

Forest Nursery Seedling Production in the United States—Fiscal Year 2020

Diane L. Haase, Carolyn Pike, Scott Enebak, Lori Mackey, Zhao Ma, Chelsea Silva, and Jim Warren

Western Nursery Specialist, U.S. Department of Agriculture (USDA), Forest Service, Portland, OR; Northeastern Area Regeneration Specialist, USDA Forest Service, West Lafayette, IN; Director, Southern Forest Nursery Management Cooperative, School of Forestry and Wildlife Sciences, Auburn University, Auburn, AL; Special Projects Coordinator, Center for Forest Nursery and Seedling Research, Department of Forest, Rangeland, and Fire Sciences, University of Idaho, Moscow, ID; Professor, Purdue University, Department of Forestry and Natural Resources, West Lafayette, IN; Graduate Student, Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN; Biological Scientist, USDA Forest Service, Northern Research Station, West Lafayette, IN

Abstract

Forest nursery production for the 2020 planting season was more than 1.27 billion tree seedlings (including about 18.5 million container seedlings imported from Canada). Approximately 73 percent of seedlings were produced as bareroot stock. Only a small portion (3 percent) of seedlings were hardwood species. Seedling production in some States was affected by the coronavirus pandemic which left some nurseries unable to lift and ship their stock. Based on this total number of seedlings and estimated planting densities in each State, more than 2.4 million ac (977,542 ha) were planted. Approximately 84 percent of production and planting occurred in the southern States.

Background

This annual report summarizes forest nursery seedling production in the United States. The number of seedlings reported is used to estimate the number of acres of forest planting per year. Prepared by the U.S. Department of Agriculture, Forest Service, Forest Inventory and Analysis (FIA) and State and Private Forestry, this report includes State-by-State breakdowns, regional totals, and an analysis of data trends. Universities in the Southern, Northeastern, and Western Regions of the United States made an effort to collect data from all the major producers of forest and conservation seedlings in the 50 States. Forest and conservation nursery managers provided

the information presented in this report. Because all data are provided voluntarily by outside sources and some data are estimated, caution must be used in drawing inferences.

Methodology

State and Private Forestry, in collaboration with Auburn University, the University of Idaho, and Purdue University, produced the data for this report. These universities collected forest tree seedling production data directly from the forest and conservation nurseries that grow forest tree seedlings in their region of the United States (Auburn University collected from 13 States in the Southeast, the University of Idaho collected from 17 States in the West, and Purdue University collected from 21 States in the Northeast and Midwest). The estimate of planted acres for each State was calculated using FIA estimates of planting densities. In addition, FIA average annual estimates of tree planting area based on ground-plot data that States collected during 5-, 7-, or 10-year periods is included. FIA estimates of acres of trees planted by State may not correlate with nursery production surveys because nurseries do not report shipments across State lines. Total acres by region, however, provide a reasonable estimate of planted acreage. Data collected are reported for both hardwood and conifer species by bareroot and container seedlings produced (table 1) and by estimated acreage planted of each (table 2).

Table 1. Hardwood and conifer tree seedling production for each State and each region during the 2020 planting year.

