Global climate change impacts on cocoa

RESEARCH PROGRAM ON Climate Change, Agriculture and Food Security

CGIAR

CCAFS

Cocoa climate zones in a changing climate

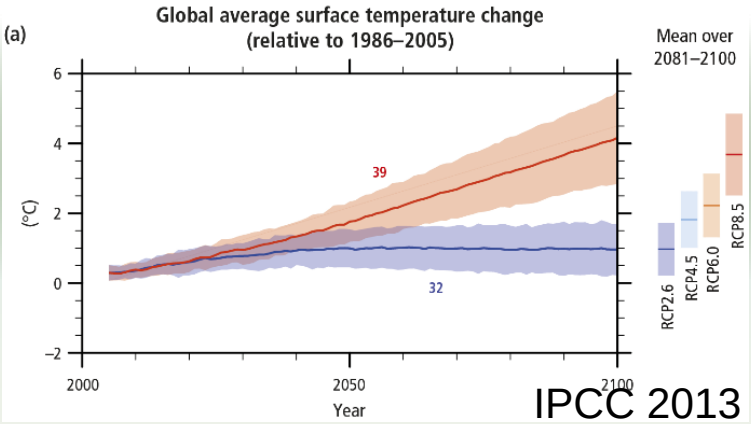
CIAT

2017 International Symposium on Cocoa Research (ISCR), Lima, Peru, 13-17 November 2017

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

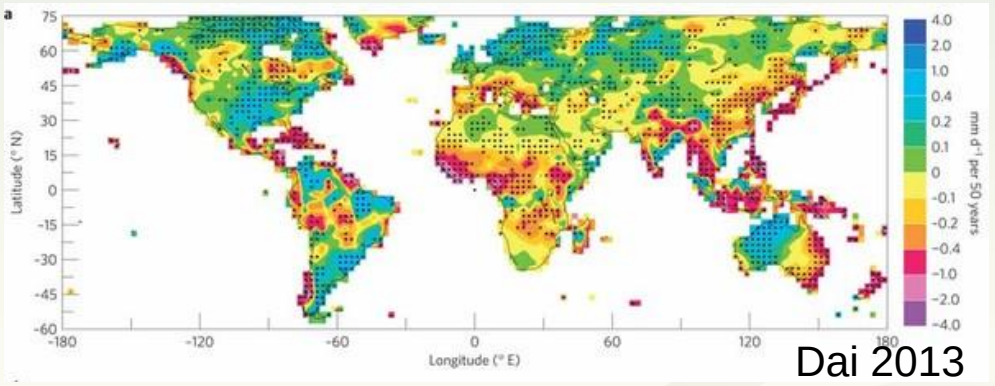
Climate change trends and projections

- Increasing temperatures



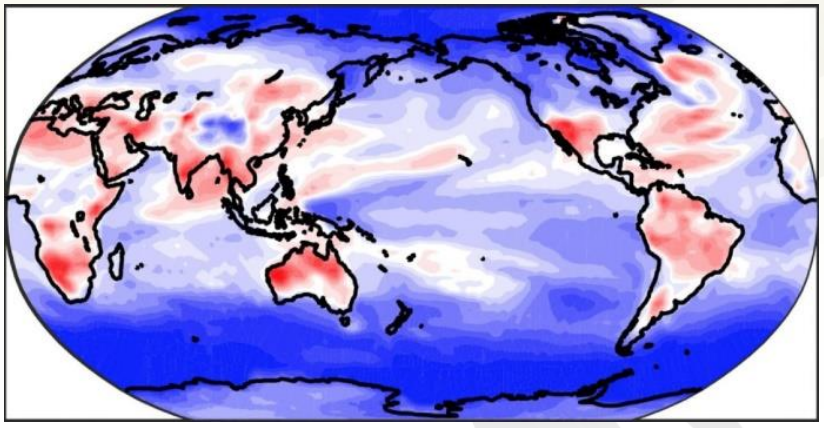
IPCC 2013

- Precipitation projections
  - Regionally differentiated
  - Highly uncertain



Dai 2013

- Climate variability likely to increase in tropics, but magnitude uncertain



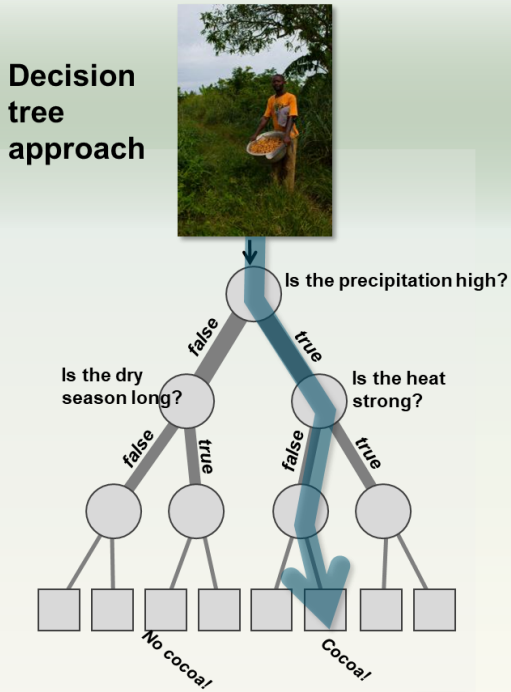
Input data

