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The Aggregate Timberland Assessment System--ATLAS: A Comprehensive Timber Projection Model

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Abstract

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The aggregate timberland assessment system is a time-based deterministic timber projection model. It was developed by the USDA Forest Service to address broad policy questions related to future timber supplies for the 1989 Renewable Resources Planning Act timber assessment. An open framework design allows for customizing inputs to account for regional and subregional growth and yield characteristics, predictions of change in land use, assumptions of future timber management practices, and projections of future demand for stumpage. As inputs, timberland inventories are aggregated into strata by age class, growth, yield, and management characteristics. Strata are projected through time with the use of yield tables and density change functions. Simulations can differ in size and complexity from a single stratum to over 10,000. The projection system will be of benefit to those requiring knowledge of current and future timber situations, including analysts, planners, economists, and policy makers. This publication is intended to help users gain knowledge and understanding necessary to make both basic and complex timber projections.

Keywords: Timber projection model, harvest scheduling, economic analysis, forest sector analysis, forest policy.

Contents

Introduction

The aggregate timberland assessment system (ATLAS) is a tool developed to project timber inventories into the future. The model simulates growth, harvest, and regeneration of timber stands. Options allow for the representation of changes in timberland area and the projection of trends in timber management. Investigative projections can be designed to test the implications of various timber management strategies or to analyze policies directed toward future timber supplies. Components of change are dependent on the passing of time (periods) and the movement of acres among age classes. The basic requirements for a simulation are a starting inventory, a base yield table, and estimates of future harvest. The model outputs are designed to provide a complete accounting of inventory, growth, acreage, and harvest for each period by age class and management intensity. Options allow for period-specific detailed reports and all-period summaries.

The ATLAS system includes four computer programs written in American National Standards Institute (ANSI) FORTRAN 77. Figure 1 shows the relation between the programs and input files. Three of the programs (IUSCAN, MUSCAN, and HUSCAN) check and process input, and the fourth (ATLAS) makes the timber projections. To run the system, the user must provide three input files: INVEN contains the starting acreage and volume; MANAGE contains growth, yield, management alternatives, and area change parameters; and HARVEST contains the desired harvest volumes and reporting parameters. A descriptive list of all input records and their format is presented in appendices A and B.

The model can be used to represent many different stand conditions. This flexibility allows assumptions of real conditions to be translated into growth, yield, and management inputs. For the tool to be most effective, the development of program inputs requires the user to have a basic understanding of the model processes. Gaining this understanding can be difficult for inexperienced users. The objective of this paper is to help the reader achieve the basic knowledge of how the system works and its requirements and limitations. The following sections present the concepts of inventory aggregation, area change, and the basic algorithms underlying growth and harvest. The last section in the main body of text reviews the model hierarchy. Appendices provide the detailed information required to assemble input decks: card-by-card descriptions, input formats, output file interpretation, and personal computer (PC) requirements. Appendix G puts everything together by presenting two sets of example runs (inputs and outputs): the first example is a relatively simple set up; the second is more complex and takes advantage of additional options.

Input Hierarchy

As shown in figure 1, three input files are required to make an ATLAS simulation: INVEN, MANAGE, and HARVEST. Each input file is functionally different, and to model the dynamics of a forest, a linking of these files is required. The files INVEN and MANAGE are processed independently; however, the program HUSCAN links the contents of these files with the contents of the file named HARVEST. Linking joins a static forest inventory with dynamic parameters, and linking allows for the aggregation of individual inventory stands into units of larger geographic boundaries.

In the terminology of ATLAS, the word "aggregation" describes the combining of individual pieces of data into larger units. Smaller pieces of data generally cannot be modeled individually because the sampling error is too high, the amount of variability associated with individuals in a population cannot be simulated, or the data do not include detailed enough information. The structure of ATLAS allows the user to combine data to high confidence levels. The timber stands in the forest inventory are frequently at the lowest level of aggregation. The user-supplied harvest often is at the highest aggregate level. The structure of this aggregation in terms of linkages between the inputs is shown in figure 2. Timberland

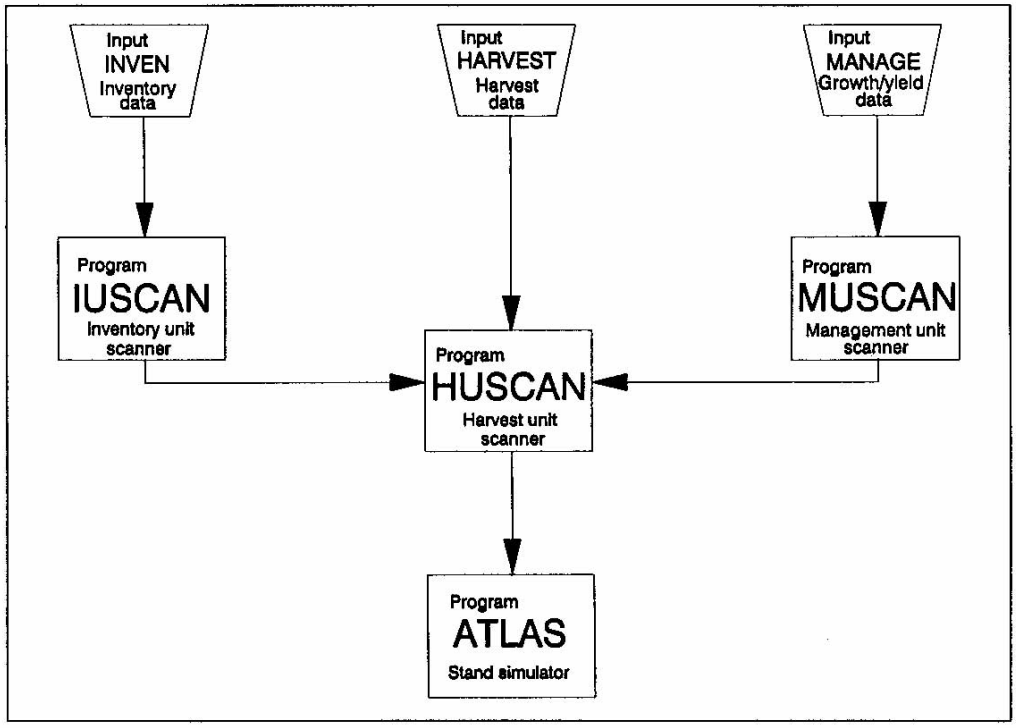

Figure 1—Simplified flowchart of the four programs in the ATLAS system and the three required input files. Arrows indicate the direction of information flow between inputs and programs.

inventories are assembled in what is called the inventory unit (IU). The input file INVEN may contain one or several individual IUs. At the next highest level, each inventory unit is assigned to a specific management unit (MU). Management units generally are developed to represent the dynamics for a group of stands having similar characteristics. An MU contains the growth, yield, area change, and harvest parameters essential for the assigned inventory (up to 10 IUs may be assigned to one MU). The input file MANAGE is composed of one or several management units. At the highest level of aggregation is the harvest unit (HU). Harvest volume often is the variable for which the least detailed knowledge is available, and this allows harvest to be applied at a broad level. Projections of harvest volumes are derived outside the model (they may be estimates, products of other models, and so forth). The volume to be harvested is apportioned among the MUs assigned to the HU. Within each period of a projection, the model can allocate one harvest value among up to 65 MUs. This allocation is based on several factors including available inventory, growth rates, and harvest constraints. Up to 32 HUs may be added to the HARVEST file. Each HU and all MUs and IUs linked to it are modeled separately. The linkage of IUs to MUs to an HU is accomplished by assigning a specific identification code to each unit.

Inventory

Timberland inventory is represented as acres and volume per acre by age class. The volume per acre can be in any unit of measure so long as it is consistent with the base yield table and harvest volumes. By default, the model allows for 18 age classes. (Changing the number of age classes requires adjustment of the PARAMETER statements within each program.) The number of years represented by an age class must be consistent with the length of the projection period; that is, inventory projected in 5-year periods would be aggregated in 5-year age classes.

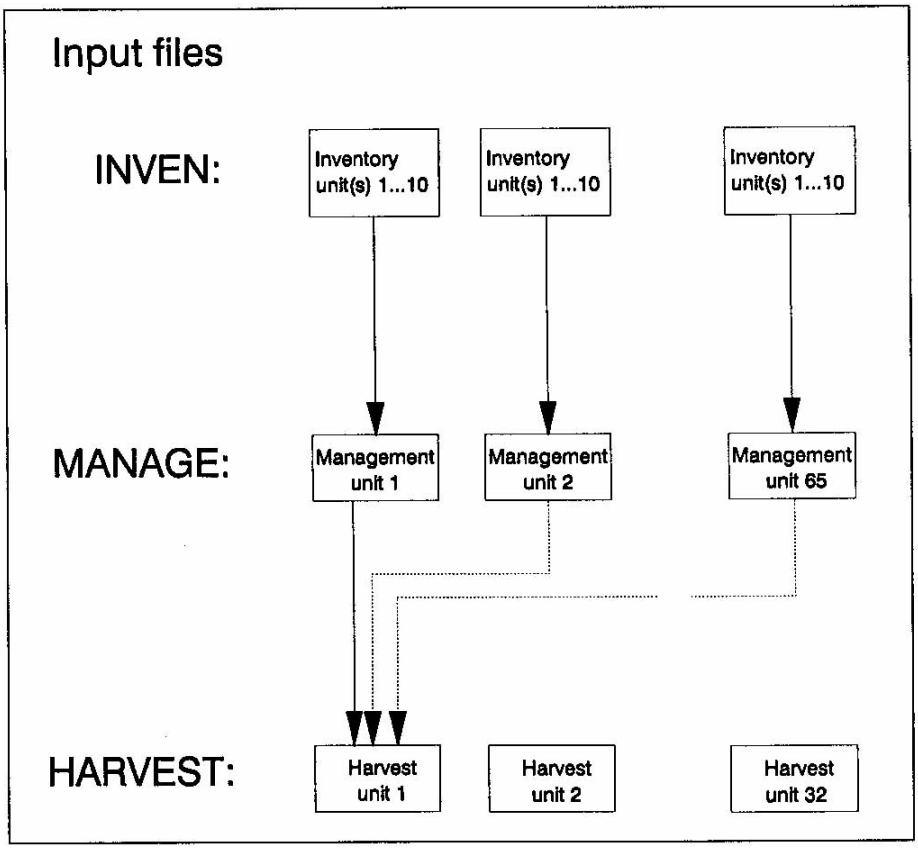

Figure 2—The linkage between input components in the ATLAS system. Starting with the initial inventory at the top, aggregation increases in the direction of the arrows. Harvest units are independent of one another.

For input to IUSCAN, acres and volume per acre are aggregated into IUs. The inventory unit represents a stratification of the inventory; this is often by geographic region, owner, forest type (or species), site, and so forth. Within an inventory unit, five management intensities (MIs) are available for further stratification of the inventory. Regeneration, growth, and harvest parameters may differ for each MI to represent responses to alternative silvicultural treatments or variations in stand behavior due to the species composition. When initially input, acres are assigned to a specific MI. During the simulation, acres can be moved (we say "shifted") among the MIs.

The following is an example of an IU:

Identification number	Age class	Acres	Volume per acre
14102 3 1	0	43168	443.0
14102 3 1	1	21933	443.0
14102 3 1	2	40561	2000.2
14102 3 1	3	55898	3658.6
14102 3 1	4	134810	4590.4
14102 3 1	5	113990	4486.3

This inventory unit is part of one used in example 2 in appendix G. The first nine columns identify the IU, the type of input record, and the MI of the associated inventory. The next three columns are for the age class; next are acres and volume per acre (in net cubic feet) for the particular age class. This IU represents management intensity 1; medium site productivity class; Douglas-fir forest type; forest-industry-owned timberland; the region of western Oregon and Washington. (The complete IU in example 2, appendix G, includes inventory in MIs 2 through 5.)

Figure 3 shows how the above inventory fits into the input hierarchy of a simulation for the forest industry ownership in western Oregon and Washington. Inventory is entered into IUs by MI and age class. Within the first MI (MI-1), acres and volume may be subdivided by three stocking classes (or levels). Parameters entered in the MU file define the range of these stocking levels (see MU card types 23 and 24, appendix A). Stocking levels were not modeled in our example so the inventory has been placed in stocking level 1. Management intensities 2 through 5 do not allow for subdivision by stocking level. The only model action that can make a difference between a projection of all inventory at one stocking level versus a projection of inventory by three stocking levels is the restriction of acreage shifts. Only acres in stocking level 1 may be moved to higher MIs. Unless it is desirable to restrict the acres shifting out of MI-1, we recommend aggregating the inventory to one stocking level (as shown here). This will save development time and reduce the size of files.

Another category in an IU is unstocked, or nonstocked, acres. Acres can be placed in the nonstocked category when the beginning inventory is set up; however, they carry no volume and have no associated age. When acres are removed from the nonstocked category and placed in the regular inventory (regenerated), they are assigned to MI-1. Acres harvested from any MI can be placed in the nonstocked category. Nonstocked acres are counted as part of the total acreage within an MU. (Note: In the set of MUs shown in figure 3, MU number 20 is titled "Nonstocked Low Site." Rather than using the option to enter nonstocked acres within an IU, a separate MU was created to carry all nonstocked acres. This configuration allowed the nonstocked acres to carry low residual volumes, and it allowed for acreage control via the MU area-change options.) For input format of unstocked acres, see IU card type 01 and appendices A and B. For further discussion of unstocked acres and area change options, see the section, "Area Change," below.

Up to 10 IUs can be linked to a single MU. This ability to assign multiple IUs to an MU does not increase either the significance of the modeling detail or the resolution of the model outputs. When multiple IUs are assigned to an MU, their inventories are combined to fit the MU dimension, acres are added, and volume-per-acre values are recalculated. The MU dimension is the same as that of a single IU. The dimension is 3 by 18 for MI-1 (MI-1 has three stocking categories), and 1 by 18 for MIs 2 through 5. This combining of the inventories to the MU level occurs in program HUSCAN. The combined (or linked) MUs and their associated inventories are then treated as individual growth and yield modules. The lowest level of resolution in the output is at this MU level. (This is 18 age classes by five MIs. For reporting purposes, the three stocking categories in MI-1 are combined—the weighted average is reported.)

Area change, growth, and harvest are examined in the following sections. These processes are modeled for the group of acres that make up an inventory cell. We will define the inventory cell as an identifiable array variable within the ATLAS program at the MU level of aggregation. This is acres and volume per acre of a single age class within a specific MI. At the MU level, each inventory cell is modeled independently. At this level of aggregation, growth, harvest, and regeneration take place (and can be accounted for in output reports). The example IU

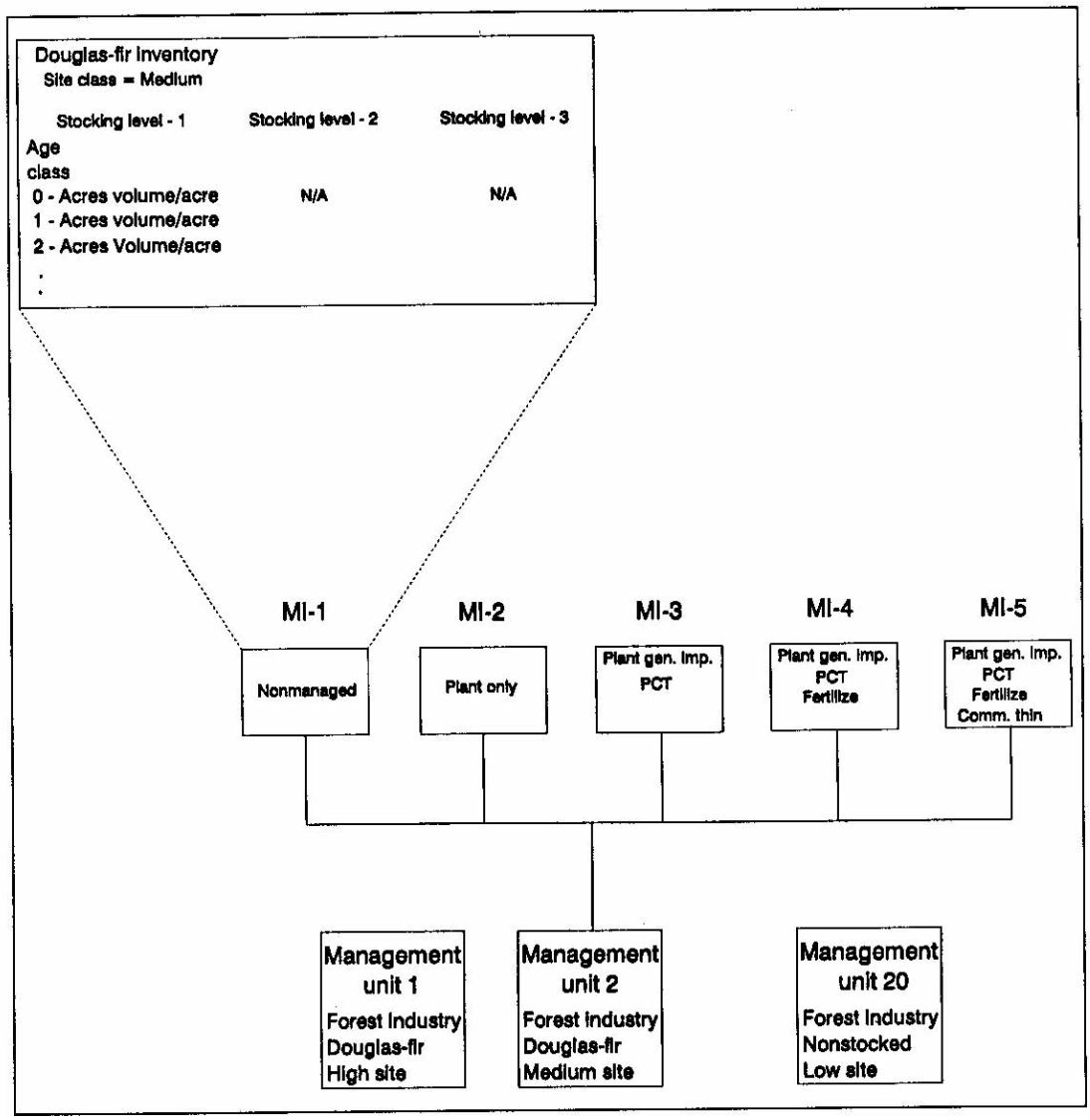

Figure 3—Expanded view of an inventory unit showing five management intensities (MI-1 to MI-5) and the organization of the acres and volume within MI-1. The linkage of inventory to the MU shows how one inventory might fit into a simulation for a large area. (Gen. imp. is genetically improved stock; PCT is precommercial thinning).

presented earlier can be said to represent six inventory cells. Management intensity 1 is a special case requiring some simplification. Within the ATLAS program, each age class in MI-1 is actually represented by four cells: stocking level 1, stocking level 2, stocking level 3, and the total of all three stocking levels (volume per acre in this total is a weighted average of all three stocking levels). But because there is so little difference in the way the individual stocking levels are treated, we will refer to MI-1 as if we are dealing with one average stocking level—one inventory cell. Throughout the rest of this document, the reference to the inventory cell will be in context of the linked IU to MU module (this is the MU level).

Area Change

It is at the MU level, or within the linked IU to MU module, that acres are accounted for and area change takes place. During a simulation, inputs to the file MANAGE regulate both the total acres and their distribution within the MU. Three types of area change are possible within ATLAS. The first type is MU area change. Change in the MU area facilitates the

simulation of acres moving in and out of the timberland base or the simulation of acres moving among MUs. The second type of area change is unstocked acres. Options allow for movement of acres to and from the unstocked category. And the third type of area change is the Ml shifting within MUs.

Management Unit Area Change

The total acres within an MU initially reflect the beginning forest inventory input in the associated IU(s). Total acres in an MU can be changed to simulate shifts in forest ownership, timberland losses or gains from land-use changes, or long-term forest-type transitions. Entered in MU card type 11 are the total acres to be represented within the MU for each projection period. Card type 11 is required only if the MU total acreage is to change; when omitted, total acres within the MU remain constant (equaling the initial IU input). Card type 11 has three companion card types that allow the assignment of acreage changes (and inventory volume changes) to selected age classes (MU card types 12,13, and 14). Although card type 11 contains absolute values (number of acres), the companion card types require the entry of proportions.

When acres are gained, card type 12 allows for the distribution of incoming acres among specified age classes, and card type 14 is used to specify the Ml to receive these acres (only one Ml can receive acreage gain). When acres within an MU increase, gain in inventory volume within the specified age class is the product of the average stocking proportion (MU card type 23 or 24) and the yield-table volume (MU card type 33).

When acres are lost, card type 13 is used to specify a distribution of the loss among age classes or among a range of age classes (called an age-class group). Groups of age classes may be specified for area loss because whether a specified age class will contain enough acres to meet the requested loss may not be certain. Within an age-class group, the area loss in any one age class is determined by the total acres to be lost, the proportion of the loss assigned to the group, and the relative proportion of acres in the particular age class as compared to the rest of the group. Should the age-class group not have enough acres to fulfill the proportion assigned to it, the model will remove acres by defaulting to an oldest first approach. If this happens, the deficit is made up by removing acres from the oldest age class(es) in the inventory. Volume loss associated with area loss is based on the number of acres removed and the inventory volume per acre of those acres (the inventory ceil value). If there is the assumption that harvest takes place on the acres lost, then MU card type 29 can be used to apply the area loss volume to the input harvest request (this scenario could be used to simulate conversion of acres to a different forest type—assuming an area gain in another MU is calibrated to keep total acreage in balance).

For input details about MU area change, see appendix A and MU card types 11,12,13,14, and 29. Appendix G contains examples of area-change inputs.

Unstocked Acres

Acres within each MU can be moved between the unstocked (or nonstocked) and stocked categories. The beginning inventory may contain nonstocked acres initially assigned in the IU input. These acres can be brought into the inventory (regenerated) via MU card type 21. Entered in card type 21 is a proportion of unstocked acres to regenerate in each projection period. By default, acres are regenerated to age class zero in MI-1. Once the simulation begins, only acres harvested may be assigned to the unstocked category. Management unit card type 22 is used to assign a proportion of the acres harvested to the nonstocked category (by period). Shifts to and from the nonstocked category might be used to represent lags in regeneration. See appendices A and B for more detailed format information.

Management Intensity Shifts

Within the IU file, acres in the beginning inventory can be assigned to any of the five MIs. Shifting of MI may represent trends in the application of alternative silvicultural treatments or changes in stand composition after treatments. Each MI has an independent set of regeneration, growth, and harvest parameters entered in the MU input file (MANAGE). All MIs are eligible to donate or receive acres from all other MIs. Acreage shifts between the MIs can occur either at regeneration (age class zero—the default) or can take place for all age classes up to **a** specified maximum age class. Acres do not change age classes when they shift MI. Inventory volume associated with acres that change MI is carried with the acres and added to volume that might already exist in the assigned MI.

Shifting of acres among MIs is accomplished by entering (1) the maximum age class (age limit) for which shifting will occur, and (2) for each period, the proportion of total acres in the donating MI to shift to the receiving MI (of those at or younger than the maximum shift age). Management unit card type 07 allows entry of the age limits for shifting. If this card type is omitted, shifting will occur only at regeneration (age class zero). The proportion of acres to be shifted each period is on MU card type 28. This proportion is applied to ail acres in age classes equal to and younger than the age class specified on card type 07. Each age limit and shift proportion is identified by the entry of the donating MI (MIFR) and the receiving MI (MITO). Within each period, both acres gained via card type 11 and acres restocked (from unstocked) via card type 21 are eligible for redistribution through MI shifting. For input details on MI shifting see appendices A and B, MU card types 07 and 28. For examples of usage, see example 2, appendix G.

Modeling Forest Growth

In simplest terms, growth in ATLAS is represented by a periodic change in net volume per acre. In a real system, growth is dynamic, it is continuous throughout any period. But the addition of harvest and area change within the periodic model framework requires that growth be specifically defined to include fundamental components of change measurable in a real system. Figure 4 shows the order that ATLAS simulates various activities. Model activities are sequential; acres and volume enter and leave the system at specific times. To account for what might be called observable growth, in one period, only one class (or type) of growth will be calculated for any one acre. What is reported as total periodic growth is the sum of the individual calculations.

The model was programmed to simulate four classes of growth (regular growth, regeneration growth, growth on harvest, and growth on area change). The growth calculations require parameters that are supplied in the MU input file. The inputs required for each MI include a base yield table, average stocking proportion(s), and coefficients for a density-change equation (to adjust stocking proportions). The base yield table is simply volume per acre by age class that is input in tabular form. All MIs within the MU are dependent on the same set of density change coefficients. (For more detail, these inputs are described in appendix A; see MU cards 23, 24, 30, 33, and 37.)

Relative-Density Change

The concept of a stocking adjustment, or density change, is a key assumption for use of yield tables to project inventories within ATLAS. Stocking, as defined in ATLAS, is a ratio of the existing inventory volume per acre over the corresponding base yield-table volume per acre. In simplified form, stocking in a single inventory cell of age class i can be represented as,

$$S_i = V_i / Y_i \; ; \qquad (1)$$

where S equals the current stocking ratio, V equals the inventory volume per acre, and Y

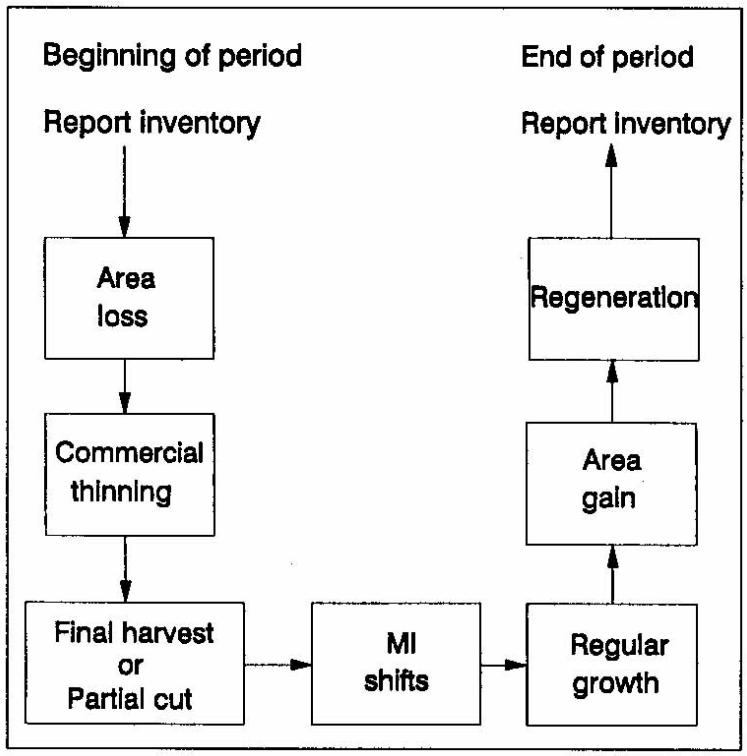

Figure 4—The order of occurrence of model activities in each projection period.

equals the base yield-table volume per acre. To define the single inventory cell as part of a larger inventory, the subscripts j, k, and t could be added to represent MI, MU, and period (Y would not be subscripted by period).

The projected volume per acre within a cell is the product of the stocking ratio and the appropriate yield-table value. The equation for relative-density change allows for periodic adjustment of stocking. This procedure has its roots in the concept of approach-to-normal, which assumes that over time stand stocking will asymptotically approach an equilibrium representing the condition of a normal undisturbed stand (Chaiken 1939). Leary and Smith (1990) and Mills (1990) have shown that a stocking adjustment mechanism can play a central role in the projection of existing inventories with a fixed yield table. The mechanism for relative-density change allows for the calibration of inventory growth rates to the yield tables; it does not require the use of normal yield tables. This very concept is found in the literature as far back as Chapman (1924).

The density-change equations available to a MU can be applied over a range of age classes. Following are the forms of the density-change equation:

$$S_{i+1,t+1} = \beta_1 + \beta_2 S_{it} \quad , \tag{2}$$

$$S_{i+1,t+1} = (S_{it} + \beta_1 + \beta_2 S_{ik}) / 2 \quad , \tag{3}$$

$$S_{i+1,t+1} = S_{it} + \beta_1 S_{it} - \beta_2 S^2_{ik} \quad , \tag{4}$$

$$S_{i+1,t+1} = S_{it} + (S_{it} + \beta_1 S_{it} - \beta_2 S^2_{ik}) / 2 \quad , \text{and} \tag{5}$$

$$S_{i+1,t+1} = S_{it} \quad ; \tag{6}$$

where S = stocking ratio,
i = age class,
t = projection period, and
B_1,B_2 = input coefficients.

Equations (2) and (3) are linear forms derived from McArdle and others (1961).' Equation (2) calculates the full adjustment for a range of specified age classes. Equation (3) calculates a "half adjustment;" it returns half of the density adjustment that would be returned via equation (2). This half-adjustment option is valid for age classes greater than those assigned the full stocking adjustment. The assumption behind the option for the half adjustment is based on the idea that older stands may exhibit slower rates of stocking change than younger stands.

Equations (4) and (5) are quadratic forms of the adjustment equation. This form was initially derived by Gevorkiantz and Duerr (1938) and later introduced to the predecessor of ATLAS, the timber resource inventory model (TRIM; Tedder and others 1987), by Leary and Smith (1990). As in the linear form, equation (4) makes the full stocking adjustment, and equation (5) is for the half-adjustment. Equation (6) represents no change in stocking density; constant density is an option only for age classes older than those assigned the half-adjustment rate.

The stocking asymptotes for these equations that calculate relative density change can be found by calculating,

$$AL=B_1/(1-B_2) \quad (7)$$

when B_1 and $B_2 > 0$, and

$$AQ=B_1/-B_2 \quad (8)$$

when $B_1 > 0$ and $B_2 < 0$;

where AL equals the stocking ratio being approached in the linear form of the adjustment equation, and AQ equals the stocking ratio being approached by the quadratic form. Stocking will approach this asymptote from either above or below, at a rate determined by B_1 and B_2. The relation between the asymptote and the base yield table depends on stocking, growth in the inventory, and the yield table. The stocking asymptote associated with normal yield tables generally is less than 1.00 (100 percent), whereas asymptotes associated with fully stocked empirical yields are greater than 1.00 (Leary and Smith 1990).

The model allows for two sets of the coefficients B_1 and B_2 to be entered for each MU. The first set is for the stocking adjustment of the beginning inventory, and the second set will adjust stocking only for acres regenerated within the MU. This second set of coefficients is optional; if omitted, the model makes projections with the entered coefficients for both the starting inventory and regenerated acres. The option allows for greater latitude in project-

Their prediction of a 10-year change in normality (stocking) for second-growth Douglas-fir can be approximated when $B_1 = 0.11$ and $B_a = 0.90$.

Mills, John R. 1989. Inventory, growth, and management assumptions for the 1989 RPA timber assessment, final draft. 2 vol. On file with: J. Mills, Social and Economic Values Research Program, Pacific Northwest Research Station, P.O. Box 3890, Portland, OR 97208-3890.

ing the growth behavior Of the initial forest inventory and the projected behavior of regenerated Stands. It makes it possible to calibrate the initial inventory to observed growth rates while allowing the Stocking adjustment of regenerated stands to have independence in slope of the adjustment and the asymptote approached. (The relative-density-change coefficients are entered on MU card type 30; for details see appendices A and B.)

Regular Growth

Regular growth occurs on acres that have volume at the Start Of the period, remain in the inventory, and increase one age Class by the end of the period. Growth is calculated as the difference in volume between the beginning and end of the period. (For the purpose of explaining growth, we can say that the end of a period is equivalent to the beginning of the next period.) In the absence of harvesting and area change, a base yield table and an equation for change in relative density calculate growth for each age class of existing inventory. The following formulation represents the summation of regular growth reported for period t:

$$V_{i+1,t+1} = S_{i+1,t+1} Y_{i+1} \text{ , and} \tag{9}$$

$$TRG_t = \sum_{i=0}^{n-1} V_{i+1,t+1} A_{i+1,t+1} - V_{it} A_{it} \text{ ;} \tag{10}$$

where equation (9) equals the new volume per acre calculated in a single cell, and in equation (10), TRG equals the total regular growth calculated for all cells under one base yield table (the variable A represents acres in a cell with associated volume per acre V; n is the oldest age class). Acres in age class n when time equals t remain in age class n when time equals t+1 (assuming the acres are not harvested); however, acres achieving the oldest age class will not necessarily stop growing. Even though the yield-table volume no longer increases, acres in the oldest age class are subject to the effect of the density-change equations. Growth in the oldest age class would be a result of a change in relative density (assuming equation 2, 3, 4, or 5 and the stocking asymptote have not been achieved).

