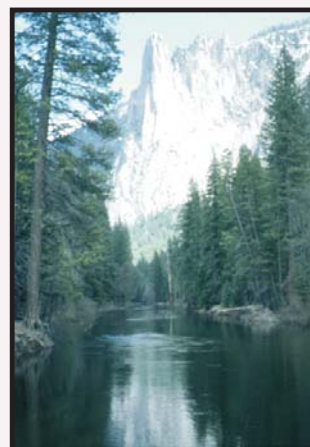


Native Plants



For National Parks

FY 2004 Plant Materials Project Summary Reports

From the
Natural Resources Conservation Service
To the
National Park Service



A Cooperative Program between the
National Park Service, U.S. Department of the Interior
and Natural Resources Conservation Service,
U.S. Department of Agriculture



FY 2004

Plant Materials Project Summary Reports

from the

Natural Resources Conservation Service

to the

National Park Service

April 2005

Compiled By

Russell J. Haas

NRCS Plant Materials Technical Advisor to NPS

National Park Service, Denver Service Center, Lakewood Colorado

INTRODUCTION

This is the 2004 NRCS Plant Materials Centers annual progress report on cooperative project agreements between the National Park Service (NPS) and the Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service. These projects relate to development of native plant materials for park roads and restoration projects. The NPS and NRCS have been cooperating in testing and increasing native plants under a Memorandum of Understanding and Interagency Agreement since 1989.

The NRCS Plant Materials Centers have prepared two types of reports. (1) Brief One Page Summary (attached) and (2) A comprehensive Annual Technical Report.

The "One Page Summary Report" is sent to parks with current projects, to respective NPS field areas and associated park resource managers and respective NRCS offices. Additional copies of the "one page summary report" are available on request. This report can be requested from Russ Haas, NRCS National Technical Advisor, National Park Service, Denver Service Center, Planning and Site Design, P.O. Box 25287, Lakewood, CO, 80225 at 303- 969-2172, e-Mail: russ_haas@nps.gov. The comprehensive 2004 Annual Technical reports are also available at the above address or from respective plant material centers. Following the comprehensive 2004 Annual Technical reports is the "Table of Contents" which lists the projects that were active at parks in 2004. If you have any questions or comments to improve the use and distribution of these reports, please contact Russ Haas or Sarah Wynn, the NPS National Technical Advisor at 303-969-2292, e-Mail: sarah_wynn@nps.gov.

NATIONAL PARK SERVICE

And

NATURAL RESOURCES CONSERVATION SERVICE

INTERAGENCY PLANT MATERIALS PROGRAM

2004 PROGRAM SUMMARY

Technical Assistance

- NRCS NTA provided assistance to Landscape Architects, Job Captains and Project Managers at the NPS Denver Service Center relative to revegetation project needs with 6 National Parks in addition to those with interagency agreements.
- On site program technical assistance was provided by NRCS NTA and the NPS NTA at 9 National Parks.
- Technical assistance in addition to that agreed to Interagency Agreements was provided by Plant Materials Center staff or Specialists to 5 National Parks.

Development and Administration of Interagency Agreements

- Eleven new agreements and 5 IA amendments to agreements were developed this Fiscal Year.
- There were 43 active projects at 29 National Park units in cooperation with 12 Plant Materials Centers.
- 75% of the projects are Federal Lands Highway Program (FLHP) related. The remainders involve bioengineering, exotic species control, riparian/wetland restoration and revegetation of campgrounds, new visitor's facilities, parking lots etc.
- Prepared a draft of the 5th extension of the national Memorandum of Understanding and Interagency Agreement which authorize the NRCS/NPS Interagency Plant Materials Program.

Native Seed and Plant Production

- 28 National Parks
- 2,745 PLS pounds of seed
- 63,913 transplants
- 170 park indigenous species (76 grass, 27 forb, 31 shrub and 36 tree)

Native Seed/Plant Deliveries

- 13 National Parks
- 1555 PLS pounds of seed
- 49,467 transplants (container and bareroot)
- 249 park indigenous species (92 grass, 56 forb and 39 shrub)

Processing of Park Collected Seed

- 3 National parks
- 119 pounds of seed
- 108 species (30 grass, 54 forb, 24 shrubs and 15 trees)

Interagency Program Reviews

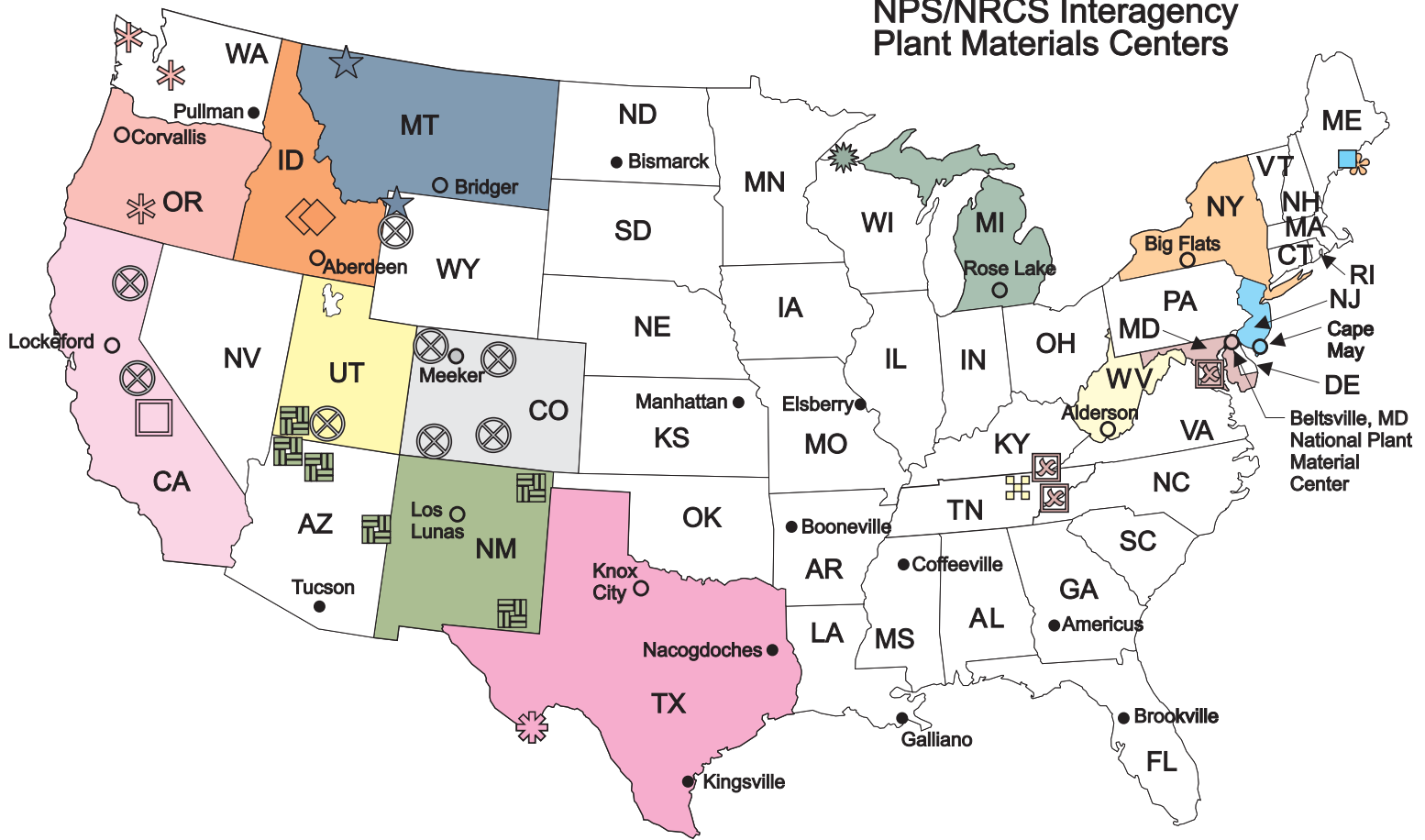
Reviews were held at:

- National Parks: Bryce Canyon NP, Rocky Mountain NP, Mesa Verde NP and Mount Rainier NP
- Plant Materials Centers: Meeker Colorado, Los Lunas New Mexico, Corvallis Oregon and Bridger Montana

Technology Transfer and Research

- Data entry into the interagency website, “Native Plants Network” (<http://nativeplantnetwork.org>) continues to grow. NPS and NRCS contributions make up approximately 50% of the 2020 entries of 1500 species/ecotypes in the database.
- NRCS/NPS NTA and program staff coordinated with DSC Operations Information/Technology staff to continue down load of revegetation program related information to the *Inside NPS* intranet website.
- Information provided includes basic FLHP program guidelines, examples of revegetation specifications, tools (seed collection, storage, plant salvage, propagation, cost estimating, monitoring etc.) Links to the NRCS PM and Plant Propagation Protocols websites are also available.
- Wetland/Riparian and Bioengineering Technical Assistance to Intermountain and western parks. Technical assistance and training workshops were provided to Grand Teton and Yellowstone NPs.
- NRCS NTA made two formal oral presentations at professional society meetings and NPS workshops.
- NRCS NTA and program staff prepared and distributed to cooperating Parks/PMCs and key NPS and NRCS personnel, the FY2004 Annual Interagency Program Report.
- The program information brochure and poster were updated to reflect accomplishments, goals and objectives. The poster is available for use at various conferences etc.

NPS/NRCS Interagency Plant Materials Centers



Plant Materials Center

Aberdeen, ID



Alderson, WV



Beltsville, MD



Big Flats, NY



Bridger, MT



Cape May, NJ



Corvallis, OR



Rose Lake, MI



Knox City, TX



Lockford, CA



Los Lunas, NM



Meeker, CO



In cooperation with these National Parks

Craters of the Moon NM

Stones River NB

Cumberland Gap NHP, George Washington MP,
Great Smoky Mountains NP

Acadia NP

Glacier NP, Yellowstone NP

Acadia NP

Crater Lake NP, Mt. Rainier NP, Olympic NP

Apostle Islands NL

Big Bend NP, Chickasaw NRA

Sequoia and Kings Canyon National Park

Carlsbad Caverns NP, Capulin Volcano NP, Grand Canyon
NP, Hubbell Trading Post NHS, Pipe Spring NM, Zion NP

Bryce Canyon NP, Dinosaur NM, Grand Teton NP,
Great Sand Dunes NM, Lassen Volcanic NP,
Mesa Verde NP, Rocky Mountain NP, Yosemite NP

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BIG BEND NATIONAL PARK

FY 2004 Summary Report

Prepared by

**NATURAL RESOURCES CONSERVATION SERVICE
JAMES E. "BUD" SMITH, PLANT MATERIAL CENTER
KNOX CITY, TEXAS**

Introduction: The original agreement with Big Bend National Park and the James E. 'Bud' Smith Plant Materials Center (PMC) was developed and signed in 1989. Early agreements involve seed and/or plant collection at the Park and seed increase at the PMC. Materials produced were used for roadside revegetation within the park. Plant materials (seeds) were drilled and/or broadcast along road shoulders following construction. The first agreement was completed in 1993. The second agreement scheduled for completion in 1997 was modified to incorporate an additional study to look at techniques for road slope revegetation. In 1998 an additional agreement was put into place to provide materials for the next phase of road construction. This agreement originally scheduled from 1998 - 2001 was amended in 1999 and placed on hold through 2001, pending the rescheduling of construction activities. Currently there are no active agreements targeting roadside revegetation projects.



In 2001 a new agreement was prepared between the Park and PMC addressing the need to revegetate areas after removal of invasive plants. Several new plant species will be looked at to determine if seed production fields can be developed.

Accomplishments: Since 1989 nine different species have been produced for the park and three species are being looked at to determine production and propagation techniques. At the end of 2004, the park had received a total of 2380 bulk pounds of seed totaling 983 PLS lbs.

Seed Production and Available Inventory

Common Name	Area(ac)	2004 Prod./Lbs *	PLS Inventory On Hand
Alkali sacaton	-	-	329.0
Sideoats grama	-	-	186.0
Green sprangletop	-	-	392.0
Cane bluestem	.50	15.00	37.0
Showy menodora	.50	-	238.00
Whiplash pappusgrass	increase	0.60	.30
Chino grama	.75	4.00 **	29.0
Tobosa	.10	1.25	increase
Limoncillo	-	-	29.0 *

* Bulk material wt.

** New production field

Conclusion: At the end of FY 2004 seed production fields being maintained and harvested included showy menodora, cane bluestem, and Chino grama. The center will continue to work with and develop the *Hilaria mutica*, tobosagrass increase field. In 2003, seeds of *Scleropogon brevifolius*, burrograss, and *Pappophorum vaginatum*, whiplash pappusgrass were planted to investigate the possibilities of field seed production. The burrograss failed to establish and the whiplash pappusgrass is undergoing small scale seed increase. The agreement signed in 2001 addressing post weed control revegetation expired in 2004.



