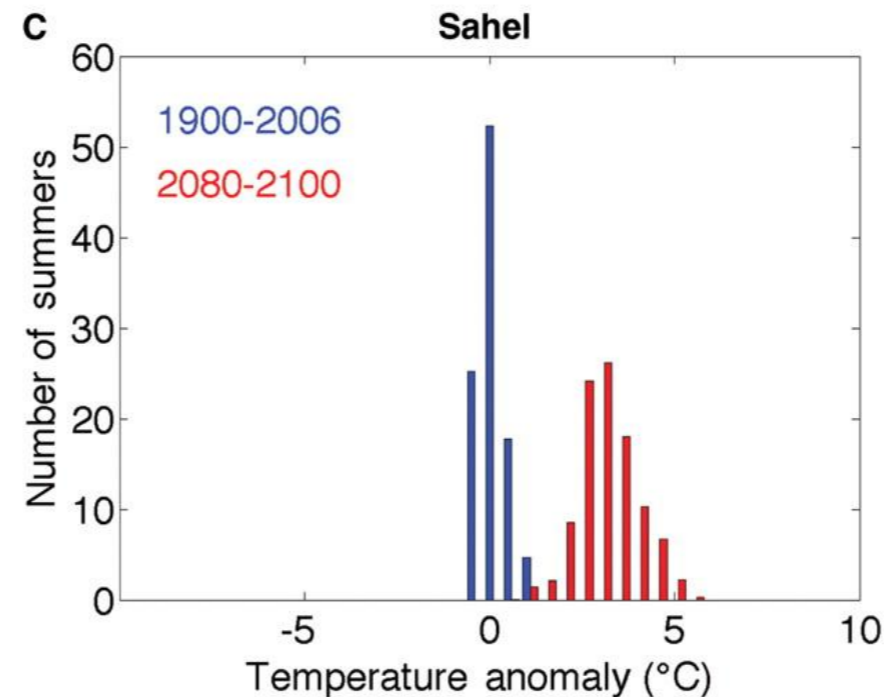
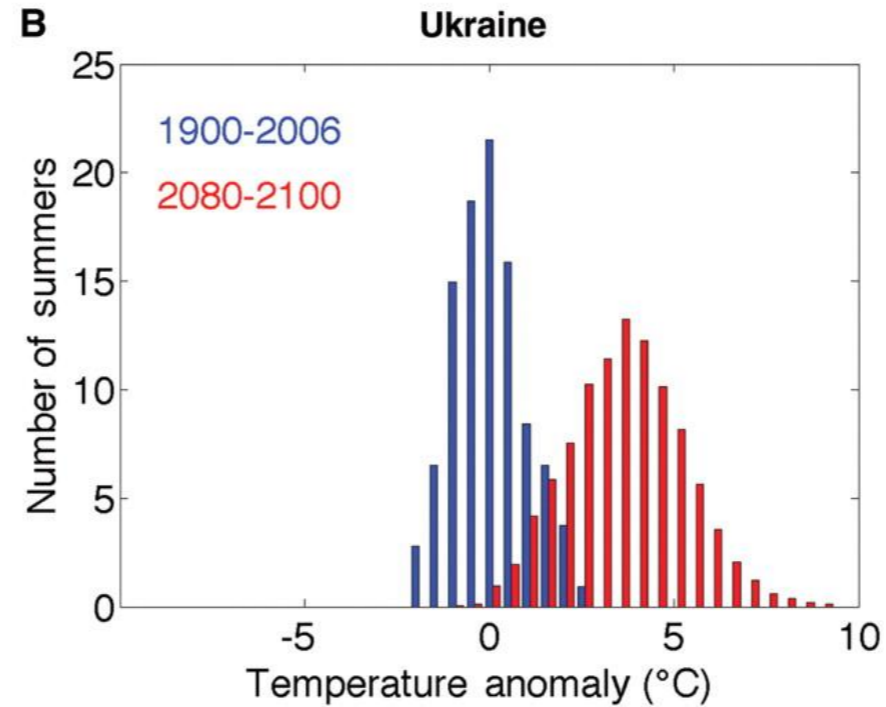
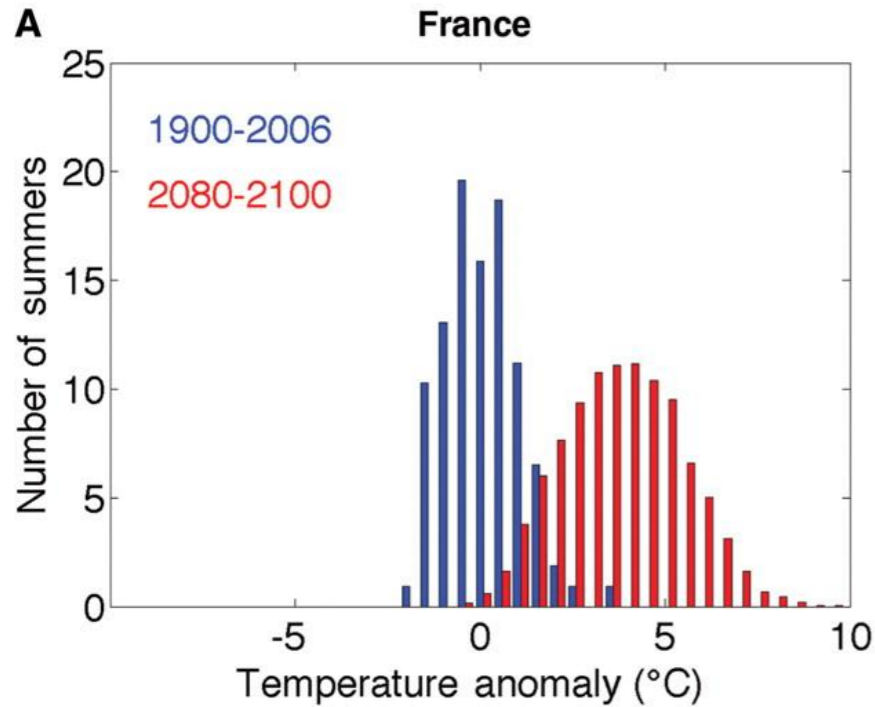


