Food systems, CSA and Food Security

Post-IPCC AR5 WG2 C7

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Topics

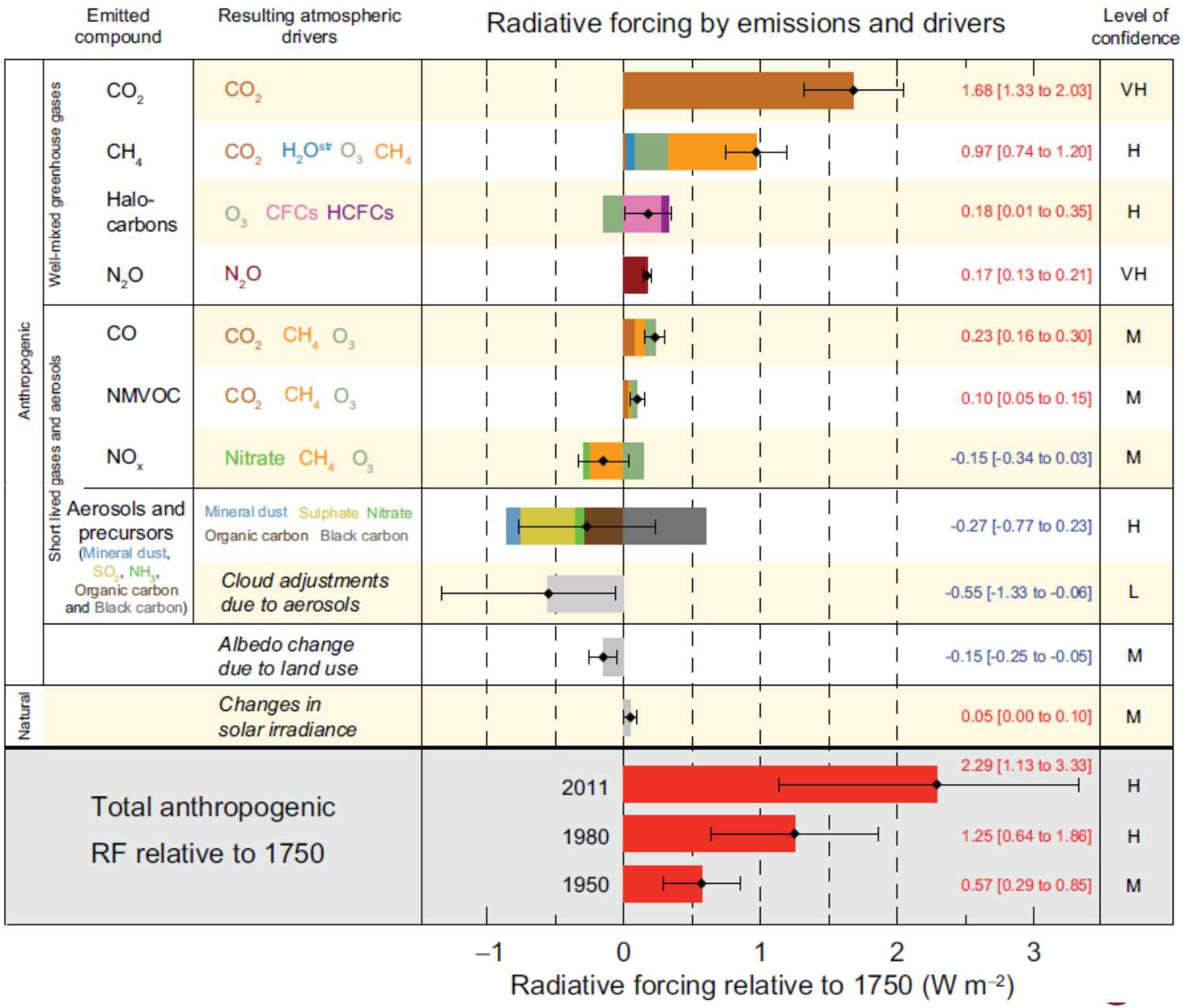
IPCC AR5

Post – AR5

Sustainable intensification and new models

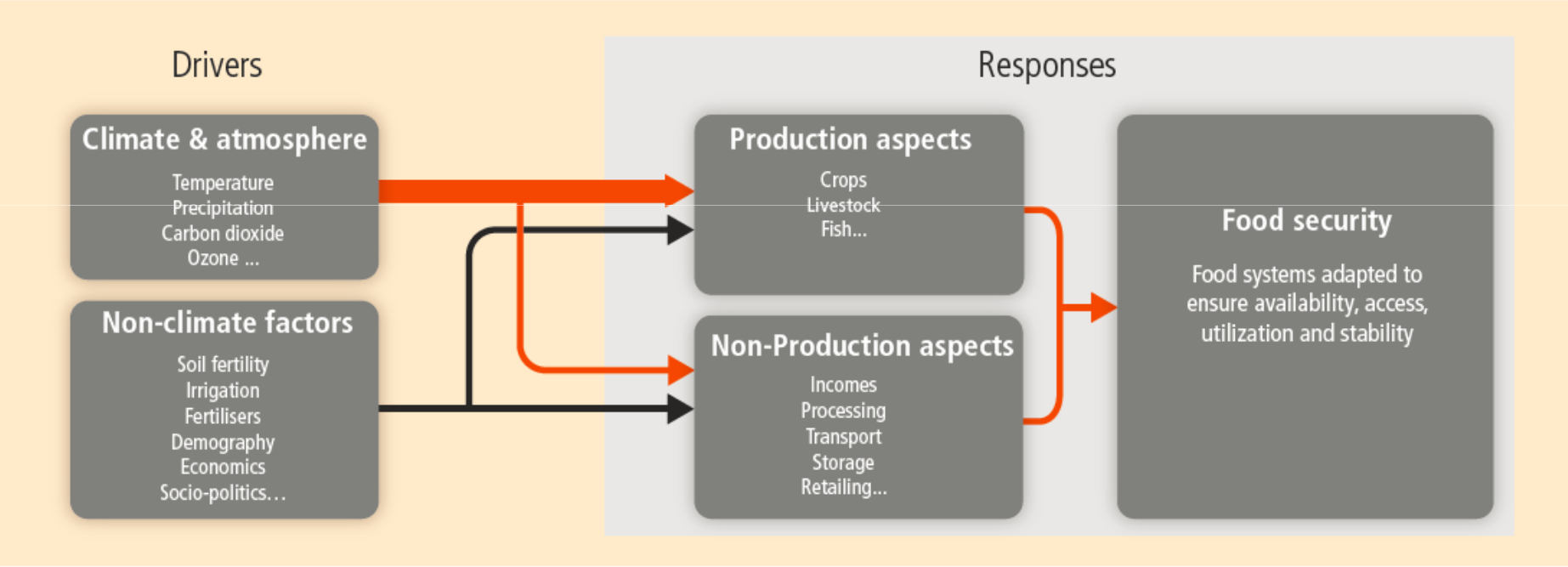
Conclusions

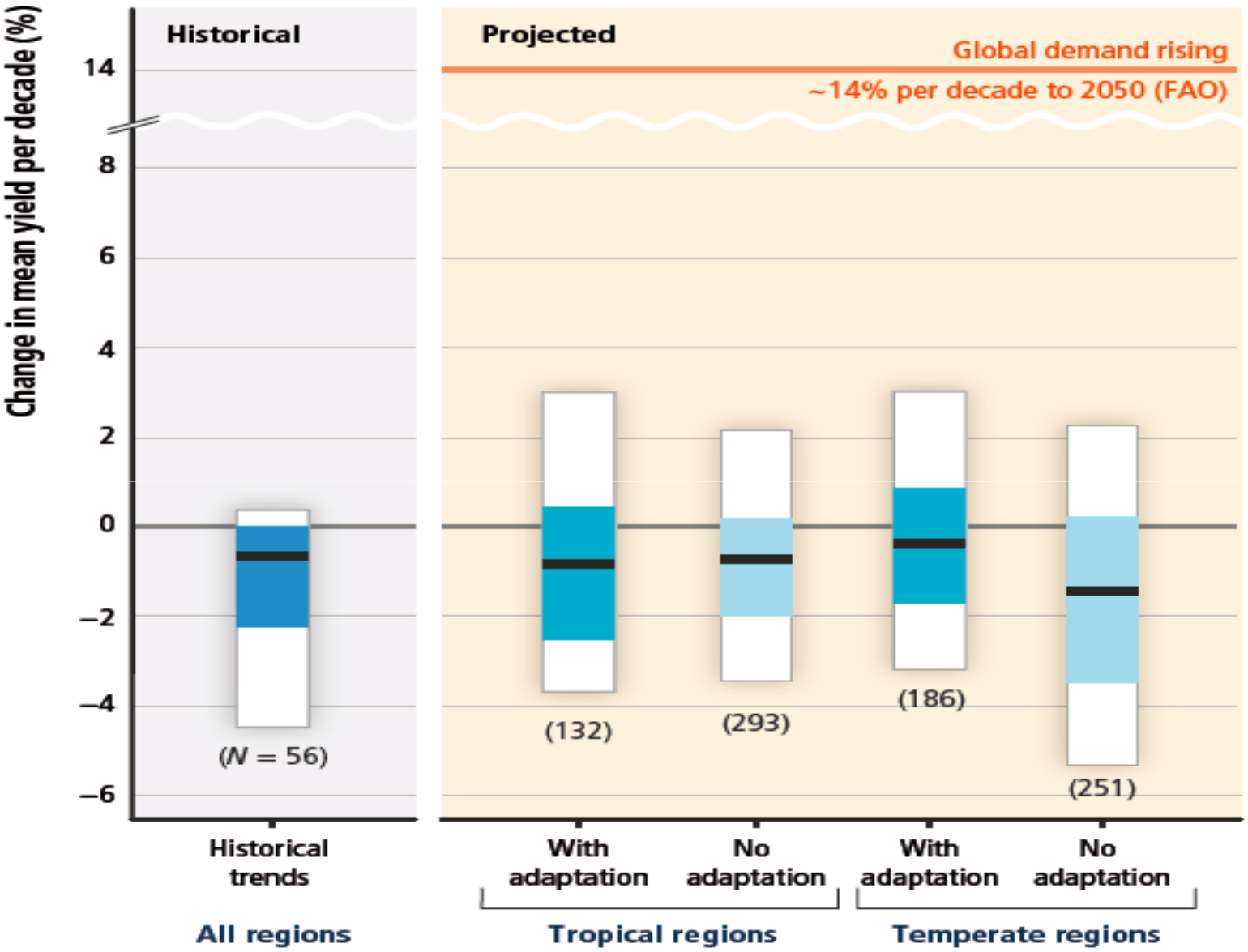
IPCC AR5 WG1

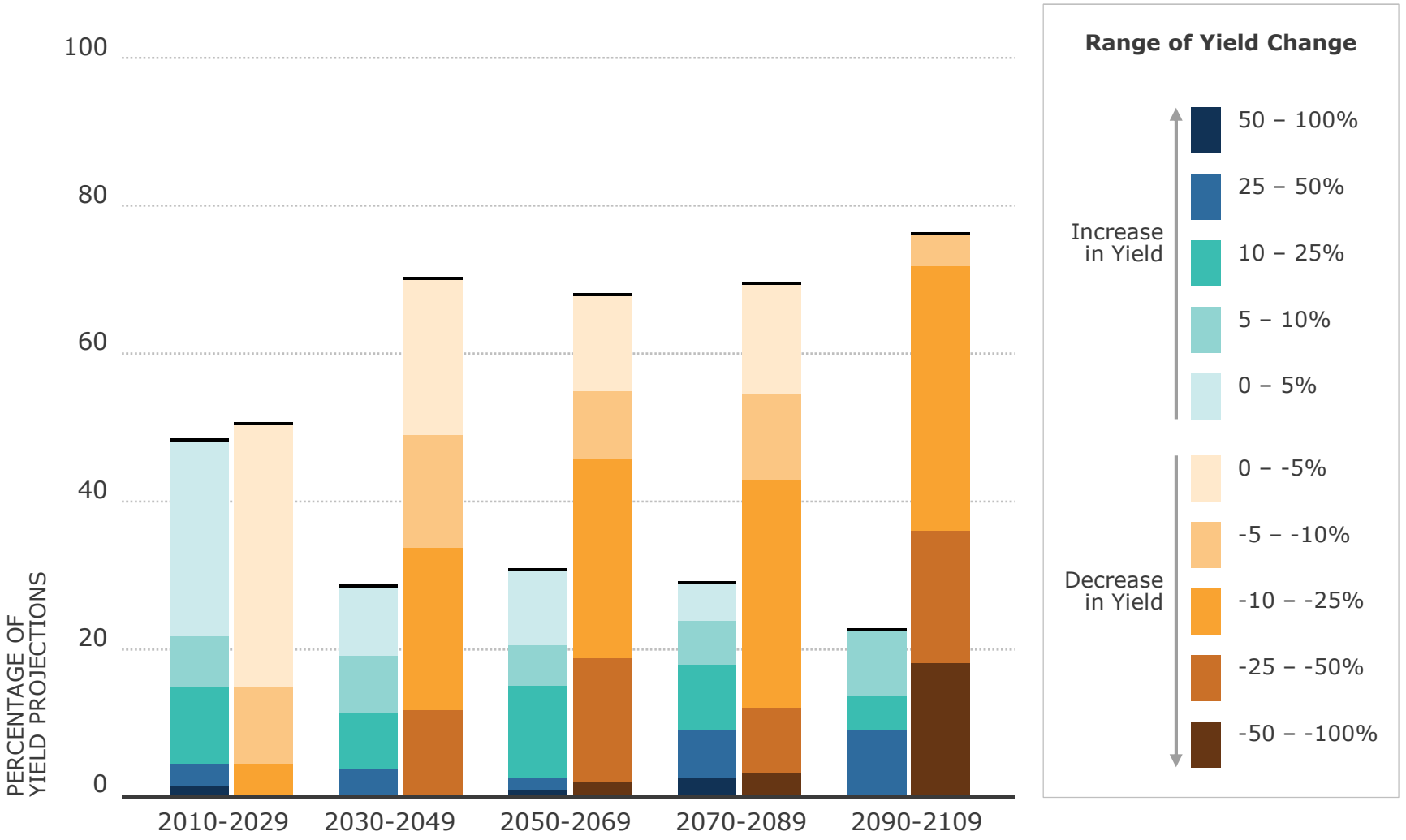

Emitted compound
Resulting atmospheric drivers
Radiative forcing by emissions and drivers
Level of confidence
