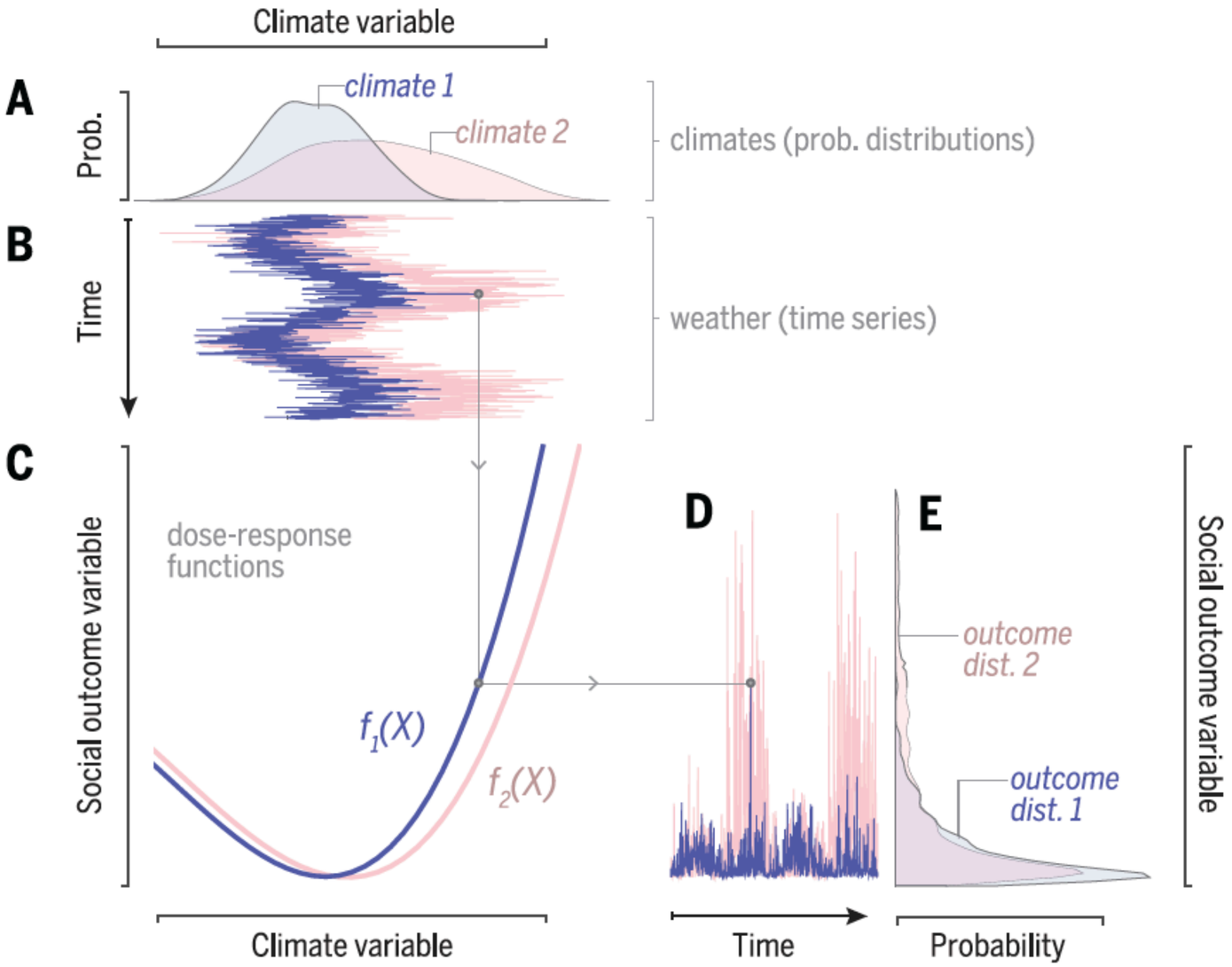
# *Estimating Future Economic Damages from Climate Change - Statistical Approaches*

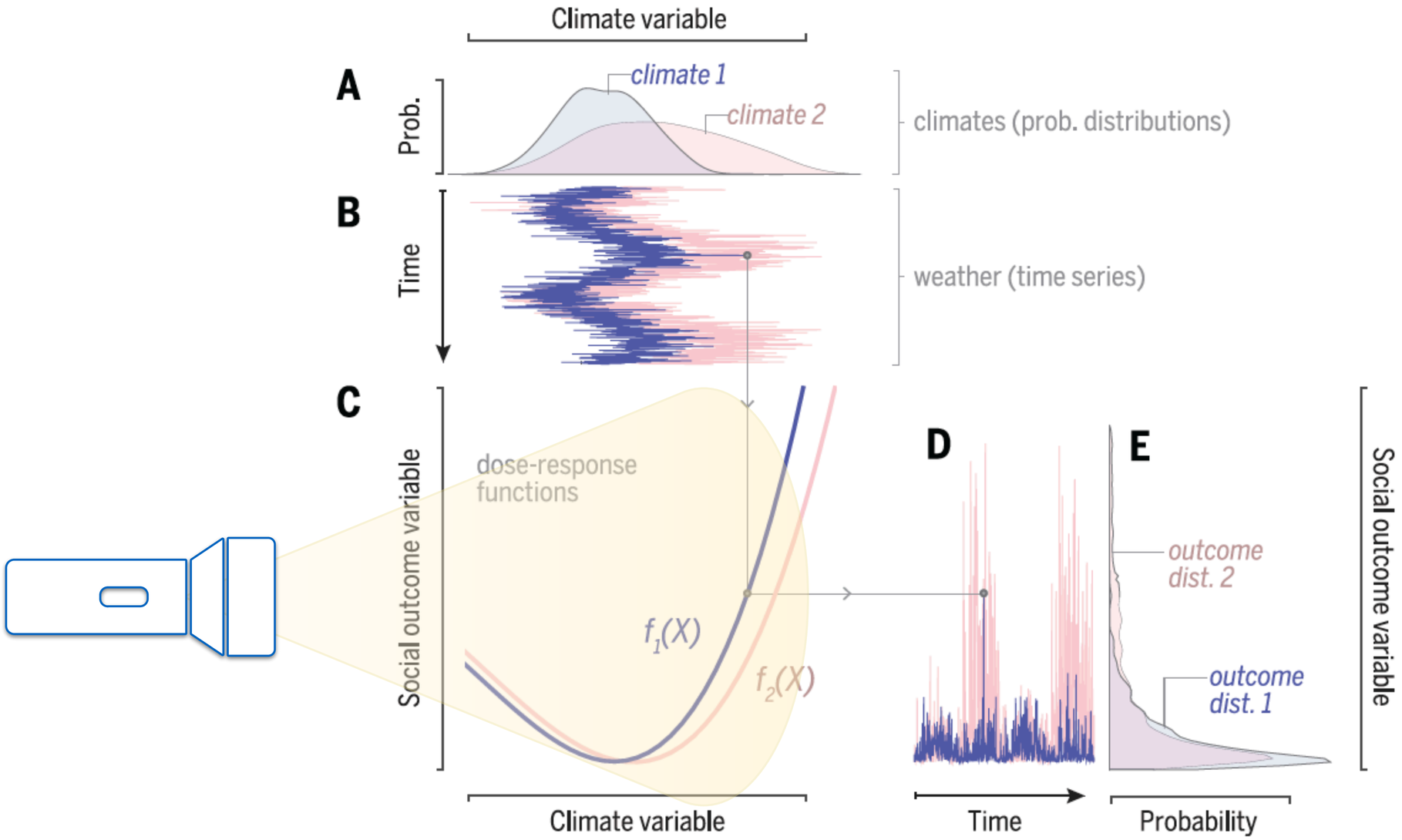
Max(imilian) Auffhammer
Alice M. Saint Professor, UC Berkeley
Options for estimating the global economic impacts response to a future climate - February 26, 2024

