https://docs.google.com/presentation/d/1zjOlcs6Q5G9QAkyUdp7w1F0LK-dPz_hlmTszrJ59b_A/edit?usp=sharing

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A M DEL
EARTH


bluedot


A M DEL
EARTH




Controls on Tropical Tree Cover

Douglas Kelley, France Gerard, **Dr.** Chantelle Burton, Rhys Whitley, Guangqi Li, Gitta Lasslop, Ioannis Bistinas, Rich Ellis, Elmar Veendendaal, Graham Weedon, Eddy Robertson, Edward Comyn-Platt, Alistair Sellar, Colin Jones, Toby Marthews, Anna Harper, Ning Dong, Jon Lloyd

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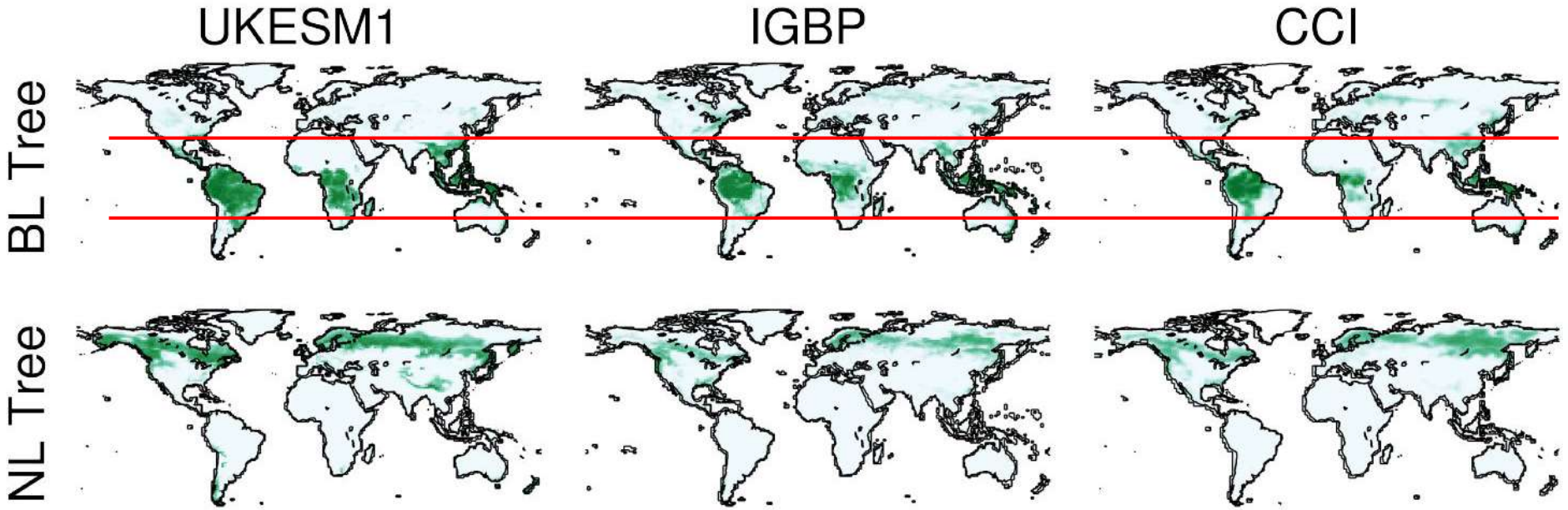
UKESM tree cover



Sellar et al. UKESM1: Description and evaluation of the UK Earth System Model, sumbitted

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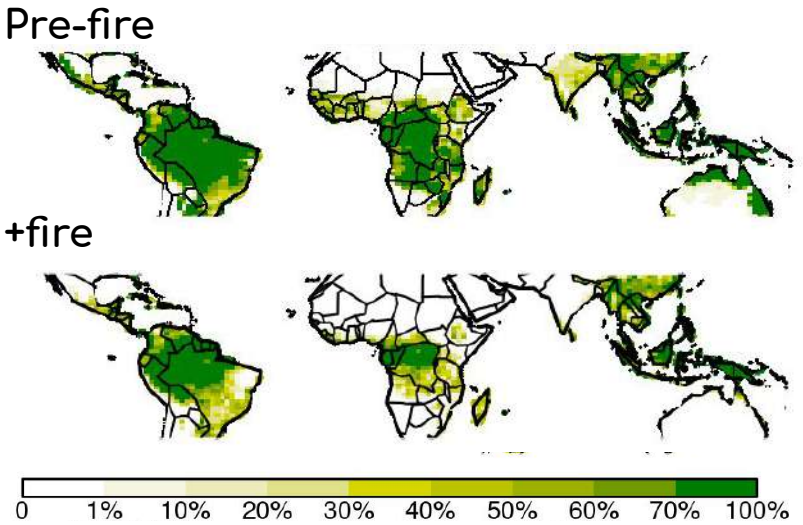
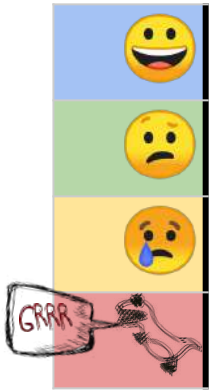
JULES-ES(+fire) fireMIP benchmarking

Comparison	Dataset	Time period	Pre-fire	+ Fire
	VCF	2002-2012	0.78	0.51
Life form			0.72	0.63
Tree Cover	CCI	2010	0.53	0.3
	VCF	2002-2012	0.64	0.29
Wood Cover	CCI	2010	0.45	0.36
	VCF	2002-2012	0.64	0.42
Herb cover	CCI	2010	0.43	0.42
	VCF	1992-1993	0.56	0.53
Leaf type			0.56	0.54
BL vs NL			0.18	0.17
Shrub	CCI	2010	0.36	0.23





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Controls on tropical tree cover

- How well are different controls & disturbances on tree cover represented in JULES?

Controls on tropical tree cover

- How well are different controls & disturbances on tree cover represented in JULES?
- What are the controls & disturbances on tree cover?

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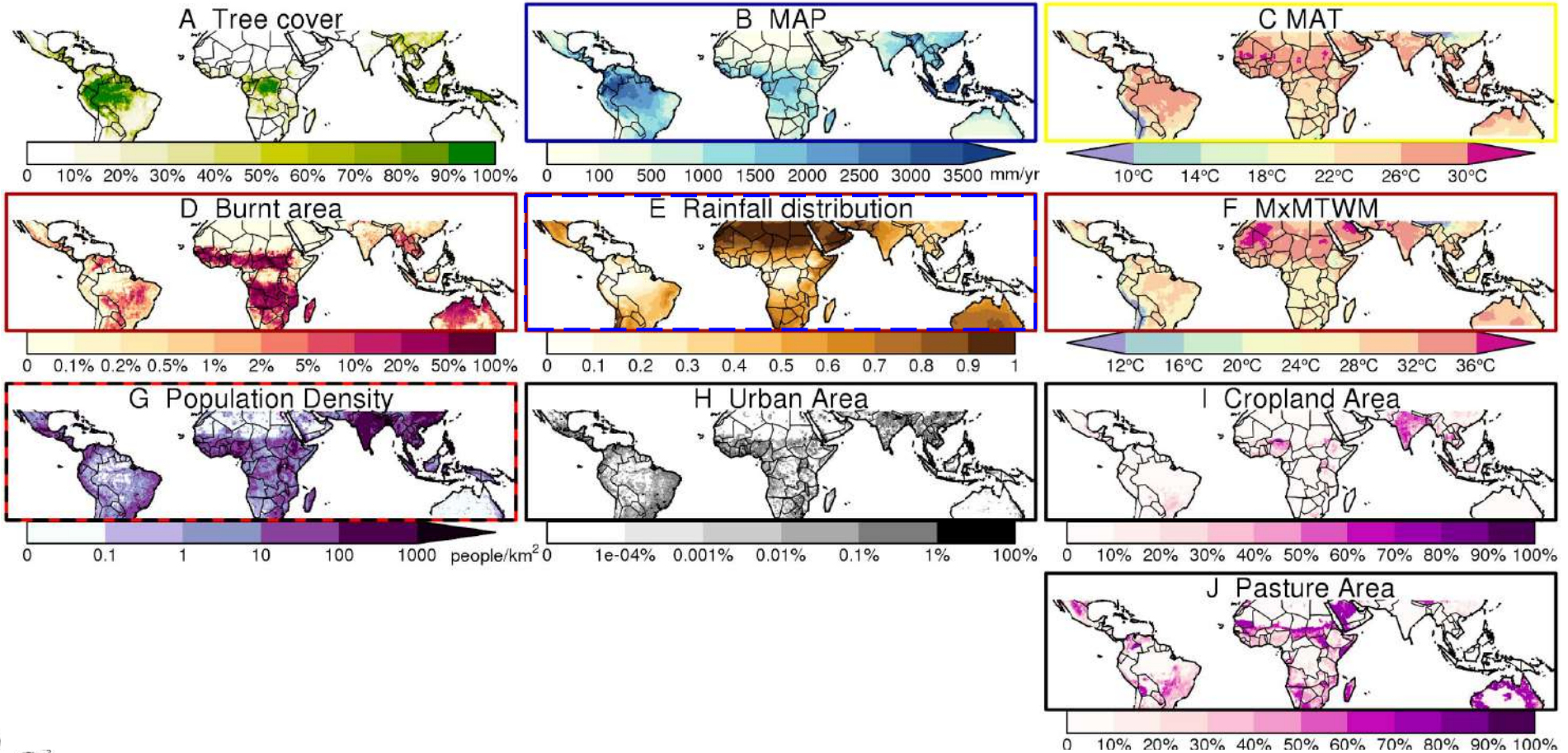
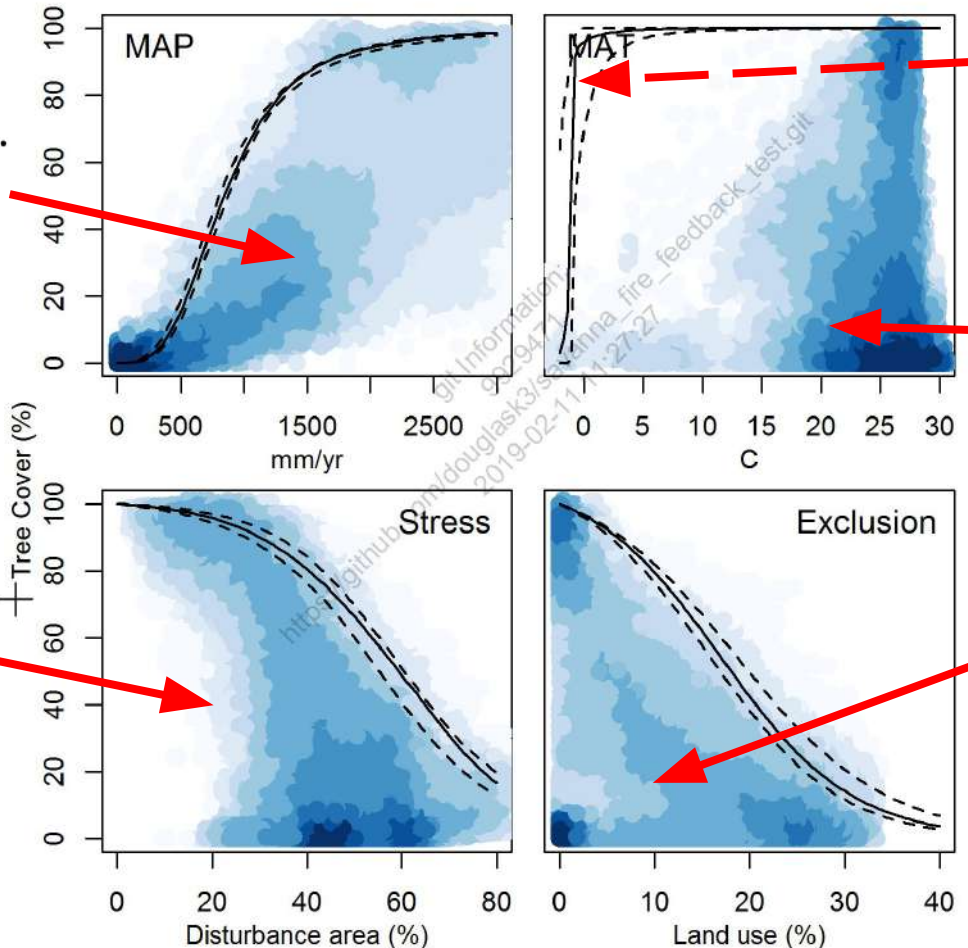
Inferred tree cover controls



