



I L L I N O I S

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

PRODUCTION NOTE

**University of Illinois at
Urbana-Champaign Library
Large-scale Digitization Project, 2007.**

Performance Report

Job Progress Report

State: Illinois

Project No.: W-66-R-20

Project Type: Research

Project Title: Cooperative Wildlife Research

Sub-Project No.: VI; Title: Illinois Squirrel Investigations

Period Covered: 1 July 1979 - 30 June 1980

Study No. VI-B; Title: Artificial Nest Boxes for Fox Squirrel Management in the Immature Forests of Illinois.

Study Objectives:

- a. To determine the effects of nest boxes on fox squirrel densities, survival, reproduction, and physical conditions.
- b. To determine what characteristics of the forest environment influence fox squirrel utilization of nest boxes.
- c. To determine the effects of tree seed crops on fox squirrel survival, breeding rates, and physical condition.

Job No. VI-B-9; Title: Management potential of nest boxes for fox squirrels.

Objectives: To analyze data and prepare reports and manuscripts on the use and management potential of den boxes for fox squirrels.

(a) Activity: This study has been underway since 1971 on 2, 60-acre upland hardwood tracts (Areas A & B), located on the Vermilion River Observatory in Vermilion County, Illinois. Nest boxes were placed first on Area A from March 1972 through September 1974 and then on Area B from October 1974 until June 1978. Both areas were livetrapped for 10-day periods twice each year, in October and May. Leaf nests were counted each November and March. We attempted to locate all tree cavities and to count all trees >12.7 cm dbh on each area. Field work was completed in June 1978. Work during the R-20 segment included completion of data coding, key punching data onto computer cards, and initiating data analysis.

A preliminary analysis of these data suggests that nest boxes have little or no effect on natality but they may improve the overwinter survival of adult males and subadult (6-10 months old) squirrels. The presence of nest boxes apparently has no effect on numbers of weaned young captured in spring or in fall or on the survival of recently weaned juveniles (<6 months old). We believe that social behavior (possibly agonistic behavior by adults toward adults of their sex and of adults toward juveniles of both sexes) is a more important regulator of fox squirrel population densities than the shortage of nest sites.

We have also been unable to demonstrate any tendency for squirrels to prefer nest boxes placed in any particular forest type.

- (b) Target Date for Achievement:
Completion of field work: 30 June 1978.
Completion of final report: 30 September 1981.
- (c) Date of Accomplishment: As indicated.
- (d) Significant Deviations: Data analysis requires additional time beyond the target date for a final report of 30 September 1979. Nest boxes were left in place on Area B for an additional year, until 30 June 1978, and this extension delayed data analysis. The new final report date is 30 September 1981.
- (e) Remarks: None.
- (f) Recommendations: None.
- (g) Cost: Federal - \$14,295; State - \$6,704; Total - \$20,999

Job No. VI-B-10; Title: Social behavior and its role in affecting nest box use by fox squirrels.

Objectives: To evaluate the effect of resident adults on breeding, reproductive success, and survival of resident and immigrant fox squirrels.

(a) Activity: Seven separate forested plots were utilized in this study. During fall 1979 we livetrapped and removed (1) all captured males from 2 plots (Allerton B and Busch), (2) all captured females from 2 plots (Allerton A and C), and (3) all captured fox squirrels from 1 plot (Allerton D). We monitored 2 woodlots, from which fox squirrels had not been removed, as controls (Trelease and Brownfield). Fox squirrels captured elsewhere were released on all of the experimental and control plots to serve as introduced "immigrants" (Table 1). Each study plot was retrapped during spring 1980 to determine recapture and reproductive rates of resident and introduced squirrels and the rates of recruitment of new squirrels.

Regardless of any prior removals, few of the released squirrels were recaptured on the same plots where they were released (Table 1). Apparently, most introduced squirrels dispersed shortly after release. Individuals which we have moved from one end of Allerton Park to the other (1-2 miles) homed within a few days after release. Previous experience with radiotelemetry also indicated rapid dispersal of translocated squirrels from release points. It was obvious that the use of translocated individuals as experimental immigrants was not a feasible means of testing hypotheses regarding the status of naturally occurring immigrants.

Recovery of resident fox squirrels by livetrapping on the plots from which males had been removed was higher (80%) than on the plots from which females had been removed (56%) and on the control plots (69%) (Table 2). Recovery of adult males and females was similar but higher on the treated (91%) than on the control (75%) plots. Recovery of young female fox squirrels may have been enhanced by removal of males, whereas survival of young males was not affected by either experimental treatment.