24 Bioclimatic variables from monthly data
20ArcMin resolution
Current climate data: WorldClim interpolated data
2050s climate data: 10 Global climate models RCP 6.0

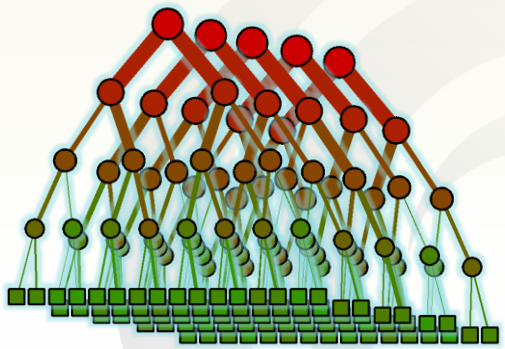
Random Forests for classification

Random Forests are decision tree ensembles

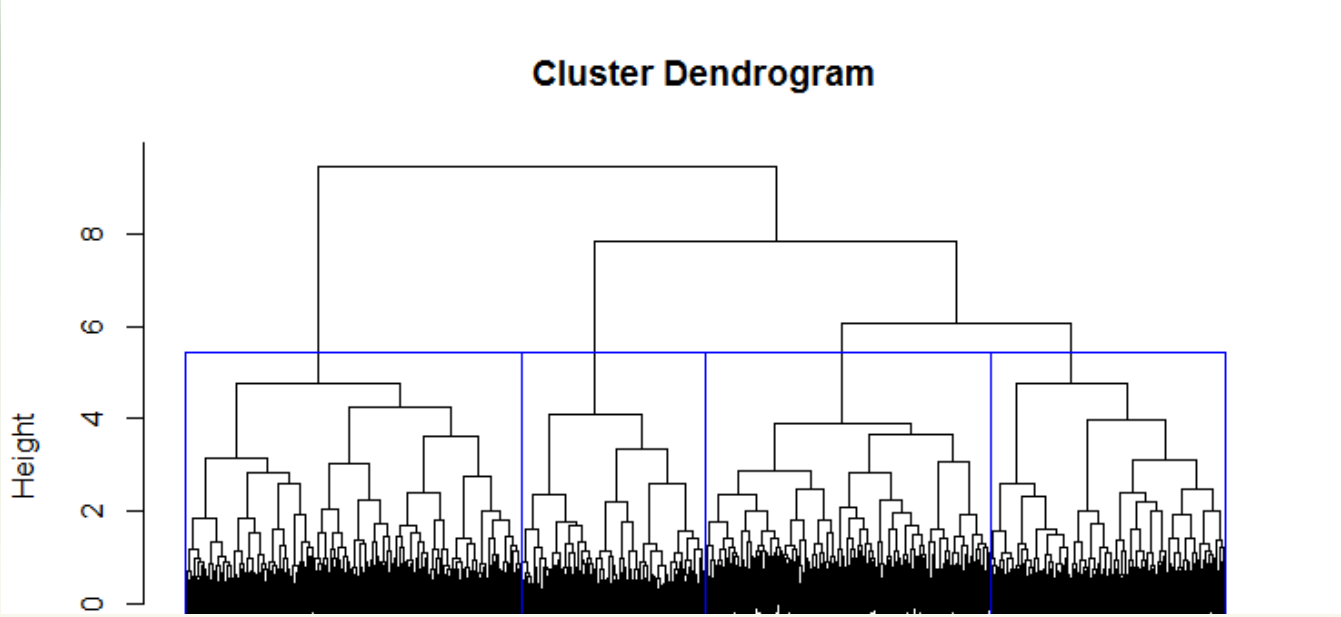
1. Unsupervised learning to identify groups
   a) 250 forests
   b) 100 trees each
   c) 4 variables picked
2. Supervised learning on specified groups
   a) Balanced training set
   b) 5 forests
   c) 200 trees
   d) 6 variables picked
   e) Node size 2
3. Evaluation of climate data
   a) Classification into groups
   b) Votes for occurrence groups (“Suitability”)
   c) Novelty detection using proximity matrix on