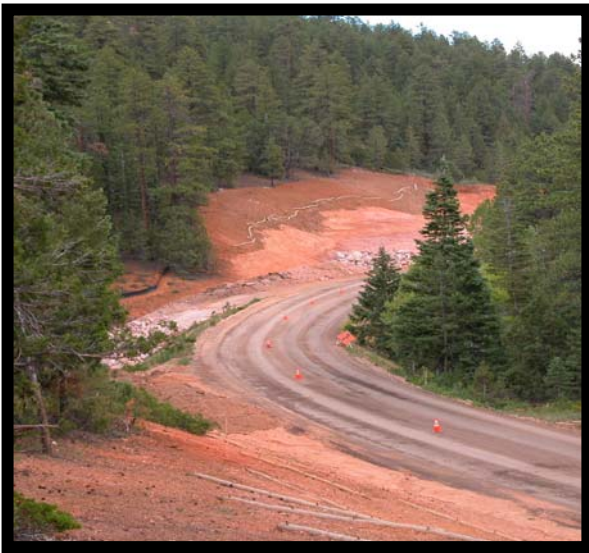
BRYCE CANYON NATIONAL PARK

FY2004 Annual Report

Prepared by

UPPER COLORADO ENVIRONMENTAL PLANT CENTER MEEKER, COLORADO

Introduction: Bryce Canyon National Park and Upper Colorado Environmental Plant Center entered into an agreement, which was formally approved June 1998. Preliminary steps were initiated to amend the agreement to increase target production quantities for additional vegetative treatment for highway projects within Bryce Canyon National Park through Fiscal Year 2003. In December 2003, a new agreement was signed into effect to continue production of two species, slender wheatgrass, *Elymus trachycaulus*, and nodding brome, *Bromus anomalus*, through 2006.



Rainbow Point Road construction



Revegetation of Road Shoulders

Accomplishments: The fifth consecutive year of below average precipitation was, however, cooler than the previous five years, and cool season grasses for Bryce responded well to irrigation. Bryce slender wheatgrass produced 398 pounds of clean seed from 0.5 acre planted August 12, 1998 and 0.8 of an acre that was planted September 5, 2000. A one half-acre nodding brome field was planted August 29, 2001. One hundred thirty-eight pounds of clean nodding brome seed was produced this year. Two seed shipments to Bryce Canyon were made in 2004. On July 22, 2004, 235 pounds of slender wheatgrass and 45 pounds of nodding brome were shipped to Bryce Canyon National Park for revegetation purposes. Seed produced in 2004 was also used for park revegetation projects and a second shipment was made on September 25, 2004. Twenty-five PLS pounds of nodding brome and 128 PLS pounds of slender wheatgrass were shipped to Bryce Canyon after seed test results were received. On August 13, 2004, a new slender wheatgrass field was planted in order to continue production of two acres through 2006.

Technology Development: Specific information about germination trials, soil preparation, seeding rates, equipment, seeding establishment methods or any other seed processing or handling techniques are available upon request.



Bryce Canyon NP nodding brome grass at Meeker CO UCEPC

CAPULIN VOLCANO NATIONAL MONUMENT

2004 Annual Summary Report Prepared by

NATURAL RESOURCES CONSERVATION SERVICE PLANT MATERIALS CENTER LOS LUNAS NEW MEXICO

Introduction: On August 30 2004, an agreement was made between Capulin Volcano National Monument (CVNM) of the U.S. Department of Interior (USDI) National Park Service and the Natural Resources Conservation Service (NRCS) of New Mexico. This agreement declares that the Los Lunas Plant Materials Center (LLPMC) will produce seed of agreed upon native species for CVNM. The agreement species includes blue grama, sideoats grama, little bluestem and mountain muhly.



Capulin Volcano National Monument

Accomplishments: No seed was harvested at the LLPMC in 2004.

Seed of the agreement species was collected by the Monument in 2004 and shipped to the LLPMC. This seed will be cleaned and stored at the LLPMC for use in establishing production fields. Seed field establishment will depend on the amount of viable seed processed from the 2004 collections.

Technology Development: The collected seed was received by the LLPMC in 2004 and is waiting processing .

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CARLSBAD CAVERNS NATIONAL PARK

2004 Annual Summary Report Prepared by

NATURAL RESOURCES CONSERVATION SERVICE PLANT MATERIALS CENTER LOS LUNAS NEW MEXICO

Introduction: On August 23, 2004 an agreement was made between Carlsbad Caverns National Park (CCNP) of the U.S. Department of Interior (USDI) National Park Service and the Natural Resources Conservation Service (NRCS) of New Mexico. This agreement declares that the Los Lunas Plant Materials Center (LLPMC) will produce seed for CCNP for use in revegetation and restoration projects. . The 2004 agreement species include: Blue grama, Plains bristlegrass, Muttongrass, Purple three-awn and Sideoats grama.



Accomplishments: Seed Production 2004

No seed was harvested at the LLPMC in 2004. Seed of the agreement species was collected by RECON, a seed collection contractor and provided to LLPMC in 2004. This seed will be cleaned and stored at the LLPMC. If enough good, viable seed is available after the cleaning, it will be used to start transplants for the establishment of production fields at the LLPMC in 2005.

Technology Development: Greg Fenchel, manager of the LLPMC, traveled to CCNP in 2004 to provide technical assistance to park personnel for collection of the agreement species. This assistance to the park will help in the collection of the species listed in the agreement, and will ensure that the seed harvested is of good quality and sufficient quantity for shipment to the LLPMC.

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DINOSAUR NATIONAL MONUMENT

FY2004 Annual Summary Report

Prepared by

UPPER COLORADO ENVIRONMENTAL PLANT CENTER

MEEKER, COLORADO

Introduction: The Upper Colorado Environmental Plant Center entered into an agreement with Dinosaur National Monument in September of 1996 and amended the agreement in August of 1997. A new agreement was developed in 2002. These agreements involve the collection and seed production of four grass species native to Dinosaur National Monument. Targeted species are: Western wheatgrass (*Pascopyron smithii* - 9070955), Indian ricegrass (*Oryzopsis hymenoides* - 9070953), basin wildrye (*Leymus cinereus* - 9070951), bluebunch wheatgrass (*Psuedoroegneria spicata* ssp. *spicata* - 9070952), alkali sacaton (*Sporobolus airoides* - 9070954), sand dropseed (*Sporobolus cryptanderus*), and salina wildrye (*Leymus salinus* ssp. *salinus*). The last two species were not collected. An additional species was added in 2002, squirreltail (*Elymus elymoides*); however, no seed field has been planted. The grasses will be used for restoration and to prevent non-indigenous weedy plants from invading. The western wheatgrass seed field was plowed in 1999, due to numerous off types. Two seed fields (Indian ricegrass and alkali sacaton) were interseeded to improve stands in 1999. An additional planting of bluebunch wheatgrass was planted in 2001, since no seed was produced on the original planting for that year (2001). This new planting had a good stand in 2002 and was harvested with the original planting in 2004.



Dinosaur NM alkali sacaton

Accomplishments: Seed was harvested from all seed fields in 2004. One field (alkali sacaton) was harvested twice (July and September).

<u>Seed Harvested</u>		<u>Seed Fields</u>	
Name	Clean Seed Amount	Name	Size
Indian ricegrass	10.0 lb	Basin wildrye	0.24 acre
Basin wildrye	43.0 lb	Bluebunch wheatgrass**	0.42 acre
Bluebunch wheatgrass	25.5 lb	Indian ricegrass *	0.24 acre
Alkali sacaton	8.0 lb	Alkali sacaton *	0.18 acre

* Interseeded in 1999

** Increased in 2001

Technology Development: Specific information on procedures and methods for seed cleaning etc. can be requested for each species.

GLACIER NATIONAL PARK

FY 2004 Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE PLANT MATERIALS CENTER BRIDGER MONTANA

Introduction: The Bridger Plant Materials Center (BPMC) has maintained a cooperative agreement with Glacier National Park (GNP) since FY 1986. This agreement facilitates the collection, increase, and re-establishment of indigenous plant materials, and the development of technologies for the restoration of disturbances resulting from road construction and other projects within Park boundaries. Wildland seeds are collected by GNP staff, dried, and then mailed to the BPMC where they are cleaned, weighed, accessioned, inventoried, and stored until needed. GNP projects their seed and plant needs for each construction project, allowing 2 to 3 years of lead time for the increase of seeds or plants at the BPMC.



Glacier National Park *Aster laevis*

Accomplishments: In 2004, 54 seed lots representing 29 individual species and totaling 3.4 pounds (1.54 kg) were delivered to GNP or used for BPMC production. The 2004 distribution included 1 grass lot (1 species), 26 forb lots (18 species), and 27 shrub lots (10 species). In early 2004, a shipment of old seed lots was delivered to Glacier Park. Records of that shipment appear in the Glacier National Park 2003 Annual Technical Report.

In 2004, 107 wildland collections were sent to the BPMC and cleaned: 11 collections of grasses, sedges, and rushes (9 species); 65 forb collections (30 species); and 41 shrub and tree collections (18 species). A total of 10.82 lbs. (4.91 kg) of clean seed were processed; 3.70 lbs. (1.68 kg) of grass and grass-like, 4.48 lbs. (2.03 kg) of forbs, and 2.64 lbs. (1.20 kg) of trees and shrubs. A total of 41 new species: collection sites were identified and accessioned representing 3 grass or grass-like species (3 species), 26 forbs (15 species), and 12 woody plants (10 species).



Glacier National Park *Phleum alpinum*



Carex athrostachya

Six seed production fields remained active in 2004, including *Carex athrostachya* (9078591-Camas); *Carex athrostachya* (9081443-Avalanche); *Carex pachystachya* (9078645-Avalanche); two fields of *Symphyotrichum laeve* (*Aster laevis*) (9081447-Avalanche) and *Phleum alpinum* (9054559-Logan Pass).

These fields produced a total of 6.30 lbs. (2.86 kg) of seed. The *Carex pachystachya* (9078646-Avalanche), *Carex deweyana* (9078646-Avalanche), and *Elymus glaucus* (9075844-Many Glacier) seed production fields were retired in 2004 because of declining productivity. *Elymus glaucus* (9075846-West Glacier) completely winter killed and was also removed. Two new fields were established from plugs in 2004. Approximately 2,021 plugs of *Phleum alpinum* (9054559-Logan Pass) and 739 plugs of *Symphyotrichum laeve* (9081447-Avalanche) were lined out in Field 4. Both fields produced some seed in 2004; the *Symphyotrichum laeve* produced heavily, although the exact amount is unknown because it was bulked with seed from the original stand. Seed production for most stands was down in 2004, probably the result of a combination of factors including drought, open winters, and increasing stand age. In the fall of 2004, approximately 40 lbs/acre of nitrogen was applied to all seed production fields in Field 4. An additional 40 lbs/acre application is planned for spring 2005.

Seed germination tests are currently being conducted on five accessions (four species) grown in 2004 including *Carex athrostachya* (9078591-Camas), *Carex athrostachya* (9081443-Avalanche), *Carex pachystachya* (9078645-Avalanche), *Symphyotrichum laeve* (*Aster laevis*) (9081447-Avalanche), and *Phleum alpinum* (9054559-Logan Pass). Results will be presented in the Glacier National Park 2004 Annual Technical Report.

No containerized woody plants were delivered to GNP in 2004. As noted earlier, a total of 2,021 plugs of *Phleum alpinum* (9054559-Logan Pass) and 739 plugs of *Symphyotrichum laeve* (9081447-Avalanche) were grown in the greenhouse and then lined out for seed production. A total of 588 2-0 *Mahonia repens* (9054489-Apgar) remain in cold storage at the BPMC. No new stratifications were initiated in late 2004.

Technology Development: The results from a cooperative research project between GNP and the BPMC titled, *Effects of Erosion Control Blanket on Germination and Germinant Survival of Six Native Species and Potential Management Implications* was summarized as Plant Materials Technical Note No. MT-47 and distributed to National Park Service and NRCS personnel.

GRAND CANYON NATIONAL PARK

2004 Annual Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE PLANT MATERIALS CENTER LOS LUNAS NEW MEXICO

Introduction: In July 1990, an agreement was made between the Grand Canyon National Park (GCNP) of the U.S. Department of Interior (USDI) National Park Service and the Natural Resources Conservation Service (NRCS) of New Mexico. This agreement declares that the Los Lunas Plant Materials Center (LLPMC) will produce seed and propagate plants for the GCNP. Amendment No. 1 of 1999 and Amendment No.2 of 2001 provides for seed production of two native grass species, and for growing transplants of 10 native tree and shrub species. Of the 10 native tree and shrub species, the LLPMC agreed to deliver 900 transplants to the GCNP. All transplants will be grown from seed collected from indigenous ecotypes at the GCNP.



Grand Canyon National Park muttongrass

Accomplishments: The following seed was produced in 2004

Blue Grama	<i>Bouteloua gracilis</i>	9.22 PLS lbs
Muttongrass	<i>Poa fendleriana</i>	14.18 PLS lbs

No transplants were distributed to GCNP in 2004.

Technology Development: The blue grama and muttongrass fields were both harvested in 2004. In 2004, the muttongrass field produced about 50 percent less seed than in 2003, and the blue grama field about 40 percent less seed than in 2003. Water application rates were not decreased in 2004 on either species. Fertilizer was applied at a lower rate on the muttongrass in 2004 and could account for the lower seed production. The blue grama field received the same amount of fertilization in 2004 as it did in 2003. The lower production percentages of both species are hard to explain.



