USES, TYPES, AND AVAILABILITY OF GROWTH AND YIELD MODELS FOR THE CENTRAL HARDWOOD REGION[1/2/]

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Reliable growth and yield models are needed in the central hardwood region to help forest managers make responsible decisions. Growth and yield models are used to: (1) evaluate various silvicultural prescriptions, (2) make large-scale projections of timber resources, and (3) perform economic analyses of multiresource alternatives. Growth and yield models are particularly useful for studying the type, timing, intensity, and frequency of intermediate thinnings for a wide range of age, site, and stand conditions. The models also provide a base that can be adjusted to account for the effects of other growth-modifying factors such as fertilization, pruning, and gypsy moth outbreaks. We are just beginning to link wildlife, recreation, and watershed models with growth and yield models to provide more reliable evaluations of multiresource alternatives.

Existing growth and yield models in the central hardwood region can be classified according to the resolution of the projections that they provide. Stand models provide only total stand information such as basal area per acre, number of trees per acre, and volume per acre. They are less complex than other types of models and usually can be programmed on pocket computers. Stand table projection models provide information for selected species groups by diameter class, and usually can be programmed on microcomputers with at least 256K of memory. Individual-tree models provide the highest degree of resolution. The species and dbh of every tree are available at any given point in time during the projection period. Most individual-tree models can be run on microcomputers with at least 256K of memory, but some require mini or mainframe computers. Individual-tree models provide a logical framework for assigning tree grades. Species, dbh, and quality are the factors needed to determine tree values used in economic analyses of high-value central hardwood stands.

Growth and yield models that have been developed for the central hardwood region are listed in Table 1. Also included for your information are those models that are in the development stages. All but one of the models are available free of charge (a small handling fee maybe necessary). Choosing the correct model to use depends on several factors: (1) the species under investigation, (2) the geographic region for which the model was developed, (3) the intended use, and (4) the type of computer available. For example, if only total stand projections are needed for an even-aged upland oak stand in Ohio and the only hardware available is a pocket computer, then GROAK is the logical choice. If individual-tree projections are needed and a mainframe is available, then OAKSIM is a good choice. However, if the stand is an uneven-aged mixture of oaks and other species, then Central States TWIGS is the model to use. Users may find programs such as ERGYS and YIELD-MS particularly useful because they have several growth and yield models consolidated into one user-friendly system.

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Table 1.--Growth and yield models for the central hardwood region (affiliation of contact person and expected application of model is shown)

MODEL	CONTACT	AFFILIATION 1/	HARDWARE 2/	APPLICATION	REFERENCES
STAND LEVEL					
GROAK	Arlyn Perkey	NA S&PF	1	Upland oaks	Perkey 1986
GROPOP	Arlyn Perkey	NA S&PF	1	Yellow-poplar (West Virginia)	Dale 1972 Perkey 1986 Schlaegel and Kulow 1969
____ 3/	Harold Burkhart	VPI & SU	2	Yellow-poplar	Knoebel et al. 1986
GROWPINE 4/	Arlyn Perkey	NA S&PF	1	White pine (Ohio plantations)	Dale et al. 1987 Perkey 1987
STAND-TABLE PROJECTION					
SILVAH	Dave Marquis	NEFES	2	Allegheny hardwoods (cherry, maple, oak)	Marquis 1986
TIMPIS 5/	John Moser	Purdue Univ.	3	Mixed central hardwoods	Unpublished
INDIVIDUAL-TREE					
COPPICE	Paul Johnson	NCFES	2	Red oak stump sprouts	Johnson and Rogers 1984
G-HAT	Harold Burkhart	VPI & SU	2	Appalachian mixed hardwood stands	Harrison et al. 1986
OAKSIM	Don Hilt	NEFES	3	Upland oaks	Hilt 1985a; 1985b
TWIGS (Central States and Lake States)	Steve Shifley	NCFES	2	Mixed central hardwood stands (OH, IN, IL, MO)	Belcher 1982 Shifley 1987
NE TWIGS 4/ Northeastern States	Don Hilt	NEFES	2	Mixed central hardwood stands (OH, KY, WV)	Unpublished
SE TWIGS 4/ Southeastern States	Ralph Meldahl	Auburn Univ.	2	Southeastern forest stands (AL, GA, SC)	Unpublished
CONSOLIDATED					
ERGYS 4/	Tom Gullett	NCFES	2	----- 6/	Gullett 1986
YIELD	Todd Hepp	TVA	2	----- 7/	Hepp 1982
YIELD-MS	Todd Hepp	TVA	2	----- 8/	Hepp 1986

1/NA S&PF--Northeastern Area, State and Private Forestry, Broomall, PA.
NEFES--Northeastern Forest Experiment Station, Broomall, PA.
NCFES--North Central Forest Experiment Station, St. Paul, MN.
VPI--Virginia Polytechnic Institute and State University, Blacksburg, VA.
TVA--Tennessee Valley Authority, Norris, TN.

2/Hardware: 1 = pocket computer or larger; 2 = micro or larger; 3 = mini or mainframe.

3/This model has no specific name (acronym). While it is based on stand level projections, diameter distribution methods are used to obtain the number of trees in each diameter class.

4/In development.

5/This is the only program listed that is not in public domain, i.e., free of change. Write for most recent cost information.

6/ERGYS includes GROAK, SILVAH, OAKSIM, TWIGS and other models for the Northeastern United States.

7/YIELD includes GROAK, a yellow-poplar model, and other models for southern pines.

8/YIELD-MS uses diameter growth and mortality rates from G-HAT, OAKSIM, SILVAH, and TWIGS. Also has option for using local growth rates.