Indiana Department of Natural Resources
Division of Forestry
DRAFT
RESOURCE MANAGEMENT GUIDE

State Forest: Harrison-Crawford
Forester: John Segari

Compartment: 02 Tract: 02
Date: __8/10/2012 _

INVENTORY SUMMARY

Number of stands: **3**
Permanent Openings: **0.0 ac**
Tract Acreage: **85**
Average Basal Area: **109 sq. ft/ac**

Est. Annual Growth: 200 bd. ft/ac/yr*
Est. Cutting Cycle: 13-18 yrs*
Site Index: **68** (for upland oaks)

Table 1. Tract 202 Inventory Summary

Species	Harvest		Leave		Total	
	Total	Per Acre	Total	Per Acre	Total	Per Acre
Yellow poplar	57,270	674	37,310	439	94,580	1,113
Black oak (total)	38,710	455	61,340	722	100,050	1,177
-quality	4,490	53	11,920	140	16,410	193
White ash (total)	30,600	360	14,320	168	44,920	528
-quality	0	0	5,890	69	5,890	69
White oak (total)	26,230	309	116,190	1,367	142,420	1,676
-quality	3,250	38	31,530	371	34,780	409
Pignut hickory	23,150	272	10,850	128	34,000	400
American beech	17,300	204	0	0	17,300	204
Sugar maple	13,470	158	14,100	166	27,570	324
Shumard oak	9,630	113	19,980	235	29,610	348
Northern red oak	9,050	106	50,270	591	59,320	698
-quality	0	0	3780	45	3780	45
Chinkapin oak	5,000	59	4,400	52	9,400	111
Ailanthus	1,590	19	0	0	1,590	19
Scarlet oak	1,230	14	2,030	24	3,260	38
Blue ash	1,070	13	0	0	1,070	13
Blackgum	990	12	0	0	990	12
American sycamore	0	0	14,180	167	14,180	167
Bitternut hickory	0	0	3,160	37	3,160	37
Black walnut	0	0	2,620	31	2,620	31
Shagbark hickory	0	0	28,480	335	28,480	335

Silver maple	0	0	2,220	26	2,220	26
Total	**235,290**	**2,768**	**381,450**	**4,488**	**616,740**	**7,256**

Location

The PLSS description is part of T4S R1E Section 1. The tract is less than a mile west of Leavenworth, IN. It is south of Highway 62 across from the Leavenworth Memorial Gardens. It is north of Indiana Hollow Rd.

General Description

This tract covers approximately 85 acres of southerly facing slopes. It has three covertypes. Oak-hickory covers 65 acres, mesic hardwoods covers 13 acres, and bottomland hardwoods account for another 7 acres. The tract has a ledge of limestone that separates an upper slope from lower slope. This slope has several rock outcroppings. These stands will be described briefly below and in more detail in the Management section.

Stratum 1

Oak- Hickory

This covertype covers approximately 76% of the tract acreage. This tract is over stocked (105%) with 7,060 bd.ft to the acre. This type is found on the mid to upper slopes and is dominated by various oak species which account for 76% of the volume. Most of the timber here is small to medium sawtimber. There are pockets of larger timber as well as old openings. The timber is generally of good quality, with approximately 87 Mbf of timber being inventoried as quality.

Stratum 2

Mesic Hardwoods

This tract covers approximately 15% of the tract acreage. This tract is fully stocked (97%) with 7,499 bd.ft to the acre. It is found in the two drainages of the tract. It is dominated by yellow poplar, white ash, sugar maple, northern red oak, and beech. These species account for 87% of the volume in the tract. The trees here are medium sized and of medium to good quality. There is a large amount of Ailanthus in this covertype that needs to be controlled.

Stratum 3

Bottomland Hardwoods

This tract covers approximately 8% of the tract acreage. It is located in the bottomland at the southern corner of the tract near Indian Hollow Rd. This covertype is a sparsely stocked (25%) old field area that is dominated by large sycamore, yellow poplar, and some black walnut. The area is too wet to be harvested and is carpeted with Japanese chaff flower and stinging nettle.

