

# Whither Genebanks?



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European Plant Genetic  
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## Whither Genebanks?

# Overview

- Current status, trends and priorities
- International collections - CGIAR
- Some recent institutional developments
- Towards a 'rational global system'



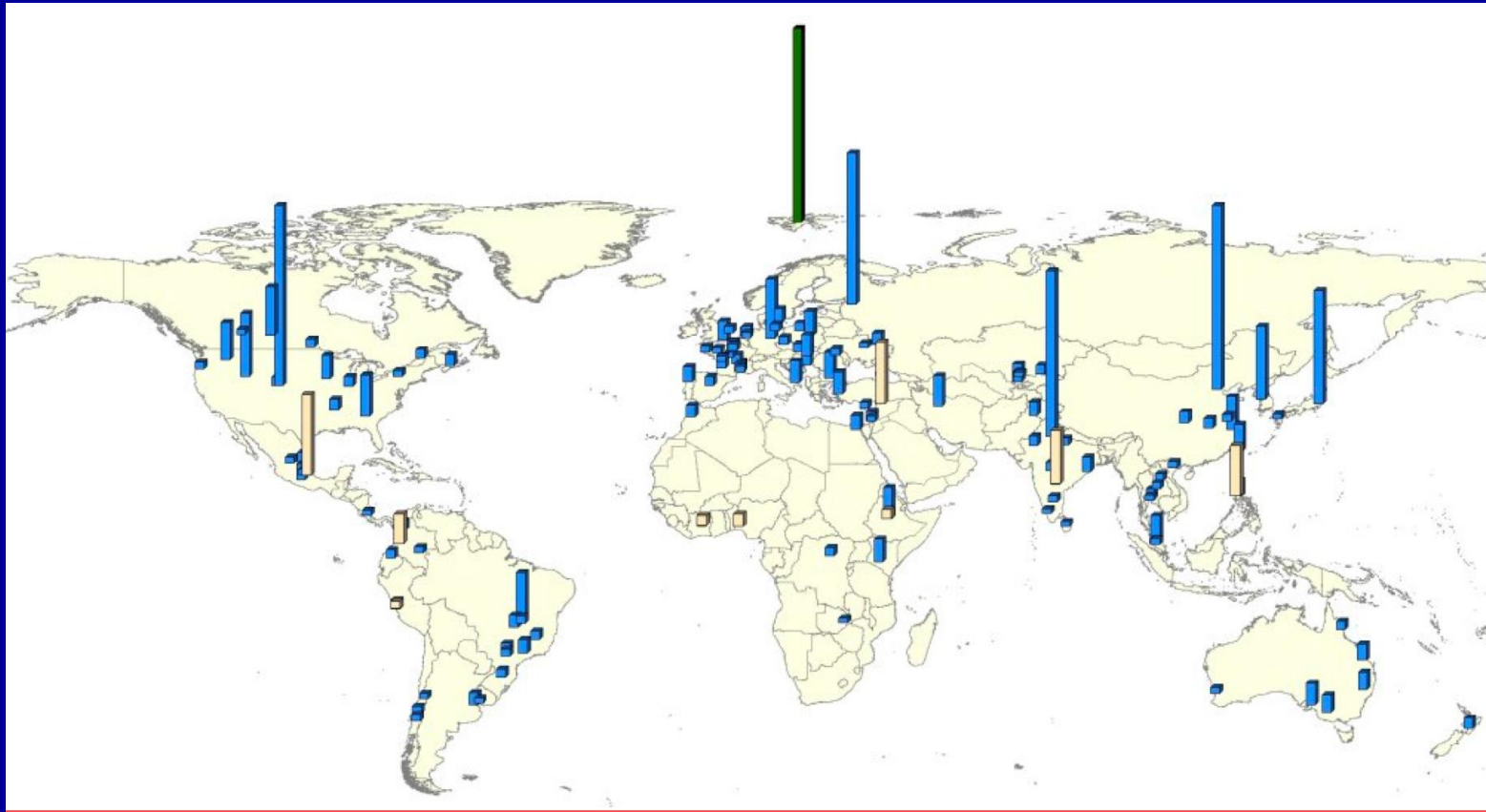
# Status of *ex situ* conservation\*

- **Number of genebanks worldwide**  
(public, private; local, national, international)
  - 1970: < 10
  - 1995: > 1400
  - 2009: > 1,750
- **Number of accessions:**
  - 1996 approx. 6 million accessions worldwide
  - 2009 approx 7.4 million accessions worldwide
- **Number of distinct accessions:**
  - 1996–2007, 240,000 new accessions collected from field
  - 2009 only 1.9 – 2.2 million distinct accessions