Tree cover controls assessment

$$log\left(MAP + \frac{MAWD}{v_{MAWD}} \cdot (e^{-v_{MAWD} \cdot MAP} - 1)\right)$$

$$Background + v_{fire} \cdot BurntArea + v_{MADD} \cdot MADD + v_{temp} \cdot MxTWM + v_{pop} \cdot population$$



$$f(x) = \frac{1}{1+e^{-k_c \cdot (x_c - x_{c,0})}}$$

MAT

$$Urban + v_{crop} \cdot crop + v_{pas} \cdot pasture$$

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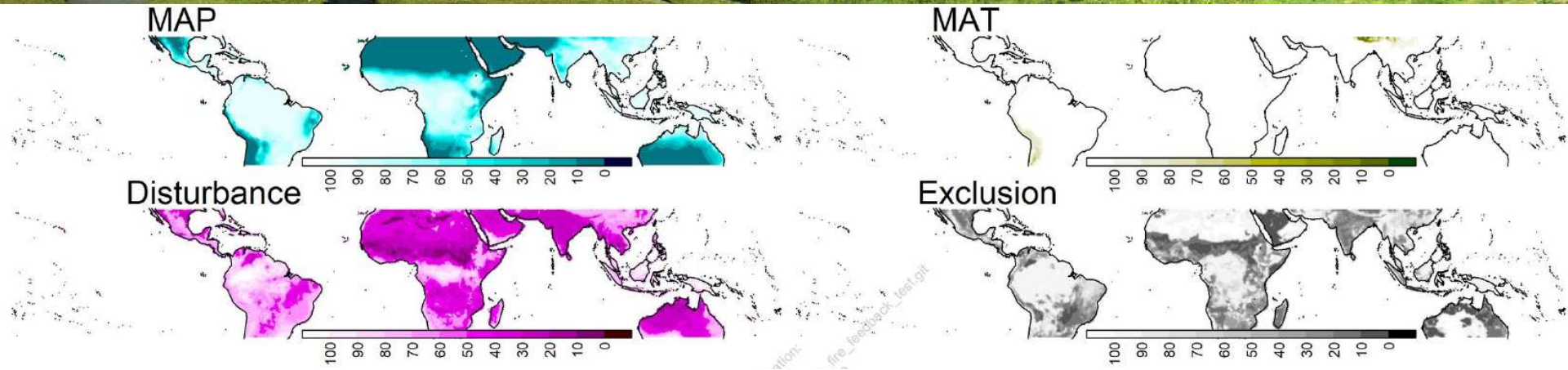
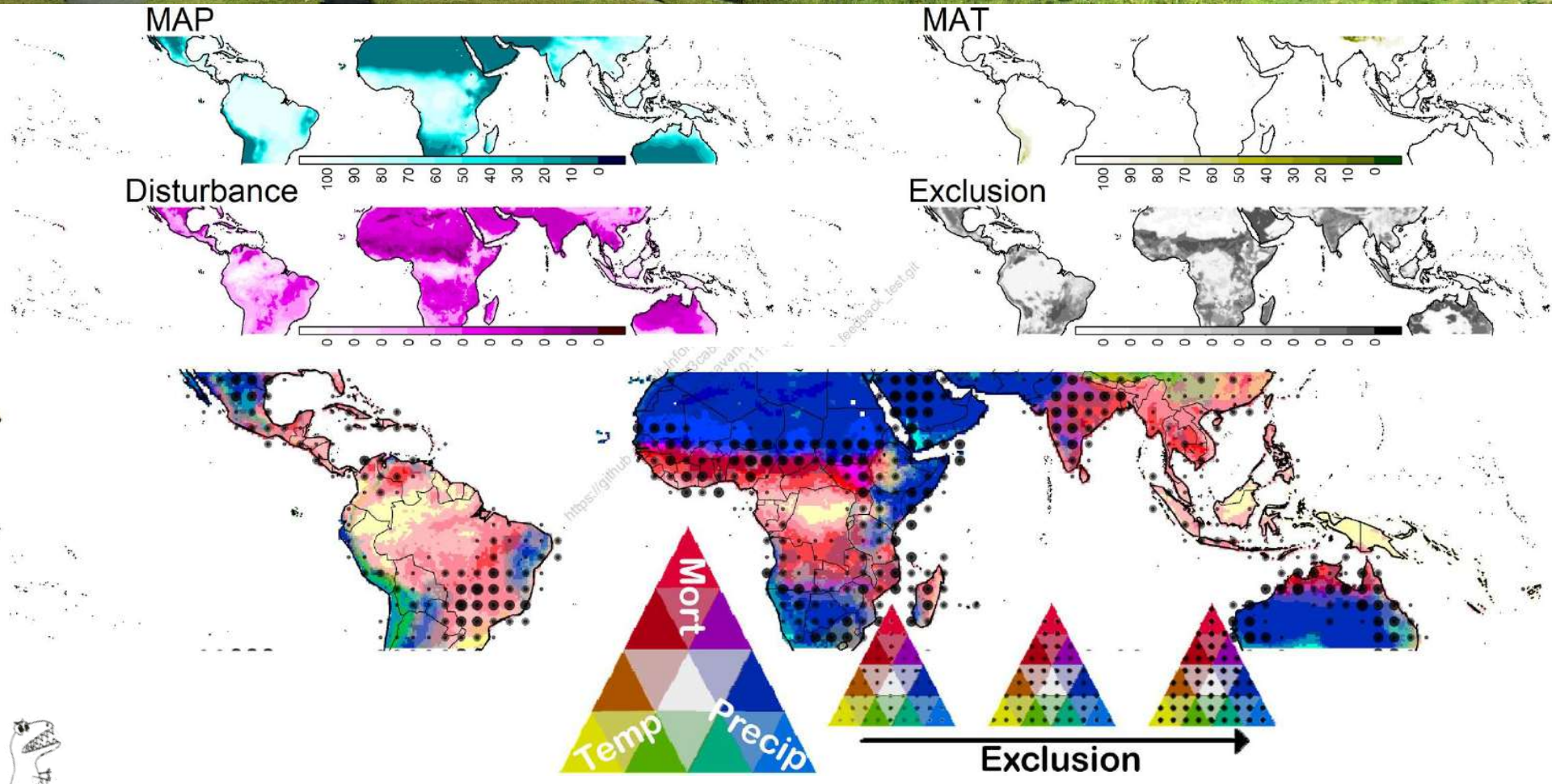
Tree cover controls assessment