History

This area was acquired in 1944 (deed 131.127) from a Mr. Elbert Ewing. There have been two prior inventories and subsequent managed sales in this tract. In 1973, there was a total volume of approximately 61 Mbf. The following year 10,683 feet of black walnut logs were sold (some likely came from 203). An inventory in 1987 indicated a total volume of 361

Mbf. A harvest in 1988 removed 170 Mbf. This may have included the portion of tract 203 north of Indian Hollow Rd. but there is no way to differentiate the volume. The harvest was yarded out through the privately owned field to the north of the tract.

Landscape Context

The dominant land use within a 5 mile radius is forests and crop fields. The town of Leavenworth is located within a mile of the tract. Development and management trends in this location include housing development. The nearby private forestland has recently been subdivided and is up for sale.

Geology, Soils, and Hydrology

This tract is dominated by a broad north-south ridge with 2 side drainages. There are several significant limestone outcroppings.

Soils

The following soils cover 95% of the tract.

Tipsaw-Adyeville Complex, 42 acres

The Tipsaw series consists of moderately deep, somewhat excessively drained soils. They formed in loamy residuum from sandstone with shale and siltstone. The surface is a dark grey very fine sandy loam about 2 inches thick. The subsurface horizon is also a very fine sandy loam about 3 inches thick. The subsoil is 15 inches is a fine sandy loam and the last 20 inches is a loam. The bedrock consist of a weakly cemented and moderately cemented sandstone with shale, siltstone.

Corydon Silt Loam, 39 acres

The Corydon series consists of shallow, well drained soils that formed in as much as 8 inches of loess and in the underlying limestone residuum. The Corydon soils are on hills underlain with limestone. The surface horizon is 8 inches of a silt loam. The subsoil is 9 inches of clay. The bottom of the profile is unweathered bedrock.

Soil concerns

These soils have the same concerns as most other soils; erodability on slopes and compaction.

Hydrology

There are several karst features located in this tract including sinkholes and limestone outcrops. The drainage of the tract goes directly to the Ohio River.

Access

External access to this tract is limited. While Indian Hollow Rd. is to the south, it is too steep or too wet to provide access for heavy equipment. The only viable access is through the neighbor to the north. Trucks could access across the corn field. This entrance was used during the last harvest in 1988. Internal access is fair. The majority of the tract is accessible but the limestone outcropping limits movement from the upper to the lower slopes. There are gaps that can be used but these will be heavily disturbed and prone to soil erosion if BMP's are not followed.

Boundaries

The boundaries of this tract are fairly well monumented. The southeast boundary is the eastern drainage of Indiana Hollow. The southwest boundary is the deep drainage north of Indian Hollow Rd. The western line is monumented with fence remnants terminating at the NW corner of section 1. This corner is monumented by a Crawford County surveyor's set monument. The north line is evidenced by old fencing running east from the previously mentioned monument across the top of the ridge.

Wildlife

This tract represents typical upland forest habitat, in addition to a component of bottomland hardwood forest. Consequently, it likely receives use from a typical assemblage of common game and nongame wildlife species such as white-tailed deer, wild turkey, squirrels, songbirds, snakes, box turtles, and others. Hard mast food sources are provided by the oak hickory stand.

Snags were tallied in this inventory for potential uses by wildlife. The following tables summarize guidelines and actual data with regard to the new strategy for consideration of the Indiana bat. The categories of optimal and maintenance guideline numbers were broken down by size class subcategory, but are inclusive of size classes above that. In other words, the maintenance guideline for number of snags in the 6" class and larger was 4 per acre, but of that number, 0.5 per acre should be 20"+ and 3 should be 10'-18" or greater. This was done because larger trees are more valuable and less common, and were given the greater importance when calculating total guideline numbers.

Guidelines for preferred density of live and dead trees for use by Indiana bat:

# of live trees per acre	Guidelines Maintenance	Tract 0202 actual present
12"-18" DBH class	6	24.6
20" DBH and greater	3	5.8
Total	9	30.4

# snags per acre	Guidelines Maintenance	Guidelines optimal	Tract 0202 actual
6" - 8" DBH class	1	1	1.9
10"-18" DBH class	2.5	5	4.2
20" DBH and greater	0.5	1	1.4
Total	4	7	7.5

These numbers show that both live tree densities as well as snag densities meet optimal guidelines on this tract except in the 10-18" DBH class. However, all classes meet maintenance guidelines and it is likely that additional snags in the medium size class will be created by post harvest TSI activities.

