TECHNICAL AND FINANCIAL CONSIDERATIONS FOR THE NAVAL STORES INDUSTRY

by

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OUTLINE

TECHNICAL AND FINANCIAL CONSIDERATIONS FOR THE NAVAL STORES INDUSTRY

I Types of operations common in the naval stores belt

(a) Nonowner-operator
(b) Owner-operator

II Trend of past decade has been toward owner-operator type

(a) Factors influencing this change

1. Awakening of timber land owners to their losses through leasing.
2. Owners begin to take cognizance of possabilities of increasing and perpetuating land incomes through self-management.
3. Increasing inavailability of round timber suitable for chipping has forced progressive operators to insure a private supply.
4. Concentration of large blocks of timber in the hands of the more successful operators due to economic pressure within the industry.

III Probable effect such a change in the producers status will have upon the adoption of Sustained Yield Management plans in the industry.

(a) Policy of the nonowner-operator
(b) " " " owner-operator
(c) What sustained yield management can offer the owner-operator.
(d) Certainty of sustained yield management coming into its own in the future.

IV Present conditions in the naval stores belt

(a) Stocking of chippable timber

1. Use of Southern Experiment Station chart
2. Use of per acre stand and stock table

(b) Present chipping practice
(c) Present reservoir of exploited timber which is hindering natural reproduction.

(d) Economic life of stands under current practices.
1. High direct production costs
2. High overhead charges
3. High carrying charges

V Need of comprehensive management plans to meet present conditions in the naval stores belt.

(a) Simple workable plans essential.
(b) Must be able to show definite profits over present practices.
(c) Must produce naval stores at an F.O.B. price which will successfully compete with wood naval stores and discourage substitution.

VI Advocated plan of management to meet the above needs:

(a) Detailed woods practice.
(b) Presentation of method of maintaining an average annual production of 10 crops.
NOTE--These general subjects will require considerable explanation and discussion.
(c) Summary of plan.

VII Methods of arriving at financial returns under various policies of operation:

(a) Presentation of Se formula
1. Explanation of its terms.
2. Its meaning.
3. Its application in arriving at the most desirable plan of management to follow.

(b) Presentation of Fe formula
1. See above
2. " "
3. " " , also application in placing a dollars and cents value on stands of immature timber.

(c) Case comparison of expectation values from stands widely separated:
1. Economic lives.
2. Stockings per acre.
3. Yields per acre and per crop.

rest for Thesis

VIII Production costs and net returns as influenced by stand stockings of trees of place

(a) Production costs:
1. Stands of 15 trees per acre
2. " " 120 " " "
(b) Explanation of figures used
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(d) Assumption of annual yield
(e) " " market value per unit

IX Comparison of Se and Fe returns under advocated management plan with Se and Fe returns from currently operated stands: i.e. 120 trees per acre vs 15 trees

(a) Show detailed example
(b) Insert 3, 6, and 8% series. i.e. tables.
(c) Explain the use of these tables
(d) Compare tabular values with actual market values of naval stores property. As per Savanah.

X Presentation of P.W. formula for liquidation operations

(a) The formula
(b) Its terms
(c) Its meaning and use

XI Comparison of returns per acre and per crop under policies of progressive liquidation vs returns under advocated sustained yield management plan:

(a) Per crop and per acre annual returns of a liquidating operation in 15 tree per acre stands of slash pine
(b) Per crop and per acre annual returns of a liquidating operation in 60 face per acre stands of slash pine
(c) Per crop and per acre values of sustained yield operations in 120 tree per acre stands
(d) Emphasize advantages of sustained yield operations as brought out in above comparison.

XII Advantages enjoyed by sustained yield operators:

(a) Technical advantages
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XIII An accurate method for the determination of lease values

(a) Need for such a method
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    3. Scientific analysis would be of value on state and federal forests that lease timber
    4. Arriving at accurate values for lease figures would give a more equitable basis for taxation and would hasten the adoption of good forest practice.

(b) The formula
    1. Its terms
    2. Its meaning
    3. Its application
(c) A practical example of its application

XIV Fire loss appraisals for the naval stores belt

(a) Menace fire holds for the operators
(b) Fire the major problem of all operators
    1. Its ability to wipe out his entire capital and plant
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(c) Nature of flatwoods fire
    1. The hazards
    2. The risks
    3. The frequency
(d) Need for accurate determination of fire losses
    1. As shown by a, b, and c for pressing justifiable claims in legal suits

(e) Presentation of formula for determination of collectable losses for immature stands with natural reproduction.
   1. Its terms
   2. Its meaning
   3. Its use
   4. A practical example

(f) Formula for immature stands with artificial reproduction:
   1. Same as above
   2. " " "
   3. " " "
   4. " " "

(g) Formula for mature stands with natural reproduction
   1. Same as above
   2. " " "
   3. " " "
   4. " " "

(h) Formula for mature stands with artificial reproduction
   1. Same as above
   2. " " "
   3. " " "
   4. " " "

CONCLUSIONS

SUMMARY

1. Liquidation operations
2. Sustained yield
3. Simplicity of a 10 crop sustained yield crop
4. Practical application of:
   (a)
   (a) The Se formula
   (b) The Fe formula
   (c) The P.W. formula
   (d) The stumpage appraisal formula
   (e) The fire loss appraisal formulae

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INTRODUCTION

The naval stores industry of the southern United States represents an annual production valued at $50,000,000 and employs directly over 50,000 people. This immense flow of wealth and source of employment springs from the oleo-resin yielded by two indegenous species of pine, namely, slash (Pinus carribaea) and longleaf (Pinus palustris); which cover an approximate area of 52 million acres in the coastal plains section. Although these invaluable species represent a form of replaceable resource from which the South might benefit indefinitely, they have not in the past been treated as such. It shall be the object of this paper to make certain technical suggestions and point out definite financial consideration for handling these species of naval stores. These practices if adopted universally throughout the naval stores belt, would insure a stabilization of land revenues and thus alleviate the serious problem of tax delinquency and land-abandonment confronting the inhabitants of the naval stores section.

I

Types of Operations Common in the Naval Stores Belt

When based upon the ownership status of timber worked, two distinct types of operators are common in the naval stores industry. They are the owner-operator, who owns all or a major portion of the timber he chips annually, and the nonowner-operator who depends almost exclusively upon leased timber to maintain his annual production.

From both an historical and economic point of view the nonowner-operator looms the most important producer of the two. For more than a century he has been the major factor in exploiting naval stores from stands of virgin timber and upon exhastion of such timber he has turned his operations into high yielding second-growth stands. Today the bulk of crude gum is produced from leased timber. According to Forest Survey statistics 75% of the crops worked for the 1934-35 season in the naval stores territory were leased outright.

The table giving the proportion of crops owned and leased during the 1934-35 season for the entire region follows:

Proportion of Turpentine Crops Owned and

Leased with Woods Operations, 1934-35

Survey areas	Owned crops	Leased crops	Total
	Percent		
S. Carolina #1	18.5	81.5	100.0
Georgia #1	35.3	64.7	100.0
Georgia #2	11.3	88.7	100.0
Florida #1	22.2	77.8	100.0
Florida #2	20.9	79.1	100.0
Alabama #1	35.0	65.0	100.0
Mississippi #5 & Louisiana #4 & Louisiana #3 & Texas #1	20.4	79.6	100.0
	16.1	83.9	100.0
Averages for total region	26.9	73.1	100.0

For areas embraced in various units of the survey, see plate #1.

(not in carbon)

The owner-operator, though not a prominant figure in either the history of naval stores development nor in current production, gives promise of dominating the future industry. It is this type of operator with a proprietary interest in his land and timber who becomes most attentive to progressive ideas for bettering his yields and placing his stands upon a sustained yield basis.

II

Trend of Past Decade Has Been Toward Owner-operator Type

Probably the most significant trend evident in naval stores production in the past decade has been the increase in the number of owner-operator production units*.

Several distinct factors may be sited, which working collectively, are responsible for this trend. Foremost of these influencing factors is the awakening of timber land owners to the losses incurred in leasing. It has long been common practice in the naval stores belt to lease stands of round timber** for a given period of years, and then abandon

* Appendix c contains a letter from Mr. of the naval stores industry verifying this trend.

** Round timber is that of chippable size which has not previously been worked.

chipping operations in them when reductions in gum yields make further workings unprofitable. Such a practice supplies the land owner with an acceptable revenue for a short period of time, but leaves him wholely unprepared for carrying his non-productive timber stands after the leasor has withdrawn operations. The inevitable consequence of this practice has been widespread land abandonment and vastly increasing tax delinquency throughout the naval stores region. Progressive timber land owners, recognizing the fallacy of offering property under such leasing privileges, have gradually increased their lease fees and chipping restrictions. In many instances land owners have closed their property to leasors and have entered the production field themselves.

Personal observation and experience, aided by widespread research and education, have pointed out to many timber owners the possabilities of increasing and perpetuating land incomes through enforced policies of management. Once assured that permanent incomes are possible from pine stands, the owners have not been slow to adopt timber management. As success from such operations become common knowledge further adoption of self-management of timber by owners may be expected.

The increasing inavailability of round timber, suitable for chipping, has forced progressive operators to provide private supplies. Annually rising lease charges plus the

gradually decreasing desirability of the timber leased have been two additional factors indluencial in bringing about large-scale timber ownership on the part of the producer.

The final important influencing factor has been the concentration of large blocks of timber in the hands of the more successful operators. The naval stores industry, similar to all private business, has in the past been subject to periods of acute economic depression. At such times marginal gum producers, exhibiting mal-management or posessing insufficient capital, have been subject to intense financial pressure which has usually found its outlet in liquidation to the larger producing units. The larger units in turn have thus entered the ranks of owner-operators.

III

Probable Effect Such a Change in the Producers Status Will Have upon the Adoption of Sustained Yield Management Plans in the Industry

The policy of the nonowner-operator is essentially that of rapid exploitation and abandonment. As long as there exists a sufficient supply of round timber into which he may transfer operations this policy presents the only sane one for him to follow. To chip conservatively would mean increas-

ing his production costs and general overhead without proportionally increasing his yields, which state of affairs could only spell ruin for him.

The policy of the owner-operator on the other hand must of necessity be along the lines of sustained yield or conservative production over long periods of years. It is to his destined advantage that his timber produces steady yields at short intervals so that the revenues from his land may flow uninterrupted. Unlike the nonowner he cannot sheer away from land responsibilities and obligations once his operations have become unprofitable . He then is most interested in increasing and perpetuating his returns per acre both by better woods practice and the adoption of long-time managerial policies.

Sustained yield management of naval stores stands places a premium upon conservative woods practice and efficient management technique and in return produces permanent land incomes so vital to property owners. The widespread trend toward timber ownership and the decided necessity for conservation of natural resources in the naval stores belt assures a prominant future position for sustained yield management practice in this region.