**Adapting to climate change:
the importance of
ex situ conservation
of crop genetic diversity**

Luigi Guarino
Global Crop Diversity Trust
Rome, Italy

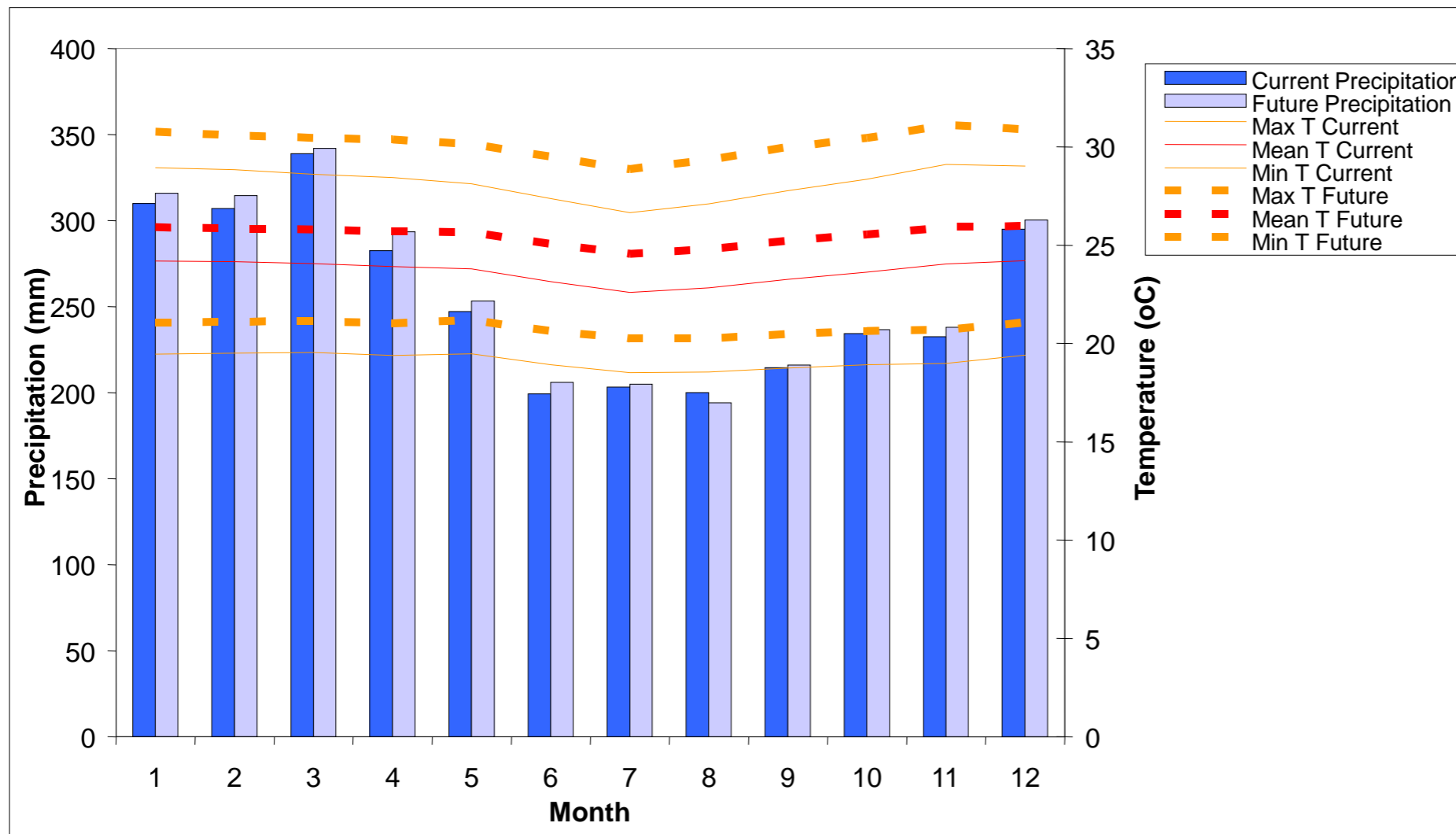
A new world



Distributions of average (summer) temperature for 20th century (blue), and climate model projections for 2080-2100 (red) (y = number of summers, x = departure from long-term 20th century mean)

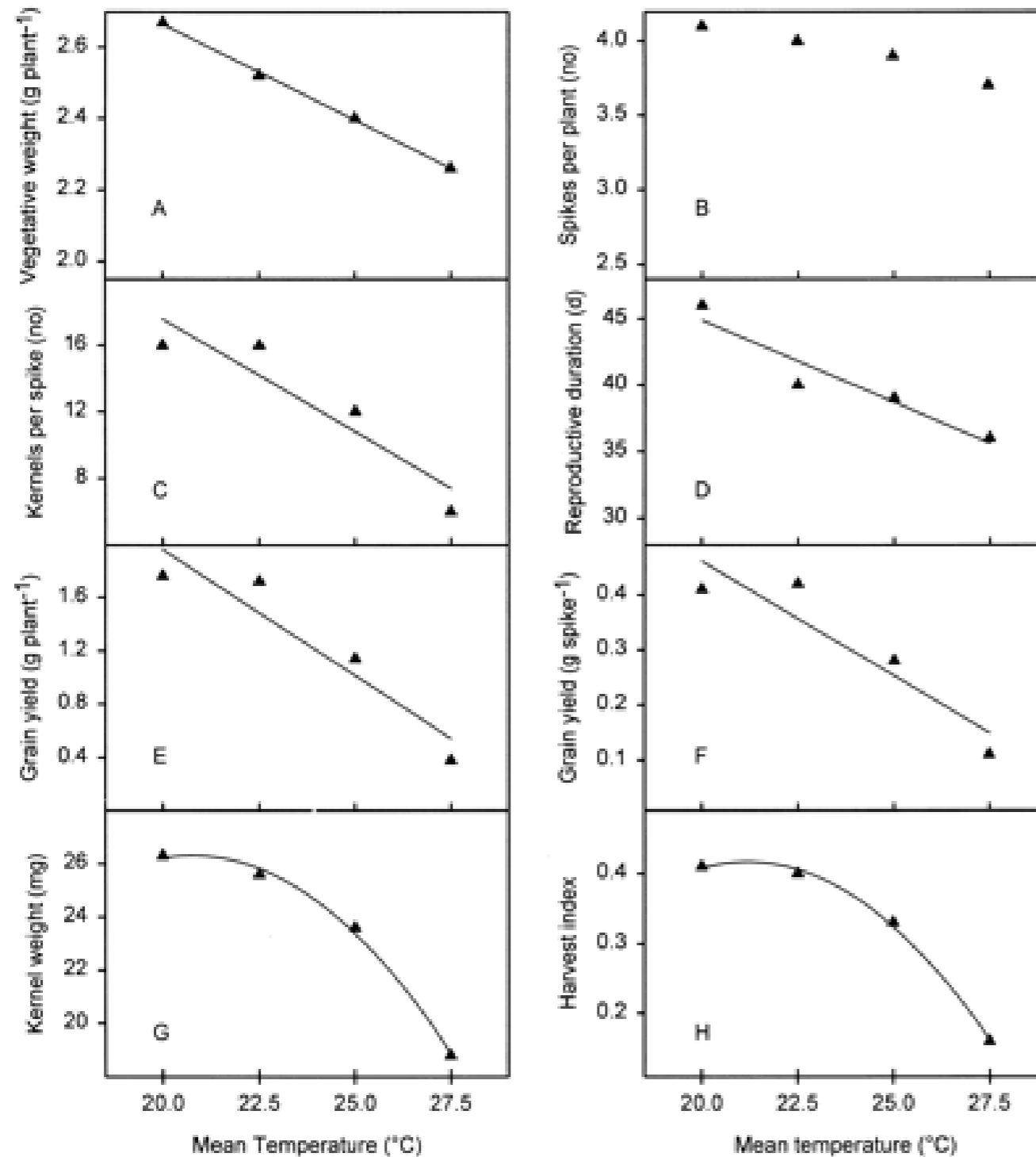
Source: Battisti, D.S., and R.L. Naylor. 2009. Historical warnings of future food insecurity with unprecedented seasonal heat. *Science*, 323, 240-244.