Growth on Harvest

The sequencing of harvest requires growth adjustments on harvested acres. We assume that in a real system, inventory is distributed uniformly over each age class, and that for a group of stands, harvesting and growth occur over the entire 5- or 10-year period. The average volume harvested represents the beginning of the period value, plus one half-period of growth. In the model, however, harvest is calculated at the beginning of the period, before regular growth takes place (this is an artifact of the model sequencing these events; see figure 6 in appendix D). So were there no adjustment to growth, it would be assumed that the entire harvest for the period took place at a single time. Barber (1985) found that this kind of representation underestimates available harvest volume by one half-period of growth. If we looked at the inventory in the middle of the period, we would expect that half of the acres would be in the next higher age class. The growth-on-harvest multiplier increases the harvest volume per acre, thereby correcting the underestimate. Harvest volume in a single cell equals $GH_i V_{lt} A_{(t}$; where GH is the growth-on-harvest multiplier for age class i, and A is acres with volume per acre v. The following equation represents total growth on harvest (TGH) as calculated for period t:

$$TGH_t = \sum_{i=0}^{n} GH_i V_{it} HA_{it} - V_{it} HA_{it} \; ; \qquad (11)$$

where HA is the acres harvested in age class i, period t. The growth-on-harvest calculated for harvested acres is added to the total growth in period t.

If chosen, the growth-on-harvest multiplier is applied to all four types of ATLAS harvest: (1) final harvest, (2) commercial thinning, (3) partial cutting, and (4) harvest recovery of volume on acres lost via area change. The multiplier should reflect the average expected half-period volume gain on acres harvested. A simple way to calculate the multiplier is to use the ratio of growth over inventory volume, commonly called growth percent. If, for example, the period length is 5 years and annual growth for the harvestable age classes is 6 percent of inventory volume, then the total increase would be about 6 percent multiplied by the number of years to the midpoint of the period (2.5). In this case, the multiplier would be 15 percent; it would be entered on MU card type 37 as 1.15. The GH variable could be the average for all harvestable i, as it was presented here, or GH can differ by age class and Ml if additional detailed growth data are available.

Growth-on-Area Loss

Growth-on-area loss takes place on all acres (with volume) leaving the timberland base via area change. As shown in figure 4, area loss occurs before regular growth. The assumption is that area loss really takes place over an entire period; therefore, growth normally is expected to occur on most timbered acres leaving the system. Growth-on-area loss is consistent with growth on harvest; the same multiplier is used for both. The growth calculation is made only for the acres and volume being removed from the inventory and only after they have been subtracted. The growth calculation is simply the growth-on-harvest multiplier multiplied by the volume per acre on the acres leaving the system. With the substitution of lost acres (LA) for harvested acres (HA), this is the same calculation as that shown in equation (11). In the output reports of area loss, the growth is included in the volume reportedly lost. In the output reports of growth, the growth gained by way of the multiplier is included in the total periodic growth.

Regeneration Growth

Regeneration growth is a special case of growth that is calculated when acres enter the inventory in the zero age class. All additions of volume must be accounted for in total growth. The initial volume for regenerated stands is determined by the base yield table and an input parameter called the average stocking proportion (ASP) (also called the regeneration stocking ratio; for the TRIM model [Tedder and others 1987], refer to ASP as the stocking level midpoint). When i=0, the initial regeneration volume per acre under each base yield table can be represented by,

$$V_{it} = ASPY_i \qquad (12)$$

Regeneration growth is set equal to this initial volume per acre. If i=0 and Y_i=0, then V_{it}=0 and regeneration growth is zero. When acres enter the first age class where Y, is greater than 0, the stocking proportion S_{lt} is assigned the value of ASP; stocking in subsequent age classes is a function of the relative-density-change equation.

Growth-on-Area Gain A calculation called growth-on-area gain is made because, like growth on harvest, it is an attempt to overcome the sequencing artifact of a periodic model. Area gain (acres coming into an MU) is sequenced after regular growth has been calculated. Within each age class gaining acres, the incoming acres are assigned the volume per acre as determined by the ASP multiplied by the base yield-table volume. This volume per acre is the same as V_{it} from equation (12), with the difference that i is the age class to gain acres (the age classes to assign area gain are chosen in the MU input file). If acres are added to **a** cell already containing acres and volume, a new cell volume per acre is calculated as a weighted average of the previous and added inventories. At this point in the calculation, the inventory volume represents an end of the period value. Nothing more needs to be done with the volume. But growth-on-area gain becomes important because we assume that actual area change is distributed uniformly across the period. Because of this, we must attempt to add to total cell growth the growth that these acres should achieve between the time they enter the inventory and the end of the period (where they are actually added and assigned end of the period volume). For modeling purposes, we assume area gain takes place in the middle of the period, which means a calculation is needed to estimate what that midperiod volume will be. Growth-on-area gain is simply the difference between the midperiod estimated volume and the end-of-period assigned volume. The calculated growth-on-area gain is then added to total growth. This is consistent with the structure of the model; area loss occurs, regular growth takes place, then area gain occurs (fig. 4). When the area change represents acres changing management units, growth is neither missed nor double counted.

The midperiod volume per acre is calculated as a linear approximation of the difference between an estimate of the volume at the beginning of the period and the assigned end-of-period volume. The calculation first requires the estimate of stocking for the beginning of the period. Stocking is used to estimate volume, and growth-on-area gain (GOG) is half of the difference in volume between the estimate for the beginning of the period and the end-of-period (assigned) value. When age class i gains acres in period t, the following equations outline this technique:

$$S_{i-1,t} = (ASP - \beta_1) / \beta_2 \text{ , and} \quad (13)$$

$$GOG_{it} = (V_{it} - S_{i-1,t}Y_{i-1}) / 2 \text{ ;} \quad (14)$$

where V_{it} is the end-of-period assigned volume, $S_{i-1,t}$ is a function of ASP, and GOG_{it} is a linear approximation of the difference between midperiod and end-of-period volume per acre. Total growth-on-area gain in period t ($TGOG_t$) represents GOG_{it} multiplied by the acres gained, GA_{it}, and summed for all i.

No specific user input is required for the growth calculation; however, f(ASP) is an inverse form of the equations for relative-density-change (equations 2 and 3). Should the MU be using the nonlinear density change equations (equations 4 and 5), equation (13) is not used and stocking is held constant so that in equation (14), $S_{i-1,t}$ is set equal to ASP.

Total Periodic Growth The growth reported by ATLAS includes regular growth, growth calculated on all forms of harvest, growth-on-area loss (TGOL), growth-on-area gain, and growth on regeneration. The total components of growth have been expanded by the acre variable. Regeneration growth comes only from age class 0 (i = 0), and A_{ijk} represents the regenerated acres. Total periodic growth for up to five yield tables (j), within m management units (k), can be represented as:

$$\sum_{k=1}^{m} \sum_{j=1}^{5} TRG_{jk} + TGH_{jk} + TGOL_{jk} + TGOG_{jk} + ASP_{jk}Y_{ijk}A_{ijk} \text{ .} \quad (15)$$

Growth Examples

This section provides a numerical example of the various ATLAS components of growth. The values employed here are drawn from example 1 presented in appendix G; they include: inventory volume per acre, yield table volume per acre, average stocking proportion, the coefficients for change in relative density, and the growth-on-harvest multiplier. This example presents the calculation of stocking, change in relative density, regular growth, growth on harvest, growth-on-area loss, and growth on regeneration. Within a single period, the model growth components are mutually exclusive for any single acre.

The forest type presented here is oak-pine from the forest industry ownership of the Northeast region. Age class 4 will be the starting point of the inventory. To keep the calculations simple, we will assume 10 acres in the inventory rather than all 26,000 that exist in example 1.

Inventory and yield table	Age class	Volume per acre	Acres
Initial 1980 inventory	4	1,762	10
Oak-pine yield table	0	0	
	1	522	
	2	1,013	
	3	1,473	
	4	1,902	
	5	2,300	

Average stocking proportion: 0.8858
Coefficients for relative-density change: 61 = 0.162, B2 = 0.890
Growth-on-harvest multiplier equals: 1.1904

The calculation of regular growth—Regular growth depends on the calculation of initial stocking and the projection of stocking in the next period (where it corresponds to the next oldest age class). Initial stocking, based on equation (1) is,

$$0.9264 = 1{,}762/1{,}902 \ ;$$

and equation (2) is used to adjust this value to 1990 as,

$$0.9866 = 0.162 + 0.890 * 0.9264 \ .$$

The new inventory volume per acre in 1990 (at age class 5) results from equation (9):

$$2{,}269 = 0.9866*2{,}300 \ ,$$

and total regular growth calculated with equation (10) is simply the difference between volume this period and volume last period. For our 10 acres this is:

$$5{,}070 = 10* (2{,}269-1{,}762) \ .$$

Growth on harvest—This growth would be calculated on any of these acres if they had been harvested (harvest occurs before regular growth—see fig. 4). If we assume five of the acres were harvested, then total growth on harvest from equation (11) is:

$$1{,}677 = 5*(1.1904*1{,}762-1{,}762) \ .$$

The additional amount of volume added by growth on harvest is included in the reported harvest volume and included in the report of total growth.

Growth-on-area loss—This is the same calculation as the growth-on-harvest calculation, and it is made with the same multiplier. Growth-on-area loss is used to increase the volume per acre for acres (with volume) that leave the inventory base. The growth-on-area loss is added to total periodic growth. If harvest recovery of volume loss is invoked via MU card type 29 (see the section "Harvesting Methods"), the growth volume is recovered as harvest (this is the same as growth on harvest). If the inventory volume is not recovered via harvest, the growth-on-area loss is part of the volume reported lost due to area loss. If 5 acres in age class 4 leave the timberland base via area loss, the growth-on-area loss would be 1,677 cubic feet.

Growth-on-area gain—As shown in fig. 4, area gain takes place after regular growth. The volume assigned is assumed to be the end of the period value (the end of one period is considered the same as the beginning of the subsequent period). Let us assume 10 acres have moved into age class 5 of our inventory. The acres currently in age class 5 have just been advanced from age class 4 via the growth subroutine. Equation (13) then calculates the expected stocking at beginning of the period (10 years prior, or the age class 4 value) as,

$$0.8133 = (0.8858-0.162)/0.890 \ .$$

Growth on area as derived from equation (14) equals,

$$2{,}452 = 10*[(0.8858*2{,}300-0.8133*1{,}902)/2] \ .$$

Growth on regeneration—When acres enter the zero age class, regeneration is assumed to take place. Growth on regeneration means equal volume assigned to acres as they enter the inventory in age class 0. The acres may have been in the initial inventory and previously been harvested, they may have been moved into the inventory out of the unstocked category, or they may have been moved into the inventory via area gain. In any case, if there is volume assigned to them in age class 0, it is called growth on regeneration. Equation (12) is the average stocking proportion multiplied by the value in age class 0 of the yield table. In this example, there is no volume per acre in age class 0 of the yield table, and growth on regeneration would be zero.

Assuming 5 acres had been previously regenerated, as they move from age class 0 to age class 1, regular growth will occur. The initial stocking will be set equal to ASP and volume will be,

$$2{,}312 = 5*0.8858*522 \ .$$

Because age class 0 has no volume per acre, the volume assigned in age class 1 also will equal growth.

Harvesting Methods

Timberland harvest is simulated at what is usually the highest level of aggregation. Harvest is usually allocated to a group of MUs (and their linked inventories). Management units are assigned to HUs; up to 65 MUs can be assigned to a single HU. Harvest units are assembled in the file HARVEST and input to the program HUSCAN. The HUSCAN program links the MU(s) to the HU(s) (recall that this program also links the IU to the MU). Each HU contains one array of total harvest volume by period. This input harvest request is designated as either softwood or hardwood, or both (combined). The MU(s) linked to the HU is

assumed to include the forest types that most closely match the harvest fiber type. The parameters controlling harvest at the inventory level are input as part of the MU.

Within the HARVEST input file, preceding the individual HUs, are simulation parameters required by the program ATLAS. These include headings for reports, the initial starting year of the simulation, and user requests for output reports. Within each HU, additional simulation parameters are required. These include title of HU to be used in output reports, the number of years in a simulation period, the number of periods to run the model, a limit on the highest stocking proportion allowed in any MU inventory, warnings levels for high or low stocking, and labels for MIs and forest types found in the linked MUs.

Endogenous vs. Exogenous

The ATLAS model allows four harvesting options; commercial thinning, volume recovery from area loss, partial cutting, and final harvest. These four types of ATLAS harvest are classified as either endogenous or exogenous. Final harvest and partial cutting are called endogenous, whereas commercial thinning and volume recovery from area loss are referred to as exogenous. The difference is that endogenous harvest occurs in response to a user-requested harvest volume entered on HU card types H3 and H4; exogenous harvest is dependent only on parameters entered in the individual MUs. The volume to be harvested endogenously is dependent on both the user request and the amount of volume to come from exogenous harvest. This is because exogenous harvest occurs before final harvest or partial cutting (see fig. 4). The ATLAS harvest mechanism then subtracts any exogenous harvest recovered from the user-requested harvest.

Figure 5 shows the linkage of MUs to HUs in the context of harvest flows. Harvest units arid their associated, or linked, MUs are processed one at a time. (After their linkage in HUSCAN, an IU and associated MU might be thought of as an inventory growth module.) Each of these IU-MU modules is completely independent of the other. The endogenous harvest requires a two-way flow of information. It is allocated to a IU-MU inventory based on both the requested harvest value and the volume available for harvest in the MU (as a percentage of the total available volume in all linked MUs). The exogenous harvest is independent of the requested harvest; it is based on the inventory in either the age classes assigned a commercial thinning or the recovery from acreage loss. Should exogenous harvest be greater than the endogenous request, no endogenous harvest will take place (this can happen if the simulation includes substantial loss in area coupled with the recovery of area-loss volume).

The total volume harvested is a function of a user request and the volume available in the inventory. If the requested harvest is higher than available harvest volume, a message is written to output file ATLOG (see appendix C) that all available volume is harvested, and the simulation continues. Unsatisfied harvest is not carried into the next period. the number of acres harvested in any period depends on the total volume requested and the volume per acre in the harvestable age classes. Commercial thinning can take place within any MU; however, final harvest and partial cutting are mutually exclusive for the same MU. The MU designation for partial cutting or final harvest is made on MU card type 03. The requested harvest volumes for the two treatments are separate entries in the HARVEST input file. (Partial cut volume does not satisfy the final harvest requested nor vice versa [see appendix A, HU cards H3 and H4].)

Commercial Thinning

All commercial thinning options are set in the MU input file. Up to five thinnings can occur in a single MI. Commercial thinning reduces the cell volume. Thinning volumes are subject to growth on harvest. The model simulates commercial thinning before it simulates final

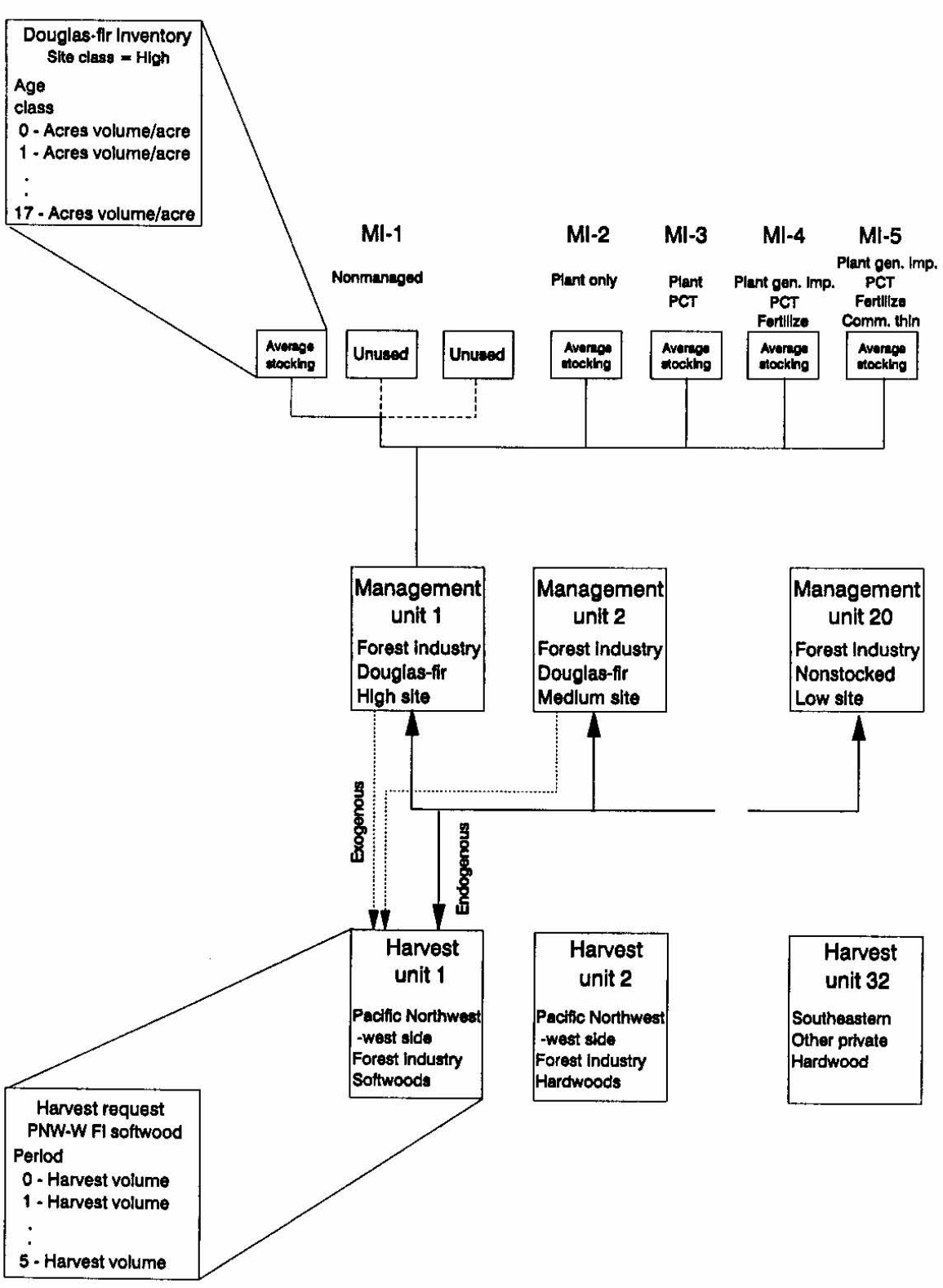

Figure 5—The linkage of harvest to the inventory. Endogenous harvest is represented by the two-way arrows; exogenous harvest is a one-way flow.

harvest, and the volume removed from thinning is applied toward the total harvest; this reduces the volume to be removed in final harvest. Under commercial thinning, all acres in the designated age class get treated regardless of the requested total harvest.

The inputs required for thinning are a base yield table and the associated base thinning volume(s). These inputs must be coordinated. The thinned volume should equal the volume removed from the base yield table at the chosen thinning age class(es), and the yield table needs to reflect the volume trajectory of a treated stand. The yield table is a growth guide curve; the value entered as the base thinning volume (MU card 34) may not be the same volume subtracted from an inventory cell. The volume subtracted from the inventory is the product of the base thinning volume and the ASP (entered on MU card 23 or 24). When i is the thinning age class, the equation,

$$RV_{ij} = V_{ij} - BT_{ij}ASP_j \ , \qquad \textbf{(16)}$$

calculates the residual cell volume per acre (RV) for a thinning in management intensity j when the base thinning input is BT. The volume reported as commercial thinning is $BT_{ij}ASP_jGH_{ij}A_{ij}$ This is the thinning volume per acre inflated by growth on harvest and the acres in cell ij. This total thinned volume will reduce the amount of the endogenous harvest required to meet the user request.

In ATLAS, the thinning treatment does not change cell stocking density. This is because the treatment and subsequent response are to be reflected in the base yield table. The yield-table value for the age class after the thin, $Y_{i+1\ j}$, should represent a stand that began as $Y_{i,\ j,}$ was thinned at midperiod, and grew for the remainder of the period to age class i+1. In the linear form of the relative density change equation (equation 2), cell volume per acre in the period after thinning is determined by,

$$V_{i+1,j} = Y_{i+1,j}\{\beta_1 + [(RV_{ij} + BT_{ij}ASP_j) / Y_{ij}]\ \beta_2\} \ , \qquad (17)$$

where it can be seen that for the purpose of calculating stocking, the thinning volume is added back to the residual cell volume. It is important to remember this when developing thinning yield tables. The removal of thinning volume per acre does not change stocking; therefore, the density standard (yield table) must change. The density standard and change equation work together. The yield table should reflect the postthinning density, and the change equation will continue to adjust the relative density in relation to that standard.

Recovery From Area Loss

This exogenous harvest depends on a loss of timberland area from the MU. This means that acres on MU card type 11 decline from one period to the next. Should area loss occur, MU card 29 can be set to recover a proportion of inventory volume from the acres removed. In this case, the word "recovery" means to count as harvest. Two card type 29s are allowed, one for each fiber type (hardwood and softwood). Up to 100 percent of the volume on acres leaving the MU base can be applied toward harvest.

This harvest mechanism might be used to model the conversion of acres from one forest type to another (that is, natural to managed forests). Under this scenario, acre declines in one MU can be matched with acre additions to another MU. This recovery should be somewhat consistent with the expected harvestable volume for age classes leaving the inventory. The MU card 13 allows for age-class control of area loss. It might not be realistic to expect 100-percent volume recovery if area loss is occurring in age classes under minimum harvest age. The MU cards 11,13, and 29 need to be considered together.

Partial Cutting

The partial cutting concept assumes a treatment that removes older trees from within a mixed-age stand. After treatment, the residual stand will have volume and growth attributes of a younger stand. In ATLAS, partial cutting is accomplished by removing cell volume in a "reverse growth" fashion and, in doing so, moving acres to younger age classes. Compared to commercial thinning, the volume removed in this treatment is not easy to predict. The amount of volume removed from a treated cell will depend on the base yield table, current cell stocking, and the stocking adjustment parameters. The number of acres in a cell that will be treated depends on the total available partial cut volume, the volume available in the cell, and the total partial cutting harvest request. Within an MU, partial cutting and final harvesting are mutually exclusive.

Three special inputs are required in a partial cutting MU. These are the harvest type selection (MU card 03), the partial cutting age classes (MU card 40), and the minimum stocking proportion (MU card 41). Card types 03 and 41 are rather simple: the first denotes that partial cutting, rather than final harvest, will take place; the second does not allow cells with stocking less than a lower limit to be treated. The card type 40 inputs determine, cell by cell, the change in age class that will be associated with a treatment. The user must decide, for age classes selected on card type 40, which target age class to assign posttreatment residual stands to. Unlike commercial thinning, the mechanism does not necessarily treat all acres within a cell, but instead, the treatment acts to remove only the acres necessary to fulfill the partial cut volume request.

In the partial cutting calculation, the model first determines the total partial cutting volume available in the inventory (from the partial cutting MUs). The process involves taking the difference between current volume and residual volume and adding growth on harvest. The residual volume represents the volume when acres in each cell are moved (or cut) to the age assigned on card type 40. This residual volume is calculated from the inverse form of the linear relative-density-change equation:

$$S_{i-1} = (S_i - \beta_1) / \beta_2 \ , \qquad (18)$$

where S_{i-1} is stocking in the previous (next youngest) age class given current stocking *(S_i).* When the acres removed from a cell are assigned to a younger age class, a form of equation (18) is used to determine the new volume per acre associated with the younger age. If m is the posttreatment, or target, age class, then we can let $f(S_I)$ equal the new stocking in age class m found by recalculating equation (18) i-m times (subject to the limitation that the new stocking proportion remain positive and not increase in value). New volume for acres treated in cell V_{it} can be expressed as,

$$TV_{mt} = f(S_I)Y_m \ , \qquad (19)$$

where TV_{mt} equals the volume after treatment at age class m. The volume removed from treated acres is equal to V_{it} - TV_{mt}. The treated acres are removed from their original cell and added to any existing acres in the target age class (age class m). The new volume per acre in a cell of age m (V_{mt}) is a weighted average equal to the initial volume in m plus the residual volume TV_{mt} on the treated acres. The acres not treated in cell V_{it} retain their original volume per acre and are subject to the regular growth calculation.

The treatment begins with the youngest designated age class and advances to the oldest. This is a relatively simple process; however, harvest takes place before growth, and treated acres are not added back into the inventory until after growth takes place. This means that in the period of treatment, the residual inventory on treated acres receives no regular growth. If the treated acres were added to the target age classes before growth, then by the end of the period they would be one age class ahead of the target age class. If partial cutting is implemented, an assumption must be made as to the growth response of partial cut acres. One might assume that treated acres undergo a response lag. If so, can growth on harvest be calibrated to capture most of the net growth on acres treated during the period? This area is open for user experimentation. Research currently is underway to validate the partial cutting mechanism in ATLAS.

Though final harvest is not explicitly an option for an MU implemented for partial cutting, a target age set to equal 0 will have the same effect. When this is the case, treated acres are moved to the zero age class; all volume is counted toward harvest, and the acres will be eligible for regeneration. If several age classes (above the minimum harvest age) are assigned a target age of 0, the harvest is proportioned among them by the available volume in each age class. In this kind of harvest, the number of treated acres in a cell is relative to total available volume and the volume per acre, so unless the requested harvest volume cannot be satisfied, a distribution of untreated acres will be maintained in the inventory.

Final Harvest

Final harvest is a treatment analogous to clearcutting. All volume is removed from acres treated by final harvest. After treatment, acres can be regenerated or be placed into the nonstocked category. Like partial cutting, the percentage of total HU harvest assigned to an individual MU is based on that MU's proportion of the total final harvest that could be supplied by all MUs. Available MU harvest volume is defined as all volume on acres at or older than the minimum harvest age class(es). The minimum harvest age class, MU card type 08, is Ml specific (see appendix A.) In each age class, the total available harvest volume includes the addition of growth on harvest. The total available (TA) harvest volume within an HU can be represented as,

$$TA = \sum_{k=1}^{N} \sum_{j=1}^{5} \sum_{i=m}^{n} A_{ijk} V_{ijk} HG_{ijk} , \qquad (20)$$

which is the product of acres, volume per acre, and the growth-on-harvest factor, when N equals the number of MUs in the harvest unit; j is the Ml within MU k; and for each j, i ranges from the minimum harvest age m to the oldest age class n. The total harvest assigned to MU k (H_k) is then,

$$H_k = \left(\sum_{j=1}^{5} \sum_{i=m}^{n} A_{ijk} V_{ijk} HG_{ijk} / TA \right) HR , \qquad (21)$$

where HR equals the harvest requested on HU card type H3 (the same proportioning scheme with a harvest request on HU card type H4 is used to assign H_k for partial cutting). If the commercial thinning option was chosen, HR would already have been reduced by the sum of all commercial thinnings or,

$$\sum_{k=1}^{N} \sum_{j=1}^{5} BT_{ijk} ASP_{jk} GH_{ijk} A_{ijk} \ , \qquad (22)$$

where i equals the commercial thinning age class(es) associated with each MU[3]. The number of acres to be final harvested in cell ijk, when $i \geq m$, will depend on the cell volume per acre (V_{ijk}), the final harvest option chosen, and the total harvest assigned to the MU (H_k). Within an MU, the harvest is distributed similarly among MIs as its distribution was by MU. The distribution is based on a percentage of the total amount available, but this calculation is age class by age. How the calculation is made depends on the final harvest option chosen. Two final harvest options are available: oldest first and proportion by age class. The option is MU specific; it will apply to all MIs within an MU.

Oldest first—This final harvest option is what its name implies—oldest first. Volume from all MIs is first removed from the oldest age class starting at n, and then the next youngest, n-1, and so on until either H_k has been met or all volume in age classes from n through m has been removed (TA_k. If TA_k is less than H_k, the requested harvest is not met, an MU-specific message is written to file ATLOG, and the simulation continues (missing the cut request is not considered to be a fatal error; when this happens the output file ATLIST will contain a negative value under the heading Com Dif in Block F, see appendix C). When H_k is assigned, volume is removed proportionally across all MIs, one age class at time. This means that the oldest age class within the MU to have volume is harvested before any younger age classes in other MIs are treated. The following example illustrates this point.

Suppose an MU has two MIs (MI-1 and MI-2) and is assigned a harvest value of 1,000. Now assume the inventory in MI-1 has a volume of 500 in age class 8 and a volume of 300 in age class 7; MI-2 has 0 volume in age class 8 and a volume of 700 in age class 7. Let us also assume that the minimum harvest age class is equal to 7 for both MIs, which means the available harvest volume is 1,500 (for simplicity we will ignore growth on harvest). The oldest first harvest mechanism would remove all 500 from MI-1 age class 8 and assign the remaining 500 to age class 7, to be divided between MI-1 and MI-2 in proportion to existing inventory; 30 percent (150) would be harvested from MI-1, and 70 percent (350) would be removed from the inventory in MI-2.

Proportion by age class—This final harvest option allows H_k to be removed across a range of age classes. Proportioning the harvest across several age classes addresses a criticism often leveled at the oldest first scheme; that is, the oldest first mechanism tends to truncate the distribution of inventory by age classes by eliminating the older age classes. (Though many forests are managed this way.) The harvest is proportioned by age class by assigning a percentage (P_{ik}) of the harvest (H_k) to age classes m through n on MU card type 38. The value assigned to each age class is constant over time. For each k chosen to have this harvest option,

$$\sum_{i=m}^{n} P_{ik} = 1.0 \ . \qquad (23)$$

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[3] Final harvest also is reduced by any volume recovered from area loss (MU card 29) when MU acreage is declining.

Like oldest first, this option is not Ml specific. The harvest assigned to a cell of age class i equals H_kP_{lk}. Like the oldest first mechanism, the amount of harvest assigned to age class i of Ml-j can be represented as,

$$H_kP_{lk} \left(A_{ijk}V_{ijk}GH_{ijk} / \sum_{j=1}^{5} A_{ijk}V_{ijk}GH_{ijk} \right) .$$

If H_kP_{lk} is greater than the available harvest volume $A_{ijk}V_{ijk}GH_{ijk}$, the proportioning mechanism harvests all volume in age class i and defaults to the oldest first method (as described previously) to supply remainder of H_kP_{ik}. If the harvest is great enough, this too will lead to a truncated age class distribution.

This is not the same proportioning scheme referred to in "Partial Cutting" when zero is the target age class (though this will mimic final harvest). Here a proportion of the harvest request is allocated to the particular age class. In partial cutting, the harvest is allocated based on volume available among the age classes. In the partial cutting MU, it is possible to simulate a third type of final harvest by assigning target ages of 0 for all harvestable age classes (providing the yield-table volume per acre is 0 in age class 0). Doing this will proportion the harvest across age classes by availability, and unless the harvest (H_k) was greater than or equal to the total available MU volume, the distribution of acres across the m though n age class will not be subject to truncation. Brooks (1987) employs a similar mechanism to proportion final harvest in the SPATS model.

The ATLAS System

This section describes, in detail, the link among input files, the computer programs, and the output files. It includes descriptive information that may seem redundant to some readers; however, we feel the consistency will help less experienced users (and those who have not read the first section).

Model Hierarchy

The programs and their inputs were defined by the natural breaks in a hierarchy of inventory, management, and harvest. Data in each category are entered into a separate file; each file is scanned by a corresponding program to check for data errors and process the data into a form useful for retrieval by a subsequent program. Each of the three scanning programs writes a report file, which can be printed or examined in an editor, and a binary file used by another program in the system. Figure 6 illustrates these links.

The beginning timber inventory is subdivided into IUs; an IU contains acres and volumes per acre for existing age classes in one to five Ml categories. These data comprise file INVEN, which is processed by program IUSCAN. The IUSCAN program writes report file IULIST and binary file IURAF. (The letters RAF stand for random access file, which is organized to permit retrieval by record-location index.)

