

# State of Wildfires Report 2023/2024

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# Key Extremes of the 2023-24 Fire Season

## Canada



Eyevine / Xinhua News Agency

Almost a decade's worth of fire emissions in one fire season. 230,000 evacuations.

## Amazonas, Brazil



REUTERS/Bruno Kelly

Manaus temporarily had among the worst air quality on the planet.

## Greece



Maxar Technologies

Largest wildfire ever recorded in Europe.

## Chile



JAVIER TORRES / AFP

Valparaíso wildfire leaves 131 dead.

## Hawaii



AP

Lahaina wildfire leaves 100 dead.

## Venezuela, Bolivia, Peru, Pantanal



Henry González/Mongabay

Continued drought brings high fire counts and emissions extending into 2024.



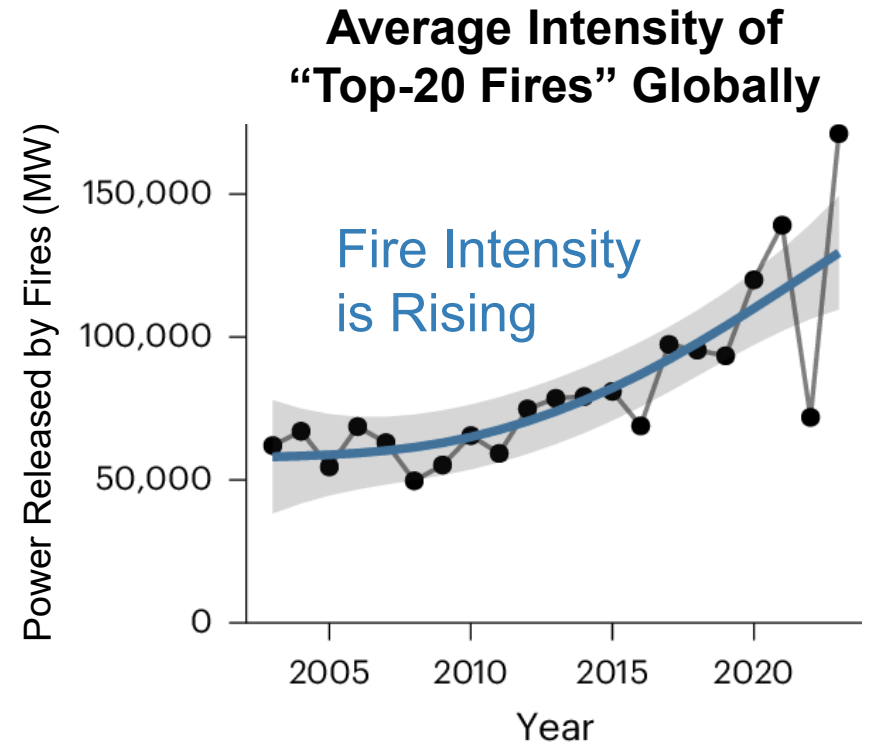
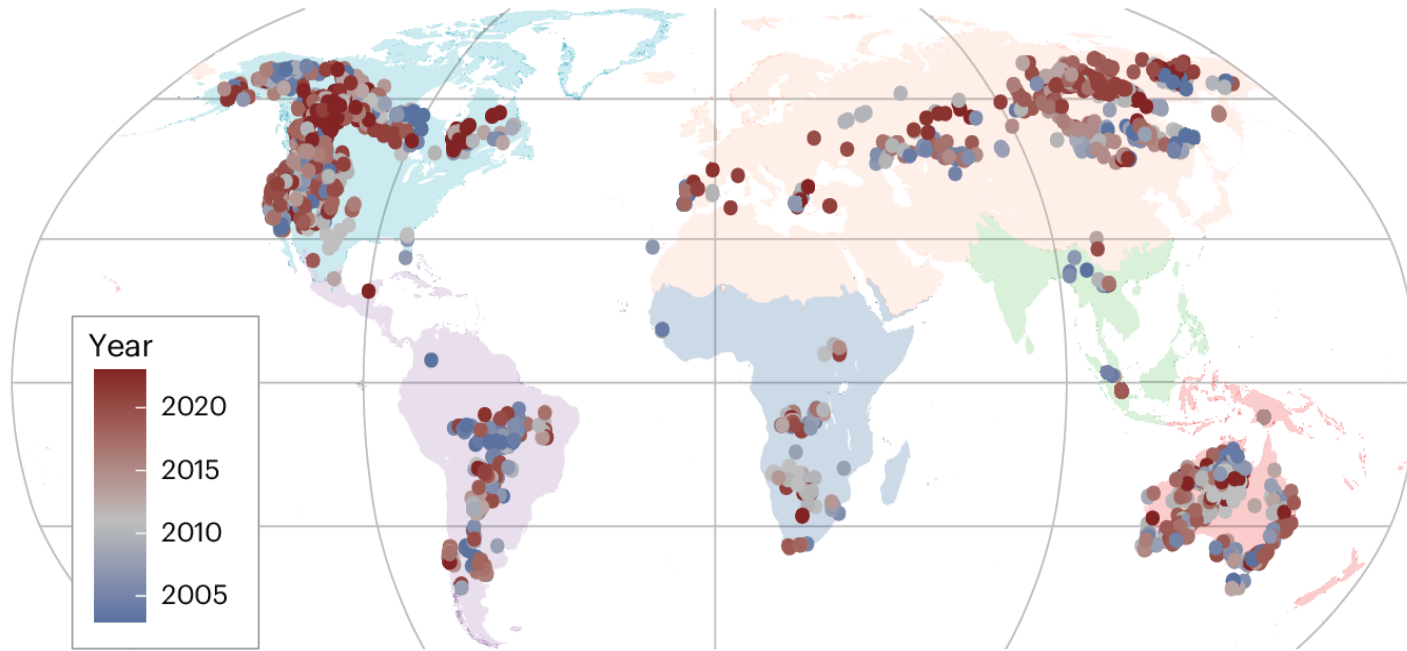
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# Extreme Fires are on the Rise



Cunningham et al. (June 2024) Nature Earth & Env., doi: 10.1038/s41559-024-02452-2



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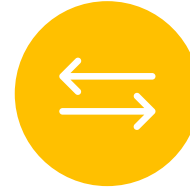
# Society's Questions to Scientists



Is climate change to blame?



Did land management factors contribute?



Was this predictable?



Is this the "new normal"? Will it get worse?



Will delivering on climate commitments help to avoid a repeat?



How can land use or land management policy help?



Can firefighters be better prepared and resourced?



How should governments invest to tackle the problem?