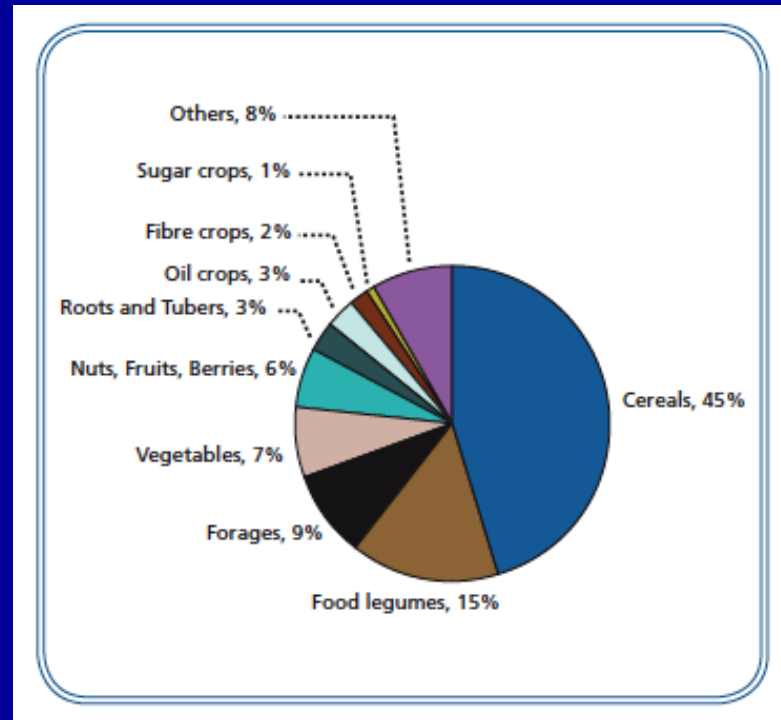


# Location of 130 genebanks with holdings of >10,000 accessions



**National and regional genebanks (blue); CGIAR genebanks (beige);  
The Svalbard Global Seed Vault (dark green)**

# Conservation status of different crop groups



- Cereals, food legumes, vegetables and forages account for 76%
- Urgent need to conserve more fruits, vegetables and 'minor' crops – also CWR

# Priorities for future *ex situ* conservation (from SoW-2)

- Increase the use of collections
- Increase institutional and human capacity to conserve and use PGRFA
- Secure additional, more sustainable funding
- Identify major gaps in *ex situ* collections (especially of minor crops and wild relatives)
- Get better feedback from users
- Reduce regeneration backlogs



# Priorities for future *ex situ* conservation cont...

- Reduce unintended duplication
- Expand safety duplication
- Strengthen characterization, evaluation and documentation
- Make data management systems more compatible
- Raise awareness of the importance of conserving and using PGRFA
- Put in place a more rational global system of *ex situ* collections



# CGIAR collections, 2009



– Barley: ICARDA	27,000
– Beans: CIAT	36,000
– Chickpea: ICARDA + ICRISAT	34,000
– Forages: CIAT + ICARDA + ILRI	66,000
– Maize: CIMMYT + IITA	28,000
– Potato: CIP	7,000
– Rice: AfricaRice + IRRI	129,000
– Wheat: CIMMYT + ICARDA	167,000

**TOTAL of all crops 704,000**

Approx 100,000 samples distributed per year  
>50% outside CGIAR to developing countries





# Future of CGIAR collections



- CGIAR Renewal: research consolidation within 'Strategy and Results Framework'
- Few CGIAR Research Programs (Mega-Programs): no genetic resources CRP
- Systemwide Genetic Resources Programme (SGRP) to be terminated
- New arrangements to guarantee funding plus new mechanisms for oversight and coordination of the CGIAR genebanks



# Future of CGIAR collections



- $>3/4$  million accessions by 2015
- Costing Study: annual cost: \$15 million for basic conservation and distribution
- Cost to reach \$16 million (2010 \$) by 2015
- \$3 million p.a. for other key activities e.g. collecting, training, collaboration, policy...
- One-off \$17.4 m. needed for entering new material, disease cleaning, and completing long-term storage and cryopreservation.
- Addition funding required to support research and pre-breeding (e.g. from CRPs)