Source: Criminisi et al 2013

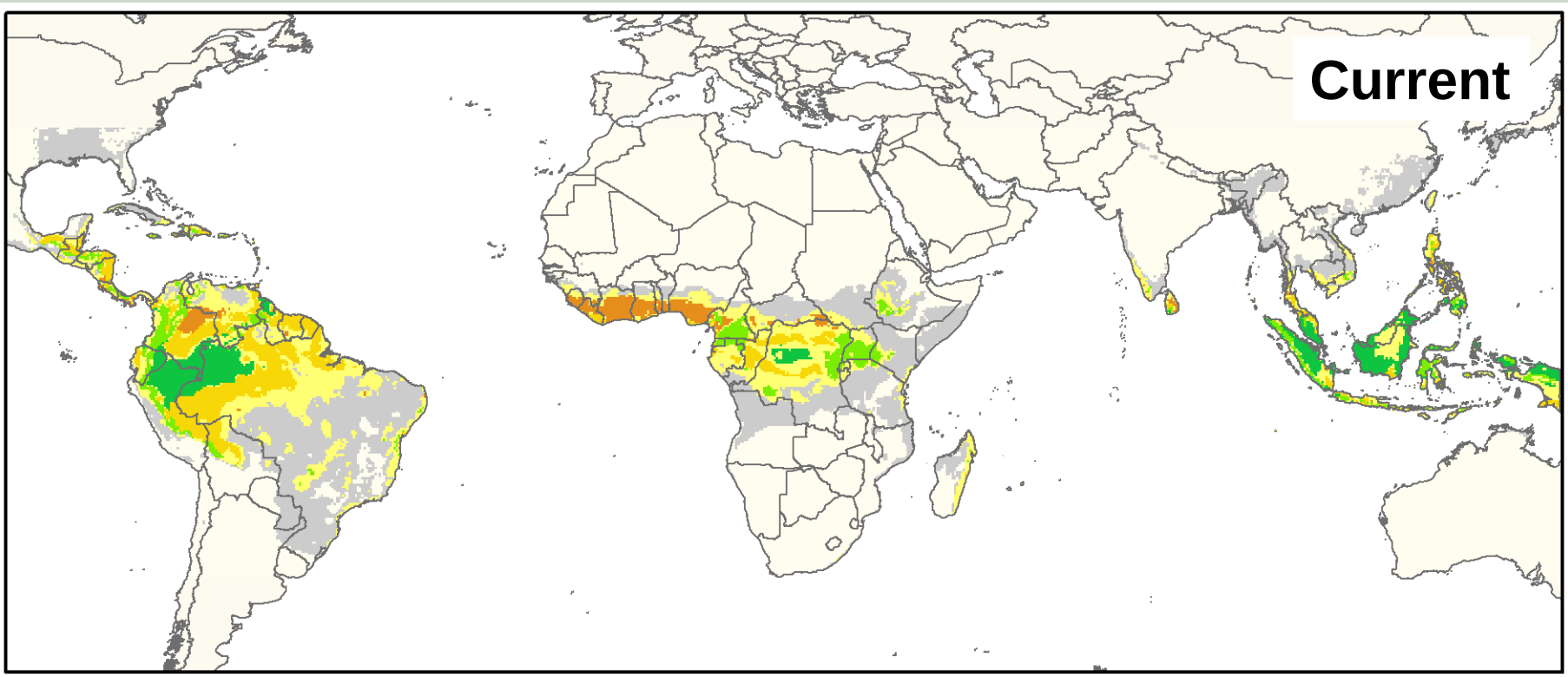


Climate zones for cocoa



CLUSTER	SYMBOL	TYPICAL REGION	TEMPERATURE	PRECIPITATION
1	WA	West Africa	High	Low, seasonal
2	SLA	Seasonal Latin America	Average	High, seasonal
3	High	Highlands	Low	Low
4	Ama	Amazon	Even	High

