CSA and crop diversity conservation: issues and prospects

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Plant genetic resources are critical for CSA

Plant genetic resources (PGR) encompass all the worlds' crop species and varieties and their traits, which are needed to face shifting climate and biotic stresses and enable long term crop adaptation.

- Short term risk management through diversified production
- Crop evolution in the field, mediated by farmer and natural selection
- Traits for to crop breeding (heat, drought and salt tolerance, pest and disease resistance, short maturity, etc.)

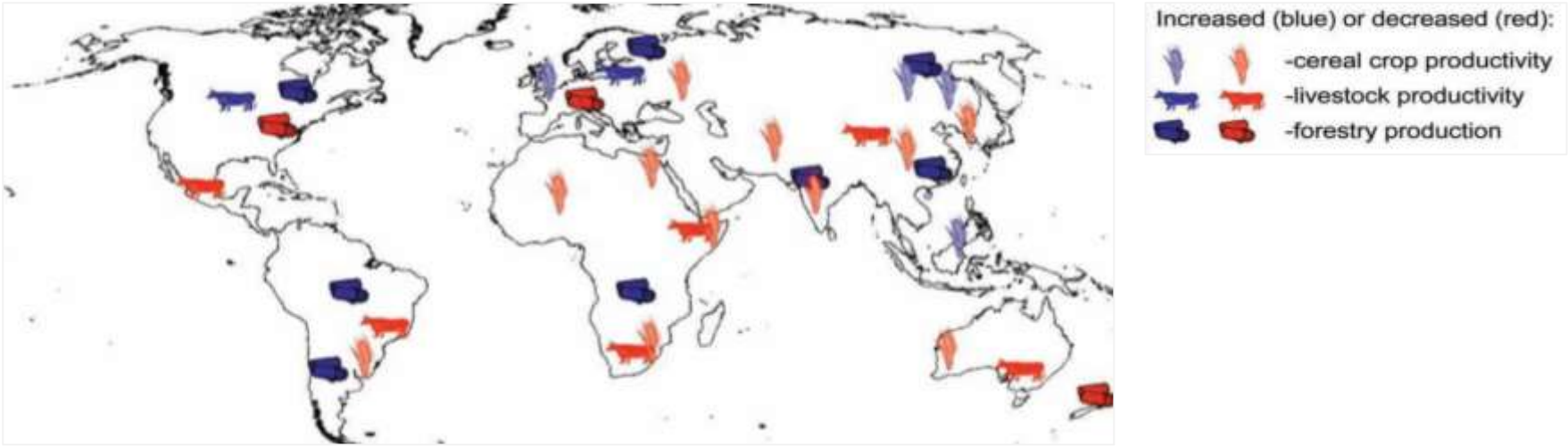
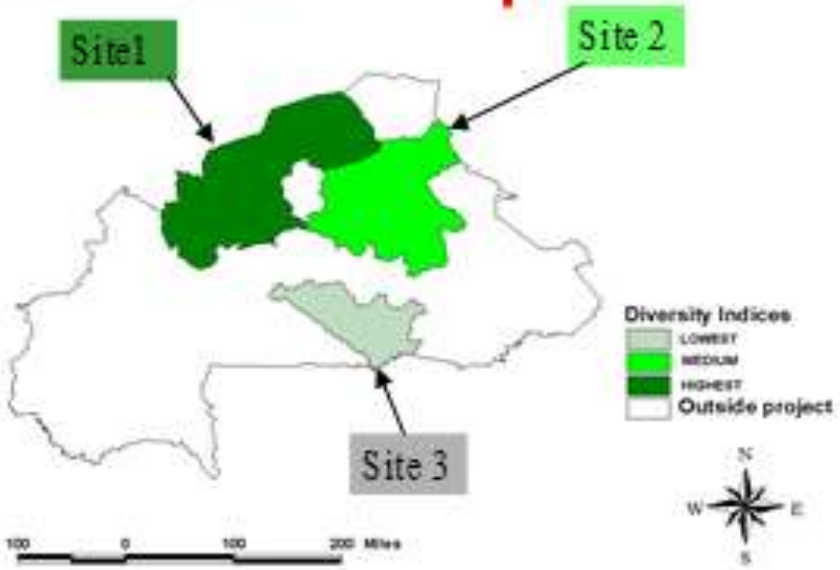