State	Bareroot hardwood	Container hardwood	Total hardwood	Bareroot conifer	Container conifer	Imported container conifer	Total conifer	Total seedlings produced
Southeast								
Florida	1,547,000	174,000	1,721,000	47,614,000	3,368,000	—	50,982,000	52,703,000
Georgia	3,927,000	—	3,927,000	199,645,000	133,732,000	—	333,377,000	337,304,000
North Carolina	231,000	—	231,000	54,310,000	12,204,000	—	66,514,000	66,745,000
South Carolina	—	—	—	148,944,000	—	—	148,944,000	148,944,000
Virginia	1,206,000	—	1,206,000	29,115,000	427,000	—	29,542,000	30,748,000
Regional Totals	6,911,000	174,000	7,085,000	479,628,000	149,731,000	0	629,359,000	636,444,000
South Central								
Alabama	5,051,000	10,000	5,061,000	87,845,000	28,455,000	—	116,300,000	121,361,000
Arkansas	9,149,000	—	9,149,000	84,245,000	—	—	84,245,000	93,394,000
Kentucky	546,240	—	546,240	7,683,000	—	—	7,683,000	8,229,240
Louisiana	—	—	—	—	44,904,000	—	44,904,000	44,904,000
Mississippi	1,000,000	154,000	1,154,000	73,718,000	11,000,000	—	84,718,000	85,872,000
Oklahoma	451,000	3,000	454,000	2,396,000	160,000	—	2,556,000	3,010,000
Tennessee	1,750,000	—	1,750,000	3,400,000	—	—	3,400,000	5,150,000
Texas	—	—	—	76,781,000	—	—	76,781,000	76,781,000
Regional Totals	17,947,240	167,000	18,114,240	336,068,000	84,519,000	0	420,587,000	438,701,240
Northeast								
Connecticut	—	2,000	2,000	—	500	—	500	2,500
Delaware	—	—	—	—	—	—	—	—
Maine ¹	—	2,055	2,055	2,000	1,100	3,600,000	3,603,100	3,605,155
Maryland	1,006,420	50,500	1,056,920	639,775	400	—	640,175	1,697,095
Massachusetts	5,001	50,010	55,011	—	4,000	—	4,000	59,011
New Hampshire	16,850	—	16,850	184,910	—	—	184,910	201,760
New Jersey	35,550	—	35,550	17,375	—	—	17,375	52,925
New York	90,900	20,678	111,578	445,000	25,140	—	470,140	581,718
Pennsylvania	54,333	25,500	79,833	10,826	100	—	10,926	90,759
Rhode Island	—	—	—	—	—	—	—	—
Vermont	500	100	600	100	150	—	250	850
West Virginia	82,908	—	82,908	45,535	—	—	45,535	128,443
Regional Totals	1,292,462	150,843	1,443,305	1,345,521	31,390	3,600,000	4,976,911	6,420,216
North Central								
Illinois	590,000	7,025	597,025	175,000	2,040	—	177,040	774,065
Indiana	1,905,465	810	1,906,275	757,800	450	—	758,250	2,664,525
Iowa	315,620	500	316,120	10,125	2,500	—	12,625	328,745
Michigan ¹	4,792,593	500	4,793,093	3,716,203	20,000	7,920,888	11,657,091	16,450,184
Minnesota ¹	23,725	2,250	25,975	931,725	60,015	91,720	1,083,460	1,109,435
Missouri	1,035,770	—	1,035,770	498,900	—	—	498,900	1,534,670

State	Bareroot hardwood	Container hardwood	Total hardwood	Bareroot conifer	Container conifer	Imported container conifer	Total conifer	Total seedlings produced
Ohio	2,000	4,000	6,000	—	—	—	—	6,000
Wisconsin ¹	173,595	114,120	287,715	592,915	546,550	131,660	1,271,125	1,558,840
Regional Totals	8,838,768	129,205	8,967,973	6,682,668	631,555	8,144,268	15,458,491	24,426,464
Great Plains								
Kansas	—	25,000	25,000	—	50,000	—	50,000	75,000
Nebraska	402,545	4,000	406,545	360,000	850,000	—	1,210,000	1,616,545
North Dakota	19,575	14,856	34,431	548,196	78,552	—	626,748	661,179
South Dakota	234,822	1,070	235,892	273,975	12,780	—	286,755	52,2647
Regional Totals	656,942	44,926	701,868	1,182,171	991,332	0	2,173,503	2,875,371
Intermountain								
Arizona	—	5,120	5,120	-	680	—	680	5,800
Colorado	60,225	39,124	99,349	12,925	119,114	—	132,039	231,388
Idaho ¹	—	63,739	63,739	1,994,408	5,118,614	3,942,980	11,056,002	11,119,741
Montana ¹	89,766	140,384	230,150	—	673,647	64,000	737,647	967,797
Nevada	—	2,600	2,600	—	170	—	170	2,770
New Mexico	—	4,500	4,500	—	54,000	—	54,000	58,500
Utah	20,000	1,500	21,500	5,000	2,000	—	7,000	28,500
Wyoming	—	—	—	—	—	—	—	—
Regional Totals	169,991	256,967	426,958	2,012,333	5,968,225	4,006,980	11,987,538	12,414,496
Alaska								
Alaska	—	—	—	—	—	—	—	—
Pacific Northwest								
Oregon ¹	1,806,650	2,309,540	4,116,190	33,924,235	37,864,909	786,850	72,575,994	76,692,184
Washington ¹	169,400	48,920	218,320	3,1457,050	18,315,297	2,008,550	51,780,897	51,999,217
Regional Totals	1,976,050	2,358,460	4,334,510	65,381,285	56,180,206	2,795,400	124,356,891	128,691,401
Pacific Southwest								
California	—	72,900	72,900	1,155,489	23,334,217	—	24,489,706	24,562,606
Hawaii	—	10,500	10,500	—	500	—	500	11,000
Regional Totals	0	83,400	83,400	1,155,489	23,334,717	0	24,490,206	24,573,606
Totals	37,792,453	3,364,801	41,157,254	893,455,467	321,387,425	18,546,648	1,233,389,540	1,274,546,794