Climate zones for cocoa

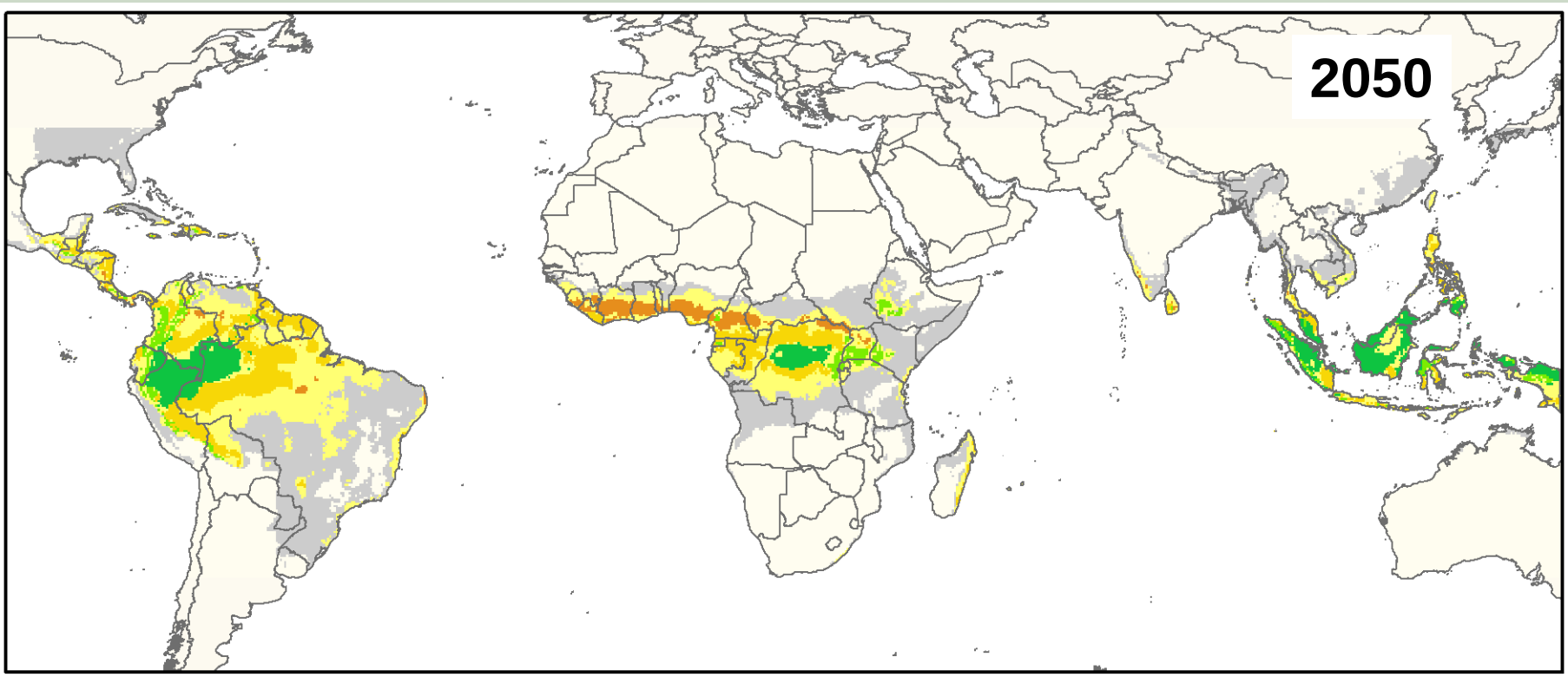


Cocoa climate types
Current

CLIMATE CHANGE AGRICULTURE AND FOOD SECURITY

Unsuitable
SLA
Ama
Novel2
WA
High
Novel1

Climate zones for cocoa

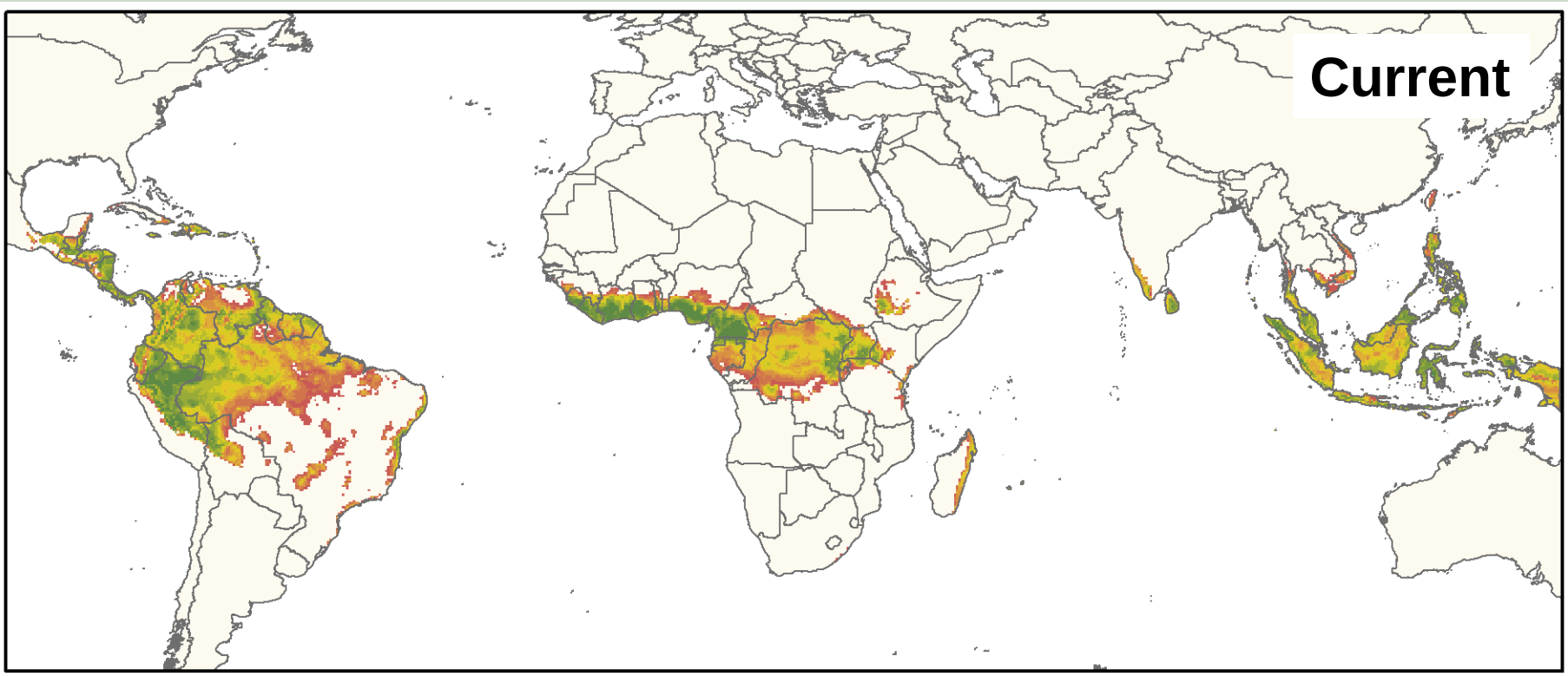


Cocoa climate types
2050

