DISCUSSION

One mission of the Department of Horticulture and the University of Kentucky Arboretum is outreach education. Each year, hundreds of school children visit the Arboretum as part of school-sanctioned field trips or home-school activities. While these visits help illustrate ecological topics, many teachers are not prepared to take full advantage of plant-based environmental education without additional support material. The Virtual Arboretum web pages may provide such support material. In many cases, these materials may encourage teachers to go beyond the classroom into natural settings when they discuss ecological topics. These materials will also help improve the understanding of future Kentucky residents in the benefits of preserving existing trees and supporting urban forestry in their community.

Acknowledgement. Funding to support development of these materials was obtained from the Urban and Community Forestry Grant Program of the Kentucky Division of Forestry.

Effective Restoration at the Grass Roots©

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NATIVE SEED PRODUCTION

The importance of protecting and restoring native habitats within the Willamette Valley has become apparent to many public agencies, nonprofits, and private landowners. Unfortunately, there has been a lack of native seed available for restoration projects. Heritage Seedlings, hoping to fill this void, has begun the propagation of native Willamette Valley grasses and forbs for seed production. Currently, there are 9 acres in production with 67 different taxa. The taxa range from upland and wet prairie to mixed woodland. Since there has been new urgency placed on upland prairie habitat, the emphasis will be to produce seed from these taxa in large quantities. Table 1 lists the taxa in propagation. Some of the seed will be used for restorations occurring on farm property. Excess seed will be listed for sale on the Native Seed Network.

THREATENED AND ENDANGERED SPECIES PROPAGATION

Heritage Seedlings has also begun a partnership with the Institute for Applied Ecology (IAE). Heritage provides greenhouse space for IAE's threatened and endangered (T&E) propagation at no charge. Heritage is also propagating Nelson's checkermallow (*Sidalcea nelsoniana)* for the Willamette Valley Refuges and Marion County Parks. Four other T&E taxa are in grow-out in hopes of finding appropriate agency sites and/or protected private land sites. The owner of Heritage Seedlings, Mark Krautmann, hopes others in the nursery industry will begin working cooperatively with various nonprofit groups and agencies assisting in the propagation of rare, native plant species.

NATIVE HABITAT RESTORATION AT HERITAGE SEEDLINGS

Heritage Seedlings is currently restoring a 20-acre remnant prairie at the farm property on Joseph St. east of Salem. The restoration is in cooperation with the

United States Fish and Wildlife (USFW) Partners for Wildlife Program. Heritage will increase the amount of upland habitat at the farm by creating native prairie and oak savanna on 25 acres of cover crop adjacent to the remnant prairie. The goals of the prairie restorations are to increase the number of natives on site and improve the habitat for native wildlife that relies on undisturbed native grasslands and oaks. Heritage is also restoring 14 acres of riparian habitat at their farm 20 miles east of Salem. The site is adjacent to Stout Creek near the confluence with the North Santiam River. The restoration is in cooperation with the Natural Resources Conservation Service (NRCS's) Conservation Reserve Enhancement Program. The goal of this restoration is to create a forested riparian buffer; which will improve the habitat for native wildlife and fish. In addition, the restorations are used as a living laboratory for local young people to learn about the importance of native habitats.

Upland Prairie/Oak Habitat. The prairie remnant is composed of open meadow with mostly nonnative pasture grasses and forbs, meadow with clusters of young oaks, oak woodland, and oak woodland with conifers. The site has been grazed by sheep but never cultivated. The lack of cultivation has allowed the retention of areas of native forbs. Grazing, however, has stripped the meadows of native grasses; and has facilitated the infestation of many areas with invasive weeds such as thistles, blackberry, burdock, English hawthorn, and domestic cherry.

The site supports a wide range of oak-related bird species including: Bewicks wren, downy woodpecker, American kestrel, western wood pee-wee, white-breasted nuthatch, white-crowned sparrow, mourning dove, and northern harrier.

The oaks have been thinned and the majority of the conifers removed. This has allowed much more light into the understory and released the suppressed oaks. To protect the soil and reduce the possibility of an increase in blackberry, the disturbed understory areas were seeded with fast growing Blue wildrye (*Elymus glaucus*), California brome (*Bromus carinatus*), and Sitka brome (*Bromus sitchensis*) as well as a range of native forbs that establish quickly. The woodland supports a large component of native shrubs and forbs so herbicide application was not an option prior to seeding. Native bunchgrass plugs were out-planted in Fall 2003.

Non-native shrubs and trees that were cut last spring have, unfortunately, resprouted. These will be recut in early summer and immediately treated with a stump killer. Canadian thistle was treated in early summer with clopyralid (Stinger®) and blackberry in the fall with glyphosate (Round-up®). It is unknown at this time how successful this has been.