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# International Partnership



University of East Anglia



UK Centre for Ecology & Hydrology



Met Office



ECMWF



UNIVERSIDADE  
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MONDLANE



UNIVERSITY OF THE  
WITWATERSRAND,  
JOHANNESBURG



CFA



Natural Resources Canada  
Canadian Forest Service



UNIVERSIDADE  
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E ALTO DOURO



THE UNIVERSITY OF  
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ELGO - DIMITRA  
HELLENIC AGRICULTURAL  
ORGANIZATION - DIMITRA



University of  
Reading



The  
Alan Turing  
Institute



VRIJE  
UNIVERSITEIT  
BRUSSEL



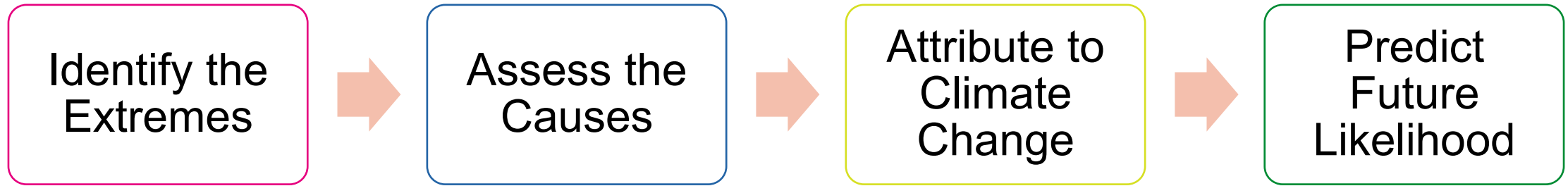
A UNEP Partner



WAGENINGEN  
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# The State of Wildfires Report



Earth Observations (Satellite Images)

Regional Expert Panel

Meteorological Reanalysis (Weather Datasets)

Probabilistic Fire Models (Simulations using Observations)

Hadley Centre Climate Model (UK's Flagship Atmosphere Model)

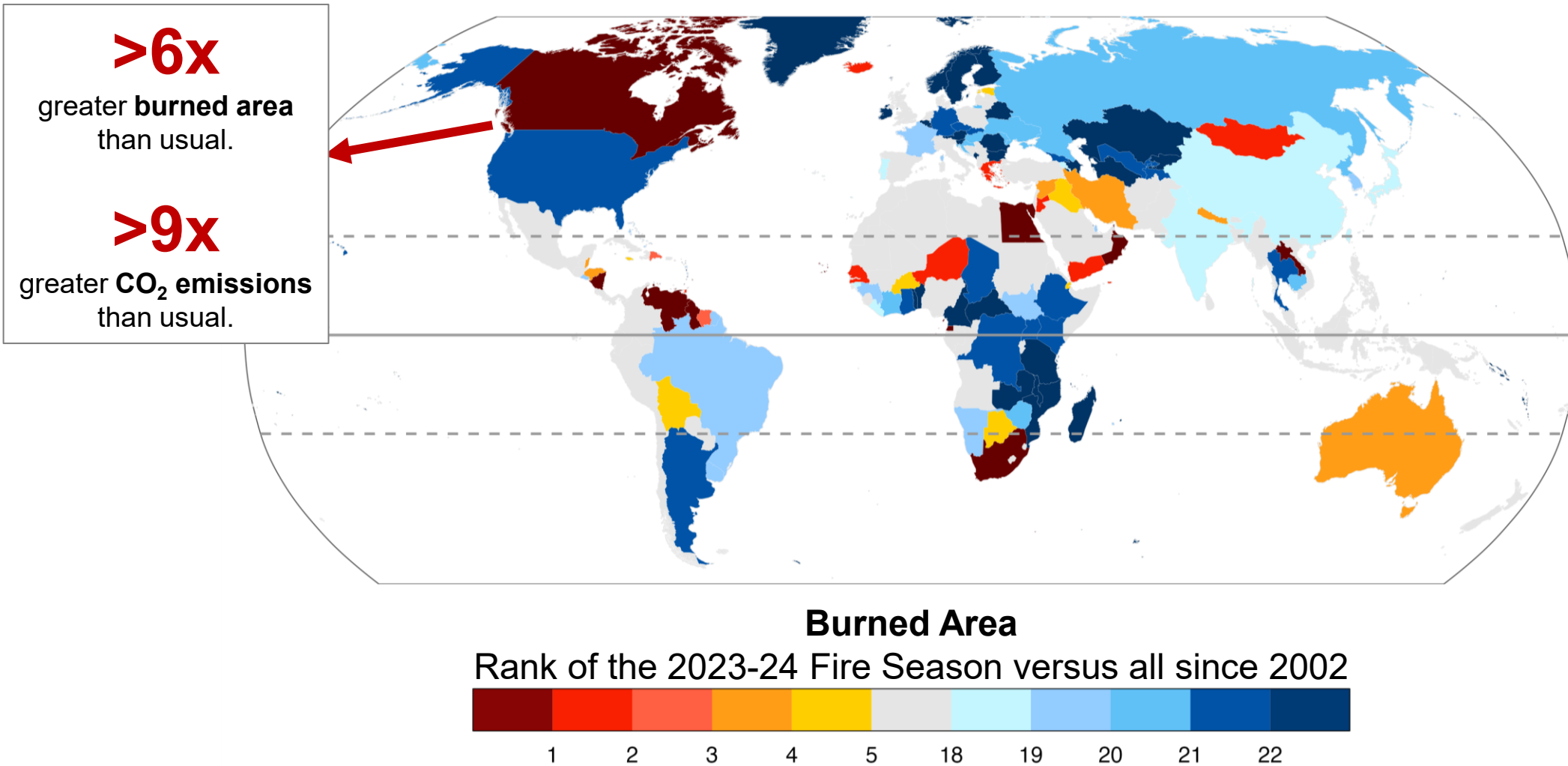
UK Land Model 'JULES' (UK's Flagship Land Model)



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# 2023-24 was a Year of Extremes



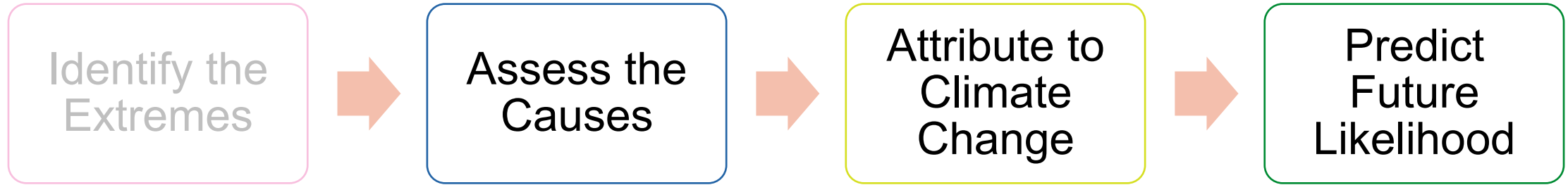
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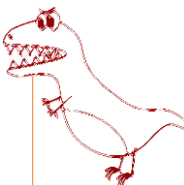