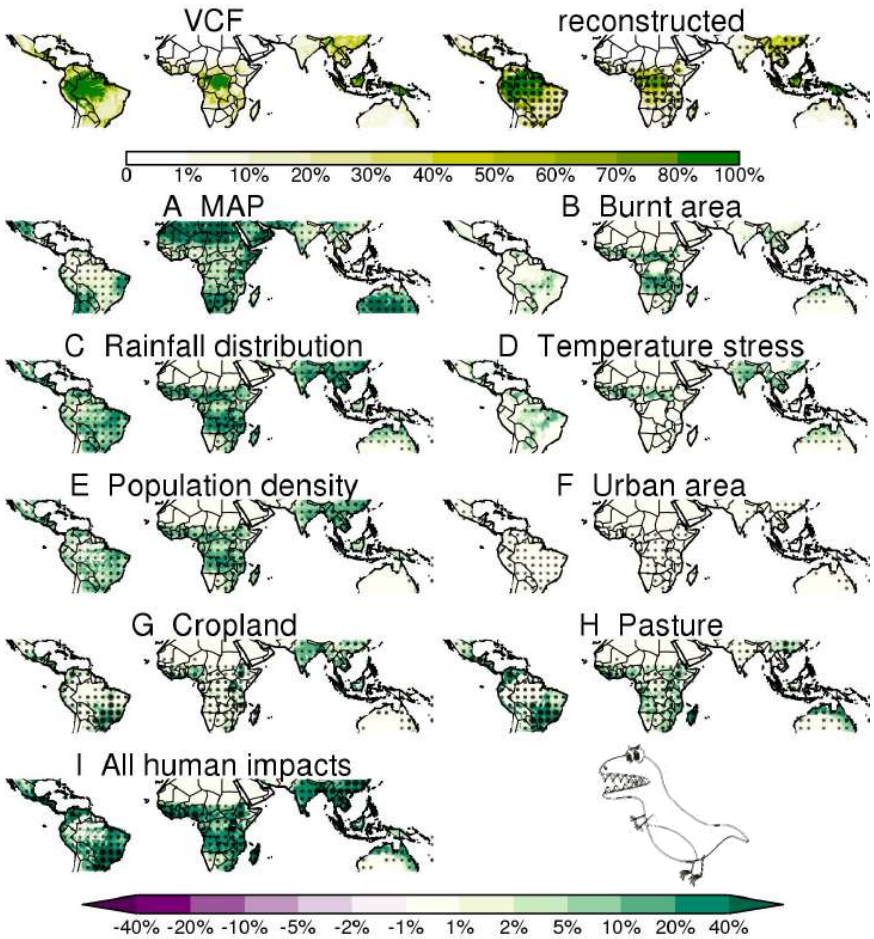
Optimized using Bayesian Inference:

- Tracks and quantifies parameter uncertainty and model error
- Gives more confidence to model predictions
- Provides a constraint rather than hard target

Tree cover controls assessment



Mortality types



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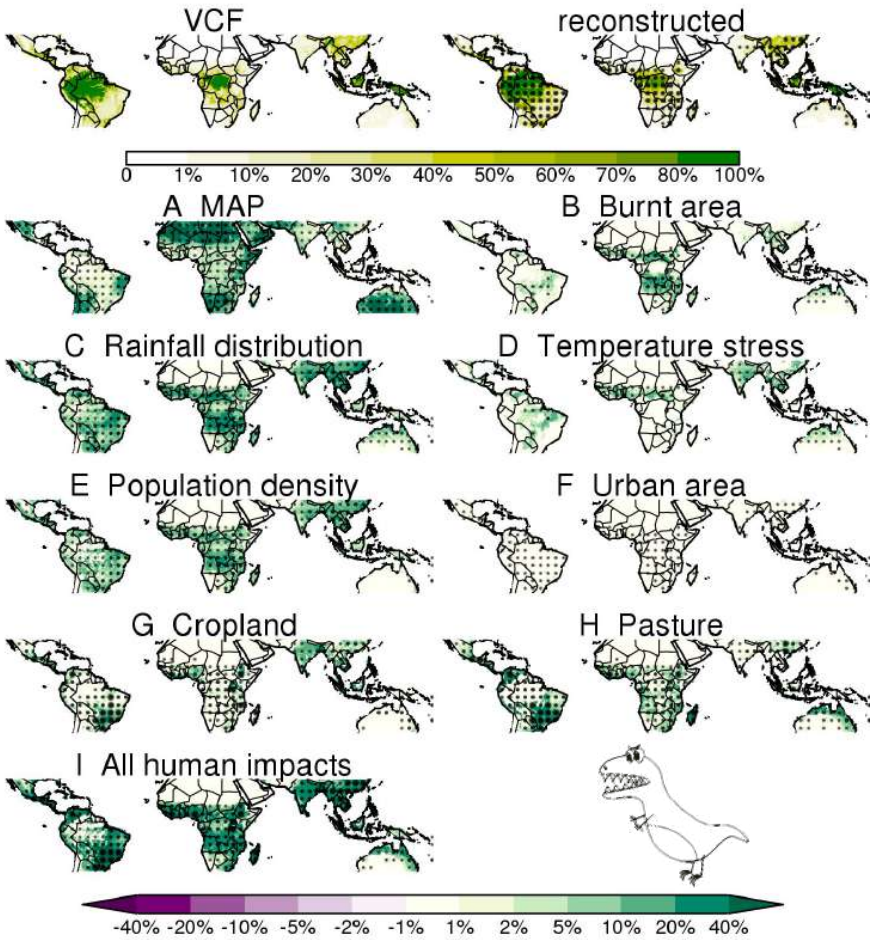
Mortality types



T_{upp} !!

