Final Report

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
1952 ~~ANNUAL PROGRESS REPORT~~, NON-FEDERAL PROJECTS
(Four copies to be sent to Director's Office)

1. PROJECT: (Fund number, and title): State - S68-F2-A125 Evaluation of a Cattle Grazing System for Promoting Germination and Development of Pine in Competition with Hardwoods

2. Departments and Cooperating Agencies: Forestry, Animal Husbandry

3. Personnel: C. M. Kaufman, E. U. Dillard

4. NATURE OF RESEARCH AND PRINCIPAL RESULTS OF THE YEAR (Confidential information should be so marked):

Various investigators have found that grazing is detrimental in hardwood forest because the tree reproduction is damaged or killed. This grazing effect might be used to advantage for favoring pine in competition with undesirable hardwoods.

Two forest tracts from which the pine timber had been cut (leaving 3 seed trees per acre) were grazed heavily for 2- to 3-week periods in the spring, early summer, and late summer of 1949 and 1950, and the forest and cattle responses were measured. The study was discontinued in 1951 due to the absence of both project leaders.

By the end of the second year, a large proportion of the hardwood reproduction had been destroyed and the remaining small hardwoods had been weakened, but the grazing should have been continued 1 or 2 more years to reduce the hardwoods to a point where they would no longer compete with pine reproduction. First year pine seedlings also suffered from browsing, but after they were a foot tall cattle avoided them.

Cattle lost weight while in the woods but regained it on pasture. Feeding 1 pound of cottonseed meal per head daily reduced weight losses.

5. APPLICATION OF FINDINGS (expressed in terms of measurable public benefits if and when justified):

The results have definitely indicated a possibility for using cattle to control undesirable hardwoods on upland areas where pine will grow 2 to 3 times more usable wood than will hardwoods. Grazing would probably be more economical than most other control measures.

6. WORK PLANNED FOR NEXT YEAR:

Consider possibilities for completing or revising the study.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR:

None

8. Prepared by H. O. Shepherd Approved _____ (Director)

Date _____ Date _____

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
1951 ANNUAL PROGRESS REPORT, NON-FEDERAL PROJECTS
(Four copies to be sent to Director's Office)

1. PROJECT: (Fund, number and title):

   S68-F2-Ai25 Evaluation of a Cattle Grazing System for Promoting Generation and Development of Pine in Competition with Hardwoods.

2. Departments and Cooperating Agencies:

   Department of Animal Industry and School of Forestry.

3. Personnel:

   E. U. Dillard and C. W. Kaufman

4. NATURE OF RESEARCH AND PRINCIPAL RESULTS OF THE YEAR (Confidential information should be so marked): Two mature pine stands in which advance growth of young hardwoods was present were cut in 1948. In addition, a pine pole stand with advanced hardwood reproduction was thinned. These areas have been grazed intermittently at a heavy over-grazing rate for the 1949 and 1950 growing seasons. The rates were such that the grazing periods were two to three weeks and the intervals between periods, during which regrowth of hardwood browse and other forage took place, were four or more weeks. By keeping the animals on improved pasture when not in the woods it was found that they could be maintained in good flesh even though weight loss per animal was as high as 70-80 pounds during some of the woods grazing periods. The young hardwoods in the grazed areas were browsed intensively and retarded so that the aspect of the areas has become quite open. It is anticipated that regeneration of a pine stand can take place without excessive competition from advanced hardwood growth.

5. APPLICATION OF FINDINGS (expressed in terms of measurable public benefits if and when justified):

   Intermittent heavy over-grazing can be used to retard advanced hardwood growth up to 6 or 8 feet tall in recently cut over pine areas in which pine regeneration is desirable.

6. WORK PLANNED FOR NEXT YEAR:

   Project will be terminated and final report prepared in spring of 1951.

7. PUBLICATIONS ISSUED OR MANUSCRIPTS PREPARED DURING THE YEAR.

   None.

8. Prepared by_____ Approved_____
   (Director)

   Date _____ Date_____

Lele

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION
PROJECT OUTLINE

Revised Copy

Project No. S68-F2-Ai25
Date
Submitted .....
Approved .....
Revised .....

