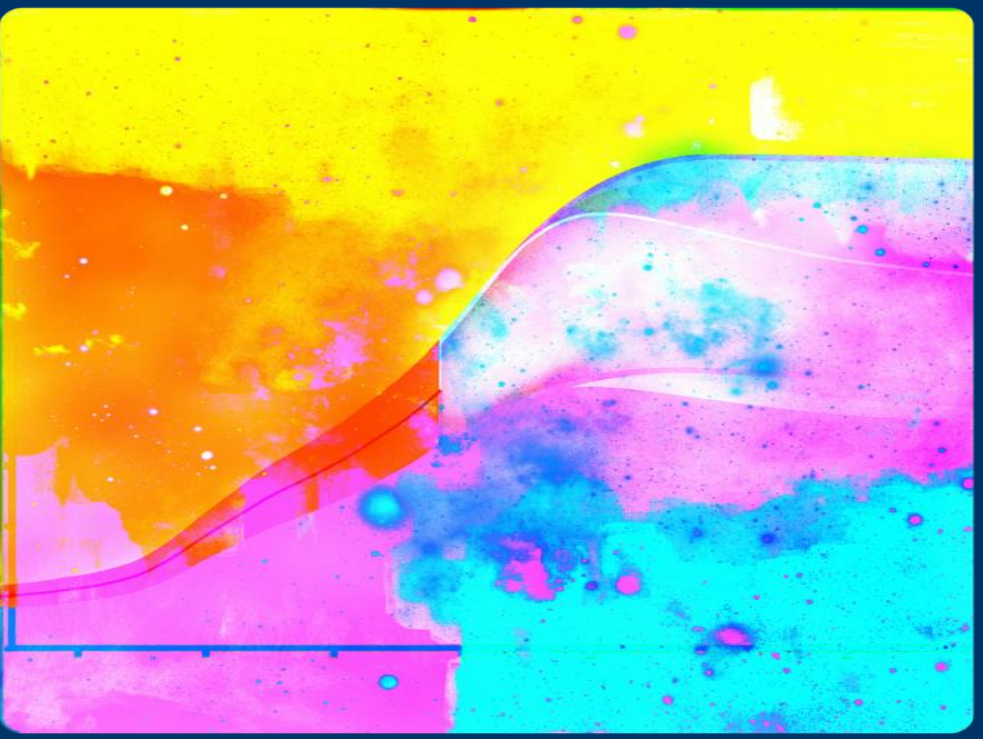
Biodiversity and Ecosystem Services - Risks at 1.5°C and 2°C



IPCC Special Report on Global Warming of 1.5°C

Dr. Jeff Price and Professor Rachel Warren,
Tyndall Centre for Climate Change Research, Trondheim Conferences on Biodiversity, 2019

Chapter 3 Impacts of 1.5°C Warming on Human and Natural Systems: CLAs and LAs

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Jason Florio / Aurora Photos

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Key messages

- Climate change is already affecting people, ecosystems and livelihoods all around the world
- Limiting warming to 1.5°C is not impossible but would require unprecedented transitions in all aspects of society.
- There are clear benefits to keeping warming to 1.5°C compared to 2°C, or higher. Every bit of warming matters.
- Limiting warming to 1.5°C can go hand-in-hand with achieving other global goals.

Lower risks to natural and human systems at 1.5°C compared to 2°C

- Limiting warming to 1.5°C compared to 2°C lowers risks to terrestrial, freshwater and coastal ecosystems retaining more of their services to humans

- Climate-related risks to health, livelihoods, food security, water supply, human security increase with 1.5°C warming and further with 2°C warming

Lower impacts in Arctic and Marine Ecosystems

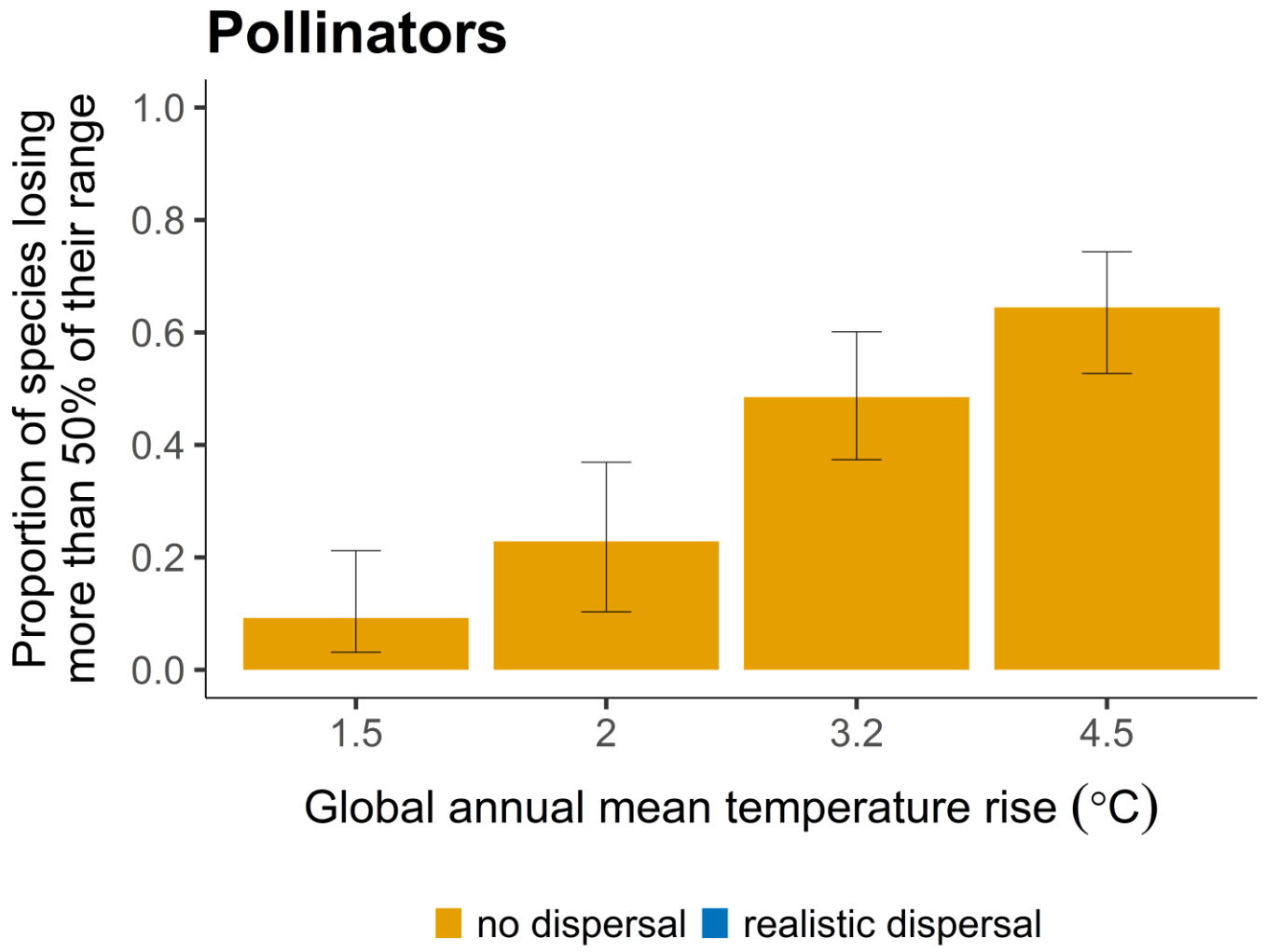
- At 1.5°C Arctic summer sea ice persists for 99 in 100 years. At 2°C one in every 10 summers ice free
- At 1.5°C 70-90% decline in existing healthy coral reefs. At 2°C >99% decline
- Thawing of 1.5-2.5 million km^2 permafrost avoided if warming limited to 1.5°C rather than 2°C

