

In situ conservation of crop wild relatives: introduction and a proposal

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WHC 40th Session – Side event on World Natural Heritage Potentials of Turkey and World
Agricultural Heritage

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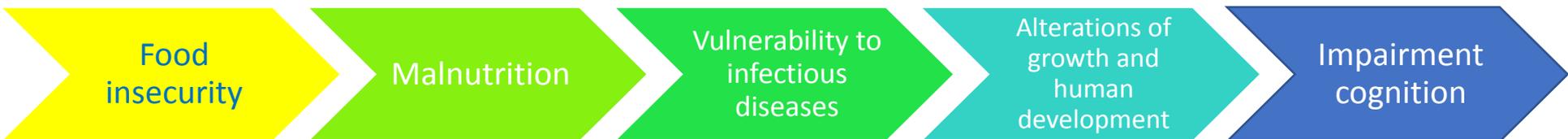
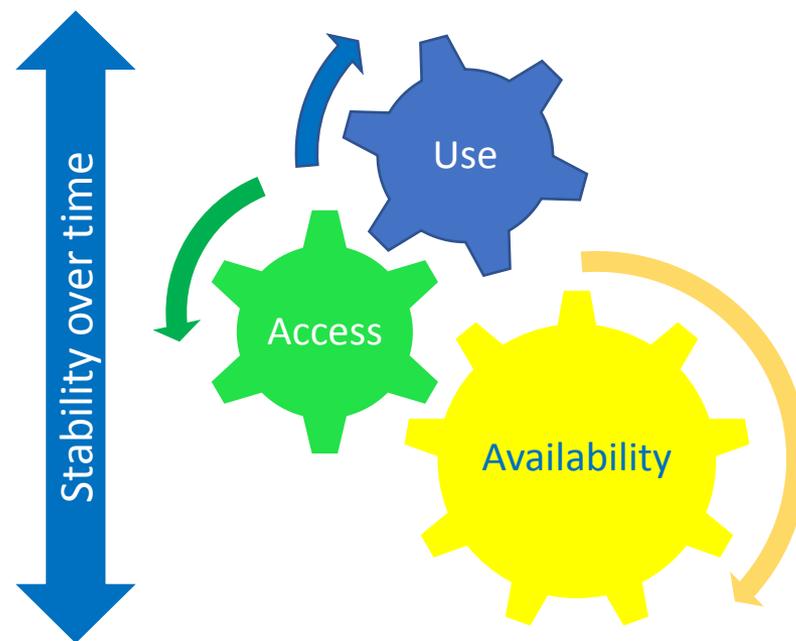
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- Crop wild relatives
- *In situ* conservation of crop wild relatives
- Establishing crop wild relatives networks
- A proposal... World Heritage Sites and crop wild relatives

FOOD SECURITY / INSECURITY

‘Food security exists when all people, at all times, **have physical, social and economic access to sufficient, safe and nutritious food...**’

(World Food Summit FAO 2009)



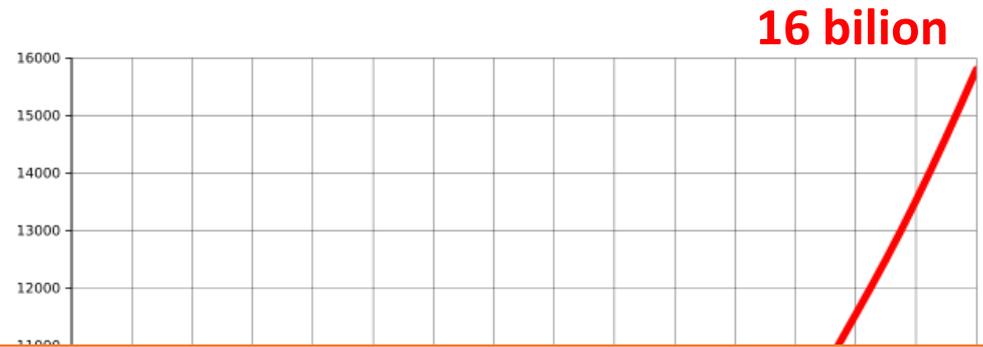
(The State of Food Insecurity in the World 2013)

FOOD INSECURITY – FUTURE?

