Coffee and climate change

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

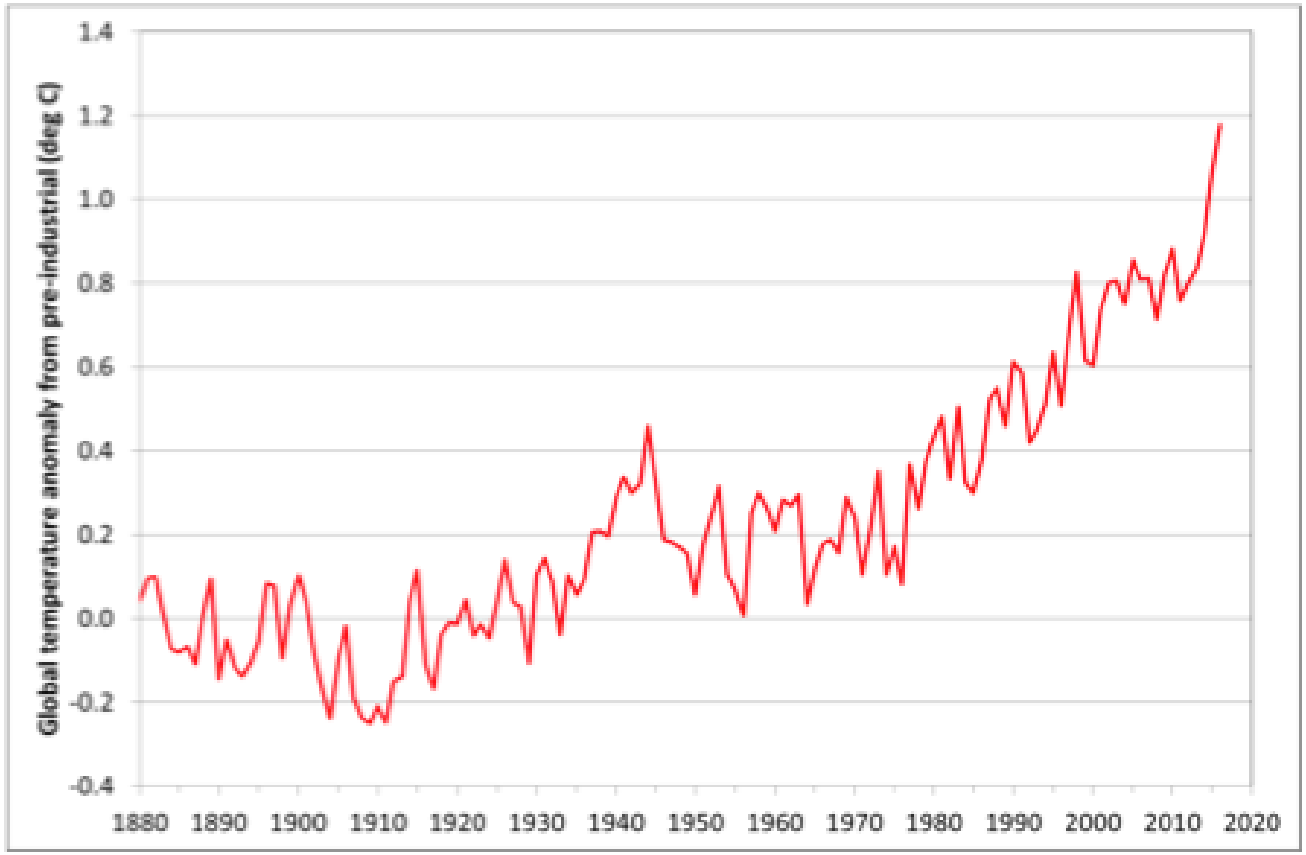
Effectively guiding forward looking climate change adaptation of global coffee supply chains

Led by CIAT International Center for Tropical Agriculture Since 1967 / Science to cultivate change