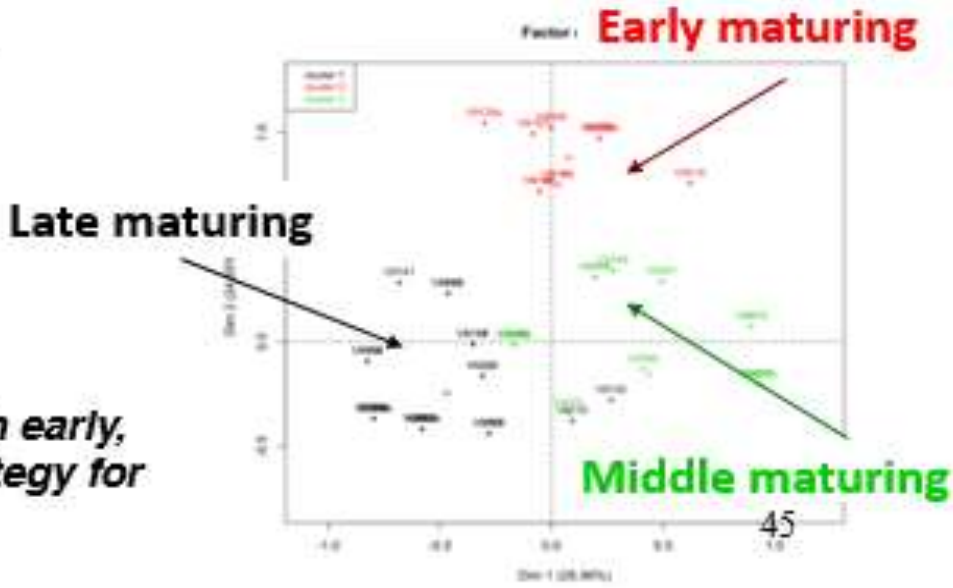
Figure: IPCC 2007

Varietal diversity provides harvest security in the face of unpredictable environmental conditions

