Safety duplicating global ex-situ collections:
Taxonomic and institutional representation in the
Svalbard Global Seed Vault collection.

European Plant Genetic Resources Conference 2013

Ola T. Westengen, Simon Jeppson, Roland von Bothmer
NordGen
Objective

“Provide a safety net for the international conservation system of plant genetic resources, and to contribute to the securing of the maximum amount of plant genetic diversity of importance to humanity for the long term”

(Three-part agreement between the Norwegian Ministry of Agriculture, the Global Crop Diversity Trust, and NordGen, 2007)
Global policy context

• ITPGRFA: “cooperate to promote the development of an efficient and sustainable system of ex situ conservation…”

• GPA: “develop a rational, efficient, goal oriented, economically efficient and sustainable system of ex-situ conservation and use …”
Genebank standards – Safety duplication available at Svalbard

AGP - Revisioning the Genebank Standards

UPDATING GENEBANK STANDARDS

In order to ensure that plant genetic resources are conserved under conditions that meet recognized and appropriate standards, based on current and available technological and scientific knowledge, the Commission on Genetic Resources for Food and Agriculture has agreed on the need for revision of the Genebank Standards published in 1994 and requested FAO to undertake the review together with relevant international institutions.

The Genebank Standards were developed to respond to the need of appropriate standards for international ex situ conservation and concerned solely with the storage of seeds of orthodox species. The focus of the current review is limited to orthodox seed only. Conservation of recalcitrant seeds, clonally propagated planting materials, fruit trees require different strategies and approaches. Availability of updated genebank standards can provide an internationally accepted framework to monitor the viability and genetic integrity of the variety of ex situ collections held by genebanks all the collections in the long term.

FAO, in cooperation with the International Treaty, the CGIAR and other relevant international institutions, has undertaken the review as requested by the Commission. The draft Revised Genebank Standards will be presented for the consideration of the Intergovernmental Technical Working Group on Plant Genetic Resources at its Sixth Session in Rome in November 2012.

While commending the technical quality and presentation of the Draft Revised Genebank Standards, the Commission requested FAO to provide in addition draft standards on “evaluation” in order to achieve more comprehensiveness. The Commission recommended that any further inputs be provided through an electronic consultation prior to the next session of its Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture.

Download the Draft Revised Genebank Standards for the Conservation of Orthodox Seeds here: En Fr Sp

Review of Draft Genebank Standards the Conservation of Non-Orthodox Seeds and Clonally-Propagated Plants

On the request of the Commission on Genetic Resources for Food and Agriculture, the Draft Genebank Standards for the Conservation of Non Orthodox Seeds and Clonally-Propagated Plants has been prepared in cooperation with the International Treaty, Diversity International, other CGIAR centers, Global Crop Diversity Trust and relevant international institutions. In order to ensure a thorough review of the current draft (available in English only), FAO Members and National Focal Points for Plant Genetic Resources are invited (en, fr, sp) to provide inputs and suggestions by 14 May 2012 by email: ITWG-PGRFA@fao.org, or by fax: (+39) 06570-56499.

The document may be downloaded here.
Global ex-situ system

Policy
- ITPGRFA

Institutions
- CGIAR
- Global Crop Diversity Trust
- Regional Networks

Genebanks
- NARCs
- IARCs
- Universities / NGOs

Back-up
- SGSV
In the Seed Vault today

783,336 samples
55 depositor institutions
95% of 193 UN member states represented as «country of origin»
Genebank origin

- OECD member: 17
- Not OECD member: 26
- IARCs: 12
Sample origin

- IARC: 71%
- OECD member: 22%
- Not OECD member: 7%
Global Ex-Situ Crop Diversity Conservation and the Svalbard Global Seed Vault: Assessing the Current Status

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Abstract

Secure conservation of crop diversity is a global concern, and the development of an efficient and sustainable conservation system is in the interest of both national and international policy. We assess the completeness of the safety duplication collection in the Svalbard Global Seed Vault with respect to data on the Nordic Crop Collections as represented by the Seed and Agriculture Organisation of the Nordic Region (NordGen) and US seed collections as represented by the Svalbard Global Seed Vault. The number of collections of 16,000 accessions of 752 crop genera stored in the Seed Vault at Svalbard exceeds 29% of the estimated numbers of accessions in global seed collections. The number of accessions from the Nordic crops is included in the safety collection at Svalbard in some genera of high importance for food security by local researchers, such as *Artemisia* (Asteraceae), *Chrysanthemum* (Asteraceae), *Rhipsalis* (Cactaceae), and *Ananas* (Bromeliaceae). The larger crop genera is represented in the Seed Vault with the largest number of accessions stored globally. An average of 55% of the 10 largest crop genera is represented in the Seed Vault collection, which is covered by existing international agreements. The high level of accessions indicates that access to the global conservation system is important for national crops to be safeguarded in case of a disaster, and that access to the global Seed Vault collection is needed to ensure the conservation of national crops in case of a disaster. In a backup role for the global conservation system, the Seed Vault plays not only a practical but also a symbolic role for enhanced integration and cooperation for conservation of crop diversity.
- Meta-level data
- 190 countries
- 1750 genebanks
- 365 genebanks
- Accession level
- 2,3 million accs.
ITPGRFA and MLS
Largest genera in SGSV