Grand Canyon - unburned bluegrama (L) vs. burned bluegrama (R)

GRAND TETON NATIONAL PARK

FY2004 Annual Summary Report

Prepared by

UPPER COLORADO ENVIRONMENTAL PLANT CENTER

MEEKER, COLORADO



Stages of Restoration of Snake River Gravel Pit

Introduction: An agreement between Grand Teton National Park and Upper Colorado Environmental Plant Center (UCEPC) was formally approved September of 2001. This new agreement will extend through fiscal year 2005, and calls for the production of five grass species. One species, basin wildrye, had been established for production in an earlier agreement. Two other species, bluebunch wheatgrass and slender wheatgrass, had been produced in an earlier agreement as well. It was hoped that seed from these previously produced materials could be used to establish new seed fields. However, only bluebunch wheatgrass seed had enough viability to establish a field. Two other species, blue wildrye and slender wheatgrass, were collected from the park in 2001, cleaned, tested, and were established in July 2002. Because of drought conditions, a

fifth material, prairie Junegrass, did not produce good collectible populations of seed for seed increase as targeted in the agreement. Discussions of producing a substitute material occurred, and during the summer of 2003, showy golden eye was collected by park personnel for increase.

Accomplishments: In the second year of production for blue wildrye, slender wheatgrass, and bluebunch wheatgrass, a total of 577 clean pounds were produced. In addition, basin wildrye produced 60 pounds of clean seed for Grand Teton National Park. The fifth material, showy golden eye was direct seeded on 0.3 acres July 28, 2004. Park personnel collected timber oatgrass in 2004. This collection was cleaned by UCEPC and 283 grams were shipped along with the entire lot of mountain brome produced in 1999 (21 lb.), 5.8 lb. of blue wildrye, and 11 pounds of slender wheatgrass, both produced in 2003.

Technology Development: Black grass bug infestation occurred in the basin wildrye field this year and reduced production by nearly 75% from the previous year. Bob Hammon, Colorado State University Extension Entomologist, provided information on the life cycle of black grass bugs and treatment options for control. Work is continuing with head smut occurrence, transfer, longevity, and relationship through time to infected and resistant plants, particularly mountain brome and the smut species *Ustilago bullata*.

GREAT SAND DUNES NATIONAL MONUMENT AND PRESERVE

FY2004 Annual Report

Prepared by

UPPER COLORADO ENVIRONMENTAL PLANT CENTER MEEKER, COLORADO

Introduction: In April of 2003, an interagency agreement was signed that calls for Upper Colorado Environmental Plant Center (UCEPC) to produce seed of two species, one acre of blue grama and one half acre of Indian ricegrass, through 2005. These products will be utilized for revegetation projects in and around the headquarters area of the monument in 2006. In 2004, an amendment to the above interagency agreement was signed. The amendment stipulates that UCEPC will establish two-tenths of an acre seed increase field of ring muhly.



Accomplishments: As per agreement, half an acre of Indian ricegrass was planted on July 27, 2004. In addition, half an acre of blue grama was planted on July 27, 2004, and two tenths of an acre of ring muhly was planted on July 30, 2004. During the summer of 2004, park personnel collected seed that resulted in 302 clean grams of ring muhly and 117 clean grams of blue grama. Both species were cleaned by UCEPC.

Technology Development: Standard cleaning and planting protocols were utilized for each material. All plantings done in 2004 germinated about three weeks after seeding.

Observations: A wasp pupae was observed in the seed of ring muhly collected by park personnel. Assistance was requested from a Colorado State University Entomologist to identify species and determine if

the wasp was detrimental to the seed. The Entomologist stated this insect was a chalcid wasp pupae (seed parasite) and can cause damage to seed, but can be controlled by freezing the seed. Seed was placed in a freezer for two weeks. After the two weeks, seed was examined to see if treatment was effective. Freeze treatment was effective in controlling the wasp pupae.

HUBBELL TRADING POST NATIONAL HISTORIC SITE

2004 Annual Summary Report Prepared by

NATURAL RESOURCES CONSERVATION SERVICE PLANT MATERIALS CENTER LOS LUNAS NEW MEXICO

Introduction: On August 13, 2002 an agreement was made between Hubbell Trading Post National Historic Site (HTPNHS) of the U.S. Department of Interior (USDI) National Park Service and the Natural Resources Conservation Service (NRCS) of New Mexico. This agreement declares that the Los Lunas Plant Materials Center (LLPMC) will produce plants and cuttings of agreed upon native species for riparian restoration.



Hubbell Trading Post National Historic Site

Accomplishments: Transplant Production 2004

Two shipments of transplants were made in 2004 to the Hubbell Trading Post. A total of 474 one-gallon transplants of 20 native species were picked up at the LLPMC by the park on July 21 and September 16, 2004. The species included fourwing saltbush, skunkbush sumac, stretchberry, desert false indigo, prairie sagewort, Utah serviceberry, Utah agave, banana yucca, woods' rose, New Mexico Locust, squawthorn, Fremont's mahonia, boxelder, sacahuista, winterfat, golden currant, squaw apple, netleaf hackberry and Fremont cottonwood.

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MESA VERDE NATIONAL PARK

FY2004 Annual Summary Report

Prepared by

UPPER COLORADO ENVIRONMENTAL PLANT CENTER

MEEKER, COLORADO

Introduction: The Upper Colorado Environmental Plant Center (UCEPC) entered into an agreement with Mesa Verde National Park September 26, 1990. The Interagency Agreement Project No. 1211-00-003 was amended in 2000 and an additional amendment referred to as "MEVE 278F, Main Entrance Road" was signed September 17, 2003, involving the live plant production of seven shrubs and one conifer species. Seed production for Mesa Verde was concluded in 2000. All seed lots of Mesa Verde materials were updated for germination in 1999.

UCEPC will provide stored seed as requested.

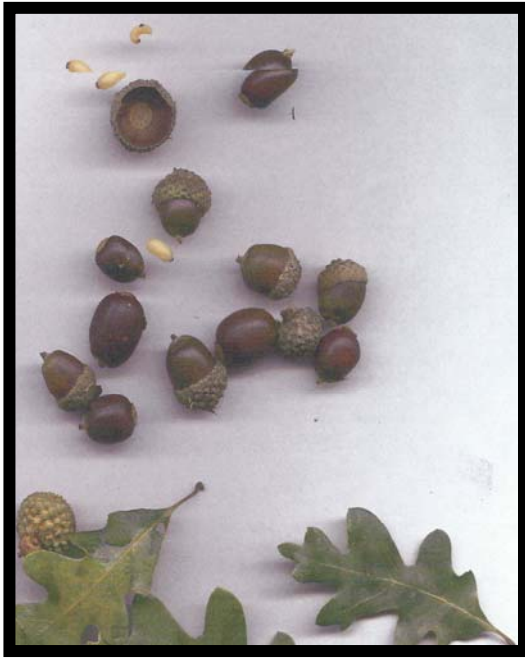


Main Entrance Road "B Cut before and during construction activities

Accomplishments: Seed of some of the following species were collected in Mesa Verde National Park in 2004, and shipped to UCEPC to be dried, cleaned, stored, and conditioned for live plant production. Additional non-contract species were received and are being held in storage.

Targeted Species:

Scientific Name	Common Name	Quantity
<i>Quercus gambelii</i>	Gambel oak	875
<i>Amelanchier utahensis</i>	Utah serviceberry	875
<i>Cercocarpus montanus</i>	Mountain mahogany	260
<i>Symphoricarpos oreophilus</i>	Mountain snowberry	675
<i>Atriplex canescens</i>	Fourwing saltbush	100
<i>Rosa woodsii</i>	Woods' rose	175
<i>Prunus virginiana</i>	Chokecherry	175
<i>Pseudotsuga menziesii</i>	Douglas fir	100
Total:		3235



Technology Development: While working with a good collection of Gambel oak acorns from Mesa Verde National Park, observations were made regarding larvae damage and viability. Upon receipt of the acorns, they were immersed overnight, then planted or held in the refrigerator in moist peat moss and planted as germination occurred. Other shrub seed was shipped to us fresh and then cleaned in a modified blender for immediate processing.

PIPE SPRING NATIONAL MONUMENT

2004 Annual Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE

PLANT MATERIALS CENTER

LOS LUNAS NEW MEXICO

Introduction: On September 12, 2002, an agreement was made between Pipe Spring National Monument (PSNM) of the U.S. Department of Interior (USDI) National Park Service and the Natural Resources Conservation Service (NRCS) of New Mexico. This agreement declares that the Los Lunas Plant Materials Center (LLPMC) will produce seed for PSNM.



Pipespring National Monument

Accomplishments: Seed Production 2004

No seed was harvested in 2004.

In 2004, the Galleta grass seed from PSNM was used to start transplants for establishment of a 0.10 acre production field. The seed from this field will be used to grow future transplants for establishing a larger production field and also to fulfill the contract obligation. A 0.25 acre production field of Indian ricegrass was also direct seeded in December of 2004 at the LLPMC. Seed may be harvested from both species in 2005.

Technology Development: The LLPMC received 7.8 grams of Galleta grass seed from the monument in 2004. This seed will be used if needed to produce transplants in 2005. The galleta transplants did well after planting, and seedheads were produced by a majority of the plants. However no viable seed was detected at the end of the growing season.



Pipe Spring blue grama and galleta in raised beds at Los Lunas PMC

ROCKY MOUNTAIN NATIONAL PARK

FY2004 Annual Summary Report

Prepared by

UPPER COLORADO ENVIRONMENTAL PLANT CENTER MEEKER, COLORADO

Introduction: The Upper Colorado Environmental Plant Center (UCEPC), Rocky Mountain National Park (ROMO), and the USDA Natural Resources Conservation Service (NRCS), signed a cooperative plant materials agreement Project No. O8S211 (IA No. 1520-2-9001) on September 9, 1999. This agreement involves the collection and seed production of three grass species native to the East side of Rocky Mountain National Park. The targeted species were: mountain muhly *Muhlenbergia montana*, Junegrass *Koeleria cristata*, and sleepy grass *Stipa robusta*.

Another cooperative plant materials agreement: Project No. S-0308CR (IA Project No. 1211-03003), NPS Project Name: Rehab Route 10, Bear Lake Road, was signed April 22, 2003. This agreement involves the collection and seed production of eight species: four forbs and four grass species, referenced in the table below.



Oxytropis lambertii/sericea



Thermopsis divericarpa

Targeted species:

Scientific Name	Common Name	Target PLS Amt	Current Acres
Grasses			
<i>Bouteloua gracilis</i>	blue grama	12.6	1.5 (t)
<i>Stipa comata</i>	needle and thread	12.9	0.25 (t)
<i>Muhlenbergia montana</i>	mountain muhly	6.2	0.5 (s)
<i>Koeleria macrantha</i>	Junegrass	4.5	0.25 (s)(t)
Forbs/Legumes			
<i>Artemisia frigida</i>	fringed sage	1.7	0.07(t)
<i>Heterotheca villosa</i>	hairy golden aster	11.4	0.8 (s)
<i>Thermopsis divericarpa</i>	spreading golden bean	86.5	2.0 (s)
<i>Oxytropis lambertii/sericea</i>	purple loco weed	5.9	0.5 (s)

Accomplishments: In order to optimize collected seed amounts for the Bear Lake Road Project, plugs were grown in the UCEPC greenhouse for field re-establishment and interplanting of 2003 plots. The Oxytropis field was reseeded with scarified seed. The following table includes actual seeded (s) or transplanted (t) plot size at UCEPC with germplasm received from Rocky Mountain National Park. In regards to continued work on cooperative agreement, IA No. 1520-2-9001, the experimental (25' by 35') plot of mountain muhly, established in 1997, produced a small amount of seed again this year.



Technology Development: Jiffy forestry peat pots (25 mm) were used to interplant the Blue grama field. Holland Transplanter Model 1500 worked well for new field establishment with RLC-3 and 4 cu. inch greenhouse-produced plugs.

YELLOWSTONE NATIONAL PARK

FY2004 Annual Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE

PLANT MATERIALS CENTER

BRIDGER, MONTANA

Introduction: The Bridger PMC has maintained a cooperative agreement with Yellowstone National Park (YNP) since FY 1986. This agreement facilitates the collection, increase, and reestablishment of indigenous plant material for restoration of disturbances resulting from road construction and other improvement projects within Park boundaries.

In 2004, 13 allocations of 348 seed lots from 83 species were distributed to YNP, YNP-contracted growers, seed testing labs, or the PMC totaling 928 pounds (421 kg). This included 184 grass lots (29 species) weighing 881 pounds (400 kg); 155 forb lots (48 species) weighing 38 pounds (17 kg); and 9 woody lots (6 species) weighing 7 pounds (3 kg). This includes the distribution of 8 grass lots (6 species) to the PMC for planting seed increase fields.

Accomplishments: Yellowstone National Park has identified future road projects allowing collection and production efforts to begin at least 3 years in advance of each project.

