

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE GENERAL SPECIFICATIONS**

**FOREST STAND IMPROVEMENT**

(Acre)

CODE 666

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**GENERAL CRITERIA**

Comply with applicable laws, regulations, and the Texas Best Management Practices (BMPs).

**HARVESTING / SILVICULTURAL SYSTEMS**

**General Criteria**

Planning a silvicultural method will consider

1. the age, size and condition of the stand
2. the current stocking level of desired species
3. the erosion potential of the site
4. the landowners' objectives, financial limitations and concern for aesthetics and wildlife

When using natural regeneration, only high quality trees (high form class, favorable conformation and good growth rate) of the desired species will be retained as seed trees. Choose methods and timing of harvesting in preparation natural regeneration that will not harm the remaining trees.

When natural regeneration methods are used in pine stands, adequate reproduction will be:

**500 - 700 seedlings per acre within the first 2 years.**

If reproduction exceeds 1500 seedlings per acre after 3-5 years, it may be necessary to use pre-commercial thinning (see below).

**Harvesting Methods**

• **Clearcut**

Clearcutting removes all merchantable trees from the stand in one cut. This method is used for establishing a new stand of shade-intolerant species such as pines or oaks whether through natural seeding / sprouting or replanting. The harvest is usually followed by some form of site preparation. Harvest by clearcut requires strict adherence to any limitations of the soil or site that exist. Careful planning is essential to avoid long-term site degradation and infraction of the National Clean Water Act.

○ **Hardwood** Clearcut is applicable in hardwood stands when:

- 1) There are at least 200-500 large, well-developed seedlings of desirable species and form per acre present – OR
- 2) Planting or direct seeding is planned – OR
- 3) The site is to be managed for light seeded species and there is suitable seed source Nearby – OR

Conservation practice specifications are reviewed periodically, and updated if needed, to obtain the NRCS, TX current version of this specification, contact the Natural Resources Conservation Service

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- 4) Regeneration from coppice and root sprouts can be achieved.

Where natural regeneration is planned, limit the size of the clearcut to less than 40 acres. All trees larger than 2" DBH will either be harvested, cut or deadened.

- **Pine** Clearcutting pine stands is applicable when:
  - 1) Planting or direct seeding is planned – OR
  - 2) An adequate seed source is available – OR
  - 3) There are at least 300-500 viable pine seedlings per acre present.

When natural regeneration is planned and advanced reproduction is not present, the clearcut will be  $\leq 400'$  wide for loblolly, shortleaf and slash. Whenever possible, orient the clearcut perpendicular to the prevailing fall winds. Planting following clearcutting will be planned for longleaf pine.

- **Group Selection/Patch, Block or Strip Clearcuts**

- **Hardwood** Hardwood stands are suitable for group selection when:
  - 1) There are at least 200-500 large, well-developed, viable seedlings of desirable species and form per acre present. – OR
  - 2) The site is to be managed for light-seeded species and there is a suitable seed source available.

The size of the harvest area will be 1-5 acres in size. All trees  $\geq 2"$ DBH will be harvested, cut or deadened.

- **Pine** Pine stands are suitable for group selection when:
  - 1) An adequate seed source is available – OR
  - 2) There are at least 300-500 viable pine seedlings per acre present.

The minimum width and size of a group selection harvest will be 100' to 120' or  $\frac{1}{4}$  to  $\frac{1}{3}$  acre.

- **Seed Tree**

- **Hardwood** Hardwood stands lend themselves to seed tree management when: the desirable species are light-seeded and/or shade tolerant. This does not include oaks, hickories and other heavy-seeded species.

Retain 8 - 15 well formed, superior trees per acre on a 50' to 70' spacing.

- **Pine** Pine stands are suitable for seed tree management when:
  - 1) An adequate seed source is available on the site - AND
  - 2) The species to be managed is loblolly, shortleaf or slash.

Longleaf pine is suitable for natural regeneration but requires the seeds falling on bare mineral soil for successful germination and early survival, frequent prescribed burning to reduce the threat of brownspot needle blight, and protection from free-ranging hogs. Chemical weed control as well as prescribed fire also serves to bring the longleaf seedlings out of their "grass stage" more quickly.

