

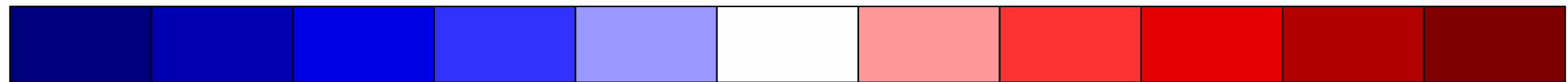
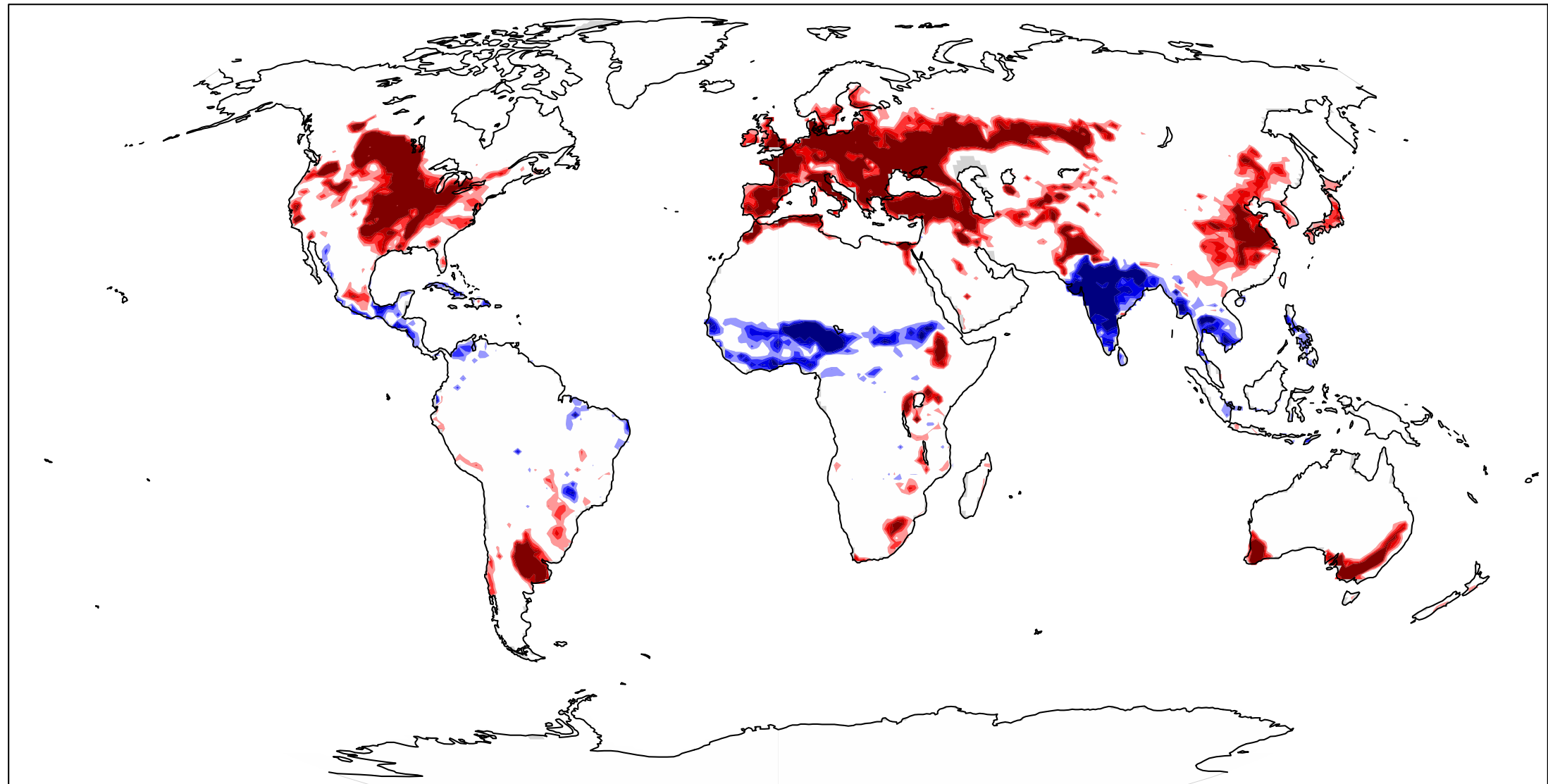
CLM5 Crop Model

Danica Lombardozzi



Impact of Simulated Managed Crops

(relative to simulating generic crops)



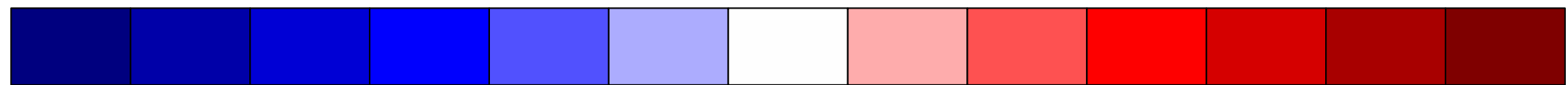
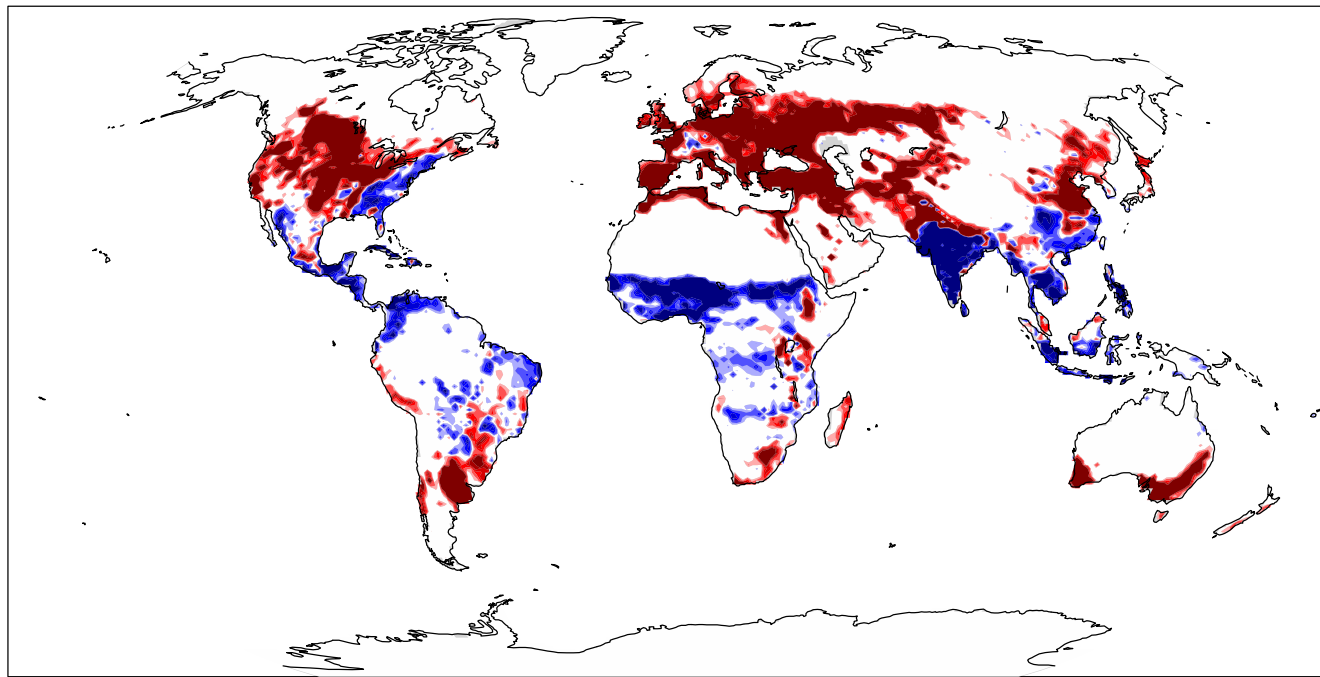
-2 -1.6 -1.2 -0.8 -0.4 0.4 0.8 1.2 1.6 2

Change in Annual Maximum Gross Primary Productivity ($\text{g C m}^{-2} \text{ day}^{-1}$)

Impact of Simulated Managed Crops

(relative to simulating generic crops)

