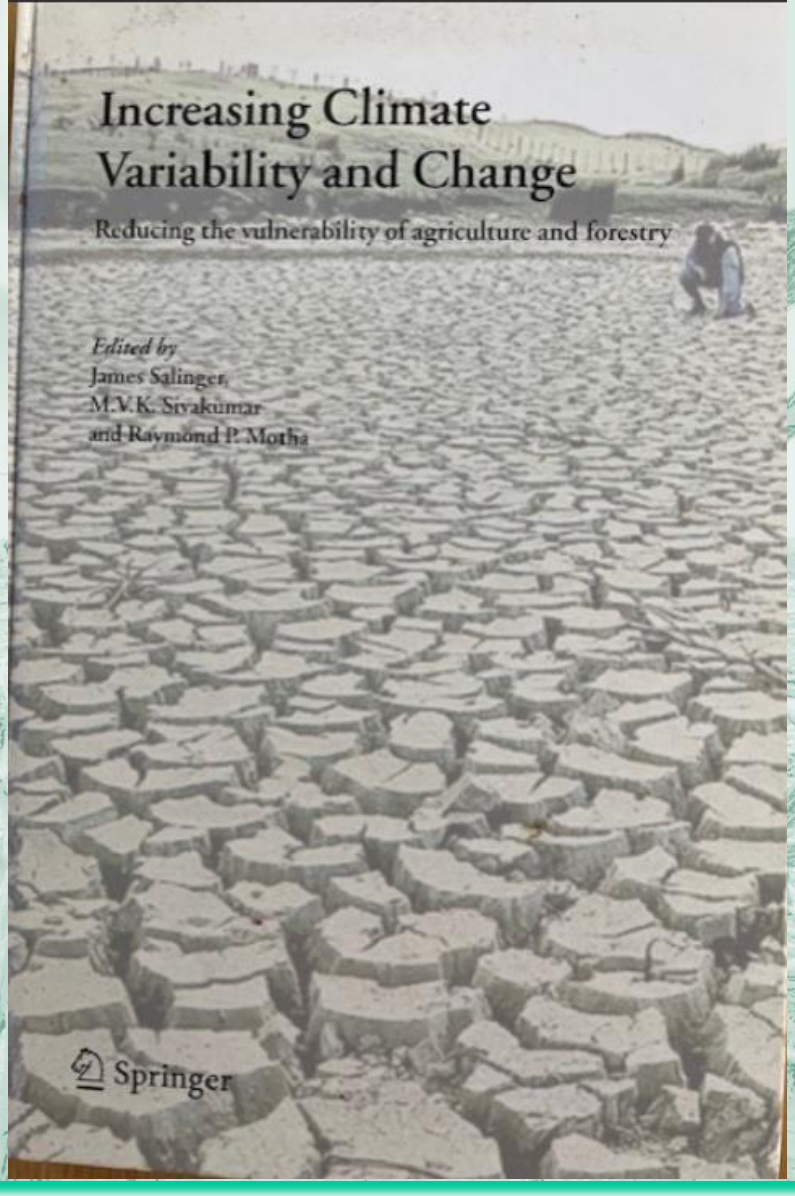

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Increasing climate variability and climate change in agriculture & forestry

Dr Jim Salinger

Former WMO CAgM President, 2007 IPCC Nobel Peace Prize Contributor

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OUTLINE

- Increasing Climate Variability
- Climate Change
- Changes in Significant Climate Extremes
- Forestry
- Changes required

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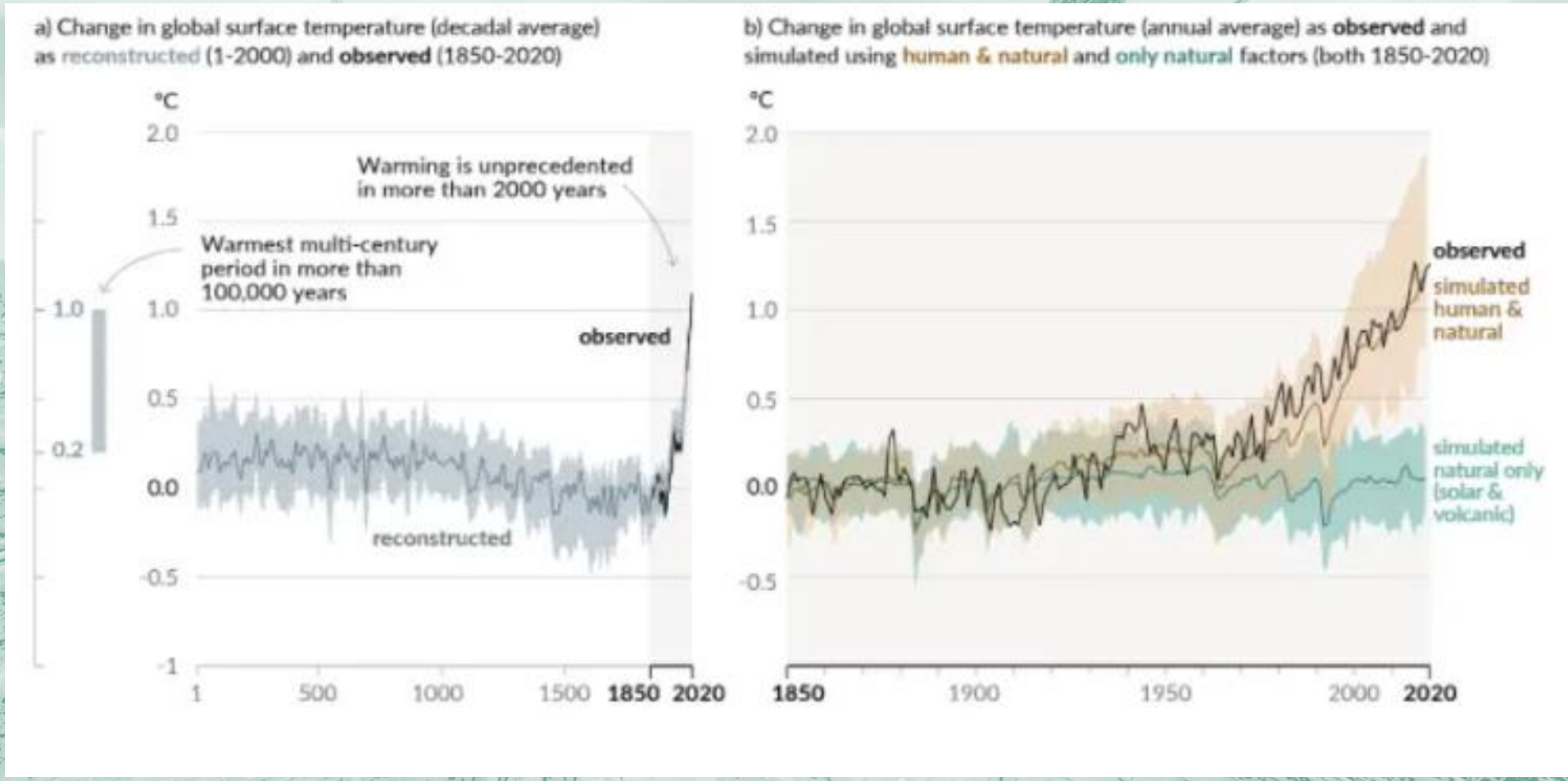