- 7.4 billion (Jul 2016)

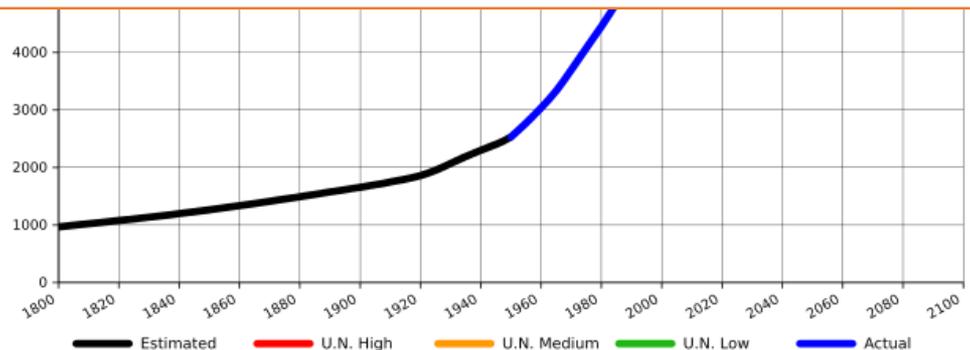
9.6 billion by 2050
(UN 2014)

**Is human population beyond the
earth's carrying capacity?**



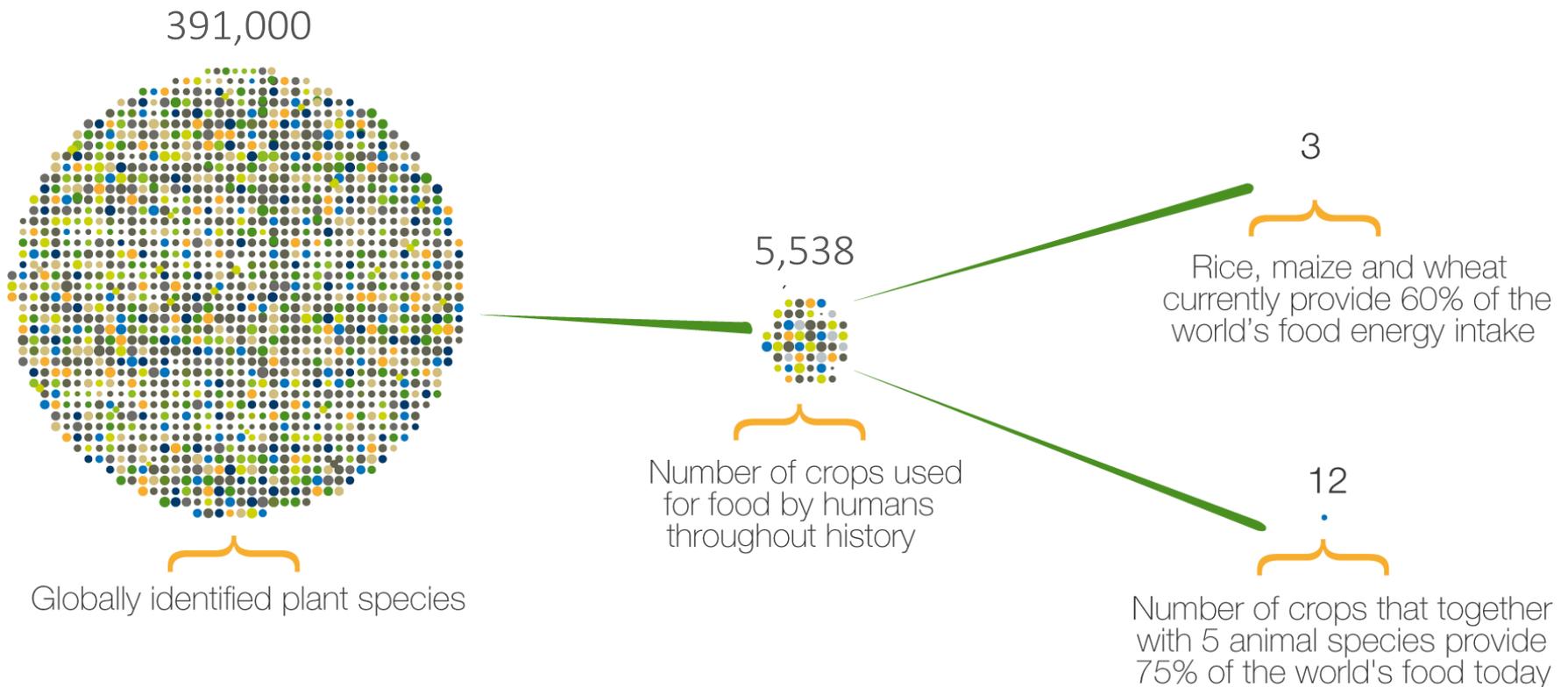
To feed the human population in 2050
we will require food supplies to
increase by 60% globally, and 100% in
developing countries

(FAO 2011)



THE NEED FOR AGRICULTURAL BIODIVERSITY

Heavy dependence on narrow diversity of crops puts future food and nutrition security at risk!