Annual Monthly Maximum



-5 -4 -3 -2 -1 -0.5 0.5 1 2 3 4 5

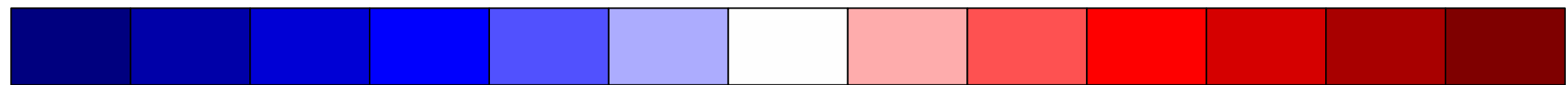
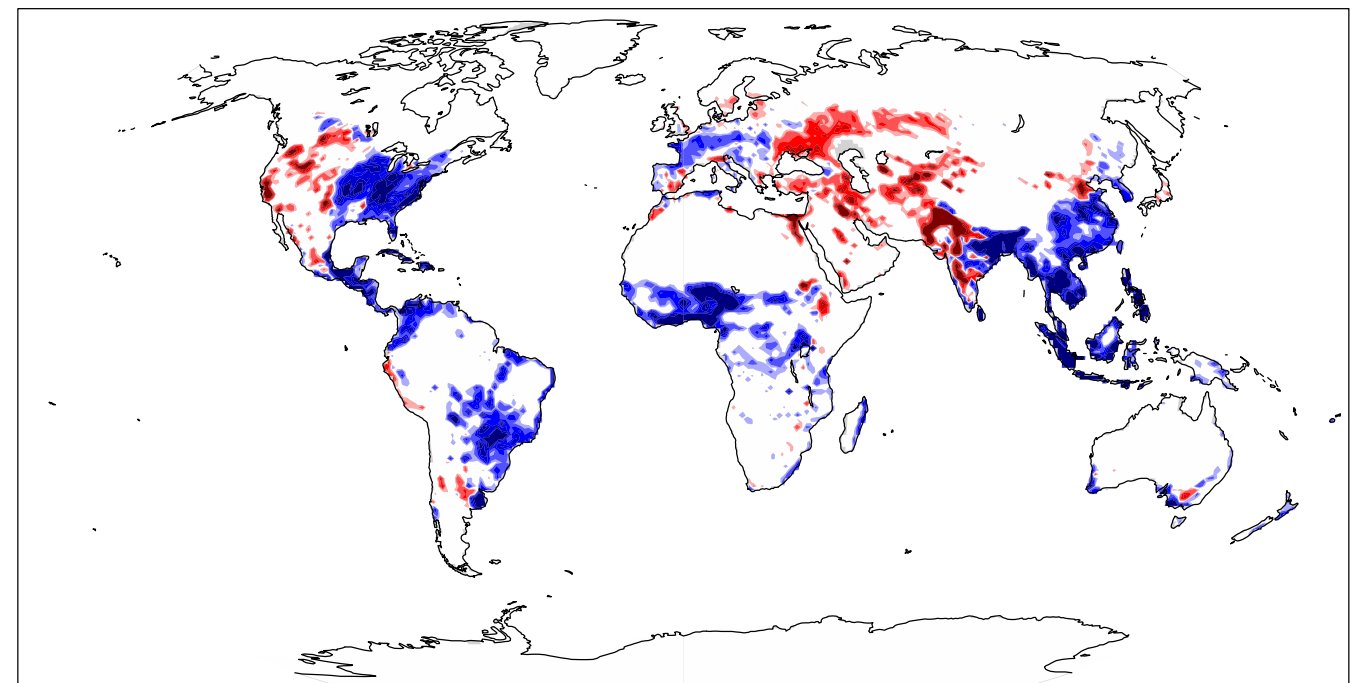
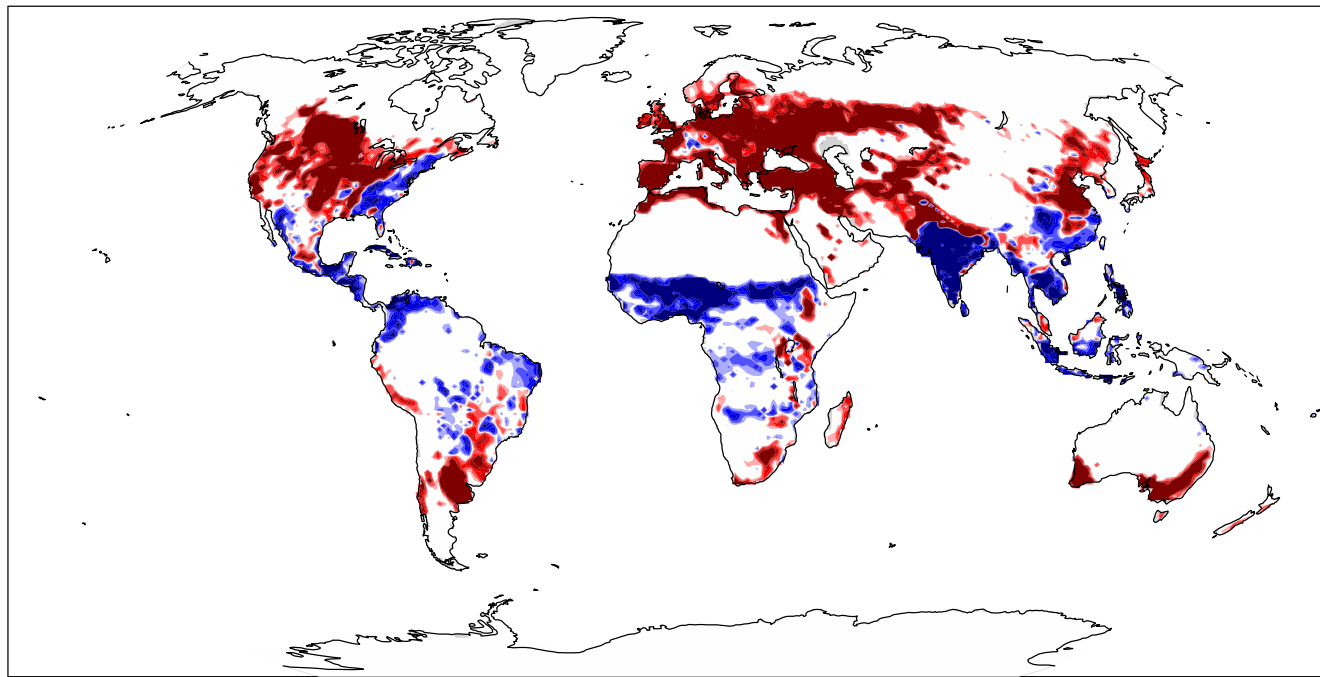
Change in Latent Heat Flux (W m^{-2})

Impact of Simulated Managed Crops

(relative to simulating generic crops)

Annual Monthly Maximum

Annual Average



-5 -4 -3 -2 -1 -0.5 0.5 1 2 3 4 5

Change in Latent Heat Flux (W m^{-2})