The rainfall increases from 3064.37mm to 3129mm
 The wet season gets wetter with 373.92mm instead of 364.09mm in the wettest quarter and is 1.92C hotter
 The dry season gets dryer with 152mm in the driest quarter and an increase in temperature of 2.04C
 Overall this climate becomes more seasonal in terms of variability through the year in precipitation
 Temperatures increase, with a mean increase of 2C
 The maximum temperature of the hottest month increases from 29.2oC to 31.43C
 The minimum temperature of the coldest month increases from 18.43C to 20.1C
 The daily range in temperature increases from 9.08C to 9.42C
 The length of the dry season increases from 0.79 months to 0.87 months
 The coefficient of variation of predictions between models is 2.99% for temperature and 4.64% for precipitation



Papua
 New
 Guinea

Yield and temperature

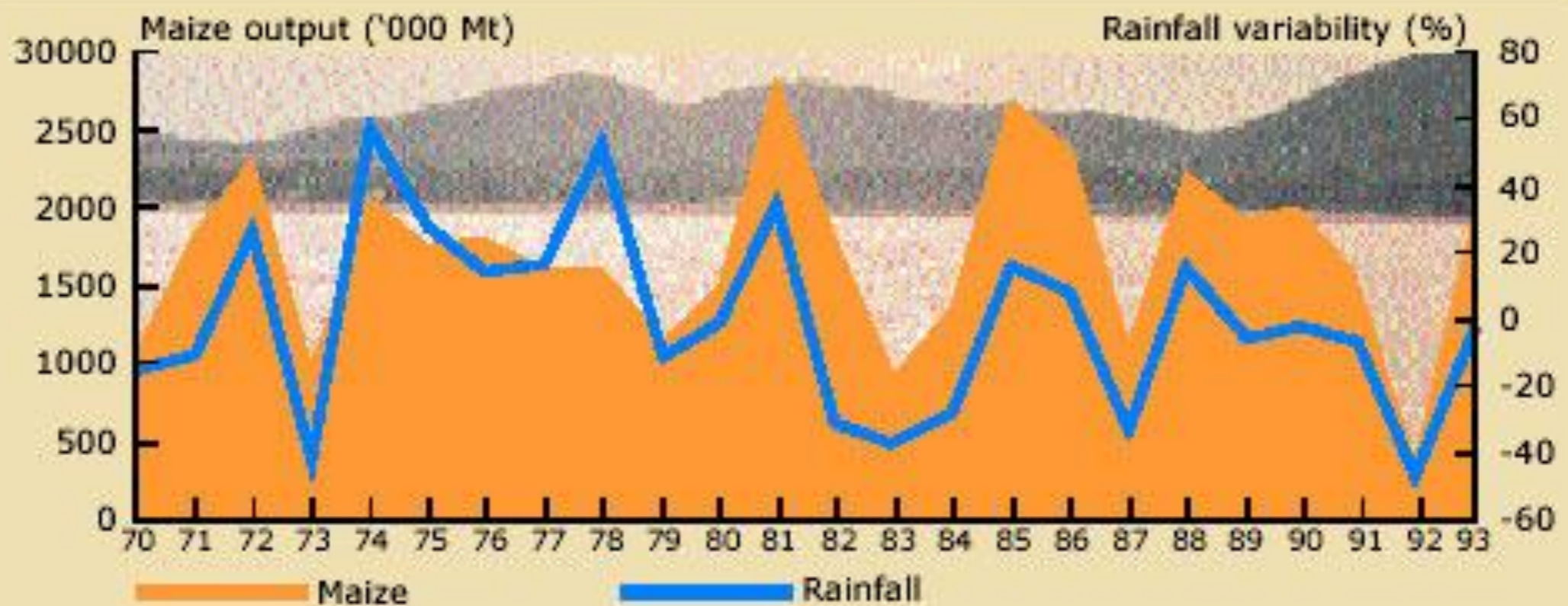


The response of vegetative weight (A), spikes per plant (B), kernels per spike (C), reproductive duration (D), grain yield per plant (E), grain yield per spike (F), kernel weight (G), and harvest index (H) of Karl 92 wheat to increasing temperature applied from 10 d after anthesis until ripeness.

