National Survey of State Operated Tree Seedling Nurseries and Tree Improvement Programs

A Report Developed by the National Association of State Foresters
EXECUTIVE SUMMARY

In May of 2016 the National Association of State Foresters provided all states, territories and the District of Columbia a comprehensive questionnaire (See Appendix) concerning state-operated tree seedling nurseries and tree improvement programs. Responses were received from 48 states, Guam and the District of Columbia.

Twenty-nine states and Guam currently operate nurseries. Eight states used to have nurseries with most of those having closed since 2005. The principle reason for closing was that they were unable to adequately cover costs through nursery sales. Of those eight, seven have concerns about commercial nurseries providing an adequate supply. Overall, states are more concerned about declining seedling demand and difficulty hiring both skilled personnel and laborers.

Nurseries produced 117,011,000 seedlings per year and shipped over 40,000 orders. Over 70 species were listed among the top five for each nursery with obvious regional differences. Six nurseries grew between 5 and 25 different species. Nineteen grew between 26 and 55 species and three grew from 56 to 75 species.

The most important customers are family forest owners and contractors serving family forest owners. Unlike commercial nurseries, state nurseries sell speculatively and for that reason are important to family forest projects. The most common use of state seedlings was reforestation after harvest, though a variety of other common uses were also well represented in the responses. Over half of the nurseries are expected to cover their costs through sales income.

Thirty states operate seed orchards, though they are not exactly the same as the ones who operate nurseries. The most common coniferous species involved were loblolly pine, eastern white pine, and douglas-fir. Though several orchards contained a variety of hardwoods the most common was black walnut. The most common user of orchard seed was the state’s own nursery. Conferences, workshops and a variety of other cooperative endeavors were listed as the most desired assistance that orchard managers would like to receive.

Less than half of the states have a tree improvement program within their agency and these are staffed by only 9 trained geneticists. Almost half actively participate in a tree improvement cooperative. The most commonly mentioned desire for additional assistance involved setting up or enhancing cooperatives.

Nearly everyone was aware of the US Forest Service Reforestation, Nursery and Genetic Resources (RNGR) Cooperative Program. Few acknowledged using RNGR funds. They would certainly welcome them, but most also acknowledge that their programs would go forward without RNGR funding. States do appreciate the technical assistance that RNGR provides.
INTRODUCTION/METHODOLOGY
At their 2015 summer meeting members of the NASF Forest Resource Management Committee engaged in a discussion about the challenges facing state tree nurseries, the need for greater tree species gene conservation and other related issues. It became apparent that no one had a comprehensive picture of the extent of these programs nation-wide. It was decided that the committee would develop and implement a questionnaire that would gather sufficient information to provide this nation-wide view.

That fall it was learned that Northeast Area State Foresters and US Forest Service staff were planning to conduct a survey in that region dealing with the Reforestation, Nursery and Genetic Resources cooperative federal program. In order to avoid duplicative efforts this work was combined with the committee’s.

The questionnaire was drafted, then reviewed and modified at the committee’s February 2016 meeting. Members provided the second draft to selected nursery staff for field testing and then a third draft was provided to the NASF Executive Committee who offered additional suggestions.

At the end of May all states, territories and the District of Columbia were given a Survey Monkey web link to the survey and asked to complete it. In total 48 states, Guam and the District of Columbia responded to the survey. After 3 requests, responses were not received from Maine and Nevada.

RESULTS
Seedling Nursery Operations
Thirty respondents currently operate at least one nursery. Twelve do not and eight had nurseries which are now closed.

Does your agency operate a seedling nursery?

- Yes
- No
- Agency previously had a nursery which is now closed.
Respondents with State Operated Nurseries

(Southern Region)
- Tennessee
- Arkansas
- Virginia
- Oklahoma
- Kentucky
- Georgia
- North Carolina
- Florida
- South Carolina
- Texas

(Northeast Region)
- Pennsylvania
- Wisconsin
- New Jersey
- Missouri
- Michigan
- Iowa
- New York
- West Virginia
- Maryland
- Minnesota
- Indiana
- Illinois
- New Hampshire

(Western Region)
- Kansas
- Hawaii
- Colorado
- Washington
- North Dakota
- Guam
- Montana

Respondents Who had Nurseries in the Past
- Louisiana
- Arizona
- California
- Massachusetts
- Oregon
- Utah
- Mississippi
- Vermont

One nursery closed as early as 1976, but most closures occurred after 2005. South Dakota turned theirs over to a Conservation District. Illinois consolidated their operations from two nurseries to one, while Wisconsin and Florida went from three to one.

Of the 20 without nurseries 13 indicated that private nurseries were providing an adequate supply of seedlings. Six felt they did not and one did not answer the question. Of the eight with closed nurseries, seven indicated that there were concerns, primarily around inadequate supplies.

**Are there problems/issues that have arisen since it closed, such as: (Please check all that apply)**

![Bar chart showing percentages for inadequate supplies, large cost increases, and fewer planting stock choices.]
Of the reasons why nurseries closed the most common answer was because they were unable to cover costs through nursery sales.

![Chart showing the primary reasons nurseries closed. The most common reason is inability to cover costs through sales, followed by reduced seedling demand and political pressure from commercial operations.]

Only 2 have given any thought to starting a nursery – one (CA) to fill a niche need for having at least one nursery in the state that grows speculatively rather than with pre-orders. The other state (ID) feels there is a need for seed sources better tied to elevation.