Active Crop Types

Corn*



Wheat



Sugarcane



Soy*

Cotton

Rice

* *Temperate and tropical varieties*

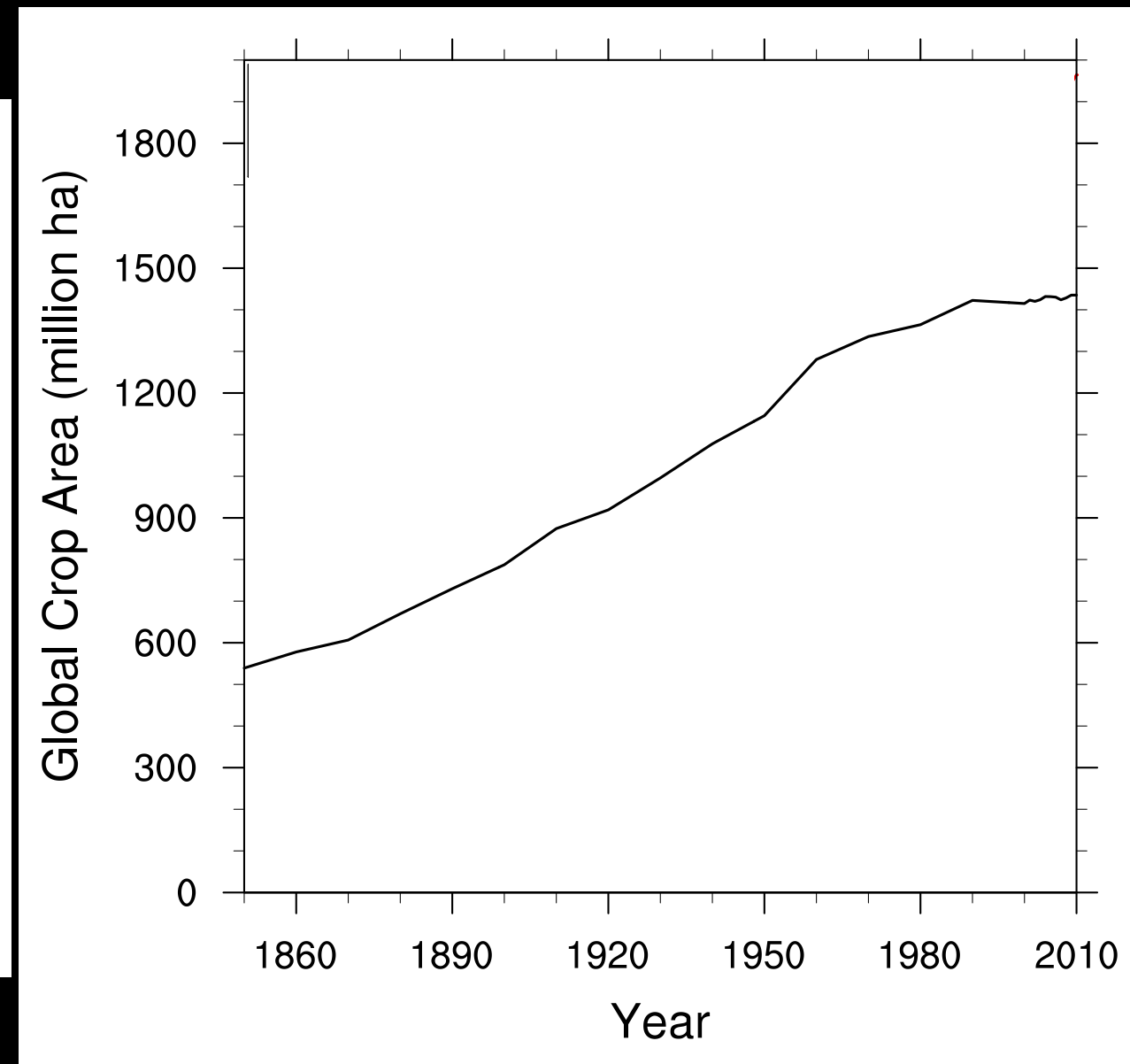
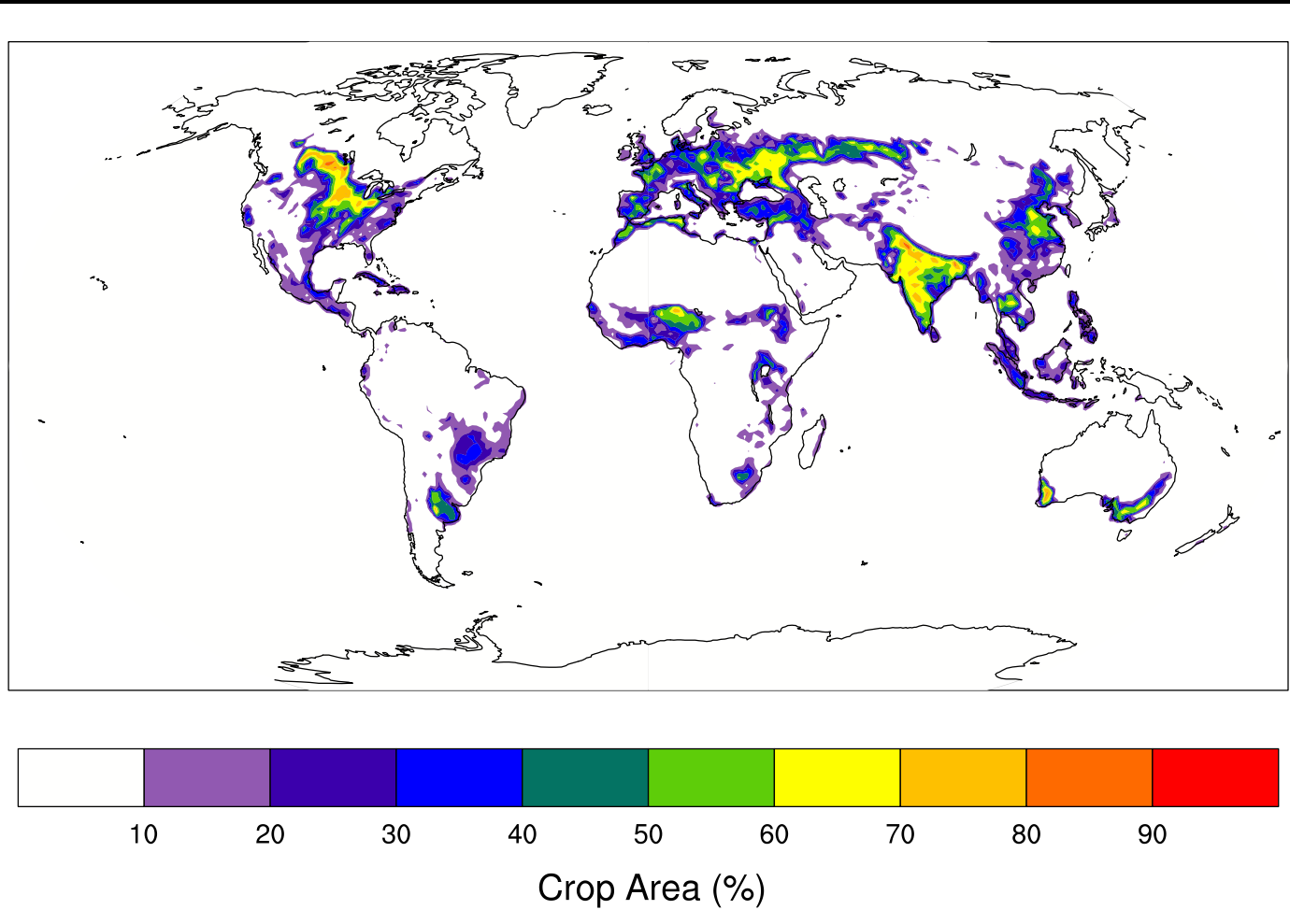
Additional Crops: Placeholders

barley
winter barley
rye
winter rye
cassava
citrus
cocoa
coffee
date palm
fodder grass
grapes
groundnuts
millet
oil palm
potatoes
pulses
rapeseed
sorghum
sugarbeet
sunflower
miscanthus
switchgrass

The surface dataset includes distributions for these crops, but we do not have the required parameters to represent them.

Crop Distributions

1991-2010 Crop Area



Phenology

1) Plant



3) Grain Fill



2) Leaf Emergence



4) Harvest



Management

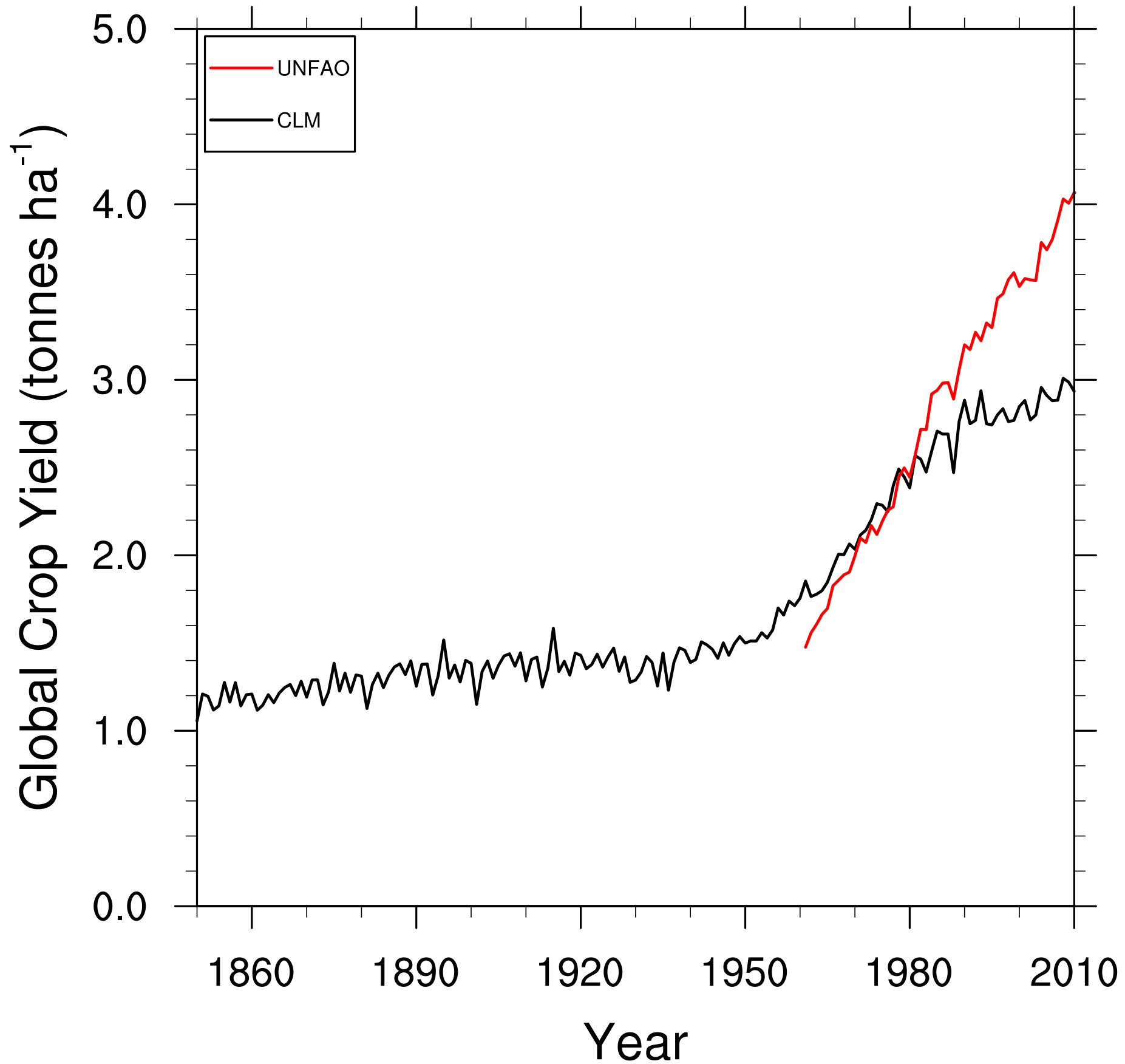
Fertilization



Irrigation



Global Crop Yield



Global Grain Production (million tonnes)