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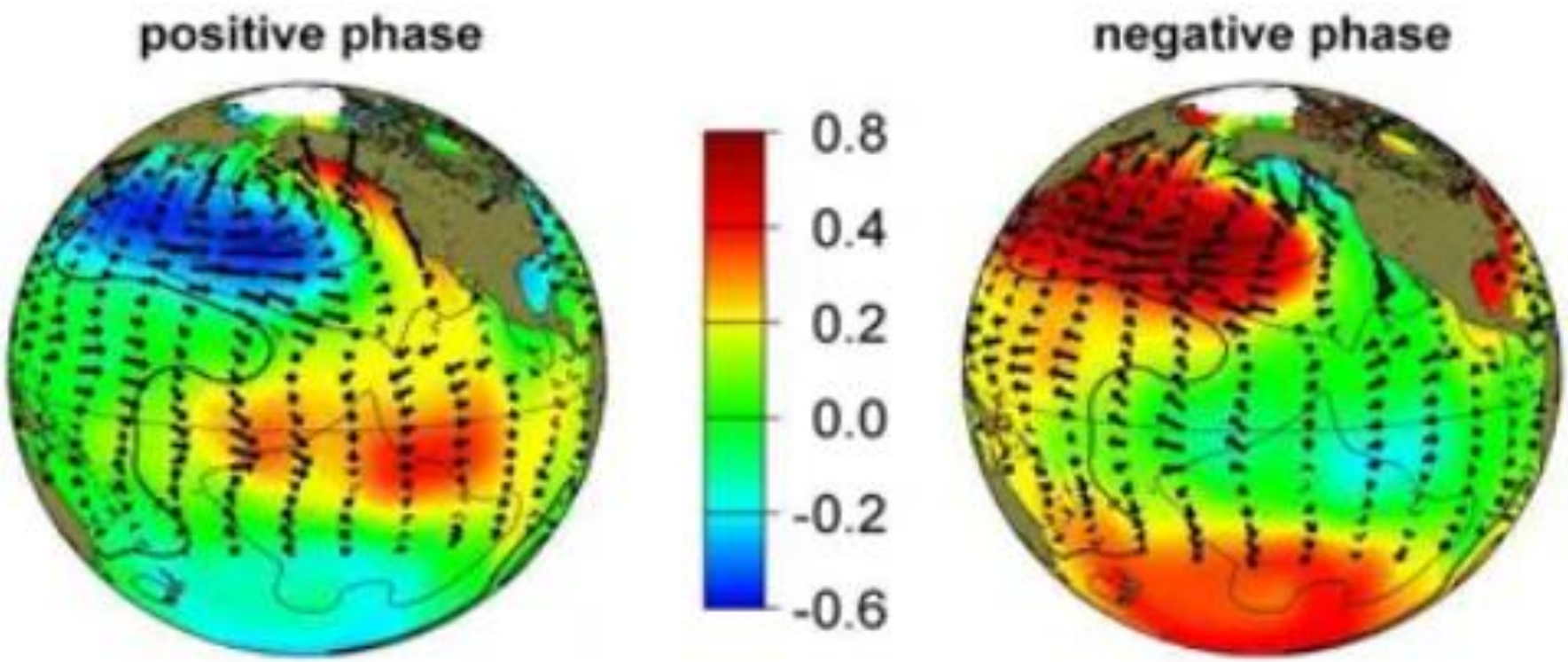
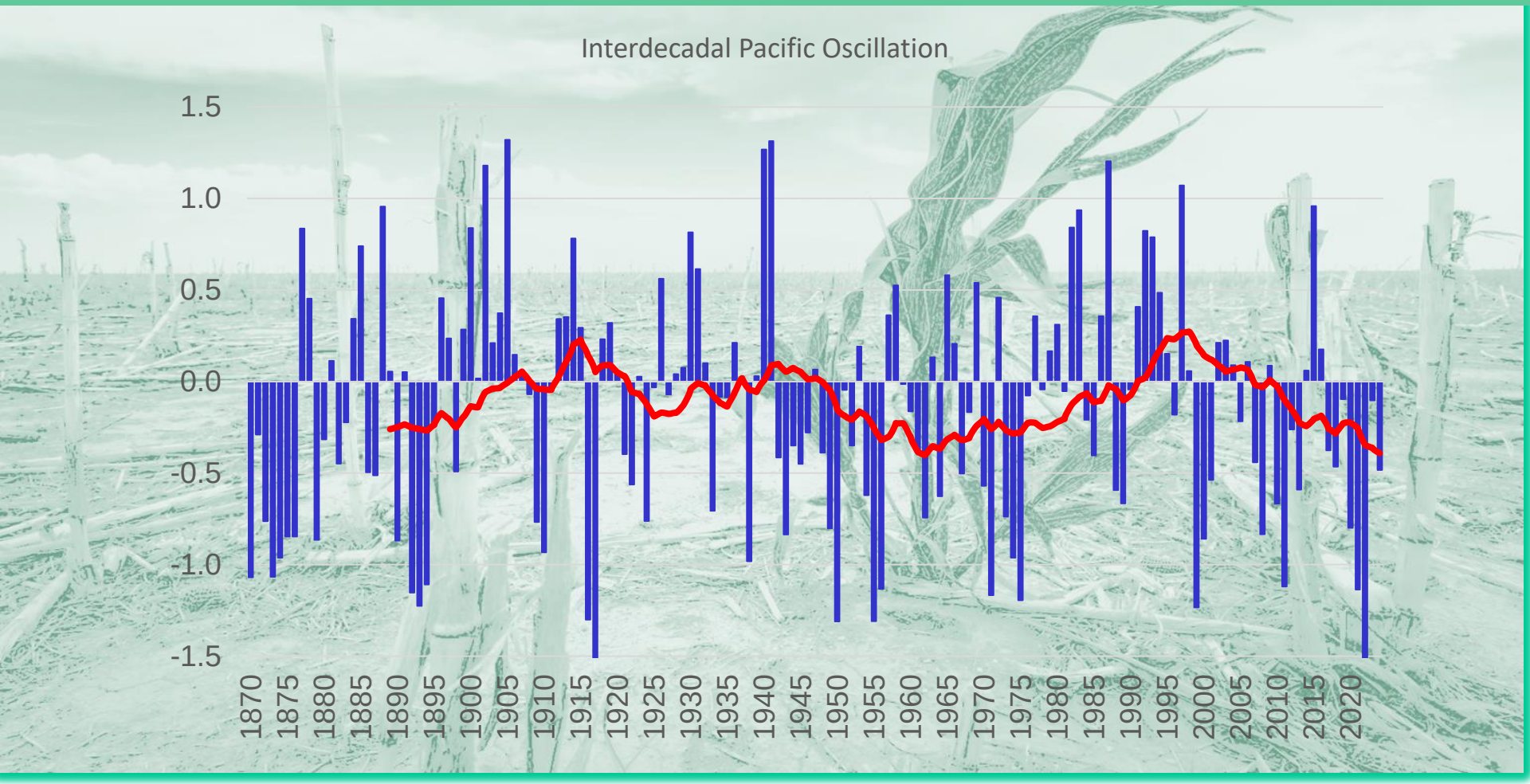
INCREASING CLIMATE VARIABILITY
INTERDECADAL PACIFIC OSCILLATION



