Timber Resource Analysis

The silviculture/timber sale program areas apply active management to the vegetative resource in order to move the forest toward desired conditions (see Chapter 1 of the Plan, VEG-1 through VEG-9). Activities described in this section include commercial timber sales of intermediate timber harvesting (thinning, seed tree removal), and silvicultural harvest treatments that are even-aged in nature (clearcut, shelterwood), two-aged regeneration (shelterwood with reserves), or uneven-aged (group selection). The size of the vegetation management program (acres of management activity) has been determined by the ecological needs of the resource, tempered by the historical budget and personnel levels (physical capability) for the Uwharrie National Forest.

Following is a table showing estimated average annual vegetation treatments to be applied to the Uwharrie National Forest for the first decade covered by this plan:

Estimated Vegetation Management Practices
(Annual Average Treatment Area (Acres) in First Decade for Lands Generally Suitable for Timber Harvest)

Practice	Primary Management Emphasis						
Lands where Timber Production Achieves, or is Compatible with Desired Conditions and Objectives	**Timber Prod.**	**Water Yield**	**Wildlife/ Fisheries**	**Recreation/ Scenery**	**Fire/Fuels/ Forest Health**	**Ecological Restoration**	**Totals**
Regeneration Cutting (even- or two-aged)						266	266
Uneven-aged Management							
Intermediate Harvest							
Commercial Thinning					400	34	434
Salvage/Sanitation							
Other Harvest Cutting							
Reforestation						266	266
Timber Stand Improvement						300	300
Other Lands		**Water Yield**	**Wildlife/ Fisheries**	**Recreation/ Scenery**	**Fire/Fuels/ Forest Health**	**Ecological Restoration**	**Totals**
Regeneration Cutting (even- or two-aged)							
Uneven-aged Management							
Intermediate Harvest							
Commercial Thinning							
Salvage/Sanitation							
Other Harvest Cutting							
Reforestation							
Timber Stand Improvement							

Note that timber harvesting activity in the first decade is dedicated primarily toward restoration of ecosystems and commercial thinning for forest health reasons. To see estimated activity levels in future decades, refer to the tables that follow later in this report.

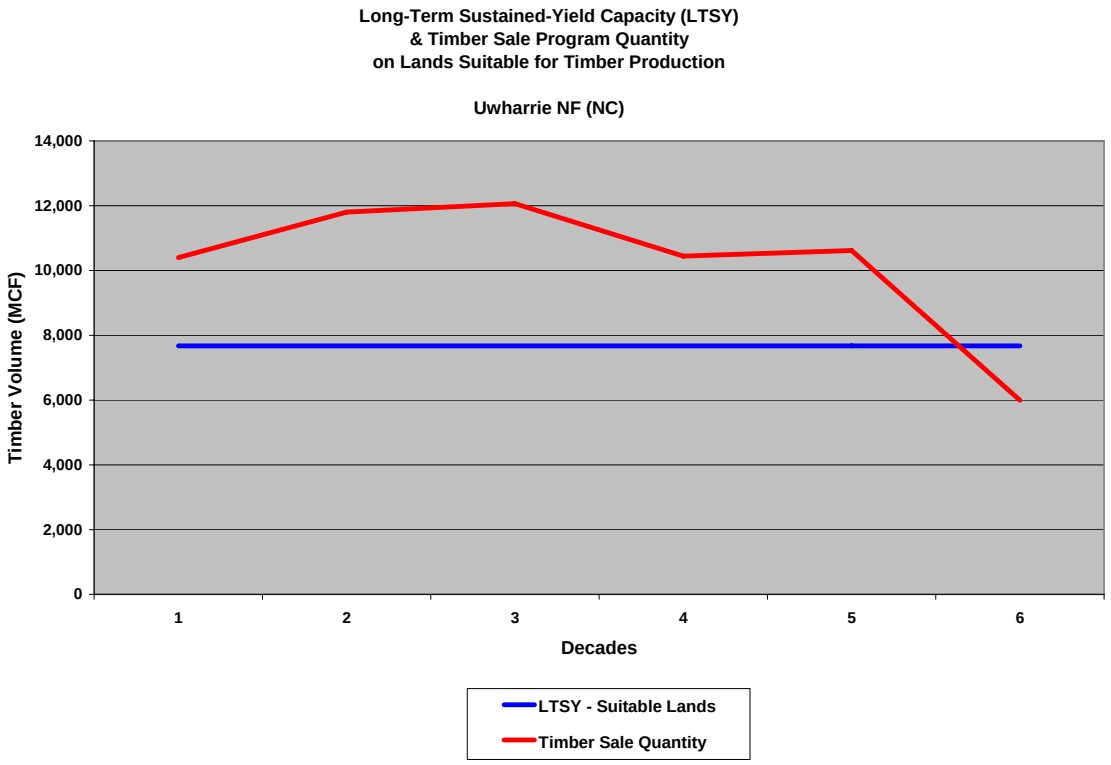
The timber sale activities described above will yield wood products to the commercial markets in the form of pulpwood and sawtimber. The following table shows the estimated average annual outputs (MBF = Thousand Board Feet, and MCF = Thousand Cubic Feet) from the harvesting described above – the **Timber Sale Program Quantity**:

Timber Sale Program Quantity
(Annual Average Volume Outputs for First Decade)

Practice	Timber Sale Program Quantity (TSPQ) By Management Emphasis						
Lands where Timber Production Achieves, or is Compatible with Desired Conditions and Objectives	**Timber Prod.**	**Water Yield**	**Wildlife/ Fisheries**	**Recreation/ Scenery**	**Fire/Fuels/ Forest Health**	**Ecological Restoration**	**Totals**
Regeneration Cutting (even- or two-aged)						570	570
Uneven-aged Management							
Intermediate Harvest							
Commercial Thinning					450	20	470
Salvage/Sanitation							
Other Harvest Cutting							
Subtotal, Sawtimber (MBF)					750	1,475	2,225
Subtotal, All Products (MCF)					450	590	1,040
Other Lands		**Water Yield**	**Wildlife/ Fisheries**	**Recreation/ Scenery**	**Fire/Fuels/ Forest Health**	**Ecological Restoration**	**Totals**
Regeneration Cutting (even- or two-aged)							
Uneven-aged Management							
Intermediate Harvest							
Commercial Thinning							
Salvage/Sanitation							
Other Harvest Cutting							
Subtotal, Sawtimber (MBF)							
Subtotal, All Products (MCF)							
Grand Totals – Sawtimber (MBF)					750	1,475	2,225
Grand Totals, All Products (MCF)					450	590	1,040

Note that neither table indicates harvesting activity on "Other Lands", which include those lands that have been determined to be not generally suitable for timber production. While this plan does not estimate, in advance, that harvesting will occur on these lands, it does acknowledge that harvesting may be necessary on these lands (if generally suitable for harvesting) to address an unforeseen future event such as wind storm, ice storm, or insect/disease infestation.

The harvest levels proposed must also be compared to the long term sustained yield (LTSY) calculated for the Uwharrie National Forest. The following chart depicts the LTSY of 7,672 MCF per decade, compared to the estimated harvesting levels, by decade:



This chart depicts an initial rise in timber sale quantity followed by a decline that approaches the LTSY level. As the Uwharrie NF restores forest land currently occupied by loblolly pine to either longleaf pine or oak-hickory-shortleaf pine, the Timber Sale Program Quantity (TSPQ) will be high relative to a LTSY that is based on desired future conditions (restored forest types) instead of actual conditions (loblolly pine forest type). This higher TPSQ reflects the opportunity we have to move the forested landscape toward our desired conditions and better meet our ecosystem management objectives (FSH 1909.12_63.5). The existing loblolly pine plantations are fully stocked or overstocked, having basal areas often exceeding 140 sq ft/ac, and because loblolly pine stands often have volumes per acre that are 50-150% higher than other forest types. Volumes per acre for stands having desired conditions are low due to stocking being below full stocking levels, with target basal areas between 60 and 70 sq ft/ac.