Reproductive rates of fox squirrels were low during fall 1979 and high during spring 1980 on both treated and control plots (Table 3). However, reproductive activity appeared somewhat higher on the experimental plots, especially those where females were removed. Unfortunately, sample sizes were low because most adult females had been removed as part of the treatment.

Recruitment of new fox squirrels onto the study plots was greatest where both males and females were removed (2.50/ha), intermediate where females were removed (1.24/ha), and least where only males were removed (0.75/ha) (Table 4). These data suggest that recruitment is limited by density of resident squirrels, particularly adult females, but to some degree by adult males. In effect, recruitment is density limited.

Although we could establish no clear relationship between reproduction and the experimental treatments, recovery and recruitment rates apparently were affected by the treatments. Increased rates of recovery of resident fox squirrels, especially young females, was most closely associated with removal of males whereas increased rates of recruitment were most closely associated with removal of females. Although preliminary, the results suggest that male

and female fox squirrels could limit total numbers in different ways--the adult females preventing immigration and adult males reducing resident survival. Why such relationships would evolve is at this time unknown. However, these observations suggest that an abundance of dominant adult male fox squirrels may prevent use of available shelter (including nest boxes) by subordinate (mainly young) females. When confronted by numerous adult males, females may tend to disperse or use less suitable shelter. Continuation of current procedures is necessary to clarify and substantiate the results presented and to gain further insights into how social behavior may affect nest box use.

(b) Target Date for Achievement:

Completion of field work: 30 June 1983.

Completion date for final report: 30 September 1982

(c) Date of Accomplishment: On schedule.

(d) Significant deviations: None.

(e) Remarks: None.

(f) Recommendations: Work during the next segment should continue as in the previous segment. However, Trelease and Brownfield were not fully suitable as control plots because their tree species composition, maturity and isolation differed markedly from the experimental plots. In the future we will not use Trelease and Brownfield and will try to find suitable controls at Allerton Park.

(g) Cost: Federal - \$14,295; State - \$6,704; Total - \$20,999

Study No. VI-D; Title: Effects of Timber Management Practices on Gray and Fox Squirrels - Selection Cutting.

Study Objectives:

- a. To determine in late winter the effects of the selection type timber harvest on density, condition, survival, fecundity, and movement of squirrels.
- b. To determine the effects of selection cutting on numbers of potential squirrel dens.
- c. To determine the effects of selection cutting on the availability of squirrel foods.
- d. To determine the effects of removal of cull trees on the availability of tree dens.
- e. To develop criteria for selective cutting that would minimize its adverse effects on squirrels.

Job No. VI-D-7; Title: Data analysis and recommendations for management.

Objectives: To make recommendations concerning selective cutting and removal of cull trees so as to minimize the effects of these practices on squirrels.

(a) Activity: The final report for this study was written, reviewed, and submitted for publication during the R-20 segment. The abstract of this report can be found in Appendix I.

(b) Target Date for Achievement: 30 September 1981.

(c) Date of Accomplishment: 30 September 1980.

(d) Significant Deviations: None.

(e) Remarks: None.

(f) Recommendations: When stands are marked for a selection cut, a minimum of 6-8 oaks and the same number of hickories/acre should be retained as food trees. This number and size should be ≥ 25.4 cm dbh, to maintain fall densities of 1 squirrel per acre (a high density). Hickories often comprise <10% of the overstory in many midwest forests. When forests with few hickories are marked for selection cuts, as many seed bearing hickories as possible should be saved from cutting where squirrel abundance is an important management objective.

All trees to be retained should be selected during good seed years so that proven seed producers are saved. A good mix of tree species will minimize the possibility of a seed failure due to late spring frosts. We found that removals of up to 55% of the basal area of merchantable trees did not reduce squirrel numbers, at least for 1-2 years after logging, but removals greater than 40% of the merchantable volumes may be expected to reduce the number of breeding females the year of logging.

For gray squirrels, we believe that retaining 2-3 trees per acre with suitable cavities for nesting is a reasonable guide when planning selection cuts or cull tree removal. Fox squirrels need fewer cavities than grays, perhaps 1-2 per acre. Sufficient cavities should always be retained to provide shelter for those other wildlife species that nest and shelter in tree cavities.

In Midwest forests, black oak, maples, basswood, cottonwood, beech, and elm readily form cavities and if present, should be favored for present and future cavity formation.