Rare, Threatened, and Endangered Species

A Natural Heritage Database Review is part of the management planning process. If Rare, Threatened or Endangered species were identified for this area, the activities prescribed in this guide will be conducted in a manner that will not threaten the viability of those species.

Exotic Species

Ailanthus altissima, tree of heaven, was found on the western boundary near Indian Hollow Rd. This tree should be controlled as soon as possible.

Japanese Chaff Flower, *Achyranthes japonica,* is found in the bottomland in large quantities. The species is abundant but mixed with native nettles and other lowland species.

Recreation

This tract does not currently have any established recreational facilities or amenities. There are some trails going in from adjoining property and the area is likely used for hunting by local residents, however no deer stands were found. Due to the limited size and steep slopes this area has very limited potential for developed recreation. Residents of Leavenworth have mentioned the idea of developing a trail system throughout Compartment 2.

Cultural Resources

Cultural resources may be present, but their location(s) are protected. Adverse impacts to significant cultural resources will be avoided during management or construction activities

Management Prescription

Stratum 1: Oak-Hickory

Current condition:

This stratum is found on the upland and upper slopes of the tract and comprises 53% of the area and 55% of the volume of the tract. This covertype is dominated by small to medium sawtimber white, black, and red oak with pignut hickory. The inventory is summarized in Table 2 with species composition detailed in Table 3. Currently the stratum is just below the 100% stocked condition.

Table 2. Oak-Hickory Inventory Summary

STAND: Oak-Hickory		**ACREAGE: 45**	
	CUT (bd ft)	**LEAVE** (bd ft)	**TOTAL** (bd ft)
Volume/acre	2,446	4,614	7,060
Volume total	158,990	299,910	458,900
Basal area/acre	52	62	114
Trees/acre	209	121	330

Table 3. Oak-Hickory Volume by Species

Species	CUT (bd ft/ac)	LEAVE (bd ft/ac)	TOTAL (bd ft/ac)
White oak	372	1224	1596
-quality	53	510	563
Black oak	503	799	1302
-quality	73	159	232
Northern red oak	146	541	687
-quality	0	61	61
Pignut hickory	375	175	550
Shagbark hickory	0	461	461
White ash	304	65	369
-quality	0	95	95
Shumard oak	0	248	248
-quality	156	76	232
Sugar maple	152	58	210
Chinkapin oak	81	71	152
Yellow poplar	128	0	128
American beech	68	0	68
Scarlet oak	20	33	53
Silver maple	0	36	36
Blue ash	17	0	17
Total	**2,448**	**4,612**	**7,060**

Desired future condition:
The objective of this stratum is to provide for multiple economic and ecological services specifically a quality hardwood timber stand, dominated by oak and hickory, while providing hard mast and early to mid-seral habitat for wildlife and providing a natural filter for Ohio River watershed.

Silvicultural Prescription:
In order to meet the desired future condition, a harvest is recommended. Oaks and hickories are not only the best species for supplying hard mast but are also the best quality timber group that is occurring in this covertype. The inventory data, approximates a harvest volume of 2,448 bd ft/ac . Most of this would be removed under a single tree selection routine with larger regeneration openings targeting groups of low-grade trees or multiple large trees growing together. When possible, selection should also favor releasing future crop trees. The residual stand should be heavier to numbers of white and northern red oaks, with a lesser component of other oak and some hickory species, as well as a minor component of mesophytic species (6%). This provides a stand of longer-lived higher-quality white oak that allows for more management options into the future. Openings created by group selection areas will be used to ensure the supply of oak into the future as well as maintain the presence of early seral habitat. Openings should be large enough to achieve regeneration of desirable species and should coincide with the release of advance regeneration when possible. Stocking in this covertype would be reduced from 100% to approximately 55%. This reduction slightly below the b-line will allow some resources to be shifted to the ground layer and understory allowing for oak regeneration to establish and/or release. Maintenance of a fully stocked stand would increase volume yields, but would make oak regeneration difficult into the future. Stocking between regeneration openings will remain in fully stocked range.

