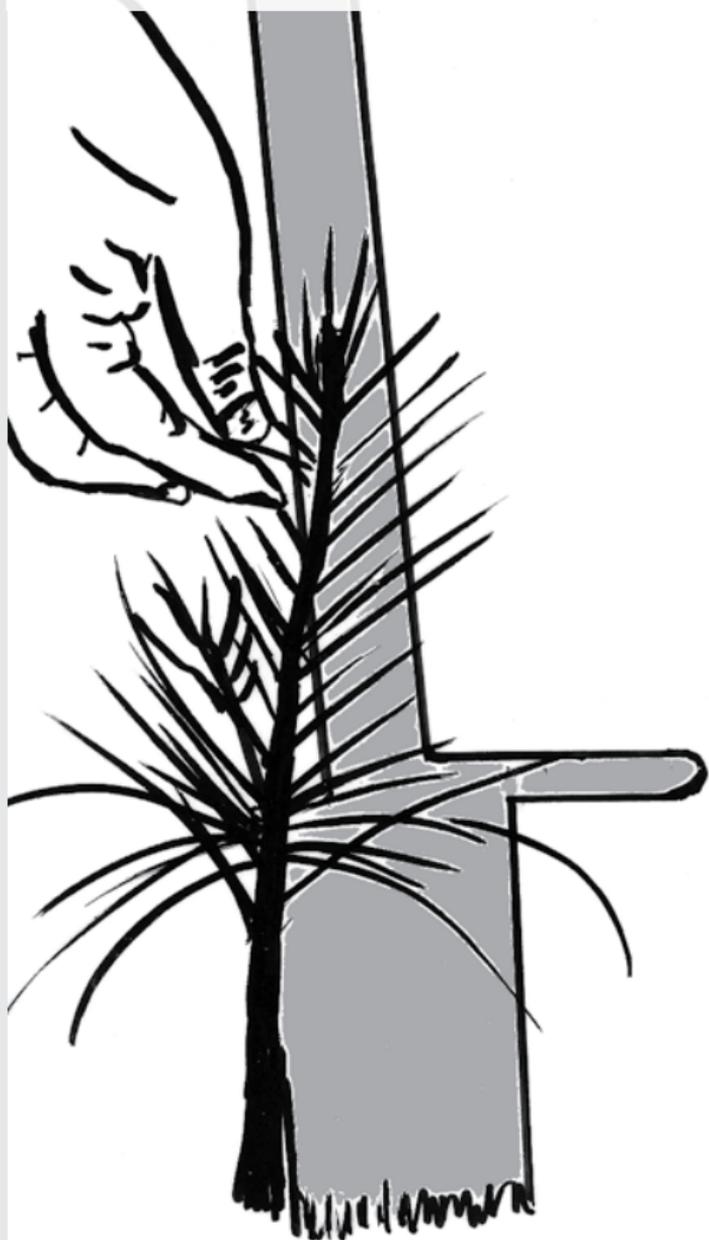


ARKANSAS FORESTRY COMMISSION



SEEDLING CARE AND PLANTING GUIDELINES



Arkansas Forestry Commission
2008 Edition

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Foreword

Forest tree seedlings must be handled carefully from the time they are lifted at the nursery, until they are transplanted in the field. This booklet will tell you how.

Proper seedling handling is complicated by the variety of environmental conditions that may occur during this critical time between lifting and transplanting. Monitor environmental conditions continuously. Adjust field operations as necessary to adhere to these guidelines. By following these standards, you enhance the likelihood of a successful planting.

Reforestation costs are the landowner's primary forestry investment during a timber stand's life. Seedling survival contributes to both the landowner's returns on investment and the future strength of Arkansas's forest economy.

General Guidelines

These forest tree seedling handling and planting guidelines were developed for broad practical field use. They include a general description of seedling handling, followed by lists of specific “Do’s and Don’ts.” If you have questions regarding a particular field condition or planting project, contact an Arkansas Forestry Commission Forester for professional recommendations. Included in the Appendix is a list of the Arkansas Forestry Commission offices and phone numbers.