CLIMATE CHANGE AGRICULTURE AND FOOD SECURITY

Unsuitable
SLA
Ama
Novel2
WA
High
Novel1

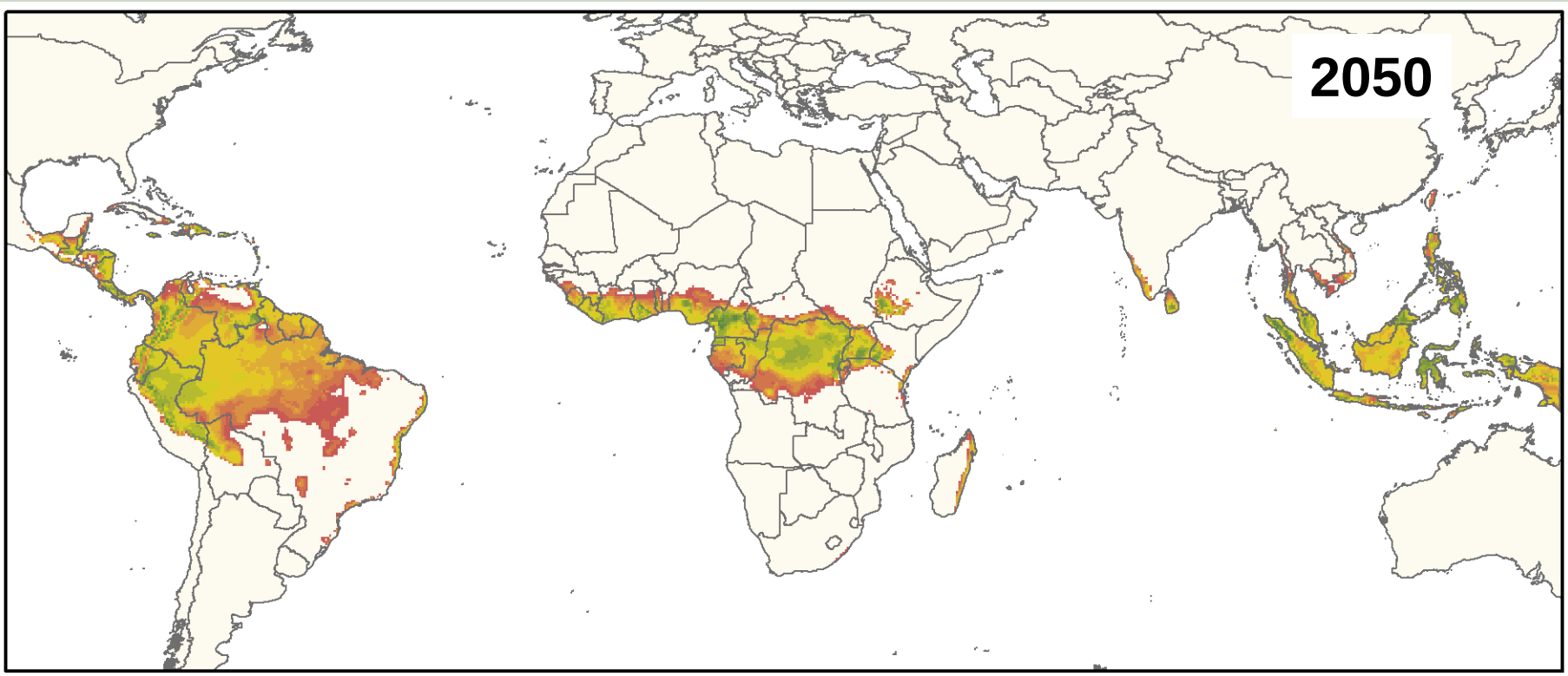
Climate suitability for cocoa



Cocoa suitability score
Current

Low — High

Climate suitability for cocoa



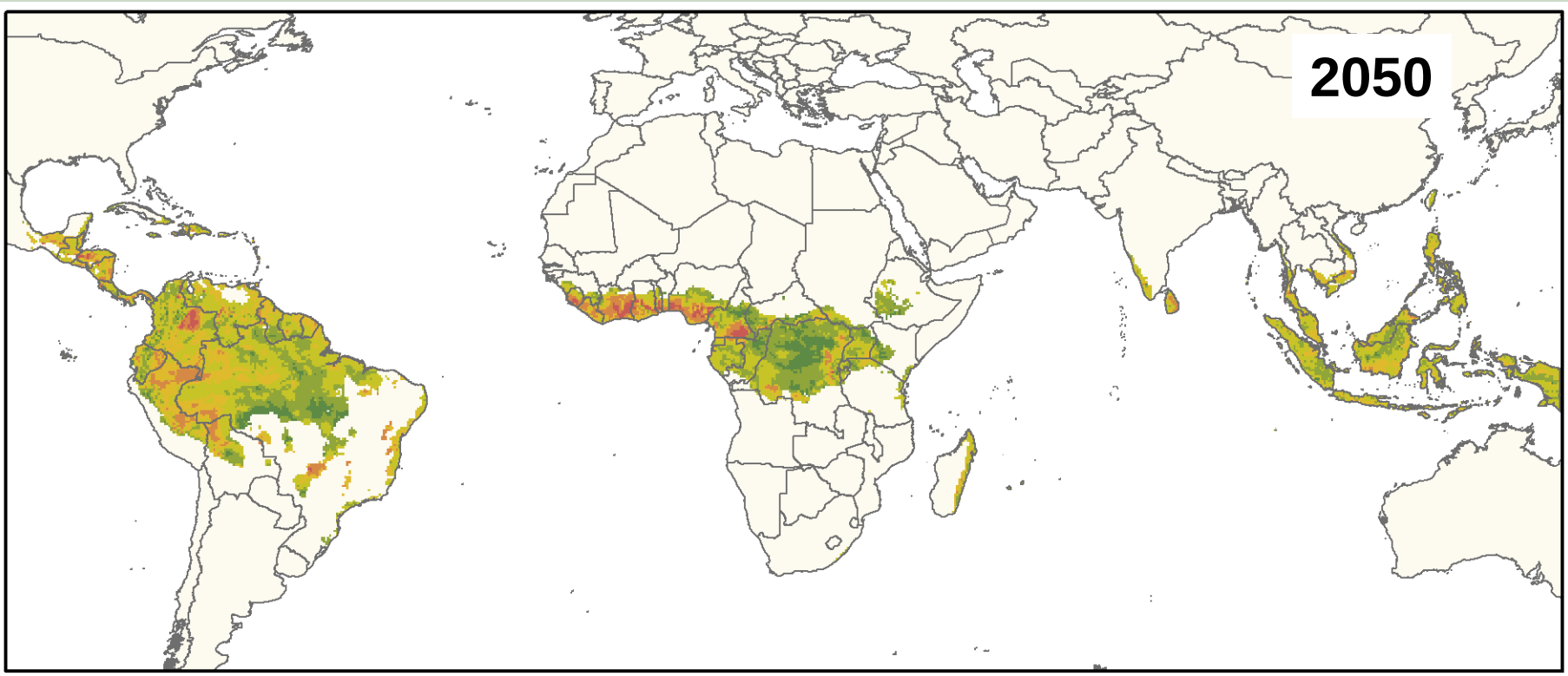