Uneven-aged management requires that trees in all size classes be removed during harvesting to ensure regeneration. Given that many of these will be un-merchantable, post harvest TSI

will be needed to ensure that poorly-formed, low-quality trees are removed and treat the understory to eliminate shade tolerant species in favor of oaks and other more desirable species. The girdling of large cull trees will also help to replace any large snags that are accidentally felled during harvest operations as well as increase the downed woody material present and provide invertebrate and small vertebrate habitat. Pre-harvest TSI will also be needed to control ailanthus that has been found.

Stratum 2: Mixed Mesic Hardwoods

Current Condition:

This stratum is found on the toe-slopes of the northern parcel and comprises 15% of the area and 16% of the volume. This covertype is dominated by small to medium sawtimber Yellow poplar, American beech, and sugar maple. The inventory is summarized in Table 4 with species composition detailed in Table 5. Currently the stratum is just below the 100% stocked condition. This site is certainly a more productive covertype than the oak-hickory. The stratum is experiencing drought damage to the poplar and has a large occurrence of ailanthus.

Table 4. Mixed Mesic Hardwoods Inventory Summary

STAND: Mixed Mesic-Hardwoods		**ACREAGE: 26**	
	CUT (bd ft)	**LEAVE** (bd ft)	**TOTAL** (bd ft)
Volume/acre	4,080	3,420	7,500
Volume total	53,040	44,460	97,500
Basal area/acre	68	39	107
Trees/acre	218	95	313

Table 5. Mixed Mesic Hardwoods Volume by Species

Species	CUT (bd ft/ac)	LEAVE (bd ft/ac)	TOTAL (bd ft/ac)
Yellow poplar	2,397	1,374	3,771
White ash	574	214	788
Sugar maple	197	509	706
American beech	635	0	635
Northern red oak	0	634	634
White oak	0	436	436
Bitternut hickory	0	154	154
Black oak	152	0	152
-quality	0	100	100
Ailanthus	77	0	77
Blackgum	48	0	48
Total	**4,080**	**3,421**	**7,501**

Desired Future Condition:

The objective of this stratum is to provide for multiple economic and ecological services specifically a quality hardwood timber stand, dominated by mid- and late-seral species, while providing hard mast and mid to

late-seral habitat for wildlife and providing a natural filter for the Ohio River watershed.

Silvicultural Prescription:
In order to meet the desired future condition, a harvest is recommended. No action would result in an increase in the abundance of ailanthus and poorly formed trees in the stand. The poplar is dying out and should be harvested to capture the mortality. This site is more productive than the oak-hickory type discussed above, attempting to manage for oak would be futile. More appropriate would be to manage for a mixture of mesic species such as sugar maple, northern red oak, and beech while maintaining the more intolerant white oak since these are the best quality timber group that is appropriate to this site. The inventory data, approximates a harvest volume of 3565 bd ft/ac. This would leave more than 4000 bd ft/ac on the residual stand. The heavier harvesting in this stand as compared with the oak hickory type is due to the high productivity of the site. The majority of the harvest volume is in the form of poplar. This is because the species is being hit hard by the current drought. Much of the beech will be removed during the harvest and post harvest TSI as the current component is mostly culls and poorly formed individuals. This will provide snag habitat and release higher quality crop trees.

Most of this would be removed under a single tree selection routine with larger group openings targeting groups of low-grade trees or multiple large trees growing together. However, multiple tree selection should be used to encourage higher stem quality in saplings by releasing better formed individuals of desirable species. When possible, selection should also favor releasing future crop trees. The residual stand should still be dominated by yellow poplar but with an increase in oak importance. This provides a stand of longer-lived higher-quality poplar, sugar maple, and white oak that allows for more management options into the future. Removing all the harvestable material would result in a reduction to approximately 35%. The prescribed harvest would reduce stockingto approximately 50%, but remain at fully stocked levels between regeneration openings. This prescription means that poorly formed trees of desirable species should be left to maintain densities that will encourage quality formed reproduction. The reduction to 50% will capture poplar mortality and eliminate the ailanthus.

