Final Performance Report

1. State: California
   FBMS/FAIMS Grant Number: F08AP00214 (E-2-P-32)
   Grant Name: Seed Collection and Banking of 50 Plant Species of Critical Conservation Concern, Phase 2
   Grant Year: 2007

   Final Report Due: 12/29/2012
   Grant Period: 8/10/2007 – 9/30/2012

3. Location of work: The project was located statewide. Habitat types varied based on the requirements of the species selected for seed collection.

4. Objectives and Expected Results: The project continued work started under a 2006 grant project (E-2-P-31). The objectives of this project (F08AP00214/ E-2-P-32) were to: 1) develop prioritized seed collection lists for listed or otherwise sensitive species of plants; 2) evaluate existing seed collections, such as that at Rancho Santa Ana Botanic Garden (RSA), to determine whether they are adequate to prevent extinction of all known populations of each taxon and provide material for future enhancements, repatriations and/or introductions; 3) develop a strategy to accomplish any additional collections which are determined to be needed; and 4) collect seeds as necessary if plants are present in large enough numbers to allow collection without adversely affecting donor populations.

The goal and expected results were to place seed from 30-40 taxa into long-term conservation storage at RSA.

5. If the work in this grant was part of a larger undertaking with other components and funding, present a brief overview of the larger activity and the role of this project.

This project is a continuation of a project funded under a 2006 grant (E-2-P-31). When proposed in 2006, E-2-P-31 envisioned collection of seed from 50 species of critical conservation need. E-2-P-31 was scaled back due to state budget constraints and unfavorable climatic conditions. 36 species were prioritized for collection following criteria developed by the Department of Fish and Game (Department). The project did not achieve its goal of adding accessions of 36 taxa over the life of the project, although 37 accessions from 16 taxa were placed in long-term conservation storage.

This project continued work started under the 2006 project.

6. Describe how the objectives were met.

A total of 5 accessions were made during the last reporting period, which are summarized in the table below.
2011/2012 Accessions

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Status</th>
<th># Accessions</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astragalus albens</td>
<td>Cushenbury milk-vetch</td>
<td>FE</td>
<td>1</td>
<td>San Bernardino Mountains; on south slopes above unnamed stream just north of Whiskey Springs, about 1/2 mile south of CNDDB element occurrence 6 at Monarch Flats.</td>
</tr>
<tr>
<td>Astragalus pycnostachyus var. lanosissimus</td>
<td>Ventura marsh milk-vetch</td>
<td>SE/FE</td>
<td>1</td>
<td>Oxnard, northeast corner of West Fifth Street and Harbor Blvd. Population known as North Shore.</td>
</tr>
<tr>
<td>Eriogonum kennedyi var. austromontanum</td>
<td>Southern mountain buckwheat</td>
<td>FT</td>
<td>1</td>
<td>San Bernardino Mountains; north of Big Bear Lake, northwest Holcomb Valley northwest of Forest Service Road 3N12.</td>
</tr>
<tr>
<td>Poa atropurpurea</td>
<td>San Bernardino blue grass</td>
<td>FE</td>
<td>1</td>
<td>San Bernardino Mountains; north of Big Bear Lake, Belleville Meadow northeast of Holcomb Campground.</td>
</tr>
<tr>
<td>Poa napensis</td>
<td>Napa blue grass</td>
<td>SE/FE</td>
<td>1</td>
<td>3000 block of Myrtledale Road, 1.65 miles northwest of downtown Calistoga, near southwest corner with Tubbs Lane.</td>
</tr>
</tbody>
</table>

All accessions made during this project are summarized in the attached table. The overall goal of the project was to place seed from 30-40 taxa into long-term conservation storage at RSA. This goal was not met; however 26 accessions representing 15 taxa were placed in storage. Multiple accessions were made for several species in order to capture the genetic diversity of these species. Each accession generated an additional expense for the grant; thus multiple accessions per species decreased the number of species that could be represented.

7. Discuss differences between work anticipated in grant proposal and grant agreement and that actually carried out with Federal Aid grant funds; include differences between expected and actual costs.

The previous grant manager for this project attempted to merge this grant with a previous grant (E-2-P-31) and set up one payable contract for both grants. Unfortunately, the paperwork was not submitted, and most of the invoices for this grant were paid from Department funds rather than federal grant funds. A total of $18,750 of the grant was used, and $50,600 of Department funds was used to pay the invoices submitted by the grantee.

8. List any publications or in-house reports resulting from this work. N/A
9. Name, title, phone number, and e-mail address of person compiling this report

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Section 6 Grants Analyst  
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cwonnakata@dfg.ca.gov
## SEED ACCESSIONS – TRADITIONAL SECTION 6 GRANT F08AP00214 (E-2-P-32)

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Status¹</th>
<th># of Accessions</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arenaria ursina</em></td>
<td>Big Bear Valley sandwort</td>
<td>FT</td>
<td>2</td>
<td>Collections from San Bernardino Mountains. Germination ranged from 62% – 100%.</td>
</tr>
<tr>
<td><em>Astragalus albens</em></td>
<td>Cushenbury milk-vetch</td>
<td>FE</td>
<td>1</td>
<td>Collection from CNDDB EO 2. Germination of treated seeds 100%; untreated seeds 20%.</td>
</tr>
<tr>
<td><em>Astragalus pycnostachyus var. lanosisimus</em></td>
<td>Ventura Marsh milk-vetch</td>
<td>FE/SE</td>
<td>1</td>
<td>Collection from CNDDB EO 7. Germination 20% – 100% depending on treatment.</td>
</tr>
<tr>
<td><em>Castilleja cinerea</em></td>
<td>Ash-gray Indian paintbrush</td>
<td>FT</td>
<td>2</td>
<td>Collections from the vicinity of EOs 21 and 22. Germination 0%.</td>
</tr>
<tr>
<td><em>Ceanothus cyanus</em></td>
<td>Lakeside ceanothus</td>
<td>CRPR 1B.2</td>
<td>2</td>
<td>Collections from the vicinity of CNDDB EO 1. Germination 2% - 18% depending on type of treatment.</td>
</tr>
<tr>
<td><em>Erigeron parishii</em></td>
<td>Parish’s daisy</td>
<td>FT</td>
<td>1</td>
<td>Collection from San Bernardino Mountains. Germination 75%.</td>
</tr>
<tr>
<td><em>Eriogonum cedrorum</em></td>
<td>The Cedars buckwheat</td>
<td>CRPR 1B.3</td>
<td>2</td>
<td>Endemic to The Cedars in Sonoma County. Bulk sampled collections from two populations. Germination 16%. Estimated viability (% live seed) of each sample is greater than 95%.</td>
</tr>
<tr>
<td><em>Eriogonum kennedyi var. austromontanum</em></td>
<td>Southern mountain buckwheat</td>
<td>FT</td>
<td>1</td>
<td>Collection from CNDDB EO 16. Germination 40%.</td>
</tr>
<tr>
<td><em>Hesperocyparis</em> (=<em>Cupressus</em>) stevensoni*</td>
<td>Cuyamaca cypress</td>
<td>CRPR 1B.1</td>
<td>1</td>
<td>Restricted to the southwest slopes of Cuyamaca Peak on gabbroic rock. Germination 9%.</td>
</tr>
<tr>
<td><em>Physaria</em> (=<em>Lesquerella</em>) kingii ssp. bernardina</td>
<td>San Bernardino Mountains bladderpod</td>
<td>FE</td>
<td>2</td>
<td>Collections from San Bernardino Mountains. Due to limited quantity of seed, germination tests only conducted on one collection. Germination 28%.</td>
</tr>
<tr>
<td><em>Poa atropurpurea</em></td>
<td>San Bernardino blue grass</td>
<td>FE</td>
<td>2</td>
<td>Collections from CNDDB EO 10 and near EO 2. Germination conducted on second accession. 56% germination.</td>
</tr>
<tr>
<td><em>Poa napensis</em></td>
<td>Napa blue grass</td>
<td>FE/SE</td>
<td>2</td>
<td>Two accessions from CNDDB EO 1. Germination conducted on second accession. 100% germination.</td>
</tr>
<tr>
<td>Scientific Name</td>
<td>Common Name</td>
<td>Status</td>
<td># of Accessions</td>
<td>Comments</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------------------------------</td>
<td>---------</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><em>Rorippa subumbellata</em></td>
<td>Tahoe yellow cress</td>
<td>SE</td>
<td>5</td>
<td>Collections from several populations occurring around the margins of Lake Tahoe. Germination for each accession: 0%, 0%, 70%, 2%, 8%.</td>
</tr>
<tr>
<td><em>Sidalcea pedata</em></td>
<td>Bird-foot checkerbloom</td>
<td>FE/SE</td>
<td>1</td>
<td>Collection from CNDDB EO 5. Due to small quantity of seed, no germination tests were conducted.</td>
</tr>
<tr>
<td><em>Thelypodium stenopetalum</em></td>
<td>Slender-petaled thelypodium</td>
<td>FE/SE</td>
<td>1</td>
<td>Collected from south side of Big Bear Lake in the San Bernardino Mountains. Germination 52%.</td>
</tr>
</tbody>
</table>