Anthropogenic
Well-mixed greenhouse gases
Short lived gases and aerosols
Natural
CO2
CO2
1.68 [1.33 to 2.03]
VH
CH4
CO2 H2Ostr O3 CH4
0.97 [0.74 to 1.20]
H
Halo-carbons
O3 CFCs HCFCs
0.18 [0.01 to 0.35]
H
N2O
N2O
0.17 [0.13 to 0.21]
VH
CO
CO2 CH4 O3
0.23 [0.16 to 0.30]
M
NMVOC
CO2 CH4 O3
0.10 [0.05 to 0.15]
M
NOx
Nitrate CH4 O3
-0.15 [-0.34 to 0.03]
M
Aerosols and precursors (Mineral dust, SO2, NH3, Organic carbon and Black carbon)
Mineral dust Sulphate Nitrate Organic carbon Black carbon
-0.27 [-0.77 to 0.23]
H
Cloud adjustments due to aerosols
-0.55 [-1.33 to -0.06]
L
Albedo change due to land use
-0.15 [-0.25 to -0.05]
M
Changes in solar irradiance
0.05 [0.00 to 0.10]
M
Total anthropogenic RF relative to 1750
2011
2.29 [1.13 to 3.33]
H
1980
1.25 [0.64 to 1.86]
H
1950
0.57 [0.29 to 0.85]
M
−1
0
1
2
3
Radiative forcing relative to 1750 (W m−2)

IPCC AR5 was Hell!

Food Security: IPCC AR5 – 3 main points




Change in mean yield per decade (%)
14
8
6
4
2
0
−2
−4
−6
Historical
Projected
Global demand rising
~14% per decade to 2050 (FAO)
(N = 56)
(132)
(293)
(186)
(251)
Historical trends
With adaptation
No adaptation
With adaptation
No adaptation
All regions
Tropical regions
Temperate regions


100
80
60
40
20
0
PERCENTAGE OF YIELD PROJECTIONS
2010-2029
2030-2049
2050-2069
2070-2089
2090-2109
Range of Yield Change
Increase in Yield
50 – 100%
25 – 50%
10 – 25%
5 – 10%
0 – 5%
Decrease in Yield
0 – -5%
-5 – -10%
-10 – -25%
-25 – -50%
-50 – -100%