1. Title

Evaluation of a cattle grazing system for promoting generation and development of pine in competition with hardwoods.

2. Objective(s)

1. To determine the effectiveness of cattle grazing in reducing growth of hardwood sprouts and seedlings to favor generation and growth of pine in the Piedmont.

2. To determine the effect of grazing hardwoods on cattle management practices in a beef-production program.

3. Reasons for undertaking Investigations*

Through natural ecological succession hardwoods will invade and take over pine forest areas in the Piedmont. This successional relationship is demonstrated by the Forest Resources Appraisal of 1945 which showed that although present sawlog-size material is composed of 62 per cent pine and 38 per cent hardwoods in the Piedmont, the reproduction that will replace the present stand is 28 per cent pine and 72 per cent hardwoods. Cutting of mature pine stands or thinning in immature stands is an open invitation to conversion from a pine to a hardwood forest.

On upland areas pine will grow 2 to 3 times more usable wood annually than hardwoods and the hardwood species found on uplands are of inferior quality. Where pine has seeded in and seedlings are present, the young pine can be brought into dominance by cutting the hardwood growth down several times. This is expensive. Present information on the influence of cattle in hardwood forests indicates that cattle could be used to so suppress hardwood sprouts and seedlings during the seeding and establishment of the pine that the hardwoods would no longer provide serious competition for the pine.

Present information indicates that cattle will browse on hardwoods extensively but seldom browse pine. However the successful application of a grazing program must eventually be measured not only in terms of controlling hardwood growth, but also by the adaptation of such a system to beef production. Little information is available at present concerning the management of cattle to insure practical and economical beef production under such a system of forest grazing. Information relative to the effect of forest grazing on cattle gains, and calf production, variation in

*Including economic justification

length of grazing period, the use of supplemental feeds, etc., is vital to the successful integration of a forestry-cattle program.

4. Previous work and present status of investigations in the field of this project:

Reports by the Indiana Agricultural Experiment Station and the U. S. Forest Service have shown that cattle will eat hardwood browse indiscriminately of species when forced to do so by hunger. Heavy overgrazing of woodland areas will eventually eliminate all hardwood reproduction.

Studies in the Richland Creek pastures during the past four years demonstrated that the amount of tree browsing is inversely proportional to the amount of other browse available. Sprout growth and the leaders and shoots of small trees are more palatable to cattle than the browse of older twigs and branches in which the woody material has become more dense. Palatability varies widely among species with yellow poplar, black gum, ash, and redbud most highly preferred. Sweet gum, maple, and the oaks are low on the preference list so that an area must be heavily overgrazed before these species are browsed in any quantity. Pine reproduction is seldom browsed by cattle.

5. Outline of Procedure:

In Pasture I at Richland Creek a mature pine stand of approximately 5 acres will be logged over, leaving an average of 2 to 3 good seed trees per acre. The logging slash will be lopped, cut apart. A fence will then be built across the pasture so that cattle can be confined within the cutover area.

In Pasture II a mature stand of pine intermixed with hardwoods and approximately 3 acres in area will also be logged for all sawlog-size material with the exception of 2 to 3 pine seed trees per acre. The logging slash will be lopped.

Adjoining the mature timber of Pasture II are 3.2 acres of small pine poles ranging in diameter from 4 to 6 inches. The stand is overstocked and in addition an understory of hardwood seedlings up to 2 inches in diameter is present. The pine stand will be thinned to about 300 stems per acre. Two fences (see attached map) will then be built in order that cattle can be confined on the cutover and thinned areas.

Cattle Management - Six beef cows and their calves will be turned on each area shortly after growth starts in the spring and left until the hardwood sprouts and seedlings on the respective areas have been grazed down. They will then be removed for three or four weeks or until regrowth warrants further grazing. Intermittent grazing will be continued throughout the summer as deemed necessary to control the hardwoods. Both groups of cattle will be grazed together on farm pasture when not on forest grazing. One group of mature cows will receive a cottonseed meal supplement while on forest grazing to determine the effect of cottonseed meal on cattle gains and appetite for forage. Cattle groups will be alternated between grazing areas to minimize forage differences and cattle management practices will be evaluated at the

Cattle will be weighed at the beginning and end of grazing periods and in addition at approximately 28 day intervals throughout the season.