Wildland seed collections are made by Yellowstone National Park crews, dried, and either delivered to the Bridger PMC, or picked up by PMC personnel. In 2004, 112 collections were made from 50 species: 51 grasses (20 species) at 43.1 pounds (19.55 kg); 55 forbs (24 species) at 12.6 pounds (5.714 kg); and 6 woodies at 0.26 pound (0.118 kg). The wildland seed collections totaled 56 pounds (25.38 kg).

Records are maintained by the PMC of person-hours to collect each seed lot, from which the approximate cost of collecting native seed can be estimated. In 2004, YNP personnel spent more than 381 person hours in the activity of seed collection on 25 different sites. There were 187 hours (approximately 4 hours per collection) dedicated to collecting grass seed on 21 sites, 186 hours (approximately 3 hours per collection) for forbs on 19 sites, and 8 hours for woody species on 3 sites.



Yellowstone Stipa comata



Yellowstone slender wheatgrass

There were 9 grass increase blocks of 7 species planted on 2 acres in 2004. Seed increase blocks of 12 grasses (2.3 acres) and 3 forbs (0.48 acres) were removed due to natural decline in production or poor establishment. Currently there are 4.1 acres planted with 18 accessions of 9 grass species, and 0.43 acres with 4 accessions of 3 forb species in seed increase blocks at the Bridger PMC.

During the past growing season, 14 different grass accessions (9 species) and 1 forb species were harvested on 3 acres, producing 58 pounds (26.3 kilograms) of clean seed. Seed production averaged approximately 20 pounds-per-acre (18 kilograms-per-hectare).

Purity analysis and tetrazolium viability tests were conducted on PMC seed increase production for 7 grass accessions. All samples exceeded purity standards set forth for foundation seed class as established by the Association of Official Seed Certifying Agencies. The percentage viability ranged from 78 to 99 and averaged 92.

The wildland collection and seed increase inventory contains 587 lots (107 species) totaling 1,728 pounds (784 kg). This is comprised of 284 grass lots (25 species) at 1,643 pounds (745 kg), 287 forb lots (69 species) at 60 pounds (27 kg), and 16 woody lots (13 species) weighing 25 pounds (11 kg).

Technology Development: All plant material collections are assigned accession numbers and inventoried in a database. The lot identification numbers have been upgraded to include identification by individual construction projects.

The Park expressed interest in having a basic set of protocols developed in order to implement a monitoring program that will evaluate the ecological condition of seeded sites. The PMC drafted and sent for review a “Yellowstone National Park Vegetation Monitoring Site Data Sheet”, accompanied by a sampling form to calculate percentage plant frequency. The site data sheet is designed to record location, physical attributes, original seeding mix composition, existing seeded plant occupancy, and relative degree of non-native or invasive plant occupancy.

A comprehensive inventory assessment project was initiated to determine the potential affect of natural seed aging on the YNP material stored at the PMC. Tetrazolium and selected germination tests were conducted on 85 seed lots at the Montana State Seed Testing Laboratory in Bozeman. Test results on the 14 grass and 12 forb species tentatively indicate an apparent decline in viability over time. Future efforts are planned to develop species-specific timetables to optimize the use of seed.



Yellowstone seed in storage

ZION NATIONAL PARK

2004 Annual Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE PLANT MATERIALS CENTER LOS LUNAS NEW MEXICO

Introduction: On September 12, 2002, an agreement was made between the Zion National Park (ZNP) of the U.S. Department of Interior (USDI) National Park Service and the Natural Resources Conservation Service (NRCS) of New Mexico. This agreement declares that the Los Lunas Plant Materials Center (LLPMC) will produce seed for the ZNP.



Zion NP cane bluestem

Accomplishments: Seed Production 2004

Sand bluestem	<i>Andropogon hallii</i>	1.76 pounds
Cane bluestem	<i>Bothriochloa barbinodis</i>	Not available

In 2004, Cane bluestem transplants were grown by the LLPMC to increase our seed production field from 0.25 to 1.1 acres. Bottlebrush squirreltail transplants were also grown and were planted at the LLPMC to establish a 0.41 acre production field. The ZNP Galleta grass transplants were also grown in 2004 and were

used to start a 0.10 acre field. Seed of the Park's collection of Indian ricegrass was used to direct seed a 0.25 acre production field in December of 2004.

Technology Development: The Galleta grass field will be used to increase available seed for establishing a larger production block at the LLPMC and for meeting the contract seed amounts.

A resolution of what species of bluestems had been collected by Park personnel was completed by a taxonomist in Oregon. This identification showed four species of bluestem: Sand, Cane, Yellow and Big. These had been sent to the LLPMC for processing. The majority of seed collected was sand and cane bluestem. The seed production field of big bluestem, planted in 2003, turned out to be 95 percent Sand bluestem. This field will be maintained as a Sand bluestem field and any other species will be rogued out. Sand bluestem, Cane bluestem, Galleta grass and Indian ricegrass fields are planted, and harvest of these production fields should take place in 2005.



Zion NP bluestems before roguing of off types

APOSTLE ISLANDS NATIONAL LAKESHORE
IAA No. IA-6140-A-0007 (Raspberry Oak and Outer Islands)

FY2004 Annual Summary Report
Prepared by

NATURAL RESOURCES CONSERVATION SERVICE
PLANT MATERIALS CENTER
EAST LANSING, MICHIGAN

Introduction: This project was initiated in 2000 to produce native plant stock for stabilizing slopes, preventing erosion, preserving native plant resources and revegetating park lands. Under a Memorandum of Agreement species to be propagated were selected from an amendable list. A minimum of 2 grass, 2 forb and 4 shrub species from this list were supplied by the Center based on the material's availability, viability and site adaptability for the intended use. The Agreement further specified deliverables as 30 pounds of Canada wildrye seed, 500 forb/grass plugs and 500 shrub transplants. Deliverables were distributed in 2002, 2003 and 2004. Additional plant distributions are planned for 2005.

Accomplishments: Thirteen species were propagated in 2003 and 2004 for delivery to the Park in 2004. A total of 5164 plants were delivered in May of 2004. Propagation efforts continue at the PMC greenhouse for plant delivery in 2005.



Propagation of Apostle Island grass, forb and shrub species

The following is a list of species propagated and number of plants delivered to Apostle Island National Lakeshore in 2004:

Pennsylvania Sedge	1698
Wavy Hairgrass	1460
Lowbush Blueberry	650
American Beachgrass	350
Grayleaf Red Raspberry	250
Redosier Dogwood	200
Red Elderberry	100
Purpleflowering Raspberry	100
Evening-Primrose	100
Beach Pea	95
Sandcherry	92
Common Juniper	62
Bush Honeysuckle	7

Technology Development and Observations: The Rose Lake Plant Materials Center tested several propagation techniques for several gymnosperm species, including common juniper and yew. Establishing either species from cuttings was, for the most part, not successful. Common juniper seeds were stratified in a series of warm and cold treatments over a nine month timeframe. Germination rate of common juniper using this method was greater than 50%.

Outer Island: Technical assistance was provided by David Burgdorf, Plant Materials Specialist for stabilization of the Outer Island Lighthouse slope protection. Further assistance and training is scheduled for April 2005.

GEORGE WASHINGTON MEMORIAL PARKWAY

2004 Annual Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE

NATIONAL PLANT MATERIALS CENTER

BELTSVILLE, MARYLAND

Introduction: This is the second project initiated with the National Park Service to produce plants for revegetation of construction sites along the George Washington Memorial Parkway (GWMP). The National Plant Materials Center (NPMC) has been working with GWMP since 1994. The small agreement was initiated in 2000 for the NPMC to provide 1,200 tree and shrub container seedlings (minimum of 6 species from a recommended species list) from spring 2002 through 2004. An amendment was signed in October 2002 for production of an additional 200 woody container plants of the same species to revegetate a telecommunications tower site within the park.

Accomplishments: A total of 371 woody plants were delivered to the park in May 2003. Materials were either planted by the GWMP natural resource management staff or held at the park's small nursery for planting at a later date.

In November 2003 the remainder of the seed used to produce plants for this agreement was shipped to the GWMP.

In October 2004, 719 woody plants of 12 different species were delivered to the park. These plants were also installed by the GWMP natural resource management staff or maintained at the park's small holding nursery until planting locations could be prepared.

A total of 13 different species of woody plants were produced.

Black gum (<i>Nyssa sylvatica</i>)	Mountain laurel (<i>Kalmia latifolia</i>)
Black walnut (<i>Juglans nigra</i>)	Paw paw (<i>Asimina triloba</i>)
Chestnut oak (<i>Quercus prinus</i>)	Red maple (<i>Acer rubrum</i>)
Flowering dogwood (<i>Cornus florida</i>)	River birch (<i>Betula nigra</i>)
Ironwood (<i>Carpinus caroliniana</i>)	Spicebush (<i>Lindera benzoin</i>)
Mockernut hickory (<i>Carya tomentosa</i>)	Sycamore (<i>Platanus occidentalis</i>)
	White oak (<i>Quercus alba</i>)

With the fall 2004 delivery, the NPMC has fulfilled its obligations for the current agreement and amendment. 2004 is the final year of reimbursable work with the George Washington Memorial Parkway

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ACADIA NATIONAL PARK

2004 Annual Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE PLANT MATERIALS CENTER BIG FLATS, NEW YORK

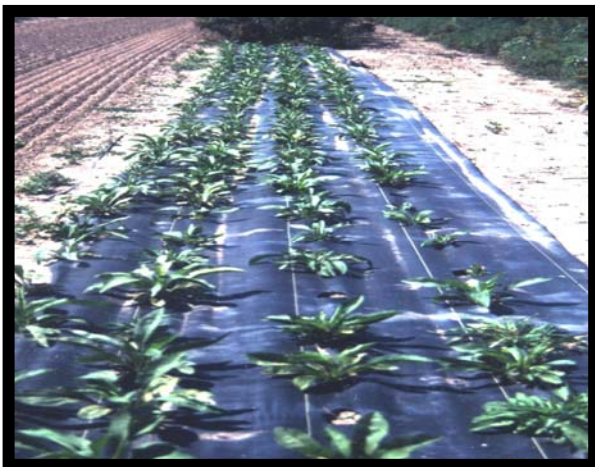
Introduction: The USDA, Natural Resources Conservation Service, Big Flats Plant Materials Center, entered into two interagency agreements with the USDI, National Park Service, Acadia National Park: IA Project No. 4500-02-001 (ACAD 234 Rehab of Seawall Campground) and IA Project NO.4500-03-001 (ACAD 320 Rehab Carriage Road Bridges). The Natural Resources Conservation Service agreed to:

- (A) Collect seed and plant materials of selected species within Acadia National Park boundaries.
- (B) Use these seeds and plant materials to establish isolated seed increase fields of grasses and forbs, to produce plugs and transplants of grasses, forbs, trees and shrubs.
- (C) Make available seed, plugs and transplants to Acadia National Park for re-vegetation of the Seawall Campground and Carriage Road rehab projects in 2003 and 2004.

The park will use the plant materials for roadside re-vegetation after completion of the Seawall Campground and Carriage Road Bridges, and seeding areas disturbed during the reconstruction projects in the park. The PMC activities have focused on seed and plant collections in the Acadia National Park, seed production, processing and conditioning, seed/plant propagation of plugs and transplants at the plant materials center, maintaining seed increase fields, propagating materials vegetatively and delivering the plant materials back to the Park.

Accomplishments: Seed was collected in September (arrowwood, viburnum, white birch, wild raisin, mountain holly, mapleleaf viburnum, bayberry, Mountain ash, Red Oak, Highbush Cranberry, Sambucus, White Spruce, and Hobblebush). Vegetative materials were collected in late May of arrowwood viburnum, meadowsweet, and fly honeysuckle.

Two deliveries of plant materials were made in 2004. The June delivery was 1,361 plants and 1,220 plugs. September delivery was 773 plants. Seed was shipped in May, totaling 93 pounds.



**Native Forbs planted
into weed control fabric**



**Woody plant production
area at Big Flats PMC**

Seed increase fields of red fescue grew very well this year, with wetter than normal moisture conditions. For forb production, in 2001 we established new seed production blocks, using weed fabric that has worked well in controlling weeds.

Seed of goldenrods (Canada and rough stemmed) and asters (New York, large leaf and white flat-topped) were harvested in 2004, using both combine and hand harvest methods. The small, light seed is still challenging to harvest and clean. All seed is being tested at the New York State Agricultural Experiment Station's Seed Lab in Geneva, New York. We found that deer like NY Aster, eating the entire production area down to a one foot height, but the plants still produced a good seed crop.

Seed of trees and shrubs were seeded in flats in late January and placed in the PMC cold frames to get the cold stratification requirement. Seedlings that germinated from prior year seedings were potted up and placed in the lath house. Young plants in the lathhouse were re-potted into 1 gallon containers. Species included winterberry, white birch, pasture rose, Mountain Holly, bayberry, spruce, Mountain Ash, Mapleleaf viburnum, Sweet Gale, meadowsweet and white pine. Cuttings from the greenhouse mist system (wild raisin, and fly honeysuckle) were potted up and placed in the greenhouse.

