Illinois - An Example of How Public Nurseries Can Help Meet the Need for Non-traditional Plant Materials[1]

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Abstract.--The Illinois Division of Forest Resources has traditionally grown tree and shrub species at its nurseries. Other Divisions within the Department of Conservation, responsible for the restoration of prairies and other natural plant communities, have made requests for the production of non-traditional plant materials. The Division's nursery program has been expanded to accommodate the needs for these other plant species.

Introduction

The Division of Forest Resources operates two nurseries--the **Mason State Nursery** at Topeka, Illinois in Mason County, and the **Union State Nursery** at Jonesboro, Illinois in Union County. Both facilities have been in operation since the early 1930's. Production has traditionally been tree species for afforestation or reforestation projects on public and private property. The production of shrub species, for wildlife habitat enhancement, has always been a part of the nurseries' production schedule. A third species component was to be added to the nurseries' production palette in the late 1970's.

In the 1970's the Department of Conservation began to expanded its activities to include personnel and programs designed to protect and manage the prairie and other natural community areas of the State.

One of the important components of this new direction was the development of programs to establish prairie restorations on Department owned properties. While over two-thirds of Illinois had originally been prairie, by the 1960's less than one (1) percent of these areas remained in native vegetation. The increasing demand for agricultural lands coupled with the growing population of the State resulted in the loss of over ninety-nine percent of the State's prairies.

The Department efforts to manage natural communities was developed with two major focuses: 1) To reestablish prairies so the citizens and visitors to the State could see and appreciate these unique plant communities, and 2) To save the genetic resources found within Illinois' prairie communities (both plant and animal). While restorations could have been made with seeds purchased from other states, the desire to save the genetic resources of Illinois required the development of a program that would produce needed materials (seeds and/or plants) from Illinois plant communities.

In 1977 the Division of Forest Resources was approached for assistance in the establishment of grass seed collection areas. The nursery program was considered for this role for several reasons: 1) Land for the establishment of seed collection areas was available. 2) An experienced work force was located at the nursery. 3) Equipment for collection and processing was either available on site or could be located in the surrounding farm community.

The initial reaction to this request was not positive. What self-respecting forestry organization would get involved with the production of plant materials for the restoration of "prairies"? In the end, the decision was made to go ahead with this program.

In making the decision to undertake this new program, the Department and the Division were forced to step back and take a serious look at the role its nurseries should take in meeting the broad goals of the Department. These discussions led to the conclusion that a "conservation" nursery should be involved in this type of program.

The "environmental community" continues to be amazed by the fact that the Illinois Department of Conservation has allowed and fostered the development of an expanded prairie restoration program through its "forest" nurseries. The willingness to commit resources to activities other than forestry or wildlife management is not consistent with the environmental community's view of the Department. The implementation of the prairie program has enabled the Department and the Division to generate support from groups that in the past would have been opposed to many of its programs.

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The development of this new program created an opportunity to look at the overall operations and direction of the nursery program. The changes resulting from this review have been ongoing since 1977 and have effected all aspects of the Department's programs.

NURSERY PROGRAM IMPACTS

During the 1930's and into the 1940's, nursery produced seedlings were used for planting surface-mined lands, Department of Conservation properties, and Soil Conservation Service projects. Of the plants produced, less than twenty (20) percent were used on private lands. Starting in the late 1940's, and into the 1960's, over eightyfive (85) percent of the seedlings were used on private lands. Annual nursery production peaked at 11,745,000 seedlings in 1957. This production level was a result of the Federal Soil Bank Program.

In 1957, over seventy-two (72) percent of the production was coniferous species. Shrub species (mainly multiflora rose) accounted for twenty-three (23) percent of the production. Less than five (5) percent of the seedlings distributed were native hardwoods.

While this percentage breakdown (large emphasis on conifers) continued into the early 1980's, a change in production strategy occurred in 1983. This change in strategy resulted in a major shift in emphasis from conifers to native hardwoods, and involved the discontinuation of the production of non-native plant species (such as amur honeysuckle and autumn olive).

Currently, nursery production averages approximately 4.5 million seedlings per year. The shift to hardwood production has had a major impact on the production capabilities of the nurseries. While coniferous production can average 25-30 trees per square foot, seedbed densities for the hardwood species (black walnut and oaks) is only six (6) per square foot.