Minimum stocking and spacing is dependent upon the average size of the seed source trees as shown in the following table.

Seed Source Trees		Average Diameter (DBH)			
		10"	12"	14"	16"+
Loblolly or Slash	Trees per Acre	12	10	6	4
	Spacing	60' x 60'	66' x 66'	85' x 85'	105' x 105'
Shortleaf	Trees per Acre	20	14	12	12
	Spacing	45' x 45'	55' x 55'	60' x 60'	60' x 60'

- **Shelterwood**

- **Hardwood.**

Shelterwood management is applicable in hardwood stands when heavy seeded species are desired.

This method will generally involve 3 cuts. The first is to remove the lower crown class trees (midstory and understory). The second will reduce the stocking to 25 to 50 trees per acre to encourage the development of desirable seedlings by root sprout or coppice. The third cut removes the overstory once the seedlings are well established.

- **Pine**

This method is applicable when there is an adequate pine seed source available on the site.

This method will involve 2 to 3 cuts. If the seed trees to be left have well-developed crowns, the first cut is a harvest to the seed tree number listed below. Three to five years afterwards the final harvest will occur.

If, on the other hand, the seed trees do not have well-developed crowns, the first cut will be an improvement cut to release the seed trees. Once the crowns of the seed trees have developed, reduce the stand to the desired number of trees listed below.

The number of seed source trees depends on their DBH and species as shown in the following table.

Avg. DBH	Min. Trees/Ac*	Max. Trees/Ac
10	55	110
12	40	75
14	30	55
16	20	45
18+	15	30

\* Use the minimum number for longleaf pine.

## **INTERMEDIATE SYSTEMS - THINNINGS**

### **General Criteria**

Thinning operations will be carried out to minimize soil disturbance and compaction. Harvest in compliance with Texas Forestry Best Management Practices. The method and timing of tree harvest will not damage the residual stand beyond an acceptable level. *Riparian Forest Buffers*, code 391, or SMZs and any unique or sensitive areas will be protected during all harvest operations.

Normally removal of slash is not necessary. However, if it poses a potential wildfire threat, the slash should be removed. Felled trees should not remain lodged in standing trees.

- **Pre-commercial Thinnings in Pine Stands**

When young pine seedlings exceed 1500 stems per acre at age 2 to 5 years, pre-commercial thinning will ensure an optimum growth rate in the residual stand. Stands should be thinned as soon as the overstocking is recognized. Reduce the number to 450-700 stems per acre.

Thinning these young stands may be done by hand or mechanically. When thinning by hand, leave desirable trees 8 to 10 years apart.

Mechanical methods include the use of bush hogs, hydro-axes, other rotary type cutters, drum choppers and bulldozers. These machines can be run in strips or in "checkerboard" patterns. Take care to minimize damage in the residual strips or blocks. Cleared strips should be 7 to 10 feet wide with the residual strips as narrow as possible (1-3 feet wide). Checkerboard blocks should be 8-10 feet wide. Hand thinning within the strips or blocks may be needed, as well.

- **Commercial Thinning**

Determine the desired level of stocking that meets the landowners' objectives and the stand's management needs. Use **Table 1** or **Table 2** to establish the stand's present condition in relation to the desired stocking level. The charts contain benchmark lines showing the stocking levels where stands are understocked, fully (or adequately) stocked, and overstocked. The "understocked" line represents minimum stocking - the site is not fully occupied by trees. Within the fully or adequately stocked levels, the site is fully dedicated to growing trees. Individual trees here have enough space to maximize growth, but the site is still fully occupied by trees. As the stand develops and approaches the "overstocked" line, the canopy begins to close as tree crowns expand, and competition and subsequent reduced growth rates begin to affect the productivity of the stand. In many management situations, particularly where an uneven-aged structure is the goal, long-term objectives are best served by maintaining stocking within the fully (or adequately) stocked levels. These charts are developed as guides and are usually applied in a "rule-of-thumb" manner.