# The Basic Idea




Source: Carleton and Hsiang, Science

# The Basic Idea




Source: Carleton and Hsiang, Science

# Different Approaches

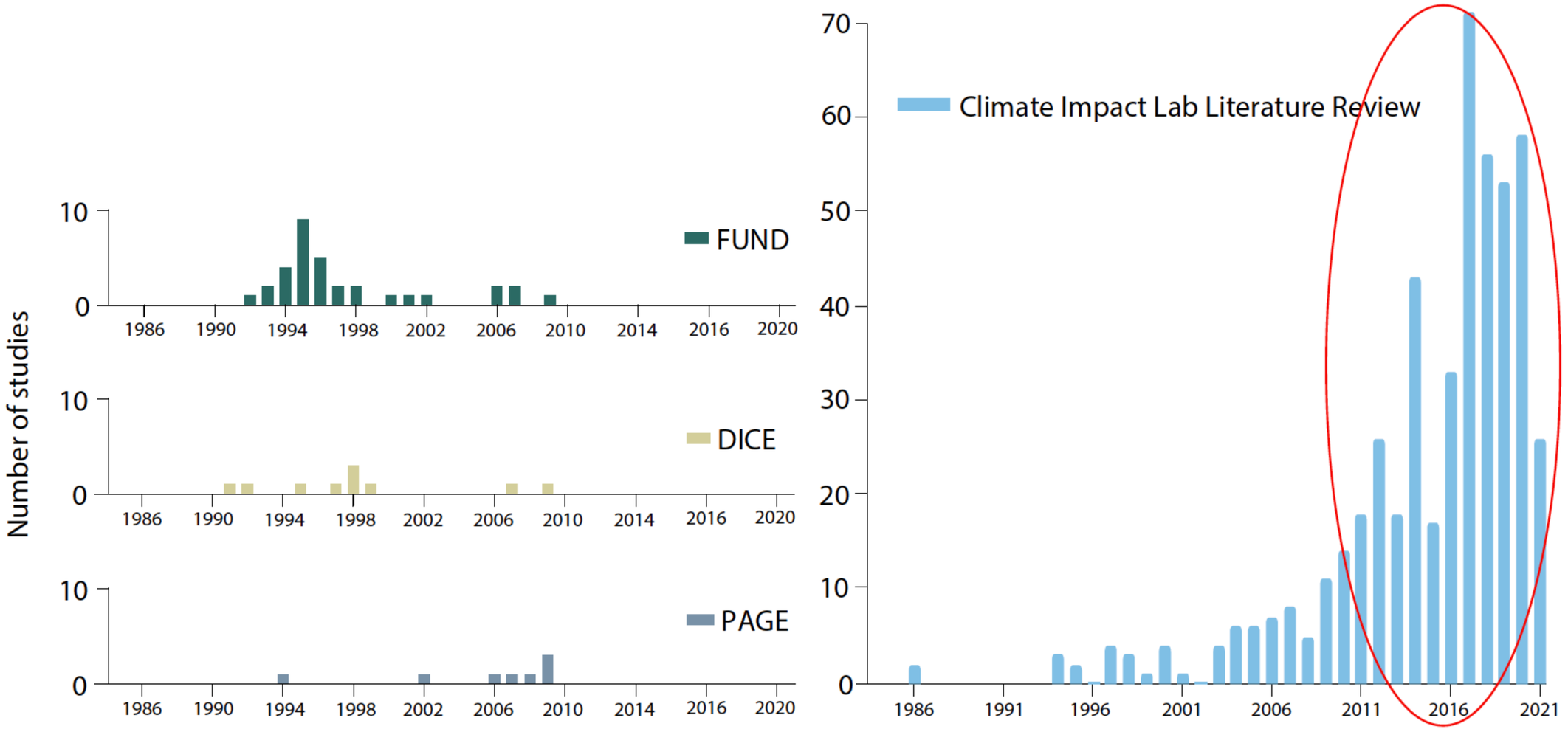
## The “old stuff”

- Cross Sectional Comparisons
  Mendelsohn (19xx/20xx); Mansur and Mendelsohn (20xx)
- Pure Time Series Comparisons
  Franco and Sanstad, 2008; Auffhammer, Baylis and Hausman, 2017
- Panel “Weather” Models
  Auffhammer, Ramanathan and Vincent (2006), Deschenes and Greenstone (2007)