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Jules Experiments

A Rainfall set to 10,000 mm/yr

B Fire mortality set to zero

C Rainfall Distribution removed

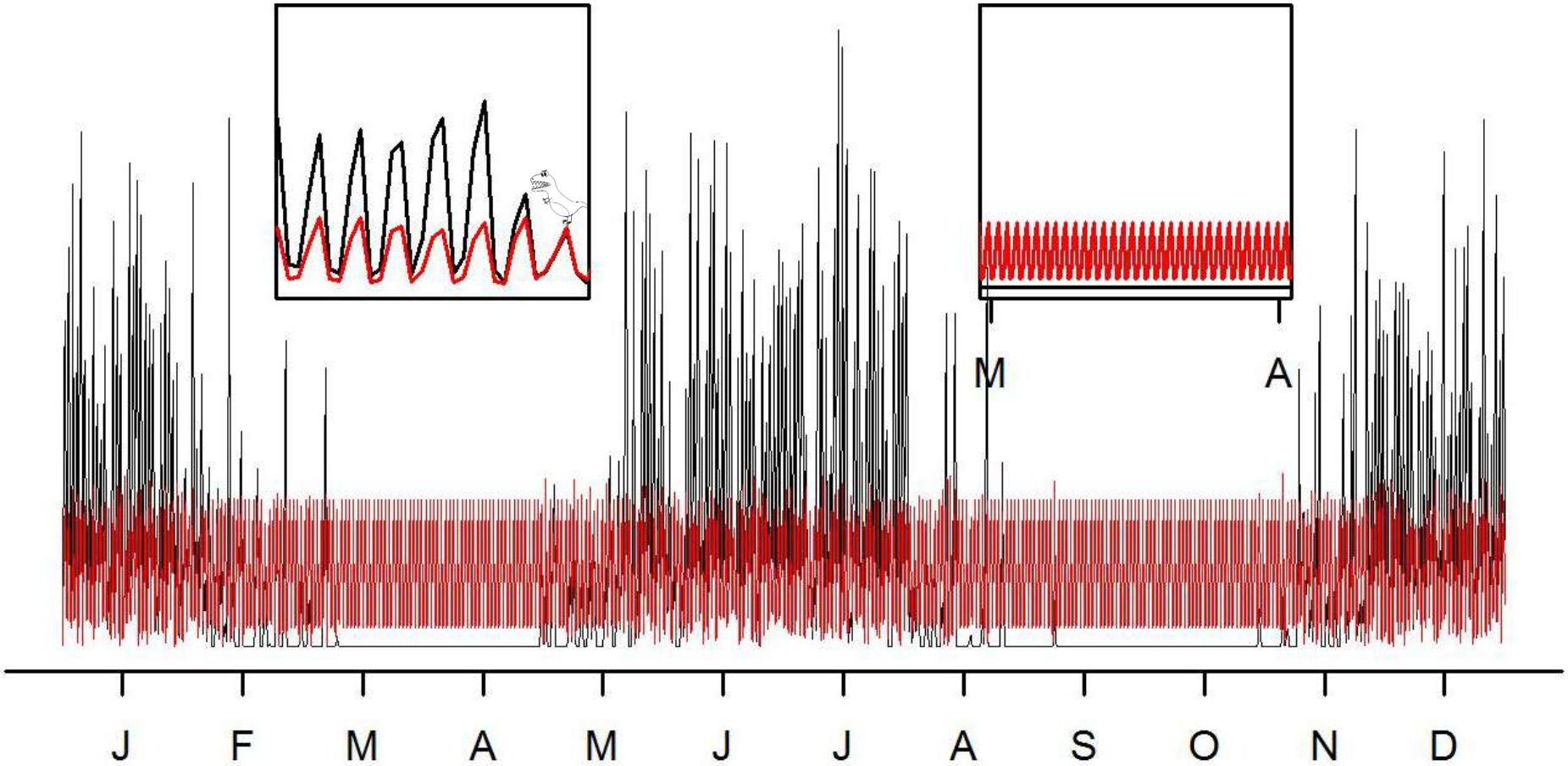
D T_{upp} on V_{cmax} removed

E None: Pop den deforestation not included

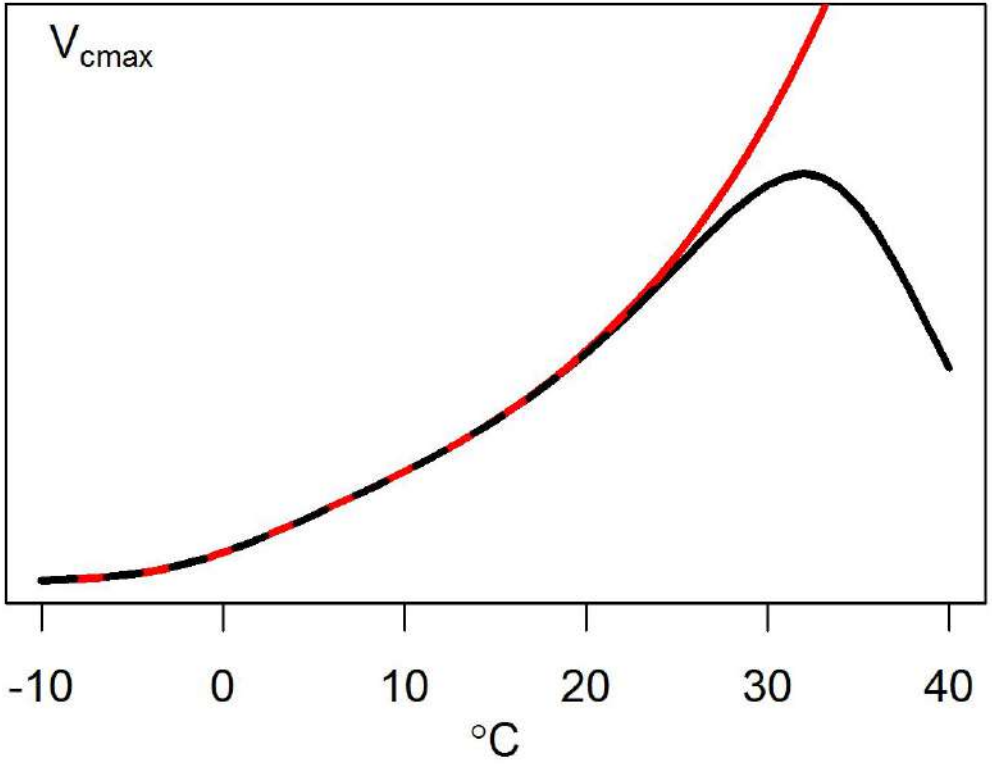
F, G, H Human land cover type set to zero in turn

I All land cover set to zero

Jules Experiment - C Rainfall distribution



Jules Experiment - Temperature stress



$$V_{cmax} = \frac{V_{cmax25} \cdot Q_{10}^{0.1 \cdot (T_c - 25)}}{\left[1+e^{0.3 \cdot (T_c - T_{upp})}\right] \cdot \left[1+e^{0.3 \cdot (T_{low} - T_c)}\right]}$$

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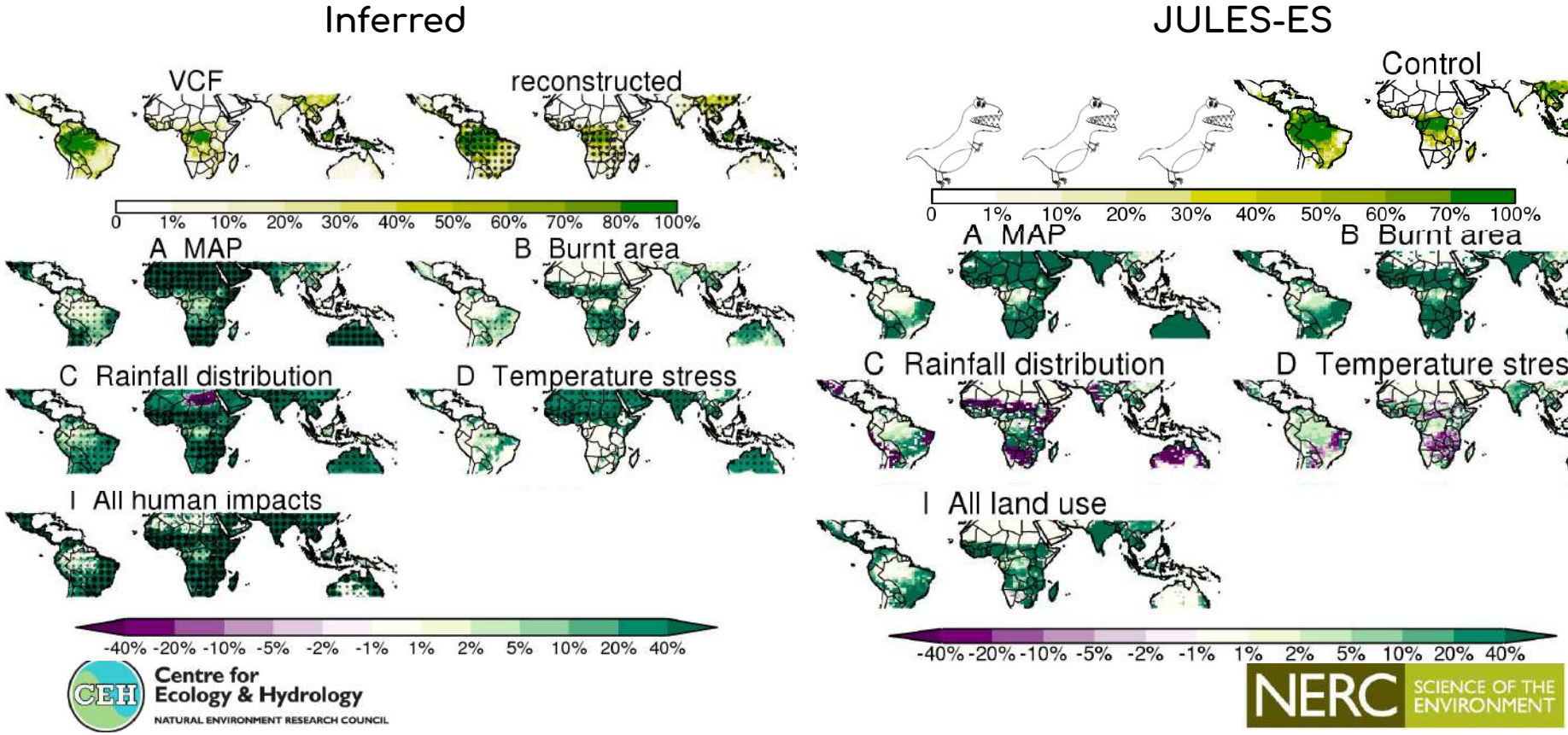
Mortality types