Existing stand conditions in the naval stores belt are in direct opposition to conditions necessary for producing acceptable land revenues. It has been computed in the

Southern Forest Survey that the average stocking of chippable trees per acre in the 52,000,000 acre naval stores forest is approximately 17 trees. Numerous stands carry concentrations in excess of this average but for the region as a whole this is thought to be a fair figure. Although the correct number of trees to the acre for best gum production is still an open question, clearly a stand well in excess of 17 trees would be called for. From the best experimental data now available it appears that stockings somewhere between 100 and 200 trees-of-place* per acre will produce the highest net yield.

The accompanying diagram (fig.) is a stand and stock table for Florida Unit number #1 of the Southern Forest Survey. The figures plotted are in millions of trees for a gross area of 10,000,000 acres and the conditions portrayed are quite representative for all the naval stores region in Georgia and Florida.

Fig. missing in carbon

Figure B is a per acre stand and stock table developed from the data presented in figure A. Note in this table the extremely poor stocking of the average per acre stand. Less than .9 of 1% of the trees are 18 inches D.B.H. and over, while by far the greatest number of trees are under 8 inches in diameter. Since present progressive woods practice recognizes only trees in excess of 9 inches D.B.H.

* Trees-of-place are those crop trees which are worked for resin.

as being able to produce acceptable revenues this diagram readily depicts the gross understocking of the naval stores stands.

The most common woods practice current in the naval stores belt is to lease crops of round or rested* timber for a period of years, usually 4, 6, or 8, and then proceed to chip these trees heavily untill falling gum yields make further operations impractical. Under such leasing proceedure it is to the decided advantage of the leasor to exploit the oleoresin of the leased timber in the period of time covered by his lease; providing of course that heavy chipping means increased annual yields, which assumption the operator usually makes.

Ordinarily in the naval stores territory the timber is considered exhausted and liquidated when it still averages slightly less than 12 inches in diameter. Thereupon, since the trees are too small for sawlogs and since the pulpwood industry of the South is not yet in position to absorb them, the timber is considered not to possess any commercial value and is turned loose. The Southern Forest Survey indicates a very serious damming up of this discarded turpentine timber. To maintain its present production of 500,000 units the naval stores industry discards annually 1,800,000 cords of wood in abandoned trees. Since this timber is not being

* Rested timber is that which has been previously worked for a period of years.

currently removed any further, gum production on the abandoned areas is blocked because the soil is not opened for regrowth. Here then again is an inherent disadvantage to the liquidation policy. On the other hand the practice of Sustained Yield Management would offer a solution to the discarded timber land which is rapidly becoming one of the most serious economic problems faced by the South.

With these existing conditions of poor stand stocking and relatively short chipping life there must consequently exist enormous production, overhead, and carrying charges against the timber currently worked. One of the major cost items in the woods operations is the walking time of the woods hand. The more widely spaced the trees-of-place the greater becomes the amount of working time that must be allocated to each face; therefore the fewer producing trees per acre the greater must be the cost of chipping and collecting the gum per pound. The fact that overhead and carrying charges for the timber are inversely proportional to the stand stocking per acre is self-evident; providing we assume annual yields per crop are not excessively reduced when up to 120 trees per acre are carried.

Sustained Yield Management Plans, in order to best meet the general needs of the naval stores industry, should be patterned with the following items in mind:

1. Simple, workable plans, comprehendable to the progressive turpentine operator are essential.

2. Sustained Yield must be able to show definite profits over present liquidation practices.
3. Sustained Yield must produce naval stores products at an F.O.B. price which will successfully compete with wood naval stores, and discourage extensive substitution.
4. All secondary revenues from naval store stands must be utilized completely so as to produce the highest obtainable soil rent.
5. All technical considerations involved in management must be handled in the plan so as to produce the forenamed results.

VI

Advocated Plan of Management to Meet the Forgoing Needs

Under this proposed plan of management even-aged stands of slash pine with a stocking per acre of 120 trees of place will be aimed at. A rotation of 40 years would be adopted with one thinning in the 20th year and one in the 30th year. Regular chipping would begin in the 30th year and continue uninterrupted to the 40th year. The trees of place will be finally utilized, in the 40th year as B-40 foot poles. Restocking of cut areas would be taken care of by scattered seed trees.

The following detailed working plan would be adhered to throughout the entire rotation.

I The stands would be adequately protected from fire, disease, and trespass while attaining maturity. Such fire protection would be most effectively obtained under a T.P.O.* setup.

II The stands would be first entered for cultural work in the 20th year when they would be thinned to the 200 best trees per acre. Equality of spacing as well as desirability of retained timber should be the object of this preparatory thinning. A spacing of approximately 15 by 15 feet will leave the desired 200 trees per acre.

NOTE--This thinning, due to the large size of slash pine at 20 years, will pay for itself in the production of cord wood for the turpentine still.

III The operations in the 30th year would consist of two distinct activities, namely,

(a) a thinning to 120 trees per acre and

(b) the initiation of chipping practice

* T.P.O. is an abreviation for "Timber Protective Organiaztion" which organizations for maintaining fire protection are common in the Southern Pinery.

in the stand.

(1) The final thinning of the stand will take place in the 30th year and will reduce the trees of place to 120 trees per acre. The trees selected to be left will average approximately 19 feet apart, will have large healthy crowns, and no defects such as crook, lean, large fire scars, or evidence of disease or insect infestation. Size, promise, and position of individual trees will be taken into account, but trees equally good will be cut to obtain desired spacing and relieve crowding. The final thinning should produce some cash revenue, if administered by an efficient supervisor, but here again we shall assume the thinnings merely pay their own way.

(2) Chipping practice will be inaugurated in 30 year old stands. This woods operation shall consist of cupping all 120 trees per acre; these trees to carry but one face not over 1/3 the bark circumference in width. Chipping

will be with an "00" hack, 32 streaks per season, and shall continue on the same face for 5 seasons. The "nailed"* cups and tins shall be progressively raised every 2 years. Preferably an advance streak** will be placed on the trees prior to the regular chipping in March of the 30th year.

(4) In the 35th year the tins and cups on the original faces whall be pulled*** and the same trees backfaced****. The chipping practice of the following 5 years will be identical with the practice as outlined for the 30 to 35th year.

(5) In the 40th year chipping operations in the stands, which have yielded continuously for 10 years, shall cease. The cups and gutters shall then be pulled and all the timber cut except for four thrifty, full-crowned ssed trees per acre. This number of mature seed

* Nailed cups are those cups and gutters that are fastened to the face by nails in accordance with present advocated woods practice.

** A streak made in the winter months prior to the regular chipping season.

*** Simply a cessation of operations on this face.

**** A face placed upon the opposite side of the tree from the original face.

trees should effectively take care of restocking the area in from one to five years. The trees harvested in the 40th year should find a ready market as B-40 foot southern pine poles at a stumpage value of approximately $.25 each. Upon failure of such a market to absorb the timber the trees should bring a comparable stumpage revenue on the sawlog market.

Summary of Plan

Although at first appearance the plan seems complicated it is actually very simple and merely resolves itself into the following policy. The trees are grown to an age of 40 years; two thinnings are made in the stand to secure correct spacing, one in the 20th year reduces the stand to 200 trees per acre, and one in the 30th year further reducing it to 120 trees; chipping begins in the 30th year and is continuous for a 10 year period, the trees being frontfaced the first 5 years and backfaced the second 5 years; woods operations cease in the 40th year and the trees harvested as poles, four healthy trees being left per acre to take care of reproduction.

In order to better clarify the practical application of the foregoing plan the following example is presented. The average number of crops worked for the entire naval

stores belt is 9.1. Therefore, assuming that a permanant annual production from 10 crops is desired the area needed to maintain the production for a 10 year period would be $\frac{10,000 \text{ faced}}{120 \text{ trees per acre}} \times 10 \text{ crops}$, or 833 acres. But since a permanant production from 10 crops of turpentine timber is desired there must be in existance three similar compartments of 833 acres, each carrying timber 10 years younger than the predeeding compartment, i.e. an 833 acre compartment of 30 year slash pine, and 833 acre compartment of 20 year pine, one of 10 year stock, and one 833 acre of restocking land. Thus the total area required for supporting a permanant annual operation of 10 crops would be 833 acres X 4 or 3,332 acres. The woods operations of 833 acres would be identical with that outlined under the Advocated Management Plan". Plate is a diagramatic presentation of a 10 crop sustained yield operation carrying 120 trees per acre.

An operator practicing progressive liquidation in stands of naval stores timber carrying the average 17 trees per acre would require an area of 5,882 acres (i.e. $\frac{10,000}{17} \times 10$) every 4, 6, or 8 years, depending upon the period involved in his leases. In other words he would require periodically an area greater by over 2,000 acres than the total area necessary to produce 10 crops of turpentine annually forever.

VII

Methods of Arriving at Financial Returns Under Various Policies of Operation

Plans of land-use based on sound economic principals are the only plans that may be expected to persist over long periods of time. Therefore it becomes of paramount importance in outlining policies of forest management that financial as well as technical justifications be secured for the advocated plans. In arriving at the comparative financial merits of one managerial policy over another, individual property values must of necessity be determined. To facilitate in the determination of these Values certain mathmatical formulae are here presented which take into consideration the nature and amount of the anticipated returns from the property, and the period of time that must elapse before such returns are received.

The Determination of the Expectation Value of Forest Soil in the Naval Stores Belt

Since land is the principal asset of a permanent forest buisness, it is essential that an attempt be made to assign a true production value to the soil. The capitalization of a permanant periodic income offers a fair mathmatical interpretation of the flow of revenue from forest land; thus the following formula may be used in a determination of land

values:

$$Se = \frac{\left[\frac{Yr(1.0p^{c}-1)}{.0p}\right]+R}{(1.0p^{n+c}-1)} - (Ca+E)$$

Explanation of Symbols

Se -- The soil value under a given managerial policy of an area of land capable of producing one crop of turpentine timber.

Yr -- Annual net return in dollars per crop of 10,000 faces exclusive of taxes, land charges, and protection.

.op -- Rate of interest currently used in a given region.

c -- Chipping life in years.

R -- Return at rotation age from 10,000 B-40 foot poles @ 25¢ stumpage.

n -- Years required to raise trees to a chipping size of 9 inches D.B.H.

C -- Cost of planting one acre.

a -- Number of acres required to produce one crop of timber.

E -- Capitalized annual expenses at .op interest; i.e. if annual charges for protection plus taxes are equal to e, then E.

The meaning of the above formula is quite simple, for in words it merely states: The soil expectation value "Se" under a given managerial policy is equal to the capitalized amount of "c" future yields of "Yr" value plus and additional

return of "R" dollars coming periodically at the end of "n plus c" years, where "n" equals the period of years preceeding chipping and "c" equals the chipping life; inasmuch as all yields are contingent upon a present expenditure for planting of "Ca" dollars and since the capitalized amount of annual expences needed to operate the crop amount to "E" dollars, the future returns must necessarily be reduced by the sum of "Ca plus E".

