

Risk of Amazonian Drying in the 21st Century

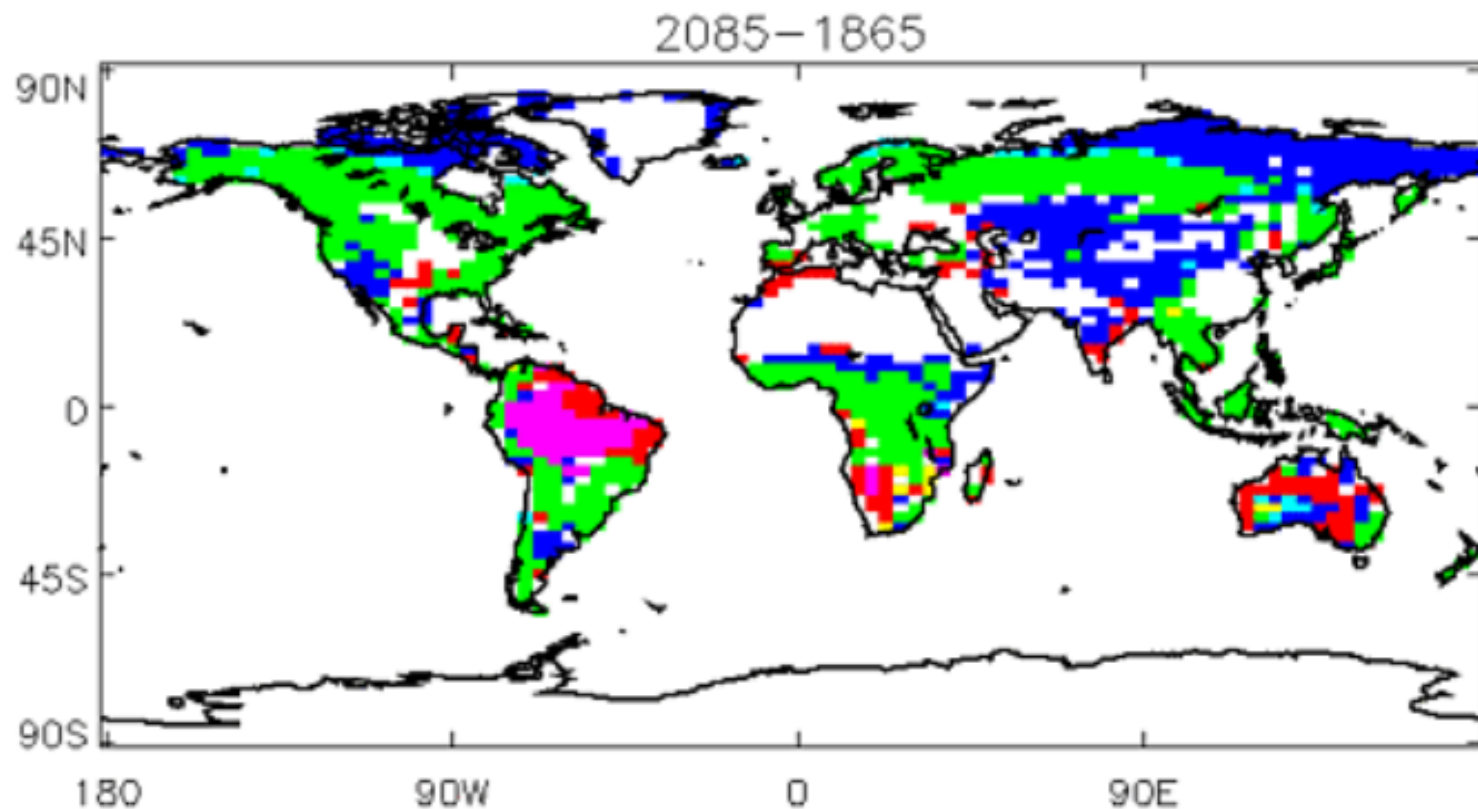
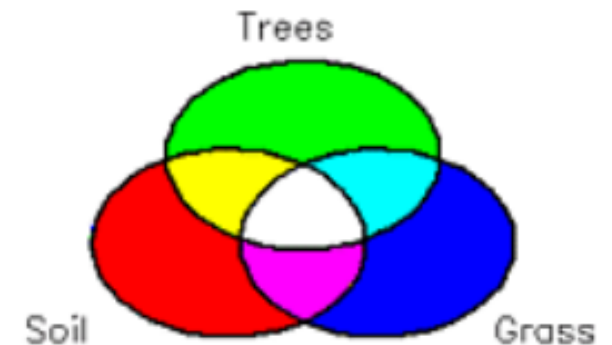
**Prof. Peter Cox
&
Dr Tim Jupp**