¹Totals include an estimate of container conifers produced in Canada; bareroot imports for Maine and containers for other States.

Table 2. Esitimated hardwood and conifer tree seedling acres planted for each State and each region during the 2020 planting year.

State	Hardwood acres planted	Conifer acres planted	Total acres planted	FIA estimated acres planted ⁹
Southeast				
Florida ²	3,129	92,695	95,824	150,006
Georgia ²	7,140	606,140	613,280	212,353
North Carolina ²	420	120,935	121,355	108,401
South Carolina ²	—	270,807	270,807	88,362
Virginia ²	2,193	53,713	55,905	57,031
Regional Totals	12,882	1,144,289	1,157,171	616,153
South Central				
Alabama ²	9,202	211,455	220,656	218,748
Arkansas ²	16,635	153,173	169,807	89,136
Kentucky ³	1,256	17,662	18,918	1,142
Louisiana ²	—	81,644	81,644	160,561
Mississippi ²	2,098	154,033	156,131	140,495
Oklahoma ²	825	4,647	5,473	31,659
Tennessee ²	3,182	6,182	9,364	24,386
Texas ²	—	139,602	139,602	126,044
Regional Totals	33,198	768,397	801,594	792,171
Northeast				
Connecticut ³	5	1	6	-
Delaware ²	-	-	-	515
Maine ⁵	3	6,005	6,009	4,069
Maryland ²	1,922	1,164	3,086	—
Massachusetts ³	126	9	136	—
New Hampshire ³	39	425	464	402
New Jersey ³	82	40	122	—
New York ⁵	186	784	970	2,077
Pennsylvania ³	184	25	209	1,847
Rhode Island	—	—	—	—
Vermont ³	1	1	2	—
West Virginia ³	191	105	295	—
Regional Totals	2,738	8,558	11,297	8,910
North Central				
Illinois ³	1,372	407	1,779	1,667
Indiana ⁴	2,933	1,167	4,099	2,413
Iowa ⁵	527	21	548	—
Michigan ²	8,715	21,195	29,909	6,330
Minnesota ²	47	1,970	2,017	8,403
Missouri ³	2,381	1,147	3,528	223
Ohio ³	14	—	14	2,173
Wisconsin ⁶	360	1,589	1,949	8,256
Regional Totals	14,976	27,088	42,064	29,465