1 **FE** = Federally Endangered; **FT** = Federally Threatened; **SE** = State Endangered; **ST** = State Threatened

   **CRPR 1B.1** = Plants rare, threatened, or endangered in California and elsewhere; seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)

   **CRPR 1B.2** = Plants rare, threatened, or endangered in California and elsewhere; fairly threatened in California (20-80% of occurrences threatened/moderate degree and immediacy of threat)

   **CRPR 1B.3** = Plants rare, threatened, or endangered in California and elsewhere; not very threatened in California (<20% of occurrences threatened/low degree and immediacy of threat or no current threats known).

2 **CNDDB EO** = California Natural Diversity Database Element Occurrence
**Arenaria ursina**  
**CNDDB EO# undetermined**  
*Caryophyllaceae*

(Bear Valley sandwort)  
23252  ... SD wild collected in USA  

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>4363</td>
<td>23252</td>
<td>2010</td>
<td>1B.1</td>
<td>FT</td>
<td>1413</td>
<td>50</td>
</tr>
</tbody>
</table>

Based on the quantity of seed and the number of individuals sampled this collection **IS** considered sufficient to serve its intended purpose as a conservation seed collection.

**Arenaria ursina**  
**CNDDB EO# undetermined**  
*Caryophyllaceae*

(Bear Valley sandwort)  
23294  ... SD wild collected in USA  

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>4396</td>
<td>23294</td>
<td>2010</td>
<td>1B.1</td>
<td>FT</td>
<td>2576</td>
<td>500</td>
</tr>
</tbody>
</table>

Based on the quantity of seed and the number of individuals sampled this collection **IS** considered sufficient to serve its intended purpose as a conservation seed collection.
The preceding table shows the quantity of filled sound seed that was extracted from the total number of seed received. Hollow, sterile, or parasitized seeds were removed using an air blower unit. Viability (\% pure live seed) is estimated to be greater than 95\% based on a dissection exam where 5 of 5 of the lightest weight seeds are filled and sound.

These seeds were dried to equilibrium at 12\% - 18\% relative humidity. After three weeks the seeds were placed into heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18\° C.

**Germination Test Results**

Initial germination tests were conducted on 0.5\% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20\° C and 13 hrs. dark at 12\° C. Test results indicate that there is no dormancy in fresh seed under these test conditions.

<table>
<thead>
<tr>
<th>LOT_NUM</th>
<th>ACC #</th>
<th># TESTED</th>
<th>SEED TYPE</th>
<th>START DATE</th>
<th>END DATE</th>
<th>NUM</th>
<th>GERM</th>
<th>PRE TREATMENT</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4363*1</td>
<td>23252</td>
<td>48</td>
<td>Fresh seed</td>
<td>14-Feb-11</td>
<td>23-Feb-11</td>
<td>48</td>
<td>100</td>
<td>No Treatment</td>
<td>all seedlings with very healthy root and cotyledon development</td>
</tr>
<tr>
<td>4396*1</td>
<td>23294</td>
<td>50</td>
<td>Fresh seed</td>
<td>1-Feb-11</td>
<td>22-Feb-11</td>
<td>31</td>
<td>62</td>
<td>Cold moist stratification; up to 14 days at 5\° C</td>
<td>all seedlings with very healthy root and cotyledon development</td>
</tr>
</tbody>
</table>

1 March, 2011
Michael Wall – Seed Conservation Program Manager
**SEED BANK COLLECTION REPORT**

23486 *Astragalus albens* **CNDD EO# 2**
(Fushenbury milkvetch)


<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th>MATERNAL LINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>4985</td>
<td>23486</td>
<td>2011</td>
<td>1B.1</td>
<td>FE</td>
<td>173</td>
<td>20</td>
</tr>
</tbody>
</table>

Based on the quantity of seed and the number of individuals sampled this collection **is short** of the number of individuals as considered best practices to serve the collections intended purpose. However, depending on the genetic diversity between individuals within the population, this collection may be sufficient as it is.

**Processing:** Seed was received as fruits from each sampled plant in separate envelopes. Seeds were separated from the fruits by gentle threshing on a brass sieve. The threshed material was then blown to separate out the lighter weight chaff and any sterile or parasitized seed. Each seed sample was then placed into a separate glassine envelope. See number of seeds per individual work sheet.

The preceding seed lot table shows the quantity of filled sound seed that was extracted from the total quantity of plant material received. The estimated viability (% live seed) is greater than 95%.

**Packaging:** To prepare the seed for long term storage at -20° C the seed moisture content is reduced by allowing the seed to equilibrate at 12-15% RH using silica gel desiccant. After two weeks the seed is packaged in heavy duty foil plastic laminate heat sealed storage pouches, labeled, and placed into freezers.
Germination Test Results

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20°C and 13 hrs. dark at 12°C. Test results indicate that there is a simple seed coat dormancy in this seed lot that is over come by clipping through the seed coat.

<table>
<thead>
<tr>
<th>LOT_NUM</th>
<th>ACC #</th>
<th>SEED TYPE</th>
<th># TESTED</th>
<th>START_DT</th>
<th>END_DT</th>
<th># GERM</th>
<th>% GERM</th>
<th>PRE TREATMENT</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4985*2</td>
<td>23486</td>
<td>Fresh seed</td>
<td>5</td>
<td>13-Dec-11</td>
<td>10-Jan-12</td>
<td>5</td>
<td>100</td>
<td>Clip; rupture seed coat using pin, knife, or scalpel</td>
<td>All seedlings etiolated but with very healthy root and cotyledon development</td>
</tr>
<tr>
<td>4985*1</td>
<td>23486</td>
<td>Fresh seed</td>
<td>5</td>
<td>13-Dec-11</td>
<td>10-Jan-12</td>
<td>1</td>
<td>20</td>
<td>No Treatment</td>
<td>Seedling with very healthy root and cotyledon development</td>
</tr>
</tbody>
</table>

2 February, 2012

Michael Wall – Seed Conservation Program Manager
No. of seed per individual worksheet

## Documentation Worksheet - No. of Seeds per Individual

**Astragalus albens**

**23486**

<table>
<thead>
<tr>
<th>Plant #</th>
<th>Stor.</th>
<th># Seeds</th>
<th>Vth.</th>
<th>Notes</th>
<th>Plant #</th>
<th>Stor.</th>
<th># Seeds</th>
<th>Vth.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>30</td>
<td>0.065</td>
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<td>1</td>
<td>6</td>
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</table>

**Total Fruits**

<table>
<thead>
<tr>
<th>Plant #</th>
<th>Stor.</th>
<th># Seeds</th>
<th>Vth.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>23486</td>
<td>Active</td>
<td>30</td>
<td>0.065</td>
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</tr>
<tr>
<td>23486</td>
<td>Base</td>
<td>143</td>
<td>0.311</td>
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**Parents**

<table>
<thead>
<tr>
<th>Plant #</th>
<th>Stor.</th>
<th># Seeds</th>
<th>Vth.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>173</td>
<td></td>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Seeds**

20 Total Parents

**0.376 Total Seed Weight**

**0.217 Avg. 100 Seed Weight**

**#DIV/0! Avg. viable seeds per fruit**
SEED BANK COLLECTION REPORT

23517  *Astragalus pycnostachyus var. lanosissimus*  
Fabaceae  
(Ventura Marsh milkvetch)  
CNDDB EO# 7

United States: California: Ventura: Coastal Backdune: Oxnard, NE corner of West Fifth Street and Harbor Blvd. Population known as North Shore. Californian: Coastal dune. 29 ft. 34.19935°, 119.24048°. Funded maternal line conservation collection: Population roughly estimated at 100 juveniles and 32 reproductive individuals. Pods collected from 29. This original source population for all existing experimental populations has been on irrigation since June 2009 with the extra moisture having a dramatic effect on plant growth and reproductive output. Mary Meyer s.n. 8 Dec 2011.