Lower impacts in terrestrial ecosystems at 1.5°C

- Range losses of 50% or more projected in around 6% insects, 8% plants and 4% vertebrates at 1.5°C. At 2°C this rises to around 18% insects, 16% plants and 8% vertebrates
- About 6.5% terrestrial land area projected to change from one biome to another at 1.5°C. At 2°C this rises to 13%.
- Above 1.5°C: expansion of desert in the Mediterranean biome causing changes unparalleled in the last 10,000 years

Proportion of key pollinators losing >50% range

- **Key agricultural pollinators: bees, hoverflies**
- **Risks small at 1.5C warming globally but not regionally**



Source: Warren, R., Price, J., Graham, E., Forstenhaeusler N., Vanderwal J. 2018. The projected effect on insects, vertebrates and plants of limiting global warming to 1.5°C rather than 2°C. *Science* 360,791-795

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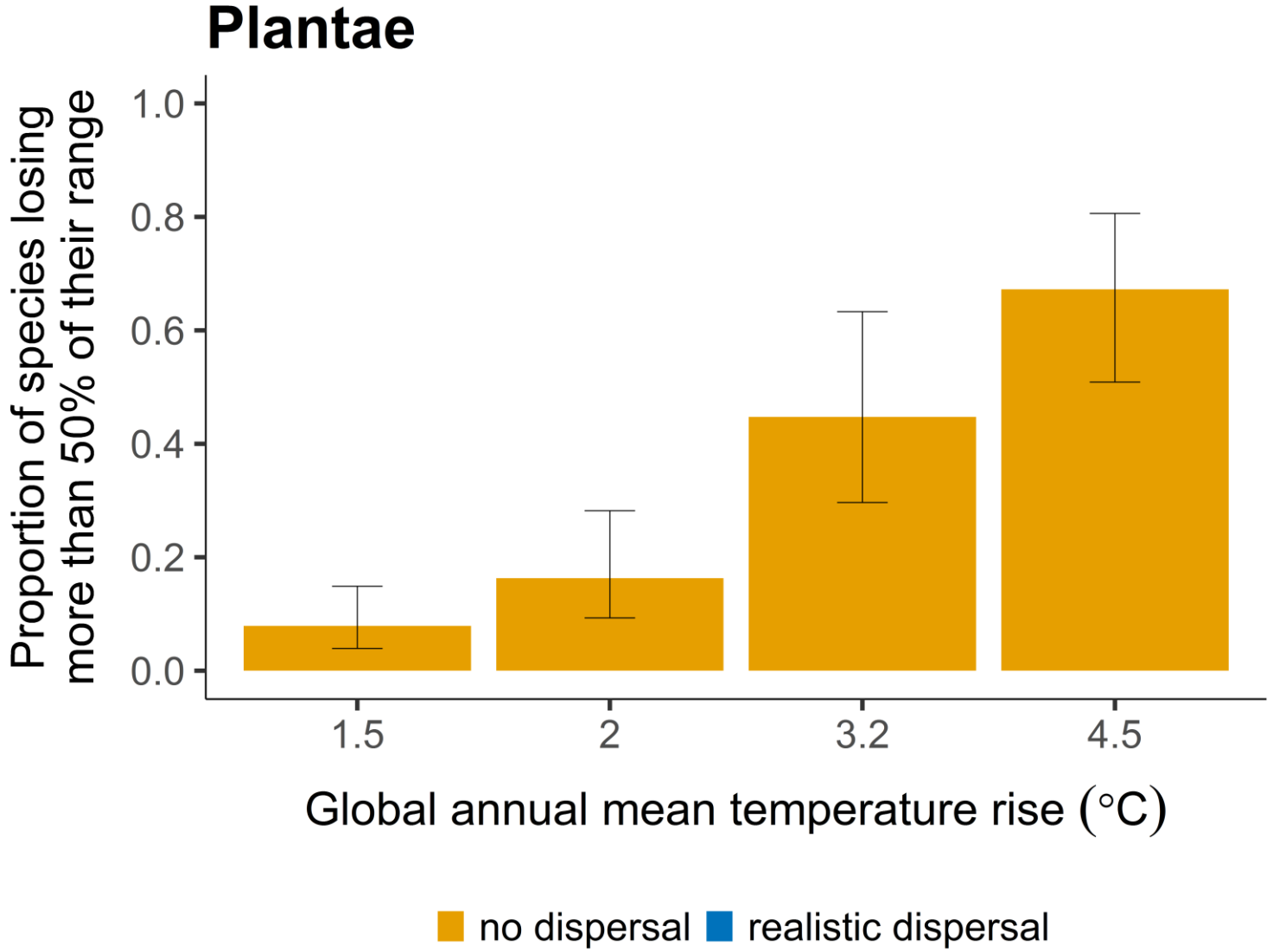
University of East Anglia