The management information is entered by MU; 1 to 10 lUs subject to the same growth and yield parameters are assigned to an MU. The MU growth, harvest, land shift, and regeneration options are specified in file MANAGE, which is processed by program MUSCAN. The MUSCAN program writes a report file MULIST and binary file MURAF.

The harvest information is entered by HU; from 1 to 65 MUs can be combined for harvesting and assigned to each HU. The harvest requests, report requests, output labels, and other simulation parameters are specified in file HARVEST, which is processed by program HUSCAN. The HUSCAN program links lUs and MUs by reading the previously processed

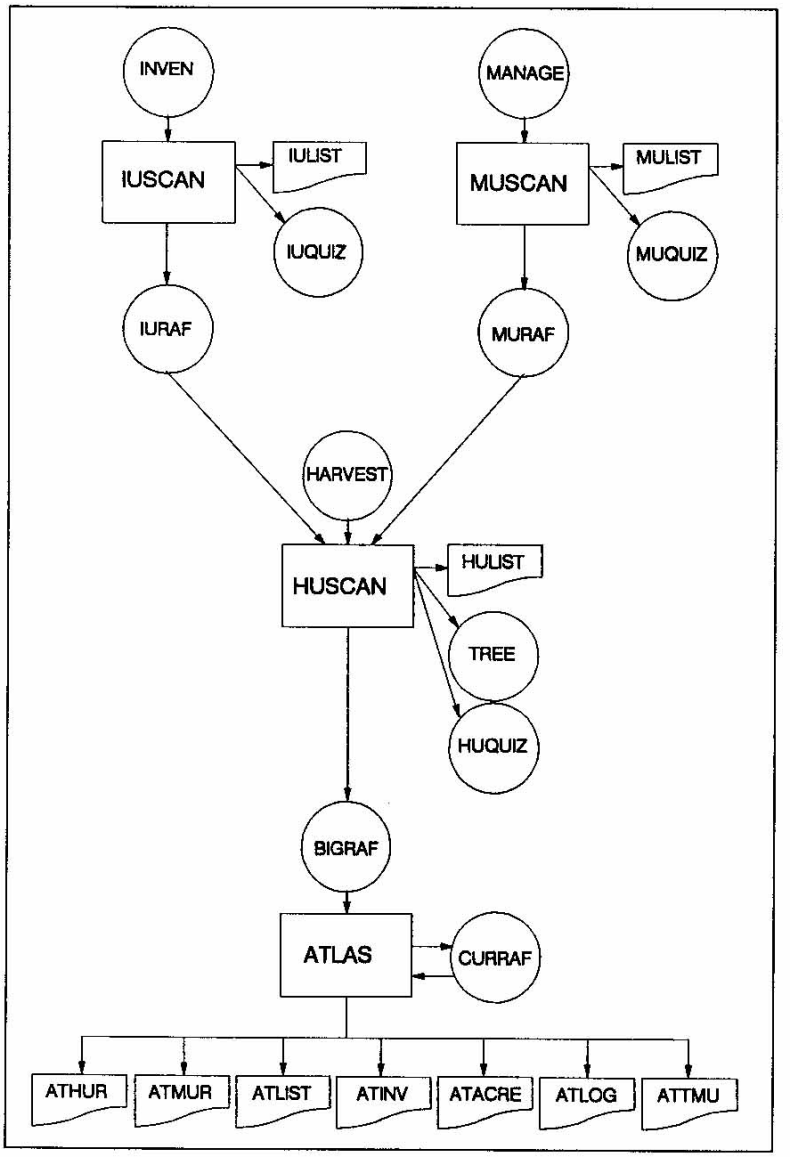

Figure 6—Detailed diagram of the ATLAS system programs, input files, and all output files.

inventory and management data in binary files IURAF and MURAF. The HUSCAN program writes report file HULIST and binary file BIGRAF. The file BIGRAF contains the complete requirements of the simulation program ATLAS.

The ATLAS simulation program produces up to six output files. The amount of detail in outputs is specified by the user. Options range from projections of input components at the MU level by chosen year, to general summary reports of projection periods. One output file includes a period-by-period report of any internal or runtime errors. An acreage report includes the number of acres harvested, regenerated, and in the inventory by MI within each MU.

The Inventory Unit Scanner

The inventory data describing the initial status of the timberland are supplied in file INVEN to program IUSCAN. For each IU, the program reads, prints, and checks the input data, which are acres and volumes per acre. Then IUSCAN computes inventory totals, writes the data in a single record on a random access file called IURAF, and prints a report on file IULIST. The RAF is used to make retrieving the information easy for subsequent programs, and data need not be translated into and from formatted forms, thereby saving input time. After all IUs have been scanned, the program sorts the IU identifying codes into ascending order and writes the sorted list with accompanying record location indices on the IURAF. The creation date and time, IU count, and record location indices of the sorted list are written on the IURAF key record. The IUSCAN program also prints the sorted IU codes on IULIST. This arrangement of information permits the later program to readily locate the IU information for a specific IU.

The IUSCAN program output can be examined for errors. The program lists a summary to the standard output unit, (either the CRT screen or printer), records the program's progress, and provides a count of errors detected. If no errors are found, printing or editing the IULIST file can be omitted. If errors are detected, the IULIST file contains details of the error. An output file called IUQUIZ[4] is written specifically to test the operating system for successful completion of the IUSCAN program, so that command files may proceed with a stacked set of program runs. If any error in IU data is found, IUQUIZ will not be created.

The Management Unit Scanner

The management data used to project future inventories are supplied by the file MANAGE to program MUSCAN. For each MU, the program reads, prints, and checks the input data, which include yield tables, thinning volumes, stocking proportions, area shifting limits, and proportions. The MUSCAN program supplies default values for many of the choices. A particularly convenient feature is the user-default value, a single value that can be used for all age classes or all periods instead of keying in the same number several times. If a constant proportion of unstocked acres is to be restocked each period, the user-default value can be set to that constant, and the program will use that value for all periods. Or a sequence of softwood proportions of volume can be provided for specific age classes 0 to 4, and the user-default value is used for all other age classes.

All specified and default values are written in a single record on the RAF named MURAF, and a report is written on file MULIST. After all MUs have been scanned, the program sorts the MU identifying codes into ascending order and writes the sorted list with accompanying record location indices on the MURAF. The creation date and time, MU count, and record location indices of the sorted list are written on the MURAF key record. The MUSCAN program also prints the sorted MU codes to MULIST. The arrangement is parallel to that for the IU data.

The MUSCAN program output can be examined in the same way as the output for IUSCAN. The summary of program progress and the count of errors are printed, and the MUQUIZ file provides a similar function as IUQUIZ.

The Harvest Unit Scanner

The harvest data and labels are supplied in file HARVEST to program HUSCAN. The general information, such as title, starting year, and report requests, are read, printed, and checked first. For each HU, the program reads, prints, and checks HU data and then looks

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Note that PC-ATLAS does not write the scanner "QUIZ" files to disk. During program execution, screen output will alert users to the simulation progress and error status.

in the sorted MU codes for the MUs belonging to the HU, and in the sorted IU codes for the IUs belonging to each MU. Inventory data are summed across IUs and reported by MU. For each MU, the MU data and the summed inventories are included on a single record in the file BIGRAF. The BIGRAF key record contains the general information and the record location indexes of each MU and HU. Reports are written to file HULIST, and a simplified hierarchial tree of the HU, MU, and IU links is listed in file TREE.

Errors in HUSCAN can include illegal harvest data or incorrect references to MU or IU data. The summary of program progress and the count of errors are listed on the screen, and details appear on HULIST, in a parallel mode to IUSCAN and MUSCAN. The HUQUIZ file also signals the error-free completion of HUSCAN.

The ATLAS Program

By the time ATLAS is run, most errors should have been found and corrected, so that ATLAS will have correct values to compute with. The programs generally screen legal ranges, so wrong values within the ranges will not be caught (many of these legal ranges are guesses as to probable ranges). There also are coordinated values that must be complementary to work successfully, and the programs do not check all possibilities. Some required data cause a signal that values are missing, but most missing data merely cause the use of the defaults. During assembly of a data set, for example, inclusion of yield tables for all management intensities must be checked by the user. We recommend printing and reviewing the IULIST, MULIST, and HULIST files during development of a new ATLAS data set.

Historical Perspective

This model represents another step in the evolution of systems designed to predict the future based on what we know about the past and the present. The ATLAS system was developed to project the National timber supply for the 1989 Renewable Resources Planning Act (RPA) timber assessment (Haynes 1990). For this application, ATLAS was a subcomponent of what is referred to as the TAMM90/ATLAS model. This system represents the state-of-the-art in forest sector projection models. The TAMM forest economic model (timber assessment market model; Adams and Haynes 1980) was used in both the 1979 assessment and the subsequent 1984 assessment update. The principle inventory projection mechanism used previously with TAMM was a diameter-class inventory model known as TRAS (Larson and Goforth 1974).

The programming of ATLAS was done by Jonna Kincaid on a VAX 8820 computer at the University of Washington, Seattle.[5] The design was based mainly on the TRIM system developed for use with TAMM in the Southern fourth forest study (U.S. Department of Agriculture 1988). The TRIM model is based on the timber resource economic estimation system (TREES; Tedder and others 1980). The TREES model was developed at Oregon State University for use in a comprehensive analysis of the timber resources in Oregon (Beuter and others 1976); TREES was again used in an update of the earlier study (Sessions and others 1990). All three models have many of the same data requirements and algorithms, but improvements in ATLAS include a reorganization of model sequencing, more direct control of area change, the addition of partial cutting, increased execution efficiency, and a reorganization of output reports that includes comprehensive accounting

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of acres and volume from period to period. Both TRIM and ATLAS can be classified as deterministic, because they do not have harvest optimization options such as those in TREES; harvest must be specified by the user.

In the RPA application, privately owned timberland was aggregated by eight timber supply regions, two ownership groups, and two fiber types. Within each region, up to nine timber types and up to three site classes were identified.[6] For three regions, the option to simulate alternative management added another five categories. The timber inventory within a category was aggregated across 18 available age classes. Periods and age classes were 5 years for Southern U.S. regions and 10 years elsewhere. Growth and yield inputs were calibrated to type- and site-specific conditions at the region-owner level of aggregation. The input volume units were cubic feet per acre for inventory and yield tables and million cubic feet for harvest requests. Harvests volumes were calculated through the interaction between TAMM and ATLAS.

The ATLAS model is available in three compatible versions: TAMM90/ATLAS, stand-alone ATLAS for mainframes, and PC-ATLAS for microcomputers. Input files are transportable between model versions.

[6] **These limits on the number of types and sites allowed within an HU are based on the number of heading labels available for output. By sharing titles assigned in the file HARVEST, additional types and sites may be carried within an HU. For more information see appendix A.**

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Appendix A: Descriptions of Input Card Types

Introduction

This appendix describes input records by card type. It has three sections, one for each input file. The 80-column format of each card type can be found in appendix B.

Each card type description includes the variable name and type used in the program source code, default value if card is not used, range of legal values, and in some cases the associated card types. Listed here are parameters used to describe ranges and limits:

AC—Age class. Length in years equal to period length (LENPD on HU card H1). Largest value allowed equals MAXAGE.

AOP—Age or period. A numeric input for card types that contain variables arrayed by age class or projection period. The value is an index that corresponds to the age class or period associated with the first entry on the record (the entry in data field 1).

MAXAGE—The highest age class allowed; value is set with parameter statement in program source code. The default setting is 17, meaning 18 age classes are available (0-17).

MAXSIM—The maximum number of periods ATLAS will simulate at one time. The default parameter setting is 12.

MI—Management intensity (1-5). MI identification is supplied as input and it also is used in ATLAS programs as an array indexing variable.

MT—Management type (1-8). Used in the ATLAS programs as an array indexing variable. MTs 1-3 are used to represent MI 1, stocking levels 1-3; MT 4 is the sum or average for all of MI 1; MTs 5-8 represent MIs 2-5.

The diagnostic output reports, or "dumps," are not covered in detail. They originally were development tools used for program debugging and system testing. It was assumed few users would need them. The dump routines will produce output of variable values by subroutine for each period. It is suggested that programmers attempting to change the source code become familiar with the dumps because, though voluminous, the reports can be of value.

This appendix is not intended to give detailed explanations of inventory, stocking, growth, area change, and harvest. For more information on these topics, see the appropriate sections in the main text.

Numerical Values Represented in Input and Output

Input—Numbers representing area and volume can be input in any unit of measure (that is, board feet or cubic feet, acres or hectares, and so forth), but those units must be used consistently in all inputs. The same measure of volume per unit area must be used in both the inventory entered in INVEN and the yield table(s) entered in MANAGE. The same standard also must be used when the removal volume is entered in HARVEST. The same measure of area must be used for both the inventory in INVEN and area projections in MANAGE.

There are, however, important differences in the values of units entered in the three input files. The volume per unit area entered in INVEN and the volume per unit area entered for

the yield table(s) in MANAGE should be in the same units, but the volume entered as the periodic removal request in file HARVEST is in millions. The area entered in INVEN and the area projection entered on card type 11 in MANAGE are not of the same units. The entry in INVEN is in single-unit values, and the card type 11 entry is read as millions. Both the harvest request and the area projection allow for three or more decimal places.

Output—All output is by default expressed in millions (with three decimal places). The modeling is done in single units and rounding does not occur until time of output. This is accomplished via a variable, XMILL. Within the HUSCAN and ATLAS programs, XMILL has been set to equal 1000000.0. Within ATLAS, the area projections entered in MANAGE and the removal entered in HARVEST are both multiplied by XMILL so that the entire simulation takes place in single units. Output of area and volume are then divided by XMILL in the various report-writing subroutines. If an alternate unit value is desired, the user can change XMILL and recompile the various programs (the projected area and the harvest must be in the same units as XMILL).

Inventory Unit Card Descriptions

Note: There is no IU card type 2.

IU card type 1, unstocked acres (no distinguishable timber stand)—

Real variable UNSIU.
Acres in unstocked category.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

IU card type 3, regular acres-
Supply cards in ascending numerical order of MI, and within MI, in ascending numerical order of age class. No entry needs to be made when age class has no associated acres.

For management intensity = 1:

(An option for MI-1 is to stratify the inventory by three stocking levels.)

Integer variable MI.
Management intensity.
No default when acres are present. Legal value is 1.

Integer variable AC.
Age class.
No default when acres are present. Legal values are 0 to MAXAGE.

Real variable ACIU(AC,1).
Acres in each age class for MI-1, stocking level 1, which translates to management type 1.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

Real variable VPAIU(AC,1).
Existing volume per acre in each age class for MI-1, stocking level 1, which translates to management type 1.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

Real variable ACIU(AC,2).
Acres in each age class for MI-1, stocking level 2, which translates to management type 2.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

Real variable VPAIU(AC,2).
Existing volume per acre in each age class for MI-, stocking level 2, which translates to management type 2.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

Real variable ACIU(AC,3).
Acres in each age class for MI-1, stocking level 3, which translates to management type 3.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

Real variable VPAIU(AC,3).
Existing volume per acre in each age class for MI-1, stocking level 3, which translates to management type 3.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

For management intensities = 2 to 5:

Integer variable MI.
Management intensity.
No default. Legal values are 2 to 5, which translate to management types 5 to 8.

Integer variable AC.
Age class.
No default. Legal values are 0 to MAXAGE.

Real variable ACIU(AC,MT).
Acres in each age class for each MI.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

Real variable VPAIU(AC,MT).
Existing volume per acre in each age class for each MI.
Default is 0.0. Legal values are 0.0 to 10,000,000.0.

Management Unit Card Descriptions

Note: There are no MU card types 4-6, 9-10,15-20,25-27, 31, or 35.

MU card type 00, MU name-

Character variable *15 MUNAME.

Name of MU.
Default is identification code in character form. Any alphanumeric character is legal (up to 15 characters).

MU card type 01, IUs belonging to MU—

Integer array IUID(1-10).
IU numeric identifier(s) (up to six per card). No default. Legal values are numbers of five or fewer digits. Values are read with trailing blanks null.

MU card type 02, timber type (species)—

Integer variable ORGSP.
Reference number associated with timber type (species) name(s) entered on H8 card(s) of

input file HARVEST.
No default. Legal values are 1 to 9.

MU card type 03, options-

Integer variable HARSEL.

Harvest type.

Default is 1. Legal values: 1 =final harvest, 2=partial cutting.

Integer variable DUMP.
MU level diagnostic output request.
Default is none. Legal values range from 0 (or blank) to 5; where 0=none, 5=most.

Integer variable IFDUMP.
First period for diagnostic output at MU level.
Default is no diagnostic output at the MU level.
Legal values are 0 to MAXSIM; where 0 represents period zero.

Integer variable LSDUMP.
Last period for diagnostic output at MU level.
Default is no diagnostic output at the MU level.
Legal values are 0 to MAXSIM; greater than or equal to IFDUMP; where 0 represents period zero.

MU card type 07, age limits for shifting—

Management intensity pairs must be in ascending numerical order with no duplication.

Integer variable MIFR.
Management intensity, source of shift.
No default. Legal values are 1 to 5.

Integer variable MITO.
Management intensity, destination of shift.
No default. Legal values are 1 to 5; not equal to MIFR.

Integer array HISHIF(MIFR,MITO)
Maximum age class to shift acres from MIFR to MITO.

Default is 0. Legal values are 0 (regeneration only) to MAXAGE.

MU card type 08, minimum harvest ages-

Integer array MINHAR(1-5).

Minimum age class to allow final harvest in each MI (5 values per card).
Default is 0 (all volume available). Legal values are 0 to MAXAGE.

MU card type 11, acres in MU—

Integer variable AOP.
Period of first area specified. The remaining nonblank areas are for periods AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXSIM.

Real array AREA(AOP).
Area in million acres for each period. Up to six entries per card. If left blank, user default will be assumed.
Default is 0.0 which implies no change. Legal values are 0.0 to 100.0.

MU card type 12, age class distribution of acres entering MU—

Integer variable AOP.
Age class of first proportion specified. The remaining nonblank proportions are for age classes AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real array ENTER(AOP).
Proportion of acres entering MU to assign to an age class (assuming acreage increase from MU card 11). Up to six values per card. User default may be used. Legal values are 0.0 to 1.0. Sum of all proportions specified must equal 1.0.
Default for blank (assuming no user default card) is 0.0, no acres.
Default when card type 12 is omitted equals 1.0 for age class 0.

MU card type 13, age class distribution of acres exiting MU—In the case of area loss, proportions can be for a single age class or a range of age classes called groups. From 1 to 10 groups may be specified; groups must be arranged in ascending order.

Integer variable KEX.
Index number of age class group.
No default. Legal values are 1 to 10.

Integer variable LEX(KEX).
Lowest age class of group.
No default. Legal values are 0 to MAXAGE; must be greater than maximum age class of lower indexed group.

Integer variable UEX(KEX).
Maximum age class of group.
No default. Legal values are 0 to MAXAGE; must be greater than or equal to LEX(KEX).

Real variable EXIT(KEX).
Proportion of MU acreage loss to be extracted from the age classes in the group.
Default is 0.0 (no acres). Legal values are 0.0 to 1.0. Sum of all specified groups must equal 1.0.

MU card type 14, management intensity of entering acres—

Integer variable MIENT.
Management intensity to assign acres entering the MU (through MU cards 11 and 12).
Default is 1. Legal values are 1 to 5.

MU card type 21, proportion of acres in unstocked category to be restocked—

Integer variable AOP.
Period of first proportion specified. The remaining nonblank proportions are for periods AOP+1 to AOP+5.

Default (blank) defines user default. Legal values are 0 to MAXSIM.

Real array UNSTRE(AOP).
Proportion of unstocked acres restocked each period.
Up to six values per card. User default may be used.
Default is 0.0. Legal values are 0.0 to 1.0.

MU card type 22, proportion of cut acres to remain unstocked—

Integer variable AOP.
Period of first proportion specified. The remaining nonblank proportions are for periods AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXSIM.

Real array CUTUNS(AOP).
Proportion of acres cut in MU to remain unstocked each period.
Up to six values per card. User default may be used.
Default is 0.0. Legal values are 0.0 to 1.0.

MU card type 23, average stocking proportion, regeneration distribution—

Real array AVSPRO(1-3).
Average stocking proportion for stocking levels 1 to 3 of MI-1, translates to management types 1 to 3. (Also called regeneration stocking ratio.)
Three values.
Defaults are 0.0. Legal values are 0.0 to 4.0.

Real array SLDIST(1-3).,
Regeneration distribution for stocking levels 1 to 3 of management intensity 1.
Three values.
Defaults are 1.0 for stocking level 1 and 0.0 for stocking levels 2 and 3. Legal values are 0.0 to 1.0. Sum of values must equal 1.0.

MU card type 24, stocking level thresholds, average stocking proportions—

Real array SLMIN(1-2).
Lower bound of stocking levels 1 and 2. Two values.
Defaults are 0.0. Legal values are 0.0 to 4.0; proportion for stocking level 1 must be greater than proportion for stocking level two, unless both are 0.0.

Real array AVSPRO(5-8).
Average stocking proportions for MIs 2 to 5, translates to management types 5 to 8 (also called regeneration stocking ratios). Four values.

Defaults are 0.0. Legal values are 0.0 to 4.0.

MU card type 28, management intensity shift rates-

Integer variable MIFR.

Management intensity source (Ml to lose acres).
No default. Legal values are 1 to 5.

Integer variable MITO.
Management intensity destination (Ml to gain acres).
No default. Legal values are 1 to 5; not equal MIFR.

Integer variable AOP.
Period of first shift proportion specified. The remaining nonblank proportions are for periods AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real array MISHIF(MIFR,MITO,AOP).
Proportion of acres in specified age class(es) (from MU card 07) to shift from MIFR to MITO in period AOP.
Default is 0.0 Legal values are 0.0 to 1.0.

MU card type 29, proportion of area loss volume to recover in harvest—

Integer variable FIB.
Fiber type.
No default. Legal values: 1 =softwood, 2=hardwood.

Integer variable AOP.
Period of first proportion specified. The remaining nonblank proportions are for periods AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real variable ARCREC(FIB,AOP).
Proportion of volume on acres lost from the timberland (via MU card 11) that is classified as harvest volume by fiber type, for each period.
Default is 6.0. Legal values are 0.0 to 1.0.

MU card type 30, relative density change (stocking adjustment) options—
Two card type 30 entries are allowed. If present, the second card type 30 allows the use of a separate set of coefficients applicable to acres regenerated within the MU. When using the second card, variable ENT equals 2, this follows the initial card where ENT equals 1. On the second card, the variables FULLDC, HALFDC, and EQNDC are not entered; they are derived from values found on the first card.
Default: If card type 30 is omitted, no stocking adjustment takes place.

For ENT=1:

Integer variable ENT.
Specifies the first set of relative-density-change coefficients. Should the option be chosen to specify a second set of coefficients, then the coefficients on this card will apply only to all stands existing at the beginning of the simulation.
No default if card 30 is present. The value of 1 must be present.

Integer variable FULLDC.
Maximum age class of full stocking adjustment for both current and regenerated acres.
Default is 0. Legal values are 0 to MAXAGE.

Integer variable HALFDC.

Maximum age class of one-half the full stocking adjustment for both current and regenerated acres. No stocking adjustment takes place on acres in age classes higher than HALFDC.
Default is 0. Legal values are 0 to MAXAGE; must be greater than or equal to FULLDC.

Integer variable EQNDC.
Form of stocking-adjustment equation.
Default is 1. Legal values: 1 for the linear form (equations 2 and 3 in text), or 2 for the quadratic form (equations 4 and 5 in text).

Real variable COEFDC(1).
First coefficient in stocking-adjustment equation; used only for existing inventory if a second card type 30 is supplied; otherwise used for both existing inventory and regenerated acres. This coefficient is defined as $I3_1$ in equations (2), (3), (4), (5), (7), and (8) of text.
Default is 0.0. Value not checked for error.

Real variable COEFDC(2).
Second coefficient in stocking-adjustment equation; used for existing inventory if a second card type 30 is supplied; used for both existing inventory and regenerated acres if not. This coefficient is defined as 6_2 in equations (2), (3), (4), (5), (7), and (8) of text.
Default is 1.0. Value not checked for error.

For ENT=2:

Integer variable ENT.
Specifies the application of a second set of stocking-adjustment coefficients to acres regenerated within the MU.
No default. Legal value is 2.

Real variable CREGDC(1).
First coefficient for stocking-adjustment equation; used for regenerated acres (including acres entering the zero age class via area change cards 11 and 12). This coefficient is defined as 13_1 in equations (2), (3), (4), (5), (7), and (8) of text.
Default is 0.0. Value not checked for error.

Real variable CREGDC(2).
Second coefficient for stocking-adjustment equation; used for regenerated acres (including acres entering the zero age class via area change cards 11 and 12). This coefficient is defined as 6_2 in equations (2), (3), (4), (5), (7), and (8) of text.
Default is 0.0. Value not checked for error.

MU card type 32, average diameter by age class—

Integer variable MI.
Management intensity.
No default. Legal values are 1 to 5.

Integer variable AOP.
Age class of first diameter specified. The remaining nonblank proportions are for age classes AOP+1 to AOP+5,

Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real array AVDIAM(AOP,MI).
Average diameter of inventory in each age class by management intensity.
Default is 0.0. Legal values are 0.0 to 100.0.

MU card type 33, base yield table volume—

Integer variable MI.
Management intensity.
No default. Legal values are 1 to 5.

Integer variable AOP.
Age class of first volume specified. The remaining nonblank proportions are for age classes AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real array VOLPA(AOP,MI).
Yield-table volume per acre for each age class by MI.
Default is 0.0. Legal values are 0.0 to 100,000.0.

MU card type 34, commercial thinning volumes-

Integer variable MI.

Management intensity.

No default. Legal values are 1 to 5.

Integer variable AOP.
Age class of first volume specified. The remaining nonblank proportions are for age classes AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real array THINPA(AOP,MI).
Thinning volume per acre by age class and MI. This value should be reflected in the volume of the corresponding base yield table (thinning does not change stocking). Volume removed from inventory will equal the product of THINPA and AVSPRO.
Default is 0.0. Legal values are 0.0 to 10,000.0.

MU card type 36, softwood proportions of volume-

Integer variable MI.

Management intensity.

No default. Legal values are 1 to 5.

Integer variable AOP.
Age class of first proportion specified. The remaining nonblank proportions are for age classes AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real array SOFTPA(AOP,MI).
Softwood proportion of volume per acre for each age class in each MI.

Default is 1.0. Legal values are 0.0 to 1.0.

MU card type 37, growth on harvest—

Integer variable MI.
Management intensity.
No default. Legal values are 1 to 5.

Integer variable AOP.
Age class of first multiplier specified. The remaining nonblank proportions are for age classes AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real array HARGR0(A0P).
Growth on harvest multiplier for each age class.

Default is 1.0, which implies no growth on harvest. Legal values are 1.0 to 10.0.

MU card type 38, harvest priority proportions-

Integer variable AOP.
Age class of first proportion specified. The remaining nonblank proportions are for age classes AOP+1 toAOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.
Real array HVPROP(AOP).
Proportion of the share of total harvest volume for this MU to be assigned to each age class. If volume in age class cannot fulfill the assigned proportion, then harvest not fulfilled will be removed from oldest age class with available volume.
Default is 0.0 for age classes 0 to 16 and 1.0 for age class 17. Legal values are 0.0 to 1.0.

MU card type 39, volume unit conversion factors—

Integer variable AOP.
Age class of first factor specified. The remaining nonblank proportions are for age classes AOP+1 to AOP+5.
Default (blank) defines user default. Legal values are 0 to MAXAGE.

Real variable CONFAC(AOP).
Factor for converting reported volumes to alternate volume units for each age class.
Default is 1.0. Legal values are 0.0 to 100.0.

MU card type 40, partial-cutting target age class—

Integer variable AOP.
First age class to receive partial-cutting treatment. The remaining nonblank entries are for age classes AOP+1 to AOP+5.
Blank defines PCAGE entry as user default. Legal values are 0 to MAXAGE.

Integer array PCAGE(AOP).
Target age class: new age class to assign acres during the partial cutting treatment. Entry is by age class to receive treatment.

Legal values are 0 to MAXAGE.
Default is MAXAGE, which is equivalent to no harvest. An entry of 0 is equivalent to final harvest. Age classes with targets greater than the existing age receive no treatment (same as blank entries). Partial-cutting harvest is proportioned by available volume among those age classes with target ages.

MU card type 41, partial-cutting minimum stocking proportion-

Real variable PCMIN.
Minimum stocking proportion for eligibility for partial cutting. No treatment will take place in any age class when inventory stocking is below this value.
Default is 0.0 Legal values are 0.0 to **1**.0.

Harvest Unit Card Descriptions

Note: The HU is composed of two parts. The first part consists of card types 01 through 07. These records contain parameters that control the ATLAS simulation, and this also is where the user selects output reports. Only one set of cards 01 through 07 are allowed in a simulation. The second set of records, card types HO through H8, defines the individual HUs (up to 32 sets of these are allowed). All HUs share the same simulation run-time and report parameters found in card types 01 through 07, but each contains an individual set of MUs, harvest requests, management intensity labels, and species (or forest type) labels.

HU card type 01, simulation heading—
Required.

Character variable *60 RHEAD.
Heading written on all reports.
No default. Any alphanumeric characters are legal.

HU card type 02, starting year—
Required.

Integer variable STYEAR.
The beginning year for the simulation.
No default. Legal values are 1900 to 5000.

HU card type 03, diagnostic and standard report requests-
Required.

Integer variable DOVER.
Overall diagnostic output request.
No default. Legal values: 0=none, 1 =some, 2=extensive.

Integer variable IFDOV.
First period for diagnostic output.
Default (blank) is no diagnostic output. Legal values are 0 to MAXSIM.

Integer variable LSDOV.
Last period for diagnostic output.
Default (blank) is no diagnostic output. Legal values are 0 to MAXSIM; must be greater than or equal to IFDOV.

Integer variable SUMREP.
Summary report flag (ATLIST report).
Default (blank) is no summary reports. Legal values: 0=no summary reports, 1 ^summary reports.

Integer variable HUREP.
HU report flag (ATHUR report).
Default (blank) is no HU reports. Legal values: 0=no HU reports, 1=HU reports for totals across MIs, 2=HU reports for individual MIs and totals.

Integer variable MUREP.
MU report flag (ATMUR or ATTMU report).
Default (blank) is no MU reports. Legal values: 0=no MU reports, 1=MU reports totals across MIs (totals by MU), 2=MU reports for individual MIs and totals by MU, 3=ATTMU report of MU grand totals for every period (no ATMUR report). Note: Linked ATLAS (TAMM90/ATLAS) will not produce MU-level reports, regardless of the value of this flag.

HU card type 04, HU report years-

Integer array HURYR(1-12).

HU report years for ATHUR.
Up to 12 values. The calendar years (for example, 1980) for which HU reports are wanted.
Default is no HU report. Legal values are 1900 to 5000.

HU card type 05, MU report years-

Integer array MURYR(1-12).

MU report years for ATMUR.
Up to 12 values. The calendar years (for example, 1980) for which MU reports are wanted.
Default is no MU report. Legal values are 1900 to 5000.

HU card type 06, minimum diameter for alternate volume—

Real variable DIAMIN.
Minimum diameter for including volume in conversion to alternate volume unit.
Default is 0.0. Legal values are 0.0 to 50.0.

HU card type 07, initial softwood fractions of harvest—
This card type is only used by the TAMM90/ATLAS mainframe model, it is ignored by other versions of ATLAS. Card 07 consists of four cards that supply TAMM with an initial estimate of the softwood proportion of the total harvest. The dimensions reflect its use in the RPA timber assessment; eight regions, two ownerships, and two fiber types.

Real array SFRAC(1 -8,1 -4)
Initial value for softwood fraction of harvest.
Eight values per card, four cards.
Default is 0.0. Legal values are 0.0 to 1.0.

Card Descriptions for Individual Harvest Units

Note: There is no HU card type H5.

HU card type HO, HU heading-
Required.

Character variable *60 HUHEAD.
Title for HU.
No default. Any alphanumeric characters are legal.

HU card type H1, HU name and other information-
Required.

Character variable *10 HUNAME. \
Name of HU.
No default. Any alphanumeric characters are legal.

