



**WEIHENSTEPHAN · TRIESDORF**  
University of Applied Sciences



# Climate change and its management in Ethiopia: Lessons and Practices

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University of applied science



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Freising, Germany



# Outline

## The climate of Ethiopia

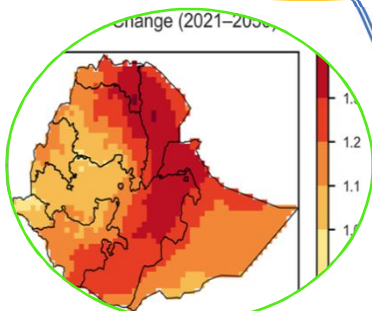
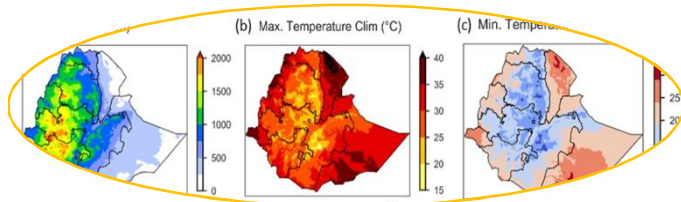
### Climate variability, change and extremes

- Observed and Projected

### Climate change impacts

### Climate change management practices

- National level
- Institutional level
- Farm /watershed level



# Agriculture & Ethiopia

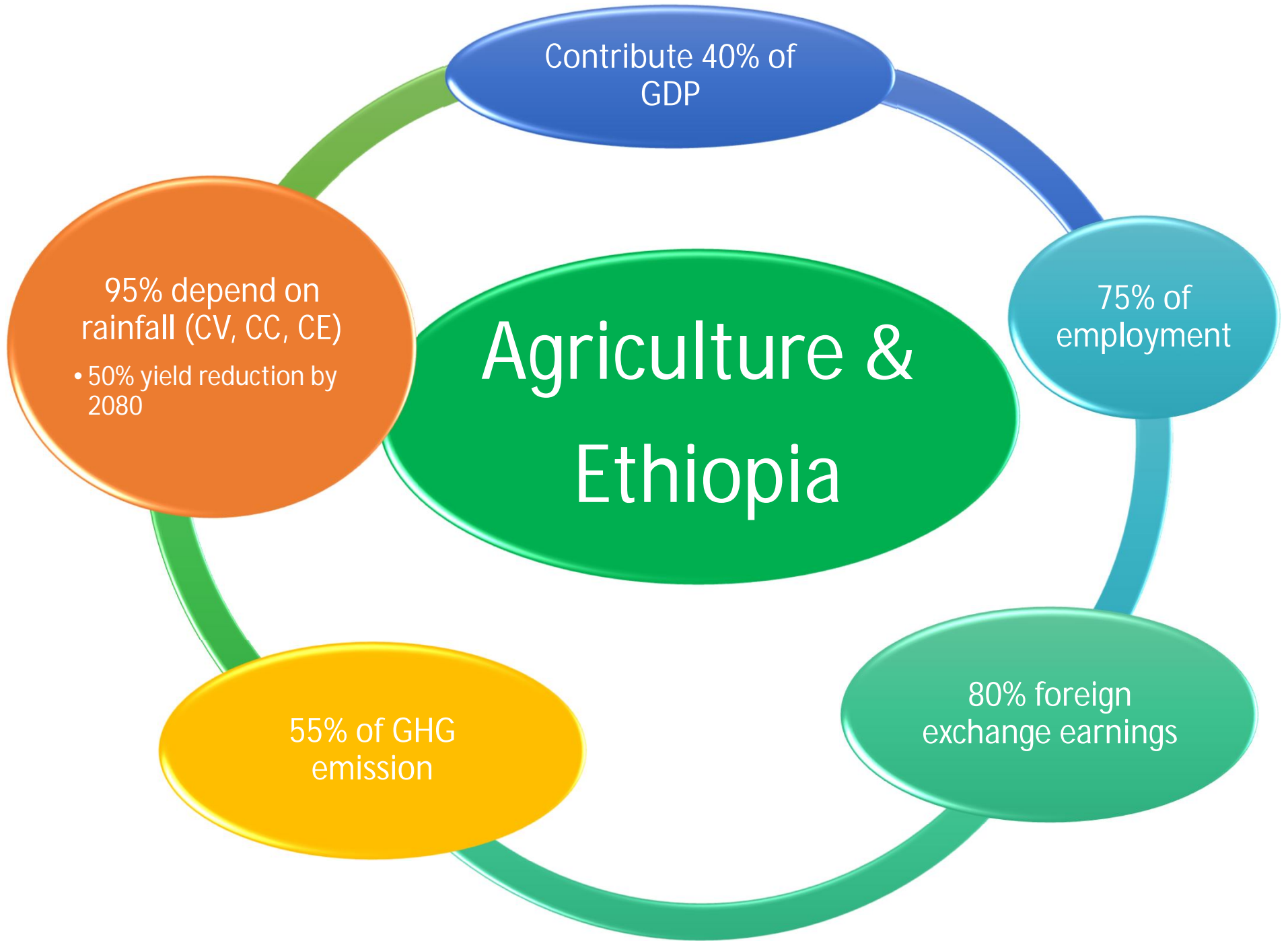
Contribute 40% of GDP

75% of employment

80% foreign exchange earnings

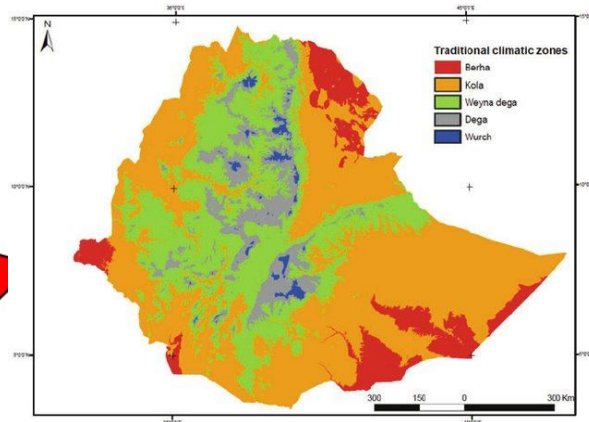
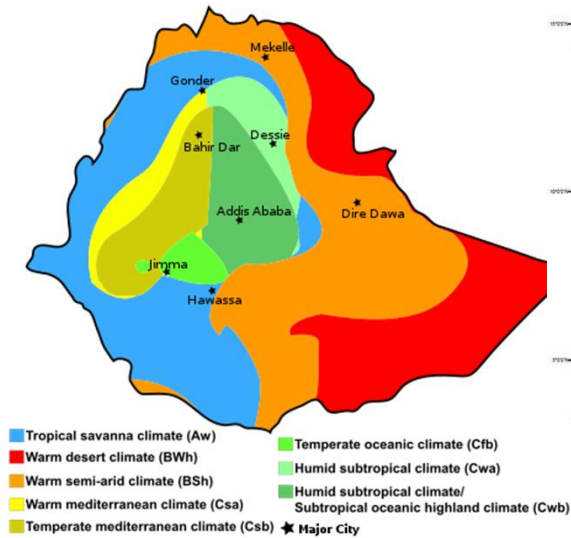
55% of GHG emission

95% depend on rainfall (CV, CC, CE)  
• 50% yield reduction by 2080

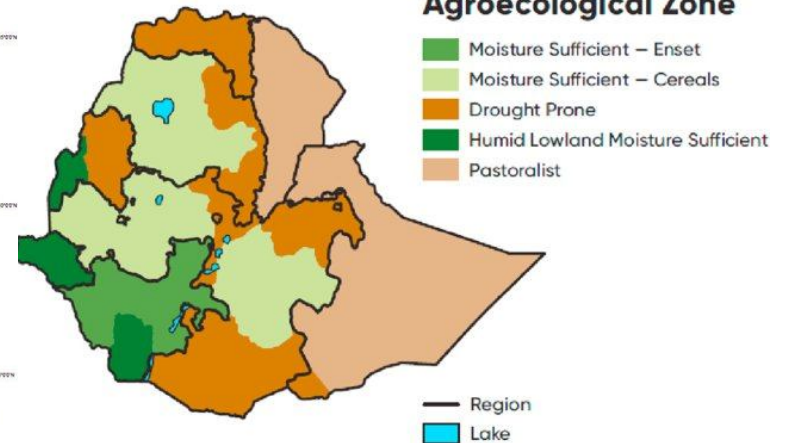


# The climate of Ethiopia

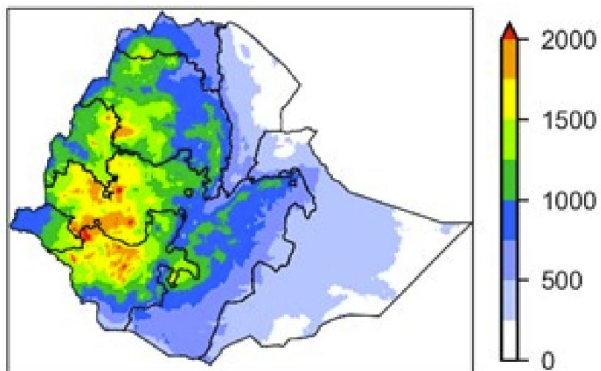
Ethiopia map of Köppen climate classification