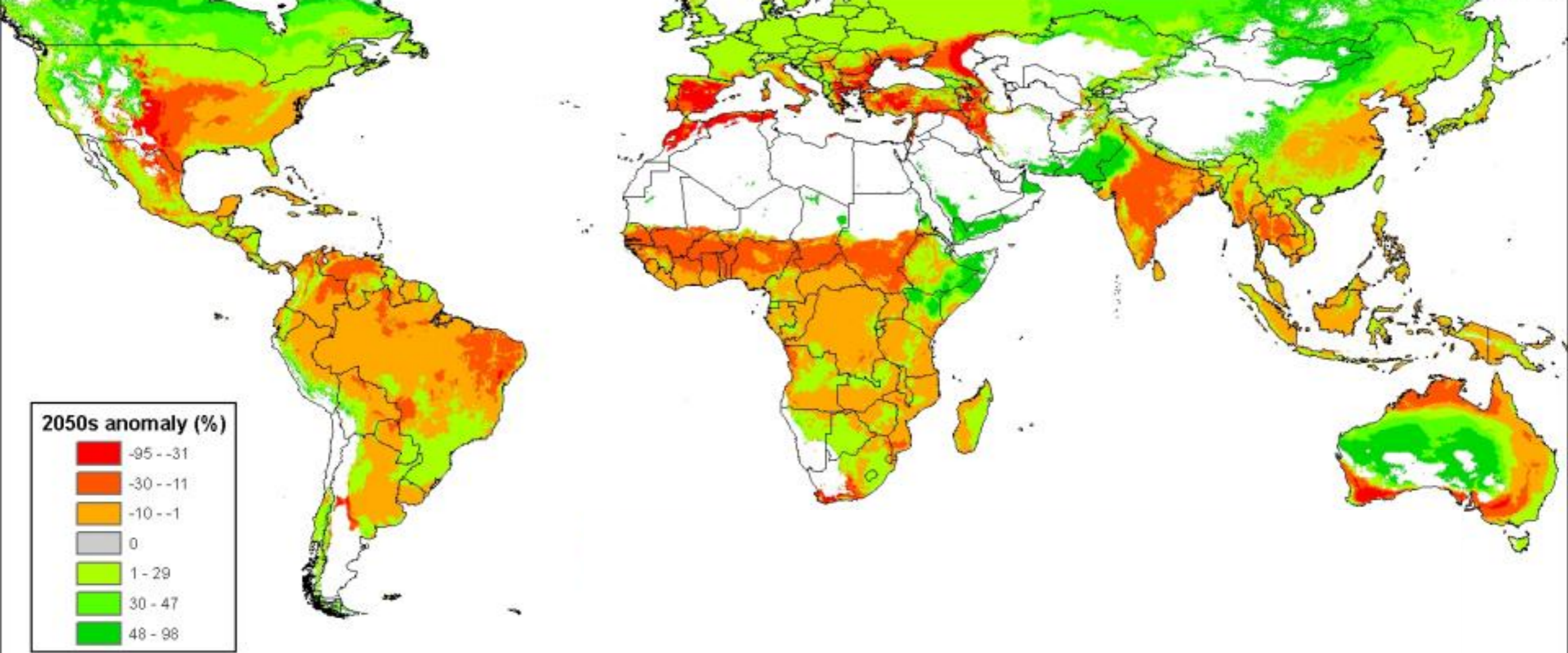
Yield and precipitation

Rainfall Variability and Maize Output in Zimbabwe, 1970-93

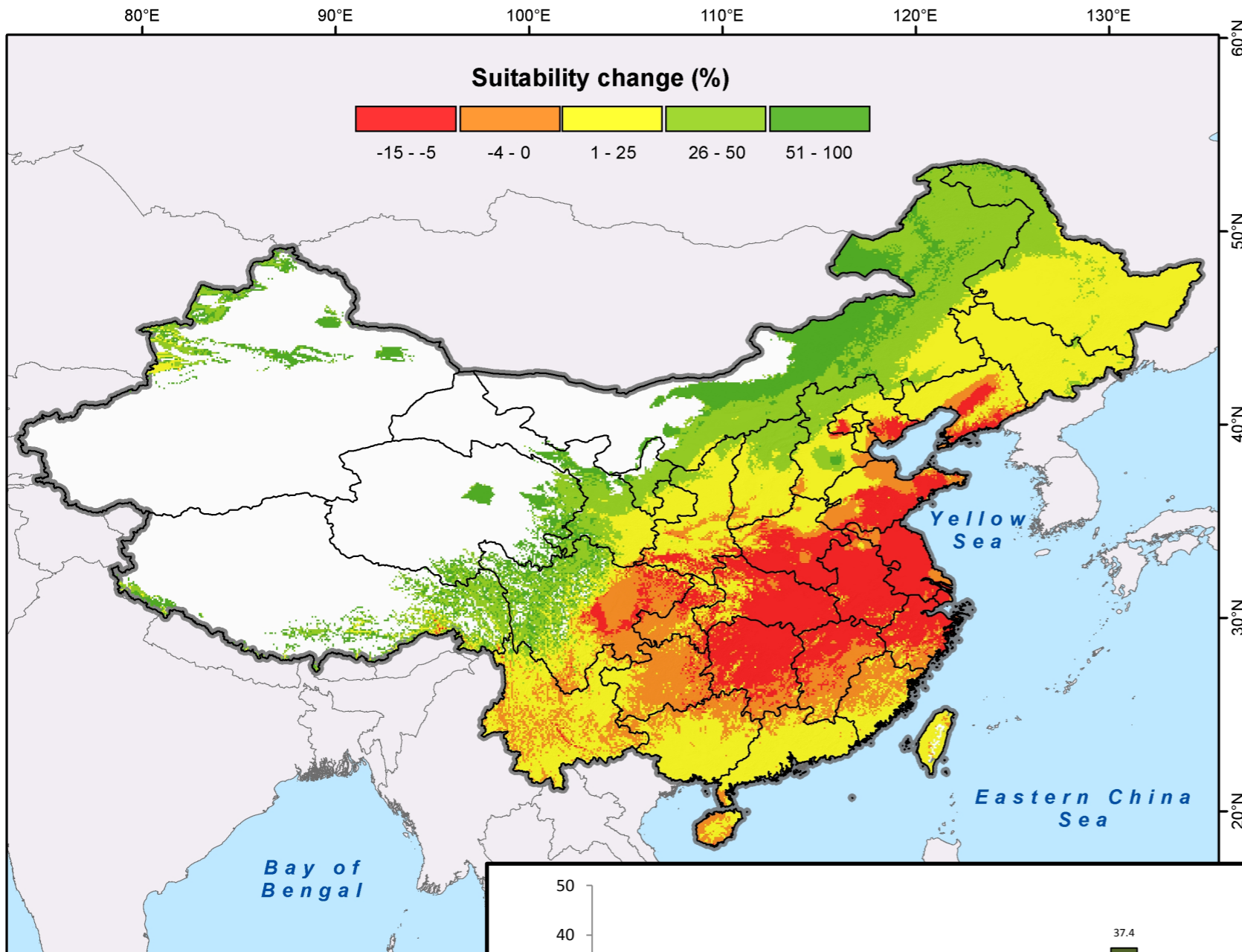
Figure 2.9



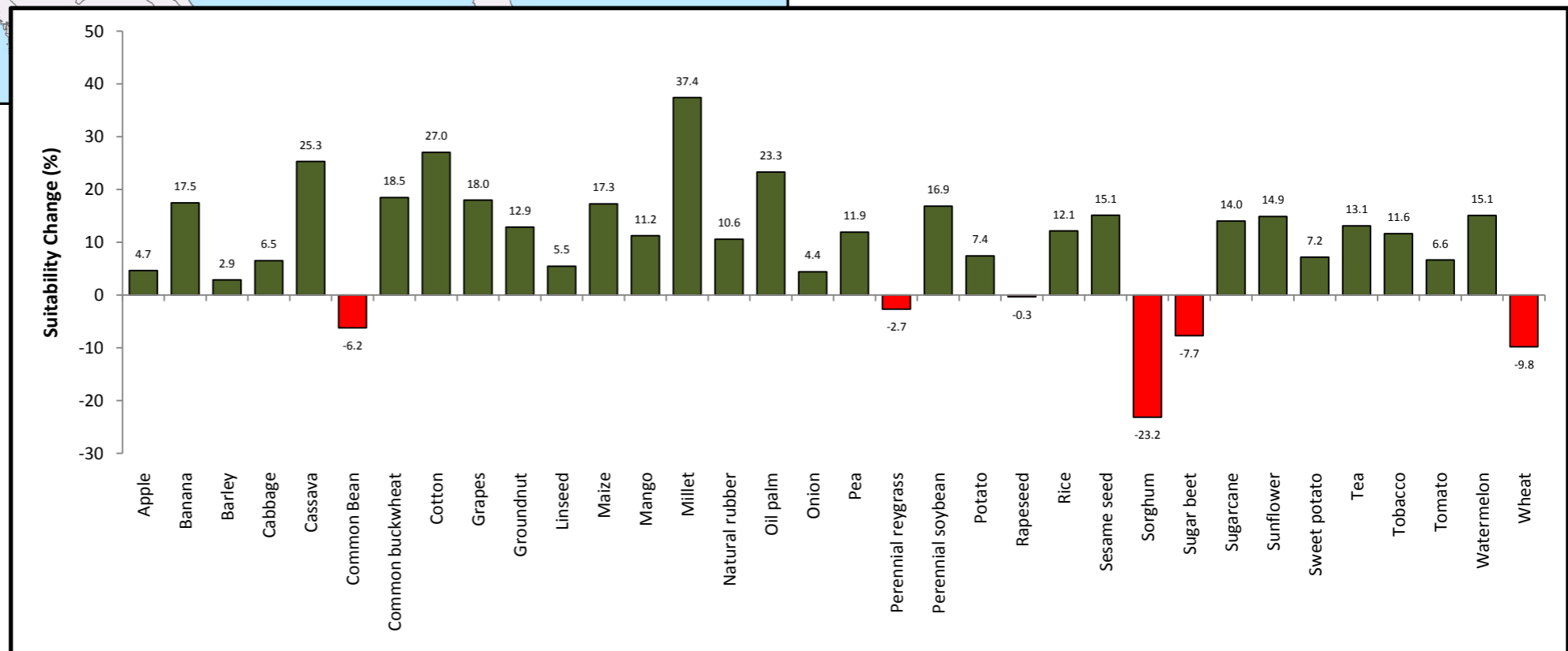
Alemu et al 2001



Average projected % change in suitability for 50 crops, to 2050



Suitability change for 34 important crops in China



Courtesy of Emmanuel Zapata-Caldas (CIAT)



New varieties in
farmers' fields

Seed systems

Breeding

Crop
diversity

Breeding challenges

- Drought
 - Waterlogging
- High temperature
 - Frost (eg clear nights during drought in PNG)
- Biotic stresses

Missing in action

- Genebanks
- Crop wild relatives
- Information
- Policy
- Diversification

Genebanks



4.1 Status of Collections

China has 64 genebanks and repositories conserving nearly 400,000 accessions of crops

- 1 National long-term genebank in Beijing, with a duplicate in Qinghai – 351,332 accessions
