Climate Change and Biodiversity in Subsaharan Africa

Jeff Price, PhD
Senior Scientist, Climate Change Impacts and Adaptation
World Wildlife Fund

ABCG Meeting 19 July 2011

CENTRE FOR Tropical Biodiversity & Climate Change

CIAT
International Center for Tropical Agriculture
Centro Internacional de Agricultura Tropical
Consultative Group on International Agricultural Research

GBIF

WWF

Wallace Initiative

Mapping the Refugia in a Warming World

Tyndall Centre for Climate Change Research

NCCARF
National Climate Change Adaptation Research Facility

JAMES COOK UNIVERSITY AUSTRALIA

Wallace Initiative

- Mapping refugia, species range shifts and climate migratory pathways
  - For 50,000 species
  - For 50 major crops
- Design of future protected area systems
- So far, have used more than 60,000 hours of computing time…….

Identifying Refugia

- Macro- refugia by climate sensitivity, probability of species loss
- Limited in scale to best practices in climate change downscaling – 0.5 x 0.5 lat/long in most of the world

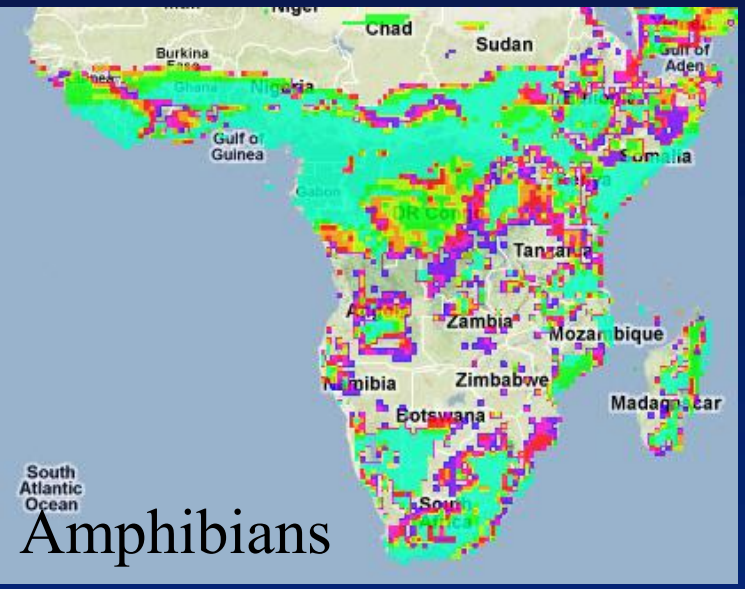
Refugia vs. Areas of Concern

- Refugia - an area projected to remain climatically suitable for >75% of the species modeled – modified business as usual conservation

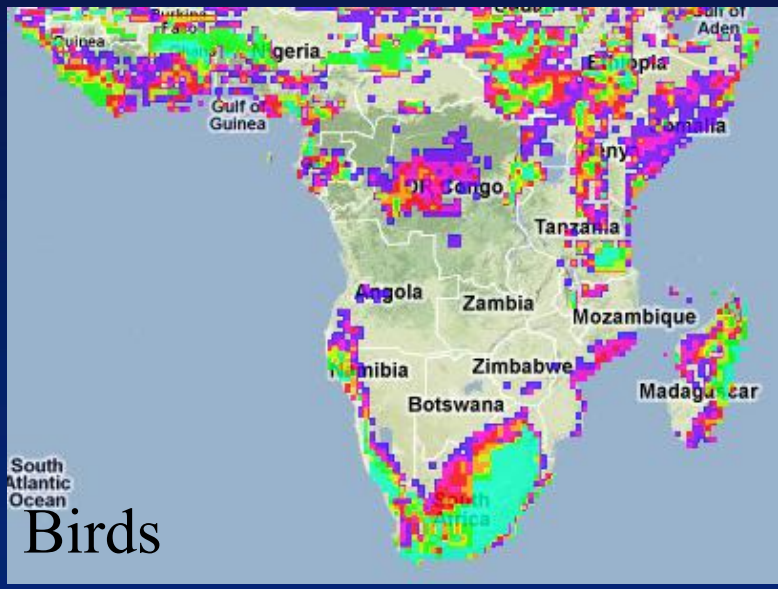
- Area of Concern - an area projected to become climatically unsuitable for >75% of the species modeled – new conservation strategies will be required

ADAPTATION IS A JOURNEY, NOT A DESTINATION.