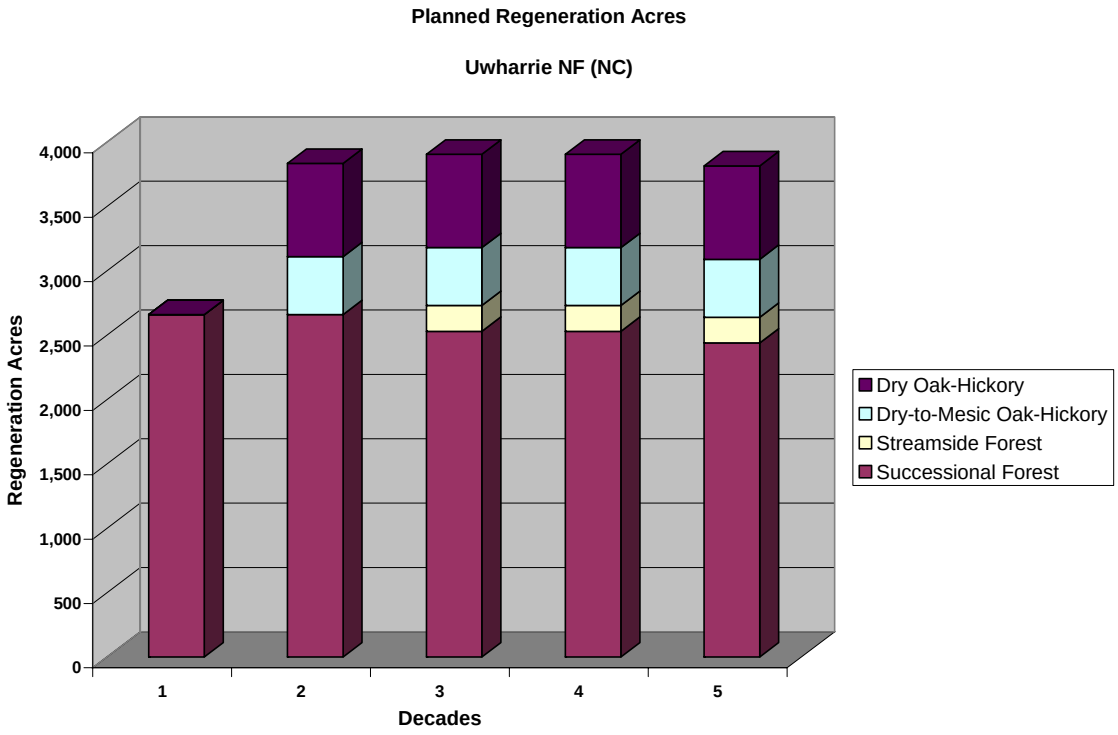
A downward trend in TSPQ is not evident until after the fifth decade because conversion of loblolly pine stands to the desired longleaf pine or oak-hickory forest ypes would still be occurring in Decade 5, with approximately 2,640 acres of regeneration harvest and 1,300 acres of thinning in loblolly and shortleaf pine forest types. Therefore, a sixth decade is shown to represent future harvest levels after off-site loblolly stands have already been restored to more appropriate forest types (a reduction of over 7,000 MCF

