Formation of a Cooperative to Conduct Research on Native Plants and Restore Damaged Ecosystems

Steven O. Link, School of Biological Sciences, Washington State University, 2710 University Drive, Richland, WA 99354; slink@wsu.edu

Sally A. Simmons, School of Biological Sciences, Washington State University, 2710 University Drive, Richland, WA 99354; ssimmons@tricity.wsu.edu

Rico O. Cruz, Department of Science and Engineering, Confederated Tribes of the Umatilla Indian Reservation, 73239 Confederated Way, P.O. Box 638, Pendleton, OR 97801

Barbara Harper, Department of Science and Engineering, Confederated Tribes of the Umatilla Indian Reservation, 73239 Confederated Way, P.O. Box 638, Pendleton, OR 97801; bharper@amerion.com

A major challenge facing restorationists is preparing for restoration in local areas before an ecological disturbance. This is particularly true after land development and can be true after wildfires. After disturbances, invasive species can dominate, reducing native species diversity (Sheley and Petroff 1999). Ecological restoration is difficult if local ecotypes have been destroyed. The Confederated Tribes of the Umatilla Indian Reservation and Washington State University are building a cooperative to conduct research on native species propagation and restoration using highly diverse plant communities.

We are attempting to engage land managers and the public in valuing and restoring highly diverse ecosystems. This is not trivial. It requires restoring entire ecosystems and being prepared to do this before a disturbance. Restoration is often an afterthought done in an emergency stabilization mode after a disturbance. This behavior forces the use of a few species that may not be locally derived. If local genetic resources are not available, then remaining local ecotypes can become genetically polluted (Link 2006). Collecting seeds of local ecotypes would reduce the likelihood of genetic pollution. A local seed store can retain local genetic characters. When a restoration need arises, the local stock can be "increased" to produce adequate numbers of seed for the restoration area.

The goal of our efforts is to create a sustainable research cooperative to resolve issues in restoration ecology, focused first on Columbia Basin shrub-steppe and riparian species. Successful and sustainable restoration is integrally tied to the cultural values of the tribes. The very nature of natural areas is, in some part, a product of thousands of years of Native American manipulation environmental management (Senos et al. 2006). Thus, successful and sustainable ecological restoration depends on understanding the values Native Americans have for native plants and ecosystems. Our cooperative includes members of societypeople with an interest in native plant research including land management agencies, Native American groups, commercial greenhouses, ecological restoration contractors, and local homeowners among others.

Our cooperative serves a strong social need by being an example of how like-minded groups can address difficult ecological restoration questions. We decided toare creatinge our cooperative with funding contributions from many groups and individuals to overcome difficulties associated with funding long-term restoration efforts. We are modeling our cooperative after Oregon State University's Nursery Technology Cooperative (www.cof.orst.edu/coops/ntc). An element of the group can fall out without destroying the entire effort. In contrast, funding cuts from a single group or institutional funding can have devastating consequences.This lowers the risk of failure if a major funding source is interrupted.

A good strategy is to form a cooperative business model and encourages all elements of society to fund the cooperative similar to a government-funded natural resources group except the cooperative asks for financial support as opposed to taxing the public. Cooperatives can be formed in local areas or regions to address local or regional restoration problems. Local groups are knowledgeable about local flora and are able to collect local seed thereby conserving the genetic diversity of local areas. If local cooperatives collect sufficient local seed then the likelihood that areas subjected to disturbances such as severe fire can be restored with locally derived genetic material.

As climate changes, cooperatives can network to anticipate species change, understand requirements of new species, and assist in plant movement. Tribes can educate others on the proper cultural use of new species before they arrive, and can send their own information to the new hosts of species that migrate northward from their current locations. As the effects of climate change become better known, networks of native plant collaboratives can exchange seed and knowledge to mitigate some of the impacts.

