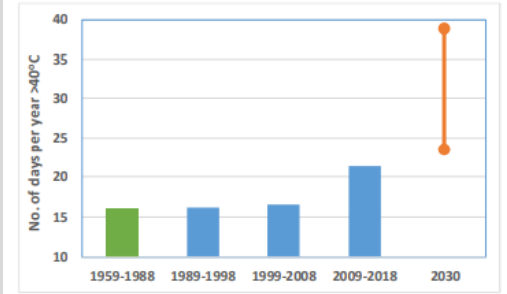

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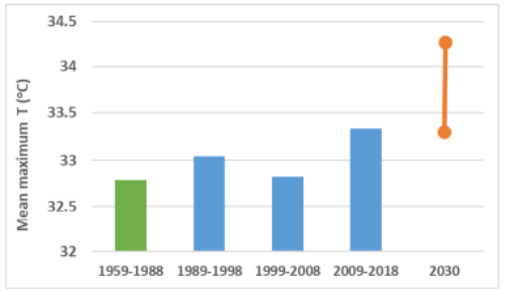

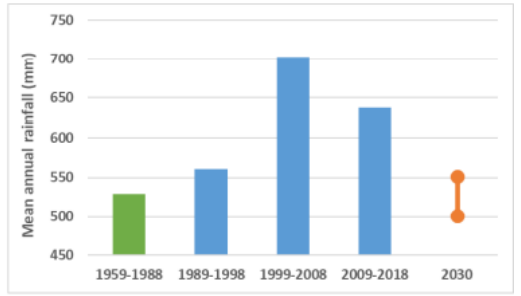

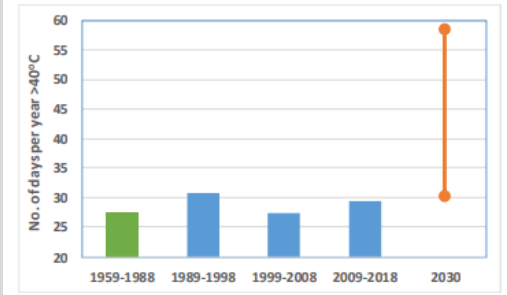

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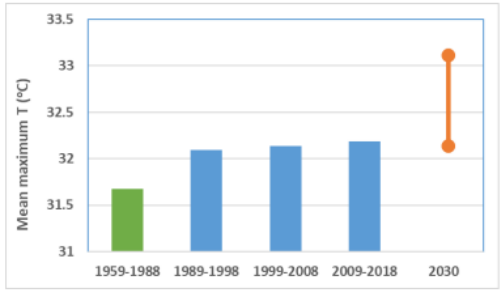

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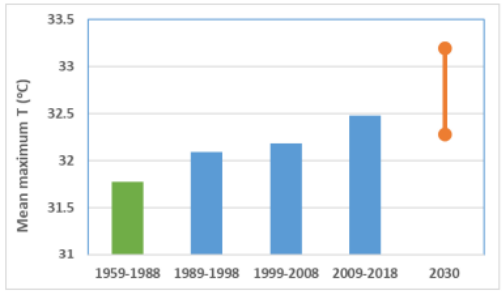