- 10 National mid-term genebanks - 286,604 accessions
- 32 National field repositories – 38,803 accessions
- 2 National *in vitro* genebanks – 1,784 accessions
- 20 Provincial mid-term genebanks

Genebanks





Global Safety Backup

Svalbard Global Seed Vault





Photo: Mari Tefre; Global Crop Diversity Trust

Crop wild relatives



- Insect resistance
- Disease resistance
- Tolerance abiotic stresses
- QTLs for yield

Disease resistance from CWR of rice



Pest and disease resistance from CWR



Aegilops tauschii-
hessian fly
resistance



Musa acuminata- black sigatoga resistance

Manihot glaziovii-
cassava mosaic
disease (CMD)
resistance



Pest and disease resistance from CWR



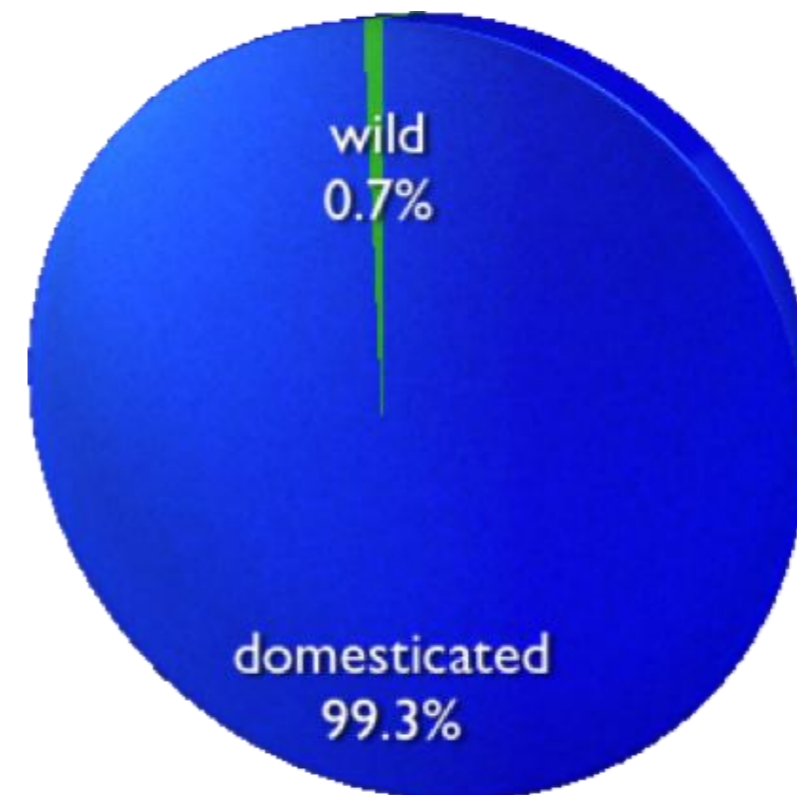
Cassava cultivar susceptible to green mites



Cassava cultivar containing QTLs for resistance to green mites from wild progenitor of cassava