2400
2000
1600
1200
800
400
0

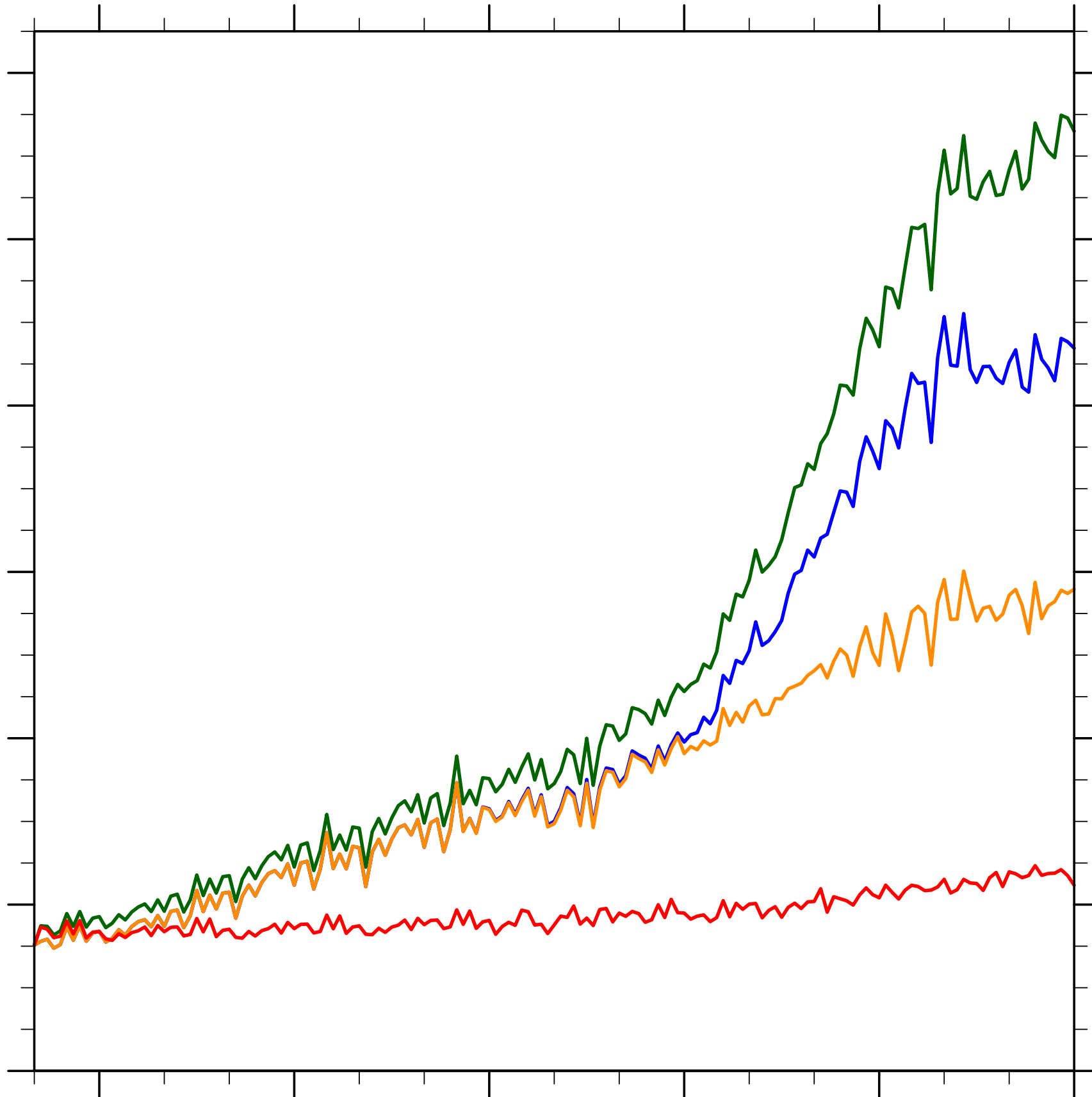
1860 1890 1920 1950 1980 2010

Year

Irrigation Effect

Fertilizer Effect
(without irrigation interaction)