CLIMATE CHANGE HAS CHANGED THE GAME

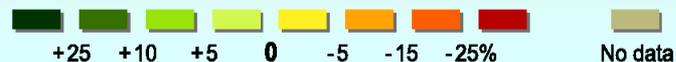
Projected impact of climate change on agricultural yields

Climate change may reduce agricultural production by 2% each decade (IPCC 2014)

* A key culprit in climate change – carbon emissions – can also help agriculture by enhancing photosynthesis in many important (...) crops such as wheat, rice, and soybeans. The science, however, is far from certain on the benefits of carbon fertilisation.*

This map represents the case of beneficial carbon fertilisation processes.

Change in agricultural productivity
between 2003 and the 2080s



Source: Cline W., 2007, *Global Warming and Agriculture*.

CROP WILD RELATIVES

- CWR are an important source of trait diversity for crop improvement
- Tried and proven
- Still largely untapped as their importance is not well recognised
- Food and economic security

Wheat (*Triticum aestivum*)

Almond (*Prunus dulcis*)

Pigeon pea
(*Cajanus cajan*)

Tomato
(*Solanum lycopersicum*)



Aegilops tauschii
Drought tolerance

P. davidiana
Root stock nematodes
resistance

C. cajanifolius
High seed protein

Lycopersicon pimpinellifolium
Early maturity, fruit size and
shape

CROP WILD RELATIVES

Threatened in the wild - **16% of the species assessed are (near) threatened**
(intensive farming, tourism, urbanization) (Kell *et al.* 2012)

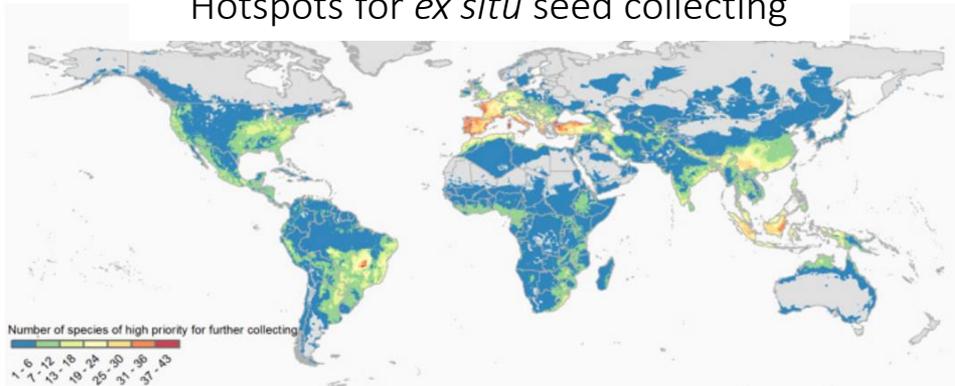
Ex situ conservation inadequate

- CWR represent 10.5% of total germplasm accessions
- Globally priority CWR:
 - $\approx \frac{1}{3}$ with no accessions in gene banks
 - $\approx \frac{1}{3}$ with <10 accessions

In situ virtually non-existent

- CWR found in existing PAs but not monitored and actively managed
- Few CWR genetic reserves established but not formally recognized
(e.g. Ethiopia for wild coffee, Peru for wild potatoes, Armenia for wild wheat, China for wild rice)

Hotspots for *ex situ* seed collecting



(Castañeda-Álvarez *et al.* 2016)



Oryza rufigopogon in Gaozhou, Guangdong province, China
(photo: Wei Wei)

IN SITU CWR CONSERVATION

To ensure **maximum range** of CWR genetic diversity is represented within the **minimum number** of *in situ* conservation sites / populations