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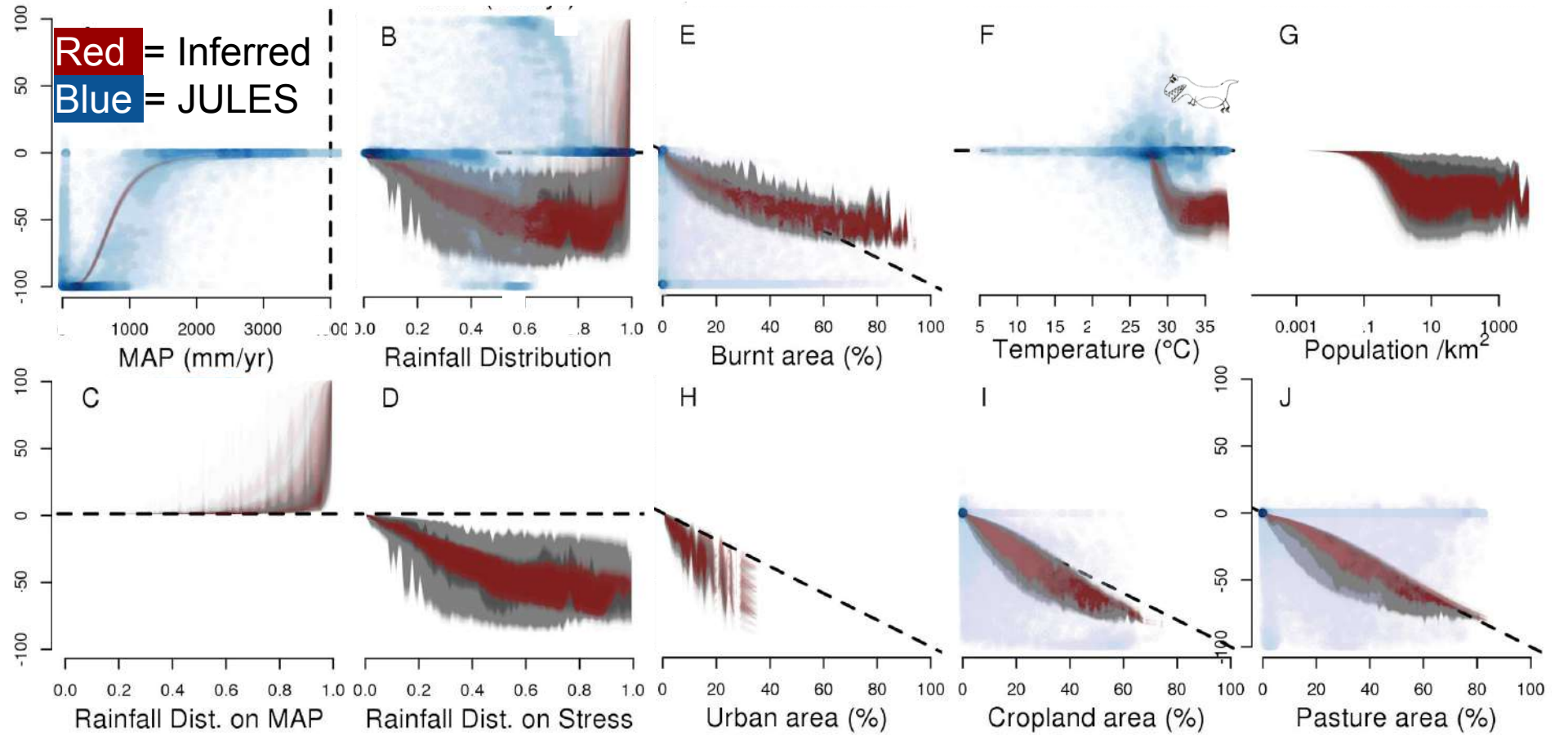
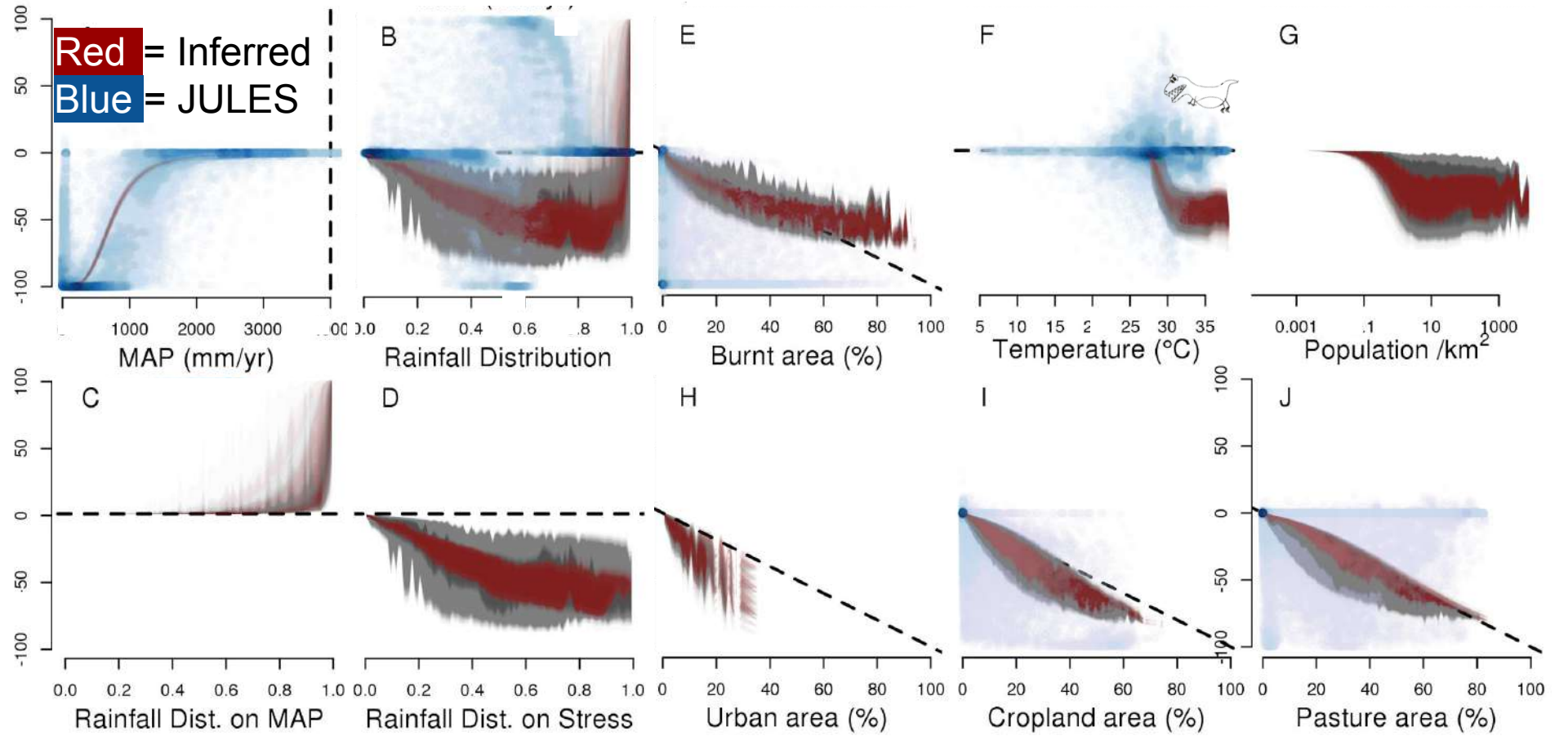
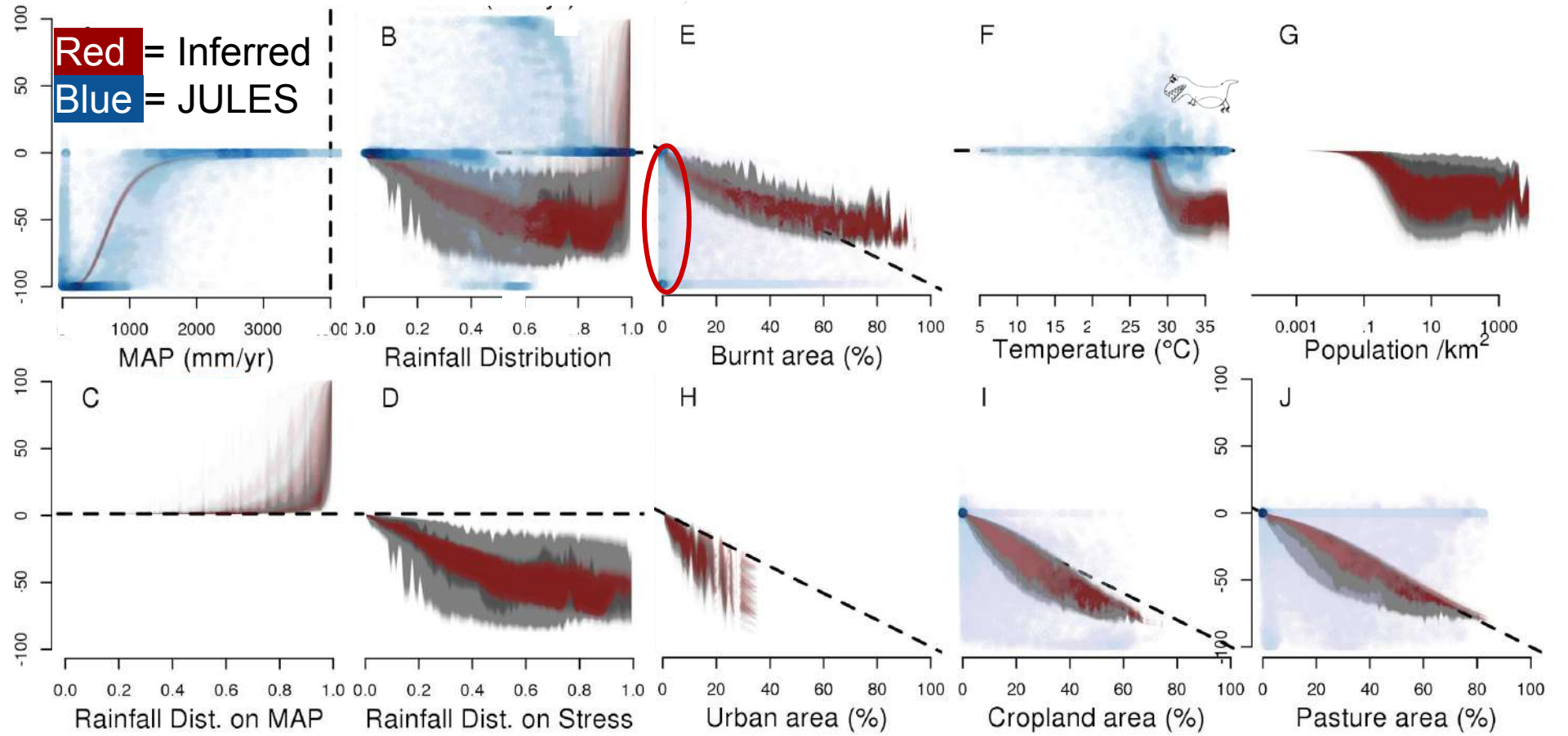
Mortality types