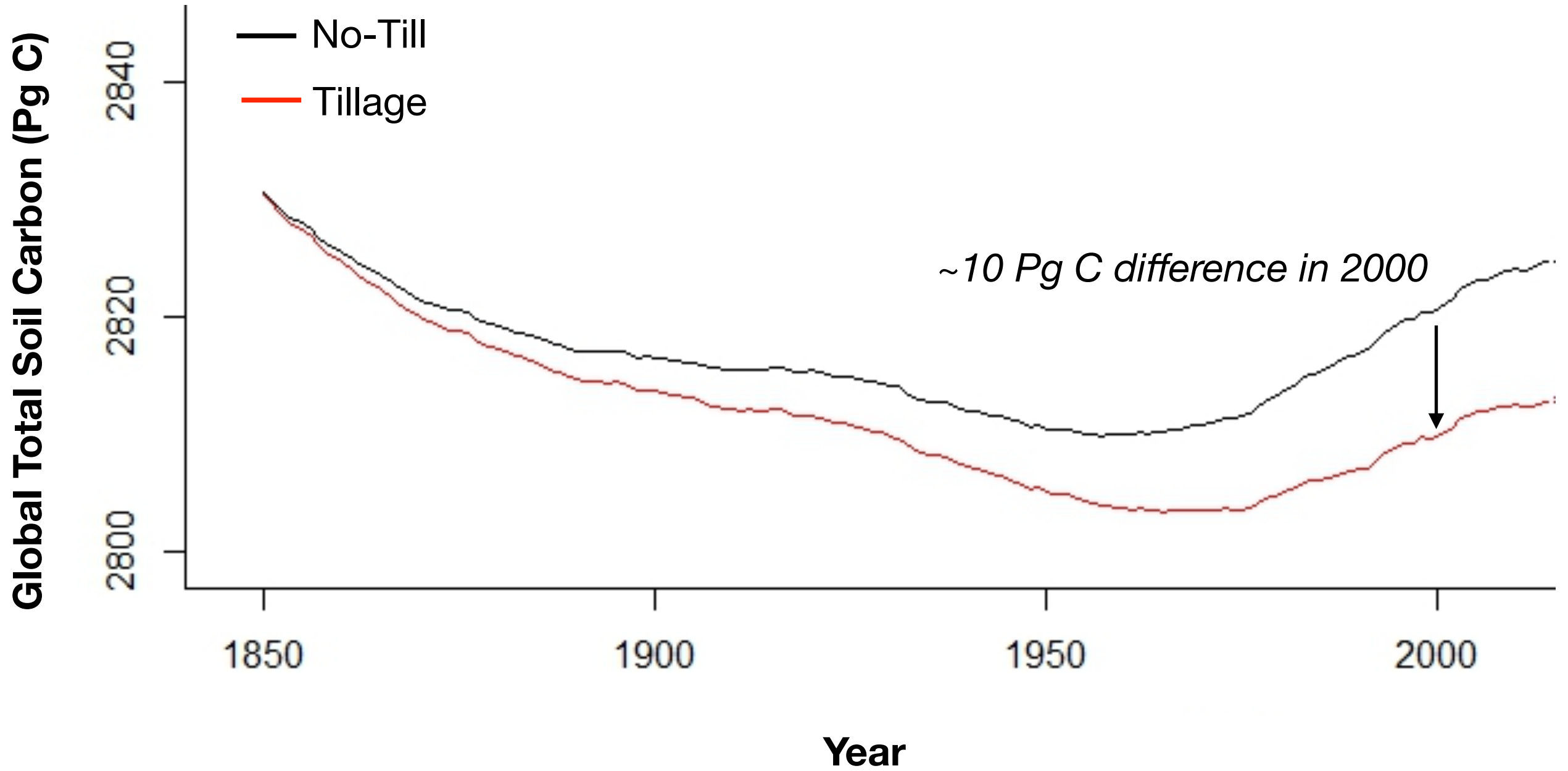
Crop Expansion Effect



Future Plans

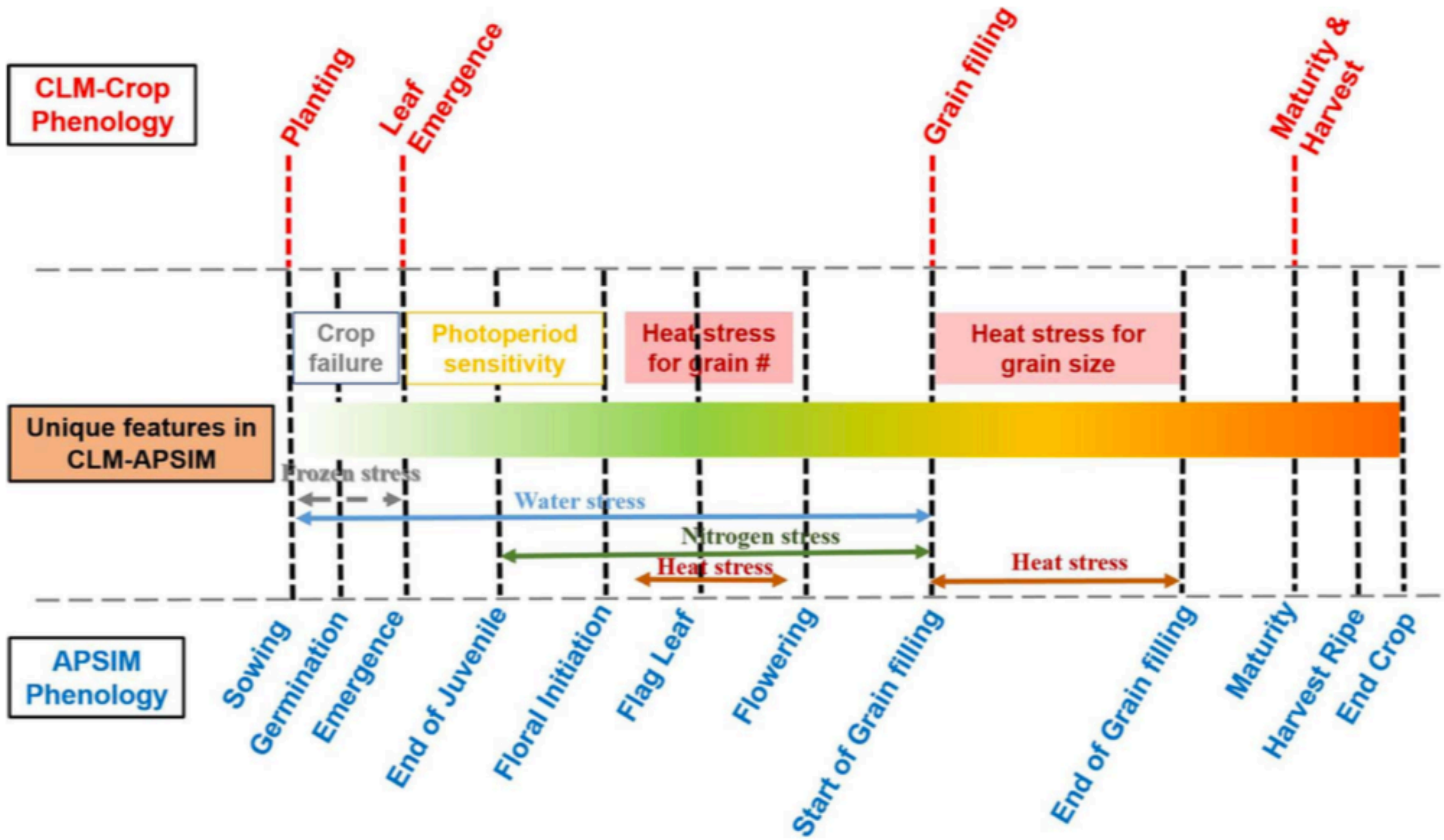


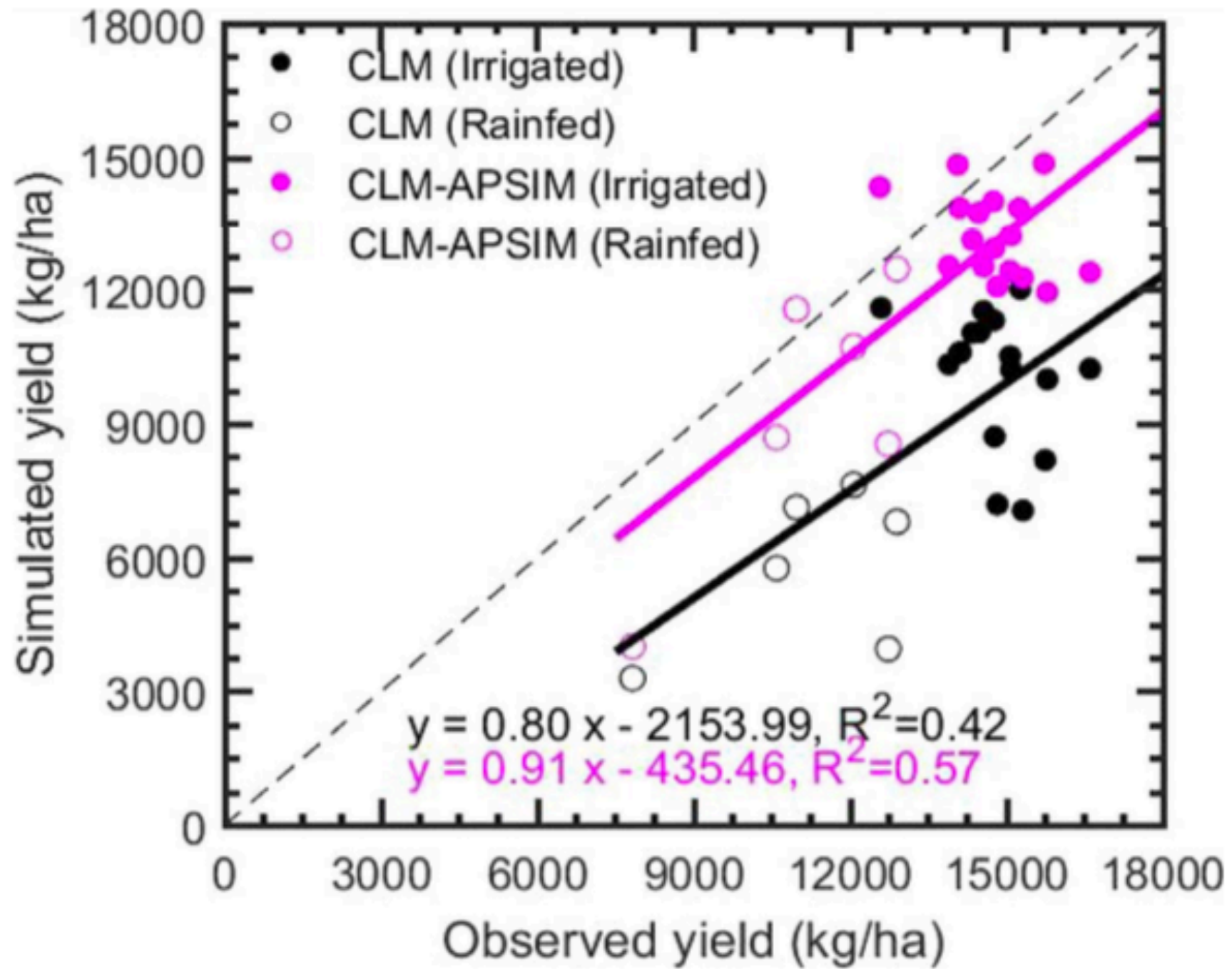
Tillage



Adding APSIM Phenological Phases to CLM

(Agricultural Production Systems sIMulator)