↑ Unpredicatable rainfall = ↑ Variety diversity



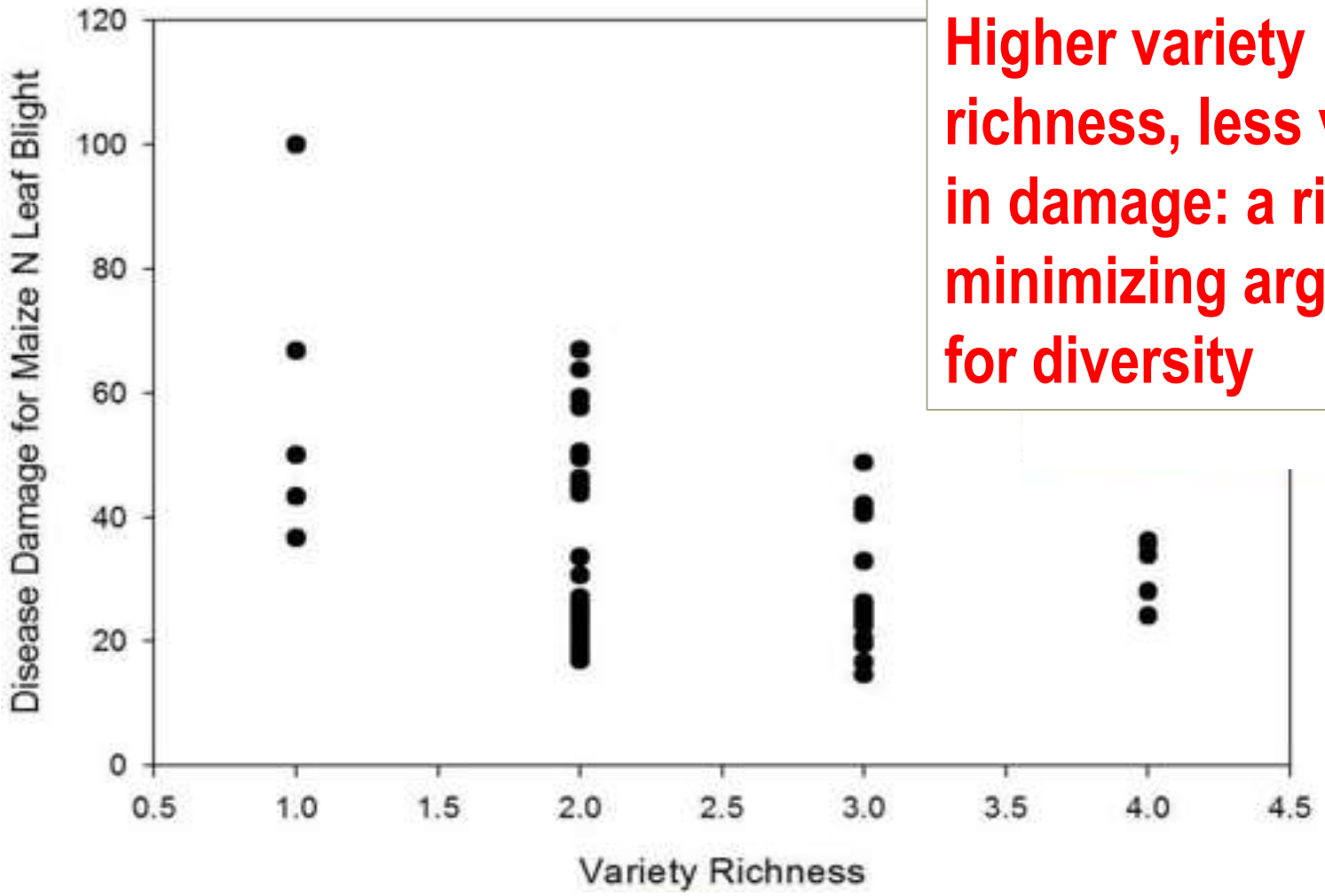
Uzbekistan and Kazakhstan
(Baymetov et al 2012 *unpublished data*)



Apple tree diversity in flowering times within early, middle and late maturing varieties: IK - strategy for unpredictability of frost