Complete data on cattle gains, breeding records, calf crops, and supplemental feed will be collected.

Forestry. In the cutover mature areas the effectiveness of the treatment in promoting pine will be studied by means of a pattern of 10 2-mil-acre plots in Pasture I and the same in Pasture II. Response to treatment will be determined by the number and vigor of the pine seedlings on the plots. Three ungrazed areas (fenced) 1 x 1/2 chains in size in each of which 3 2-mil-acre plots will be located will be provided so that comparisons between grazed and ungrazed conditions can be made.

A pattern of 15 2-mil-acre plots will be established on the thinned area. Response to treatment will be determined by the growth-rate and vigor of the hardwood sprouts and seedlings present plus the number of new seedlings which become established. These data will be a measure of the suppressing effect of grazing on hardwood growth. Three fenced areas as in the cutover stands will be provided for comparison with grazed areas.

Division of Responsibility. The Forestry Department will be responsible for all forestry and forage data, and for providing and maintaining adequate fences. The Animal Husbandry Section will be responsible for furnishing cattle, scales, supplementary feed and supervising personnel for cattle management. Both Forestry and Animal Husbandry representatives will collaborate on determining when cattle will be turned on and removed from grazing areas.

6. Probable Duration of Project: Grazing will be carried on for 4 or 5 years. Observations will be continued for possibly 10 years more to determine if pine remains the dominant species.

7. Date of Initiation: 1948.

8. Personnel:

Name	Department	Relation to Project	Time on Project
C. H. Kaufman	Forestry	Leader of Forestry Phase	33%
J. C. Pierce, Jr.	Animal Husbandry	" " Animal Husbandry Phase	

9. Coöperation:

a. Interdepartmental

J. A. Rigney, Dept. of Statistics, Adviser

b. Other Agencies

10. Financial Support:

a. Proposed Budget July 1,1948 to July 1, 1949

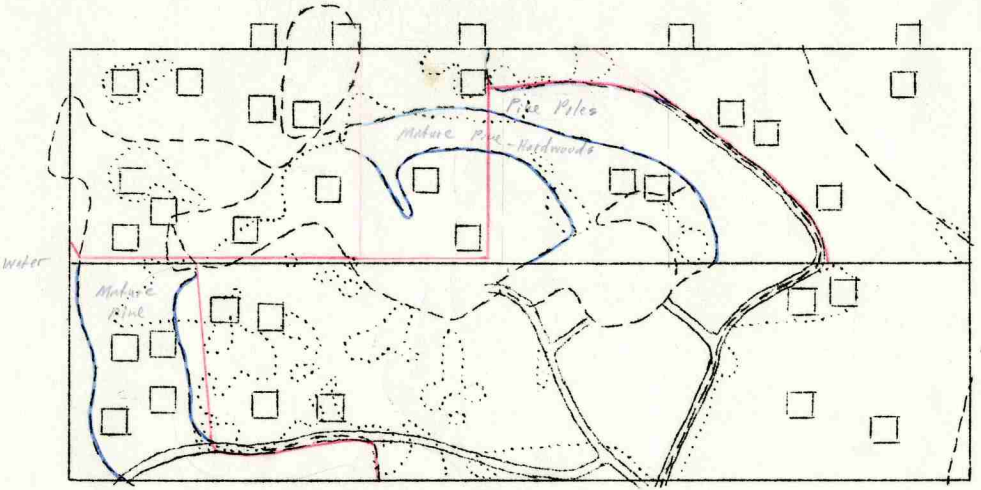
Items	ALLOCATION OF FUNDS					
	Bankhead-Jones	Purnell	Adams	State	Other	Total
1. Salaries				For.$1520 A.H. 500		1520. 500.
2. Labor				For. 500		500.
3. Travel				A.H. 250		250.
4. Equipment & Supplies				For. 375 A.H. 750		375. 750.
5. All Other				For. 200		200
Total				For. 2595. A.H. 1500		$2595. 1500.

b. Proposed Future Budgets:

Year	Salaries	Total Expenditures	Estimated Income

11. General Remarks:

Forest Grazing
Richland Creek Pastures



Electric fence

Type lines

Pasture I

Mature Pine	4.8 A.
Bottomland	.7 A.
other	.4
	5.3 A.