Integer variable LENPD.
Length of period in years.
No default. Legal values are 1 to 50.

Integer variable MAXPD.
Number of periods for the simulation.
No default. Legal values are 0 to MAXSIM.

Real variable DCLIM.
Upper allowable stocking limit as a proportion of yield-table volume. Inventory with stocking above this proportion will be moved ahead into the next and subsequent age classes until the stocking proportion is equal to or less than DCLIM (in some cases age class MAXAGE may have stocking higher than DCLIM).
Default value (blank) is 1.50 (or 150 percent). Legal values are 0.5 to 10.0.

Real variable DCMIN.
Minimum stocking ratio within expected range. Age classes with lower ratios are flagged in HU report.
Default value (blank) is 0.10. Legal values are 0.0 to 2.0.

Real variable DCMAX.
Maximum stocking ratio within expected range. Age classes with higher ratios are flagged in HU report.
Default value (blank) is 1.30 or DCLIM, whichever is greater. Legal values are 0.5 to 10.0.

HU card type H2, MUs belonging to HU—
Required.

Integer array MUID(1-65).
MU numeric identifiers. Up to six per card.
Default values (blank) are no MU identified. Legal values are numbers of 10 or fewer digits, trailing blanks are considered null.

HU card type H3, HU final harvest volumes—
(Either H3 or H4 is required—having both is ok.)

Integer variable HARTYP.
Fiber type of harvest.
No default. Legal values are 1=softwood, 2=hardwood, or 3=combined.
This variable is repeated on each H3 record.

Integer variable PD.
Period corresponding to first harvest entered on this card.
No default. Legal values are 0 to MAXSIM. The remaining five harvests are for periods PD+1 to PD+5.

Real array HARVHU(PD).
Final harvest volumes of specified fiber-type in million units for each period of the simulation.
Default is 0. Legal values are 0.0 to 1 .OE+6.

HU card type H4, HU partial cutting harvest volumes—
(Either H3 or H4 is required-having both is ok.)

Integer variable HARTPC.
Fiber type of harvest.
No default. Legal values are 1=softwood, 2=hardwood, or 3=combined.
This variable is repeated on each H4 record.

Integer variable PD.
Period corresponding to first harvest entered on this card.
No default. Legal values are 0 to MAXSIM. The remaining five harvests are for periods PD+1 to PD+5.

Real array PCHARV(PD).
Partial cutting harvest volumes of specified fiber type in million units for each period of the simulation.
Default is 0. Legal values are 0.0 to 1 .OE+6.

HU card type H6, HU management intensity names—
Required.

Integer variable LTYP.
Management intensity.
No default. Legal values are 1 to 5 in ascending order with none missing.

Character array *15 MINAME(LTYP)
Name or description of MI to be used in output reports.
No default. Any alphanumeric characters are legal.

HU card type H7 was previously HU site names—Site names should be incorporated into the MU name. This card served no useful purpose in ATLAS; it has been deleted.

HU card type H8, HU timber type names and fiber types—

Integer variable LTYP.
Timber type (or species).
No default, at least one required. Legal values are 1 to 9. Those card types present must be in ascending order.

Character array *15 SPNAME(LTYP)

Name or description of timber type (species) to be used in output reports (referenced in MU card 02).
No default. Any alphanumeric characters are legal.

Integer array SPGROU(LTYP)
Fiber type (for harvest purposes) of timber type, 1 =softwood, 2=hardwood. Used in TAMM90/ATLAS for region owner summary. Used in stand-alone ATLAS for controlling printing of timber types (blank means timber type does not exist in data). No default.

Appendix B: Formats of Input Records

This appendix shows the required input format of the IUs in INVEN, the MUs in MANAGE, and the HUs in HARVEST. The card types are listed in the same order as in appendix A.

Each page in this appendix has a heading of column numbers followed by names or abbreviations used to describe groups of columns or fields. All three input files have a similar format: all are 80 columns wide, the first 20 columns contain identification information, and the last 60 columns are divided into six 10-column data fields. The six data fields are used to enter acres and volume by stocking classes in the IU (one record for each age class). In the MU and HU, the data fields are used to enter variables such as yield tables and harvest requests, where each data field represents an age class or period.

The abbreviations used for the headings are:

AC Age class; zero is the youngest age class. In IU file, this is the age class associated with the acre and volume entries on the record.

Card type This corresponds to the card type value listed in appendix A.

HT CT In the file HARVEST, these represent harvest type and count. The word count is in this case associated with an index for the field for MI names (1-5), site class names (1-3), and species names (up to 9). Harvest type designates the HU as partial cutting or final harvest.

ID Unique identifier used for the particular IU or MU. In the file HARVEST, columns 3-4 with the heading HU are used to identify multiple HUs (only for cards HO though H8).

MI Management intensity. A value must be entered, even if only one MI is present.

MIFR Used to list the MI from which acres will come on MU card types 07 and 28. Otherwise this column is for the management intensity associated with the values in data fields 1-6, for the fiber type associated with card type 29, or to identify card 30.

MITO This column is used only in conjunction with MIFR on MU cards 07 and 28 to designate the MI to receive acres.

PD Simulation period, when represented by PD, or age class when represented by AC. The period or age class to be associated with value in data field 1 (where 0 is the first period of a simulation, and 0 is the youngest age class). The value in data field 2 is associated with the subsequent period or age class.

Inventory Unit Input Format

1-5 IU ID	7 Card type	9 MI	11-12 AC	21 - 30 Data field 1	31 - 40 Data field 2	41 - 50 Data field 3	51 - 60 Data field 4	61 - 70 Data field 5	71 - 80 Data field 6
				Unstocked acres.					
	1			UNSIU					
				Regular acres and volumes per acre for MI 1, each stocking level, 1 to 3, and age class.					
	3	1		ACIU(ac,1) stocking level 1	VPAIU(ac,1)	ACIU(ac,2) stocking level 2	VPAIU(ac,2)	ACIU(ac,3) stocking level 3	VPAIU(ac,3)
				Regular acres and volumes per acre for MIs 2 to 5, stocking level 1, and age class.					
	3	mi		ACIU(ac,mi+3)	VPAIU(ac,mi+3)				

Management Unit Input Format

1-10 MU ID	11-12 Card type	14 MIFR	16 MITO	18-19 PD	21 - 30 Data field 1	31 - 40 Data field 2	41 - 50 Data field 3	51 - 60 Data field 4	61 - 70 Data field 5	71 - 80 Data field 6
					MU Name: 15 characters.					
	00				**HNAME** (to column 35)					
					IUs belonging to MU: IU identification code, 1 10 IUs per MU.					
	01				IUID(i)	IUID(j)	IUID(k)	IUID(l)	IUID(m)	IUID(n)
					MU species (forest type).					
	02				ORGSP Species					
					MU options.					
	03				HARSEL Harvest type: 1=final harv. 2=partial cut	DUMP Diagnostic output flag: 0=off, 1=on	IFDUMP First period for diagnostic output	LSDUMP Last period for diagnostic output		
					Age class limit for shifting among Mis.					
	07	mifr	mi to		MSHIF(mifr,mito)					
					Minimum harvest age class for each MI, 1 to 5.					
	08				MINHAR(1)	MINHAR(2)	MINHAR(3)	MINHAR(4)	MINHARC5)	
					Areas.					
	11				AREA(-1) User default					
	11			Pd	AREA(pd)	AREA(pd+1)	AREA(pd+2)	AREA(pd+3)	AREA(pd+4)	AREA(pd+5)
					Proportions of entering acres.					
	12				ENTER(-1) User default					
	12			ac	ENTER(ac)	ENTER(ac+1)	ENTER(ac+2)	ENTER(ac+3)	ENTER<ac+4)	ENTER(ac+5)
					Minimum and maximum age class of group and proportion of exiting acres for group.					
	13			kex	LEX(kex)	UEX(kex)	EXIT(kex)			
					Management intensity of entering acres.					
	14				MIENT					
					Proportion of unstocked acres restocked for period.					
	21				UNSTRE(-I) User default					
	21			pd	UNSTRE(pd)	UNSTRE(pd+1)	UNSTRE(pd+2)	UNSTRE(pd+3)	UNSTRE(pd+4)	UNSTRE(pd+5)

MU Format

1-10 MU ID	11-12 card type	14 MIFR	16 MITO	18-19 PD	21 - 30 Data field 1	31 - 40 Data field 2	41-50 Data field 3	51-60 Data field 4	61 - 70 Data field 5	71 - 80 Data field 6
					Proportion of cut acres to unstocked for period.					
	22				CUTUNS<-1)					
					User default					
	22			pd	CUTUNS(pd)	CUTUNS(pd+1)	CUTUNS(pd+2)	CUTUNS(pd+3)	CUTUNS(pd+4)	CUTUNS(pd+5)
					Average stocking proportion and regeneration distribution for MI 1, stocking levels 1 to 3.					
	23				AVSPRO(I)	AVSPR0(2)	AVSPRO(3)	SLDIST(1)	SLDIST(2)	SLD1ST(3)
					Minimum stocking proportion for stocking levels 1 and 2; average stocking proportion for MI 2 to 5					
					(equivalent to MT 5 to 8).					
	24				SLMINC1)	SLMIN(2)	AVSPRO(5)	AVSPRO(6)	AVSPR0(7)	AVSPR0(8)
					Proportion of acres to shift among Mis for period.					
	28	mifr	mito		MISHIF(-1, mifr, mito)					
					User default					
	28	mifr	mito	pd	MISHIF(pd, mifr, mito)	MSHIF(pd+1, mifr, mito)	MISHIF(pd+2, mifr, mito)	MISHIF(pd+3, mifr, mito)	MISHIF(pd+4, mifr, mito)	MISHIF(pd+5, mifr, mito)
					Recovery factor for softwood forests for period.					
	29	1			ARCREC(-1,1)					
					User default					
	29	1		pd	ARCREC(pd,1)	ARCREC(pd+1,1)	ARCREC(pd+2,1)	ARCREC(pd+3,1)	ARCREC(pd+4,1)	ARCREC(pd+5,1)
					Recovery factor for hardwood forests for period.					
	29	2			ARCREC(-1,2)					
					User default					
	29	2		pd	ARCREC(pd,2)	ARCREC(pd+1,2)	ARCREC(pd+2,2)	ARCREC(pd+3,2)	ARCREC(pd+4,2)	ARCREC(pd+5,2)
					Relative density change equation information.					
	30	1				FULLDC: Last age class to receive full density adjustment	HALFDC: Last age class to receive half of the full density adjustment	EQNDC: Equation type: 1=linear, 2-quadratic	COEFDC(I): 1st coefficient of density change equation	C0EFDC(2): 2d coefficient of density change equation
	30	2			Coefficients for regeneration relative density change equation. (FULLDC, HALFDC, EQNDC default from 1st equation--above)				CREGDC(1): 1st coefficient of regen. density change equation	CREGDC(2): 2d coefficient of regen. density change equation

1-10 MU ID	11-12 Card type	14 HIFR	16 HITO	18-19 PD	21 - 30 Data field 1	31 - 40 Data field 2	41 - 50 **Data** field **3**	51 - 60 **Data** field 4	61 - 70 **Data** field 5	71 - 80 Data field 6
					Average diameter for MI and age class.					
	32	mi			AVDIAM(-1,mi) User default -					
	32	mi		ac	AVDIAM(ac,mi)	AVDIAM(ac+1,mi)	AVDIAM(ac+2,mi)	AVDIAM(ac+3,mi>	AVDIAM(ac+4,mi)	AVDIAM(ac+5,mi)
					Standard net volume per acre for Ml and age class.					
	33	mi			V0LPA(-1,mi) User default					
	33	mi		ac	VOLPA(ac.mi)	VOLPA(ac+1,mi)	VOLPA(ac+2,mi)	VOLPA(ac+3,mi)	VOLPA(ac+4,mi)	V0LPA(ac+5,mi)
					Thinning volume per acre for MI and age class.					
	34	mi			THINPA(-1,mi) User default					
	34	**mi**		ac	THINPA(ac,mi)	THINPA(ac+1,mi)	THINPA(ac+2,mi)	THINPA(ac+3,mi)	THINPA(ac+4,mi)	THINPA(ac+5,mi)
					Softwood proportion of volume per acre for Mt and age class.					
	36	**mi**			SOFTPA(-1,mi) User default					
	36	**mi**		ac	SOFTPA(ac,mi)	SOFTPA(ac+1,mi)	S0FTPA(ac+2,mi)	SOFTPA(ac+3,mi)	SOFTPA(ac+4,mi)	SOFTPA(ac+5,mi)
					Growth on harvest adjustment factor for MI and age class.					
	37	**mi**			HARGRO(-1,mi) User default					
	37	mi		ac	HARGROCac.mi)	HARGR0(ac+1,mi)	HARGRO(ac+2,mi)	HARGRO(ac+3,mi)	HARGR0(ac+4,mi)	HARGRO(ac+5,mi)
					Preferred harvest proportion for age class.					
	38				HVPROP(-1) User default					
	38			ac	HVPROP(ac)	HVPROP(ac+1)	HVPROP(ac+2)	HVPROP(ac+3)	HVPROP(ac+4)	HVPROP(ac+5)
					Volume conversion factor.					
	39				CONFAC(-1) User default					
	39			ac	CONFAC(ac)	CONFAC(ac+1)	CONFAC(ac+2)	CONFAC(ac+3)	CONFAC(ac+4)	CONFAC(ac+5)
					Partial-cutting target age class.					
	40				PCAGE(-1) User default					
	40			ac	PCAGE(ac)	PCAGE(ac+1)	PCAGE(ac+2)	PCAGE(ac+3)	PCAGE(ac+4)	PCAGE(ac+5)
					Partial-cutting minimum stocking proportion.					
	41				PCMIN					

Harvest Unit Input Format

1-2 Card type	3-4 HU	7 HT, CT	10-11 PD	21-25 Data field 1	26-30	31-35 Data field 2	36-40	41-45 Data field 3	46-50	51-55 Data field 4	56-60	61-65 Data field 5	66-70	71-75 Data field 6	76-80
				Run header.											
01				RHEAD											
				60-character run description (to column 80)											
				Beginning year of simulation.											
02				STYEAR											
				General Options.											
03				DOVER Overall diagnostic report flag: 0=off, 1=on		IFDOV First period of diagnostic reports		LSDOV Last period of diagnostic reports		SUMREP Summary report flag: 0=off, 1=on		HUREP HU report flag: 0=off, 1= total, 1= 2=MI and total		MUREP HU report flag: 0=off, 1= total, 2=MI and total 3=ATTMU report	
				HU report years.											
04				HURYR (1)	HURYR (2)	HURYR (3)	HURYR (4)	HURYR (5)	HURYR (6)	HURYR (7)	HURYR (8)	HURYR (9)	HURYR (10)	HURYR (11)	HURYR (12)
				Calendar years in 5 column fields											
				HU report years.											
05				MURYR (1)	MURYR (2)	MURYR (3)	HURYR (4)	MURYR (5)	MURYR (6)	MURYR (7)	MURYR (8)	MURYR (9)	MURYR (10)	MURYR (11)	MURYR (12)
				Calendar years in 5 column fields											
				Minimum diameter.											
06				DIAHIN											
				Initial softwood fractions (valid only for TAMM90/ATLAS model).											
07				SFRAC (1,1)	SFRAC (2,1)	SFRAC (3,1)	SFRAC (4,1)	SFRAC (5,1)	SFRAC (6,1)	SFRAC (7,1)	SFRAC (8,1)				
				(1,2)	(2,2)	(3,2)	(4,2)	(5,2)	(6,2)	(7,2)	(8,2)				
				(1,3)	(2,3)	(3,3)	(4,3)	(5,3)	(6,3)	(7,3)	(8,3)				
				(1,4)	(2,4)	(3,4)	(4,4)	(5,4)	(6,4)	(7,4)	(8,4)				
				4 cards of 8 values every 5 columns											
				HU heading.											
HO				HUHEAD											
				60-character HU description (to column 80)											
				HU options.											
H1				HUNAME 10-character HU name		LENPD Number of years in a period		MAXPD Last period of simulation		DCLIH Upper density limit for beginning inventory		DCLIM Minimum density for warning in list file		DCMAX Maximum density for warning in list file	
				MUs belonging to HU (maximum number is 65).											
H2				MUID(n)		MUID(n+1)		MUID(n+2)		MUID(n+3)		MUID(n+4)		MUID(n+5)	

1-2	3-4	7	10-11	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80
Card type	HU	HT, CT	PD	Data field 1		Data field 2		Data field 3		Data field 4		Data field 5		Data field 6	
				HU final harvest volume for period: ht=1 for softwood, =2 for hardwood, =3 for combined.											
H3		ht	pd	HARVHU(pd)		HARVHU(pd+1)		HARVHU(pd+2)		HARVHU(pd+3)		HARVHU(pd+4)		HARVHU(pd+3)	
				HU partial-cutting volume for period: ht=1 for softwood, =2 for hardwood, =3 for combined.											
H4		ht	pd	PCHARV(pd)		PCHARV(pd+1)		PCHARV(pd+2)		PCHARV(pd+3)		PCHARV(pd+4)		PCHARV(pd+3)	
				HU management intensity name: five H6 cards required, one per MI 1 to 5 (where ct equals 1 to 5).											
H6		ct		MINAME(ct) 15-character MI name (to column 35)											
				HU species (forest type) name and fiber type: one H8 card for each forest type in HU, ct may be 1 to 9.											
H8		ct		SPNAME(ct) 15-character species name (to column 35)		SPGROU(ct) Species fiber type: 1=softwood, 2=hardwood									

Appendix C: ATLAS Output Files

ATLAS produces up to seven output files (see fig. 4):

ATLIST Period total: inventory, area loss, harvest, area gain, and growth for each HU.

ATACRE Period total area: in inventory, harvested, and regenerated by each HU timber type.

ATHUR For selected periods: inventory, growth, net area change, and harvest by age class for each HU. Options allow for Ml level of detail.

ATMUR For selected periods: inventory, growth, net area change, and harvest by age class for each MU. Options allow for Ml level of detail.

ATTMU Periodic MU total: area, inventory, growth, harvest, and area change (unlabeled to allow for further processing).

ATINV Inventory and harvest totals for each HU (unlabeled to allow for further processing).

ATLOG Error and informative messages.

Report Summary

The creation of output to the ATLIST and ATACRE files depends on report request SUMREP on card type 03 of the HARVEST file. A value of 0 produces no reports; a value of 1 creates the reports for each HU. The length of each ATLIST report is two or three pages (depending on the number of periods chosen for the simulation). Within the ATLIST file is a separate report for each projected HU. We have found the ATLIST output to be the most commonly used information from ATLAS; it includes values for all simulation periods. The ATACRE reports are half a page to a page for each timber type accounted for in the HU, with one additional page for an HU total.

Output to ATHUR and ATMUR is dependent on report requests HUREP and MUREP on card type 03 and report year arrays HURYR and MURYR on card types 04 and 05 of the HARVEST file. Output to ATTMU also depends on the variable MUREP but is independent of card type 05 (ATMUR and ATTMU are mutually exclusive). Values of 0 for HUREP or MUREP produce no reports, a value of 1 creates a report by age class totaled over MIs, and an entry of 2 creates a report for both the total by age class and a breakdown of age-class reports by individual MIs. The report year arrays (card types 04 and 05) specify the beginning year of the period for which reports will be written. Each selected report consists of one page per report year for each HU or MU report year, or both, and if chosen, an additional page for each Ml report; for example, for each period requested on card type 05, an MU containing five MIs would be summarized in one page of output if MUREP=1 and six pages of output if MUREP=2 (five MIs plus the total). The output file ATTMU contains periodic totals for each MU (summed over all age classes). The format of ATTMU excludes headings to ease further processing of the output data.

Neither ATINV nor ATLOG depends on report requests: they both are written invariably. The format of ATINV excludes headings and labels so that further processing in other programs is possible. The file ATLOG contains warning messages of any runtime errors encountered and error messages if the simulation aborts.

ATLIST Output

File ATLIST contains the main summary output from a simulation. If ATLIST is chosen, each HU in the file HARVEST will have a separate report (no summary report combines all harvest units). Nine sections of data, or blocks, are written to ATLIST. In this example, these blocks are numbered 1 to 9. Within the first six blocks, lines have been drawn to group

columns under the letters A through S. The contents of these blocks and columns is explained in the ATLIST key following this file listing.

The simulation presented here was derived from the RPA assessment (Haynes 1990). Three MUs were taken from the Southeastern inputs. They represent the forest industry ownership, in the planted pine forest type, stratified by three site classes. The harvest request closely matches the original RPA projections. Harvests were derived from the output file ATTMU produced when the entire Southeastern forest industry softwood simulation was run. There is an exception, however; the harvest entered for period 6 (2010 to 2015) was arbitrarily increased by 20 million cubic feet. This was done to provide an example of the reports when the harvest request is not met. Because harvest was already running close to the amount of volume available, almost none of the increased request was available.

File ATLIST

P C - A T L A S ATLAS linked with TAMM90 - Base Run 8-Extended Harvest.
Run on 1/30/1991 11: 6:15 Using RAF from 1/30/1991 11: 6: 9

1 — Harvest Unit 1 SE F: SU SE Forest Industry Softwoods

		A					B				C		
		Inventory at start of period, Areti Loss, and Volume Recovered from area loss.											
Pd	Year	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	Acres	SU Loss	HU Loss	Com Loss	SW Rec	HU Rec	Com Rec
0	1980	5.349	2341.650	41.663	2383.314	5.953	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	1985	6.579	3535.267	52.876	3588.143	6.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	1990	7.690	5302.176	70.402	5372.579	6.121	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	1995	8.719	7220.892	81.142	7302.033	6.048	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	2000	9.750	8201.834	86.123	8287.958	5.863	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	2005	10.175	9012.661	96.621	9109.281	5.919	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	2010	10.601	10503.816	104.233	10608.049	6.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	2015	10.786	11719.502	110.993	11830.495	6.144	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	2020	10.970	11722.094	109.948	11832.041	6.129	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	2025	11.069	11412.474	110.440	11522.913	6.077	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	2030	11.168	11329.343	109.599	11438.940	6.051	0.005	9.868	0.104	9.972	9.868	0.078	9.946
11	2035	11.163	11256.208	109.868	11366.077	6.053	0.004	8.507	0.104	8.611	8.507	0.078	8.585
12	2040	11.159	11336.033	109.106	11445.140	6.065							

2

		D				E					F	
		Thinning and Final Harvest.										
Pd	Year	Acres	SU Thin	HU Thin	Com Thin	Acres	SU FH	HU FH	Com FH	AvD FH	Com Req	Com Dif
0	1980	0.112	90.588	0.464	91.052	0.330	647.468	7.063	654.531	7.925	745.583	0.000
1	1985	0.098	76.424	0.484	76.908	0.658	1268.996	12.758	1281.754	7.756	1358.662	0.000
2	1990	0.120	98.974	0.613	99.588	1.165	2110.923	20.538	2131.461	7.664	2231.049	0.000
3	1995	0.195	167.793	1.034	168.827	1.997	3676.815	32.580	3709.395	7.280	3878.222	0.000
4	2000	0.299	254.525	1.668	256.193	1.943	4743.363	38.674	4782.037	7.266	5038.229	0.000
5	2005	0.349	297.835	1.930	299.765	1.936	4918.565	40.364	4958.928	7.276	5258.694	-0.001
6	2010	0.433	364.755	2.551	367.305	2.060	5451.308	43.132	5494.440	7.322	5881.743	-19.998
7	2015	0.456	385.017	2.671	387.688	2.502	6595.226	51.900	6647.126	7.299	7034.814	0.000
8	2020	0.289	244.785	1.654	246.439	2.524	7040.958	55.030	7095.988	7.486	7342.427	0.001
9	2025	0.340	290.283	1.886	292.169	2.491	6976.914	54.471	7031.384	7.525	7323.553	0.000
10	2030	0.329	280.112	1.858	281.970	2.565	7069.342	53.308	7122.649	7.350	7414.566	0.000
11	2035	0.378	322.019	2.112	324.130	2.577	6809.983	53.132	6863.115	7.289	7195.829	0.001

3

		G					H		I		
		Partial Cutting and Total Harvest.									
Pd	Year	Acres	SW PC	HU PC	Com PC	AvD PC	Com Req	Com Dif	SU Har	HU Har	Com Har
0	1980	0.000	0.000	0.000	0.000	0.000	0.000	0.000	738.056	7.527	745.583
1	1985	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1345.420	13.242	1358.662
2	1990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2209.898	21.151	2231.049
3	1995	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3844.608	33.614	3878.222
4	2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4997.888	40.341	5038.229
5	2005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5216.399	42.294	5258.694
6	2010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5816.062	45.683	5861.745
7	2015	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6980.243	54.571	7034.814
8	2020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7285.743	56.684	7342.427
9	2025	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7267.196	56.357	7323.553
10	2030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7359.322	55.245	7414.566
11	2035	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7140.509	55.321	7195.830

P C - A T L A S ATLAS linked **with TAMM90** - Base Run 8-Extended Harvest.
Run on 1/30/1991 11: 6:15 Using **RAF** from **1/30/1991 11: 6: 9**

4 Harvest Unit 1 SE **FI SW SE Forest Industry Softwoods**

		J			K				L		
		Growth, Area Gain, and Gain Adjusted for growth.									
Pd	Year	SU Gro	HU Gro	Com Gro	Acres	SU Gain	HU Gain	Com Gain	SU Adj	HU Adj	Com Adj
0	1980	1931.672	18.740	1950.412	1.230	0.000	0.000	0.000	0.000	0.000	0.000
1	1985	3112.330	30.768	3143.098	1.111	0.000	0.000	0.000	0.000	0.000	0.000
2	1990	4128.613	31.890	4160.504	1.029	0.000	0.000	0.000	0.000	0.000	0.000
3	1995	4825.550	38.595	4864.146	1.031	0.000	0.000	0.000	0.000	0.000	0.000
4	2000	5808.714	50.839	5859.553	0.425	0.000	0.000	0.000	0.000	0.000	0.000
5	2005	6707.554	49.907	6757.460	0.426	0.000	0.000	0.000	0.000	0.000	0.000
6	2010	7031.750	52.443	7084.192	0.185	0.000	0.000	0.000	0.000	0.000	0.000
7	2015	6982.835	53.526	7036.361	0.184	0.000	0.000	0.000	0.000	0.000	0.000
8	2020	6976.122	57.177	7033.298	0.099	0.000	0.000	0.000	0.000	0.000	0.000
9	2025	7184.065	55.516	7239.581	0.099	0.000	0.000	0.000	0.000	0.000	0.000
10	2030	7286.147	55.540	7341.688	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	2035	7220.288	54.585	7274.872	0.000	0.000	0.000	0.000	0.000	0.000	0.000

5		M				N		O		P	
		Inventory at end of period, Unstocked and Regeneration Acres, and BF/CF Ratios for Inventory and Harvest.									
Pd	Year	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	Un End	Un Sta	Regen	Reg Ad	Inv Rat	Har Rat
0	1980	6.579	3535.267	52.876	3588.143	6.030	0.000	0.000	1.560	0.330	1.301	2.241
1	1985	7.690	5302.176	70.402	5372.579	6.121	0.000	0.000	1.769	0.658	1.174	2.109
2	1990	8.719	7220.892	81.142	7302.033	6.048	0.000	0.000	2.194	1.165	0.999	2.041
3	1995	9.750	8201.834	86.123	8287.958	5.863	0.000	0.000	3.028	1.997	0.984	1.354
4	2000	10.175	9012.661	96.621	9109.281	5.919	0.000	0.000	2.368	1.943	0.932	1.254
5	2005	10.601	10503.816	104.233	10608.049	6.055	0.000	0.000	2.362	1.936	0.896	1.212
6	2010	10.786	11719.502	110.993	11830.495	6.144	0.000	0.000	2.245	2.060	0.940	1.150
7	2015	10.970	11722.094	109.948	11832.041	6.129	0.000	0.000	2.686	2.502	1.025	1.143
8	2020	11.069	11412.474	110.440	11522.913	6.077	0.000	0.000	2.623	2.524	1.021	1.286
9	2025	11.168	11329.343	109.599	11438.940	6.051	0.000	0.000	2.590	2.491	0.951	1.310
10	2030	11.163	11256.208	109.868	11366.077	6.053	0.000	0.000	2.565	2.565	0.927	1.178
11	2035	11.159	11336.033	109.106	11445.140	6.065	0.000	0.000	2.577	2.577	0.940	1.136

6		Q				R				S		
		Inventory Identity.										
Pd	Year	Acres	SU Inv	HU Inv	Com Inv	Acres	SU Dif	HU Dif	Com Dif	SU Gro	HU Gro	Com Gro
0	1980	6.579	3535.266	52.876	3588.143	0.000	0.001	0.000	0.000	1796.635	17.417	1814.051
1	1985	7.690	5302.176	70.402	5372.578	0.000	0.000	0.000	0.000	2863.051	28.408	2891.458
2	1990	8.719	7220.892	81.142	7302.034	0.000	0.000	0.000	0.000	3713.275	28.053	3741.328
3	1995	9.750	8201.833	86.123	8287.957	0.000	0.000	0.000	0.001	4094.911	32.235	4127.146
4	2000	10.175	9012.660	96.621	9109.282	0.000	0.001	0.000	-0.002	4859.433	43.064	4902.496
5	2005	10.601	10503.815	104.233	10608.048	0.000	0.001	0.000	0.001	5715.785	41.802	5757.587
6	2010	10.786	11719.503	110.994	11830.496	0.000	-0.001	0.000	-0.001	5920.481	43.639	5964.120
7	2015	10.970	11722.095	109.948	11832.041	0.000	-0.001	0.000	0.000	5652.463	43.008	5695.472
8	2020	11.069	11412.472	110.440	11522.912	0.000	0.002	0.000	0.001	5587.604	46.257	5633.861
9	2025	11.168	11329.343	109.599	11438.941	0.000	0.000	0.000	•0.001	5798.899	44.687	5843.586
10	2030	11.163	11256.168	109.868	11366.036	0.000	0.040	0.000	0.041	5879.103	44.802	5923.906
11	2035	11.159	11335.987	109.106	11445.094	0.000	0.046	0.000	0.046	5859.092	43.904	5902.996

PC -AT LAS ATLAS linked with TAMM90 • Base Run 8-Extended Harvest.
Run on 1/30/1991 11: 6:15 Using RAF from 1/30/1991 11: 6: 9

Harvest Unit 1 SE FI SW SE Forest Industry Softwoods

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Available Softwood Final Harvest Volume.

Pd	Year	1	
0	1980	1961.352	1961.352
1	1985	2691.775	2691.775
2	1990	3550.985	3550.985
3	1995	5465.859	5465.859
4	2000	5434.123	5434.123
5	2005	4918.566	4918.566
6	2010	5451.308	5451.308
7	2015	7669.430	7669.430
8	2020	8084.936	8084.936
9	2025	7995.580	7995.580
10	2030	7152.505	7152.505
11	2035	7069.090	7069.090

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Available Hardwood Final Harvest Volume.

Pd	Year	1	
0	1980	25.493	25.493
1	1985	30.571	30.571
2	1990	39.083	39.083
3	1995	48.147	48.147
4	2000	44.857	44.857
5	2005	40.364	40.364
6	2010	43.132	43.132
7	2015	59.115	59.115
8	2020	61.983	61.983
9	2025	61.148	61.148
10	2030	53.867	53.867
11	2035	54.869	54.869

9

Forest (Species) Type.
1 PLANTED PINE

ATLISTKey

Subsections of data within blocks 1 to 6 are marked as A to S. Values are written for each period of the simulation. Volumes are reported for softwood and hardwood fiber types, the combined is total volume.

Under the heading "Year" are the years that mark the beginning of each projection period. Period 0 marks the start of the projection, the first year reported was entered as the starting year in the file HARVEST. The volume associated with the starting year represents the sum of the initial IU input. Growth, harvest, and area change occur during the period, after the initial volume is reported.

The values for each block and subsection are as follows:

Block 1. A—Inventory at start of period. B—area loss. C—volume recovered from area loss.

A. Acres, volume, and average diameter of the inventory at the start of the period. Acres include unstocked acres at the start of the period. MU level values are stored in subroutine MUINIT.