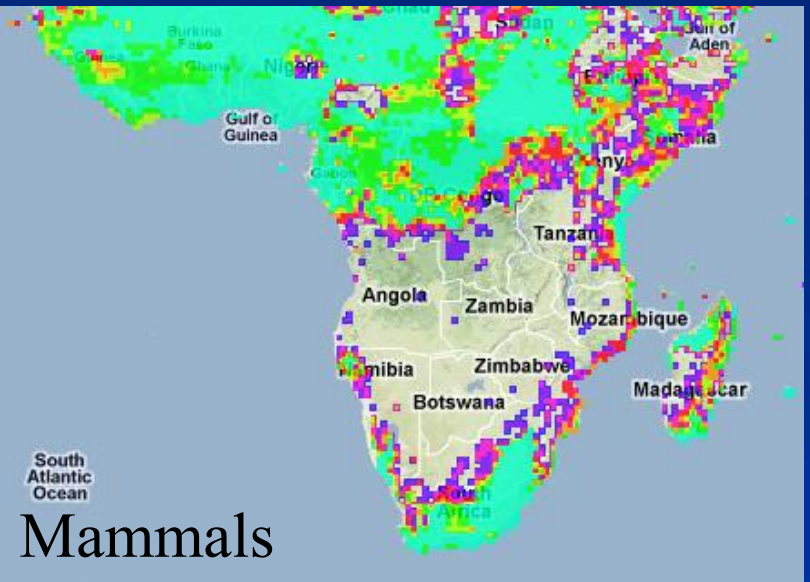
Refugia ~2°C



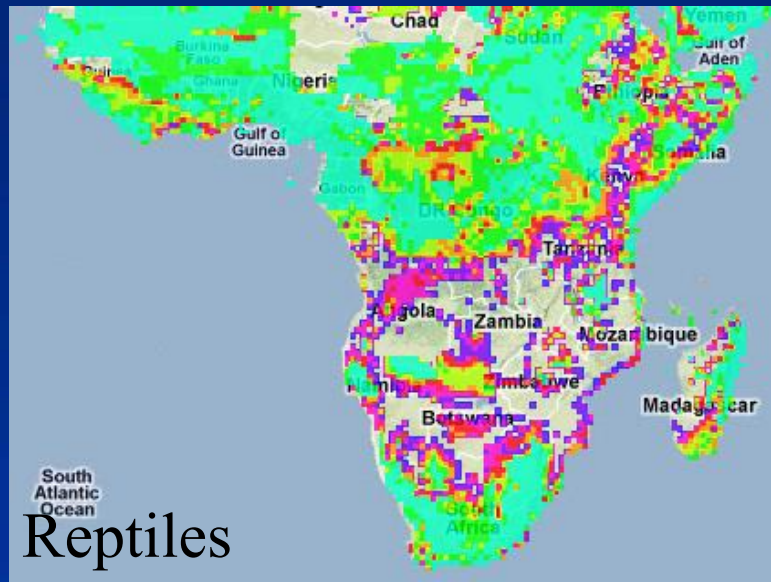
Amphibians



Birds

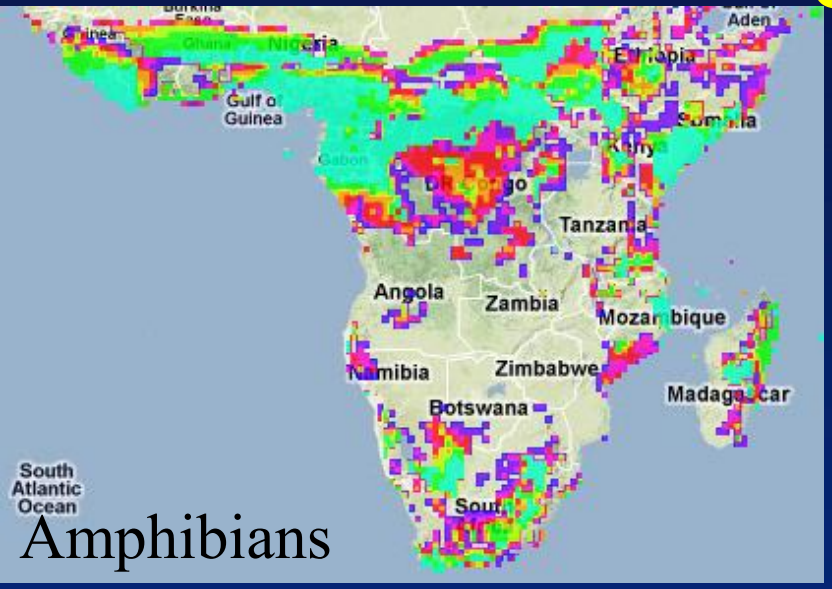


Mammals

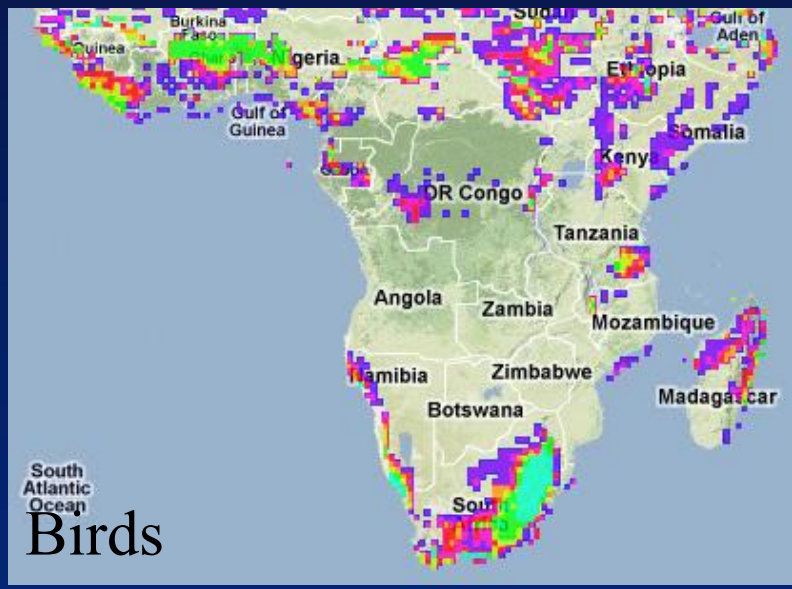


Reptiles

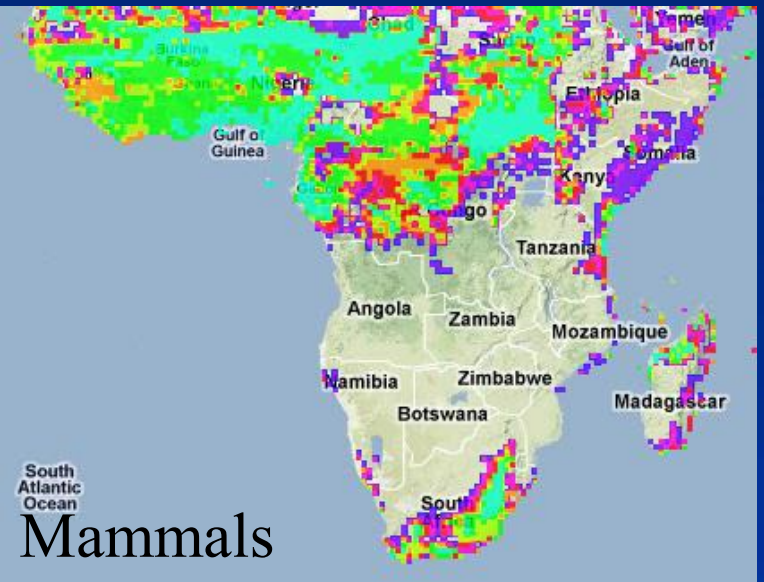
Refugia ~3.5°C



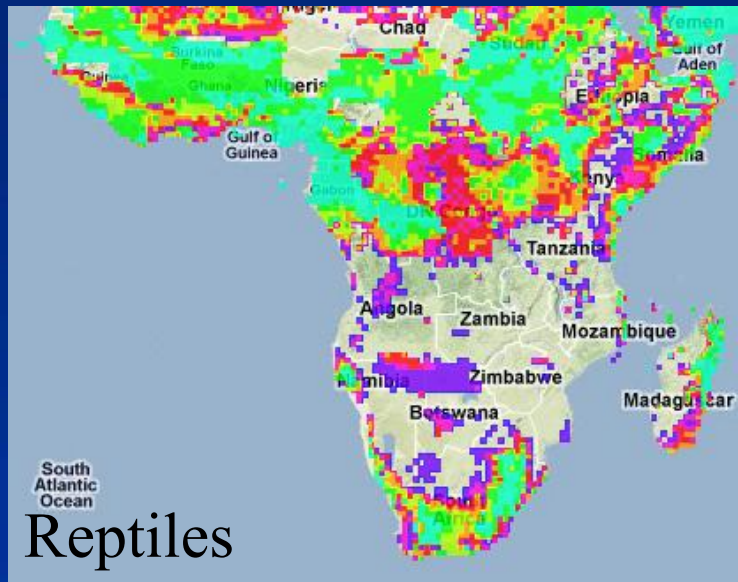
Amphibians



Birds

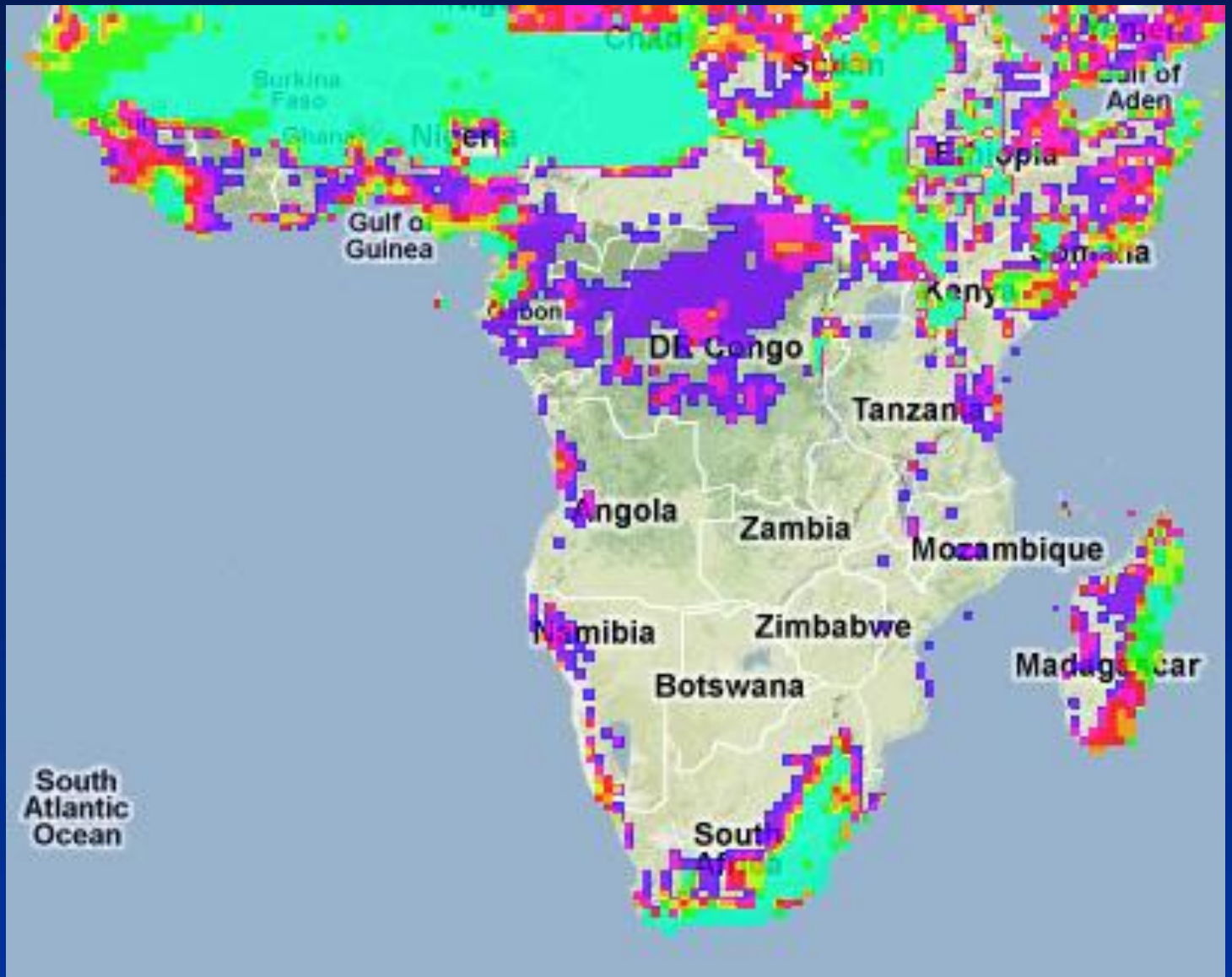


Mammals

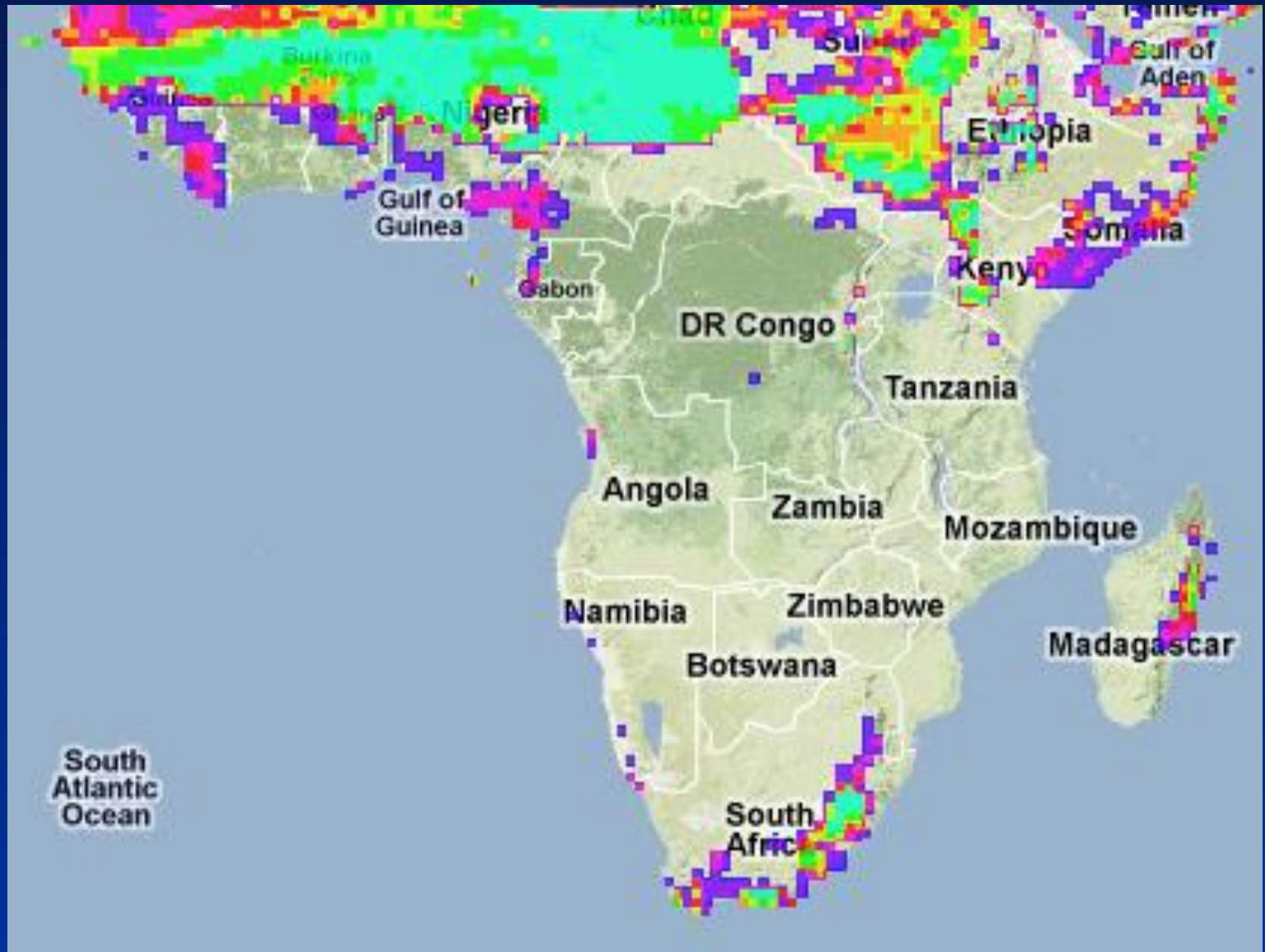