At Acadia, plant materials were utilized to re-vegetate disturbed areas, with the summer crew. Roped off areas and the posting of re-vegetation signs has helped keep visitors out of the plantings, giving the plants a chance to grow. At the Seawall Campground, three-legged wooden fence barriers were added to protect the plantings. All the plantings were mulched and watered with excellent survival of the plantings.



Signage to educate the public and deter trampling.



Use of three-legged fence barriers to keep campers out of the new planted area in Seawall Campground

Technology Development: Forb seed production using the weed fabric has worked well in controlling weeds. Propagation of Sweet Gale and Meadowsweet from seed was successful this year. In September, collections of seed for the Cape May Plant Materials Center were made for their Blackwood Campground Rehab Project. The re-vegetation signs have minimized the trampling of plants as well as educated the public on how the park service is utilizing native plants. Many of the plantings in the park are growing well where wood mulch was applied to assist in retaining moisture in the soil.

ACADIA NATIONAL PARK

2004 Annual Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE PLANT MATERIALS CENTER CAPE MAY, NEW JERSEY

Introduction: The USDA, Natural Resources Conservation Service, Cape May Plant Materials Center, entered into an interagency agreement, 4500-03-002 Rehabilitation of Blackwoods Campground, with the USDI, National Park Service, Acadia National Park.

The Natural Resources Conservation Service agrees to:

- (D) Collect seed and plant materials of selected species within Acadia National Park boundaries.
- (E) Use these seeds and plant materials to produce plugs and transplants of forbs, trees and shrubs.
- (F) Make available plugs and transplants to Acadia National Park for re-vegetation of the Blackwoods Campground.

The PMC activities have focused on seed and plant collections in the Acadia National Park, seed collection, processing and conditioning, seed/plant propagation of plugs and transplants at the plant materials center, propagating materials vegetatively and delivering the plant material back to the Park.



**Blackwoods Campground
before rehab**



**Campground after placement of
log barriers, mulch and trees
and shrubs**

Accomplishments: Seed was collected September through November (pasture rose, arrowwood, viburnum, white birch, wild raisin, mountain holly, winterberry, maple leaf viburnum, bayberry, Mountain ash, hawthorn), in mid-September (bayberry, arrowwood viburnum, sheep laurel, fly honeysuckle, pasture rose, wild raisin, mountain holly, hobblebush and maple leaf viburnum), and early November (winterberry, meadowsweet, pasture rose, downy goldenrod, sweet gale, grass-leaved goldenrod, while flat-topped aster and staghorn sumac). No vegetative materials were collected at this time.

During the first week of October 2003, seed of trees and shrubs were stratified. The first week of December storage bins were removed from the cold storage; opened and seeding flats were immediately placed into the

greenhouse- Seedlings were potted and placed in a shaded nursery holding area. Young plants were re-potted into 1 gallon containers. Species included winterberry, white birch, pasture rose, bayberry, spruce, meadowsweet and white pine.

One delivery of 650 winterberry plants was made in July 2004.



Acadia winterberry

Technology Development and Transfer:

At the recommendation of some national nursery operations, PMC staff originally potted several hundred winterberry seedlings into one gallon containers filled with native mineral soil from PMC fields. A couple hundred other winterberry plants were placed into pots containing standard Pro-mix type media. At the end of the season, there was a marked difference in plant growth, vigor and bio-mass between the two media. The native soil produced a superior quality plant than did the standard nursery potting mixtures. However, the one gallon containers with native soil weighed an average of 18.2 pounds compared with 3.7 pounds for the standard nursery potting mixes.

The fact that a superior quality plant could be produced with a native soil could not be simply ignored. This observation led to the implementation of a three year study titled: Growth Response of Selected Native Plants to Variations in Potting Soil Treatments. The resulting technology will be made available to NPS and others.

CRATER LAKE NATIONAL PARK

FY 2004 Annual Summary Report

Prepared by Amy Bartow

NATURAL RESOURCES CONSERVATION SERVICE CORVALLIS PLANT MATERIALS CENTER CORVALLIS, OREGON

Introduction: The Corvallis Plant Materials Center (PMC) entered into a new agreement with Crater Lake National Park in 2003 to provide native plant materials for the ecological restoration of the Highway 62 construction area. It was agreed that the PMC would propagate a minimum of 9150 plants of nine herbaceous species (two grasses, four sedges, one rush, one legume, and two forbs) as well as produce 180 lbs of seed of two grass species for delivery in 2004.

Accomplishments: Activities in 2004 included, expanding and maintaining two grass seed production fields, harvesting seed production fields, continued germination research on new species, containerized plant production, and delivery of plant materials.

Seed increase fields of California brome and blue wildrye were expanded via carbon banding on October 22, 2003. These fields produced 160 lbs and 29 lbs of cleaned seed, respectively. Seed was not delivered to the park in 2004 and will remain in seed storage facilities at the PMC until requested by the park. Plant production was very successful; 10,417 plants were delivered to the park, exceeding contract goals.



Crater Lake plants ready for delivery

(Amy Bartow)



Crater Lake NP California brome and blue wildrye seed increase fields

Technology Development and Transfer: Seed stratification/germination trials were performed on five species that have not been previously produced for the Park. Initial trials with these species indicated that some form of pretreatment may be needed to overcome seed dormancy. Cold-moist stratification trials were set up in the fall of 2003. Howell's pioneer rockcress, western mountain aster, many rib sedge, and Parry's rush were all found to need at least 5 weeks of cold-moist stratification to break seed dormancy.

CRATERS OF THE MOON NATIONAL MONUMENT

2004 Annual Summary Report Prepared by

Natural Resources Conservation Service
Aberdeen, Idaho Plant Materials Center

Introduction: The Aberdeen Plant Materials Center (PMC) entered into an interagency agreement with Craters of the Moon National Monument (CMNM) in 2004 to produce seed and plants of thirteen native plant species for use in revegetation of disturbed areas following road construction.



**Personnel from Craters of the Moon, Glacier NP and NRCS
PMC Aberdeen Idaho get acquainted with native vegetation.**

Accomplishments: CMNM personnel hand collected seed during the summer of 2004. PMC personnel provided technical assistance in seed collection techniques. The seed was dried, bagged and transported to the PMC. In December, 2004 PMC staff cleaned the collections listed below:



Species	Scientific Name	Estimated minimum required (lbs)	Actual collected (lbs)
Antelope bitterbrush	<i>Purshia tridentata</i>	0.31	0.82
Rubber rabbitbrush	<i>Chrysothamnus nauseosus</i>	0.03	0.22
Mountain big sagebrush	<i>Artemisia tridentata ssp. vasseyana</i>	0.04	Not collected
Limber pine	<i>Pinus flexilis</i>	0.68	1.58
Sulphurflower buckwheat	<i>Eriogonum umbellatum</i>	0.02	1.00
Hotrock penstemon	<i>Penstemon deustus var. deustus</i>	0.003	0.34
Dwarf buckwheat	<i>Eriogonum ovalifolium var. depressa</i>	0.21	0.12
Thurber's needlegrass	<i>Achnatherum thurberianum</i>	3.8	0.50
Indian ricegrass	<i>Achnatherum hymenoides</i>	3.8	1.40
Sandberg bluegrass	<i>Poa secunda</i>	1.2	4.68
Dusty maiden	<i>Chaenactis douglassii</i>	1.68	1.84
Scorpion weed	<i>Phacelia hastata</i>	1.28	0.70
Dwarf monkey flower	<i>Mimulus nanus</i>	0.04	0.11

CMNM personnel also made additional collections of the following species that were not originally planned for collection: *Achnatherum nelsonii*, *Eriogonum ovalifolium* var. *ovalifolium*, *Achnatherum occidentale* and *Chamaebatiaria millefolium*. Seed from the collections made during 2004 were to be propagated in the PMC greenhouse beginning in early 2005. However, due to delays in road construction propagation will be postponed until the winter of 2005-2006. Additional seed collections may be made during the upcoming growing season to enhance amounts for propagation.

LASSEN VOLCANIC NATIONAL PARK

FY2004 Annual Summary Report

Prepared by

UPPER COLORADO ENVIRONMENTAL PLANT CENTER
MEEKER, COLORADO



Introduction: An agreement was made between Lassen Volcanic National Park and Upper Colorado Environmental Plant Center (UCEPC) June 2001. The agreement, as signed, calls for the production of one material, blue wildrye. An amendment to the agreement, signed in September 2001, added production of California brome to the list of contracted species. An additional amendment, executed in the fall of 2002, allowed for the cleaning and testing of wild collected seed from Lassen Volcanic National Park. A third amendment, signed in September of 2003, extended production of California brome and blue wildrye through 2004 and a fourth amendment further extended the agreement through 2005.

Accomplishments: On September 4, 2001, a one-acre field of blue wildrye was planted using a hand pushed Planet Junior and on November 16, 2001, a 0.18-acre field of California brome was planted utilizing the same method. An additional 0.70 of an acre was planted on May 29, 2003 bringing the total production acreage to 0.88 acres, or 26 480-foot rows. The seed for the new seeding had been collected by Bitterroot Growers in 2002. Seed was treated with 'Vitavax' for head smut control prior to planting all but the four southern most rows, which were not treated for head smut. On June 30, 2003, 64 pounds of clean *Bromus carinatus* seed were harvested while 205 pounds of blue wildrye were harvested July 21, 2003.

Strong production of both products continued in 2004. The blue wildrye produced 285 clean pounds of seed while the California brome produced 200 pounds. The four southern most rows that had not been treated with Vitavax were not harvested because of near total infestation with head smut. On July 27, 2004, four rows that were not planted the previous year were planted with Vitavax treated seed produced in 2003 for additional production in 2005. The four untreated rows will continue to be monitored through time.

A small seed shipment was made on October 8, 2004 that consisted of 4.6 pounds of blue wildrye and 2.2 pounds of California brome.

Technology Development: Head smut in mountain and California brome continues to be puzzling relative to the method and incidence of occurrence. Cultural practices that reduce the likelihood of infection are at this time not well understood. Dr. Howard Swartz, Colorado State University, visited UCEPC to view the seed increase field first hand. His discussion indicated some species of smut can be transmitted through infected soil or seed, and can occur at different times of year under various environmental conditions. Five plantings have been done with Lassen California brome for this project. Two plantings, one with visually smutted seed and one which was not obviously infected, but both treated with Vitavax and planted November 16, 2003, have not had any significant occurrence of head smut. Two other plantings, one treated and one untreated, had distinctly different levels of infection. The untreated seed was so badly smutted that it was not harvested. However, the treated seed did produce some degree of infected plants as well. These plantings occurred on May 29, 2003. The fifth planting, done July 27, 2004, was also treated with Vitavax. Head smut in this project will be monitored in 2005.

MOUNT RAINIER NATIONAL PARK
State Road 123 Revegetation Project

2004 Annual Summary Report
Prepared by Amy Bartow

NATURAL RESOURCES CONSERVATION SERVICE
CORVALLIS PLANT MATERIALS CENTER
CORVALLIS, OREGON



Mt. Rainier NP Tipsoo Lake Area

Introduction: The Corvallis Plant Materials Center (PMC) entered a new agreement with Mount Rainier National Park (NPS) to provide native plant materials for the ecological restoration of State Road 123. It was agreed that the PMC would produce a minimum of 25 lbs (PLS) of blue wildrye, 50 lbs (PLS) of California brome, and 25 lbs (PLS) of red fescue for delivery in the fall of 2005.

Accomplishments: Seed collected by the park staff in 2003 was provided to the PMC and seeded into containers in late fall of 2003. Plants were transplanted into seed increase fields in early spring of 2004. Fields were hand-harvested in late June and July. The fields of Blue wildrye and California brome produced 8 lbs (bulk) and 20 lbs (bulk), respectively. NPS staff collected seed again in 2004 and amounts were large enough to seed directly into fields in September and October. Fields will not be expanded in future years.



Personnel from the park, NPS- Denver Service Center and Federal Highway Department plan for next phase of highway construction.

Technology Developments: Park staff had collected very little seed in the fall of 2003, but were hoping to have moderate size fields (0.5 acre) established by fall of 2004. The PMC received the 46g of blue wildrye and sowed it into cone-tainers. Seedlings were grown in a greenhouse for two months (November and December), then moved to a lathhouse to acclimate to winter temperatures. They were transplanted into the fields in late February. It was not known if the seedlings were properly vernalized due to late exposure to winter temperatures. Plants flowered abundantly considering that it was the first production year. The .02 acre field produced 8 lbs. This technique worked well for quickly establishing a seed increase field with very small amount of seed.

OLYMPIC NATIONAL PARK
Elwha River Ecosystem and Fisheries Restoration

2004 Annual Summary Report
Prepared by Amy Bartow

NATURAL RESOURCES CONSERVATION SERVICE
CORVALLIS PLANT MATERIALS CENTER
CORVALLIS, OREGON



Introduction: The Corvallis Plant Materials Center (PMC) entered into a new agreement with Olympic National Park in 2004 to provide native plant materials for the ecological restoration of drained lakebeds of Lake Mills and Lake Aldwell following the removal of two dams on the Elwha River. It was agreed that the PMC would propagate a minimum of 300 lbs (PLS) of seed and 60,000 containerized shrubs; 900 lbs (PLS) of seed and 46,000 containerized herbs and forbs; and 2,020 lbs (PLS) of grass, sedge, and rush seeds. A more detailed production list will be determined by PMC and NPS as restoration plans are finalized. Dam removal is scheduled to begin in 2008.