When a thinning is needed, the thinning level will be expressed in terms of D+spacing; or the number of trees, basal area, or percent stocking per acre to be removed or retained.

Stands that are maintained in an overstocked condition or those that have been thinned to an understocked condition will not be planned. Exceptions may be made for thinnings delayed for market, financial or weather related reasons, or harvest cuttings made for regeneration efforts. In addition, removing trees in a change of landuse is not to be planned or reported under this practice.

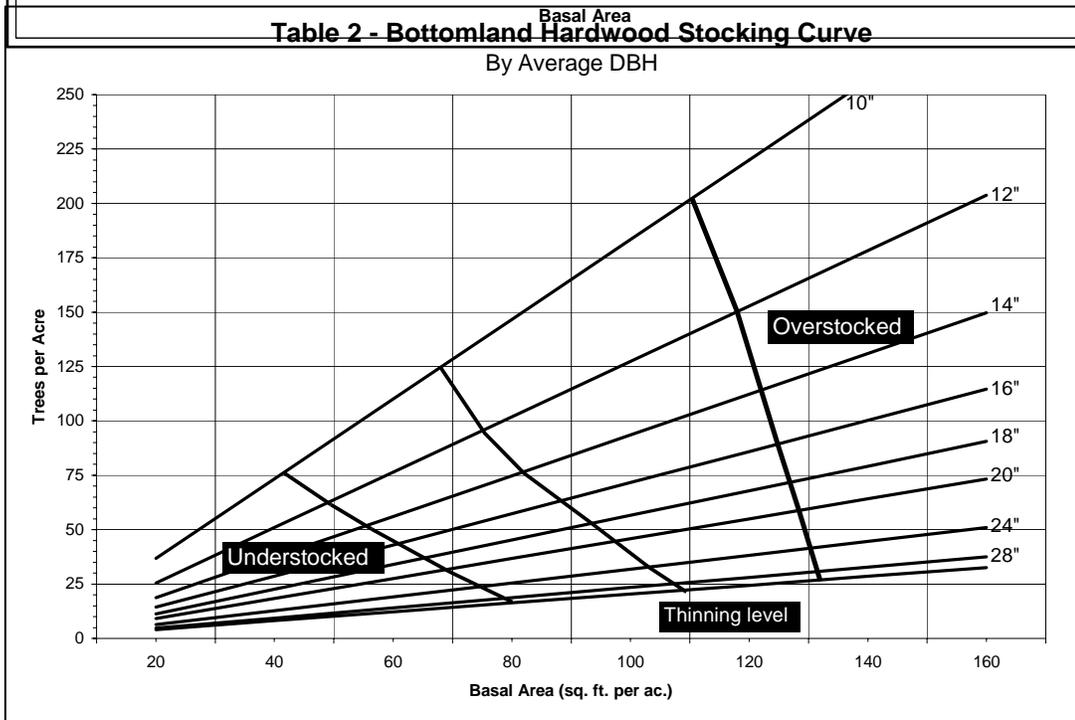
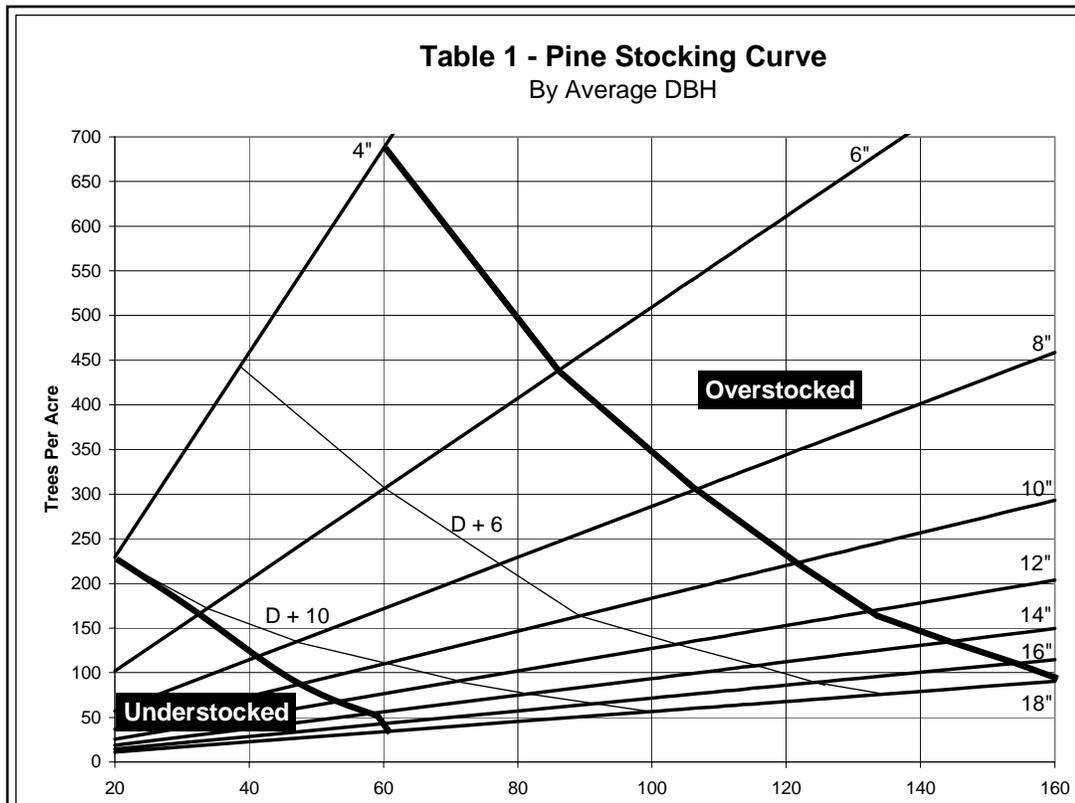
The purpose of intermediate cuttings or thinnings is to improve the stand's overall vigor, quality and composition. The means used to reach the desired stocking level will be consistent with this purpose. The maximum response to thinning usually is found among the remaining co-dominant trees once they are relieved from competition with equals.