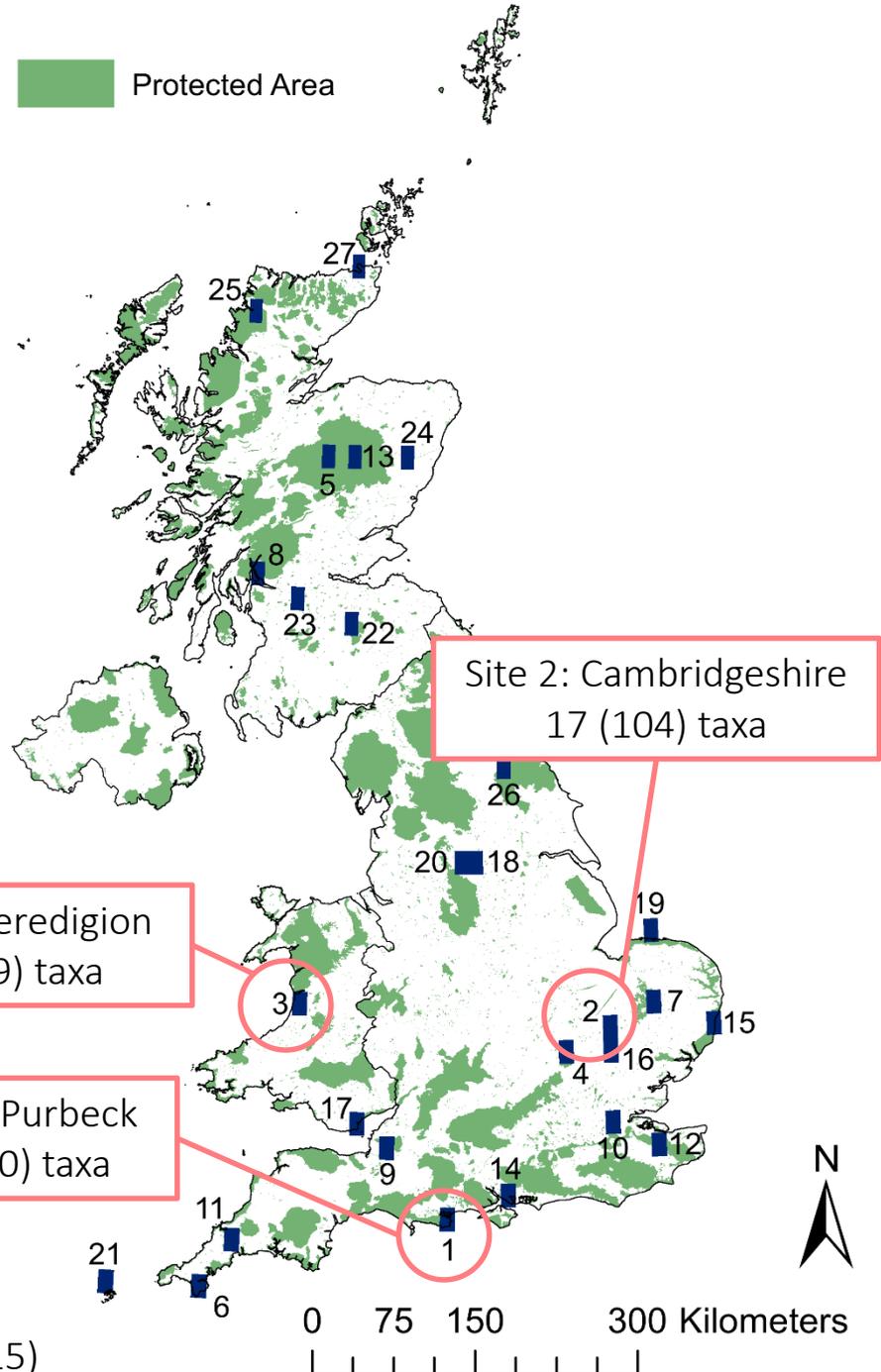
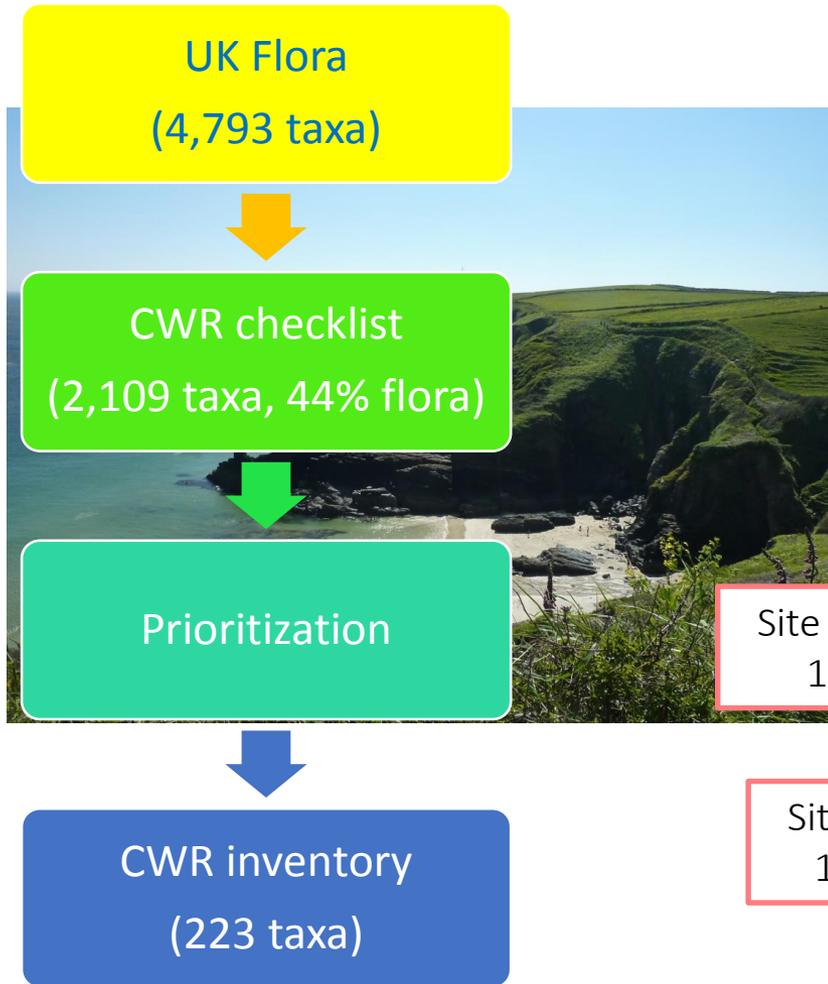
Wild wheat in the Erebuni State Reserve (Armenia)
(photo: René Hauptvogel)