<table>
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<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th>MATERNAL LINES</th>
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<tbody>
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<td>5000</td>
<td>23517</td>
<td>2011</td>
<td>1B.1</td>
<td>FE/SE</td>
<td>6,406</td>
<td>28</td>
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</table>

Based on the quantity of seed and the number of individuals sampled this collection is sufficient to serve the collections intended purpose.

**Processing:** Seed was received as fruits and partially processed seed samples with each sampled plant’s seed in separate envelopes. To separate the seeds the fruits were gently threshed on a brass sieve. The threshed material was then blown to separate out the lighter weight chaff and any sterile or parasitized seed. Each seed sample was then placed into a separate glassine envelope. See number of seeds per individual work sheet.

The preceding seed lot table shows the quantity of filled sound seed that was extracted from the total quantity of plant material received. The estimated viability (% live seed) is greater than 95%. A small and variable percentage of each seed sample consisted of a different seed type which was duller in color, more brown than green, flatter in development, and rougher in surface texture. See seed photos and germination test results.

**Packaging:** To prepare the seed for long term storage at -20°C the seed moisture content is reduced by allowing the seed to equilibrate at 12-15% RH using silica gel desiccant. After two weeks the seed is packaged in heavy duty foil plastic laminate heat sealed storage pouches, labeled, and placed into freezers.
Germination Test Results

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20\(^\circ\) C and 13 hrs. dark at 12\(^\circ\) C. Test results indicate that there is a simple seed coat dormancy in this seed lot that is over come by clipping through the seed coat.

<table>
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<tr>
<th>LOT_NUM</th>
<th>ACC #</th>
<th>SEED TYPE</th>
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<th>END_DT</th>
<th># GERM</th>
<th>PRE TREATMENT</th>
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<td>No Treatment</td>
<td>seedlings with healthy normal root development; remaining ungerminated seeds unimbibed</td>
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<td>19-Jan-12</td>
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<td>15</td>
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<td>all seedlings with very healthy root and cotyledon development</td>
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<td>No Treatment</td>
<td>Test on unusual seed morphs that have darker, thin walled, dull, buff colored, and sometimes moldy seed coats. **</td>
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</table>

** While some of this seed type are sterile or parasitized some are filled and viable. This test 2 of 10 seedlings with reduced vigor compared to 'normal' seeds with clipped seed coats. Ungerminated seeds 2 of 8 were empty while 6 of 8 contained mushy embryo and endosperm tissue.

15 February, 2012

Michael Wall – Seed Conservation Program Manager
<table>
<thead>
<tr>
<th>Plant #</th>
<th>Stor.</th>
<th># Seeds</th>
<th>Wt.</th>
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Total Fruits: 492
Total Fruits: 1.511
Total Fruits: 0
Total Fruits: 3260
Total Fruits: 10,446
Total Fruits: 0
2055: 7.078

Parents TSD TWT
28 Total Parents 492 1.511

19.026 Total Seed Weight
28 Total Parents
5288: 10.446

0.297 Avg. 100 Seed Weight
2055: 7.079
Germination test images (A & B) taken on 26 January, 2012. B image showing atypical seeds (*), typical seeds without treatment (NT), and typical seeds with clipping of seed coat pretreatment (CL). Image A is a close up cropping of NT and CL treatments. Image C taken on 14 February shows late germinants from NT normal seeds.
Seed imaging by John Macdonald, 2012 Rancho Santa Ana Botanic Garden
SEED BANK COLLECTION REPORT
9 March, 2011

**Castilleja cineria**  
(ash-gray paintbrush)  
23297  ... SD wild collected in USA  
United States: California: San Bernardino: San Bernardino Mountains: North of Big Bear Lake, W of Holcomb Valley, off 3N12 ca. 1/2 mile south of 3N16; ca. 0.3 miles west of CNDDB EO#22. USGS Quad: Big Bear Lake. Sierran/Cascade: pebble plain forest. 7232 ft. 34.30432°N, 116.93025°W. CDFG funded bulk sampled conservation seed collection; Federally listed as Threatened; CNPS listing 1B.2. Gina Richmond SN. 31 Aug 2010.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
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Based on the the number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose.

**Castilleja cineria**  
(ash-gray paintbrush)  
23298  ... SD wild collected in USA  
United States: California: San Bernardino: San Bernardino Mountains: Aspen Glen picnic area south of Big Bear Lake and northwest of Red Ant Canyon; ca. 1.25 miles northwest of EO#21. USGS Quad: Big Bear Lake. Sierran/Cascade: pebble plain forest. 6928 ft. 34.23636°N, 116.92464°W. CDFG funded bulk sampled conservation seed collection; Federally listed as Threatened; CNPS listing 1B.2. Also found with Cordylanthus nevinii, Ivesia agrycomata Gina Richmond SN. 31 Aug 2010.

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Based on the the number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose. We highly recommend augmenting this conservation collection with additional samples from this population.
The preceding table shows the quantity of filled sound seed that was extracted from the total number of seed received. Hollow, sterile, or parasitized seeds were removed using an air blower unit. Viability (% pure live seed) is estimated to be greater than 95% based on a dissection exam where 5 of 5 of the lightest weight seeds are filled and sound.

These seeds were dried to equilibrium at 12% - 18% relative humidity. After three weeks the seeds were placed into heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

**Germination Test Results**

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is dormancy in fresh seed that inhibits germination under these test conditions.
**SEED BANK COLLECTION REPORT**

**23225 Ceanothus cyaneus** \(\text{CNDDB EO# (new occ.)}\) \(\text{Rhamnaceae}\)

(San Diego Ceanothus)

23225...SD wild collected in USA

California: San Diego: Cuyamaca Mountains: Crestside Ecological Reserve; 17 miles NE of San Diego and SW of El Capitan Reservoir; 0.9 miles SW of CNDDB EO#1. Californian: Chaparral. 1500 ft. 32.833422°, 116.833586°. Funded maternal line conservation seed collection; area burned in the 2003 Cedar Fire; plants recovering well although overall pop. size reduced from pre-fire extent; area receives some recreational use; primary threat is from another fire prior to the development of a soil seed bank; minor threats from trail impacts and invasive species. Patricia Gordon-Reedy SN. 16 Aug 2010.

**23226 Ceanothus cyaneus** \(\text{CNDDB EO# (new occ.)}\) \(\text{Rhamnaceae}\)

(San Diego Ceanothus)

23226...SD wild collected in USA

California: San Diego: Cuyamaca Mountains: Crestside Ecological Reserve; 17 miles NE of San Diego and SW of El Capitan Reservoir; 1.75 miles SW of CNDDB EO#1. Californian: Chaparral. 1400 ft. 32.833443°, 116.850063°. Funded maternal line conservation seed collection; plants on Cienega soils; most of the area burned in the 2003 Cedar Fire; plants 1-12 from unburned chaparral; area receives some recreational use; primary threat is from another fire prior to the development of a soil seed bank; minor threats from trail impacts and invasive species. Patricia Gordon-Reedy SN. 19 Aug 2010.

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Based on the quantity of seed and the number of individuals sampled these collections are considered sufficient to serve their intended purpose.

Active, Base, and Back-up storage units of accession 23225
These seed collections were received as maternal line samples collected from 80 plants in two populations at the Crestridge Ecological Reserve. The fruits were collected at an optimal period and there was a very high percentage of filled, sound, ripe seed. The preceding seed lot table above shows the quantity of filled sound seed that was extracted from the material received. The estimated viability (% live seed) of each sample is greater than 95%. Excellent collection.