Bare-root pine seedlings are vulnerable plants that require careful handling. The four primary rules for tree seedling care between the nursery bed and out-planting are:

- Keep seedlings moist.
- Keep seedlings cool.
- Handle seedlings gently.
- Keep storage duration short.

Every effort must be made to keep roots moist while the tree is out of the ground. The nurseries usually spray seedling roots with a gel to reduce moisture loss. The trees are then commonly packed in moisture resistant Kraft boxes. These practices are effective. Once a box is opened, the seedlings should be planted immediately. ***Seedling roots must not be allowed to dry out!***

If a box of seedlings is only partially used, the box should be closed and stored in a shady cool place.

Seedlings use stored food to survive transplant shock. These critical food reserves are depleted quickly if the trees are stored warm. To conserve this stored energy and promote seedling survival, trees should be stored as cool as practical without freezing. Inside box temperature guidelines for storing bare-root tree seedlings are:

Storage for 1 - 5 Hours

Ideal	34° - 40°F
Tolerable	40° - 50°F
Risky	50° - 60°F
Damage Probable	60° - 80°F
Damage Occurring	more than 80°F

Storage for More Than 5 Hours

Ideal	34° - 40°F
Tolerable	40° - 50°F
Risky	50° - 60°F
Damage Occurring	more than 50°F
Damage Occurring	less than 32°F

Keep seedlings cool

Talk to a Forester before planting trees that have experienced abnormally high or low temperatures. Seedling survival will suffer if seedlings are exposed to excessively high or low temperatures. The amount of mortality is directly related to length of exposure to these temperature extremes. An exposure to 80°F for two hours can significantly reduce survival.

Handle trees carefully

Seedlings must be protected from physical damage. Seedling boxes should not be thrown or walked on. Physical abuse of the seedlings can lead to reduced seedling survival. Get professional advice before planting trees that have been excessively damaged.

Minimize storage time

As length of seedling storage increases, seedling vigor decreases. Under ideal conditions this loss in vigor is very slow. The further storage conditions are from ideal, the faster the loss in vigor. Seedlings should be stored without refrigeration only when weather conditions permit. Even under ideal conditions, seedling storage should be kept as short as possible.

Seedling Transportation

Do:

- ☺ Transport seedlings in a refrigerated van with temperatures maintained between 34°F and 45°F whenever possible.
- ☺ Keep inside box temperatures below 60°F.
- ☺ Keep truck bed free from pesticides and other chemicals.
- ☺ Keep truck bed free from sharp objects.
- ☺ Promptly repair or replace torn boxes.
- ☺ Shield seedlings from direct sunlight, wind, and temperature extremes.
- ☺ Minimize transportation time.
- ☺ Consider transporting trees at night.

Don't:

- ☹ Allow seedlings to freeze.
- ☹ Ship trees without refrigeration when air temperature exceeds 70°F.
- ☹ Stack seedlings more than two boxes deep without spacers to support weight.
- ☹ Walk on or stack heavy objects on seedlings.
- ☹ Routinely open seedling boxes to inspect seedlings. (*Open only if the box has been damaged and/or been too hot or cold*).

Refrigerated Seedling Storage

Do:

- ☺ Store seedlings in coolers if possible.
- ☺ Maintain cooler temperatures between 34°F and 40°F.
- ☺ Provide good air circulation around the boxes.
- ☺ Plant trees as soon as possible after removal from cold storage.

Don't:

- ☹ Stack seedling boxes over two deep without supports and spacers supporting weight.
- ☹ Store pesticides or other chemicals that could harm seedlings in cooler with seedlings.
- ☹ Store non dormant seedlings. (*Non dormant trees should be planted within two days of lifting.*)

Non-Refrigerated Storage

Do:

- ☺ Plant seedlings as soon as possible.
- ☺ Protect seedlings from direct sunlight and temperature extremes.
- ☺ Allow space for air circulation between seedling boxes.

Don't:

- ☹ Allow seedlings to freeze. (*If freezing briefly occurs, thaw slowly without artificial heat.*)
- ☹ Plant seedlings that have been frozen for 2 or more days.
- ☹ Allow inside box temperatures to get above 50°F.