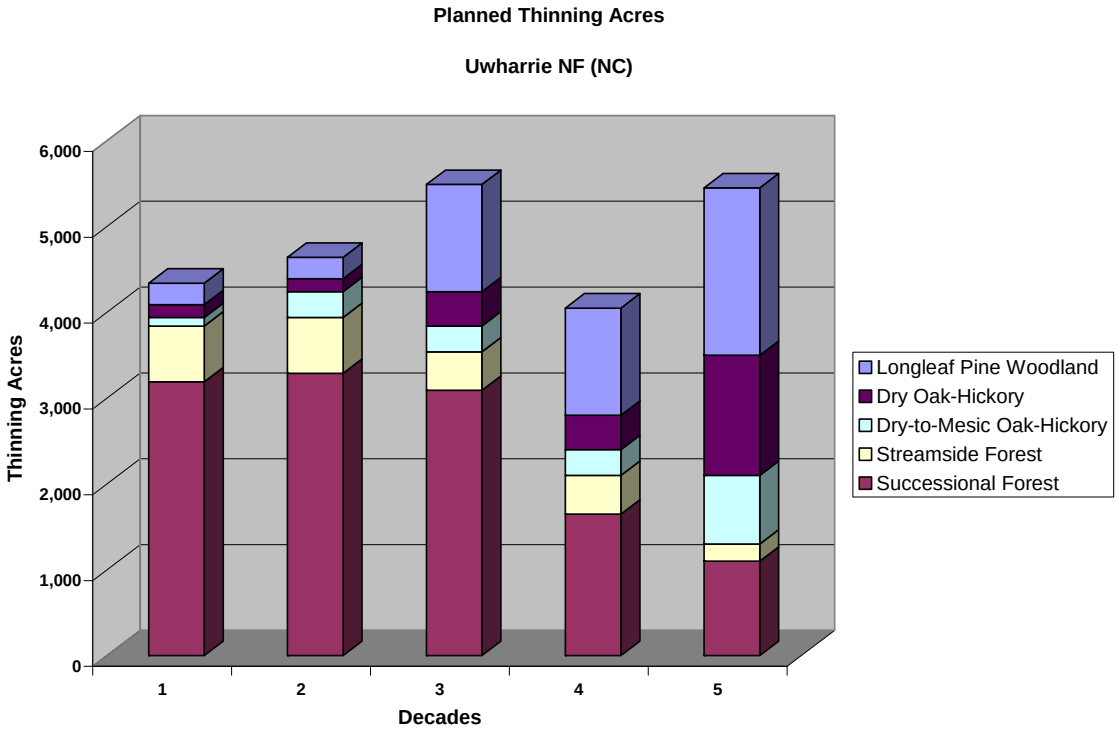
less than Decade 5), and when group selection of restored oak-hickory stands greater than 50 years old is underway (an increase of about 2,500 MCF per decade). The actual decrease in TSPQ between Decades 5 and 6 may actually occur over a period of several decades, resulting in a more gradual trend toward the LTSY, but we only modeled one additional decade (6), and we wanted to display what the TSPQ would be after all offsite loblolly had been restored.

The following tables and charts show the projected acres treated and volumes produced by forest type and silvicultural treatments over the next 5 decades:

			ACRES/DECADE				
			1	2	3	4	5
Longleaf Pine Woodland	**EAM**	**Thin**	250	250	1,250	1,250	1,950
Dry Oak-Hickory	**EAM**	**Regen**	0	200	200	200	200
Dry Oak-Hickory	**UEAM**	**Thin**	150	150	400	400	1,400
Dry Oak-Hickory	**UEAM**	**Regen**	0	525	525	525	525
Dry-to-Mesic Oak-Hickory	**UEAM**	**Thin**	100	300	300	300	800
Dry-to-Mesic Oak-Hickory	**UEAM**	**Regen**	0	450	450	450	450
Streamside Forest (Lob)	**EAM**	**Thin**	650	650	450	450	200
Streamside Forest (Lob)	**EAM**	**Regen**	0	0	200	200	200
Successional Forest	**EAM**	**Thin**	3,190	3,290	3,090	1,650	1,100
Successional Forest	**EAM**	**Regen**	2,660	2,660	2,530	2,530	2,440
TOTALS			7,000	8,475	9,395	7,955	9,265

			MCF/DECADE				
			1	2	3	4	5
Longleaf Pine Woodland	**EAM**	**Thin**	120	120	758	758	1,354
Dry Oak-Hickory	**EAM**	**Regen**	0	175	175	175	175
Dry Oak-Hickory	**UEAM**	**Thin**	53	53	140	140	491
Dry Oak-Hickory	**UEAM**	**Regen**	0	584	584	584	584
Dry-to-Mesic Oak-Hickory	**UEAM**	**Thin**	38	117	118	118	319
Dry-to-Mesic Oak-Hickory	**UEAM**	**Regen**	0	569	573	573	582
Streamside Forest (Lob)	**EAM**	**Thin**	796	796	583	583	267
Streamside Forest (Lob)	**EAM**	**Regen**	0	0	486	486	501
Successional Forest	**EAM**	**Thin**	3,692	3,688	3,239	1,624	1,012
Successional Forest	**EAM**	**Regen**	5,699	5,699	5,405	5,405	5,332
TOTALS			10,398	11,800	12,062	10,446	10,617


Planned Regeneration Acres
Uwharrie NF (NC)
Regeneration Acres
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1
2
3
4
5
Decades
Dry Oak-Hickory
Dry-to-Mesic Oak-Hickory
Streamside Forest
Successional Forest


Planned Thinning Acres
Uwharrie NF (NC)
Thinning Acres
6,000
5,000
4,000
3,000
2,000
1,000
0
1
2
3
4
5
Decades
Longleaf Pine Woodland
Dry Oak-Hickory
Dry-to-Mesic Oak-Hickory
Streamside Forest
Successional Forest

This table shows the productivity levels of those lands classified as generally suitable for timber production versus those lands classified as generally suitable for timber harvest but not generally suitable for timber production (the "Other Lands").