INCREASING CLIMATE VARIABILITY
INTERDECADAL PACIFIC OSCILLATION



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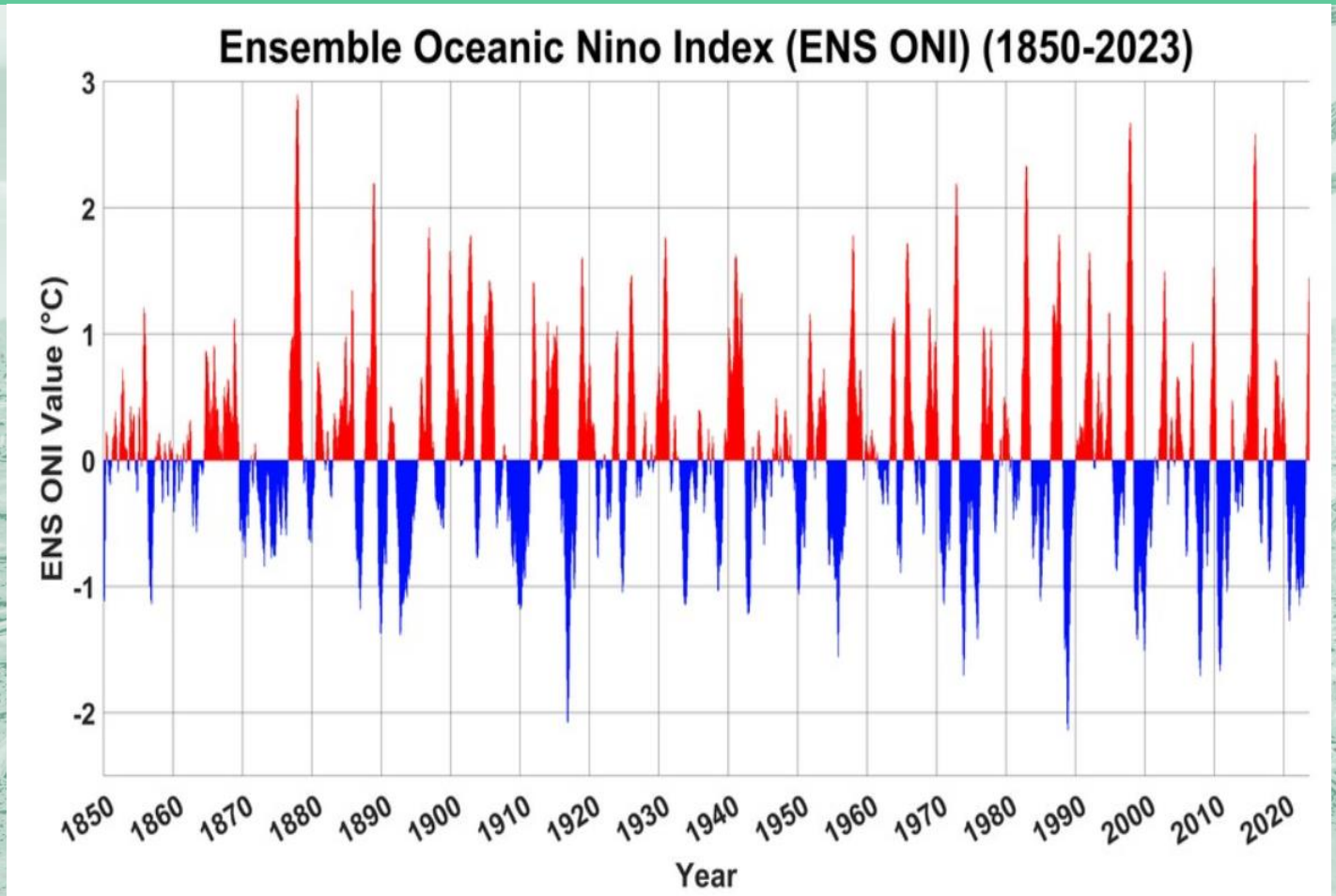
INCREASING CLIMATE VARIABILITY
EL NIÑO/SOUTHERN OSCILLATION (ENSO)



- After global warming ENSO's has the most significant effect on climate variability;
- Both the range and intensity of ENSO events much higher since 1950

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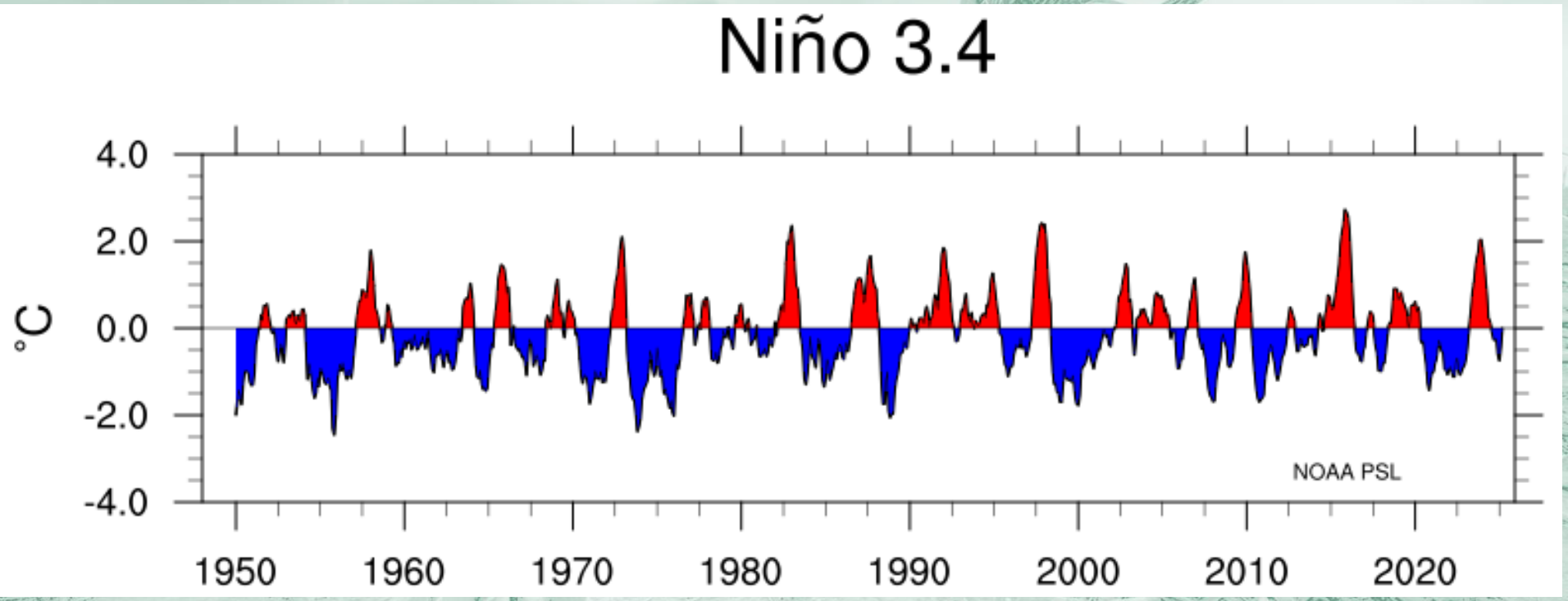
INCREASING CLIMATE VARIABILITY
EL NIÑO/SOUTHERN OSCILLATION