The distribution of production in 1992 was -- twenty-five (25) percent conifers, fifty-six (56) percent native hardwood trees, sixteen (16) percent native shrub species, and three (3) percent prairie forbs.

In 1957 the nurseries were involved in producing about fifteen (15) species. Today both the Mason and Union Nurseries are involved in the production of over 130 plant species. Production involves thirty-five (35) native tree species (table 1); eighteen (18) native shrub species (table 1); forty-seven (47) prairie forb species (table 2); seven (7) warm-season grasses (table 3); twenty (20) woodland understory trees, shrubs and herbaceous species (table 4); and eleven (11) wetland species (table 5).

TREE AND SHRUB PROGRAM

Since our nursery program has been restructured to use native species and native seed sources, seed procurement has become a major activity for the nurseries. With the exception of the conifer species and black locust, seeds are obtained from plants growing in Illinois. Seed procurement involves nursery personnel, personnel from the Department's other divisions, and purchases from the general public.

Seeds for the oak species, black walnut and several other hardwoods are obtained by means of a Permit Seed Collection Program. The following is a list of species involved in the permit program: hickories, hackberry, black walnut, white oak, bur oak, red oak, pin oak, black oak, chinkapin oak, Shumard oak, swamp white oak, shingle oak, cherrybark oak, pecan, and hazelnut.

District forester offices located across the State are used as collection centers for the. seeds purchased through the permit program. The district foresters are given quotas. of seed that they may purchase. Individuals must obtain a permit prior to bringing seed in for sale. The issuance of a permit controls the purchase of seed and prevents the various offices from purchasing seed in excess of budgeted amounts. In 1991, over 400 individuals collected 387,873 pounds of seed. The cost of this collection effort was over $117,000.

The seed collection program enhances nursery production through increased genetic diversity. Prior to the introduction of this program, seed collection was done by nursery crews and occurred within a fifty (50) mile radius of the two nurseries. Plants produced under this old system had very limited genetic diversity. With the existing program, we are obtaining seeds from all areas of the state. Genetic diversity is important to our nursery program because of the climatic differences that occur over the approximately 400 mile north to south length of the State of Illinois.

As a part of our seed collection program, the state has been divided into three collection zones. In the case of the fine hardwoods (walnut and oaks), seedlings are planted in the nurseries by zones and shipped back to the zone where the seed originated. This provides landowners with seedlings best suited for their particular growing conditions.

The use of zone collections is just one component of Illinois' tree improvement program. The other components involve:

- The establishment of seed collection areas for tree and shrub species. At the Mason State Nursery we have: a five (5) acres shrub area, a thirty (30) acre oak area involving white oak, black oak, and bur oak. At the Union State Nursery we have: a ten (10) acre red oak area, a one and three tenths (1.3) acre swamp white oak area, a one (1) acre white oak area, and a ten (10) acre cherrybark oak area. All oak areas are established using selections from the three zones. These areas are blocked to allow collection by zones.

- The establishment of grafted seed orchards. With the approval of a focus funding grant from the United States Forest Service, we have established two black walnut seed orchards at the Union State Nursery. These orchards are: 1) A fourteen (14) acre orchard of selections for southern Illinois, and 2) A twenty (20) acre orchard for northern Illinois. Many of the clones in these orchards are second and third generation selections from ongoing tree improvement programs in the Midwest.

- The establishment of three (3) black walnut sublines. This is a cooperative project of the North Central Fine Hardwoods Tree Improvement Cooperative. These sublines were established using

Table 1.--Tree and shrub species scheduled for seeding during the 1992-93 planting season.