This Expectation Value formula has its greatest practical application in determining the financial results that may be expected to attend the adoption of a given managerial policy. As an illustration of this practicality the economic merits of the two following hypothetical plans of management are contrasted:

Plan #I

It is assumed that an area of land in the naval stores belt is to be planted with slash pine so as to furnish one crop of turpentine timber and, under the plan of management proposed the rotation will be 40 years with a waiting period of 30 years and a chipping life of 10. The trees will be so planted and thinned as to give a stocking of 120 per acre in the 30th year. The estimated receipts and expenses per crop basis will be as follows:

Cost of planting 83 acres at $3.50 per acre---$290.50.

Annual expenses "e" (i.e. taxes and protection) are estimated at ---- $33.75.

Thinnings at the stand ages of 20 and 30 years respectively are assumed to just carry their cost.

The annual yield from the crop of timber during its 10 year chipping life is 45 units of naval stores which represents a total net value of --- $914.20.

The trees of place will bring in $ .25 each in the 40th year when sold as pole stumpage, value per crop ----- $2,500.00.

Interest to be calculated at 6 %.

Substituting the appropriate values in the "Se" formula we get:

$$Se = \frac{\left[\frac{\$914.20\,(1.06^{10}-1)}{.06}\right] + \$2500}{(1.06^{30+10}-1)} - \left(\$290.50 + \frac{\$33.75}{.06}\right)$$

Further solving the equation:

$$Se = \frac{\left[\frac{914.20\ \ (.791)}{.06}\right] + 2500}{10.29-1} - \left(290.50 + 675\right)$$

$$Se = \frac{\left[\frac{723.132}{.06}\right] + 2500}{9.29} - 965.50$$

$$Se = \frac{14552.20}{9.29} - 965.50 \text{ or } 1566.43 - 965.50$$

Se = $600.93 .....for 83 acres, or $7.24 per acre.

This value of $600.93 is the amount an operator could afford to pay for 83 acres of land if he porposed to manage it as indicated , and the revenues and expenses as outlined in the plan were forthcoming. Purchase of bare land at this price would assure the operator of a 6 % interest return upon the capital he invests in the property.

Plan #II

The alternative plan up for consideration by the operator involves the following proceedure. A continuous production of one crop of turpentine timber is to be grown on bare land under a plan of management which will bring into bearing 120 trees per acre in the 25th year. This timber due to its immature condition at 25 years will yield a reduced amount of gum (i.e. 40 units) over a shorter chipping life (i.e. 8 years) and the estimated receipts and expenses on a per crop basis will be as follows:

Cost of planting 83 acres ---- $290.50

Annual Expenses ---- $33.75

Thinnings at the ages of 20 and 25 years will carry their own costs.

The annual yield from the crop of timber during its 8 year chipping life is 40 units of

naval stores which represents a net annual revenue of ------ $664.20

The trees of place will return $ .10 each in 33 years when sold as barrel-stave stumpage.

Interest calculations at ----- 6 %.

Substituting the appropriate values in the same Se formula:

$$Se = \frac{\left[\frac{\$664.20\,(1.06^{8}-1)}{.06}\right] + \$1000}{(1.06^{25+8}-1)} - \left(\$290.50 + \frac{\$33.75}{.06}\right)$$

Solving further:

$$Se = \frac{\left[\frac{664.20\,(.594)}{.06}\right] + 1000}{6.841} - (290.50 + 675)$$

$$Se = \frac{\left[\frac{394.535}{.06}\right] + 1000}{6.841} - (965.50)$$

$$Se = \frac{7575.58}{6.841} - 965.50 \text{ or } 1107.38 - 965.50$$

$Se = \$141.88$ .....for 83 acres or $1.71 per acre.

The expectation value of 83 acres of land when placed under the managerial policy advocated in Plan #II is therefore $141.88, whereas when managed in accordance with

Plan #I it was $600.93. Clearly an operator, if he contemplated starting with bare land, would be foolish to adopt a policy of management comparable to Plan #II if he had at his disposal a plan as outlined in Plan #I.

Similarly, comparative advantages may be worked out with the "Se" formula for any combination of the component factors involved in the formula. Therefore, to the naval stores operator who seriously considers the adoption of a sustained yield plan of management for his cut-over lands this formula becomes indispensable.

The Determination of the Expectation Value of Forest Property (Land and Timber) in the Naval Stores Belt

Few, if any, naval stores operators would seriously consider the development of a regulated forest property from bare land. Fortunately enough in the South the necessity of starting with non-restocking land will only be necessary on small concentrated areas. On the other hand, much of the land within the naval stores belt carries well stocked stands of young pine timber ranging from one up to 30 years of age. Immature stands of this type offer to the progressive naval stores operator an excellant opportunity

for acquiring or developing a regulated sustained yield property. However, in order to correctly evaluate such stands for purchase, and again to be able to select the most desirable plan for their management, the operator must be able to place a dollars and cents value upon them. To facilitate in such valuation of immature forest property the following formula has been devised:

$$Fe\ (a) = \frac{\frac{Yr(1.0p^{c}-1)}{.0p} - E(1.0p^{n-a+c}-1) + R + \frac{\frac{Yr(1.0p^{c}-1)}{.0p} + R}{1.0p^{n+c}-1} - E}{1.0p^{n-a+c}}$$

In which formula:

Fe -- The forest expectation value under a given managerial policy.

Yr -- Annual net return in dollars per crop of 10,000 faces; exclusive of taxes, land charges, and protection.

c -- Chipping life in years.

n -- Years required to raise trees to chipping size.

.0p -- Rate of interest acceptable to producer

a -- Present age of timber stand.

R -- Return at rotation age from timber when harvested as 10,000 B-40 foot poles, or comparable stumpage.

E -- Capitalized annual expenses of taxes plus protection charges, i.e. $\frac{\text{annual expenses}}{.0p} = E$

In words this formula states: Upon a crop basis, the expectation value of a stand of timber at any given age "Fe(a)" is equal to the capitalized value of "c" annual incomes of "Yr" amounts carried forward with compound interest, plus a final return equal to "R" dollars, which incomes are contingent upon an annual expenditure, whose capitalized value is "E", for a period of "n minus a plus c" years. In addition the expectation value of the property will be increased by an amount equal to the expectation value of all future yields upon the land calculated as-of-the-end of the first rotation. Finally, since the total of the above amounts is a future value computed at the end of the first rotation, this sum must be discounted for "n minus a plus c" years at op percent interest.

As has been previously stated this "Fe(a)" formula has considerable practical application in placing realizable values upon immature stands of timber. In order to facilitate the rapid determination of such property values the following much simplified algebraic equivalent of the "Fe (a)" formula is presented:

$$Fe(a) = \frac{\left(\frac{Y_R(1.0p^c-1)}{.0p}+R\right)\left(1.0p^{n+c}\right)}{\left(1.0p^{n-a+c}\right)\left(1.0p^{n+c}-1\right)} - E \qquad *$$

* Acknowledgment is here made to Dean S.T. Dana, of the University of Michigan, for his derivation of this simplified formula.

The meaning of the above symbols being identical with the meaning of those in the original "Fe(a)" formula presented on page .

A practical illustration of the application of the "Fe(a)" formula in placing a dollars and cents value upon the stands of immature timber is offered in the following example:

An operator is interested in the possabilities offered by sustained yield management and is considering the purchases of 100 acres of 20 year old slash pine adequately stocked to give him 100 trees of place per acre in the 30th year. He plans to begin chipping when the stand attains the age of 30 years , and to cease and sell his timber as slack-cooperage stock in the 40th year. He anticipates that he can net an average of $700.00 per year from his gum, that his stumpage on the trees of place will be $ .12 apiece, and that his annual expenses consisting of taxes and protection will amount to $42.00 for his crop of timber. Seeking such timber on an open market he desires to know the maximum price he can afford to offer for the 100 acres and still guarantee himself a 6 % return on the capital he invests.

By substituting the above data in the "Fe(a)" formula he can quickly be given a satisfactory answer to his query.

$$Fe(20) = \frac{\left(\frac{\$700(1.06^{10}-1)}{.06} + \$1200\right)\left(1.06^{30+10}\right)}{\left(1.06^{30-20+10}\right)\left(1.06^{30+10}-1\right)} - \frac{\$42}{.06}$$

$$Fe(20) = \frac{\left(\frac{700(.791)}{.06} + 1200\right)(10.29)}{(3.207)(9.29)} - 700$$

$$Fe(20) = \frac{(9228.33 + 1200)(10.29)}{29.793} - 700$$

$$Fe(20) = \frac{107,307.52}{29.793} - 700$$

$$Fe(20) = \$2,902$$

$2902 is the maximum amount the operator should be willing to pay for 100 acres of timber if he wishes his money invested to earn at the compound rate of 6 %.

Necessarily the true expectation value of a forest property , calculated by any correct present worth method, will vary with the following factors:

1. Duration of waiting periods.
2. " " chipping life.
3. Stocking of trees of place per acre.
4. Annual yields per acre and per crop.
5. Annual expenses (taxes and protection).

6. Production costs per unit.

7. Market value per unit.

8. Rate of interest demanded.

Naturally enough the progressive naval stores operator becomes most interested in those of the above factors over which he has a degree of direct control. Therefore, judging the comparative merits of contrasting management plans for his property he should become expecially critical of the considerations they make for; (1) character and duration of economic life, (2) stocking of trees of place per acre, and (3) yields anticipated per acre and per crop. Preferably, in arriving at the financial merits of various plans of management he should make use of some type of highly flexible formula such as the "Se" or "Fe(a)" formulae here presented.

VIII

Production Costs and Net Returns as Influenced by Stand Stockings of Chippable Trees per Acre.

An outstanding cost factor which has attracted the attention of but few operators in the naval stores terri-

tory is that of stand density. Yields of gum per tree and per crop have long claimed considerable interest, but yields per acre have been given but slight recognition. An operator contemplating sustained yield, however, will do well to give stand desity per acre serious consideration. As shall be pointed out, he will find it to his decided advantage to maintain maximum stockings and consequent high yields per acre, for in so doing he is able to materially reduce his production, carrying, and overhead charges.

The accompanying is a tabular statement of per crop production costs and returns supplied to the author by Mr. C.H. Coulter, of the Florida Forest Service. The comparative production costs in the table, bring out effectively the reduction in net returns that may be expected with a reduction in crop* trees per acre.

* Crop trees are those currently worked for oleoresin.

Summary of Producing Costs *

	15 Faces	60 Faces	120 Faces	
Hanging cups and tins	$ 98.00	$ 90.00	$ 83.00	
Raising cups and tins	(72.50)	(63.50)	(57.50)	
Raised once every 2 years	217.50	190.50	172.50	
Cost of hanging and raising 6 years	315.50	280.50	255.50	
Cost of hanging and raising per year	52.60	46.80	42.60	(app)
Supervision	234.00	195.00	178.00	
Annual Depreciation	165.00	165.00	165.00	
Annual Maintenacne	31.00	31.00	31.00	
Interest on average annual investment @ 6%	65.00	65.00	65.00	
Fire protedtion	50.00	20.00	13.00	
Still taxes and insurance	7.50	7.50	7.50	
Chipping and pulling 35 streaks	315.00	280.00	262.00	
Dipping and scraping	120.00	100.00	80.00	
Hauling dip and scrape	100.00	80.00	60.00	
Still operation	245.00	245.00	245.00	
Selling costs	200.00	200.00	200.00	
Recruiting	20.00	15.00	10.00	
Boiling and cleaning cups	10.00	8.00	7.00	
Lease costs	250.00	250.00	250.00	
Total	$1,865.30	$1,708.80	$1,616.80	
Value at $50.00 per unit	2,000.00	2,000.00	2,000.00	
Total costs	1,865.30	1,708.80	1,616.80	
Profit (per crop)	$134.70	$291.20	$383.20	
Number of acres per crop	666	166	83	
Earnings per acre (during turpentine life)	.22	1.75	4.61	

* Inasmuch as progressive operators will probably be intensely interested in a detailed discussion of these cost variations, the complete analysis for the tabular costs, as determined by Mr Coulter, has been included in Appendix C of this report.