# The State of Wildfires Report



3 selected events

Canada	Western Amazonia	Greece
 <p>Eyevine / Xinhua News Agency</p>	 <p>REUTERS/Bruno Kelly</p>	 <p>Maxar Technologies</p>

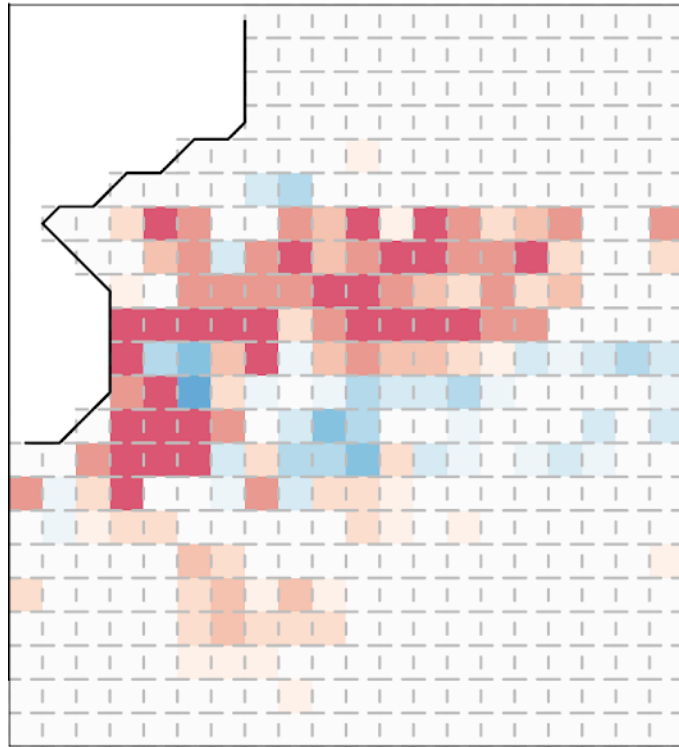




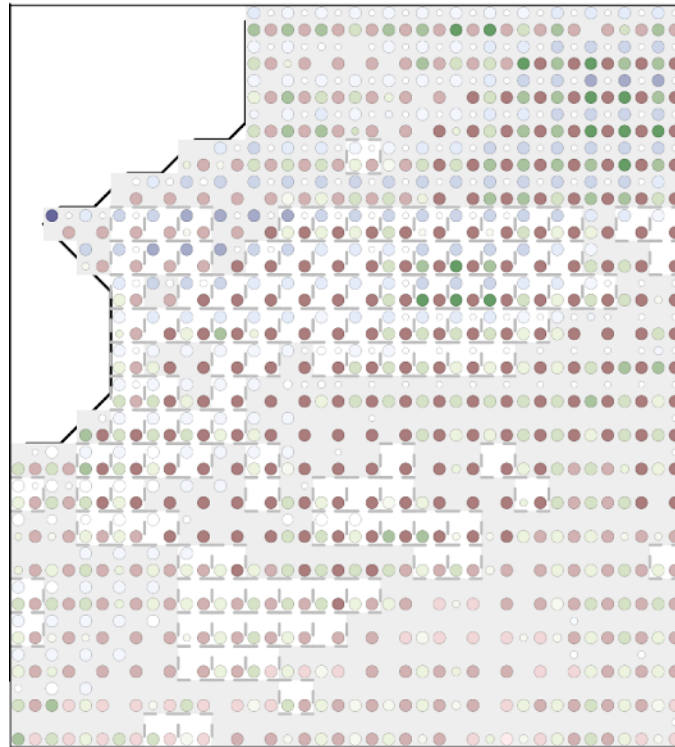
# Not Just Weather: No Fire without Fuel, Ignitions

## Quebec – July 2023

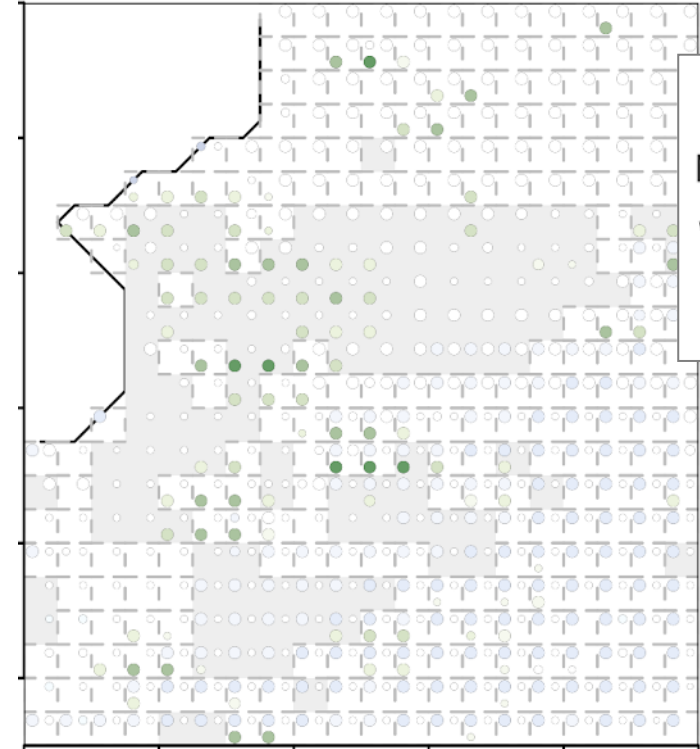
Burned area anomaly (%)



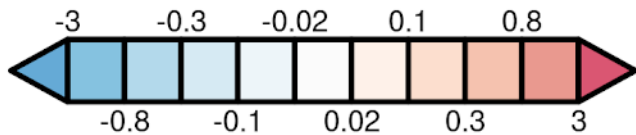
Increase from controls



Decrease from controls



- Fuel ●
- Moisture ●
- Weather ●
- Human ●



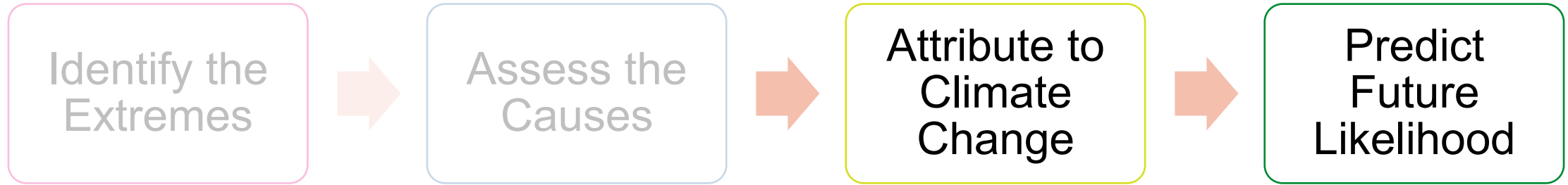
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# How we Attribute to Climate Change