## The “new stuff”

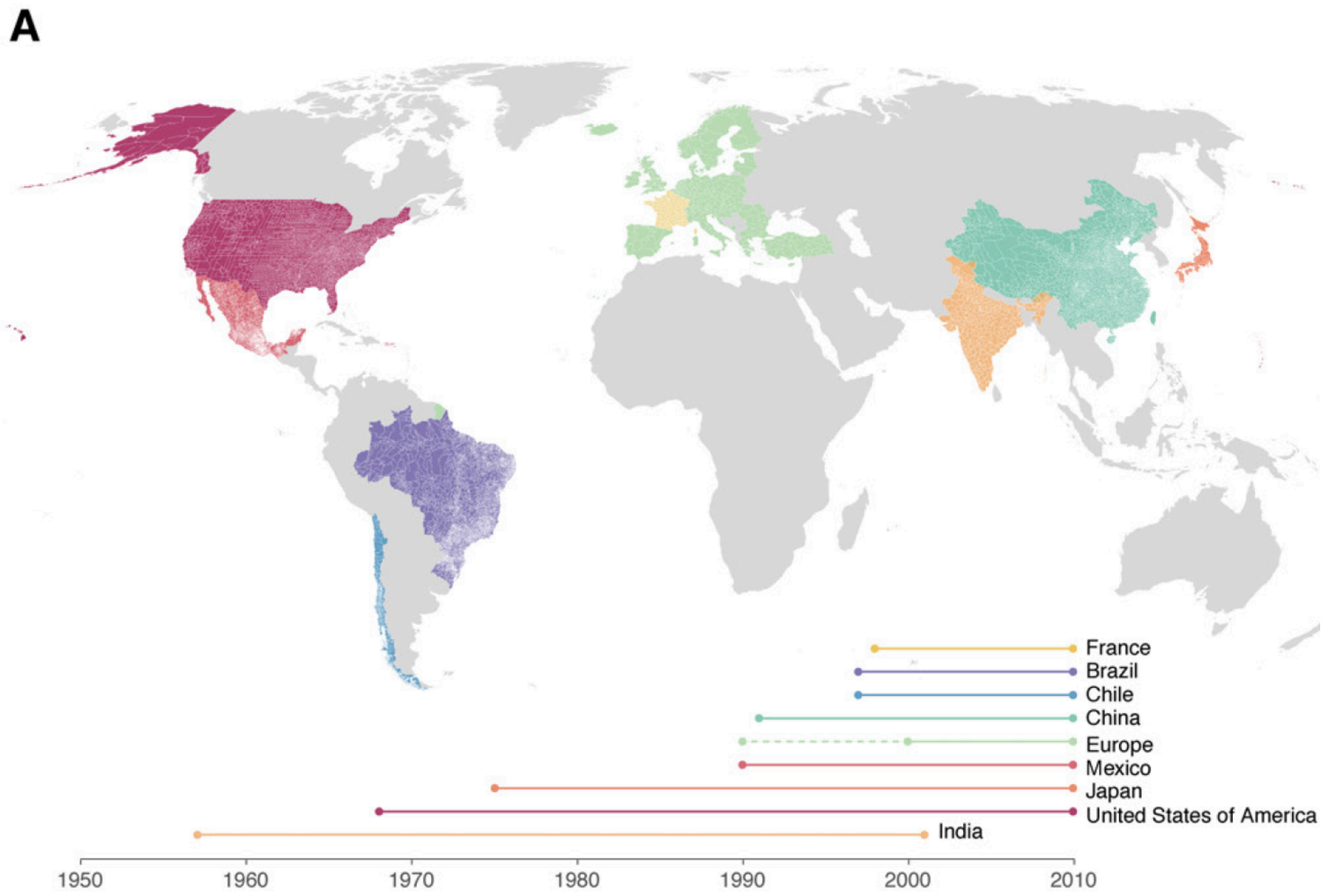
- Long Differences
  Burke and Emerick, 2015
- Panel “Adaptation” Models
  Hsiang and Narita, 2012; Auffhammer and Aroonruengsawat 2012, Butler et al. 2013; Barreca et al. 2016; Dell, Jones, and Olken 2012, 2014; Carleton et al. 2023