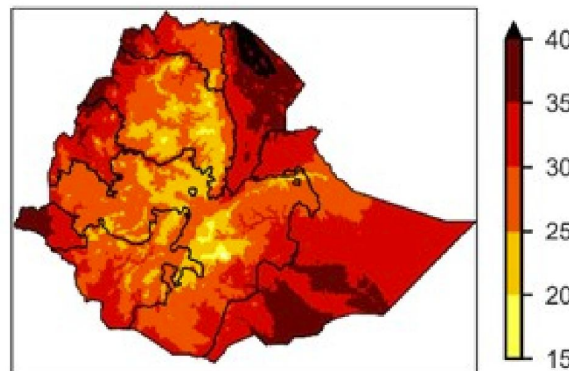
Ethiopia  
Agroecological Zone



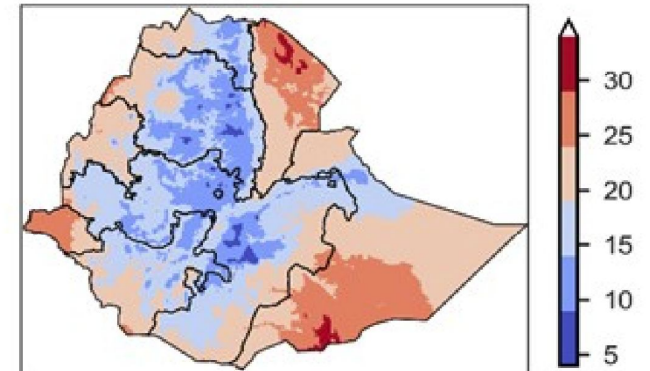
a) Rainfall Clim (mm)



(b) Max. Temperature Clim (°C)



(c) Min. Temperature Clim (°C)



# Some of our works related to climate

## Trends and variability



Weather and Climate Extremes  
Volume 29, September 2020, 100263



Climate trends and variability at adaptation scale: Patterns and perceptions in an agricultural region of the Ethiopian Highlands

Dereje Ademe<sup>a</sup>, Benjamin F. Zaitchik<sup>b</sup>, Kindie Tesfaye<sup>c</sup>, Belay Simane<sup>d</sup>, Getachew Alemayehu<sup>e</sup>, Enyew Adgo<sup>e</sup>

## Events



Agricultural and Forest Meteorology  
Volume 311, 15 December 2021, 108697



Analysis of agriculturally relevant rainfall characteristics in a tropical highland region: An agroecosystem perspective

Dereje Ademe<sup>a, b, c</sup>, Benjamin F. Zaitchik<sup>b</sup>, Kindie Tesfaye<sup>d</sup>, Belay Simane<sup>e</sup>, Getachew Alemayehu<sup>c</sup>, Enyew Adgo<sup>c</sup>

## Extremes

International Journal of Climatology  
RMets



RESEARCH ARTICLE  
Observed and projected trends in climate extremes in a tropical highland region: An agroecosystem perspective

Dereje Ademe Birhan<sup>a</sup>, Benjamin F. Zaitchik, Kindie Tesfaye Fantaye, Belay Simane Birhanu, Getachew Alemayehu Damot, Enyew Adgo Tsegaye

First published: 06 September 2021 | <https://doi.org/10.1002/joc.7378> | Citations: 4



## Trends and variability

Hindawi  
Advances in Meteorology  
Volume 2023, Article ID 9562801, 13 pages  
<https://doi.org/10.1155/2023/9562801>



Research Article

Analysis of Climate Variability and Trends for Climate-Resilient Maize Farming System in Major Agroecology Zones of Ethiopia

Abebe Zeleke<sup>1</sup>, Kindie Tesfaye<sup>2</sup>, Tilahun Tadesse<sup>3</sup>, Teferi Alem<sup>4</sup>, Dereje Ademe<sup>5</sup>, and Enyew Adgo<sup>6</sup>

## Extremes



Article

Trends in Rainfall and Temperature Extremes in Ethiopia: Station and Agro-Ecological Zone Levels of Analysis

Gizachew Belay Wubaye<sup>1,2</sup>, Temesgen Gashaw<sup>1,4</sup>, Abeyou W. Worqlul<sup>3</sup>, Yihun T. Dile<sup>4</sup>, Meron Teferi Taye<sup>5</sup>, Amare Hailelassie<sup>5</sup>, Benjamin Zaitchik<sup>6</sup>, Dereje Ademe Birhan<sup>7</sup>, Enyew Adgo<sup>10</sup>, Jemal Ali Mohammed<sup>8</sup>, Tadele Melese Lebeza<sup>10</sup>, Amare Bantider<sup>9,10</sup>, Abdulkarim Seid<sup>9</sup> and Raghavan Srinivasan<sup>4</sup>

## ENVIRONMENTAL RESEARCH LETTERS

LETTER • OPEN ACCESS

Vulnerability of sorghum production to extreme, sub-seasonal weather under climate change

M Eggen<sup>7,1</sup>, M Ozdogan<sup>2</sup>, B Zaitchik<sup>3</sup>, D Ademe<sup>4</sup>, J Foltz<sup>5</sup> and B Simane<sup>6</sup>



RESEARCH ARTICLE

Estimating variability in downwelling surface shortwave radiation in a tropical highland environment

Stephanie Stettz<sup>1\*</sup>, Benjamin F. Zaitchik<sup>1\*</sup>, Dereje Ademe<sup>2†</sup>, Sintayehu Musie<sup>2†</sup>, Belay Simane<sup>3†</sup>

Track your submission

This is a new submission-tracking service.

Is this helpful?