Reptiles

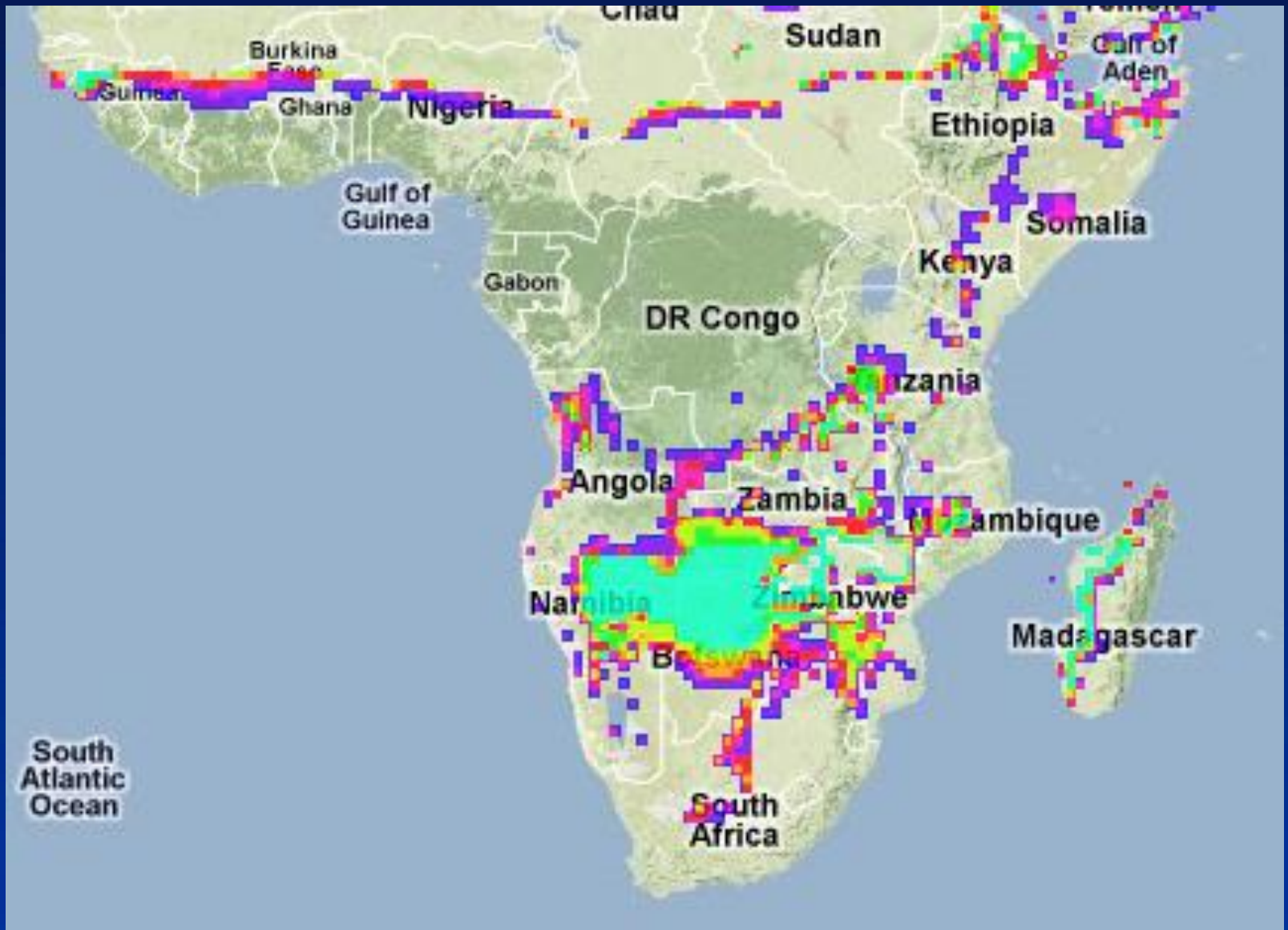
Plant Refugia ~2°C



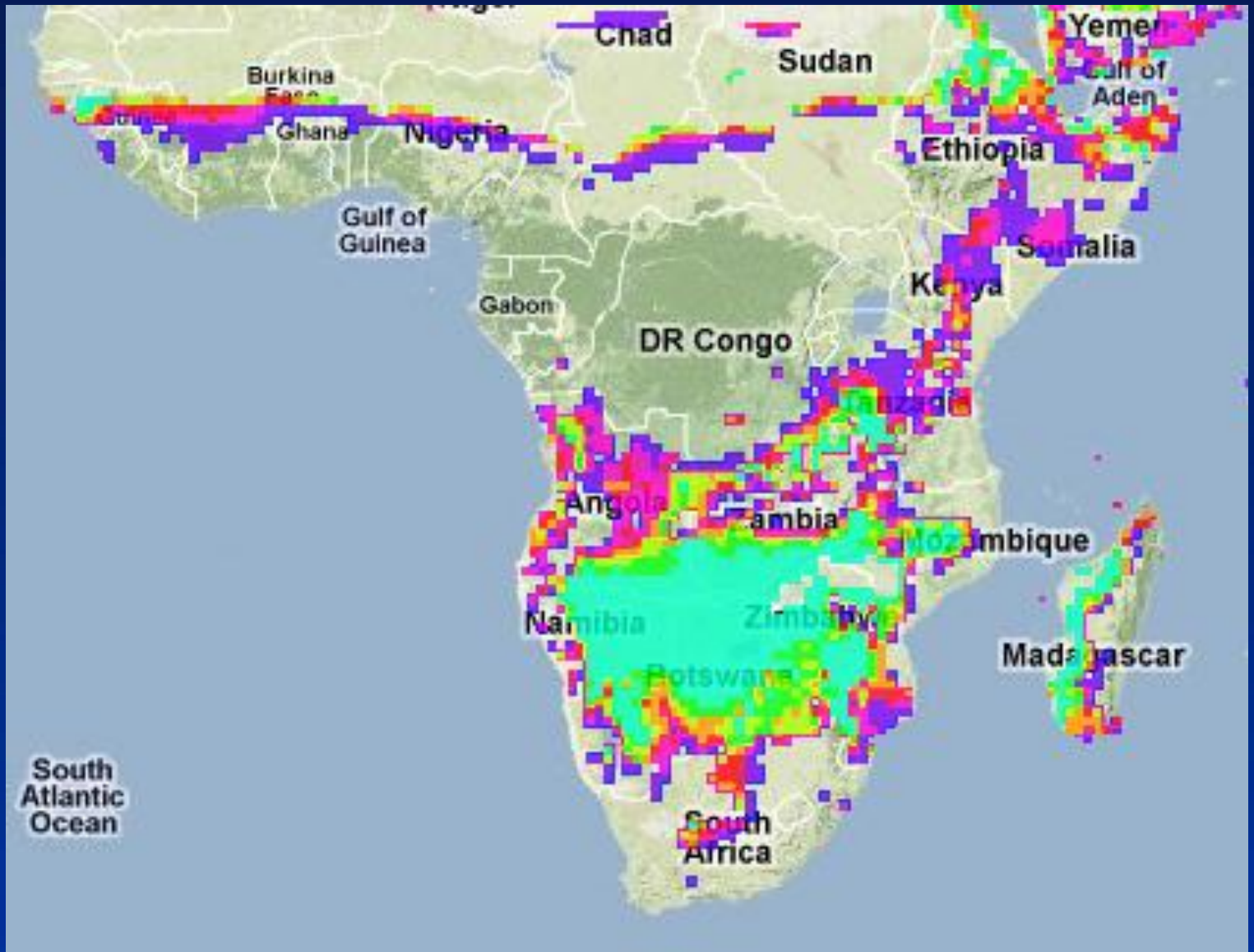
Plants Refugia ~3.5°C



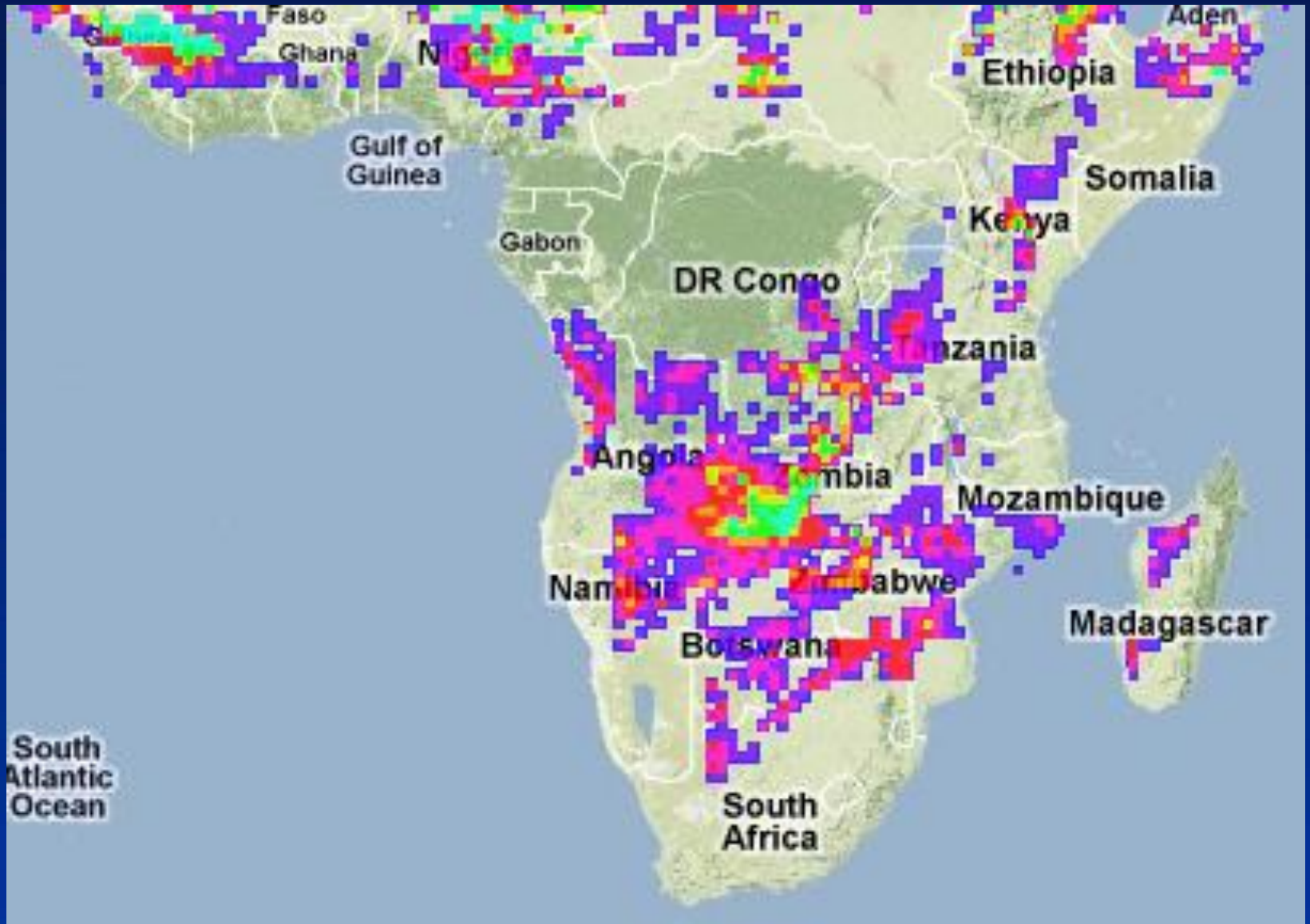
Amphibians AOC ~2°C



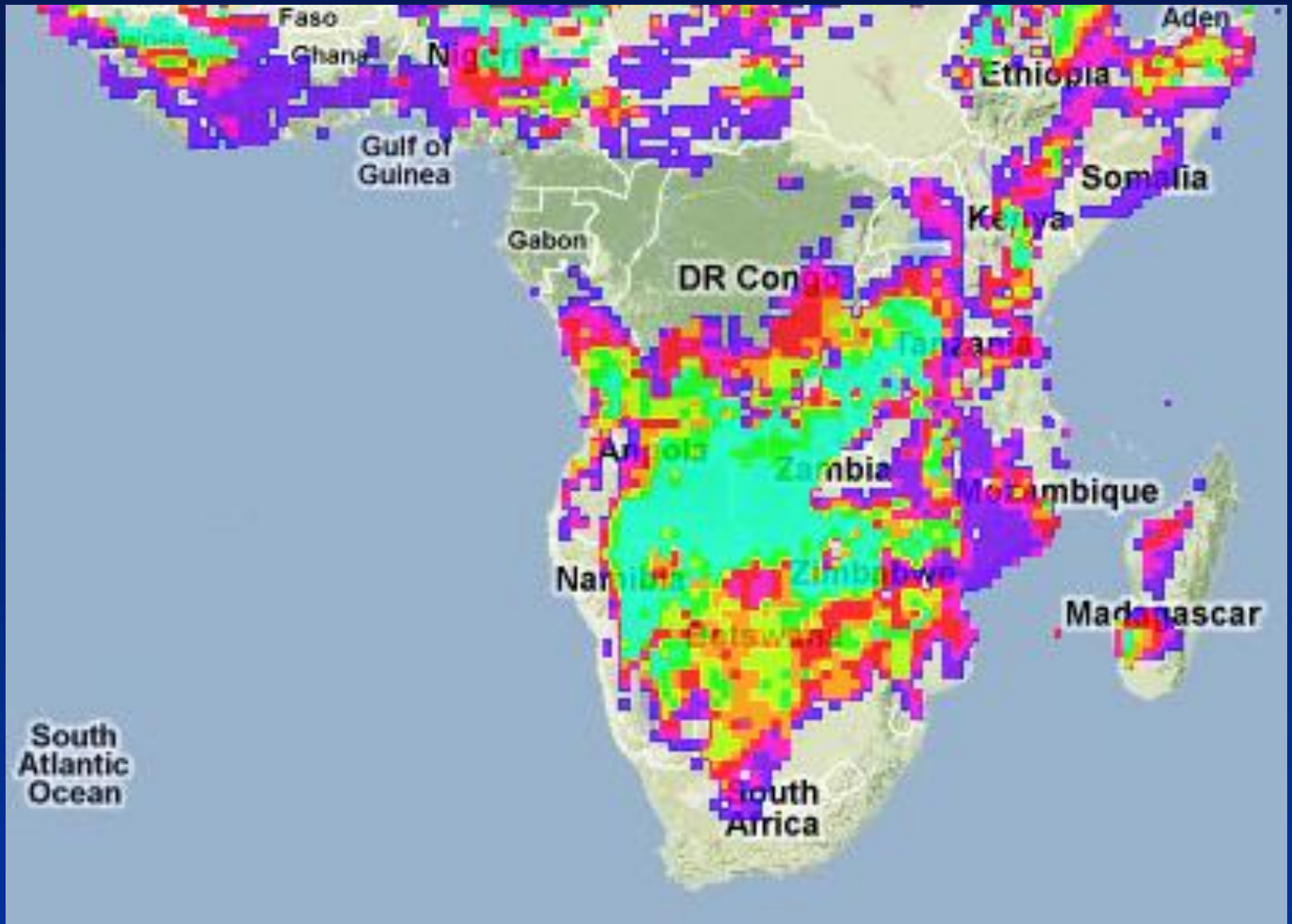
Amphibians AOC ~3.5°C



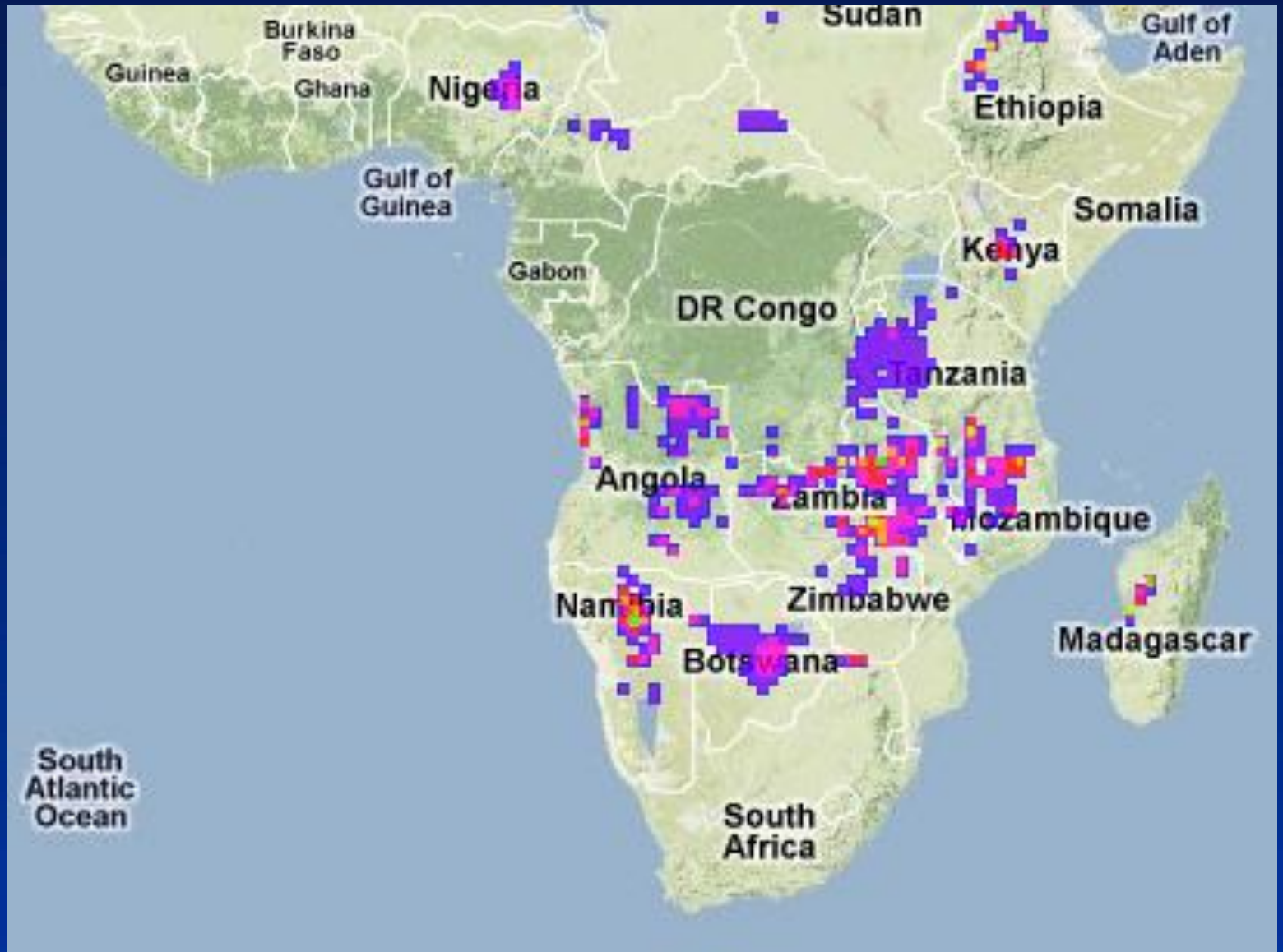
Birds AOC ~2°C


Ghana
Ethiopia
Gulf of Guinea
Somalia
Gabon
DR Congo
Mozambique
Madagascar
South Atlantic Ocean
South Africa