Field Handling and Planting Guidelines

Do:

- ☺ Protect seedling boxes from exposure to wind, sun, and temperature extremes.
- ☺ Store seedling boxes in shade or under reflective tarp.
- ☺ Keep seedling root exposure to an absolute minimum.
- ☺ Open only one box of seedlings at a time.
- ☺ Remove only one handful of seedlings at a time from the seedling box when sorting.

- ☺ Keep presorting to a minimum.
- ☺ Use care when separating roots.
- ☺ Transfer trees from seedling boxes to mechanical tree planter boxes or hand planter bags quickly.
- ☺ Keep seedling roots covered with moist burlap, in planting bags, or in buckets with moist medium.
- ☺ Cull seedlings significantly smaller than the rest while planting.
- ☺ Plant when there is good soil moisture.
- ☺ Train all personnel before allowing them to plant.
- ☺ Closely supervise the planting crew. (*One foreman should supervise no more than 12 planters.*)
- ☺ Replace planters who do not meet quality standards.
- ☺ Remove one seedling at a time from planting bags.
- ☺ Plant trees at the same depth they grew at the nursery or slightly deeper.
- ☺ Pack the soil firmly around each seedling. (Don't leave air pockets.)
- ☺ Plant in accordance with instructions listed in this booklet.

Don't:

- ☹ Empty the whole seedling box when sorting seedlings.
- ☹ Leave seedling boxes open or seedlings exposed.

- ☹ Carry excess trees on machine planters.
- ☹ Expose seedling roots to the elements.
- ☹ Allow seedling roots to dry out.
- ☹ Cull the seedlings before planting.
- ☹ Hit or vigorously shake roots to remove soil.
- ☹ Store seedling boxes close to a fire.
- ☹ Use a fire to thaw frozen seedlings.
- ☹ Plant in unusually dry or hot conditions.
- ☹ Remove seedling from planting bag until planting hole has been made.
- ☹ Allow planted trees to have “L” or “J” roots since survival and growth will be sacrificed.
- ☹ Plant when soil is frozen.
- ☹ Plant when soil is saturated with water.
- ☹ Allow planting foreman to plant. *(The foreman should supervise.)*

Root Pruning

Do:

- ☺ Prune only if required for proper planting.
- ☺ Always ask a forester for advice before root pruning. *(Root pruning is usually unnecessary.)*
- ☺ Assign one properly trained person to do the root pruning and supervise them.
- ☺ Protect seedlings from the elements during root pruning.
- ☺ Cut roots with sharp knife or machete.

Don't:

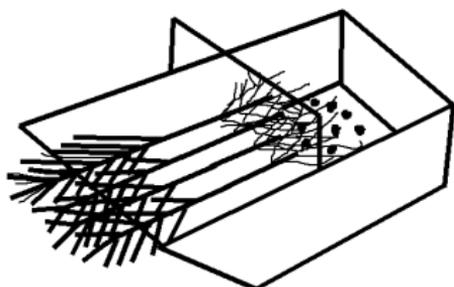
- ☹ Cut roots shorter than 5" for pine, 6" for hardwood.
- ☹ Root prune routinely.
- ☹ Break or twist roots off by hand.
- ☹ Allow roots to dry out.
- ☹ Empty the whole seedling box when sorting.

Summary

- ✓ Keep seedlings cool.
- ✓ Keep seedlings from freezing.
- ✓ Keep seedlings moist. Seedling roots must never be allowed to dry out even for a few minutes.
- ✓ Handle seedlings carefully.
- ✓ Keep storage duration short.
- ✓ Don't plant small, weak seedlings.
- ✓ Don't plant when soils are dry.
- ✓ Don't plant when weather conditions are critical. *See Page 15.*