Different approaches to answer the question:  
**How much has climate change increased the probability of the 2023 fires?**



Fire Weather

Peak burned area

We use modelling to look at simulations with vs without climate change



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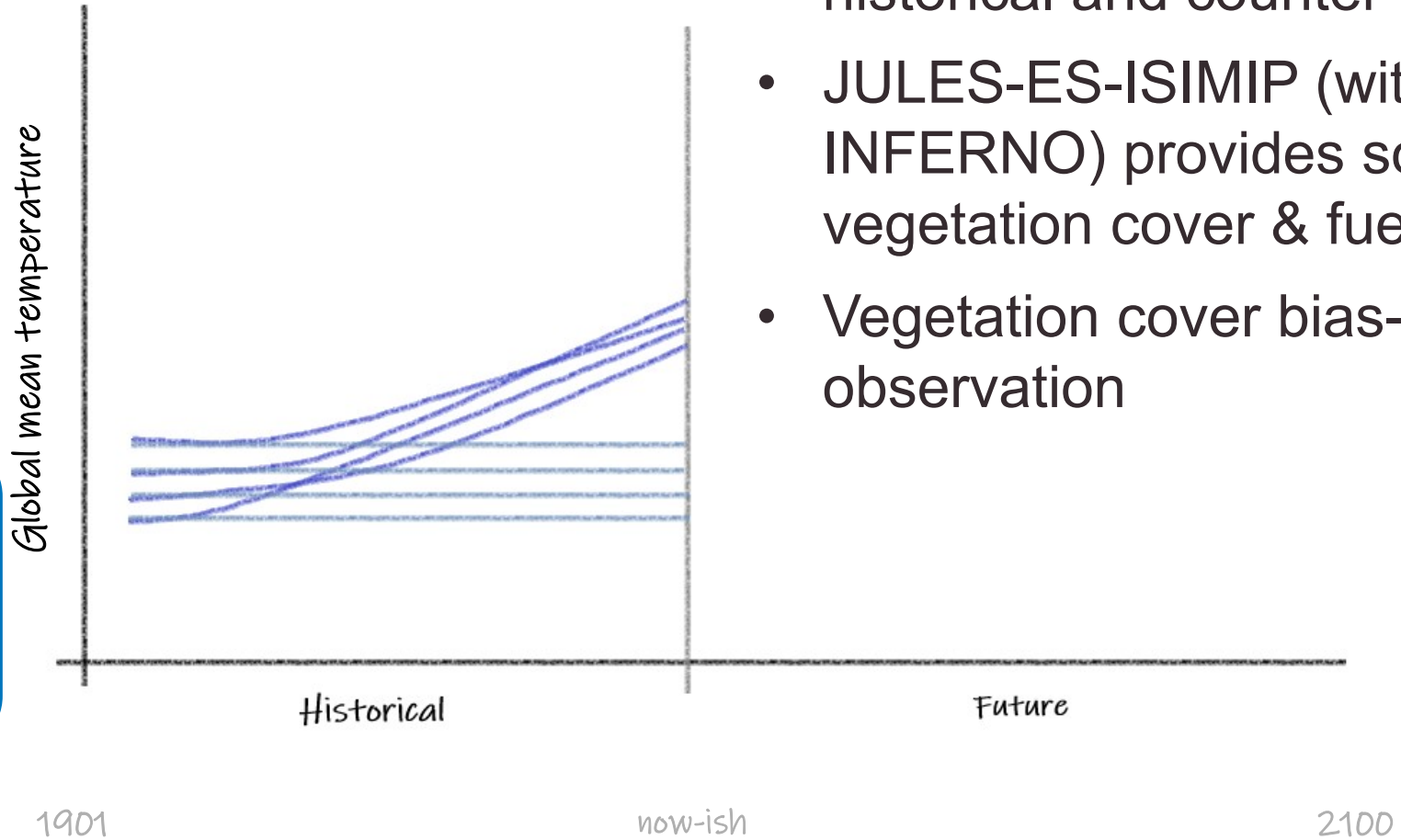


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Historical climate  
Counter climate  
**ISIMIP3a**



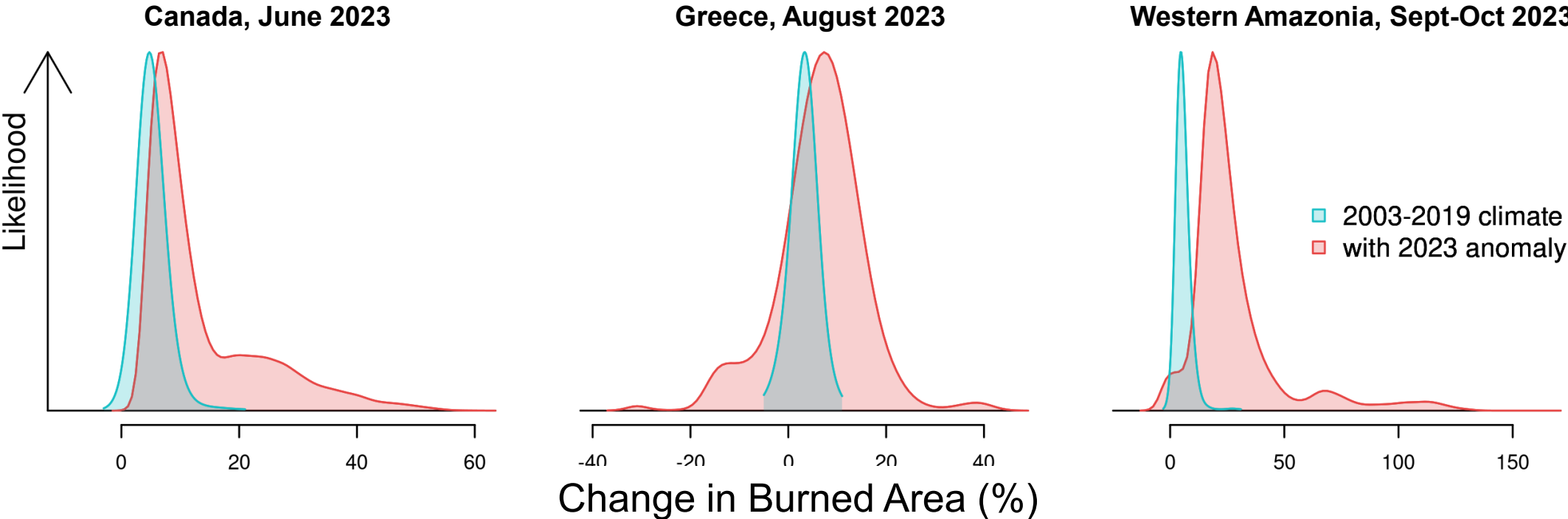
- Metrological data from ISIMIP3a historical and counter climate
- JULES-ES-ISIMIP (without INFERNO) provides soil moisture, vegetation cover & fuel information
- Vegetation cover bias-corrected to observation