(g) Cost: Federal - \$11,436; State - \$5,363; Total - \$16,799

Study No. VI-F; Title: Silviculture of Hickory (Carya spp.) in Clear-cut Hardwoods.

Study Objectives:

- a. To determine the fate of hickory seedlings, seedling sprouts, and stump sprouts after clear-cutting.
- b. To determine if hickory can be increased and maintained by culture in clear-cut hardwood stands.

Job No. VI-F-2; Title: Fate of hickory reproduction after clear-cutting.

Objective: To determine the survival and growth rate of different types of hickory reproduction after clear-cutting under natural conditions (no treatment).

(a) Activity: This job was inactive during the R-20 segment, due to the work load of other studies. We reported on two areas in the R-16 progress report.

(b) Target Date for Achievement:
Completion date for field work: 30 June 1981.
Completion date for final report: 30 September 1981.

(c) Date of Accomplishment: As amended below.

(d) Significant Deviations: We were not able to locate suitable study areas that had been cut in the same year. Thus in order to sample hickories of the same age on different areas, we had to wait a year for two areas to reach the desired age class. These two areas must be remeasured after the 1980 growing season. Therefore the final report will not be submitted until 30 September 1981.

(e) Remarks: This study is an attempt to provide foresters and wildlife managers with guidelines for managing hickory for wildlife.

(f) Recommendations: None.

(g) Cost: None.

Job No. VI-F-3; Title: Responses of Carya spp. to stem release.

Objective: To determine the response of various types of hickory reproduction to release cutting applied 7 and 15 years after clear-cutting.

(a) Activity: In 1974 and 1975 seedling sprouts of hickory were selected for release on good (site index for black oak 70 +), intermediate (site index 55-70), and poor (site index 55) sites in stands clearcut 7 and 15 years ago. Stems were paired by height and one stem of each pair, selected by a coin flip, was released by cutting all competing stems.

The 7-year-old clearcut stands were selected on the Zaleski Area, Vinton County, Ohio, and on the Snake Hollow Area, Athens County, Ohio. Twenty-four pairs of hickory stems (pignut, Carya ovalis, C. glabra; mockernut, C. tomentosa; and shagbark, C. ovata) were tagged on the Zaleski Area and 22 pairs of hickory stems were marked on the Snake Hollow Area. One of each pair of stems was released from the competition of surrounding woody vegetation. We recorded the man-hours required to release these hickory stems and the type of vegetation removed.

Three 15-year-old clearcut areas were selected on the Vinton Furnace Experimental Forest, Vinton County, Ohio. These clearcuts were located on a good site, an intermediate site, and a poor site. Seven pairs of the previously mentioned species of hickory were marked on the good site, 18 pairs were tagged on the intermediate site, and 15 pairs were marked on the poor site. One of each pair of hickory stems was released from competing woody vegetation.

In fall 1977, we remeasured our hickory stems in the 7-year-old Zaleski Area and the three 15-year-old Vinton Areas and reported on the results in the R-18 segment.

In fall 1979, after 5 growing seasons, we remeasured hickory stems in the 7-year-old Zaleski and in the 15-year Vinton clear-cuts (3). We found no significant differences in the growth in either stem diameter or height between released and control (no release) hickories in the 7-year-old clear-cut, and no differences in stems for pignut hickory in the 15-year clear-cuts. Released mockernut hickory stems were found to be significantly ($p < 0.01$) larger in diameter and significantly ($p < 0.04$) shorter than control stems in the 15-year cuts. However, a comparison of crown classes (vigorous free-to-grow crowns vs. those stunted, broken or dead) showed that release cutting improved crown vigor for all but shagbark hickories in the 7-year cut (Table 5).

Unfortunately, the requirement for light of hickories <20 years old are not documented. We did our best but obviously from the slow reponse of many of the released stems, we over released (provided too much light) for many of them. Reduction in apical growth shown by released hickories is apparently a normal response to increased light following release. Such a response has been reported for released stems of red oak (Quercus rubra), tuliptree (Liriodenron tulipifera), black cherry (Prunus serotina), and yellow birch (Betula alleghaniensis).

- (b) Target Date for Achievement:
Completion date for field work: 30 June 1981.
Completion date for final report: 30 September 1981.
- (c) Date of Achievement: on schedule.
- (d) Significant Deviations: none.
- (e) Remarks: none.
- (f) Recommendations: none.
- (g) Cost: Federal - \$3,028; State - \$1,010; Total - \$4,038

Job No. VI-F-4; Title: Response of Carya spp. stems to crown release.