State	Hardwood acres planted	Conifer acres planted	Total acres planted	FIA estimated acres planted ⁹
Great Plains				
Kansas ²	45	91	136	1,012
Nebraska ²	739	2,200	2,939	—
North Dakota ²	63	1,140	1,202	—
South Dakota ²	429	521	950	164
Regional Totals	1,276	3,952	5,228	1,176
Intermountain				
Arizona ²	9	1	11	-
Colorado ²	181	240	421	669
Idaho ²	116	20,102	20,218	10,016
Montana ²	418	1,341	1,760	4,506
Nevada ²	5	—	5	—
New Mexico ²	8	98	106	—
Utah ²	39	13	52	—
Wyoming	—	—	—	846
Regional Totals	776	21,796	22,572	16,037
Alaska				
Alaska ²	—	—	—	—
Pacific Northwest				
Oregon ⁷	11,761	207,360	219,121	118,350
Washington ⁷	624	147,945	148,569	96,376
Regional Totals	12,384	355,305	367,690	214,726
Pacific Southwest				
California ⁸	162	54,422	54,584	36,986
Hawaii ⁸	23	1	24	568
Regional Totals	185	54,423	54,608	37,554
TOTALS	78,416	2,383,808	2,462,223	1,716,192

¹ Acres planted were estimated assuming:

² 550 stems/acre.

³ 435 stems/acre.

⁴ 650 stems/acre.

⁵ 600 stems/acre.

⁶ 800 stems/acre.

⁷ 350 stems/acre.

⁸ 450 stems/acre.

⁹ FIA = Forest Inventory and Analysis; average annual acreage planted estimated for all States on 5-year cycles, except for Alabama, Louisiana, Mississippi, and North Carolina, which are on 7-year cycles, and for Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, and Washington, which are on 10-year cycles. Data generated by Andy Hartsell, USDA Forest Service.

Assumptions

The following assumptions were used in compiling this report.

1. *The number of seedlings reported by the participating forest and conservation nurseries was the number of shippable seedlings produced for distribution in the 2020 planting season (i.e., seedlings that were planted from fall of 2019 through spring of 2020).*

Some species of forest seedlings require two or more growing seasons to reach accepted forest and conservation seedling size standards, so not all seedlings in production at a nursery at any given time are considered shippable (i.e., available for distribution). Therefore, only shippable seedlings were counted.

2. All seedling production reported in this survey met the grading standards for the respective nurseries (i.e., cull seedlings were not included in the estimates).

Production estimates are often based on seedbed inventories of seedlings meeting grading standards. For cases in which nurseries ship seedlings by weight, as opposed to examining and counting each seedling, landowners and tree planters often plant every seedling that is shipped to them.

3. Seedling production data were collected from all the major nurseries that produced forest and conservation tree seedlings for the planting season.

Considerable effort was made to contact all major producers of forest and conservation seedlings. The universities collecting the survey data reported, with few exceptions, that the major producers were included in the results.

4. All seedlings reported in this survey were produced for reforestation and conservation projects.

Some of the nurseries that participated in this survey also produce seedlings for ornamental use, Christmas tree production, or other horticultural purposes. Private nurseries were asked to report only seedling production destined for conservation and reforestation planting.

5. Forest tree seedlings remain in the general area where they are produced.

Forest and conservation seedlings are routinely shipped across State borders and at times across international borders. It is assumed that, on average, the number of

seedlings imported into a State is equal to the number of seedlings exported from that State. In some States, a significant number of seedlings are produced in Canada and imported for planting in those States. Estimates of the amount of seedlings shipped from Canada were obtained from Canadian nurseries that routinely export seedlings to the United States.

6. Dividing the number of seedlings shipped from forest and conservation nurseries by the average number of stems planted per acre in a specific State is an appropriate proxy of the number of acres of trees planted during the planting season.

These estimations do not include direct seeding or natural forest regeneration activities. Average tree planting densities for each State were provided by FIA.

7. Respondents to the production survey reported only hardwood and conifer trees produced.

Nurseries were asked not to include shrubs in their production estimates. Many conservation and restoration plantings include shrubs and herbaceous plants to address wildlife, biodiversity, or other management objectives. Using only tree production to estimate acres planted results in an underestimate of planted acreage where a mixed planting of shrubs and trees occurred.

Data Trends

More than 1.27 billion forest tree seedlings were planted in the United States in fiscal year (FY) 2020. This production level is a decrease from FY 2019 (table 3).

Table 3. Annual forest nursery seedling production in each region for FY 2012 to FY 2020.