The following general guidelines will be followed no matter which method of thinning is used.

- Remove all merchantable trees that are suppressed
- Salvage high-risk damaged or diseased trees

- Space the "keep" trees to allow for room for growth and development
- Favor high quality dominant and codominant trees for retention

Correct spacing of leave trees will be accomplished by the application of a recommended system of thinning. These systems include D+, crown friction, row thinning in plantations, and thinning from below (removing weak co-dominants and suppressed trees).



○ **Examples of Commonly Used Spacing and Stocking Based Thinning Guides**

SPACING, STOCKING AND APPROXIMATE RESIDUAL BASAL AREA THINNING GUIDE FOR COMMONLY USED D + X THINNING SYSTEMS								
D.B.H	PINE				BOTTOMLAND HARDWOOD			
	X =	SPACING	T.P.A.	APPROX. B.A.	X =	SPACING	T.P.A.	APPROX. B.A.
4	6	10	436	40				
6	6	12	303	60				
8	6	14	222	75	8	16	170	60
10	6	16	170	90	8	18	134	75
12	6	18	134	105	9	21	99	80
14	6	20	109	115	9	23	82	90
16	6	22	90	125	10	26	65	90
18	6	24	76	135	10	28	56	100
20	6	26	65	140	11	31	45	100
25	6	31	45	155	12	37	32	110
30	6	36	34	165	14	44	23	115

Basal Area to Spacing Guide	
If Basal Area (sq. ft. / ac.) = 50, then	Average Spacing = D x 2.20
60	D x 2.00
70	D x 1.85
80	D x 1.75
90	D x 1.65
100	D x 1.45
120	D x 1.40

**TIMBER STAND IMPROVEMENT (TSI) / RELEASE**

**General Criteria**

An inventory that identifies both the species to be controlled and retained will be needed in order to plan appropriate methods of control. This inventory will also include information on the stocking and consideration of the desired trees as well as the undesirable plants.