Uneven aged management requires that trees in all size classes be removed during harvesting to ensure regeneration. Given that many of these will be un-merchantable, post harvest TSI will be needed to ensure that poorly-formed, low-quality trees are removed and treat the understory to eliminate shade tolerant species in favor of oaks and other more desirable species. The girdling of large cull trees will also help to replace any large snags that are accidentally felled during harvest operations. This will help provide additional habitat for tree dwelling species such as owls, raccoons, squirrels, and woodpeckers. As these snags fall over time they will increase the downed woody material present and provide invertebrate and small vertebrate habitat. Pre-harvest TSI will also be needed to control ailanthus that has been found.

Stratum 3: Bottomland Hardwoods

Current condition:
This stratum is found on the toe slopes of the tract and comprises 8% of the area and 11% of the volume of the tract. This covertype is dominated by medium to large sawtimber silver maple, sycamore, and poplar. The inventory is summarized in Table 2e 8 with species

composition detailed in Table 9. Currently the covertype is just below the 30% stocked condition using bottomland hardwoods stocking charts. There is no tree regeneration occurring. The floor of the area is carpeted with false nettle, stinging nettle, and Japanese Chaff flower. There is also a large amount of rutting and compaction from local ATV use.

Table 8. Bottomland Hardwoods Inventory Summary

STAND: Bottomland Hardwoods		**ACREAGE: 20**	
	CUT (bd ft)	**LEAVE** (bd ft)	**TOTAL** (bd ft)
Volume/acre	0	10,018	10,018
Volume total	0	70,126	70,126
Basal area/acre	0	70	70
Trees/acre	0	24	24

Table 9. Bottomland Hardwoods Volume by Species

Species	CUT (bd ft/ac)	LEAVE (bd ft/ac)	TOTAL (Bd ft/ac)
American sycamore	0	5,505	5,505
Black walnut	0	1,019	1,019
Yellow poplar	0	3,494	3,494
Total	0	10,018	10,018

Desired future condition:
The objective of this stand is to provide for ecological services specifically, water filtration and sediment control for the Ohio River, quality bottomland forest habitat, and a quality hardwood timber stand.

Silvicultural Prescription:
Disagree- Due to current site conditions and stocking levels no harvest is recommended at this time. The soil is often too wet to support machinery. Long term maintenance of a quality hardwood forest will require the establishment of tree regeneration. The Japanese chaff flower should be evaluated for treatment feasibility and treated according to the most current methods of dealing with the problem in order to allow trees to establish. ATV access should be limited by possibly felling trees across trails but the location is so extensive that it will not be easy.

Tract summary

Summary of silviculture throughout the tract:
Due to the current condition of the stand, a medium level improvement harvest could be undertaken in this tract at anytime. Overall stocking should be reduced from the current 100% to approximately 55%. This is accomplished by a combination of crop tree release, cull removal, and converting some of the mature oak hickory back to early successional stages through regeneration openings. This would produce a sale volume of approximately 200 Mbf or about 2,250 board feet per acre and leave about 417 Mbf board feet or 4,900 board feet per acre. It is recommended that Timber Stand Improvement (TSI) be undertaken in this tract prior to the harvest to control the ailanthus. Post harvest TSI will also likely be needed to accomplish a variety of tasks, including completion of any marked openings.

Effect of Prescription on Tract properties:

Soils: The management activities prescribed in this plan should have minimal impact on soils in this tract. Some soil disturbance is likely during harvesting but this should be confined to landings and main skid trails. These areas should be properly closed out according to Indiana's BMPs to minimize the impact of management on soils.
Hydrology: Hydrology should not be permanently affected by management on this tract. Water quality and yield should not be altered if BMPs are followed during harvest.
Wildlife: Wildlife in this tract should not be adversely affected. No rare threatened or endangered species will be adversely affected during the planning period. Snags and coarse woody debris should remain at viable levels in the stand and should continue to provide habitat for the Indiana bat. No action in this tract would result in the reduction of a hard mast source for small mammals and birds. Managing to recruit newly established or released oaks and hickories will help to ensure that this important food source is available into the foreseeable future.