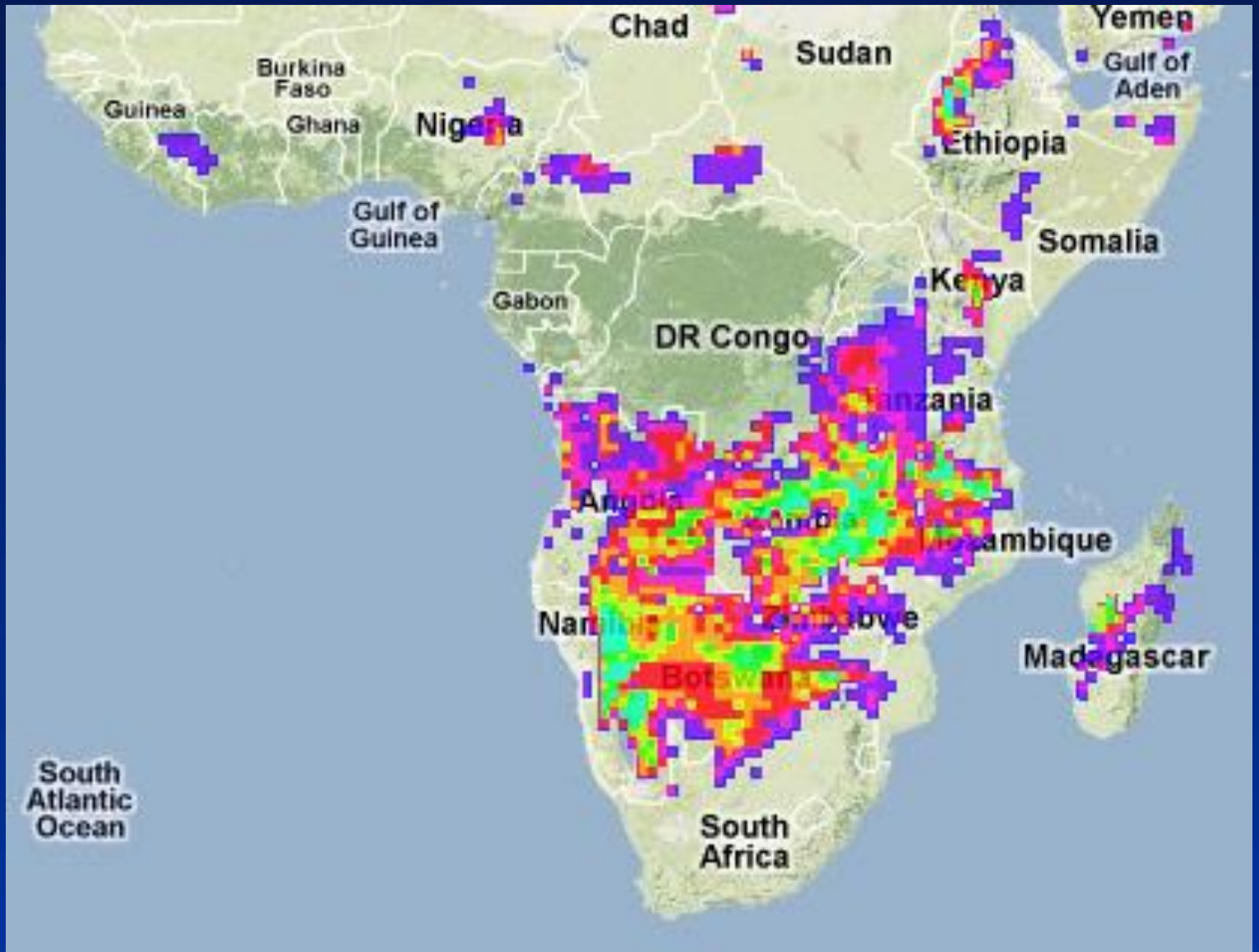
Birds AOC ~3.5°C



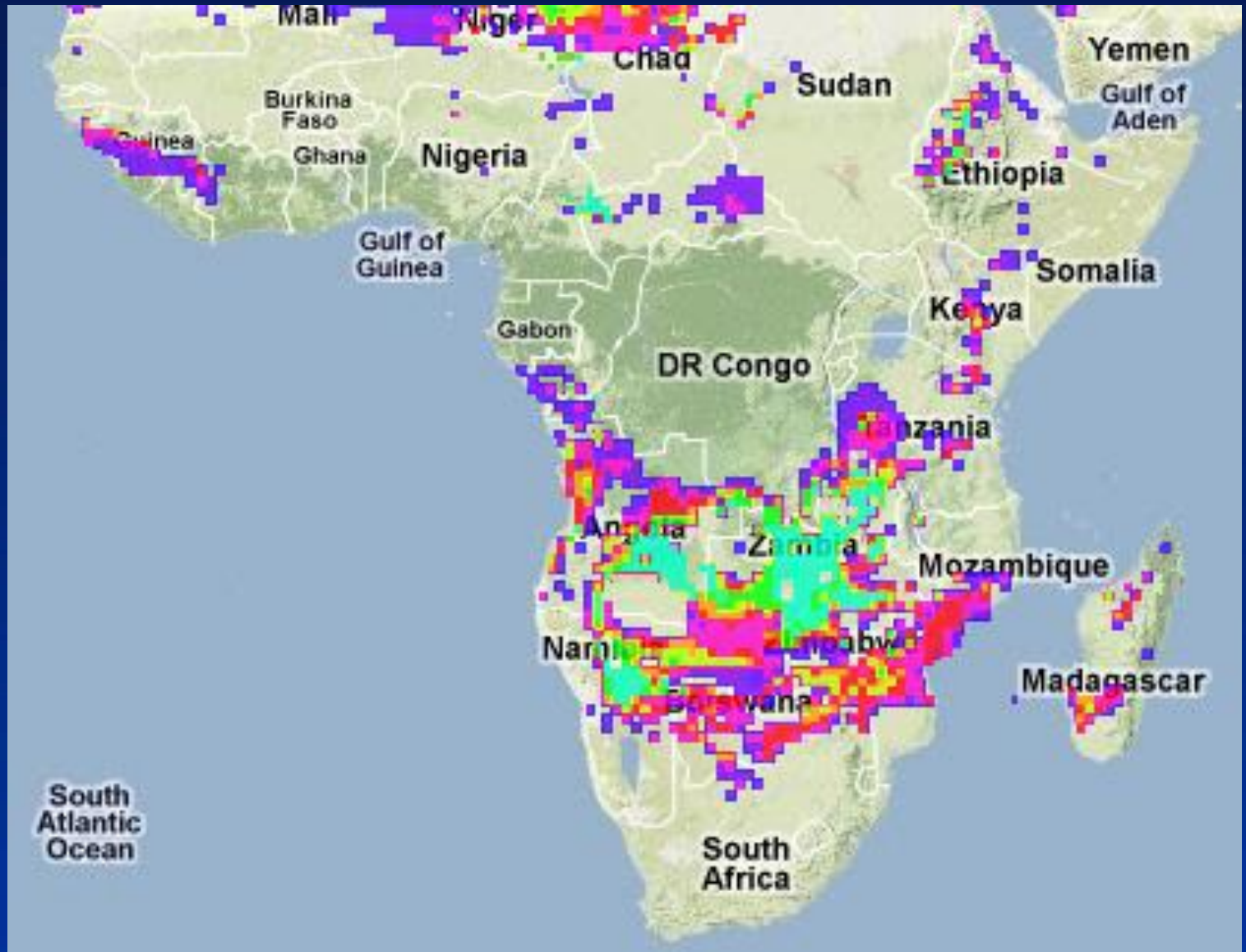
Mammals AOC ~2°C



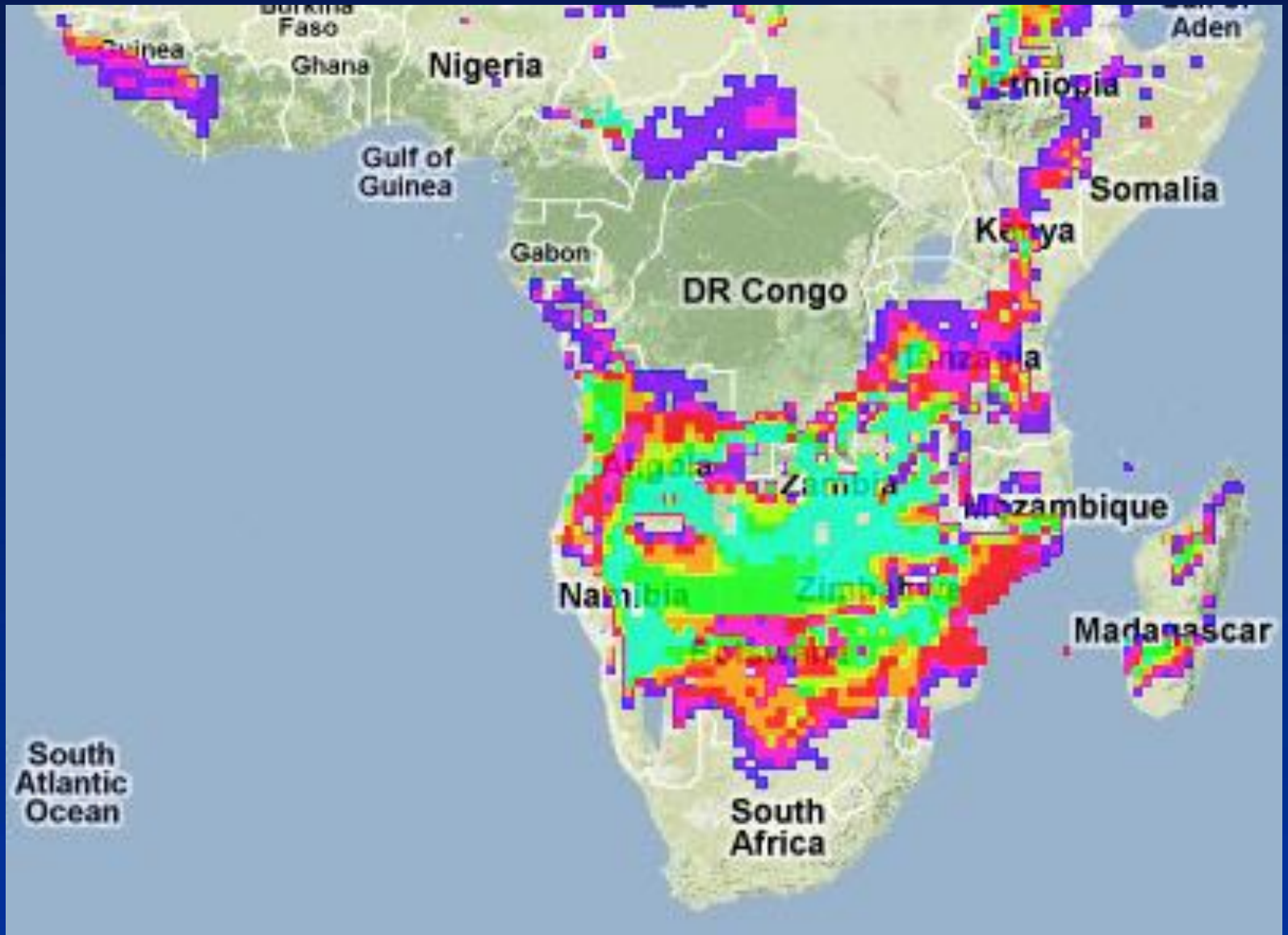
Mammals AOC ~3.5°C



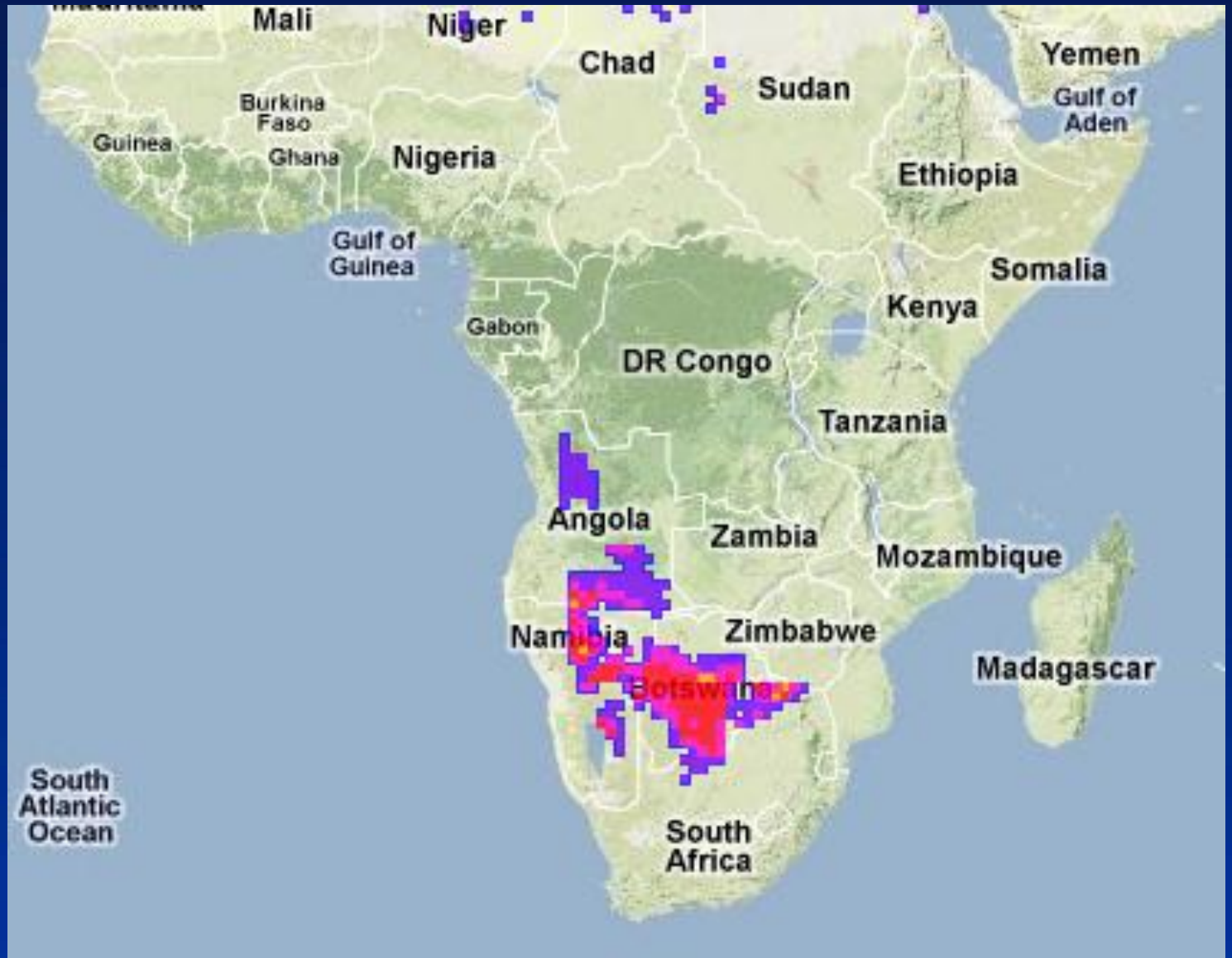
Reptiles AOC ~2°C



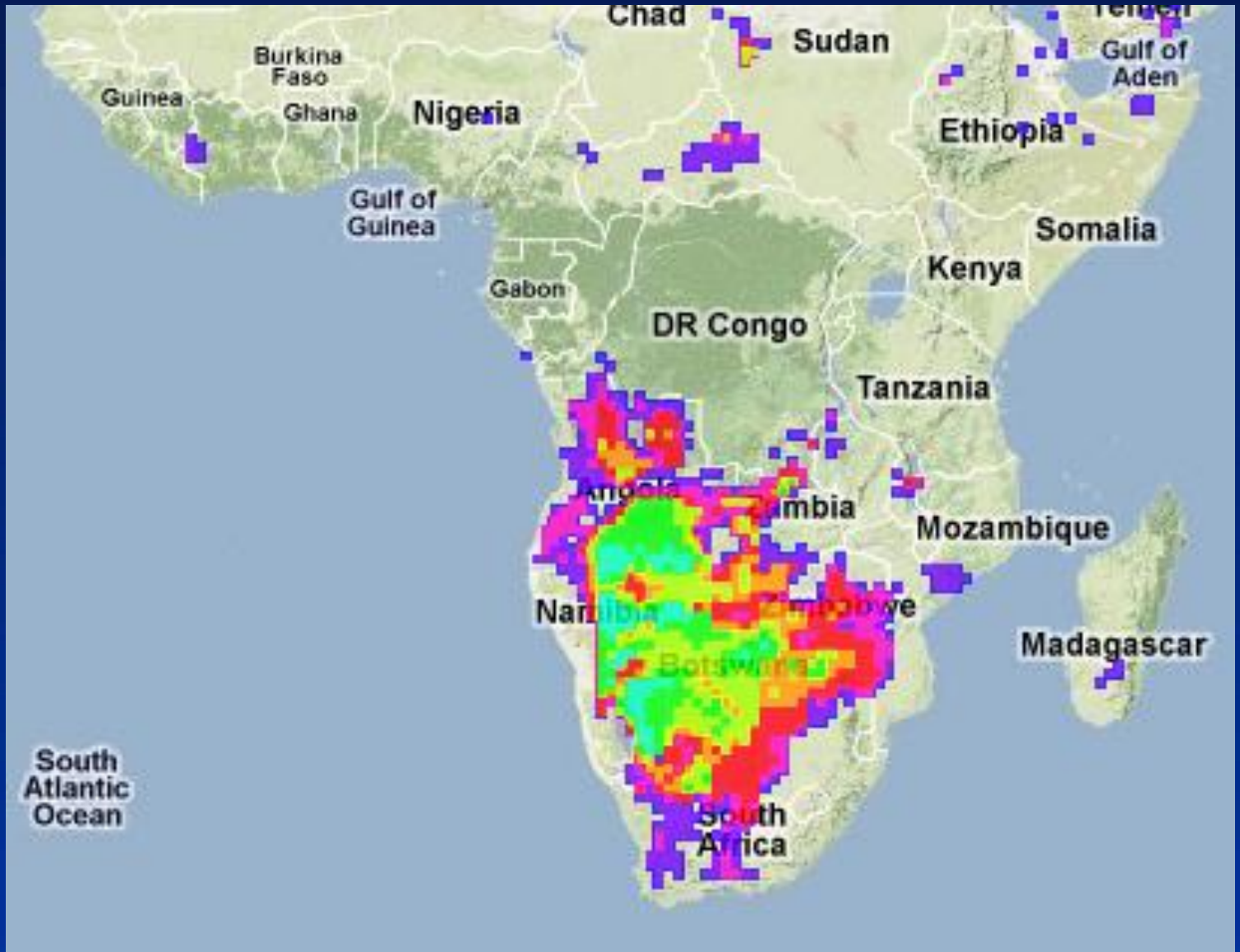
Reptiles AOC ~3.5°C



Plants AOC ~2°C



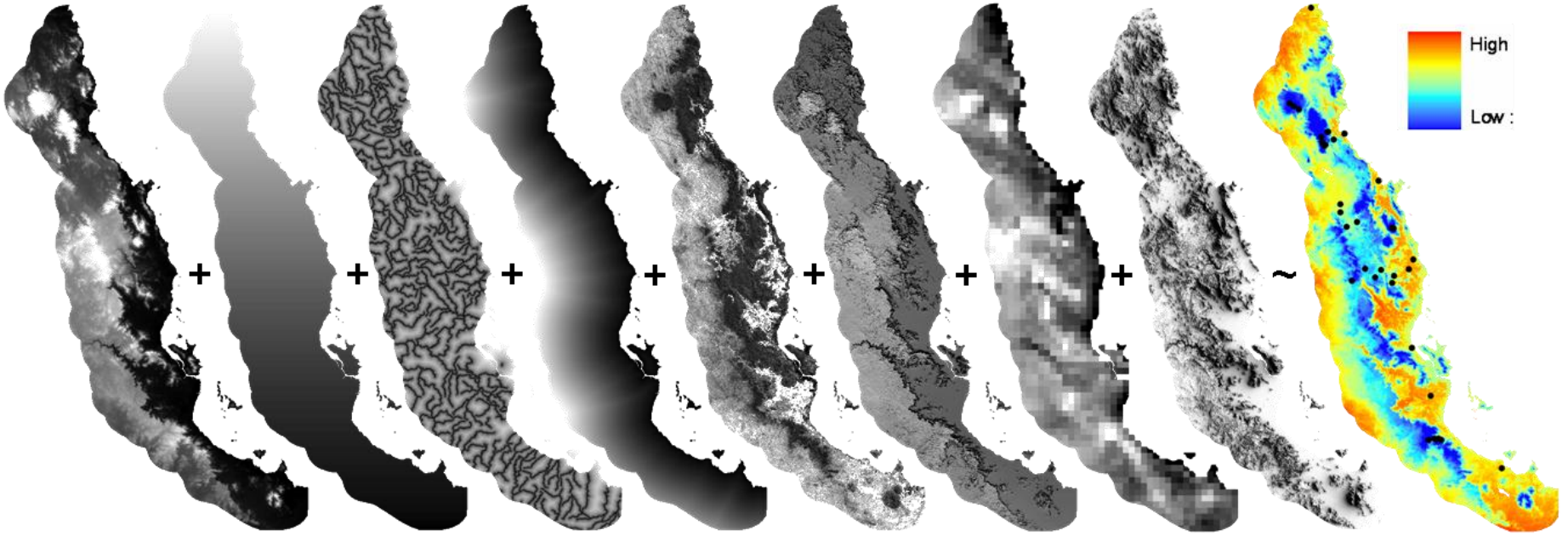
Plants AOC ~3.5°C

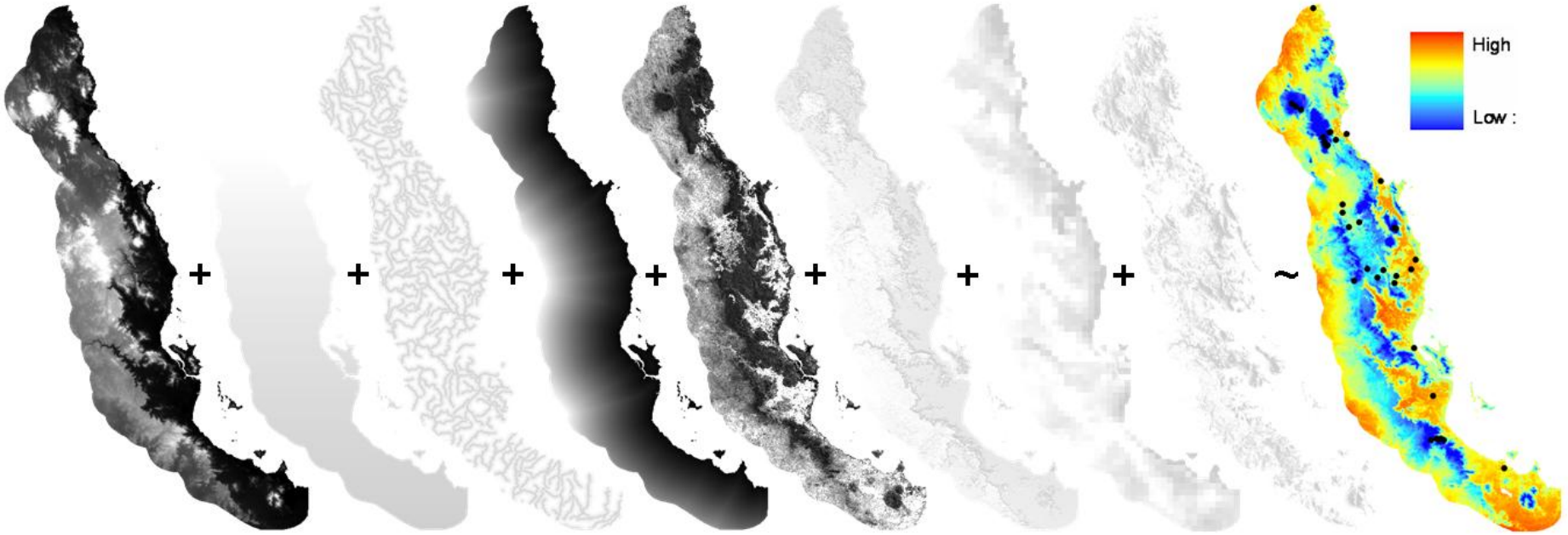


Identifying Refugia

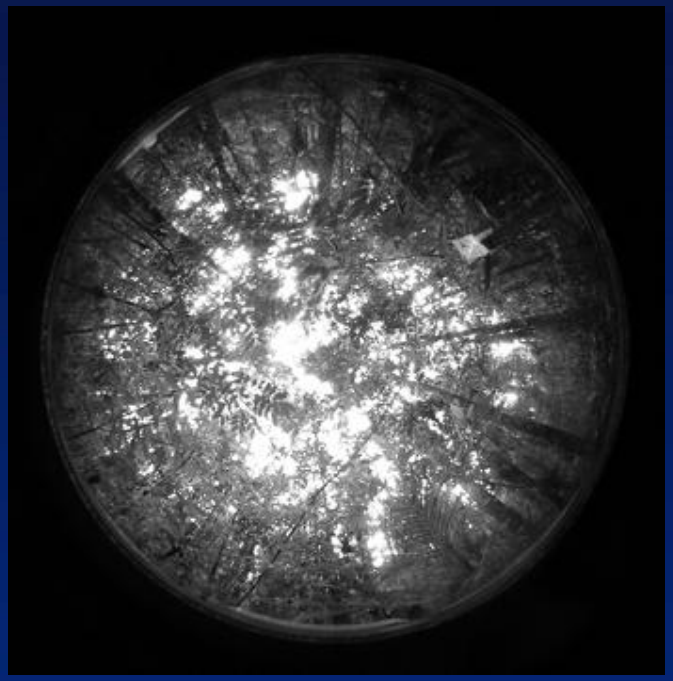