ESTABLISHING CWR *IN SITU* NETWORKS

Numerous approaches to *in situ* CWR conservation



EXAMPLE: UK CWR



(Fielder *et al.* 2015)

REGIONAL CWR *IN SITU* CONSERVATION STRATEGIES (SADC REGION)

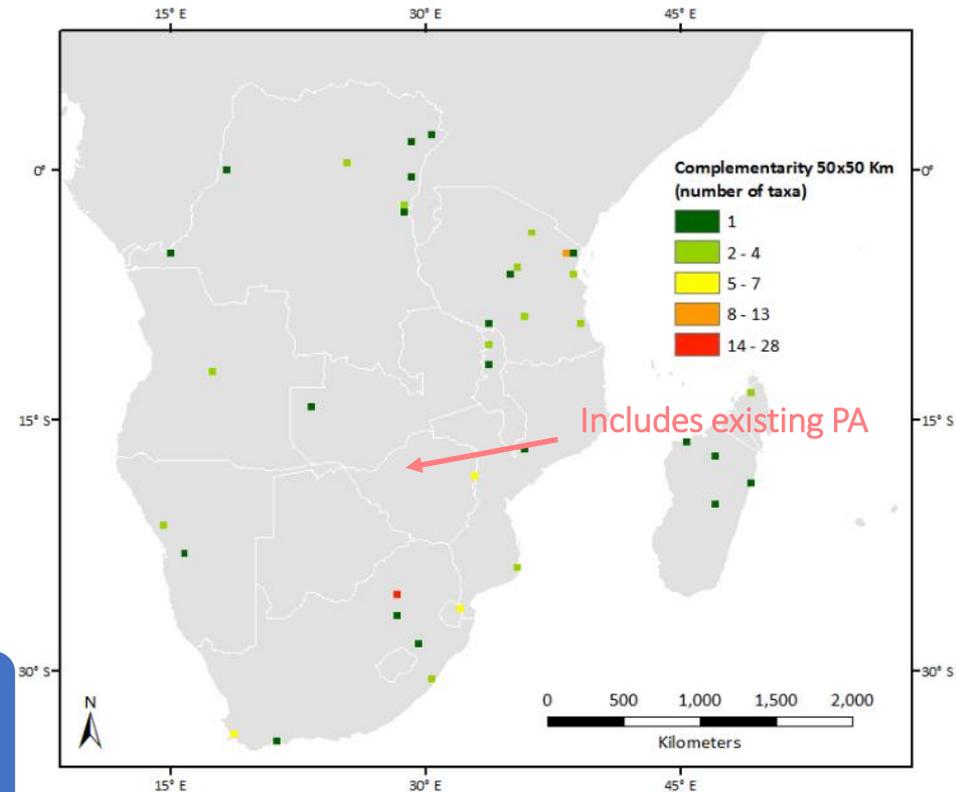
Development of food and beverage **CWR checklist** for the SADC region