Varietal diversity reduces pest & disease pressure

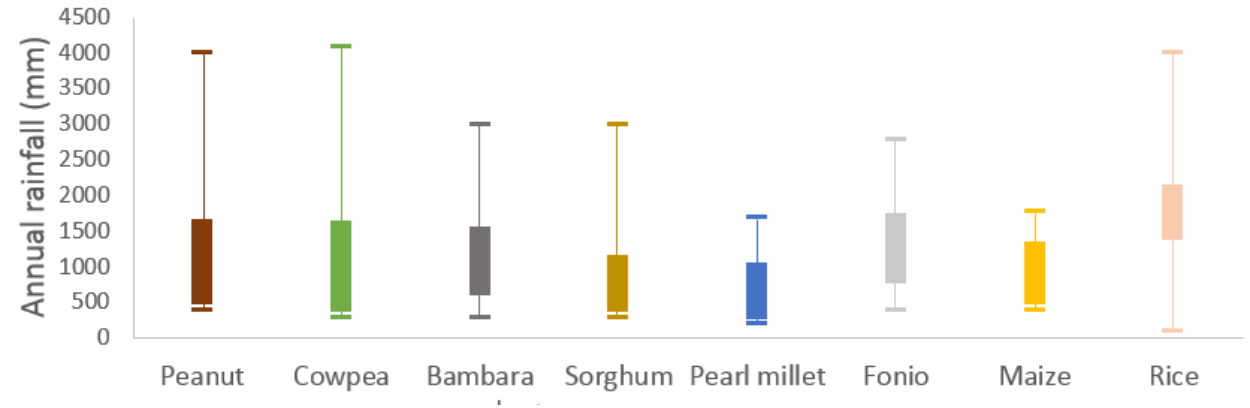
Richness x Disease Index

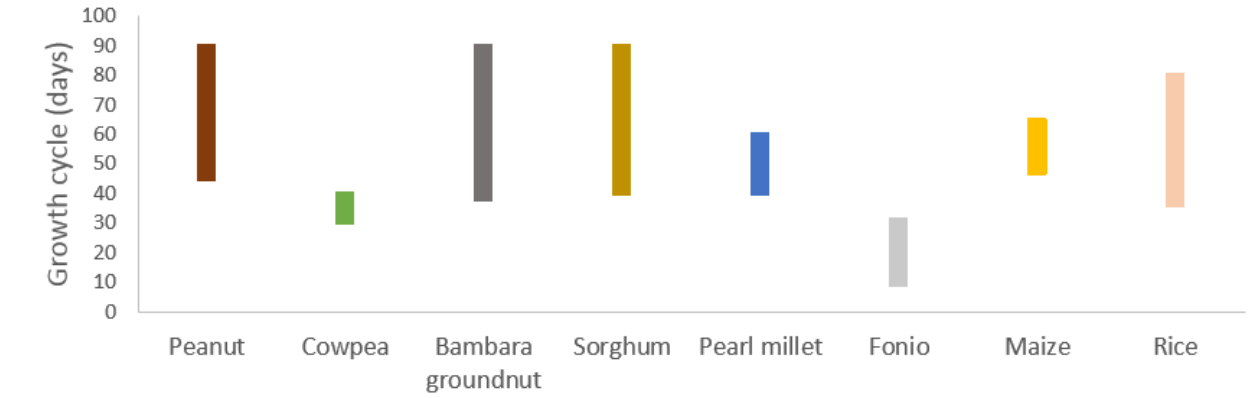


Higher variety richness, less variance in damage: a risk-minimizing argument for diversity

Devra Jarvis, Bioversity

Neglected and underutilized species (NUS) have traits to support CSA





Soil quality	Moderate-High	Low-Moderate	Low	Low-Moderate	Low-Moderate	Low-Moderate	Low-High	Moderate-High

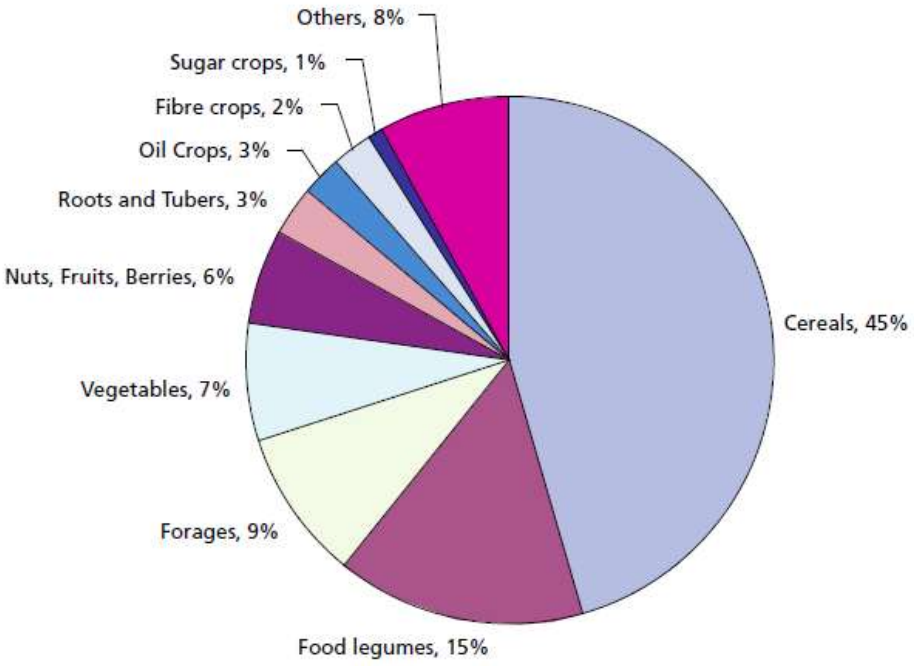
e.g. Stress tolerance, early maturation, tolerance to poor soil quality