From these two collections back-up collections of 8,000 seeds from ca. 80 parents will be stored at the USDA National Center for Genetic Resource Preservation in Ft. Collins, CO. See number of seed per individual worksheet.

These seed collections were dried to equilibrium at 12% relative humidity, packaged in heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

**Germination Test Results**

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is physical dormancy in a high percentage of fresh seed that inhibits germination.

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<th>ACC #</th>
<th># TESTED</th>
<th>START_DT</th>
<th>END_DT</th>
<th># GERM</th>
<th>% GERM</th>
<th>SEED TYPE</th>
<th>PRE TREATMENT</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4299*1</td>
<td>23225</td>
<td>Fresh seed</td>
<td>14-Sep-10</td>
<td>6-Oct-10</td>
<td>20</td>
<td>2</td>
<td>NT</td>
<td>No Treatment</td>
<td></td>
</tr>
<tr>
<td>4299*2</td>
<td>23225</td>
<td>Fresh seed</td>
<td>14-Sep-10</td>
<td>6-Oct-10</td>
<td>20</td>
<td>12</td>
<td>SC</td>
<td>Scarification of seed coat using abrasive medium</td>
<td></td>
</tr>
<tr>
<td>4299*3</td>
<td>23225</td>
<td>Fresh seed</td>
<td>14-Sep-10</td>
<td>6-Oct-10</td>
<td>20</td>
<td>18</td>
<td>HW1</td>
<td>Boiled water; soak cooling 24 hrs.</td>
<td></td>
</tr>
</tbody>
</table>

Tests on accession 23226 are in process at this time.
Seed Photos by John Macdonald

6 October, 2010
Michael Wall – Seed Conservation Program Manager
**SEED BANK COLLECTION REPORT**

**Erigeron parishii**  
(CNDDB new)  
Asteraceae  

23300  ... SD wild collected in USA  
United States: California: San Bernardino: San Bernardino Mountains: Cactus Flats, off Smart's Ranch Road ca. 0.9 mile south-southeast of junction with Hwy. 18 at the head of Lone Valley. USGS Quad: Big Bear City. Californian: Pinyon Juniper woodland. 6139 ft. 34.30428°N, 116.79949°W. CDFG funded bulk sampled conservation seed collection; population adjacent to off road vehicle use area; population within 1.0 mile of CNBBG EO #39; Federally listed as Threatened, CNPS listing 1B.1. Semi shade. Scott Eliason, CRAIG 1617. 27 Jul 2010.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>4412</td>
<td>23300</td>
<td>2010</td>
<td>1B.1</td>
<td>FT</td>
<td>781</td>
<td>10</td>
</tr>
</tbody>
</table>

Based on the quantity of seed and the number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose as a conservation seed collection.

The preceding table shows the quantity of filled sound seed that was extracted from the total number of seed received. Hollow, sterile, or parasitized seeds were removed using an air blower unit. Viability (% pure live seed) is estimated to be greater than 95% based on a dissection exam where 5 of 5 of the lightest weight seeds are filled and sound.

These seeds were dried to equilibrium at 12% - 18% relative humidity. After three weeks the seeds were placed into heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

Photo of accession 20332  by John Macdonald 2008
Germination Test Results

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is no dormancy in fresh seed under these test conditions.

<table>
<thead>
<tr>
<th>LOT_NUM</th>
<th>ACC #</th>
<th># TESTED</th>
<th>SEED TYPE</th>
<th>START DATE</th>
<th>END DATE</th>
<th>NUM GERM</th>
<th>% GERM</th>
<th>PRE TREATMENT</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4412*1</td>
<td>23300</td>
<td>20</td>
<td>Fresh seed</td>
<td>1-Feb-11</td>
<td>9-Feb-11</td>
<td>15</td>
<td>75</td>
<td>No Treatment</td>
<td>15 of 20 seedlings with healthy root and cotyledon development; 3 of 5 with cotyledons but undeveloped roots; 2 of 5 seeds sterile</td>
</tr>
</tbody>
</table>

No test image

16 March, 2010
Michael Wall – Seed Conservation Program Manager
23239 Eriogonum cedrorum  **CN DDB EO# 1**  Polygonaceae
(The Cedars buckwheat)
23239 ... SD wild collected in USA
United States: California: Sonoma: North Coast Ranges: The Cedars, headwaters of Big Austin Creek, main canyon at Upper Mine (type locality). USGS Quad: Fort Ross. Californian: talus barrens. 1240 ft. 38.621123°N, 123.1272001°W. Some pig damage each spring but not extensive. Historic mining on opposite side of creek (no Eriogonum there). Type locality for the taxon. Full sun; also found with Phacelia corymbosa, Eriogonum nudum var. auriculatum, Eriogonum luteolum, Epilobium minutum, Claytonia exigua, Claytonia gypsophiloides
Roger Raiche 047.10. 16 Sep 2010.

23239 Eriogonum cedrorum  **CN DDB EO# (new)**  Polygonaceae
(The Cedars buckwheat)
23240 ... SD wild collected in USA
United States: California: Sonoma: North Coast Ranges: The Cedars, headwaters of Big Austin Creek, Azalea Creek drainage. USGS Quad: Fort Ross. Californian: talus barrens. 1257 ft. 38.611323°N, 123.125769°W. No disturbance, very few animals, more or less pristine. Full sun; also found with Streptanthus morrisonii, Phacelia corymbosa, Eriogonum nudum var. auriculatum, Eriogonum luteolum, Epilobium minutum, Claytonia exigua, Claytonia gypsophiloides
Roger Raiche 046.10. 16 Sep 2010.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>4311</td>
<td>23239</td>
<td>2010</td>
<td>1B</td>
<td></td>
<td>1188</td>
<td>seed - 150 individual(s)</td>
</tr>
<tr>
<td>4312</td>
<td>23240</td>
<td>2010</td>
<td>1B</td>
<td></td>
<td>2292</td>
<td>seed - 200 individual(s)</td>
</tr>
</tbody>
</table>

Based on the quantity of seed and the number of individuals sampled these collections **are** considered sufficient to serve their intended purpose.
These seed collections were received as bulk sampled collections from two populations. The fruits were harvested at an optimal period and there was a very high percentage of filled, sound, ripe seed. The preceding seed lot table above shows the quantity of filled sound seed that was extracted from the material received. The estimated viability (% live seed) of each sample is greater than 95%. Both collections while not large are very adequate and contain fully developed, sound seed. Excellent collections!

From these two collections back-up collections of 1,374 seeds were packaged separately and will be stored at the USDA National Center for Genetic Resource Preservation in Ft. Collins, CO. [http://www.ars.usda.gov/npa/ftcollins/ncgrp](http://www.ars.usda.gov/npa/ftcollins/ncgrp)

These seed collections were dried to equilibrium at 12% relative humidity, packaged in heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

**Germination Test Results**

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is possibly a chemical dormancy in a high percentage of fresh seed that inhibits germination. Germination is normal after excising the embryos from their seed coats. Test results on accession 23240 were identical.

<table>
<thead>
<tr>
<th>LOT_NUM</th>
<th>ACC #</th>
<th>#TESTED</th>
<th>START_DT</th>
<th>END_DT</th>
<th># GERM</th>
<th>% GERM</th>
<th>SEED TYPE</th>
<th>PRE TREATMENT</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4311*1</td>
<td>23239</td>
<td>25</td>
<td>13-Oct-10</td>
<td>2-Dec-10</td>
<td>4</td>
<td>16</td>
<td>Fresh seed</td>
<td>No Treatment</td>
<td>Cold Stratification</td>
</tr>
</tbody>
</table>
Germination test on November 29th above and on December 2 below showing development of excised embryos. In the figure below note seeds on the right which have been split but are still showing dormancy with little to no root or cotyledon development.
Seed Photo by John Macdonald

6 December, 2010
Michael Wall – Seed Conservation Program Manager
23495  *Eriogonum kennedyi var. austromontanum*  
(southern mountain buckwheat)  
Polygonaceae  
CNDDB EO# 16


<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th>MATERNAL LINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>4987</td>
<td>23495</td>
<td>2011</td>
<td>1B.2</td>
<td>FT</td>
<td>1,649</td>
<td>80</td>
</tr>
</tbody>
</table>

Based on the quantity of seed and the number of individuals sampled this collection is sufficient to serve the collections intended purpose.