Wildlife Discussion from Ecological Resource Review: 1.1 Additionally, management activities involving a timber sale should not affect this habitat long-term from the perspective of any wildlife utilizing it due to the maintenance of a forested habitat on the tract. Creation of regeneration openings will create early successional habitat that will be beneficial to certain groups of wildlife dependent upon this habitat. Likely, early successional habitat created with such management will also benefit a wider segment of wildlife species that preferentially utilize such habitat for feeding and cover more so than later successional stage habitat.

1.2 While this tract borders the Ohio River, there are no real riparian areas that will be adversely affected by the recommendations of this plan. This tract, and compartment as a whole, represents the largest contingent of contiguous forest within a mile. As such it is likely utilized more by wildlife than the surrounding area. The development pressures on the adjacent woodland will only increase the importance of maintaining a forested setting here in the future. The habitat on this tract in the context of the surrounding landscape does represent a component that would be used more preferentially or exclusively by wildlife for traveling or dispersion, as riparian habitat might be, or as forest in a non-forested landscape might be. This travel may be disrupted in the short-term but long-term, the area will remain forested and provide dispersal and travel corridors into the future.

1.3 This tract represents a somewhat disjointed component of contiguous forest. It is possible that forest management activities might disrupt forest interior species by creating temporary edge habitat for generalist species to "invade" the area. This would possibly occur if regeneration openings were put in place that offered a habitat preferred by such generalist species which might move in and start using such habitat. In the context of the surrounding landscape, this tract represents a medium- sized chunk of forest in a matrix of surrounding forest and agricultural land.

Indiana Bat

Guidelines for preferred density of live trees for use by Indiana bat:

# of live trees per acre	Guidelines	Tract 0202	Planned	Planned

	Maintenance	present	Harvest	Residual
12"-18" DBH class	510	2098	1007	1091
20" DBH and greater	255	500	116	384
Total	765	2598	1123	1475

As noted above, snag counts for all size classes are above the maintenance levels with only the middle size class not meeting optimal guidelines. Management activities will not intentionally remove snags, with a few exceptions of large recently dead trees or storm damage when possible, so the timber sale will not negatively impact that component significantly. Some snags may be felled during harvest operations if they present a physical hazard to field personnel. The table above shows that live tree densities will also not be below the recommended levels.

Recreation: Given the limited amount and type of recreation that is carried out on this tract, this resource will be temporarily affected. Hunting opportunities should be improved be the maintenance of early successional habitat and the recruitment of hard mast producers such as oak and hickory to provide deer and small mammal browse. ATV trails should be closed off in the bottomland area. Hiking trail access could be increased if the town of Leavenworth produces a proposal that is acceptable.

Landscape: Landscape forest patterns will remain similar to the current situation due to this tract being kept in a forested condition.

Proposed Activities Listing:

Proposed Activity	**Proposed date:**
Treat ailanthus	2012-13
Evaluate Japanese chaff flower	2013-14
for possible treatment	-
Contact landowners for access	2012-13
Mark sale	2013-14
Sell timber	2013-14
Post harvest tsi	2014-15
Monitor regeneration openings	2020
Re-inventory	2031
Write new management plan	2031