Diversify farm portfolios for risk management and sustainable intensification

Source:
FAO EcoCrop database

Current PGR conservation coverage

7.4 millions accessions in 1,740 ex situ gene banks (only 30% original samples, i.e. not duplicates), 80% major food commodities



Source: FAO 2010

Impressive but still some major concerns:

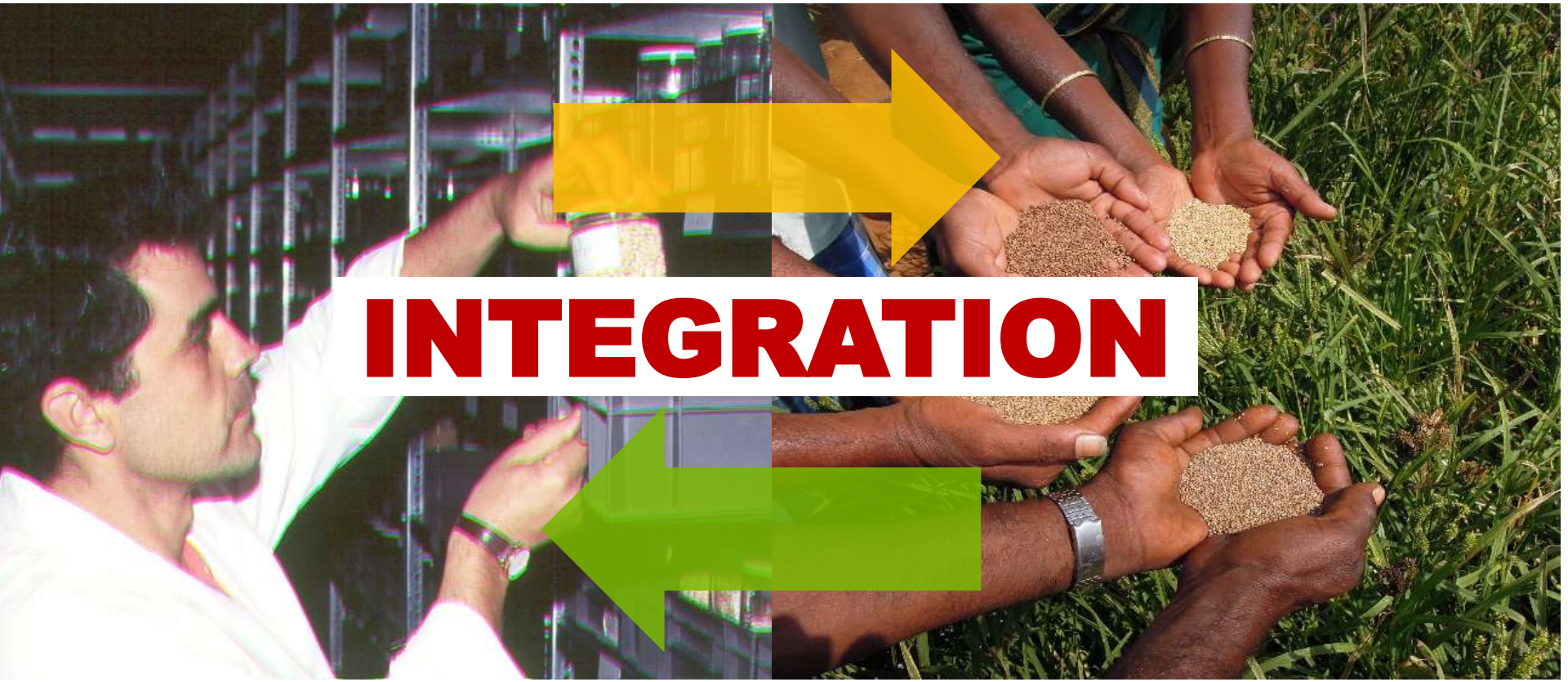
- Huge gap in conservation coverage by *ex situ*, most PGR for food maintained in situ/ on farm.
- Extremely limited *ex situ* coverage for non-commodity crops, major gaps for CWR and NUS
- Poor synergy between ex situ and in situ
- Lack of documentation and monitoring in situ
- Very limited support to on farm conservation.