# Previous “Damage Functions” were *seriously* outdated



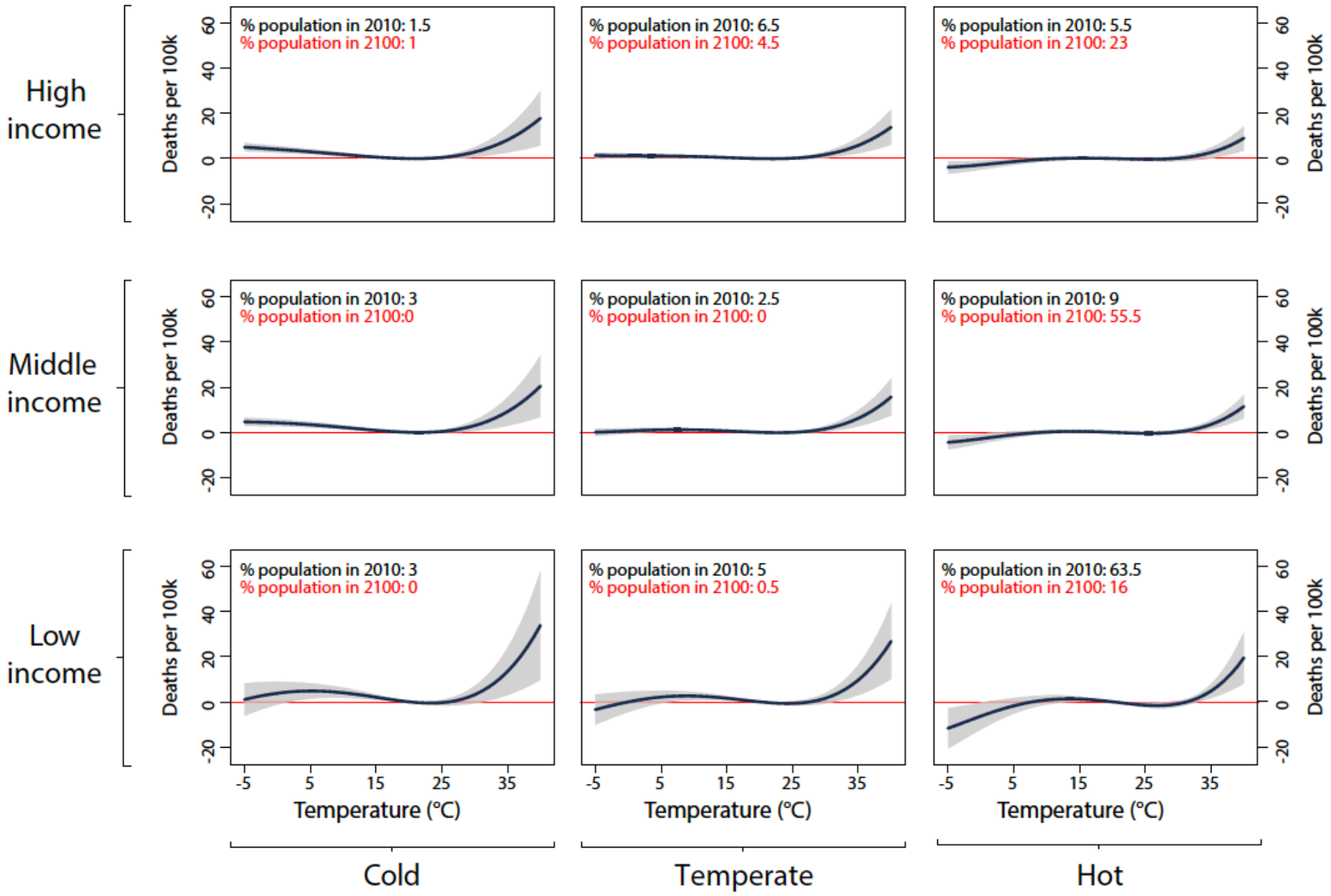

Source: Climate Impact Lab

# Human Mortality Damages - Data



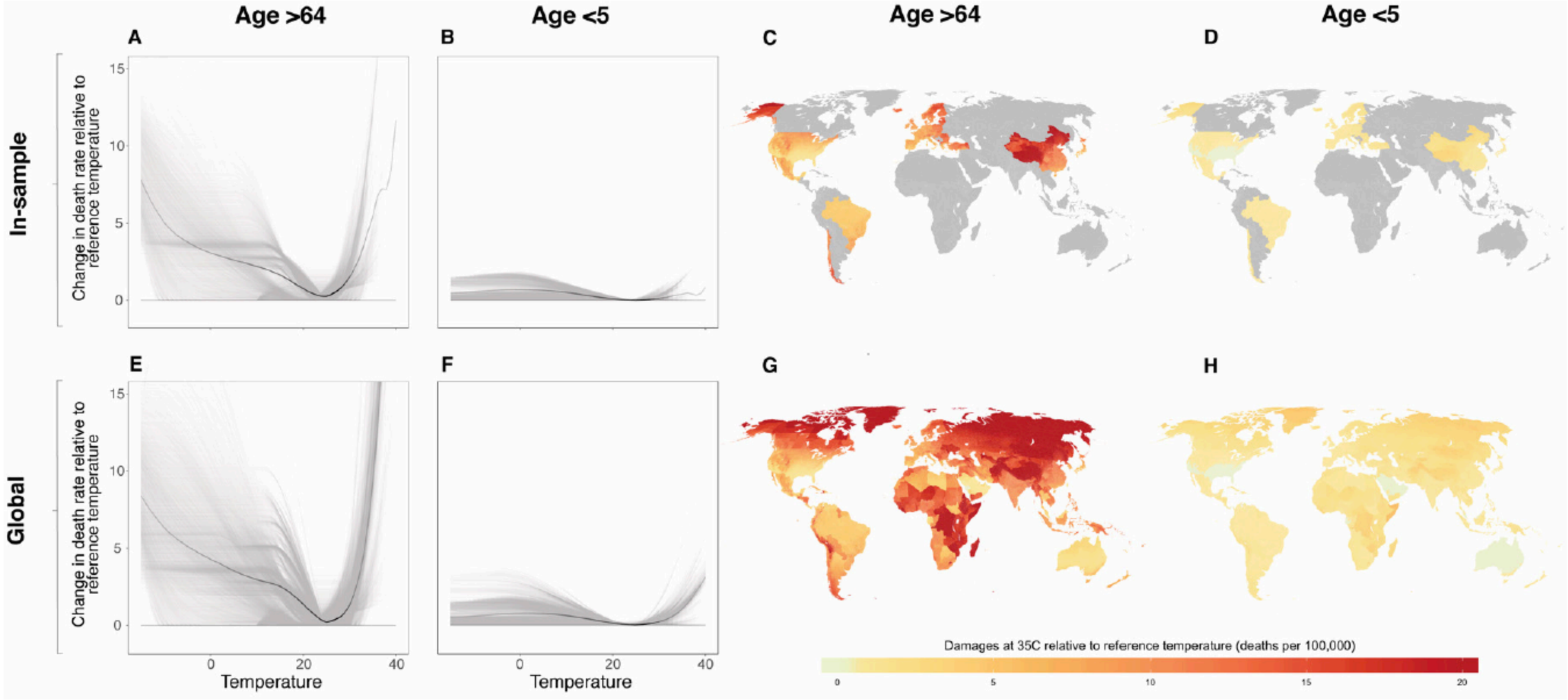

Source: Carleton et al, QJE

# Human Mortality Damage Functions



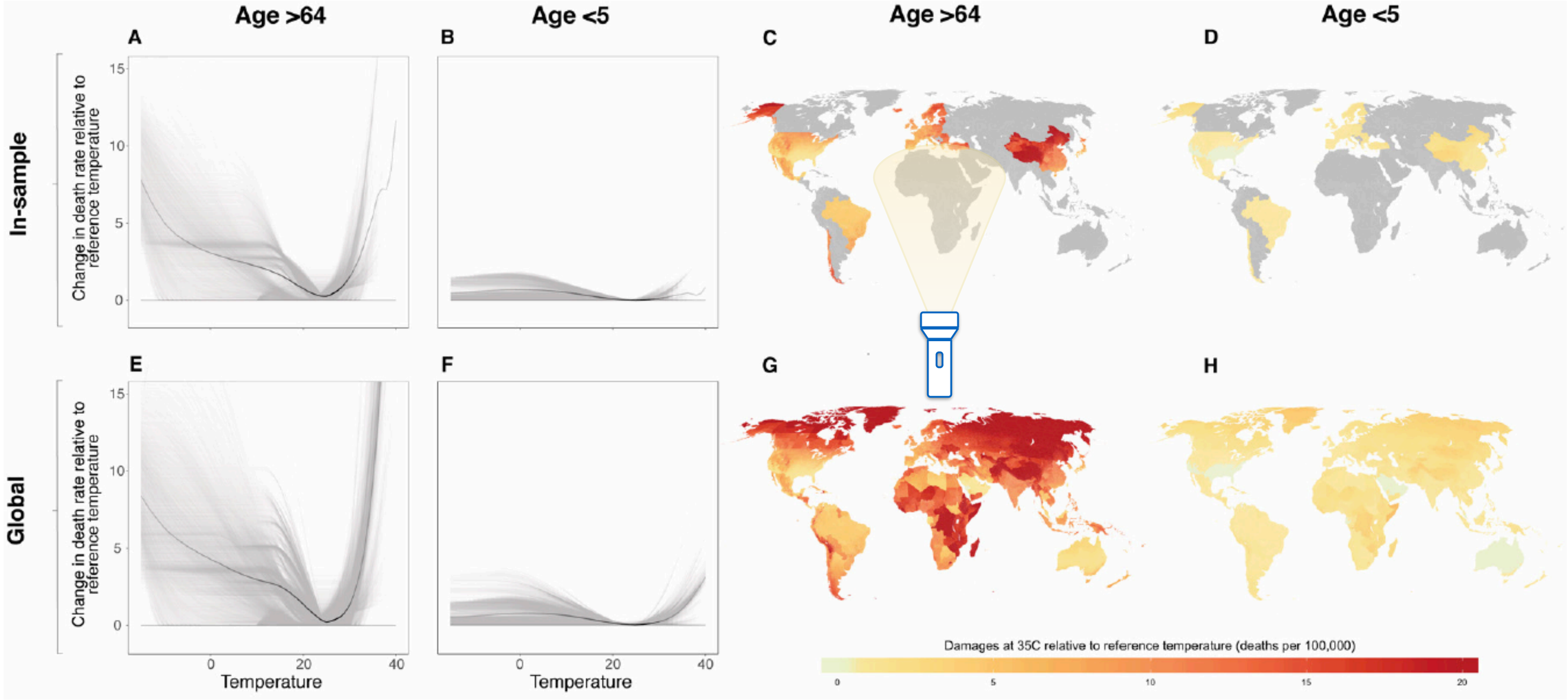

Source: Carleton et al, QJE

# Human Mortality - Damage Calculations & Extrapolation




Source: Carleton et al, QJE