El Niño - Red **La Niña - Blue**

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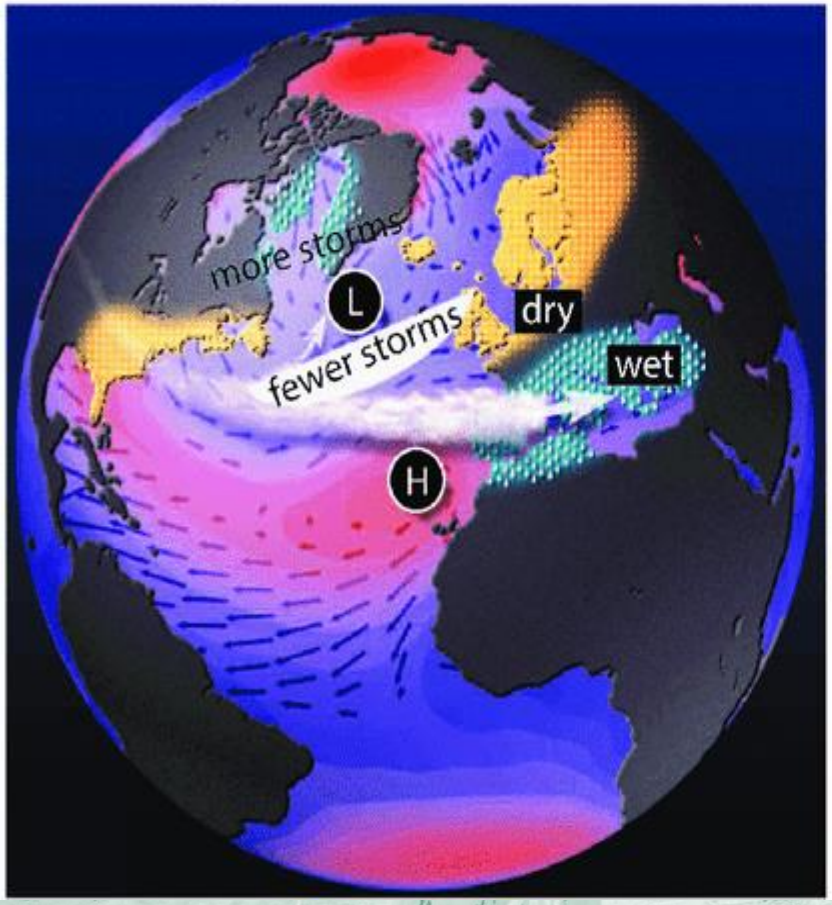
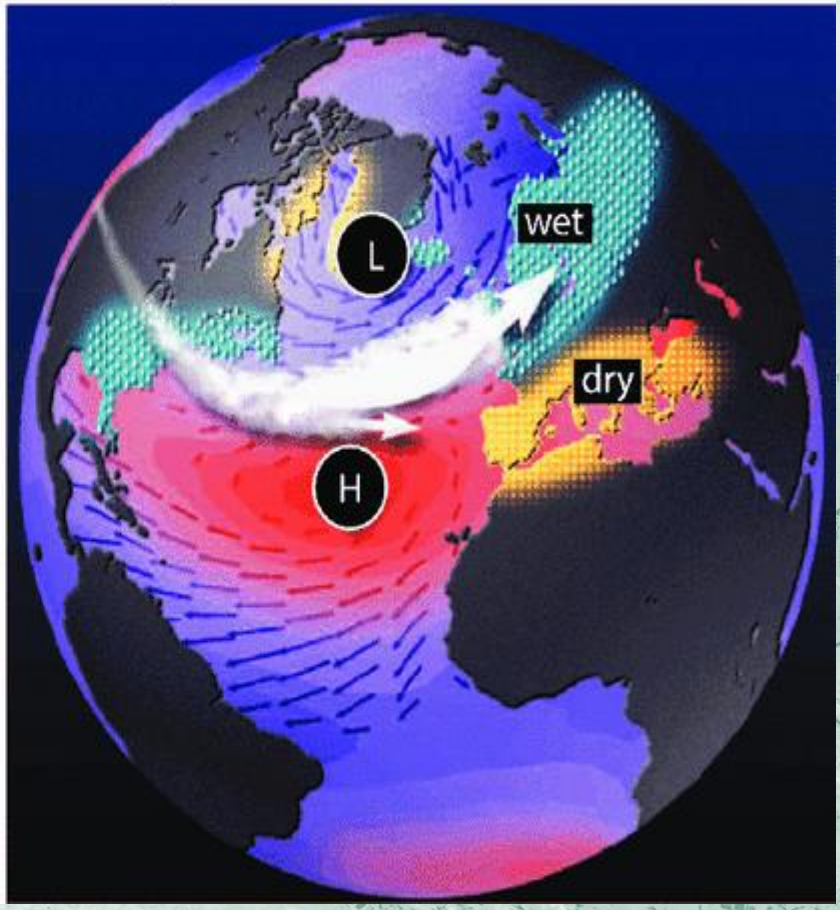
a) NAO negative-mode



b) NAO positive-mode



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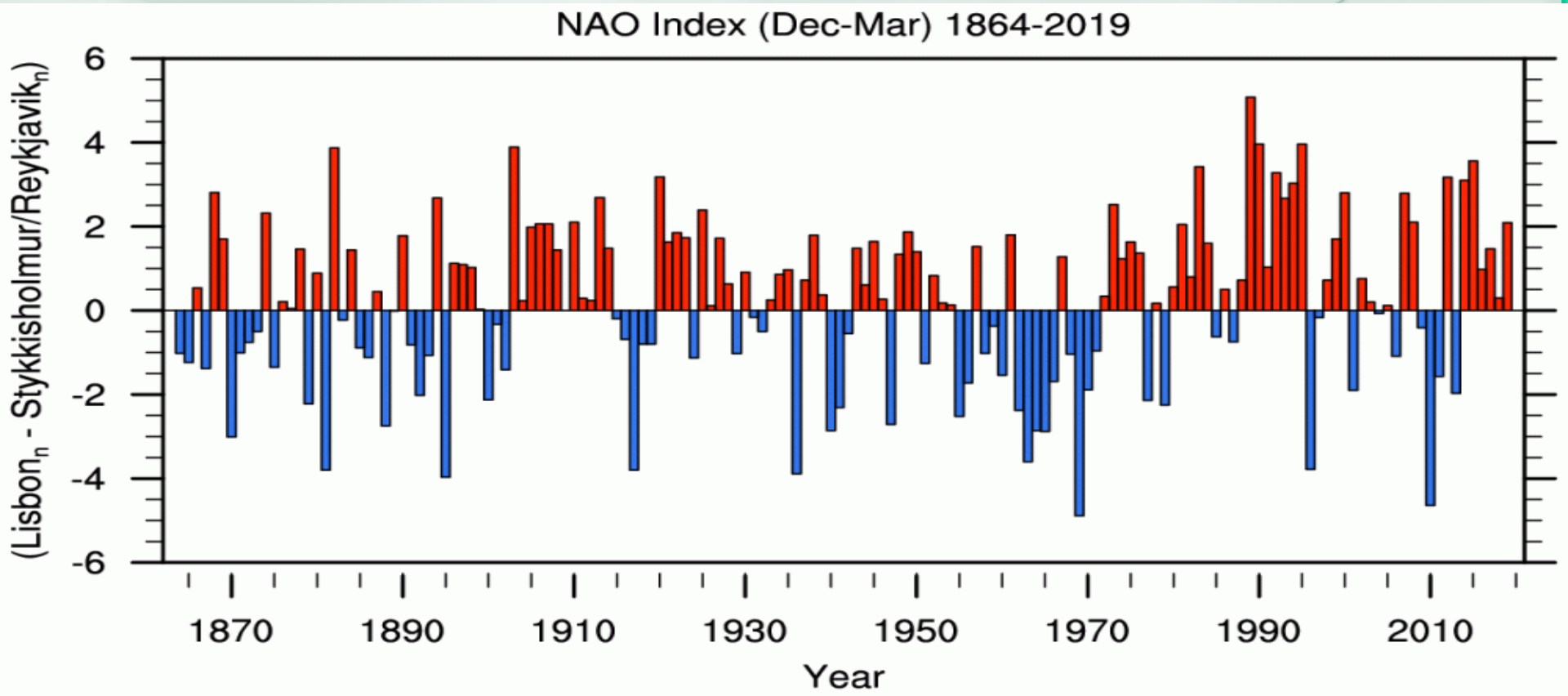
NORTH ATLANTIC OSCILLATION (NAO)



Positive trends for the NAO winter indices were observed between the 1960s and the early 1990s, but this index has become less positive thereafter.