- Meso-refugia, areas buffered from change occurring at the macro-level
  - Abiotic – elevation, slope, aspect, distance to stream, distance to coast
  - Biotic – canopy closure
- Can be calculated at a 1 km x 1 km scale and other factors can operate at even smaller scales

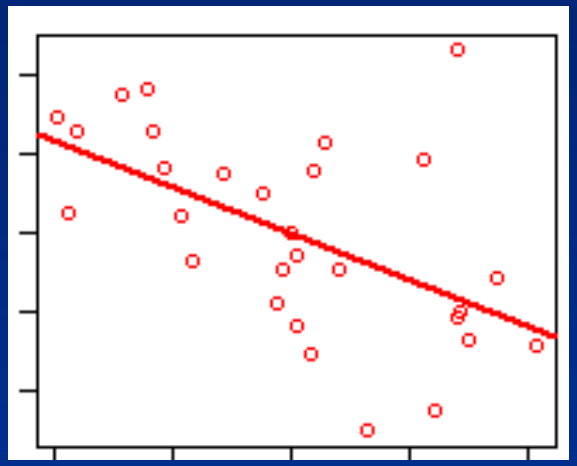
Factors mediating temperature…

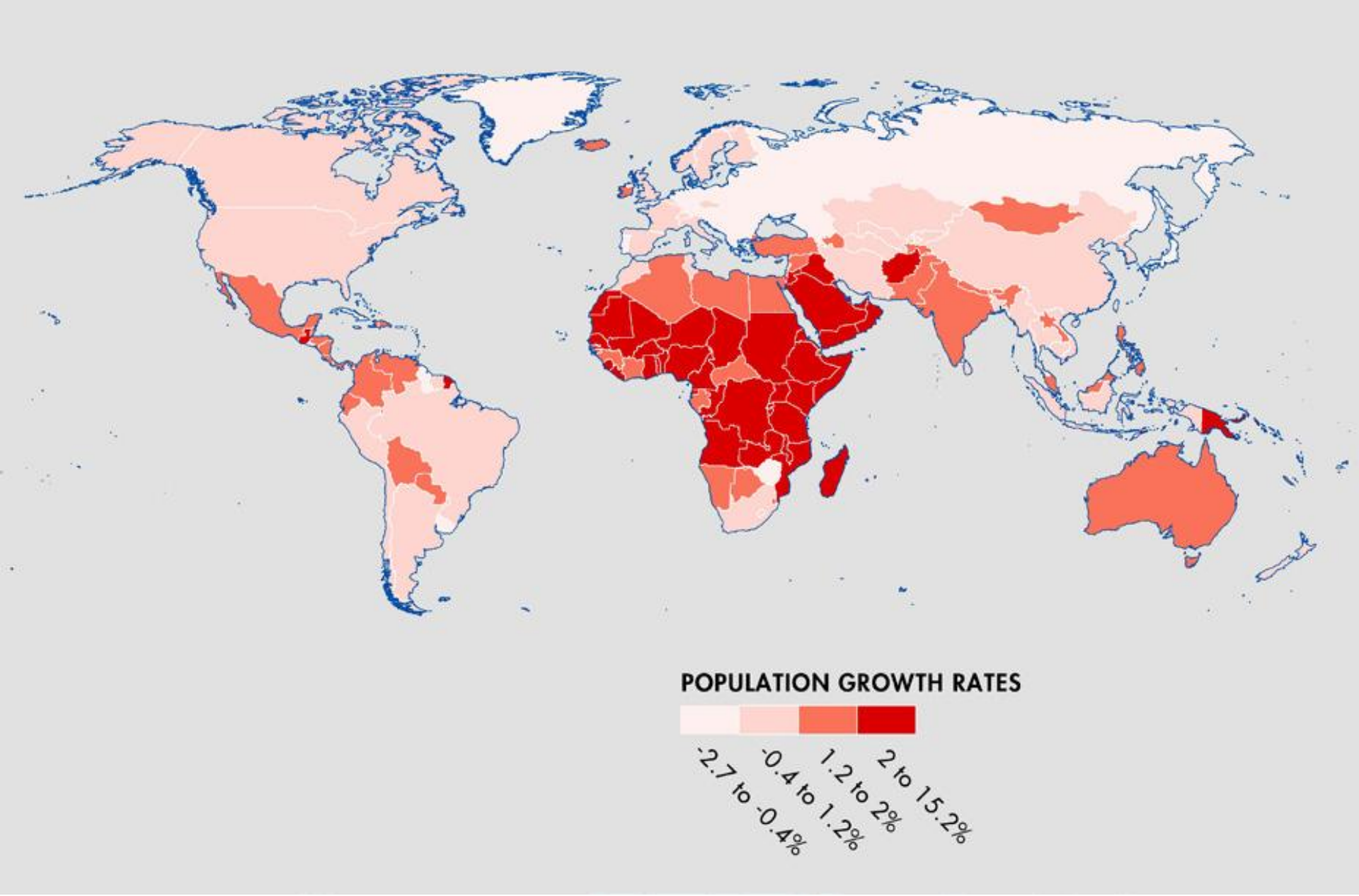



High
Low :
elevation
latitude
distance to stream
distance to coast
foliage cover
clear sky radiation
cloud offset
wind exposure
maximum temperature