B. Acres and volumes lost from the timberland base during the period. Volumes include growth on harvest. MU values are stored in subroutine ALOSS.

C. Volumes recovered from area loss; the volume from column B that will be counted as part of the exogenous harvest. Volumes include growth on harvest. MU values are stored in subroutine ALOSS.

Block 2. D—Thinning. E—final harvest. F—final harvest request.

D. Thinning acres and volumes; these are also part of the exogenous harvest. Volumes include growth on harvest. MU values are stored in subroutine THIN.

E. Final harvest acres and volume (endogenous harvest), and the average diameter of the final harvest. Volumes include growth on harvest. MU values are stored in subroutine HARV.

F. Final harvest request for the fiber type requested, and the difference between final harvest taken and final harvest request. The request is input in HARVEST then read in subroutines HUINIT and FINAL; the difference is computed in subroutine IDENT.

Block 3. G—Partial cutting. H—partial cutting request. I—total harvest.

G. Partial-cutting acres, volumes and average diameter. Volumes include growth on harvest. MU values are stored in subroutine PARCUT.

H. Partial-cutting request for the fiber type of the request, and difference between partial cutting taken and partial cutting request. The request is an input value read in subroutines HUINIT and FINAL; the difference is computed in subroutine IDENT.

I. Total harvested volumes, the sum of volumes C, D, E, and G. The Com Dif column in block F is equal to Com Har minus Com Req (expect small rounding errors). These volumes include growth on harvest. MU level values are computed in subroutine SUM.

Block 4. J—Growth. K—area gain. L—gain adjusted for growth.

J. Total growth volume, which includes growth on harvest from items B, D, E and G; from S, both regular growth from age-class increases and regeneration growth; and growth-on-area gain, the difference between K and L. MU level values are computed in subroutines ALOSS, THIN, HARV, PARCUT, GROWTH, and AGAIN; totals are computed in subroutine SUM.

K. Acres and volume added to the timberland base via area gain during the period. The volume reported in this column represents the end of the period value. We assume that acres are added in the middle of the period and then grow to the end of the period. Column L reports the midpoint volume. MU level values are computed in subroutine AGAIN.

L. The midperiod volume on acres added to the timberland base through area gain. The difference between the volume in column L and column K is computed as growth-on-area gain. Values at the MU level are computed in subroutine AGAIN.

Block 5. M—Inventory at end of period. N—unstocked acres. O—regeneration acres. P—board-foot-per-cubic-foot ratios for inventory and harvest.

M. Inventory acres, volumes, and average diameter at the end of the period. Acres include unstocked acres at the end of the period. Values at the MU level values are computed in subroutine SUM. These should be identical to the values for the beginning of the next period (found in block 1. A.)

N. Acres in the unstocked category at the end of current period and unstocked acres at the start of the current period.

O. Regeneration acres, total and adjusted. The total includes the regeneration of harvested acres, acres regenerated from the unstocked category, and the acres gained in the zero age class via area gain. The adjusted value omits the area gained in the zero age class. Values of total regeneration acres at the MU level are computed in subroutine SUM. There is no MU-level value for adjusted regeneration acres; the HU summary-level value is computed in SUMHU.

P. Board-foot-per-cubic-foot ratios for the inventory at the end of the period and for final harvest (this can be any desired conversion unit; that is, net to gross or cubic feet to board feet). Derived from MU card type 39 and computed in subroutine SUM.

Block 6. Q—Inventory identity. R—differences. S—growth subtotal.

Q. Inventory identity for area and volume, as computed in subroutine IDENT. For area, the equation is A - B - E + K + O-adjusted. For volume, the equation is A - B - D - E - G + J + L. The identity is an internal checking mechanism, it is an alternate calculation of the end of the period inventory. These values theoretically are identical to the inventory at the end of the period.

R. Differences between inventory at the end of the period and the inventory identity, as computed in subroutine IDENT. In a perfect program, these values should all be 0; however, when many acres are exchanged via area change, differences in rounding and calculating show in these columns. The values should always be a minute percentage of the inventory—if not, there may be internal problems.

S. Growth subtotal from age-class increase and from regeneration. Area gained in the zero age class is included in regeneration growth calculations. Values at the MU level are computed in subroutine GROWTH.

Block 7. Available softwood final harvest volume (does not include any available partial cutting volume). For each timber type (species), the softwood volume in age classes equal to and greater than the minimum harvest age(s) entered in the MU(s). This value includes growth on harvest. There is no MU-level value of this variable; the HU-level value is computed in subroutine AGGREG except for totals computed in SUMHU.

Block 8. Available hardwood final harvest volume (does not include any available partial cutting volume). For each timber type (species), the hardwood volume in age classes equal to and greater than the minimum harvest age(s) entered in the MU(s). This values includes growth on harvest. There is no MU-level value of this variable; the HU-level value is computed in subroutine AGGREG except for totals computed in SUMHU.

Block 9. Timber type (species). The timber type or species names are listed for reference to blocks 8 and 9. These are input in the file HARVEST.

Internal ATLAS computations—Values at the ML) level are computed and stored in the specified subroutines. Age-class values at the HU level, which start with "T," are summed in SUMMU); average diameters, available volume totals, and adjusted gain are computed in SUMHU. Some HU-level timber-type values, which start with "X," also are summed in SUMMU. Other HU-level summary values, which also start with "X," are set in SUMHU.

ATACRE Output

File ATACRE contains HU-level total area by Ml and timber type subdivided by area in inventory, area harvested, and area regenerated. The sections are separated by description and column titles but are not additionally marked. Within each section, there is a row of values for each period of the simulation; the row contains five columns of MIs and a total column. Unstocked acres are not included. Values are summed in subroutine SUMMU except for the total regeneration acres, which are summed in SUMHU.

Inventory area is the value at the start of the period, and both harvest and regeneration take place over the period. It is incorrect to sum area from the three sections, because for some acres it can lead to double (or triple) counting. In this simulation, for example, the harvested acres are already counted in the inventory, and they also are counted in regeneration (along with the acres gained via area gain).

ATHUR and ATMUR Output

Files ATHUR and ATMUR contain age-class tables for the HU and MU aggregation of inputs, respectively. The output pages of both files have the same four age-class sections marked as blocks 1 to 4 on the sample output. The page of totals across all Mis has an Ml section, block 5. An exception to this format occurs when the ending period of the simulation is chosen; for each MU or HU, an additional page is written to report the inventory at the end of the simulation (only blocks 1 and 5). If a simulation has only one MU, then the ATHUR and ATMUR reports would be identical (for the same level of detail).

This example shows the ATHUR report and a page of the ATMUR report when period 2 (1990) was chosen. All inventory values represent volume at the beginning of 1990 and the reported growth, harvest, and area change occurring over period 2 (between the start of 1990 and the end of 1994). The level of detail chosen for ATHUR was 1, and the level of detail chosen for ATMUR was 2. There were three MUs in the simulation, so this ATHUR report is complete—it represents the sum of these units. The ATMUR report shown here is just one page of the MU-2 report (Southeast, forest industry, planted pine, medium site class, Ml-3). The original report file contained a one-page report for each Ml in each MU plus a summary page for each MU. Selecting additional report periods will increase the number of report pages.

FILE ATACRE

P C - A T L A S ATLAS linked with TAMM90 - Base Run 8-Extended Harvest.
Run on 1/30/1991 11: 6:15 Using RAF from 1/30/1991 11: 6: 9

Harvest Unit 1 SE FI SU SE Forest Industry Softwoods

Inventory Acres by Management Intensity for PLANTED PINE.

Pd	Year	REG NO THIN	REG THIN	IMP NO THIN	IMP THIN	IMPROVED INTEN	Total
0	1980	3.493	0.362	1.239	0.255	0.000	5.349
1	1985	3.648	0.346	1.727	0.546	0.312	6.579
2	1990	3.314	0.287	2.273	0.885	0.931	7.690
3	1995	2.266	0.175	2.934	1.319	2.026	8.719
4	2000	1.055	0.078	3.647	1.775	3.196	9.750
5	2005	0.374	0.018	4.001	2.004	3.779	10.175
6	2010	0.001	0.018	4.256	2.149	4.178	10.601
7	2015	0.000	0.010	4.314	2.186	4.274	10.786
8	2020	0.000	0.000	4.373	2.225	4.372	10.970
9	2025	0.000	0.000	4.404	2.243	4.421	11.069
10	2030	0.000	0.000	4.436	2.261	4.471	11.168
11	2035	0.000	0.000	4.434	2.259	4.470	11.163
12	2040	0.000	0.000	4.433	2.257	4.469	11.159

Harvest Acres by Management Intensity for PLANTED PINE.

Pd	Year	REG NO THIN	REG THIN	IMP NO THIN	IMP THIN	IMPROVED INTEN	Total
0	1980	0.306	0.024	0.000	0.000	0.000	0.330
1	1985	0.589	0.069	0.000	0.000	0.000	0.658
2	1990	1.048	0.112	0.005	0.000	0.000	1.165
3	1995	1.211	0.098	0.689	0.000	0.000	1.997
4	2000	0.681	0.060	0.910	0.060	0.232	1.943
5	2005	0.373	0.000	0.669	0.195	0.699	1.936
6	2010	0.000	0.007	0.667	0.292	1.094	2.060
7	2015	0.000	0.010	1.174	0.339	0.979	2.502
8	2020	0.000	0.000	1.244	0.433	0.846	2.524
9	2025	0.000	0.000	0.991	0.456	1.043	2.491
10	2030	0.000	0.000	0.892	0.287	1.386	2.565
11	2035	0.000	0.000	1.190	0.338	1.048	2.577

Regeneration Acres by Management Intensity for PLANTED PINE.

Pd	Year	REG NO THIN	REG THIN	IMP NO THIN	IMP THIN	IMPROVED INTEN	Total
0	1980	0.461	0.007	0.488	0.292	0.312	1.560
1	1985	0.255	0.010	0.546	0.339	0.619	1.769
2	1990	0.000	0.000	0.667	0.433	1.094	2.194
3	1995	0.000	0.000	1.402	0.456	1.170	3.028
4	2000	0.000	0.000	1.264	0.289	0.816	2.368
5	2005	0.000	0.000	0.923	0.340	1.099	2.362
6	2010	0.000	0.000	0.725	0.329	1.191	2.245
7	2015	0.000	0.000	1.232	0.378	1.076	2.686
8	2020	0.000	0.000	1.276	0.451	0.896	2.623
9	2025	0.000	0.000	1.023	0.474	1.092	2.590
10	2030	0.000	0.000	0.892	0.287	1.386	2.565
11	2035	0.000	0.000	1.190	0.338	1.048	2.577

FILE ATHUR (When HUREP=1)

```
P C - A T L A S    ATLAS linked with TAMM90 - Base Run 8-Extended Harvest.
Run on  1/30/1991 11: 6:15        Using RAF from  1/30/1991 11: 6: 9

Harvest Unit  1     SE   FI SW  SE   Forest Industry Softwoods
Period  2   Year 1990     Total over Management Intensities
```

1 Inventory at start of period

AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv
0	1.769	0.000	0.000	0.000	
1	1.560	435.480	16.386	451.867	
2	1.745	1662.976	20.321	1683.297	
3	1.298	1205.116	14.826	1219.942	
4	0.795	979.374	8.806	988.181	
5	0.523	1019.230	10.063	1029.293	
6	0.000	0.000	0.000	0.000	
7	0.000	0.000	0.000	0.000	
8	0.000	0.000	0.000	0.000	
9	0.000	0.000	0.000	0.000	
10	0.000	0.000	0.000	0.000	
11	0.000	0.000	0.000	0.000	
12	0.000	0.000	0.000	0.000	
13	0.000	0.000	0.000	0.000	
14	0.000	0.000	0.000	0.000	
15	0.000	0.000	0.000	0.000	
16	0.000	0.000	0.000	0.000	
17	0.000	0.000	0.000	0.000	
Stock	7.690	5302.176	70.402	5372.579	6.121
Unst	0.000				
Total	7.690				

2 Growth during period

SW Gro	HW Gro	Com Gro
0.000	0.000	0.000
538.157	17.855	556.012
1205.380	4.256	1209.636
1297.992	4.656	1302.647
780.629	1.981	782.610
306.457	3.142	309.598
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
4128.613	31.890	4160.504

3 Harvest during period

AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har
0	0.000	0.000	0.000	0.000	0.000	
1	0.000	0.000	0.000	0.000	0.000	
2	0.000	0.000	0.000	0.000	0.000	
3	0.022	122.153	1.001	123.154	0.011	
4	0.620	841.577	7.973	849.550	0.394	
5	0.523	1246.167	12.177	1258.344	0.595	
6	0.000	0.000	0.000	0.000	0.000	
7	0.000	0.000	0.000	0.000	0.000	
8	0.000	0.000	0.000	0.000	0.000	
9	0.000	0.000	0.000	0.000	0.000	
10	0.000	0.000	0.000	0.000	0.000	
11	0.000	0.000	0.000	0.000	0.000	
12	0.000	0.000	0.000	0.000	0.000	
13	0.000	0.000	0.000	0.000	0.000	
14	0.000	0.000	0.000	0.000	0.000	
15	0.000	0.000	0.000	0.000	0.000	
16	0.000	0.000	0.000	0.000	0.000	
17	0.000	0.000	0.000	0.000	0.000	
Total	1.165	2209.898	21.151	2231.049	1.000	7.664
Req				2231.049		
Regen	2.194					

4 Net Area Change

Acres	SW Net	HW Net	Com Net
1.029	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
1.029	0.000	0.000	0.000

6 Inventory at start of period

MI	Acres	SW Inv	HW Inv	Com Inv	MI	Identification
1	3.314	2615.175	39.025	2654.199		REG NO THIN
2	0.287	455.630	3.767	459.397		REG THIN
3	2.273	1680.968	18.245	1699.213		IMP NO THIN
4	0.885	444.363	6.210	450.572		IMP THIN
5	0.931	106.041	3.156	109.197		IMPROVED I[NTEN

FILE ATMUR (When MUREP=2)

```
P C - A T L A S  ATLAS linked with TAMM90 - Base Run 8- Extended Harvest,
Run on  1/30/1991 11: 6:15       Using RAF from  1/30/1991 11: 6: 9

Harvest Unit  1     SE   FI SU  SE   Forest Industry Softwoods
Period  2   Year 1990     Management Unit  2     SE-FI-PP-MEDIUM     Management Intensity 3      IMP NO THIN
```

1 Inventory at start of period

AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv
0	0.340	0.000	0.000	0.000	
1	0.312	90.779	2.808	93.586	
2	0.695	781.360	7.893	789.253	
3	0.215	262.686	2.653	265.340	
4	0.000	0.000	0.000	0.000	
5	0.000	0.000	0.000	0.000	
6	0.000	0.000	0.000	0.000	
7	0.000	0.000	0.000	0.000	
8	0.000	0.000	0.000	0.000	
9	0.000	0.000	0.000	0.000	
10	0.000	0.000	0.000	0.000	
11	0.000	0.000	0.000	0.000	
12	0.000	0.000	0.000	0.000	
13	0.000	0.000	0.000	0.000	
14	0.000	0.000	0.000	0.000	
15	0.000	0.000	0.000	0.000	
16	0.000	0.000	0.000	0.000	
17	0.000	0.000	0.000	0.000	
Stock	1.562	1134.825	13.353	1148.178	5.980

2 Growth during period

SW Gro	HW Gro	Com Gro
0.000	0.000	0.000
98.981	3.061	102.042
252.299	0.658	252.957
593.210	5.992	599.202
110.055	1.112	111.167
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
0.000	0.000	0.000
1054.545	10.823	1065.368

3 Harvest during period

AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har
0	0.000	0.000	0.000	0.000	0.000	
1	0.000	0.000	0.000	0.000	0.000	
2	0.000	0.000	0.000	0.000	0.000	
3	0.005	8.237	0.083	8.320	0.006	
4	0.000	0.000	0.000	0.000	0.000	
5	0.000	0.000	0.000	0.000	0.000	
6	0.000	0.000	0.000	0.000	0.000	
7	0.000	0.000	0.000	0.000	0.000	
8	0.000	0.000	0.000	0.000	0.000	
9	0.000	0.000	0.000	0.000	0.000	
10	0.000	0.000	0.000	0.000	0.000	
11	0.000	0.000	0.000	0.000	0.000	
12	0.000	0.000	0.000	0.000	0.000	
13	0.000	0.000	0.000	0.000	0.000	
14	0.000	0.000	0.000	0.000	0.000	
15	0.000	0.000	0.000	0.000	0.000	
16	0.000	0.000	0.000	0.000	0.000	
17	0.000	0.000	0.000	0.000	0.000	
Total	0.005	8.237	0.083	8.320	0.006	6.800
Regen	0.447					

4 Net Area Change

Acres	SW Net	HW Net	Com Net
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000
0.000	0.000	0.000	0.000

ATHUR and ATMUR Key

Values for each age-class section are as follows:

Block 1. Inventory at the start of the period.
- Age-class values for acres and volumes.
- Total values for stocked acres and their volumes.
- Average diameter of stocked acres.
- Unstocked acres.
- Grand total acres.

Block 2. Growth during the period, including growth on harvest.
Age-class values for volumes.
Total volumes for stocked acres.

Block 3. Harvest during the period, including exogenous harvest, final harvest, and partial cutting.
Age-class values for acres, volumes, and proportion of final harvest from the class. Note: Acres includes only area final harvested; it does not include area subject to commercial thinning or partial cutting.
Total values for acres, volumes, and proportion of final harvest and average diameter of the final harvest.
Harvest request (Req), the amount assigned to the MU will appear under the fiber type of the request.
Total regenerated acres (Regen), including acres from unstocked, cut acres, and acres gained in the zero age class.

Block 4. Net area change, which is the difference between area and volumes gained, and area and volumes lost. Net loss of area and volume is negative, and net gains are positive.
Age-class values for acres and volumes.
Total values for acres and volumes.

Values for the Ml section are as follows:

Block 5. Inventory at the start of the current period. Acres and volumes in each Ml and the Ml identification (from HARVEST file). Block 5 is not printed on individual Ml reports.

ATTMU Output

This MU-level output file includes the same MU totals found in the file ATMUR (the values are summed by all age classes). But unlike ATHUR, there is no option to select specific periods for output. When selected, this report includes the totals for every MU for every period of the simulation. To select this output file, enter the value 3 for the MU-level report (in HARVEST, card type 03). This file will be produced Instead of ATMUR; the period selection option on card type 05 has no effect on ATTMU.

The output is the year at the beginning of the period, the MU name, acres at the beginning of the period, softwood and hardwood inventory (beginning of period), softwood and hardwood growth (over the period), softwood and hardwood harvest (over the period), acres gained or lost over the period, and softwood and hardwood volume gained or lost over the period.

This file allows for analysis of MU by MU activities in a compact form. The file was written with the FORTRAN format statement: FORMAT(1X,I4,5X,A15,10F10.3) .

FILE ATTMU

1980	SE-FI-PP-HIGH	1.207	1048.417	12.829	643.008	8.464	316.490	3.927	0.278	0.000	0.000
1980	SE-FI-PP-MEDIUM	3.681	1220.988	28.228	1212.299	10.882	395.658	3.600	0.847	0.000	0.000
1980	SE-FI-PP-POOR	0.460	72.245	0.606	76.365	-0.606	25.908	0.000	0.106	0.000	0.000
1985	SE-FI-PP-HIGH	1.485	1374.935	17.366	960.360	10.667	531.661	6.188	0.251	0.000	0.000
1985	SE-FI-PP-MEDIUM	4.528	2037.629	35.511	2025.163	20.101	753.607	7.054	0.764	0.000	0.000
1985	SE-FI-PP-POOR	0.566	122.703	0.000	126.807	0.000	60.152	0.000	0.096	0.000	0.000
1990	SE-FI-PP-HIGH	1.736	1803.634	21.844	1277.703	7.372	730.869	8.358	0.232	0.000	0.000
1990	SE-FI-PP-MEDIUM	5.292	3309.185	48.558	2668.069	24.518	1385.209	12.793	0.709	0.000	0.000
1990	SE-FI-PP-POOR	0.662	189.358	0.000	182.841	0.000	93.820	0.000	0.088	0.000	0.000
1995	SE-FI-PP-HIGH	1.968	2350.468	20.858	1487.182	6.672	1113.303	7.400	0.233	0.000	0.000
1995	SE-FI-PP-MEDIUM	6.001	4592.045	60.283	3099.835	31.923	2555.841	26.214	0.709	0.000	0.000
1995	SE-FI-PP-POOR	0.750	278.378	0.000	238.534	0.000	175.464	0.000	0.089	0.000	0.000
2000	SE-FI-PP-HIGH	2.201	2724.346	20.130	1727.503	9.556	1522.812	5.663	0.096	0.000	0.000
2000	SE-FI-PP-MEDIUM	6.710	5136.040	65.993	3785.708	41.283	3214.081	34.678	0.293	0.000	0.000
2000	SE-FI-PP-POOR	0.839	341.448	0.000	295.502	0.000	260.995	0.000	0.036	0.000	0.000
2005	SE-FI-PP-HIGH	2.297	2929.038	24.023	1945.339	8.031	1639.997	7.011	0.096	0.000	0.000
2005	SE-FI-PP-MEDIUM	7.003	5707.668	72.597	4423.732	41.876	3266.324	35.283	0.293	0.000	0.000
2005	SE-FI-PP-POOR	0.875	375.955	0.000	338.483	0.000	310.078	0.000	0.037	0.000	0.000
2010	SE-FI-PP-HIGH	2.393	3234.380	25.043	2021.439	5.777	1622.014	6.441	0.042	0.000	0.000
2010	SE-FI-PP-MEDIUM	7.296	6865.076	79.190	4652.911	46.666	3891.158	39.242	0.127	0.000	0.000
2010	SE-FI-PP-POOR	0.912	404.360	0.000	357.400	0.000	302.890	0.000	0.016	0.000	0.000
2015	SE-FI-PP-HIGH	2.435	3633.804	24.379	2031.042	7.309	1982.406	7.690	0.041	0.000	0.000
2015	SE-FI-PP-MEDIUM	7.423	7626.828	86.615	4580.267	46.217	4654.748	46.881	0.127	0.000	0.000
2015	SE-FI-PP-POOR	0.928	458.870	0.000	371.526	0.000	343.089	0.000	0.016	0.000	0.000
2020	SE-FI-PP-HIGH	2.476	3682.440	23.997	2007.696	8.941	2100.812	8.085	0.023	0.000	0.000
2020	SE-FI-PP-MEDIUM	7.550	7552.347	85.950	4591.983	48.235	4811.375	48.600	0.068	0.000	0.000
2020	SE-FI-PP-POOR	0.944	487.307	0.000	376.443	0.000	373.555	0.000	0.008	0.000	0.000
2025	SE-FI-PP-HIGH	2.499	3589.324	24.854	2066.600	8.079	2146.473	8.684	0.022	0.000	0.000
2025	SE-FI-PP-MEDIUM	7.618	7332.955	85.586	4739.325	47.437	4719.591	47.673	0.068	0.000	0.000
2025	SE-FI-PP-POOR	0.952	490.195	0.000	378.140	0.000	401.133	0.000	0.009	0.000	0.000
2030	SE-FI-PP-HIGH	2.521	3509.451	24.249	2099.442	7.291	2065.417	5.833	-0.001	0.000	-0.010
2030	SE-FI-PP-MEDIUM	7.686	7352.689	85.350	4805.321	48.249	4892.859	49.411	-0.003	0.000	-0.016
2030	SE-FI-PP-POOR	0.961	467.202	0.000	381.385	0.000	401.046	0.000	-0.001	0.000	0.000
2035	SE-FI-PP-HIGH	2.520	3543.487	25.697	2104.763	6.497	2039.764	7.455	-0.001	0.000	-0.010
2040	SE-FI-PP-HIGH	2.519	3608.500	24.729							
2035	SE-FI-PP-MEDIUM	7.683	7265.179	84.171	4736.181	48.088	4739.871	47.866	-0.003	0.000	-0.016
2040	SE-FI-PP-MEDIUM	7.680	7261.521	84.377							
2035	SE-FI-PP-POOR	0.960	447.542	0.000	379.343	0.000	360.873	0.000	0.000	0.000	0.000
2040	SE-FI-PP-POOR	0.960	466.012	0.000							

ATINV Output

Like file ATTMU, output to ATINV is unlabeled and intended as possible input to other computer programs or spreadsheets. The first line contains the 10-character HUNAME, and six numeric values; the remaining lines each contain six numeric values, except for the last line, which contains two numeric values. The six values are softwood and hardwood inventory volumes at the start of the period, softwood and hardwood growth volumes for the period, and softwood and hardwood harvest from all sources. The two values on the last line are softwood and hardwood inventory values at the end of the last period, which are the inventory values for the start of the period after the simulation.

A single line with date and time of the run is written in main program ATLAS. The FORTRAN format for the line is FORMAT(' ATLAS Inventories from \2A10). The remaining lines, one per simulation period plus a short line for each harvest unit, are written in FORTRAN format as FORMAT(1 X.A10.6F10.3/(11 X.6F10.3)) .

The following example of ATINV is from the same 12-period PC-ATLAS simulation presented in the other examples of output.

FILE ATINV

```
PC-ATLAS Inventories from  1/30/1991  11: 6:15
SE    FI SW  2341.650    41.663   1931.672    18.740    738.056     7.527
             3535.267    52.876   3112.330    30.768   1345.420    13.242
             5302.176    70.402   4128.613    31.890   2209.898    21.151
             7220.892    81.142   4825.550    38.595   3844.608    33.614
             8201.834    86.123   5808.714    50.839   4997.888    40.341
             9012.661    96.621   6707.554    49.907   5216.399    42.294
            10503.816   104.233   7031.750    52.443   5816.062    45.683
            11719.502   110.993   6982.835    53.526   6980.243    54.571
            11722.094   109.948   6976.122    57.177   7285.743    56.684
            11412.474   110.440   7184.065    55.516   7267.196    56.357
            11329.343   109.599   7286.147    55.540   7359.322    55.245
            11256.208   109.868   7220.288    54..585  7140.509    55.321
            11336.033   109.106
```

ATLOG Output

The ATLOG output contains a period-by-period report of runtime errors and informative messages. Some of the messages also are written to the computer screen during the simulation. Messages were intended to stand without further need for explanation, but it is helpful to understand subroutine names and variable names and to know what to look for in the messages. The file contains the names of the harvest units processed, the status of the report flag, and if errors occur, it includes an error (or warning) message and the name(s) of the subroutine(s) where any error was detected.

In this example, both the HU- and MU-level reports were written for period 2. Error messages were written when the harvest request could not be met in period 6. In this case, the first error messages are reported from the subroutine APPORT (where the calculations are made to allocate the harvest). The values from APPORT are in millions of cubic feet. First is the HU summary total. Reported is the total volume available for harvest, the harvest request, and the exogenous harvest already recovered (in the form of thinning, see ATLIST block 2.D.). The available volume minus the request will be the unsatisfied shortage, which, is reported in ATLIST under the heading Com Dif in block 2.F. The request plus the exogenous volume equals the total harvest request reported on the next line (the total originated in the file HARVEST, see also ATLIST block 2.F.). The proportion is simply the ratio of available volume to the unsatisfied harvest request. Next in the error message is the MU-by-MU reporting of how harvest will be allocated and where the volume shortage is distributed. Notice that the MU labeled MEDIUM (for medium site class) carries the greatest available volume and is assigned the largest proportion of harvest volume. The final error message is from the subroutine HARV (where harvest is subtracted from the inventories). This message indicates that even after the allocation of harvest, an error existed between what was available and what was assigned to the medium site MU. The values reported from HARV are in actual amounts, not millions. Comparing the shortage to the amount available shows that the unsatisfied volume was very small (0.000007 percent of available volume) and probably a result of an internal rounding error. A difference this small should not be a concern, and it is not possible to calculate it from the regular outputs.

FILE ATLOG

```
   P C - A T L A S     ATLAS linked with TAMM90 • Base Run 8-Extended Harvest.
   Run on  1/30/1991   at 11: 6:15

Period  0
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period  1
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period  2
     HU  1 SE   FI  SW  Reports 1   1
    SE   Forest Industry Softwoods

Period  3
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period  4
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period  5
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period  6
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods
Warning Error in APPORT  during period  6  year 2010   for HU  1 SE  FI SW  final harvest
Avail         5494.440     Req        5514.438     Exog         367.305
Total         5881.743     Prop       0.996
Warning Error in APPORT  during period  6  year 2010   for HU  1 SE  FI SW      MU     60311000 SE-FI-PP-HIGH
Insufficient volume        1516.207 for harvest request        1521.725
Warning Error in APPORT  during period  6  year 2010   for HU  1 SE  FI SW      MU     60312000 SE-FI-PP-MEDIUM
Insufficient volume        3675.343 for harvest request        3688.720
Warning Error in APPORT  during period  6  year 2010   for HU  1 SE  FI SW      MU     60313000 SE-FI-PP-POOR
Insufficient volume         302.890 for harvest request         303.993
Warning error in HARV    during period  6  year 2010
HU  1 SE   FI   SW  HU    60312000 SE-FI-PP-MEDIUM      Harvest type  3
Unsatisfied volume              256.000 of harvest request       3675343360.000

Period  7
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period  8
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period  9
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period 10
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Period 11
     HU  1 SE   FI  SW  Reports 0   0
    SE   Forest Industry Softwoods

Normal exit from PC-ATLAS
```

Appendix D: Program Descriptions

Program IUSCAN

Main program IUSCAN opens files, initializes values, and gets the date and time; reads data in character form until a set is recognized, and prints the character form of the data; interprets the numeric values for IU identifying code, card type, MI, and age class; converts the six data fields into numeric values; and assigns the values to program variables depending on card type and MI. The IUSCAN program writes the data in unformatted (binary) form on the random access file IURAF.

Within IUSCAN are the following subroutines:

SET—counts errors and resets the message for repeated errors on the same IU card.

CHECK—writes a FORTRAN page eject and page headings for every NTEST number of lines.

SHELL—sorts the IU identifying codes into ascending numeric order and keeps the IURAF location index and error counts with the corresponding identifying code.

IUREP—reports the processed data for each IU.

PRLIST—reports the list of IU identifying codes with the IURAF location index and error count for each IU. It also finds any duplicate IU identifying codes.

Program MUSCAN

Main program MUSCAN opens files, initializes values, and gets the date and time; reads data in character form until a set is recognized, and prints the character form of the data; interprets the numeric values for MU identifying code, card type, MIs, and age class and period; converts the six data fields into numeric values; and assigns the values to program variables by card type and other values. The MUSCAN program sets the user default value to the program default for missing cards, checks proportions which must sum to 1.0, checks age-class limits, and counts preselected shifts and thinning entries. It also checks for required cards and prints the types of missing cards, for which program defaults are used. The MUSCAN program writes the data in unformatted (binary) form on the random access file MURAF.

Within MUSCAN are the following subroutines:

MUDATA—the block data section for MUSCAN.

INIT—initializes data.

SET—counts errors and resets the message for repeated errors on the same MU card.

CHECK—writes a FORTRAN page eject and page headings for every NTEST number of lines.

SINGLE—processes input for one-dimensional real arrays, which are always dimensioned by age class or period (AOP). It checks the AOP value to see that no duplicate values are supplied, and keeps track of the blank fields, which are set to the default value. It also screens values less than the minimum legal value or more than the maximum legal value.

SININT—processes input for one-dimensional integer arrays, similarly to SINGLE.

DOUBLE—processes input for two-dimensional real arrays, which have the first dimension by age class and period AOP, and the second-dimension ILIM supplied by MUSCAN; ILIM is most commonly 5 for the levels of MI. It initializes the AOP counting for each new value of ILIM. Within a value of ILIM, DOUBLE performs the same functions as SINGLE.

TRIPLE—processes input for three-dimensional real arrays, which have the first dimension by age class and period AOP, and the second and third dimensions, ILIM and JLIM, supplied by MUSCAN. Both ILIM and JLIM are 5 and represent MIs of source and destination. For each new pair of ILIM and JLIM, TRIPLE initializes the AOP counting. Within entries belonging to the pair, TRIPLE performs the same functions as SINGLE.

FILONE—sets missing values of one-dimensional real arrays to the default value. The -1 location contains the program default or specified user-default value.