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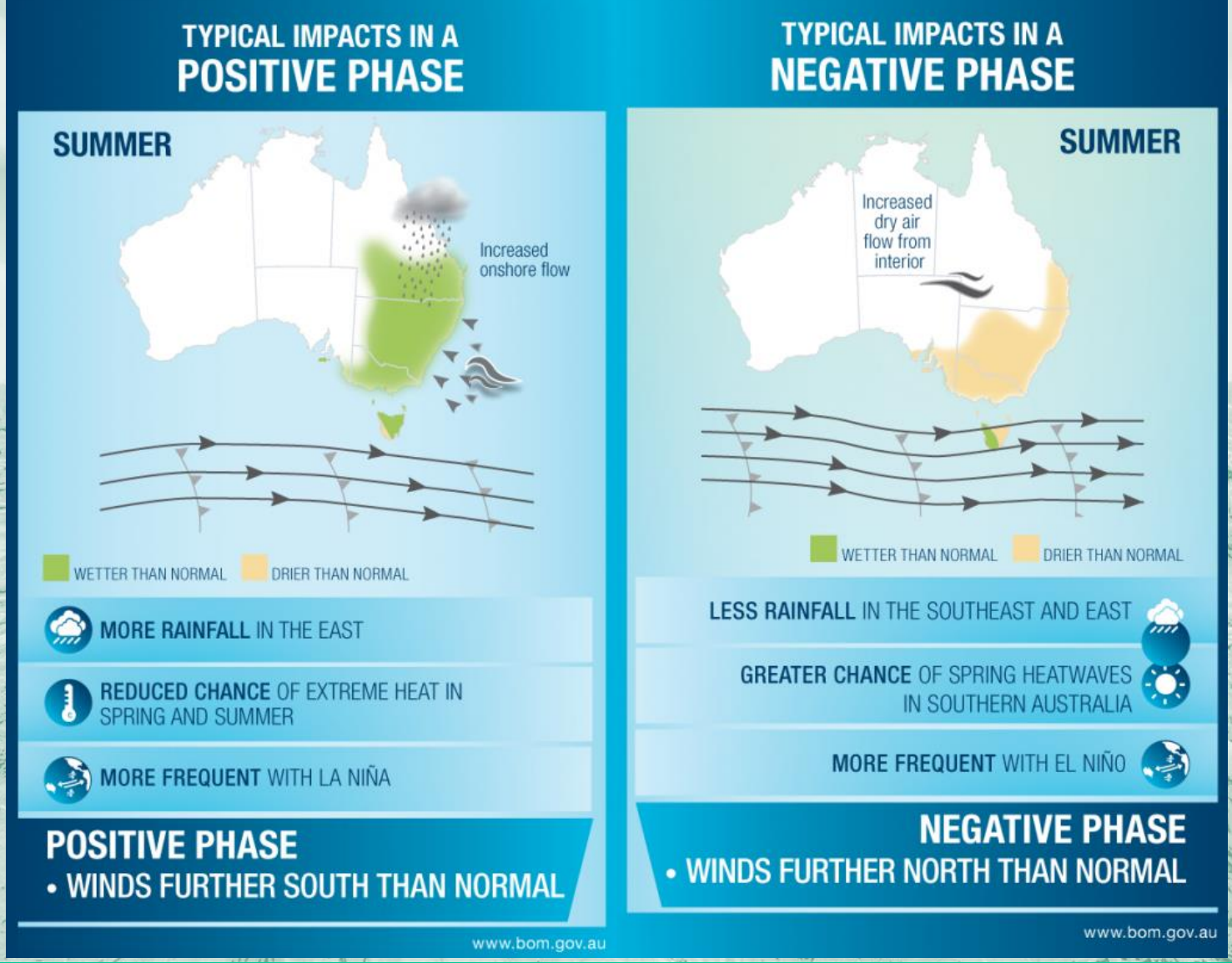

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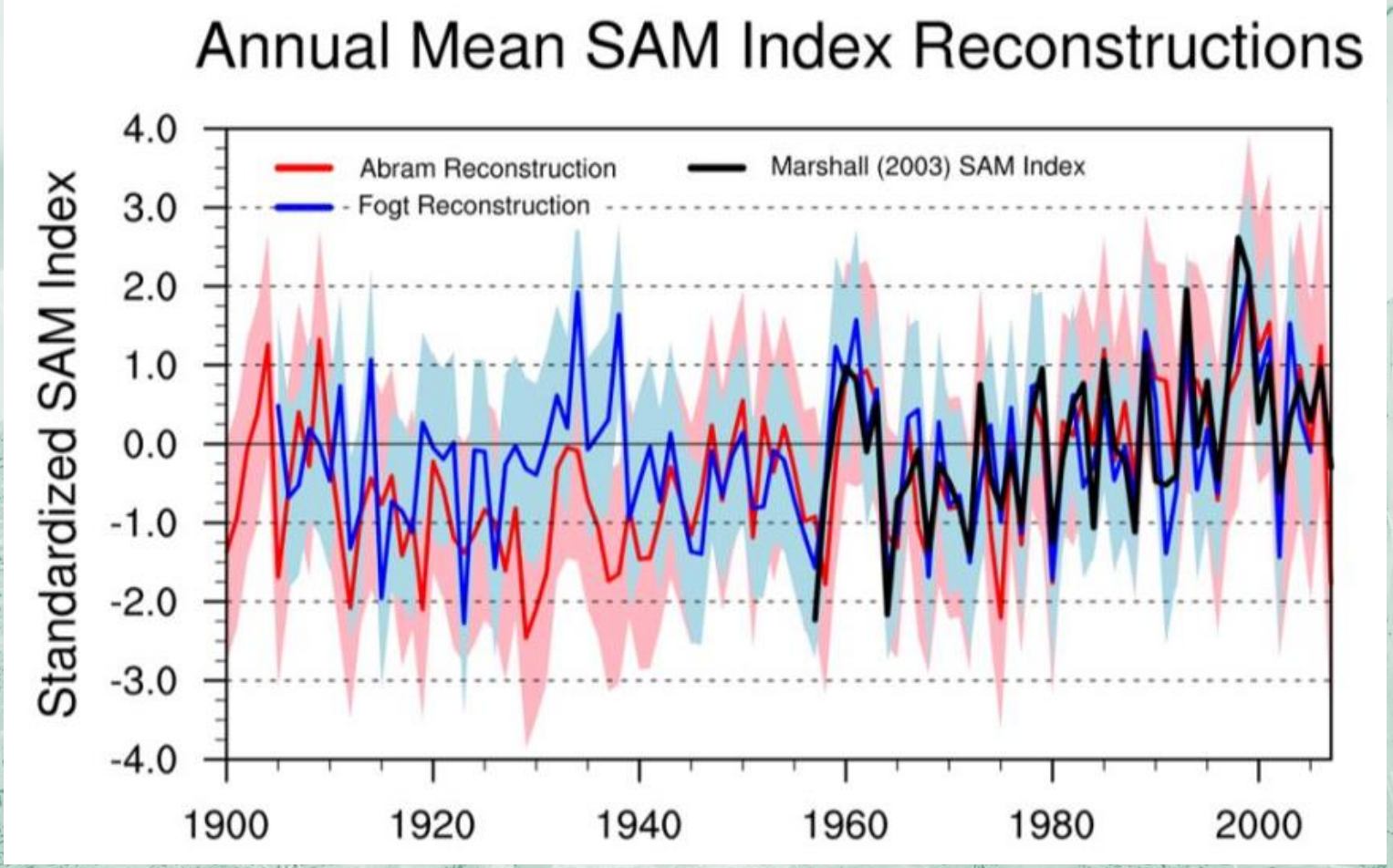