There is a very wide range in the number of seedlings produced each year with the greatest annual production occurring in the Lake States and the South. Virtually all indicated that they had more capacity than what they were using. In some cases, it was substantially more. About one-third (12) said they were considering expansion in amounts that ranged from 1 million to 20 million (+) seedlings per year.

![Nurseries Grouped by Seedling Production. In total, states produce about 117,011,000 seedlings per year.]

Annual Seedling Distribution

- 11 nurseries produce between 150,000 and 200,000 seedlings annually.
- 3 nurseries produce between 200,000 and 250,000 seedlings annually.
- 4 nurseries produce between 250,000 and 300,000 seedlings annually.
- 2 nurseries produce between 300,000 and 350,000 seedlings annually.
- 1 nursery produces between 350,000 and 400,000 seedlings annually.
- 0 nurseries produce between 400,000 and 450,000 seedlings annually.
- 0 nurseries produce between 450,000 and 500,000 seedlings annually.
- 0 nurseries produce between 500,000 and 550,000 seedlings annually.
- 0 nurseries produce between 550,000 and 600,000 seedlings annually.
- 0 nurseries produce between 600,000 and 650,000 seedlings annually.
- 0 nurseries produce between 650,000 and 700,000 seedlings annually.
- 0 nurseries produce between 700,000 and 750,000 seedlings annually.
- 0 nurseries produce between 750,000 and 800,000 seedlings annually.
- 0 nurseries produce between 800,000 and 850,000 seedlings annually.
- 0 nurseries produce between 850,000 and 900,000 seedlings annually.
- 0 nurseries produce between 900,000 and 950,000 seedlings annually.
- 0 nurseries produce between 950,000 and 1,000,000 seedlings annually.
- 0 nurseries produce between 1,000,000 and 1,250,000 seedlings annually.
- 0 nurseries produce between 1,250,000 and 1,500,000 seedlings annually.
- 0 nurseries produce between 1,500,000 and 1,750,000 seedlings annually.
- 0 nurseries produce between 1,750,000 and 2,000,000 seedlings annually.
- 0 nurseries produce between 2,000,000 and 2,250,000 seedlings annually.
- 0 nurseries produce between 2,250,000 and 2,500,000 seedlings annually.
- 0 nurseries produce between 2,500,000 and 2,750,000 seedlings annually.
- 0 nurseries produce between 2,750,000 and 3,000,000 seedlings annually.
- 1 nursery produces between 3,000,000 and 3,250,000 seedlings annually.
- 0 nurseries produce between 3,250,000 and 3,500,000 seedlings annually.
- 0 nurseries produce between 3,500,000 and 3,750,000 seedlings annually.
- 0 nurseries produce between 3,750,000 and 4,000,000 seedlings annually.
- 0 nurseries produce between 4,000,000 and 4,250,000 seedlings annually.
- 0 nurseries produce between 4,250,000 and 4,500,000 seedlings annually.
- 0 nurseries produce between 4,500,000 and 4,750,000 seedlings annually.
- 0 nurseries produce between 4,750,000 and 5,000,000 seedlings annually.
- 0 nurseries produce between 5,000,000 and 5,250,000 seedlings annually.
- 0 nurseries produce between 5,250,000 and 5,500,000 seedlings annually.
Thirteen states indicated they purchase seedlings from other nurseries. Most (10) indicated they purchased from private nurseries. Three purchased from other state nurseries. Mississippi purchased nearly 6.5 million seedlings from private sources, but most other states purchased smaller amounts ranging from 450,000 to 20,000. Of the states that acquired seedlings from outside sources they were about evenly split as to whether the material was intended for state-owned land or for distribution to private landowners. Ten states indicated that they traded stock with other nurseries in varying amounts.

A few nurseries shipped a very small number of orders and one shipped a great many, but most were grouped in the range 1000 to 4000 orders shipped per year. In total, state nurseries ship about 44,300 orders in a given year.
The number of species that each nursery grows is characterized by a typical bell-shaped curve. Some only grow just a few...as few as 5 species. Some grow much more...as many as 75 species. Most fall somewhere in between those amounts.

States listed nearly 70 different species among the top 5 they grow, with obvious differences by region.

**In the South** these species were the most commonly grown:
- Loblolly Pine
- Pecan
- Swamp White Oak
- Eastern White Pine
- Bur Oak

**In the Northeast** the most common species were:
- Eastern White Pine
- Pitch Pine
- Pitch x Loblolly Pine
- Shortleaf Pine
- Silver Fir
- Sycamore
- Northern Red Oak
- Red Pine
- White Oak
- Black Walnut
- Balsam Fir
- Loblolly Pine

**Species**
- Shortleaf Pine
- Longleaf Pine
- Swamp Chestnut Oak
- Italian Stone Pine
- Fraser Fir
- Black Walnut
- Prunus spp.
- Eastern Redcedar
- White Spruce
- Wild Plum
- Blue Spruce
- Red Osier Dogwood
In the West the most common species were:

- Eastern Redcedar
- American Plum
- Sandhill Plum
- Fragrant Sumac
- Sycamore
- Ponderosa Pine
- Caragana
- Western Larch
- Golden Current
- Silver Buffaloberry
- Rocky Mountain Juniper
- Colorado Blue Spruce
- Chokecherry
- Black Hills Spruce

Hawaii and Guam grow tropical species unique to their islands.

Most southern pines and a few northern conifer species are grown from 1st, up to 3rd or more, generation improved seed sources. Pennsylvania grows all of their black cherry from 1st and 2nd generation improved seed. Indiana grows a small amount of black walnut from improved seed.