Post AR5 – Food Security

IPCC does synthesis and evaluation

Climate change as an exercise in risk management

FS chapter AR5 – pest and diseases important

FOOD security and climate change

Extremes

IPCC WG2: Food security

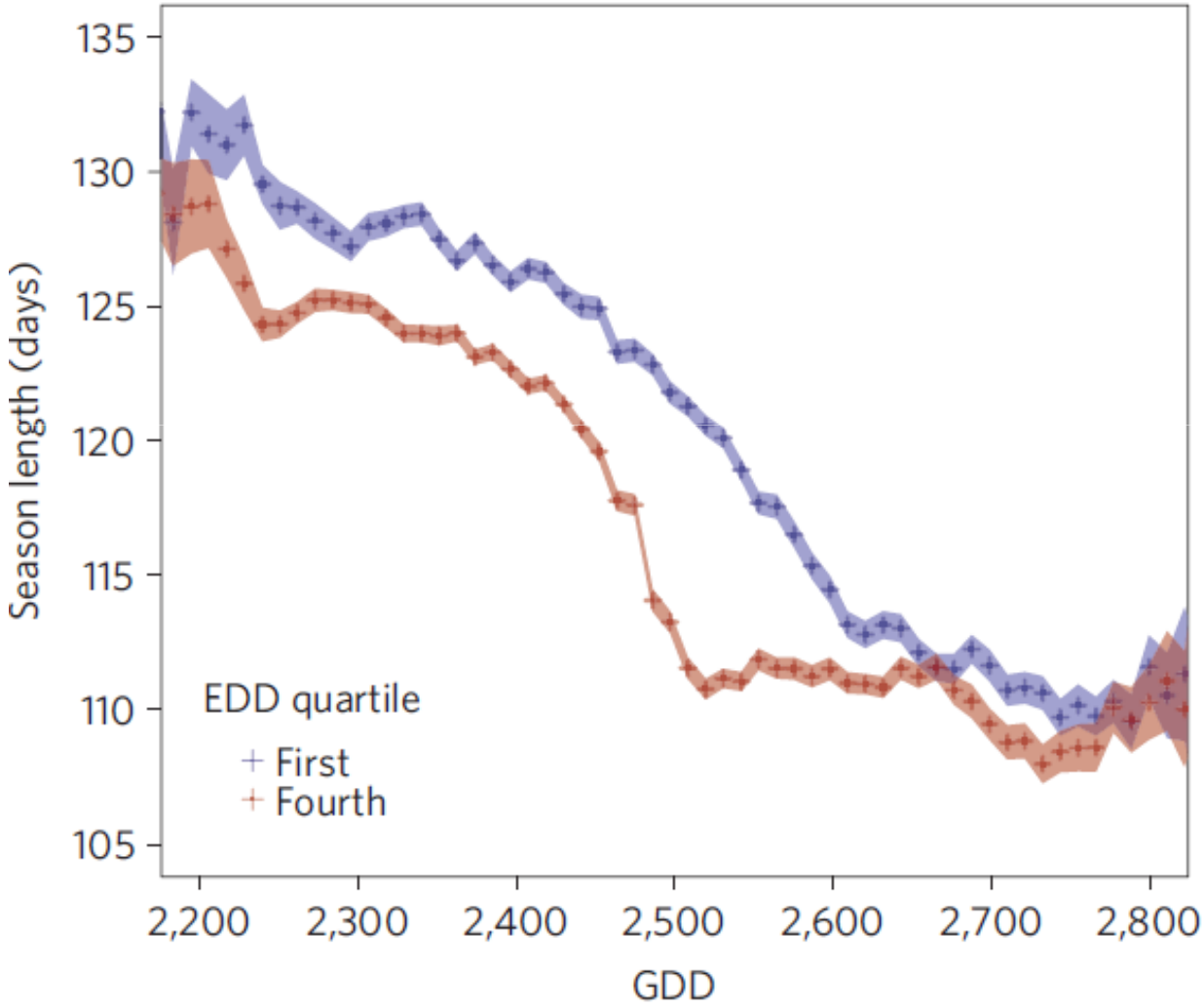
Chronic and acute temperature effects on crops