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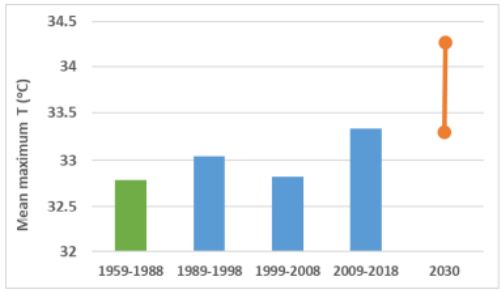
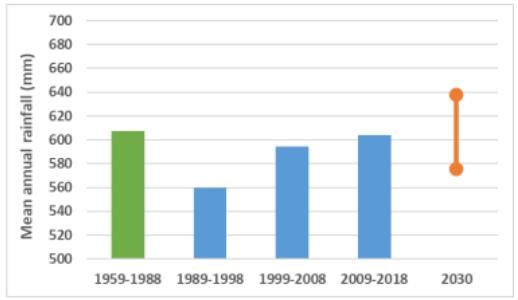
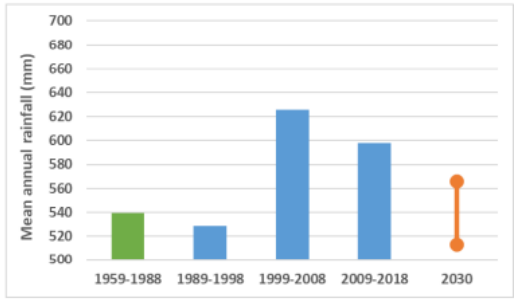
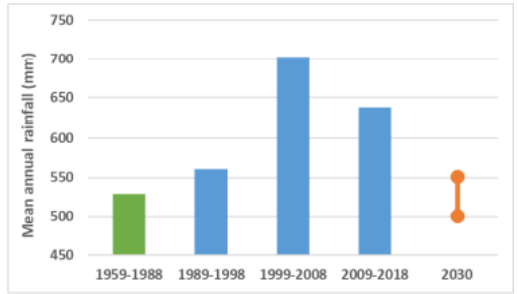


Decadal mean annual rainfall







No of days per year >40°C

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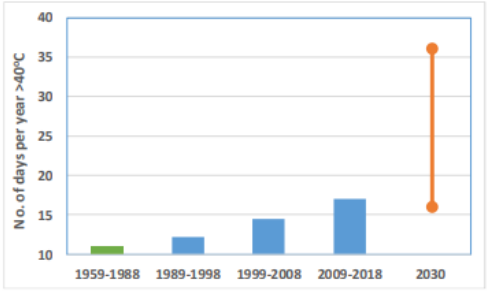

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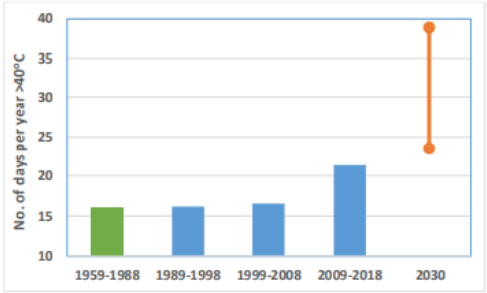

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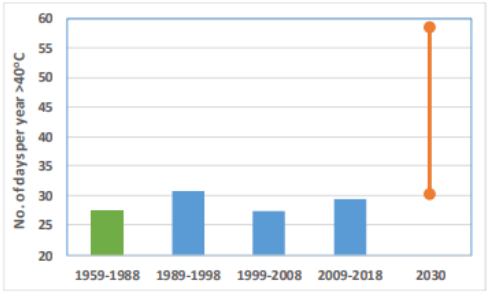
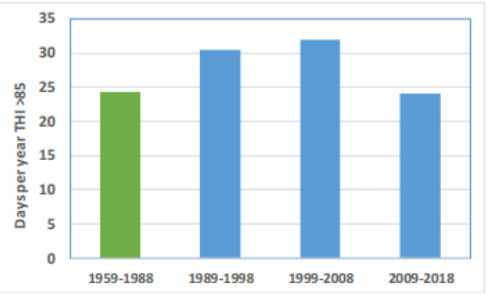
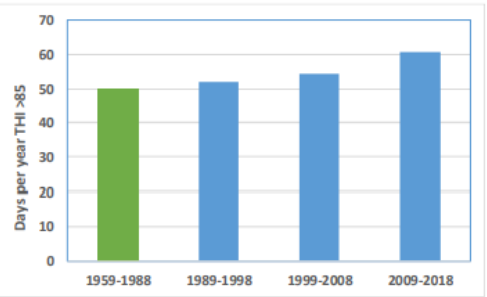
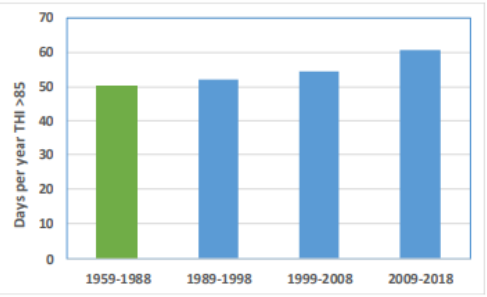