Cleaning Elwah collected seed



Elwah fireweed before processing

Accomplishments: PMC and NPS staff and volunteers collected 12 lbs of clean seed of 19 species in 2004. Seed was cleaned and informal germination tests were performed on most of the seed lots prior to planting. Four grasses and two sedges were seeded into seed increase fields on September 29 and October 5, 2004 using a six-row Planet Jr. seeder. In late October, PMC staff traveled to the park to collect dormant hardwood cuttings of nine species of trees and shrubs. 2620 cuttings were collected in 61 person hours and subsequently planted into cone-tainers. Vegetative cutting blocks of three forbs were also established. 6340 transplants were grown from seed to expand or establish seed increase fields of 10 species in early spring of 2005.

Technology Development and Transfer: Large quantities of fireweed seed had never been collected or cleaned by PMC staff. Harvest techniques were successful. When lowest capsule split open, entire racemes were cut from the plant, placed in paper sacks or cloth bags, and left in an open greenhouse to dry. There was no decrease noted in seed viability with this collection technique, and it proved to be very efficient. After drying, bags were emptied into a large brush machine (using the smallest screen available, size #14). The down draft created by the spinning brushes drew the tiny seeds into the machine. Seeds and fluff fell that through the screen were collected and cleaned with an air-screen machine.

Experimental propagation of six species began in the fall of 2004. Results determined that Dewey's sedge, Bolander's rush, and common rush require at least five weeks of cold-moist stratification to break seed dormancy, whereas Henderson's sedge, goatsbeard, and small-flowered wood rush require at least 90 days of cold moist stratification. This information will help PMC staff determine optimum seeding times for these species. Plants that were produced in these trials will also be used as transplants to establish seed increase fields.

OLYMPIC NATIONAL PARK
Hurricane Ridge Road Project

2004 Annual Summary Report
Prepared by Amy Bartow

NATURAL RESOURCES CONSERVATION SERVICE
CORVALLIS PLANT MATERIALS CENTER
CORVALLIS, OREGON



Hurricane Ridge Olympic NP

Introduction: The Corvallis Plant Materials Center (PMC) entered into a new agreement with Olympic National Park in 2004 to provide native plant materials for revegetation of Hurricane Ridge Road. It was agreed that the PMC would propagate a minimum of 255 lbs (PLS) of two lower elevation grasses, 100 lbs (PLS) of two upper elevation grasses, and 45 lbs of three upper elevation forbs. The PMC is also responsible for native seed collecting a minimum 3.5 lbs of seed of four forbs. Project is expected to be completed in 2007.

Accomplishments: PMC staff collected 5.6 lbs of seed of six species (seven accessions). The seed was cleaned and germination tests were performed prior to sowing. Four grass fields (two blue wildrye fields, Columbia brome and sitka brome) and one forb field (broadleaf lupine) were seeded in early October. White sage seed was sown into cone-tainers in fall of 2004 and the resulting plants will be transplanted out into a seed increase field in 2005. Seed collection will be performed again in 2005 and these fields will be expanded.

Accomplishments: Lupine species are difficult to harvest efficiently due to their indeterminate ripening and easily shattering pods. To aid in seed collection, 2ft-wide strips of weed fabric were tacked down between

the rows of lupine to control weeds and to act as a passive seed collector. Seeds can be swept from the weed fabric as the seeds shatter.

Initial germination test results for Sitka brome were very low. Seed appeared to be viable, so trials were performed. Seeds were placed in plastic germination boxes on moistened germination paper and stored in a walk-in cooler for 60 and 90 days each. One “control” box of seeds was left in a greenhouse set at fall temperatures (60 degree days, 50 degree nights). The control boxes exhibited 16% germination (after 6 weeks), while boxes that were left in the cooler for 60 and 90 days had 75% and 90% germination, respectively. These findings suggest that this high elevation (4000-5000ft) ecotype has a physiological dormancy.

SEQUOIA/KINGS CANYON NATIONAL PARK

FY2004 Annual Summary Report

Prepared by

NATURAL RESOURCES CONSERVATION SERVICE
PLANT MATERIALS CENTER
LOCKEFORD CALIFORNIA



Introduction: During FY2004, six different species were grown at the Lockeford PMC for maximum seed production. A total of 101.54 pounds of pure live seed (PLS) was produced at the PMC. The project total is now 189.81 pounds of PLS. The PMC propagated 4000 plugs of two species for transplanting on an area which was covered with weed control fabric. The fabric allowed shattered seed to be vacuumed up with no soil.

This project started in FY2003 and will be completed in FY2005. The overall goal of the project is to produce a minimum of 150 PLS pounds of seed of six species.

Accomplishments: All initial seed collection was accomplished by the park staff. The seed was then cleaned by PMC staff and tested by a seed laboratory. The initial cleaned seed was then used to propagate plants for placement on fabric (5000 S.F., one foot spacing) of three species (*Trifolium ciliolatum*, *Lupinus bicolor*, *Poa secunda*) and direct seed three species (*Melica californica*, *Elymus glaucus*, *Bromus carinatus*) on 30 inch rows .5 acre ea. . The three species on the fabric were hand harvested and shattered seed was vacuumed off the fabric. The three direct seeded species were harvested using a FailVac or combine harvester. All seed was cleaned and tested.

Species	FY03 PLS. Lbs.	FY04 PLS Lbs.	Total PLS 03&04
Trifolium ciliolatum 9083009 TRCI	22.93	6.5	29.43
Lupinus bicolor 9083008 LUBI	28.37	32.75	61.12
Poa secunda 9083007 POSE	.15	.59	.74
Melica californica 9083006 MECA	.54	.70	1.24
Elymus glaucus 9083005 ELGL	26.70	35.0	61.7
Bromus carinatus 9083004 BRACA	9.58	26.0	<u>35.58</u>
TOTAL			189.81

Technology Development and Transfer: All seed cleaning was documented and screen size and air flow for each species was determined. The weed control fabric was successfully used to control weeds and allow shattered seed to be vacuumed up with out soil.

YOSEMITE NATIONAL PARK

FY2004 Annual Summary Report Prepared by

UPPER COLORADO ENVIRONMENTAL PLANT CENTER MEEKER, COLORADO

Introduction: Yosemite National Park and Upper Colorado Environmental Plant Center (UCEPC) entered into an agreement, which was formally approved September of 2001. This agreement extends a cooperative relationship which was initiated in 1997, and entails field establishment and seed increase of one grass species, blue wildrye, *Elymus glaucus*, for use in park revegetation efforts through 2004. The seed used for establishing the new field was from seed grown in 1999 by UCEPC.



Accomplishments: A 2.5 acre field of blue wildrye was planted on November 20, 2001, with a Tye drill. Although seed production was not expected until the summer of 2003, 25 pounds of clean seed was produced from UCEPC Field 8 in 2002. On July 21, 2003, the blue wildrye field produced 271 pounds. In 2003, seed shipments of blue wildrye seed were made March 26, April 21, and December 30. The first two shipments were approximately 25 PLS pounds while the December shipment was 50 PLS pounds.

In 2004, 365 pounds of blue wildrye were harvested on July 30. One seed shipment, 60 pounds, was made November 15, 2004. Yosemite blue wildrye has produced 661 pounds of seed since being planted in November 2001. This agreement has expired, but produced seed remains on inventory.

Technology Development: This particular collection of blue wildrye is very fine stemmed and is prone to lodging. Fertilization trials were conducted on a large scale, with a single replication, to determine if reductions in fertilization might reduce stem length. It was thought shorter stems would reduce lodging. No obvious difference was noticed in production or lodging. This year, because of heavy lodging, the harvest was conducted in one direction only by direct combining. Because a large quantity of green stem material was fed into the combine, clean threshing was not easily obtained, and on numerous occasions, harvesting was halted to clean out the clogged machine. Swathing and use of a pick-up head would likely result in a more productive, cleaner harvest and would be less stressful on machinery.

CUMBERLAND GAP NATIONAL HISTORIC PARK

2004 Annual Summary Report prepared by

NATURAL RESOURCES CONSERVATION SERVICE NATIONAL PLANT MATERIALS CENTER BELTSVILLE, MARYLAND

Introduction: Cooperative agreements between the Cumberland Gap National Historical Park (CUGA) and the National Plant Materials Center (NPMC) have been in place since 1990. Currently, the fourth cooperative agreement with the Park covers the replanting of the Gap restoration areas, visitor areas and other revegetation needs. This agreement was initiated in 2002 and continues through 2005, with final plant deliveries scheduled for the spring of 2005. This agreement is expected to complete the remaining revegetation work anticipated by the park. All herbaceous seeds required for the agreement have been delivered, but additional seed has been harvested and conditioned. The 2005 plantings will complete the agreement and utilize remaining live plant materials at the National Plant Materials Center.

Restoration of Historic Cumberland Gap



Before revegetation



After revegetation

Accomplishments: This year the NPMC staff coordinated a spring planting at the park.

In March, twelve students from Cumberland Mountain Research Center, Lincoln Memorial University in Harrogate, TN were hired to help plant 4,404 bare-root woody plants consisting of 7 species and 900 container-grown woody plants consisting of 19 species of trees, 6 species of shrubs and 1 vine species. An estimated total of 12 acres was planted. A total of 900 container-grown plants of 26 species were delivered in 2004.

All areas in need of planting have been planted at least once with the exception of the Visitor Information Center (VIC) and a slide area adjacent to the Thomas Walker Parking. The VIC will be planted in 2005. The slide area will not be planted due to expected repairs not being complete. The majority of the 2004 planting was used to further enhance areas that had already been planted in previous years.

About 18 pounds of grass seed were produced and conditioned in 2004, bringing the amount of bulk seed in the inventory to approximately 130 lbs.

For March 2005 delivery and planting, approximately 2,400 bare-root trees and shrubs have been harvested, 6,000 herbaceous plugs are being produced and 525 container-grown trees and shrubs have been prepared. Trees and shrubs will be planted in March, 2005. Herbaceous plugs have been scheduled to be planted in April, 2005 to allow for better survival in the warmer weather.

Technology Developments and Observations: This year the roots of all bare-root material was again dipped in Silva-Dip (RTI), a solution of mycorrhizal inoculum, water-holding polyacrylamide gel, humic acid and other biostimulants. To minimize loss of the root dip from excess handling, the bare root bundles were combined into large mixed bundles and wrapped in burlap and stretch wrap. This was the same procedure that was done for the spring 2002 planting, but was not repeated last year due to time constraint in preparation. Handling labor at the planting site was reduced greatly. This and the excellent student workers contribute to the completion of the planting in just 3 days, one day earlier than expected.

The spring plantings were evaluated during a trip in October, 2005 and were observed to have excellent survival (>95%) and growth. Again there was adequate rain this year which certainly contributed greatly to their survival. In the vernal pool area, the sphagnum moss has continued to spread over a larger area and is expected to continue to do so, thereby increasing critical nesting habitat for the rare four-toed salamander.

GREAT SMOKY MOUNTAINS NATIONAL PARK

2004 Annual Summary Report prepared by

NATURAL RESOURCES CONSERVATION SERVICE NATIONAL PLANT MATERIALS CENTER BELTSVILLE, MARYLAND

Introduction: The current cooperative agreement between the Great Smoky Mountains National Park (GRSM) and the National Plant Materials Center (NPMC) was signed in May, 2000, for Fiscal Years 2001–2005. Approximately 300 lbs. of grass/forbs seed, 30,000 grass/forbs plugs, 4,200 bare root and 800 containerized trees and shrubs were to be supplied under the agreement for revegetation of approximately 2 acres yearly in the Foothills Parkway. GRSM staff will collect 530 pounds of seed from within the Park and ship it to NPMC for conditioning, testing, storage, and plug production. The NPMC will continue producing grass and wildflower seed for several species that are difficult to grow. It will also continue to produce plugs for the GRSM grass and wildflower seed production fields. The fields were established in Cades Cove in 1998 because of delays in the Foothills Parkway construction, the need to utilize materials produced by NPMC per the interagency agreement, and to ensure availability of native plants when construction on the FHP resumes. The Park plans to be able to handle the 2-acre per year revegetation efforts for the Foothills Parkway beyond 2005 by raising its own plugs and seed and increasing its own seed cleaning and storage.



GRSM indianguass and big bluestem seed increase fields.



Plant plugs were grown by the Beltsville PMC and planted by park personnel and volunteers with the planter shown.

Accomplishments:

- **Woody Plant Materials:**

A handful of containers remain in the NPMC container nursery which will be delivered to the park in 2005. The total amount of woody plant material required by the 2004 – 2005 interagency agreement has been met.

- **Herbaceous Plug Production:**

In May, 2004, the NPMC delivered 10,050 (3 different species) herbaceous plugs to the Park for planting in Cades Cove. The total amount of plugs required by the 2001 – 2005 interagency agreement has been met.