- General response to mean temperatures
- Acute response to extremes

Linkage of local effects to RCPs, time and global changes

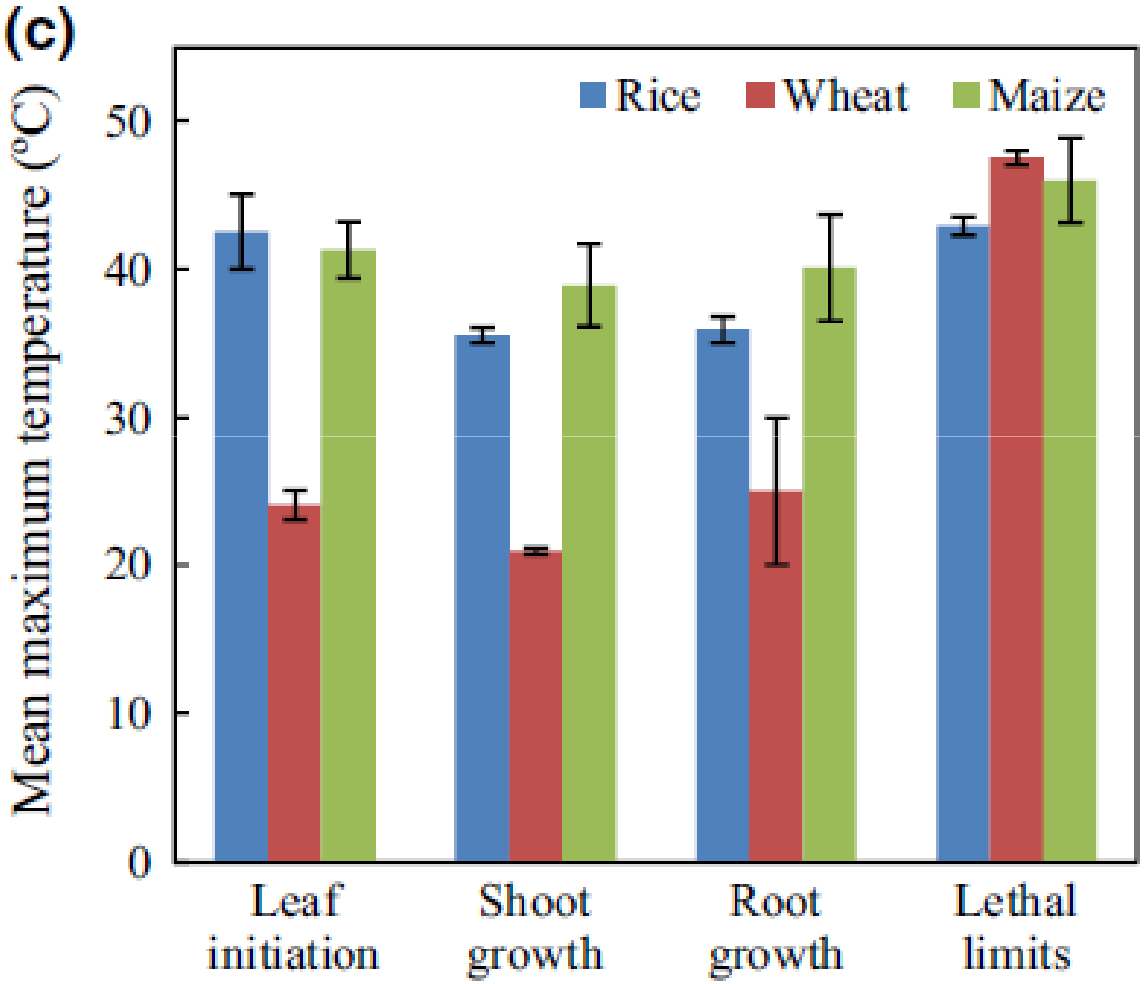
Policy makers are interested in this stuff – UK FCO