# Human Mortality - Damage Calculations & Extrapolation




Source: Carleton et al, QJE

# We Traded Off Sectoral Coverage for Fewer Better Damage Functions

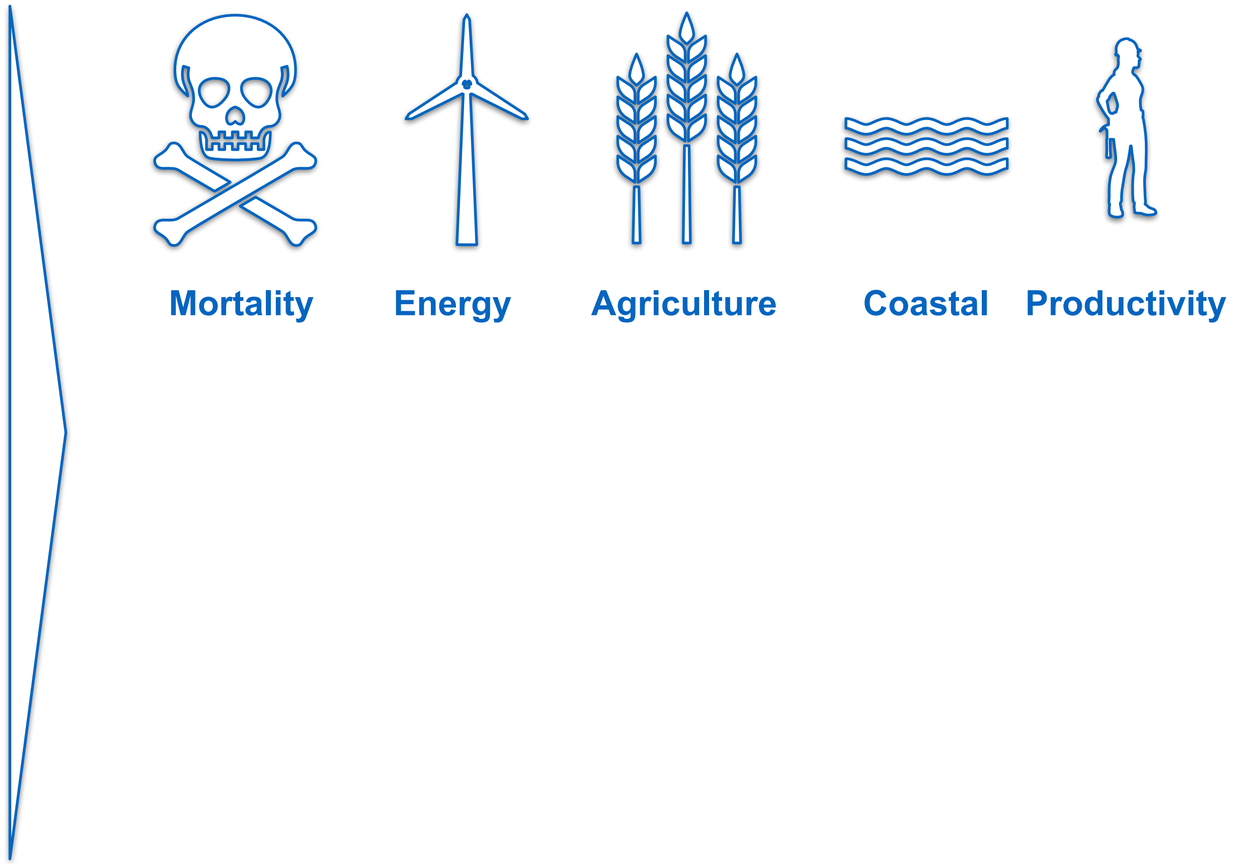
## Properties of a  Damage Function

- Should be **globally valid**.
- Should incorporate **long-run adaptation.**
- Should carry **causal interpretation.**
- Should be valid for **long periods of time.**
- Should **cover extreme events**.