FILINT—sets missing values of one-dimensional integer arrays to the default value. The -1 location contains the program default or specified user-default value.

FILTWO—sets missing values for two-dimensional real arrays to the default value. The -1 location for each value of ILIM, the second dimension, contains the program default or specified user-default value.

FILTHR—sets missing values for three-dimensional real arrays to the default value. The -1 location for each pair of ILIM and JLIM, the second and third dimensions, contains the program default or specified user-default value.

MUREP—reports the processed data for each MU.

PUT1—writes nonzero values of one-dimensional real arrays to a character variable, according to the supplied format. This character variable is then printed, with blanks for zero values, thereby reducing report clutter.

PUT2—writes nonzero values of two-dimensional real arrays to a character variable, similarly to PUT1.

PRLIST—reports the list of MU identifying codes with the MURAF location index and error count for each MU. It also finds any duplicate MU identifying codes.

SHELL—sorts the MU identifying codes into ascending numeric order and keeps the MURAF location index and error counts with the corresponding identifying code.

RDC—evaluates the relative-density-change equation.

Program HUSCAN

Main program HUSCAN opens files, initializes values, and gets the date and time; reads general HU data in character form until the first HU individual card is found, and prints the character form of the data; interprets and assigns the values to program variables; and writes the general run information on the BIGRAF key record, number 1.

Within HUSCAN are the following subroutines:

HUDATA—the block data section for HUSCAN.

CHECK—writes a FORTRAN page eject and page headings for every NTEST number of lines.

GENREP—reports the processed general HU data.

HULOOP—reads individual HU data in character form until a set is recognized, and prints the character form of the data; interprets and assigns the values to program variables; and writes the individual HU data on a single BIGRAF record.

SET—counts errors and resets the message for repeated errors on the same individual HU card.

FILONE—sets missing values of one-dimensional real arrays to the default value. The -1 location contains the program default or specified user-default value.

HUREPO—reports the processed individual HU data.

SUM—reads the IU and MU location indexes from IURAF and MURAF on the initial call. Subroutine SUM uses the information to find each MU belonging to the HU and reads its organized data from MURAF. It then locates each IU belonging to the MU, reads the organized IU data from IURAF, checks the stocking proportions against the HU limit, and sums the IU inventory data into MU totals. Then SUM attempts to reassign to other age classes those volumes per acre that exceed the HU limit and writes the MU data from MURAF and the MU summed inventory data on a single record on BIGRAF.

BINSRC—locates the element ID in the sorted list of identifying codes LIST, and returns the array index in IND. If ID is not found, IND is 0. This routine is used for finding both IU and MU identifying codes in their respective lists.

MUCOMB—reports the combined MU inventory data, which may have been reassigned by SUM.

Program ATLAS

Main program ATLAS opens files, initializes values, and gets the date and time; it loops through the strata (such as, regions, owners, and forest fiber types), calling the subroutines that perform the simulation functions. Figure 7 shows the sequencing in ATLAS by subroutine name; figure 8 is the same flowchart with text in place of the subroutine name.

Within ATLAS are the following subroutines:

RUNIN—makes the run time initializations.

ATTERM—ends the program run if errors are found.

HUINIT—brings in data for an HU, initializes the summary variables that begin with "X" for the zero period, and initializes the summary variables that begin with "T" in every period.

DUMPHU—reports the HU input data.

MUINIT— brings in data for an MU, initializes the MU summary variables, and stores the starting inventory summary.

DUMPMU—reports the MU input data, except for the inventory data.

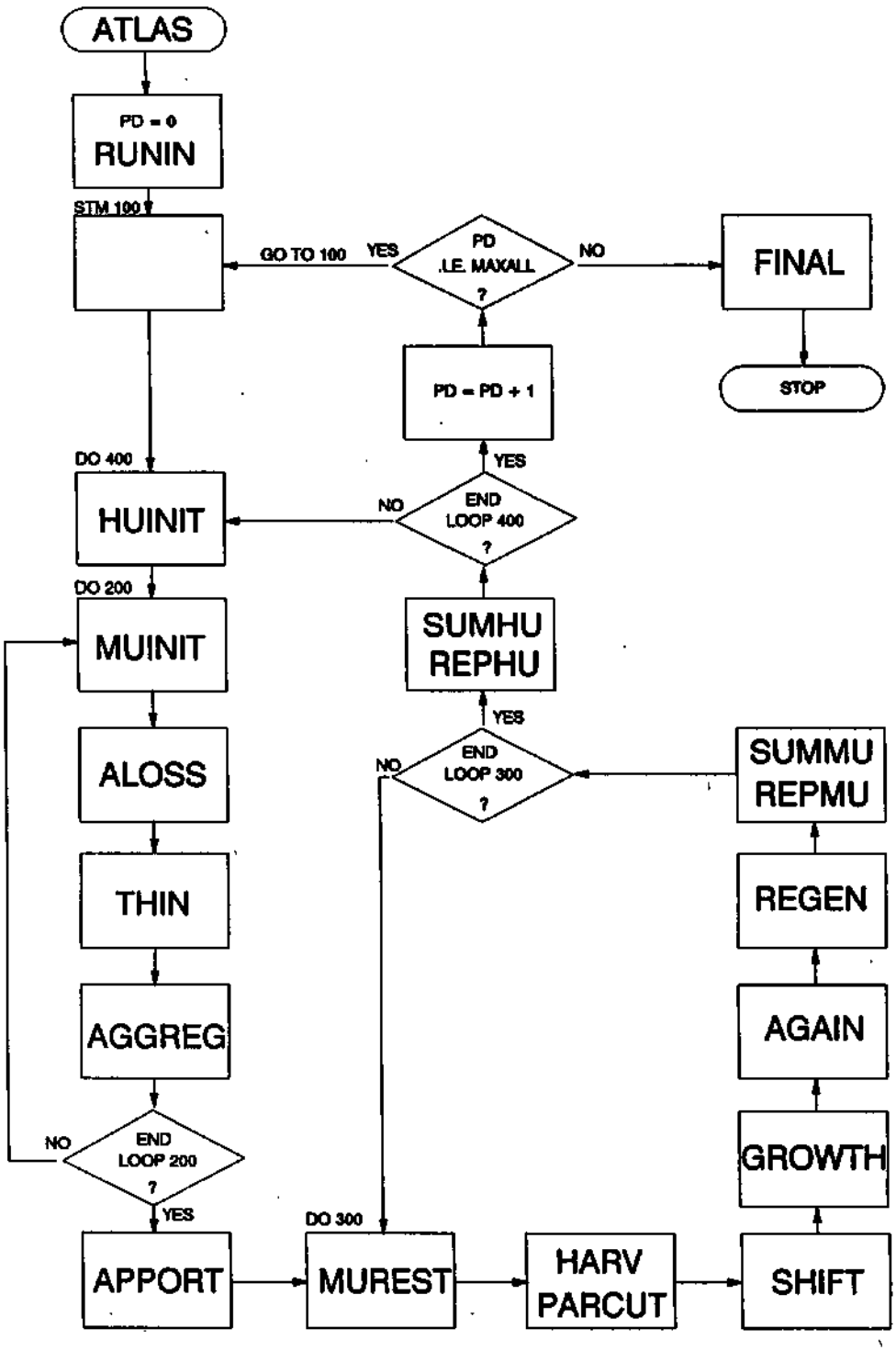

Figure 7—Flowchart of subroutines in program ATLAS.

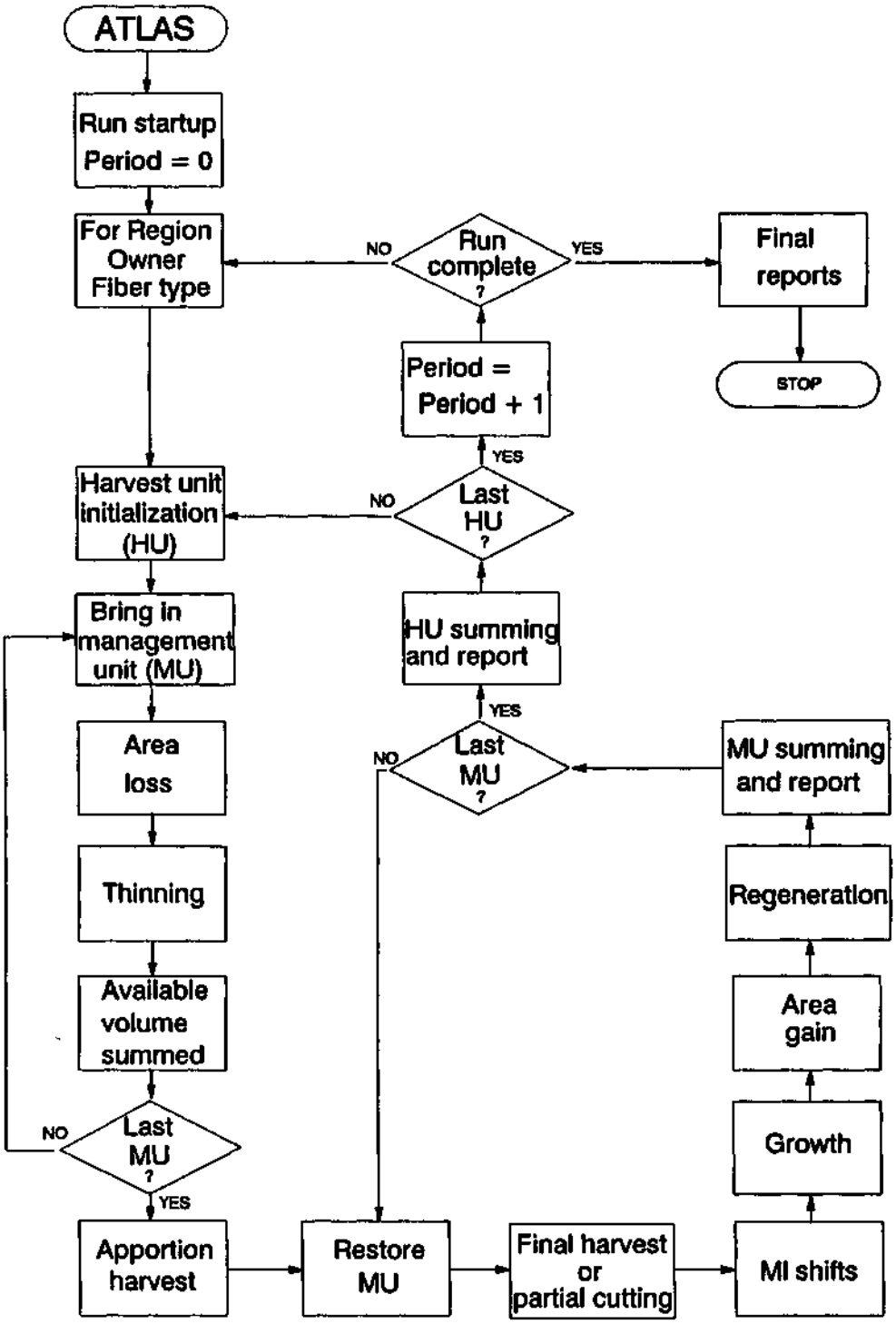

Figure 8—The flowchart from figure 7 with descriptive names replacing the proper ATLAS subroutine names.

DUMPIN—reports the MU inventory data, the arrays ACINI, VOLINI, and VPAINI at the beginning of the last subroutine executed; the arrays ACREG, VOLREG, and VPAREG at the end of the last subroutine executed; and the differences between the respective arrays, representing the change occurring during the last subroutine executed.

ALOSS—computes area loss and assigns it to age classes in the specified groups if possible. The fail-safe computation removes acres by oldest first. Acres and volumes lost to the inventory and volumes recovered as exogenous harvest are computed.

UPINI—transfers the values from arrays ACREG, VOLREG, and VPAREG, respectively, to arrays ACINI, VOLINI, and VPAINI, and recomputes total acres in REGTOT.

THIN—removes thinning volumes. Acres and volumes thinned are computed. Thinning volume is considered exogenous.

AGGREG—computes volume available for final harvest and partial cutting.

BACAPN—computes the volume available from partial cutting from the existing age class to the target age class.

RETAPN—computes the previous stocking proportion that an existing age class had at an earlier age class.

APPORT—apportions the final harvest and partial cutting volumes to MUs belonging to an HU, according to the proportion of total available volume in the MU divided by total available volume in the HU, after subtracting exogenous volume from the original requests.

MUREST—rereads the MU data.

HARV—assigns the final harvest volume for the MU to individual age classes within MIs, starting with the preferred harvest proportions. The fail-safe assignment if the final harvest is not satisfied by the preferred proportions is oldest first. Acres and volumes harvested are computed, as are average diameters of the harvest.

PARCUT—assigns the partial-cutting volume for the MU to individual age classes within MIs. Acres and volumes partially cut are computed, as are average diameters of the partial cut.

SHIFT—makes preselected shifts among management intensities, for ages classes 1 to MAXAGE. The existing volumes are averaged into the volumes for the shifted MIs.

GROWTH—computes growth via the yield table and relative-density-change equation.

RDC—computes the end-of-period stocking proportion for an age class.

AGAIN—computes area gain and assigns the acres to age classes. Growth corresponding to density change for a half-period is computed for age classes 1 to MAXAGE, and that amount of the volume gained is assigned to growth. The remaining volume gained is the adjusted area gain value.

BACGAI—computes the stocking proportion of the previous period for an age class.

REGEN—computes regeneration of unstocked and harvested acres, which are added to any acres gained in the zero age class. Preselected shifts among MIs for this age class are made, and appropriate volumes per acre are assigned. The entire volume in the zero age class is assigned to growth. Acres regenerated, including and excluding acres gained in the zero age class, are computed.

SUMMU—writes MU data on the CURRAF and sums MU) variables.

SUM—stores the end-of-the-period inventory and computes summary variable totals.

REPMU—reports MU age-class values on file ATMUR.

SUMHU—sums HU variables and writes HU data on the CURRAF.

REPHU—reports HU age-class values on file ATHUR.

FINAL—reads HU data from BIGRAF and CURRAF and writes data on file ATINV.

I DENT—reports the summary information, including the inventory identity, on file ATLIST.

Appendix E: Introduction to PC-ATLAS

The mainframe ATLAS program has been compiled to run on IBM-compatible personal computers. The personal computer version of ATLAS (PC-ATLAS) is nearly identical to the stand-alone mainframe version. We expect the PC version will become more widely used than its mainframe parent. This section is intended to help PC users manage the model in the DOS environment and to illustrate differences between PC-ATLAS and mainframe ATLAS. It assumes the reader is already familiar with the DOS operating system.

System Requirements

The four PC-ATLAS programs have been compiled with either RM/FORTRAN™ version 2.4, (Ryan-McFarland Corp.) or Microsoft® FORTRAN version 5.0. Running PC-ATLAS on a microcomputer requires the following hardware and software:

At least 300K bytes of memory for program execution.
Hard disk, bernoulli drive, or memory drive of at least 1M byte.
DOS 2.1 or later.
Math-coprocessor chip (8087, 80287, or 80387).

Setting Up Your System

The following section is provided to help users efficiently run the PC-ATLAS programs on a microcomputer. The programs themselves are large and they create many large files. To avoid system errors, the CONFIG.SYS file of the computer should contain the following minimum parameters:

Buffers = 20
Files = 20
Fcbs = 20,20 (if using DOS 3.x)
Break = on (not required but recommended)

If the CONFIG.SYS file does not contain these settings, add them and reboot the system before attempting to run PC-ATLAS programs. These settings should not interfere with the operation of any other software, so they can remain in the CONFIG.SYS file when PC-ATLAS is not being used. If these parameters are unfamiliar, reference section on configuring your system in your DOS manual. (If buffers and files currently are larger than 20, they do not need to be changed.)

Batch Files

To execute any of the PC-ATLAS programs, a special parameter is required to allow Ryan-McFarland FORTRAN to read and write long, direct-access input and output records. The following parameter needs to be entered on the command line just after the program name: /R 2000. To execute the IUSCAN program enter: IUSCAN/R2000(in either upper or lower case).' Because this is an awkward command, it makes sense to use batch files to save keystrokes (and errors); for example, the batch file called GOIU needs to contain a one-line entry: IUSCAN/R2000. To easily run an entire simulation, a batch file called RUNALL could contain the following:

```
IUSCAN/R2000
MUSCAN/R5000
HUSCAN/R8000
ATLAS/R32000
```

As each program finishes execution, the next begins. (If a program finishes execution after reporting errors, the ATLAS program will detect this condition, report an error message to the screen, and abruptly stop.)

Batch files can be developed to erase unneeded files after a run. Each time HUSCAN and ATLAS are run, 10 new files are created (LIST.HU, TREE, BIGRAF, CURRAF, ATMUR, ATHUR, ATLIST, ATINV, ATACRE, and ATLOG). File maintenance can be simplified by using a batch file to delete unwanted files after a simulation (be sure to first rename, or copy, any files that should be saved; that is, LIST.HU or ATLIST). If you are unfamiliar with batch files, see your DOS manual.

File Handling

The PC-ATLAS programs require the user to provide three input files; the programs create an additional 14 files. File management can be simplified by using DOS subdirectories to separate the PC-ATLAS programs and batch files from the input and output files. Subdirectories should be used to keep related sets of inputs and outputs together.

The program files should be stored apart from the inputs and outputs by invoking the DOS PATH statement. The PATH statement will act to bridge subdirectories so that the program and batch commands will operate as if they reside locally. It is possible to run PC-ATLAS from any subdirectory (or disk drive) as long as the input files (INVEN, MANAGE, and HARVEST) reside in the "current" directory. A PATH statement can be issued from the keyboard or be added to the AUTOEXEC.BAT file. The following example illustrates how to create subdirectories for the program and input files and how to add the PATH statement to the AUTOEXEC.BAT file:

First create the subdirectories PCATLAS and DATA on drive C: (any hard drive will do) with the commands MD\PCATLAS and MD\DATA.

Modify the path command in the AUTOEXEC.BAT file to contain the string C:\PCATLAS.

---

[1] **The minimum record-length parameter required for each program is different; BRUSCN will run with a record-length parameter of 2000 and ATLAS requires a value of 32000. Larger values cause no problems, and for simplicity the same number can be used for all programs (32000). This parameter is ignored when programs are compiled with Microsoft FORTRAN.**

A change to the path statement might look like this:

Before: path c:\dos;c:\fortran

After: path c:\dos;c:\fortran;c:\pcatlas

If there is no PATH command in the AUTOEXEC.BAT file, see the DOS manual and create one. A PATH statement will allow the DOS command (COM) files to be stored together in a subdirectory rather than in the root directory of drive C:. Be sure to include that subdirectory in the PATH statement. The modification to AUTOEXEC.BAT will remain transparent; PATH can be invoked at all times without affecting the performance of other applications.

Copy the PC-ATLAS EXE and any BAT files into the C:\PCATLAS subdirectory, and copy the input files (INVEN, MANAGE, HARVEST) into the subdirectory C:\DATA. The PC-ATLAS programs can now be run from the\DATA subdirectory by using the appropriate commands (IUSCAN/R2000, GOIU, and so forth). All PC-ATLAS output files will be written to the \DATA subdirectory. With the use of the PATH command shown above there is no restriction as to the subdirectory, or drive, that must be current to run PC-ATLAS; for example, a user can insert a floppy disk in drive A:, which contains the INVEN file, and issue the GOIU command from drive A:. The IUSCAN program located in C:\PCATLAS reads INVEN from A: and writes the outputs to drive A:.

A word of caution: Create a logical system to rename the input and output files. Because a single simulation involves 17 files that always have the same names, it is easy to become confused over the differences among sets of inputs and outputs. We recommend the use of a scratch subdirectory or drive to make most simulations. Create inputs in a separate subdirectory and copy them to the scratch subdirectory dedicated to input and output files. After the simulation, edited inputs and savable outputs can be renamed and copied into other subdirectories for saving. When a session is finished, CURRAF and BIGRAF should be deleted because they will have no further use and they occupy disk space.

Note: The ASCII (American Standard Code for Information Interchange) input files are 80 columns wide and the ASCII output files are 122 columns wide. A condensed print mode is required to print the output files on an 80-column printer.

Using RAM Memory

The PC-ATLAS programs are "disk intensive," meaning that a program will spend much of the total processing time reading and writing files on the disk. An increase in the disk access speed can significantly reduce the time required for PC-ATLAS to complete a simulation. A noticeable decrease in processing time can be accomplished by using random access memory (RAM) configured as a disk drive. A RAM drive may require the addition of an expanded (or extended) memory board to the computer. For the execution of PC-ATLAS, a RAM drive of 3 to 4 megabytes should be sufficient; however, a simulation using 50 or more MUs will require prudent file management.

This procedure works well with the subdirectory and PATH approach described above (the executable PC-ATLAS programs themselves require over 600K bytes). The PC-ATLAS programs will load into operating system memory from their subdirectory on the hard disk, and all file reading and writing will take place on the RAM memory disk rather than on a slower physical disk.

One final reminder concerning RAM drives; they lose all memory when the power is off. The inputs INVEN, MANAGE, and HARVEST will need to be copied to the RAM drive before the run. When the run is finished, copy the inputs back to the hard disk if they have

been modified and need to be saved again (that is, if they were edited after being copied to the RAM drive). If an output file is worth keeping, it can be copied to a subdirectory on the hard disk. All files on the RAM disk are lost when the computer is turned off.

Rounding Problems

A PC does not necessarily carry the same precision or use the same rounding scheme as a mainframe computer. The ATLAS program contains many error-checking algorithms that often depend on a high level of precision (double precision). The single precision and rounding that takes place on the microcomputer will sometimes cause problems for MU card types 28 and 38 in the program ATLAS. Card type 28 is an Ml-shifting card that allows portions to sum to 1.00. The MU card 38 allocates a proportion of the harvest to an age class, and the total proportions should sum to 1.00. (See appendix A for more details about these MU card types.) While ATLAS is running, it checks the total proportion of acres shifted or harvested; if they sum to more than 1.0000, an error message is written to the CALLS file and the program aborts.

These errors can be avoided by adjusting proportions (within an MU) so that the total is slightly less than 1.0000. In the case of MU card 28, the error may occur when 100 percent of the acres are shifted out of any one Ml category. The problem can be eliminated by reducing the acreage shift by less than 1 percent; for example, if the total shift out of Ml 1 equals 1.00, then lower one card 28 so that the new total is equal to 0.9999. The same strategy applies to MU card type 38; the sum of the harvest proportions should be slightly less than 1.00 (0.9999 works fine); however, if the difference between 1.00 and the lower sum is too great, the MUSCAN program will indicate an error. This solution to the error-checking problem does not significantly alter projection results.

Appendix F: Comparison of Input and Output From ATLAS and PC-TRIM

This section is intended to help PC-TRIM users quickly understand the differences between PC-TRIM and ATLAS input files. In many cases, it should provide enough information to allow a quick conversion of TRIM input decks into ATLAS input decks. The TRIM and ATLAS input and output file names are listed; card types eliminated from the TRIM input are followed by a star (*); card types that have changed definitions are listed as "NEW."

Most eliminated TRIM card types will be ignored by ATLAS programs. Problems will arise, however, if the cards declared NEW are in the wrong format. For format questions, users should reference appendices A, B, and C for detailed information.

Inventory

The term inventory unit (IU) replaces basic resource unit (BRU). The input format is the same.

Program:	IUSCAN (inventory unit scanner) replaces BRUSCN
Input file:	INVEN the same for both models
Output files:	IURAF binary file used by HUSCAN (replaces BRURAF)
	LIST.IU replaces LIST.BRU

Card types:	1 unstocked acres—same
	2* donor acres—eliminated
	3 regular acres—same

Management

The term management unit (MU) replaces grouped resource unit (GRU).

Program:	MUSCAN (management unit scanner) replaces GRUSCN
Input file:	MANAGE replaces CONTROL
Output files:	MURAF binary file used by HUSCAN (replaces GRURAF)
	LIST.MU replaces LIST.GRU

Card types:

00 name—same
01 IU list—same format, whole IUs only, no proportioning allowed
02 site, species, conversion species —same for species; site and conversion-species deleted
03 MU options—PNW option replaced with harvest select option; where 1 = final harvest, 2 = partial cutting. Default = 1.
04* planting stock indicator—eliminated
05* PCT age—eliminated
06* fertilization age—eliminated
07 age limit for MI shift—same
08 min. harvest age—same
09* rotation age—eliminated
10* discount rate—eliminated

New area-change cards, with examples from southern planted pine:

Card 11—Total acres in MU (incl. nonstocked) by period, in millions. Format same as other cards that allow "fill-value," up to six decimal places may be declared (field is F10.0). Acres in the starting period are determined by the IU. The first card 11 entry represents acres at the end of the first period (and beginning of the second period). One card per MU, no MI designation. No card 11 means that acres remain constant.

		Period						
60311000	11		2.519					
60311000	11	0	1.485	1.736	1.968	2.201	2.297	2.393
60311000	11	6	2.435	2.476	2.499	2.521	2.520	

Card 12—Proportions to distribute acreage increases (from card type 11) across age classes. Entries are in age-class format (similar to card 33). Incoming acres are assigned the volume per acre equal to the average stocking proportion multiplied by the yield-table volume associated with the age class. Entries should sum to 1.0. One card per MU. This example shows that 100 percent of an acreage increase will be assigned to age-class 0.

		Age class						
60311000	12	0	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Card 13—Exiting acre proportions. Proportion of acreage loss to come from designated range of age classes. Up to 10 age-class ranges are allowed. A range may consist of one age class or several (up to all age classes). Proportions should sum to 1.0.

		Group number			
60311000	13	1	0	0	0.0400
60311000	13	2	1	1	0.2200
60311000	13	3	2	5	0.3410
60311000	13	4	6	17	0.3990

Card 14—Ml to receive acre gain (default = acres assigned to MI-1 and redistributed based on card 28). Eliminated economic cards:

15*. 16*, 17*. 18*. 19*, and 20*

Other cards:

21 unstocked to restocked—same
22 cut acres to unstocked—same
23 regeneration stocking (called stocking level midpoint in TRIM)—same
24 stocking thresholds, regen stocking—same
25* donor acre shift—eliminated
26* donor acre shift—eliminated
27* donor acre shift—eliminated
28 Ml shift—same
29 NEW—proportion of volume recovered from area loss (cards 11 and 13) by period, fill value ok. Recovered volume is applied to harvest request. Two cards allowed, 1 in column 14 is for softwood volume; 2 in column 14 is for hardwood volume.
30 NEW—relative-density-change parameters with option to use linear or quadratic form of equation. A second card 30 can be used to differentiate regenerated stands from existing stands. Variables: ENT (column 14), FULLDC, HALFDC, EQTYP, COEFDC (or b_1), COEFDC (or b_2). EQTYP=1 for linear, EQTYP=2 for quadratic. ENT=1 for first card 30, ENT=2 for second card 30—the regeneration option. In the case of ENT=2, only CREGDC(1) and CREGDC(2) need to be entered and all other variables from the first card 30 are used.
31* mortality salvage—eliminated
32 Average stand diameter by age—same
33 base yield tables—same
34 thinning volume—same
35* mortality volume per acre—eliminated
36 softwood proportion—same
37 growth on harvest multiplier—same
38 harvest proportion by age—same
39 unit conversion factor—same
40 NEW—partial-cutting "target" age class. In a partial cutting, ML) values entered by age class represent the age class in which treated acre will be placed. Partial-cutting volume removal is based on the difference in current age and target age. Target age of zero means final harvest.
41 NEW—minimum allowable stocking for partial cutting to take place

Harvest

The term harvest unit (HU) replaces allowable cut unit (ACU). The input format has some changes. The "A" cards are now "H" cards.

Program:	HUSCAN (harvest unit linker) replaces ACUSCN
Input file:	HARVEST replaces HEADER
Output files:	BIGRAF binary file for ATLAS
	LIST.HU replaces LIST.ACU
	TREE is a listing of IU acres and volume for each MU

Card types:

01 run header—same
02 NEW—starting year of simulation
03 NEW—diagnostic output request, first period of diagnostic output, last period for diagnostic output, summary report request, HU report request, MU report request
04 NEW reporting years for HU detailed output
05 NEW reporting years for MU detailed output
06 NEW minimun diameter for alternate volume conversion
07 NEW initial softwood fractions of harvest
HO harvest unit name (like old A1 card but now 60 characters)—new
H1 NEW- harvest unit ID (10 characters); period length; number of periods; relative-density-change limit (1.0 = 100 percent); stocking warning flags: dcmin, dcmax
H2 MU membership list—same format
H3 harvest request—NEW format: field = 6F10.0 (units=millions) up to nine decimal places may be carried
H4 NEW—partial cut-harvest request—same format as H3
A5* treatment labels—eliminated
H6 Ml labels—same
A7* site labels—eliminated; earlier versions of ATLAS recognized an H7 card, this too has been eliminated (though an error will not occur if H7 cards are included).
H8 species labels—same

Example HARVEST file:

```
** ATLAS Standalone -                    SE FM OP HIGH
01                      ATLAS - Test Run                    SE FM OP HIGH
02                           1980
**                         DUMP      IFDUMP      LSDUMP      SUMREP      HUREP       MUREP
03                            0           0           0           1          2           2
04 HU Reports              1980 2010 2035
05 MU Reports              1980 2010 2035
**
**SEFMOPHIGH
H032                                  SE  Farmer Oak-Pine High Site
H132                    SE FM OP H          5          11         2.0       0.10        1.30
H232                       60431000
H332  3  0                  190.000    190.000    190.000     190.000    190.000     190.000
H332  3  6                  190.000    190.000    190.000     190.000    190.000     190.000
H632  1                   NON TREATED
H632  2                       NOT USED
H632  3                   IMP NO THIN
H632  4                      IMP THIN
H632  5                IMPROVED INTEN
H832  3                       OAK-PINE                1
```

ATLAS

Program ATLAS replaces TRIM.

Input: BIGRAF

Output: ATLIST Projection results; replaces DETAIL. Acres and volumes are in millions (rounded to nearest thousand at time of output).

ATHUR An HU report (if requested) of inventory, growth, harvest, and area change by age class and Ml for selected periods.

ATMUR An MU report (if requested) of inventory, growth, harvest, and area change by age class and MI for selected periods.

ATACRE Periodic report of inventory, harvest, and regenerated acres for each MU by MI.

ATINV Softwood and hardwood projections of inventory, growth, and total harvest.

ATLOG Record of warning and error messages by period.

CURRAF Binary file created and used by ATLAS.

Appendix G: Examples of Input and Output

This section provides two examples of ATLAS simulations. The input files are derived from a larger set developed for the 1989 RPA Timber Assessment (Haynes 1990). The first example is relatively simple, and the second example shows several options; for example, management intensity shifting, and multiple MUs and HUs. All input files are presented and are followed by a card-by-card discussion of the input. The inputs are the actual files used to generate the output files that follow. As used in this appendix, the word "record" describes a single line of input, and "card type" describes a particular kind of input. Most card types require the use of more than one record (such as inventory by age class or acres by period). The term "data field" is used to describe the format position of many input values. Appendix B shows the location of these data fields. All input files are 80 columns wide, and all output files are up to 132 columns wide; the output files are presented in condensed print.

Comments are inserted into the input files by beginning the line with double asterisks (**). The programs ignore the contents of all records with an asterisk (*) in columns one and two. This makes it possible to add pertinent notes, activate and deactivate records, to turn options on and off, and save original records when modifications are made.

Example 1 Input Files

As shown in figure 9, the first example is a simple one-to-one configuration (one IU to one-MU to one-HU). The inventory is the oak-pine forest type in the forest industry ownership in the Northeastern United States. Inventory is projected within a single MI.