**Mathematics Research Institute
University of Exeter**

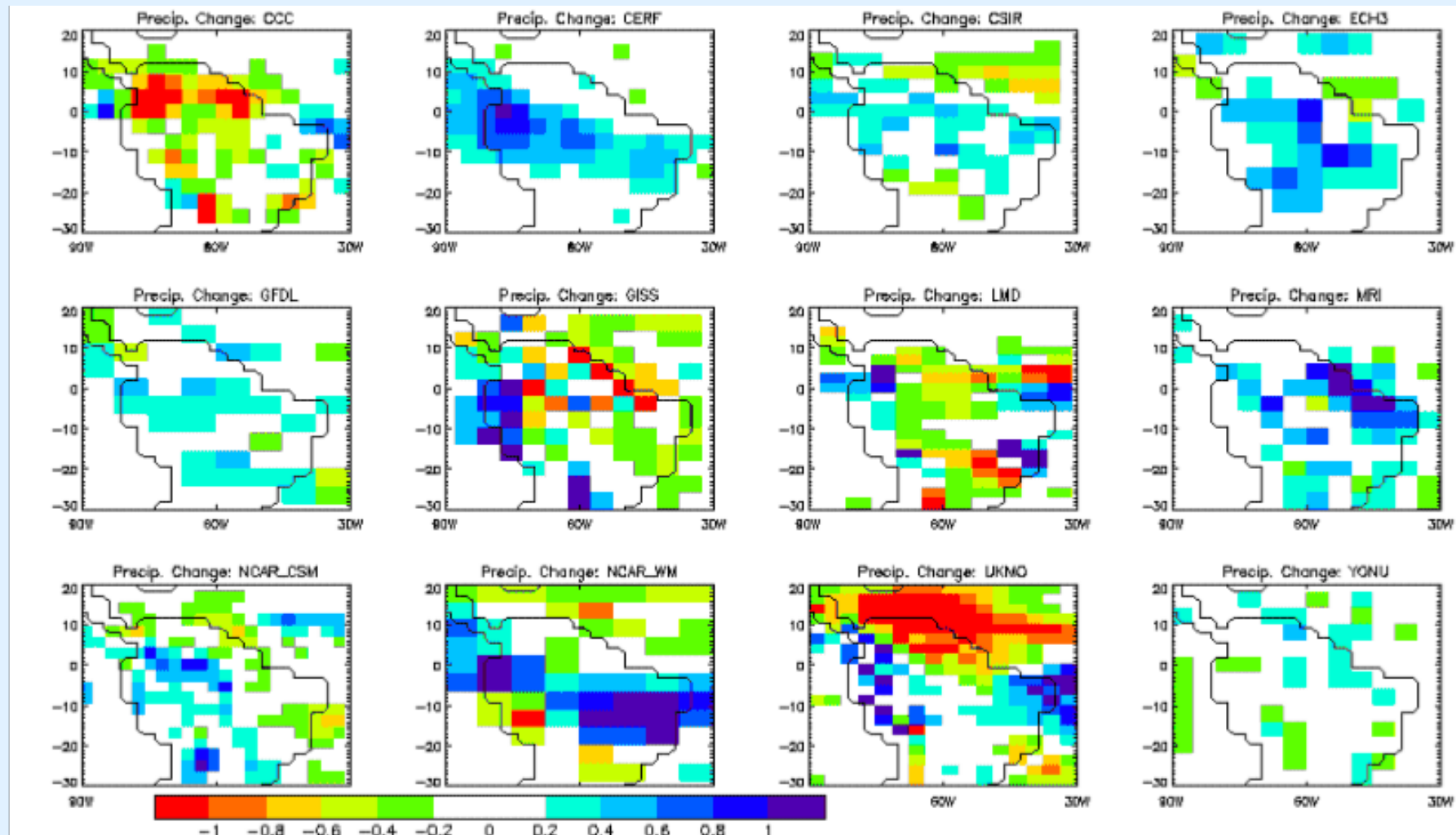
Project Motivation

What is the risk of
“dieback” of the Amazon Rainforest
due to climate change ?