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# Climate Change Caused Larger Area Burned



**Up to 40%**  
more land area burned  
due to climate change

**Up to 18%**  
more land area burned  
due to climate change

**Up to 50%**  
more land area burned  
due to climate change



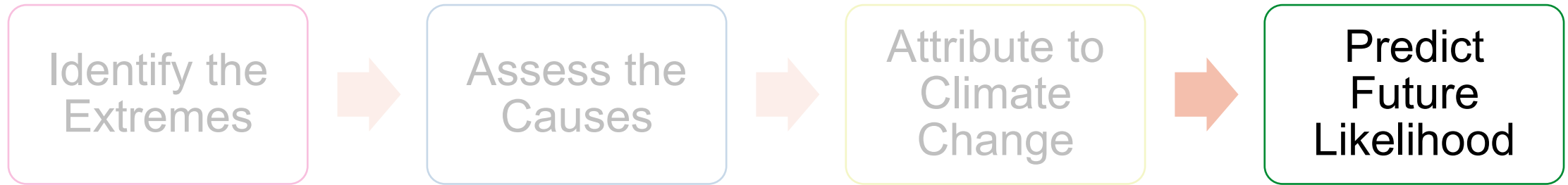
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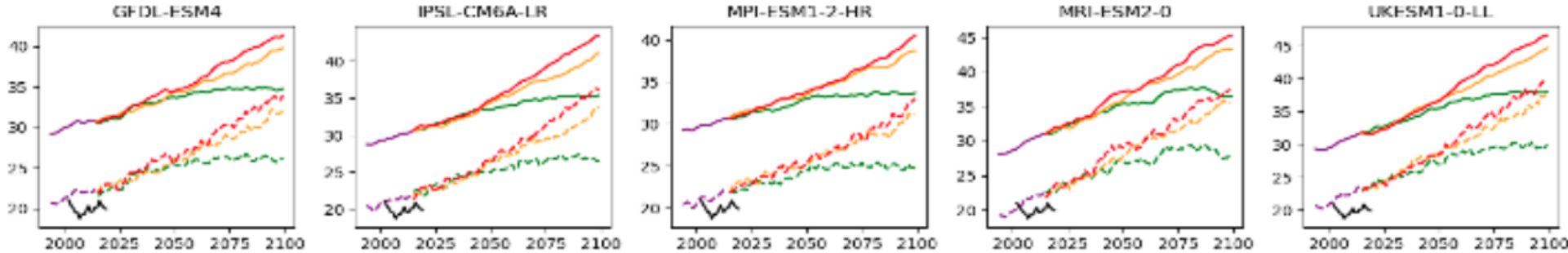


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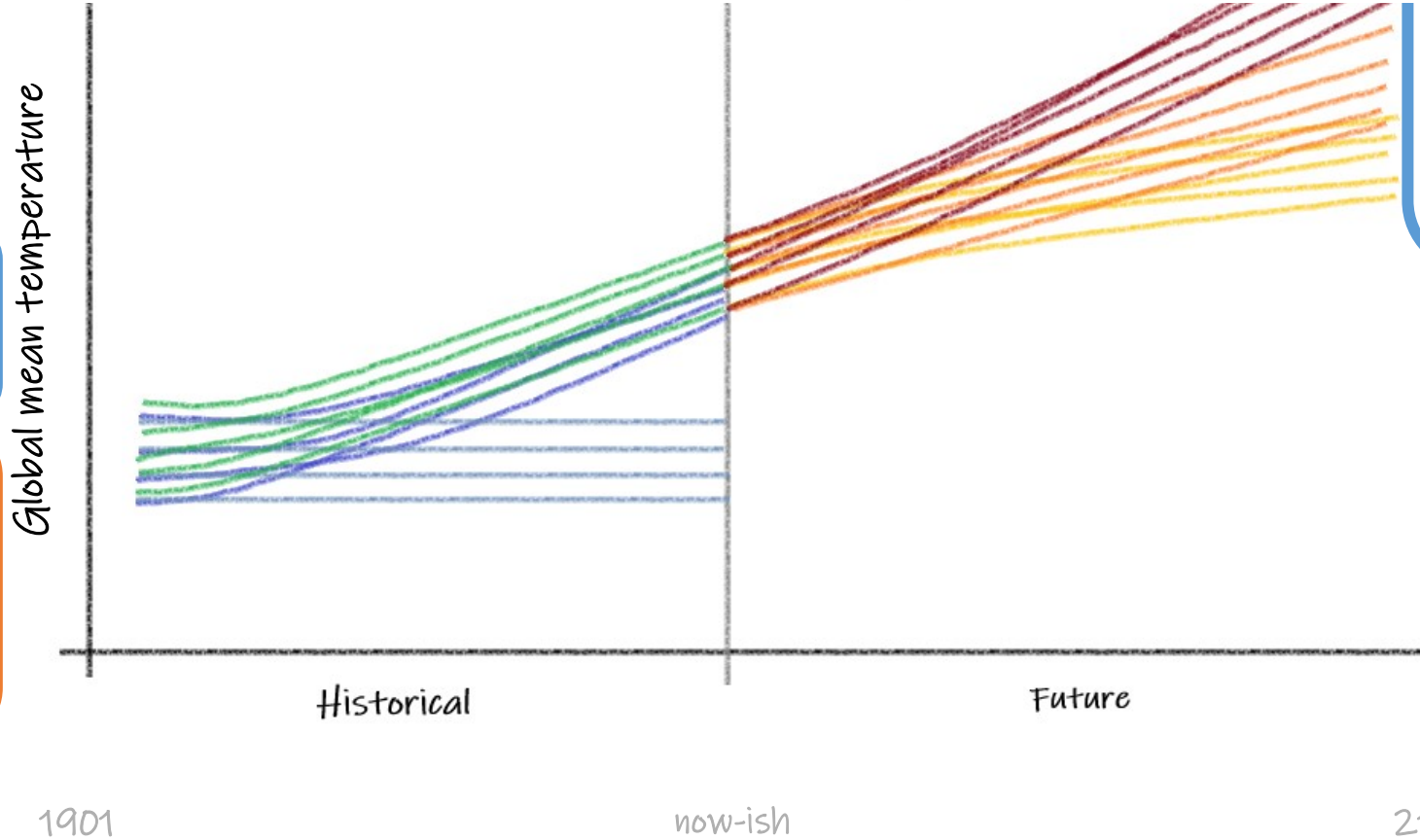