Peer review status

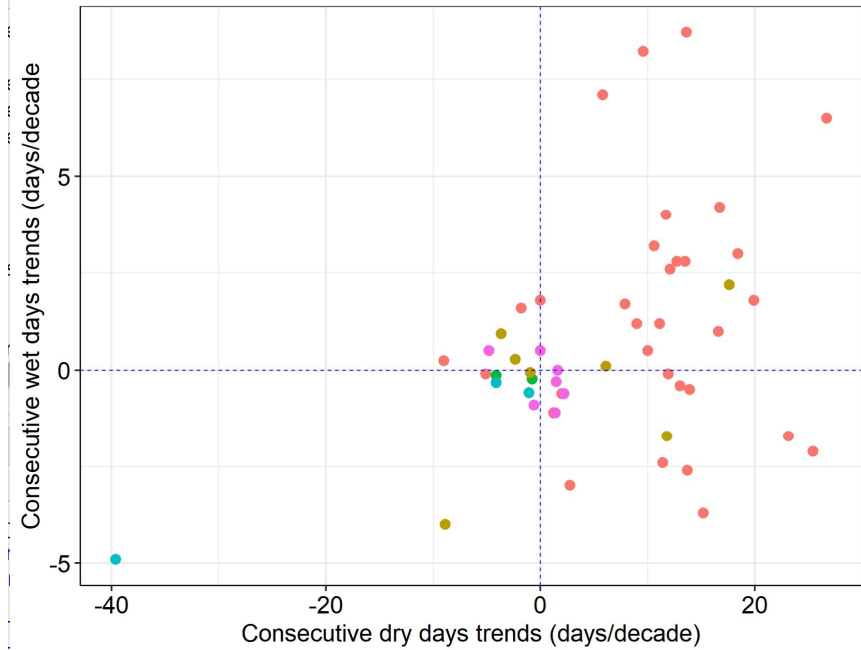
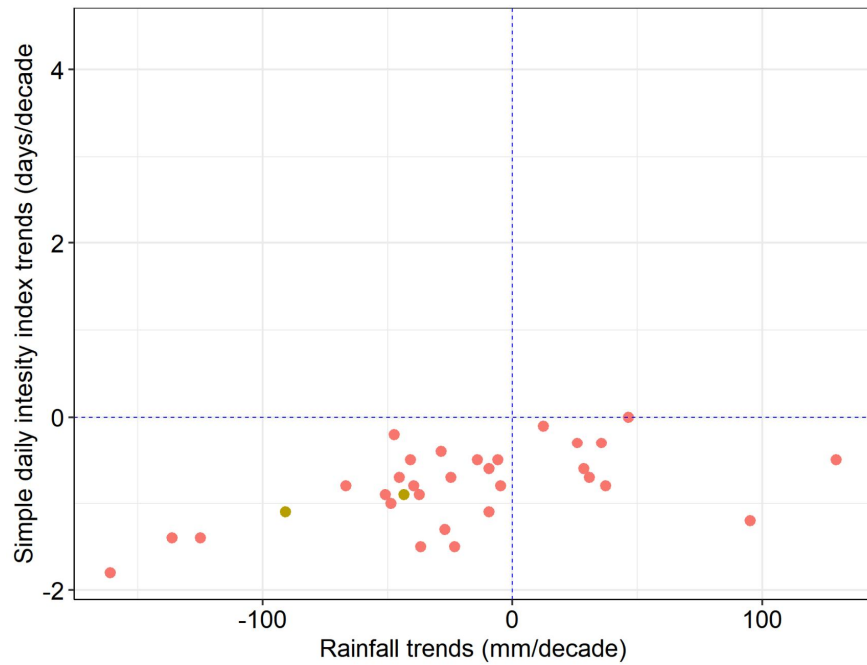
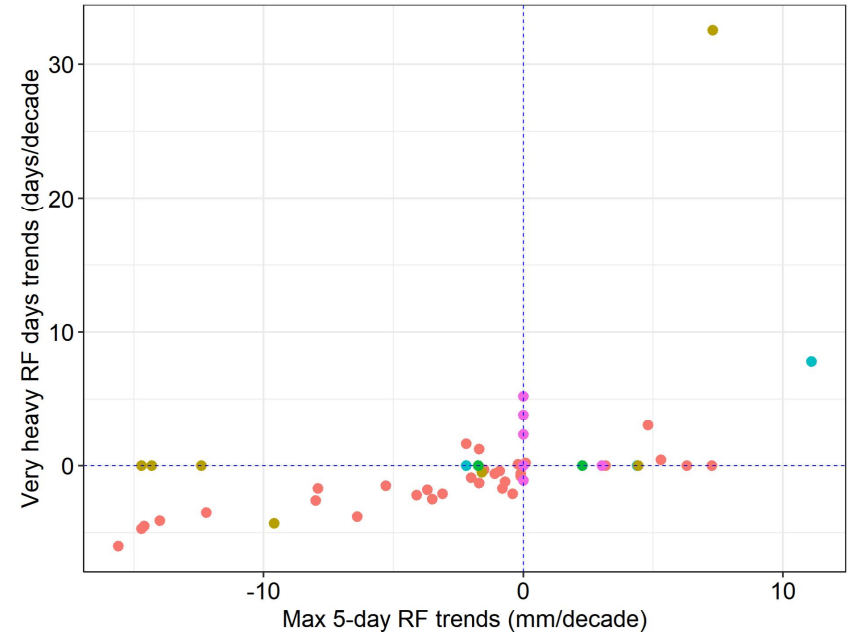
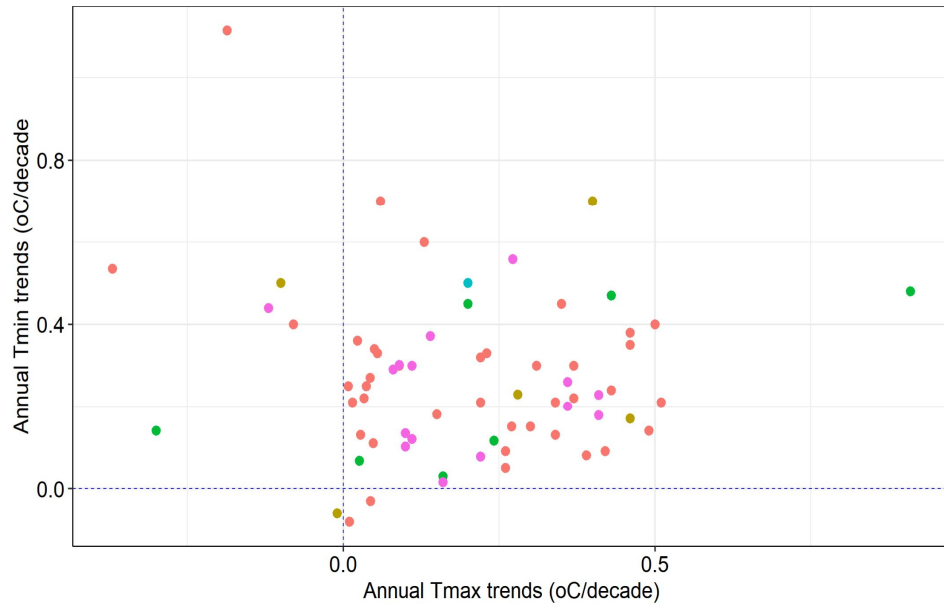
[1st revision] Optimizing Agronomic Practices to Harness Climate Change Impacts on Potato Production in Tropical Highland Regions

- Reviews completed: 0
- Review invitations accepted: 1
- Review invitations sent: 2

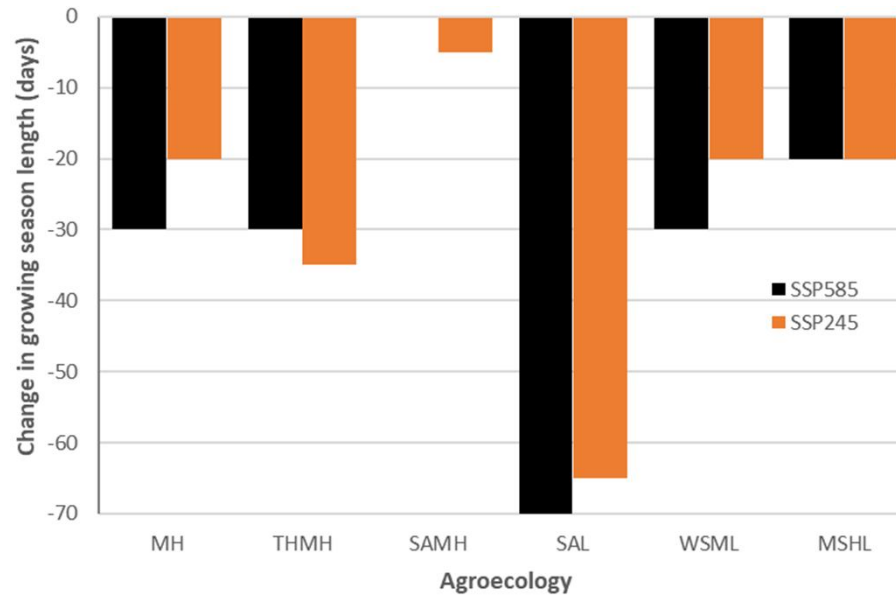
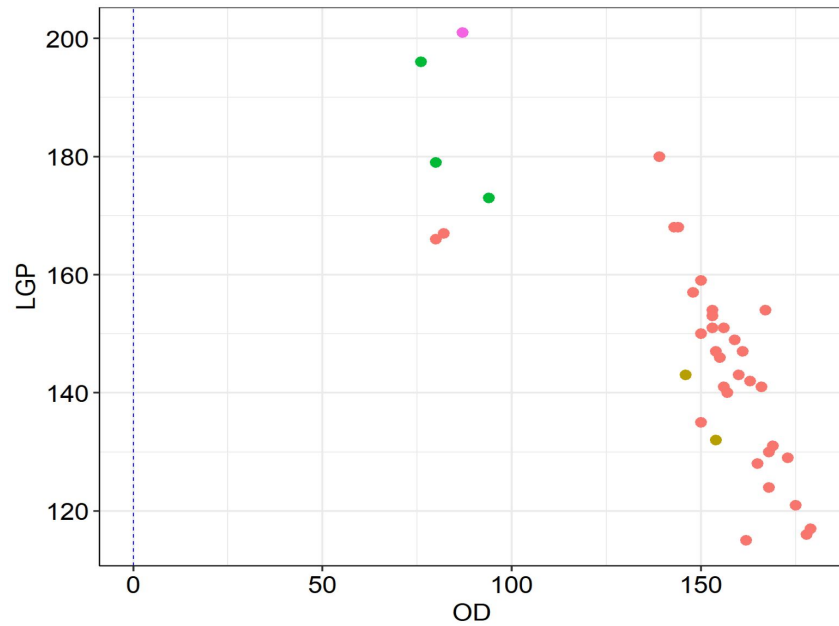
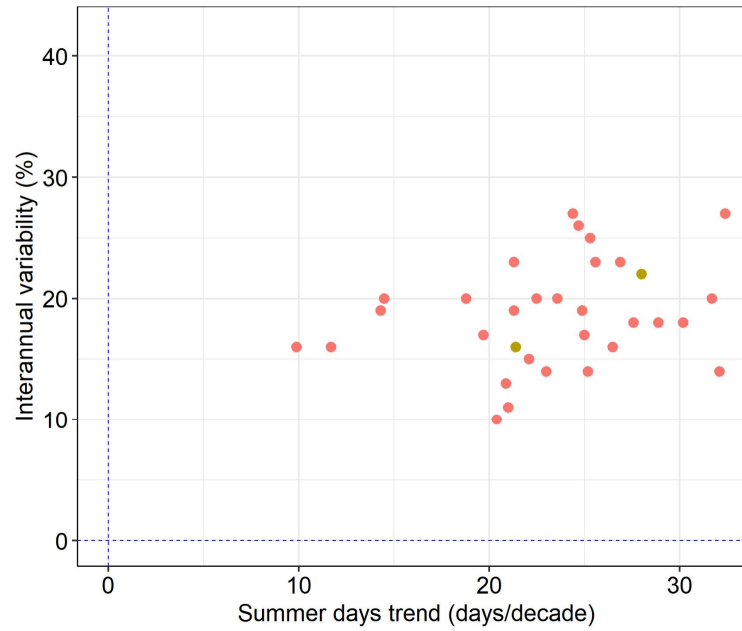
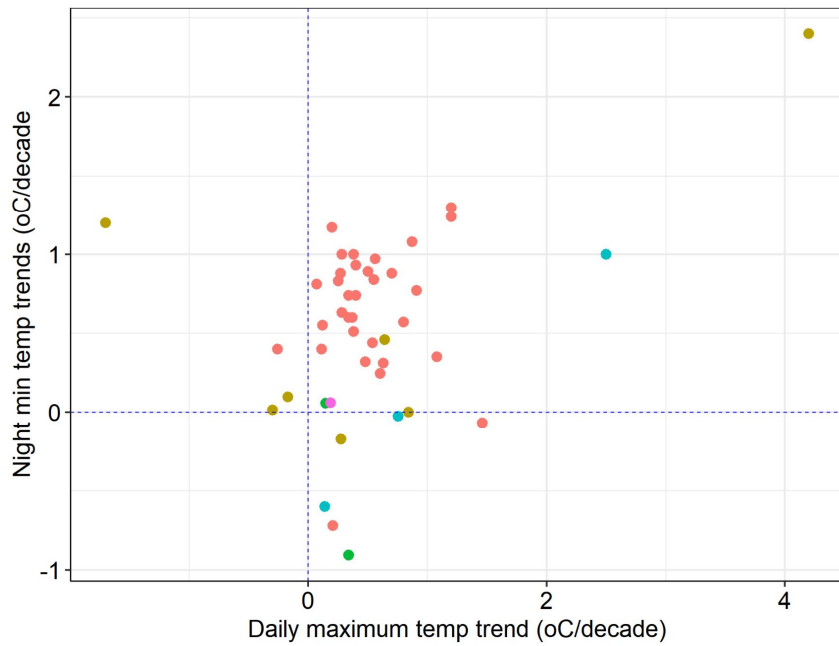
1st revision  
Under Review