Historical reconstructions demonstrate that recent positive SAM index values are unprecedented in the last millennia, and fall outside the range of natural climate variability.

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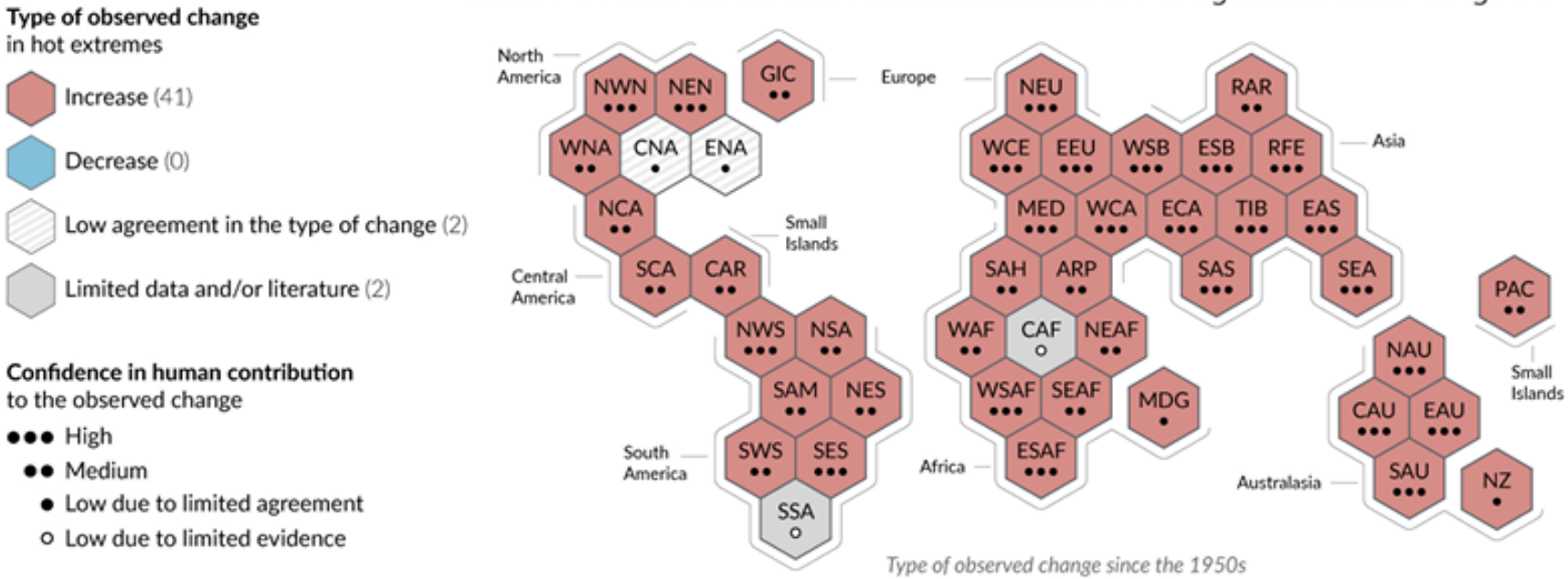
Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

Figure SPM.3

a) Synthesis of assessment of observed change in **hot extremes** and confidence in human contribution to the observed changes in the world's regions



Changes in hot extremes

Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

Figure SPM.3

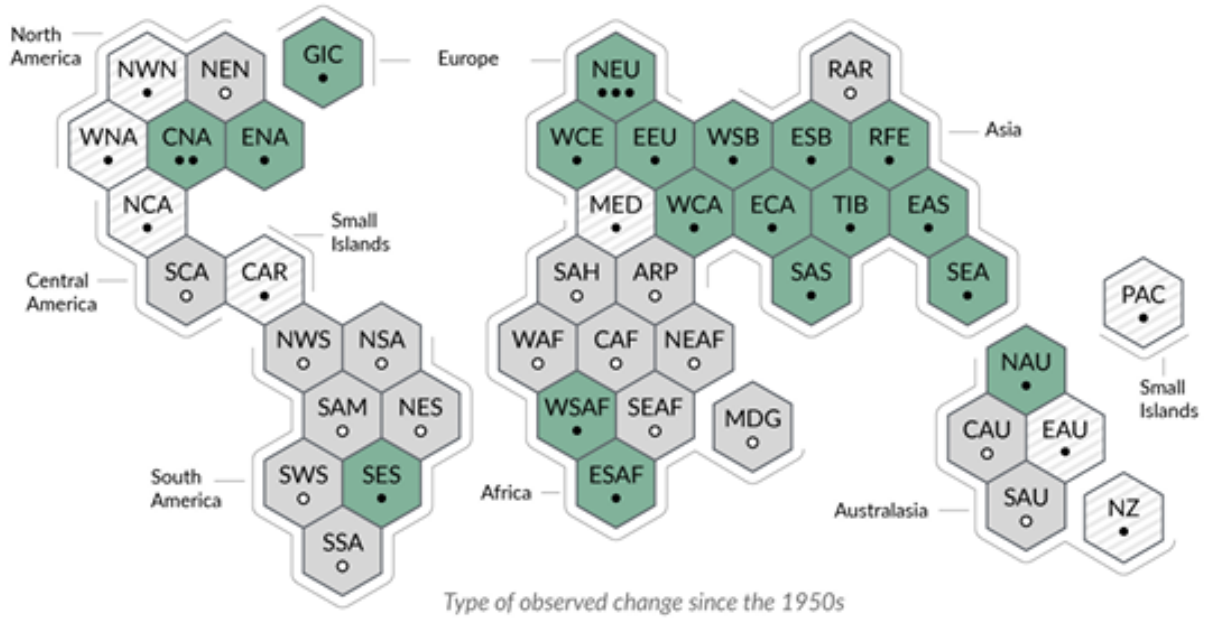
b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions

Type of observed change in heavy precipitation

- Increase (19)
- Decrease (0)
- Low agreement in the type of change (8)
- Limited data and/or literature (18)

Confidence in human contribution to the observed change

- ●●● High
- ●● Medium
- ● Low due to limited agreement
- ○ Low due to limited evidence