Pasture II

Pine Poles	3.2 A.
Mature P-H	3.0
other	1.1
	7.3 A.

Project No. S68-F2-Ai 25

SIGNATURES OF APPROVAL

1. Approval of Project Leaders

Date Jan. 30, 1948 ..... Clemens Kaufman

Title Associate Research Professor

Date Jan 30, 1948 ..... J. C. Pierce, Jr., In charge

Title Beef Cattle and Sheep Research

Date .....

Title .....

2. Approval of Heads of Departments or Coöperating Agencies

Date Jan. 30, 1948 ..... J. V. Hofmann

Head, Director, Division of Forestry

Date 2-2-48 ..... Earl H. Hostetler

Head, Animal Husbandry

Date 2-11-48 ..... A. C. Coward

Head, Animal Industry Dept.

3. Approval of Committee on Experiment Station Projects

Date 2/18/48 ..... R. W. Cummings

Chairman of Committee

4. Approval of Director

Date 2/18/48 ..... R. W. Cummings

assoc. Director, North Carolina Agricultural Experiment Station

5. Approval of U. S. D. A.

Date .....

Chief, Office of Experiment Stations

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

PROJECT OUTLINE

Project No.	
Date	
Submitted	
Approved	
Revised	

1. Title Cattle as a tool in promoting generation and development of pine in competition with hardwoods.

2. Objective(s) To determine the effectiveness of cattle grazing in reducing growth of hardwood sprouts and seedlings to favor generation and growth of pine.

Old copy

3. Reasons for Undertaking Investigations*

Through natural ecological succession hardwoods will invade and take over pine forest areas in the Piedmont. This successional relationship is demonstrated by the Forest Resources Appraisal of 1945 which showed that although present sawlog-size material is composed of 62 per cent pine and 38 per cent hardwoods in the Piedmont, the reproduction that will replace the present stand is 28 per cent pine and 72 per cent hardwoods. Cutting of mature pine stands or thinning in immature stands is an open invitation to conversion from a pine to a hardwood forest.

On upland areas pine will grow 2 to 3 times more usable wood annually than hardwoods and the hardwood species found on uplands are of inferior quality. Where pine has seeded in and seedlings are present, the young pine can be brought into dominance by cutting the hardwood growth down several times. This is expensive. Present information on the influence of cattle in hardwood forests indicates that cattle could be used to so suppress hardwood sprouts and seedlings during the seeding and establishment of the pine that the hardwoods would no longer provide serious competition for the pine.

*Including economic justification

4. Previous work and present status of investigations in the field of this project:

Reports by the Indiana Agricultural Experiment Station and the U. S. Forest Service have shown that cattle will eat hardwood browse indiscriminately of species when forced to do so by hunger. Heavy overgrazing of woodland areas will eventually eliminate all hardwood reproduction.

Studies in the Richland Creek pastures during the past four years demonstrated that the amount of tree browsing is inversely proportional to the amount of other browse available. Sprout growth and the leaders and shoots of small trees are more palatable to cattle than the browse of older twigs and branches in which the woody material has become more dense. Palatability varies widely among species with yellow poplar, black gum, ash, and redbud most highly preferred. Sweet gum, maple, and the oaks are low on the preference list so that an area must be heavily overgrazed before these species are browsed in any quantity. Pine reproduction is seldom browsed by cattle.

5. Outline of Procedure:

In Pasture I at Richland Creek a mature pine stand of approximately 5 acres will be logged over, leaving an average of 2 to 3 good seed trees per acre. The logging slash will be lopped, cut apart. A fence will then be built across the pasture so that cattle can be confined within the cutover area.