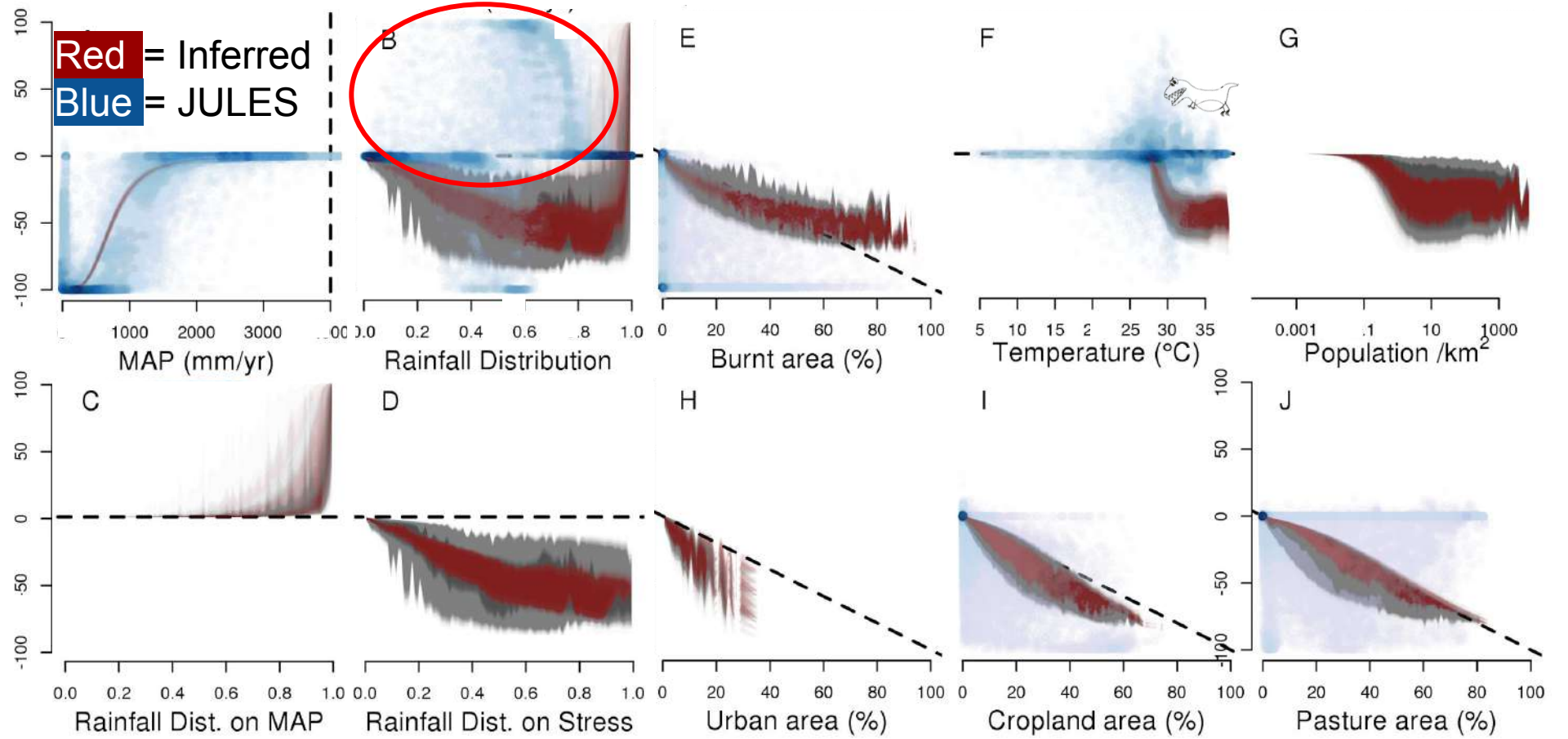
Mortality types



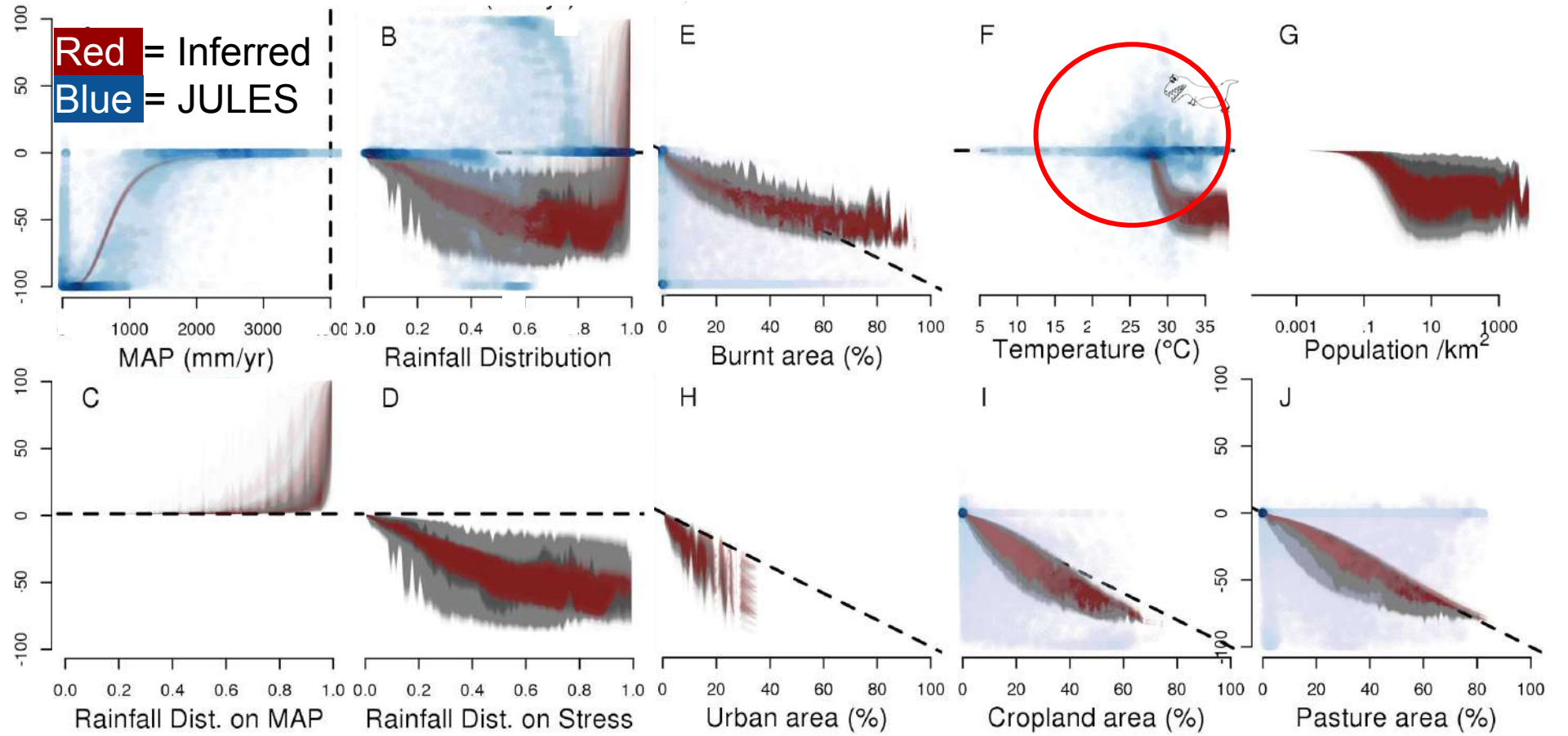
Mortality types



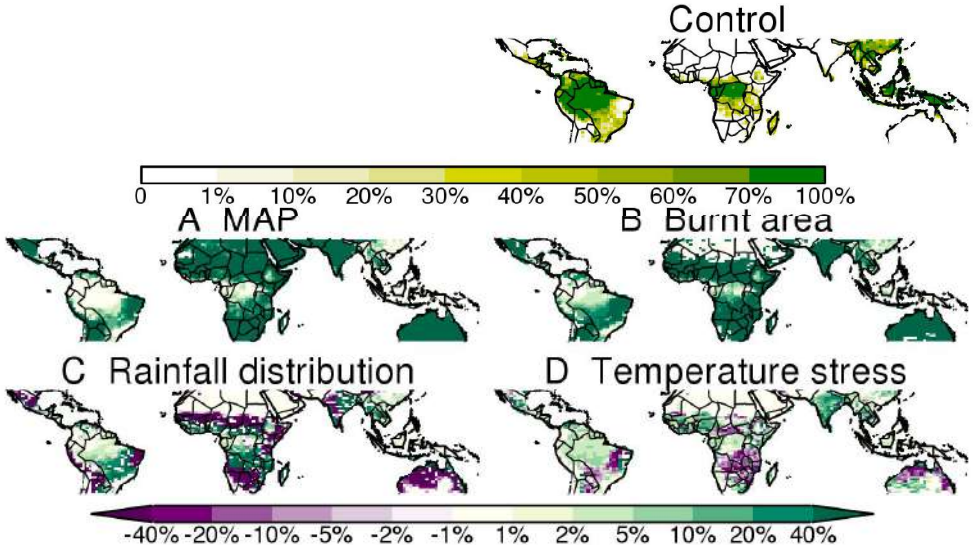
Mortality types

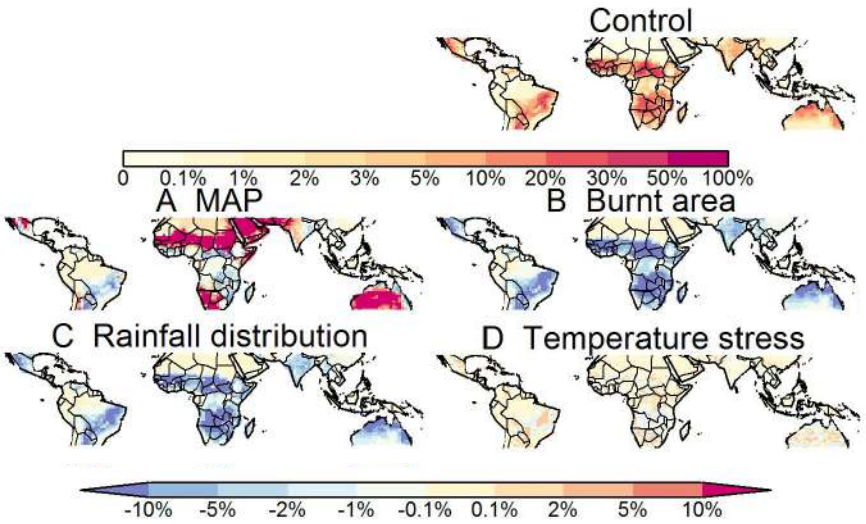


Mortality types



But not everything is kept constant





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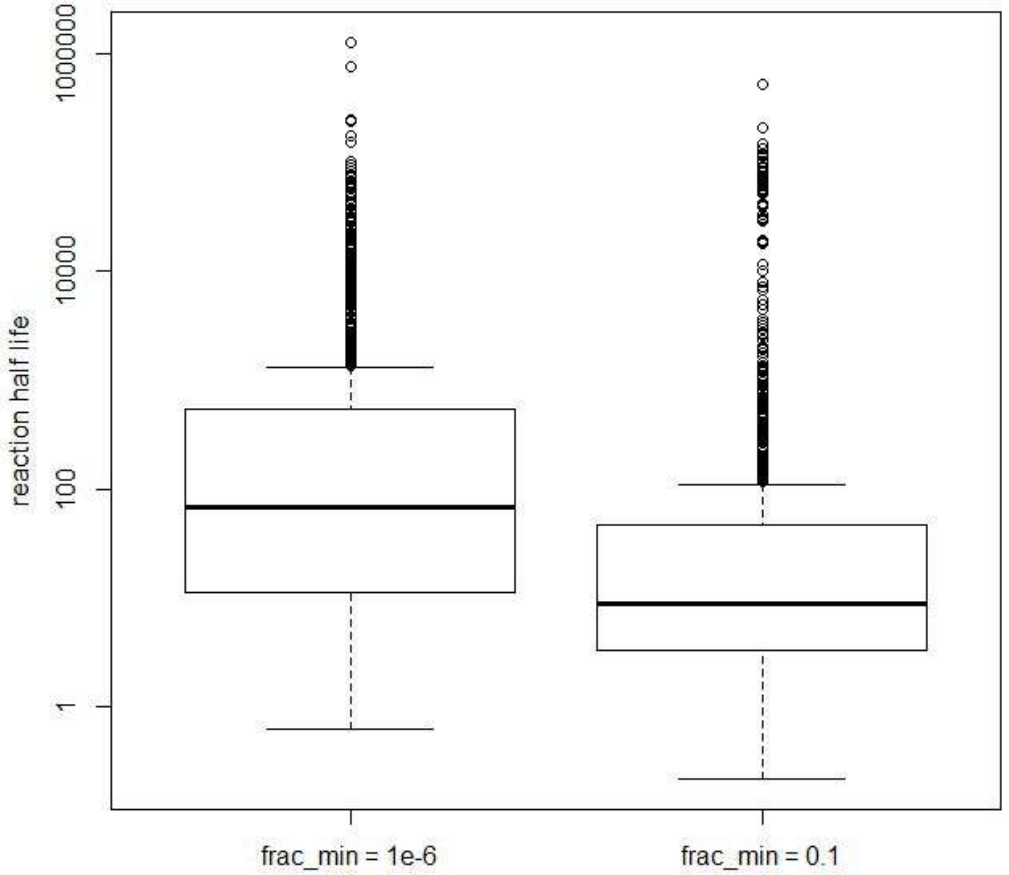
Recovery time after burning



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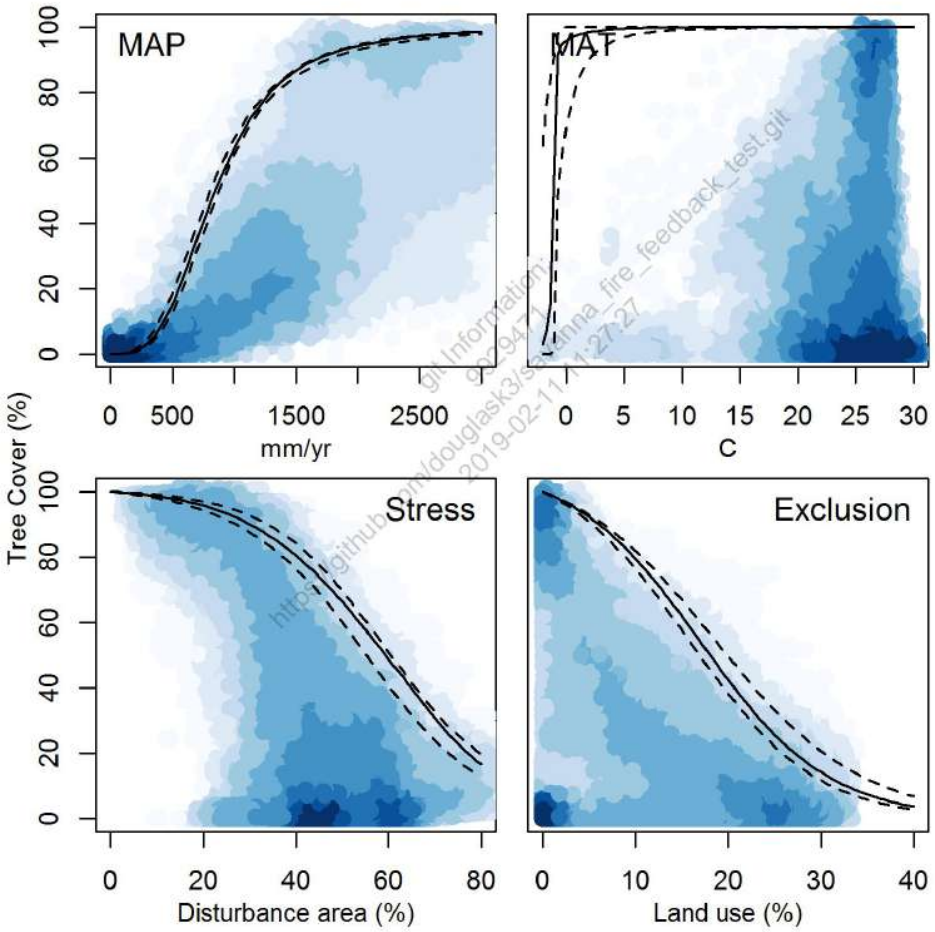
Summary