Objective: To determine the response of 3.0- to 6.0-inch dbh hickory stems to complete crown release after clear-cutting.

(a) Activity: Sixty-six hickory poles (3-6 inch dbh) have been tagged, measured, and left standing in three recent clear-cuts (one made in 1974 and two made in 1975). Two of these clear-cuts were in the Hoosier National Forest, Indiana, and one was in the Wayne National Forest, Ohio. A total of 20 hickories were tagged and measured in the Snake Hollow clear-cut in Ohio, 25 hickories were tagged on the Frog Pond sale in Indiana, and 31 on the Pleasant View sale also in Indiana.

For each stem, we noted any logging damage, measured the trunk diameter 1 m from the ground, estimated the amount of crown available, recorded the slope position and site class, and attached a numbered metal tag to each tree.

In winter 1980, we remeasured our marked hickories in both Indiana clear-cuts. As shown in Table 6 half of the pignut trees and more than half of the shagbark hickories are either of low vigor or dead. Most of the low vigor or dead trees were badly suppressed or had suffered some damage during logging and thus probably were not good candidates for retention in the new stand. Apparently long suppressed hickory stems have difficulty in adjusting to the sudden changes in the environment associated with a clear-cut. On good sites, grapevines may pose an additional problem as the hickory stems left standing in the clear-cut provide a principal support for vines. Once in the crown, grapevines reduce crown vigor and may kill the tree.

(b) Target Date for Achievement:
Completion date for field work: 30 June 1981.
Completion date for final report - 30 September 1981.

(c) Date of Accomplishment: on schedule.

(d) Significant Deviations: none.

(e) Remarks: none.

(f) Recommendations: In 1981, we plan to remeasure marked hickory in the Snake Hollow (Ohio) and Pleasant View (Indiana) clear-cuts, 5 years postcutting. The final report for this study will be based on the response of hickories to 5 years of release from competition.

(g) Cost: Federal - \$2,859; State - \$1,341; Total - \$4,200

Study No.: VI-H; Title: Managing Forested Habitats for Squirrels in Illinois.

Study Objectives: To prepare guidelines for managing forested habitats for gray and fox squirrels in Illinois.

Job No. VI-H-1; Title: Literature search for a squirrel management bulletin.

Objectives:

1. To search the available literature for information dealing with squirrel ecology and forest management.

2. To formulate management strategies for gray and fox squirrels.

(a) Activity: A literature search was undertaken during the R-20 segment. Compilation of a bibliography was begun dealing with squirrel ecology and management.

(b) Target Date for Achievement:
Completion of work: 30 June 1980.

(c) Date of Accomplishment: on schedule.

(d) Significant Deviations: None.

(e) Remarks: None.

(f) Recommendations: None.

(g) Cost: Federal - \$4,288; State - \$2,011; Total - \$6,299

Job No. VI-H-2; Title: Preparation of a management bulletin.

Objective: To prepare a management bulletin titled "Managing forested habitats for gray and fox squirrels."

- (a) Activity: No activity during the R-20 segment.
- (b) Target Date for Achievement:
Completion of work: 30 September 1982.
- (c) Date of Accomplishment: on schedule.
- (d) Significant Deviations: none.
- (e) Remarks: none.
- (f) Recommendations: none.
- (g) Cost: none.

Study No.: VI-1; Title: Publication of Manuscripts and Reports.

Objective: To help defray the cost of publishing the manuscripts and reports resulting from project study investigations.

Job VI-1-2; Title: Publication of manuscripts and reports.

Objective: To help defray the cost of publishing the manuscripts and reports resulting from project study investigations.

(a) Activity: Three manuscripts were published (reprints appended) during the R-20 segment. These were:

Nixon, C.M. and R.W. Donohoe. 1979. Squirrel nest boxes - are they effective in young hardwood stands? The Wildlife Society Bull. 7:283-284.

_____, M.W. McClain, and R.W. Donohoe. 1980. Effects of clear-cutting on gray squirrels. J. Wildl. Manage. 44:403-412.

_____, _____, and L. P. Hansen. 1980. Six years of hickory seed yields in southeastern Ohio. J. Wildl. Manage. 44:534-539.