In Pasture II a mature stand of pine intermixed with hardwoods and approximately 4 acres in area will also be logged for all sawlog-size material with the exception of 2 to 3 pine seed trees per acre. The logging slash will be lopped.

Adjoining the mature timber of Pasture II are 4.6 acres of small pine poles ranging in diameter from 4 to 7 inches. The stand is overstocked and in addition an understory of hardwood seedlings up to 2 inches in diameter is present. The pine stand will be thinned to about 300 stems per acre. Two fences (see attached map) will then be built in order that cattle can be confined on the cutover and thinned areas.

Shortly after growth starts in the spring 4 stock cows will be turned into the area in Pasture I and 8 cows into the area in Pasture II. The cows will be left on the areas until the hardwood sprouts and seedlings have been browsed down. They will then be removed for a period of probably 3 to 4 weeks until sprout growth has been sufficiently renewed to warrant rebrowsing. It is anticipated that throughout the grazing season of April to the end of August, about 4 treatments of 10-- 14 days' duration will be necessary to keep hardwood sprout and seedling growth down.

Providing cows on rough forage with about a pound of cottonseed meal per day is considered an economical practice because of the improvement in appetite of the animals. Since the aim in this study is to browse the hardwoods down as quickly as possible, the value of a supplement of cottonseed meal will be tested by feeding one group a pound per animal per day during one grazing period and the other group during the next grazing period, alternating in that manner throughout the season. The value of the supplement will be measured by the length of time required to browse the area down, the intensity of browsing of less palatable hardwood species, and weight differences in the cows themselves.

In the cutover mature areas the effectiveness of the treatment in promoting pine will be studied by means of a pattern of 10 2-mil-acre plots in Pasture I and the same in Pasture II. Response to treatment will be determined by the number and vigor of the pine seedlings on the plots. Three ungrazed areas (fenced) 1 X 1/2 chains in size, in each of which 3 2-mil-acre plots will be be located, will be provided so that comparisons between grazed and ungrazed conditions can be made.

A pattern of 15 2-mil-acre plots will be established on the thinned area. Response to treatment will be determined by the growth-rate and vigor of the hardwood sprouts and seedlings present plus the number of new seedlings which become established. These data will be a measure of the suppressing effect of grazing on hardwood growth. Three fenced areas as in the cutover stands will be provided for comparison with grazed areas.

6. Probable Duration of Project: Grazing will be carried on for 4 or 5 years. Observations will be continued for possibly 10 years more to determine if pine
7. Date of Initiation: remains the dominant species.
1948. Logging, brush removal, and fence building will be started in 1947.
8. Personnel:

Name	Department	Relation to Project	Time on Project
C. M. Kaufman	Forestry	Project Leader.....	33 %

9. Coöperation:

a. Interdepartmental

J. A. Rigney, Department of Statistics, adviser.
J. C. Pierce, Jr., Dept. of Animal Husbandry, adviser and in charge of the cattle.

b. Other Agencies

10. Financial Support:

a. Proposed Budget ..... to .....

Items	ALLOCATION OF FUNDS					
	Bankhead-Jones	Purnell	Adams	State	Other	Total
1. Salaries				$1520		1520.
2. Labor				500		500
3. Travel						
4. Equipment & Supplies				375		375
5. All Other				200		200
Total				2595		2595.

b. Proposed Future Budgets:

Year	Salaries	Total Expenditures	Estimated Income

11. General Remarks:

SIGNATURES OF APPROVAL

1. Approval of Project Leaders

Date Jan. 6, 1948 ..... C. M. Kaufman .....

Title Associate Research Professor .....

Date ....

Title .....

Date ....

Title .....

2. Approval of Heads of Departments or Coöperating Agencies

Date Jan. 6, 1948 ..... J. V. Hofmann .....

Head, Division of Forestry .....

Date ....

Head, ...

Date ....

Head, ...

3. Approval of Committee on Experiment Station Projects

Date ....