Last review activity: 15th June 2023

# Observed trends in climate variables

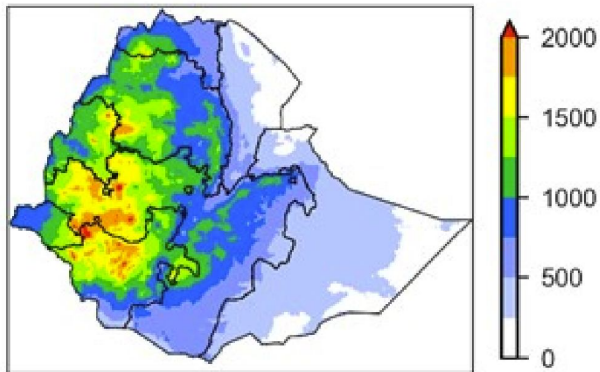


# Observed trends in climate variables

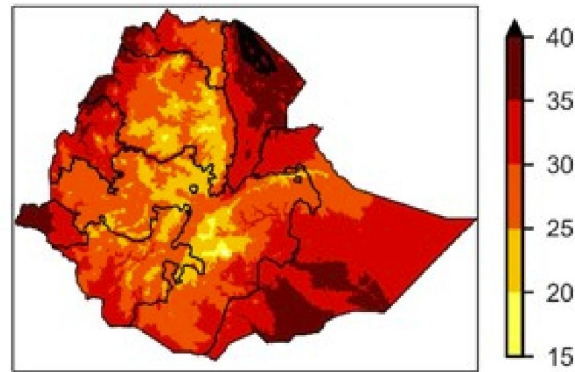


# Observed and projected RF and Temp

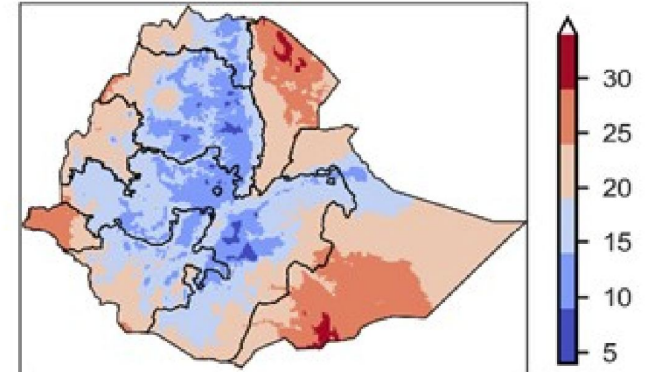
a) Rainfall Clim (mm)



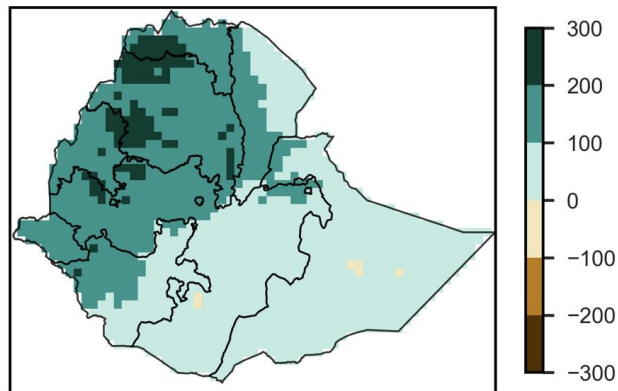
(b) Max. Temperature Clim (°C)



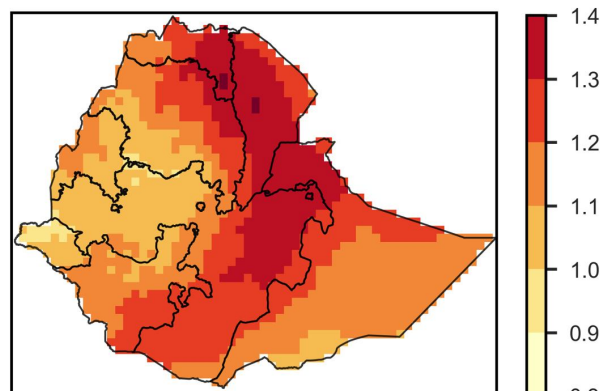
(c) Min. Temperature Clim (°C)



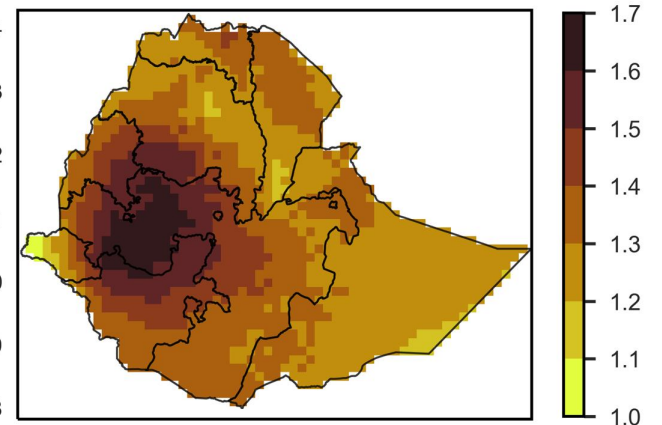
d) SSP5-8.5: Change (2021–2050)



d) SSP5-8.5: Change (2021–2050)