Comparing Conservation Methods

	ADVANTAGES	DISADVANTAGES
Ex situ	•Greater diversity conserved as seed •Easy access for researchers •Relatively little maintenance	•No evolution •Genetic shift / drift •Limited access by farmers
In situ	•Dynamic process •Co-evolution of species/ pathogens •Good for recalcitrant spp.	•Material not easily available to users (esp. farmers) •Vulnerability to natural disasters •Appropriate management regimes not well understood •Need long term supervision/ monitoring •Less diversity in any single location.

The Vision

Effective conservation and management of PGR to address climate change, poverty, food & nutrition insecurity



Ex situ conservation ***In situ* / on farm conservation**

Benefits of an integrated *ex situ –in situ* conservation approach

- Species conservation coverage (especially NUS)
- Monitoring to prevent loss of diversity, guide reintroduction
- More effective selection of resilient species and varieties
- Informed decision on crop cultivations by farmers
- Strengthening of seed systems for resilient production/food systems
- **National agricultural biodiversity conservation plans consistent with CSA goals**

Example 1: Documentation/monitoring

Ex situ gene banks distribution maps

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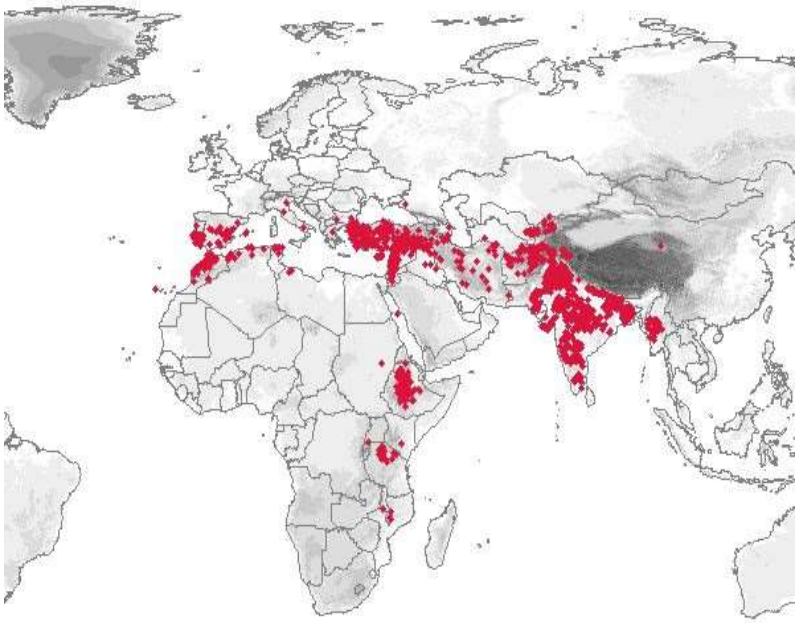
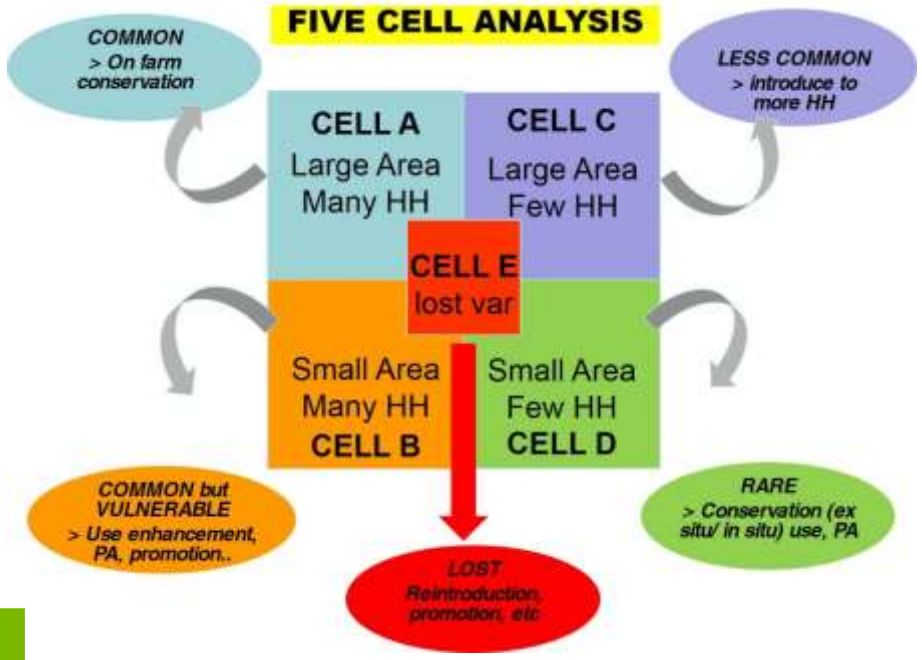
On farm distribution maps and red listing for cultivated species