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
PECAN	*Carya illinoensis*	RED MAPLE	*Acer rubrum*
HICKORIES	*Carya sp.*	PERSIMMON	*Diospyros virginiana*
HACKBERRY	*Celtis occidentalis*	TULIP TREE	*Lirodendron tulipifera*
WHITE ASH	*Fraxinus americana*	LOBLOLLY PINE	*Pinus taeda*
GREEN ASH	*F. pennsylvanica*	GRAY DOGWOOD	*Cornus racemosa*
BLACK WALNUT	*Juglans nigra*	SILKY DOGWOOD	*C. amomum*
RED CEDAR	*Juniperus virginiana*	HAZELNUT	*Corylus americana*
SWEETGUM	*Liquidambar styraciflua*	WASH. HAWTHORN	*Crateagus phaenopyrum*
RED PINE	*Pinus resinosa*	NATIVE CRABAPPLE	*Malus ioensis*
WHITE PINE	*P. strobus*	AMERICAN WILD PLUM	*Prunus americana*
BLACK CHERRY	*Prunus serotina*	SMOOTH SUMAC	*Rhus glabra*
WHITE OAK	*Quercus alba*	BLACKBERRY	*Rubus allegheniensis*
BUR OAK	*Q. macrocarpa*	ELDERBERRY	*Sambucus canadensis*
PIN OAK	*Q. palustris*	CORALBERRY	*Symphoricarpos orbiculatus*
RED OAK	*Q. rubra*	BLACK CHOKEBERRY	*Aronia melanocarpa*
BLACK OAK	*Q. velutina*	RED OSIER DOGWOOD	*Cornus stolonifera*
SWAMP WHITE OAK	*Q. bicolor*	COCKSPUR HAWTHORN	*Crataegus crus-galli*
CHERRYBARK OAK	*Q. falcata*	FRAGRANT SUMAC	*Rhus aromatica*
BALD CYPRESS	*Taxodium distichum*	STAGHORNN SUMAC	*R. typhina*
BLACK LOCUST	*Robinia pseudoacacia*	REDBUD	*Cercis canadensis*
RIVER BIRCH	*Betula nigra*	H. B. CRANBERRY	*Viburnum trilobum/opulus*
SYCAMORE	*Platanus occidentalis*	OTHER VIBURNUMS	*Viburunum sp.*
SILVER MAPLE	*Acer saccharinum*	SUGAR MAPLE	*Acer saccharum*

Table 2.--Prairie forb species available through the Prairie Plant Material Program.

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
NODDING WILD ONION	*Allium cernuum*	WESTERN SUNFLOWER	*Helianthus occidentalis*
LEAD PLANT	*Amorpha canescens*	ALUM ROOT	*Heuchera richardsonii*
THIMBLE WEED	*Anemone cylindracea*	KANKAKEE MALLOW	*Iliamna remota*
SULLIVANT'S MILKWEED	*Asclepias sullivanti*	WILD BLUE IRIS	*Iris shrevei*
BUTTERFLY WEED	*A. tuberosa*	P. BUSH CLOVER	*Lespedeza capitata*
SMOOTH ASTER	*Aster laevis*	NARROWHD BUSH LESP.	*Lespedeza leptostachya*
NEW ENGLAND ASTER	*A. novae-angliae*	ROUGH BLAZING STAR	*Liatris aspera*
TENN. MILKVETCH	*Astracalus tennesseensis*	TALL GAYFEATHER	*Liatris pycnostachya*
WHITE FALSE INDIGO	*Baptisia leucantha*	SPIKE BLAZING STAR	*Liatris spicata*
FALSE INDIGO	*B. leucophaea*	WILD BERGAMOT	*Monarda fistulosa*
D. FALSE ASTER	*Boltonia decurrens*	GLADE MALLOW	*Napaea dioica*
INDIAN PLANTAIN	*Cacalia tuberosa*	AMERICAN FEVERFEW	*Parthenium integrifolium*
WILD HYACINTH	*Camassia scilloides*	OBEDIENT PLANT	*Physostegia virginiana*
NEW JERSEY TEA	*Ceanothus americanus*	PRAIRIE CINQUEFOIL	*Potentilla arguta*
LANCE LEAF COREOPSIS	*Coreopsis lanceolata*	GRAY HD. CONEFLOWER	*Ratibida pinnata*
STIFF TICKSEED	*C. palmata*	CAROLINA ROSE	*Rosa carolina*
WHITE PRAIRIE CLOVER	*Dalea candida*	ROYAL CATCHFLY	*Silene regia*
LACEY PRAIRIE CLOVER	*D. foliosa*	ROSIN WEED	*Silphium integrifolium*
PURPLE PRAIRIE CLOVER	*D. purpurea*	COMPASS PLANT	*Silphium laciniatum*
ILLINOIS MIMOSA	*Desmanthus illinoensis*	PRAIRIE DOCK	*Silphium terebinthinaceum*
CANADA TICK TREFOIL	*Desmodium canadense*	RIGID GOLDENROD	*Solidago rigida*
ILL. TICK TREFOIL	*D. illinoense*	SPIDERWORT	*Tradescantia ohiensis*
PURPLE P. CONEFLOWER	*Echinacea pallida*	GOLDEN ALEXANDER	*Zizia aurea*
RATTLESNAKE MASTER	*Eryngium yuccifolium*		