Proportion of plants losing >50% range

- At 3.2°C warming, range losses >50% projected in 44% plants
- At 2°C : 16% plants
- At 1.5°C: 8% plants
- When warming is limited to 1.5°C as compared with 2°C, numbers of species projected to lose >50% of their range are reduced by ~50% in plants



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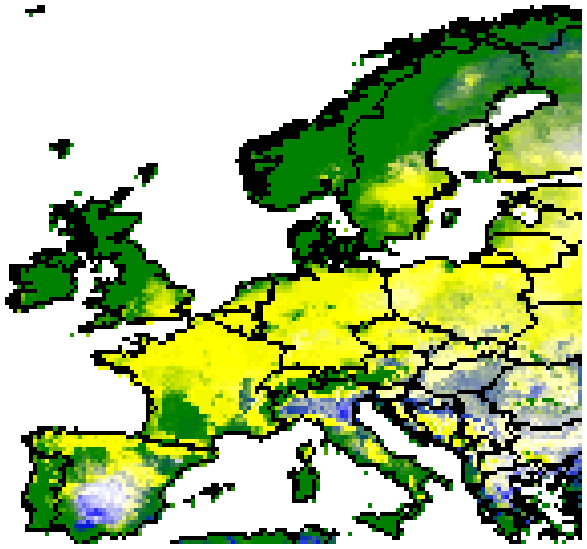
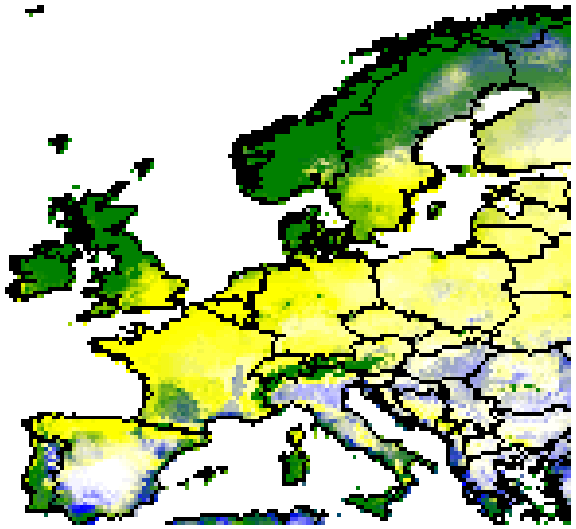
Source: Warren, R., Price, J., Graham, E., Forstenhaeusler N., Vanderwal J. 2018. The projected effect on insects, vertebrates and plants of limiting global warming to 1.5°C rather than 2°C. *Science* 360,791-795

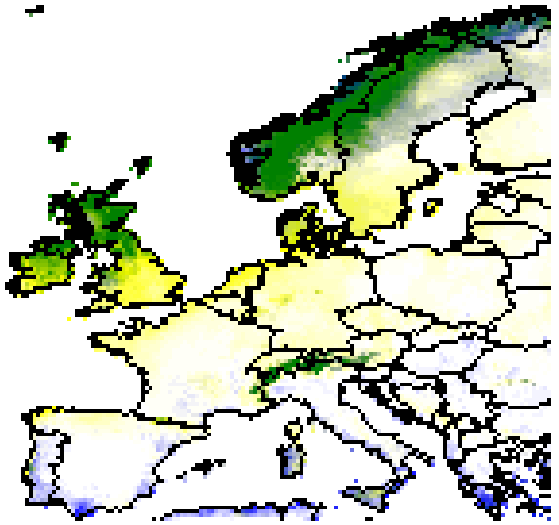
Refugia of pollinators versus flowering plants



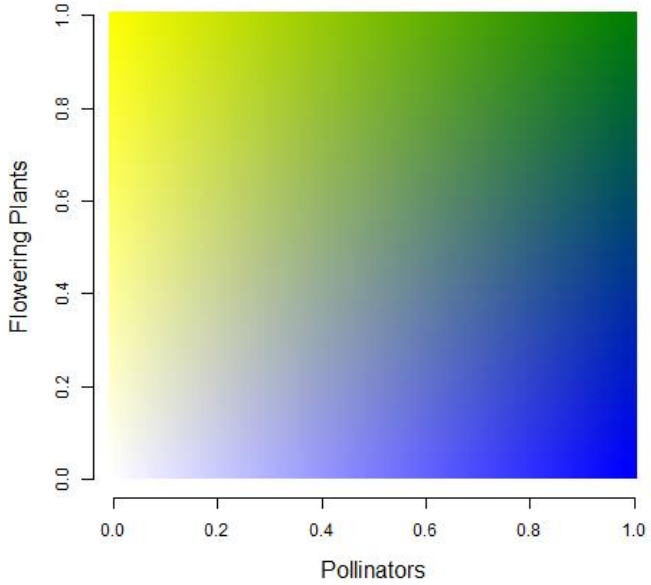
1.5°C



2°C



3.2°C



Refugia are areas remaining climatically suitable for >75% of the species modelled

Adaptation

- Most adaptation needs will be lower for global warming of 1.5°C compared to 2°C
- Limits to adaptation and adaptive capacity for some human and natural systems at global warming of 1.5°C, with associated losses