- GCM SSP585
- GCM SSP370
- GCM SSP126
- ISIMIP3b

- ISIMIP3b
- GCM historical
- Historical climate
- Counter climate
- ISIMIP3a



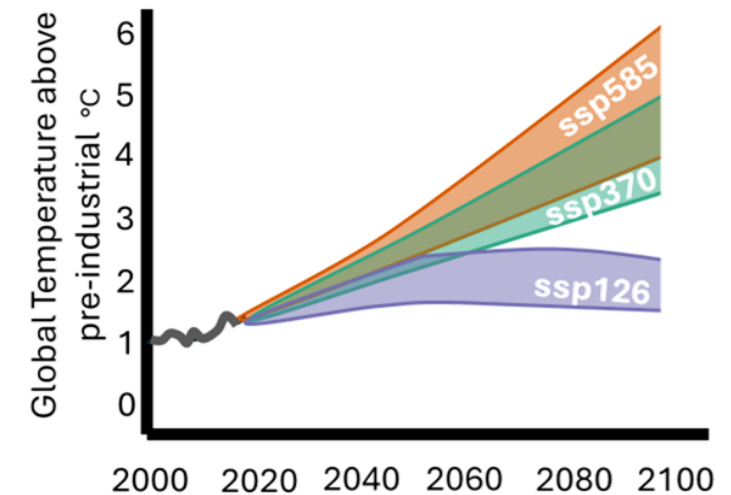
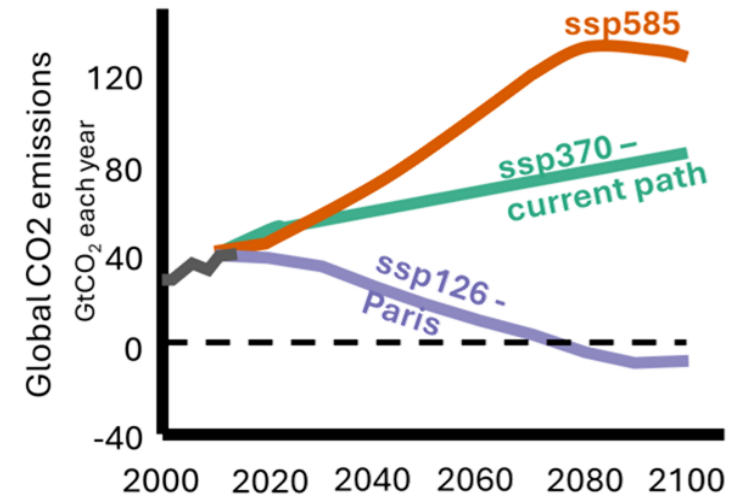
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# Future Climate Scenarios

We tested three future emission scenarios:

1. 'No mitigation' – Economy based on fossil fuel dependence (SSP585).
2. 'Current path' – A high-end emissions future aligned with current global trends in emissions and policies (SSP370).
3. 'Low-carbon future' – Reduce emissions and reach Net Zero, targetting Paris Agreement (SSP126).



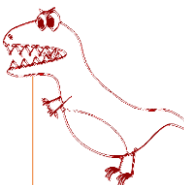
For more, see: <https://www.carbonbrief.org/explainer-how-shared-socioeconomic-pathways-explore-future-climate-change/>



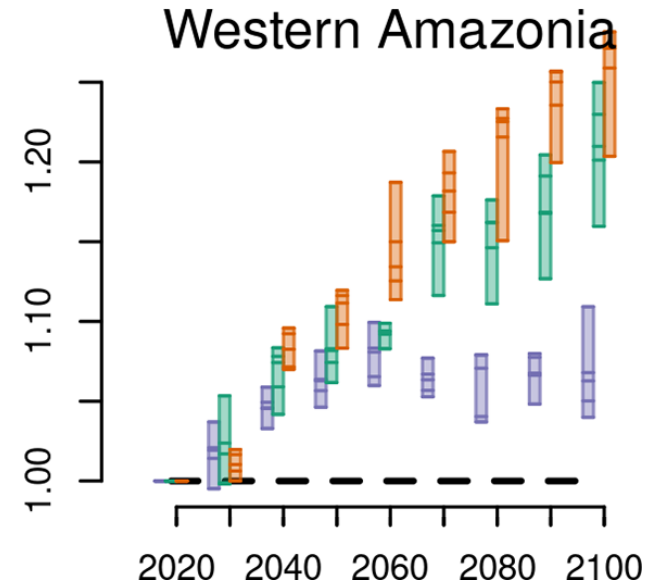
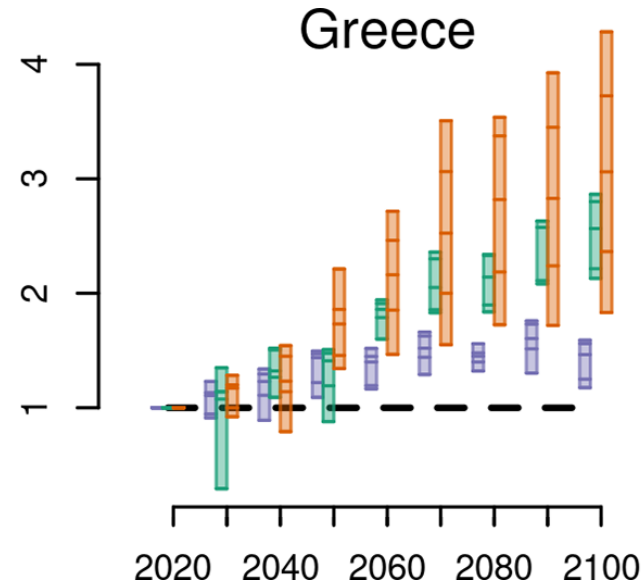
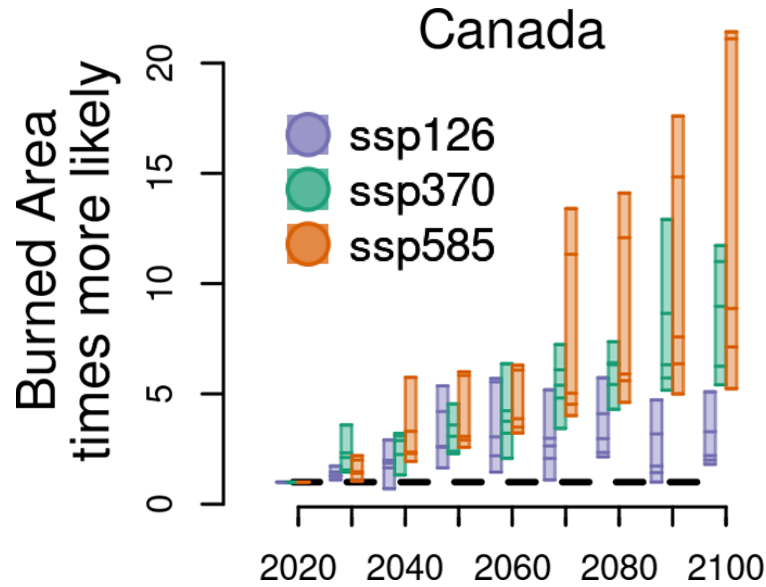
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# Fire Risks Rising in Future, but can be Avoided