Type of observed change since the 1950s

Changes in heavy precipitation

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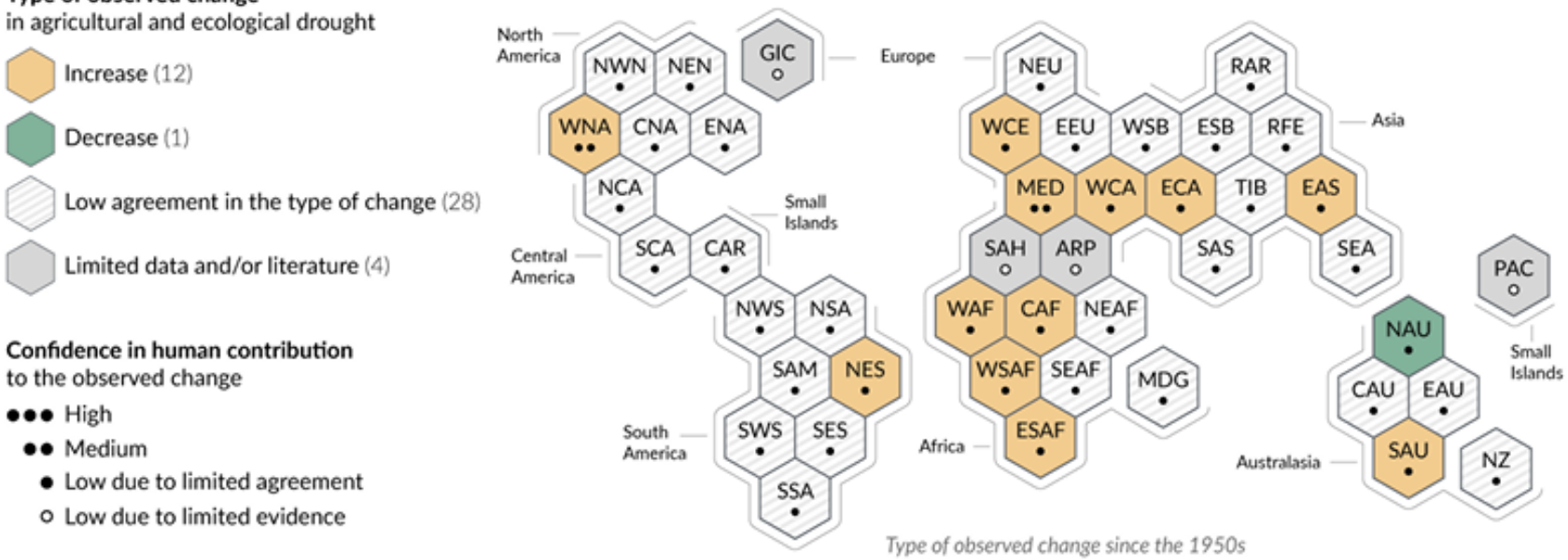
Climate change is already affecting every inhabited region across the globe, with human influence contributing to many observed changes in weather and climate extremes

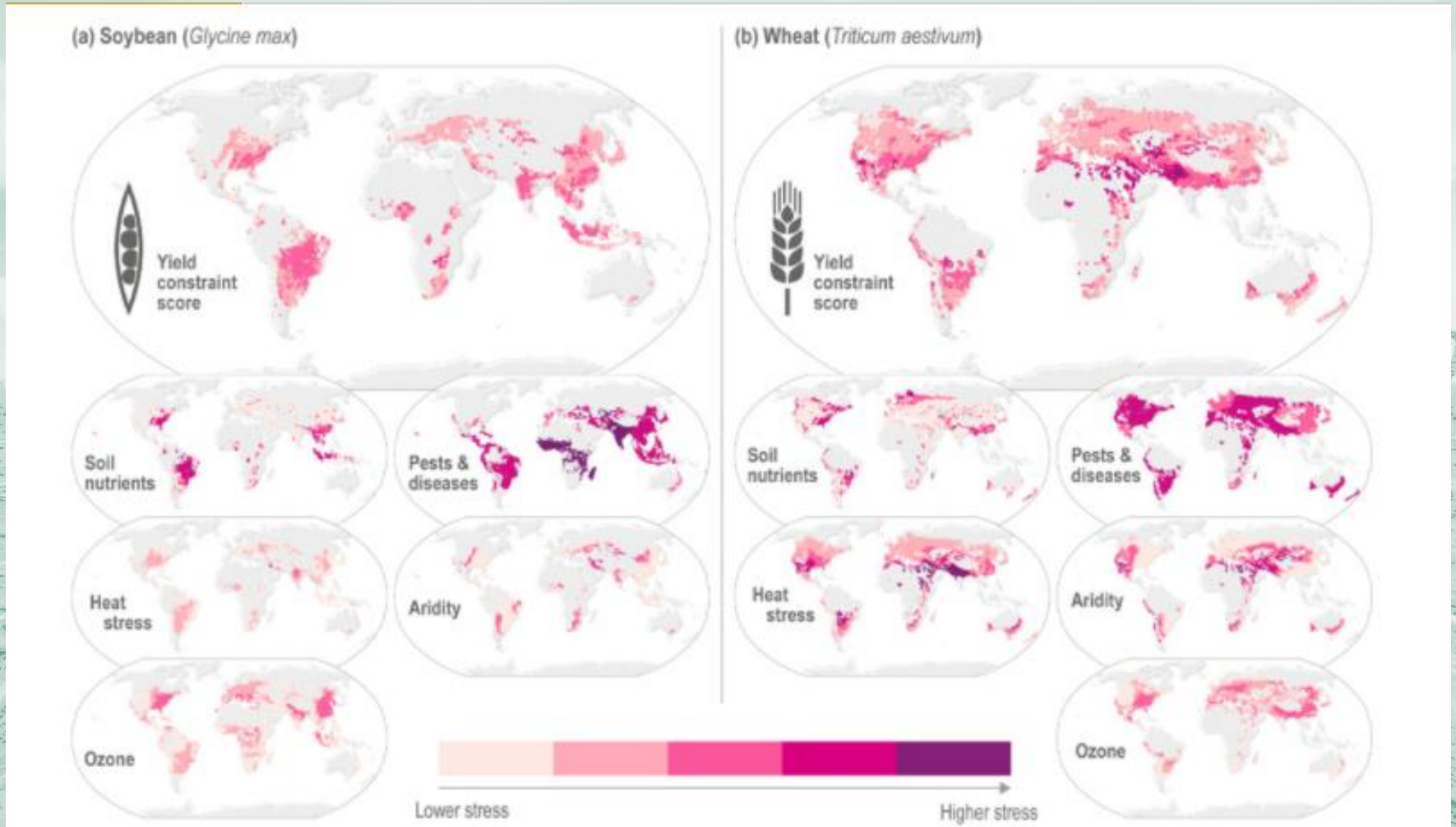
Figure SPM.3

c) Synthesis of assessment of observed change in **agricultural and ecological drought** and confidence in human contribution to the observed changes in the world's regions