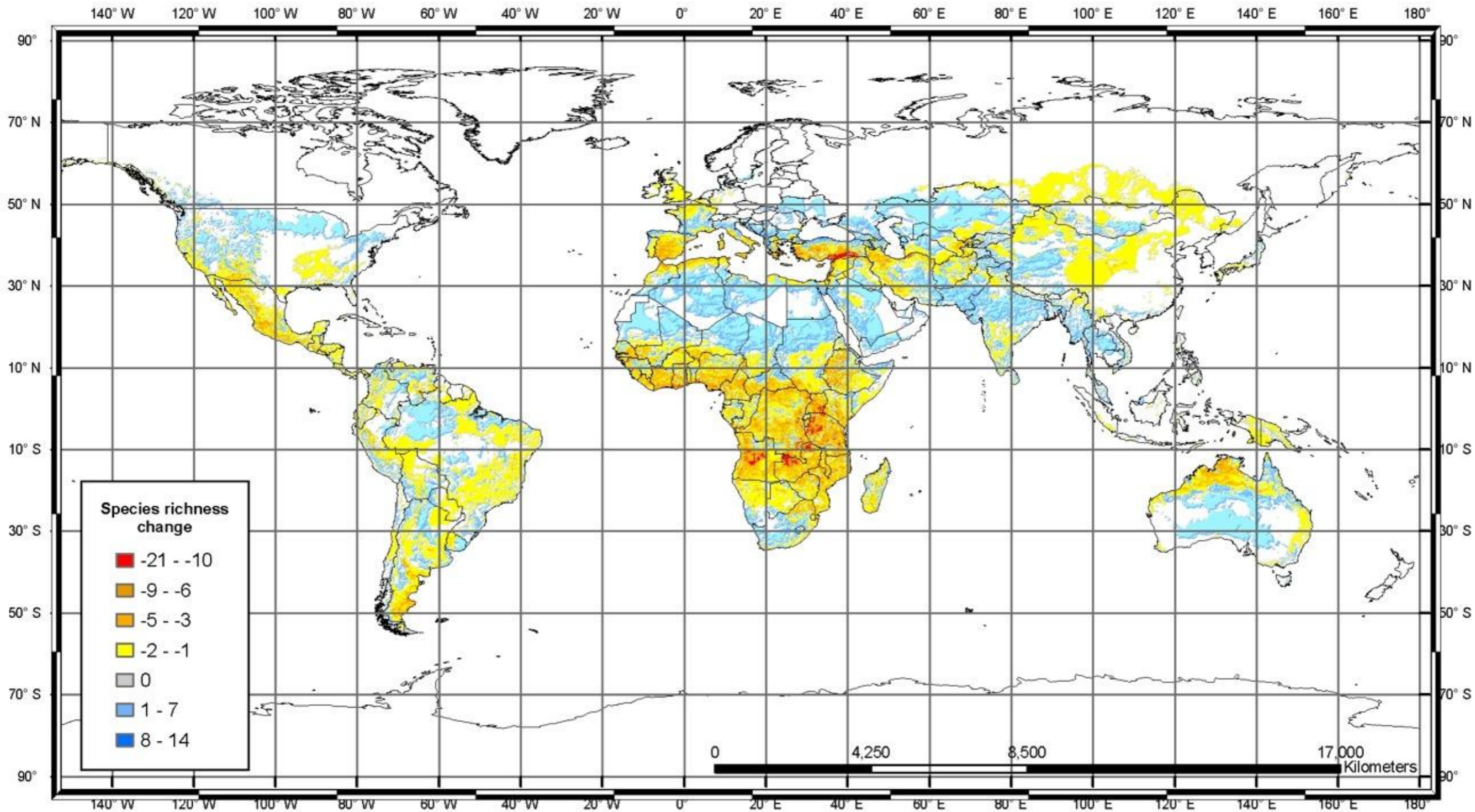


Threats to CWR



Of approx. 80,000 total accessions of annual *Cicer* species, there are 572 accessions of wild annual species, only **124** of which are unique and distinct.

Impacts of climate change on CWRs



Source: Jarvis A. 2009. personal communication.

Information



Search for Taxonomy or Identifier(s)

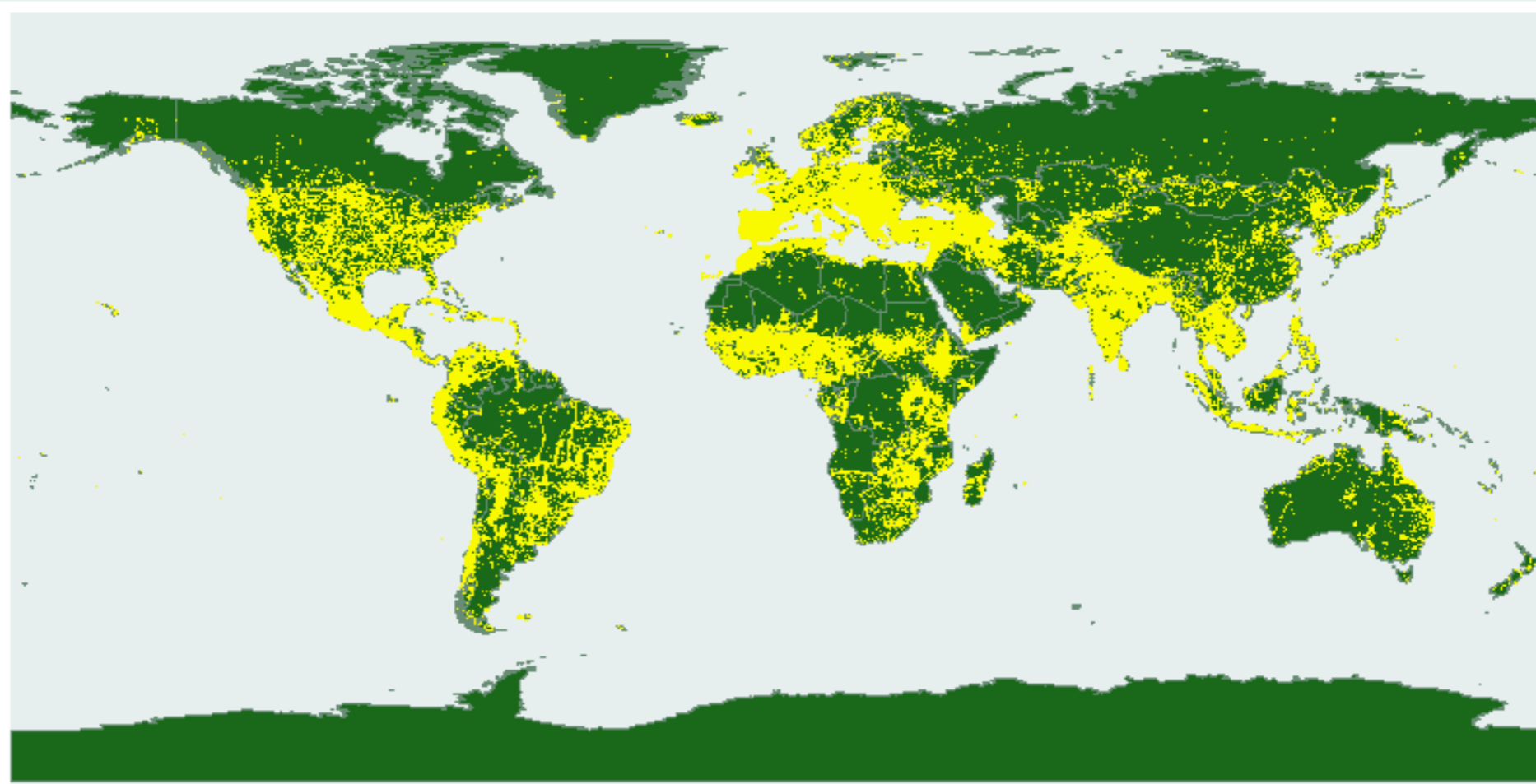
≡ HOME ≡ DATA SUMMARIES ≡ DATA BROWSER ≡ TRAIT QUERIES ≡ ABOUT GENESYS

≡ Full extent ≡ Reset map ≡ Previous extent ≡ Google earth file ≡ Shape file ≡ Download map image

CROP LIST

- Banana
- Barley
- Beans
- Breadfruit
- Cassava
- Chickpea
- Coconut
- Cowpea
- Potato
- Faba bean
- Finger millet
- Grass pea
- Lentil
- Maize
- Pearl millet
- Pigeonpea
- Rice
- Sorghum
- Sweet potato
- Taro
- Wheat
- Yam

Accession Level
2,333,733



Longitude: -19.545455

Latitude: -85.454545

625289 accessions from 136585 sites

My results (2333733)

My selection (0)

Map

Help

Latest news

[Data is up-to-date](#)
GENESYS recently received full data updates from EURISCO, SINGER...[more](#)