**SSP370** →  
>3°C warming

**6-11x**

more likely by 2100  
under 'current path'

**SSP126** →  
<2°C warming

**2-3x**

more likely if Paris  
targets are hit

**2-3x**

more likely by 2100  
under 'current path'

**NO**

more likely if Paris  
targets are hit

**1.2-1.3x**

more likely by 2100  
under 'current path'

**NO**

more likely if Paris  
targets are hit





Unless global greenhouse gas emissions fall, Canadians born today face a **48-84% likelihood of witnessing an event like 2023** in their lifetime.

This is significantly greater than the **12% likelihood** faced by someone born in the 1940s.



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# Take-homes

- The State of Wildfires report will provide **timely, policy-relevant science** explaining extremes of the past fire season.
- Wildfires in Canada, western Amazonia, and Greece were among the stand-out features of the 2023-24 fire season, and they were **several times more likely due to climate change**.
- Future climate change could bring further increases in the likelihood of events like 2023-24, however increases in **risk are minimised or avoided completely in a low-carbon future**.



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# Future plans

- 2024/25 report aimed publication date in May/June
- Linked with Special Issue
- EGU session on “Extreme fires and their impacts”
- Any ideas of what we could add, or if you have any science or perspectives you think you might be able to contribute, get hold of us.



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UK Centre for  
Ecology & Hydrology  
**NATIONAL CAPABILITY  
FOR GLOBAL CHALLENGES**  
International science for net zero plus

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# Thanks

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**Chantelle Burton**

(on Matt leave but back for 25/26), Met Office

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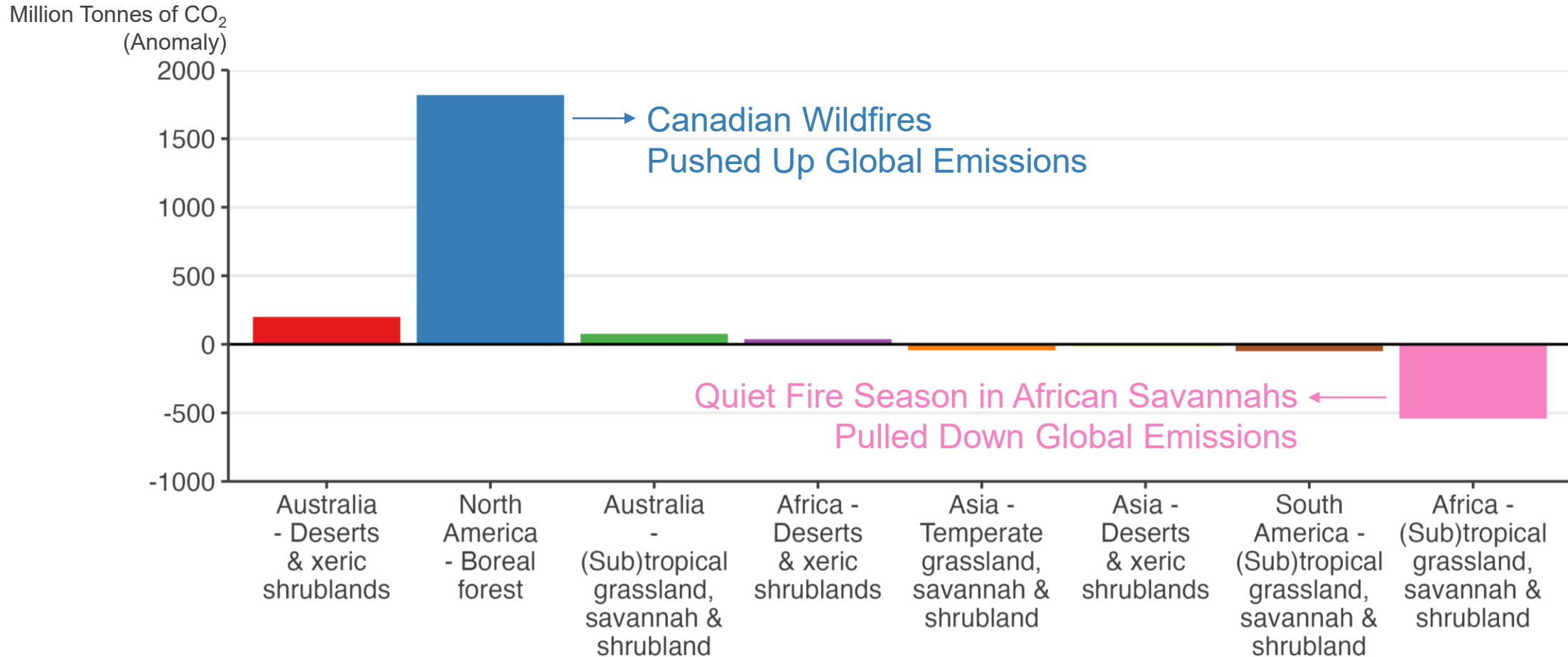
**Matt Jones**