- **Seed Production, Conditioning and Delivery:**

101 pounds, PLS, of seed (18 different species) were delivered to the Park. Around 100 pounds of cleaned seed (3 different species) was harvested from NPMC seed increase fields in 2004. NPMC staff has processed 51 pounds (4 different species) of seed harvested in 2004 from the Cades Cove seed increase fields. Approximately 470 pounds, PLS, of cleaned GRSM herbaceous and woody seed is presently stored at the NPMC.

The total amount of seed supplied to the park required by the 2001 – 2005 interagency agreement has been met.

Miscellaneous:

Currently a surplus 1989 Norlake refrigeration unit, from the New Jersey Plant Materials Center, is being investigated for shipment to the park. Currently the specifications and manual on the unit is being shipped by the manufacturer to the PMC. This information will be passed along to the park staff. The refrigerator would greatly assist the park staff in their ability to store seed lots on site plus alleviate shipping costs of seed from the National Plants Materials Center to GRSM.

With the spring 2004 delivery, the NPMC has fulfilled all of its obligations for the current interagency contract.

STONES RIVER NATIONAL BATTLEFIELD

FY2004 Annual Report

**Prepared by
John Vandevender**

**NATURAL RESOURCES CONSERVATION SERVICE
ALDERSON, WV PLANT MATERIALS CENTER**



Introduction: The NPS, in managing the Stones River National Battlefield, has a need to preserve native plant resources and revegetate parklands. The NPS requires that revegetation of park lands utilize germplasm from within park boundaries where possible to maintain the genetic resources within the park. The NPS does not have the personnel, expertise, or equipment needed to propagate quantities of the required seed and plants.

The NRCS has the personnel and is equipped to propagate and clean quantities of seed sufficient to meet the NPS needs within the required time frame, and conduct evaluations on plant species to determine adaptation and cultural requirements for establishment.

The NPS has requested certain information and plant materials that are presently unavailable and is willing to reimburse the NRCS for the costs of obtaining such information and plant materials within the time frame specified in this agreement.

The NRCS has agreed to harvest seed from native species indigenous to Stones River National Battlefield, condition the seed, and produce seedling plugs to be used to establish permanent seed production fields at

the park and/or at the Plant Materials Center. The species of interest are: *Sporobolus compositus* var. *compositus*, *Andropogon ternarius*, *Andropogon gyrans*, *Bouteloua curtipendula*, *Carex* spp., *Chasmanthium latifolium*, *Dichanthelium* spp., *Eragrostis spectabilis*, *Leersia virginica*, *Melica mutica*, *Schizachyrium scoparium*, *Asclepiastuberosa*, *Aster* spp., *Eupatorium altissimum*, *Eupatorium coelestinum*, *Eupatorium serotinum*, *Lespedeza violacea*, *Rudbeckia* spp., *Solidago* spp., and *Forestiera ligustrina*.

Accomplishments: Fiscal year 2003 was the initiation year for this agreement. During 2003, NRCS personnel traveled to Stones River National Battlefield to become familiar with the park's ecological communities, identify prime seed collection locations for the nineteen species of interest, and to assess appropriate seed collection techniques and optimum harvest times. Several late summer seed collection trips netted small (less than 0.5 pounds) quantities of seeds from thirteen species. All seed was collected by hand stripping methods. The thirteen species represented in the 2003 seed harvest are: *Sporobolus compositus* var. *compositus*, *Andropogon ternarius*, *Andropogon gyrans*, *Chasmanthium latifolium*, *Dichanthelium* spp., *Eragrostis spectabilis*, *Leersia virginica*, *Schizachyrium scoparium*, *Aster drummondii*, *Lespedeza violacea*, *Rudbeckia hirta*, *Rudbeckia triloba*, and *Solidago nemoralis*.



***Rudbeckia* seed increase field at the park**



***Andropogon ternaries* seed increase at PMC**

In 2004, the Alderson Plant Materials Center produced approximately 20,000 seedlings from the 2003 seed harvest. The seedlings were mechanically transplanted into tilled fields at Stones River National Battlefield to establish seed production fields. Natural Resources staff at Stones River National Battlefield will harvest and use seed from these fields to restore and maintain this historic site's circa 1862 floristic authenticity.

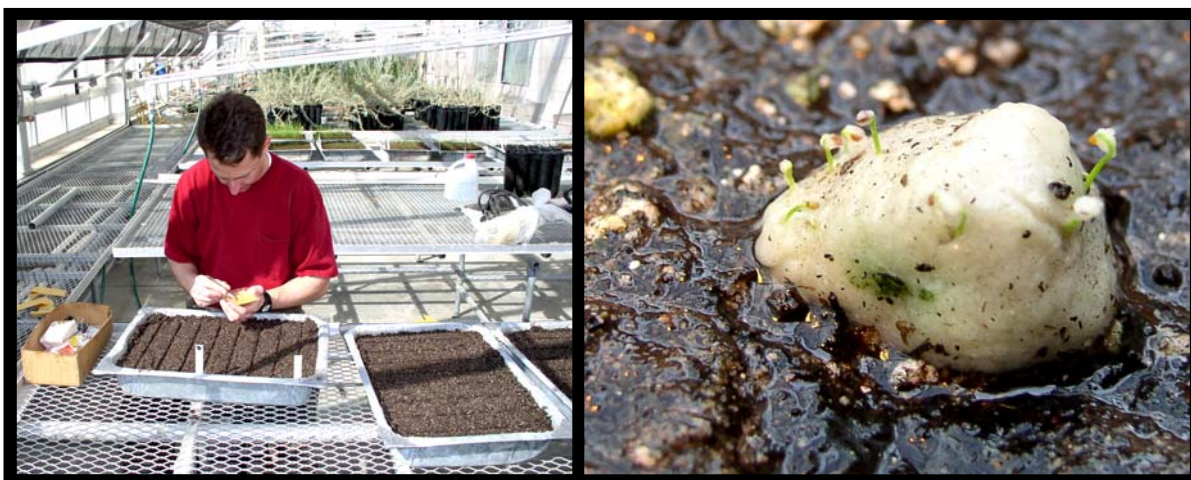
**NATIONAL PARK SERVICE
WETLAND ESTABLISHMENT RESEARCH STUDY**

**2004 Annual Summary Report
prepared**

**Natural Resources Conservation Service
Plant Materials Center
ABERDEEN, IDAHO**

Introduction: In 2003 the Aberdeen Plant Materials Center (PMC) entered into an agreement with the National Park Service to evaluate the efficacy of different methods of direct seeding of wetland plant species. At the present time, wetland restoration is best accomplished using greenhouse or wild collected plugs of the desired wetland plants. Direct seeding of wetland plants is rarely successful. However, direct seeding of wetland plants would be much cheaper.

Accomplishments: Six species were chosen to represent the most commonly utilized wetland species involved in wetland creation and restoration in the Intermountain West: Nebraska sedge (*Carex nebrascensis*), Creeping spikerush (*Eleocharis palustris*), Baltic rush (*Juncus balticus*), Hardstem bulrush (*Scirpus acutus*), Alkali bulrush (*S. maritimus*) and Common threesquare (*S. pungens*). In the late summer of 2004, 34 seed collections were made with a seed stripper (Prairie Habitats Ltd.) from wetlands throughout the Intermountain West. One collection from each species was chosen for use in this experiment based on the quantity and quality of seed collected. Due low seed production in 2004, we were unable to obtain sufficient amounts of Nebraska sedge from wildland locations for testing. We will use Nebraska sedge seed collected from the Aberdeen PMC wetland ponds in 2000. Materials harvested in 2004 were allowed to dry and were then thrashed and cleaned at the Aberdeen PMC small seed lot cleaning facility. Initial studies were conducted in the greenhouse and growth chambers at the PMC to evaluate the potential of two commercially developed seeding methods (tackifier and Submerseed). Greenhouse results were encouraging, and it was decided to include these methods in the larger trials scheduled for 2005.



Derek Tilley seeding wetland plants in the greenhouse. An example of Submerseed which is a small rock with Juncus seed embedded in a coating around the rock.

Seed is currently undergoing a cold stratification treatment. When the stratification of seed is completed, the seeds will be used for greenhouse germination and establishment tests. A larger set of trials is planned for the spring of 2005 in the PMC wetland ponds located at the PMC home farm. These will be replicated plots evaluating six different seeding methods under “real life” field conditions.

Technology Development: Both tackifier and Submerseed showed good germination and seed holding capabilities in greenhouse tests. These will continue to be evaluated against more traditional seeding methods. If either proves to be a viable wetland seeding method, the PMC will work to develop appropriate planting protocols for their use

**ESTABLISHMENT OF NATIVE VEGETATION AT
A WETLAND MITIGATION SITE
FOR AMPHIBIAN BREEDING HABITAT
at
CUMBERLAND GAP NATIONAL HISTORICAL PARK**

PROJECT REPORT

**to the
NATIONAL PARK SERVICE**



prepared by

**USDA-Natural Resources Conservation Service
National Plant Materials Center
Beltsville, MD**

February 7, 2005

Ugiansky, R.J. 2005. Project Report: Establishment of native vegetation at a wetland mitigation site for amphibian breeding habitat at Cumberland Gap National Historical Park. USDA-NRCS National Plant Materials Center, Beltsville, MD, 9p.

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Project Summary

The National Plant Materials Center (NPMC) in Beltsville, MD, has been involved in cooperative agreements with the Cumberland Gap National Historical Park (CUGA) in TN, KY, and VA for the revegetation of areas disturbed by highway construction. An agreement to produce and coordinate the planting of native materials produced by the NPMC on a wetland mitigation site in CUGA was established in 1999. The NPMC has established several cooperative agreements with the Cumberland Mountain Research Center (CMRC), Lincoln Memorial University, Harrogate, TN, for collecting and planting activities in the past. Students from the CMRC were utilized to assist with planting operations for this project in conjunction with the ongoing planting activities at CUGA.

The wetland mitigation site was created in collaboration with the Federal Highways Administration to compensate for the 0.47 acres of wetlands that were eliminated or degraded during highway construction in CUGA. Three vernal pools were created in the fall of 1998 along the floodplain of little yellow creek in CUGA on a 1.0-acre field previously used as horse pasture. The ponds were designed to hold water for at least 5 months to provide breeding habitat for local amphibians and to dry out during late summer and fall (fig.1) to reduce the buildup of predators of amphibians. The long-term goal is to create breeding habitat for the regionally rare four-toed salamander (*Hemidactylum scutatum*). Four-toed salamanders prefer forested vernal pools with thick *sphagnum* moss mats at the waters edge in which to lay their eggs. Trees, shrubs, herbaceous wetland plants, and *sphagnum* moss were established by the NPMC at the site to eventually meet these criteria.

Materials Planted and Installed

The site was planted in March of 1999 with trees, shrubs and herbaceous plants grown at the NPMC from germplasm collected within CUGA. Species and sizes planted are listed in Table 1.

Table 1. Plant material planted March 1999. Container size is indicated or BR if bare-root.

Species	Common Name	Accession	Size	Height	Number Planted
Woody					
<i>Acer rubrum</i>	red maple	9076349	BR 1-0	6-50"	20
<i>Acer saccharinum</i>	silver maple	9064524	BR 1-0	2-30"	20
<i>Cercis canadensis</i>	redbud	9077054	BR 2-0	10-32"	25
<i>Diospyros virginiana</i>	persimmon	9064525	BR 2-0	26-36"	30
<i>Fraxinus americana</i>	white ash	9078185	BR 2-0	22-40"	30
<i>Lindera benzoin</i>	spicebush	9069955	BR 2-0	12-36"	80
<i>Liquidambar styraciflua</i>	sweetgum	9076350	BR 2-0	12-36"	20
<i>Liriodendron tulipifera</i>	Tulip poplar	9076346	BR 2-0	14-48"	20
<i>Platanus occidentalis</i>	American sycamore	9049942	BR 1-0	12-52"	30
<i>Acer rubrum</i>	red maple	9076349	2 gallon	60-84"	36
<i>Asimina triloba</i>	pawpaw	9067050	3 gallon	72"	7
<i>Carpinus caroliniana</i>	American hornbeam	9069774	3 gallon	36-48"	25
<i>Diospyros virginiana</i>	persimmon	9064525	3 gallon	72"	10
<i>Hydrangea arborescens</i>	hydrangea	9077051	1 gallon	20-24"	20
<i>Lindera benzoin</i>	spicebush	9069769	2 gallon	36"	8
<i>Liriodendron tulipifera</i>	tulip poplar	9076346	2 gallon	72"	20
<i>Platanus occidentalis</i>	American sycamore	9069942	2 gallon	84"+	16
<i>Rhamnus caroliniana</i>	Carolina buckthorn	9069954	1 gallon	12"	1
<i>Sambucus canadensis</i>	common elderberry	9069768	1 gallon	18-24"	10
<i>Vaccinium corymbosum</i>	highbush blueberry	9064828	2 gallon	24-36"	10
Herbaceous			Total	Woody	418
<i>Aster pilosus</i>	frost aster		1 gallon		52
<i>Scirpus cyperinus</i> & misc.	woolgrass		1 gallon		117
			Total	Herbaceous	169

Native grass seed of *Elymus virginicus*, *Elymus villosus*, *Elymus hystrix* and *Dichanthelium commutatum* were broadcast seeded prior to tree planting. This was to facilitate good seed to soil contact created by the foot traffic of the tree planting operations. Enhancements to the vernal pools for amphibian breeding habitat were also installed in March 1999. These included the addition of leaves to provide a source of organic mater, and branches and logs to provide egg attachment sites and resting places for amphibians.