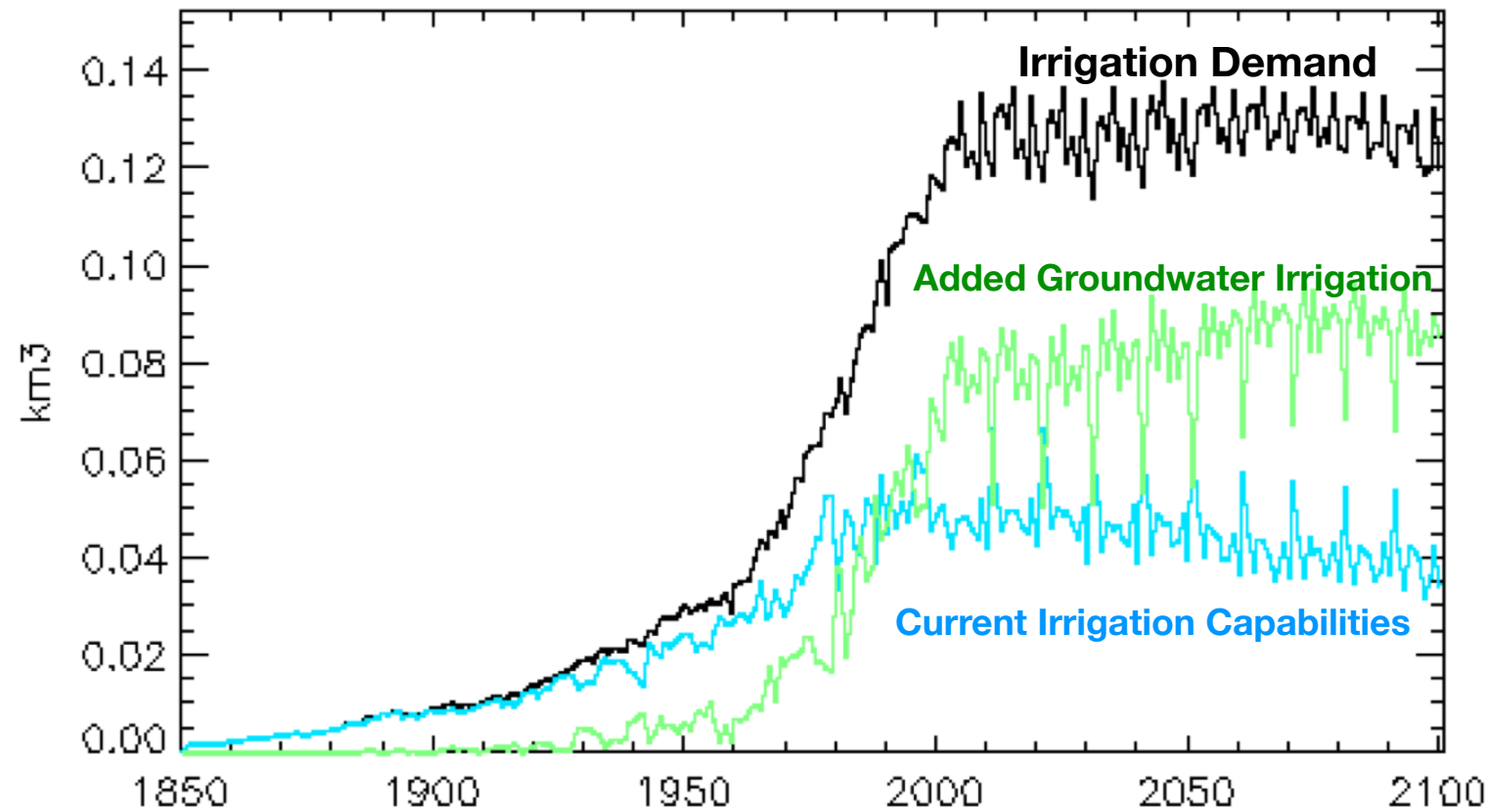




Mead, NE

New Irrigation Capabilities

Annual irrigation
Northern India



SURFACE  GROUNDWATER 

Introduce groundwater
pumping

Also Coming Soon: Drip, Sprinkler, Reservoirs



Other ongoing or planned development activities

- Cover crops
- Manure application & N₂O emissions
- Spatially explicit planting windows
- Shifting cultivation
- Additional crop types (switchgrass, oil palm, winter wheat)
- Managed pasture
- Managed trees/timber

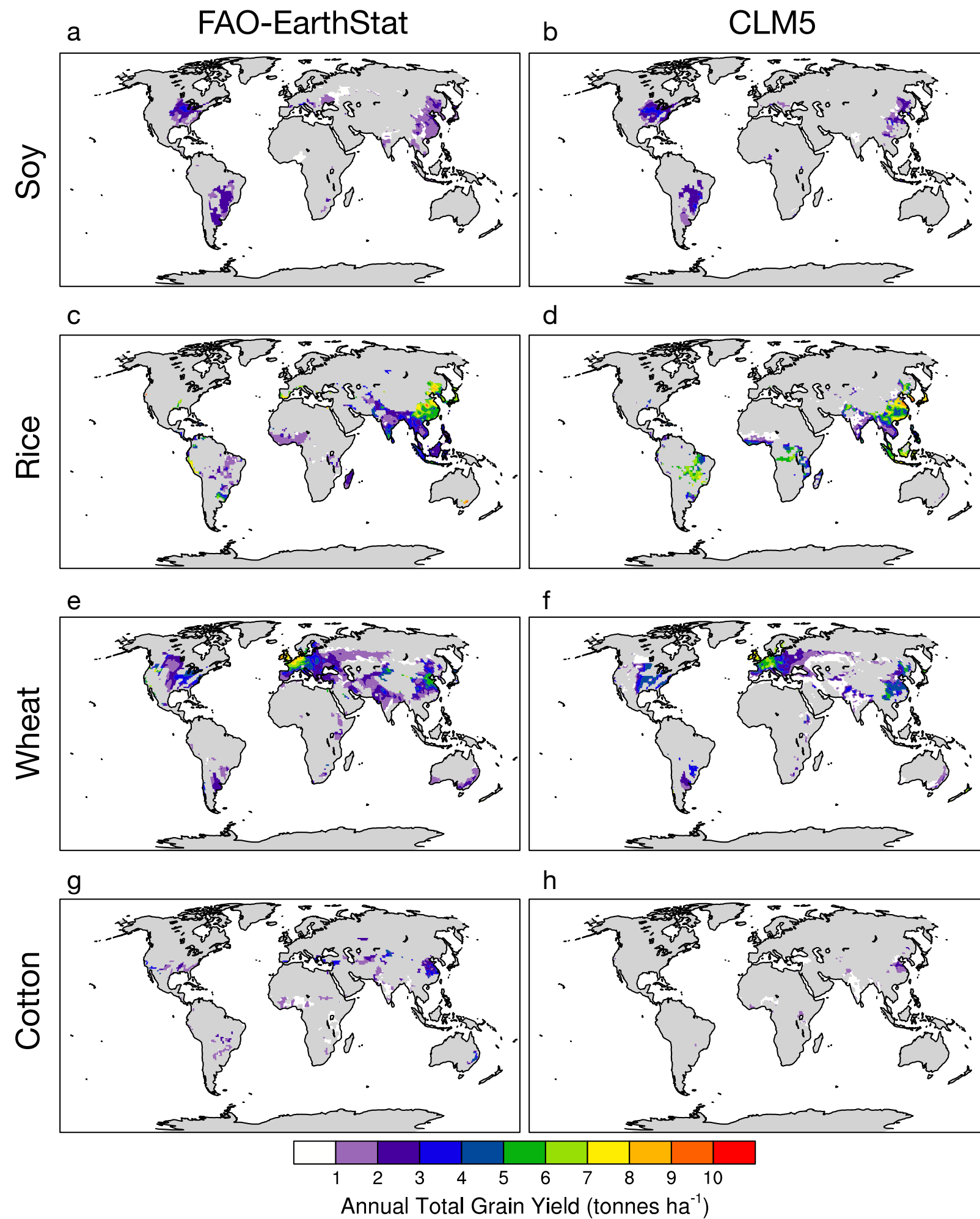
New: CTSM Agriculture Working Group

To facilitate development and application of CTSM-Crop



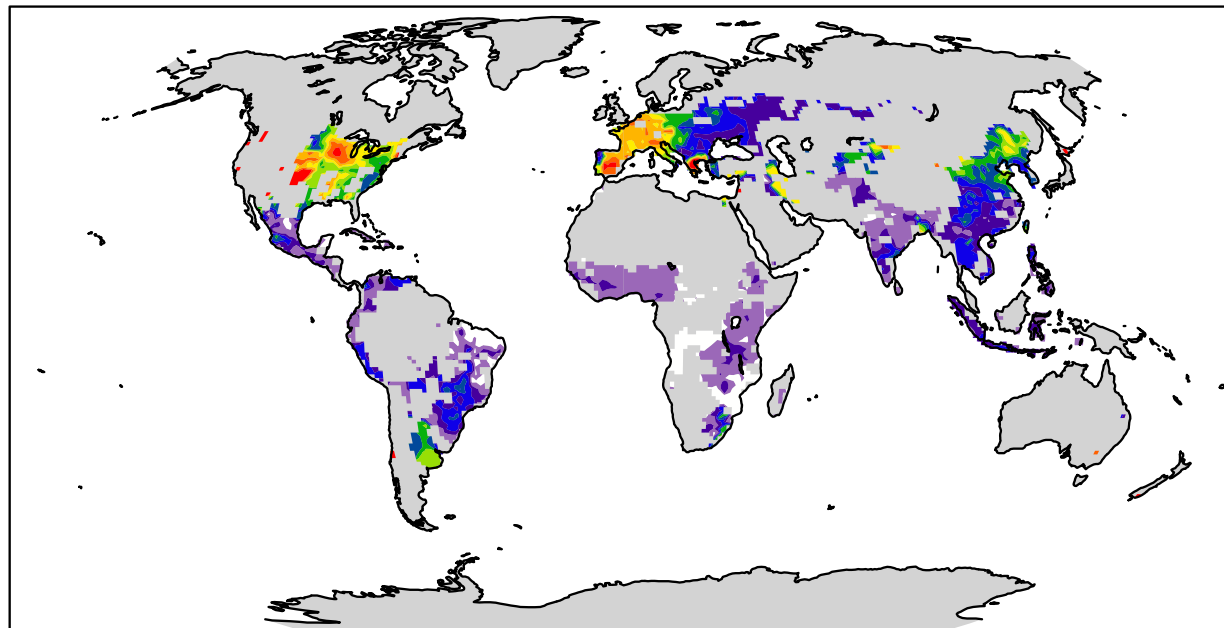
Interested in joining? Contact me (dll@ucar.edu)