Timber Productivity Classification

Potential Growth (Cubic Feet/Acre/Year)[1]	Lands Generally Suited for Timber Production (Acres)	Other Lands (Acres)
Uninventoried or Other	0	598
20-49	4,270	2,120
50-84	17,110	5,785
85-119	10,520	2,910
120-164	1,350	350
165-224	20	10
225+	150	100

Of the lands classified as "generally suitable for timber production", the following table shows a breakdown of those acres by existing and desired forest types.

Lands on which Timber Production Is compatible with desired conditions

	Existing Forest Type approximate acres	Desired Forest Type approximate acres
Southern Interior Longleaf Pine Woodland	1,490	7,890
Xeric Oak	830	1,800
Dry Oak-Hickory	6,370	15,405
Dry-to-Mesic Oak-Hickory	5,800	7,635
Successional Streamside Forest	1,500	0
Mesic Forest	220	690
Successional Forest on Longleaf Site	4,730	0
Successional Forest on Oak-Hick. Site	12,050	0
Successional Forest on Other Site	1,430	0
Total Acres	**33,420**	**33,420**

[1] Potential growth is expressed in terms of the annual cubic volume growth per acre at culmination of mean annual increment (CMAI) in fully stocked natural stands

[1] Includes lands with no forest type or site index, i.e. no calculated productivity class

Description of Anticipated Vegetation Treatments

Restoration of Longleaf Pine

Approximately 55% of loblolly pine stands (FT=31) that are over 30 years old (planted before 1976) and on sites best suited for longleaf pine will be harvested (probably by two-aged shelterwood), site prepared (probably by growing-season burning), and planted with longleaf pine seedlings. It is estimated that an average of **90 acres per year** will be treated this way.

Approximately 40% of shortleaf pine stands (FT=32) that are over 60 years old (planted before 1946) and on sites best suited for longleaf pine will be harvested (probably by two-aged shelterwood), site prepared (probably by growing-season burning), and planted with longleaf pine seedlings. It is estimated that an average of **10 acres per year** will be treated this way.

Restoration of Oak-Hickory by Thinning

Some stands that are now typed as mixed pine/hardwood (between 51 and 69% pine) could be thinned to reduce the relative stocking of pines to less than 50%, leaving stands with a preponderance of hardwoods. For example, a stand having 60 pines per acre and 40 hardwoods per acre (60% pine) could have 30 pines per acre removed to leave a stand with 57% hardwood. Oaks and hickories could continue to be favored by subsequent treatments.

Approximately 50% of mixed loblolly pine/hardwood stands (FT=13) that are over 30 years old (established before 1976) and on sites best suited for oak-hickory will be thinned to reduce the pine component and favor oak, hickory, and other hardwoods. It is estimated that an average of **12 acres per year** will be treated this way.

Approximately 50% of mixed shortleaf pine/hardwood stands (FT=12) that are over 60 years old (established before 1946) and on sites best suited for oak-hickory will be thinned to reduce the pine component and favor oak, hickory, and other hardwoods. It is estimated that an average of **22 acres per year** will be treated this way.

Other stands that are typed as loblolly pine (FT=31) or shortleaf pine (FT=32) might contain hardwood inclusions or areas with nearly as much hardwood as pine. This is because stand composition can change over time due to competition or tree harvest or because large areas have been lumped into single stands. Before making decisions to regenerate large stands, they will be examined to see if they need to be split into smaller stands with different forest types or to have hardwood inclusions identified. If stands can be converted to oak-hickory by removing patches of pines or scattered pines from mixed stands, those opportunities will be pursued. However, it is impossible to quantify the

number of acres without additional inventories. Until site-specific stand examinations are performed as part of project analyses, the acres of additional restoration will be estimated according to the following discussions based on existing stand data.