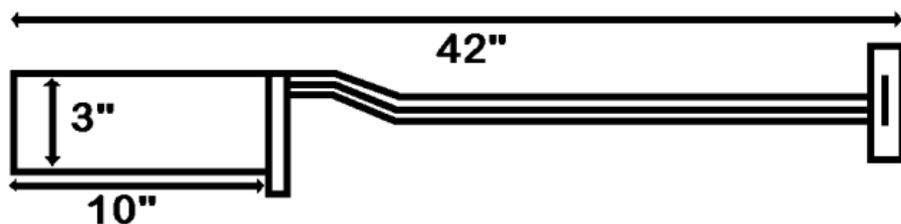


Carry seedlings in a planting tray or canvas bag



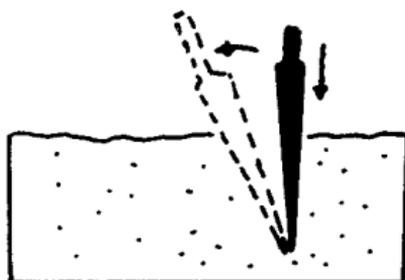
Do not carry seedlings with roots exposed to sun and wind

IMPORTANT: DO NOT LET ROOTS DRY OUT!

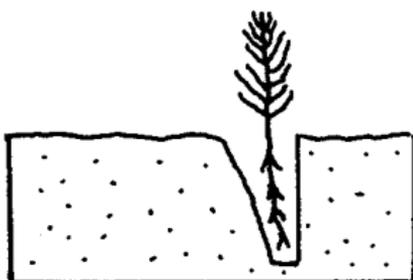


A dibble bar is a simple shop built tool for planting seedlings

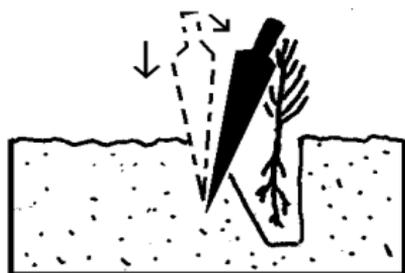
Hand Planting



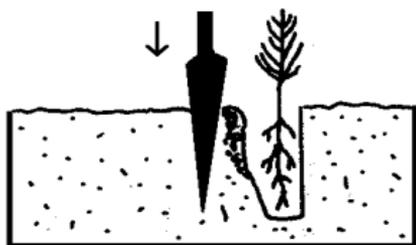
1. Insert dibble straight down. Pull backward to open hole.



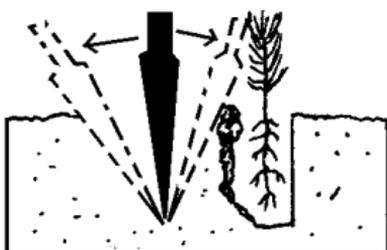
2. Remove dibble and place seedling at correct depth.



3. To hold seedling in place, insert dibble part way into soil - push forward, closing top of planting slit.



4. Insert dibble straight down into soil behind last hole.



5. Pull dibble backward, then push forward, packing soil firmly against roots.

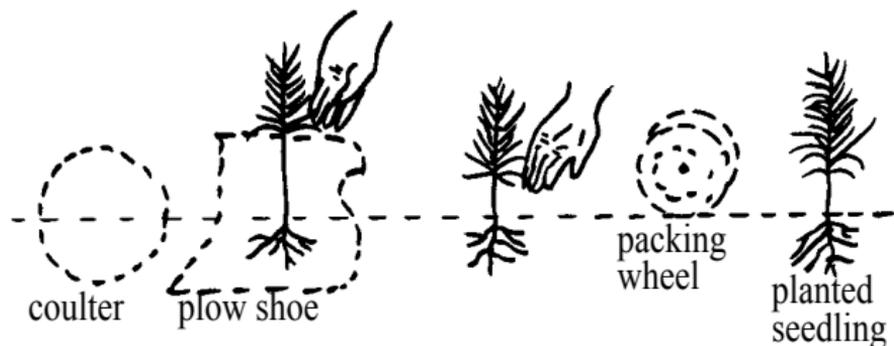


6. Fill last hole by firming with heel.

Mechanical Planting

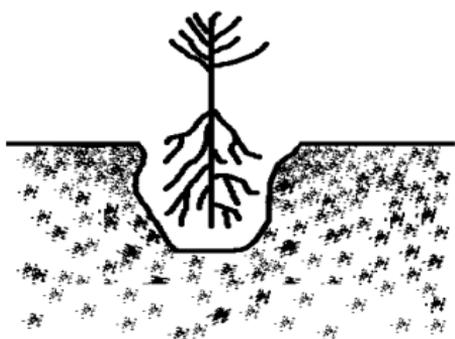


Direction of travel.