ninety-four (94) Illinois selections. The selections are a combination of natural stand and plantation grown trees.

- The establishment of a one and a half (1.5) acre red oak seed orchard. This orchard was established with 121 selections taken from a 1988 Iowa State University root morphology study. This study, located at the Mason State Nursery, had to be removed because of nursery expansion activities. The trees used to establish this orchard were five (5) years old at the time of their removal from the study.

The development of a statewide seed collection program combined with the State's tree improvement program will insure the availability of quality seedlings adapted to the varied growing conditions of Illinois. These programs also insure that a broad mix of tree and shrub species will be available. This will allow the Department's foresters and biologists to accomplish their management goals and objectives.

PRAIRIE PROGRAM

The production of plant materials for prairie restorations began with the 1978 planting of a three (3) acre seed collection area involving five

Table 3.--Prairie grass species available through the Prairie Plant Materials Program.

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
BIG BLUESTEM	*Andropogon gerardii*	INDIAN GRASS	*Sorghastrum nutans*
SIDEOATS GRAMA	*Boutilou acurtipendula*	NORTHERN DROPSEED	*Sporobolis heterolepis*
SWITCH GRASS	*Panicum virgatum*	EASTERN GAMA GRASS	*Tripsacum dactylides*
LITTLE BLUESTEM	*Schizachryium scoparium*		

Table 4.--Woodland understory trees and shrubs being produced at the Mason State Nursery.

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
DOLL'S EYES	*Actaea pachypoda*	MAYAPPLE	*Podophyllum peltatum*
JACK-IN-THE-PULPIT	*Arisaema triphyllum*	SOLOMON'S SEAL	*Polygonatum commutatum*
COMMON PAWPAW	*Asimina triloba*	AZALEA	*Rhododendron sp.*
AMERICAN HORNBEAM	*Carpinus caroliniana*	BLOODROOT	*Sanguinaria canadensis*
SPRING BEAUTY	*Claytonia virginica*	FALSE SOLOMON'S SEAL	*Smilacina racemosa*
TOOTHWORT	*Dentaria laciniata*	STARRY F. S. SEAL	*Smilacina stellata*
DUTCHMAN'S BREECHES	*Dicentra cucullaria*	WHITE TRILLIUM	*Trillium gleasonii*
SPICEBUSH	*Lindera benzoin*	PURPLE TRILLIUM	*Trillium recurvatum*
CINNAMON FERN	*Osmunda cinnamomea*	LOW BUSH BLUEBERRY	*Vaccinium angustifolium*
GINSENG	*Panax quinquefolius*	COMMON VIOLET	*Viola papilionacea*

Table 5.--Wetland plants being produced at the Mason State Nursery.

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
SWAMP MILKWEED	*Asclepias incarnata*	BLUE LOBELIA	*Lobelia siphilitica*
BLUE JOINT GRASS	*Cala magrostis canadensis*	SWAMP ROSE	*Rosa palustris*
SEDGE	*Carex sp.*	PUSSY WILLOW	*Salix discolor*
BONESET	*Eupatorium perfoliatum*	BULL RUSH	*Scirpus sp.*
RICE CUT GRASS	*Leersia ozyzoides*	CORD GRASS	*Spartina pectinata*
CARDINAL FLOWER	*Lobelia cardinalis*		

(5) different grass species. In 1985, an additional eight (8) acre grass collection area was established. Future *expansion* plans call for a total grass production area of approximately fortythree (43) acres. This additional acreage will be planted in 1993.