Adaptation interactions with Mitigation

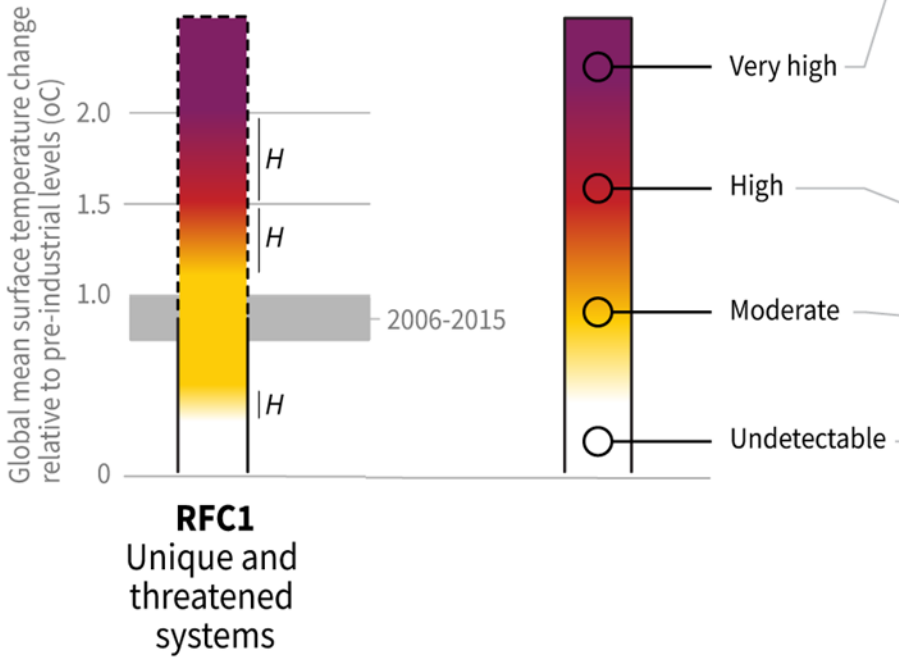
- Large-scale deployment of land-based CDR would have far-reaching implications for land and water availability (high confidence). BECCU impacts > BECCS

- This may impact food production, biodiversity and the provision of other ecosystem services (high confidence).

- Afforestation and reforestation **may** be associated with significant co-benefits if implemented appropriately, but they feature large land and water footprints if deployed at large scales (medium confidence).

- The impacts of deploying land-based CDR at large scales can be reduced if a wider portfolio of CDR options is deployed, and if increased mitigation effort focuses on strongly limiting demand for land, energy and material resources, including through lifestyle and dietary changes (medium confidence).

Reasons for Concern : Example Unique and Threatened Systems



Purple indicates very high risks of severe impacts/risks and the presence of significant irreversibility or the persistence of climate-related hazards, combined with limited ability to adapt due to the nature of the hazard or impacts/risks.

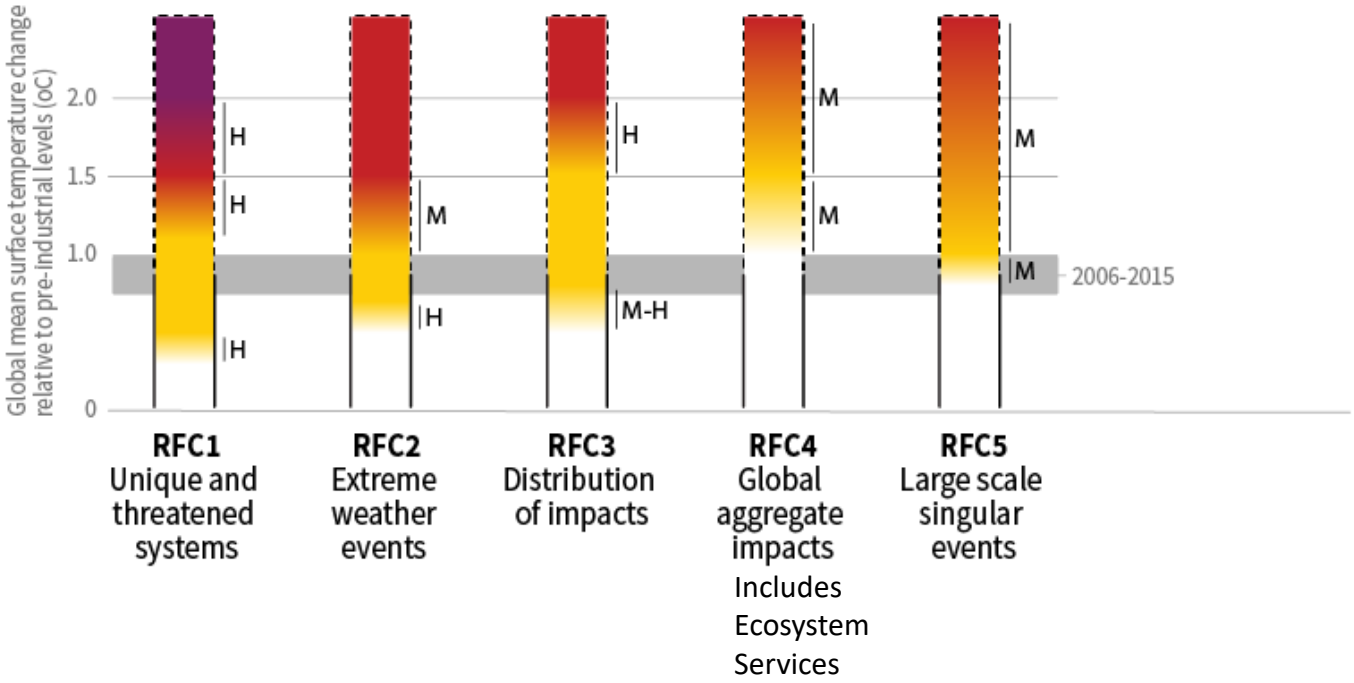
Red indicates severe and widespread impacts/risks.