C₃ Crops 1991-2010

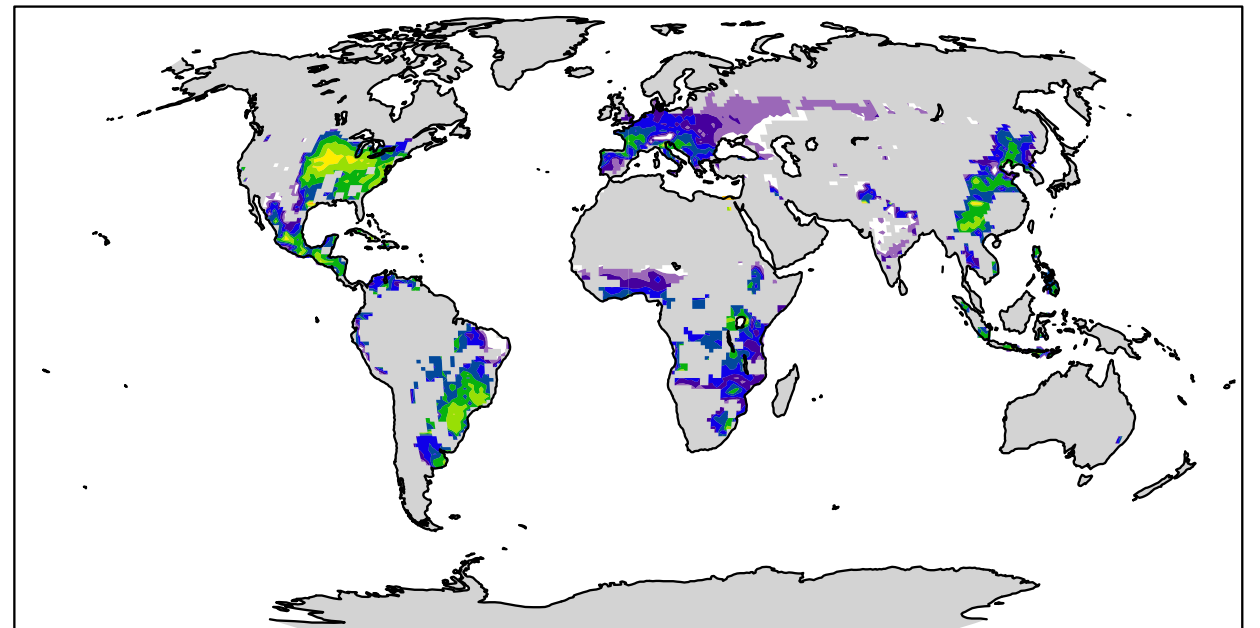


C₄ Crops 1991-2010

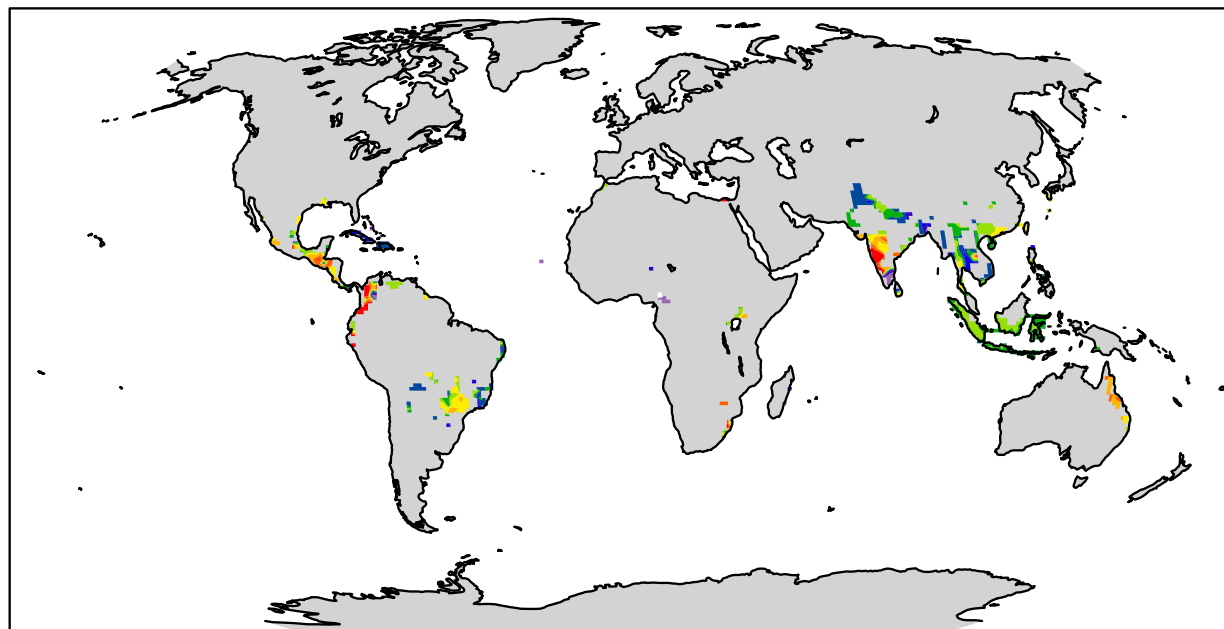
a FAO - EarthStat



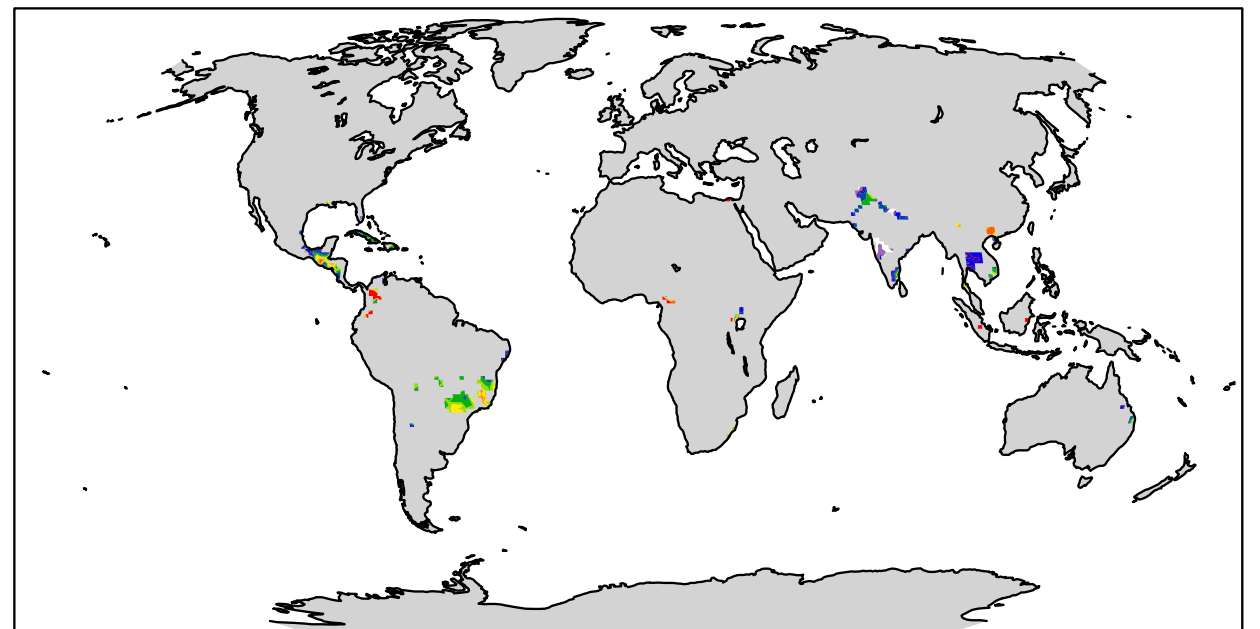
b CLM5



c



d



1 2 3 4 5 6 7 8 9 10

Annual Grain Yield (tonnes ha⁻¹)