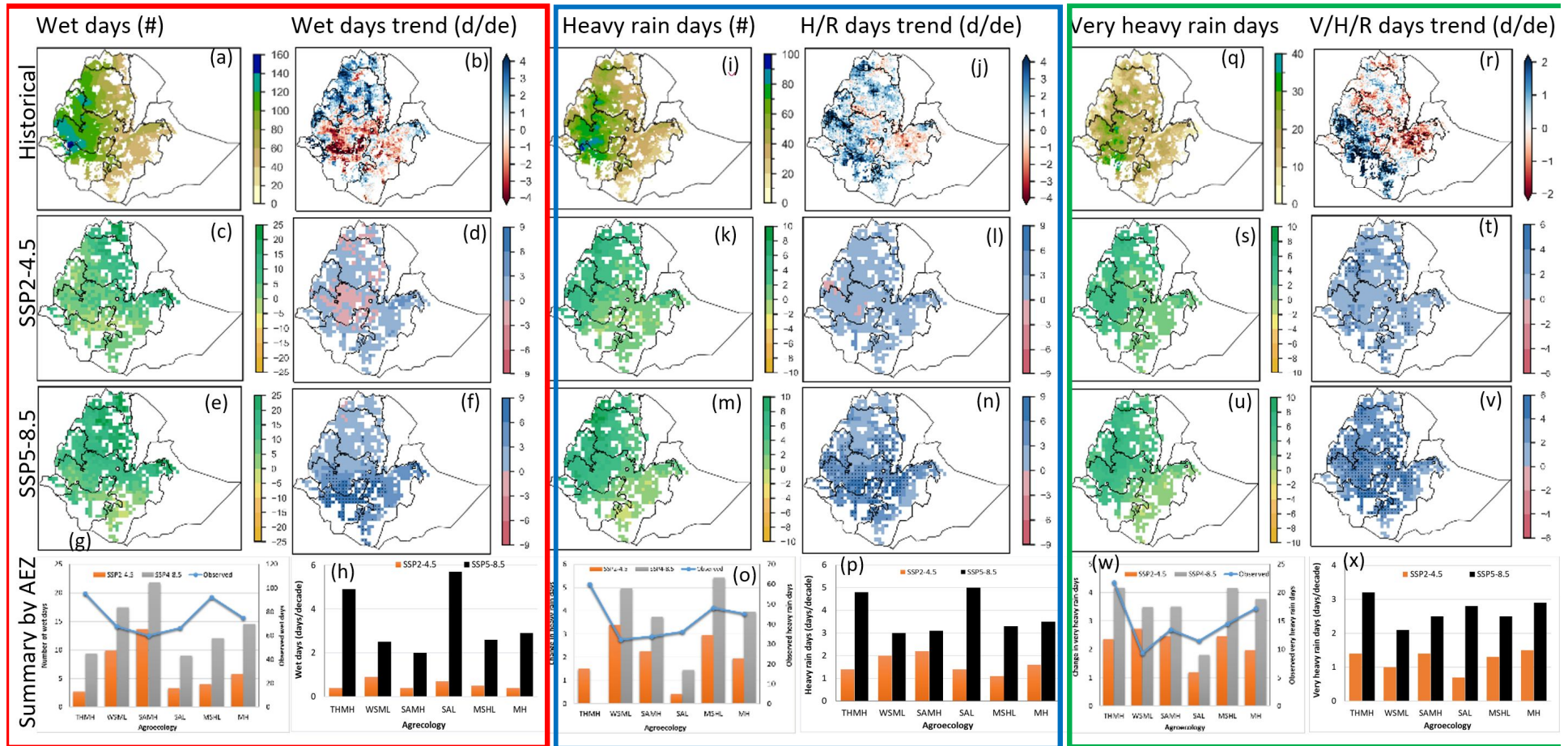


d) SSP5-8.5: Change (2021–2050)

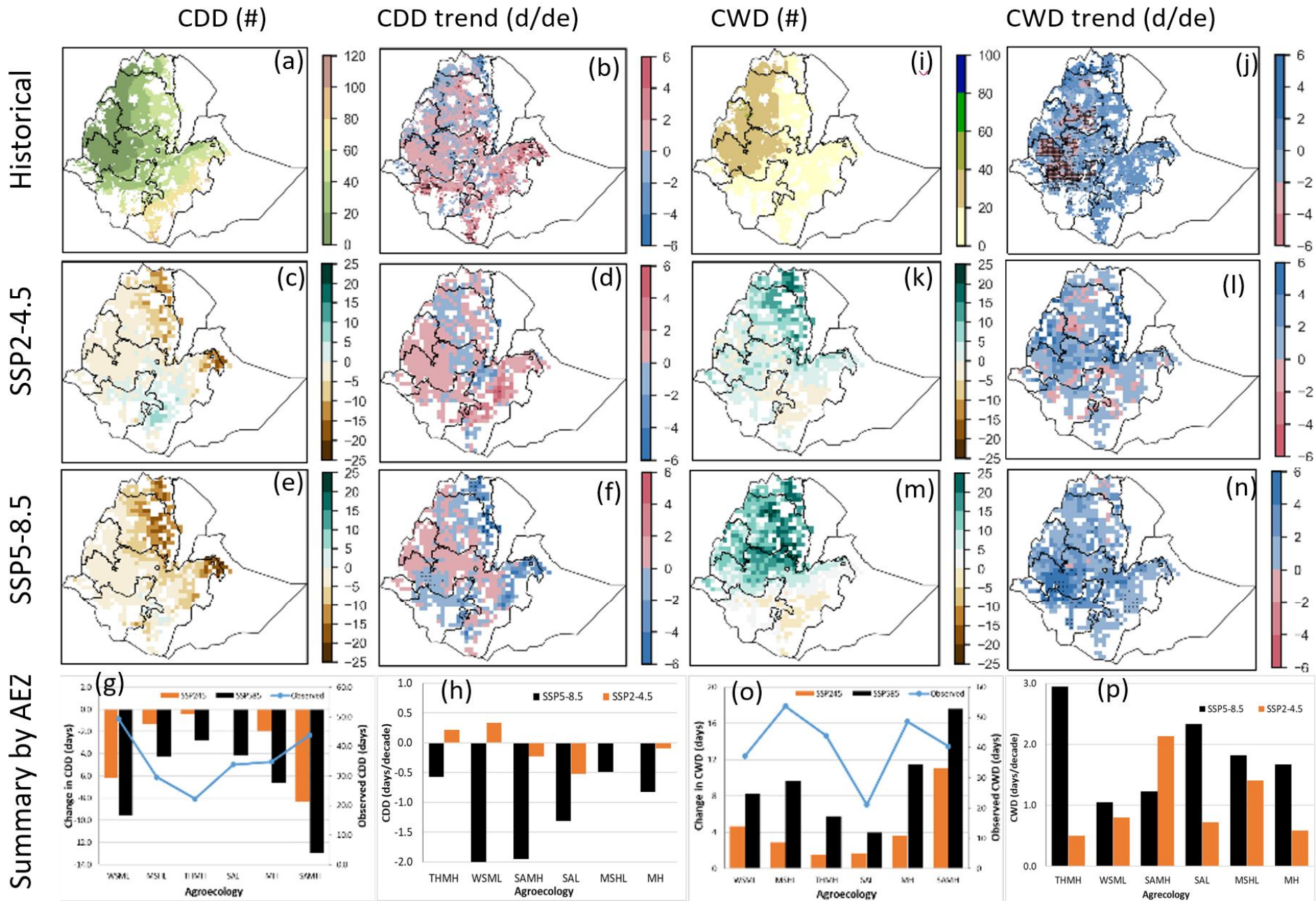




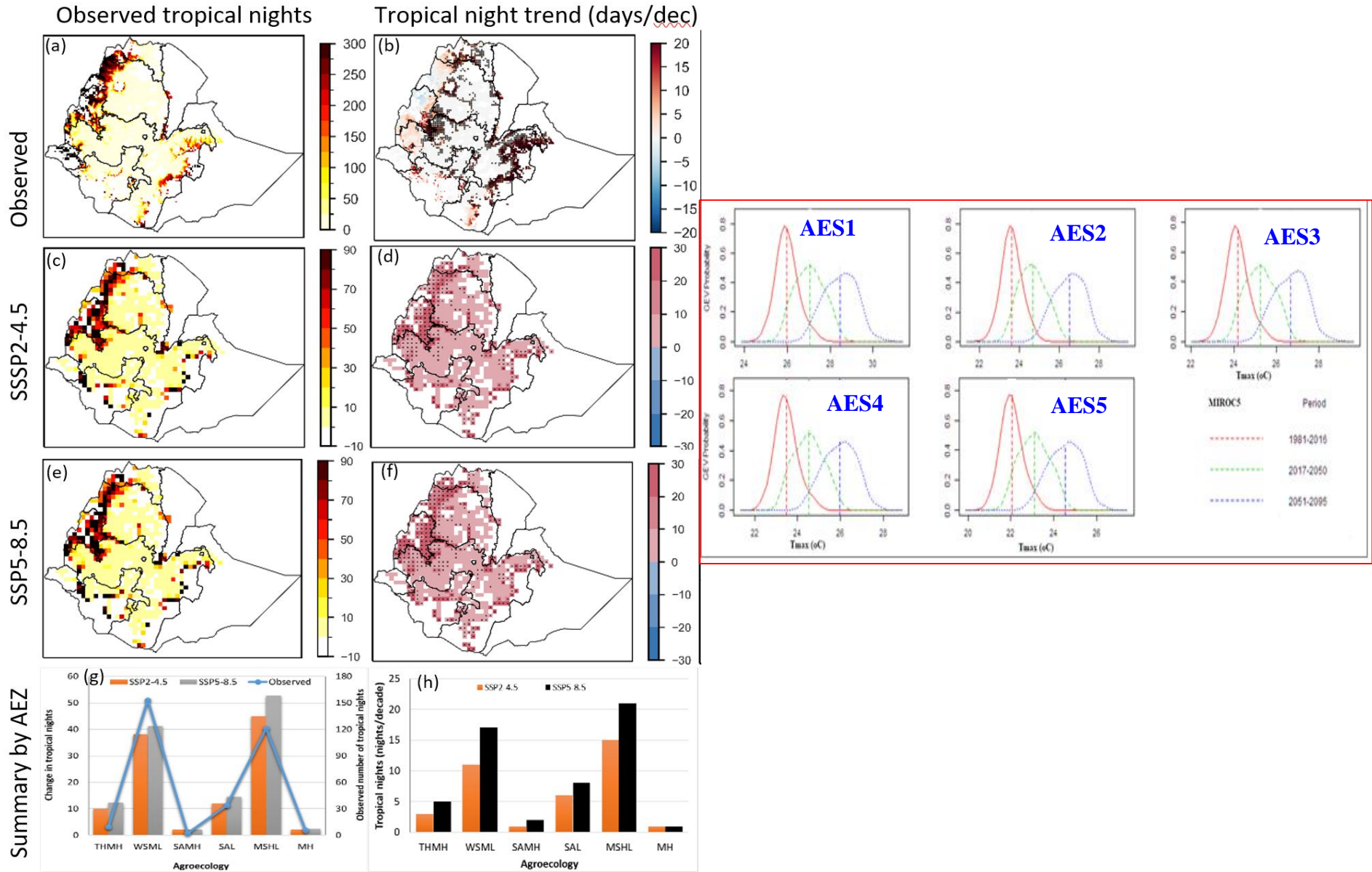
# Observed and projected changes in extremes