States ranked individual and family forest owners as their most important customers with consulting foresters or contractors working for landowners as the second most important.

<table>
<thead>
<tr>
<th>How States Ranked the Importance of Different Customers</th>
<th>Most important customer would be ranked &quot;1&quot;</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct to Family/Individual Forest Owner</td>
<td>1.73</td>
<td>26</td>
</tr>
<tr>
<td>Consulting foresters or planting contractors/vendors acting on behalf of landowners</td>
<td>2.82</td>
<td>22</td>
</tr>
<tr>
<td>Industrial/REIT/TIMO/Forest Owner</td>
<td>4.65</td>
<td>17</td>
</tr>
<tr>
<td>Federal Agency</td>
<td>5.36</td>
<td>22</td>
</tr>
<tr>
<td>Your State/Local Agency within your state</td>
<td>3.26</td>
<td>27</td>
</tr>
<tr>
<td>Other State/Local Agency from a different state</td>
<td>4.13</td>
<td>16</td>
</tr>
<tr>
<td>Urban/Community Forest Organization</td>
<td>6.06</td>
<td>16</td>
</tr>
<tr>
<td>NGO</td>
<td>6.58</td>
<td>12</td>
</tr>
<tr>
<td>Private-Sector nurseries</td>
<td>6.62</td>
<td>13</td>
</tr>
<tr>
<td>Other</td>
<td>8.14</td>
<td>7</td>
</tr>
</tbody>
</table>
Except for the two categories shown at the bottom of the next table, seedlings were used fairly equally for various purposes.

<table>
<thead>
<tr>
<th>What were the most common uses of state seedlings?</th>
<th>A lower number indicates the highest use</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reforestation after harvest</td>
<td>2.65</td>
<td>20</td>
</tr>
<tr>
<td>Produce timber income</td>
<td>3.70</td>
<td>20</td>
</tr>
<tr>
<td>Reforestation after wildfire or other natural disturbance</td>
<td>4.67</td>
<td>21</td>
</tr>
<tr>
<td>Reforestation for wildlife habitat</td>
<td>3.33</td>
<td>27</td>
</tr>
<tr>
<td>Reforest previously cleared lands (eg. CRP/WRP)</td>
<td>3.61</td>
<td>23</td>
</tr>
<tr>
<td>Shelterbelt/Windbreak Planting</td>
<td>4.83</td>
<td>23</td>
</tr>
<tr>
<td>Riparian protection planting</td>
<td>4.54</td>
<td>24</td>
</tr>
<tr>
<td>Aesthetics</td>
<td>4.67</td>
<td>21</td>
</tr>
<tr>
<td>Urban/Community (Seedlings might go to an organization that grows them on to a larger plant)</td>
<td>7.06</td>
<td>16</td>
</tr>
<tr>
<td>Prairie or savanna restoration</td>
<td>7.58</td>
<td>12</td>
</tr>
</tbody>
</table>

Choose one of the following to best describe how your nursery is funded

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly state general funds, but sales offset an unspecified portion of the cost</td>
<td>25.8%</td>
<td>8</td>
</tr>
<tr>
<td>We’re required to have sales offset at least 75% percent of the cost</td>
<td>3.2%</td>
<td>1</td>
</tr>
<tr>
<td>We’re required to have sales offset at least 50% percent of the cost</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>We’re required to have sales offset at least 25% percent of the cost</td>
<td>0.0%</td>
<td>0</td>
</tr>
<tr>
<td>We’re required to have sales offset the entire cost of the nursery operation</td>
<td>22.6%</td>
<td>7</td>
</tr>
<tr>
<td>We’re required to have sales offset the entire cost of the nursery operation, and if not then the agency must cover the shortfall by redirecting other funds</td>
<td>25.8%</td>
<td>8</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td>22.6%</td>
<td>7</td>
</tr>
</tbody>
</table>

answered question
skipped question

About half of the states are required to have sales cover the entire cost of the nursery operation. Among those who answered “Other” there was no common theme. Pennsylvania’s are used almost exclusively on state lands. State land timber sales finance Michigan’s nursery. Others receive “special” rather than general revenue and two indicated receiving some federal funds.
Clearly states are more concerned about decreasing seedling demand than increasing demand. Hiring of both skilled personnel and laborers is also a concern.

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreasing seedling demand</td>
<td>65.5%</td>
<td>19</td>
</tr>
<tr>
<td>Increasing seedling demand</td>
<td>17.2%</td>
<td>5</td>
</tr>
<tr>
<td>Pressure from commercial interests to shut down</td>
<td>27.6%</td>
<td>8</td>
</tr>
<tr>
<td>Budget pressure to cut funding</td>
<td>41.4%</td>
<td>12</td>
</tr>
<tr>
<td>Budget pressure to offset more of costs from increased sales revenue</td>
<td>24.1%</td>
<td>7</td>
</tr>
<tr>
<td>Difficulty hiring skilled personnel</td>
<td>58.6%</td>
<td>17</td>
</tr>
<tr>
<td>Shortages of laborers</td>
<td>58.6%</td>
<td>17</td>
</tr>
<tr>
<td>Difficulty procuring source-identified seed for native species</td>
<td>34.5%</td>
<td>10</td>
</tr>
<tr>
<td>Difficulty obtaining genetically improved seed</td>
<td>10.3%</td>
<td>3</td>
</tr>
<tr>
<td>Access to methyl bromide</td>
<td>17.2%</td>
<td>5</td>
</tr>
<tr>
<td>Need for more technical information around planting/tending/seed treatment requirements for specific species</td>
<td>20.7%</td>
<td>6</td>
</tr>
</tbody>
</table>

**Seed Orchard Operations**

Thirty respondents indicated that they operated seed orchards.