Prioritization of CWR for conservation action

Identification of priority sites for *in situ* conservation and *ex situ* collection (diversity analysis)

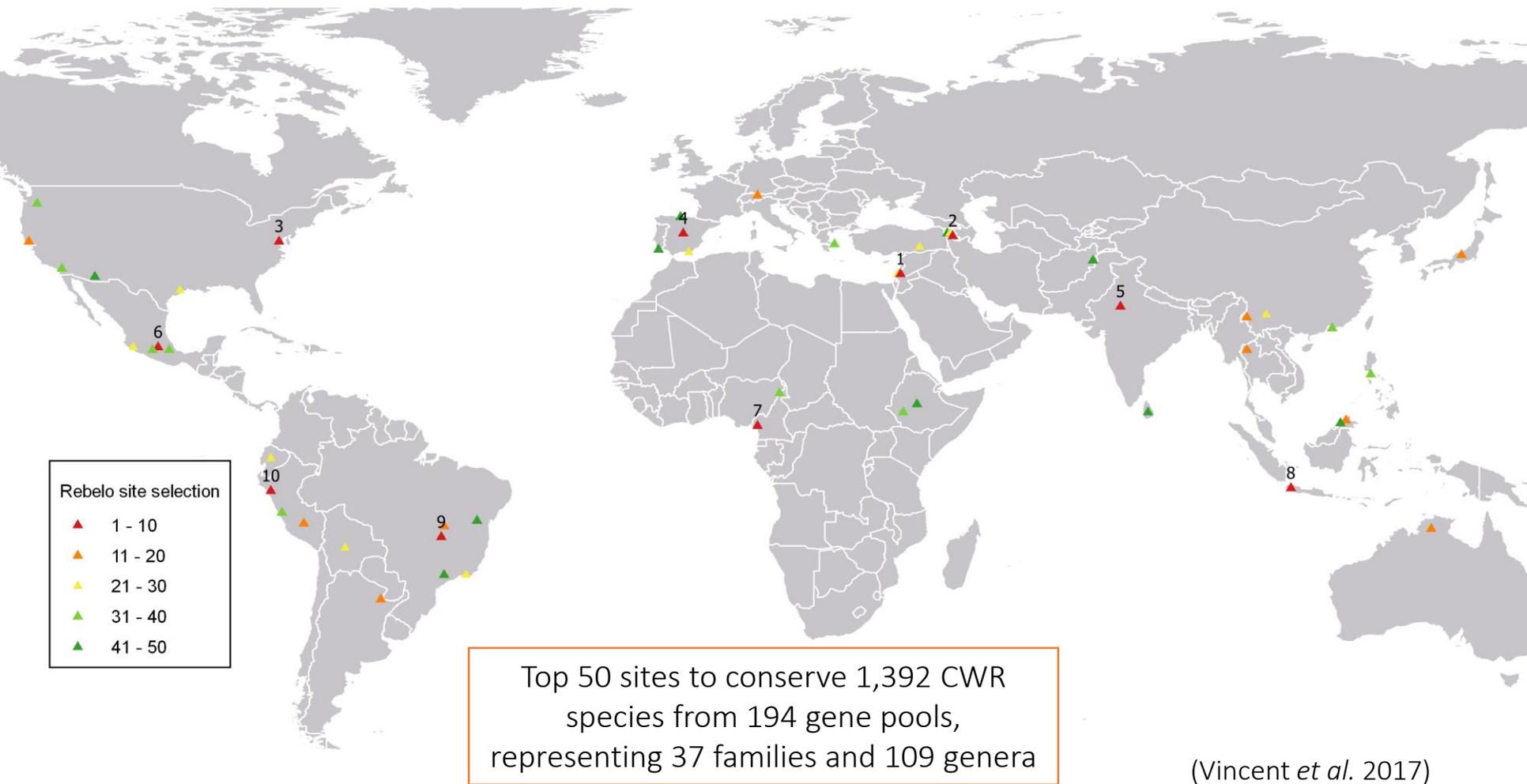
Initiation of a **Regional Strategy** for CWR conservation in the SADC region