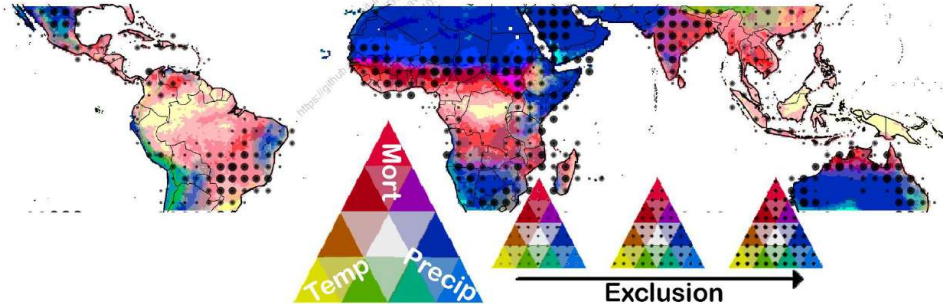
- Too much tree cover at low MAP, but generally MAP not bad
- Land use impacts are fine
- Fire "overkill"

- Something weird's going to with rainfall distribution and temp. stress:
  - Turn fire off in jules/on in inferred
  - Inc. Rainfall & temp synchronicity
  - Impact of canopy on water availability

Vulnerability



Limitation



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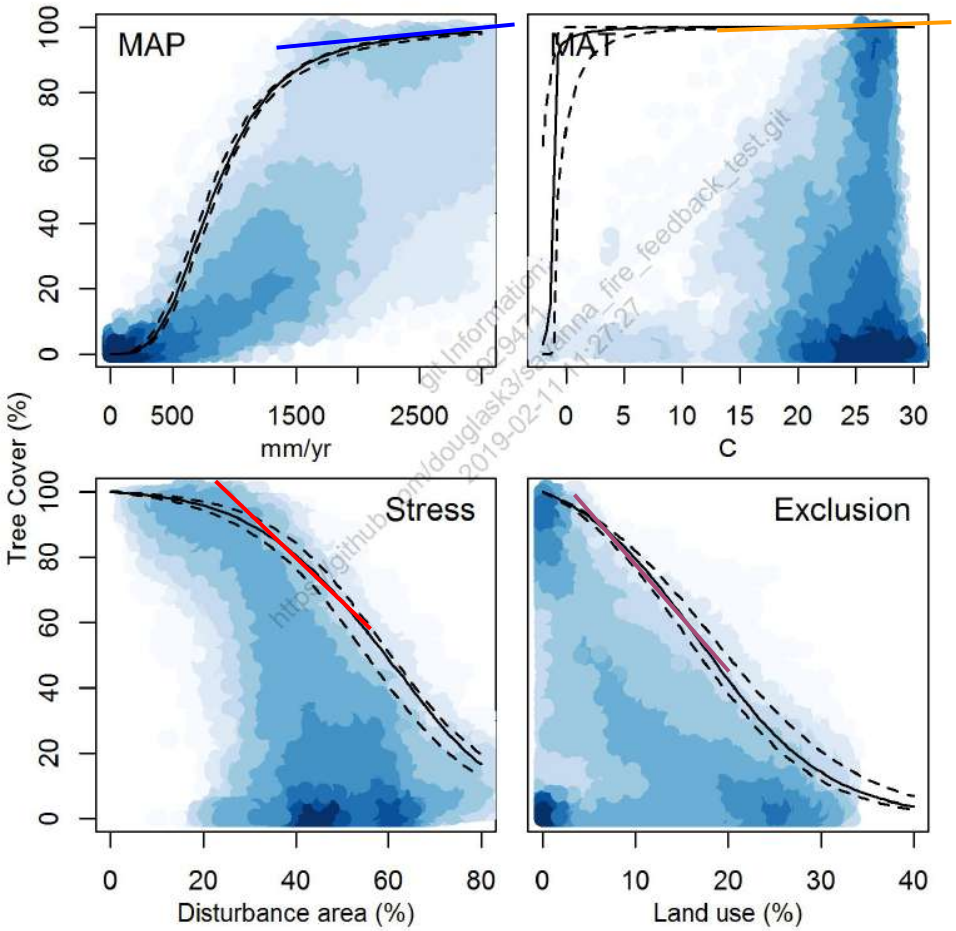
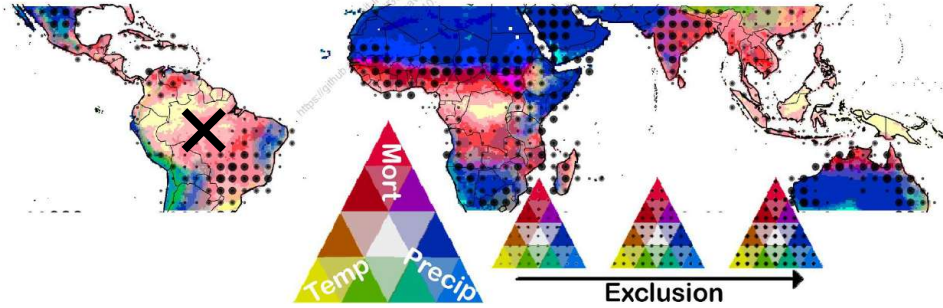
Vulnerability