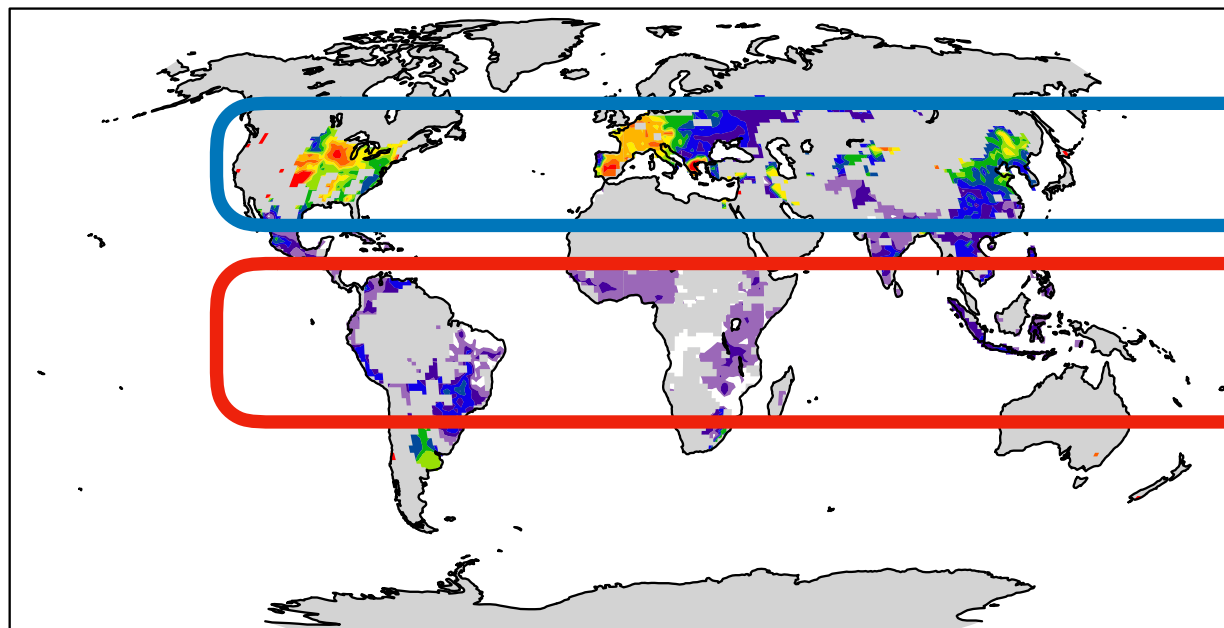
Corn

Sugarcane

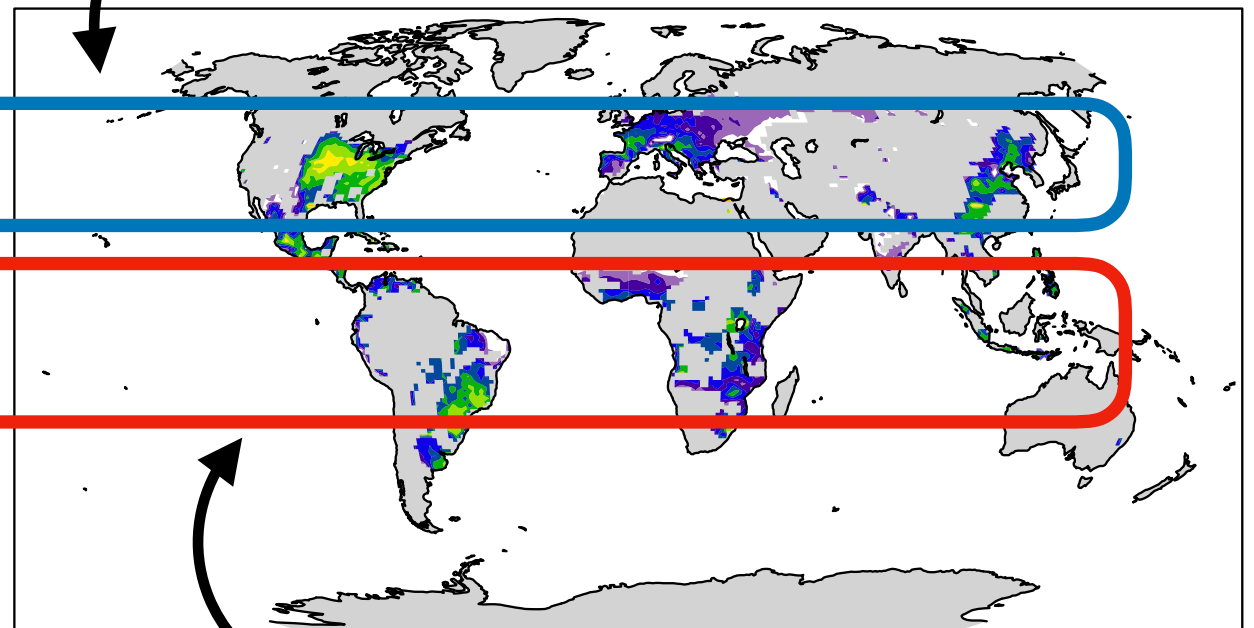
C₄ Crops 1991-2010

Underestimate Temperate Yields

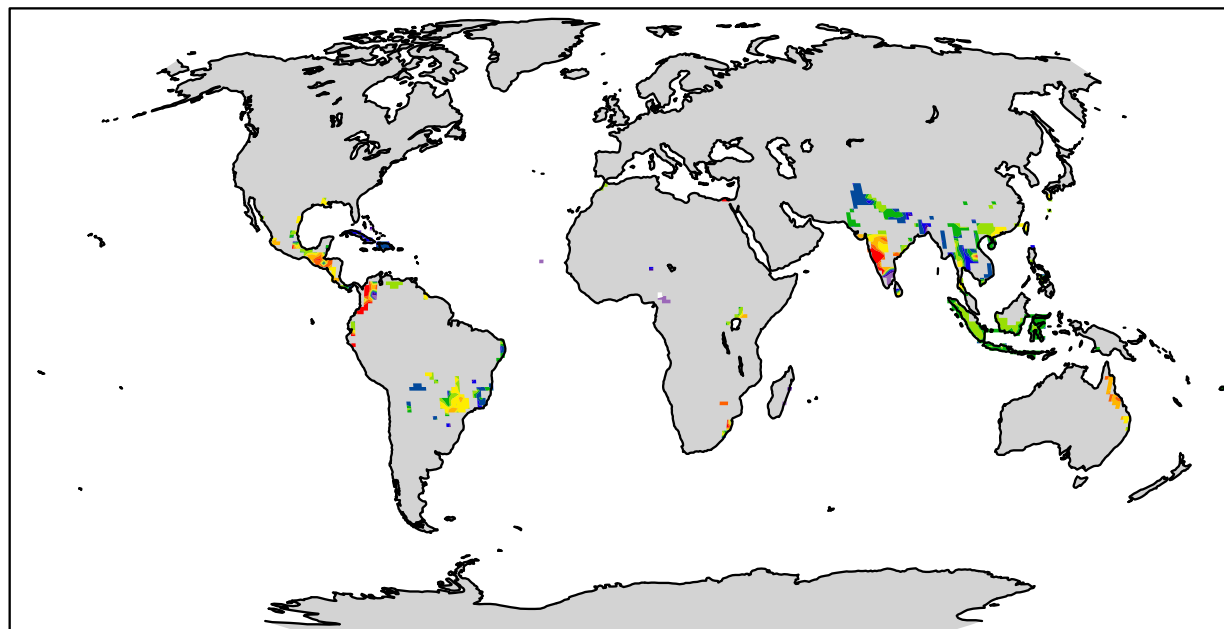
a FAO - EarthStat



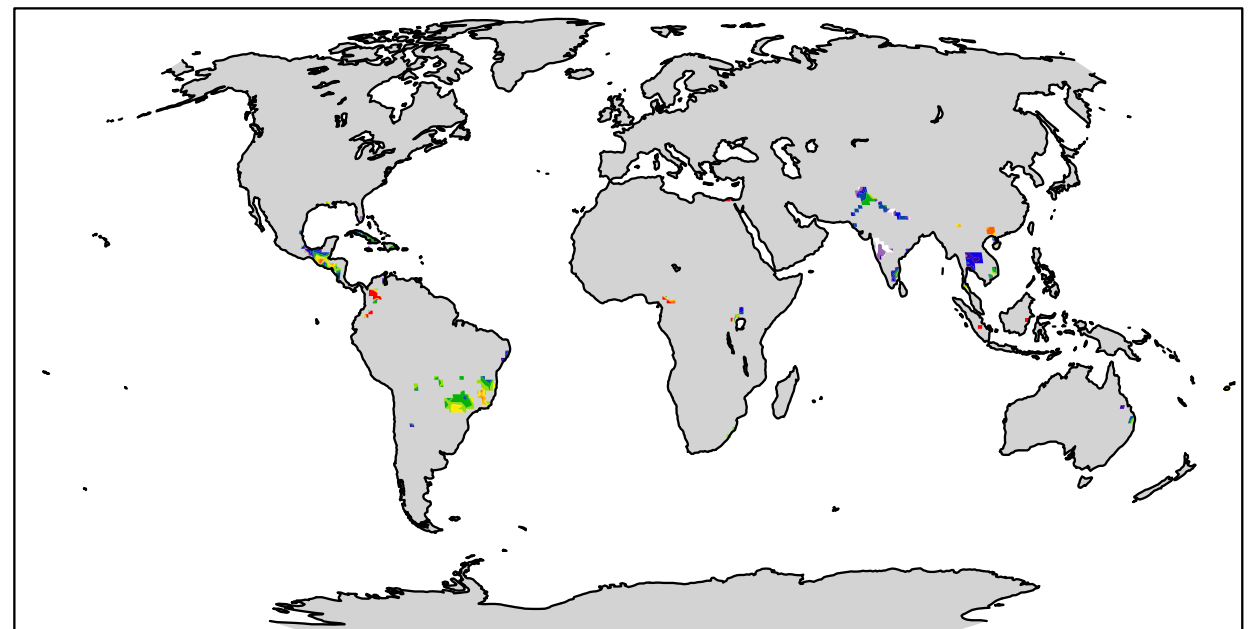
b CLM5



c



d



Overestimate Tropical Yields



1 2 3 4 5 6 7 8 9 10

Annual Grain Yield (tonnes ha⁻¹)

Corn

Sugarcane