[GRIN Update](#)
All characterisation and evaluation data from GRIN has been succe...[more](#)

[ICARDA Update](#)
All characterisation and evaluation data for five crops from ICAR...[more](#)

[IITA Update](#)
IITA has successfully submitted characterisation and evaluation d...[more](#)

[Svaldbard, Norway](#)
During February 2011, the 3rd anniversary symposium is to be held...[more](#)

Comments and Feedback

中国作物种质资源信息系统
Chinese Crop Germplasm
Resources Information System

CGRIS

[Http://www.CGRIS.net](http://www.CGRIS.net)

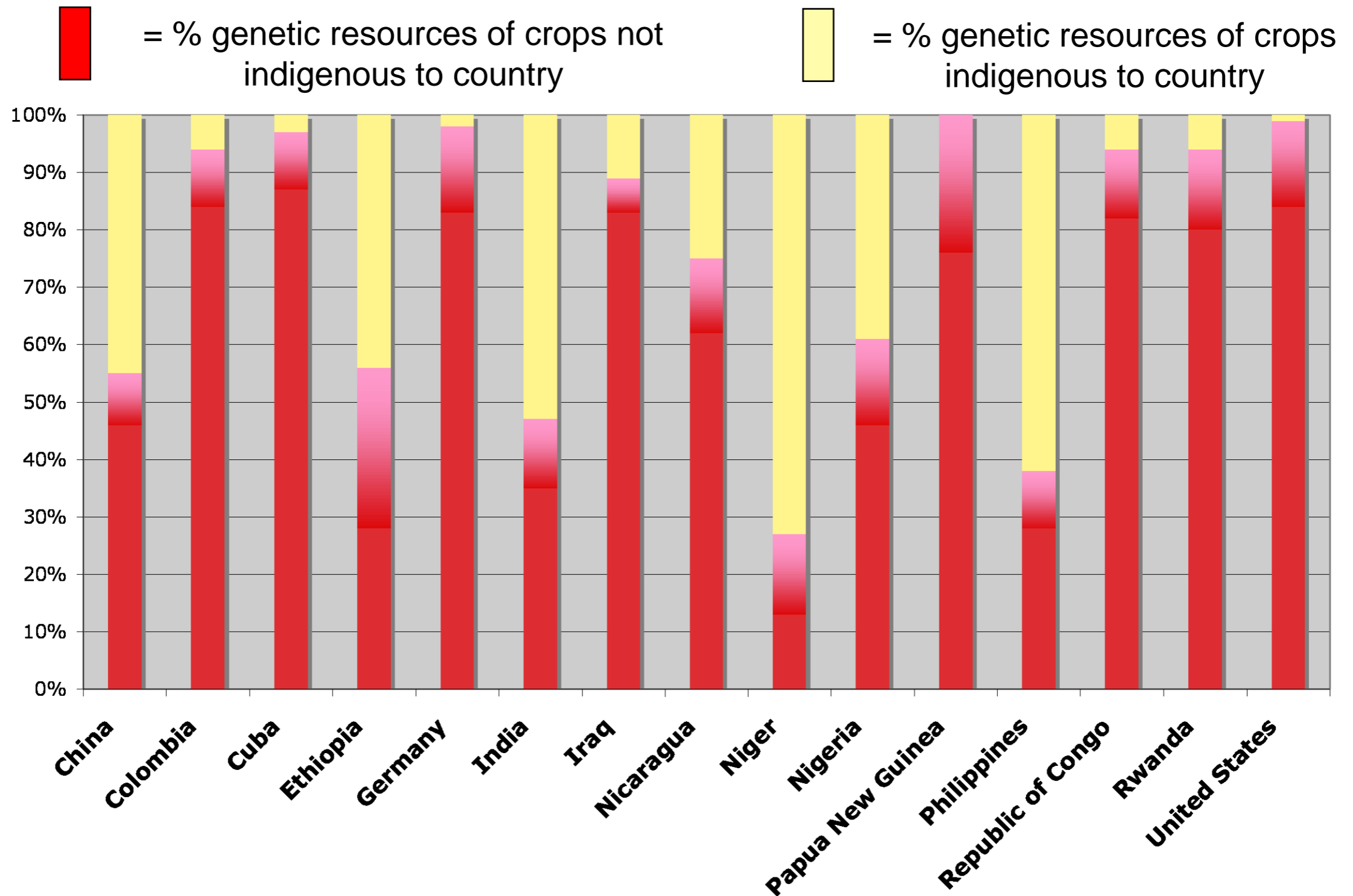
[Http://crop.agridata.cn](http://crop.agridata.cn)

[Http://icgr.caas.net.cn](http://icgr.caas.net.cn)



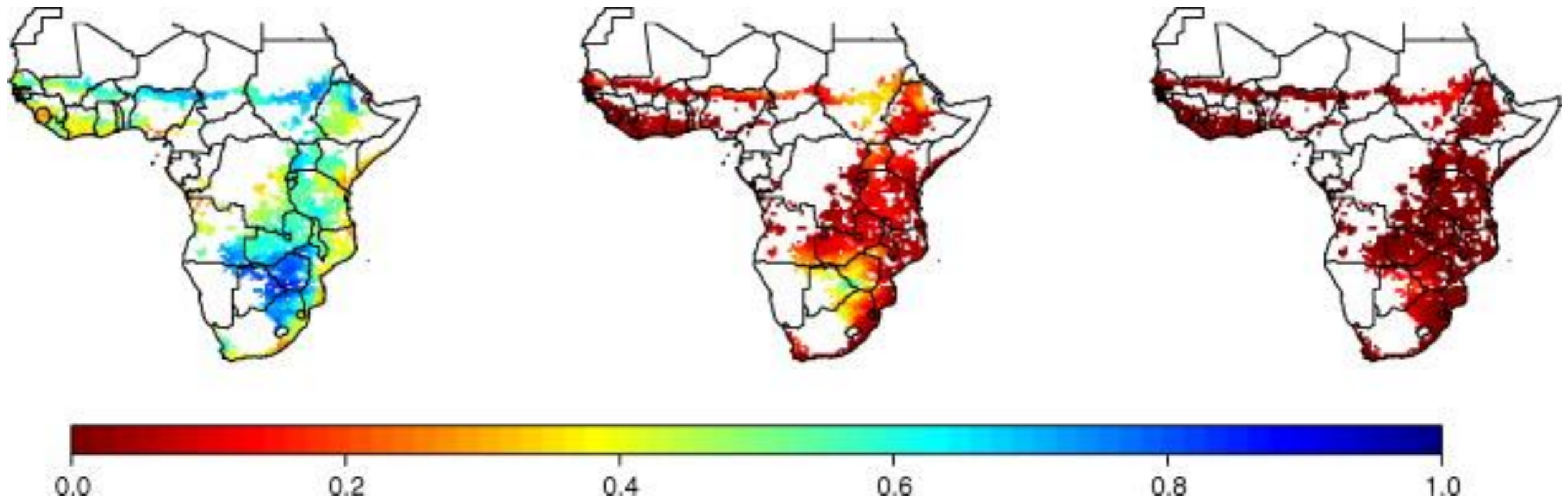
Global interdependence

Food Energy Supply (calories/day)