IIASA

WORLD COFFEE RESEARCH

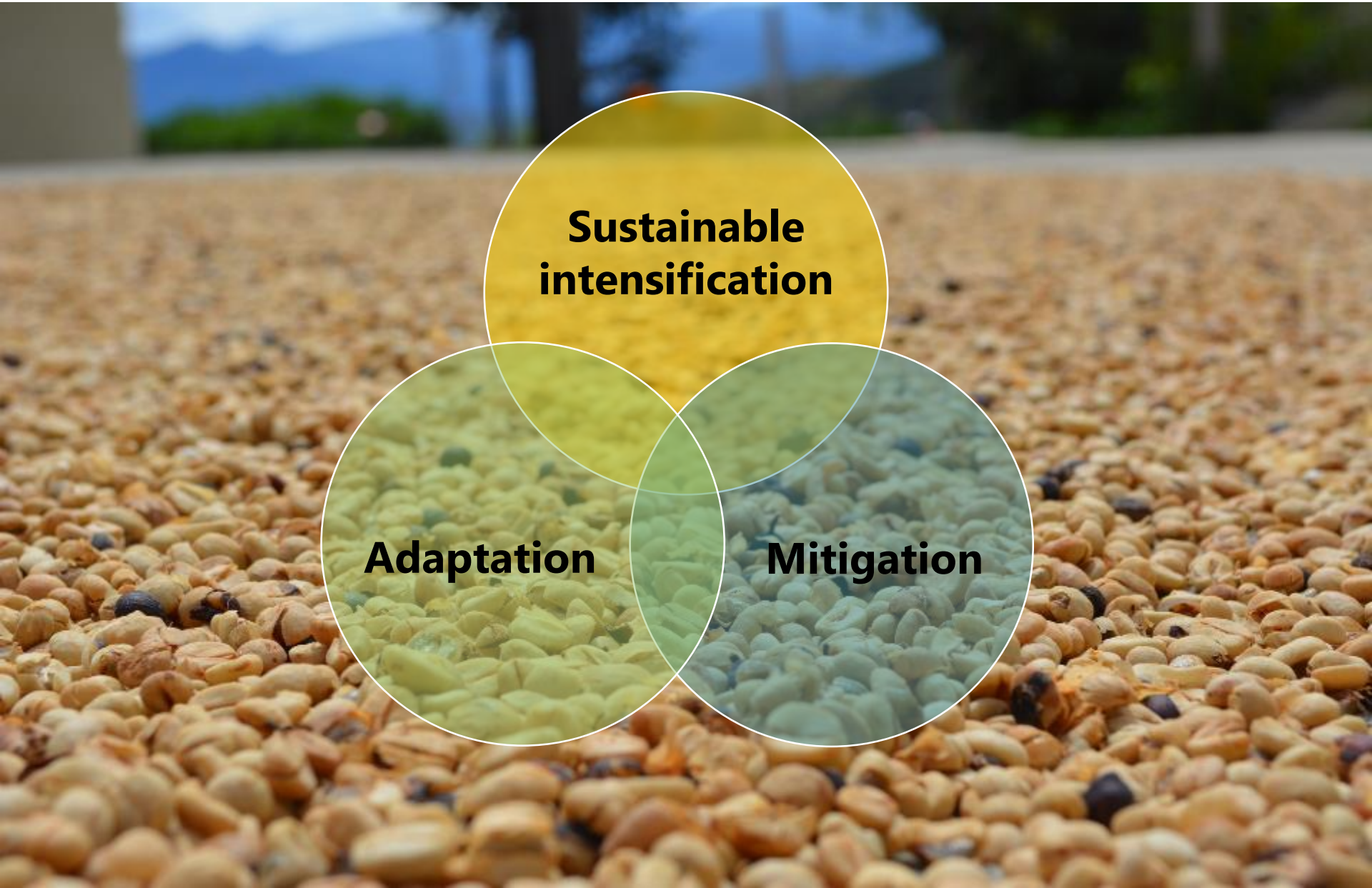
The future of coffee production



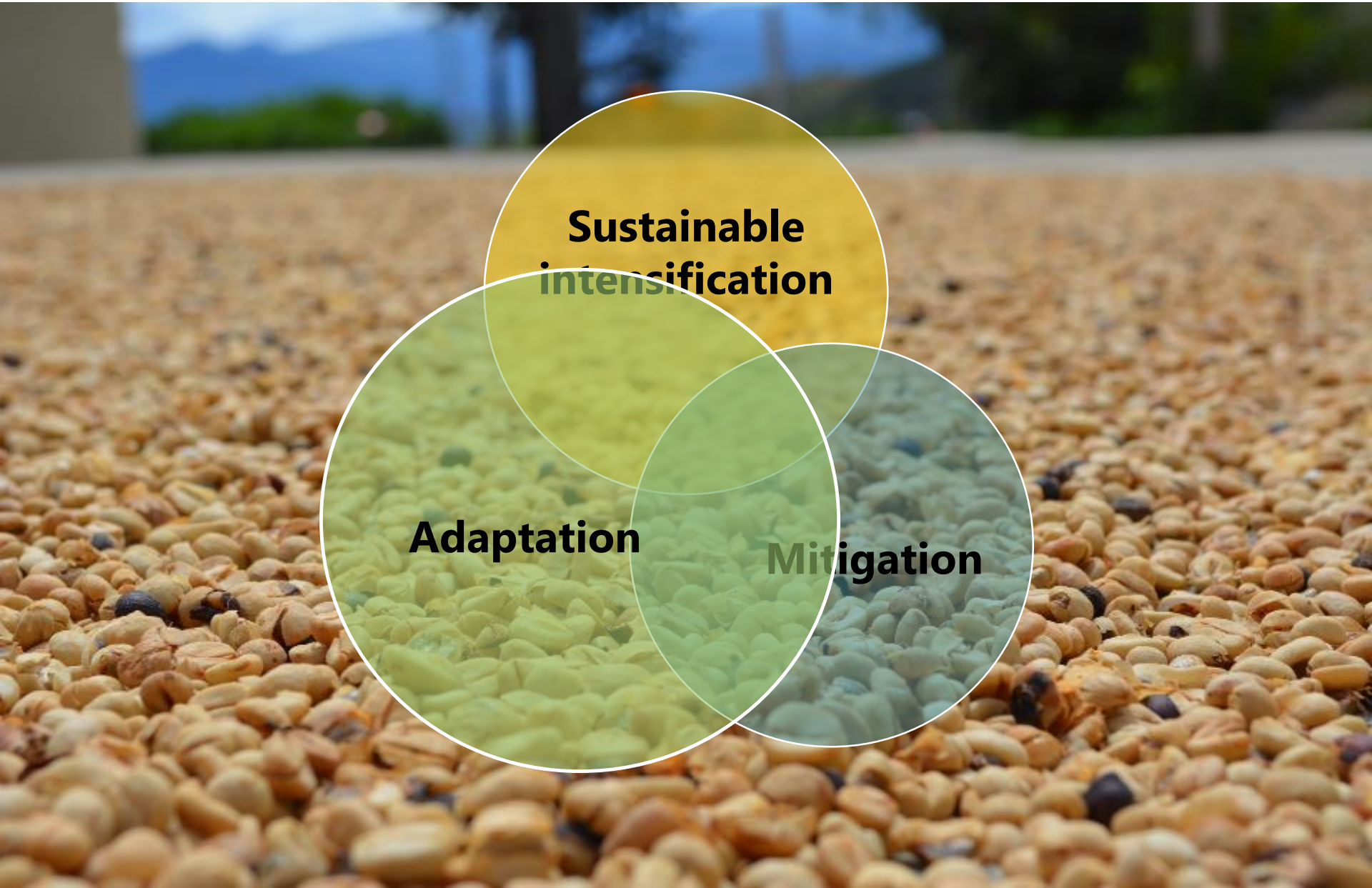
The future of coffee production

Picture: N. Palmer

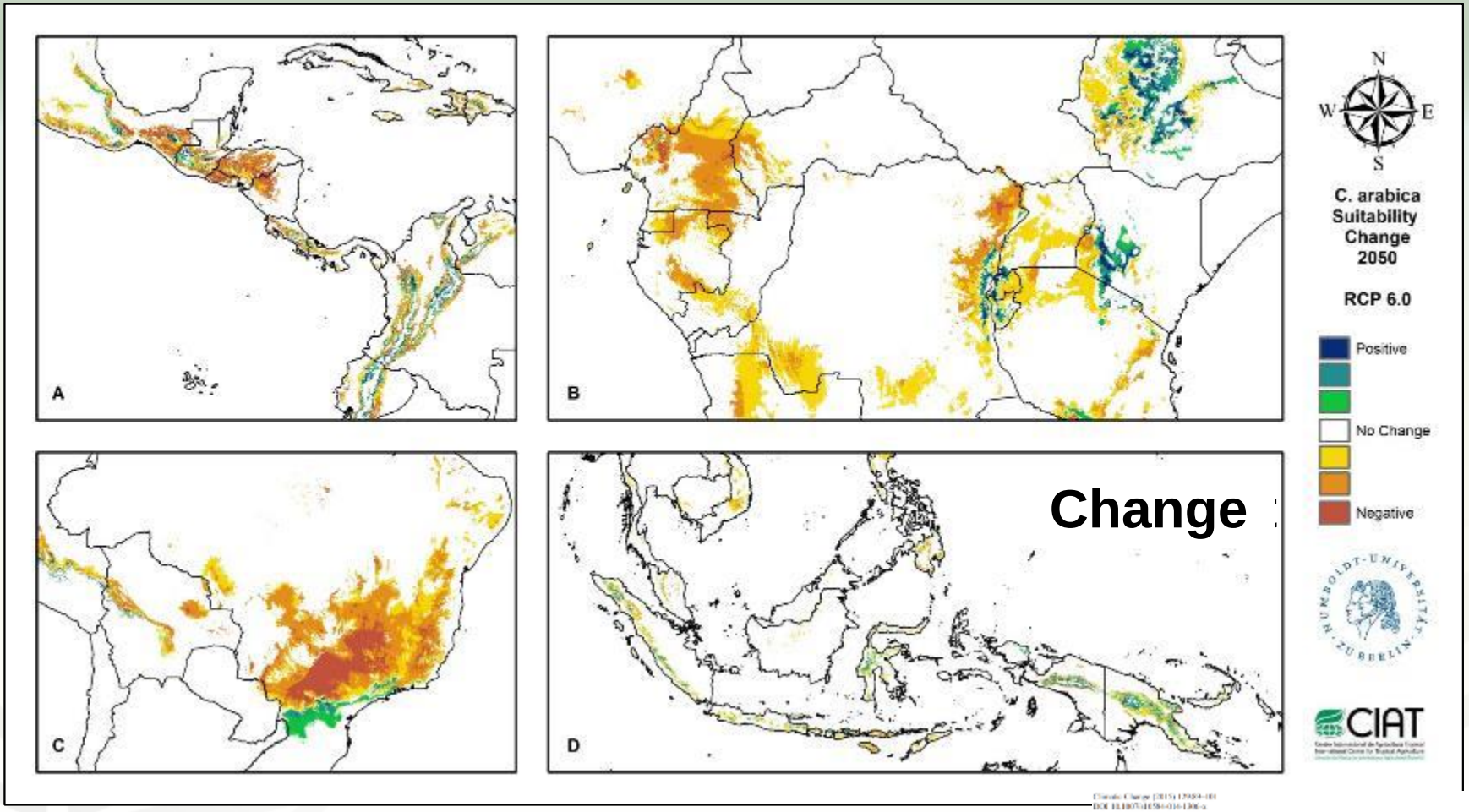
Climate smart coffee



Climate smart coffee



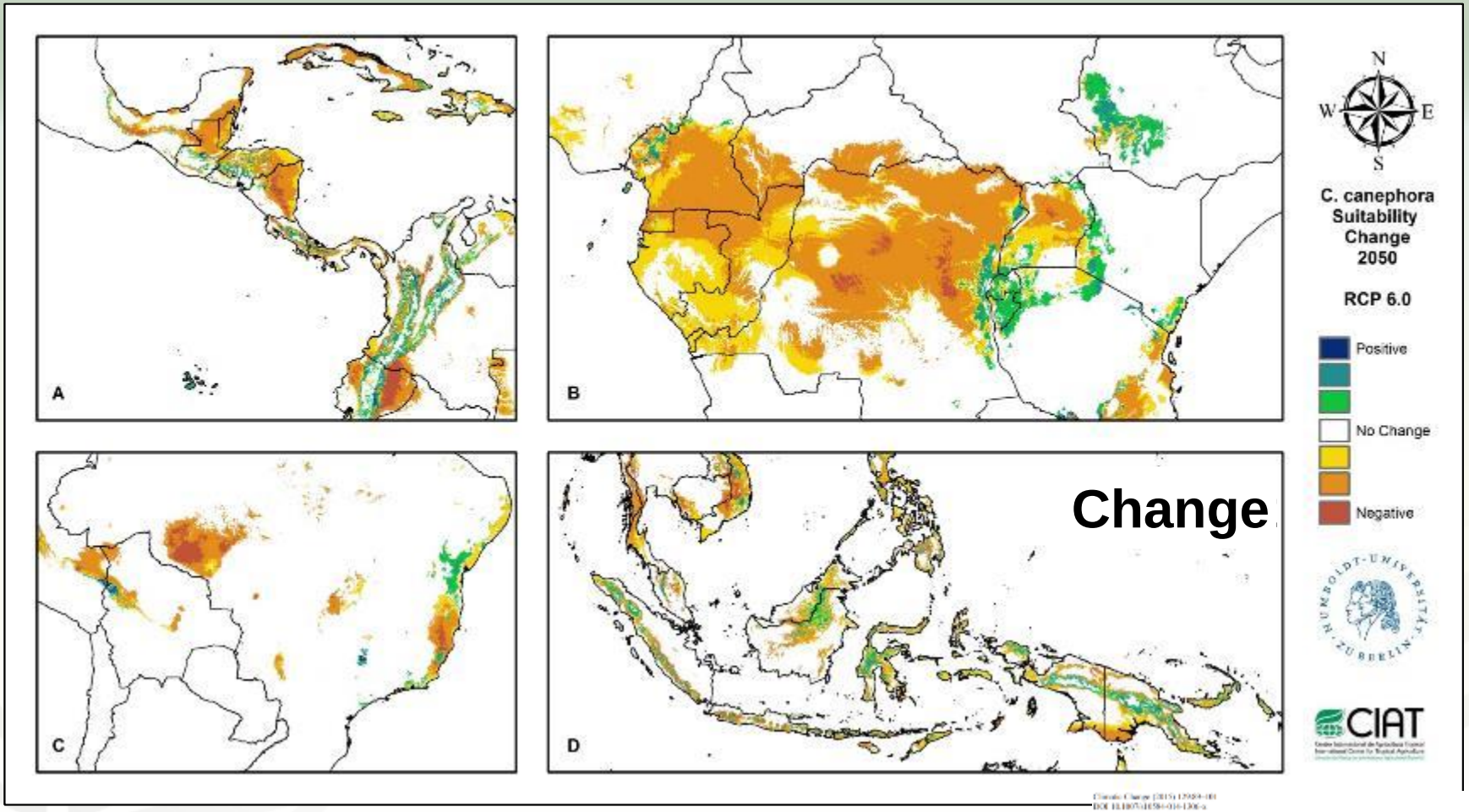
The adaptation challenge



A bitter cup: climate change profile of global production of Arabica and Robusta coffee

Christian Bunn · Peter Laderach · Oriana Ovalle Rivera · Dieter Kirschke

The adaptation challenge

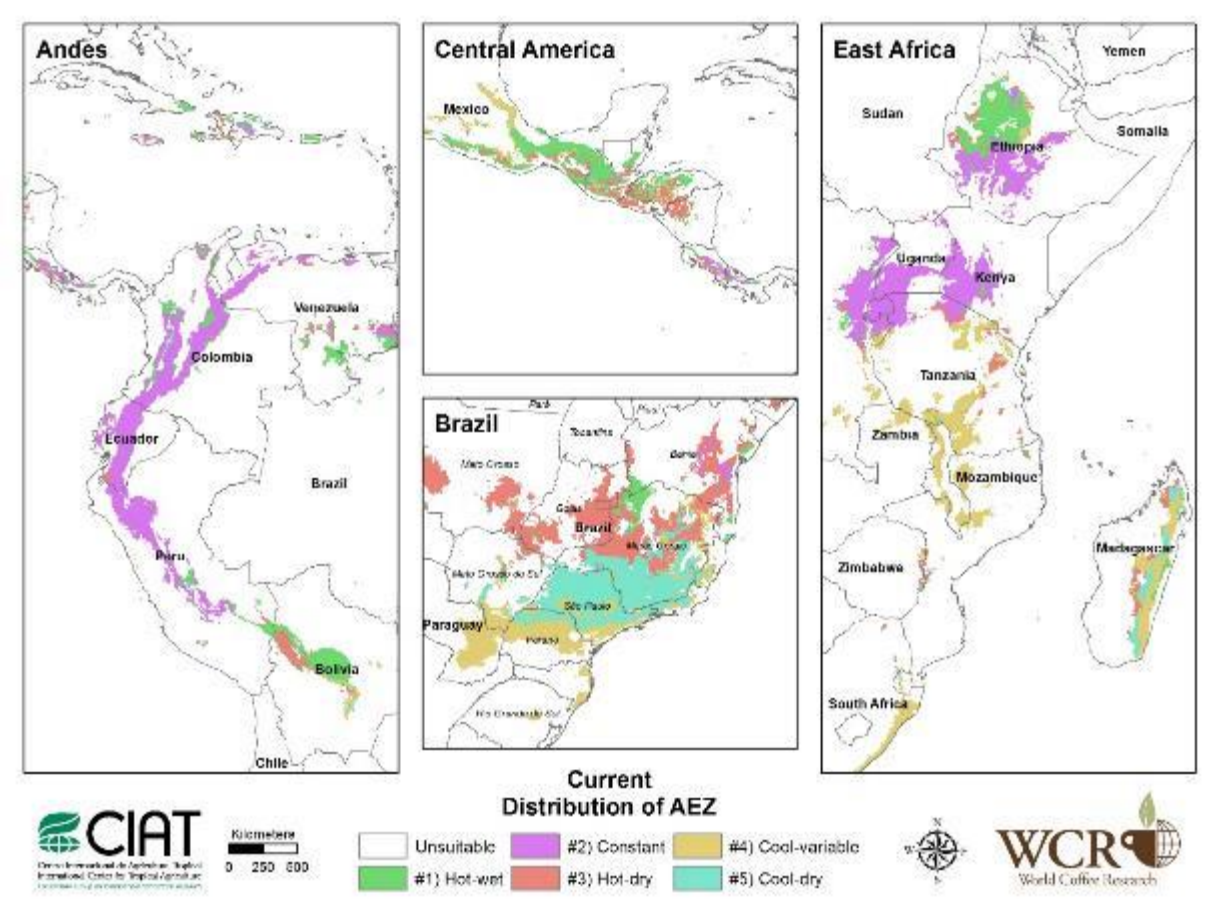


Climatic Change (2015) 129:89–101
DOI 10.1007/s10584-014-1306-x

A bitter cup: climate change profile of global production of Arabica and Robusta coffee

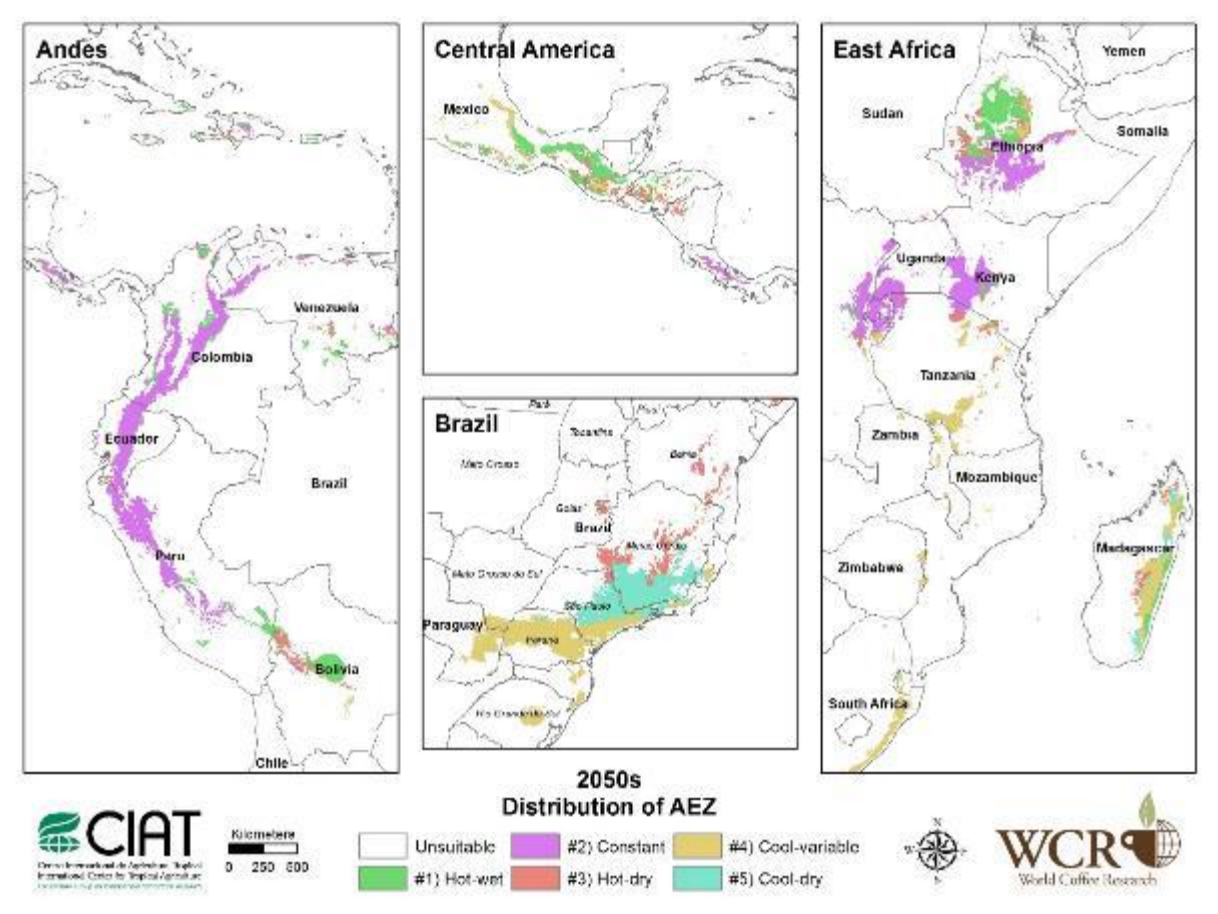
Christian Bunn · Peter Läderach · Oriana Ovalle Rivera · Dieter Kirschke