Cocoa suitability score
2050

Low — High

CLIMATE CHANGE AGRICULTURE AND FOOD SECURITY

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

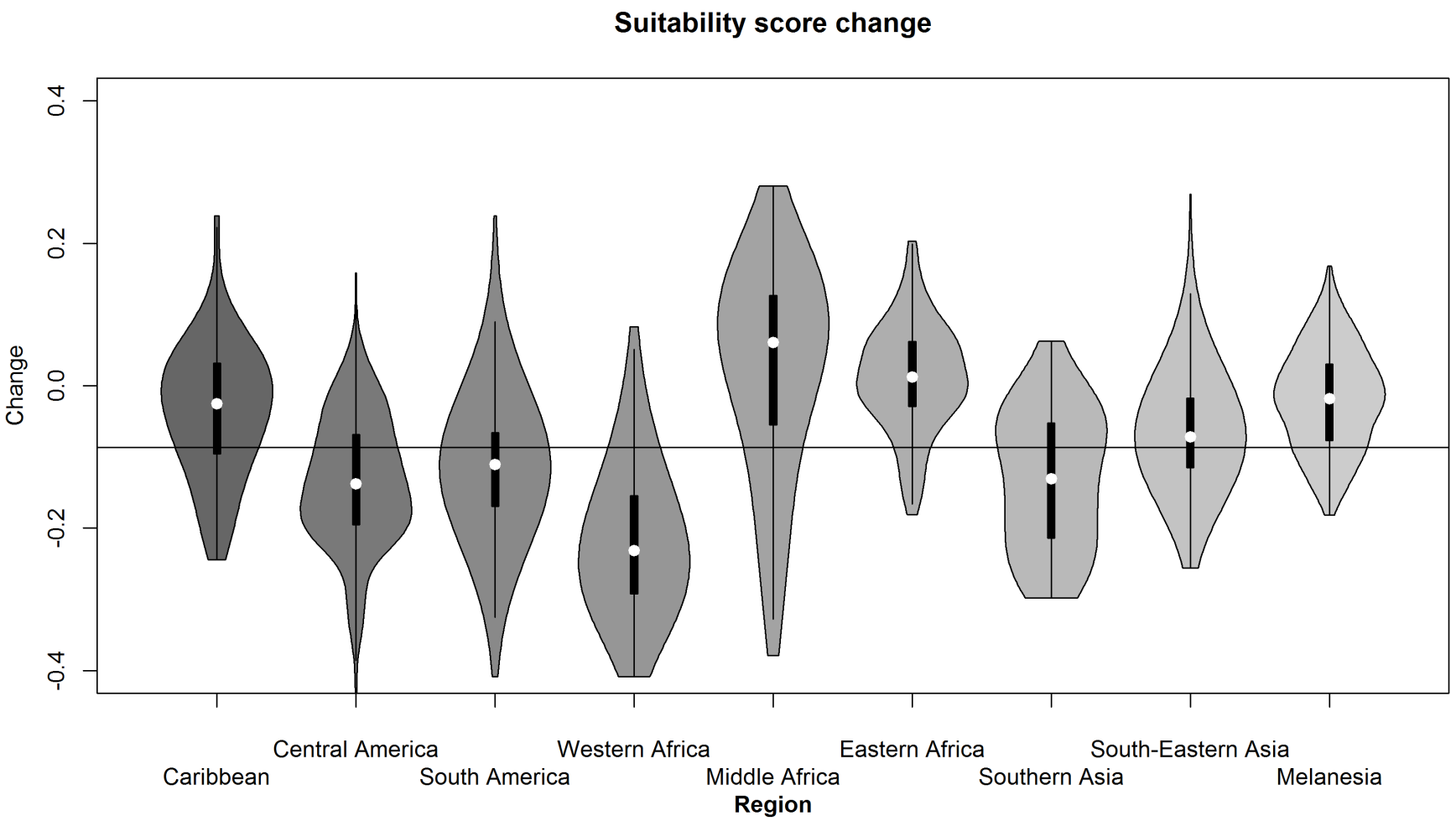
Climate suitability for cocoa - change



Cocoa suitability score
Change - 2050

Negative Unchanged Positive

Climate suitability for cocoa - change



Conclusions

- Global climate models lack the skill for unambigious projections
- West Africa and Highland climate most likely to face negative impacts
- Central Africa, SE Asia and Caribbean relatively less affected
- Risk of further deforestation driven by cocoa

Thank you!

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

Christian Bunn, M Lundy, P Laederach, F Castro et al.

International Symposium on Cocoa Research, Lima, Peru, 13 Nov 2017

CIAT

FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative