Applying Earth System Forecasts For Climate Change To Inform Conservation Planning Of The East African Great Lakes

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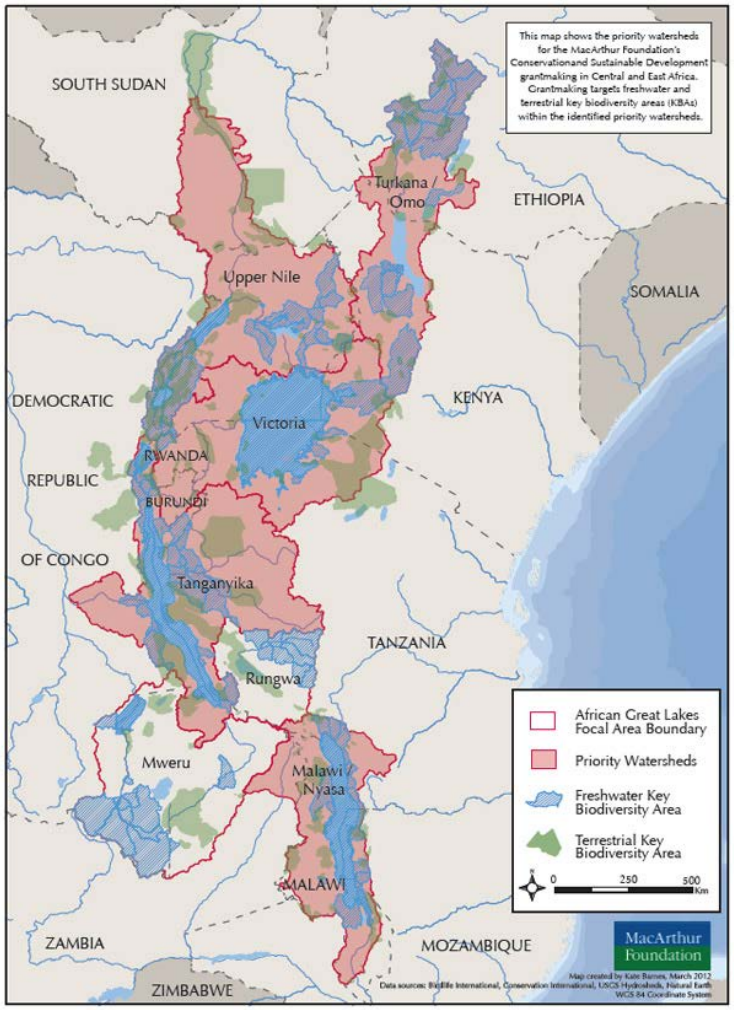
East African Great Lakes Climate Change Predictions

Uganda
Rwanda
Burundi
Tanzania
Kenya
Malawi
Mozambique
Zambia
DR-Congo

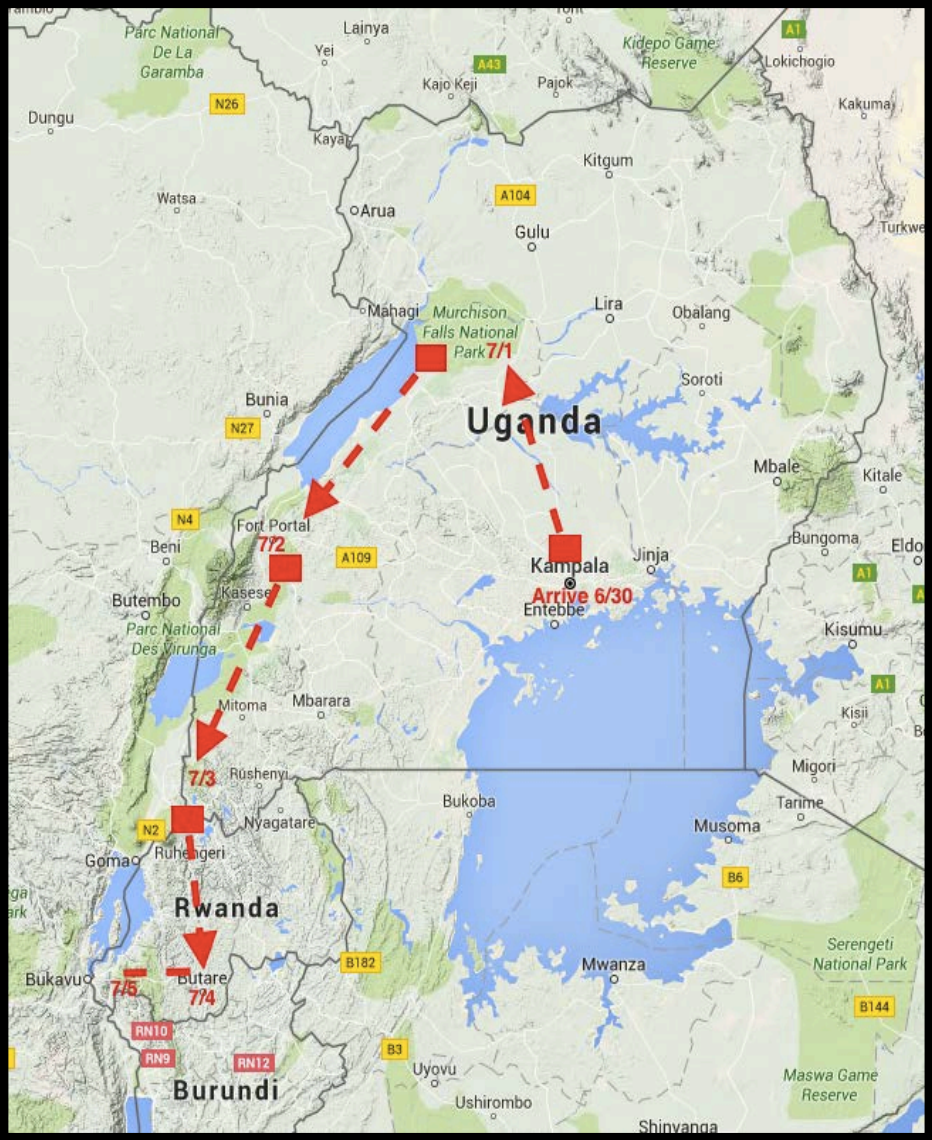


For conservation and development purposes.

Combining

- **High resolution earth system model climate predictions**
- **Real-time climate monitoring (citizen science-based weather monitoring network)**
- **Providing the information on an open-access web portal**

Travel across Uganda and Rwanda
2016 July 1 – 9



Workshop With Stakeholders

KIGALI CRAG EXPERT WORKSHOP
(July 6-July 8, 2016)
CRAG (Climate Resilient Altitudinal Gradient)

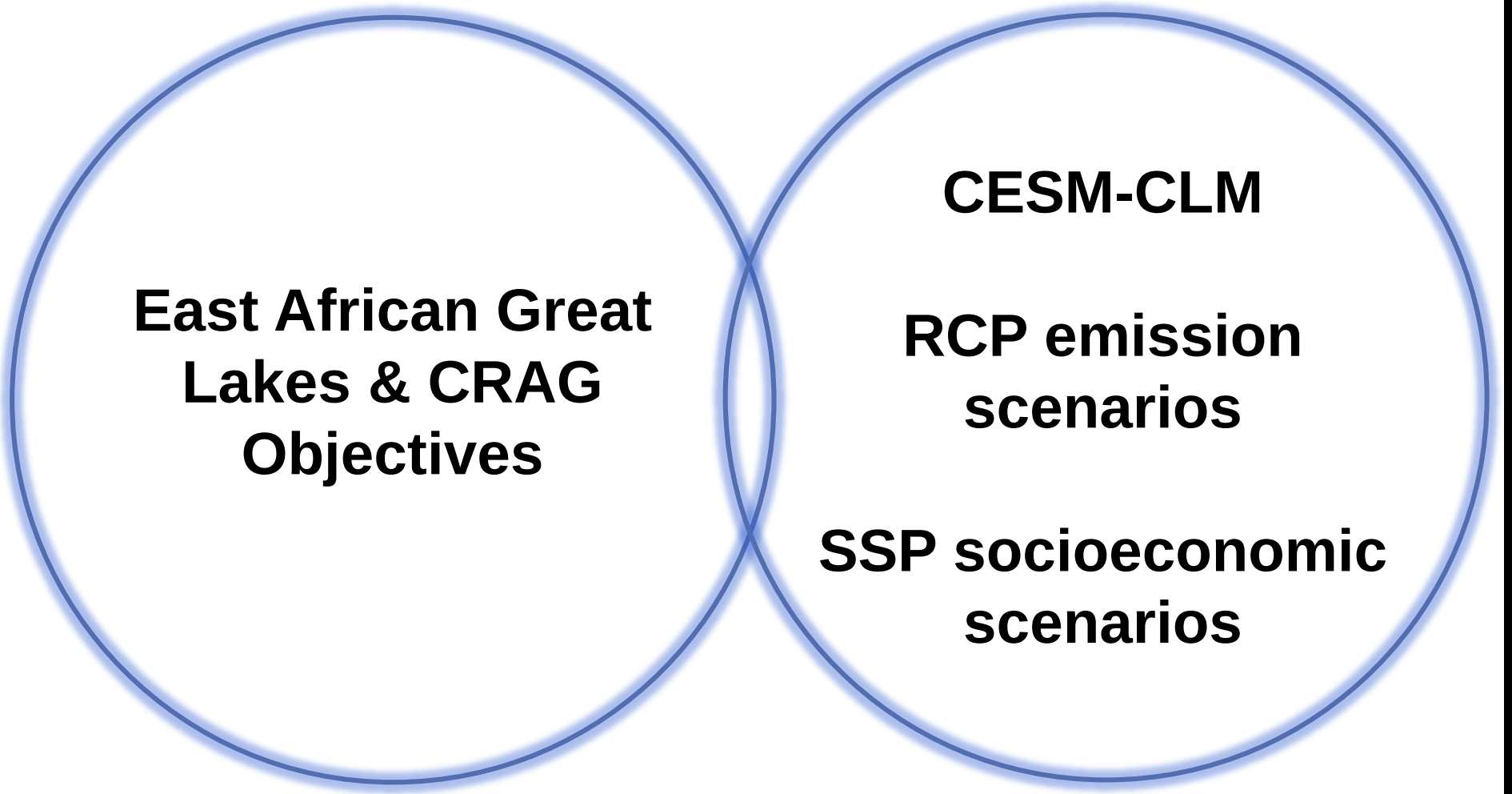
Rwanda – Burundi – DR Congo

- **Governmental planners and managers**
- **Researchers in academia**
- **Lake basin authorities**
- **Protected area and wildlife managers**
- **Conservation NGOs**

Framework For CRAG Workshop – Climate Change Related Threats

1. **Erosion**
2. **Sedimentation**
3. **Landslides**
4. **Rivers and lakes pollution**
5. **Crop failure**
6. **Habitat destruction and altitudinal shifts**
7. **Extreme climatic events**
8. **Shifting patterns in human, livestock and crop diseases**
9. **Invasive Alien Species**

Integrating Hi-Tech Science With Practical Need of People On The Ground



Objectives

Objective 1. Patterns of precipitation and temperature under the different climate scenarios and changes in seasonality and frequency of extreme events.

Objective 2. Changes in precipitation and temperature patterns linked to:

- spatial distribution of vegetation (forest, agriculture, and pastures) Changes in agricultural suitability and crop yields and distribution
- Identifying hotspots of change in terms of human and biodiversity impacts.

Climate Extremes
Heat Stress analysis

What does the future look like for the number of heat stress days?

What would the population look like?

Can we understand the future potential for human exposure to heat stress days in East Africa?

CESM simulation

CESM1-CLM4:

High-resolution (0.25° x 0.25°)

Fully coupled

Transient land surface

Prescribed SST

Outputs:

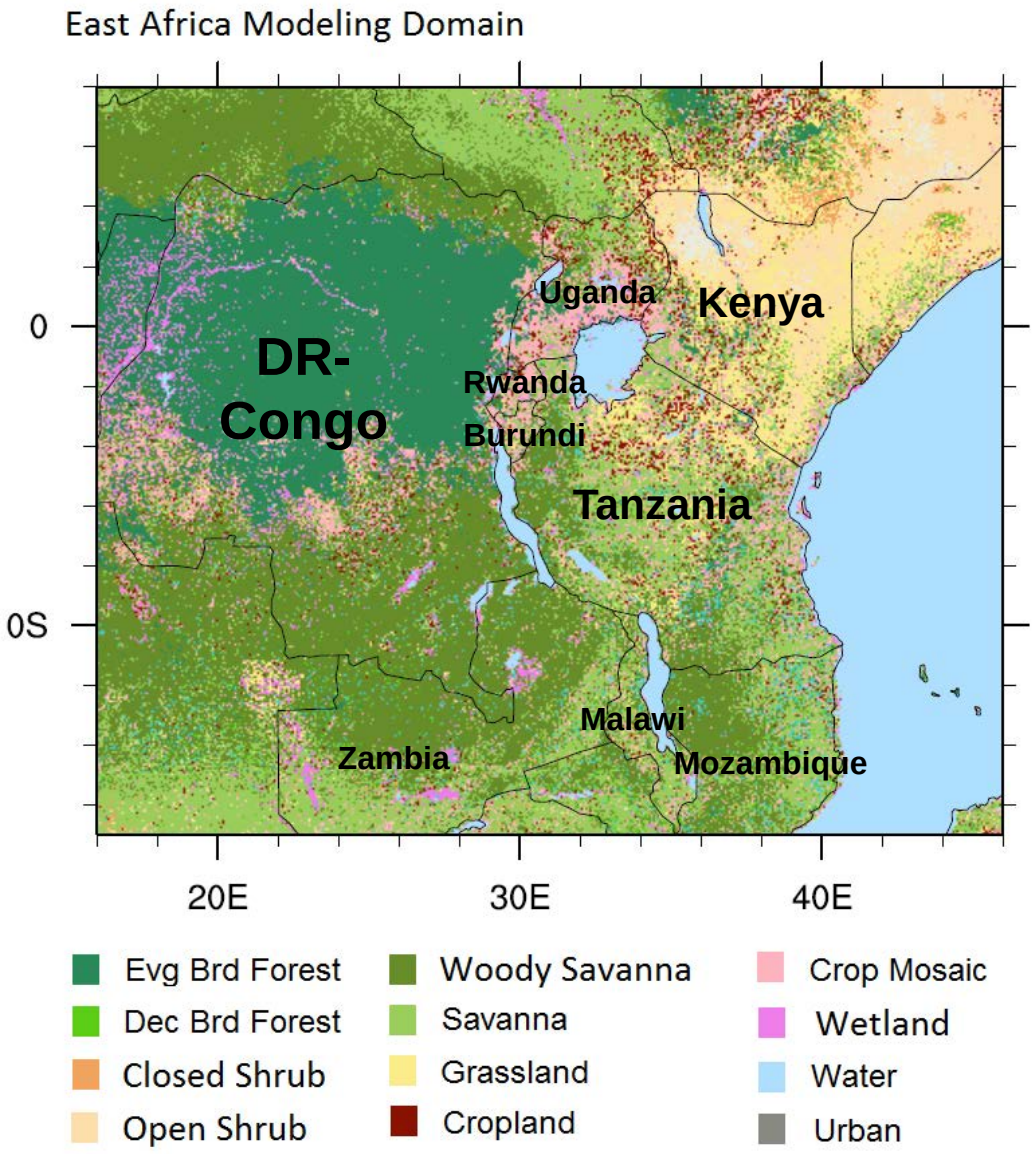
12 atmospheric variables

3-hourly & 6-hourly

For 1979-2012 and

2070-2099 (RCP 8.5)

No land variable outputs



Heat Stress definition

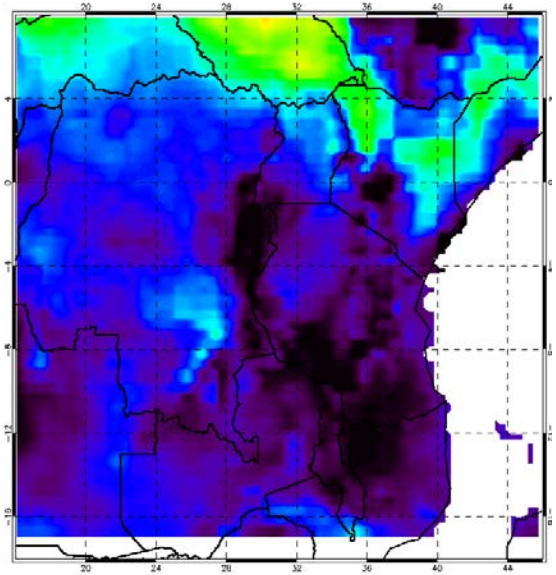
- **Temperatures > 35C**
- **Apparent Temperature** - relative humidity (**RH**) , Temp (**T**) , wind speed (**Ws**)
- **Humidex (Heat Index)** - relative humidity (**RH**) , Temp (**T**)

Symptom Band	US NWS Classification	Apparent Temperature Range (°C)	US NWS Classified "Effect on Body"
I	Caution	27–32	Fatigue possible with prolonged exposure and/or physical activity
II	Extreme caution	32–39	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
III	Danger	39–51	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
IV	Extreme Danger	51	Heat stroke highly likely

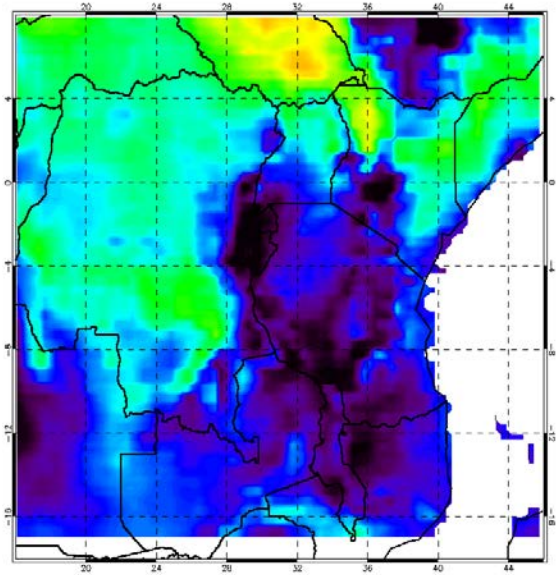
(Garland et al., 2015)

Averaged over 1979-2012
Annual # of heat stress days
T > 39C

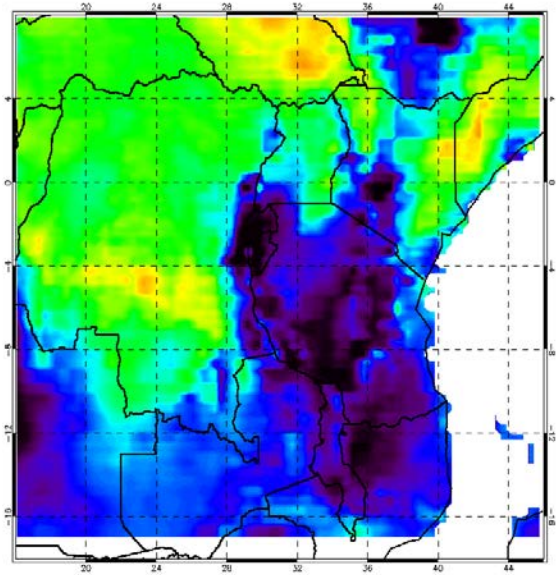
Only Temp
T



Apparent T
T , RH , Ws



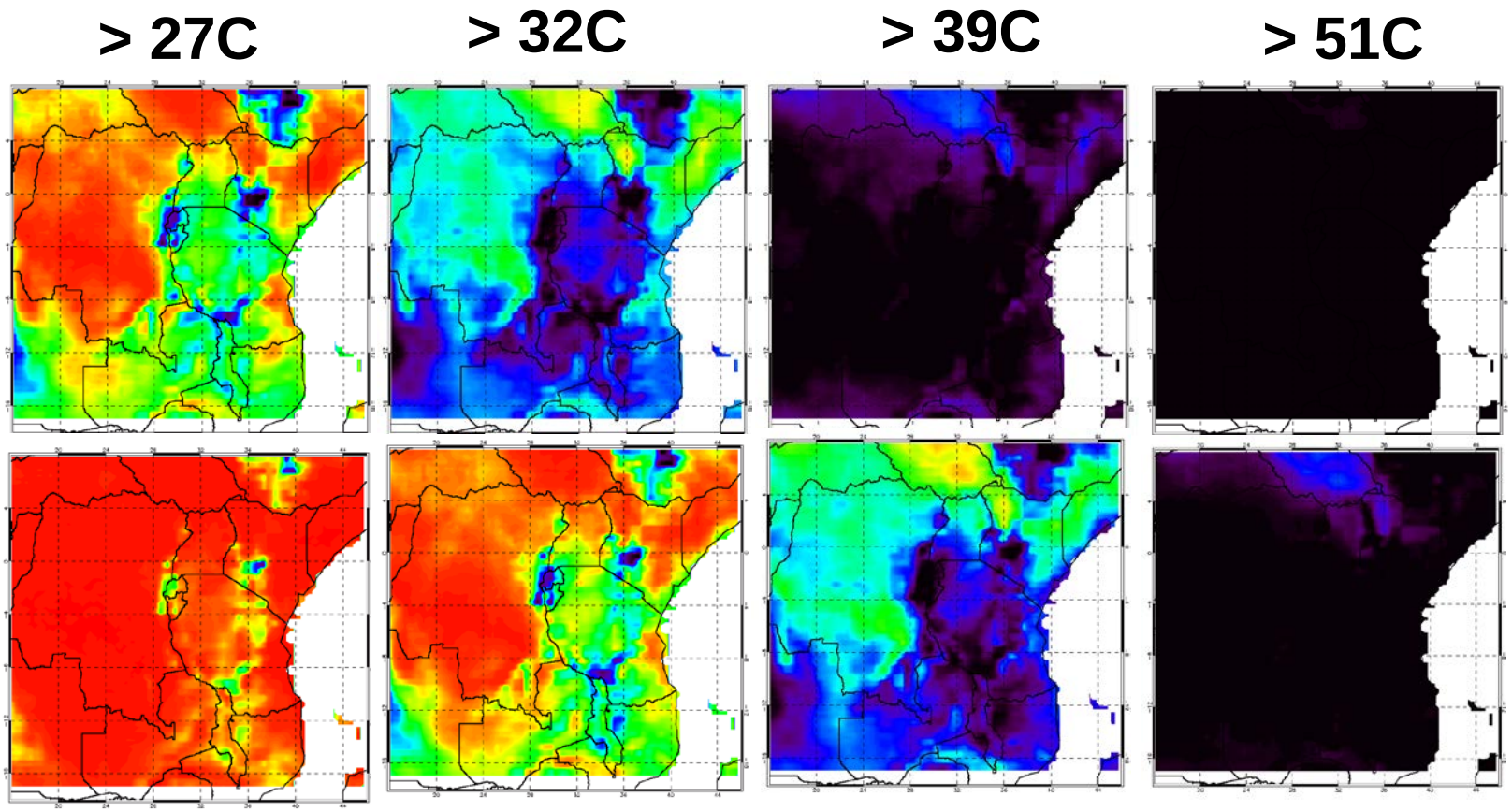
Humidex
T , RH



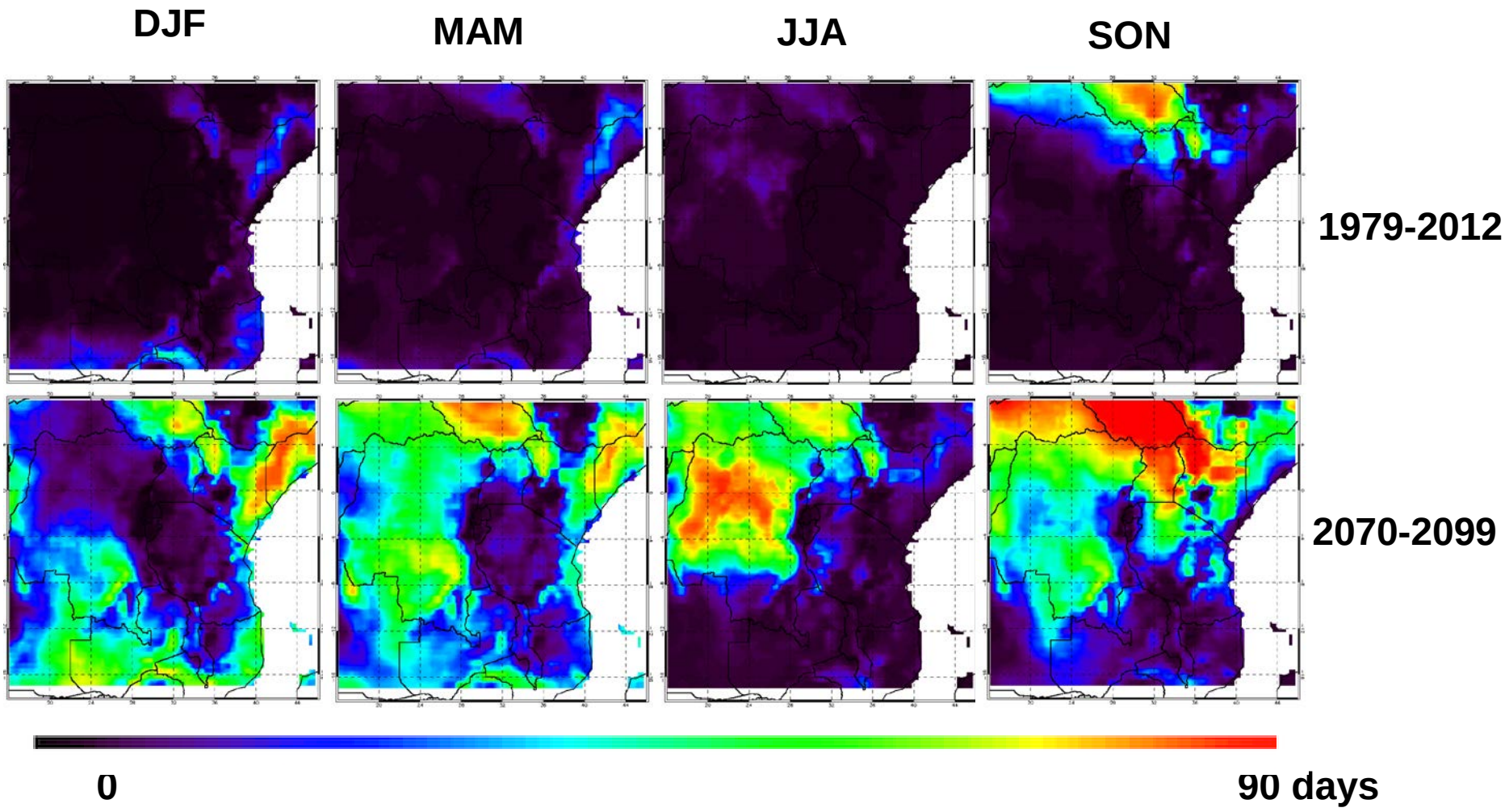
0 **365 days**

Annual # of heat stress days

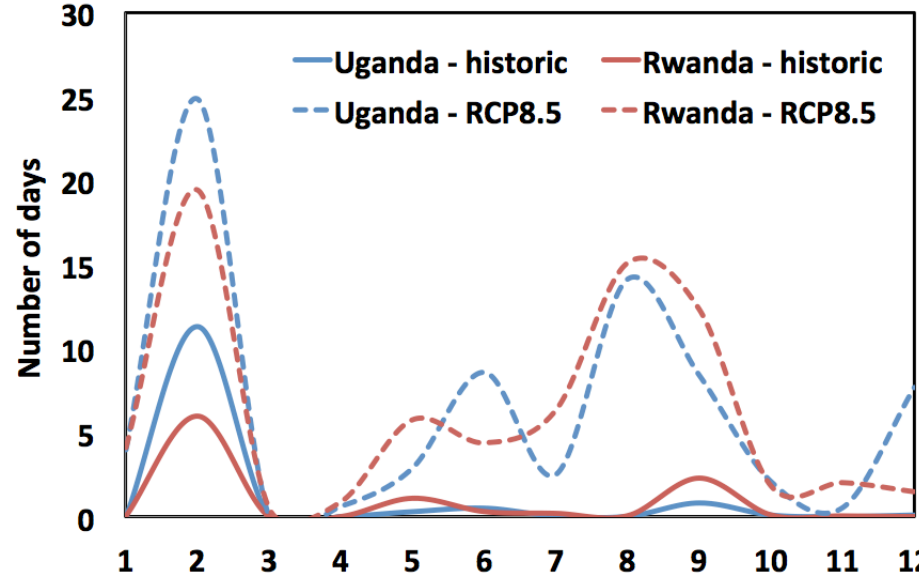
Apparent Temperature (AT)

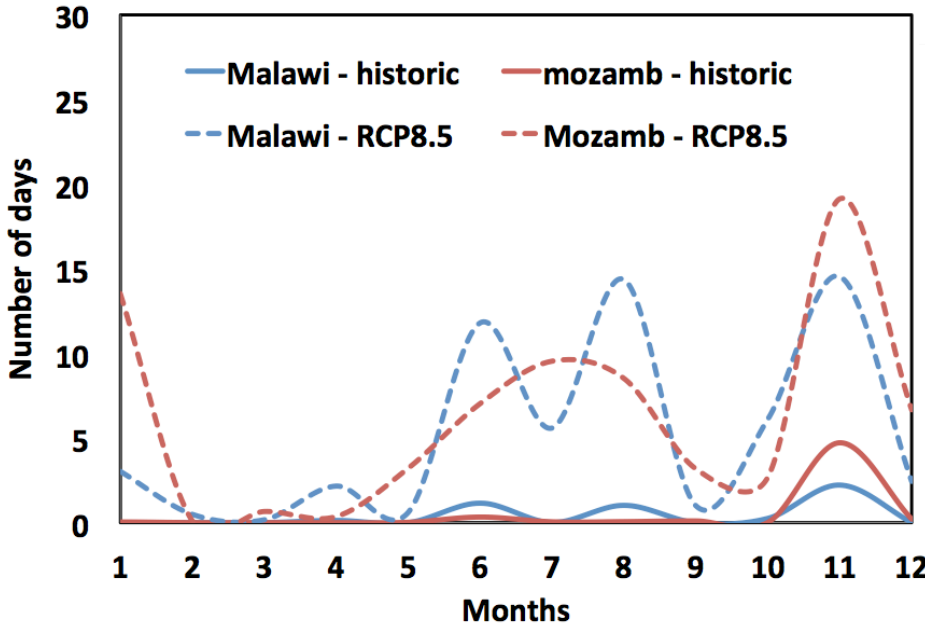


Seasonal # of heat stress days AT > 39C

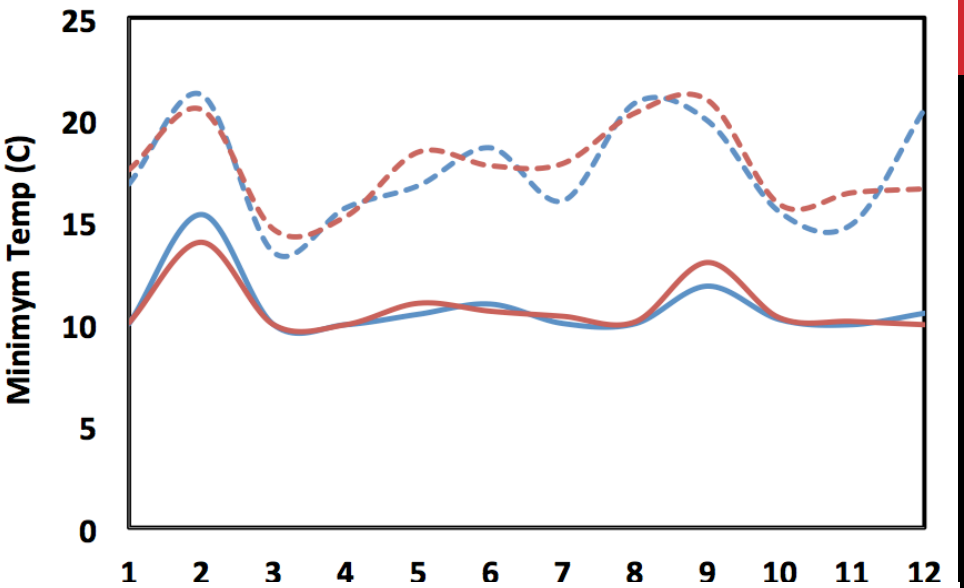


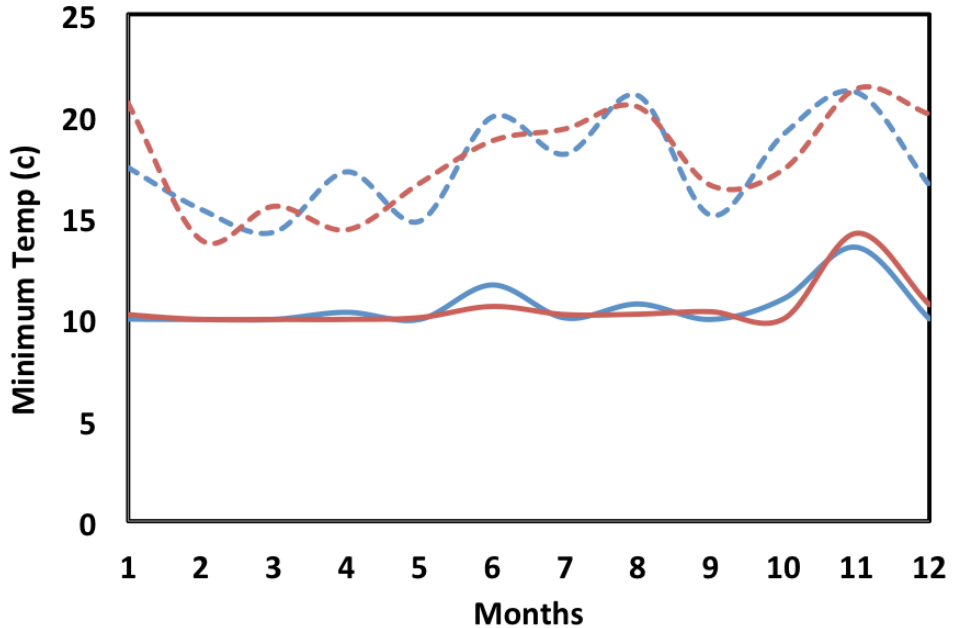
Monthly number of days with AT > 39 C





Monthly average of nighttime temp when daytime AT > 39C





SSP population projections