Chairman of Committee

4. Approval of Director

Date ....

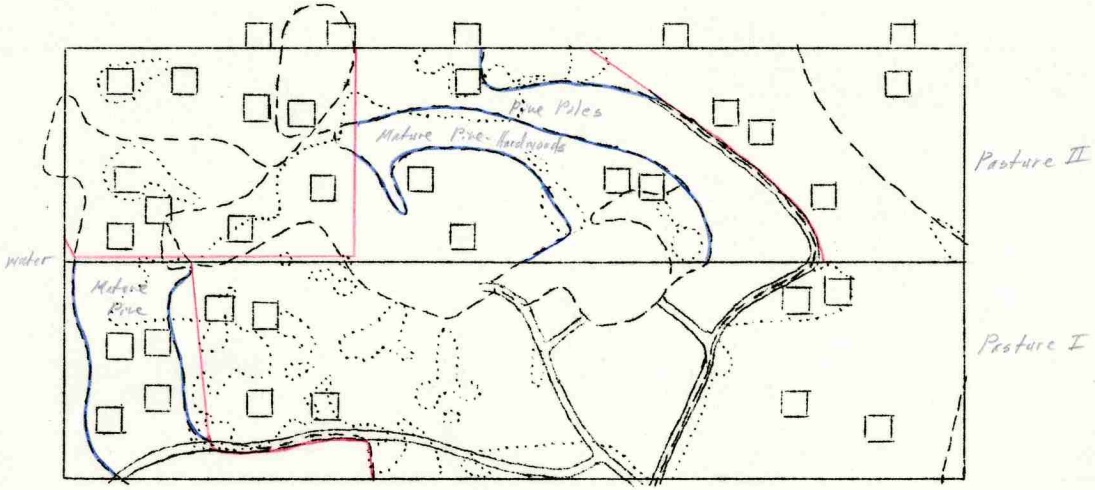
Director, North Carolina Agricultural Experiment Station

5. Approval of U. S. D. A.

Date ....

Chief, Office of Experiment Stations

Forest Grazing
Richland Creek Pastures



Electric fence

Pasture I
Mature Pine 4.8 A.
Bottomland 1
Other 4
5.3. A.

Pasture II
Pine Poles 4.6 A
Mature P-H 4.0
Other 3.8
12.4 A.

January 19, 1948

Memorandum to Professor E. H. Hostetler:

As you requested I am offering my comments for possible consideration on the Forest Grazing Project proposed by Dr. Kaufman.

1. Although this project is under consideration primarily because of the forestry aspects I feel that the cattle management is an integral part of the project. The application of any positive experimental results is going to be measured not only in terms of controlling hardwood growth but also in terms of the suitability of such a system from the standpoint of beef cattle production.

2. It was my understanding originally that some cutting would be effected on the larger hardwood growth. I feel that cattle would not only do a better job controlling hardwood growth but would remain in a much more desirable nutritional state if the area were completely cut over or burned over so that the hardwoods would consist mostly of young growth and sprouts. I am under the impression that this might even be desirable from a standpoint of pine reseeding.

3. Unless the area is cut over after logging, or some other provision made for palatable forage, it seems highly probable that one pound of cotton seed meal will be inadequate to maintain cattle at the desired level of nutrition.

4. I would like to raise the question of the relationship of this department to the project. If grazing is to be conducted on this area over a period of four or five years, the maintenance of cattle for the experiment, scales, personnel for supervision and management of cattle, etc. will represent considerable expense to the Animal Husbandry Section. I have personally made a commitment to the Forestry Department for the furnishing of cattle only during the 1948 grazing season. With our limited facilities to do beef cattle research here, I wonder if we can justify the possible curtailment of Animal Husbandry projects while acting in a service capacity to other Departments. Unquestionably the present project is a worthy one, yet I feel that it could be strengthened greatly if more attention was given the Animal Husbandry phases - its development as a joint-project would be most desirable.

I will be glad to discuss this project further with you at your convenience.

J. C. Pierce, Jr., In Charge,
Beef Cattle and Sheep Research