**Processing:** Seed was received as maternal individual inflorescence samples with each plant sample in a separate envelope. To separate the seeds each inflorescence sample was gently threshed on a brass sieve. The threshed material was then blown to separate out the lighter weight chaff and sterile empty seed. Seed samples were then placed into separate glassine envelopes. See number of seeds per individual work sheet.

The preceding seed lot table shows the quantity of filled sound seed that was extracted from the total quantity of plant material received. The estimated viability (% live seed) is greater than 95%. However, see germination test results.

**Packaging:** To prepare the seed for long term storage at -20° C the seed moisture content is reduced by allowing the seed to equilibrate at 12-15% RH using silica gel desiccant. After two weeks the seed is packaged in heavy duty foil plastic laminate heat sealed storage pouches, labeled, and placed into freezers.
**Germination Test Results**

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20°C and 13 hrs. dark at 12°C. Seeds were started at ca. 70°F then transferred to cold stratification (5 deg F) after two weeks. The variation in germination response, seedling vigor, and development indicate that there is (dormancy?) in this seed lot under these test conditions. Because of the poor and uneven germination response we recommend that future propagation should utilize a soil germination medium and possibly a cold stratification pretreatment period of at least 4 weeks.

<table>
<thead>
<tr>
<th>LOT_NUM</th>
<th>ACC #</th>
<th>SEED_TYPE</th>
<th># TESTED</th>
<th>START_DT</th>
<th>END_DT</th>
<th># GERM</th>
<th>% GERM</th>
<th>PRE TREATMENT</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4987*1</td>
<td>23495</td>
<td>Fresh seed</td>
<td>25</td>
<td>2-Jan-12</td>
<td>14-Feb-12</td>
<td>10</td>
<td>40</td>
<td>Alternating warm-cold-warm stratification; 14 - 90 day periods</td>
<td>6 of 10 with normal root and cotyledon development (2 of 4 excised embryos); 4 of 10 abnormal without roots; ungerminated seeds filled and appearing healthy within.</td>
</tr>
</tbody>
</table>

Germination test seedlings taken on February 7 and February 14, 2012

15 February, 2012

Michael Wall – Seed Conservation Program Manager
No. of seeds per individual worksheet

<table>
<thead>
<tr>
<th>Plant #</th>
<th>Sbr.</th>
<th># Seeds</th>
<th>Wt.</th>
<th>Notes</th>
<th>Plant #</th>
<th>Sbr.</th>
<th># Seeds</th>
<th>Wt.</th>
<th>Notes</th>
<th>Plant #</th>
<th>Sbr.</th>
<th># Seeds</th>
<th>Wt.</th>
<th>Notes</th>
<th>Plant #</th>
<th>Sbr.</th>
<th># Seeds</th>
<th>Wt.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32</td>
<td>0.031</td>
<td></td>
<td></td>
<td>1</td>
<td>34</td>
<td>0.043</td>
<td></td>
<td></td>
<td>1</td>
<td>34</td>
<td>0.043</td>
<td></td>
<td></td>
<td>2</td>
<td>34</td>
<td>0.043</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>0.042</td>
<td></td>
<td></td>
<td>2</td>
<td>17</td>
<td>0.021</td>
<td></td>
<td></td>
<td>2</td>
<td>17</td>
<td>0.021</td>
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<td>0.021</td>
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<td>3</td>
<td>25</td>
<td>0.054</td>
<td></td>
<td></td>
<td>3</td>
<td>19</td>
<td>0.022</td>
<td></td>
<td></td>
<td>3</td>
<td>19</td>
<td>0.022</td>
<td></td>
<td></td>
<td>3</td>
<td>19</td>
<td>0.022</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>38</td>
<td>0.060</td>
<td></td>
<td></td>
<td>4</td>
<td>21</td>
<td>0.029</td>
<td></td>
<td></td>
<td>4</td>
<td>21</td>
<td>0.029</td>
<td></td>
<td></td>
<td>4</td>
<td>21</td>
<td>0.029</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>0.053</td>
<td></td>
<td></td>
<td>5</td>
<td>20</td>
<td>0.055</td>
<td></td>
<td></td>
<td>5</td>
<td>20</td>
<td>0.055</td>
<td></td>
<td></td>
<td>5</td>
<td>20</td>
<td>0.055</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>40</td>
<td>0.050</td>
<td></td>
<td></td>
<td>6</td>
<td>58</td>
<td>0.055</td>
<td></td>
<td></td>
<td>6</td>
<td>58</td>
<td>0.055</td>
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<td></td>
<td>6</td>
<td>58</td>
<td>0.055</td>
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<td></td>
</tr>
<tr>
<td>7</td>
<td>20</td>
<td>0.020</td>
<td></td>
<td></td>
<td>7</td>
<td>17</td>
<td>0.028</td>
<td></td>
<td>Oct</td>
<td>7</td>
<td>17</td>
<td>0.028</td>
<td></td>
<td>Oct</td>
<td>7</td>
<td>17</td>
<td>0.028</td>
<td></td>
<td>Oct</td>
</tr>
</tbody>
</table>

Total Fruits: 205, Wt. 0.259

Documentation Worksheet - No. of Seeds per Individual

Eriogonum kennedyi var austromontanum

23485

Date: 10 February 2012

<table>
<thead>
<tr>
<th>Plant #</th>
<th>Sbr.</th>
<th># Seeds</th>
<th>Wt.</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>205</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
POLYGONACEAE
Eriogonum kennedyi var australmontanum
(Southern Mountain Wild Buckwheat)

Seed imaging by John Macdonald – Rancho Santa Ana Botanic Garden 2010
23193 **Hesperocyparis stephensonii**  
(Cuyamaca cypress)

23193 ... SD wild collected in USA United States: California: San Diego: Southern Peninsular Range: Cuyamaca Mountains on the upper SW slopes of Cuyamaca Peak. USGS Quad Cuyamaca Mountain. Californian. 5602 ft. 32.942578°, 116.613571°. Maternal line conservation seed collection funded under state grant agreement No. P0685104. s.n. 20 Aug 2008.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th>MATERNAL LINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>4284</td>
<td>23193</td>
<td>2008</td>
<td>1B.1</td>
<td>none</td>
<td>42,731</td>
<td>12</td>
</tr>
</tbody>
</table>

Based on the quantity of seed and the number of individuals sampled this collection **IS** considered sufficient to serve its intended purpose however the viability of each seed sample is low which reduces the quantity of seed available for reintroduction and the number of individuals represented could be higher.

The seeds were received from the Forest Service Placerville Seed Processing facility thoroughly cleaned and processed with an accompanying spreadsheet with seed weights, number of cones, results of seed fill rate as determined by x-ray, germination test results, and seed moisture content. As is typical with cypress these collections contained a high percentage of sterile aborted seeds. These are frequently filled with a dry, pithy, reddish tissue which makes separating them from the filled fertile seeds difficult. Higher viability can be achieved using a higher blower speeds to sort the seed lots but this would also result in a loss of some good seeds. Given the rarity and value of this collection we decided to keep the seed collections as they were received. For the 12 seed samples fill ratios or viability varied between <10% to a high of 34%.

Each seed sample was repackaged and dried to equilibrium at 12% - 18% relative humidity. After three weeks the seeds were placed into heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.
Germination Test Results

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is no seed dormancy in this seed lot under these test conditions. The following seed test image shows the healthy seedlings as well as the low percentage of viable seeds in this seed lot.