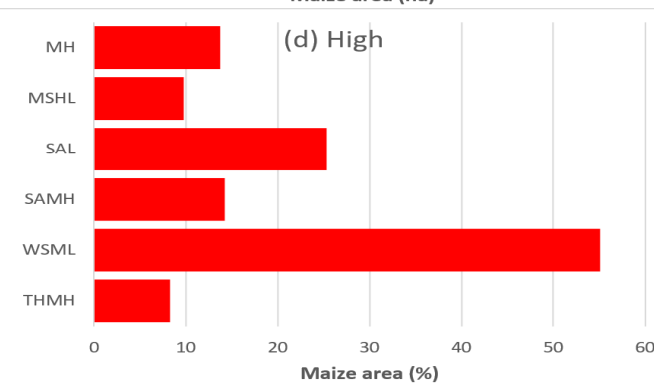
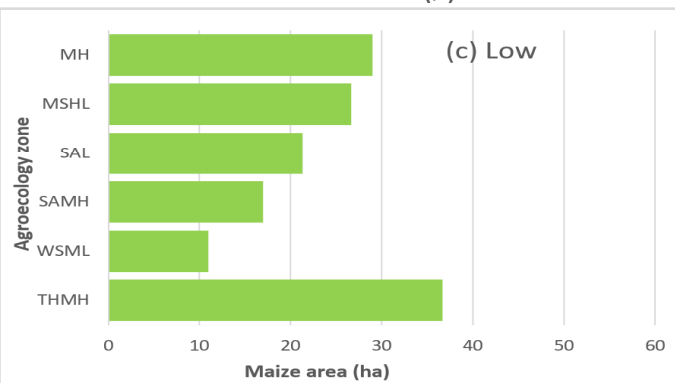
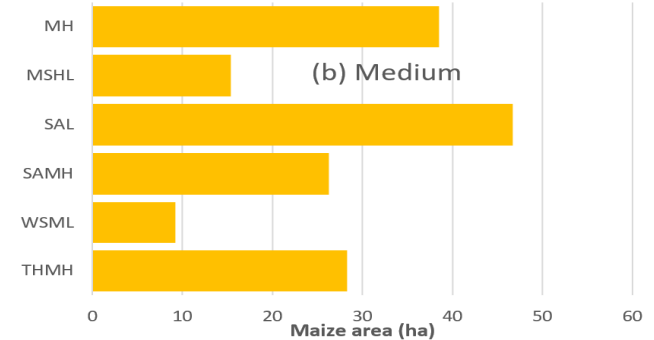
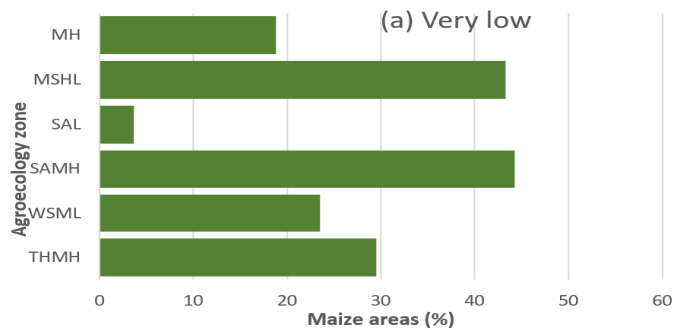
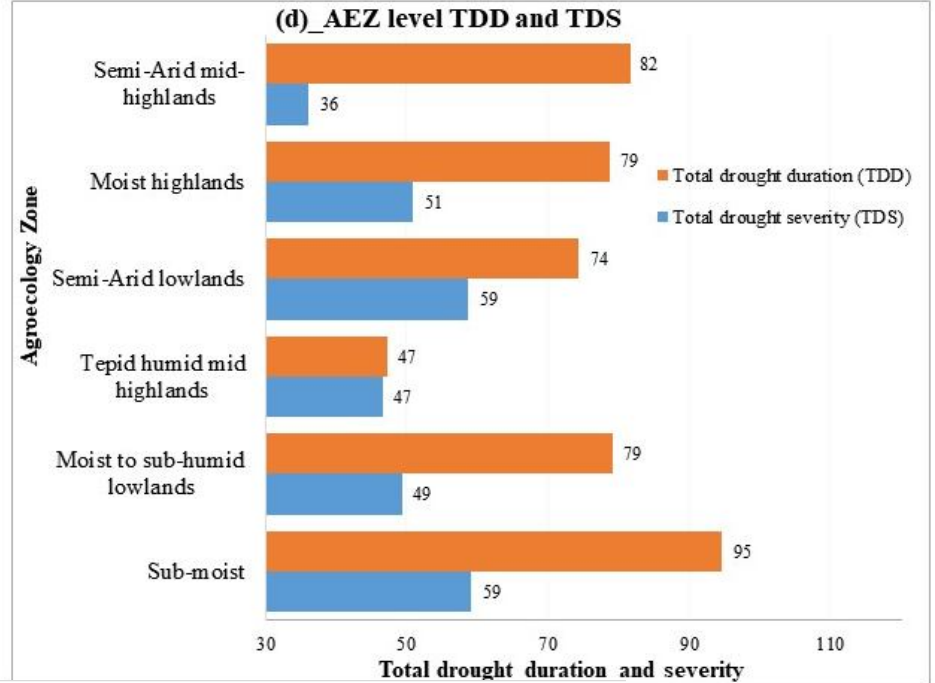
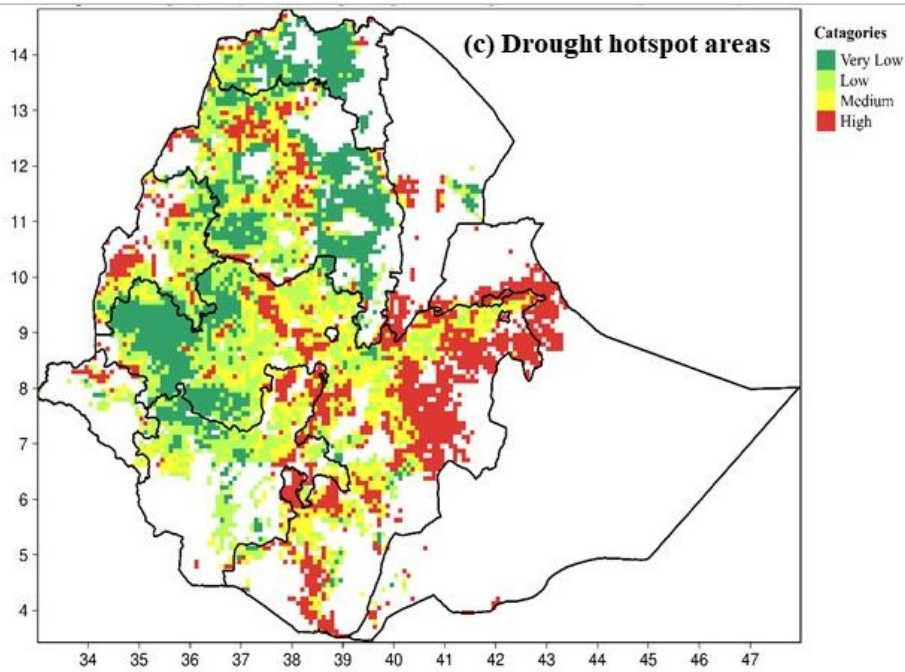


# Projected changes

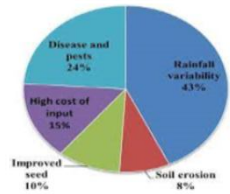


# Projected changes





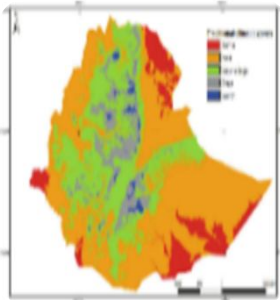
# Implication!!