The adaptation challenge



Funded by:
WORLD COFFEE RESEARCH

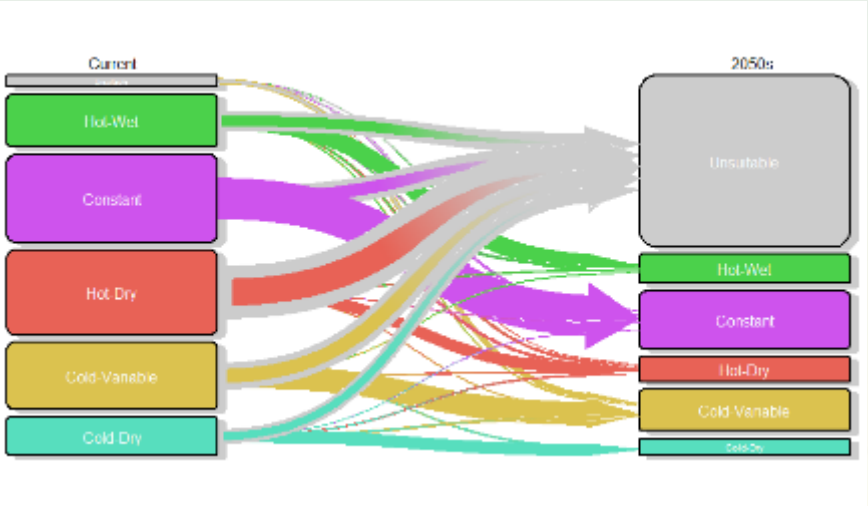
The adaptation challenge



Funded by:
WORLD COFFEE RESEARCH

The adaptation challenge

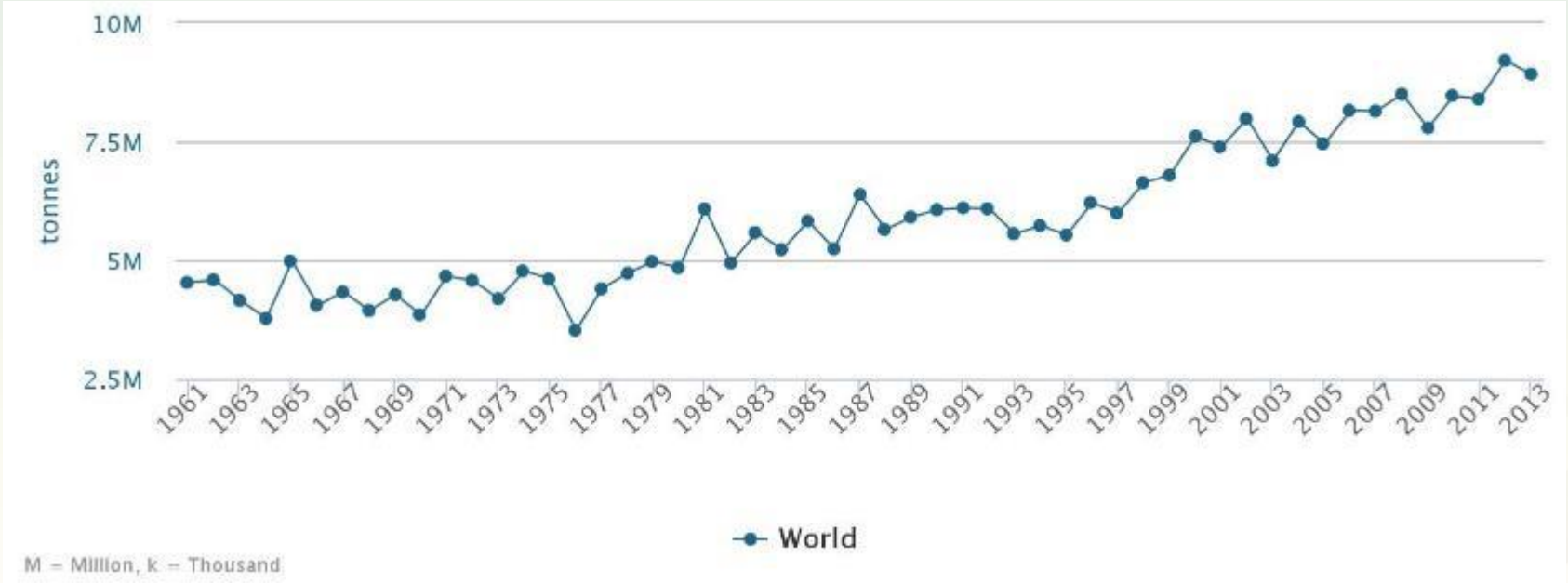
- Areas with a long dry season and high maximum temperatures will be most affected
- Area around equator least affected
- No latitudinal migration
- Altitudinal migration