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>60.0%</td>
<td>30</td>
</tr>
<tr>
<td>No</td>
<td>40.0%</td>
<td>20</td>
</tr>
</tbody>
</table>

Within that group there were five who have seed orchards but not nurseries:

Delaware        Alabama        Oregon        Idaho        California

Correspondingly, there were five who operate nurseries but not seed orchards:

Kansas        Guam        Iowa        Colorado        Hawaii

And, twenty-five who operate both nurseries and seed orchards:

(Southern Region)

Tennessee        Arkansas        Virginia        Oklahoma        Kentucky        Georgia
North Carolina    Florida        South Carolina    Texas
### (Northeast Region)

<table>
<thead>
<tr>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pennsylvania</td>
</tr>
<tr>
<td>Wisconsin</td>
</tr>
<tr>
<td>New Jersey</td>
</tr>
<tr>
<td>Missouri</td>
</tr>
<tr>
<td>Michigan</td>
</tr>
<tr>
<td>New Hampshire</td>
</tr>
<tr>
<td>New York</td>
</tr>
<tr>
<td>West Virginia</td>
</tr>
<tr>
<td>Maryland</td>
</tr>
<tr>
<td>Minnesota</td>
</tr>
<tr>
<td>Indiana</td>
</tr>
<tr>
<td>Illinois</td>
</tr>
</tbody>
</table>

### (Western Region)

<table>
<thead>
<tr>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington</td>
</tr>
<tr>
<td>North Dakota</td>
</tr>
<tr>
<td>Montana</td>
</tr>
</tbody>
</table>

**Loblolly Pine** was the most common seed orchard species and was cultivated in 10 states. The level of improvement ranged from one to five generations. Not everyone was able to report their quantity of production, but those who did totaled 7250 lbs.

Eight states had orchards containing **Eastern White Pine**, but overall production was relatively small compared to loblolly pine.

**Other eastern conifers grown** in seed orchards included:

<table>
<thead>
<tr>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slash Pine</td>
</tr>
<tr>
<td>Pitch X Loblolly Pine</td>
</tr>
<tr>
<td>Norway Spruce</td>
</tr>
<tr>
<td>White Spruce</td>
</tr>
<tr>
<td>Red Pine</td>
</tr>
<tr>
<td>Jack Pine</td>
</tr>
<tr>
<td>Longleaf Pine</td>
</tr>
<tr>
<td>Sand Pine</td>
</tr>
<tr>
<td>Shortleaf Pine</td>
</tr>
<tr>
<td>Balsam Fir</td>
</tr>
<tr>
<td>Fraser Fir</td>
</tr>
<tr>
<td>Scotch Pine</td>
</tr>
<tr>
<td>Virginia Pine</td>
</tr>
</tbody>
</table>

Of these, **Longleaf Pine** and the collective **Spruces** probably represented the next highest levels of production.

**Eastern hardwood species** found in orchards included:

<table>
<thead>
<tr>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black Cherry</td>
</tr>
<tr>
<td>Black Walnut</td>
</tr>
<tr>
<td>Sawtooth Oak</td>
</tr>
<tr>
<td>Swamp White Oak</td>
</tr>
<tr>
<td>Red Oak</td>
</tr>
<tr>
<td>White Oak</td>
</tr>
<tr>
<td>Bur Oak</td>
</tr>
<tr>
<td>Shumard Red Oak</td>
</tr>
<tr>
<td>Water Oak</td>
</tr>
<tr>
<td>Live Oak</td>
</tr>
<tr>
<td>Cherrybark Pak</td>
</tr>
<tr>
<td>Nuttall Oak</td>
</tr>
<tr>
<td>Paw Paw</td>
</tr>
<tr>
<td>Black Oak</td>
</tr>
<tr>
<td>Chestnut Oak</td>
</tr>
<tr>
<td>Shellbark Hickory</td>
</tr>
</tbody>
</table>

Of these, **Black Walnut was the most common** and was found in five state orchards. Not every state reported quantities, but of those that did they totaled 19,350 lbs. of Black Walnut production.

**In the west** orchard species were:

<table>
<thead>
<tr>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ponderosa Pine</td>
</tr>
<tr>
<td>Coulter Pine</td>
</tr>
<tr>
<td>Jeffrey Pine</td>
</tr>
<tr>
<td>Incense Cedar</td>
</tr>
<tr>
<td>Douglas-fir</td>
</tr>
<tr>
<td>Western White Pine</td>
</tr>
<tr>
<td>Western Hemlock</td>
</tr>
<tr>
<td>Western Red Cedar</td>
</tr>
</tbody>
</table>

Of these, **Douglas-fir** was produced in the greatest quantities and was the most improved. (Washington and North Dakota did not report what species were grown in their orchards.)
With a few exceptions nearly all seed production appeared to be used by the state’s own nursery. Oregon and Texas grow seed for cooperatives. Delaware provides seed to the Maryland Nursery. Alabama sells to a commercial nursery. Idaho to a land trust and California to private and industrial landowners.

**Most orchards (17) are funded as part of the nursery operation.** Six are funded through a separate general fund account and two through the sale of seed. California’s is funded by a State Seed Bank – Oregon’s by members of the cooperative and Idaho through timber sale receipts. Arkansas uses any receipts outside of general funds.