Developed at NCAR by Jones et al., 2016

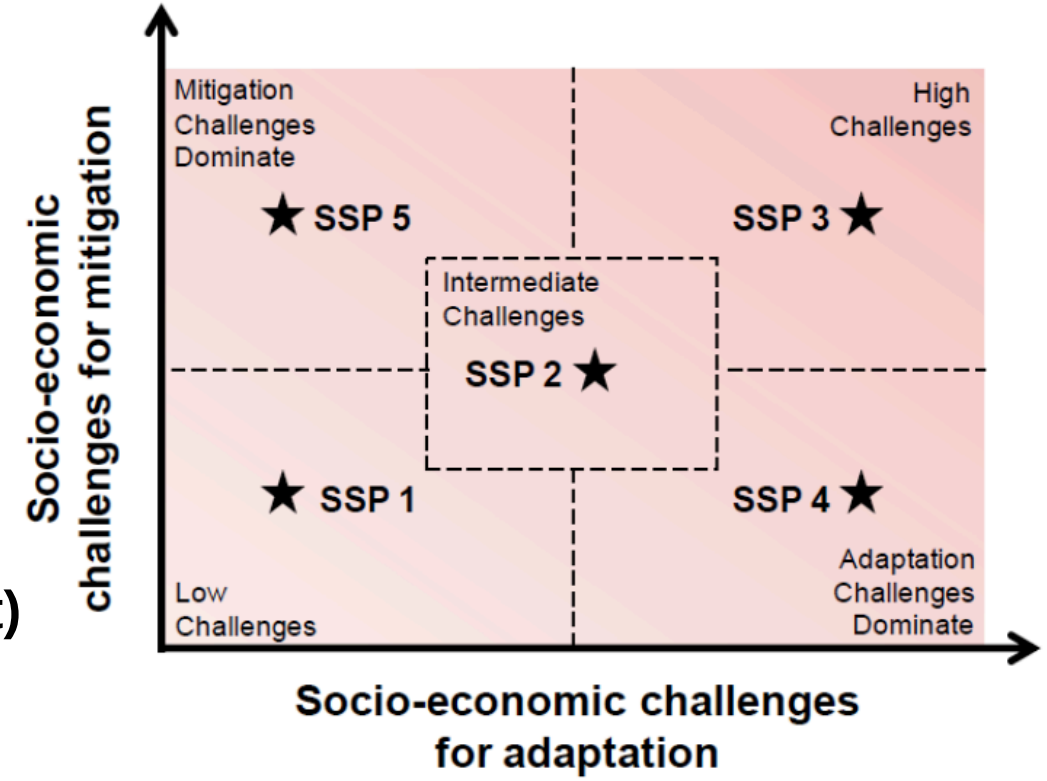
SSP1 (sustainability)

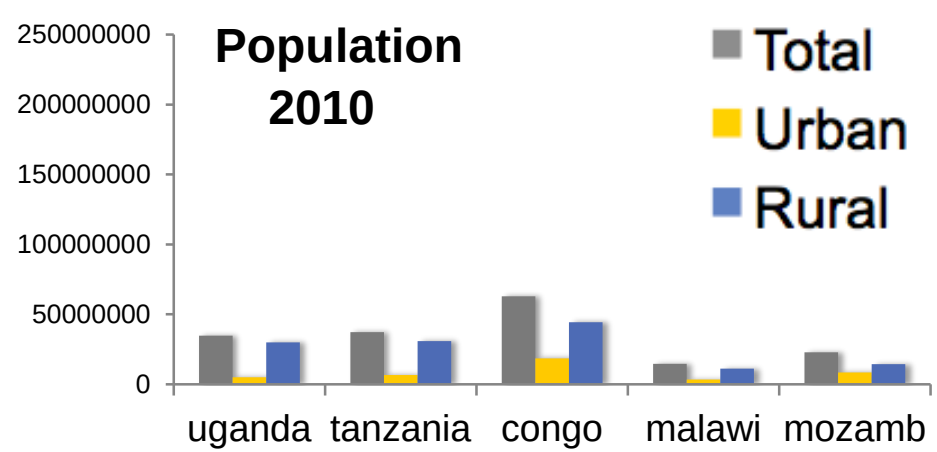
SSP2 (middle of the road)

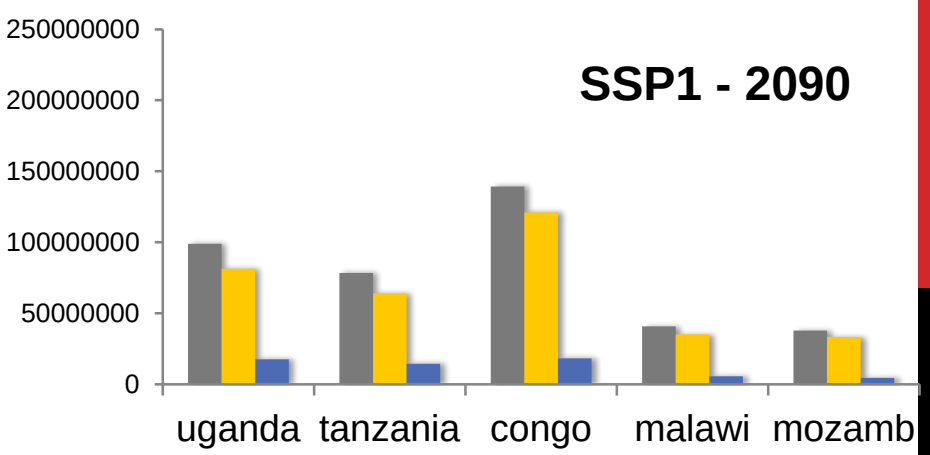
SSP3 (regional rivalry)

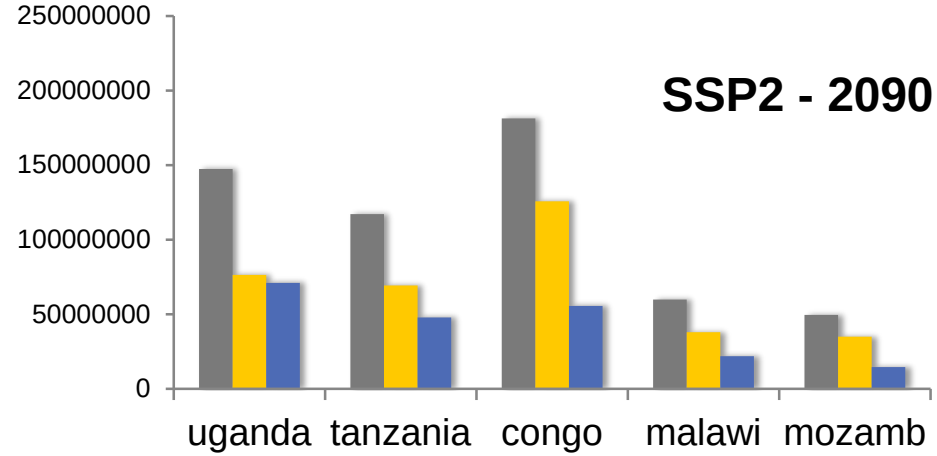
SSP4 (inequality)