- Should allow for **spatial heterogeneity**

# We Traded Off Sectoral Coverage for Fewer Better Damage Functions

## Properties of a  Damage Function

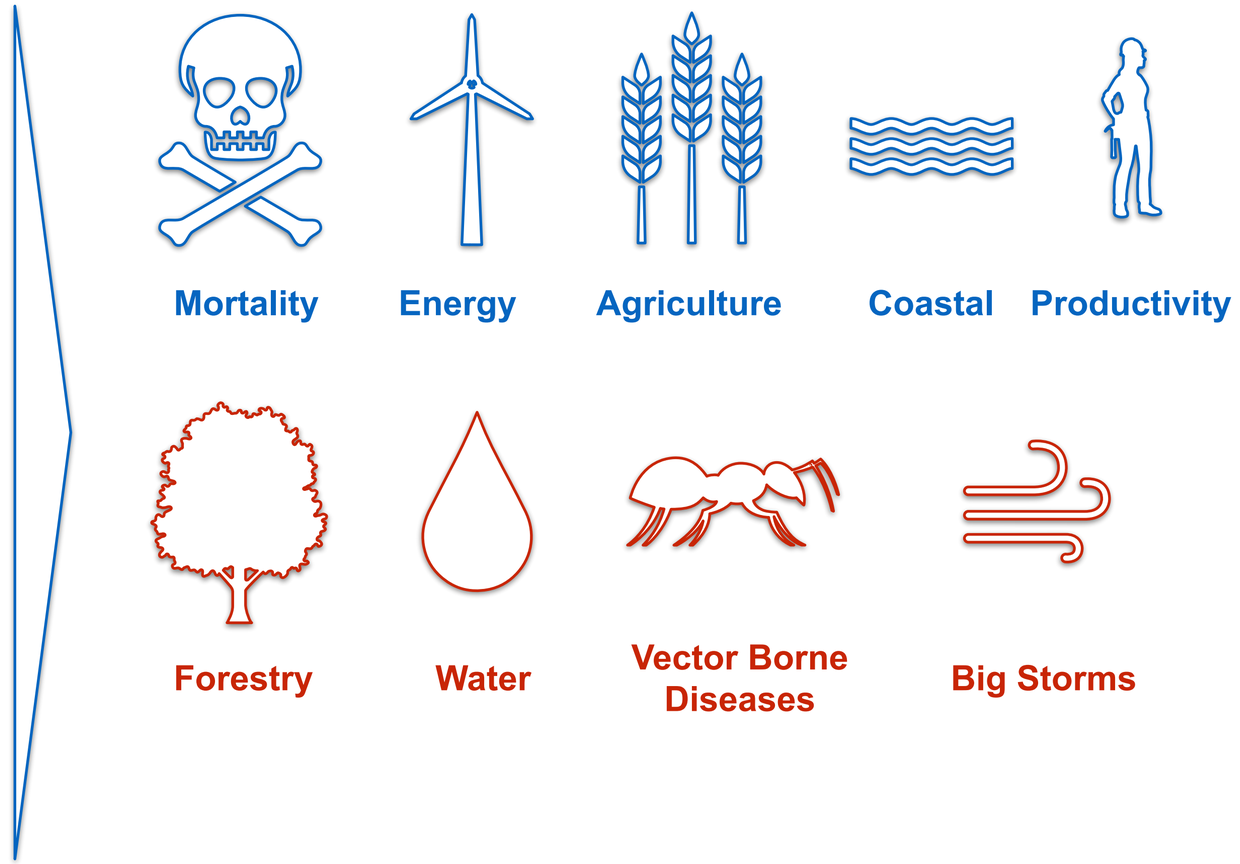
- Should be **globally valid**.
- Should incorporate **long-run adaptation.**
- Should carry **causal interpretation.**
- Should be valid for **long periods of time.**
- Should **cover extreme events**.
- Should allow for **spatial heterogeneity**