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>As part of the nursery operation</td>
<td>73.9%</td>
<td>17</td>
</tr>
<tr>
<td>Separate general fund account</td>
<td>26.1%</td>
<td>6</td>
</tr>
<tr>
<td>Through the sale of seed</td>
<td>8.7%</td>
<td>2</td>
</tr>
<tr>
<td>Other (please specify)</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

answered question 23

skipped question 27

Twenty-three indicated that there are other seed collection areas they utilize. Of these, thirteen said they mainly collect from wild sources, while the remainder had planted stands with varying levels of maintenance.

Seed purchases were from a variety of sources:

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial vendor</td>
<td>62.9%</td>
<td>22</td>
</tr>
<tr>
<td>General public</td>
<td>34.3%</td>
<td>12</td>
</tr>
<tr>
<td>Our seed orchard</td>
<td>74.3%</td>
<td>26</td>
</tr>
<tr>
<td>Seed collected by staff</td>
<td>74.3%</td>
<td>26</td>
</tr>
</tbody>
</table>
And seed was used for a variety of purposes, but most often in the nursery:

![How is your seed used? (Check all that apply)](image)

Answers to the question *Can you identify any technical assistance opportunities or cooperative efforts that would benefit your nursery program if they were more readily available?* were unique in almost every instance. They included the following:

- Containerized growing
- Disease Management
- Economic analysis
- Propagation of rare and endangered species
- Sanitation protocols
- Seed storage
- Nursery conferences and workshops
- Locating an orchard management contractor
- *Replacement for Methyl Bromide*
- *More herbicides*
- *Cone and seed processing*
- *Continue nursery conferences and workshops*
- *Continue cooperation between state nurseries*
- *Soil amendments*
- *More inter-agency cooperative planning*
- *Requesting state funds to join NC Tree Improvement Coop (SC)*
- *More local seed sources*
- *More native and “non-commercial” species seed sources*

### Genetics/Tree Improvement

Less than half of the respondents have a genetics or tree improvement program within their agency.

<table>
<thead>
<tr>
<th>Do you have a genetics/tree improvement program within your agency?</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>42.0%</td>
<td>21</td>
</tr>
<tr>
<td>No</td>
<td>58.0%</td>
<td>29</td>
</tr>
</tbody>
</table>

And most are programs distinct from the state nursery.

<table>
<thead>
<tr>
<th>Is it considered a distinct and separate program from the nursery or are two considered parts of the same program?</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>66.7%</td>
<td>14</td>
</tr>
<tr>
<td>No</td>
<td>33.3%</td>
<td>7</td>
</tr>
</tbody>
</table>

Among the 21 programs are 9 trained geneticists on staff, 25.6 field technicians and 2.76 administrative personnel.

Thirteen programs are funded 100% by state dollars, 2 through cooperatives, and 2 through nursery sales and other special programs. New Mexico indicated that they were 100% federally funded. Washington indicated that their funds were 98% state and 2% federal. Two states didn’t answer that question.
Twenty-three work cooperatively with other entities on tree improvement.

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>71.9%</td>
<td>23</td>
</tr>
<tr>
<td>No</td>
<td>28.1%</td>
<td>9</td>
</tr>
<tr>
<td>If yes, who?</td>
<td></td>
<td>23</td>
</tr>
</tbody>
</table>

**Cooperators included:**
- Two tree improvement coops (GA)
- US Forest Service (HI & NH & VT)
- US Fish and Wildlife Service (HI)
- Northern Sierra Tree Improvement Assoc. (CA)
- American Chestnut Foundation (PA & IN)
- Inland Empire Tree Improvement Coop (ID & MT & WA)
- BLM Seed Orchard (OR)
- University of Wisconsin – Madison (WI)
- University of Florida – Forest Genetics Cooperative (FL)
- University of Missouri (MO)
- Michigan State University (MI)
- University of Minnesota – MN Tree Improvement Cooperative (MN)
- New Mexico State University – John T. Harrington Forestry Research Center (NM)
- Purdue University - Hardwood Tree Improvement Research Cooperative (IN)
- Northwest Tree Improvement Cooperative (WA)
- Western Gulf Tree Improvement Cooperative (TX & AR & OK)
- North Carolina State University Tree Improvement Cooperative (VA & NC)
- University of Kentucky Forest Health Center (KY)

**In the East projects focused on:**

<table>
<thead>
<tr>
<th>Conifers</th>
<th>Hardwoods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loblolly Pine -8 (projects)</td>
<td>American Chestnut -2</td>
</tr>
<tr>
<td>Longleaf Pine -4</td>
<td>Butternut -3</td>
</tr>
<tr>
<td>Shortleaf Pine -4</td>
<td>Black Walnut -4</td>
</tr>
<tr>
<td>Jack Pine -3</td>
<td>American Beech -2</td>
</tr>
<tr>
<td>Red Pine -3</td>
<td>Ash -2</td>
</tr>
<tr>
<td>Slash Pine -2</td>
<td>White Oak -2</td>
</tr>
<tr>
<td>Virginia Pine -1</td>
<td>Red Oak -1</td>
</tr>
<tr>
<td>Eastern White Pine -2</td>
<td>Black Cherry -1</td>
</tr>
<tr>
<td>White Spruce -2</td>
<td>Cherrybark Oak -1</td>
</tr>
<tr>
<td>Black Spruce -1</td>
<td>Shumard Oak -1</td>
</tr>
</tbody>
</table>
In the West most projects focus on conifers:

**Conifers**
- Ponderosa Pine -5
- Western White Pine -3
- Western Larch -3
- Lodgepole Pine -2
- Douglas-fir -4
- Western Red Cedar -2
- Western Hemlock -1
- White Spruce -1
- Siberian Larch -1

**Hardwoods**
- Quaking Aspen -1
- Quercus spp. - 1
- Balsam Poplar -1

Answers to the question “Can you identify any technical assistance opportunities or cooperative efforts that would benefit your tree improvement operation if they were more readily available?” follow.