Funded by:
WORLD COFFEE RESEARCH

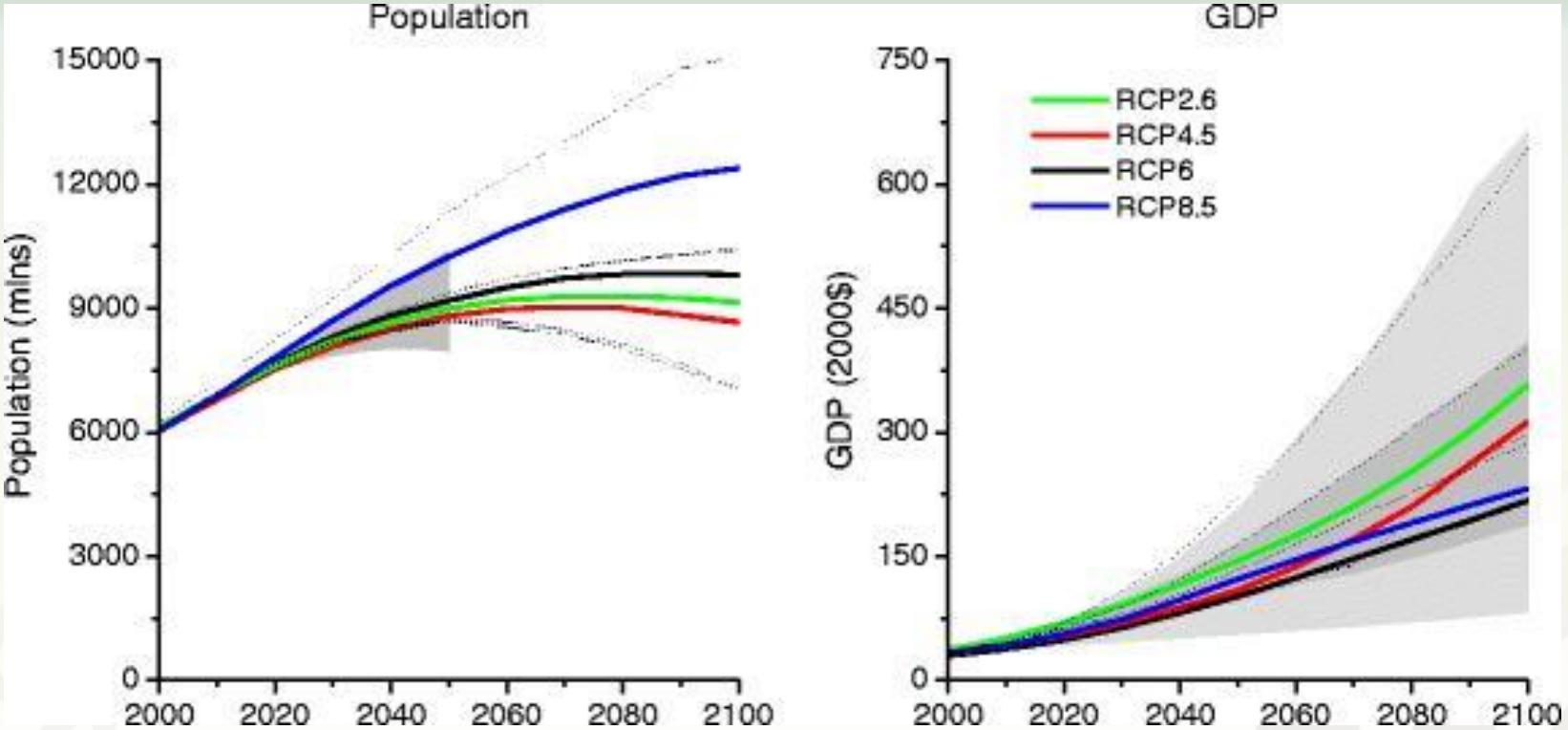
The adaptation challenge

Global coffee production 1961-2013



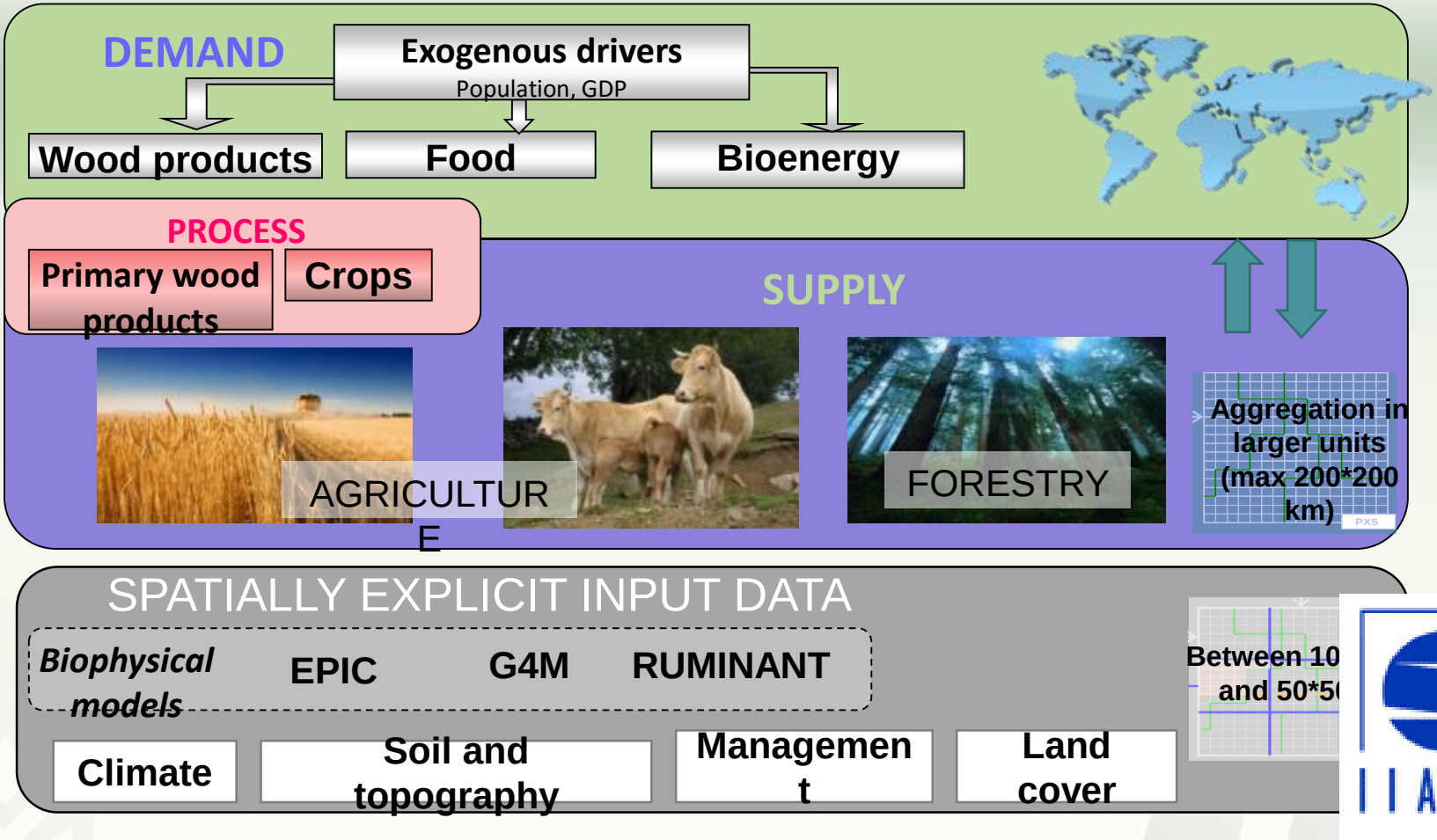
Source: FAOstat 2015

The adaptation challenge



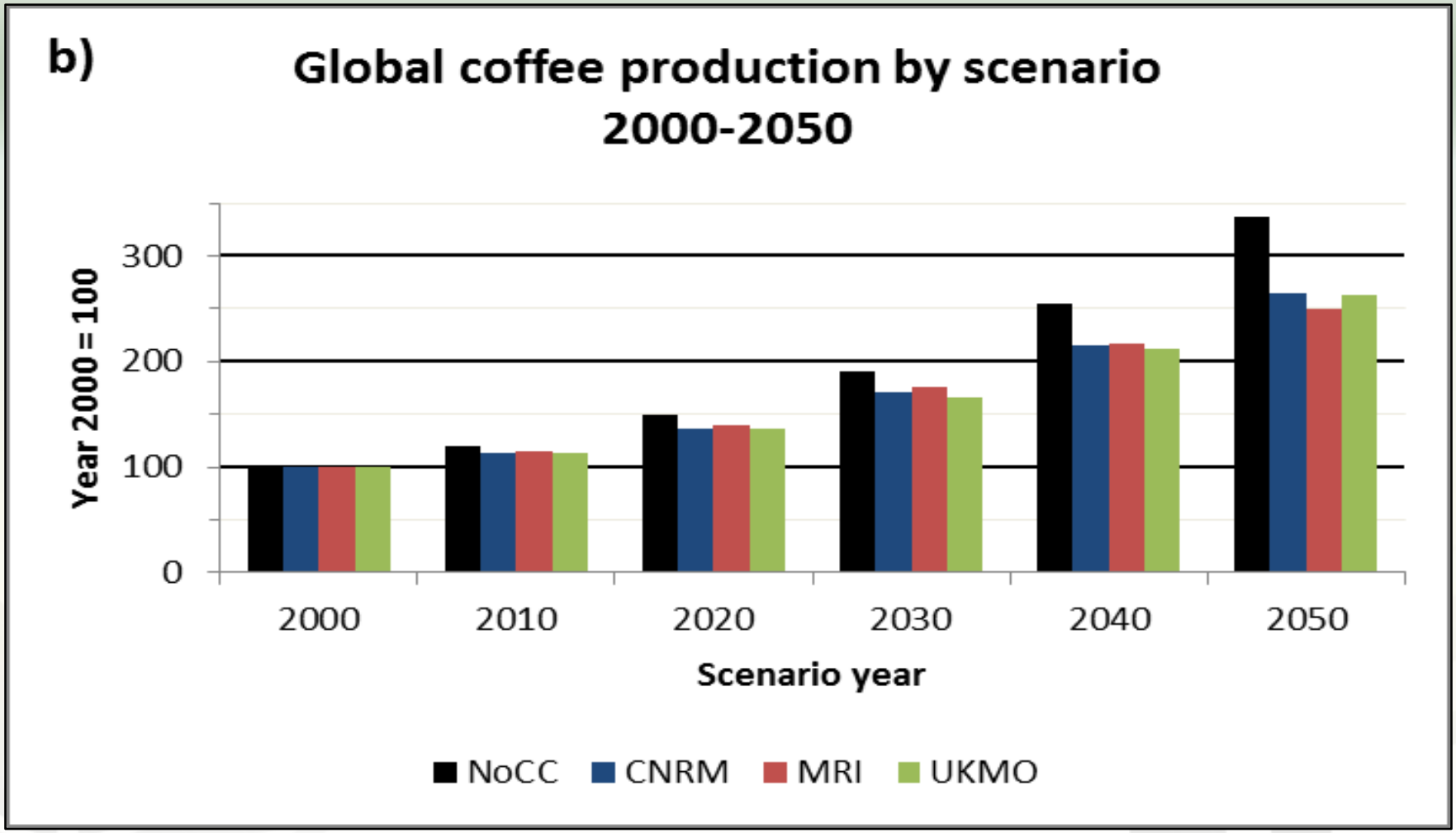
Source: Van Vuuren et al. 2011

The adaptation challenge

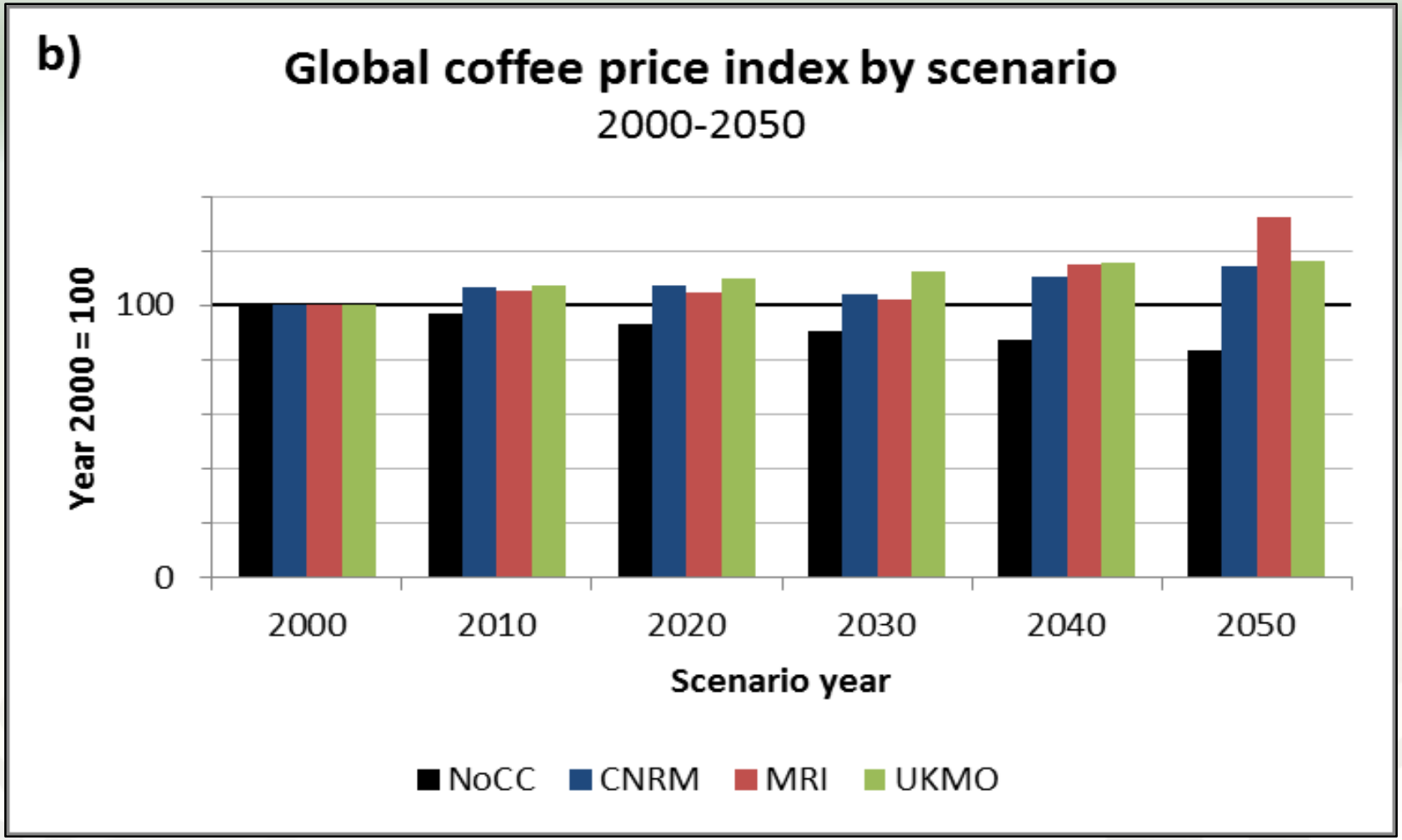


Havlik et al 2012

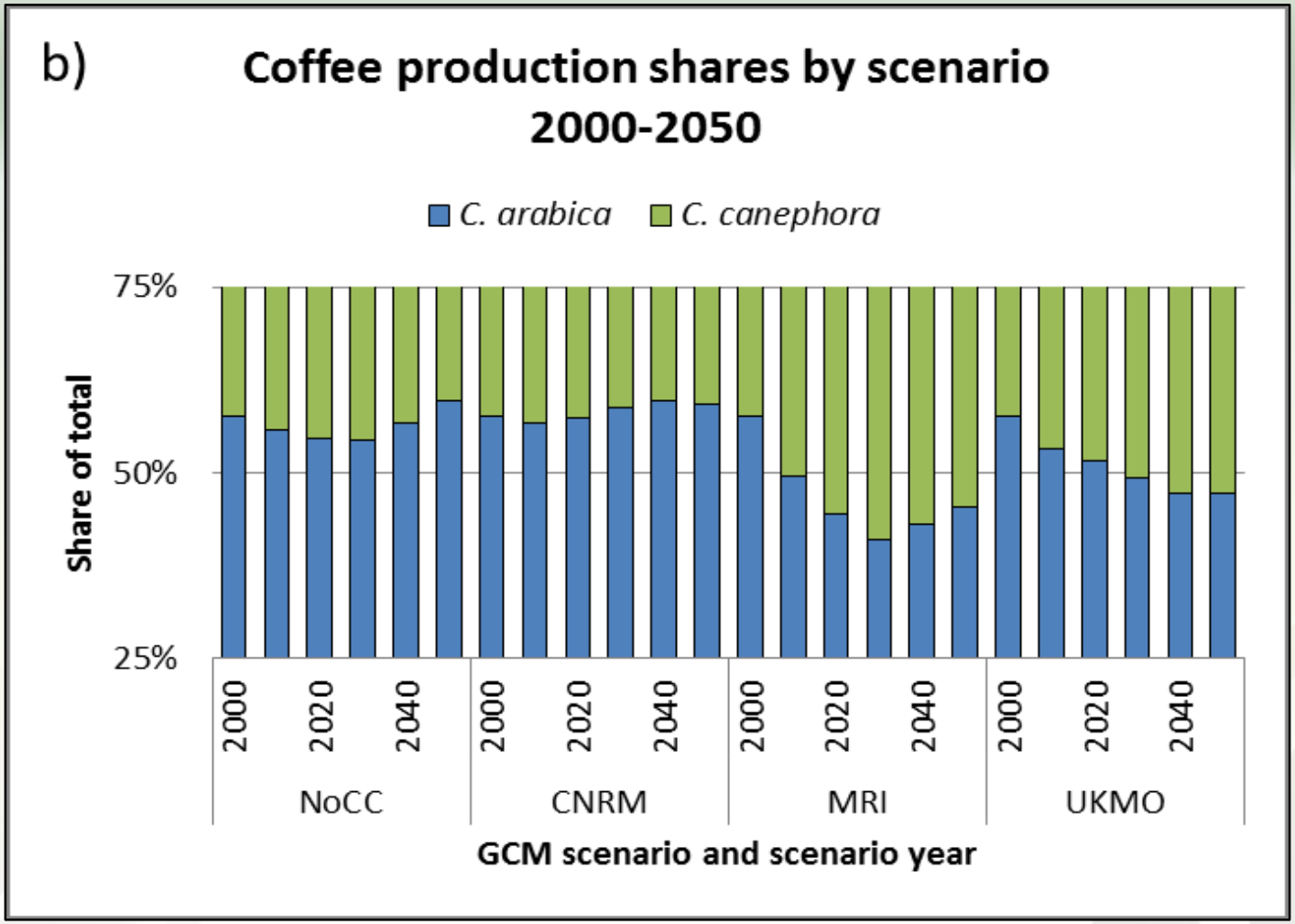
The adaptation challenge



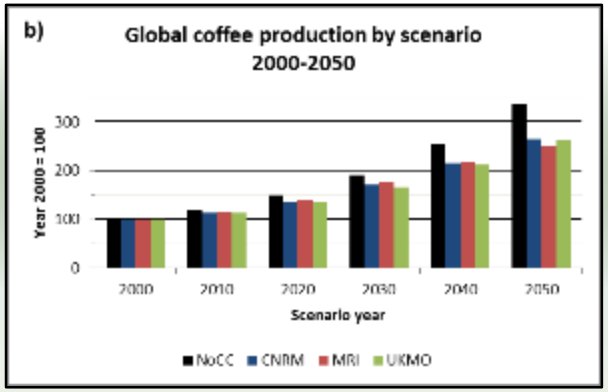
The adaptation challenge

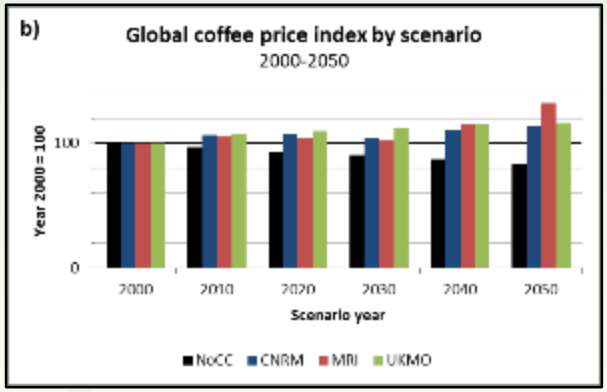


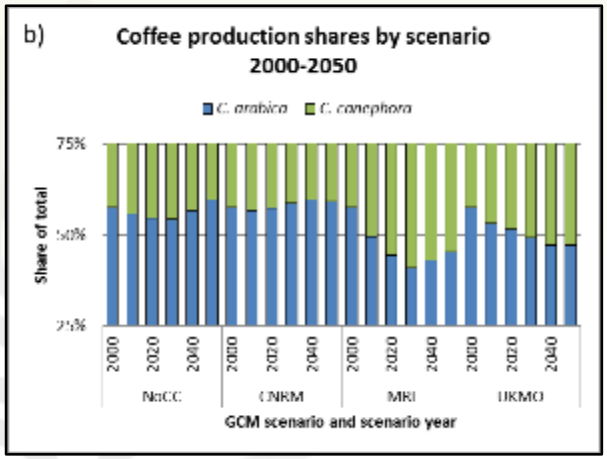
The adaptation challenge



Conclusion - The adaptation challenge





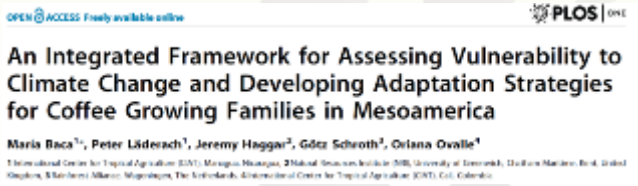


- 50% of available area
- 100% more coffee area
- 25% less total production
- 50% higher prices
- More Robusta

Source: Bunn 2015

Reactive adaptation

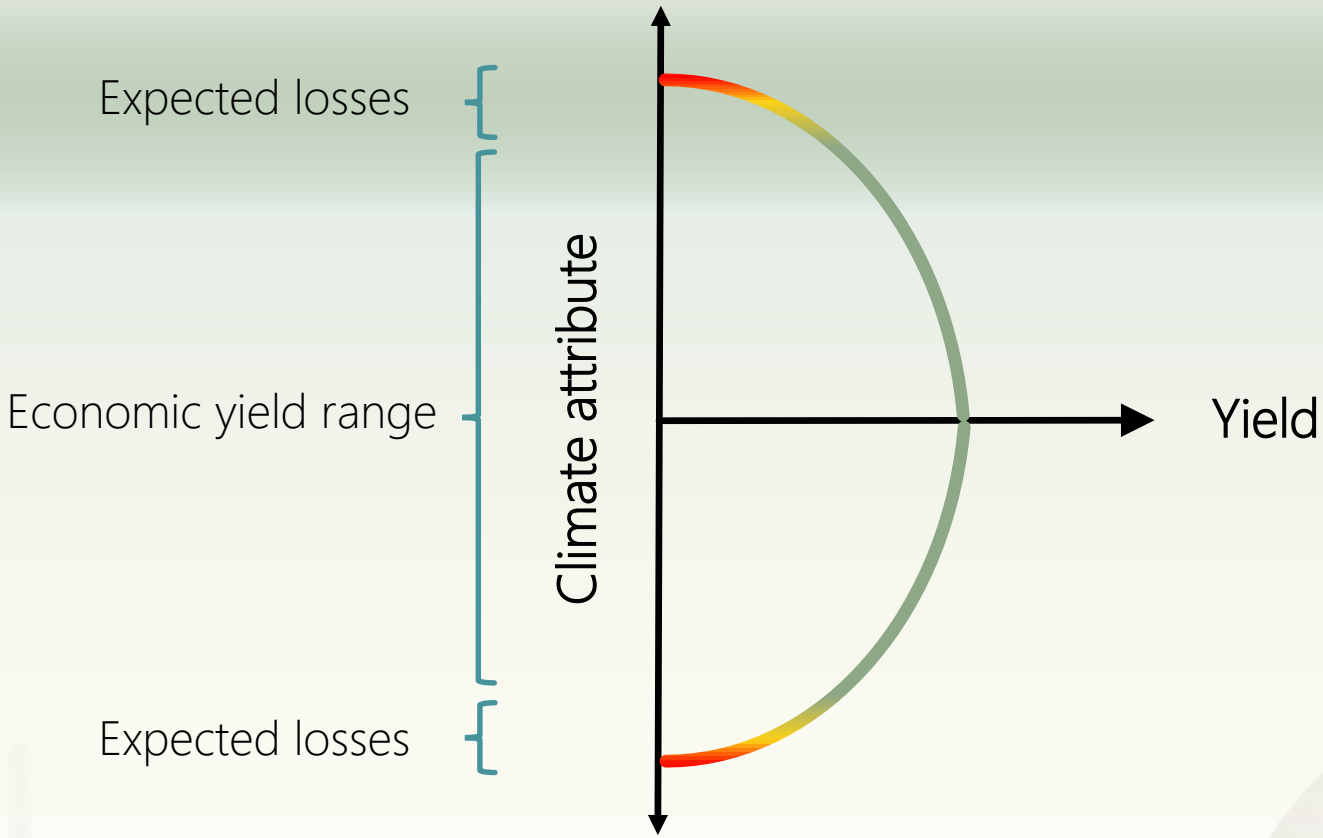
- “The climate has become unpredictable, it rains less and very irregularly, my yield has decreased and I have more pest and disease problems.”
  - Don Pedro, Nicaragua, Madriz, January, 2010
- Income uncertainty results in increased migration