For release to be effective and economically feasible there must be at least **300 released pine seedlings per acre or 500 released desirable hardwood seedlings per acre**. The seedlings must be fairly evenly distributed throughout the stand and of good form and condition.

MINIMAL STOCKING RATES BY D.B.H.		
Avg. DBH	Pine	Hardwood
4	300	500
6	200	300
8	145	175
10	100	125
12	75	80
14	55	70
16	45	60

Timber Stand Improvement should result in stocking levels of desired species that will meet the landowner's objectives. Refer to Tables 1 and 2 above for minimal stocking, by diameter class, for pine and hardwood management. Adjustments may be made for pine/hardwood mixes, wildlife, aesthetics, etc. to meet landowner's objectives.

Use only approved chemicals and comply with all relevant state laws, label instructions and Texas BMP's.

Selection of appropriate control methods will be based on effectiveness, economic considerations and landowner's objectives and concerns.

See **Table 3** for timber stand improvement / release methods

- **Release of seedlings from herbaceous weeds, grasses and vines.**

Mowing and shredding can be effective on sites that have a good plant-soil moisture relationship and where follow-up mowing, if needed, is possible.

Whenever grasses, weeds and vines pose a competition or suppression problem for seedlings or young trees, control using chemicals is an alternative. Consider the potential for runoff and leaching with all chemical use.

- **Release of seedlings and young trees from overtopping trees and brush.**

Consider harvesting the overtopping trees when the volume and quality of these trees makes this feasible. Otherwise, the use of herbicides will be considered. Chemicals can be used in single stem treatments, such as basal spray or injection, or broadcast in ground or aerial applications. Give consideration to the potential for runoff and leaching with all chemical use.

- **Control of undesirable trees within a stand of desirable trees.**

Control of undesirable trees such as unwanted species and suppressed, cull, diseased, or overmature trees must result in an adequately stocked stand of good quality, desirable trees. Methods include cutting and harvesting, *Prescribed Burning* (Code 338), application of herbicides and mechanical means of control.

Mechanical methods include shredding, mulching, shearing and bulldozing. Care must be taken to minimize damage to desirable trees during the release operation. Potential hazards such as wildfire, disease and insect infestation from slash and debris left after the release operation must also be considered.

Consider harvesting the unwanted trees when the volume and quality of these trees makes this feasible. Minimize damage to the desirable trees left in the residual stand.

Chemical methods can include: broadcast applications, foliar applications, application of soil activated herbicides, and individual stem treatments.

Table 3

TSI / RELEASE GUIDELINES			
Method	Where Applicable	Equipment	Notes
MECHANICAL	All	Mower, Chopper, Dozer, Mulcher, etc	Temporary control due to re-sprouting
CHEMICAL			
Broadcast			
Aerial	Brush and vegetation that can be covered by the air	Helicopter	Select herbicide for target species to be controlled.
Ground – Mist Blower	Trees and brush < 30' tall	ATV or tractor mounted mist blower	Select herbicide for target species to be controlled.
Ground - Spray	Low brush and herbaceous	ATV or tractor mounted sprayer	Determine the need for a general, directed spray, or "over-the-top" chemical. Uniform coverage is important
Hand Spraying	Up to 6' tall Low density	Backpack sprayer	Determine the need for a general, directed spray, or "over-the-top" chemical. Usually applied "Spray-to-Wet"
Basal Spray	Full – Up to 6" dbh Streamline – Up to 3"	Backpack sprayer	Herbicide is sprayed on lower portion of tree. Chemical is mixed with additive to aid penetration through bark.
Injection	All >1" DBH Usually best suited when trees are > 3-4" dbh and fewer than 250 – 300 tpa	Injectors or Hack-n-Squirt	Spacing of injections is chemical dependent but usually 2-3" apart. "Hard-to-control" species may require continuous cut.
Soil Spot Treatment	Brush or trees	Liquid herbicides are applied with a "spot gun".  Granules may be applied by hand or mechanically	Rates are usually soil texture dependent.