Since 1978, the prairie program has expanded to include seven (7) grass species (see Table 3), and over forty (40) forb species (see Table 2). Production of forb plants peaked in 1991 with the distribution of 293,457 plants. The production goal for the 1995 planting season is approximately 400,000 seedlings.

Forb seed production has been as much as 1,183 pounds, but generally averages around 800-900 pounds. The majority of this seed is obtained from seed collection areas, and from forb seedling seedbeds. Personnel from the Division of Natural Heritage provide additional seeds from collection within their respective districts.

The establishment of permanent seed collection areas and the ability to collect seeds from the two year old seedbeds has allowed the program to increase the amount of seeds available for restoration activities. Initial attempts to collect seeds in the wild proved to be inefficient and very costly. The program would not have reached its current level of production if it had to rely upon seed collections from wild stands.

The production of grass seed has varied greatly. In addition to the nursery collection areas, seed is collected from native stands on other Department sites. This seed is delivered to the Mason State Nursery where it is cleaned and stored until the next spring *planting* season. Grass seed production averages about 2,000 pounds per year.

In addition to the production of prairie plant materials for restoration work on state lands, another important aspect of the Mason State Nursery's prairie program involves the protection and production of Illinois endangered plant species. The collection of seed and subsequent production of plants, as well as the establishment of the plants in our forb seed collection areas, is helping to assure the availability of these plants for future generations.

The production of the prairie plant materials involves about 20-30 percent of the nursery work activities. The cost of producing these plant materials in 1992 was approximately $225,000. If the Department were to try and purchase this material (much of which is not available from commercial sources) the cost would exceed $750,000.

The activities for the production of the prairie species, for the most part, occurs or can be scheduled during those times of the year when activities for the tree and shrub species is at a minimum. While there is some overlap, much of the prairie work is accomplished with limited impact on the cultural activities for the tree and shrub species.

While the prairie program has grown to include a large number of species, historical records indicate that Illinois' prairies consisted of over 300 plant species. We do not *envision* the

program expanding to include this many species, but we do plan to continue to add species to our plant list. A major goal is to increase the number of spring flowering species. This species component has been difficult to capture because of the spring workloads of the nursery and field biologists.

The program has been designed so the field biologist can pick and chose those species that are best suited to their restoration site. This allows the biologist the opportunity to design a restoration that best represents the historical species mix for that particular site.

WOODLAND UNDERSTORY AND WETLAND PLANTS

In 1991 the Mason State Nursery began growing woodland tree and shrub species (see Table 4). The nursery is currently working with twenty (20) species of small trees, shrubs, and woodland wildflowers. This is a pilot program designed to develop a source of plant material for the restoration of forest-understory-natural communities.

While some species have been successfully grown from seed, we have found it very difficult to break the dormancy of many of these species. To overcome this difficulty we are collecting plants from the wild to establish stock plants for vegetative production of these plants. It is hoped that through rooted cuttings or root divisions we can develop a production program that does not rely upon the wholesale digging of plants from the wild.

In the fall of 1992 the Mason State Nursery made some initial seed and plant collections of wetland species (see Table 5). Nursery personnel are looking into the possibility of growing a variety of species, either from seeds or by vegetative propagation.

The production of these woodland and wetland species is an attempt to develop a source of plants that can be used by foresters, heritage biologists, and wildlife managers to address specific natural community restoration efforts.

DISTRIBUTION PROGRAM

Illinois is unique in the way it distributes seedlings and other plant materials to the State's private landowners. As a result of legislation passed in 1987, landowners with management plans approved by their district forester, wildlife biologist, or heritage biologist are able to obtain planting stock at no cost. The majority (85-90 percent) of seedlings distributed through the nursery program are utilized by landowners with management plans. Landowners with approved management plans have a priority on all plant materials until the end of January.

This priority system has resulted in better utilization of our planting stock. Our district personnel now have the ability to match species to soil types, and to give preference to those landowners willing to implement approved management practices. Prior to the implementation of this delivery system seedlings were available on a first-come, first-serve basis.

Landowners who do not have approved management plans can still purchase seedlings from the Department. These purchasers must wait until February 1st before their orders may be submitted. In many cases there are limited amounts of plants available after this date.