- Triticum
- Oryza
- Hordeum
- Sorghum
- Phaseolus
- Zea
- Cicer
- Vigna
- x Triticosecale
- Pennisetum
- Glycine
- Solanum
- Arachis
- Lens
- Vicia
- Avena
- Medicago
- Cajanus
- Pisum
- Eleusine
- Brassica
<table>
<thead>
<tr>
<th>Crop</th>
<th>WIEWS total</th>
<th>GENESYS total</th>
<th>WIEWS distinct</th>
<th>W I E W S ITPGRFA</th>
<th>SGSV (total)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Triticum</em> (Wheat)</td>
<td>855,639</td>
<td>367,994</td>
<td>270,237</td>
<td>599,876</td>
<td>145,698</td>
</tr>
<tr>
<td><em>Oryza</em> (Rice)</td>
<td>773,948</td>
<td>192,983</td>
<td>440,313</td>
<td>553,235</td>
<td>145,540</td>
</tr>
<tr>
<td><em>Hordeum</em> (Barley)</td>
<td>469,590</td>
<td>171,603</td>
<td>138,722</td>
<td>339,448</td>
<td>61,390</td>
</tr>
<tr>
<td><em>Zea</em> (maize)</td>
<td>323,802</td>
<td>104,518</td>
<td>134,185</td>
<td>145,921</td>
<td>32,822</td>
</tr>
<tr>
<td><em>Sorghum</em> (Sorghum)</td>
<td>235,690</td>
<td>88,801</td>
<td>75,355</td>
<td>167,769</td>
<td>40,695</td>
</tr>
<tr>
<td><em>Avena</em> (Oat)</td>
<td>131,332</td>
<td>56,489</td>
<td>24,619</td>
<td>79,349</td>
<td>11,302</td>
</tr>
<tr>
<td><em>Pennisetum</em> (Pearl millet)</td>
<td>65,447</td>
<td>24,910</td>
<td>37,024</td>
<td>89,688</td>
<td>20,444</td>
</tr>
<tr>
<td><em>Eleusine</em> (Finger millet)</td>
<td>35,382</td>
<td>7,516</td>
<td>14,602</td>
<td>38,105</td>
<td>7,636</td>
</tr>
<tr>
<td><em>Amaranthus</em> (Amaranth)</td>
<td>28,313</td>
<td>5,620</td>
<td>14,290</td>
<td>316</td>
<td>1,300</td>
</tr>
<tr>
<td><em>Chenopodium</em> (Quinoa)</td>
<td>16,263</td>
<td>1,648</td>
<td>9,028</td>
<td>34</td>
<td>111</td>
</tr>
<tr>
<td><em>Eragrostis</em> (Teff)</td>
<td>8,820</td>
<td>1,760</td>
<td>6,126</td>
<td>152</td>
<td>38</td>
</tr>
<tr>
<td>Crop</td>
<td>WIEWS total</td>
<td>GENESYS total</td>
<td>WIEWS distinct</td>
<td>WIEWS ITPGRFA</td>
<td>SGSV (total)</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------</td>
<td>----------------</td>
<td>----------------</td>
<td>---------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Major crops total</td>
<td>5,979,663</td>
<td>2,040,606</td>
<td>2,185,452</td>
<td>3,053,865</td>
<td>766,292</td>
</tr>
<tr>
<td>(156 taxa with more than</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000 accessions <em>ex-situ</em>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All crops total</td>
<td>7,205,007</td>
<td>2,334,747</td>
<td>2,498,098</td>
<td>3,319,398</td>
<td>774,601</td>
</tr>
<tr>
<td>(all taxa in WIEWS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collections</td>
<td>1366</td>
<td>365</td>
<td>n/a</td>
<td>n/a</td>
<td>53</td>
</tr>
</tbody>
</table>
Pools in banks

“Access and availability is good in regard to the primary genepools of the most globally important crops. Availability of the secondary and tertiary genepools of these crops, and of all genepools associated with most other crops, is limited by the paucity of the collections as well as lack of information about what is held.”