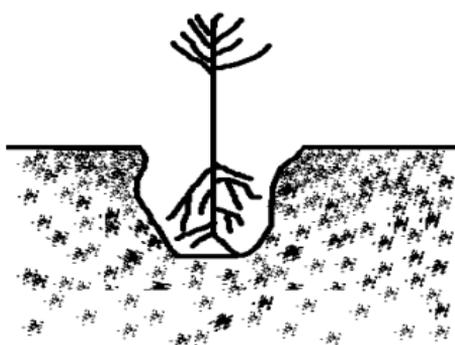
1. Insert seedling in vertical position well forward in open trench.
2. Hold seedling in vertical position until soil closes around roots.
3. Release seedling ahead of packing wheels.

Common Planting Errors



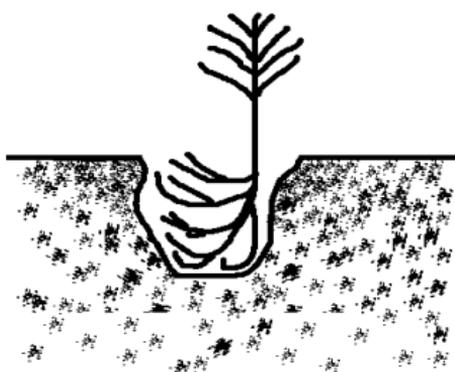
Too Shallow

Root collar and roots exposed, drying out roots



Too Deep

Hardwood root collar 2" or more below soil surface.
Pine bud within 2" of ground line.



"J" or "U" Roots

Roots form "J" or "U" shape resulting in poor or weak root development.



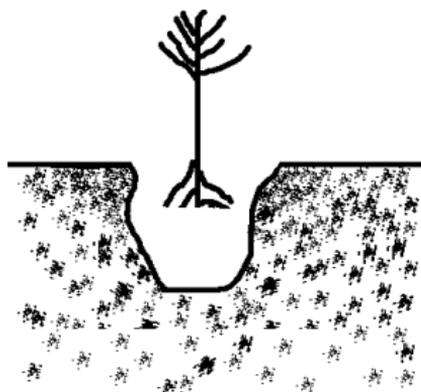
Too Loose

A firm pull on one needle cluster moves plant.

Excessive Tap Root Pruning

Pine seedling roots should not be pruned shorter than 5".

Hardwood seedling roots should not be pruned shorter than 6".



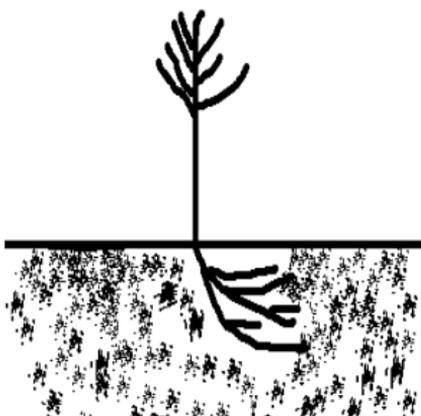
Not Erect

The tap root should not be planted at more than 30° off perpendicular.



"L" or Drag Root

Seedling pulled along in trench by planter



Weather Condition Classification

Day Classification	Weather Conditions	
Best		
	Temperature	33° - 75°F
Plan to do most of the planting during these days	Relative Humidity	50%+
	Wind	Less than 10 mph
	Available Soil Water	75% to Field Capacity
Marginal		
	Temperature	76°F - 85°F
Be extra careful and take precautions if planting on these days	Relative Humidity	30% - 50%
	Wind	10 - 15 mph
	Available Soil Water	50% - 75%
Critical		
	Temperature	Less than 32°F or more than 85°F
Do not plant on these days	Relative Humidity	Less than 50%
	Wind	15+ mph
	Available Soil Water	Less than 50%

Note: Day Classification should drop to that of the weather condition with the poorest rating.