Inventory unit—The following is the inventory unit file for example 1:

```
** EXAMPLE #1   Inventory Unit File
** CT=Card Type, MI=Management Intensity, AC=Age Class
** 10-Year Age Classes    AC 0 = Age 0-9, AC 1  = Age 10-19, Etc.
**
**ID*CTMI   AC          ACRES      VOL/ACRE
13040  3  1   1          15425        1171.0
13040  3  1   2           4001        1543.0
13040  3  1   3          12953        1457.5
13040  3  1   4          26066        1761.5
13040  3  1   5          20787        2107.5
13040  3  1   6          18579        2383.3
13040  3  1   7           7649        1282.0
13040  3  1   8           6058        1478.0
```

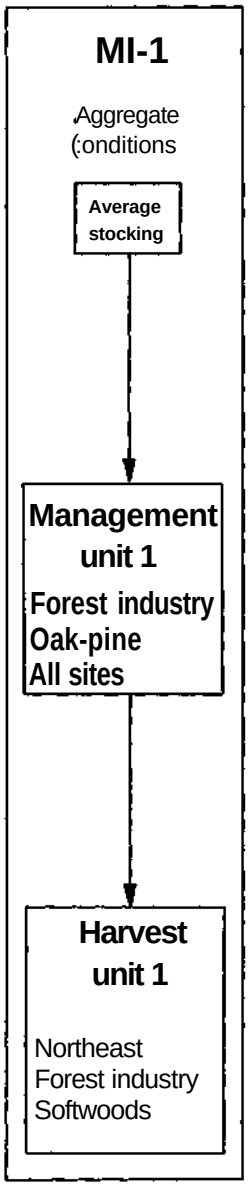

Figure 9—The linkages between the example 1 input files.

This IU has no nonstocked acres, and only card type 03 is present. One stocking level is represented so that all acres and volume are in data fields 1 and 2. The volume-per-acre column (data field 2) is carried to one decimal point. This is an option for all acre and volume inputs. Age classes are 10 years (0 = age 0-9, 1 = age 10-19, 2 = age 20-29,..., 17 = age 170+).

Management unit—The following is the management unit file for example 1:

```
** EXAMPLE 1-Management Unit File
** Northeastern / Forest Industry Ownership / Oak-pine Type / All Sites
13040000  00      NE-FI OAK-PINE
13040000   1              13040
13040000   2                      4
13040000   8                  4
13040000  11              0.128
13040000  11          0   0.112   0.116   0.118   0.122   0.125
13040000  12          0   0.500   0.250   0.125   0.065   0.060   0.000
13040000  23              0.8858   0.00    0.00    1.00    0.00    0.00
13040000  301                      17      17       1   0.162   0.890
13040000  32 1        0     7.4     8.1     7.8     9.7    11.1    12.8
13040000  32 1        6    12.8    13.6    13.7    12.0    13.7    13.7
13040000  32 1       12    13.7    13.7    13.7    13.7    13.7    13.7
13040000  331         0       0     522    1013    1473    1902    2300
13040000  331         6    2668    3004    3309    3584    3828    4040
13040000  331        12    4222    4373    4493    4581    4639    4667
13040000  361             0.4617
13040000  371             1.1904
13040000  381         0  0.0000  0.0000  0.0000  0.0000  0.0800  0.0920
13040000  381         6  0.0920  0.0920  0.0920  0.0920  0.0920  0.0920
13040000  38 1       12  0.0920  0.0920  0.0920  0.0000  0.0000  0.0000
```

Because one Ml is used, this MU) is rather simple. But this example originated as part of a larger study, so the MU includes card types in addition to the minimal inputs required for a simulation. (The only MU cards actually required are 01, 02, and 33.) The format used for most card types is that of the 10-column data field. There are six data fields—columns 21 though 80 (see appendix B). Many data variables are entered by period or age class, and for these variables, time or age increases from one data field to the next from left to right.

Card types 11, 36, and 37 are examples of the user-default input format. This input format is designed for card types that carry values by period or age class (for example, acres by period or yield table volume by age class). Within the program code, these variables are dimensioned by the number of age classes specified by the program PARAMETER statement (the default is 18 age classes and 18 periods; at six values per line, three lines of input are required). One value can be entered on the user default record (acres, volume, a proportion, and so forth); if the card type does not contain an entry for all (18) possible array values, the program will fill in the missing numbers with the user default value. This means that for cases when a card type contains a constant value, the constant can be specified in user default format rather than be repeated several times. The user default value will supply only values that are left as blanks on the input record or fill in when the record is omitted. The user default will not supply a value for zeros entered on a record.

***Card type 00*—**This is the MU) name. The label is printed in output files as part of the MU identifier. The use of pronounceable names or abbreviations will speed identification of MUs.

***Card type 01*—**This entry is for the IU identity record. The identifier is used by HUSCAN to link the inventory unit(s) to the appropriate management unit. If more than one IU is assigned to the MU, card 01 can either be duplicated the appropriate number of times (up to 10) or have data fields 2 through 6 filled in as needed.

***Card type 02*—**This card type contains the numerical identifier for the species label found in the HARVEST file on card type H8 (this entry is in data field 2). In this case, the label OAK/PINE will be used on various output files.

***Card type 08*—**The minimum harvest age class is 4 (the 40-49 year age class). The minimum harvest age class is entered by MI; data fields 1 though 5 are associated with Mis 1 though 5.

***Card type 11*—**This card type is used when the total area within the MU will increase or decrease (it is optional). The entries are acres (in millions) by period. The first card type 11 shown here is in the user-default format. This means that 128 thousand acres will be used for all periods where no entry is specified (period 5 and beyond). The second card type 11 begins with an entry of 112 thousand acres for period 0. This will be the number of acres found in the MU at the end of the first period of simulation (or beginning of the second period of simulation). If this number is larger or smaller than the total acres in the IU file (it is larger), then area gain or area loss will take place over the period. It can be seen that acres are increasing each period.

***Card type 12*—**This record also is optional; its purpose is to proportion area gain across specific age classes. It is useful only when acres are added to an MU via card type 11. As shown here, 50 percent of the total acreage increase will occur in age class 0, 25 percent in age class 1, and so forth. The sum of all proportions entered on card type 12 must equal 1.00. When area gain occurs and card type 12 is omitted, all new acres are placed in age class 0. The volume per acre assigned to incoming acres is the product of the average stocking proportion (card type 23) and the yield-table value (card type 33). All incoming acres are initially placed in MI-1; however, if MI shifting is taking place, the acres may be reassigned to a different MI.

***Card type 23*—**This card type also is optional but its use is recommended. It is associated only with MI-1. The record has two parts: entered in data fields 1 through 3 are the average stocking proportions for stocking levels 1 though 3, and entered in data fields 4 through 6 are the proportions that distribute regenerated acres among stocking levels 1 through 3. The average stocking proportion is used in three cases: (1) initial stocking ratio assigned to regenerated acres; (2) the stocking ratio assigned to area gain (acres entering MU via card types 11 and 12); and (3) in the case of commercial thinning (not shown here), the thinning volume harvested is the product of the average stocking proportion and the removal specified on card type 34 (see example 2 MUs, below).

As shown here, card type 23 will assign an initial stocking proportion of 0.8858 to acres regenerated in stocking level 1 and to all acres entering the MU via area gain. One hundred percent (1.00) of the regenerated acres will be assigned to stocking level 1. If no card type 23 is present, the average stocking proportion defaults to 1.00 and all acres are assigned

stocking level 1. The associated card type 24 is used to set the lower stocking thresholds for stocking levels 1 and 2 and to assign an average stocking proportion to MIs 2 through 5 (see example 2).

Card type 30—This record contains the input coefficients to the relative-density-change equation (formally called the approach-to-normal equation). As used here, 17 is entered for both FULLDC and HALFDC, which means the full rate of adjustment will take place in all age classes. The 1 in data field 4 specifies the linear form of the equation with an intercept of 0.162 and a slope of 0.89. If card type 30 is omitted, no stocking adjustment takes place.

Regenerated acres may have a second set of relative density change coefficients. Example 2 makes use of this option.

Card type 32—This record allows for entry of the average stand diameter associated with each age class. The entry shown here is in inches. Stand diameter is not explicitly modeled, and diameter is not used in any modeling decision. These values are used to calculate the average reported inventory and harvest tree diameters. The value of 1 entered in column 14 indicates this set of records is for MI-1. The values in columns 18 and 19 (0, 6, and 12) are the age classes associated with the value in the adjacent data field 1.

This is an example of where the user-default format could have been used (as in card type 11). The value 13.7 is repeated seven times. This value could have been assigned to a user-default card; there still would be a total of three diameter records, but fewer numbers would be entered.

Card type 33—*The* base yield-table volume per acre for MI-1 is entered by age class. In both examples 1 and 2, the base yield tables represent net cubic feet of growing stock per acre. There is no default for this entry. This yield table was derived from inventory plot data collected in stands classified as the oak-pine forest type in the Northeastern United States. This yield table will act as a volume trajectory guide curve for oak-pine stands in forest industry ownership. The concept of a guide curve is appropriate because the initial inventory is not on the yield table and regenerated acres (and area gain) will start with a stocking proportion of 89 percent of yield-table volume. The coefficients on card type 30 were derived from the growth and volume data collected from plots on forest industry-owned lands. It is the combination of card types 33, 30, and 23 that allows for calibration of the growth and yield projection.

Card type 36—This card type allows for the representation of both hardwood and softwood volume components in the timber inventory. The reports produced by the ATLAS model categorize inventory, growth, and harvest volumes by these two fiber types. The user enters the proportion of inventory volume that is softwood. The assumption is that the base yield table represents both a softwood and hardwood component (in this case, the base yield table was developed from inventories with both components).

Shown in example 1, in the user-default format, is 46.17 percent. This means the majority of the volume represented as inventory, harvest, and growth is in hardwood. As entered here, the single value will apply to all age classes; often the proportion is set to differ with age class. If the initial beginning inventory consists of both softwood and hardwood volume (in the same inventory unit), the softwood proportion should be derived from that data. If the initial inventory (within IUs) is split between both fiber types and it is desirable for the starting year of the ATLAS output report to match this total, then the proportion(s) should

be derived from that initial inventory data. In the case here, the average is weighted to represent all age classes.

Card type 37—This record contains the growth-on-harvest multiplier. The multiplier can be entered by age class, but this is another case showing the user default-format. When ATLAS begins the harvest allocation process, this value will be multiplied by the volume available for harvest within this MU. This is a growth-inflation factor of roughly 19 percent. This is another input derived from the growth information on inventory plot records. It represents an annual net growth percentage (growth volume as a percentage of inventory volume) of about 3.8 percent taken times 5 years (it is 5 years from the beginning of the period to the middle of the period).

Card type 38—This record is the harvest proportion card type. The harvest assigned to this MU will be proportioned among age classes as specified by the entered ratios (that is, 9.2 percent of the total harvest assigned to this MU will be taken from each age class of age classes 5 though 14). This distributes harvest over a range of conditions. Should the percentage of harvest not be available within an age class, the algorithm will then collect the required remainder from the oldest age class with volume. In example 1, the inventory unit has no volume beyond age class 8, which means that in addition to the 9.2 percent of the MU harvest, age class 8 will be assigned another 55.2 percent of the harvest (9.2 times six age classes with no volume). Should all the volume in age class 8 be harvested and the assigned harvest not yet be met, then the remainder will come from the next youngest age class (and so on down to the minimum harvest age class, which is 4—see card type 8). If card type 38 is omitted, then all harvest assigned to the MU is distributed on the oldest first principle. (For information on harvest of area loss, commercial thinning harvest, and partial cutting, see the section "Harvesting Methods" in the text.)

The PC version of ATLAS may have problems related to rounding when card 38 values sum exactly to 1.0000. When the harvest gets close to taking all available volume, the ATLAS program may abort and list a harvest summation error message in the file ATLOG. A simple remedy, if that were the case here (and a good rule to follow), is to change 0.0800 to 0.07999, now card 38 sums to a value slightly less than one.

Harvest unit—The following is the harvest unit file for example 1:

```
** EXAMPLE 1-Harvest Unit File
** ATLAS example run for from 1989 RPA Timber Assessment
01              PC-ATLAS NE  EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
02                        1980
**                      DUMP    IFDUMP     LSDUMP  SUMREP     HUREP     MUREP
03                         0         0          0       1         0         1
04 HU Reports
05 MU Reports      1980 1990 2030
H001                      Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)
H101                Example #1        10         5    2.00      0.10      1.30
H201                 13040000
H301  3  0             53 924    60.613     40.667  50.910    49.471    71.378
H601  1           REGEN/NO THIN
H601  2                NOT USED
H601  3                NOT USED
H601  4                NOT USED
H601  5                NOT USED
H801  4                 OAK/PINE                1
```

The harvest file contains two sets of information. First is the input that controls the ATLAS projection and allows for the selection of ATLAS reports. These are the input card types 01 through 07. The second set of information pertains to the HU and the linkage to MUs. Harvest unit parameters are entered on card types HO through H8 (two additional digits identify the HU; legal values range from 01 to 32). The example here is a single HU. The HARVEST file contains relatively fewer defaults for omitted card types than does the file MANAGE. Other than card types 04 and 05, all entries are required input. In example 2, additional HUs are added by repeating entries for card types HO through H8.

Card type 01—*The* first entry is for a heading that will be written at the top of all pages in the reports. It can be used to identify the simulation.

Card type 02—On this record, enter the starting year of the simulation. This represents the first year in the first period of the simulation. (In this case, 1980 was the average date of survey associated with the IU inventory.)

Card type 03—This card type allows for the selection of an assortment of output reports. A comment card was inserted above in the data fields that correspond to the report. The first three entries control the diagnostic reports (also called dump reports). Diagnostic output is a listing produced at the end of various subroutines; it includes the contents of several basic variables. The output is a valuable debugging tool for programmers, but the typical user would not want diagnostic output.

The entries in data fields 4 through 6 choose reports at three levels of detail. In order, the report ATLIST is most general, ATHUR is a period-by-period report at the HU level of aggregation, and ATMUR is a period-by-period report of each MU. The ATLIST report is for all projection periods; the user chooses the periods to be reported in ATHUR and ATMUR. Options allow two levels of detail for both the HU and MU reports. Entering the value 1 will produce a summary report of all inventory, growth, and area change for each period. Entering the value 2 will produce the same periodic HU and MU summary, and it also will break this information down to the Ml level. This is the most disaggregate report possible. Chosen here was the aggregate ATLIST report and the report ATMUR at the Ml total level (there is just one MI, so entering a 2 will not produce any additional information). With only one MU linked to the HU, both the HU and MU reports will contain identical information.

***Card type* 04—**This card type allows the selection of periods to be reported in the HU report (ATHUR). The format of this card type does not follow the data field convention. Up to 12 calendar years are entered and are separated by a single space. The reports produced are periodic; the year entered should reflect the first year of the period. Because the HU report was not selected (on card 03), any entry here will be ignored.

***Card type* 05—**This card type allows the selection of periods to be reported in the MU report (ATMUR). The format is the same as that explained above for card type 04. Chosen here was a report for three periods. The last period of the simulation will be from the beginning of 2030 to the end of 2039. Because this is the last period, the entry 2030 will produce the regular periodic report, and the end of the simulation inventory will be reported for 2040 (the beginning of what would be the next logical period). See the output file. (If the periods were 5 years, a request of 2035 also would result in an inventory report for the beginning of 2040.)

Card type HO—*The* HO card type marks the beginning of the HU. This record is for the entry of a title for the HU. This title will identify the HU on output reports.

Card type H1—This is a multipurpose record. Entered in the first data field is another HU name that will be output in reports. Entered in the second data field is length, in years, of projection periods and age classes.

In the third data field, is the number of the last period in the simulation. This entry can be confusing because the first period of a simulation is formally called period zero. For this example, time equals zero in 1980 and the time between 1980 and 1989 will be called the zero period. The entry of 5 means the model will make a simulation for six time periods (0 through 5).

The last three data fields are related to the stocking density when calculated for the beginning MU-IU inventory. As previously mentioned, one role of the program HUSCAN is to link the IUs and MUs. During the linkage, HUSCAN calculates the stocking proportion (at the MU level) for each inventory cell. Data field four is for the entry of an upper stocking limit. If a cell stocking proportion exceeds this value (200 percent used here), volume above this limit will be removed and placed in the next older age class. This process starts at the youngest age class and moves to the oldest. If the addition of volume pushes stocking over the limit, volume is again moved up one age class.

There is a reason for the limit. The base yield table often has low values for young age classes, and very young timber stands will contain residual volume from previous stands. High stocking proportions can lead to unrealistic growth. As an example, assume a yield-table value of 200 for age class 0 and a young timber stand with 800 cubic feet per acre of residual volume. The stand would begin the simulation with 400 percent stocking. The problem comes when this stand is projected. Even with the application of the relative-density-change equation, it is likely that 40 years later the stocking would be about 300 percent. If the base yield table had a volume of 3,500 cubic feet at age 45, this would put the stand that started with residual trees at about 10,000 cubic feet. Reasonable? Not likely. All stocking proportions are reported for all beginning inventory cells in the file called LIST.HU produced by HUSCAN (file = HULIST on mainframes). To prevent this potential stocking problem, check LIST.HU, but even so, it is always a good idéa to have an arbitrary upper stocking limit.

The final two entries define the expected range for all initial stocking proportions. Any stocking proportion to fall outside this range will be flagged in the LIST.HU file. This is just a warning device that makes the spotting of probable outliers easier.

Card type H2—*The* listing of the MU(s) to be linked to the HU. The MU identifying number(s) are input in data field format (up to six per record). Up to 65 MUs may be linked to one HU. Harvest will be allocated among the MUs by the relative available harvest volume in each MU (for example, a MU with 20 percent of the total available volume would be allocated 20 percent of the harvest volume).

Card type H3—The periodic harvest is entered in data field format. The units are million cubic feet. The entry of 3 in column 7 means both softwood and hardwood fiber types will count towards harvest. The entry of 0 in column 11 associates the first harvest value with period 0.

Card type H6—This card type allows for the entry of MI names to be used as labels on output. The use of these labels implies that MIs are coordinated across the member MUs (for example, if MI-2 is commercial thinning, then for all MUs linked to that HU, commercial thinning should take place in all uses of MI-2). Five records are required for this card type regardless of the number of MIs actually used. As shown here, NOT USED was filled in for the Mis having no entries.

Card type H8—This is the forest type associated with MU card type 02. The entry here will be printed on reports at the MU level. Up to nine forest type records can be entered (unlike card type H6, not all nine cards need be present). The value 1 is entered in data field 3. It means the softwood fiber type associated with the harvest of this forest type. An entry of 2 would associate the MU with the hardwood fiber type.

A note about harvest—*The* harvest fiber type selected is **both** hardwood and softwood (3 = combined). Were either softwood **or** hardwood selected, acres would be harvested until the specified harvest volume is satisfied by the selected fiber type. When an acre is harvested, volume from both fiber types is removed. The number of acres harvested depends on the volume per acre and the percentage of that volume in the requested fiber type (a function of MU card type 36). Harvested volume of the nonselected fiber type is referred to as come-along volume; it is not explicitly used to satisfy a harvest request.

As an example of how this works, assume a harvest request is selected for 100 units and flagged (on card type H3) as a softwood fiber request. Also assume that the inventory volume available for harvest is 1000 units, of which 800 units are softwood and 200 units are hardwood (this means that based on MU card type 36, the average softwood proportion on each acre will be 80 percent). To meet the requested 100 units of softwood, 20 percent of the total volume harvested will be hardwood. The total volume removed from the inventory will be 125 units, 25 of which will be hardwood. The 25 units of hardwood harvest is what we call come-along volume; the model reports this removal, but it is not explicitly used to meet demand. If the 100 units of harvest had been flagged as the combined fiber type, then harvest would consist of 80 units of softwood and 20 units of hardwood. A 100-unit hardwood fiber request will produce 100 units of hardwood and 500 units of softwood come-along volume.

In the RPA simulations, softwood types are aggregated into softwood HUs and receive a softwood harvest request; hardwood MUs are treated accordingly. The assumption is made that a portion of the come-along volume will be used, therefore, both the softwood and hardwood harvest requested need to be reduced to eliminate excess harvesting. In the TAMM90/ATLAS model, the card type 07 includes softwood and hardwood proportions that adjust the TAMM requested harvest for the come-along percentage. In the stand-alone and PC versions of ATLAS, this might be accomplished by running calibration simulations and making adjustments by hand (or by some automated process).

Example 1 Output Files

The complete set of the outputs from the inputs shown in example 1 is included. The simulation was done with PC-ATLAS, and the outputs from the SCANNER programs reflect PC file names.

The SCANNER outputs are LIST.IU, LIST.MU, LIST.HU, and TREE. Each file includes a reproduction of the input file and then a reorganization of the input into a table. Any errors encountered in reading and checking the data are reported.

The file LIST.MU shows how the program interprets the input data in MANAGE. In this case, the file has many tables that either are not filled in or are filled in with default values. This reflects the rather simple nature of example 1. To see how additional information is reported, complete the simulation in example 2 (or run MUSCAN on any MANAGE input file) and print the file LIST.MU. A disadvantage of the large detailed listing such as LIST.MU is that when 50 or more MUs are processed, this file can become larger than a megabyte in size. This large size becomes a real disadvantage when the file is to be printed, but more often it is a disadvantage when it must be viewed in an editor to find errors reported by MUSCAN. For most errors this can be avoided by paying attention to the screen output during the execution of MUSCAN. If an error is found in MANAGE, the MU number comes to the screen; for many errors, the MU card type with the error is also reported to the screen. If one is a little familiar with the correct input format, it might take only a look at the suspected card to determine the problem (incorrect format, incorrect MU number, and card type out of order are common). As a last resort, look up the MU with errors in LIST.MU; at the bottom of each MU report, error messages are listed in detail.

It is important to note the LIST.HU file. It includes tables showing the initial stocking relation (at the "cell" level) between inventory and yield-table volumes. This is an excellent place to spot potential inventory volume outliers (for example, a stand in age class 1 with 400 percent stocking). This is helpful if either the HARVEST variable DCLIM or the inventory volume needs to be adjusted. This is the inventory that will begin the ATLAS simulation.

There are three cases when stocking is assigned to acres. First, and most frequently, stocking is assigned to regenerated acres based on the ratios on MU cards 23 and 24. The average stocking proportion is adjusted by the relative density change parameters on MU card 30. But the adjustment occurs only if the yield-table value for the subsequent age class has been assigned a volume (that is, if the yield-table values in age class 0 and age class 1 are both 0, then the first stocking adjustment will not take place until the acres enter age class 2). Second, stocking is assigned to acres any time they are in an age class that has a zero volume on the corresponding yield table. Regardless of the age class, or any volume on the inventory acres, the regeneration stocking ratio is assigned in all cases of a zero yield-table entry. Inventory volume in the subsequent period (and subsequent age class) is determined by the assigned stocking value, the approach-to-normal adjustment, and the yield-table volume. Any initial inventory volume is used in the calculation of growth, the growth may be negative if the initial volume was larger than the value calculated for the subsequent age class. This often occurs for zero-aged plots that have residual plot volumes larger than the yield table values in age class 1. Third, stocking is assigned when the yield table has volume and the inventory does not. This might be a rather peculiar case where acres (in an age class other than zero) have no volume. In this case, the value 1.00 (100 percent) is assigned to the acres. In the first period of growth, any stocking adjustments are made and volume is assigned from the yield table. All assigned volume will be counted as growth.

The next five files are from ATLAS (ATLOG, ATLIST, ATMUR, ATACRE, and ATINV). The format of these files is described in more detail in appendix C. The file ATLIST is an all-period summary accounting for inventory, growth, harvest, and area change within a harvest unit. The file ATHUR accounts for inventory by age class for the selected periods. The file ATACRE is an acreage report, it has a redundant table because there was only one MI (the summary of all MIs equals the MI-by-MI report). The files ATINV and ATLOG usually are not printed. The file ATINV is formatted for possible use as an input to a customized program. The period-by-period summary in file ATLOG is another place to look for error messages when the ATLAS program sends an error message to the screen (check it for warning messages).

```
P C - I U   S C A N    11/28/1990 16:10:49          PAGE     1

RECORD **IU*CT*M*AC***************D1********D2********D3********D4********D5********D6

    1  ** EXAMPLE #1  Inventory Unit File
    2  ** CT=Card Type, MI=Management Intensity, AC=Age Class
    3  ** 10-Year Age Classes    AC 0 = Age 0-9,  AC 1 = Age 10-19, Etc.
    4  *•
    5  **ID*CTMI AC             ACRES  VOL/ACRE
    6  13040 1 1                    0
    7  13040 3 1  1             15425     1171.0
    8  13040 3 1  2              4001     1543.0
    9  13040 3 1  3             12953     1457.5
   10  13040 3 1  4             26066     1761.5
   11  13040 3 1  5             20787     2107.5
   12  13040 3 1  6             18579     2383.3
   13  13040 3 1  7              7649     1282.0
   14  13040 3 1  8              6058     1478.0
0 14  RECORDS  READ  FOR  IU 13040
    5 COMMENT RECORDS (NOT PROCESSED)
    9 ACTIVE RECORDS

INFORMATION PAST COLUMN 80 IS NOT PROCESSED.
```

Example 1. FIle-LIST.IU

IU 13040 RAF LOCATION 2 CONTAINS NO ERRORS

UNSTOCKED ACRES	TOTAL MANAGED ACRES	TOTAL MANAGED VOLUME	CROSS CHECK ACRES
0.	111518.	195878.	111518.

	MI 1 TOTAL			MI 2 SL 1		
AC	ACRES	CF/A	MCF	ACRES	CF/A	MCF
1	15425.	1171.	18062.7			
2	4001.	1543.	6173.5			
3	12953.	1458.	18879.0			
4	26066.	1762.	45915.3			
5	20787.	2108.	43808.6			
6	18579.	2383.	44279.3			
7	7649.	1282.	9806.0			
8	6058.	1478.	8953.7			
TOTAL	111518.		195878.1			

Example 1. File-LIST.IU

```
P C - I U  S C A N   11/28/1990 16:10:49          PAGE    3

   1 IUs                    RAF Location   First    Last
   0 IUs with errors        IU Data            2       2
   0 Duplicate IUs          IU List            3       3

     IU REC E     IU REC E     IU REC E     IU REC E
   13040    2

Inventory Unit Scan Complete
   14 Records read
  No errors found
```

Example 1. File-LIST.IU

```
P C - M U    S C A N    11/28/1990 16:10:51          PAGE    1

RECORD ****MU****CT* F*T*AP*********D1********O2********D3********D4********D5********D

     1  ** EXAMPLE 1--Management Unit File
     2  ** Northeastern / Forest Industry Ownership/Oak-pine Type/All Sites
     3  13040000  00        NE-FI OAK-PINE
     4  13040000   1              13040
     5  13040000   2                      4
     6  13040000   8                  4
     7  13040000  11              0.128
     8  13040000  11      0       0.112      0.116     0.118     0.122     0.125     0.128
     9  13040000  12      0       0.500      0.250     0.125     0.065     0.060     0.000
    10  13040000  23              0.8858      0.00      0.00      1.00      0.00      0.00
    11  13040000  30 1                          17        17         1     0.162     0.890
    12  13040000  32 1    0         7.4         8.1       7.8       9.7      11.2      12.8
    13  13040000  32 1    6        12.8        13.6      13.7      12.0      13.7      13.7
    14  13040000  32 1   12        13.7        13.7      13.7      13.7      13.7      13.7
    15  13040000  33 1    0           0         522      1013      1473      1902      2300
    16  13040000  33 1    6        2668        3004      3309      3584      3828      4040
    17  13040000  33 1   12        4222        4373      4493      4581      4639      4667
    18  13040000  36 1              0.4617
    19  13040000  37 1              1.1904
    20  13040000  38 1    0       0.0000      0.0000    0.0000    0.0000    0.0800    0.0920
    21  13040000  38 1    6       0.0920      0.0920    0.0920    0.0920    0.0920    0.0920
    22  13040000  38 1   12       0.0920      0.0920    0.0920    0.0000    0.0000    0.0000
0   22 RECORDS READ FOR MU 13040000
     2 COMMENT RECORDS (NOT PROCESSED)
    20 ACTIVE RECORDS

 INFORMATION PAST COLUMN 80 IS NOT PROCESSED.


 DEFAULT VALUES WILL BE USED FOR CARD TYPE  3
 DEFAULT VALUES WILL BE USED FOR CARD TYPE  7
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 13
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 14
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 21
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 22
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 24
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 28
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 29
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 34
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 39
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 40
 DEFAULT VALUES WILL BE USED FOR CARD TYPE 41
```

Example 1. File-LIST.MU

MU NUMBER "13040000 " NE-FI OAK-PINE

CARD TYPE 01 IUS BELONGING TO MU 13040

CARD TYPE 02 FOREST TYPE (SPECIES) 4

CARD TYPE 03 HARVEST SELECTION 1 FINAL HARVEST
DIAGNOSTIC OUTPUT 0 NO FIRST PERIOD 0 LAST PERIOD 0

CARD TYPE 07 AGE CLASS LIMITS FOR MI SHIFTING

FROM MI	TO MI 1	2	3	4	5
1	*	0	0	0	0
2	0	*	0	0	0
3	0	0	*	0	0
4	0	0	0	*	0
5	0	0	0	0	*

08 MINIMUM HARVEST AGE CLASS

MI	
1	4
2	0
3	0
4	0
5	0

AREA PROJECTIONS, ENTERING AND EXITING PROPORTIONS, AND PARTIAL CUTTING TARGET AND MINIMA

CARD TYPE	11	12			13		40	41
PD/AC	AREA	ENTER PROP	LOWER AC	UPPER AC	EXIT PROP	AC	PC AGE	PC MIN
0	.112	.5000	0	0	.0000	0	17	.000
1	.116	.2500	0	0	.0000	1	17	
2	.118	.1250	0	0	.0000	2	17	
3	.122	.0650	0	0	.0000	3	17	
4	.125	.0600	0	0	.0000	4	17	
5	.128	.0000	0	0	.0000	5	17	
6	.128	.0000	0	0	.0000	6	17	
7	.128	.0000	0	0	.0000	7	17	
8	.128	.0000	0	0	.0000	8	17	
9	.128	.0000	0	0	.0000	9	17	
10	.128	.0000				10	17	
11	.128	.0000				11	17	
12	.128	.0000				12	17	
13	.128	.0000				13	17	
14	.128	.0000				14	17	
15	.128	.0000				15	17	
16	.128	.0000				16	17	
17	.128	.0000				17	17	

CARD TYPE 14 MI OF ENTERING ACRES 1

Example 1. File-LIST.MU

CARD TYPE 21 PROPORTION OF UNSTOCKED ACRES RESTOCKED

PD	
0	.000
1	.000
2	.000
3	.000
4	.000
5	.000
6	.000
7	.000
8	.000
9	.000
10	.000
11	.000
12	.000
13	.000
14	.000
15	.000
16	.000
17	.000

22 PROPORTION OF CUTOVER ACRES REMAINING UNSTOCKED

PD	
0	.000
1	.000
2	.000
3	.000
4	.000
5	.000
6	.000
7	.000
8	.000
9	.000
10	.000
11	.000
12	.000
13	.000
14	.000
15	.000
16	.000
17	.000

CARD TYPE 23 MI 1 AVE. STOCKING PROPORTION

LEVEL	
1	.886
2	.000
3	.000

24 MINIMUM STOCKING TO ENTER LEVEL

LEVEL	
1	.000
2	.000

CARD TYPE 23 DISTRIBUTION OF HI 1 REGENERATION TO ENTER LEVEL

LEVEL	
1	1.000
2	.000
3	.000

24 HI 2 - 5 AVERAGE STOCKING PROPORTION

MI	
2	1.000
3	1.000
4	1.000
5	1.000

Example 1. File-LIST.MU

```
P C - M U    S C A N     11/28/1990 16:10:51            PAGE      4

MU NUMBER  "13040000  "    NE-FI OAK-PINE

CARD TYPE    28 PROPORTIONS TO SHIFT AMONG MIS

          FROM M  I   1    1    1    1            2    2    2    2            3    3    3    3
          T  O M  I   2    3    4    5            1    3    4    5            1    2    4    5
               PD
                0
                1
                2
                3
                4
                5
                6
                7
                8
                9
               10
               11
               12
               13
               14
               15
               16
               17

CARD TYPE    28 PROPORTIONS TO SHIFT AMONG MIS                                29 RECOVERY PROPORTIONS

          FROM M  I   4    4    4    4            5    5    5    5
          TO   MI      1    2    3    5       1    2         3    4

               PD                                                          PD
                0                                                          0   .000  .000
                1                                                          1   .000  .000
                2                                                          2   .000  .000
                3                                                          3   .000  .000
                4                                                          4   .000  .000
                5                                                          5   .000  .000
                6                                                          6   .000  .000
                7                                                          7   .000  .000
                8                                                          8   .000  .000
                9                                                          9   .000  .000
               10                                                         10   .000  .000
               11                                                         11   .000  .000
               12                                                         12   .000  .000
               13                                                         13   .000  .000
               14                                                         14   .000  .000
               15                                                         15   .000  .000
               16                                                         16   .000  .000
               17                                                         17   .000  .000
```