Yellow indicates that impacts/risks are detectable and attributable to climate change with at least medium confidence.

White indicates that no impacts are detectable and attributable to climate change.

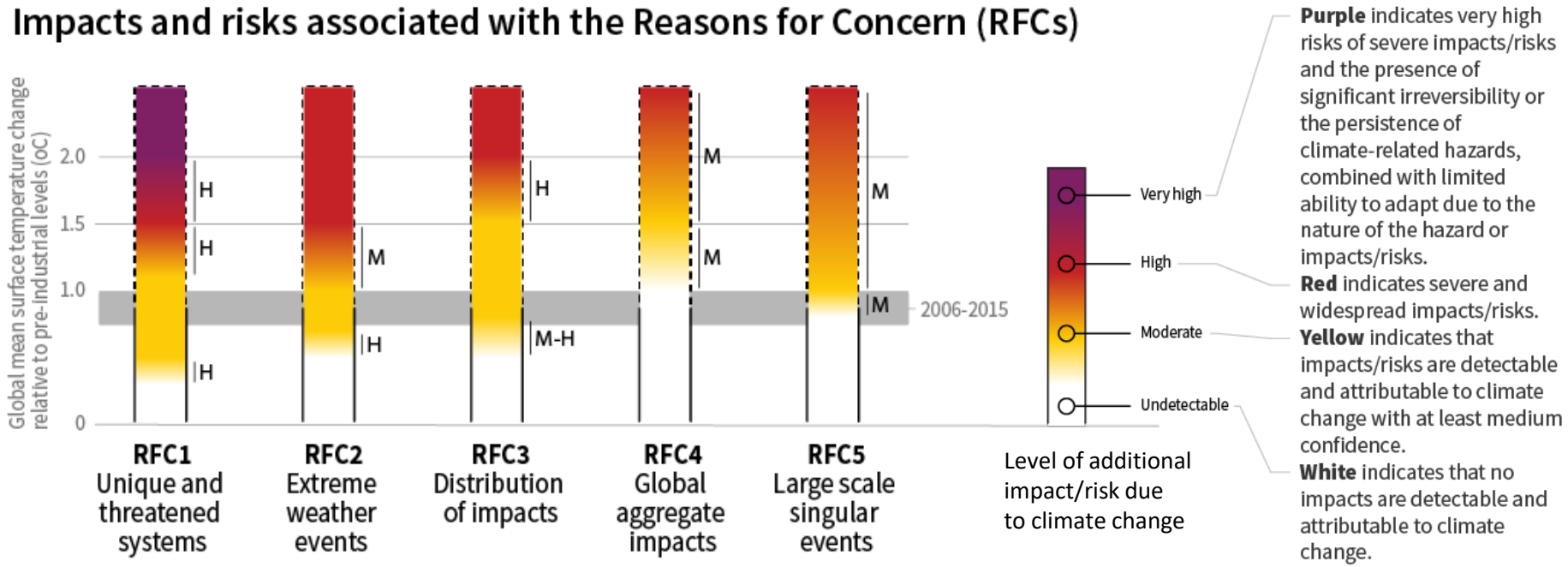
SPM2 | How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems

Impacts and risks associated with the Reasons for Concern (RFCs)



Confidence level for transition: L=Low, M=Medium, H=High and VH=Very high

SPM2 | How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems



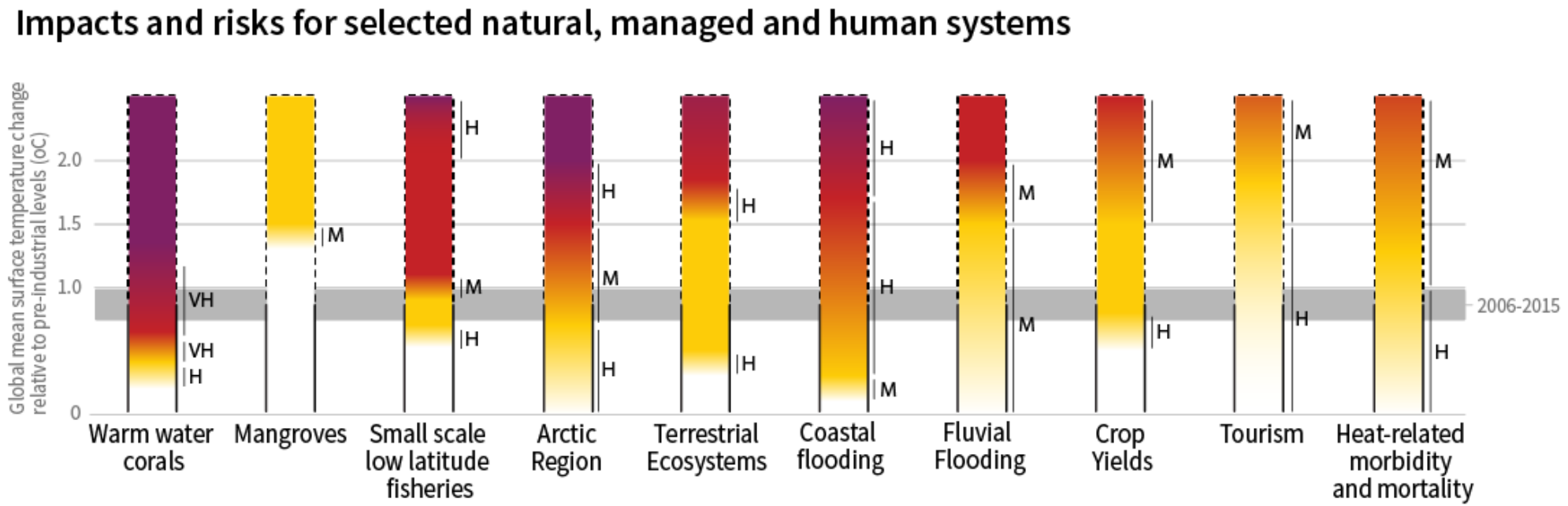
Confidence level for transition: L=Low, M=Medium, H=High and VH=Very high

Increased Concern

Assessed levels of risk have increased since AR5 for global warming of 2°C.