Chronic - shortening of growing season: wheat Punjab



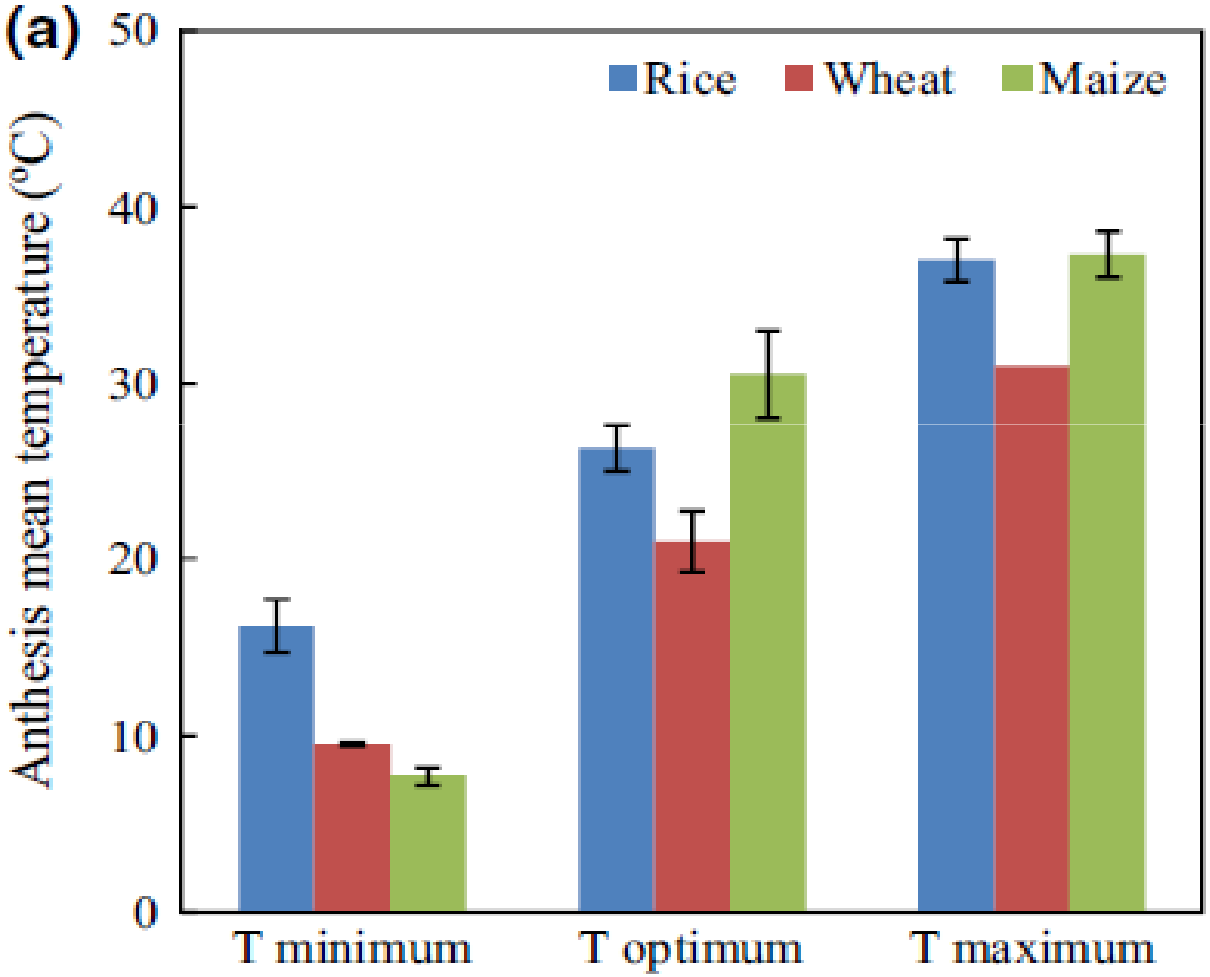
Lobell et al, 2012

Acute effect: lethal max T



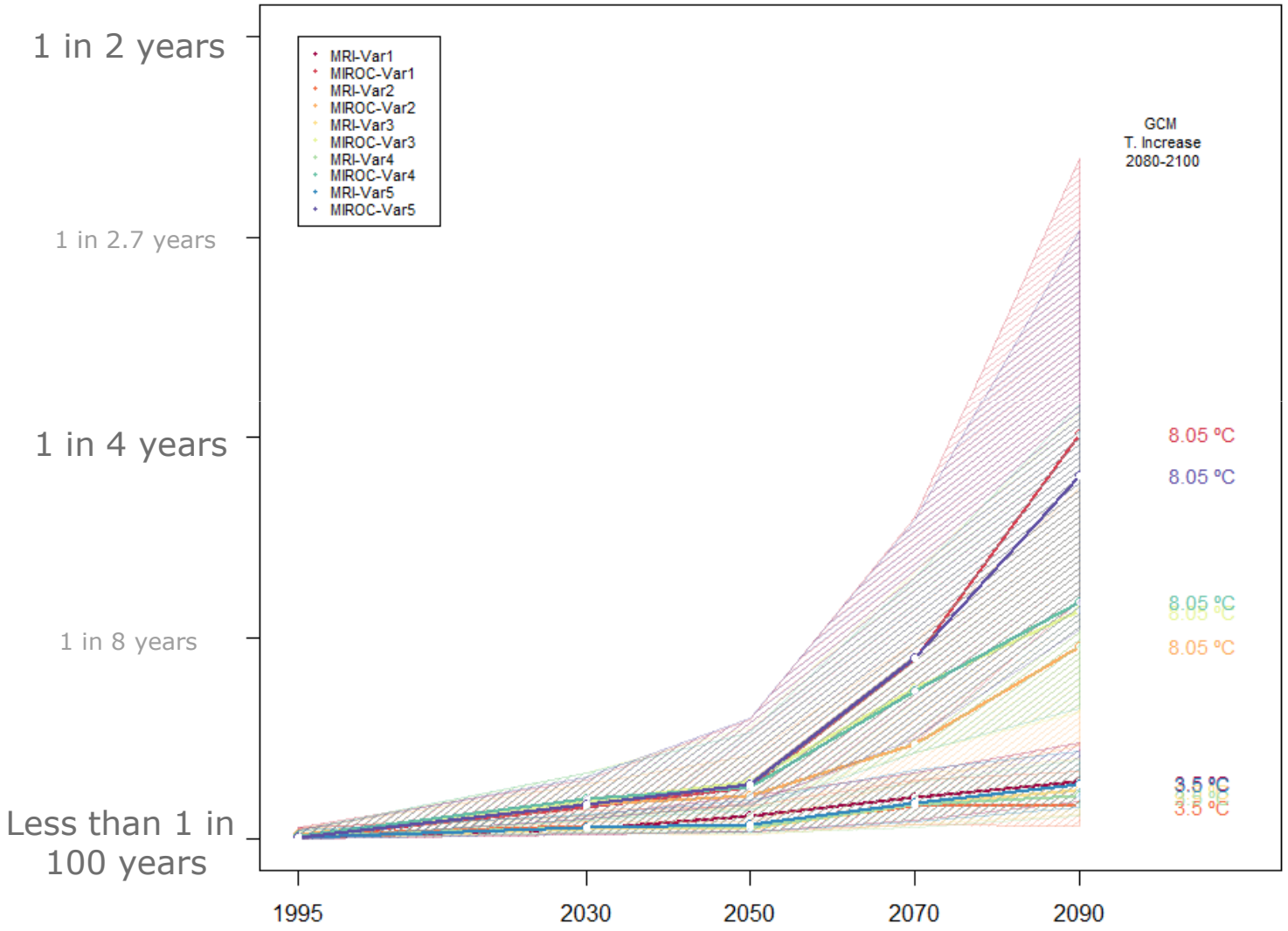
Sanchez et al., 2014

Acute effect: T max at flowering



Sanchez et al., 2014

Acute flowering effect probability – maize



Montesino, Semenov, Porter 2015

Summary – Acute flowering probability

Maize (USA): A 1 in more than 100 year event can become a 1 in 50 event for 2-3 degC global warming; can become a 1 in 4-8 year event for 8 degC global warming.

Rice (China): A 1 in more than 100 year event can become a 1 in 10 year event for 2-3 degC global warming; becomes a 1 in 1-4 year event for 5-6 degC global warming.

Wheat (India): A 1 in 100 year event can become a 1 in 20-25 year event for 3-4 degC global warming; and does not change much for 5-6 degC global warming.

Montesino, Semenov, Porter 2015

Sustainable Intensification and CSA

What does it mean? More for less?

Intensification of what?

What's the metric? System level?

From

Euphytica 17 (1968): 385–403

THE BREEDING OF CROP IDEOTYPES

C. M. DONALD

To

THE DEVELOPMENT OF CROP IDEO-SYSTEMS

Suggestions

Use of identities in conjunction with modelling and experimental studies – model validation

More experimental validation of models

Threshold effects in models

Exploration of the effect of data uncertainty on the accuracy and precision of models and their projections

Summary Points

IPCC

Sustainable Intensification – quantitative and qualitative aspects

The need for metrics – identities

Thanks

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IPCC WG2 Chapter 7 colleagues

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