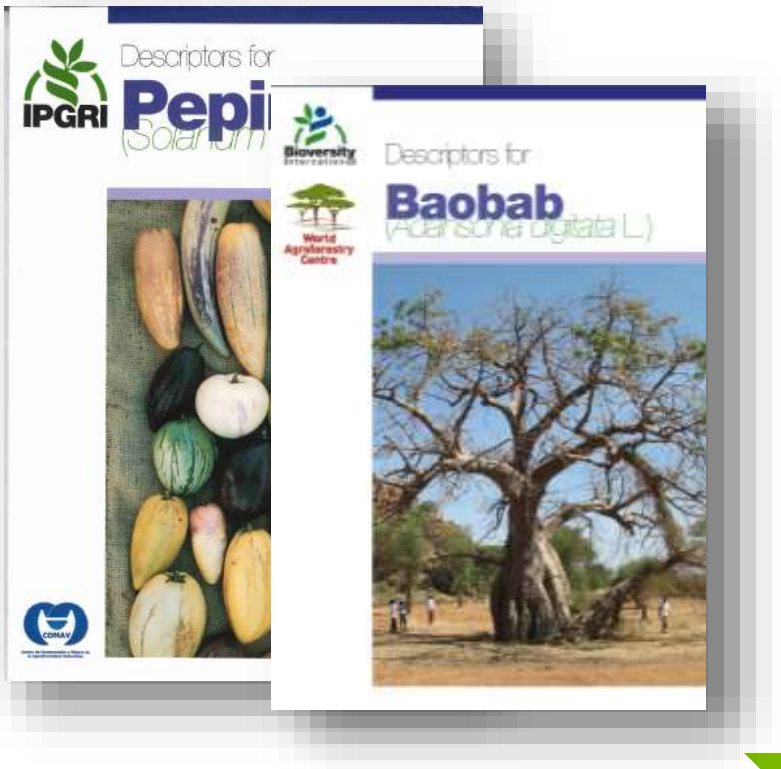




Filling knowledge gaps re on farm situation which is extremely limited for traditional crops/NUS

Example 2: Documenting useful traits

Revisit descriptors lists and include also on farm descriptors -geared more towards use- to make these useful to all users



Characterization efforts to benefits farmers as well

Example 3: Joint seed fairs

- Opportunity to share material from community seed bank and *ex situ* gene banks
- Facilitate sharing of material and knowledge (scientific and traditional) for more effective CSA

Promote greater use of PGR by farmers to support their experimentation towards adaptation/ resilience

Example 4: Joint germplasm multiplication

14 potato vars. conserved by the community gene bank in Cachilaya,Bolivia

Variety	Species
Waycha	*Solanum tuberosum*
Axahuiri	*Solanum ajanhuiri*
Chiar imilla	*Solanum tuberosum*
Yurima	*Solanum stenotum*
Qhaty kusillu	
Zaqampaya	*Solanum stenotum*
Chiar surimana	*Solanum stenotum*
Q'aqa surimana	Solanum stenotum
Bolivia 29	
Janqu zacampaya	*Solanum stenotum*
Lloqallito	
Luki	Solanum juzepzukii
Zapallito	Solanum goniocalix
Choquepitu	Solanum cortilubum