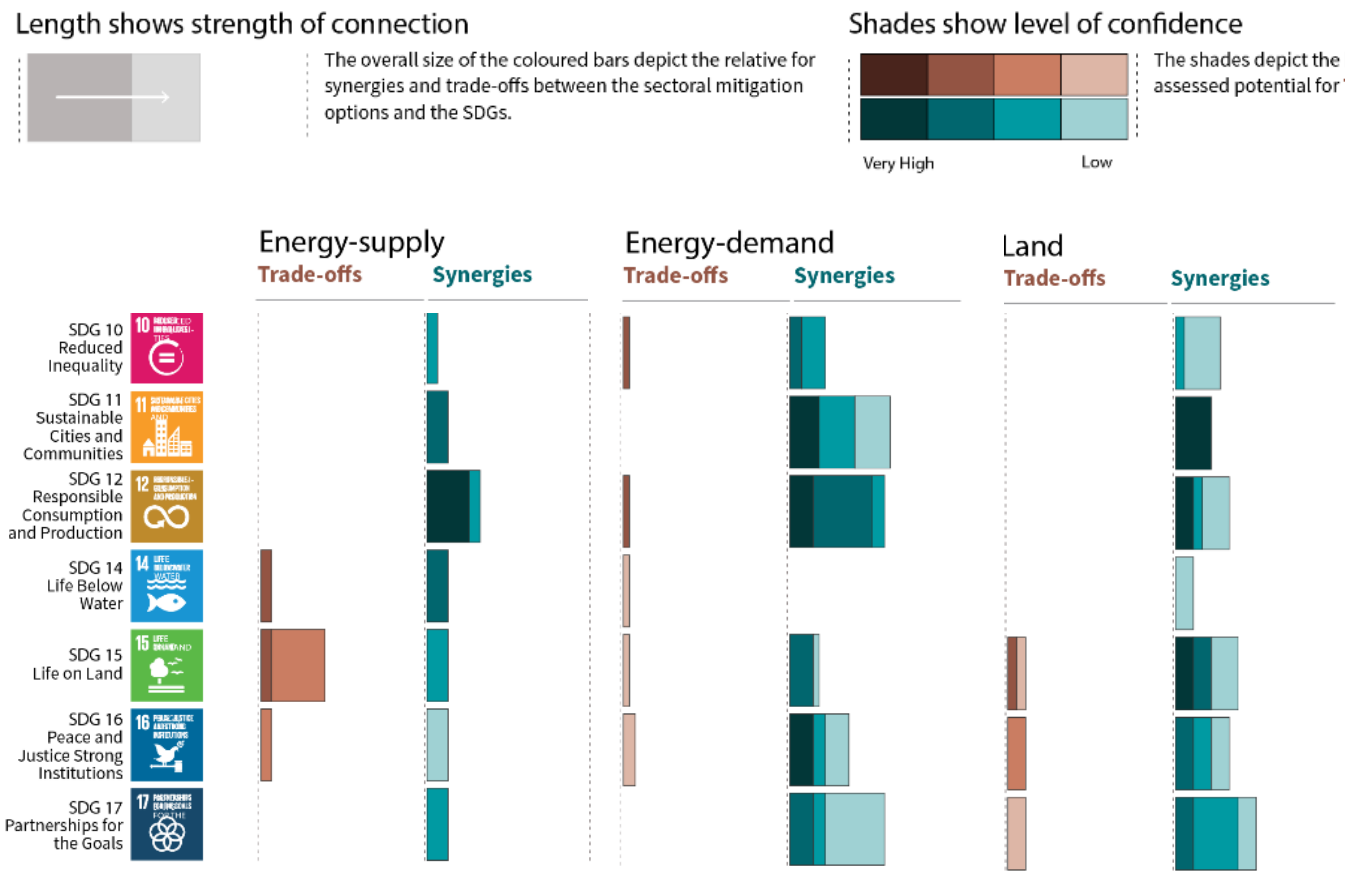
- Transition from high to very high risk between 1.5 and 2°C for RFC1 (Unique and threatened systems) (Arctic and Corals)
- Transition from moderate to high risk between 1°C and 2°C for RFC3 (Distribution of impacts)
- Global aggregate impacts includes ecosystem services and global biodiversity risks

SPM2 | How the level of global warming affects impacts and/or risks associated with the Reasons for Concern (RFCs) and selected natural, managed and human systems



Confidence level for transition: L=Low, M=Medium, H=High and VH=Very high

SPM4 | Indicative linkages between mitigation and sustainable development using SDGs (the linkages do not show costs and benefit)