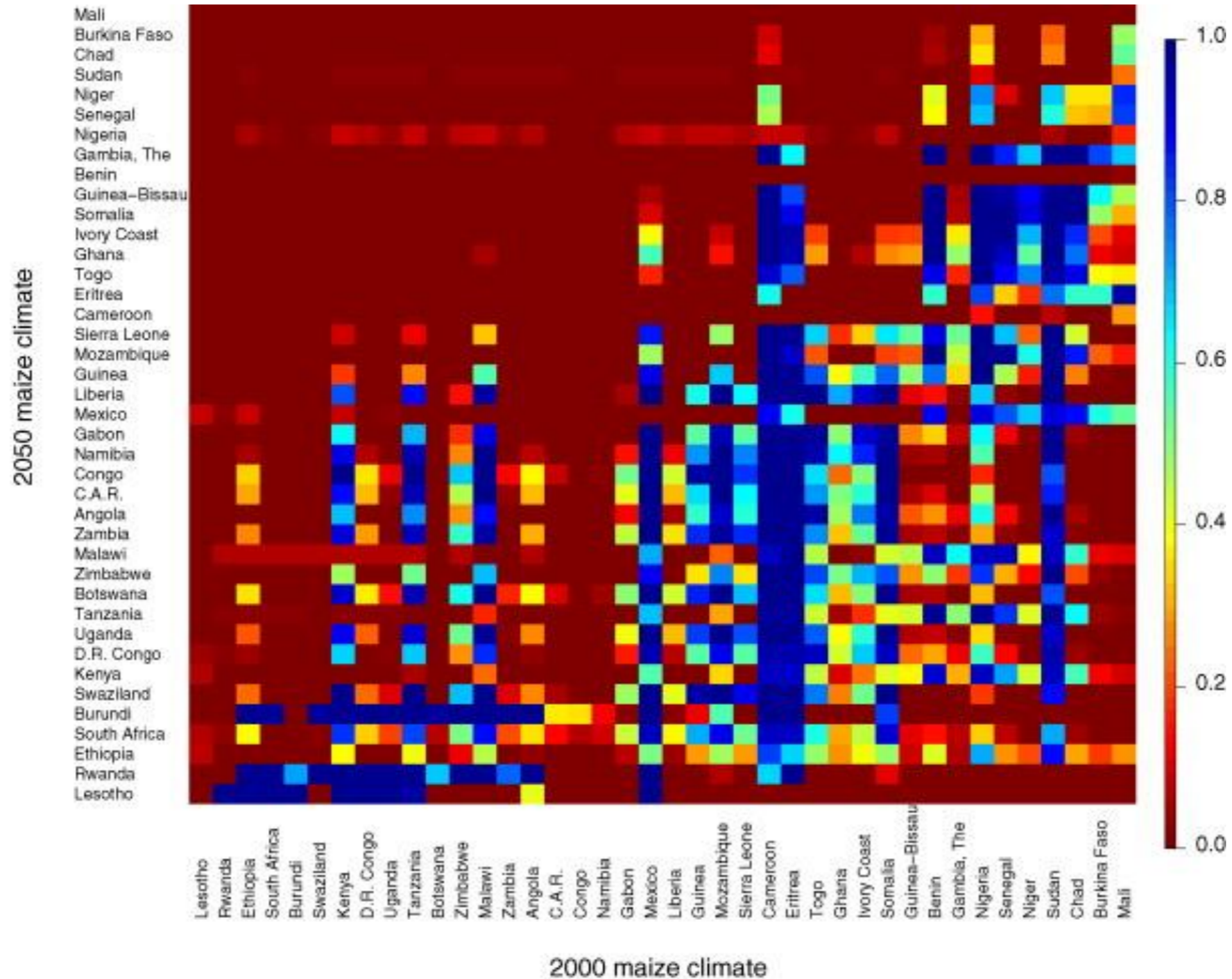
Source: adapted from Palacios XF. 1998. Contribution to the Estimation of Countries' Interdependence in the Area of Plant Genetic Resources. Rep. 7, Rev. 1, UN Food. Agric. Org. Comm. Genet. Resour. Food Agric., Rome, Italy. taken from Fowler C. and Hodgkin T. 2004. Plant Genetic Resources for Food and Agriculture: Assessing Global Availability. Annu Rev Environ Resour 29: 10.1-10.37.

Climate change and crop adaptation



Percentage overlap between historical and 2025 (left), 2050 (middle), and 2075 (right) simulated growing season average temperature at over African maize area. Dark blue colors represent 100% overlap between past and future climates, dark red colors represent 0% overlap

Climate change and crop adaptation



Source: Burke, M.B., et al., Shifts in African crop climates by 2050, and the implications for crop improvement and genetic resources conservation. *Global Environ. Change* (2009), doi:10.1016/j.gloenvcha.2009.04.003

International Treaty for PGRFA

Text only français español



The International Treaty

ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE



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The Treaty

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- [Members](#)
- [From the Secretary](#)

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- [Governing Body](#)
- [Multilateral System](#)
- [Funding Strategy](#)
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- » [The Secretariat of the International Treaty and the Convention on Biological Diversity sign a cooperation agreement](#)

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The Importance of the International Treaty



The International Treaty on Plant Genetic Resources for Food and Agriculture is crucial in the fight against hunger and poverty and essential for the achievement of Millennium Development Goals 1 and 7. No country is self-sufficient in plant genetic resources; all depend on genetic diversity in crops from other countries and regions. International cooperation and open exchange of genetic resources are therefore essential for food security. The fair sharing of benefits arising from the use of these resources has for the first time been practically implemented at the international level through the Treaty and its Standard Material Transfer Agreement. [read more](#)

This Portal

The Portal of the International Treaty aims at improving access to information, knowledge and training materials. It is a **gateway** to sound information on the Treaty, its Governing Body and its activities, that provides access to essential documents and information resources. [Read more](#) [From the Secretary](#)

Illustrating Generations of Generosity



Crops that produce our food

With this Treaty, crops that produce our food - our breads, our curries, our tortillas, our couscous,

Fourth Session of the Governing Body Bali, Indonesia

[Second Call for Proposals](#)

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[Standard Material Transfer Agreements](#)



[Ask the Treaty](#)

 [Download free products](#)

Crops Covered in Annex I



Diverse farms, resilient farmers



Missing in action no longer

- Genebanks
 - Need ongoing support, should not be taken for granted
- Crop wild relatives
 - Need to be collected, evaluated, used in breeding programmes
- Information
 - Needs to be shared
- Policy
 - Ratify the Treaty!
- Diversification
 - Needs to be promoted at genetic, species and landscape level

The Global Crop Diversity Trust

“providing a permanent source of funds to support the long-term conservation of the *ex-situ* germplasm on which the world depends for food security”