Promote adaptation, facilitate access, provide income for custodians, motivate communities for conservation

Example 5: Sharing innovations for strengthening on farm conservation activities

Innovative cheap seed conservation technology developed by scientists

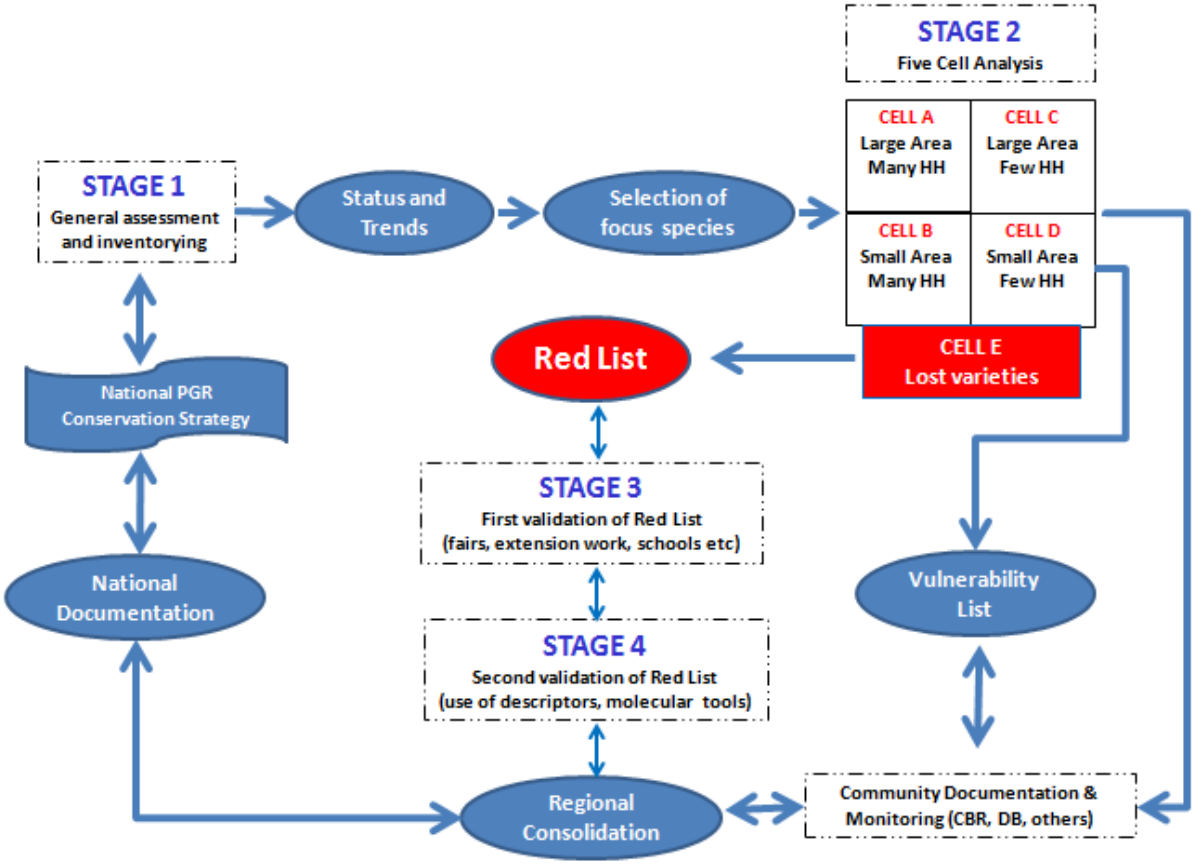
Traditional seed conservation at the Community Seed Bank of Kachorwa, Nepal

More effective conservation of traditional crops and landraces of staple crops scarcely represented in ex situ gene banks

Proposed Integrated Framework

Guiding Principles

- Both wild and cultivated spp. (incl.CWR) important
- Facilitate access of inter/intra-specific diversity to all users (breeders and farmers)
- Promote interactions across genetic-species-landscape levels through in situ/on farm management



Focus on information flow

Thank you

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