Restoration of Oak-Hickory by Regenerating Pine Stands

Following disturbances, oaks and hickories naturally regenerate primarily from stump sprouts, seedling sprouts, and large seedlings already in place. Little or no oak regeneration results from new seedlings or acorns because of their slow growth relative to red maple, sweet gum, and other competing hardwoods. In older stands, where a midstory of shade-tolerant hardwoods has become established due to exclusion of fire and grazing, there might not be many oak seedlings in the understory due to excessive shade. Even if pole-sized oaks and other sources of oak and hickory regeneration are present, selective control of competition by cutting, fire, and/or herbicides will likely be required to keep young oaks and hickories free-to-grow as the new stand develops.

Planting acorns or oak seedlings (artificial regeneration) is not a dependable way to establish stands of oak in a forest setting at this time. Technology exists to grow large seedlings in the nursery, but availability of local seed sources limits that option. The operation is an expensive one, with costs higher due to acorn collections, losses due to weevils, fewer seedlings per square foot of nursery space, more fertilizer, heavy culling of seedlings to keep only the best ones, and higher planting costs (auger planting). Even then, a minimum of two or three treatments to set back faster-growing trees competing with planted oak seedlings is necessary. Presently, oaks are being planted only for future seed production or species enrichment on a very small scale. There might be some opportunities for oak planting on the Uwharrie NF during the next fifteen years, but it will probably be limited in scope. With oak, we cannot presently achieve the consistent and cost-effective results that we typically have with planting pine seedlings.

Therefore, to restore these predominately pine stands to oak-hickory will require a process over several decades to establish natural oak and hickory regeneration and allow it to grow and develop into a size that can effectively compete with faster growing trees occupying the same site.

Most existing **loblolly pine** plantations, especially young ones, do not have a well-developed component of oak and hickory. Loblolly pines grow very fast, and they typically overtop and crowd out competing hardwoods except on the most productive (moist) sites or where fire, windthrow, thinning, or other disturbances have killed or removed pines, leaving spaces for hardwoods to dominate. Therefore, it will be difficult to restore or convert loblolly plantations to oak-hickory, because sources of regeneration of oak and hickory are not present in adequate numbers to fully occupy the sites after the loblolly pines are removed. Older loblolly pine stands, many of them resulting from natural regeneration during a period of fire exclusion, are more likely to contain existing oaks and hickories, especially on drier sites.

However, most existing **shortleaf pine** stands, even young plantations, already contain an appreciable component of oak, hickory, and other hardwoods that have developed alongside the shortleaf pines and also as seedlings and saplings in the understory. In contrast to loblolly pines, shortleaf pine crowns are narrow, and height growth is maintained without crowding out codominant hardwoods. Apparently, light conditions in **shortleaf pine stands are well-suited to development of oak seedlings** while sun-loving sweet gum is held in check. To restore these shortleaf pine stands to oak-hickory will require less time than it does for loblolly pine plantations.

In any case, before a prescription for restoring oak-hickory can be written for a given stand, a preharvest inventory should be made to determine if natural regeneration will be adequate. If oaks, hickories, and other desirable hardwood regeneration is abundant and well-distributed, then it is possible to establish natural hardwood in adequate numbers without planting trees. If natural regeneration of oak and hickory is lacking or insufficient to occupy a site, other less-desirable tree species will do so. These might include red maple, sweet gum, black gum, sourwood, dogwood, and/or yellow-poplar that originate from seedlings or sprouts, root suckers (sweet gum), or seed-in-place (yellow-poplar). If these species become dominant, they will shade out any oak seedlings that might germinate underneath them.

A faster way to establish oaks where they do not occur naturally or occur only in limited numbers would be to create mixed oak-pine stands like the ones discussed in the previous section. In predominately pine stands, we can retain whatever overstory oaks are present when the pines are harvested, and being careful not to leave loblolly and Virginia pines that could produce new seed, then regenerate a mixed oak and shortleaf pine stand following a growing-season burn. After the burn, small existing oaks and hickories will sprout, and during the winter after the burn, shortleaf pines can be interplanted, if necessary, to temporarily occupy the spaces between them. Other hardwoods can be controlled with selective application of herbicide if needed. As the stand develops, the shade from oaks, hickories, and planted shortleaf pines will suppress development of competing hardwoods, but allow enough sunlight for oaks and hickories to germinate and grow in the understory. As oaks and hickories become larger over time, future thinnings can gradually remove planted pines, allowing the stand composition to become increasingly dominated by desirable hardwoods and complete the restoration process.

