AGE SIZE CLASS STRUCTURE OF YOUNG CENTRAL HARDWOOD STANDS TO SUPPORT REGENERATION MODELS IN STEMS.

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(Tables follow the Text)

ABSTRACT

The Stand and Tree Evaluation and Modeling System, (STEMS) is being developed by the U. S. Forest Service. This paper reports on a cooperative project to evaluate reproduction in central hardwood stands to support regeneration models in STEMS.

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INTRODUCTION

STEMS is a computerized single tree, distance independent model that projects growth and mortality of individual trees over simulated time (Holdaway and Brand, 1981). The system will also apply management when called for, i.e., harvesting and thinning (Brand, 1981).

Tree growth in STEMS is an expression of three different functions:

1. Potential annual dbh growth function;
2. Modifier function; and
3. Mortality function.

Annual change in diameter is expressed by the multiplicative combination of the potential and modifier functions. The potential function of STEMS was developed by Hahn and Leary (1979). The growth potential function predicts the growth of the tree without respect to stand density. The modifier function limits the tree growth by reducing the growth potential to accommodate for relative position in the stand (Leary, 1979). The death of the tree is determined by the mortality function developed by Buchman (1979). This function predicts the probability of death of the individual tree over a time period as a function of current tree diameter and annual growth rate.

METHODS

Field data was collected from two separate inventories. For the first inventory 84 point samples were taken in an upland oak-hickory stand utilizing a BAF 10 prism. This data was processed through an Illinois Department of Conservation computer program to give estimates of numbers of trees and basal area per acre. This provided the data base for the initial STEMS projection (Caprata, 1982).

The second inventory consisted of 48 1/10-acre plots located in harvested areas across southern Illinois. The stands had been clearcut for 8-15 years, and contained only natural hardwood reproduction. This inventory provided the data base for the regeneration values used in STEMS projection.

Data utilized for the STEMS projection consists of species code, number of trees per acre, dbh of the tree of average basal area, and standard deviation of tree diameters. Table 1 shows the data entered from the point sample inventory. Three 10-year projections of this data was requested from STEMS.

R E S U L T S

Table 2 shows the summary of initial conditions provided by STEMS. To accommodate the point sample data a plot size of 1 acre was entered. This results in a slight rounding error from the inventory data.

Based on management information for the timber type (Brand, 1981), it is recommended that the stand be clearcut during the first 10-year cycle. Table 3 shows the stand conditions after management, reflecting the cutting of all live trees.

STEMS then calls for regeneration, and at this point reproduction data from the second inventory of 8-15 year old clearcut stand is entered. This data is summarized in Table 4.

Tables 5 and 6 show the projection of the young stands for the remaining two cycles.

CONCLUSION

This paper demonstrates the use of the Stand and Tree Evaluation and Modeling System (STEMS) being developed by the U. S. Forest Service. Reproduction data obtained from clearcut stands in southern Illinois is entered into the program and projected for two 10-year cycles. The projection shows that, during the two cycles, numbers of trees per acre are reduced from more than 1,800 to 1,432, while average dbh is increased from less than two inches to 4.0 inches. The projection also includes mortality and shows how different species groups respond to management.

Key Words: STEMS, Modeling, Tree growth, Hardwood reproduction.

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TABLE 1

VALUES FROM POINT-SAMPLE INVENTORY USED IN STEMS PROJECTION

Group Number	STEMS Species Group	Trees Per Acre	Average DBH	Standard Deviation
1	15	6.7	7.5	2.50
2	18	6.6	7.8	2.60
3	20	25.2	12.0	4.00
4	21	5.6	14.2	4.70
5	22	18.0	12.9	4.30
6	23	17.3	10.0	3.30
7	30	4.8	9.6	3.20

TABLE 2

SUMMARY OF INITIAL CONDITIONS

Species Group	-------- Number ---------				No. Live Trees/Acre	B/A Acre	Average DBH	Volume in Cubic Feet
	Total	Dead	Cut	Live				
Elm	6	0	0	6	6.0	2.1	7.7	33.19
Hard Maple	6	0	0	6	6.0	2.2	7.7	32.07
White Oak	25	0	0	25	25.0	22.8	12.3	498.36
S. Red Oak	5	0	0	5	5.0	5.8	14.2	134.68
O. Red Oak	18	0	0	18	18.0	17.2	12.7	376.37
Hickory	17	0	0	17	17.0	9.7	9.9	180.60
Other Hardwoods	4	0	0	4	4.0	2.2	9.9	39.60
TOTAL	81	0	0	81	81.0	62.1	11.2	1294.87

TABLE 3

STAND CONDITIONS AFTER MANAGEMENT

Species Group	Total	Number Dead	Cut	Live	No. Live Tree/ Acre	BA/ Acre	Average DBH	Volume in Cubic Feet
Elm	6	0	6	0	0.0	0.0	0.0	0.0
Hard Maple	6	0	6	0	0.0	0.0	0.0	0.0
White Oak	25	0	25	0	0.0	0.0	0.0	0.0
S. Red Oak	5	0	5	0	0.0	0.0	0.0	0.0
O. Red Oak	18	0	18	0	0.0	0.0	0.0	0.0
Hickory	17	0	17	0	0.0	0.0	0.0	0.0
Other Hardwoods	4	0	4	0	0.0	0.0	0.0	0.0
TOTAL	81	0	81	0	0.0	0.0	0.0	0.0

TABLE 4

REGENERATION CRITICAL VALUES

Species Group	No. Trees/Acre	Average DBH	Standard Deviation
15	162.0	1.9	0.6
18	226.0	1.7	0.5
20	94.0	1.8	0.6
21	139.0	1.7	0.5
23	74.0	1.7	0.5
30	1130.0	1.8	0.6

TABLE 5

SUMMARY FOR THE END OF THE SECOND CYCLE

Species Group	Total	Number --------- Dead	Cut	Live	No. Live Trees/Acre	BA/ Acre	Average DBH	Volume in Cubic Feet
Elm	18	0	0	17	155.1	6.4	2.7	0.0
Hard Maple	24	0	0	24	219.0	8.8	2.6	0.0
White Oak	10	0	0	10	91.3	2.1	2.0	0.0
S. Red Oak	15	0	0	15	136.9	4.4	2.4	0.0
Hickory	8	0	0	8	73.0	1.9	2.1	0.0
Other Hardwoods	123	10	0	113	1031.1	49.1	2.9	0.0
TOTAL	197	10	0	187	1706.4	72.7	2.7	0.0

TABLE 6

SUMMARY FOR THE END OF THE THIRD CYCLE

Species Group	Total	Number --------- Dead	Cut	Live	No. Live Trees/Acre	BA/ Acre	Average DBH	Volume in Cubic Feet
Elm	17	0	0	17	155.1	12.3	3.7	21.08
Hard Maple	24	4	0	20	182.5	23.7	4.7	208.55
White Oak	10	2	0	8	73.0	2.2	2.3	0.0
S. Red Oak	15	0	0	15	136.9	8.4	3.3	0.0
Hickory	8	1	0	7	63.9	2.3	2.5	0.0
Other Hardwoods	123	33	0	90	821.2	84.7	4.3	260.11
TOTAL	197	40	0	157	1432.6	133.7	4.0	489.74

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