Days per year THI >85







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Climate impacts throughout the value chain

On-farm production

(e.g., feed yields, pests, weeds, pollinators, water quantity and quality, labour, prices)

Transportation

(e.g., labour, infrastructure, prices)

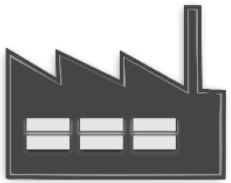
Climate change hazards

Changes in mean climate trends, overall variability and extreme events

- Atmospheric CO_2
- Tropospheric O_3
- Temperature
- Precipitation, sea level rise storm surges

Consumption

(e.g., availability, nutritional quality, food safety, sensorial appeal, price)



Processing

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Retailing

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Godde et al. (2021)

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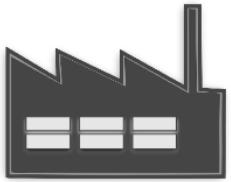

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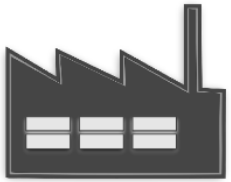

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E.g. Heat stress during transportation

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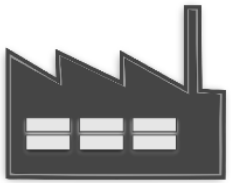

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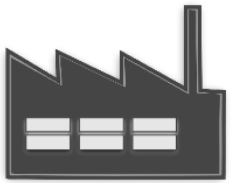

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Consumption

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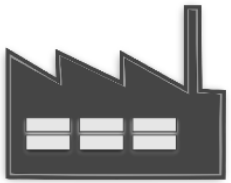
E.g. Societal concerns about climate change and animal welfare



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1. Impacts of climate change

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3. Concluding remarks

Adaptation strategies

Grazing and pasture management

- Select **forage species**
- Adjust **stocking rate** strategies
- Improve **water** management
- Improve **nutrient** management (legume sowing, P fertilisation where appropriate)
- Adjust **pests, diseases and weeds management** improve **fire** management

Brahman and Brahman cross cattle, northern Queensland – Australia. Photo credits: C. Godde

Chilcott et al. (2020), Stokes et al. (2012)

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Livestock management

- Select **animals**
- Modify **timing of mating, weaning and feed supplementation** based on seasonal conditions
- Provide extra **shade** and **water points**

Brahman and Brahman cross cattle, northern Queensland – Australia. Photo credits: C. Godde

Chilcott et al. (2020), Stokes et al. (2012)