CC and CV related problems are major causes for lower yield (Adem et al., 2021)



More intense in mountainous areas



- Diverse spatial climate
- High variability
- Low public awareness
- Low adaptive capacity



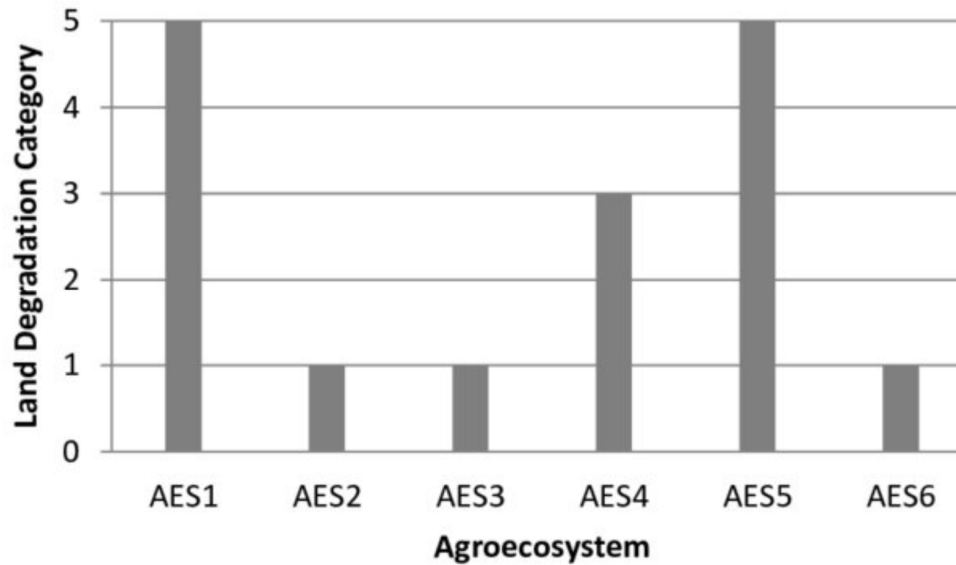
The changing climate will aggravate existing problems

- High soil acidity
- Prolonged dry spell => crop failure
- Disease and pest burden
- Sever soil erosion (~42 t/ha) and fertility degradation

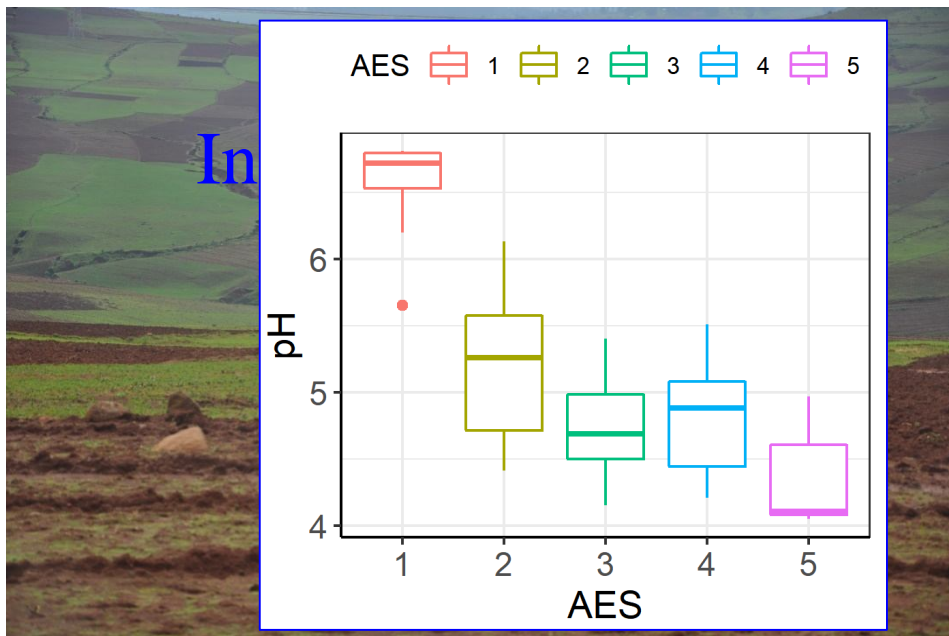


Future production and productivity will be more challenged!!

# Contexts: Constraints for agriculture

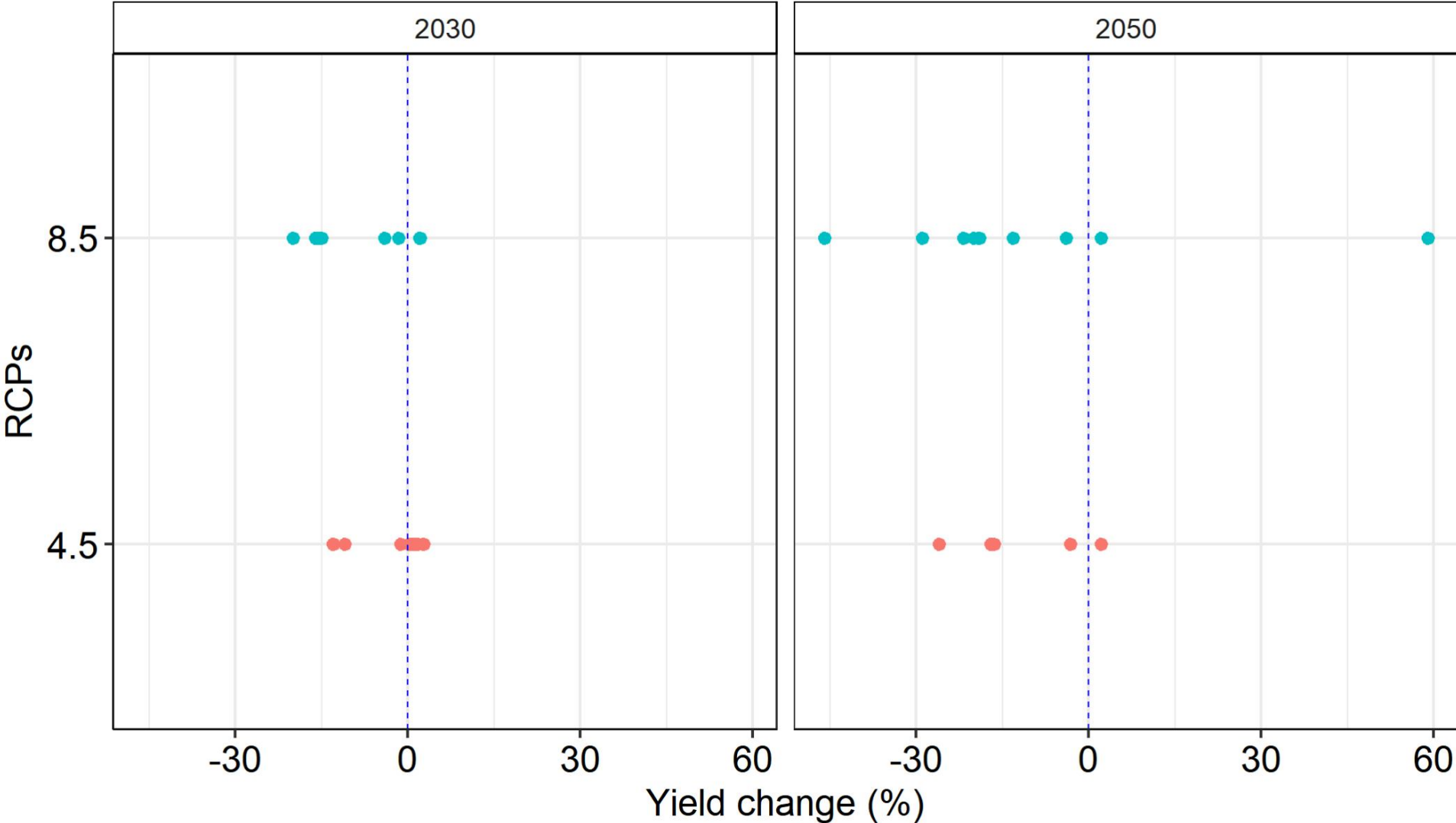


Human-induced land degradation of Choke Mountain watersheds by AES (Simane et al., 2013)