The 15 face per acre stands of the table very closely approach the 17 trees per acre average stand conditions found to exist throughout the naval stores territory by the Southern Forest Survey. Therefore, production costs as set up in the table should approximate average costs per acre encountered by the naval stores industry. On the other hand costs and returns as indicated for the 120 cup per acre timber should be indicative of values that may be encountered from regulated yield properties with effective fire protection.

In order to organize the data in the Production Cost Table for comparing managerial policies, which involve contrasting degrees of stocking, table was prepared. This original production cost table varies only in that annual expenses for taxes and protection have been withdrawn as a production cost in order to facilitate the substitution of values in the "Se" and "Fe(a)" Formulae. Also the 8 % charge against the average capital investment was considered high and was reduced to 6 %; and an annual production of 45 units has been inserted, which figure more closely approaches the 46.6 units average as determined for the State of Georgia by the Southern Forestry Survey.

Production Costs per Crop
(Exclusive of protection and taxes)

	15 Faces	120 Faces
Cost of hanging and raising, 10 years	$486.00	$396.00
Cost of hanging and raising per year	48.60	39.60
Supervision	234.00	178.00
Annual depreciation	165.00	165.00
Annual maintenance	31.00	31.00
Interest on average annual investment @ 6%	50.00	50.00
Chipping and pulling 35 streaks	315.00	262.50
Still taxes and insurance	7.50	7.50
Dipping and scraping	120.00	80.00
Hauling dip and scrape	100.00	60.00
Still operations	245.20	245.20
Selling costs	200.00	200.00
Recruiting labor	20.00	10.00
Boiling and cleaning cups	10.00	7.50
Total costs	$1,546.30	$1,335.80

Average annual production per crop on both stockings--45 units
Average market value per unit--$50.00 45 units X $50.00---$2250.00

Gross value per crop	$2,250.00	$2,250.00
Production costs (exclusive of protection and taxes)	1,546.30	1,335.80
	$ 703.70	$ 914.20
N		
Net return at 40 units	453.70	664.20
Net returns exclusive of actual cost of land, taxes, and protection charges	$ 703.70	$ 914.20
Number of acres required per crop	663 acres	83 acres
Average annual earnings per acre during chipping life	$ .70	$ 10.64
Annual cost of fire protection	50.00	13.00
Annual cost of taxes @ 11¢ per acre	73.26	9.13
Total charges for taxes and protection	$ 123.26	$ 22.13
Capitalized value of taxes and protection at 5%	$2466.00	$ 443.00

In the preceeding revised table several entries may be deserving of some explanation. The annual expenses for fire protection and taxes have been capitalized at 5% interest by the following process: $\frac{\text{annual expenses}}{.05}$. This gives a capital sum the interest from which at 5% will pay annual charges indefinitely and will in addition return to the operator the capital sum at any time he wished to discontinue his activities. For a discussion of actual protection charges as found in the table, the reader is referred to Appendix A. Annual taxes have been calculated at $ .11 per acre which, according to recent tax data from the Southern Forest Experiment Station, is the average annual general property tax levied against timberland* in the naval stores belt of Georgia and Florida. In asuming an average market value of $50.00 for a unit of naval stores, considerable criticism amy be justly expected. However, this is an item that cannot possibly modify the principals upon which the "Se" and "Fe(a)" formulae are based. Any given value which is thought to be in keeping with current market conditions may be substituted in the calculations without altering the equity of the valuation

* In Appendix ~~B~~ D? will be found land assessment values and tax revenues per acre for cutover and for timbered land in 8 counties in the Florida naval stores section and 6 counties in the Georgia belt.

methods as outlined.

IX

Comparison of "Se" and "Fe(a)" Returns Obtainable from Plans of Management which Maintain Contrasting Degrees of Stand Density.

In order to further emphasize the desirability of maintaining well stocked timber stands and to indicate the practicality of the "Se" and "Fe(a)" formulae in arriving at the comparative financial merits of one plan of management over another, the following illustrative examples are offered. In each instance production costs and returns have been taken from table ; the assumption being made that such tabular values will be identical with those allowed for under the management plans here presented;

Case #I Comparison of "Se" Values

Plan (A1) The determination of a soil expectation value for a management plan which provides for the following:

1. Planting cost ---- $ 1.00 per acre
2. Stocking of 15 chippable trees per acre in the 30th year.
3. Chipping begins --- 30th year.
4. Chipping life --- 10 years.

5. Annual yield per crop --- 45 units
6. Rotation --- 40 years
7. Final utilization of crop trees
--- $ .25 each

By use of the formula:

*

$$Se = \frac{\left(\frac{Yc\,(1.0p^{c}-1)}{.0p}\right)+R}{(1.0p^{n+c}-1)} - (Ca+E)$$

Substituting from the tabular values: (see table)

$$Se = \frac{\frac{\$703.70\,(1.06^{10}-1)}{.06}+\$2500}{1.06^{40}-1} - (\$666+\$2466)$$

$$Se = \frac{\frac{703.70\,(.791)}{06.}+2500}{9.29} - 3132$$

$$Se = \frac{8110.45+2500}{9.29} - 3132$$

Se = $ — 1989.86 for 666 acres or a loss of approximately $ 3.00 per acre.

Plan (B1) Determination of a soil expectation value for a management plan which differs from Plan (A1) only in that 120 chippable trees

* For a complete explanation of this formula, see page of this report.

per acre are provided for.

Substituting in the "Se" formula the tabular values for 120 trees per acre stands and using a new increased planting charge of $ 3.50 per acre.

$$Se = \frac{\frac{914.20(1.06^{10}-1)}{.06} + 2500}{(1.06^{30+10}-1)} - (290.50 + 443)$$

$$Se = \frac{\frac{914.20(.791)}{.06} + 2500}{9.29} - 733.50$$

$$Se = \frac{12,052.20 + 2500}{9.29} - 733.50$$

Se = $ + 832.93 for 83 acres, or approximately $10.00 per acre.

Thus the use of the "Se" formula has shown decided financial advantage of the 120 tree per acre plan. An approximate loss of $ 1900.00 would accompany the adoption of "Plan (A1)", providing the land itself was considered to have a negligable value. Whereas, the adoption of "Pland (B1)", with its provision for greater stand density, would insure a profitable operation which could pay $ 10.00 per acre for its bare land and still earn 6% compound interest upon its capital.

Case #II A Comparison of "Fe(a)" Values

If, instead of management plans involving bare land, an operator wishes to compare the financial merits of plans dealing with ready stocked timber property, he is referred to the "Fe(a)" formula. Management plans (A1) and (B1) can easily be modified so that instead of dealing with bare land they deal with 10 year old stands of slash pine. Then by application of the "Fe(a)" formula we can readily arrive at the financial merits that may be expected to accompany managerial policies which produce stands of apposing densities; such a comparison follows:

Plan (A2) The determination of a forest expectation value for a 10 year old stand of pine where the plan of management includes the following items:

1. Reproduction -- obtained naturally at no cost.
2. Stocking of 15 chippable trees per acre in the 30th year.
3. Chipping begins -- 30th year.
4. Chipping life -- 10 years.
5. Annual yield per crop -- 45 units.
6. Rotation -- 40 years.
7. Final utilization of crop trees $ .25 each.

"Fe(a)" value determined by use of the formula:

$$\text{"Fe(a)"} = \frac{\left(\frac{Y_r(1.0p^c - 1)}{.0p} + R\right)\left(1.0p^{n+c}\right)}{\left(1.0p^{n-a+c}\right)\left(1.0p^{n+c} - 1\right)} - E \quad *$$

Substituting the values found in table for the 15 trees per acre stands we get:

$$Fe(10) = \frac{\left(\frac{\$703.70\,(1.06^{10} - 1)}{.06} + \$2500\right)\left(1.06^{30+10}\right)}{\left(1.06^{30-10+10}\right)\left(1.06^{30+10} - 1\right)} - \$2466$$

$$Fe\ (10) = \frac{\left(\frac{703.70(.791)}{.06} + 2500\right)(10.29)}{(5.744)(9.29)} - 2466$$

$$Fe\ (10) = \frac{(8110.45 + 2500)(10.29)}{53.362} - 2466$$

$$Fe\ (10) = \frac{109,181.53}{53.362} - 2466, \text{ or } 2046.05 - 2466$$

Fe (10) = $ - 419.95 for 666 acres, or $ - .62 per acre.

Plan (B2) The determination of a forest expectation value for a 10 year old stand where the plan

* For a complete discussion of the symbol meanings and the application of this formula see page .

of management differs from Plan (A2) only in that 120 chippable trees per acre are produced.

Substituting the tabular values (table) for the 120 trees stands in the "Fe(a)" formula we obtain:

$$Fe\ (10) = \frac{\left(\frac{\$914.20\,(.791)}{.06} + \$2500\right)\left(\$10.29\right)}{\left(5.744\right)\left(9.29\right)} - \$443$$

$$Fe\ (10) = \frac{\left(12,052.20 + 2500\right)\left(10.29\right)}{53.362} - 443$$

$$Fe\ (10) = \frac{149,742.14}{53.362} - 443, \text{ or } 2806.15 - 433$$

Fe (10) = $ 2373.15 for 83 acres, or $ 28.60 per acre.

The pronounced advantage of timber management which provides for fully stocked stands becomes clearly evident from the above mathmatical comparison. Whereas, 15 tree per acre stands represents a $ 420.00 per crop loss to the operator, stands of 120 chippable trees per acre show a positive present worth of $ 2,373.00 per crop; this assumes that both stands are treated as sustained yield properties. When the per crop value of $ 2,373.00 is

reduced to an acre basis ($\frac{2373}{83}$) the value of $ 28.60 is obtained. Thus it is seen that immature stands of second-growth slash pine possess very attractive money values if sound, definite plans are outlined and adopted for their management.

The accompanying tables (tables IV, V, VI) contain soil and forest expectation values that have been computed at three rates of interest. It has been attempted in these three tables to compare the present worth of naval stores properties if operated on sustained yield plans, conparable to the one on page of this report, carrying the average stand stockings with those advocating 120 trees per acre.