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Growth Calculations

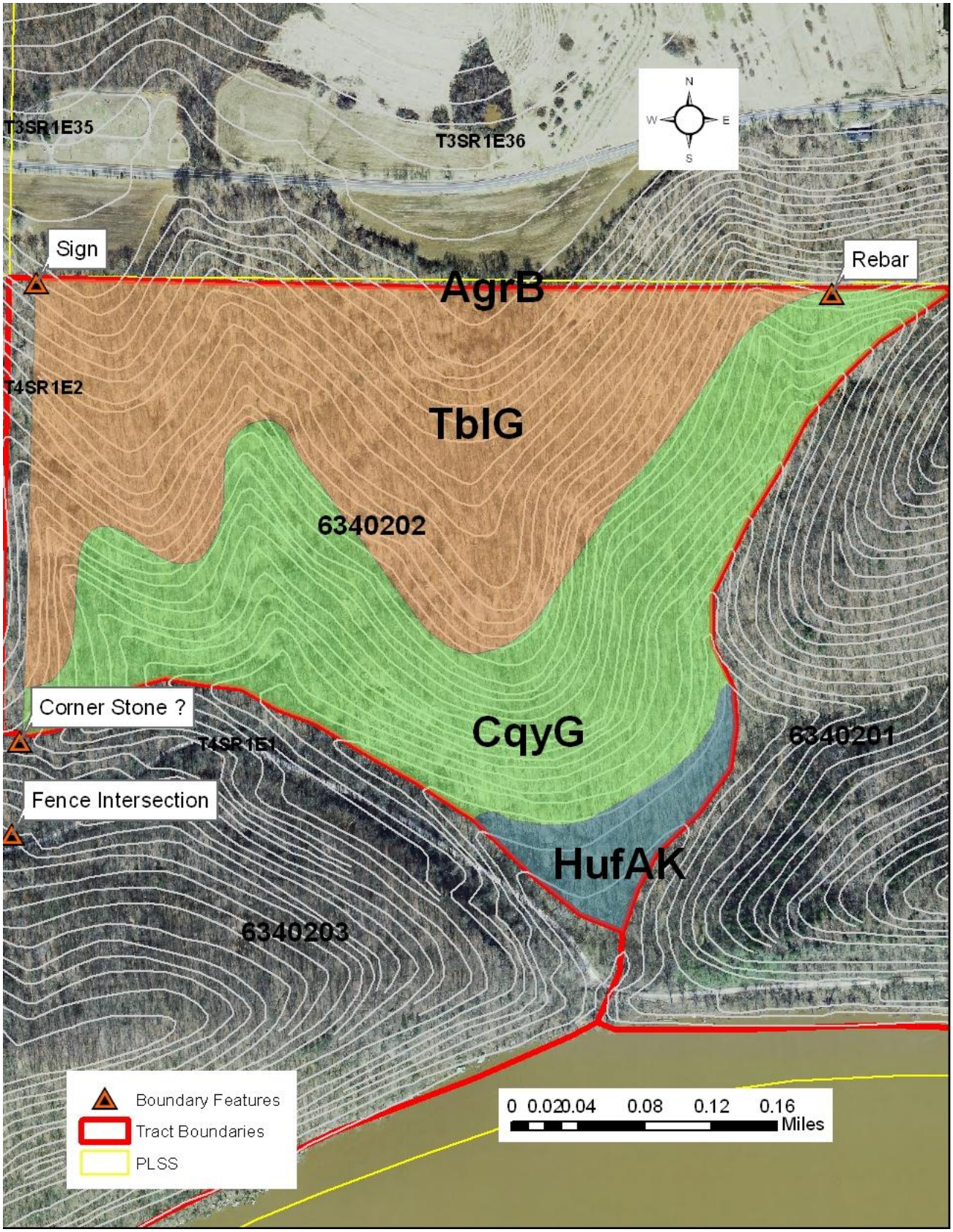
Growth calculations are based on successive inventories. Growth is calculated as the increase in growing stock between two periods.

1975 inventory	69,371 bdft
1975 removals	10,863 bdft
1975 residual	50,528 bdft
1987 inventory	377,188 bdft
1988 removals	170,425 bdft
1988 residual	206,763 bdft
2012 inventory	616,750 bdft

In the period from 1975 to 1987 the growth was 320 bdft /acre /year.
In the most recent period, 1988 to 2012, the growth was 200 bdft /acre /year.