Adaptation strategies

Managing stocking rates under high climate variability

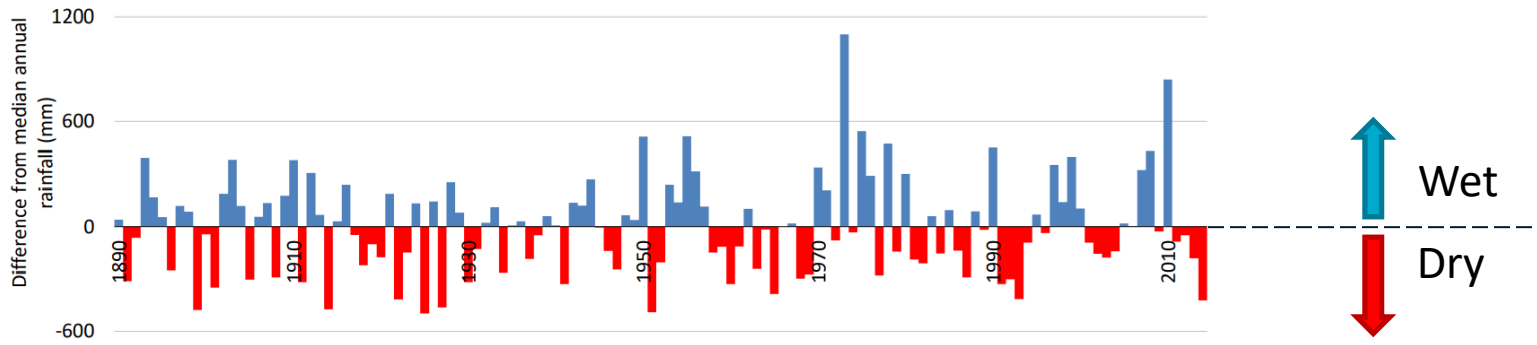

Figure 15 Runs of wet (blue columns) and dry (red columns) years at Chillagoe, Queensland
Source: Adapted from Charles et al. (2017)

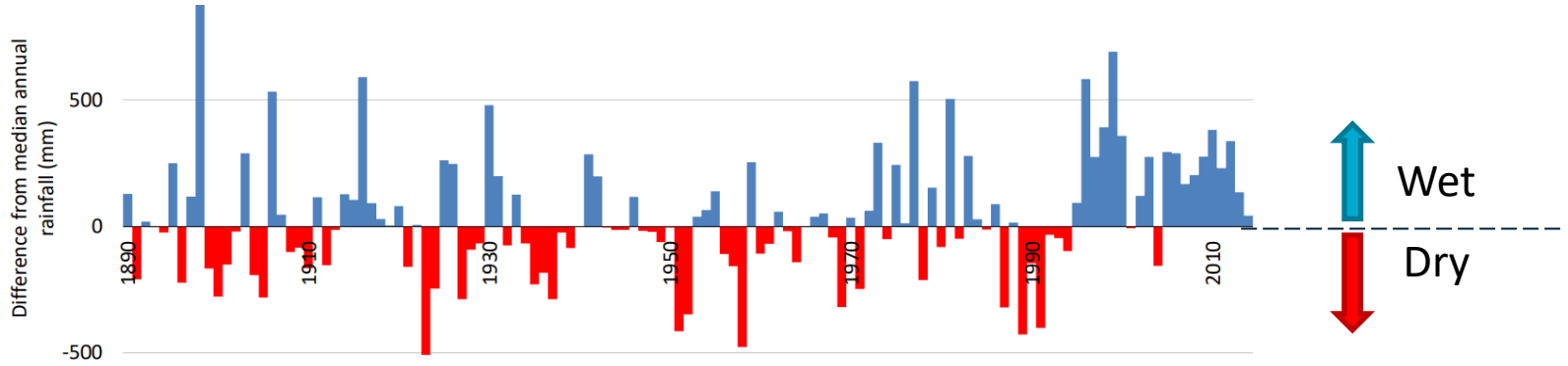

Figure 14 Runs of wet (blue columns) and dry (red columns) years at Derby, WA
Source: Adapted from Charles et al. (2017)