The methods of arriving at the figures found in the "Expectation Value Tables" were identical with those explained in detail on pages , and . Annual property taxes, however, were figured at $ .25 per acre which raised the capitalized annual expenses (i.e. E) for the 15 tree stands to $ 4330.00, and those of the 120 tree stands to $ 675.00. The figures in these three tables are of practical interest inasmuch as they show very distinctly the rise in expectation values of naval stores property with (1) the increase in stand stocking per acre, (2) the increase in yield per crop, (3) the increase in age of existing stands, and (4) the decrease in interest

EXPECTATION VALUES OF NAVAL STORES STANDS - - 3% SERIES. TABLE VI

	Stocking of 15 Trees Per Acre				Stocking of 120 Trees per Acre			
	Annual Production 40 Units		Annual Production 45 Units		Annual Production 40 Units		Annual Production 45 Units	
Expectation values of:	Per Crop: 666 A.	Per A.	Per Crop: 666 A.	Per A.	Per Crop: 83 A.	Per A.	Per Crop: 83 A.	Per A.
Bare lands	-$1590.86	-$2.39	-$ 323.55	-$ .49	$3519.98	$ 42.41	$4744.53	$ 57.16
5 Year old stands	- 382.76	- .57	1086.33	1.63	4509.43	54.33	5978.50	72.03
10 Year old stands	246.56	.37	1950.00	2.93	5335.73	64.28	7039.20	84.81
15 Year old stands	974.05	1.46	2948.68	4.43	6291.20	75.79	8265.96	99.59
20 Year old stands	1820.63	2.73	4109.38	6.17	7403.09	89.19	9691.76	116.77
30 Year old stands	3961.22	5.95	7010.91	10.53	10179.90	122.65	13255.91	159.71

EXPECTATION VALUES OF NAVAL STORES STANDS - - 6% SERIES. TABLE V

	Stocking of 15 Trees Per Acre				Stocking of 120 Trees Per Acre			
	Annual Production 40 Units		Annual Production 45 Units		Annual Production 40 Units		Annual Production 45 Units	
Expectation values of:	Per crop: 666 A.	Per A.	Per Crop: 666 A.	Per A.	Per Crop: 83 A.	Per A.	Per Crop: 83 A.	Per A.
Bare land	-$4093.82	-$6.15	-$3853.86	-$5.78	$ 245.08	$ 2.95	$ 600.93	$ 7.24
5 Year old stands	- 3108.00	- 4.66	- 2800.91	- 4.20	947.17	11.41	1410.95	17.00
10 Year old stands	- 2694.53	- 4.04	- 2283.93	- 3.43	1495.61	18.02	2131.32	25.68
15 Year old stands	- 2141.24	- 3.21	- 1591.74	- 2.39	2229.92	26.87	3080.50	37.11
20 Year old stands	- 1400.71	- 2.10	- 665.33	- 1.00	3212.77	38.71	4351.08	52.42
30 Year old stands	+ 914.73	+ 1.37	+ 2952.84	+ 4.79	6285.82	75.73	8998.93	108.42

EXPECTATION VALUES OF NAVAL STORES STANDS -- 8% SERIES. TABLE IV

	Stocking of 15 Trees Per Acre				Stocking of 120 Trees Per Acre			
	Annual Production 40 Units		Annual Production 45 Units		Annual Production 40 Units		Annual Production 45 Units	
Expectation Values of:	Per Crop 666 A.	Per A.	Per Crop 666 A.	Per A.	Per Crop 83 A.	Per A.	Per Crop 83 A	Per A.
Bare land	-$4558.33	-$6.84	-$4383.96	-$6.58	-$380.72	-$4.59	-$2-5.98	-$2.48
5 Year old stands	- 3686.96	- 5.53	- 3430.25	- 5.15	+ 184.12	+ 2.22	+ 440.21	+ 5.30
10 Year old stands	- 3384.61	- 5.08	- 3007.21	- 4.51	588.15	7.08	965.53	11.63
15 Year old stands	- 2941.33	- 4.41	- 2387.05	- 3.58	1180.37	14.22	1734.66	20.90
20 Year old stands	- 2289.47	- 3.44	- 1478.98	- 2.21	2051.39	24.71	2865.82	34.53
30 Year old stands	+ 74.73	+ .11	+ 1833.08	+ 2.76	5210.25	62.77	6968.59	83.96

demanded from invested capital.

It becomes of considerable practical interest to compare a few of the tabular expectation values of 120 tree per acre stands found in the 6% series with current market values of comparable land in the naval stores belt. Figures supplied by the Savannah Real Estate Board, of Savannah, Georgia, place a selling price of $ 5.00 per acre upon cutover land of a character suitable for growing slash pine, and $ 8.00 per acre upon restocking pine lands. The $ 7.24 of the table favorably compares with the actual $ 5.00 sale price; while per acre expectation values ranging from $ 17.00 to $ 37.00 seem to indicate that many excellent opportunities for profitably managing the $ 8.00 land are being at present overlooked.

X

Presentation of a Present Worth Formula for Liquidation Operations

The education of naval stores operators to the advantages that will follow the adoption of sustained yield practice may be expected to require a considerable period of time. Therefore the majority of producers, for some time at least, will no doubt remain nonowner-operators carrying on their activities of progressive liquidation

It would be to the advantage of this type of producer to be able to carry on his operation so that he may realize the highest net return from his leased timber. With this aim in mind it has been attempted to work out a formula which will indicate, by means of a present worth value, the most advantageous point for him to cease woods operations in any given stand. Annual yields, under his plan of operation, start at a maximum and fall gradually through a period of years to a minimum below which he finds it unprofitable to work the timber. A valuation formula, developed at the University of Michigan, to give the present worth of a decreasing tax series was easily modified to fit the requirements of the naval stores operator. The resulting formula for obtaining the present worth of anticipated future returns from a liquidating operation in turpentine timber follows.

$$P.W. = \frac{Y/c\left(\frac{1.0p^{c}[(c\times.0p)-1]+1}{0p^{2}}\right)+\frac{(Y-e)(1.0p^{c}-1)}{.0p}}{1.0p^{c}} - L$$

Where:

P.W. --Present worth per crop of liquidation operation chipping over "c" years.
c -- Number of years in current operations
Y -- Initial net yields in dollars above an acceptable minimum exclusive of annual protection charges.

$\left(\frac{1.op^{c}((c \times .op)-1)+1}{.op^{2}}\right)$ -- Compound value of a series of decreasing annual incomes. (Obtainable from prepared Tables in Mathew's Management of American Forests).

Y' -- Minimum acceptable net yield

e -- Annual protection charges

.op -- rate of interest desired.

The meaning of the above formula is quite easily put into words for it states as follows: the present worth of the returns from a crop of leased timber is equal to the discounted value of the sum of a series of decreasing annual net yields which start at "Y" dollars (and fall to Y' dollars) in a period of "c" years, when interest is figured at op percent, annual protection at "e" dollars, and the lease costs "L" must be expended for the timber.

Most turpentine operators who lease timber have a fair knowledge of the minimum net gum yield for which they can afford to work a crop of timber. Likewise they have a fair knowledge, from past experience, of the approximate yields they can expect from a crop of virgin* faces. Also experince and recent research activities have pointed out to them the fact that the productive life of turpentine timber can be prolonged by conservative chipping practice, although initial yields

* Virgin faces are those being worked for the first year.

in conservative chipping may be reduced somewhat. The problem then arises as to which procedure would be the most desirable one financially for the nonowner-operator to follow: (1) to be content with slightly reduced initial yields, chip his leased timber over a long period of years, and benefit from low annual lease charges; or (2) obtain high initial yields, chip for a short period, and pay the consequent high lease premiums demanded when such practice is the known intention of the operator.

By substituting all the available data, as discussed in the predeeding paragraph, in the "P.W." formula, the operator can determine the present value represented by each alternative liquidating plan he may have under consideration. Clearly, after performing such a comparative analysis of returns, he should adopt that plan of procedure which gives him the highest present worth.

XI

Comparison of Financial Returns Obtainable under Policies of Progressive Liquidation with those Returns from Sustained Yield Properties

If a regulated naval stores property, such as outlined on page , cannot hold its own financially

against 10-crop liquidating operations then intensive practice of forestry by producers can never expect widespread adoption. It therefore becomes of great moment to indicate the financial returns that may be expected to attend adoption of each of the three opposing types of operations: first, annual returns from liquidation operations in 15 face-per-acre timber; second, annual returns from liquidation in 60 face-per-acre stands; and last, annual returns from a 10 crop sustained yield operation in 120 tree-per-acre timber.

Throughout the following calculations production costs and returns were obtained from table II, page for the two liquidating operations, and from table III, page , for the sustained yield property.

(A) Presentation of annual returns from a 10-crop operation following a plan of progressive liquidation in 15 face-per-acre timber.

Area of land required for annual production of 10 crops 6667 acres.

Annual net income per crop of turpentine timber--$ 135.00

" " " from 10 crops of timber (i.e. 10 x $135) $1,350.00.

NOTE: Net returns are those of table , calculated for 40 unit crops. This liquidation plan presupposes access to 10 crops of virgin, 15 face-timber every 6 or 10 years.

(B) Presentation of annual returns from a 10-crop operation following a plan of progressive liquidation in 60 face-per-acre timber.

Area of land required for annual production of 10 crops- 1667 acres.

Annual net income per crop of turpentine timber-- $292.00.

" " " from 10 crops of timber (i.e. 10x $292) $2,920.00.

NOTE: Net returns are those calculated for 40 unit crops as per table II. Such a plan presupposes access to 10 crops of virgin 60-face timber every 6 or 10 years.

(C) Presentation of annual returns from a 10-crop sustained yield forest property which operates under a plan of management identical to that outlined on page of this report.

Area required to maintain annual production of 10 crops 3,333 acres.

Annual net income per crop of timber -- $664.00.

Annual net income from 10 crop regulated property--$6,640.00.

*Annual expenses per crop for taxes and protection- $33.75.

Annual expenses on regulated property (i.e. 40x$33.75) $1,350.00.

Total annual net returns from sustained yield property-- $5, 290.00.

It appears evident from these calculations that the sustained yield property, with its provisions for high stand density, is in a more favorable economic position than either of the liquidation operations. Whereas, the 15-face and 60-face liquidating operations could only show an annual net return of $1,350. and $2,920 respectively, the sustained yield property produced an annual net revenue of $5,290. In addition to the pronounced financial advantage enjoyed by the regulated naval stores property, it also maintains certain technical and social advantages. Both of the liquidation operations must lease new croppages of virgin or rested faces periodically at 6 or 10 year intervals in order to perpetuate their annual 10-crop yields.

* Annual expenses have here been calculated with a $.25 per acre charge for taxes. The resulting $33.75 should be extremely conservative then since average per acre taxes were found to be only $11. for such property by the Southern Forest Experiment Station.

Such periodic leasing practice causes a serious drain upon desirable naval stores timber and contributes constantly to the rapidly mounting reservoir of abandoned timber. By using and re-using forest soil, as is done under the plan proposed for the sustained yield property, the above problems incurred by the liquidating operations are eliminated, and vastly increased land revenues and greater industrial and social stability become attainable.