# Three recent institutional developments: building on the International Treaty

## Global Crop Diversity Trust

- To fund, forever, an efficient and effective global system for conserving germplasm and making it available
- Endowment to support key collections for the long-term
- Additional project activities
- Independent legal entity under international law, 2004
- To date almost \$220 m. pledged and >\$155 m. received



# Global Crop Diversity Trust cont...



- Regional and crop conservation strategies
- Long-term grants as of Jan 2011:
  - Aroids, banana, barley, bean, cassava, fababean, forages, grasspea, pearl millet, rice, sorghum, wheat, yam
- Upgrading and capacity building
- Collecting, regeneration and evaluation
- Information systems
- Crop Wild Relatives
- Svalbard Global Seed Vault

*Complementary to the Benefit Sharing Fund of the International Treaty*



# Millennium Seed Bank

- Opened 2000, Wakehurst Place, Royal Botanic Gardens, Kew
- Focus on threatened dryland spp.
- To date: >28,000 spp. conserved including >90% of UK's 2,297 native higher plant spp.
- 2020 target: 60,000 spp. (25% of all flowering plant species)
- Major public education programme



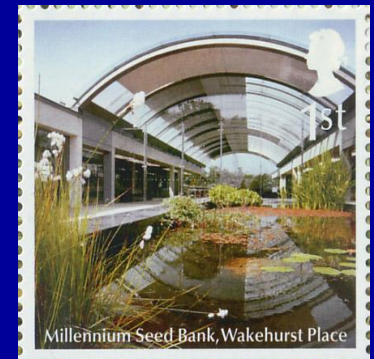


# Millennium Seed Bank cont ...

Kew

PLANTS PEOPLE  
POSSIBILITIES

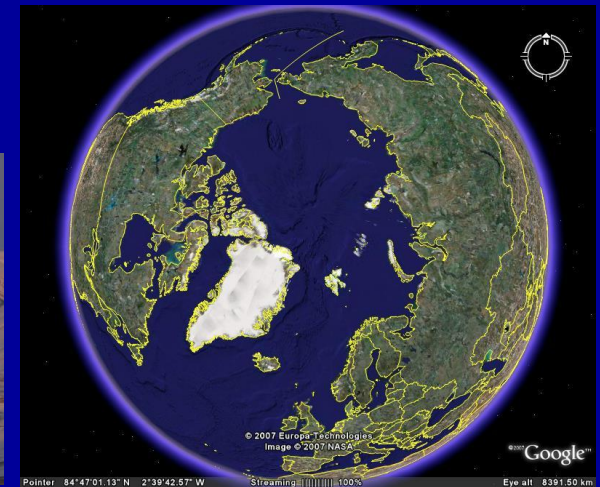
- Focus on inter- rather than intra-specific diversity: average <10 accessions per species
- Increasingly important as use of crop wild relatives (CWR) increases
- 60-70,000 CWR species (25% of all plant spp.)



# Svalbard Global Seed Vault

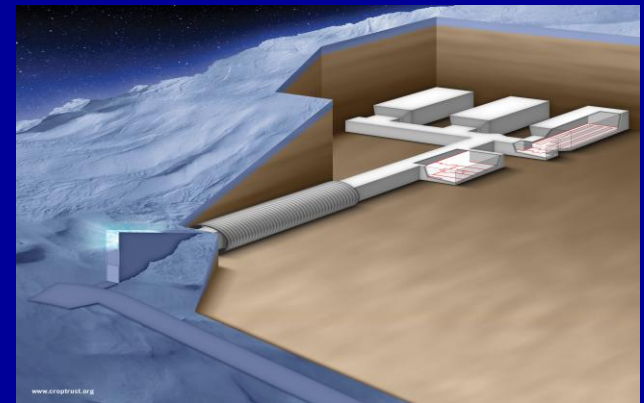


- Unique international back-up facility
- Norwegian government initiative - with Global Crop Diversity Trust
- On Spitsbergen, Svalbard Archipelago
- 78°N latitude, 1,200 km from N. Pole
- Opened Feb 2008



# Svalbard cont ...

- Located 130 m. AMSL in sandstone
- Permafrost at approximately  $-3^{\circ}\text{C}$
- Artificially cooled to  $-18^{\circ}\text{C}$
- Tunnel: 95 m. into side of the mountain
- 3 vaults, each 10 m. x 6 m. x 27 m.