Figure 1. View of wetland mitigation site in October 2002. Planted trees are most visible against the background of mature forest. Pond #1 in center, pond #2 upper left and pond #3 upper right of photo. The ponds were dry.

Establishment of *Sphagnum* Moss

In conjunction with providing shaded vernal pools, the establishment of sphagnum moss at the water's edge was another important component to eventually providing optimal breeding habitat for the four-toed salamander. Failed attempts were made to locate *sphagnum* moss growing nearby in natural vernal pools, or other areas, to use for transplanting. It was then decided to collect just a small amount, from a known population located in a remote area of CUGA, and propagate it at the NPMC. *Sphagnum* collection was conducted in a way to minimize impact on the sensitive natural bog site. Single handfuls of *sphagnum* sp. were taken from mounds over a wide area and the resulting gaps in each mound were pushed together, this made it appear as if no moss had been collected. *Sphagnum* was propagated in 14"x 20"x 4" trays with one-half-inch of milled peat moss. *Sphagnum* strands were spread thinly on the peat moss substrate and watered with dechlorinated water. These trays were placed in water holding trays which helped maintain a wet substrate. The *sphagnum* was grown in the greenhouse for at least four months to a thickness about four inches.

The establishment of *sphagnum* moss around the constructed vernal pools was anticipated to be challenging due to the *sphagnum* being very sensitive to desiccation. The clay substrate of the constructed vernal pools does not store or wick very much water. *Sphagnum* planted directly on this substrate would dry completely and perish during the driest part of the year.

Sphagnum Test Plantings

Research on establishing *sphagnum* moss for restoring cutover peatlands indicated that a moist microclimate provided by straw mulch and/or by living vascular plants is more important than access to a shallow water table for establishing *sphagnum* on bare peat (Grosvernier, 1995; Rochefort, 1997; Boudreau, 1998). The substrate and hydrology of the vernal pools are completely different than that of peat bogs and therefore a specialized approach was needed. Test plantings of small amounts of *sphagnum* were established in 2000 and 2001. Each planting utilized peat moss to provide a wick for moisture when the vernal pool was drying out and also for storage of moisture to sustain the *sphagnum* after the pool

became dry. The test plantings in 2000 utilized similar methods as in 2001 (described later in this section), though only 6-inch coir fiber tubes were filled with peat moss. Two of the three plantings in 2000 survived but were unstable and subject to dieback during prolonged dry periods. The larger 2001 test plantings were very successful and were accomplished as follows:

- "Tubes" of 12 inches in diameter were constructed of coir fiber mat filled with moist peat moss.
- Each tube was partially dug into the side and bottom of a pond so the top was above the maximum water level and the lower end was dug slightly into the bottom.
- At the open top of the tube, the soils was amended with additional peat moss and planted with *sphagnum*.
- To provide protection from desiccation a loose mulch layer of dried grasses and twigs was applied, and herbaceous wetland plants were transplanted into and around the *sphagnum* planting.



Figure 2. Established test planting of *sphagnum* moss (light green, center), in October 2002. Surrounding vegetation provides shade and protection from excessive solar and wind drying.

The greater volume of the peat moss in the 12 inch tubes wicked and stored enough moisture to allow the *sphagnum* to survive and grow in the years 2001 and 2002 (see figure 2) with well below average rainfall. The moss has thrived in 2003 and 2004, both years with above average rainfall.

Large Area *Sphagnum* Planting on Peat Moss Containment

To provide a larger and more permanent substrate, a much larger area for *sphagnum* moss was created in the fall of 2001 in Pool #1 (pool in the northwest corner of the site) as shown in figures 3 and 5. A large containment area of approximately 100 cubic feet was constructed of black locust logs to contain a pie shaped area between the berm and one of the small islands. The logs were placed to form a sloped wall from the bottom of the pool to above the high water line. The enclosed area was lined with natural burlap and filled with peat moss and rotted logs and allowed to hydrate over the fall and winter. Approximately 40 square feet of *sphagnum* planting substrate was created. Just prior to planting in March 2002, the structure needed substantial rebuilding, due to the many logs that had floated away when the vernal pool filled with water. The lower two-thirds of the walls were rebuilt with



Figure 3. View of established *sphagnum* moss planting on peat moss containment area in March 2004. Pie shaped containment between island (right center) and berm (lower left, out of view).

scrap stone pieces that were left over from sign building. Logs were used to rebuild the top of the wall and were secured with stone. The containment was supplemented with additional peat moss which was hydrated in place by thorough mixing with water.

Eight flats, each 2 square feet of 4 inch thick *sphagnum* moss were planted as whole mats without any spreading to avoid excess exposure to desiccation. The 16 square feet of *sphagnum* covered 40 percent of the containment area with 4 inches of *sphagnum*. *Sphagnum* mats were placed in scattered positions on the contained peat moss, watered, and lightly covered with dried grass leaves and small branches to provide a moist microclimate by shading and protecting from drying wind, as shown in figure 4.



Figure 4. *Sphagnum* moss planting on the peat moss containment area in October 2002. Branches and leaves are still offering protection from the drying sun and wind.



Figure 5. Peat moss containment area in March 2004 with established *sphagnum* moss. *Sphagnum* has established and is spreading well to cover logs and a large portion of the structure. Many herbaceous plants are dormant, leaving little protection, though good view of the moss. The *sphagnum* shows some surface desiccation (white color) this time of year due to sun exposure. Conditions for the moss will only improve as the surrounding trees mature and begin to shade the moss as is already occurring under the young naturally seeded sweetgum (*Liquidambar styraciflua*) tree to the left of the photo.

Results and Discussion

Survival and establishment have been excellent for the planted container and bare-root trees and shrubs as well as the *sphagnum* moss. The seeded native grasses established initially but have since been suppressed or eliminated by the aggressive tall fescue (*Lolium arundinaceum*), perennial rye (*Lolium perenne*) and many weeds that now dominate the herbaceous cover of the site. The tall fescue and the perennial rye are expected to dominate the site until the trees are large enough to provide significant shade.

Dr. James W. Petranka, of the University of North Carolina at Ashville, has monitored the wetland mitigation site since construction and will continue monitoring for a span of five to ten years. The container and bare-root trees were estimated to have over 95% survival and many are over 16 feet in height (Petranka, 2003). The planted trees and shrubs have grown very well as shown in figure 6. The woody vegetation consists primarily of planted species; however, seedlings of nine tree species and two shrub species were also found (Petranka, 2003). Two species that have seeded heavily around pond margins are river birch (*Betula nigra*) and black willow (*Salix nigra*) as shown in figures 7 and 8.



Figure 6. Pond #1 in October 2004. Planted trees have grown very well and many can be seen behind the pond berm. Water level is low, revealing most of the peat moss containment structure. Also visible are the abundant fruit on the persimmon (*Diospyros virginiana*) tree that was planted on the small island in March 1999.



Figure 7. Pond #2 in March 2004. Naturally seeded black willow is shown in the left-middle of the photo.



Figure 8. Pond #3 in March 2004. Thick stand of river birch seedlings are shown in the lower half of the photo.

The *sphagnum* moss survived its toughest trial in its most vulnerable first season. Despite the severe drought that occurred in the summer of 2002, the *sphagnum* moss continued to thrive. The *sphagnum* moss will improve in growth as the surrounding trees and vegetation provide increasing shade and as its own water holding capacity increases as it becomes thicker. An herbaceous plant cover currently provides some protection as shown in figure 9. The *sphagnum* moss is expected to form a thick mat over the entire containment surface, much of the adjacent island and portions of the berm within a few more years. In the future, large amounts of *sphagnum* moss will be available in pond #1 that could be used to supplement the other ponds.

The mitigation site has generally met the success criteria for hydrology, but has not met the criteria for establishment of wetland plant communities in areas adjoining the ponds and most likely will not until the dominant introduced grasses are shaded out with tree canopy closure (Petranka, 2003).

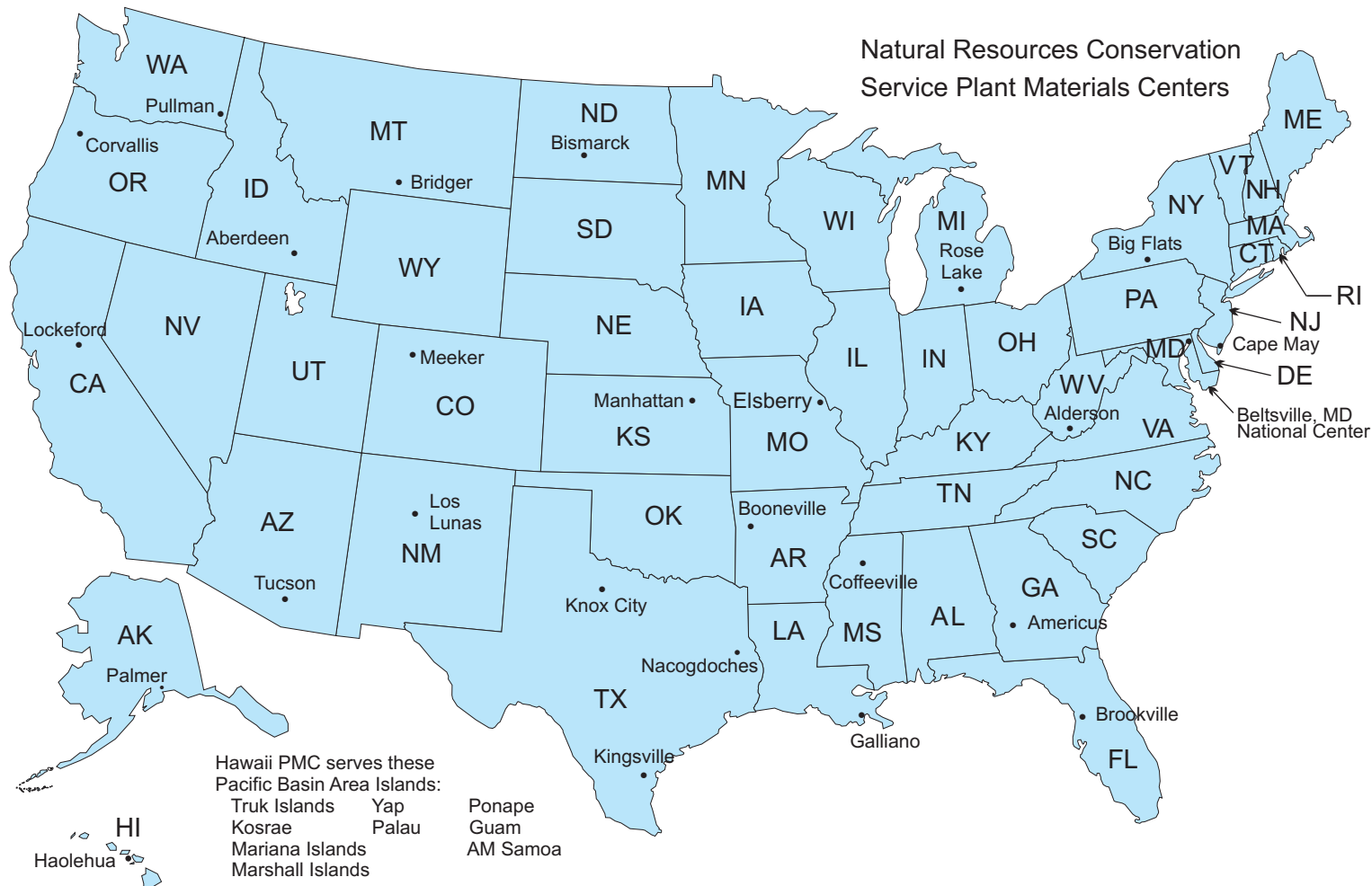
The quality of amphibian breeding habitat has been excellent for three species which prefer sunny ponds, while six other species have made minimal use of the ponds (Petranka, 2003). The three species that now use the ponds as primary breeding habitat are the American toad (*Bufo americanus*), chorus frog (*Pseudacris triseriata*) and wood frog (*Rana sylvatica*); and as expected the four-toed salamander and the marbled salamander (*Ambystoma opacum*) have not been observed using the pools for breeding habitat and would not be expected to use the ponds until after canopy closure within 15 to 20 years (Petranka, 2003). With the establishment of trees and *sphagnum* moss at the waters edge, the site could ultimately provide nesting habitat for the four-toed salamander, but this will be decided by the salamanders themselves.



Figure 9. Containment area with established *sphagnum* moss in October 2004. Herbaceous cover offers shade and slows wind, providing a moist microclimate for the moss. Much of the moss, that was visible in figure 5, is obscured by the herbaceous cover in this photo.

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