A role for foliage cover

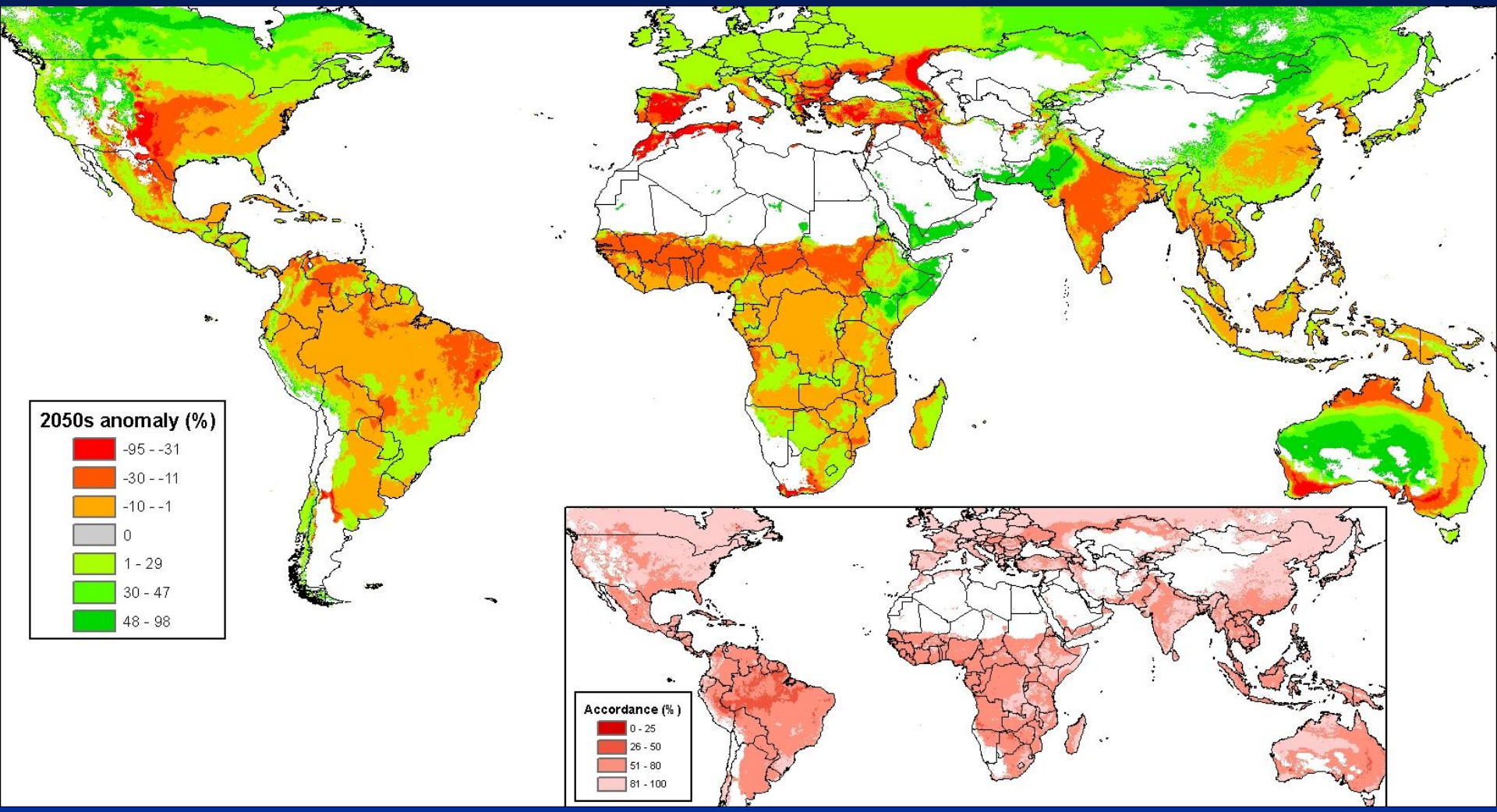


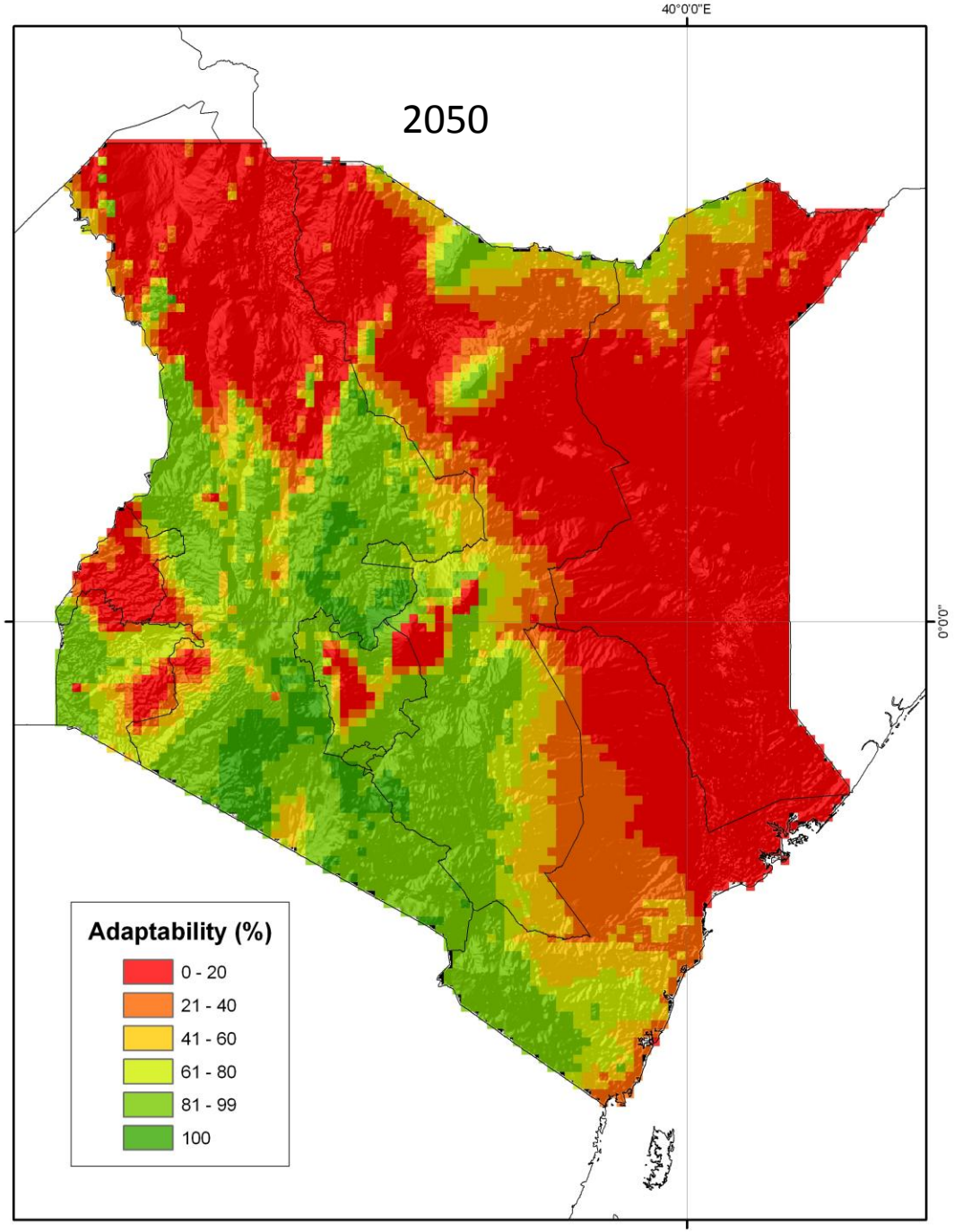




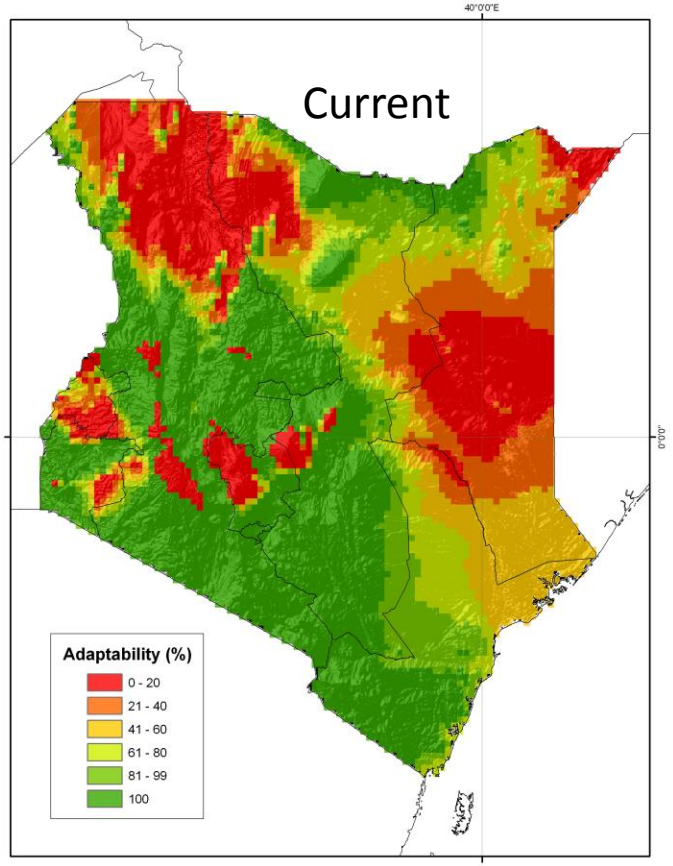
Source: United Nations, Department of Economic and Social Affairs, Population Division. 2011. *World Population Prospects: The 2010 Revision.* New York: United Nations.

Average change in suitability for all crops in 2050s

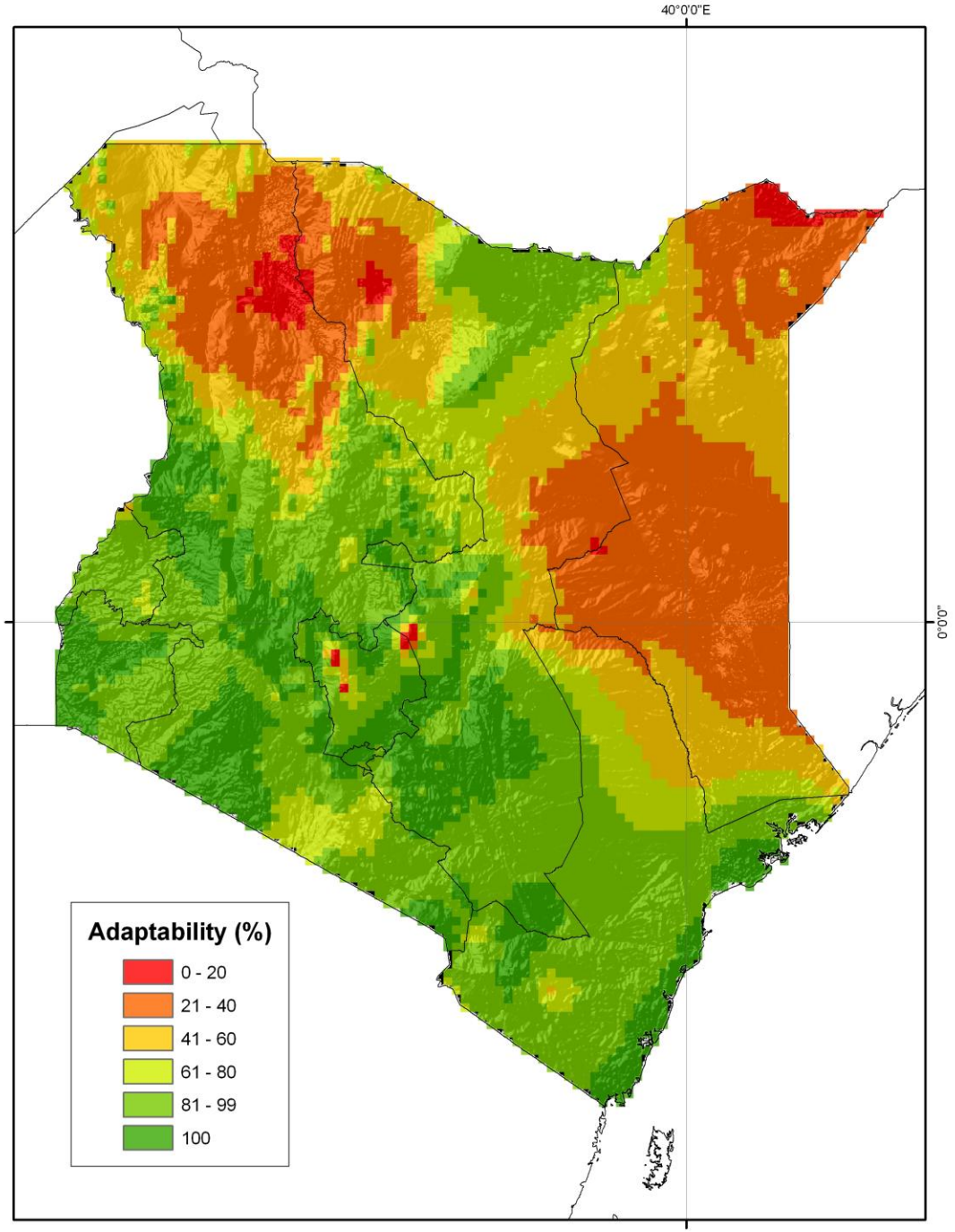


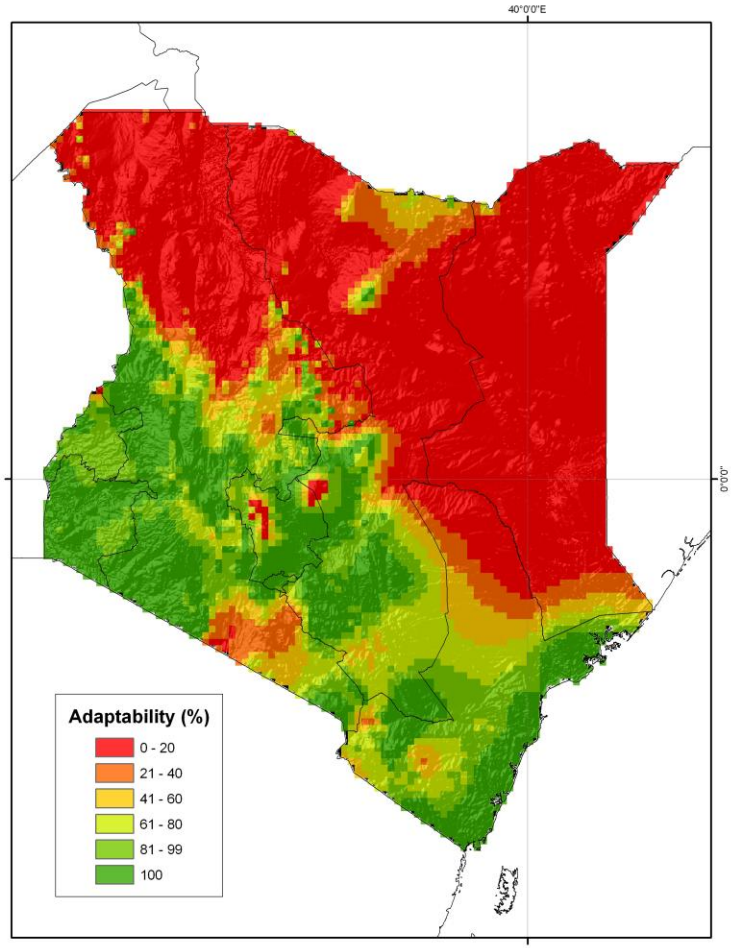


Suitability for bean as a crop in Kenya in 2050, A2 (high) scenario, ensemble of 18 GCMs; red is reduced suitability, green is increased suitability. Map from the CIAT ecocrop project.