Limitation



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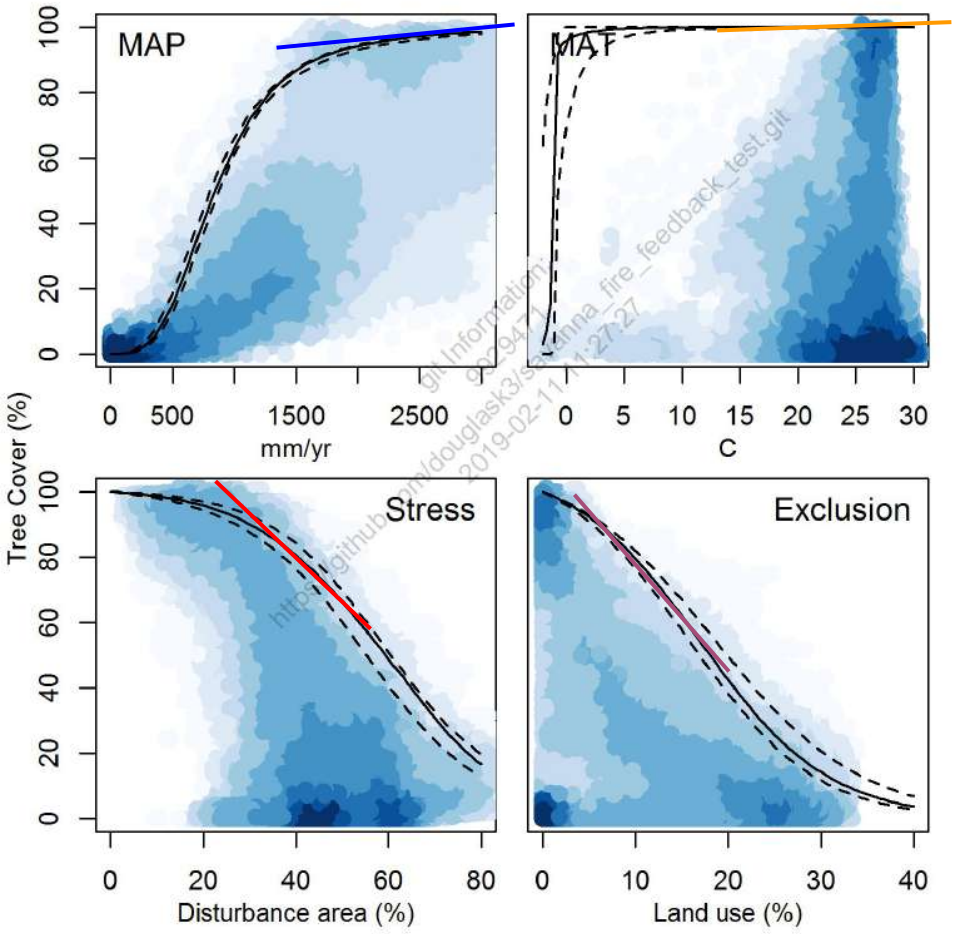
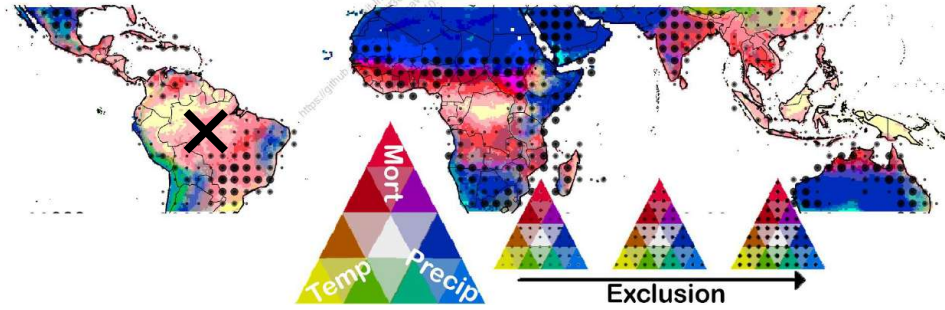
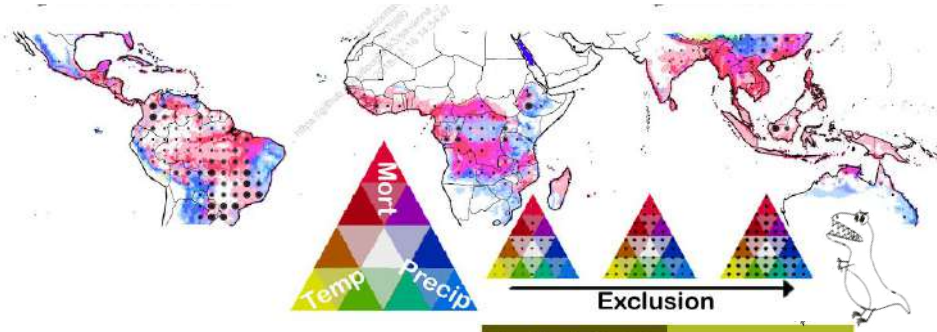
Vulnerability



Limitation





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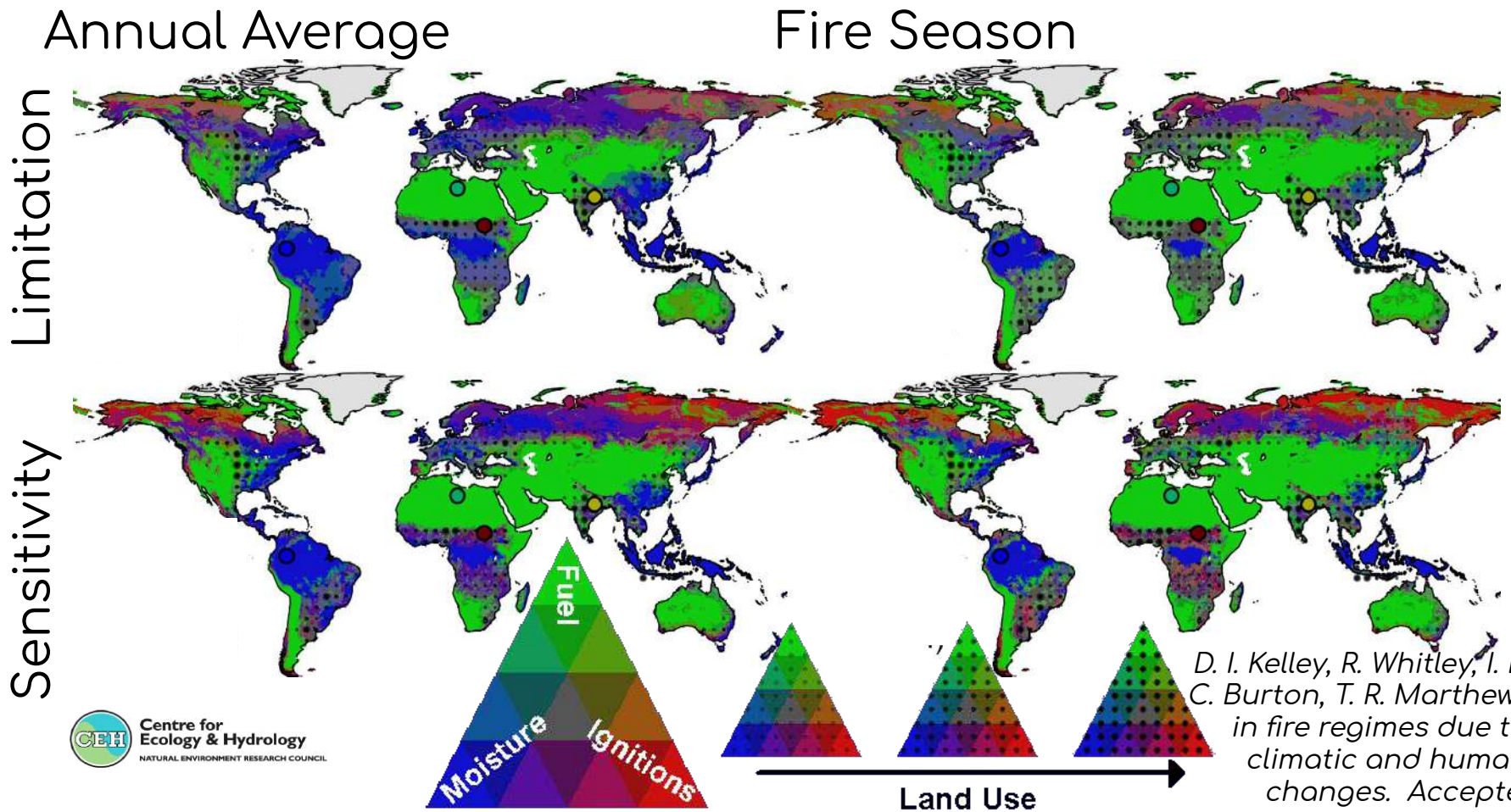
Limitation and sensitivity



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D. I. Kelley, R. Whitley, I. Bistinas, C. Burton, T. R. Marthews, Shifts in fire regimes due to global climatic and human driven changes. Accepted, NCC.