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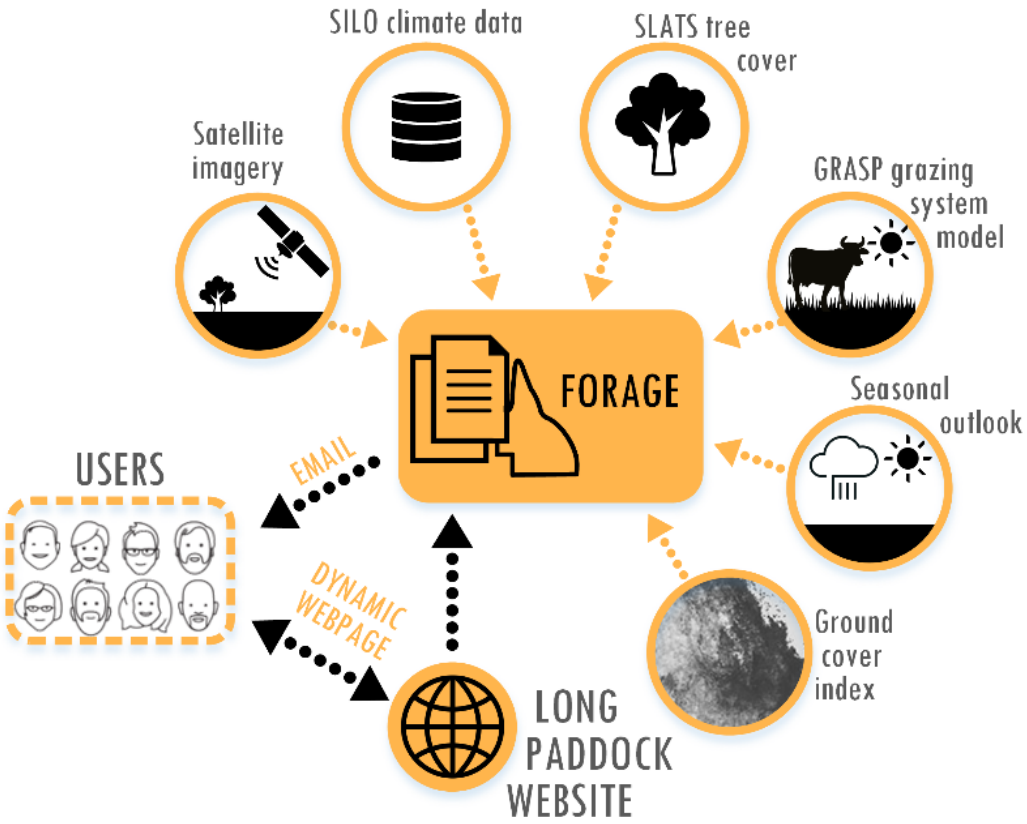
Adaptation strategies

Example of decision-support tools

Stocktake GLM App

stocktakeglm.com.au

FORAGE



longpaddock.qld.gov.au/forage

Adaptation strategies

Farm management

- Better **risk management plans**
- Use of climate forecasts, drought monitoring systems and other **decision support tools**
- **Diversify incomes** (carbon farming, solar, tourism, irrigation, horticulture, etc.)