XII

Advantages Enjoyed by Sustained Yield Properties

The goal of sustained yield management in the naval stores belt should be the regulation of forest property so that it will produce continuously a given croppage of turpentine timber upon the same unit areas of land. The benefits that will attend "Sustained Yield" practice upon a single forest property are similar in character to those benefits associated with any other form of permanent business enterprise.

Mathews* very aptly sums up the list of advantages for sustained yield production forest. Only slight modification is needed to adapt his list to the benefits to be found in the naval stores industry:

Technical Advantages

1. The establishment of permanent market connections and business good will.
2. The establishment of a permanent, skillfull, and contented labor force which does not have to be periodically increased or decreased.
3. The development of permanent financial connections which permit financing of the necessary business transactions at low interest rates.
4. The reduction of physical equipment to the minimum in relation to total output of pro - ducts over a period of years.
5. Complete utilization of chipped timber and provisions for securing restocking of cut areas.

* Essentially the same Technical and Financial advantages may be found discussed for regulated timber production forests in Mathews' "Management of American Forests".

6. Reduction of forest capital, or growing stock, to a minimum necessary for continuous production of naval stores and timber products from the forests.

Financial Advantages

1. A reduction in the direct costs of operation per unit of production.
2. A reduction in general production costs with a consequent rise in the net value per unit of production.
3. A reduction of total investment in physical equiptment for any fixed permanent output.
4. A reduction in timber capital for any fixed permanent output.
5. Elimination of the depletion charge necessitated by progressive liquidation; since under sustained yield management the timber capital is kept intact by growth.
6. Low interest rates obtainable in business transactions due to increased stability.

Practically all of the fore-listed benefits have been dealt with in one form or another in this report.

Some of the more obvious items, however, have not been considered in detail since they seem self-evident as stated in the annotioted outline. Again it should be emphasized that these listed advantages attend all permanent businesses; but the naval stores industry in general has denied itself such benefits by choosing to follow plans of progressive liquidation in preference to plans of sustained yield management.

XIII

An Accurate Method for the Determination of Lease Values

The failure of a large number of timberland owners to appreciate the possabilities offered by sustained yield management will keep many producers in the ranks of nonowner-operators for some period of time. Likewise, a lack of capital and of individual initiative, necessary to block up adequate regulated timber properties, will alsotend to prevent any very rapid shifting in the present status of turpentine operators. These very real barriers to widespread adoption of sustained yield practice in the naval stores industry

indicate clearly that attainment of the desired degree of forest regulation can only come about through a gradual evolutionary process.

Recognizing that "Leased Timber" will continue to play a major role in production for some time to come, the subject of "Lease Fees" then becomes deserving of close analysis. Lease fees have been subject to a steady increase for the past two decades. The determination of these fees has remained, even up to the present day, an arbitrary process by which the lessor offers his timber at whatever figure he feels the lessee can be made to pay. The process of bargaining has led to many malpractices, current in the industry, on both the part of the timber lessor and lessee. Paramount of these evils have been, (1) Radically fluctuating lease charges from season to season, and (2) Subsequent glutting of naval stores markets as operators attempt to realize immediate returns from high priced timber contracts.

The use of some accurate, scientific method for the determination of fair lease values should be appreciated by both the progressive timber-owner and the progressive timber-operator. For the betterment

of the naval stores industry in general both of these parties should be interested in seeing that lease fees are equitably determined. Of necessity, the fees should be set at a figure which can insure a fair margin of profit to the operator and yet does not penalize and discourage the activities of the timber-grower. Only through some form of mutually beneficial leasing system can the naval stores industry, under its present organization, hope to prosper.

A scientific method for arriving at accurate lease values would offer a sound basis for taxation and would promote better forestry practice. Since tax assessments are usually based upon the ability of land to create an income, an accurate determination of lease revenues would bring about more accurate property valuation. Such assessments, derived from lease revenues, would in turn provide a sound basis for more equitable taxation in any given county. Intensive forestry practice would receive great impetus, inasmuch as stablization of lease values would offer the timber-grower every incentive to increase and perpetuate his land incomes by means of preconceived plans of management.

Two methods have been advocated by the United States

Forest Service for the determination of stumpage values on National Forest timber sales; one is known as the "Overturn Method" and the other as the "Investment Method". Both methods arrive at a fair stumpage value for the timber after deducting from the market value of lumber all the necessary expenditures incurred in its production, plus a margin allowed the operator for profit and risk.

Because of the high favor they have gained, and because of their simplicity, the basic principals of appraisal found in these methods should find further practical application in the naval stores industry. Since the largest investment of the naval stores operator is in working capital* rather than in fixed capital** the "Overturn Method" was chosen in preference to the "Investment Method" as a model for fashioning the turpentine lease formula***.

* Working capital--funds necessarily tied up in products as items of direct costs.

** Fixed Capital--Funds invested in plant and necessary equipment.

*** The primary difference between these two stumpage appraisals formulae is that the "Investment Method" rates its margin for profit and risk against the fixed investment, whereas, the margin in the "Overturn Method" is rated against the working capital.

The resultant "Lease Appraisal Formula" for turpentine timber follows:

$$X = S-(1+\%) \times (Wc + Rc + Pc + D)$$

Where:

X--Annual lease value per crop of timber.

S--Current market value per crop i.e. Units per crop times value per unit.

Wc--Annual cost of woods operations per crop.

Rc--Annual cost of distilling or refining per crop.

Pc--Cost of processing or selling per crop.

D--Average annual depreciation per crop.

Transposed into words this formula states: the lease value of a given crop of turpentine timber is equal to the market value of the naval stores products from that crop, less a definite percentage or margin of the total working capital involved in the production of these products. Such a working capital consists of the following items: cost of woods operation, refining costs, processing costs, and depreciation.

The only data needed for putting this method of lease appraisal into application are average per crop production costs. Practically all producers maintain cost accounts of some nature. Therefore, arriving at

fair lease values for any given stand of timber merely involves substituting the production costs incurred by the average operator in the "Appraisal Formula" and solving for "X". To practically illustrate the simplicity of this proceedure let us assume that a fair per-crop lease figure is desired for two radically different properties: One carries stands of 15 round trees per acre, and the other, stands of 120 round trees per acre. Referring to table II for average production costs in the two stands we find the following items:

Annual Per Crop Production Costs

Wood Costs:	15-Face Timber	120-Face Timber
Cost of hanging and raising cups	$ 52.60	$ 42.60
Cost of chipping and pulling	315.00	262.50
Cost of dipping and scraping	120.00	80.00
Cost of hauling dip and scrape	100.00	60.00
Cost of boiling and cleaning cups	10.00	7.00

Cost of interest on investment @ 8%	$ 65.00	$ 65.00
Cost of supervision	234.00	178.00
Cost of maintenance	31.00	31.00
Cost of annual fire protection	50.00	13.00
Cost of recruiting labor	20.00	10.00
	$997.60	$749.10

Refining Costs:

Still operations	$245.20	$245.20
Still taxes and insurance	7.50	7.50
	$252.70	$252.70

Processing Costs:

Selling or marketing costs	$200.00	$200.00

Depreciation Costs:

Annual depreciation of fixed investment	165.00	165.00

Market Value of Products:

Annual production of 45 units of naval stores @ $50.00	$2,250.00

Assuming that 20% is a fair margin to allow the operator for profit and risk we can then solve for the per crop lease values of each stand by substituting the appropriate values in the formula. Solving first for the 15-tree property we get:

$$X = S-(1+\%) \times (We + Re + Pe + D)$$

$$X = 2250 - (1.20) \times (997.60 + 252.70 + 200. + 165.)$$

$$X = 2250 - (1.20) \times (1615.30)$$

$$X = 2250 - 1938.36$$

$X = \underline{\$311.16}$ per crop, or $\underline{\$.031}$ per face.

Solving next for the 120-tree property in the same manner we get:

$$X = \$2250 - (1.20) \times (749.10 + 252.70 + 200. + 165.)$$

$$X = 2250 - (1.20) \times (1366.80)$$

$$X = 2250 - 1640.16$$

$X = \underline{\$609.84}$ per crop, or $\underline{\$.061}$ per face.

Thus, by means of the "Appraisal Formula" we have quickly and accurately arrived at fair lease charges for turpentining priveleges. Needless to say the lease values so determined will vary from year to year and from one locality to another with those variations encountered

in the following factors:

1. Market values of products
2. Production costs of various operators
3. Margin demanded by operators for profit and risk
4. Yields of gum per crop
5. Stand densities per acre.

It is worthy of mention that lease values per tree (or face) as determined for the 15-face property, in the preceeding calculations, check very favorably with present annual lease fees paid for comparable timber. The only lease fees approaching $.06 a face, as determined for the 120-face property, are those demanded for working timber on the National Forests in Florida. However, few extensive stands of workable naval stores timber can show stockings of 120 cup trees per acre. It is not at all unlikely that when such well stocked stands can be offered by timber-growers they will bring in lease fees of $.06, or better, per face.

Fire Loss Appraisals for the Naval Stores Region

Fire is the one outstanding menace confronted by all turpentine producers. The high inflammability of faced timber virtually insures heavy, if not complete losses in physical equiptment* whenever uncontrolled fire enters the stand. The naval stores operator has long recognized the ability of fire to rob him over night of his capital and plant; consequently he has taken various steps to protect his timber. For many years he has protected his woods by "Raking and Burning"** under more or less controlled conditions during winter months. Recently a large number of operators have entered their stands in "T.P.O."***

* Physical equiptment includes timber as well as cups, gutters, barrels, wagons, ect.

** Raking and Burning is a protective measure in which the litter and debris are raked away from the bases of the trees and then a light surface fire is run through the woods.

*** T.P.O. is the popular abreviation for Timber Protective Organization, which cooperative organizations offer very effective fire protection service at low rates; funds being supplied on a 50-50 basis by the federal government under the Clark McNavy Acts.

units and are securing protection through the facilities of plowed fire-breaks and organized detection and suppression forces. Annual expenditures per crop for protection by the "Raking and Burning" method may vary anywhere from $40. to $50., while protection under "T.P.O." units vary between $.06 and $.15 per acre. From these figures it can readily be seen that fire not only threatens complete dissolution of the operator's forest capital but in addition necessitates his making comparatively large annual expenditures in protective measures.

Generally speaking, flatwood's fires in stands of mature timber, where turpentining is not in effect, are not of a serious character. They usually occur as intentionally set surface fires, in the late winter or early spring months, and do little damage to large thick-barked pines. However, once chipping begins in a stand the entire picture changes. Exudations of highly inflammable gum from the wounded trees cover the turpentine faces and drip down into the cups upon the woods floor. The entire woods then becomes like a tinder box waiting to be ignited by the first well directed spark.

Immature stands of pine, unlike mature unchipped

stands, are very susceptable to high fire damage. Lacking the heavy bark possessed by the mature trees, and having their foliage in close proximity to the ground surface, the young trees are unable to withstand the consuming heat developed by the surface* fire. The present exceedingly poor stocking of pine stands in the naval stores belt is almost directly traceable to losses from the periodic surface fires which have been permitted to sweep over immature stands. Clearly if a timberland-owner desires well-stocked pine stands for either private chipping or leasing, he must adequately protect his timber from fire.