Spacing (feet)	Trees Per Acre
5 x 5	1742
5 x 6	1452
5 x 7	1245
5 x 8	1089
5 x 9	968
5 x 10	871
6 x 6	1210
6 x 7	1037
6 x 8	908
6 x 9	807
6 x 10	726
6 x 12	605
6 x 15	484
7 x 7	889
7 x 8	778
7 x 9	691
7 x 10	622
7 x 12	519
7 x 15	415
8 x 8	681
8 x 9	605
8 x 10	545
8 x 12	454
8 x 15	363
8 x 25	218
9 x 9	538
9 x 10	484
9 x 12	403
9 x 15	323

Spacing (feet)	Trees Per Acre
10 x 10	436
12 x 12	303
12 x 15	242
12 x 18	202
12 x 20	182
12 x 25	145
13 x 13	258
13 x 15	223
13 x 20	168
13 x 25	134
14 x 14	222
14 x 15	207
14 x 20	156
14 x 25	124
15 x 15	194
15 x 20	145
15 x 25	116
16 x 16	170
16 x 20	136
16 x 25	109
18 x 18	134
18 x 20	121
18 x 25	97
20 x 20	109
20 x 25	87
25x 25	70

Sample Tree Planting Contract

This contract is between (name and address) hereinafter known as the Owner, and, (name and address) hereinafter known as the Contractor, for furnishing labor, and equipment necessary for planting tree seedlings and performing the actual planting in accordance with this contract.

GENERAL PROVISIONS

The Owner Agrees:

1. To pay the Contractor at the rate of (\$) per acre for planting. Payment shall be made within (number) days after completion of the Contract.
2. To purchase the necessary seedlings at no cost to the Contractor and make them available at a site mutually agreeable to both parties.
3. To provide rights of ingress and egress to the planting site for all men, materials, and equipment necessary to perform the planting job.
4. To provide a sketch map showing the location of the planting areas.

The Contractor Agrees:

1. To provide all necessary equipment, and labor for planting the trees in a satisfactory manner.
2. To provide proper care and handling of the

seedlings, while they are in the Contractor's assigned custody using the Arkansas Forestry Commission's booklet "Guidelines for Seedling Care and Planting" as the standard.

3. To plant the seedlings:

(a) at a spacing of x (trees/acre) at a rate of (\$) per acre.

(b) by (month, day, year)

(c) correctly so that planted seedlings will meet, or exceed, the federal program standards.

4. To repair, replace, or pay for damage done to any property in the performance of the Contract beyond ordinary wear and tear.

It is further agreed: **Penalties** for failure to fulfill the contract are as follows:

1. The Owner shall pay the Contractor for any delay occasioned by himself, his contractors, agents, and/or employees, by not providing trees or necessary means ingress or egress to planting site, at the rate of (\$) per day for each day's delay caused by default of the Owner; provided that this clause may be rendered null and void by mutual agreement. Cancellation shall be affected by written consent of the Contractor or by striking out the clause and both parties initialing in the margin.

2. In Case of failure of the Contractor to repair damage to property, the penalty shall be equal to the cost of having the repairs done by local contractors.

3. In case of failure of the Contractor to plant at least 90% of the trees in a satisfactory manner or at the location(s) agreed upon, penalty shall be forfeiture of payment in an amount needed for replanting plus cost of trees.

4. In case of failure of the Contractor to plant trees by the closing date of the planting season, the penalty shall be the cost value at the planting site of trees on hand which are unplanted.