- Receiving state funding would help tremendously
- Genetic improvement workshops
- Networking to find compatible seed sources and potential to develop a lodgepole pine seed source.
- Help with Family Forest Landowners
- Setting up a Great Lakes tree improvement coop to allow organizations to partner together and share material similar to south and west. Work on jack pine gall and growth, white pine for growth and blister rust, also well as resistance breeding programs for 1000 cankers, EAB, Dutch elm, etc.
- more work on longleaf pine
- We have good relationships with the academic organizations that are working on these subjects but we are lacking the presence of an expert located at our tree improvement center.
- since we do not currently have a program, it would be beneficial to get some technical assistance on the matter
- technical assistance with genetics
- Compile information from old NC99 and NC53 studies
- If the National Forest System were more active in tree improvement investments, work would be more feasible in geographic areas and species where it is not currently economically
- hybrid poplar breeding
- Regional USFS staff to help coordinate activities across states and across various tree improvement co-ops.
- No. We enjoy the support of the Western Gulf Forest Tree Improvement Program. All the breeding work we do is directed by them and all of the improved seed orchards are designed by them
- Research into hard to stratify species
Reforestation, Nursery and Genetic Resources Cooperative Program

Most everyone was aware of the RNGR Program.

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>87.8%</td>
<td>43</td>
</tr>
<tr>
<td>No</td>
<td>12.2%</td>
<td>6</td>
</tr>
</tbody>
</table>

answered question 49
skipped question 1

Fewer felt that other decision makers were also aware of RNGR.

<table>
<thead>
<tr>
<th>Answer Options</th>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>51.2%</td>
<td>21</td>
</tr>
<tr>
<td>No</td>
<td>48.8%</td>
<td>20</td>
</tr>
</tbody>
</table>

answered question 41
skipped question 9

Less than a third of the respondents indicated that they receive RNGR funds.....13 of the 44 who answered the question.

Ten states answered the question as to what percent of their nursery/tree improvement expenditures come from RNGR and answers ranged from 0% to 10%.

Answers to the question “If RNGR funds are not designated exclusively for nurseries, what programs are supported by these funds?” were:

- I’m not sure
- exclusively nurseries
- Stewardship Program
- None
- Stewardship Program
- ??
- Genetic Resources program
- Don't know
- seed bank maintenance, seed collection, field testing
- We receive no funds
- stewardship, diminished species, outreach

Of those who answered the question, less than half indicated receiving RNGR technical assistance.

<table>
<thead>
<tr>
<th>Have you received technical assistance either indirectly or directly from this program? In what areas?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer Options</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>If yes, in what areas?</td>
</tr>
</tbody>
</table>

They indicated receiving technical assistance in the following areas:

- Insect and disease identification and help to control those pests. Methyl bromide issues.
- Nursery design & technical growing advice. Alternatives to invasive spp.
- Annual nursery conference, Technical assistance nursery tours
- Website use.
- Nurseries
- Seed Processing information
- Seed orchard improvement
- nursery training on Guam with Palau and Commonwealth of the Northern Marianas Islands
- Review of entire operation by USFS staff
- Seed Processing Workshop, Nursery reviews, Meeting travel/registration assistance, Irrigation study, seed sizing study
- grant funding helps connect us to cooperatives that provide technical assistance
- seed workshops - native plant propagation data base
- USFS western nursery specialist has toured Alaska several times.
- Technical assistance to nursery
- Nursery operations
- Seed collection assistance

When asked “How would the loss of the RNGR allocation affect your nursery program?” respondents said:

- It would impact it, but not cause irreparable damage
- orchard improvement
- The loss of the RNGR allocation would require us to supplement our nursery budget with funds from our primary operations, which would be at the detriment of our other core work priorities within the WI Division of Forestry.
- No immediate impact
- Very Little
- Would not affect it. Delaware grows seed from genetically improved stock for the Maryland State nursery to grow. However, we have yet to send seed to Maryland but still maintain the seed orchard.
- It would have no impact.
- It would increase our financial loss and therefore jeopardize the continued operation of this facility.
- Although we don’t directly receive RNGR funds, we make use of nursery publication and seed testing services.
- We would lose a valuable resource in the area of technology transfer.
- Less seed available for plantations would increase reliance on natural regeneration.
- Program would probably not be affected. Funds would come from other sources.
- Very little impact at present time
- Unknown
- No financial affect.
- Currently, NONE
- Improved seed would be severely curtailed

When asked “How would the loss of the RNGR allocation affect your tree improvement program?” they indicated:

- Less manpower and supplies
- Very little here at the orchard. It may have more of an effect on the tree breeding programs.
- If the RNGR allocation were cut from the nurseries, this shortfall would potentially be covered with tree improvement funding.
- No immediate impact
- Very little (Six respondents gave roughly this same answer)
- Devastate it
- Our tree improvement allocation has dropped sharply in recent years due to changes at the national level, which has resulted in the curtailment of some program work.
- All field testing for genetic improvement would stop.
- Membership driven, so RNGR as an active member matters - otherwise, no different from losing other members.
- Advanced selections and seed production would slow
Respondents indicated that they would like to see the program assist them in the following ways in the future:

- Help in identifying opportunities and sources for funding to support local university programs that we utilize.
- Funding!
- I would like to be aware of this funding. Not sure of amount, or how it's used.
- assist in the expansion of improved seed orchards
- Need more information on funding and services available.
- To work to coordinate more efforts between the states such as forest genetics and tree improvement. Also as the nurseries need to control cost more, look for areas were cooperative efforts will pay off. That would include fumigation and pesticide trials, as well as other seedling culturing, seedling inventory and sales programs.
- More cone processing information transfer
- Technical Information – Research
- Rehab Seed Orchards
- If they could print propagation protocols for pacific native tree species document or book.
- Supply information on the affects of moving non-native seed source stock to other regions. have asked for this for ten years but have received nothing.
- Assistance in strategies to limit frost heaving of seedlings.
- These funds could be used to assist university/industry cooperative nursery and tree improvement efforts.
- Would like more information on how to apply for funds.
- Assistance with Statistical processing of data, more assistance with meeting/registration attendance
- Restore funding to previous levels.
- continue the transfer of technology via seed workshops and multistate nursery meetings
- Increased funds would help expand program.
- Help stress the importance of genetics programs - apart from nurseries. Nurseries come and go quickly, genetics programs cannot - consistency matter in genetics programs.
- Financial support of Southern Forest Nursery Management Cooperative and Western Gulf Forest Tree Improvement Program
- Assist with expanding and improving outreach programs, particularly for diminished species and continued technical assistance.
- We would like to expand to a regional facility and given the nature of State policy funding is limited, we need some funding to help us improve and grow.
- Increased funding for seedling production for planning seed production of longleaf and shortleaf pines
CONCLUSIONS
Despite several closures state operated tree seedling nurseries remain an important source of seedlings for the nation’s reforestation efforts. Obviously plant spacing varies, but at a theoretical 12’ by 12’ spacing states produce enough seedlings to plant nearly 400,000 acres per year. They fill a key role by offering planting stock for family forest projects that do not place the advanced orders that commercial nurseries generally require or at least desire.

This material fulfills a wide variety of purposes – reforestation, afforestation, wildlife habitat, economic return and aesthetics – being among the most common.

Most have room to increase capacity, but are more concerned with decreasing seedling demand and the impact that can have on their ability to continue funding and operating their nursery program. They also have difficulty hiring and retaining both skilled personnel and general labor.

Many states take advantage of Tree Improvement Cooperatives as an efficient way to develop genetically improved stock. Nine states still have geneticists on staff and thirty maintain seed orchards.

Most everyone is aware of the RNGR program, but few acknowledge using RNGR funds in their own nursery/tree improvement efforts. Most also feel that a loss of RNGR funds would not significantly affect them. On the other hand, state folks appreciate the technical assistance and coordination of cooperative efforts that the Forest Service can provide. In fact, many would like increased assistance for participating in cooperative endeavors such as conferences, workshops, multi-state planning and other ways of sharing knowledge and coordinating efforts.
APPENDIX – SURVEY QUESTIONNAIRE

Nursery/Reforestation/Tree Improvement
National Association of State Foresters - Questionnaire to States

State _________________________________

NURSERY OPERATIONS

1. Does your agency operate a tree seedling nursery? Y_____N_____

2. If your agency had a nursery, but no longer operates one:
   
   What year did it close? __________
   
   Have private nurseries provided an adequate supply since then? Y____N____
   
   Are there problems/issues that have arisen since it closed, such as: (Please check and feel free to expand upon any that apply)
   
   Inadequate supplies ___
   
   __________________________________________________________________________________________
   
   Large cost increases ___
   
   __________________________________________________________________________________________
   
   Fewer planting stock choices ____
   
   __________________________________________________________________________________________
   
   Other? Please describe ____
   
   __________________________________________________________________________________________

   What were the primary reasons it closed? (check all that apply)
   
   Political pressure from commercial operations_______
   
   Reduced seedling demand __________
   
   Inability to cover cost through sales ___________
   
   Lack of legislature/budget support for a nursery___________
   
   General agency budget cuts____________________

22 | P a g e
Other, please explain ________________________________

Is there any thought of restarting a nursery operation? Y _____ N______

If yes, why? ________________________________

If no, go to Question #15

3. Do you operate more than one? If so, then how many? ________

4. On average, how many seedlings do you distribute each year? ________________

5. Assuming your normal species mix, what is the maximum number of seedlings you could grow? ________

6. Is there any thought of expanding the nursery operation? Y _____ N______ If so, for how many seedlings______________

7. Do you purchase seedlings from other sources?
   
   a. From who? ________________________________

   b. How many? ________________

   c. For Distribution to landowners? _Y____N___Quantity______________

   d. For use on state lands? ___Y____N___Quantity______________

   e. Trades with other nurseries __Y____N____Quantity______________

8. On average, how many orders do you fill each year? ________________

9. On average, how many different species do you grow? (Include non-tree species such as shrubs and native grasses/forbs)______________

10. By quantity, what are the top 5 tree species you sell? Is any proportion of these species grown from genetically improved seed? (Lump single species together)

    | Species | Genetically Improved available? (Y/N) |
    |---------|--------------------------------------|
    | 1.      | ___                                  |
    | 2.      | ___                                  |
    | 3.      | ___                                  |
    | 4.      | ___                                  |
    | 5.      | ___                                  |
11. Who are the primary customers for your seedlings? If you can please rank these choices with “1” being the category of customers who purchase the greatest quantity. If you do not sell any seedlings to a category, then do not rank it.