Predicted Change in Vegetation Cover in the Hadley Centre Climate-Carbon Model



Big Differences in Climate Predictions of Rainfall Change (mm/day) over Amazonia !



How do we decide which is right ?

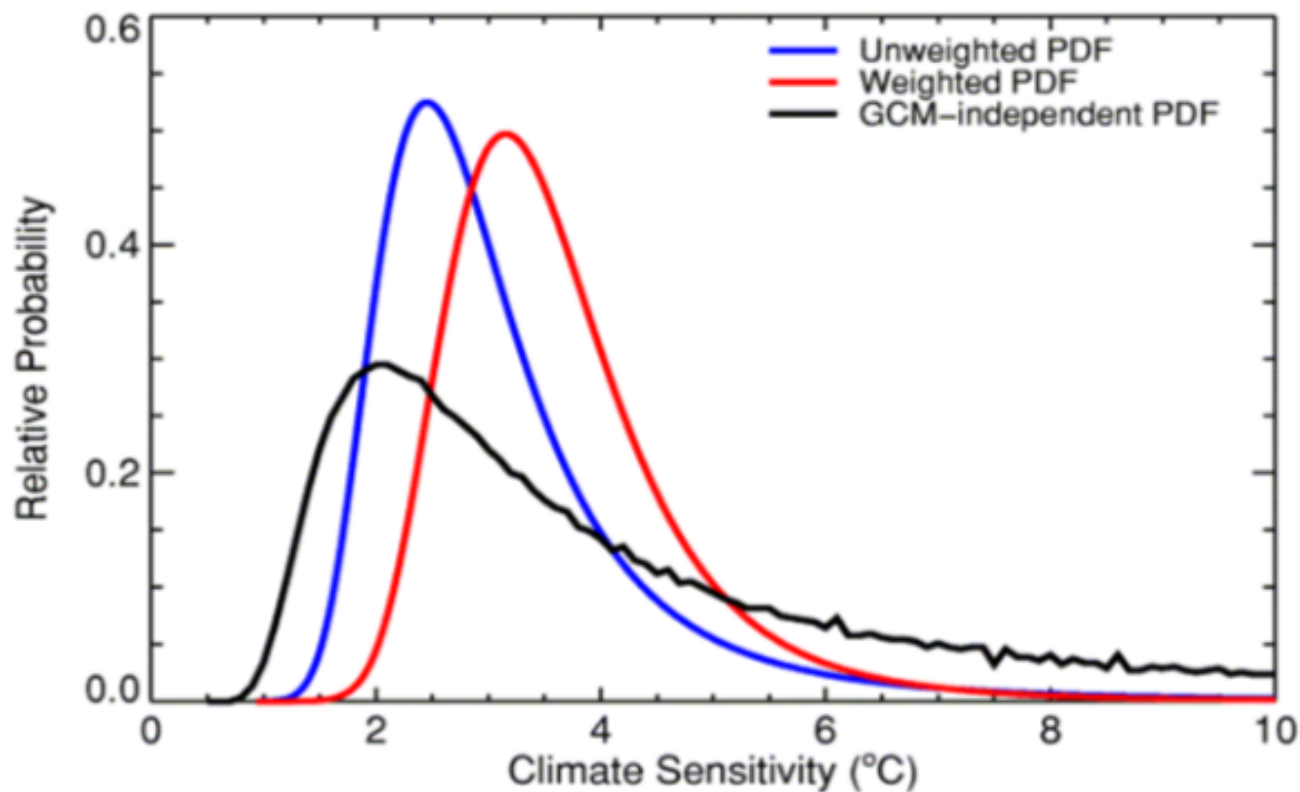
Answer : we use observations to “weight” different model predictions...