<table>
<thead>
<tr>
<th>LOT_NUM</th>
<th>ACC #</th>
<th># TESTED</th>
<th>START_DT</th>
<th>END_DT</th>
<th># GERM</th>
<th>% GERM</th>
<th>SEED TYPE</th>
<th>PRE TREATMENT</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4284*1</td>
<td>23193</td>
<td>100</td>
<td>27-Jul-10</td>
<td>17-Aug-10</td>
<td>9</td>
<td>9</td>
<td>Indoor stored seed</td>
<td>No Treatment</td>
<td>all seedlings with very healthy root and cotyledon development; ungerminated seeds 8 of 8 filled with dry reddish pithy tissue</td>
</tr>
</tbody>
</table>

25 August, 2010
Michael Wall – Seed Conservation Program Manager
**Physaria (Lesquerella) kingii ssp. bernardina**  
(San Bernardino Mountains bladderpod)

23292 ... SD wild collected in USA  
United States: California: San Bernardino: San Bernardino Mountains: NE end of  
Big Bear Lake; Big Bear Gun Club off of W North Shore Drive west of Division  
Drive. USGS Quad: Big Bear Lake. Sierran/Cascade: scrub. 6816 ft. 34.266774°N,  
116.866867°W. CDFG funded bulk sampled conservation seed collection; Semi  
shade Scott Eliason SN. 27 Jul 2010.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>4389</td>
<td>23292</td>
<td>2010</td>
<td>1B.1</td>
<td>FE</td>
<td>364</td>
<td>50</td>
</tr>
</tbody>
</table>

Based on the quantity of seed this collection **IS NOT** considered sufficient to  
serve its intended purpose as a conservation seed collection.

23310 ... SD wild collected in USA  
United States: California: San Bernardino: San Bernardino Mountains: Southeast  
of Big Bear Lake on Sugarlump Mountain at top of Geronimo Run (Bear Mountain  
34.210385°N, 116.85088°W. CDFG funded bulk sampled conservation seed  
collection; plants receive irrigation water from sprinklers on ski run; Full sun  

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
</tr>
</thead>
<tbody>
<tr>
<td>4419</td>
<td>23310</td>
<td>2010</td>
<td>1B.1</td>
<td>FE</td>
<td>202</td>
<td>300</td>
</tr>
</tbody>
</table>

Based on the quantity of seed this collection **IS NOT** considered sufficient to  
serve its intended purpose as a conservation seed collection.
The preceding table shows the quantity of filled sound seed that was extracted from the total number of seed received. Hollow, sterile, or parasitized seeds were removed using an air blower unit. Viability (% pure live seed) is estimated to be greater than 95% based on a dissection exam where 5 of 5 of the lightest weight seeds are filled and sound.

These seeds were dried to equilibrium at 12% - 18% relative humidity. After three weeks the seeds were placed into heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

**Germination Test Results**

Due to the limited quantity of seed germination tests were only conducted on one of the two collections.

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is physical dormancy that inhibits germination in a percentage of fresh seed under these test conditions.

<table>
<thead>
<tr>
<th>LOT_NUM</th>
<th>ACC #</th>
<th># TESTED</th>
<th>SEED TYPE</th>
<th>START_DT</th>
<th>END_DT</th>
<th># GERM</th>
<th>% GERM</th>
<th>PRE TREATMENT</th>
<th>MISC</th>
</tr>
</thead>
<tbody>
<tr>
<td>4419*1</td>
<td>23310</td>
<td>25</td>
<td>Fresh seed</td>
<td>1-Feb-11</td>
<td>8-Mar-11</td>
<td>7</td>
<td>28</td>
<td>Cold moist stratification; indefinite period at 5° C</td>
<td>seedlings etiolated but with healthy root and cotyledon development</td>
</tr>
</tbody>
</table>

No image

11 March, 2011
Michael Wall – Curator and Seed Conservation Program Manager
SEED BANK COLLECTION REPORT

**Poa atropurpurea**  **CNDDB EO near EO#2**  Poaceae
(San Bernardino bluegrass)

23313  ... SD wild collected in USA

United States: California: San Bernardino: San Bernardino Mountains: South side of Big Bear Lake; Eagle Point; north of Swan Road, south of Stone Bridge Road; west of Meadow View Drive. USGS Quad: Fawnskin. Sierran/Cascade: Forest meadow. 6779 ft. 34.24899°N, 116.89524°W. CDFG funded bulk sampled conservation seed collection; population ca. 0.3 miles west of CNDDB EO #2; federally listed Endangered; CNPS listing 1B.2. Semi shade Scott Eliason CRAIG 1614. 27 Jul 2010.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
</tr>
</thead>
<tbody>
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Based on the quantity of seed and the number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose as a conservation seed collection.

The preceding table shows the quantity of filled sound seed that was extracted from the total number of seed received. Hollow, sterile, or parasitized seeds were removed using an air blower unit. Viability (% pure live seed) is estimated to be greater than 95% based on a dissection exam where 5 of 5 of the lightest weight seeds are filled and sound.

These seeds were dried to equilibrium at 12% - 18% relative humidity. After three weeks the seeds were placed into heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

**Germination Test Results**

Due to the small quantity of seed no germination tests were conducted on this collection.

17 February, 2010
Michael Wall – Seed Conservation Program Manager
23496 Poa atropurpurea CNDDB EO# 10 Poaceae
(San Bernardino bluegrass)


<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
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Based on the quantity of seed and the number of individuals sampled this collection is sufficient to serve the collections intended purpose. There was not enough samples and seed to create a duplicate back up NCGRP collection.

**Processing:** Seed was received as maternal individual inflorescence samples with each plant sample in a separate envelope. To separate the seeds (florets) each inflorescence sample was gently threshed on a brass sieve. The threshed material was then blown to separate out the lighter weight chaff and sterile florets. Seed samples consisting of filled florets and extracted caryopsis were then placed into separate glassine envelopes. See number of seeds per individual work sheet.

The preceding seed lot table shows the quantity of filled sound seed that was extracted from the total quantity of plant material received. The estimated viability (% live seed) is greater than 95%. However, see germination test results.

**Packaging:** To prepare the seed for long term storage at -20° C the seed moisture content is reduced by allowing the seed to equilibrate at 12-15% RH using silica gel desiccant. After two weeks the seed is packaged in heavy duty foil plastic laminate heat sealed storage pouches, labeled, and placed into freezers.
Germination Test Results

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is no dormancy in this seed lot under these test conditions. However, there is some concern about the overall viability of a percentage of the seed as indicated by the poor state of the un-germinated caryopsis. It is a possibility that the seed that failed to germinate and rotted within the floret were immature.

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<td>all seedlings with healthy root and cotyledon development; un-germinated seeds filled but soft and mushy within (immature seeds?)</td>
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### No. of seed per individual worksheet

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**Total** 329 seeds

### Notes
- **Poa alpina purpurea**
- **Experimental Setup**
- **Documentation Worksheet - No. of Seeds per Individual**
- **Date:** 18 January 2012

### Key
- **TNS:** Total Seed
- **TN:** Total Number
- **T:** Total
- **Avg.:** Average
- **Std. Dev.:** Standard Deviation
- **Max.:** Maximum
- **Min.:** Minimum
- **St:** Standard error
23200  *Poa napensis*  
(Napa bluegrass)
23200  ... SD wild collected in USA United States: California: Napa: 3000 block of Myrtledale Road, 1.65 miles NW of downtown Calistoga, near SW corner with Tubbs Lane. USGS Quad Calistoga. Californian: grassland. 400 ft. 38°35'46.04"N, 122°36'3.5"W. Site appeared to be ungrazed and had no other apparent ground disturbances. The house looked vacant. I collected from roadside as I called the landowner 5/08 and was not able to come on to the property itself to collect seed. The owner added the property is not for sale. Full sun; also found with teasel, non-native grasses. *Lepidium latifolium* across the road. One *Lepidium latifolium* inside fence, appears to be spreading. Kate Symonds s.n. 9 Jun 2010.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
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<td>FE/SE</td>
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</table>

Based on the quantity of seed and the number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose.

6 inflorescence stems were received in this collection. The very small quantity of seed from this collection was either due to very low seed set or much of the seed had already dispersed. The image on the right shows a typical inflorescence as received and all of the seeds that we were able to extract.

These seeds were dried to equilibrium at 12% - 18% relative humidity. After three weeks the seeds were placed into heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

For these collections there was insufficient seed to run an initial germination test but viability and seed soundness is high. We highly recommend augmenting this conservation collection with additional samples from this population.