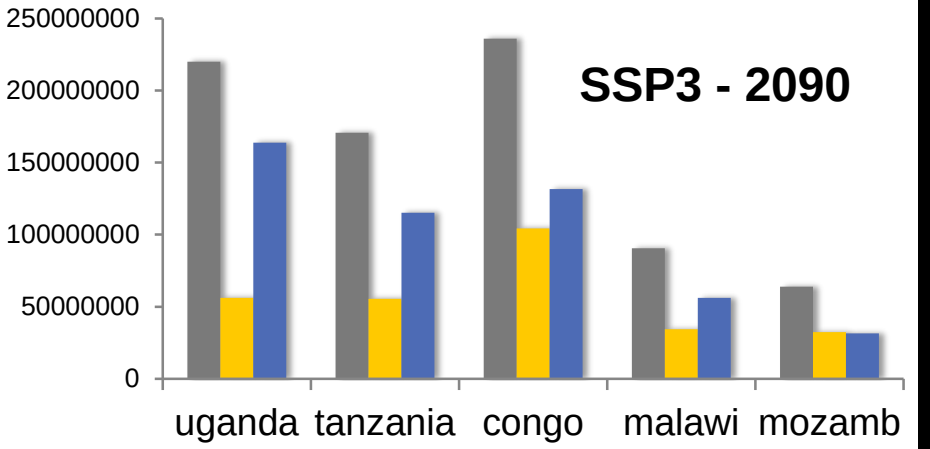
SSP5 (fossil-fueled development)

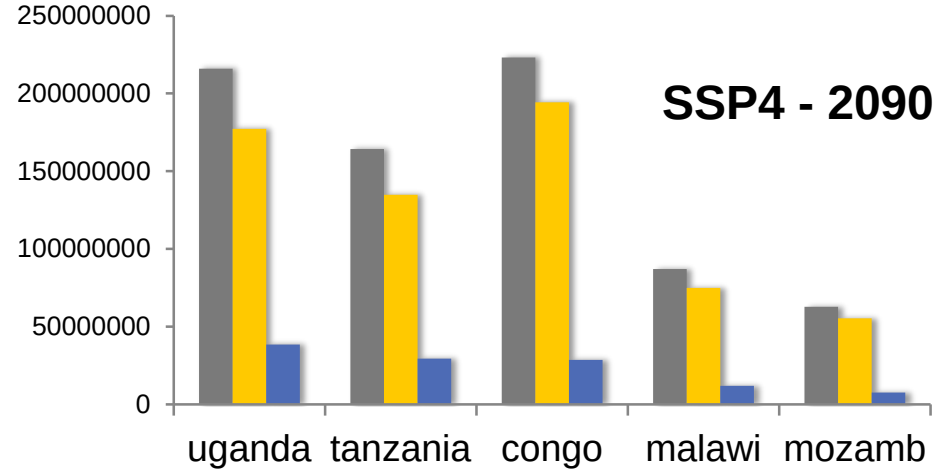



Population
2010
Total
Urban
Rural
250000000
200000000
150000000
100000000
50000000
0
uganda
tanzania
congo
malawi
mozamb


SSP1 - 2090
250000000
200000000
150000000
100000000
50000000
0
uganda
tanzania
congo
malawi
mozamb


SSP2 - 2090
250000000
200000000
150000000
100000000
50000000
0
uganda
tanzania
congo
malawi
mozamb


SSP3 - 2090
250000000
200000000
150000000
100000000
50000000
0
uganda
tanzania
congo
malawi
mozamb


SSP4 - 2090
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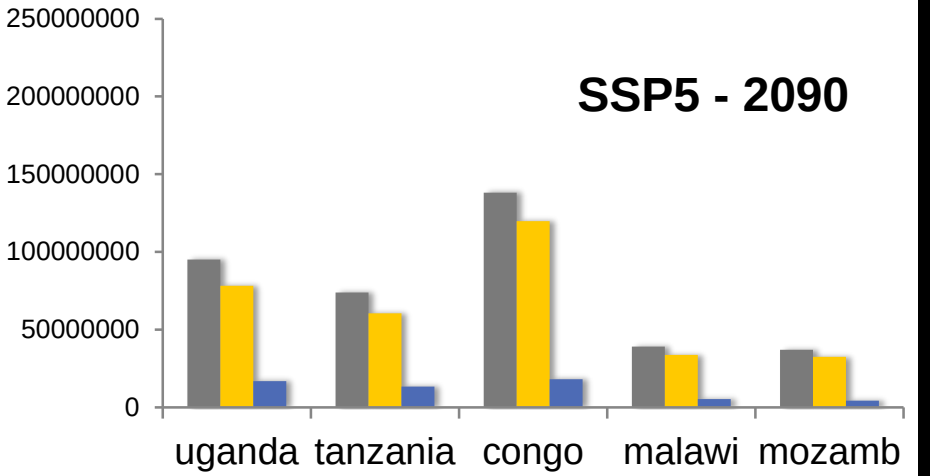
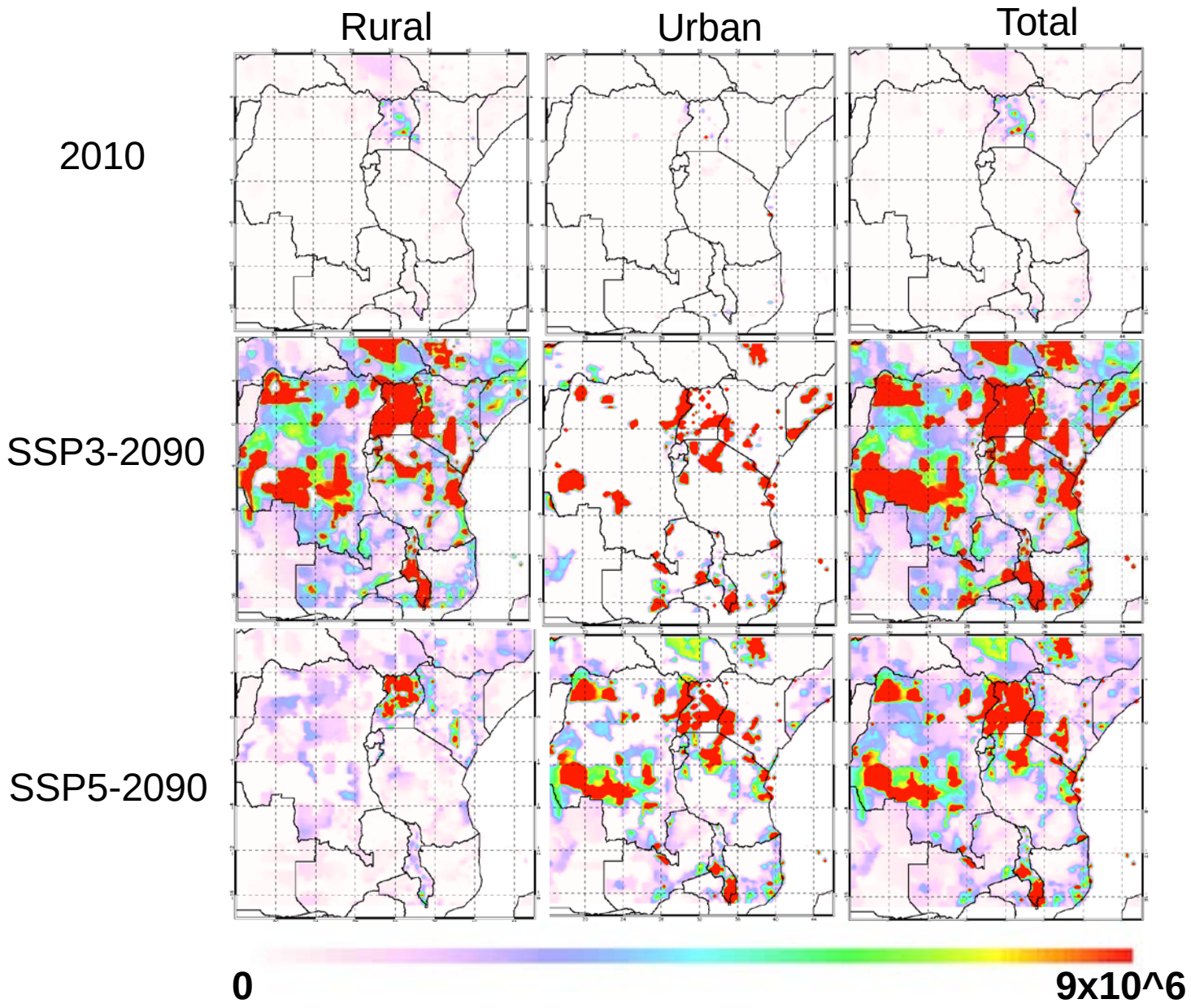
200000000
150000000
100000000
50000000
0
uganda
tanzania
congo
malawi
mozamb