OPEN ACCESS Freely available online PLOS ONE

An Integrated Framework for Assessing Vulnerability to Climate Change and Developing Adaptation Strategies for Coffee Growing Families in Mesoamerica

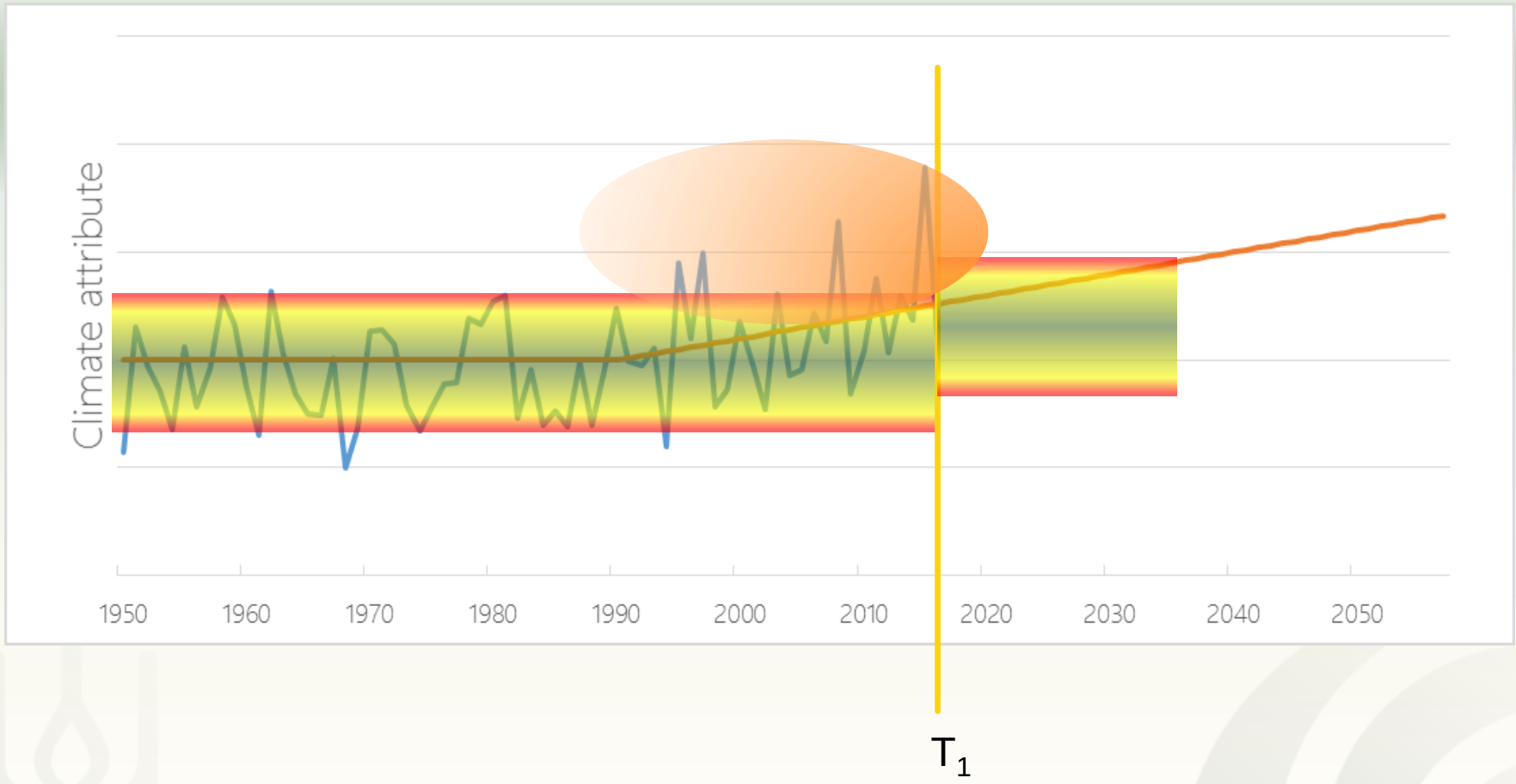
Maria Baca[1]*, Peter Läderach[1], Jeremy Haggar[2], Götz Schroth[3], Oriana Ovalle[4]

Reactive adaptation



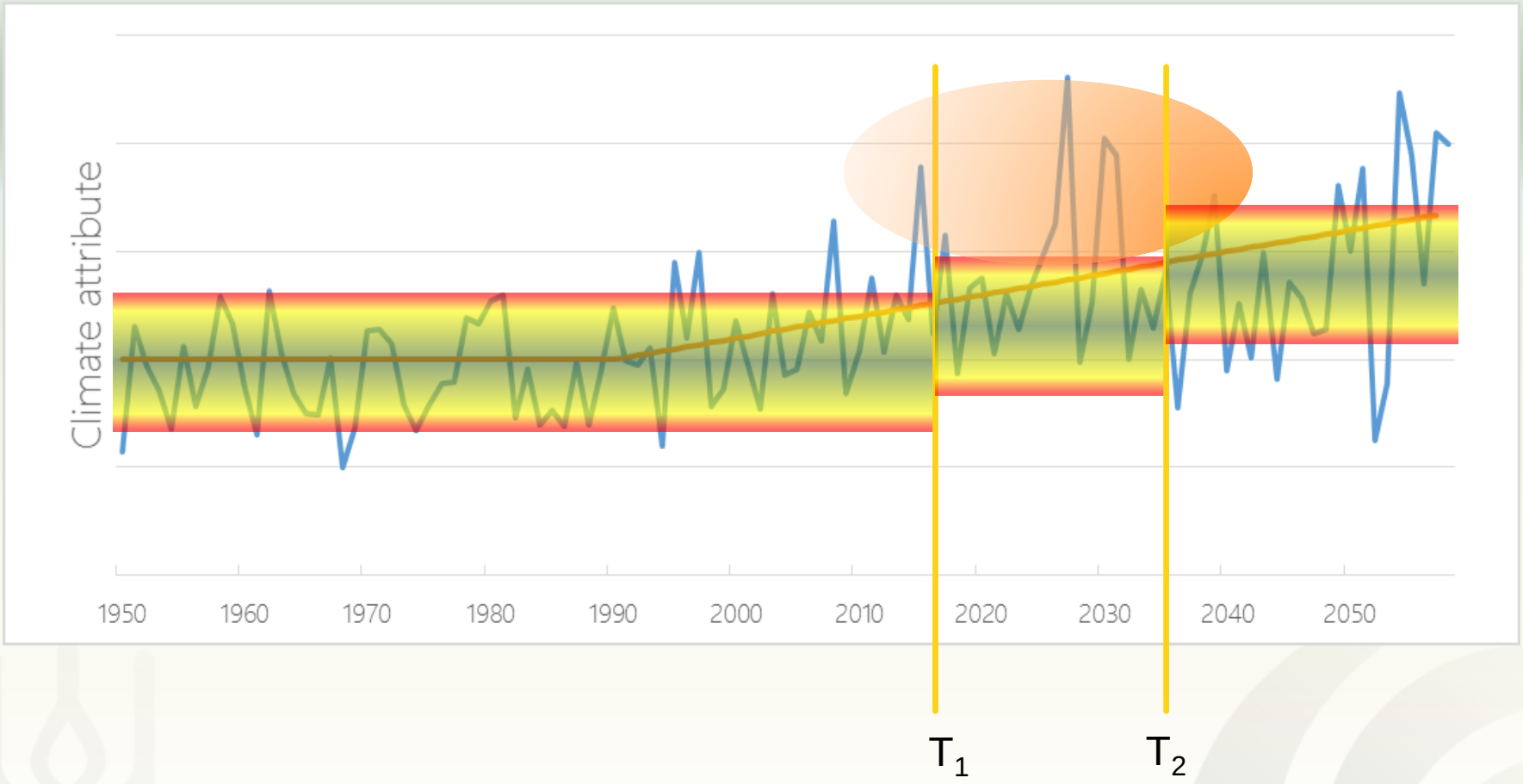
- The cost of avoiding damage is higher than expected loss!

Reactive adaptation



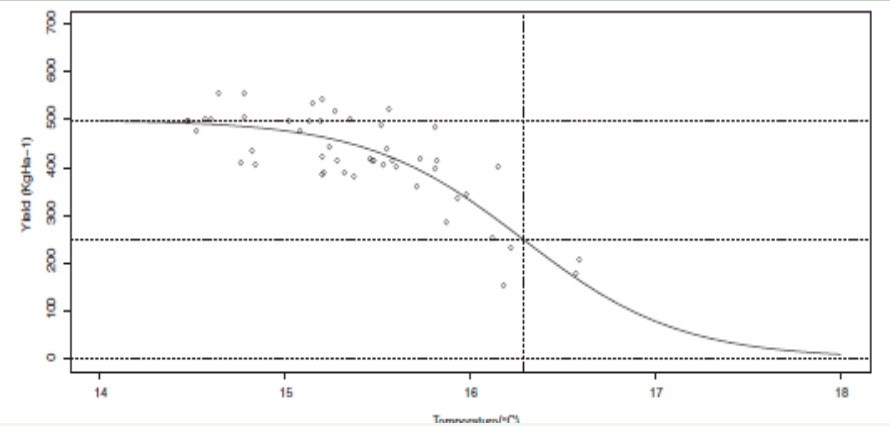
- In T_1 expectations shift. Incurred losses exceed costs of adaptation

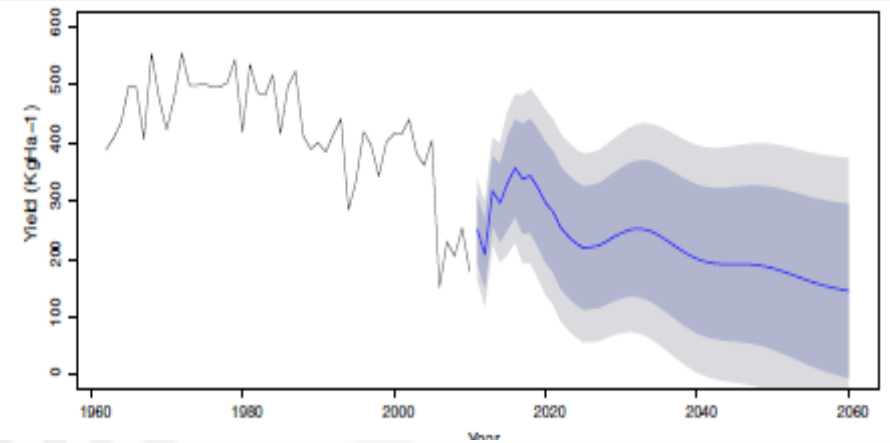
Reactive adaptation



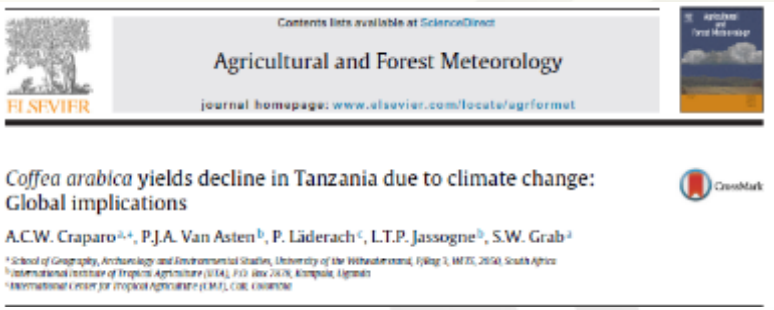
- In T_2 expectations shift again

Reactive adaptation





- Yields were reduced in Tanzania
- Every 1°C increase reduces yields by 137 kg/ha


Contents lists available at ScienceDirect

Agricultural and Forest Meteorology

journal homepage: www.elsevier.com/locate/agrformet

Coffea arabica yields decline in Tanzania due to climate change: Global implications

A.C.W. Craparo[a,*], P.J.A. Van Asten[b], P. Läderach[c], L.T.P. Jassogne[b], S.W. Grab[a]

Reactive adaptation

- Coffee berry borer incidence increased
- Higher temperatures result in higher reproduction rate

OPEN ACCESS Freely available online PLoS one

Some Like It Hot: The Influence and Implications of Climate Change on Coffee Berry Borer (*Hypothenemus hampei*) and Coffee Production in East Africa

Juliana Jaramillo[1,2*], Eric Muchugu[2,3], Fernando E. Vega[5], Aaron Davis[4], Christian Borgemeister[2], Adenirin Chabi-Olaye[2]

Reactive adaptation

- Rust crisis in Central America
- Increased night time temperatures a likely cause

Food Sec. (2015) 7:505–521
DOI 10.1007/s12571-015-0446-9

ORIGINAL PAPER

The coffee rust crises in Colombia and Central America (2008–2013): impacts, plausible causes and proposed solutions

PHILOSOPHICAL TRANSACTIONS B

rstb.royalsocietypublishing.org

Research

Cite this article: Bebber DP, Castillo ÁD, Gurr SJ. 2016 Modelling coffee leaf rust risk in

Modelling coffee leaf rust risk in Colombia with climate reanalysis data

Daniel P. Bebber[1], Ángela Delgado Castillo[1] and Sarah J. Gurr[1,2]

[1]Department of Biosciences, University of Exeter, Stocker Road, Exeter EX4 4QD, UK
[2]Rothamsted Research, North Wyke, Okehampton EX20 2SB, UK