# We Traded Off Sectoral Coverage for Fewer Better Damage Functions

## Properties of a  Damage Function

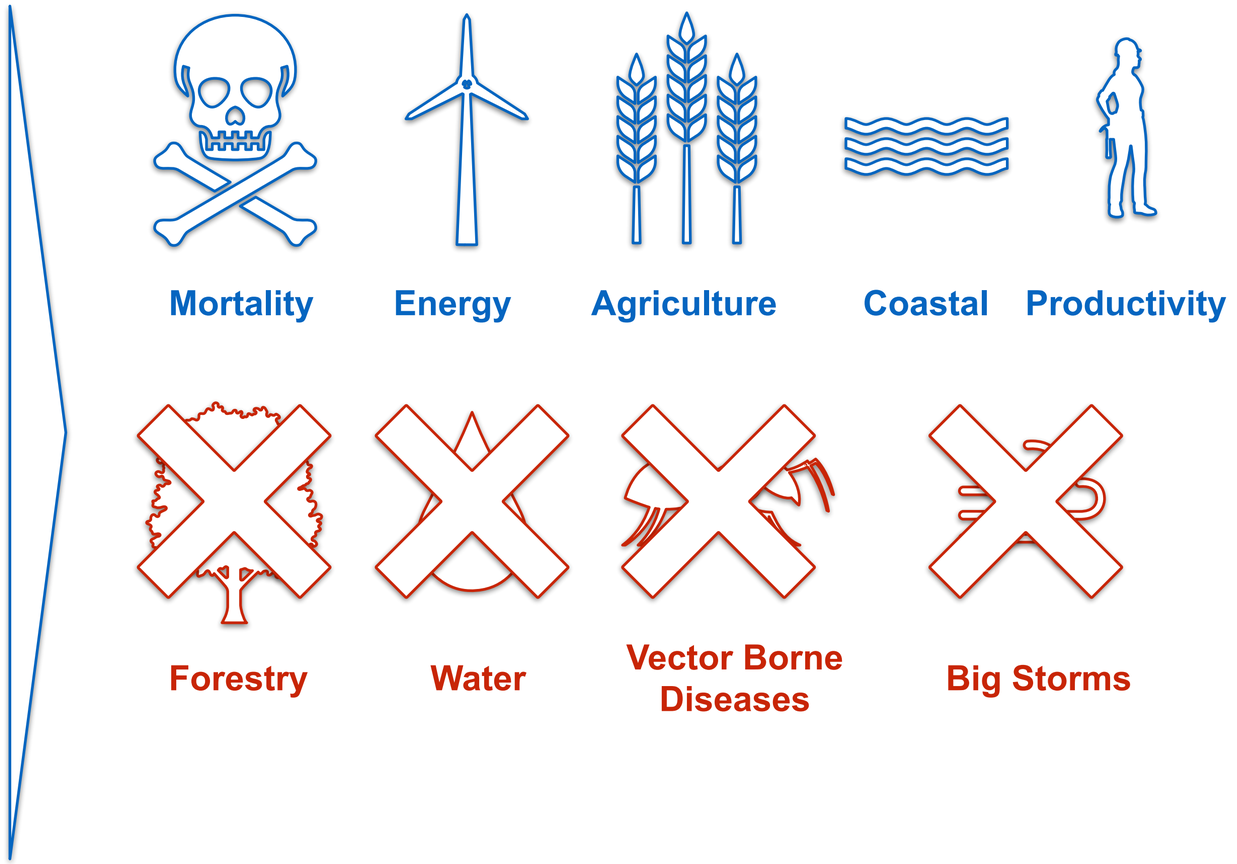
- Should be **globally valid**.
- Should incorporate **long-run adaptation.**
- Should carry **causal interpretation.**
- Should be valid for **long periods of time.**
- Should **cover extreme events**.
- Should allow for **spatial heterogeneity**



# We Traded Off Sectoral Coverage for Fewer Better Damage Functions

## Properties of a  Damage Function

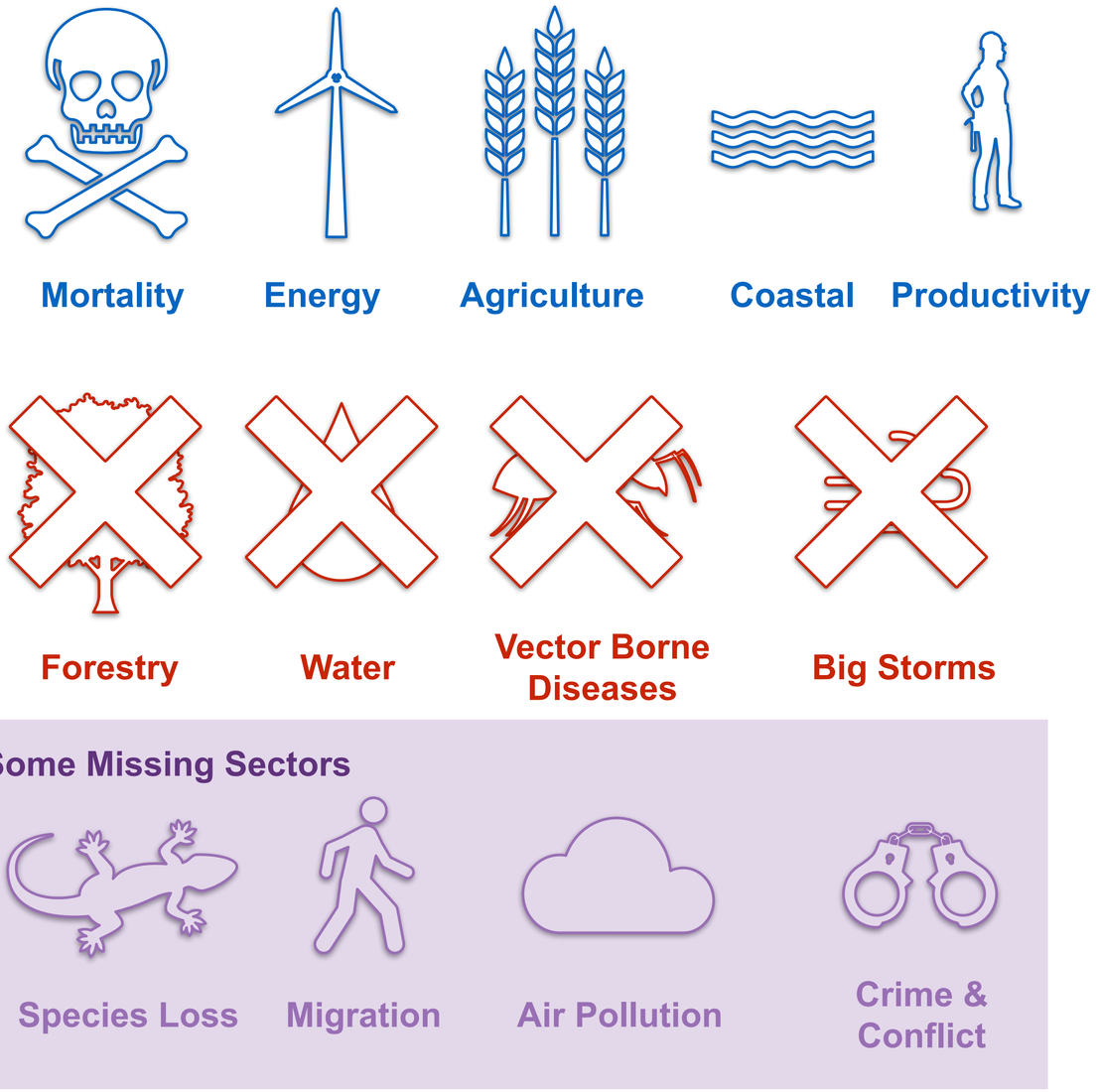
- Should be **globally valid**.
- Should incorporate **long-run adaptation.**
- Should carry **causal interpretation.**
- Should be valid for **long periods of time.**
- Should **cover extreme events**.
- Should allow for **spatial heterogeneity**