- (b) Target Date of Achievement:
As dictated by research accomplishments.
- (c) Date of Accomplishment:
As manuscripts are written and submitted for publication.
- (d) Significant Deviations: none.
- (e) Remarks: none.
- (f) Recommendations: none.
- (g) Cost: Federal - \$2,859; State - \$1,341; Total - \$4,200.

APPENDIX

Title: Initial responses of squirrels to forest changes associated with selection cutting.

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L. P. Hansen, Illinois Natural History Survey, Urbana 61801

Abstract: The 1 to 2-year post-cutting response of gray (Sciurus carolinensis) and fox (S. niger) squirrels to selection cutting without cull tree removal was studied on 3 hardwood tracts in Illinois. Logging removed 37%, 45%, and 55% of the basal area for trees ≥ 30.5 cm dbh on the 3 areas. Logging reduced the available shelter and food for squirrels but not to critically low levels. Logging had no apparent effect on squirrel densities, breeding rates, or the annual survival of marked adult males. Recovery rates for marked adult females were reduced ($P < 0.025$) the year when $>40\%$ of the merchantable volume was cut, but increased to precutting levels the following year. More squirrels were captured after logging than before logging on all 3 areas, possibly due to increased foraging by squirrels in logged areas.

Accepted for publication in: Wildlife Society Bulletin for 1981.


Prepared by:

Charles M. Nixon

Lonnie P. Hansen

Approved by:

William R. Edwards



Glen C. Sanderson

3 September 1980
Date

Table 1. Capture rates and manipulation of fox squirrel numbers on 7 study sites.

		Minimum Number (density #/ha)	Number Removed		Number Introduced		Number of Introduced Squirrels Recovered (%)	
			Male	Female	Male	Female	Male	Female
Allerton A	Fall, 1979	15(2.61)	0	7	8	5	0	0
	Spring, 1980	14(2.43)	-	-	-	-	-	-
Allerton B	Fall, 1979	21(1.83)	9	0	2	6	0	0
	Spring, 1980	18(1.57)	-	-	-	-	-	-
Allerton C	Fall, 1979	19(1.58)	0	8	8	5	1(0.13)	0
	Spring, 1980	18(1.50)	-	-	-	-	-	-
Allerton D	Fall, 1979	10(1.67)	6	4	0	0	-	-
	Spring, 1980	17(2.83)	-	-	-	-	-	-
Busch	Fall, 1979	31(2.25)	5 ^a	0	5	6	0	1(0.17)
	Spring, 1980	36(1.76)	-	-	-	-	-	-
Trelease	Fall, 1979	--	0	0	9	6	3(0.33)	0
	Spring, 1980	28(1.17)	-	-	-	-	-	-
Brownfield	Fall, 1979	--	0	0	4	7	0	1(0.14)
	Spring, 1980	fox 29(1.21) gray 21(0.88) total 50(2.08)	-	-	-	-	-	-

^aWe removed 26 males from Busch during spring, 1979.

Table 2. Recovery of resident adult (>1.0 years) and young (≤ 1.0 year) fox squirrels. A 6-month recovery rate had to be estimated for the control plots because they were not trapped during fall 1979.

Treatment Area	Proportion Recovered								
	Adult		Young				All		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Males Removed									
AB	---	7/7(1.0)	7/7(1.0)	0/1(0)	3/3(1.0)	3/4(0.75)	0/1(0)	10/10(1.0)	10/11(0.91)
Busch	3/3(1.0)	14/16(0.88)	17/19(0.89)	0/4(0)	5/6(0.83)	5/10(0.50)	3/7(0.43)	19/22(0.86)	22/29(0.76)
Total	3/3(1.0)	21/23(0.91)	24/26(0.92)	0/5(0)	8/9(0.89)	8/14(0.57)	3/8(0.38)	29/32(0.91)	32/40(0.80)
Females Removed									
AA	2/2(1.0)	---	2/2(1.0)	2/5(0.40)	0/1(0)	2/6(0.33)	4/7(0.57)	0/1(0)	4/8(0.50)
AC	5/6(0.83)	---	5/6(0.83)	1/4(0.25)	---	1/4(0.25)	6/10(0.60)	---	6/10(0.60)
Total	7/8(0.88)	---	7/8(0.88)	3/9(0.33)	0/1(0)	3/10(0.30)	10/17(0.59)	0/1(0)	10/18(0.56)
Experimental									
Total	10/11(0.91)	21/23(0.91)	31/34(0.91)	3/14(0.21)	8/10(0.80)	11/24(0.46)	13/25(0.52)	29/33(0.88)	42/58(0.72)
Controls									
Trelease*	7/9(0.75)	5/8(0.62)	12/17(0.68)	3/5(0.63)	2/3(0.57)	5/8(0.61)	10/14(0.71)	7/11(0.60)	16/25(0.66)
Brownfield*	8/11(0.74)	7/9(0.81)	16/20(0.80)	8/13(0.62)	6/12(0.53)	14/25(0.58)	17/24(0.71)	15/21(0.70)	32/45(0.70)
Control*									
Total*	15/20(0.74)	12/17(0.73)	28/37(0.75)	11/18(0.62)	8/15(0.54)	19/33(0.59)	27/38(0.71)	22/32(0.66)	48/70(0.69)