<table>
<thead>
<tr>
<th>Crop</th>
<th>Estimated, mid-1980s percentage</th>
<th>Estimated 1986 percentage</th>
<th>Estimated, mid-1990s percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Rice</td>
<td>8–15</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Maize</td>
<td>2</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Sorghum</td>
<td>25</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Pearl millet</td>
<td>&lt;.30</td>
<td>—</td>
<td>20</td>
</tr>
<tr>
<td>Potato</td>
<td>10–20</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Sweet potato</td>
<td>&gt;50</td>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>Cassava</td>
<td>25–33</td>
<td>—</td>
<td>65</td>
</tr>
<tr>
<td>Soybean</td>
<td>30</td>
<td>—</td>
<td>40</td>
</tr>
<tr>
<td>Common bean</td>
<td>&lt;.50</td>
<td>50</td>
<td>35</td>
</tr>
</tbody>
</table>

Pools in the vault

www.cwrddiversity.org
### Rice CROP TAXA

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>HYBRIDS</td>
<td>137061</td>
</tr>
<tr>
<td>CWR</td>
<td>772</td>
</tr>
<tr>
<td>Total CWR</td>
<td>7224</td>
</tr>
</tbody>
</table>

#### PRIMARY

<table>
<thead>
<tr>
<th>Species</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oryza barthii</td>
<td>204</td>
</tr>
<tr>
<td>Oryza glaberrima</td>
<td>3767</td>
</tr>
<tr>
<td>Oryza glumipatula</td>
<td>53</td>
</tr>
<tr>
<td>Oryza longistaminata</td>
<td>214</td>
</tr>
<tr>
<td>Oryza meridionalis</td>
<td>53</td>
</tr>
<tr>
<td>Oryza nivara</td>
<td>1526</td>
</tr>
<tr>
<td>Oryza rufipogon</td>
<td>728</td>
</tr>
<tr>
<td><strong>Sub total</strong></td>
<td><strong>6545</strong></td>
</tr>
</tbody>
</table>

#### SECONDARY

<table>
<thead>
<tr>
<th>Species</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oryza alta</td>
<td>12</td>
</tr>
<tr>
<td>Oryza australiensis</td>
<td>36</td>
</tr>
<tr>
<td>Oryza brachyantha</td>
<td>17</td>
</tr>
<tr>
<td>Oryza eichingeri</td>
<td>22</td>
</tr>
<tr>
<td>Oryza grandiglumis</td>
<td>10</td>
</tr>
<tr>
<td>Oryza latifolia</td>
<td>58</td>
</tr>
<tr>
<td>Oryza minuta</td>
<td>64</td>
</tr>
<tr>
<td>Oryza officinalis</td>
<td>306</td>
</tr>
<tr>
<td>Oryza punctata</td>
<td>83</td>
</tr>
<tr>
<td>Oryza rhizomatis</td>
<td>21</td>
</tr>
<tr>
<td><strong>Sub total</strong></td>
<td><strong>629</strong></td>
</tr>
</tbody>
</table>

#### TERTIARY

<table>
<thead>
<tr>
<th>Species</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oryza longiglumis</td>
<td>6</td>
</tr>
<tr>
<td>Oryza meyeriana</td>
<td>8</td>
</tr>
<tr>
<td>Oryza meyeriana var. granulata</td>
<td>24</td>
</tr>
<tr>
<td>Oryza ridleyi</td>
<td>12</td>
</tr>
<tr>
<td><strong>Sub total</strong></td>
<td><strong>50</strong></td>
</tr>
<tr>
<td><strong>Total CWR</strong></td>
<td><strong>7224</strong></td>
</tr>
</tbody>
</table>
Rice
CWR - *Oryza sativa*
## Barley

### CROP TAXA (1A)

<table>
<thead>
<tr>
<th>TAXA</th>
<th>COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hordeum vulgare L. or simmilar</td>
<td>19218</td>
</tr>
<tr>
<td>HYBRIDS</td>
<td>5</td>
</tr>
<tr>
<td>UNCERTAIN TAXA</td>
<td>206</td>
</tr>
</tbody>
</table>

**1B**

<table>
<thead>
<tr>
<th>TAXA</th>
<th>COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hordeum vulgare subsp. spontaneum</td>
<td>1971</td>
</tr>
</tbody>
</table>

**2**

<table>
<thead>
<tr>
<th>TAXA</th>
<th>COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hordeum bulbosum</td>
<td>19</td>
</tr>
</tbody>
</table>