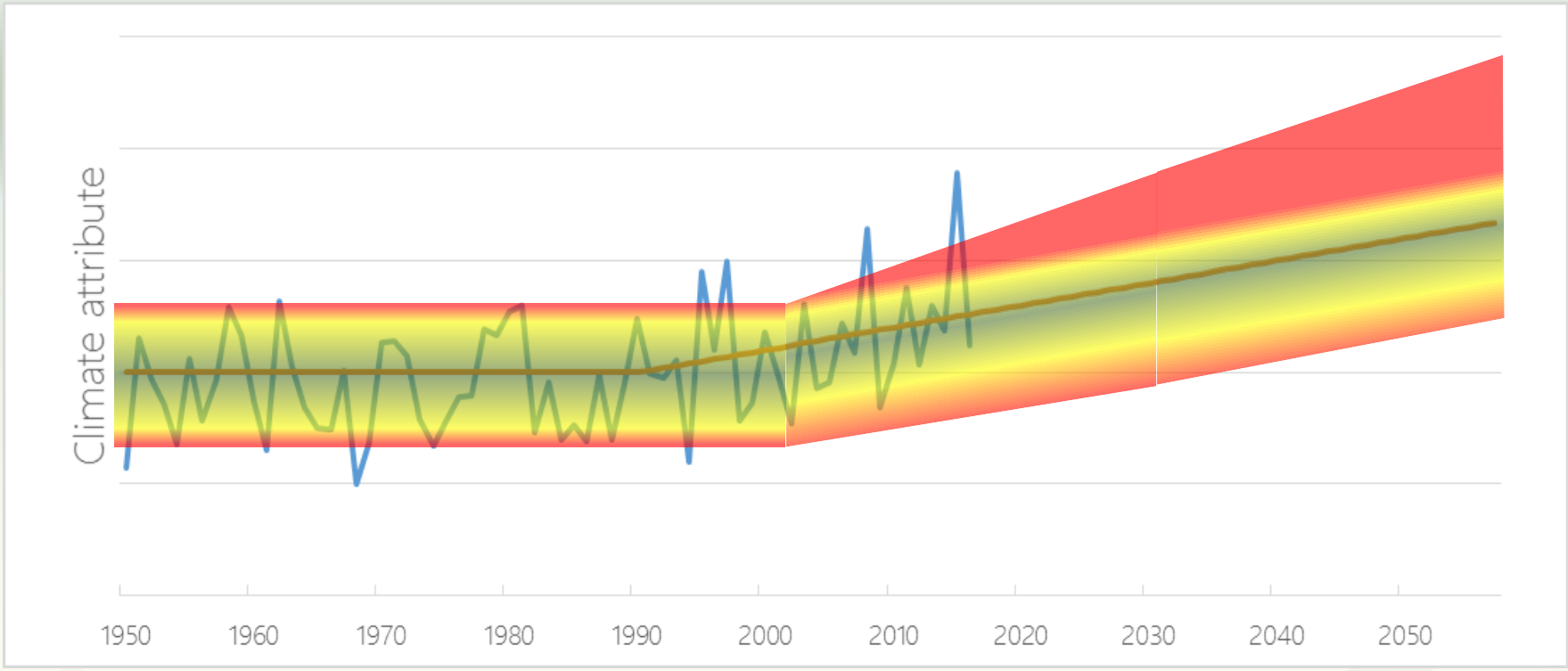
DPB, 0000-0003-4440-1482

Many fungal plant diseases are strongly controlled by weather, and global climate change is thus likely to have affected fungal pathogen distributions

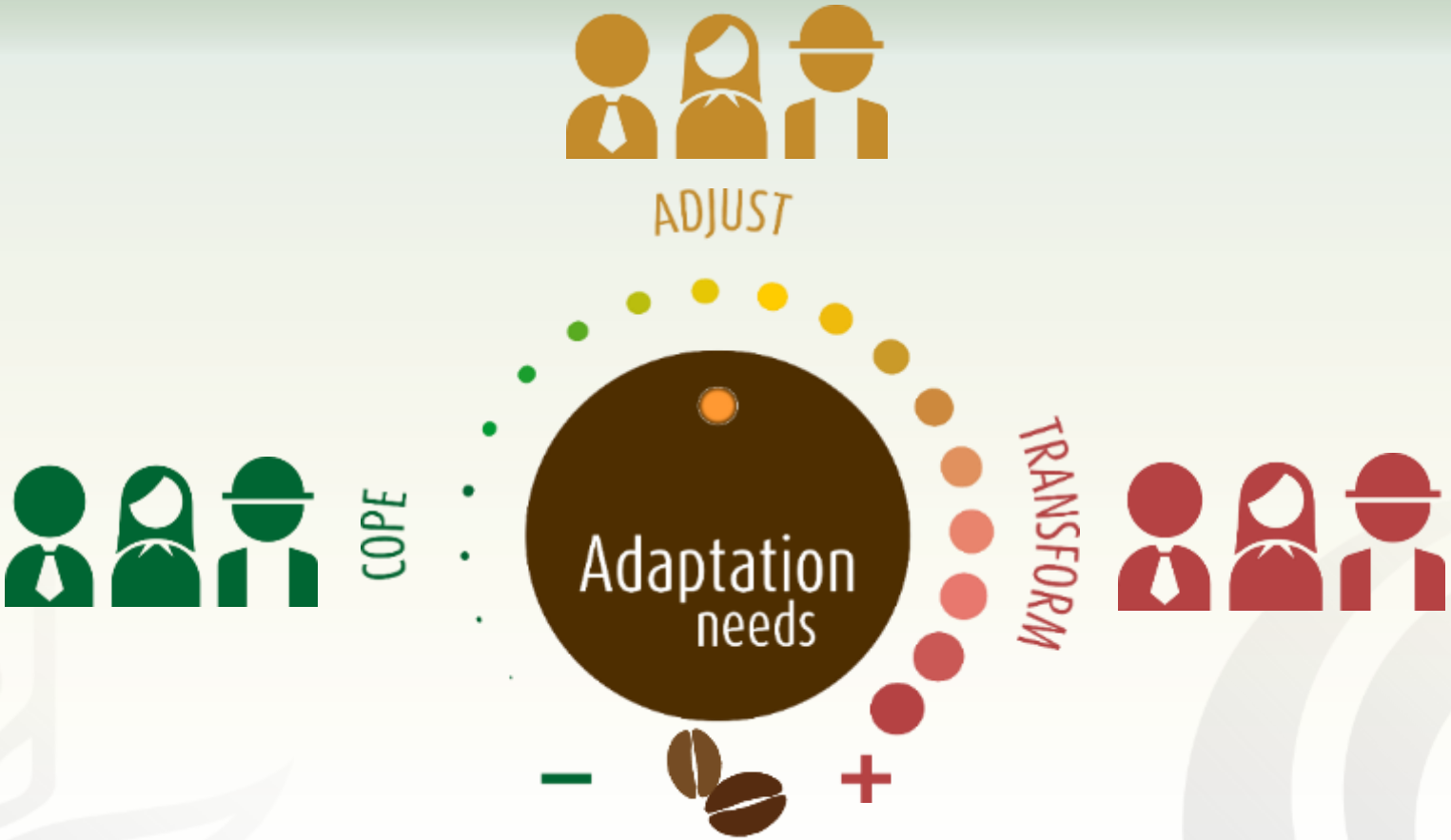
Conclusions – Reactive adaptation

- Observed impacts
  - Rust
  - Berry borer
  - Reduced yields
  - Drought
  - Migration
- Damage already incurred
- Future damage not avoided
- Trends are disputable
- A forward looking approach is preferential

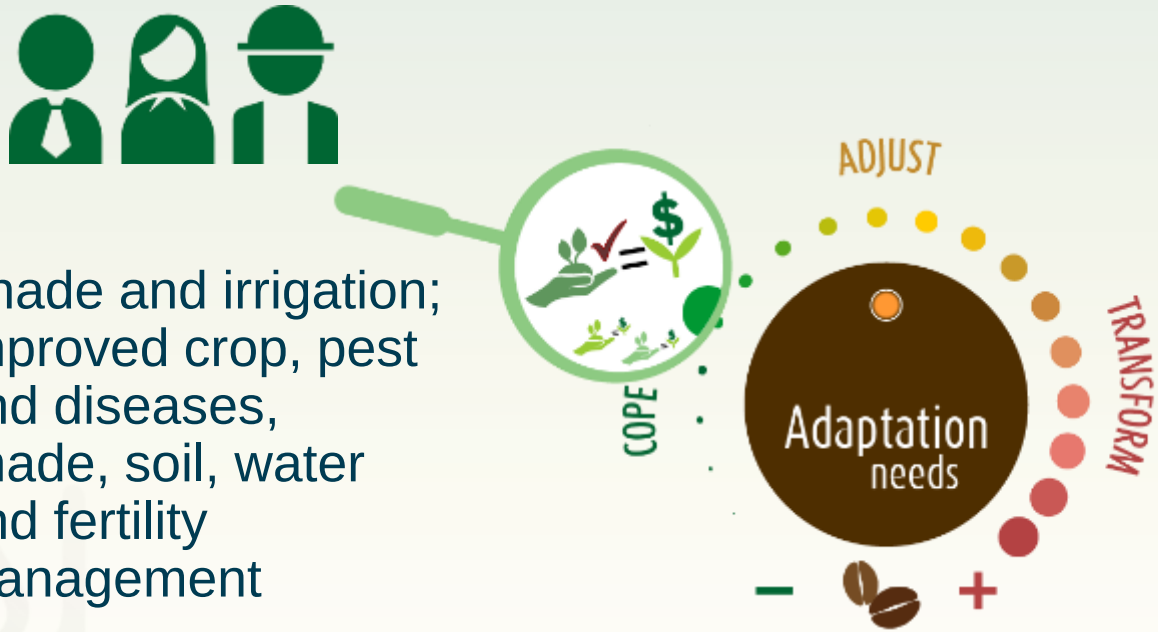
Pro-active adaptation



Pro-active adaptation

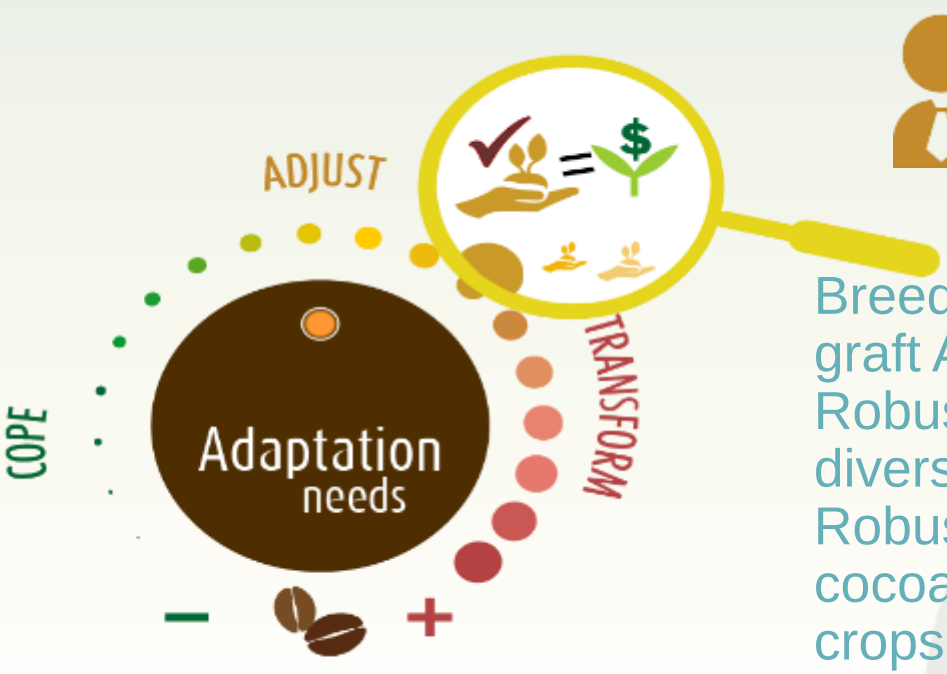


Pro-active adaptation – Incremental



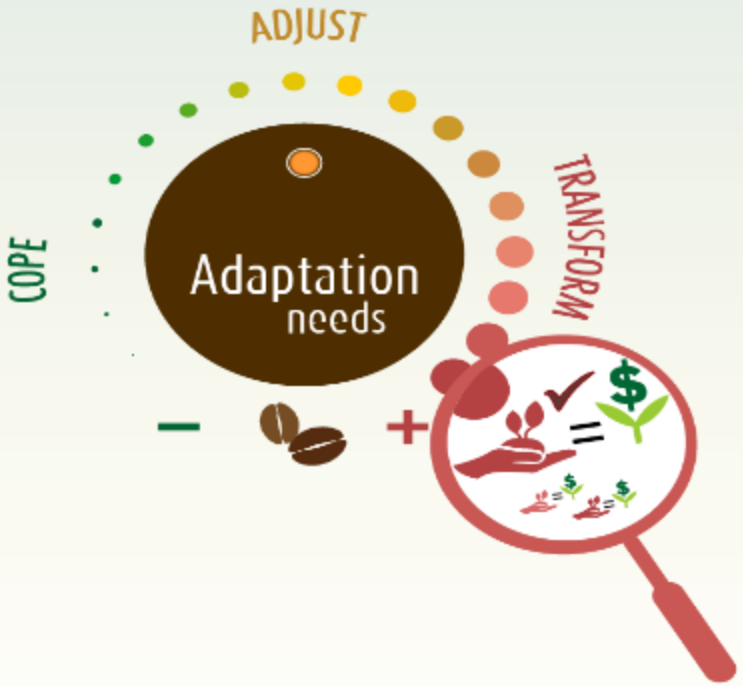
Shade and irrigation; improved crop, pest and diseases, shade, soil, water and fertility management

Pro-active adaptation – Systemic



Breed new varieties; graft Arabica on Robusta varieties, diversification into Robusta coffee, cocoa, or other tree crops.