Our initial research focuses on growing local species that are not available or have had little horticultural research. We collected seed from 80 of about 800 species in the Columbia Basin in the summer and fall of 2006, built a greenhouse, and are propagating the species. Seed were cleaned by hand and stored in glass vials at room temperature and humidity until germination and emergence trials were initiated. Germination trials were initiated in February 2007 and emergence recorded at the first sign of a radicle. Germination trials included placing seed on wetted filter paper in sterile Petri dishes. The same species were also planted just below the soil surface in pots in a greenhouse. Greenhouse temperature was not controlled. Pots were watered daily. At least 30 seeds were used to compute percent germination and emergence. Days to first germination and first emergence were noted as number of days after sowing until the first germinated or emerged seedling was observed.

Germination and emergence of the species is highly variable (Table 1). Greater than 90% of *Apocynum cannabinum* seed germinated or seedlings emerged which is much greater than the 44% observed by Mitchell (1926) under similar germination conditions. We noted only three days until first germination compared with six days in Mitchell (1926). Germination of *Asclepias speciosa* was the lowest at 27% and is less than about 70% germination under similar circumstances (Comes et al. 1978). There is little known of germination characteristics of the lithosolic species *Eriogonum thymoides, Sedum leibergii,* or *Talinum spinescens*, found at the Hanford National Monument in the Pacific Northwest. We are currently conducting seed stratification trials on species that have not germinated.

The next step is to determine how to increase the resource and plant highly diverse native plant communities. As a research effort, monitoring will occur without fail!

Cooperatives formed to conduct research on native plants and restoration of damaged ecosystems can be useful to improve our knowledge of restoration ecology. This strategy can be repeated in many regions where local expertise can be brought to bear on local ecological

Family Common Name Scientific Name	% Germination Petri Dish	Days to first Germination	% Emergence in soil	Days to First Emergence
Asclepiadaceae				
Showy milkweed				
Asclepias speciosa	27	30	48	21
Apocynaceae				
Common dogbane				
Apocynum cannabinum	93	3	98	6
Chenopodiaceae				
Spiny hopsage				
Grayia spinosa	57	10	43	21
Compositae				
Large-flowered agoseris				
Agoseris grandiflora	100	3	96	6
Coreopsis				
Coreopsis atkinsonia	70	7	0	0
Threadleaf fleabane				
Erigeron filifolius	53	5	15	8
Desert yellow daisy				
Erigeron linearis	53	5	49	11
Piper's daisy				
Erigeron piperianus	77	5	15	16
Shaggy fleabane				
Erigeron pumilus	60	5	12	18
Columbia River gumweed				
Grindelia columbiana	87	18	19	10
Sneezeweed				
Helenium autumnale	80	13	30	13
Hoary aster				
Machaeranthera canescens	77	3	58	5
False mountain dandelion				
Microseris troximoides	53	12	5	26
Crassulaceae				
Leiberg's sedum				
Sedum leibergii	60	5	45	11
Graminae				
Squirreltail				
Elymus elymoides	87	5	97	10
Sand dropseed				
Sporobolus cryptandrus	100	14	0	0
Grossulariaceae				
Wax currant				
Ribes cereum	100	5	0	0
Leguminosae				
Buckwheat milkvetch				
Astragalus caricinus	53	8	13	8
Crouching milkvetch				
Astragalus succumbens	60	23	5	25
Annual lupine				
Lupinus pusillus	63	3	5	25
Onagraceae				
Pale evening primrose				
Oenothera pallida	50	5	1	13
Polemoniaceae				
Longleaf phlox				
Phlox longifolia	87	3	81	9
Polygonaceae				
Thymeleaf buckwheat				
Eriogonum thymoides	73	10	21	8
Portulacaceae				
Spiny flameflower				
Talinum spinescens	60	3	12	11
Ranunculaceae				
Virgin's bower				
Clematis ligusticifolia	73	10	47	21
Scrophulariaceae				
Showy penstemon				
Penstemon speciosus	83	10	13	18

Table 1. Germination and emergence of a subset of species (Hitchcock and Cronquist 1973).

restoration problems. This strategy may also be useful in the National Park Service Cooperative Ecosystem Studies Units network.

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