Complementarity network:
38 grids (50 x 50 Km) in 11 countries cover 112 priority CWR (3 transboundaries)



SADC Crop Wild Relative project
(<http://www.cropwildrelatives.org/sadc-cwr-project/>)

GLOBAL CWR *IN SITU* CONSERVATION NETWORK



A PROPOSAL: TO ESTABLISH THE N.I. VAVILOV CWR NETWORK OF *IN SITU* CONSERVATION



The first step: a Turkish network of
in situ CWR sites!
UNESCO World Heritage Sites?

Rebello site selection

- ▲ 1 - 10
- ▲ 11 - 20
- ▲ 21 - 30
- ▲ 31 - 40
- ▲ 41 - 50



UNESCO WORLD HERITAGE SITES – SELECTION CRITERIA

“(v) to be an **outstanding example of a traditional** human settlement, **land-use**, or sea-use which is representative of a culture (or cultures), or **human interaction with the environment** especially when it has become vulnerable under the impact of irreversible change”

- Sites where CWR occur associated with particular land-use types (e.g. farmers' fields)
- Highly diverse areas in terms of CWR in centres of crop domestication where traditional land-use predominates?
- Associate CWR and unique landrace's management?

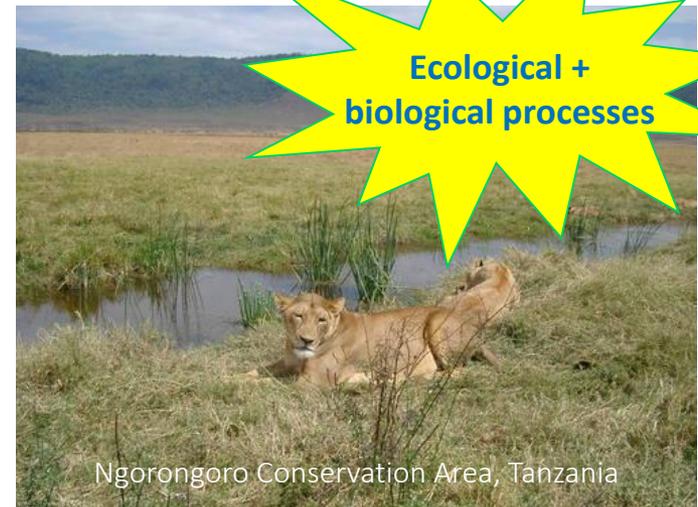


“The cultural landscape of Grand Pré bears exceptional testimony to a **traditional farming settlement** created in the 17th century by the Acadians in a coastal zone with tides that are among the highest in the world. The polderisation used traditional techniques of dykes, aboiteaux and a drainage network, as well as a community-based management system still in use today. The resultant rich alluvial soil enabled **continuous and sustainable agricultural development**” Criterion (v)...

UNESCO WORLD HERITAGE SITES – SELECTION CRITERIA

“(ix) to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals”

- Sites where CWR play an important role in ecological and biological processes?
- Sites where CWR constitute the main plant diversity of important/unique ecosystems and habitats?



“The variations in climate, landforms and altitude have resulted in several overlapping ecosystems and distinct habitats, with short grass plains, highland catchment forests, savanna woodlands, montane long grass plains and high open moorlands. The property is part of the Serengeti ecosystem, one of the last intact ecosystems in the world which harbours large and spectacular animal migrations” Criterion (ix)...

UNESCO WORLD HERITAGE SITES – SELECTION CRITERIA

“(x) to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation”

- CWR are of outstanding value for science (food security)
- Hotspots of important CWR to food security?
- Hotspots of threatened/endemic CWR?



“The Western Ghats contain exceptional levels of plant and animal diversity and endemism for a continental area. In particular, the level of endemism for some of the 4-5,000 plant species recorded in the Ghats is very high: of the nearly 650 tree species found in the Western Ghats, 352 (54%) are endemic (...). The property is also key to the conservation of a number of threatened habitats, such as unique seasonally mass-flowering wildflower meadows, Shola forests and Myristica swamps” Criterion (x)...

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Thank you!

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