University of Exeter's Role

Estimating the
Probability Density Function
for Future Rainfall
in the Amazon

Plans to define a “Probability Density Function” for Future Amazon Rainfall

Example of PDF for Climate Sensitivity (Murphy et al. 2004)



Plans to define a PDF for future Amazon Rainfall

- Use a Bayesian Approach:

$$P(\text{model given data}) \sim P(\text{data given model}) * P(\text{model})$$

*Posterior PDF
for future
Amazon
Rainfall*

*Weighting Factors
Based on model
Fit to observational
data*

*Prior PDF
for future
Amazon Rainfall*

- Will use results from the 20 GCMs which have reported appropriate data in the IPCC AR4 archive.
- Will involve defining “Amazon Climate Prediction Indices (ACPI)”, to weight different model predictions based on current day simulation

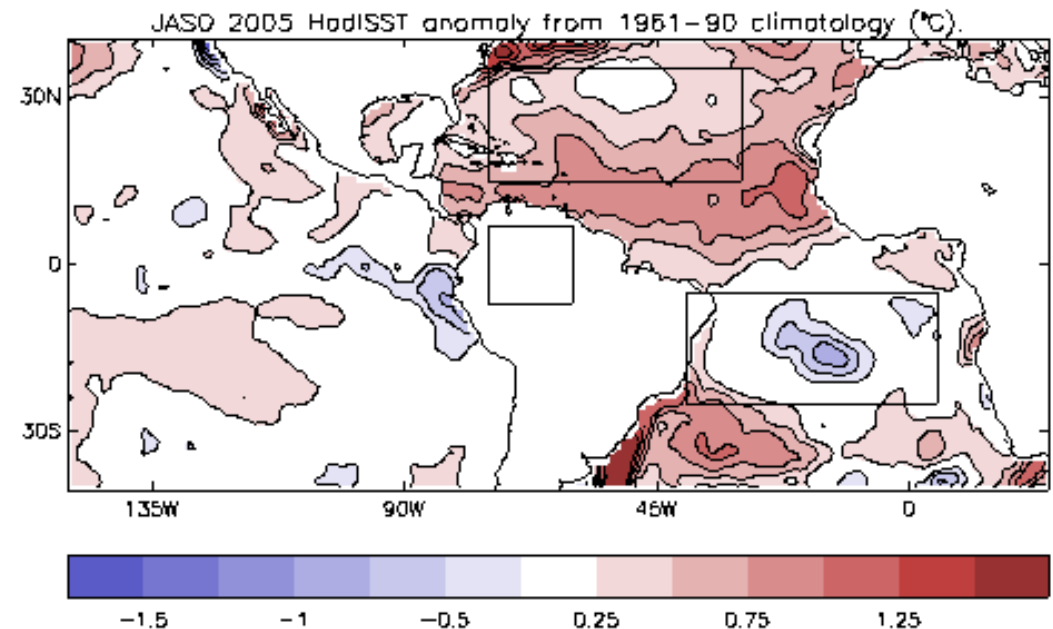
Defining Weighting Factors for the Models

- Will use observed climate variability to define relationships between patterns of tropical sea-surface temperatures and Amazon rainfall.
- Will encapsulate the role of sea-surface temperatures in the tropical Pacific (e.g. the reduction in rainfall in parts of Amazonia during *El Nino*).
- Will encapsulate the role of sea-surface temperatures in the tropical Atlantic (e.g. the 2005 drought).