# We Traded Off Sectoral Coverage for Fewer Better Damage Functions

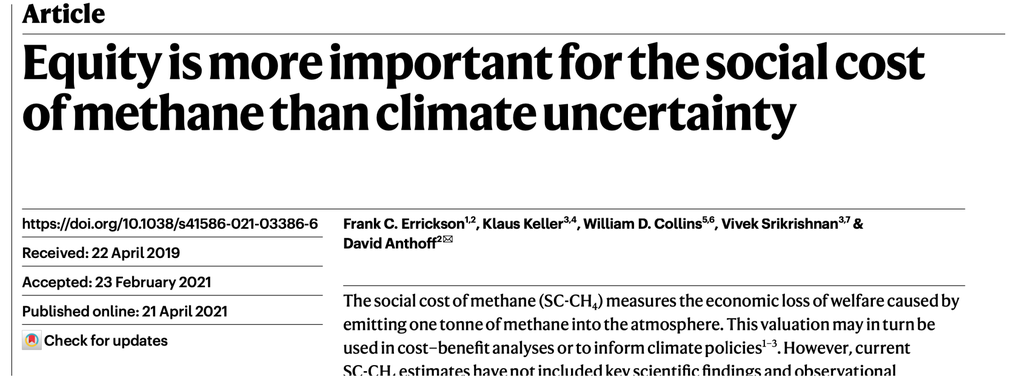
## Properties of a  Damage Function

- Should be **globally valid**.
- Should incorporate **long-run adaptation.**
- Should carry **causal interpretation.**
- Should be valid for **long periods of time.**
- Should **cover extreme events**.
- Should allow for **spatial heterogeneity**



# If We Are Serious About Equity - Why Not Equity Weight?

- A given consumption loss causes a **bigger loss in well-being to a poor person than a rich person**
- Equity weighting recognizes this and **assigns a higher weight to climate damages occurring to low income regions**
- Consistent with standard economic theory
- This is different from a domestic SCC of course.
- An equity weighted SCC is **world damages expressed as the welfare equivalent consumption loss in the US.**
- Could be reported in future iterations of SCC documents.



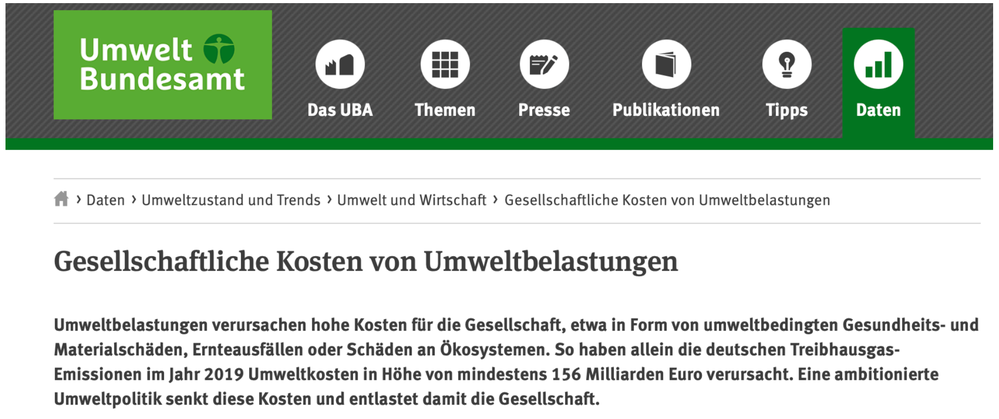
Article

**Equity is more important for the social cost of methane than climate uncertainty**

https://doi.org/10.1038/s41586-021-03386-6
Received: 22 April 2019
Accepted: 23 February 2021
Published online: 21 April 2021
Check for updates

Frank C. Errickson[1,2], Klaus Keller[3,4], William D. Collins[5,6], Vivek Srikrishnan[3,7] & David Anthoff[2]✉

The social cost of methane (SC-$CH_4$) measures the economic loss of welfare caused by emitting one tonne of methane into the atmosphere. This valuation may in turn be used in cost–benefit analyses or to inform climate policies[1–3]. However, current SC-$CH_4$ estimates have not included key scientific findings and observational



Umwelt Bundesamt

Das UBA | Themen | Presse | Publikationen | Tipps | Daten

› Daten › Umweltzustand und Trends › Umwelt und Wirtschaft › Gesellschaftliche Kosten von Umweltbelastungen

**Gesellschaftliche Kosten von Umweltbelastungen**

**Umweltbelastungen verursachen hohe Kosten für die Gesellschaft, etwa in Form von umweltbedingten Gesundheits- und Materialschäden, Ernteausfällen oder Schäden an Ökosystemen. So haben allein die deutschen Treibhausgas-Emissionen im Jahr 2019 Umweltkosten in Höhe von mindestens 156 Milliarden Euro verursacht. Eine ambitionierte Umweltpolitik senkt diese Kosten und entlastet damit die Gesellschaft.**

auffhammer@berkeley.edu