25 August, 2010
Michael Wall – Seed Conservation Program Manager
Poa napensis                              CNDDB EO# 1                              Poaceae
(Napa bluegrass)

23513  ... SD wild collected in USA
California: Napa: Inner North Coast Range: 3000 block of Myrtledale Road, 1.65 miles NW of downtown Calistoga, near SW corner with Tubbs Lane. Californian: Grassland. 400 ft. 38.596122°, 122.600972°. Population in poor condition. Property owned by a Rita Godward. Site continues to look abandoned with the one house looking derelict and abandoned. No grazing or other disturbances. Collection from roadside plants along the barbed wire property fence line. . Kate Symonds SN. 9 Jun 2011. Second maternal line seed collection made to augment the previous year's funded seed accession 23200.

<table>
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<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
<th>STATUS CNPS</th>
<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
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<td>4991</td>
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<td>2011</td>
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<td>FE/SE</td>
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Based on the quantity of seed and the number of individuals sampled this collection is short of the number of individuals as considered best practices to serve this collection's intended purpose. However, depending on the genetic diversity between individuals within the population this collection with its excellent quantity of seed may be sufficient as it is.

**Processing:** Seed was received with each population sample inflorescence in separate envelopes. To separate the florets from the inflorescences the floral material was gently threshed on a rubber mat. The florets were then blown to separate out the lighter weight sterile florets and any floral chaff.

The preceding seed lot table shows the quantity of filled sound seed that was extracted from the total quantity of plant material received. The estimated viability (% live seed) is greater than 95%.

**Packaging:** To prepare the seed for long term storage at -20° C the seed moisture content is reduced by allowing the seed to equilibrate at 12-15% RH using silica gel desiccant. After two weeks the seed is packaged in heavy duty foil plastic laminate heat sealed storage pouches, labeled, and placed into freezers.
Germination Test Results

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test seeds were surface sterilized with a 20% bleach and 1.0% Tween® solution prior to plating. Test results indicate that there is no dormancy in fresh seed when exposed to these test conditions.

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<th>START_DT</th>
<th>END_DT</th>
<th># GERM</th>
<th>% GERM</th>
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<td>3-Jan-12</td>
<td>26-Jan-12</td>
<td>50</td>
<td>100</td>
<td>Cold moist stratification; up to 14 days at 5° C</td>
<td>all seedlings with very healthy root and cotyledon development</td>
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Report prepared on:

1 February, 2011
Michael Wall, Seed Conservation Program Manager
## No. of seed per individual worksheet

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| 3.630  | Total Seeds |
| 14    | Total Parents |
| 1.389 | Total Seed Weight |
| 0.038 | Avg. 100 Seed Weight |
| #DIV/0! | Avg. viable seeds per fruit |
POACEAE

Poa napensis
(NAVY BLUEGRASS)
Seed packaging RSABG 2011
Initial germination test seedlings
Accession information

*Rorippa subumbellata* Brassicaceae
(Lake Tahoe yellowcress)

23314  ... SD wild collected in United States
United States: California: El Dorado: Northern Sierra Nevada High: Lake Tahoe; Blackwood Creek South, west shore south of Truckee River and Tahoe City CNDDB EO# 19. USGS Quad: South Lake Tahoe. Sierran/Cascade: Back beach. 6068 ft. 39.104897°N, 120.15959°W. Sampled population was stems; plants are clonal, stem counts are from 2009 census; CDFG funded maternal line sampled conservation seed collection. Semi shade Cheryl Beyer s.n. 17 Sep 2010.

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<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
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<tbody>
<tr>
<td>4408</td>
<td>23314</td>
<td>2010</td>
<td>1B.1</td>
<td>SE</td>
<td>10,760</td>
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</table>

Based on the number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose. However considering the many other samples from neaby populations this may not be a matter of concern.

23315  ... SD wild collected in United States
United States: Nevada: Douglas: Northern Sierra Nevada High: Lake Tahoe, Nevada Beach; ca. 0.75 miles north of CNDDB EO#1(Edgewood Golfcourse) USGS Quad: South Lake Tahoe. Sierran/Cascade: Riparian forest at lake side beach. 6190 ft. 38.97667°N, 119.95193°W. Sampled population was stems; plants are clonal, stem counts are from 2009 census; CDFG funded maternal line sampled conservation seed collection. Semi shade Cheryl Beyer s.n. 14 Sep 2010.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
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<th>STATUS FED STATE</th>
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<tr>
<td>4603</td>
<td>23315</td>
<td>2010</td>
<td>1B.1</td>
<td>SE</td>
<td>8,065</td>
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</table>

Based on the quantity of seed and number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose. However considering the many other samples from neaby populations this may not be a matter of concern.
23316  ... SD wild collected in United States
United States: California: El Dorado: Northern Sierra Nevada High: Lake Tahoe; Tahoe Keys just west of the town of South Lake Tahoe; 0.5 miles west of CNDBD EO#5 and 0.5 miles east of EO#9. USGS Quad: South Lake Tahoe. Sierran/Cascade: Riparian, back beach. 6068 ft. 38.93878°N, 120.00754°W. Sampled population was stems; plants are clonal, stem counts are from 2009 census; CDFG funded maternal line sampled conservation seed collection. Semi shade; also found with small willow seedlings Cheryl Beyer s.n. 17 Sep 2010.

<table>
<thead>
<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
<th>COLLECTION YEAR</th>
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<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
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</thead>
<tbody>
<tr>
<td>4410</td>
<td>23316</td>
<td>2010</td>
<td>1B.1</td>
<td>SE</td>
<td>26,992</td>
<td>21</td>
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</table>

Based on the quantity of seed and number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose. However considering the many other samples from nearby populations this may not be a matter of concern.

23317  ... SD wild collected in United States
United States: California: El Dorado: Northern Sierra Nevada High: Lake Tahoe; Taylor Creek East; east-southeast of Emerald Bay USGS Quad: South Lake Tahoe. Sierran/Cascade: Riparian; lake side beach. 6222 ft. 38.940881°N, 120.05861°W. Sampled population was stems; plants are clonal, stem counts are from 2009 census of Taylor Creek East and West populations; CDFG funded maternal line sampled conservation seed collection. Semi shade Cheryl Beyer s.n. 15 Sep 2010.

<table>
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<tr>
<th>LOT NUMBER</th>
<th>ACCESSION NUMBER</th>
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<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
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<tr>
<td>4411</td>
<td>23317</td>
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<td>SE</td>
<td>33,453</td>
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Based on the quantity of seed and number of individuals sampled this collection **IS** considered sufficient to serve its intended purpose.

23318  ... SD wild collected in United States
United States: California: El Dorado: Northern Sierra Nevada High: Lake Tahoe; Upper Truckee River East at inlet to Lake; ca. 0.75 miles north of CNDBD EO#1 (Edgewood Golfcourse) USGS Quad: South Lake Tahoe. Sierran/Cascade: Jeffrey Pine forest. 6218 ft. 38.9421901°N, 119.99574°W. Sampled population was stems; plants are clonal; stem counts are from 2009 census; CDFG funded maternal line sampled conservation seed collection. Semi shade Cheryl Beyer s.n. 14 Sep 2010.

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<th>STATUS FED STATE</th>
<th>SEED QUANTITY</th>
<th># PLANTS SAMPLED</th>
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</thead>
<tbody>
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<td>4409</td>
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<td>2010</td>
<td>1B.1</td>
<td>SE</td>
<td>31,770</td>
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</table>

Based on the quantity of seed and number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose. However considering
the many other samples from nearby populations this may not be a matter of concern.

Processing and collection quality assessment
These *Rorippa* seed collections were received as several population samples from populations occurring around the margins of the lake. According to documentation received each sample represented one plant's seed but given that the plants are clonal this is only an estimate as being genetically unique. Each sample was received in a separate manila coin envelope and was well labeled as to population, collection date, and collector’s names. Each seed sample was processed by rubbing the fruits (siliques) off of the heads and threshing to separate the seeds from their fruits. An air separation blower unit was then used to separate out any chaff and lighter weight hollow or aborted seeds. The number of filled viable seeds per individual is noted in the preceding figure. Each of the maternal samples was placed into individual glassine envelopes and stored to equilibrium at 12% relative humidity. Each accession was split into a Base and an Active storage unit and one accession (23317) provided the backup collection sample that will be sent to the USDA National Center for Genetic Resource Preservation in Ft. Collins, Co. See the enclosed No. of Individuals Worksheets for each accession.
Germination test results

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is dormancy in fresh seed that restricts germination. Several pre-treatments were applied with the five accessions including: cold stratification (CS); water soak (WS) no treatment (NT) There was no germination response in any of the treatments until a layer of deionized water was placed over the seed of accession 23316. This water gradually was absorbed over a three week period and by 8 March 70% of the seeds had initiated germination. In addition germination was also initiated by excising embryos from their seed oats. Removal of the outer seed coat had no effect. Both positive results indicate that germination inhibitors within the seed coat may play a role in controlling germination events.