Broad-scale adaptation

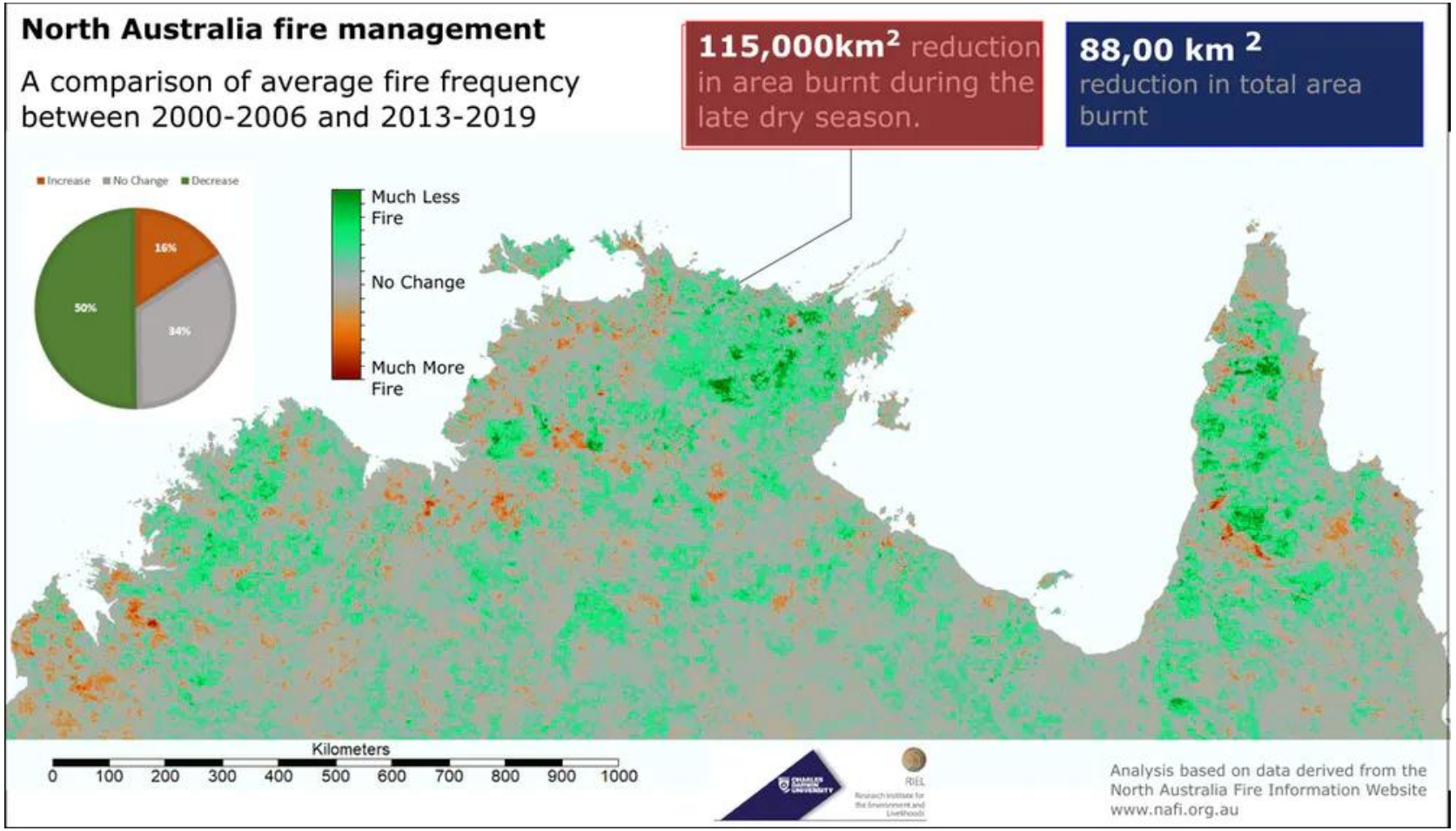
- **Include climate change considerations** into existing government policies and initiatives
- **Evaluate** adaptation options under climate change scenarios
- **Encourage** uptake of 'best practice'
- Provide adequate **buffering**
- **Adjust transport networks** to support changes in agricultural systems

northern Queensland – Australia.
Photo credits: C. Godde

Chilcott et al. (2020), Stokes et al. (2012)

Adaptation strategies

The value of local and traditional knowledge



How fire has changed in northern Australia (from Fisher, R. and Altman, J. at theconversation.com/the-worlds-best-fire-management-system-is-in-northern-australia-and-its-led-by-indigenous-land-managers-133071)