(Matthew.W.Jones@uea.ac.uk), UEA



# 2023-24 was a Year of Extremes

## CO<sub>2</sub> Emissions Above or Below Average in Key Biomes



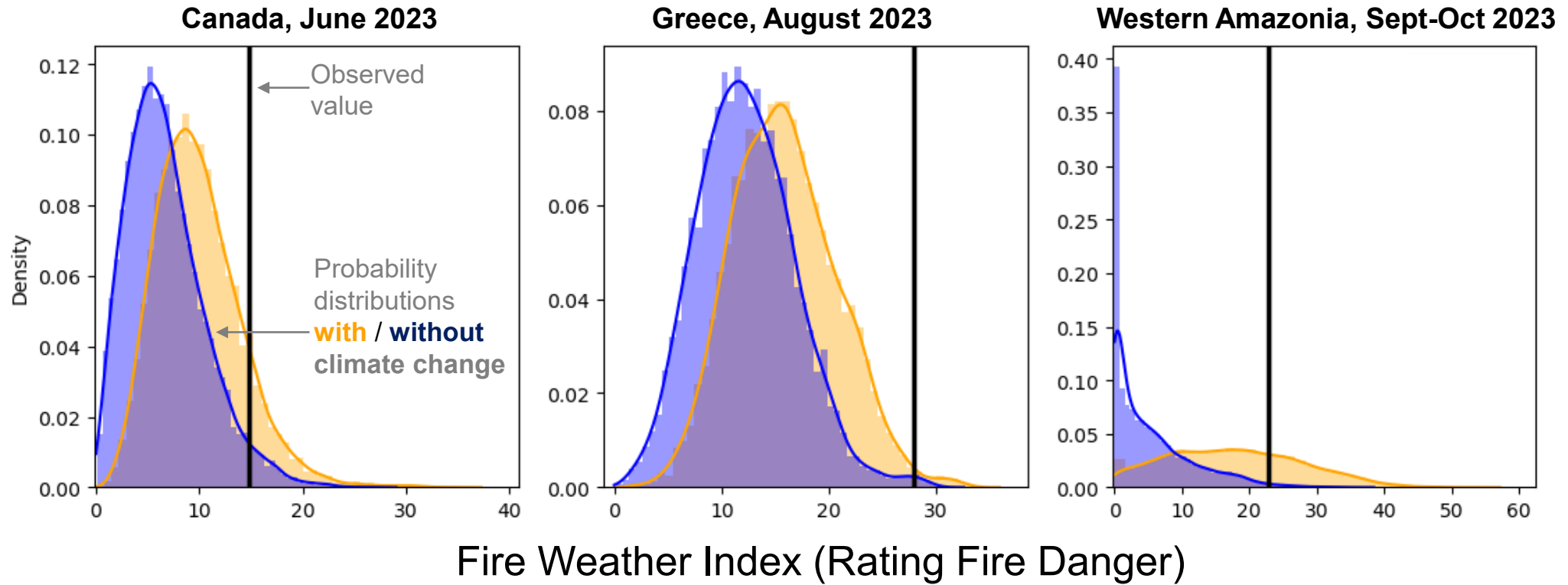
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# Climate Change Raised the Odds of Fire-prone Weather



**3x**  
more likely due to  
climate change

**>2x**  
more likely due to  
climate change

**>20x**  
more likely due to  
climate change



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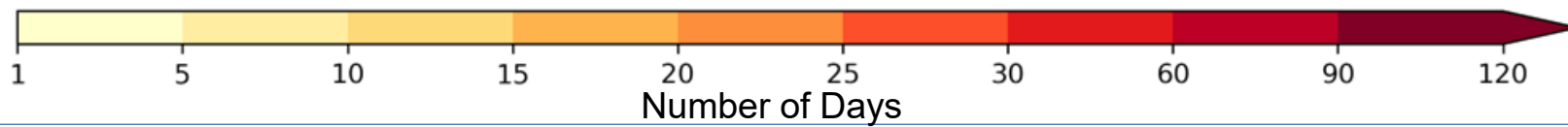
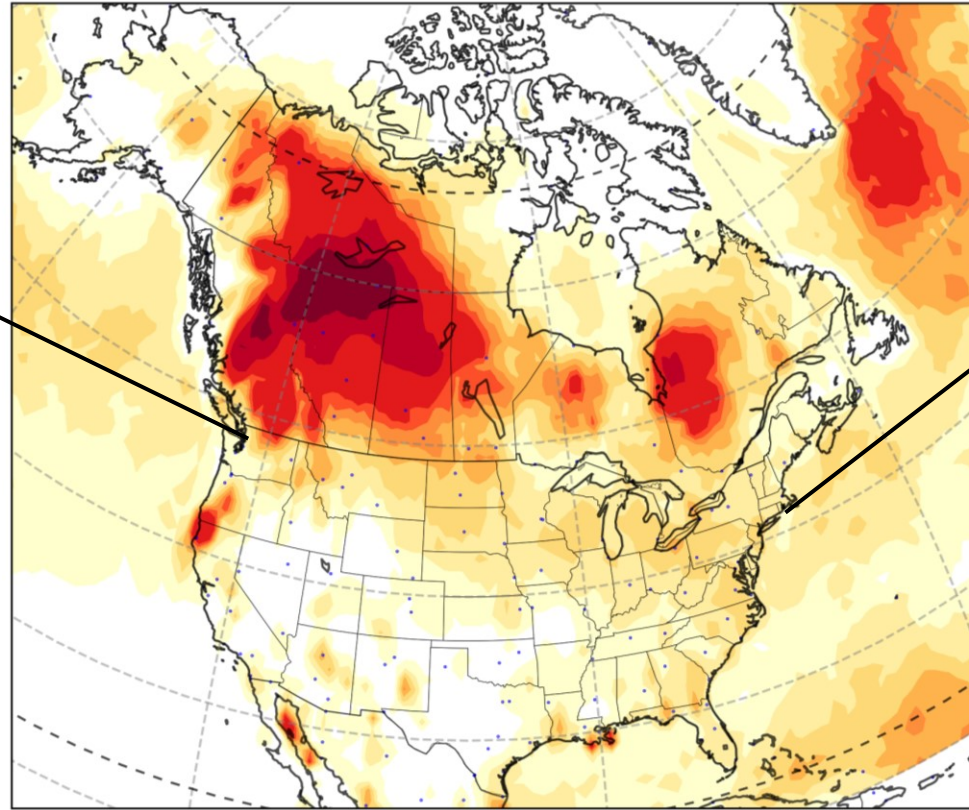
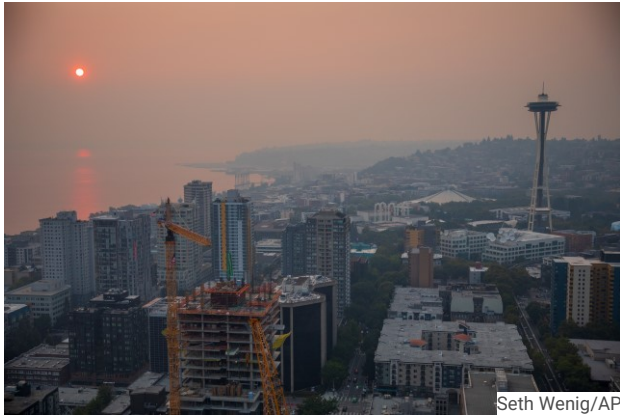
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# Full Consequences Yet to Unfold

Number of Days in 2023 with Air Quality Worse than WHO Guideline ( $35 \mu\text{g PM}_{2.5}/\text{m}^3$ )



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