Amazonian Drought of July-October 2005

**Warming of Tropical
North Atlantic Ocean
Relative to the South**



Are 2005-like Amazonian droughts set to become much more frequent ?

nature

Vol 453 | 8 May 2008 | doi:10.1038/nature06960

LETTERS

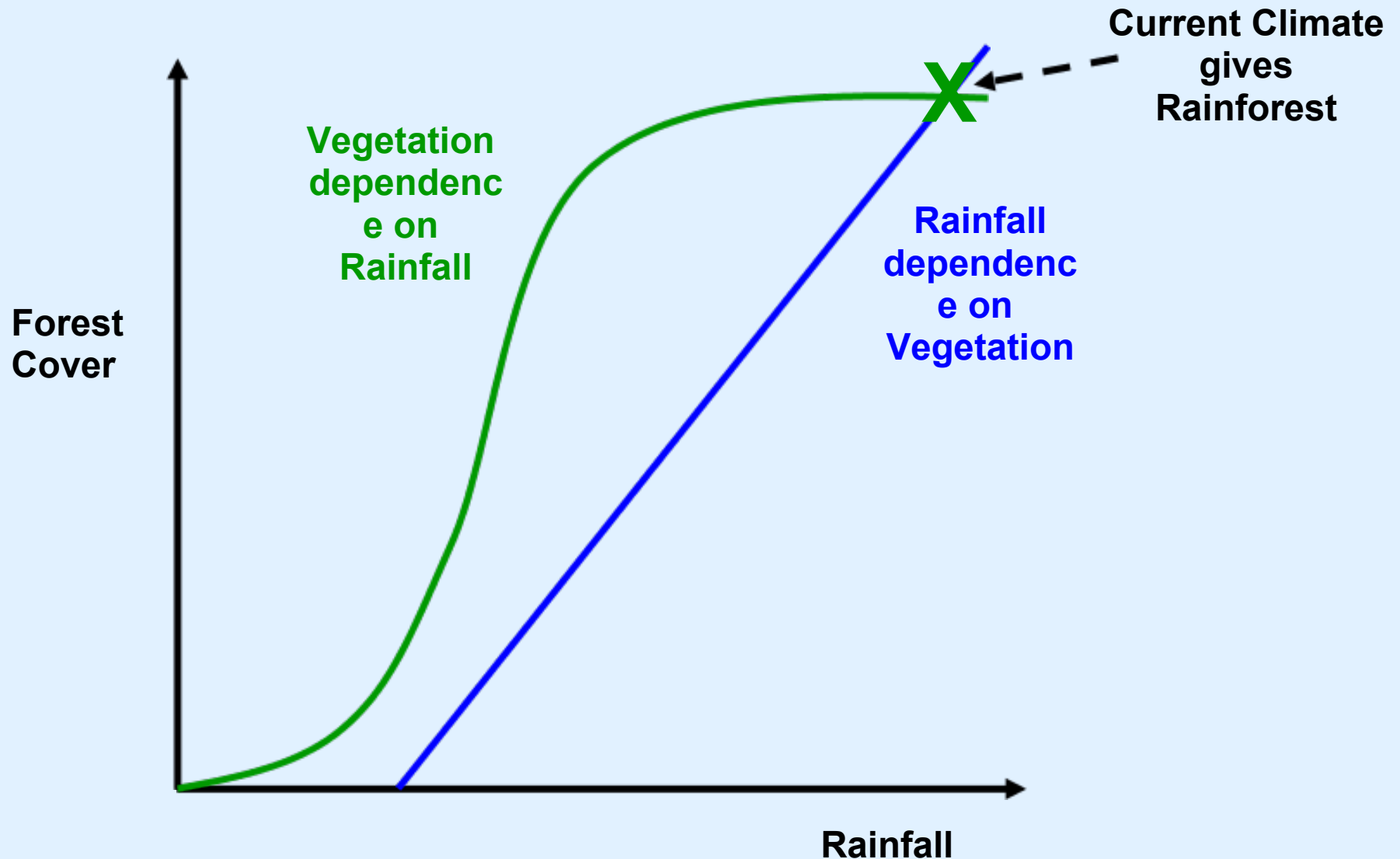
Increasing risk of Amazonian drought due to decreasing aerosol pollution

Peter M. Cox^{1,2}, Phil P. Harris³, Chris Huntingford³, Richard A. Betts², Matthew Collins², Chris D. Jones², Tim E. Jupp¹, José A. Marengo⁴ & Carlos A. Nobre⁴