Pro-active adaptation - Transform



Move from diversification to replacing crops, emigrate to other region, off farm employment

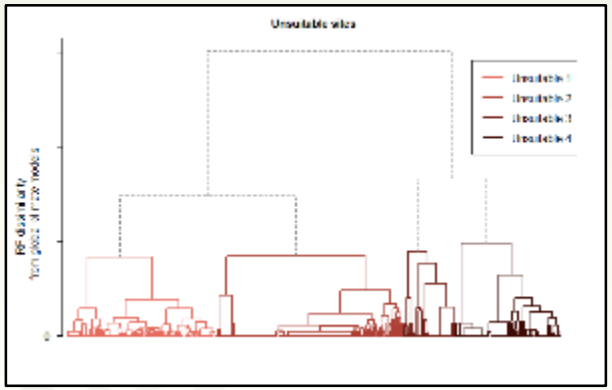
Pro-active adaptation

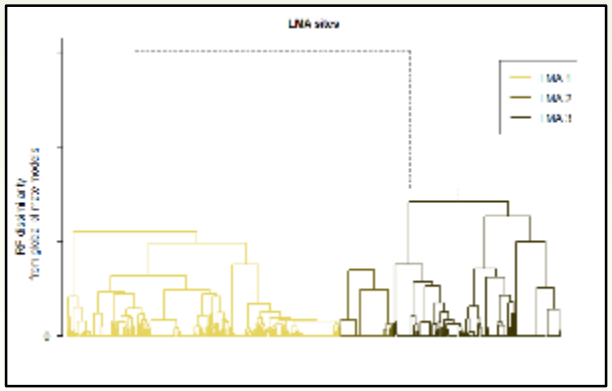
Current coffee locations

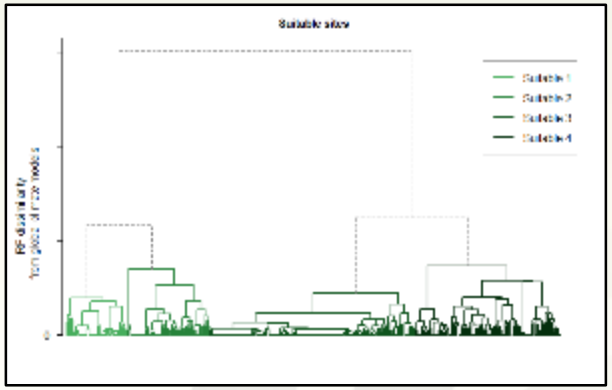
Likely unsuitable

Uncertain

Likely suitable





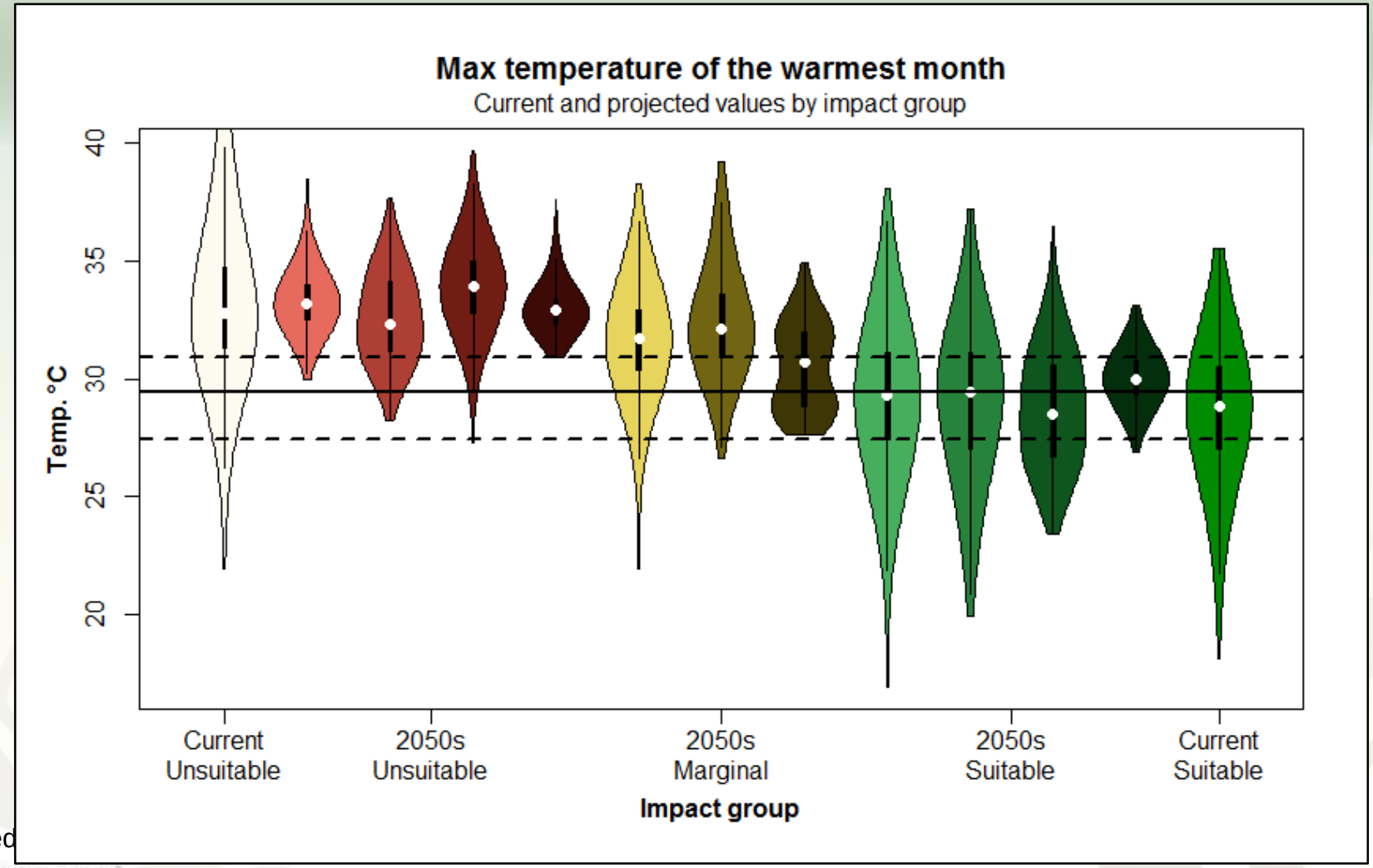


Transform

Systemic

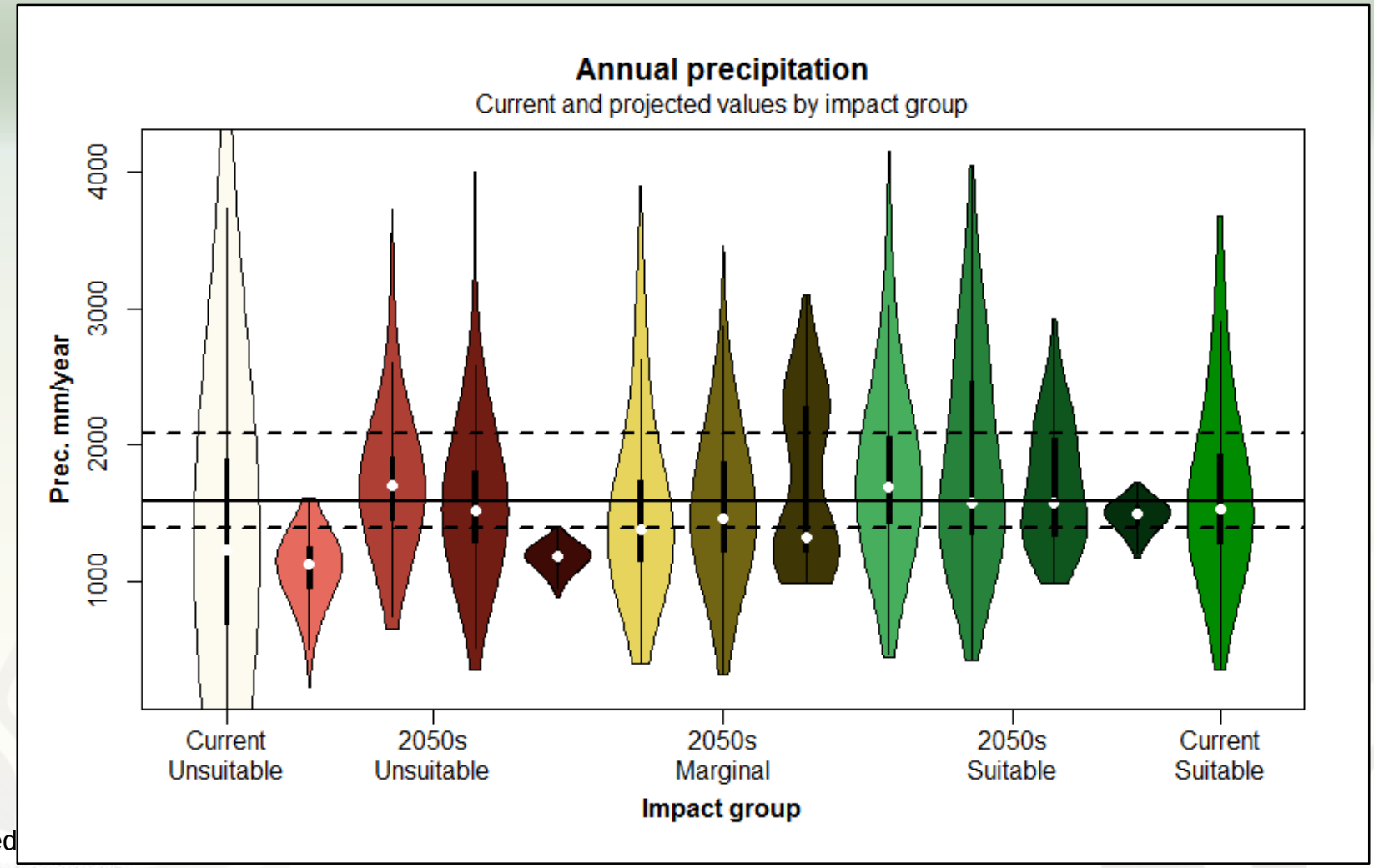
Incremental

Pro-active adaptation



Funded

Pro-active adaptation



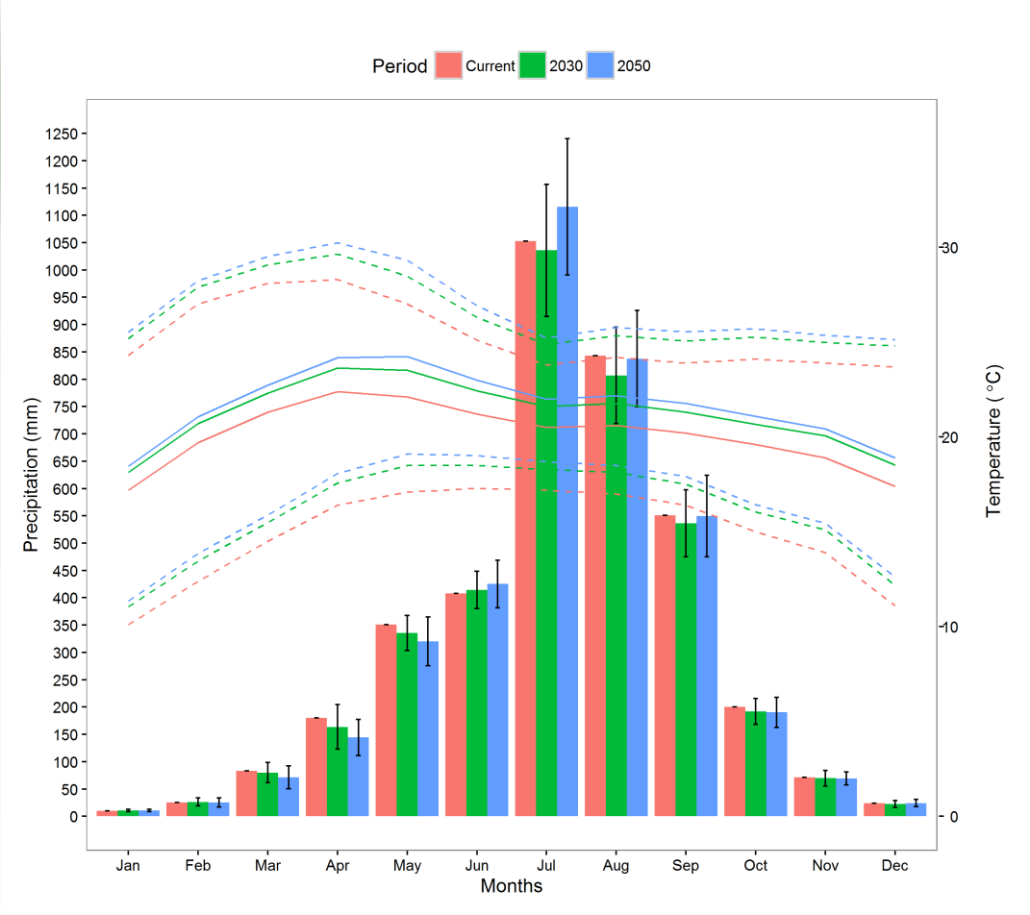
Funded

Pro-active adaptation

- We can learn from low altitudes in proximity to coffee areas

Funded by:
WORLD COFFEE RESEARCH

Pro-active adaptation



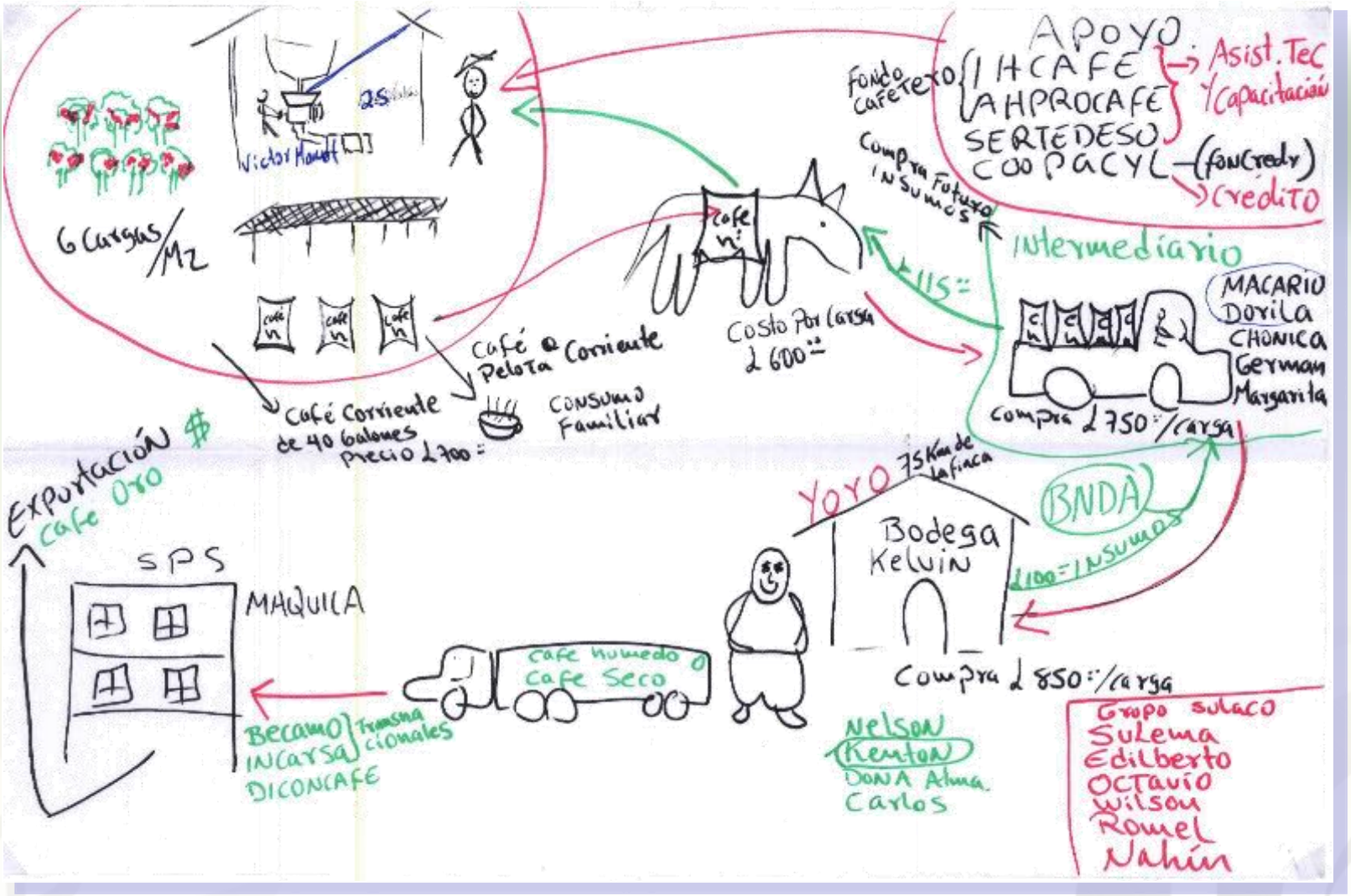
Thevada Estate, Paksong, Laos

Funded by:
WORLD COFFEE RESEARCH

Conclusions – Pro-active adaptation

- Projected impacts
  - Increased heat
  - High precipitation uncertainty
- Overcoming heat and drought may mitigate impacts
- Climate risk will increase even in a perfect scenario

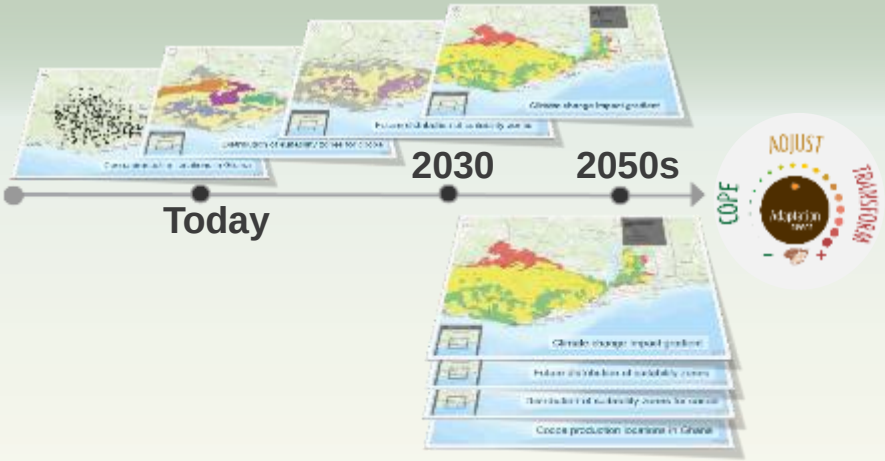
Mainstreaming Climate-Smart Coffee



Mainstreaming Climate-Smart Coffee

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security — CCAFS

1 Map the impact gradient to understand the risk of climate change over time



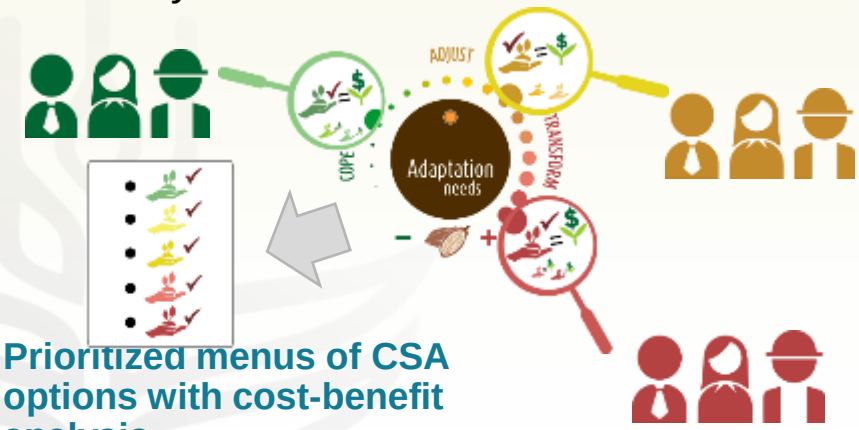
2 Convene value chain actors along the exposure gradient