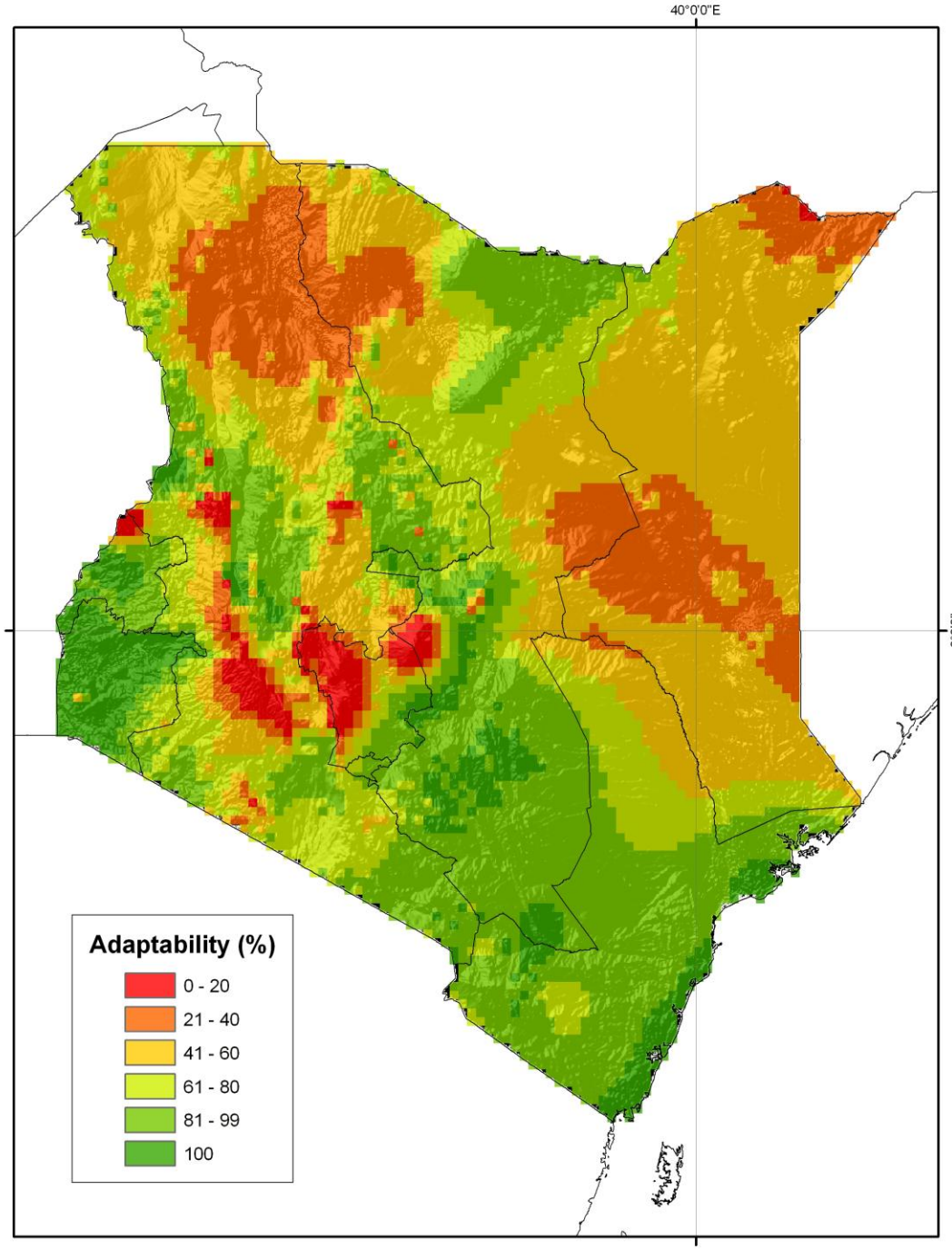


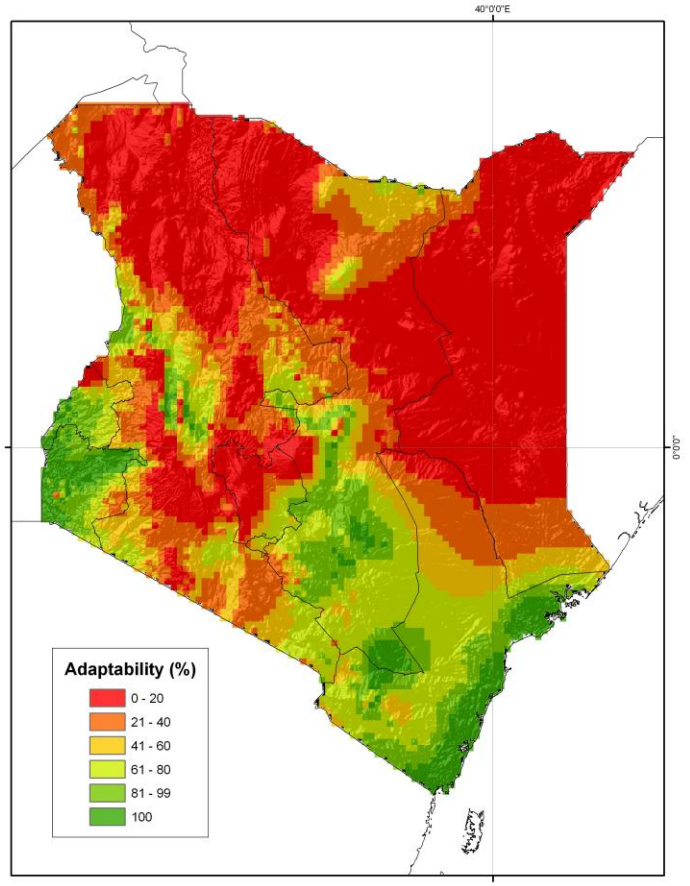
Suitability for cashew as a crop in Kenya in 2050, A2 (high) scenario, ensemble of 18 GCMs; red is reduced suitability, green is increased suitability. Map from the CIAT ecocrop project.



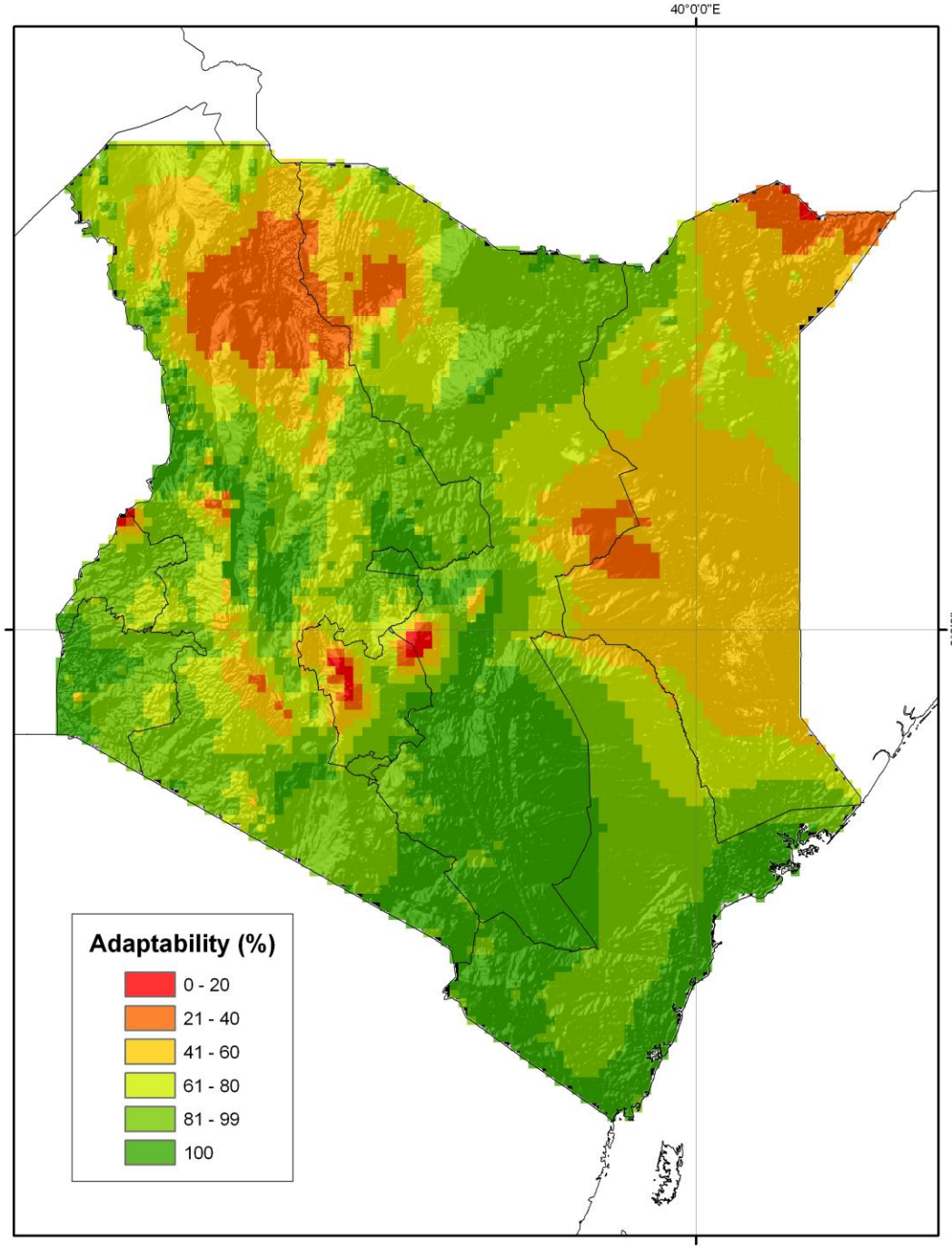


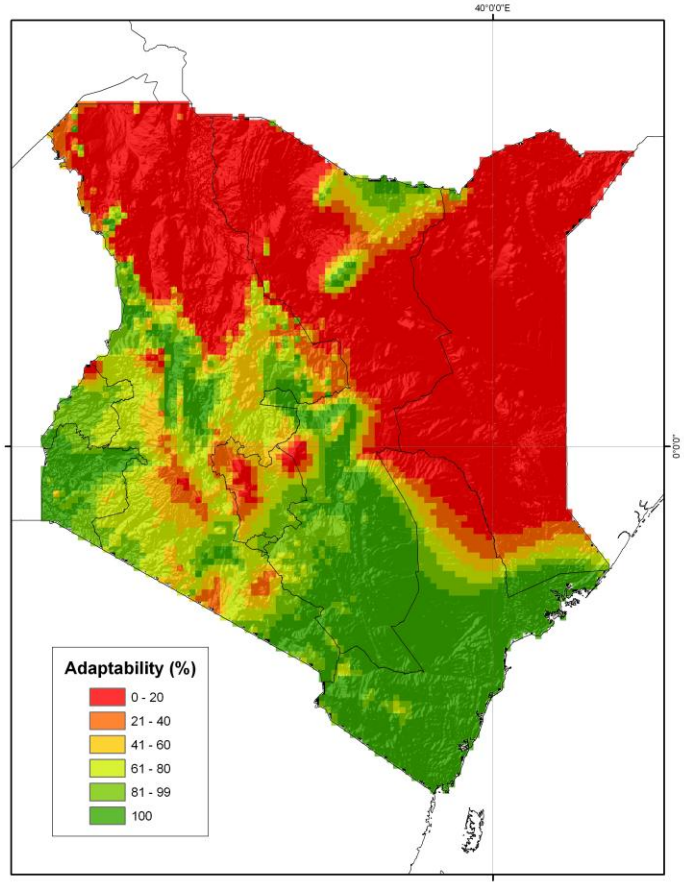
Suitability for cassava as a crop in Kenya in 2050, A2 (high) scenario, ensemble of 18 GCMs; red is reduced suitability, green is increased suitability. Map from the CIAT ecocrop project.