Changes in agricultural and ecological drought

IMPACTS



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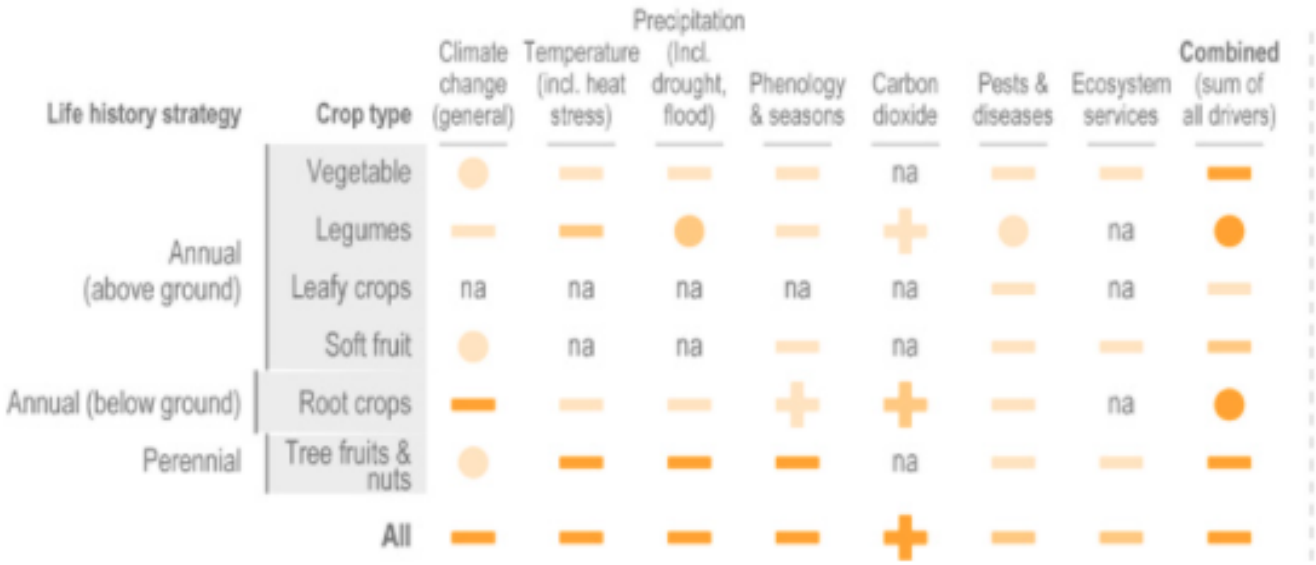
IMPACTS

Synthesis of literature on the projected impacts of climate change on different cropping systems



A synthesis of more than 60 published studies on the effects of crops on climate change. For each crop type, different factors were considered: temperature/heat stress, rainfall (including drought and floods), seasonal phenomena, increased CO2 levels, pests and disease and ecosystem services, as well as the cumulative effect. Plus signs indicate positive

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IMPACTS ON FORESTS

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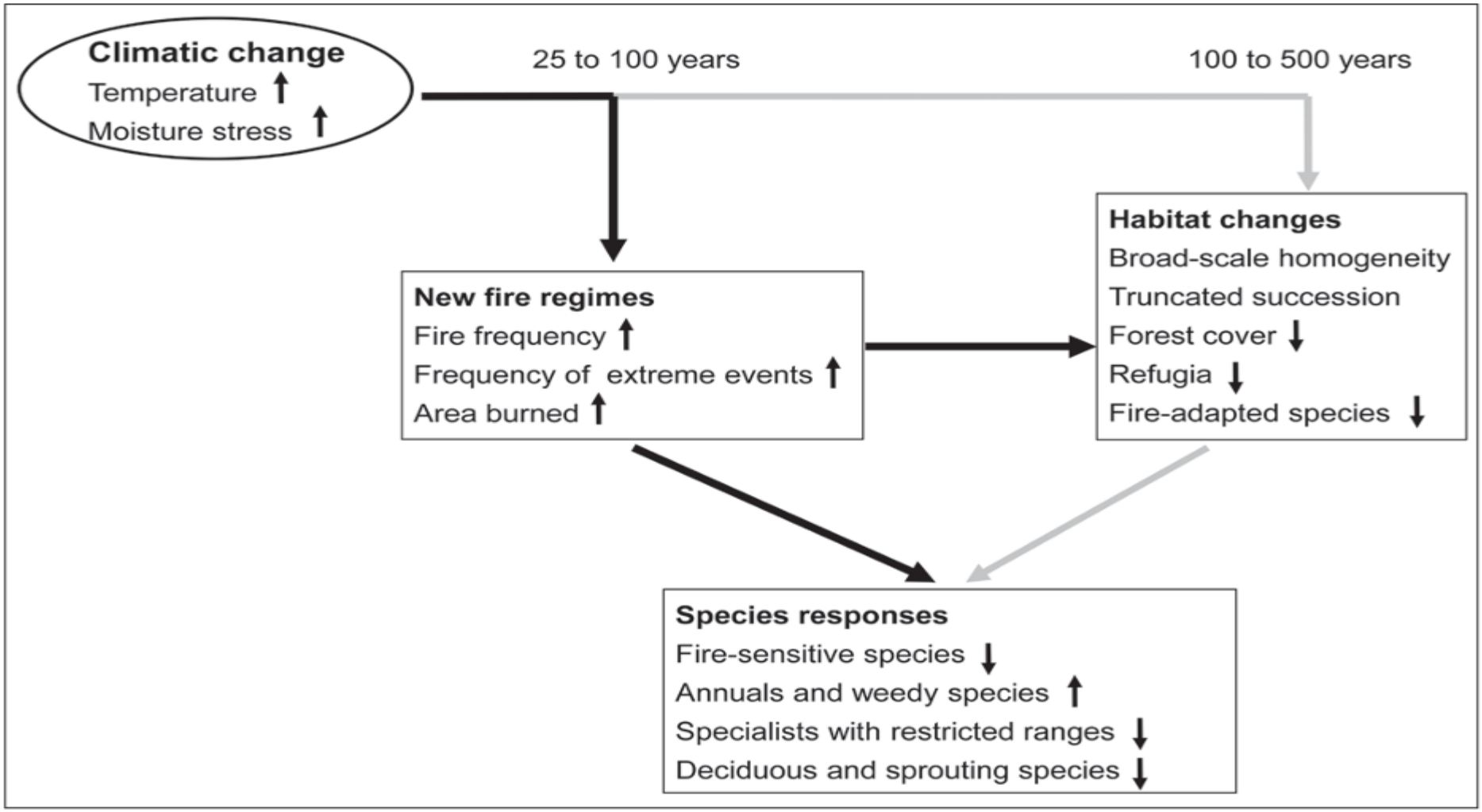
IMPACTS ON FORESTS



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CONCLUDING REMARKS

- Climate variability is on the increase with both global (El Niño/Southern Oscillation) and regional (North Atlantic Oscillation, Southern Annular Mode) modes.
- Temperatures have increased 1.3° C by 2020 compared with the period 1850-1900, with a significant increase in heatwaves, and increases in extreme rainfalls, with regional increases in drought and dry spells.
- With global warming, temperatures are projected to increase between 0.5° to 4° C by 2100 with significant increases in heatwaves and heavy rainfall events and intensification of dry seasons and drought.

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CONCLUDING REMARKS

- Climate variability is on the increase with both global (El Niño/Southern Oscillation) and regional (North Atlantic Oscillation, Southern Annular Mode) modes.
- Increases in pest & diseases, aridity and heat stress have decreased yields of many crops especially in subtropical, monsoonal and Mediterranean regions owing to global warming.
- Largest improvements in resilience occur with Nature-based solutions such as grazing optimization, improved rice cultivation, use of biochar, improved crop nutrition, conservation agriculture, trees in cropland and improved plantation.

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