Fires in the naval stores region do not originate of their own volition. Those factors responsible for the actual conception of fires are termed "Risks". Chief of these risks in the naval stores belt are "man" and "machinery". Of the two, man with his indifference and carelessness plays the major role. Education of the general populance is doing much to

* This statement is not meant to include longleaf pines still in the grass stage(1-10 years) which are very resistant to surface fires.

curb man's carelessness with fire. However, to secure adequate support and cooperation against fire will require a very considerable period of time. Flatwood's fires, untill such universal cooperation is secured, may be expected to cause heavy annual losses to timber property in general, and to naval stores timber in particular.

It appears quite evident that the progressive operator cannot afford to postpone the adoption of sustained yield practice until the present fire menace is eliminated. On the other hand, neither can he consciously afford to embark upon plans of intensive forest management until he has some assurance that an incidental fire will not wipe out his entire capital.

Inasmuch as courts of law are created for the avowed purpose of protecting man's rights, the operator should logically look to them for a solution to his problem. In most states of the Union, individuals, who maliciously, or through negligence, allow fire to enter the woods of another, can be held lawfully responsible for any loss of property which that

fire causes. Many timberland-owners have taken advantage of such protective laws and have successfully pressed legal court claims for recovery of damages. In order to press litigation for justifiable losses, However, the defendent must be prepared to correctly evaluate his fire damage. Necessarily, such valuation should be based upon sound financial calculations which do not permit of any personal sentiment. Appraisal methods which meet these requirements are easily developed as "Present Worth" formulae, similar in character to those presented earlier in this report for evaluating forest properties.

Appraisal of Damage in Immature Timber

Although immature naval stores timber has a very negligable market value it may, never the less, possess a very considerable expectation value. As Chapman* states: "The element of time elapsing between the damage and the realization of profits does not dismiss the consideration of these profits, providing they are

* Excerpt from H.H. Chapman's Forest Valuation, p. 120, New York, 1915.

reasonably certain to occur and are properly discounted. The following formula is offered an an equitable means of appraising fire damage in immature naval stores stands where natural reproduction may be depended upon to restock the burn:

$$Fv = \frac{\frac{Yr(1.0p^{c}-1)}{.0p} - E(1.0p^{n-a+c}-1) + R}{1.0p^{n-a+c}}$$

Where:

Fv-- Appraised loss value per crop of timber

Yr-- Annual net yield of naval stores which is anticipated

.0p-- Interest rate (usually 6%)

n-- Years before chipping size is attained

a-- Present age of the stand

C-- Chipping life, i.e. duration of yields

R-- Anticipated net revenue from final utilization of crop trees

E-- Capitalized annual expenses for taxes and protection.

Illustration:

It may be assumed that a crop of immature slash pine in southeastern Georgia is being administered at a cost of $60. annually with the expectation that it will come into bearing in the 30th year. The present operator anticipates he can chip this crop for an 8 year period and can realize annually a net return from gum of $800.; in addition he proposes to sell his crop trees in the 38th year for a stumpage price of $.15 each. The crop attains the age of 15 years when a careless neighboring cotton farmer permits a brush fire to get out of control and enter the pine stand where it completely destroys the crop of trees. The timberland-owner desiring to evaluate his loss, as a preliminary step in initiating civil action, selects the fire loss appraisal formula which he applies as follows:

Value of Symbols:

Yr-- $800.00

.op-- .06

n-- 30 years

a-- 15 years

d-- 8 years

R-- $1500. i.e. $.15 x 10,000

E-- $1,000. i.e. $\frac{\$60.}{.06}$

Reproduction expected to come from adjacent areas of meture timber.

$$Fv = \frac{\frac{\$800(1.06^{8}-1)}{.06} - \$1000(1.06^{23}-1) + \$1500}{1.06^{30-15+8}}$$

$$Fv = \frac{\frac{800(.594)}{.06} - 1000(2.829) + 1500}{3.829}$$

$$Fv = \frac{7920 + 2829 + 1500}{3.829}$$

$$Fv = \frac{6591}{3.829}$$

$Fv = \$1721.34$

Therefore, $1721.34 becomes the amount of damage suffered by the timberland-owner because of the fire and it is this sum which should be demanded in litigation.

Appraisal of Damage in Immature Timber with Artificial Reproduction

In the preceeding illustration, if adjacent stands of mature timber or simgle seed trees were not present, an additional charge for artificial restocking would become necessary. Such a cost can very easily be handled in the formula by merely adding the required planting expenditure, or "Cn", which makes the formula read:

$$Fv = \frac{\frac{Y_p(1.0p^{c}-1)}{.0p} - E(1.0p^{n-a+c}-1)+R}{1.0p^{n-a+c}} + Cn \ *$$

Where:

Cn-- Cost of planting "n" acres, or area required per crop of timber.

Illustration:

Let us assume the adjacent mature timber in the preceeding case, illustration on page , was also destroyed by the fire so that natural reproduction

* For the meaning of sumbols found in this formula see page of this report.

would not follow on the 83 acre burn. Under such conditions what would be a fair claim for the timberland-owner to seek?

Clearly it would merely mean augmenting his previously determined loss (page) by the cost of planting 83 acres, i.e. "Cn". The predetermined loss was calculated to be $1721.34; cost of planting 83 acres becomes 83 x $3.50, or $290.50; and his total claim should therefore be $2012.00, providing he is certain natural restocking cannot be depended upon.

Loss Appraisals for Mature Stands with Natural Reproduction

In addition to stands of immature timber, the sustained yield operator will have stands of mature turpentine timber which are currently yielding him an income form gum. Therefore, it becomes equally important that he should be able to correctly determine any fire losses such stands may incurr. To quickly and accurately arrive at the values represented by mature yielding timber, necessitates but a few slight

modifications in the methods used for computing losses in immature timber stands.

Inasmuch as the waiting periods are eliminated from consideration when dealing with currently yielding stands the original formula on page is somewhat simplified. However, since the timber may have been chipped for a number of years prior to the fire, the pre-fire gum returns must not enter into the valuation computations. This item is taken care of in the following formula by the insertion of "x" which stands for the number of years chipping has proceeded in the crop.

$$Fv = \frac{\frac{Yn(1.0p^{c-x}-1)}{.0p} - E(1.0p^{c-x}-1) + R}{1.0p^{c-x}} \quad *$$

Where:

x-- Age of stand at time of burn in terms of chipping years; i.e. a stand which has been chipped 5 years at the time the fire loss occurs will have an "x" of 5 years.

* For the meaning of symbols found in this formula see page of this report.

Illustration:

Assume a crop of slash pine timber is currently yielding 45 units of naval stores having a net value of $750.00. The timber has been chipped 2 years when a fire of known origin enters the stand and completely destroys the timber, except for concentrated drifts* of seed trees. The owner feels he is justly entitled to reimbursement for his loss by the responsible party and estimates the value of the timber destroyed, exclusive of his $48.00 annual expense charge, to be as follows:

Net returns from gum for an 8 year period (8 x $750.00) . . .	$6,000.00
Net returns from crop trees harvested after 10 years of chipping ($25.00 x 10,000)	2,500.00
Restocking by natural seeding from drift trees at no cost.	
Interest rate considered fair for industries in general	.06

* A "drift" is a rough working unit of timber in naval stores terminology which has no definite size but conforms more to the general topography of the property. For example, an elongated strip of slash pine paralleling a creek-bed would be termed a "drift".

Substituting the above values in the new "Loss Appraisal" formula found on page we get:

$$Fv = \frac{\frac{\$750(1.06^{10-2}-1)}{.06} - \frac{\$48}{.06}(1.06^{10-2}-1) + \$2500}{1.06^{10-2}}$$

$$Fv = \frac{\frac{750(1.594-1)}{.06} - 800(1.594-1) + 2500}{1.594}$$

$$Fv = \frac{\frac{750(.594)}{.06} - 800(.594) + 2500}{1.594}$$

$$Fv = \frac{7425 - 475.20 + 2500}{1.594}$$

$$Fv = \frac{9449.80}{1.594}$$

$$Fv = \$5928.00$$

Thus the value represented by the timber which was destroyed by fire aggregates $5,928.00. Courts of law would award this amount providing the timberland owner presented sufficient proof that the anticipated returns as outlined were reasonably certain to occur.

Appraisal of Damage to Mature Timber where Artificial Reproduction is Necessary

As was the case in dealing with fire damage in immature timber the seed trees in mature timber may also be destroyed by fire. If this is true, then su supplementary charges must be allowed for in the "Loss Appraisal" formula which provides for the reimbursement of the cost of planting the burn. This additional consideration merely involves the introduction of planting charges "Cn" in the formula on page . The "Loss Appraisal" formula for mature timber then reads:

$$Fv = \frac{\frac{Yo(1.0p^{c-x}-1)}{.0p} - E(1.0p^{c-x}-1) + R}{1.0p^{c-x}} + Cn \quad *$$

Where:

Cn-- The cost of planting "n" acres: i.e. the area necessary to produce 1 crop of mature turpentine timber.

* For an explanation of the symbols involved in this formula see pages and of this report.

Illustration:

Let us assume that the fire in the crop of mature timber in the preceeding illustration (see page) crowns and thus completely destroys the "drifts" of seed trees. If the area covered by the crop was 80 acres in extent what value did the stand represent to the owner at the time of the fire?

Solution:

Inasmuch as the only condition altered in the preceeding case was the destruction of restocking facilities the above question is readily answered by increasing the fires loss of $5,928.00* by $280.00 (i.e. 80 x $350.00) which is the expenditure necessary to restock the burn. The total loss suffered by the timberland-owner in this hypothetical illustration would then be $5,928.00 plus $280.00 or $6,208.00.

* This figure derived by calculation on page .

Conclusions

(1) The dual nature of returns from turpentine timber indicates that naval stores properties are highly applicable to sustained yield management.

(2) A very favorable reduction in both production charges and effective land area can be obtained with regulated forest properties carrying well stocked stands of pine timber.

(3) Decided financial advantages can be shown for sustained yield properties when compared with currently operated liquidating units.

(4) Equitable lease values can be determined by means of recognized appraisal methods, which values are in keeping with present charges for leasing rights.

(5) Immature naval stores timber, when pre-concieved plans for its future utilization are in evidence, can be shown to posses[s] very definite monetary values. Fire-loss damages, based upon such values, have well-founded financial justification.

Summary omitted.

APPENDIX

"A"

DETAILED PRODUCTION COSTS

FOR STANDS OF VARIOUS DENSITIES

Courtesy C.H.Coulter
Florida Forest Service

Costs of Producting Naval Stores Per Crop
Working 15 Cups per acre, 60 Cups per acre,
and 120 Cups per acre

The average number of cups or faces per acre worked under average conditions is approximately 15. Some few close-grown, old file stands or some slash ponds have many more, but when averaged with the scattered timber on the hills or in the flatwoods, are greatly reduced. How do the land investment, operating costs, supervision and taxes compare with this scattered 15-cup timber, with stands 60-cups per acre, and with stands 120 cups per acre?