Areas that transition from one suitability type to another but remain suitable

Locations where climate characteristics will not fundamentally change

Production in these zones will likely become unviable and other crops should be considered

3 Identify and prioritize relevant CSA practices by exposure gradient and analyze costs and benefits.

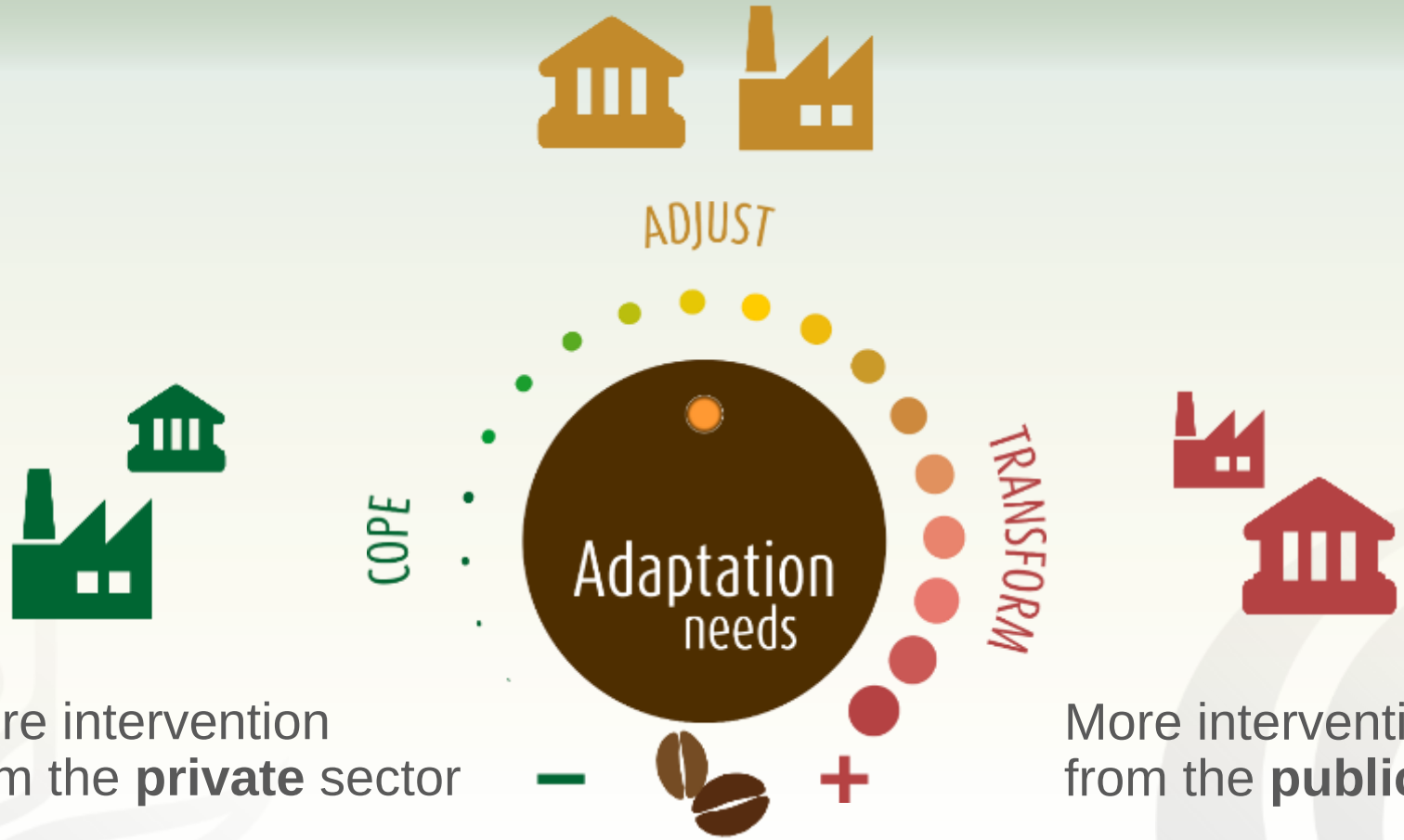


Prioritized menus of CSA options with cost-benefit analysis

4 Construct exposure specific portfolios of priority CSA practices for different investors

Tailored CSA investment plans

Mainstreaming Climate-Smart Coffee



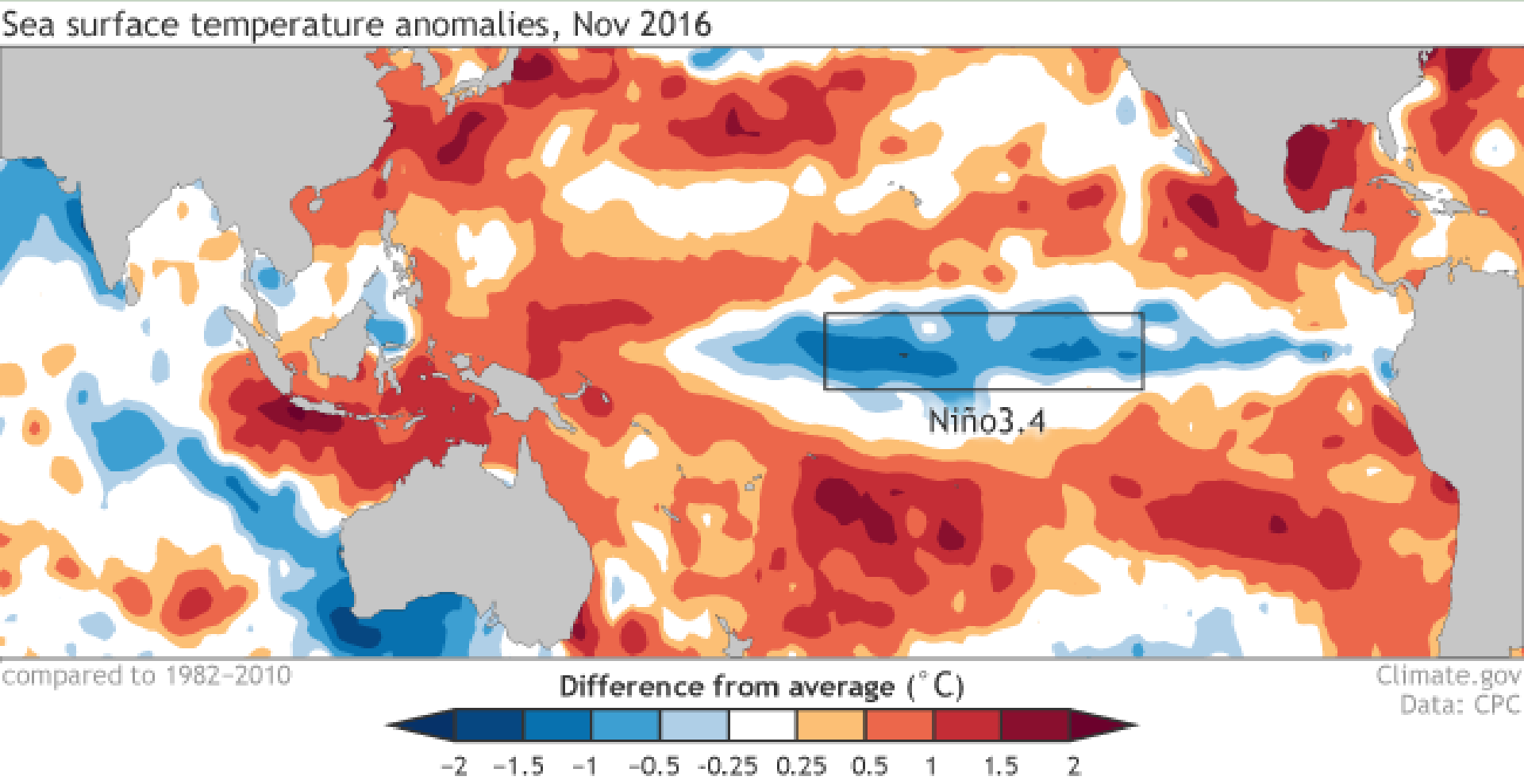
More intervention
from the **private** sector

More intervention
from the **public** sector

Mainstreaming Climate-Smart Coffee

- High institutional support
  - Knowledge exchange
  - Insurance
  - Close the yield gap
- Technical support
  - Combat pests + diseases
  - Improved varieties
  - Climate smart practices
- Suitable climate
  - Higher elevations
  - Close to the equator

The elephant in the room



Thank you

CGIAR RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security CCAFS

The 26th International Conference on Coffee Science

Bunn, Christian, P Läderach, M Lundy, C Montagnon, A Mosnier

Led by CIAT International Center for Tropical Agriculture Since 1967 / Science to cultivate change

IIASA

WORLD COFFEE RESEARCH