This new legislative language also required a revision in the method used to price plant materials. Prior to 1987, planting stock sold through the nurseries was priced at twenty (20) to thirty (30) percent of its production cost. Prices for planting stock now reflect actual production costs. Landowners ordering plant materials without an approved management plan must pay the full cost of production.

Plant materials utilized on Department owned or operated lands are provided at no cost to those facilities. Also, seedling trees, shrubs, and prairie plant materials provided to our Department of Transportation for a cooperative planting program are provided at no charge.

With the exception of a small program involving wildlife management plans that have a warm season grass component, prairie plants and seeds are not made available to private landowners. Over ninety (90) percent of this material goes on either Department owned lands or Department of Transportation rights-of-way.

CAPITAL INVESTMENT

Illinois has two specific programs driving the demand for plant materials: a State of Illinois Forestry Development Act (FDA), and the Federal Conservation Reserve Program (CRP). These two programs have created plant material demands that exceeds those generated during the Soil Bank Program of the late 1950's and early 1960"s.

Illinois has had an exceptional response to the CRP tree planting program. CRP sign-ups, as a result of the 1985 and 1990 Farm Bills, have resulted in 31,500 acres being designated for tree planting. The demands for planting stock generated by CRP and FDA, and the shift from conifers to hardwood species developed a situation where the existing nursery facilities were unable to meet production demands.

In order to meet this increasing demand, the Department instituted a capital program to expand and rehabilitate the nursery facilities. This program provided $5.8 million for nursery expansion and rehabilitation.

The majority of the expansion activity was focused at the Mason State Nursery. Nursery acreage was increased from eighty (80) acres to 240 acres. Irrigated seedbed area was increased from 40 acres to 120 acres.

Facilities were modified and new equipment obtained to upgrade the seed processing capabilities of the Mason State Nursery. Much of this work was directed towards equipment that would improve our ability to process the prairie species, both grasses and forbs. The following seed cleaning equipment is being utilized at this facility: Clipper M-2BC seed cleaner, Clipper huller/scarifier, Dybvig seed cleaner, Forsberg Gravity separator, Crippen Model GX 360-4-RH seed cleaner, Westrup brush debeader, Barnes seed cleaner, Jesse aspirator, and Carter-Day indent cylinder separator. This equipment has enabled us to greatly improve the quality of our seed cleaning operations.

Another important capital item was the construction of a 3,000 square foot greenhouse. This structure was built specifically for the production of prairie forb and grass plants. In developing the prairie program we found that many species when grown in seedbeds would not produce

individual plants. This created considerable problems during lifting and grading. These problem species are being grown successfully in containers in the greenhouse.

The capital program has allowed both nurseries to update and improve equipment maintenance areas, chemical storage, equipment storage, irrigation systems, drainage of seedbed areas, office complexes, employee facilities, grading and packing areas, and cold storage capacity.

In addition to the capital improvements, funds were provided to upgrade equipment such as tractors, lifters, bed shapers, mulchers, seeders, and other field cultivation equipment.

SUMMARY

The Division of Forest Resources has the facilities necessary to meet the ever increasing demand for plant materials. These capital resources, combined with the Department's support of the production of a variety of native plant species, has enabled Illinois' nursery program to become a model for other public nurseries. Illinois' program demonstrates that, with a willingness to abandon traditional nursery production patterns, plant materials can be produced for a wide variety of natural community restoration programs.

Yes, the production of these other plant materials has taken resources away from the traditional production of trees and shrubs. But as mentioned earlier, the nurseries are an integral part of the Department of Conservation and should be used to address the overall plant needs of the entire agency, not just the demands of the Division of Forest Resources.

The expansion of our nursery program has been very instrumental in developing partnerships and program support. This support has had positive impacts on all aspects, not just the prairie program, of our nursery program.

Conservation agencies must develop broad based partnerships if they hope to generate support and funding for their programs. The partnerships that developed through the expansion of our nursery program have created opportunities to demonstrate to the citizens of Illinois that the Department of Conservation's role extends well beyond economic and recreational opportunities. It's mission also includes the protection and management of the State's varied biotic communities.