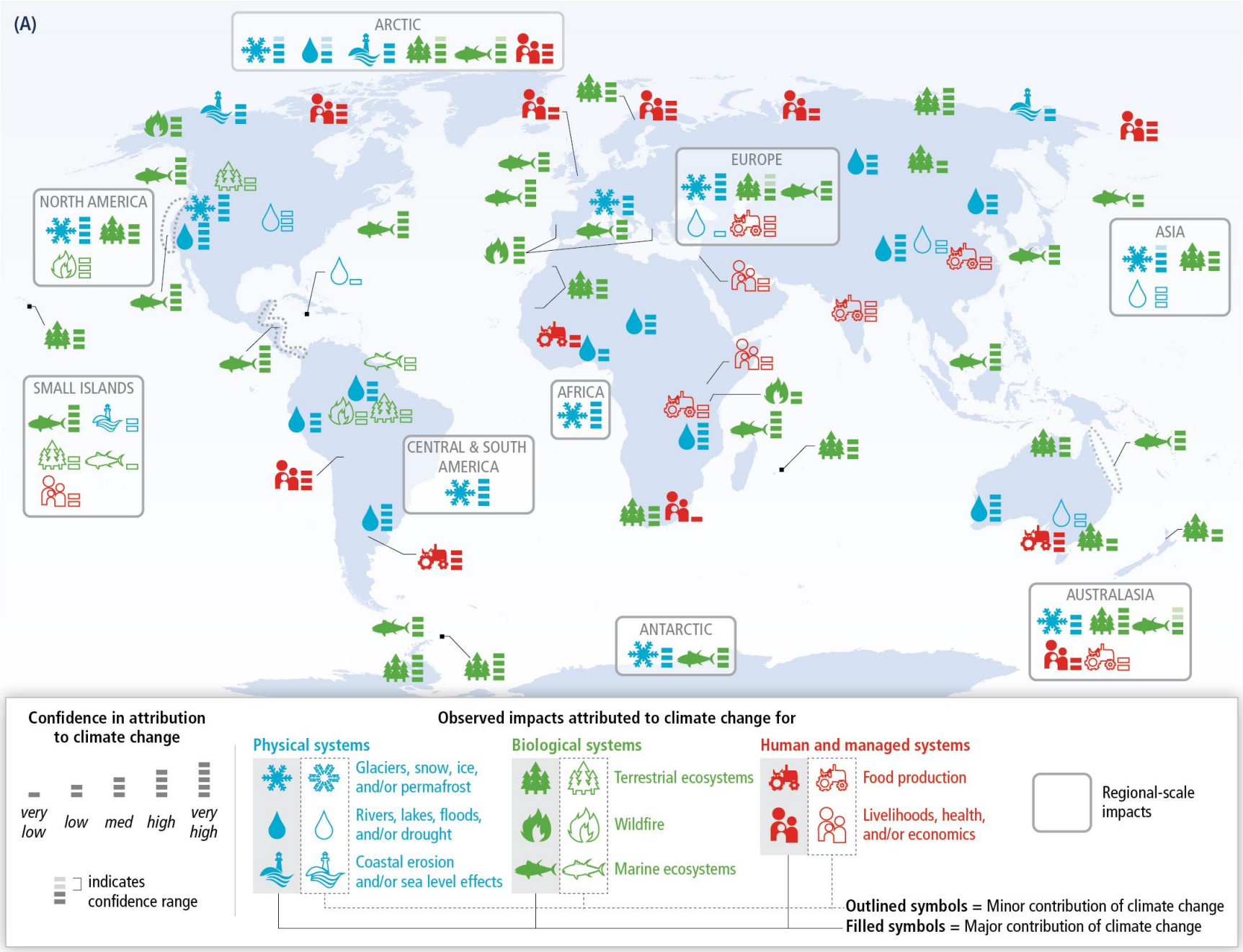


Are changes occurring?

- TAR (3rd Assessment Report) – “Recent regional changes in climate, particularly increases in temperature, have already affected hydrological systems and terrestrial and marine ecosystems in many parts of the world (see Table SPM-1).”

- These links were further documented, wording strengthened and confidence levels raised in the 4th and 5th Assessment Reports (especially on attribution).

Observed Changes in Ecological Systems



Source: Field *et al.* in IPCC (2014)

Since AR5?

- The amount of peer-reviewed literature on climate change and biodiversity has steadily increased (1378 in 2014 to 2160 in 2018 and 1179 already in 2019).

- Large scale meta-analyses show that, in general, different techniques are yielding similar results in projections of change.

- There are increasing numbers of papers linking observed changes with previously projected changes – directly and indirectly.

- New reports – IBPES, IPCC, others

Local Extinctions (example)

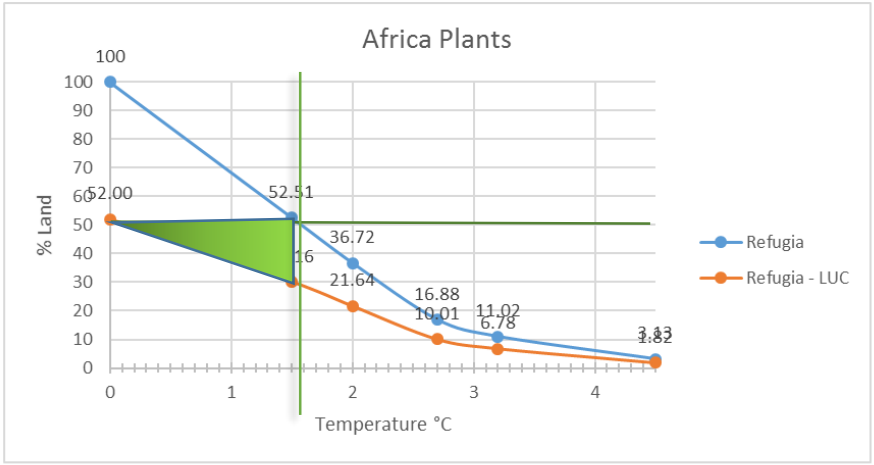
- 47% of the 976 species surveyed have seen climate related local extinctions; findings suggest that climate related local extinctions are already widespread

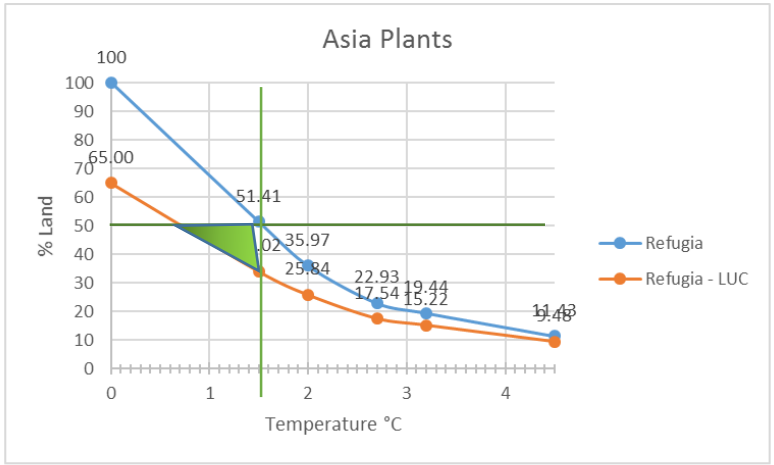
- Findings are higher in tropical than temperate regions (55% v. 39%); animals more than plants (50% v. 39%); and freshwater than marine and terrestrial (74% v. 51% v. 46%)