The meadows with the largest areas of non-natives will be treated with glyphosate for two seasons. This should ensure a clean sowing area for native seed, which often grows more slowly and has difficulty competing. The meadow areas with native forbs will be treated with a grass-specific herbicide (safe for sedges, lilies, and iris) for one season before seeding. Seed will be sown with a no-till drill. Grasses will be sown in single species patches and a mix of forbs sown perpendicular to the grasses. This will allow these areas to be efficiently harvested and thus increase the amount of seed available for future areas of restoration. Mowing the year after sowing and burning 3 or 4 years after sowing will give the area a more "natural" look.

Beginning in the Spring of 2003, the cover crop area will be tilled, sprayed with glyphosate, planted with a cover crop to hold the soil for the winter, sprayed the following spring and summer, then seeded with native grasses and forbs, and planted with oak seedlings.

Table 1. Native seed production at Heritage Seedlings.

Achillea millefollium
Agoseris grandiflora
Aphanes occidentalis
Allium amplectens
Aquilegia formosa
Asclepias speciosa
Aster hallii
Aster subspicatus
Beckmannia syzigachne
Bromus carinatus
Camassia leichtlinii
Carex deweyana
Carex tumulicola
Clarkia amoena
Clarkia purpurea
Collinsia grandiflora
Collomia grandiflora
Danthonia californica
Delphinium nuttallii (syn. *D. oreganum*)
Delphinium × *pavonaceum*
Deschampsia cespitosa var. *lanceolata*
Deschampsia danthonioides
Deschampsia elongata
Dichelostemma congestum
Dodecatheon pulchellum
Elymus elymoides
Elymus trachycaulus
Eriophyllum lanatum
Erythronium oregonum
Festuca roemeri
Geranium oreganum
Geum macrophyllum
Gilia capitata
Glyceria elata
Iris tenax
Koeleria macrantha
Ligusticum apiifolium
Lilium columbianum
Lomatium dissectum
Lomatium nudicaule
Lomatium utriculatum
Lotus micranthus
Lotus purshianus
Lupinus albicaulus
Lupinus bicolor (syn. *L. micranthus*)
Lupinus polyphyllus
Luzula comosa
Madia elegans
Madia gracilis
Perideridia gairdneri
Poa secunda (syn. *P. scabrella*)
Potentilla glandulosa
Potentilla gracilis
Prunella vulgaris
Ranunculus occidentalis
Rupertia physodes
Saxifraga integrifolia
Sidalcea campestris
Sidalcea malviflora subsp. *virgata*
Sisyrinchium idahoense
Tellima grandiflora
Tolmiea menziesii
Trifolium willdenowii (syn. *T. tridentatum*)
Triteleia hyacinthina
Vicia americana
Wyethia angustifolia
Zigadenus venenosus

Riparian Restoration. In order to prepare the site for planting, the blackberry, reed canarygrass, and scotch broom were mowed down using a brush mower. When the reedcanary grass was approximately 1 ft tall, it was sprayed with glyphosate. The creek edge was sprayed at very low pressure to reduce drift. In November of 2002, 4000 native trees and shrubs were planted along the creek. Taxa planted and their target-planting zones are listed in Table 2. Planting areas were flagged and the name of the taxa written on the flag. Each flag represented four trees that were to be spaced approximately 5 ft apart.

After a tree was planted it was sheltered with a blue plastic "gro-tube". The base of the tube was buried in the soil to a depth of about 2 inches. The tree tubes are designed to enhance the growth of the seedling, protect the tree during herbicide application, and protect the trees from damage by deer, voles, beaver, and nutria. Prior planting efforts failed due to the removal of the cambium by voles and the removal of the entire tree by nutria and beaver. Heavy wooden stakes and electrical zipties secured the tubes. The tubes will be monitored during short periods of inundation after heavy rainfall to be certain they do not wash away.

The reed canary grass will be sprayed for two summers so the trees will have less competition for water and to remove protective cover for voles. The tree tubes are "photodegradable" but will be removed before they start to break up to avoid stream pollution.

Table 2. Native trees and shrubs planted along Stout Creek, and their target planting zones.

A=dry; B=wet only during floods; C=seasonally wet; D=wet in average water height; E=streambed

Shrubs	
Acer circinatum	A,B
Amelanchier alnifolia	A,B
Cornus sericea	B,C,D
Holodiscus discolor	A,B
Oemleria cerasiformis	A,B
Philadelphus lewisii	A,B
Physocarpus capitatus	B,C
Rhamnus purshiana	A,B
Rosa nutkana	B,C
Trees	
Abies grandis	B/shade
Acer macrophyllum	A
Alnus rubra	B,C
Fraxinus latifolia	B,C,D
Pinus ponderosa	A,B
Pseudotsuga menziesii	A
Quercus garryana	A,B,C
Salix lucida subsp. *lasiandra*	B,C,D
Salix sitchensis	B,C,D
Tsuga heterophylla	B/shade
Wetland Plants	
Carex scoparia	C,D
Cyperus acuminatus	D,E
Scirpus microcarpus	D,E