Contractor _____

Date _____

Owner _____

Date _____

Cooler Locations

Arkansas Forestry Commission
Drew County
137 Scogin Drive
Monticello, AR 71656
870/367-6767

Arkansas Forestry Commission
Howard County
106 North Main Street
Dierks, AR 71833
870/286-2139

Arkansas Forestry Commission
St. Francis County
1690 Linden Road
Forrest City, AR 72335
870/633-6693

Arkansas Forestry Commission
Craighead County
2301 Fox Meadow Lane
Jonesboro, AR 72403
870/932-2251

Arkansas Forestry Commission
Arkansas County
Municipal Airport Road
(Highway. 11)
Stuttgart, AR 870/673-2851

Arkansas Forestry Commission
Lafayette County
1171 Lafayette 31
(Central Avenue North)
Stamps, AR 71860
870/533-4641

Arkansas Forestry Commission
Union County
2165 Champagnolle Road
El Dorado, AR 71730
870/863-7051

Arkansas Forestry Commission
Hot Spring County
207 Airport Road
Malvern, AR 72104
501/332-2081

Arkansas Forestry Commission
Johnson County
#1Smokey Lane
Clarksville, AR
479/754-3125

Arkansas Forestry Commission
Stone County
208 Wilcox Avenue
Mountain View, AR 72560
870/448-5014

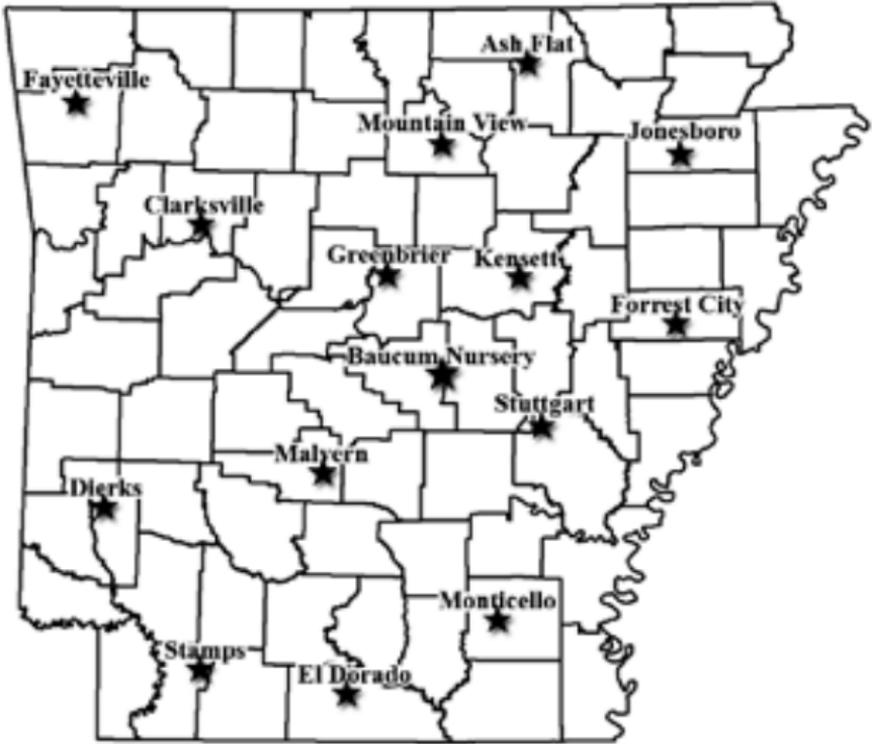
Arkansas Forestry Commission
Washington County
2752 North Garland Avenue
Fayetteville, AR 479/587-1442

Arkansas Forestry Commission
Sharp County
#40 Arnhart Street
Ash Flat, AR 72513
870/994-2188

Arkansas Forestry Commission
Faulkner County
#20 Industrial Park Boulevard
Greenbrier, AR 72058
501/679-5316

Arkansas Forestry Commission
White County
101 East Searcy Street
Kensett, AR 72082
501/742-5446

Arkansas Forestry Commission
Baucum Nursery
Pulaski County
1402 Highway 391 North
North Little Rock, AR 72117
501/907-2485



Arkansas Forestry Commission

Baucum Nursery
1402 Highway 391 North
North Little Rock, Arkansas 72117
501/907-2485 or 2486
888/457-4221
FAX 501/907-2487
baucumnursery@arkansas.gov

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