Decision-making in a changing world

Decision-making in a changing world

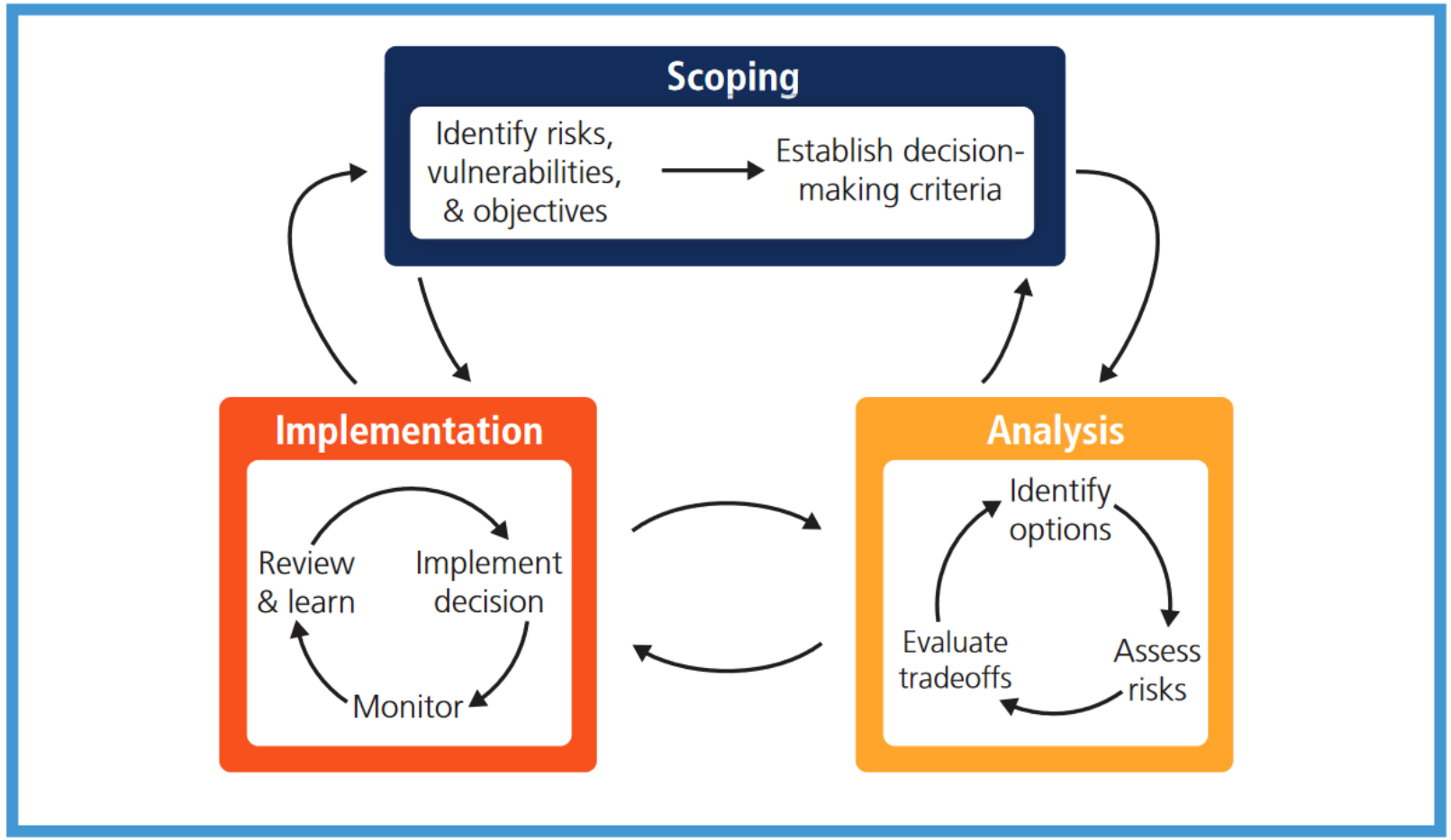


Figure SPM.3 | Climate-change adaptation as an iterative risk management process with multiple feedbacks. People and knowledge shape the process and its outcomes. [Figure 2-1]

IPCC (2014)

1. Impacts of climate change
2. Adaptation strategies

3. Concluding remarks

Concluding remarks

- **Adaptation choices will need to account for a wide range of possible futures**, including those with low probability but large consequences
- Existing suite of **adaptation** strategies **may not be enough**
- **All dimensions** of sustainability must be considered
- **Barriers** to the implementation and maintenance of adaptation strategies
- **However, various opportunities exist**, incl. carefully blending local knowledge with modern science and technology

Context-specific and timely **options** and **enabling environments** are essential to facilitate the widespread adaptation required to cope with climate change.

northern Queensland – Australia.
Photo credits: C. Godde

Thank you

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