Year	Total seedling production	West (17 States)	East (20 States)	South (13 States)
FY 2020	1,274,546,794	168,554,874	30,846,680	1,075,145,240
FY 2019	1,302,362,378	166,043,690	47,691,098	1,088,627,590
FY 2018	1,187,282,896	76,253,776	46,667,266	1,064,361,854
FY 2017	1,284,824,689	151,321,764	67,595,266	1,065,907,659
FY 2016	1,260,216,076	152,785,327	72,314,630	1,035,094,369
FY 2015	1,302,237,795	175,464,446	95,417,986	1,031,355,363
FY 2014	1,217,607,888	115,620,820	85,684,417	1,015,564,370
FY 2013	1,181,554,535	96,344,063	102,066,671	983,143,801
FY 2012	1,190,552,819	170,975,830	81,672,547	936,918,542

FY = fiscal year.

Sources: This report, Haase et al. (2019, 2020), Harper et al. (2013, 2014), Hernández et al. (2015, 2016, 2017, 2018)

In spring 2020, coronavirus pandemic restrictions coincided with lifting season and resulted in an inability of some nurseries to finish lifting seedlings. This decline in seedling production is especially notable in the Eastern States (Pennsylvania, Michigan, and Minnesota). In addition, year-to-year variation is attributed to inconsistent participation from nurseries during data collection and shifting planting needs following wildfires, pests, and harvests. Based on the total number of seedlings shipped and the average number of seedlings planted per acre in each State, more than 2.4 million ac (977,542 ha) of tree seedlings were planted during the fall 2019 through spring 2020 planting season.

Address correspondence to—

Diane L. Haase, Western Nursery Specialist, U.S. Department of Agriculture, Forest Service, P.O. Box 3623, Portland, OR 97208; email: diane.haase@usda.gov; phone: 503–808–2349.

Acknowledgments

The authors thank the U.S. Department of Agriculture, Forest Service, Washington Offices of the Forest Inventory and Analysis program and the State and Private Forestry Deputy Area for their support.

REFERENCES

- Haase, D.L.; Pike, C.; Enebak, S.; Mackey, L.; Ma, Z.; Rathjen, M. 2019. Forest nursery seedling production in the United States—fiscal year 2018. *Tree Planters' Notes*. 62(1&2): 20–24.
- Haase, D.L.; Pike, C.; Enebak, S.; Mackey, L.; Ma, Z.; Silva, C. 2020. Forest nursery seedling production in the United States—fiscal year 2019. *Tree Planters' Notes*. 63(2): 26–31.
- Harper, R.A.; Hernández, G.; Arsenault, J.; Bryntesen, M.; Enebak, S.; Overton, R.P. 2013. Forest nursery seedling production in the United States—fiscal year 2012. *Tree Planters' Notes*. 56(2): 72–75.
- Harper, R.A.; Hernández, G.; Arsenault, J.; Woodruff, K.J.; Enebak, S.; Overton, R.P.; Haase, D.L. 2014. Forest nursery seedling production in the United States—fiscal year 2013. *Tree Planters' Notes*. 57(2): 62–66.
- Hernández, G.; Haase, D.L.; Pike, C.; Enebak, S.; Mackey, L.; Ma, Z.; Clarke, M. 2017. Forest nursery seedling production in the United States—fiscal year 2016. *Tree Planters' Notes*. 60(2): 24–28.
- Hernández, G.; Haase, D.L.; Pike, C.; Enebak, S.; Mackey, L.; Ma, Z.; Clarke, M. 2018. Forest nursery seedling production in the United States—fiscal year 2017. *Tree Planters' Notes*. 61(2): 18–22.
- Hernández, G.; Harper, R.A.; Woodruff, K.J.; Enebak, S.; Overton, R.P.; Lesko, J.; Haase, D.L. 2015. Forest nursery seedling production in the United States—fiscal year 2014. *Tree Planters' Notes*. 58(2): 28–32.
- Hernández, G.; Pike, C.; Haase, D.L.; Enebak, S.; Ma, Z.; Clarke, L.; Mackey, L. 2016. Forest nursery seedling production in the United States—fiscal year 2015. *Tree Planters' Notes*. 59(2): 20–24.