Rare Plant Stabilization on O`ahu, Hawai`i

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Stability Goals

1. Minimum # of population units
2. Minimum # of mature plants
3. Stable population structure
4. All populations in genetic storage
5. All known threats controlled

Reporting & Data needs

- counts: # populations & # plants
- demographic structure: population trends
- genetic storage: founder tracking

Adaptive Management

- measure outplanting success
Biological Variables used in Planning

**Determined minimum # of plants:**

- Life span: long-lived vs. short-lived
- Mating & breeding system
- Seed bank persistence
- Population trends
- Inconsistent flowering

**Delimited population units:**

- Pollination biology
- Results from genetic testing
- Geography
- Land ownership

Took a conservative approach to preserving genotypes of individuals
Morphological variation in *Abutilon sandwicense*
Balancing founders at outplanting sites and in ex situ genetic storage

<table>
<thead>
<tr>
<th>Founder Plant Num</th>
<th>Plant Collected?</th>
<th>Founder Dead?</th>
<th>Number of Propagules Available</th>
<th>Founder</th>
<th>Founder</th>
<th>Num @ Army Nurseries</th>
<th>All Reintro Pops from Founder</th>
<th>Reintro Seeds</th>
<th>Reintro Microprop</th>
<th>Reintro ArmyNurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0008</td>
<td>Y</td>
<td>Dead</td>
<td></td>
<td>0</td>
<td>5114</td>
<td>1</td>
<td>729</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Reintro Taxon Code PopRefSite ID</td>
<td>Reintro Target PopRefSite Name</td>
<td>Target Number for Reintro</td>
<td>Num of Plants Reintro Attempt</td>
<td>Num of Plants Dead</td>
<td>+ (More Need)</td>
<td>Plants Needed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SchObo.PAH-D</td>
<td>Pahole REINTRO below snail exclusion</td>
<td>33</td>
<td>34</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total for Plant Number: 0008</td>
<td></td>
<td>33</td>
<td>34</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PopRef Site: SchObo.PAH-C</td>
<td></td>
<td>66</td>
<td>59</td>
<td>6</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Database links founder to outplanted progeny and all ex situ genetic storage collections
Replacement in *S. obovata*

1999 2011

GREEN= Total number of outplants
PURPLE= Total number of mature progeny (F1)
Rare Plant Management Tools

Seed storage: re-collection intervals

Vegetative propagation: cloning

Low seed set: hand-pollination

Outplanting: transport and planting techniques
Seed Storage

Superior form of ex situ genetic storage

1. preserves most genetic diversity
2. least amount of space & energy
3. most likely to withstand natural disaster

“When the climate changes and human disturbances bring tremendous threats to vegetation and the environment, it is seeds that confer on us a great hope to maintain a bright future.”

Dr. Xingguo Han, Chair, Seed Ecology IV
Seed Storage

Long-term Purposes:
1. backup outplantings
2. replace individuals lost to catastrophe

Short-term Purposes:
1. hold while threat control begins
2. propagation & storage research
3. accumulate founders for large, genetically diverse outplantings
Germination of Fresh & Stored Seeds of Viola chamissoniana Ging. subsp. chamissoniana (Violaceae)

Once a decline in viability is detected, the re-collection interval is set for that length of storage time.
<table>
<thead>
<tr>
<th>Taxa in storage</th>
<th>Years without decline in viability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyanea crispa</td>
<td>≥10</td>
</tr>
<tr>
<td><strong>Cyanea grimesiana subsp. obatae</strong> *</td>
<td>10</td>
</tr>
<tr>
<td>Cyanea superba subsp. superba</td>
<td>≥15</td>
</tr>
<tr>
<td><strong>Cyrtandra dentata</strong> *</td>
<td>10</td>
</tr>
<tr>
<td>Delissea waianaeensis</td>
<td>≥15</td>
</tr>
<tr>
<td>Dubautia herbstobatae</td>
<td>≥15</td>
</tr>
<tr>
<td>Euphorbia celastroides var. kaenana</td>
<td>≥5</td>
</tr>
<tr>
<td><strong>Flueggea neowawraea</strong> *</td>
<td>10</td>
</tr>
<tr>
<td>Hibiscus brackenridgei subsp. mokuleianus</td>
<td>≥10</td>
</tr>
<tr>
<td>Kadua parvula</td>
<td>≥10</td>
</tr>
<tr>
<td><strong>Lobelia koolauensis</strong> *</td>
<td>10</td>
</tr>
<tr>
<td>Melanthera tenuifolia</td>
<td>≥10</td>
</tr>
<tr>
<td>Neraudia angulata</td>
<td>≥10</td>
</tr>
<tr>
<td><strong>Sanicula mariversa</strong> *</td>
<td>10</td>
</tr>
<tr>
<td>Schiedea kaalae</td>
<td>≥10</td>
</tr>
<tr>
<td>Schiedea nuttallii</td>
<td>≥10</td>
</tr>
<tr>
<td>Schiedea obovata</td>
<td>≥15</td>
</tr>
<tr>
<td>Schiedea trinervis</td>
<td>≥15</td>
</tr>
<tr>
<td>Tetramolopium filiforme</td>
<td>≥15</td>
</tr>
<tr>
<td><strong>Viola chamissoniana subsp. chamissoniana</strong> *</td>
<td>10</td>
</tr>
</tbody>
</table>
Securing Propagules

Timing, phenology, logistics & luck
Fruitless Efforts = Vegetative Propagules

Cuttings:
Abutilon  
Cenchrus  
Eugenia  
Eurya  
Flueggea  
Gardenia  
Huperzia  
Melanthera  
Melicope  
Neraudia  
Nototrichium  
Phyllostegia  
Schiedea  
Stenogyne  
Tetramolopium  
Viola

Divisions:
Cenchrus  
Phyllostegia  
Stenogyne

Grafting:
Flueggea  
Hibiscus

Air-layer:
Abutilon  
Alectryon  
Eugenia  
Flueggea  
Gardenia  
Hesperomannia  
Hibiscus  
Labordia  
Urera
Vegetative propagation for rapidly increasing stock for outplanting and to limit generations in cultivation
Flueggea neowawraea
Air-layers and cuttings collected off wild trees & established in the nursery
Reduced or absent seed set

Dioecious taxa:

- *Flueggea neowawraea*
- *Gardenia mannii*
- *Labordia cyrtandrae*

Presumed avian pollinator absent on O`ahu for:

- *Cyanea sp.*
- *Hesperomannia sp.*
- *Lobelia sp.*

*Cyanea grimesiana subsp. obatae*
Labordia cyrtandrae
Labordia cyrtandrae
Hand Pollination
Loss of avian pollinators and reduced seed set?
Cyanea superba subsp. superba

Seedlings under outplants

Mature Fruit
Cyanea superba subsp. superba
Cyanea st.-johnii
Cyanea st.-johnii
Cross treatment marginally affected the number of seeds per fruit (GLM1, $F = 2.957$, df = 3, $p = 0.054$). Hand pollinating increases the number of seeds a fruit produces in comparison to open pollinated fruit ($t = 3.45$, df = 25, $p = 0.002$).
Outplanting

Nursery sanitation

Plant transport
Outplanting
Mahalo

Hesperomannia oahuensis 😊