**3**

<table>
<thead>
<tr>
<th>TAXA</th>
<th>COUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hordeum arizonicum</td>
<td>10</td>
</tr>
<tr>
<td>Hordeum bogdanii</td>
<td>41</td>
</tr>
<tr>
<td>Hordeum brachyantherum</td>
<td>70</td>
</tr>
<tr>
<td>Hordeum brevisubulatum</td>
<td>9</td>
</tr>
<tr>
<td>Hordeum capense</td>
<td>1</td>
</tr>
<tr>
<td>Hordeum chilense</td>
<td>3</td>
</tr>
<tr>
<td>Hordeum comosum</td>
<td>1</td>
</tr>
<tr>
<td>Hordeum cordobense</td>
<td>11</td>
</tr>
<tr>
<td>Hordeum depressum</td>
<td>21</td>
</tr>
<tr>
<td>Hordeum erectifolium</td>
<td>2</td>
</tr>
<tr>
<td>Hordeum euclastion</td>
<td>12</td>
</tr>
<tr>
<td>Hordeum flexuosum</td>
<td>6</td>
</tr>
<tr>
<td>Hordeum fuegianum</td>
<td>17</td>
</tr>
<tr>
<td>Hordeum guatemalense</td>
<td>1</td>
</tr>
<tr>
<td>Hordeum halophillum</td>
<td>1</td>
</tr>
<tr>
<td>Hordeum intercedens</td>
<td>7</td>
</tr>
<tr>
<td>Hordeum jubatum</td>
<td>31</td>
</tr>
<tr>
<td>Hordeum lechleri</td>
<td>38</td>
</tr>
<tr>
<td>Hordeum marinum</td>
<td>135</td>
</tr>
<tr>
<td>Hordeum muticum</td>
<td>185</td>
</tr>
<tr>
<td>Hordeum parodii</td>
<td>34</td>
</tr>
<tr>
<td>Hordeum patagonicum</td>
<td>74</td>
</tr>
<tr>
<td>Hordeum procerum</td>
<td>11</td>
</tr>
<tr>
<td>Hordeum pubiflorum</td>
<td>18</td>
</tr>
<tr>
<td>Hordeum pusillum</td>
<td>13</td>
</tr>
<tr>
<td>Hordeum roshevitzi</td>
<td>16</td>
</tr>
<tr>
<td>Hordeum secalinum</td>
<td>13</td>
</tr>
<tr>
<td>Hordeum stenostachys</td>
<td>27</td>
</tr>
<tr>
<td>Hordeum tetraploidum</td>
<td>6</td>
</tr>
</tbody>
</table>

**Sub total** | **836**

**Total CWR** | **2826**
Hordeum vulgare
CWR - *Hordeum vulgare*
Seed deposit guidelines

All genebanks in the world are welcome to make use of the Svalbard Global Seed Vault as long as they agree with the principles of operation and meet the requirements which can be consulted in the **Standard Seed Deposit Agreement** ([here](#)). A general flow chart of the deposit process can be seen [here](#). If you are a genebank collection holder interested in using the Seed Vault for safety duplication, please contact us at sgs@nordgen.org. Annex 2 of the Standard seed Depositor Agreement lays out the minimum requirements for the **Quality, Quantity, Packing, Inventory and Shipment of Deposit Material**.

Data accompanying the deposits

*Please read this part carefully!*

An electronic inventory of the samples to be deposited at the Seed Vault must be submitted at least six weeks in advance of the planned date of shipping. This inventory shall comprise the following data:

- **Institute code**: WIEWS Institute Code for the institute holding the genebank accession. (You may access the WIEWS institute database at [http://apps3.fao.org/wievs/](http://apps3.fao.org/wievs/)).
- **Deposit box number**: Give each box in your shipment a unique number, and record here those numbers. Do not use decimal numbers or letters, only integer numbers: (1, 2, 3, 4, ...). Use successive numbers for successive shipments (e.g. if your first shipment consisted of 35 boxes the boxes in the following shipment shall list boxes from 36 and upwards). If you have sent boxes with test samples in addition to your deposit boxes these shall also be counted.
- **Collection name**: if your genebank uses parallel numbering systems for different collections, give here the name of the collection, e.g. Bean Collection.
- **Accession number**: As registered in your genebank. Please make sure that the combination of Institute Code, Collection name and Accession number together will uniquely identify the accession at the global level.
- **Full scientific name**: *Genus species subspecies*, including Authority and year of description if available.
- **Country of collection or source**: Where the accession is originally from. Please use ISO-3166-1 (alpha 3) country codes if possible.
- **Number of seeds**: This number can be based on a full count or on an estimate from the weight of the sample.
- **Regeneration month and year**: The harvest year is mandatory to be able to identify the regeneration cycle of the seed sample.
Cary Fowler: One seed at a time, protecting the future of food

The varieties of wheat, corn and rice we grow today may not thrive in a future threatened by climate change. Cary Fowler takes us inside a vast global seed bank, buried within a frozen mountain in Norway, that stores a diverse group of food-crop for whatever tomorrow may bring.

Biodiversity warrior Cary Fowler wants to save the world from agricultural collapse, one seed at a time. Full bio

TALKS

FILMED JUL 2009 - POSTED AUG 2009 - TEDGlobal 2009

360,345 Views
https://sites.google.com/a/nordgen.org/sgsv-presentation/