Direct to Family/Individual Forest Owner __________
Consulting foresters or planting contractors/vendors acting on behalf of landowners __________
Industrial/REIT/TIMO Forest Owner ___________
Federal Agency __________
Your State/Local Agency within your state __________
Other State/Local Agency from a different state ________
Urban/Community Forest Organization ______________
NGO __________
Private-sector nurseries ________________
Other (Please describe) ________________

12. Please describe what you think are the primary uses of your seedlings, again, ranking them with “1” being the most prominent use.

Reforestation after harvest ______
Produce timber income ________________
Reforestation after wildfire or other natural disturbance ________________
Restoration for wildlife habitat ______
Reforest previously cleared lands (eg CRP/WRP) ________________
Shelterbelt/Windbreak Planting ______
Riparian protection planting ______
Aesthetics ________
Urban/Community (Seedlings might go to an organization that grows them on to a larger plant) _____

Prairie or savanna restoration ____________

13. Choose one of the following to best describe how your nursery is funded.

Mostly state general funds, but sales offset an unspecified portion of the cost_____

We’re required to have sales offset at least ______ per cent of the cost

We’re required to have sales offset the entire cost of nursery operation_______

We’re required to have sales offset the entire cost of nursery operation, and if not then the agency must cover the shortfall by redirecting other funds_______

Other, please describe_________________________________________

14. What are the main challenges that your nursery operation faces? Check all that apply and feel free to elaborate.

Decreasing Seedling Demand _________________________________________________

Increasing Seedling Demand _________________________________________________

Pressure from Commercial Interests to Shut Down ________________________________

Budget Pressure to Cut Funding ______________________________________________

Budget Pressure to Offset more of Costs with Increased Sales Revenue _____________

Difficulty Hiring Skilled Personnel __________________________________________

Shortages of laborers ____________________________

Difficulty Procuring Source-identified Seed for native species_________________

Difficulty obtaining Genetically Improved Seed ________________________________

Access to Methyl Bromide________________________________________

Need for More Technical Information Around Planting/Tending/Seed Treatment Requirements for Specific Species________________________________________
SEED ORCHARD MANAGEMENT

15. Do you manage one or more seed orchards? Y _____ N ______

If no, go to Question #20

16. What species of seed do you produce and about how many pounds do you produce of each per year? (A rough estimate is fine) Is any genetically improved?

<table>
<thead>
<tr>
<th>Species</th>
<th>Pounds/ Year</th>
<th>Genetically Improved? (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

{Please indicate the level of improvement, 1st gen, 2nd gen, etc.}

17. Who are the principal customers of orchard-grown seed?

________________________________________________________________________

18. How is your orchard operation funded?

As Part of the Nursery Operation ______

Separate General Fund Account______

Through the Sale of Seed________

Other, please describe ______________________________________________________

19. Do you have other seed collection areas that wouldn’t be described as an orchard? (please describe) _______________________________________________________________

20. From what sources do you procure seed? (Check all that apply)

   a. Commercial vendor________

   b. General Public__________

   c. Our seed orchard__________

   d. Seed collected by agency staff_______
21. How is your seed used (Check all that apply)
   a. In the nursery __________________
   b. By other nurseries______________
   c. Direct seeding reforestation________

22. Can you identify any technical assistance opportunities or cooperative efforts that would benefit your nursery operation if they were more readily available? Please explain

   ________________________________________________________________

GENETICS/TREE IMPROVEMENT

23. Do you have a genetics/tree improvement program within your agency? Y ___ N____
   If no, go to Question #30

24. Is it considered a distinct and separate program from the nursery or are two considered parts of the same program? Y____ N_______

25. If yes, how many Full Time Equivalent Positions would you classify as:
   
   Trained Geneticist _________
   Field Technician / Laborer_________
   Administrative __________

26. How is the program funded?
   Percent State Dollars __________
   Percent Federal Dollars _________
   Other, please describe_____________________________

27. Do you have a cooperative agreement to support tree improvement work conducted by another entity? Y____ N_____
   Who? ______________________________________________

28. For either internal or cooperative programs, on what species is the work focused?
   Species:
   ____________________________________________
29. Can you identify any technical assistance opportunities or cooperative efforts that would benefit your tree improvement operation if they were more readily available? Please explain ____________________________

RNGR PROGRAM

30. Are you aware of the US Forest Service Reforestation, Nursery and Genetic Resources (RNGR) Cooperative Program? Y____ N_____

31. Is your state’s governor and/or legislature aware of the Cooperative Forestry Assistance Act and its support for states’ reforestation programs? Y____ N_____

32. Do you receive funding through this program? Y_____ N_____

33. What percent of your yearly nursery & tree improvement expenditures come from your RNGR allocation?_________________

34. If RNGR funds are NOT designated exclusively for nurseries (the consolidated grant process does not require states to spend this money on a particular program), what programs are supported by these funds?____________________________________________________________

35. Have you received technical assistance either indirectly or directly from this program? In what areas? ___________________________________________

36. How would the loss of the RNGR allocation affect your nursery program? 
____________________________________________________________

37. How would the loss of the RNGR allocation affect your tree improvement program? ____________________________________________________________________________

38. How would you like to see this program assist your state in the future?

______________________________________________________________