Assuming the stand inventory is correct, approximately **50% of loblolly pine stands (FT=31) that are over 30 years old** (planted before 1976) and on sites best suited for oak-hickory will be harvested during the next fifteen years (probably by two-aged shelterwood), site prepared (probably by growing-season burning), and planted with shortleaf pine seedlings on a wide spacing (up to 350 trees per acre) if necessary to supplement natural hardwood regeneration. Subsequent thinnings would favor oaks and hickories over pines. It is estimated that an average of **125 acres per year** will be treated this way.

Approximately **35% of shortleaf pine stands (FT=32) that are over 60 years old** (planted before 1946) and on sites best suited for oak-hickory will be harvested (probably

by two-aged shelterwood), site prepared (probably by growing-season burning), and planted with shortleaf pine seedlings on a wide spacing (up to 200 trees per acre) if necessary to supplement natural hardwood regeneration. Subsequent thinnings would favor oaks and hickories over pines. It is estimated that an average of **41 acres per year** will be treated this way.

Thinning to Enhance Forest Health

Loblolly pine plantations become very overcrowded by the time they are 15-25 years old, depending on initial spacing of planted trees. On the Uwharrie NF, most loblolly stands planted by the Forest Service were at densities between 450 and 550 trees per acre. But on recently acquired lands where planting occurred under private ownership, planting densities were often 680 trees per acre. In recently examined loblolly plantations, total pine stocking level, indicated by basal area, ranged from 120 to 220 ft^2/ac. Anything above 100 ft^2/ac is considered at high risk for infestation by Southern pine beetle (SPB), a native insect known to kill large areas of pines in certain years. Thinning stands back to 80-90 ft^2/ac or below significantly reduces the risk of mortality from SPB. It also reduces wildfire risk by removing intermediate and suppressed trees before they die from competition with taller trees. Thinning promotes diversity of understory plants by increasing sunlight reaching the forest floor, and it increases diameter growth of residual stems. Thinning also reduces the risk of stem diseases like fusiform rust by removing trees that are infected with the disease.

In loblolly pine stands, it is estimated there will be an average of 350 acres of thinning per year, with thinning occurring on a 20-year cycle, starting around age 20. In the outer 70 feet of 100-foot-wide streamside zones, once they are thinned to a lower residual basal area, they will not need to be thinned for another 35-40 years. However, for a given plantation in the first and third thinnings, the streamside zones will be entered and thinned more heavily; while in the second thinning (two decades from now), the streamside zones will not be entered.

In existing oak-hickory stands, it is estimated there will be an average of 25 acres of thinning per year to lower stand density to encourage desirable native plants, to influence tree species composition, and/or to remove damaged, dying, and diseased trees.

In existing longleaf pine stands, it is estimated there will be an average of 25 acres of thinning per year to lower stand density to encourage desirable native plants and to increase diameter growth. The amount of thinning is projected to increase in future decades as stands advance in age and more acres of longleaf pine are established. Thinnings are projected to occur at ages 25, 45, and 65 years.

<u>Vegetation Management Requirements at the Project Level</u> – This plan makes the general determination about National Forest lands that are suitable/not suitable for timber harvest and timber production. Final decisions about a proposed project that involves timber harvest are made at the project level. In making this determination, the following factors must be evaluated at the project level and documented in the project or case file (Reference FSH 1909.12, Chapter 61).

- A determination must be made that the project will not cause irreversible damage to resources such as soil productivity or watershed condition, and….
- That the area can be adequately re-stocked according to the plan's desired conditions for achieving objectives, and…
- In the case of regeneration harvest, stands should generally have reached culmination of mean annual increment (CMAI). (Note that the themes of this forest plan have to do with restoration of ecosystems, and therefore, are not proposing regeneration harvests, per se.)