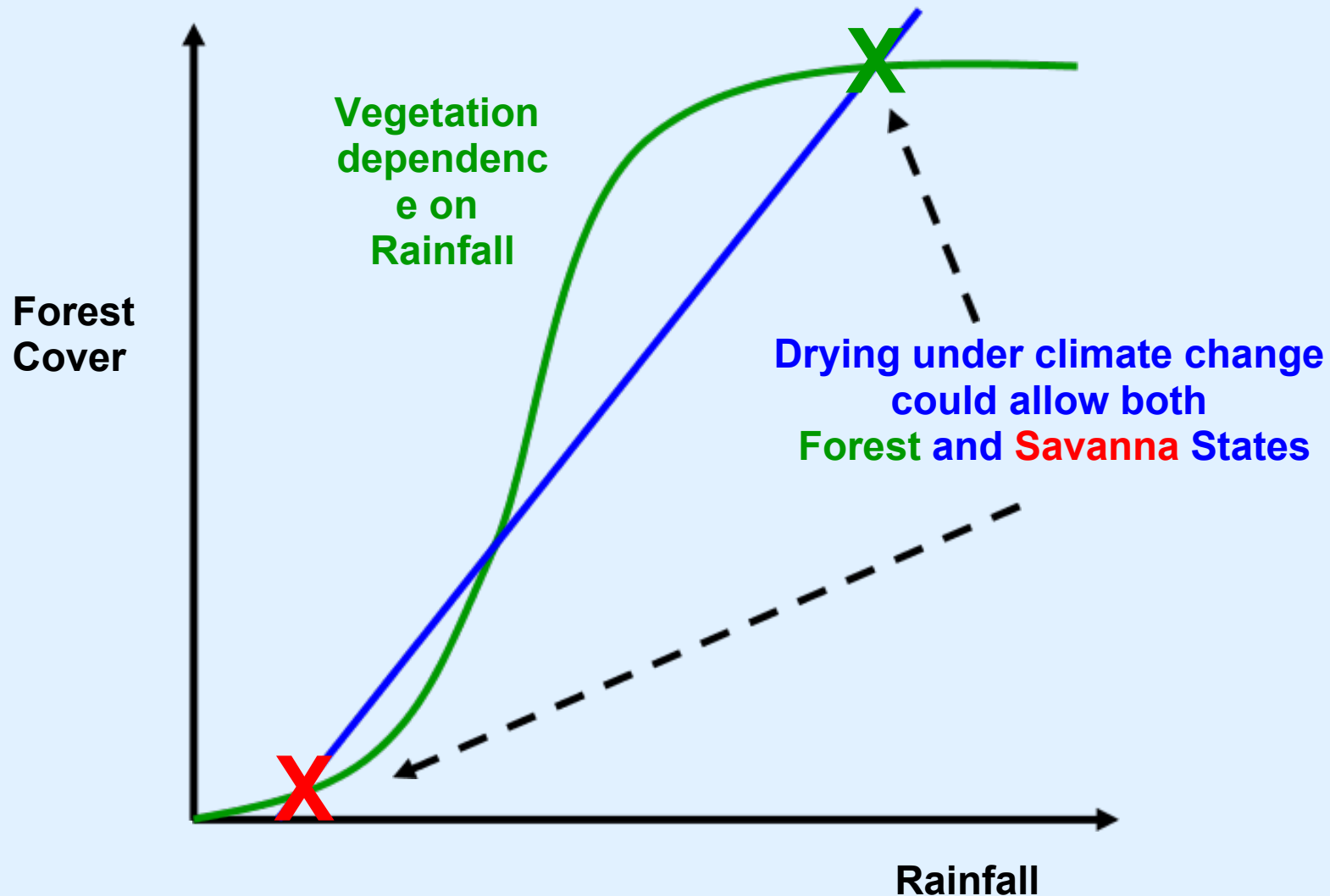
The Big Picture

· Minimising the risk of
Amazonian dieback under
the combined pressures of
Deforestation and Climate Change