These scattered stands - 15 cups per acre - are the result of destructive logging, natural reproduction and periodic burning. Denser stands at present occur only in patches but are easily possible over large areas with planting and fire protection or with fire protection and simple management. Landowner-operators will grow timber only when they realize the value of it.

Costs of producting naval stores per crop are listed for 15 cups per acre, 60 cups per acre, and 120

cups per acre for 40 unit timber which is easily possible when the 9-inch minimum and single cupping are followed.

Hanging Cups	15 Cups	60 Cups	120 Cups
Axeman per 10,000	$30.00	$27.50	$25.00
Maulman " "	30.00	27.50	25.00
Nailer " "	10.00	10.00	10.00
Hauling cups "	10.00	7.00	5.00
Nails "	18.00	18.00	18.00
	$98.00	$90.00	$83.00

Supervision not included here- listed below.

Raising Cups			
Chipping per 10,000	10.00	9.00	8.00
Pulling tins "	8.00	6.00	5.00
Tacking tins "	35.00	32.00	30.00
Nail pulling and nailing "	15.00	12.00	10.00
Nails (3d)	4.50	4.50	4.50
	$72.50	$63.50	$57.50

Supervision listed below.

One hanging and three raisings usually last for the life of the face, that is, for 6 years.

Supervision

Manager-bookkeeper	12	months	@	$75.00	per	mo.	$900.00
Woodsman	12	"	@	$50.00	"	"	600.00
Tallyman	12	"	@	40.00	"	"	480.00
Truck Maintenance	12	"	@	20.00	"	"	240.00
Horse	12	"	@	10.00	"	"	120.00
							$2,340.00

The supervision outlined above will take care of an average 10-crop place, 15 cups per acre. As the number of faces increase to 60 and 120 per acre, the costs per crop will be lowered as follows, as the same supervision set up will handle more faces.

Supervision	15 Cups	60 Cups	120 Cups
Manager	$90.00	$75.00	$70.00
Rider	60.00	50.00	45.00
Tallyman	48.00	40.00	36.00
Truck	24.00	20.00	18.00
Horse	12.00	10.00	9.00
	$234.00	$195.00	$178.00

Annual Depreciation, Annual Maintenance, and Interest on Annual Investment will remain the same per crop regardless of the number of cups per acre.

Annual Depreciation	$165.00
Annual maintenance	31.00
Interest on average annual investment @ 8%	65.00

(These items approximately the same as those on page 45 "Florida Naval Stores" Costs per Crop in Washington County, Florida).

Fire Protection

The 15 cups per acre area will no doubt be protected in the old way by raking and burning. The 60 cups per acre and the 120 cups per acre are fire control set-ups with fire lines, organized crews and equpment as well as a detection system at 12¢ and 15¢ per acre respectively.

Costs of raking and burning are between $40.00 and $50.00 per crop not including supervision. Costs of organized fire protection are in the range of 6¢ to 15¢ per acre. In this cost of fire control the state and federal government cooperate on expenditures.

	15 Cups	60 Cups	120 Cups
Fire protection	$50.00	$20.00	$13.00

Taxes and Insurance

Still taxes and insurance amount to about $75.00 per annum for the whole operation.

	15 Cups	60 Cups	120 Cups
Still taxes and insurance	$7.50	$7.50	$7.50

Chipping and Pulling

Chipping and pulling pay at the present time about 90¢ per thousand. About 7,000 trees are worked per week. When the stand is less than 7 or 8 faces per acre a bonus is paid for such scattering work. No information is on record for a lower rate for close-grown stands. However, since about 60 % of a chipper's or puller's time is spent in walking between the trees, it is altogether possible to get a slightly lower rate on the more dense stands. At the base rate of 90¢ per M for 15 cups per acre, the price is assumed to be 80¢ per M for 60 cups per acre and 75¢ per M for 120 cups per acre. A greater reduction in price is not likely

as the worker needs to get his breath and rest a little between successive trees.

	15 Faces	60 Faces	120 Faces
Chipping or pulling Avg. no. of streaks 35	$9.00	$8.00	$7.50
Cost for season	$315.00	$280.00	$262.00

Dipping Gum and Scraping

Dipping gum with the present scattered stands (15 cups per acre) is a slow and laborious job. With from four to eight times as many trees per acre, much more gum could be dipped for the same amount of work.

Present price of dipping is about 60¢ per barrel for average stands. For 60 cups per acre the price is assumed to be 50¢ per bbl. and for 120 cups per acre, 40¢ per bbl.

Scraping at the present time is removed generally with the dip at no change in price. If removed separately it brings about the same price as dip.

Four full barrels of dip and one barrel of scrape (which may be mixed with dip) produce one unit (1 50-gal. bbl. spirits, 3-1/3 (500 lbs) bbls. rosin).

	15 Faces	60 Faces	120 Faces
Dipping	$96.00	$80.00	$64.00
Scrapping	24.00	20.00	16.00
	$120.00	$100.00	$ 80.00

Hauling

In the average operation a combination of wagon and truck bunches the dip and scrape and hauls it to the still. For scattering stands this cost amounts to about 50¢ per barrel. With from four to eight times the number of trees per acre the distance to travel is reduced decidedly both between barrels and from the woods to the still. Prices are set at 50¢, 40¢, and 30¢ respectively for 15 cups, 60 cups, and 120 cups per acre.

	15 Faces	60 Faces	120 Faces
Hauling	$100.00	$80.00	$60.00

Still Operation

Stilling costs are higher per unit or per charge for a small operation than they are for an eighteen-crop place or larger. In the smaller operations the stiller only running about 6 charges (or less) per week

must be paid from 75¢ to $1.25 per charge and the deckhand somewhat less. In a big turpentine place stillers and deckhands are paid by the month and it is not uncommon to turn out from 60 to 80 charges per month. The stiller's wage for the bigger operation is from about $30.00 to $50.00 per month and the deckhand's less.

However, the number of cups per acre has no direct bearing on the stilling costs which are as follows:

	Per charge (2 units)
Stiller	$ .75
Deckhand	.60
Cooper 6-2/3 bbls. @ 5¢	.33
Gluing 2 barrels	.50
2 spirit barrels @ $2.75	5.50
6-2/3 rosin barrels @ 45¢	3.00
Hoop iron 4 hoops x 6-2/3 x 3½¢ per lb.	.93
Batting 1 lb. @ 25¢	.25
Wood 1/5 cord @ $2.50	.40
Per charge, 2 units	$12.25
Per unit	6.13
Per crop 40 x $6.13	$ 245.20

Selling Costs per Unit and per Crop

No difference in price for different output except a large operation might arrange for cheaper transportaion.

Unit Value $50.00	Turpentine 48¢ per gal.; Rosin $4.45 (280 lb. bbl.)
Handling and loading 4-1/3 bbls. @ 3¢	$ .13
Freight 1 bbl. turpentine	.75
Freight 3-1/3 bbls. rosin @ 60¢	2.00
Commission 2½% of $50.00	1.25
Insurance ½ of 1% of $50.00	.25
Inspect turpentine	.09
Grading rosin 7¢ by 3-1/3	.23
Storage of spirits 9¢ per bbl.	.09
Storage of rosin 6¢ per bbl. by 3-1/3	.20
	$4.99 or $5.00
Per crop 40 x $5.00	$ 200.00

Lease Costs

In the case of an operator-landowner the lease cost may be fixed at any price he decides on. Lease values per face (6 year's working) are between 12¢ and 18¢.

Since taxes on the property are included in the cost of producing the 15¢ lease value (2½¢ per face per year) will be used.

	15 Faces	60 Faces	120 Faces
Lease costs	$250.00	$250.00	$250.00

Recruiting

This cost varies with location of operation and the kind of operator. A camp back in the woods with a hard-boiled operator will have high costs while one located on or near the hard road with a manager who treats his hands fairly and pays off regularly will have low recruiting costs. Very scattered timber takes more chippers per crop and they are inclined to be discontented. For denser stands the labor turnover should be less.

	15 Faces	60 Faces	120 Faces
Recruiting	$20.00	$15.00	$10.00

Boiling and Cleaning Cups

Only about one-fifth of the cups are collected, brought to a central place and boiled and cleaned out annually. Some operators do not boil out their cups at all. However,

where the stands are scattering the collection will be more expensive.

	15 Faces	60 Faces	120 Faces
Boiling and cleaning cups	$10.00	$8.00	$7.00

Appendix B missing

Appendix C

Number and Ownership Status of Naval Stores Operators

Excerpt, Gum Naval Stores Statistics, So. For. Exp. Sta., Season 1934-35.

Number of Turpentine Operations and Working Turpentine Cups on Land Classified as Owned and Leased, in Survey Unit No 2, Georgia, by Types of Operations, Season 1934-35

Types of operations	Number of operations*	Working Cups			
		On owned land	On leased land	Total	Percent of total
		----Thousands of cups**----			
Operator	86	986	8,469	9,455	64.8
Operator and farmer	7	144	277	421	2.9
Operator and gum-buyer	25	408	3,090	3,498	24.0
Operator and custom-stiller	6	36	455	491	3.4
Operator, gum-buyer and custom-stiller	2	-	21	21	.1
Gum-producer-seller	325***	368***	243***	611***	4.2
Gum-producer-shipper	10***	50***	33***	83***	.6
Total	461	1,992	12,588	14,580	100.0
Percent of total		13.7	86.3	100.0	

* With the exception of the last two types of operations

these figures represent the number actually visited during July to September 1934 in the still-to-still canvass. Tabular figures for the gum-producer-sellers and gum-producer-shippers indicate the approximate number of operations working during the naval-stores year 1933-34. Corresponding figures for 1934-35 were approximately the same.

** To convert to full number of cups add "000".

*** Estimated from information furnished by still operators.

Appendix D

Assessed Valuation and Tax per Acre
of Forrest Land - 1934

Type of Land	Counties of Florida							
	Madison	Suwannee	Alachua	Dixie	Columbia	Nassau	St.Johns	Volusia
Assessed Valuation per Acre in Dollars								
Timbered land	$1.85	$4.04	$4.04	$3.52	$2.51	$2.11	$1.42	$1.43
Cut-over land	1.00	3.00	3.00	2.19	1.00	2.09	1.00	1.00
Tax per Acre in Cents								
Timbered land	9.6	15.5	21.6	16.1	10.8	9.1	8.6	8.5
Cut-over land	5.2	11.5	16.0	10.0	4.3	9.0	8.0	6.0

	Counties of Georgia					
	Clinch	Wayne	Liberty	Coffee	Dodge	Emanuel
Assessed Valuation per Acre						
Timbered land	$1.00	$1.81	$1.78	$3.72	$6.55	$5.33
Cut-over land	1.00	1.00	no data	2.77	2.40	2.03
Tax per Acre in Cents						
Timbered land	2.5	4.2	6.3	9.6	20.7	12.1
Cut-over land	2.5	2.3	- -	7.2	8.0	5.0