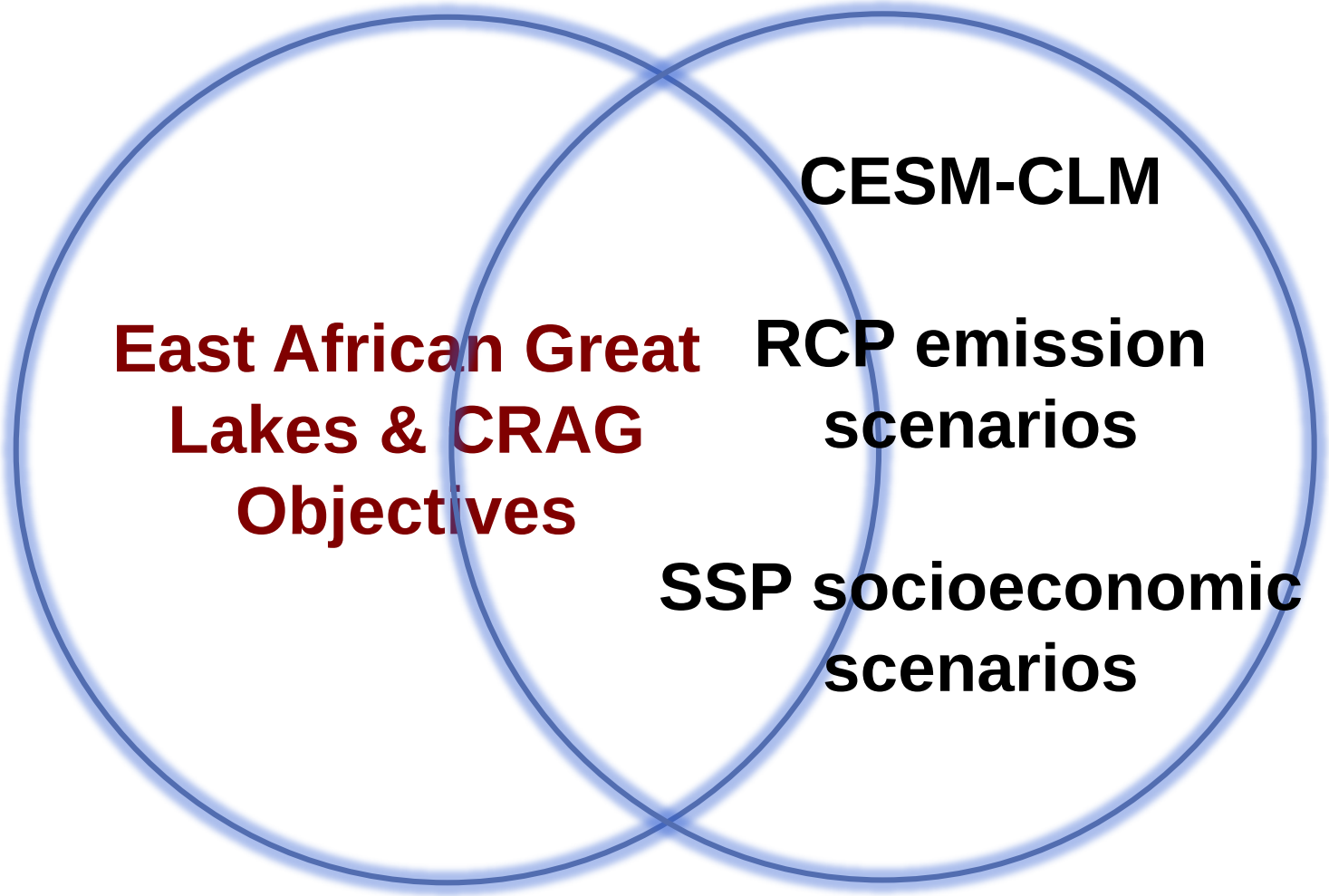

SSP5 - 2090
250000000
200000000
150000000
100000000
50000000
0
uganda
tanzania
congo
malawi
mozamb

Heat stress exposure:

(Populations count)*(average annual number of heat stress days)



Integrating Hi-Tech Science With Practical Need of People On The Ground



Implications

- **There is a great interest and a real need to make the CESM and socioeconomic products available on a practical level at the regional scale.**

Does this actually work? Is it applicable to African countries?

How could these information help the stakeholder?

What can we add to their knowledge?

What are the biases and how can we identify and reduce them?