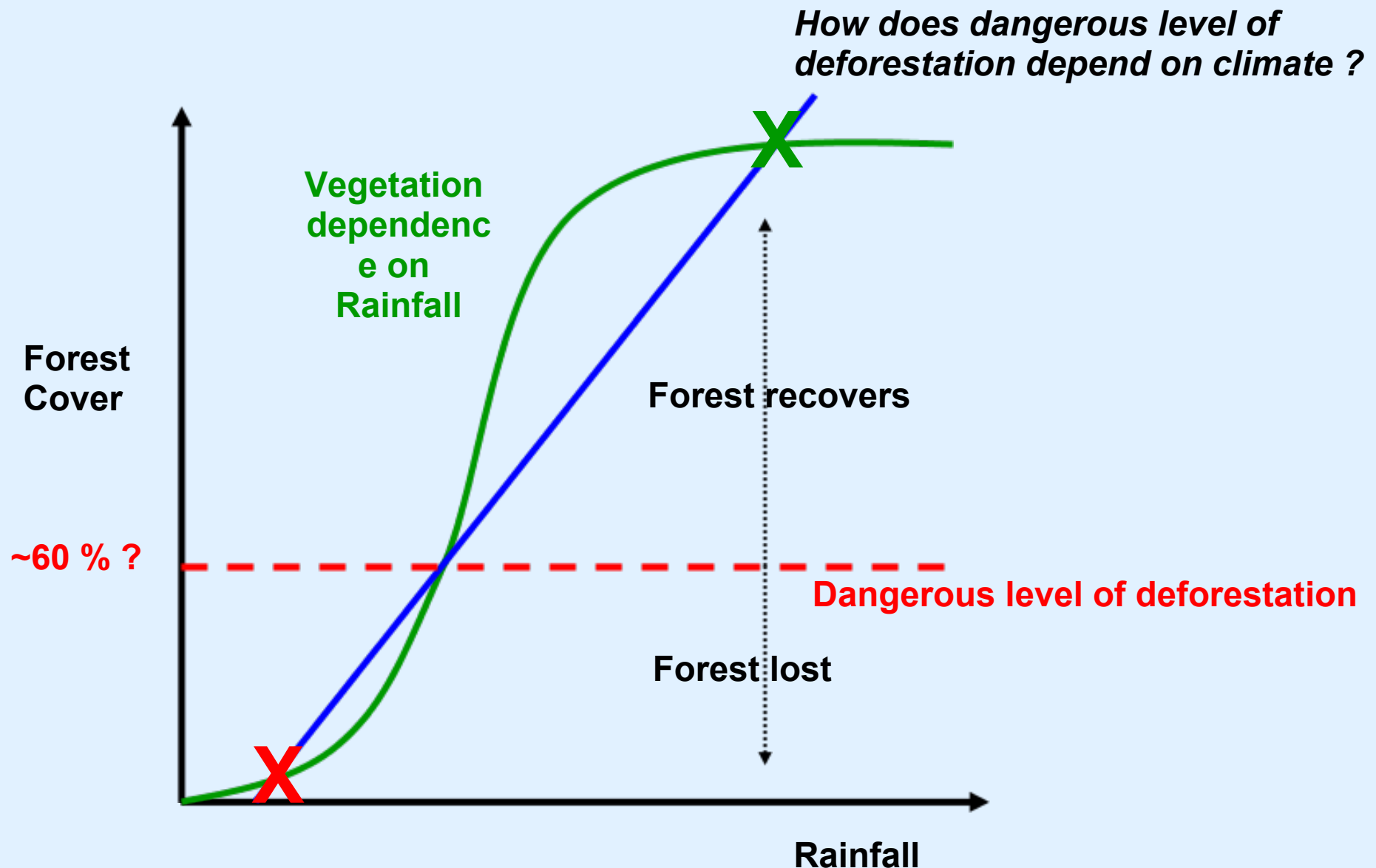
Schematic Showing Vulnerability of Amazon Rainforest Climate Change and Deforestation



Schematic Showing Vulnerability of Amazon Rainforest Climate Change and Deforestation