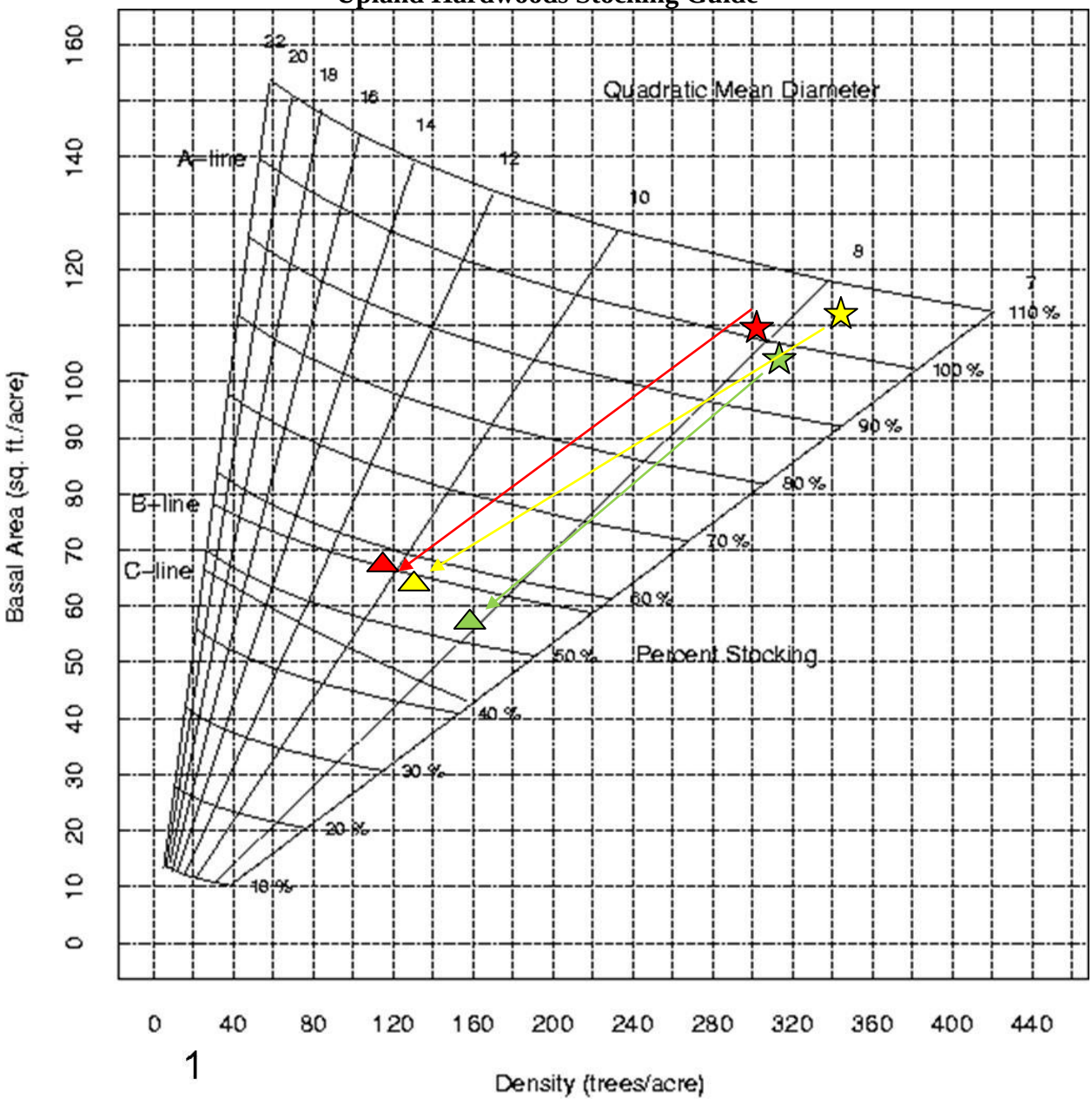
It is not uncommon for the Annual increment to decrease as an even aged stand ages. Going forward we can expect to see a more uniform yield as the tract as a whole moves into an uneven age structure.

Tract 202 Aerial Photo (2005)
with soils and boundary features



Tract 202 Stocking Charts

Upland Hardwoods Stocking Guide



☆ **Indicates the current stocking condition**

△ **Indicates the proposed (post harvest) condition**

Indicates the Tract Total

Indicates the Mixed Mesic Hardwood covertype (shows proposed harvest amounts, not inventory amount)

Indicates the Oak-Hickory covertype

Bottomland Hardwood Stocking Guide