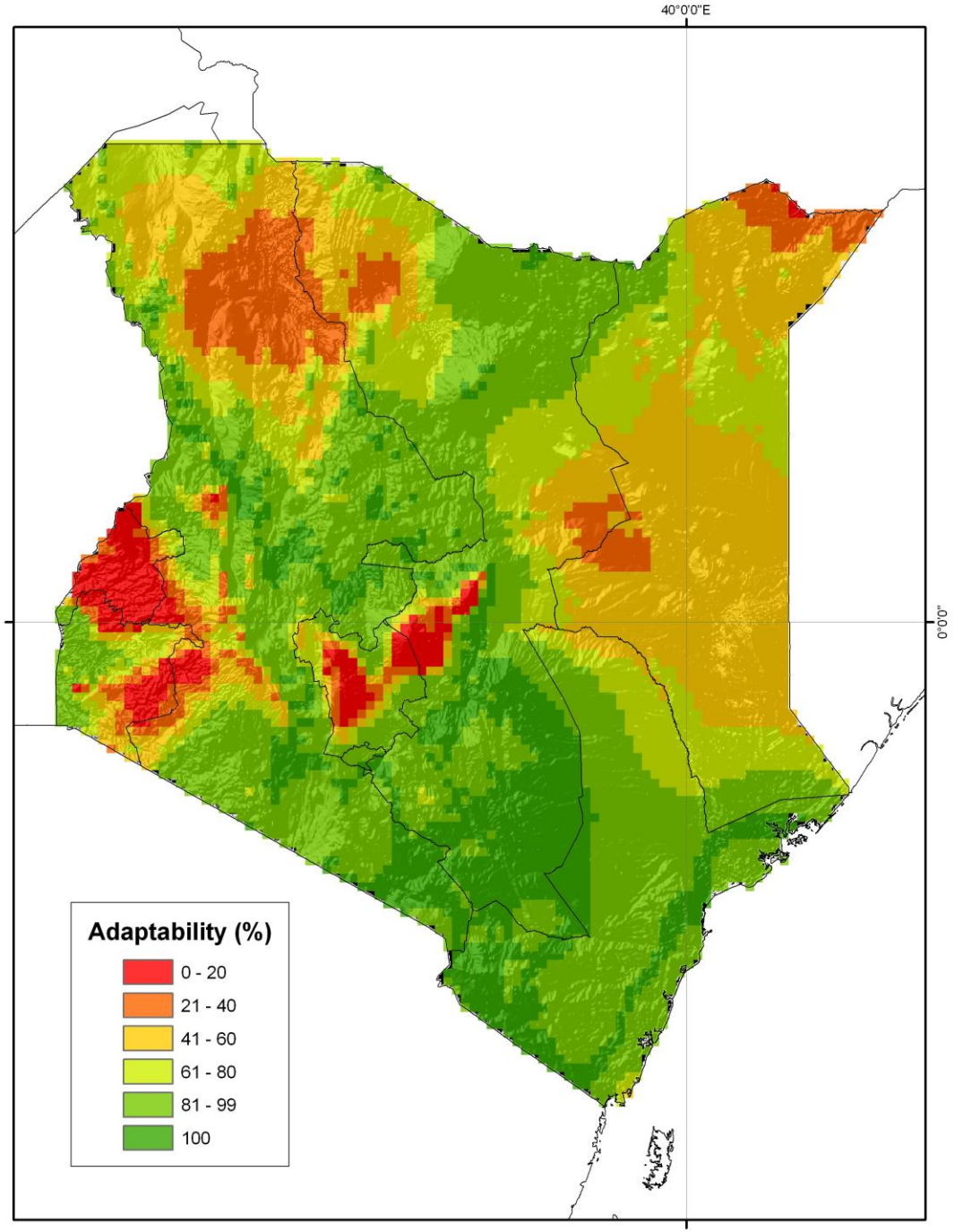




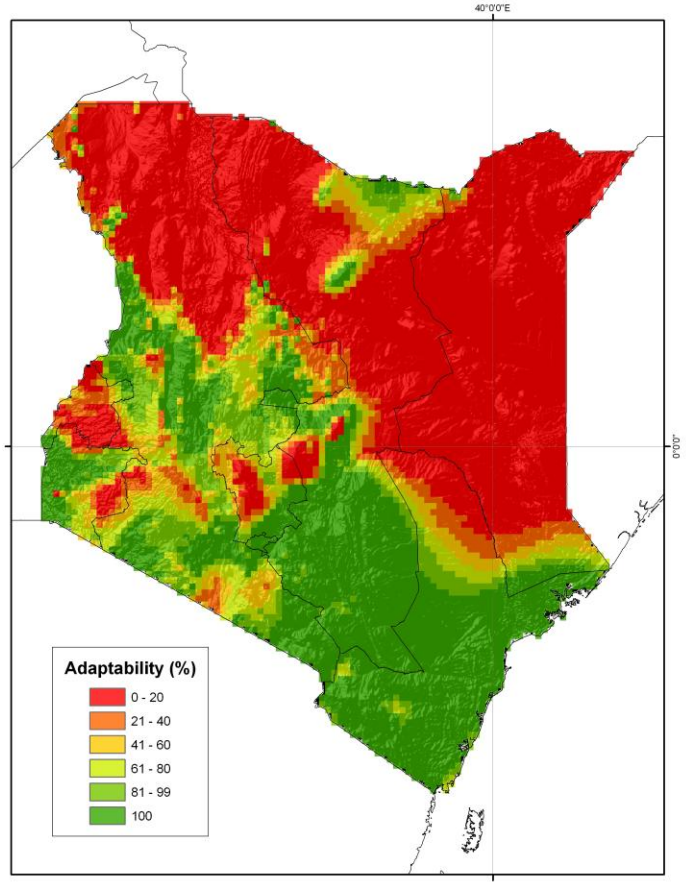
Suitability for ground nut as a crop in Kenya in 2050, A2 (high) scenario, ensemble of 18 GCMs; red is reduced suitability, green is increased suitability. Map from the CIAT ecocrop project.



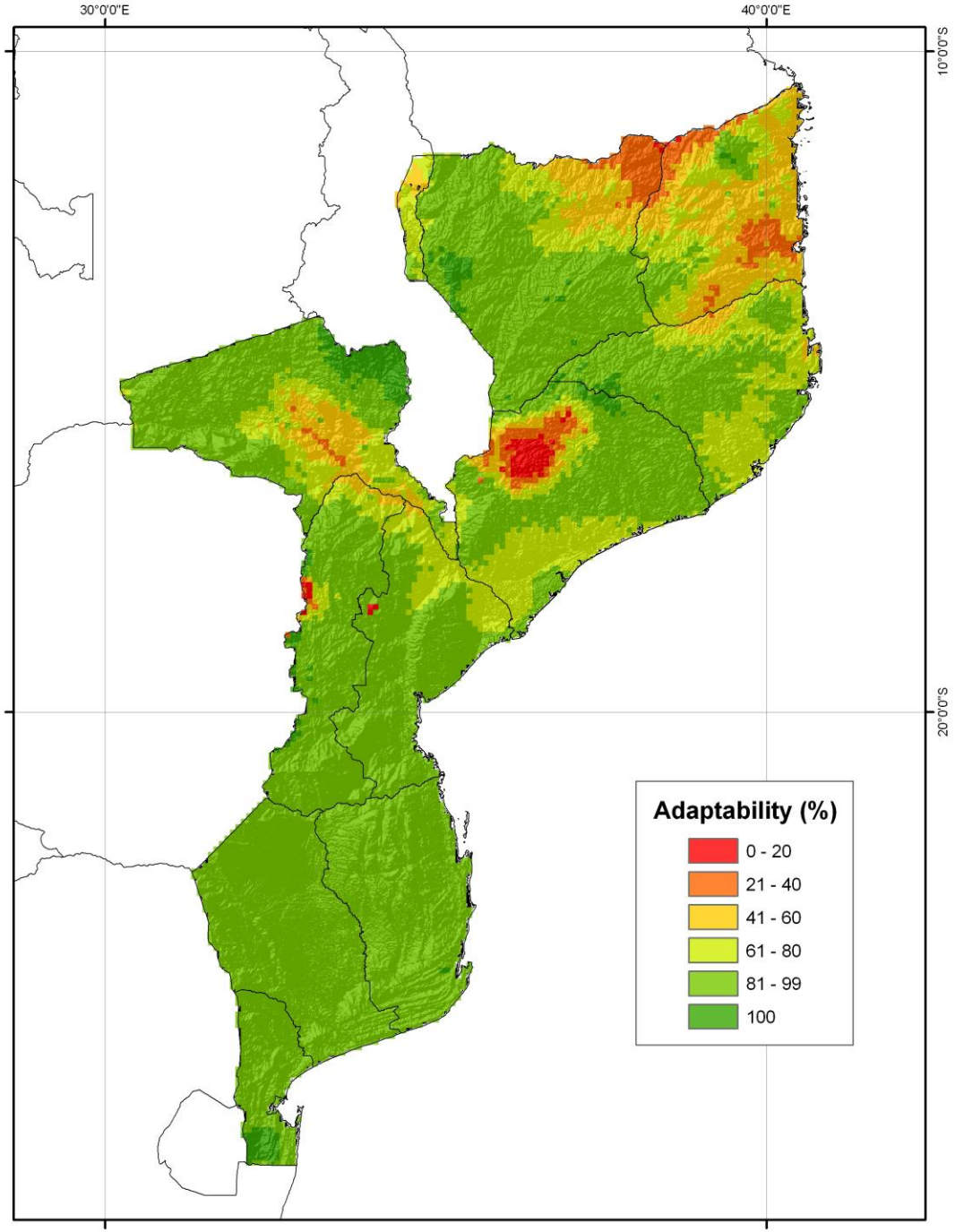


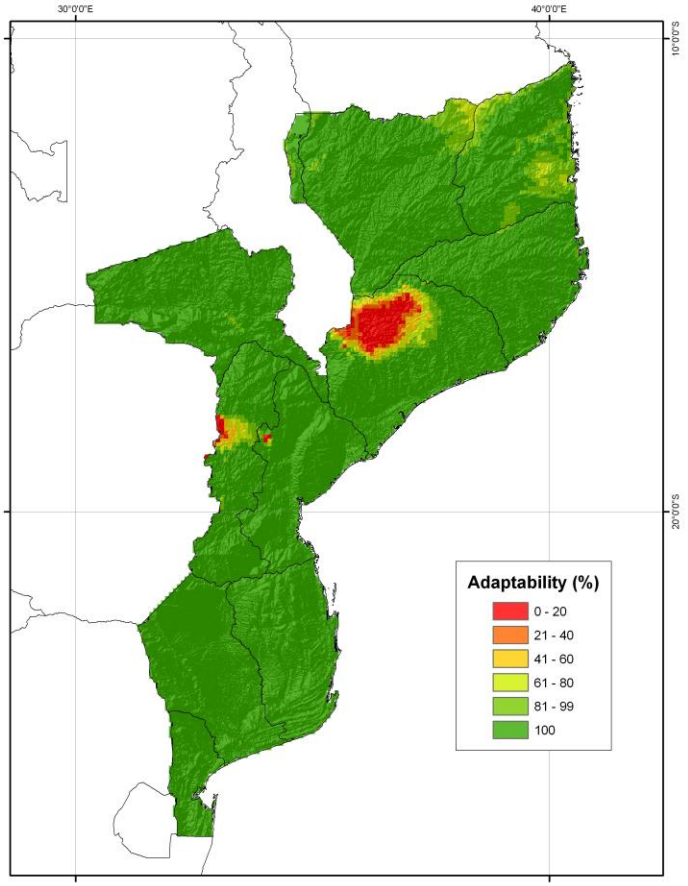


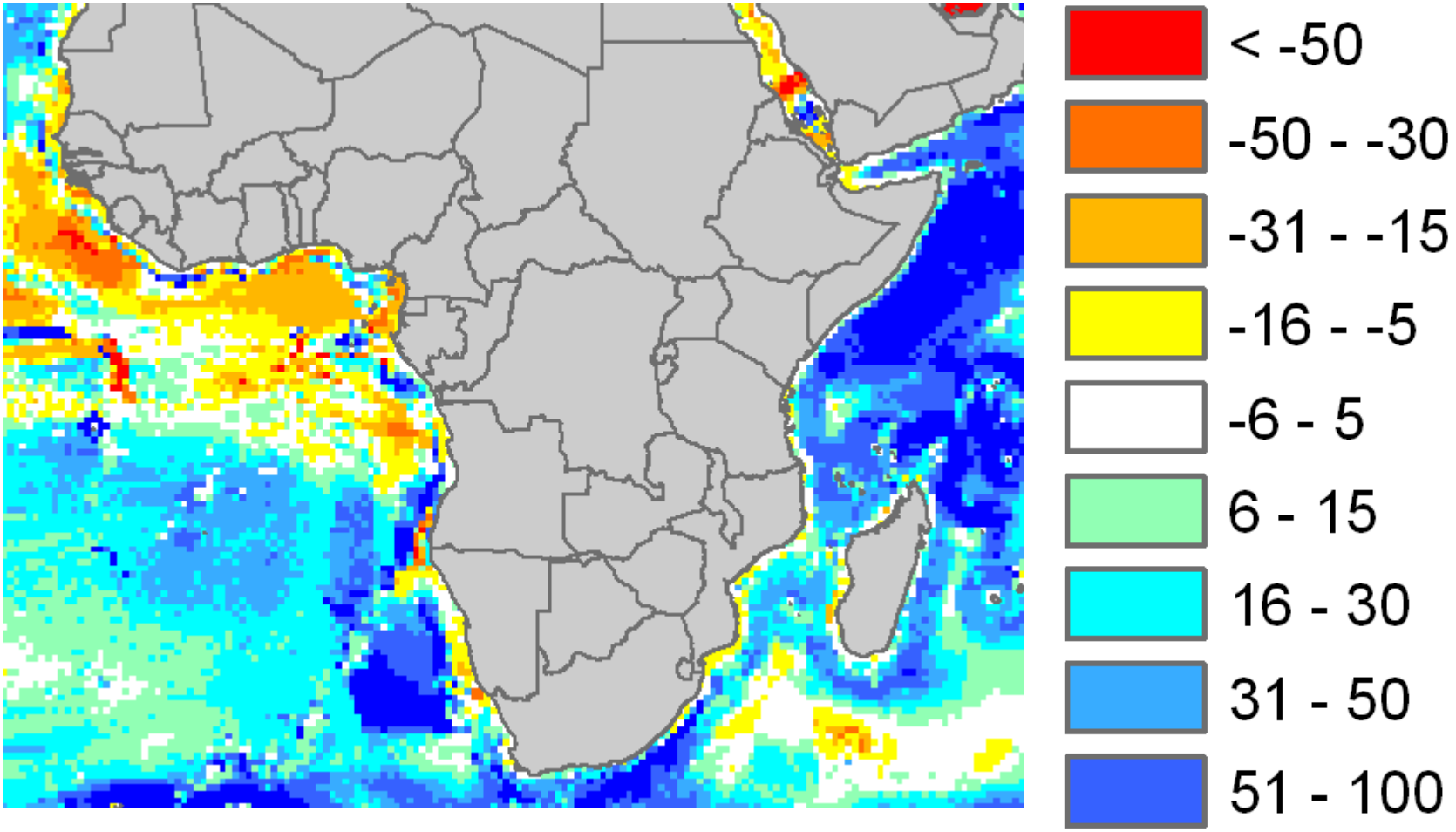
Suitability for maize as a crop in Kenya in 2050, A2 (high) scenario, ensemble of 18 GCMs; red is reduced suitability, green is increased suitability. Map from the CIAT ecocrop project.



Suitability for bean as a crop in Mozambique in 2050, A2 (high) scenario, ensemble of 18 GCMs; red is reduced suitability, green is increased suitability. Map from the CIAT ecocrop project.







Change in catch yield (%) compared to 2005