# Svalbard cont ...

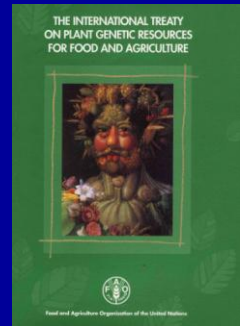
- \$9 million to construct – Norwegian Government
- Annual operations: \$125 – 150,000
- Annual maintenance: \$100,000
- Capacity 4.5 m. samples (500 seeds/sample)
- Black box safety duplicates from other genebanks
- To date >600,000 accessions of approx 4,000 spp.
- World's best insurance policy?





# Towards a more rational global *ex situ* conservation system

- Called for in the GPA and International Treaty
- Different roles and responsibilities for different genebanks with respect to different crops: not everyone needs to do everything
- A rational global system needs to build on institutional strengths and comparative advantages in a spirit of mutual cooperation and trust
- To what extent can the ECPGR/AEGIS System provide a model and/or foundation for a global system?





# What will a genebank in 2020 do?

- Maintain greater diversity of potentially useful alleles: trait collections, CWR, core collections of more crops ...etc. (through increase in total accessions – or rationalization?)
- Work more closely with breeders, molecular scientists etc. in the search for useful alleles (genomics, proteomics etc.) and pre-breeding
- Work more closely with farmers both in conservation and the provision/management of diversity
- Work more closely with environmentalists e.g. in biodiversity conservation, habitat restoration etc.
- Different genebanks will evolve differently within a more rational global system ...



# Differentiating roles and responsibilities within a rational system:

For a particular crop or group of crops:

- What is the role of resource-poor national genebanks compared to better resourced national and international genebanks?
- A rational global system comprises not only government genebanks: what is the role of collections held in community genebanks, the private sector or advanced institutions?
- Who can provide services (e.g. evaluation, regeneration...) without necessarily having a collection?
- Who will facilitate and by what mechanisms?



# Other questions to be addressed in designing a rational system:

- To what extent should collections be dispersed or consolidated? (e.g. in response to human and financial resources, management efficiency, or to meet quarantine concerns)? Is the AEGIS model applicable globally?
- Will it be necessary to handle Annex 1 crops differently from non-Annex 1 crops?
- How can systems for safety duplication be made more efficient and effective?



## ... other questions cont ...

- How much and what type of material should be conserved, and how?
- When should conservation focus on alleles rather than genotypes?
- How much effort should be devoted to wild compared to domestic germplasm?
- How much effort should go into increasing efficiency, e.g. through eliminating duplicates, increasing regeneration intervals, and/or cleaning samples from disease?



# Global Crop Diversity Trust: collaborative *ex situ* conservation strategies\*

The 30 *Annex 1* crop and regional strategies aim to:

- Identify collections of key international importance (well maintained, internationally available...)
- Identify gaps in collective coverage and how to fill them through introduction or new collecting
- Identify major ‘upgrading’ and research needs
- Propose appropriate coordination/facilitation mechanisms and information systems
- Strengthen links with users



\* <http://www.croptrust.org/main/identifyingneed.php>



# The Trust's strategies foresaw, for example:

## Lesser resourced national collections would focus on:

- The needs of national farmers and breeders
- Maintaining and distributing materials of immediate interest, including locally important crops
- Acting as a conduit for material into and out of the country
- Collecting and regenerating (in part through collaboration?)
- Conserving indigenous knowledge

## Better resourced national and international collections:

- Conserving for long-term and distribute internationally
- Molecular characterization, evaluation and pre-breeding
- Managing comprehensive information systems
- Providing global leadership and facilitation
- Major crops



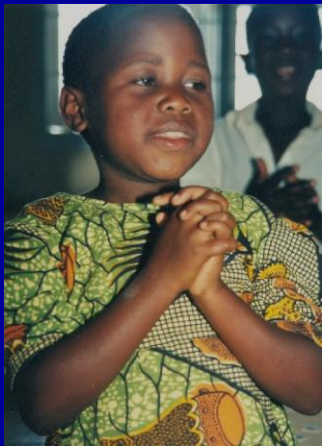
# Some Conclusions



- While significant progress has been made over recent years, SoW-2 makes it clear that much more is needed.
- The International Treaty was a major step forward and several important institutional developments have followed.
- The IT and GPA recognize the need to further develop and rationalize the global system for *ex situ* conservation



# Some Conclusions, cont...



- A start has been made through the Conservation Strategies sponsored by the Global Crop Diversity Trust.
- Progress must build on diverse institutional strengths and comparative advantages in a spirit of mutual trust.
- AEGIS provides a very good model but is not necessarily universally applicable
- A more efficient, effective and widely used *ex situ* conservation system is vital for meeting the challenges of food security and rural livelihoods





Many thanks for  
your attention