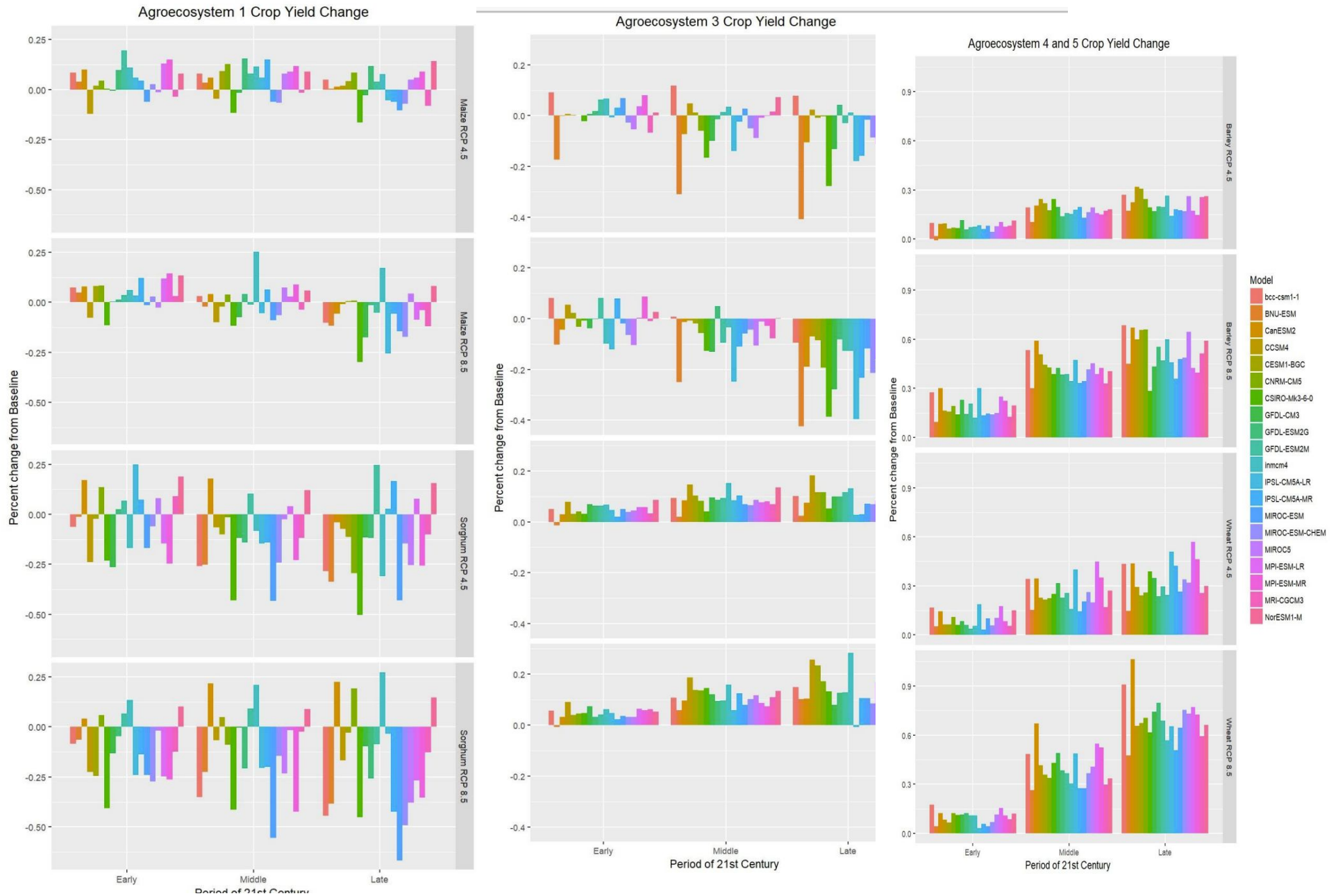


# Impacts of CC and CV on crop yield (the case of Maize)

RCP 4.5 8.5



# Impacts of CC and CV on crop yield ...

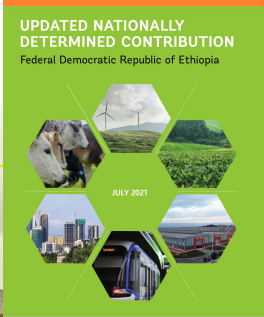
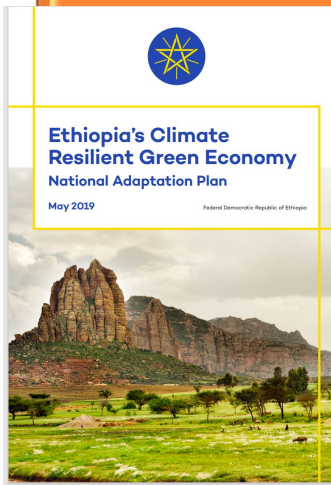




# Climate change management

## National level

- CRGE
- Green legacy NAP
- Nationally determined contribution



## Sectorial level

- Integration of climate basics, CIS, CSA and CRM in the BSc curriculum
- Establishing climate advisory services (forecasting and early warning services)
- Crop index insurance

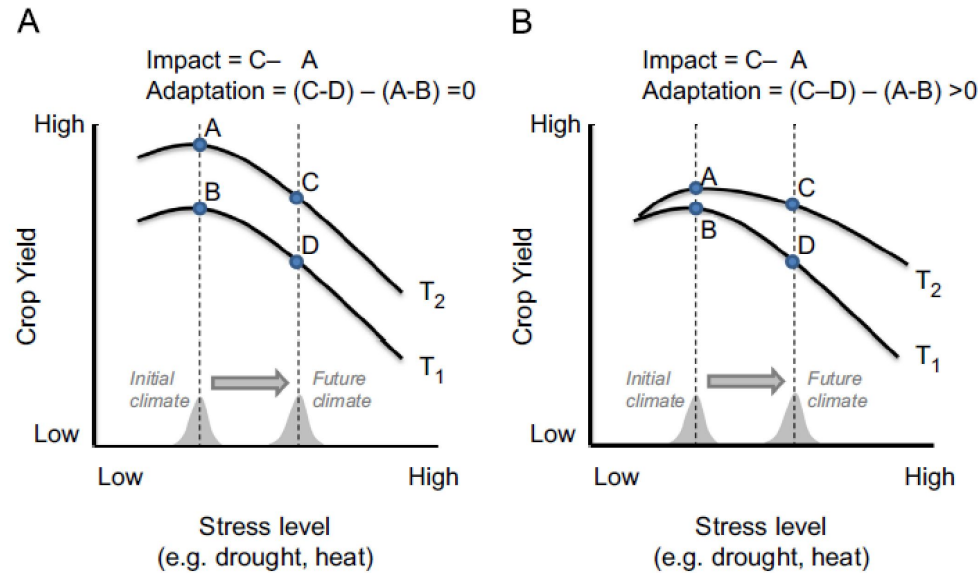


## Farm/watershed level

- Crop/variety switching
- IWSM
- Change in planting date
- Soil and water conservation
- Small-scale irrigation
- Use of early-warning system
- CSA
- Capacity building

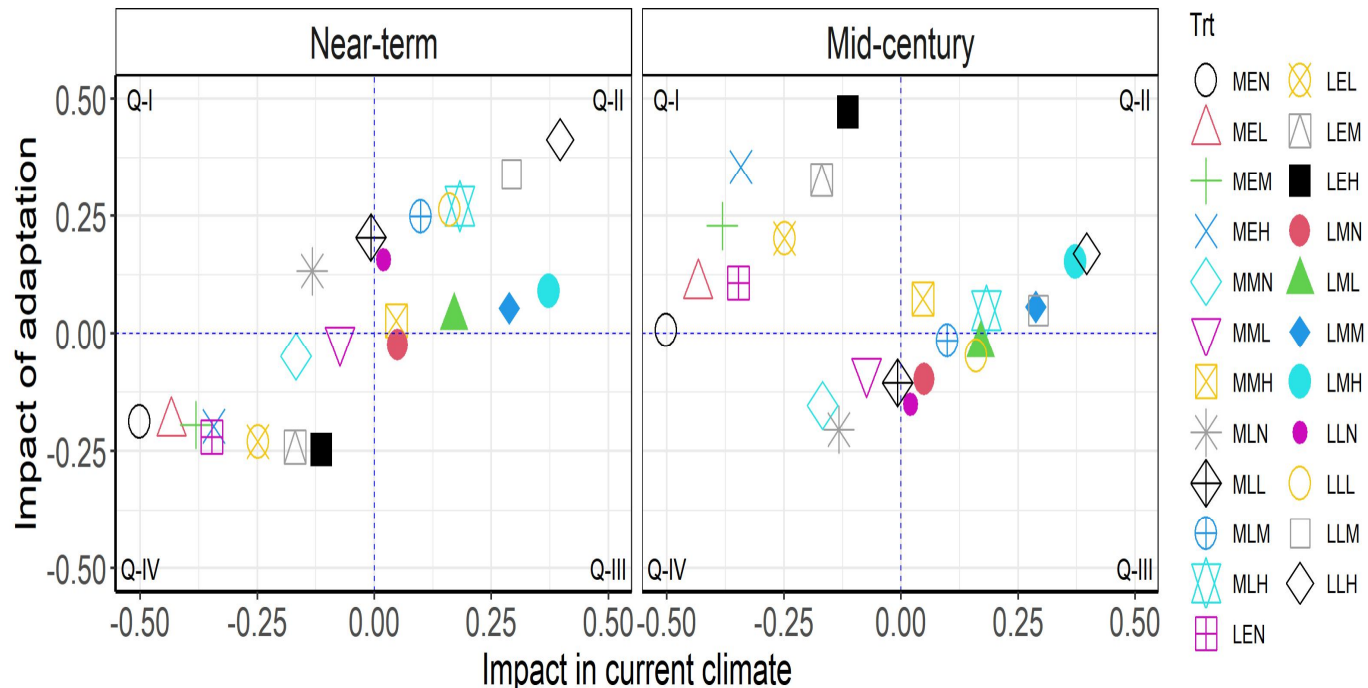


# Climate change management...



Lobel, 2014

Fig. 1. A schematic of how adaptation should be calculated for new agricultural technologies.



Thank you

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