* Proportion does not equal the fraction because 6-month survival had to be estimated from 12-month survival.

Table 3. Reproductive activity (proportion adult females breeding) during fall 1979 and spring 1980.

Treatment	Area	Proportion Breeding	
		Fall, 1979	Spring, 1980
Males Removed	AB	2/8(0.25)	11/13(0.85)
	Busch	5/8(0.63)	16/21(0.76)
	Total	7/16(0.44)	27/34(0.79)
Females Removed	AA	3/6(0.50)	2/2(1.0)
	AC	3/6(0.50)	2/2(1.0)
	Total	6/12(0.50)	4/4(1.0)
	Treated Total	13/28(0.46)	31/38(0.82)
Control	Trelease	---	6/7(0.86)
	Brownfield	---	8/11(0.73)
	Control Total	---	14/18(0.78)

Table 4. Recruitment of new animals onto 5 experimental plots. Recruitment onto control plots was not calculated because they were not trapped during fall 1979. Number per ha is in parentheses.*

Treatment	Area	New Adults			New Young			Total New Squirrels		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Males Removed	AB	3 (.26)	3 (.26)	6 (.52)	1 (.09)	0 (0)	1 (.09)	4 (.35)	3 (.26)	7 (.61)
	Busch	3 (.22)	4 (.29)	7 (.51)	1 (.07)	4 (.29)	5 (.36)	4 (.29)	8 (.58)	12 (.87)
	Total	6 (.24)	7 (.28)	13 (.51)	2 (.08)	4 (.16)	6 (.24)	8 (.32)	11 (.44)	19 (.75)
Females Removed	AA	2 (.35)	2 (.35)	4 (.70)	4 (.70)	2 (.35)	6 (1.04)	6 (1.04)	4 (.70)	10 (1.74)
	AC	1 (.08)	2 (.17)	3 (.25)	7 (.58)	2 (.17)	9 (.75)	8 (.67)	4 (.33)	12 (1.0)
	Total	3 (.17)	4 (.23)	7 (.39)	11 (.62)	4 (.23)	15 (.85)	14 (.79)	8 (.45)	22 (1.24)
Complete Removal	AD	3 (.50)	3 (.50)	6 (1.0)	4 (.67)	5 (.83)	9 (1.50)	7 (1.17)	8 (1.33)	15 (2.5)

*No data on fall recruitment are available for the control areas.

Table 5. Crown position of marked hickories 5 years after release cutting in 7- and 15-year-old clear-cuts.

Species	Released			Not Released		
	Number free to grow	Number surpressed	Percent Surpressed	Number free to grow	Number Surpressed	Percent Surpressed
<u>7-Year Clear-Cut</u>						
Pignut	4	5	55.5	4	5	55.5
Mockernut	6	2	25.0	3	5	62.5
Shagbark	5	1	16.7	4	3	42.8
Total	15	8	34.8	11	13	54.2
<u>15-Year Clear-Cuts</u>						
Pignut	8	1	11.1	5	4	44.4
Mockernut	15	1	6.2	8	8	50.0
Total	23	2	8.0	13	12	48.0 ^a

^aSignificantly higher ($P < 0.01$) number of stems surpressed compared with released stems.

Table 6. Status of hickories left standing in 2 clear-cuts in Indiana after 4 or 5 growing seasons.

Species	N	Number of trees growing well	Number of trees not growing	Number of trees with grapevines	Number of dead trees
<u>Pleasant View (4 growing seasons)</u>					
Pignut	12	6	3	2	1
Shagbark	19	6	7	3	3
<u>Frog Pond (5 growing seasons)</u>					
Pignut	8	4	1	0	3
Shagbark	19	8	5	0	6