Fig. 2  Accession 23316 showing early seedlings

Fig. 3  close up of germinating seeds
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<th>LOT_NUM</th>
<th>ACC #</th>
<th>TESTED</th>
<th>SEED_TYPE</th>
<th>START_DT</th>
<th>END_DT</th>
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<th>% GERM</th>
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<td>50</td>
<td>Fresh seed</td>
<td>1-Feb-11</td>
<td>9-Mar-11</td>
<td>0</td>
<td>0</td>
<td>Cold moist stratification; up to 14 days at 5° C</td>
<td>ungerminated seeds filled within and imbibed; some mold on plate and seeds</td>
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<tr>
<td>4603*1</td>
<td>23315</td>
<td>50</td>
<td>Fresh seed</td>
<td>1-Feb-11</td>
<td>9-Mar-11</td>
<td>0</td>
<td>0</td>
<td>No Treatment</td>
<td>Plate left open 28FEB and agar dried out; ungerminated seeds appearing filled, sound and viable</td>
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<tr>
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<td>50</td>
<td>Fresh seed</td>
<td>1-Feb-11</td>
<td>9-Mar-11</td>
<td>35</td>
<td>70</td>
<td>No Treatment; seed covered with water on 15FEB</td>
<td>seedlings with early cotyledons and just developing roots on 8MAR, 2011</td>
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<td>4411*1</td>
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<td>51</td>
<td>Fresh seed</td>
<td>1-Feb-11</td>
<td>9-Mar-11</td>
<td>1</td>
<td>2</td>
<td>Water soak prior to sowing</td>
<td>one seedling with very healthy root and cotyledons; ungerminated seeds filled within and imbibed;</td>
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<tr>
<td>4409*1</td>
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<td>49</td>
<td>Fresh seed</td>
<td>1-Feb-11</td>
<td>9-Mar-11</td>
<td>4</td>
<td>8</td>
<td>Cold moist stratification; up to 14 days at 5° C; remove outer seed coat; Excise embryos</td>
<td>The only seeds to germinate were those embryos that were excised from the seed; no germination on other seeds with outer seed coats removed</td>
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</table>
### Documentation Worksheet - No. of Seeds per Individual

**Date:** 26 January, 2011

**Rorippa subumbellata**

**23314**

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**#DIV/0! Avg. viable seeds per fruit**
Appendix 2.

Documentation Worksheet - No. of Seeds per Individual

Date: 26 January, 2011

Rorippa subumbellata

23315

<table>
<thead>
<tr>
<th>Plant #</th>
<th>Stor.</th>
<th># Seeds</th>
<th>Wt.</th>
<th>Notes</th>
<th>Plant #</th>
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</table>

Total Frute: 916, 0.124, 0

Parents: TSD, TWT

8.065 Total Seeds

4 Total Parents

1.089 Total Seed Weight

0.014 Avg. 100 Seed Weight

#DIV/0! Avg. viable seeds per fruit
### Documentation Worksheet - No. of Seeds per Individual

**Date:** 26 January, 2011

**Rorippa subumbellata**

#### 23316

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**Total Fruits:**

- **Total Seeds:** 26,992
- **Avg. Total Seed Weight:** 3.240

**Parents**

- **Total Parents:** 26,992
- **Avg. 100 Seed Weight:** 0.012

**#DIV/0!** Avg. viable seeds per fruit
Appendix 4.

Documentation Worksheet - No. of Seeds per Individual

Date: 26 January, 2011

**Rorippa subumbellata**

23317

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Total Seeds: 34,655
Total Seeds, Active: 1,198
Total Seeds, Mapped: 22,286
Average Seeds: 4.678
Average Seeds, Mapped: 4.849
Average Seeds, Per Plant: 1.065
### Documentation Worksheet - No. of Seeds per Individual

**Date:** 26 January, 2011

**Rorippa subumbellata**

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*#DIV/0!* Avg. viable seeds per fruit
SEED BANK COLLECTION REPORT

Sidalcea pedata               CNDDB EO# 5               Malvaceae
(bird-footed checkerbloom)
23319  ... SD wild collected in USA United States: California: San Bernardino: San
Bernardino Mountains: South side of Big Bear Lake; Eagle Point; north of Swan
Road, south of Stone Bridge Road, west of Meadow View Drive. USGS Quad:
Fawnskin. Sierran;Cascade: Forest meadow. 6789 ft. 34.24899°N, 116.89524°W.
CDFG funded bulk sampled conservation seed collection; very threatened
species and population; federally and state listed  Endangered; CNPS listing 1B.1.
Semi shade Scott Eliason, CRAIG 1612. 27 Jul 2010.

<table>
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<th>LOT NUMBER</th>
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<th>STATUS</th>
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Based on the quantity of seed and the number of individuals sampled this
collection IS NOT considered sufficient to serve its intended purpose as a
conservation seed collection.

The preceding table shows the quantity of filled sound seed that
was extracted from the total
number of seed received. Hollow, sterile, or parasitized seeds were
removed using an air blower unit. Viability (% pure live seed) is
estimated to be greater than 95%
based on a dissection exam
where 5 of 5 of the lightest
weight seeds are filled and sound.

These seeds were dried to
equilibrium at 12% - 18% relative
humidity. After three weeks the
seeds were placed into heavy
duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

Germination Test Results

Due to the small quantity of seed no germination tests were conducted on this
collection.

17 February, 2010
Michael Wall – Seed Conservation Program Manager
**SEED BANK COLLECTION REPORT**  
11 March, 2011

*Thelypodium stenopetalum*  
(slender-petaled thelypodium)

23322  ... SD wild collected in USA

United States: California: San Bernardino: San Bernardino Mountains: South side of Big Bear Lake; Eagle Point; north of Swan Road, south of Stone Bridge Road, west of Meadow View Drive. USGS Quad: Fawnskin. Sierran/Cascade: Yellow Pine forest. 6779 ft. 34.24899°N, 116.89524°W. CDFG funded bulk sampled conservation seed collection; population ca. 0.75 miles southwest of CNDDB EO# 13; very threatened species and population; federally and state listed Endangered, CNPS listing 1B.1. Semi shade Scott Eliason CRAIG 1615. 27 Jul 2010.

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Based on the quantity of seed and the number of individuals sampled this collection **IS NOT** considered sufficient to serve its intended purpose as a conservation seed collection.

The preceding table shows the quantity of filled sound seed that was extracted from the total number of seed received. Hollow, sterile, or parasitized seeds were removed using an air blower unit. Viability (% pure live seed) is estimated to be greater than 95% based on a dissection exam where 5 of 5 of the lightest weight seeds are filled and sound.

These seeds were dried to equilibrium at 12% - 18% relative humidity. After three weeks the seeds were placed into heavy duty foil/plastic seed pouches, heat sealed, and placed into storage at -18° C.

Photo of accession 18411 by John Macdonald 2009
Germination Test Results

Initial germination tests were conducted on 0.5% agar solution on clear plastic examination plates maintained at 11 hrs. light at 20° C and 13 hrs. dark at 12° C. Test results indicate that there is physical dormancy that inhibits germination in a percentage of fresh seed under these test conditions.

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<td>Fresh seed</td>
<td>11-Feb-11</td>
<td>7-Mar-11</td>
<td>13</td>
<td>52</td>
<td>Cold moist stratification; up to 14 days at 5° C</td>
<td>seedlings etiolated but with healthy root and cotyledon development; ungerminated seeds filled and sound within</td>
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</tbody>
</table>

No image

11 March, 2011
Michael Wall – Curator and Seed Conservation Program Manager