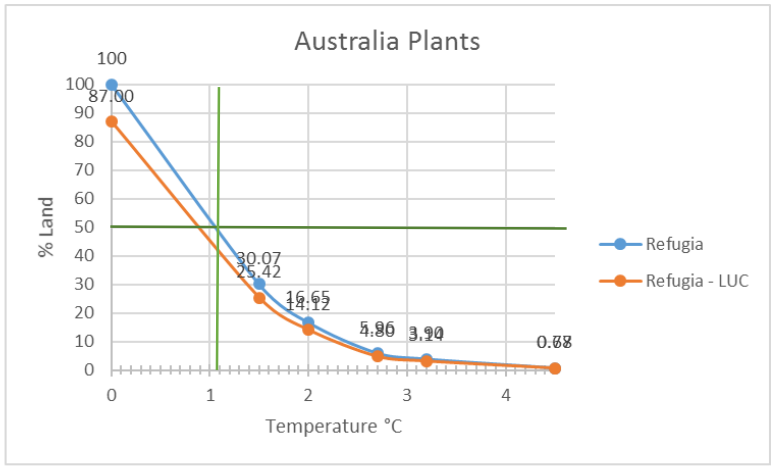
  - Wiens, J. 2016. Climate-related local extinctions are already widespread among plant and animal species. PLOS Biology

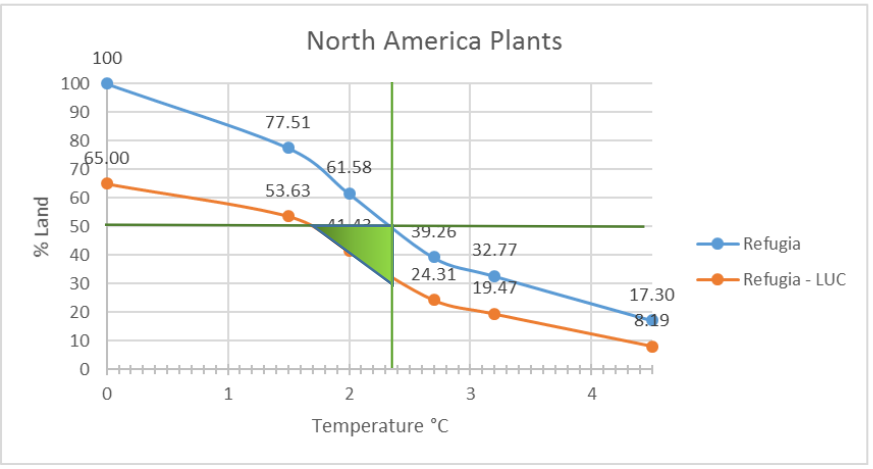
Is Half for Nature Possible? Climate versus Land-use change - what's already lost – Plants (% of land identified as a refugia for plants);

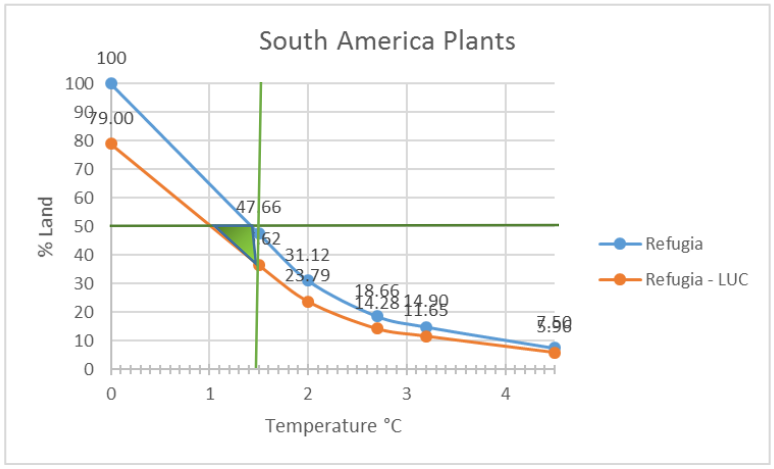
1.5°C is the limit for 50% conservation in all regions except North America

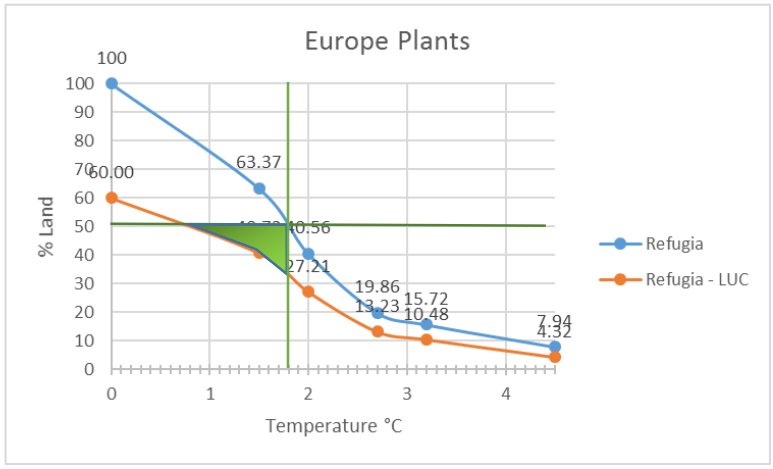












Restoration needed to keep pace with warming

Draft – not for distribution (paper in preparation)


Thank you for
your attention