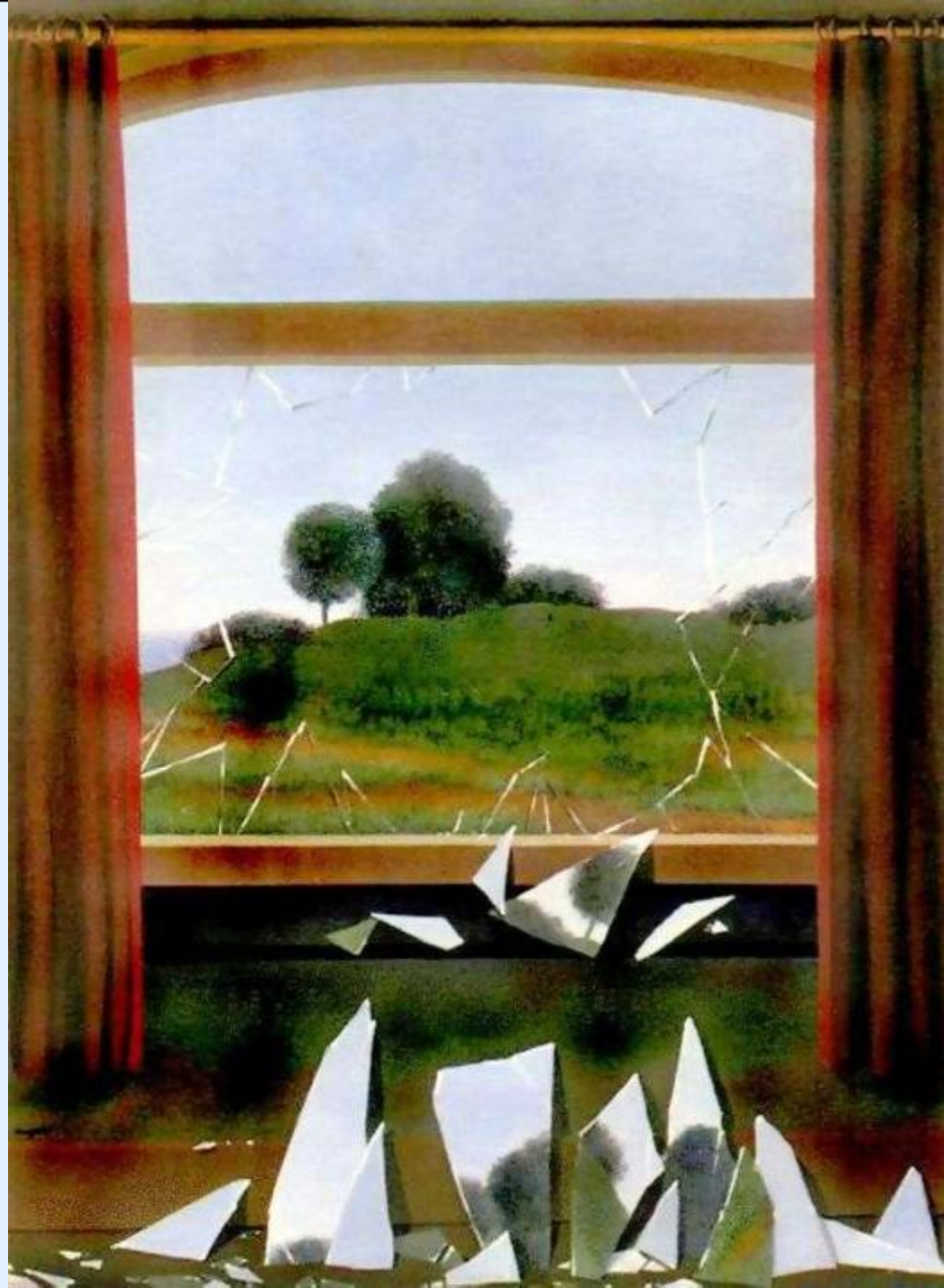
Schematic Showing Vulnerability of Amazon Rainforest Climate Change and Deforestation



Conclusions

- The Amazon rainforest is currently suffering multiple pressures, most notably from deforestation and climate change.
- Even in the absence of deforestation, some climate projections indicate a risk of climate change-driven rainforest dieback (*especially under scenarios of increased greenhouse gases and reduced sulphate aerosol pollution*).
- However, there is a large divergence amongst climate model projections for the Amazon basin.
- *Exeter University's* role is to estimate the likelihood of different degrees of rainfall change by using observations to weight the full range of model projections.

THE END !



Project Inputs and Outputs