Example 1. File-LIST.MU

MU NUMBER "13040000 " NE-FI OAK-PINE

CARD TYPE 30 RELATIVE DENSITY CHANGE EQUATION FORM OF EQN: 1 REGEN EQN PRESENT? 0

	AGE CLASS	EQUATIONS		
FULL ADJUSTMENT	0 TO 17	COEFFICIENT 1	.16200	.00000
HALF ADJUSTMENT	18 TO 17	COEFFICIENT 2	.89000	.00000

PROPORTION OF STANDARD VOLUME

CURRENT	AFTER GROWTH HALF	AFTER GROWTH FULL			CURRENT	AFTER GROWTH HALF	AFTER GROWTH FULL		
.3000	.3645	.4290	.0000	.0000	1.1000	1.1205	1.1410	.0000	.0000
.4000	.4590	.5180	.0000	.0000	1.2000	1.2150	1.2300	.0000	.0000
.5000	.5535	.6070	.0000	.0000	1.3000	1.3095	1.3190	.0000	.0000
.6000	.6480	.6960	.0000	.0000	1.4000	1.4040	1.4080	.0000	.0000
.7000	.7425	.7850	.0000	.0000	1.5000	1.4985	1.4970	.0000	.0000
.8000	.8370	.8740	.0000	.0000	1.6000	1.5930	1.5860	.0000	.0000
.9000	.9315	.9630	.0000	.0000	1.7000	1.6875	1.6750	.0000	.0000
1.0000	1.0260	1.0520	.0000	.0000	1.8000	1.7820	1.7640	.0000	.0000

DIAMETER, VOLUME PER ACRE, THINNING VOLUME PER ACRE, SOFTWOOD PROPORTION OF VOLUME, AND GROWTH ON HARVEST

CARD TYPE 32 33 34 36 37

MANAGEMENT INTENSITY 1

AC	DIAM IN.	VOLUME/ ACRE	THIN VOL /ACRE	SOFTWD PROP	GROWTH ON HARVEST
0	7.4			.462	1.190
1	8.1	522.0		.462	1.190
2	7.8	1013.0		.462	1.190
3	9.7	1473.0		.462	1.190
4	11.2	1902.0		.462	1.190
5	12.8	2300.0		.462	1.190
6	12.8	2668.0		.462	1.190
7	13.6	3004.0		.462	1.190
8	13.7	3309.0		.462	1.190
9	12.0	3584.0		.462	1.190
10	13.7	3828.0		.462	1.190
11	13.7	4040.0		.462	1.190
12	13.7	4222.0		.462	1.190
13	13.7	4373.0		.462	1.190
14	13.7	4493.0		.462	1.190
15	13.7	4581.0		.462	1.190
16	13.7	4639.0		.462	1.190
17	13.7	4667.0		.462	1.190

CARD TYPE 32 33 34 36 37

MANAGEMENT INTENSITY 2

AC	DIAM IN.	VOLUME/ ACRE	THIN VOL /ACRE	SOFTWD PROP	GROWTH ON HARVEST
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000

Example 1. File-LIST.MU

DIAMETER, VOLUME PER ACRE, THINNING VOLUME PER ACRE, SOFTWOOD PROPORTION OF VOLUME, AND GROWTH ON HARVEST

CARD TYPE 32 33 34 36 37

MANAGEMENT INTENSITY 3

AC	DIAM IN.	VOLUME/ ACRE	THIN VOL /ACRE	SOFTUD PROP	GROWTH ON HARVEST
0				1.000	1.000
1				1.000	1.000
2				1.000	1.000
3				1.000	1.000
4				1.000	1.000
5				1.000	1.000
6				1.000	1.000
7				1.000	1.000
8				1.000	1.000
9				1.000	1.000
10				1.000	1.000
11				1.000	1.000
12				1.000	1.000
13				1.000	1.000
14				1.000	1.000
15				1.000	1.000
16				1.000	1.000
17				1.000	1.000

CARD TYPE 32 33 34 36 37

MANAGEMENT INTENSITY 4

AC	DIAM IN.	VOLUME/ ACRE	THIN VOL /ACRE	SOFTWD PROP	GROWTH ON HARVEST
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000
				1.000	1.000

DIAMETER, VOLUME PER ACRE, THINNING VOLUME PER ACRE, SOFTWOOD PROPORTION OF VOLUME, GROWTH ON HARVEST, HARVEST PRIORITY, AND CONVERSION FACTOR

CARD TYPE 32 33 34 36 37 CARD TYPE 38 39

MANAGEMENT INTENSITY 5

AC	DIAM IN.	VOLUME/ ACRE	THIN VOL /ACRE	SOFTWD PROP	GROWTH ON HARVEST	HARVEST PRIORITY	CONVERSION FACTOR
0				1.000	1.000		
1				1.000	1.000		
2				1.000	1.000		
3				1.000	1.000		
4				1.000	1.000	.080	
5				1.000	1.000	.092	
6				1.000	1.000	.092	
7				1.000	1.000	.092	
8				1.000	1.000	.092	
9				1.000	1.000	.092	
10				1.000	1.000	.092	
11				1.000	1.000	.092	
12				1.000	1.000	.092	
13				1.000	1.000	.092	
14				1.000	1.000	.092	
15				1.000	1.000		
16				1.000	1.000		
17				1.000	1.000		

```
P C - N U   S C A N     11/28/1990 16:10:51          PAGE     7

        1           MUs          RAF Location   First     Last
        0 MUs with errors    MU     Data           2        2
        0 Duplicate MUs           MU List          3        3

              MU  REC E          MU  REC E          MU  REC E          MU  REC E
          13040000    2

Management Unit Scan Complete
   22 Records Read
No errors found
```

Example 1. File-LIST.MU

```
     P C - H U   S C A N    11/28/1990 16:10:53          PAGE   1

RECORD  CT**N**************__--******-___.*****.....*****.....*****____*****..._.*****

    1  ** EXAMPLE 1--Harvest Unit File
    2  ** ATLAS example run for from 1989 RPA Tinter Assessment
    3  01                PC-ATLAS NE  EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
    4  02                     1980
    5  **                     DUMP     IFDUMP     LSDUMP     SUMREP     HUREP      MUREP
    6  03                        0          0          0          1      0             1
    7  04 HU Reports
    8  05 MU Reports         1980 1990 2030
    8 RECORDS READ FOR GENERAL RUN INFORMATION
    3 COMMENT RECORDS (NOT PROCESSED)
    5 ACTIVE RECORDS

 INFORMATION PAST COLUMN 80 IS NOT PROCESSED

 DEFAULT VALUES USED FOR GENERAL CARD TYPE 06
```

Example 1. File-LIST.HU

HARVEST HEADER REPORT

CARD TYPE

01 RUN TITLE: PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest..

02 STARTING YEAR OF SIMULATION 1980

03 DIAGNOSTIC OUTPUT OVERRIDE 0
FIRST AND LAST OUTPUT PERIODS 0 0
REPORT REQUESTS SUM, HU, MU 1 0 1

	REPORT YEARS	1	2	3	4	5	6	7	8	9	10	11	12
04	HU	0	0	0	0	0	0	0	0	0	0	0	0
05	MU	1980	1990	2030	0	0	0	0	0	0	0	0	0

06 ALTERNATE VOLUME MEASURE LABEL: NO ALTER. UNIT
MINIMUM DIAMETER FOR CONVERSION TO OTHER VOLUME .00

07 INITIAL SOFTWOOD FRACTIONS OF HARVEST

REGIONS	1	2	3	4	5	6	7	8
IOF 1	.000	.000	.000	.000	.000	.000	.000	.000
IOF 2	.000	.000	.000	.000	.000	.000	.000	.000
IOF 3	.000	.000	* .000	.000	.000	.000	.000	.000
IOF 4	.000	.000	.000	.000	.000	.000	.000	.000

0 Error(s) in General Card Types 01 to 06

Example 1. File-LIST.HU

```
          P C - H U    S C A N     11/28/1990  16:10:53            PAGE   3

     RECORD CT*A**I*AOP*********-____******...******..____*****.....*****.....*****.....*****

         9  H001                 Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)
        10  H101                 Example #1         10         5      2.00        0.10       1.30
        11  H201                   13040000
        12  H301   3    0            53.924    60.613    40.667     50.910     49.471     71.378
        13  H601   1                REGEN / NO THIN
        14  H601   2                      NOT USED
        15  H601   3                      NOT USED
        16  H601   4                      NOT USED
        17  H601   5                      NOT USED
        18  H801   4                      OAK/PINE              1
0     10 RECORDS READ FOR HU NUMBER 01
       0 COMMENT RECORDS (NOT PROCESSED)
      10 ACTIVE RECORDS                -

   INFORMATION PAST COLUMN 80 IS NOT PROCESSED
```

Example 1. File~LIST.HU

SIMULATION SETUP FOR PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
HU 1 Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)

CARD TYPE

H1 HU LABEL Example #1
PERIOD LENGTH IN YEARS 10
SIMULATION LENGTH IN PERIODS 5
MAXIMUM STOCKING PERMITTED 2.0000

EXPECTED STOCKING RANGE .1000 1.3000

H2 MUS WITHIN THIS HU

13040000

H3 COMBINED FINAL HARVEST REQUEST FOR THIS HU

PD	0	1	2	3	4	5
VOL	53.9	60.6	40.7	50.9	49.5	71.4

H4 COMBINED PARTIAL CUTTING REQUEST FOR THIS HU

PD	0	1	2	3	4	5
VOL						

H6 MANAGEMENT INTENSIFICATION LABELS

MI	LABEL
1	REGEN / NO THIN
2	NOT USED
3	NOT USED
4	NOT USED
5	NOT USED

H8 SPECIES LABEL AND REPORT GROUP

SPECIES	REPORT GROUP	LABEL
4	SOFTWOOD	OAK/PINE

No errors in HU Card Types H1 to H8

Example 1. File-LIST.HU

```
MU- 13040000-

WARNING   FOR IU 13040 - STOCKING RATIO IS OUTSIDE EXPECTED RANGE OF  .1000 TO 1.3000
MI  SL  AC   Y TABLE     INVEN    STOCKING
             VOLUME     VOLUME
 1   1   1     522.0    1171.0     2.2433
 1   1   2    1013.0    1543.0     1.5232
```

Example 1. File-LIST.HU

INVENTORY REPORT FOR MU 13040000 NE-FI OAK-PINE

UNSTOCKED ACRES	TOTAL HANAGED ACRES	TOTAL MANAGED VOLUME	CROSS CHECK ACRES
0.	111518.	195878.	111518.

AC	MI 1 TOTAL ACRES	CF/A	MCF	MI 2 ACRES	CF/A	MCF
1	15425.	1096.	16908.9			
2	4001.	1620.	6482.2			
3	12953.	1523.	19724.1			
4	26066.	1762.	45915.3			
5	20787.	2108.	43808.6			
6	18579.	2383.	44279.3			
7	7649.	1282.	9806.0			
8	6058.	1478.	8953.7			
TOTAL	111518.		195878.2			

AC	MI 1 SL 1 ACRES	CF/A	MCF	HI 1 SL 2 ACRES	CF/A	MCF	HI 1 SL 3 ACRES	CF/A	MCF
1	15425.	1096.	16908.9						
2	4001.	1620.	6482.2						
3	12953.	1523.	19724.1						
4	26066.	1762.	45915.3						
5	20787.	2108.	43808.6						
6	18579.	2383.	44279.3						
7	7649.	1282.	9806.0						
8	6058.	1478.	8953.7						
TOTAL	111518.		195878.2						

Example 1. File-LIST.HU

```
P C - H U   S C A N     11/28/1990 16:10:53          PAGE   6
STOCKING  RATIO REPORT  FOR MU    13040000   NE-FI OAK-PINE

AC   MI1   SL1  MI1  SL2  MI1  SL3  MI1  ALL      MI2      MI3      MI4      MI5
       ER SRATIO ER SRATIO ER SRATIO ER SRATIO ER SRATIO ER SRATIO ER SRATIO ER SRATIO

 0
 1     *+ 2.100                    *+  2.100
 2     *+ 1.599                    *+  1.599
 3         1.034                        1.034
 4          .926                         .926
 5          .916                         .916
 6          .893                         .893
 7          .427                         .427
 8          .447                         .447
 9
10
11
12
13
14
15
16
17

 WARNING     2 STOCKING RATIO(S) OUTSIDE USER
 CHECK RANGE (HIGHER THAN   1.30 AND LOWER THAN    .10)
 CHECK  INVENTORY AND YIELD TABLE VOLUME.

No errors found combining IUs and MUs

No errors found.
```

Example 1. File-LIST.HU

ATLAS TREE FOR
PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
11/28/1990 16:10:53

HARVEST UNIT Example #1 CONTAINS

MANAGEMENT UNIT NE-FI OAK-PINE			
IU 13040	.000 UNS M AC	111.518 REG M AC	195.878100 VOL MMCF
TOTAL MU	.000 UNS M AC	111.518 REG M AC	195.878200 VOL MMCF
TOTAL HU	.000 UNS M AC	111.518 REG M AC	195.878200 VOL MMCF

Example 1.File-TREE

```
   PC -ATLAS   PC-ATLAS NE  EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
   Run on 11/28/1990   at 16:10:57

Period  0
     HU  1 Example #1   Reports 0   1
    Northeast Region -  Forest Industry Softwoods (Oak/Pine Demo)

Period  1
     HU  1 Example #1   Reports 0   1
    Northeast Region -  Forest Industry Softwoods (Oak/Pine Demo)

Period  2
     HU  1 Example #1   Reports 0   0
    Northeast Region -  Forest Industry Softwoods (Oak/Pine Demo)

Period  3
     HU  1 Example #1   Reports 0   0
    Northeast Region -  Forest Industry Softwoods (Oak/Pine Demo)

Period  4
     HU  1 Example #1   Reports 0   0
    Northeast Region -  Forest Industry Softwoods (Oak/Pine Demo)

Period  5
     HU  1 Example #1   Reports 0   1
    Northeast Region -  Forest Industry Softwoods (Oak/Pine Demo)

Normal exit from PC-ATLAS
```

Example 1. File-ATLOG

P C - A T L A S PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
Run on 11/28/1990 16:10:57 Using RAF from 11/28/1990 16::10:53

Harvest Unit 1 Example #1 Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)

Inventory at start of period. Area Loss, and Volume Recovered from area loss.

Pd	Year	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	Acres	SW Loss	HW Loss	ICom Loss	SW Rec	HW Rec	Com Rec
0	1980	0.112	90.437	105.441	195.878	11.340	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	1990	0.112	86.534	100.891	187.424	10.637	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	2000	0.116	86.064	100.342	186.406	10.322	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	2010	0.118	95.548	111.400	206.948	10.178	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	2020	0.122	101.562	118.412	219.974	10.196	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	2030	0.125	109.096	127.197	236.293	10.165	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	2040	0.128	108.087	126.019	234.106	10.343							

Thinning and final Harvest.

Pd	Year	Acres	SW Thin	HW Thin	Com Thin	Acres	SW FH	HW FH	Com FH	AvD FH	Com Req	Com Dif
0	1980	0.000	0.000	0.000	0.000	0.026	24.897	29.027	53.924	13.123	53.924	0.000
1	1990	0.000	0.000	0.000	0.000	0.019	27.985	32.628	60.613	13.083	60.613	0.000
2	2000	0.000	0.000	0.000	0.000	0.011	18.776	21.891	40.667	13.237	40.667	0.000
3	2010	0.000	0.000	0.000	0.000	0.013	23.505	27.405	50.910	13.214	50.910	0.000
4	2020	0.000	0.000	0.000	0.000	0.012	22.841	26.630	49.471	13.308	49.471	0.000
5	2030	0.000	0.000	0.000	0.000	0.016	32.955	38.423	71.378	12.239	71.378	0.000

Partial Cutting and Total Harvest.

Pd	Year	Acres	SW PC	HW PC	Com PC	AvD PC	Com Req	Com Dif	SW Har	HW Har	Com Har
0	1980	0.000	0.000	0.000	0.000	0.000	0.000	0.000	24.897	29.027	53.924
1	1990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	27.985	32.628	60.613
2	2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	18.776	21.891	40.667
3	2010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.505	27.405	50.910
4	2020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	22.841	26.630	49.471
5	2030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	32.955	38.423	71.378

Growth, Area Gain, and Gain Adjusted for growth.

Pd	Year	SW Gro	HW Gro	Com Gro	Acres	SW Gain	HW Gain	Com Gain	SW Adj	HU Adj	Com Adj
0	1980	20.928	24.400	45.328	0.000	0.092	0.107	0.199	0.066	0.077	0.143
1	1990	26.968	31.442	58.410	0.004	0.764	0.891	1.655	0.547	0.638	1.184
2	2000	27.987	32.630	60.617	0.002	0.382	0.445	0.827	0.273	0.319	0.592
3	2010	28.972	33.779	62.751	0.004	0.764	0.891	1.655	0.547	0.638	1.184
4	2020	29.965	34.937	64.902	0.003	0.573	0.668	1.241	0.410	0.478	0.888
5	2030	31.535	36.767	68.302	0.003	0.573	0.668	1.241	0.410	0.478	0.888

Inventory at end of period, Unstocked and Regeneration Acres, and BF/CF Ratios for Inventory and Harvest.

Pd	Year	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	Un End	Un Sta	Regen	Reg Ad	Inv Rat	Har Rat
0	1980	0.112	86.534	100.891	187.424	10.637	0.000	0.000	0.026	0.026	0.000	0.000
1	1990	0.116	86.064	100.342	186.406	10.322	0.000	0.000	0.021	0.019	0.000	0.000
2	2000	0.118	95.548	111.400	206.948	10.178	0.000	0.000	0.012	0.011	0.000	0.000
3	2010	0.122	101.562	118.412	219.974	10.196	0.000	0.000	0.015	0.013	0.000	0.000
4	2020	0.125	109.096	127.197	236.293	10.165	0.000	0.000	0.013	0.012	0.000	0.000
5	2030	0.128	108.087	126.019	234.106	10.343	0.000	0.000	0.017	0.016	0.000	0.000

Inventory Identity.

Pd	Year	Acres	SW Inv	HW Inv	Com Inv	Acres	SW Dif	HW Dif	Com Dif	SW Gro	HW Gro	Com Gro
0	1980	0.112	86.534	100.891	187.424	0.000	0.000	0.000	0.000	16.919	19.727	36.646
1	1990	0.116	86.064	100.342	186.406	0.000	0.000	0.000	0.000	22.275	25.970	48.245
2	2000	0.118	95.548	111.400	206.948	0.000	0.000	0.000	0.000	24.875	29.002	53.878
3	2010	0.122	101.562	118.412	219.974	0.000	0.000	0.000	0.000	24.995	29.142	54.138
4	2020	0.125	109.096	127.197	236.293	0.000	0.000	0.000	0.000	26.149	30.488	56.637
5	2030	0.128	108.087	126.019	234.106	0.000	0.000	0.000	0.000	26.101	30.432	56.533

P C - A T L A S PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
Run on 11/28/1990 16:10:57 Using RAF from 11/28/1990 16:10:53

Harvest Unit 1 Example #1 Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)

Available Softwood Final Harvest Volume.

Pd	Year	1	2	3	4	
0	1980	0.000	0.000	0.000	83.960	83.960
1	1990	0.000	0.000	0.000	88.498	88.498
2	2000	0.000	0.000	0.000	80.555	80.555
3	2010	0.000	0.000	0.000	92.124	92.124
4	2020	0.000	0.000	0.000	81.551	81.551
5	2030	0.000	0.000	0.000	98.888	98.888

Available Hardwood Final Harvest Volume.

Pd	Year	1	2	3	4	
0	1980	0.000	0.000	0.000	97.889	97.889
1	1990	0.000	0.000	0.000	103.181	103.181
2	2000	0.000	0.000	0.000	93.920	93.920
3	2010	0.000	0.000	0.000	107.408	107.408
4	2020	0.000	0.000	0.000	95.081	95.081
5	2030	0.000	0.000	0.000	115.295	115.295

Forest (Species) Type.

1	NO SPECIES	1
2	NO SPECIES	2
3	NO SPECIES	3
4	OAK/PINE	

Example 1. File-ATLIST

P C - A T L A S PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
Run on 11/28/1990 16:10:57 Using RAF 1Prom 11/28/1990 16:10:53

Harvest 1Unit 1 Example #1 Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)
Period 0 Year 1980 Management Unit 1 NE-FI OAK-PINE Total over Management Intensities

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SU Gro	HU Gro	Com Gro
0	0.000	0.000	0.000	0.000		0.000	0.000	0.000
1	0.015	7.807	9.102	16.909		0.013	0.015	0.028
2	0.004	2.993	3.489	6.482		0.007	0.008	0.014
3	0.013	9.107	10.617	19.724		1.325	1.544	2.869
4	0.026	21.199	24.716	45.915		3.523	4.108	7.631
5	0.021	20.226	23.582	43.809		5.985	6.978	12.963
6	0.019	20.444	23.836	44.279		5.995	6.989	12.984
7	0.008	4.527	5.279	9.806		3.294	3.840	7.134
8	0.006	4.134	4.820	8.954		0.787	0.918	1.705
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.,000
16	0.000	0.000	0.000	0.000		0.000	0.000	0..000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.,000
Stock	0.112	90.437	105.441	195.878	11.340	20.928	24.400	45.,328
Unst	0.000							
Total	0.112							

	Harvest during period						Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SU Net	HU Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0,.000
1	0.000	0.000	0.000	0.000	0.000		0.000	0.026	0.030	0,.056
2	0.000	0.000	0.000	0.000	0.000		0.,000	0.025	0.029	0..054
3	0.000	0.000	0.000	0.000	0.000		0.000	0.019	0.022	0..041
4	0.002	1.992	2.322	4.314	0.080		0.,000	0.022	0.026	0..049
5	0.002	2.290	2.671	4.961	0.092		0..000	0.000	0.000	0.000
6	0.008	10.304	12.013	22.317	0.414		0.,000	0.000	0.000	0.000
7	0.008	5.389	6.284	11.673	0.216		0..000	0.000	0.000	0.000
8	0.006	4.921	5.737	10.659	0.198		0..000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0..000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0..000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0,.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0,.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0,.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0,.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.026	24.897	29.027	53.924	1.000	13.123	0.000	0.092	0.107	0.199
Req				53.924						
Regen	0.026									

	Inventory at start of period				
MI	Acres	SW Inv	HW Inv	Com Inv	MI Identification
1	0.112	90.437	105.441	195.878	REGEN / NO THIN
2	0.000	0.000	0.000	0.000	NOT USED
3	0.000	0.000	0.000	0.000	NOT USED
4	0.000	0.000	0.000	0.000	NOT USED
5	0.000	0.000	0.000	0.000	NOT USED

Example 1. File-ATHUR

P C - A T L A S PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
Run on 11/28/1990 16:10:57 Using RAF from 11/28/1990 16:10:53

Harvest Unit 1 Example #1 Northeast Region - Forest Industry Softwoods I[Oak/Pine Demo)
Period 1 Year 1990 Management Unit 1 NE-FI OAK-PINE Total over Management Intensities

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvO Inv	SU Gro	HU Gro	Com Gro
0	0.026	0.000	0.000	0.000		0.000	0.000	0.000
1	0.000	0.026	0.030	0.056		6.027	7.027	13.055
2	0.015	7.832	9.131	16.963		0.082	0.096	0.178
3	0.004	4.333	5.052	9.385		4.039	4.709	8.747
4	0.013	12.331	14.376	26.707		1.605	1.872	3.477
5	0.024	25.145	29.316	54.461		3.101	3.616	6.717
6	0.019	22.649	26.406	49.055		6.122	7.138	13.261
7	0.011	14.219	16.579	30.798		5.991	6.985	12.976
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.112	86.534	100.891	187.424	10.637	26.968	31.442	58.410
Unst	0.000							
Total	0.112							

	Harvest during period						Net Area Change		
AC	Acres	SU Har	HW Har	Com Har	FH Prop	AvO Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.002	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.001	0.213	0.249	0.462
2	0.000	0.000	0.000	0.000	0.000		0.001	0.207	0.242	0.449
3	0.000	0.000	0.000	0.000	0.000		0.000	0.157	0.183	0.339
4	.0.002	2.239	2.610	4.849	0.080		0.000	0.187	0.218	0.404
5	0.002	2.575	3.002	5.576	0.092		0.000	0.000	0.000	0.000
6	0.004	6.245	7.281	13.526	0.223		0.000	0.000	0.000	0.000
7	0.011	16.927	19.735	36.662	0.605		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.019	27.985	32.628	60.613	1.000	13.083	0.004	0.764	0.891	1.655
Req				60.613						
Regen	0.021									

	Inventory at start of period				
MI	Acres	SU Inv	HW Inv	Com Inv	MI Identification
1	0.112	86.534	100.891	187.424	REGEN / NO THIN
2	0.000	0.000	0.000	0.000	NOT USED
3	0.000	0.000	0.000	0.000	NOT USED
4	0.000	0.000	0.000	0.000	NOT USED
5	0.000	0.000	0.000	0.000	NOT USED

P C - A T L A S PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
Run on 11/28/1990 16:10:57 Using RAF from 11/28/1990 16:10:53

Harvest Unit 1 Example #1 Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)
Period 5 Year 2030 Management Unit 1 NE-FI OAK-PINE Total over Management Intensities

		Inventory at start of period				Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.013	0.000	0.000	0.000		0.000	0.000	0.000
1	0.016	3.592	4.188	7.779		3.160	3.685	6.845
2	0.014	6.444	7.513	13.956		3.845	4.482	8.327
3	0.022	15.990	18.642	34.632		3.434	4.004	7.439
4	0.028	26.579	30.989	57.568		6.001	6.997	12.999
5	0.000	0.000	0.000	0.000		6.200	7.229	13.429
6	0.013	19.454	22.682	42.136		0.485	0.565	1.050
7	0.001	2.657	3.098	5.755		3.042	3.547	6.589
8	0.007	13.980	16.299	30.278		0.496	0.578	1.074
9	0.011	20.401	23.786	44.187		4.617	5.383	10.000
10	0.000	0.000	0.000	0.000		0.254	0.296	0.550
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.125	109.096	127.197	236.293	10.165	31.535	36.767	68.302
Unst	0.000							
Total	0.125							

		Harvest during period					Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.002	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.001	0.160	0.187	0.347
2	0.000	0.000	0.000	0.000	0.000		0.000	0.155	0.181	0.336
3	0.000	0.000	0.000	0.000	0.000		0.000	0.117	0.137	0.254
4	0.002	2.636	3.074	5.710	0.080		0.000	0.140	0.163	0.303
5	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
6	0.002	3.032	3.535	6.567	0.092		0.000	0.000	0.000	0.000
7	0.001	3.032	3.535	6.567	0.092		0.000	0.000	0.000	0.000
8	0.001	3.032	3.535	6.567	0.092		0.000	0.000	0.000	0.000
9	0.009	21.223	24.744	45.967	0.644		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.016	32.955	38.423	71.378	1.000	12.239	0.003	0.573	0.668	1.241
Req				71.378						
Regen	0.017									

	Inventory at start of period				
HI	Acres	SW Inv	HW Inv	Com Inv	MI Identification
1	0.125	109.096	127.197	236.293	REGEN / NO THIN
2	0.000	0.000	0.000	0.000	NOT USED
3	0.000	0.000	0.000	0.000	NOT USED
4	0.000	0.000	0.000	0.000	NOT USED
5	0.000	0.000	0.000	0.000	NOT USED

P C - A T L A S PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended Harvest.
Run on 11/28/1990 16:10:57 Using RAF from 11/28/1990 16:10:53

Harvest Unit 1 Example #1 Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)
Period 6 Year 2040 Management Unit 1 NE-FI OAK-PINE Total over Management Intensities

Inventory at start of period

AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv
0	0.017	0.000	0.000	0.000	
1	0.014	3.240	3.778	7.018	
2	0.016	7.551	8.803	16.354	
3	0.014	9.974	11.629	21.603	
4	0.022	21.689	25.288	46.977	
5	0.025	30.565	35.636	66.200	
6	0.000	0.000	0.000	0.000	
7	0.011	19.465	22.694	42.159	
8	0.000	0.121	0.141	0.262	
9	0.006	12.655	14.755	27.410	
10	0.001	2.827	3.296	6.123	
11	0.000	0.000	0.000	0.000	
12	0.000	0.000	0.000	0.000	
13	0.000	0.000	0.000	0.000	
14	0.000	0.000	0.000	0.000	
15	0.000	0.000	0.000	0.000	
16	0.000	0.000	0.000	0.000	
17	0.000	0.000	0.000	0.000	
Stock	0.128	108.087	126.019	234.106	10.343
Unst	0.000				
Total	0.128				

Inventory at start of period

MI	Acres	SW Inv	HW Inv	Com Inv	MI Identification
1	0.128	108.087	126.019	234.106	REGEN / NO THIN
2	0.000	0.000	0.000	0.000	NOT USED
3	0.000	0.000	0.000	0.000	NOT USED
4	0.000	0.000	0.000	0.000	NOT USED
5	0.000	0.000	0.000	0.000	NOT USED

Example1.File-ATHUR

P C - A T L A S **PC-ATLAS NE EXAMPLE RUN #1 - Base Run 8-Extended** Harvest.
Run **on 11/28/1990 16:10:57** Using **RAF** from **11/28/1990 16:10:53**

Harvest Unit 1 Example #1 Northeast Region - Forest Industry Softwoods (Oak/Pine Demo)

Inventory Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	REGEN / NO THIN	NOT USED	NOT USED	NOT USED	NOT USED	Total
0	1980	0.112	0.000	0.000	0.000	0.000	0.112
1	1990	0.112	0.000	0.000	0.000	0.000	0.112
2	2000	0.116	0.000	0.000	0.000	0.000	0.116
3	2010	0.118	0.000	0.000	0.000	0.000	0.118
4	2020	0.122	0.000	0.000	0.000	0.000	0.122
5	2030	0.125	0.000	0.000	0.000	0.000	0.125
6	2040	0.128	0.000	0.000	0.000	0.000	0.128

Harvest Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	REGEN / NO THIN	NOT USED	NOT USED	NOT USED	NOT USED	Total
0	1980	0.026	0.000	0.000	0.000	0.000	0.026
1	1990	0.019	0.000	0.000	0.000	0.000	0.019
2	2000	0.011	0.000	0.000	0.000	0.000	0.011
3	2010	0.013	0.000	0.000	0.000	0.000	0.013
4	2020	0.012	0.000	0.000	0.000	0.000	0.012
5	2030	0.016	0.000	0.000	0.000	0.000	0.016

Regeneration Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	REGEN / NO THIN	NOT USED	NOT USED	NOT USED	NOT USED	Total
0	1980	0.026	0.000	0.000	0.000	0.000	0.026
1	1990	0.021	0.000	0.000	0.000	0.000	0.021
2	2000	0.012	0.000	0.000	0.000	0.000	0.012
3	2010	0.015	0.000	0.000	0.000	0.000	0.015
4	2020	0.013	0.000	0.000	0.000	0.000	0.013
5	2030	0.017	0.000	0.000	0.000	0.000	0.017

Inventory Acres by Management Intensity for OAK/PINE.

Pd	Year	REGEN / NO THIN	NOT USED	NOT USED	NOT USED	NOT USED	Total
0	1980	0.112	0.000	0.000	0.000	0.000	0.112
1	1990	0.112	0.000	0.000	0.000	0.000	0.112
2	2000	0.116	0.000	0.000	0.000	0.000	0.116
3	2010	0.118	0.000	0.000	0.000	0.000	0.118
4	2020	0.122	0.000	0.000	0.000	0.000	0.122
5	2030	0.125	0.000	0.000	0.000	0.000	0.125
6	2040	0.128	0.000	0.000	0.000	0.000	0.128

Harvest Acres by Management Intensity for OAK/PINE.

Pd	Year	REGEN / NO THIN	NOT USED	NOT USED	NOT USED	NOT USED	Total
0	1980	0.026	0.000	0.000	0.000	0.000	0.026
1	1990	0.019	0.000	0.000	0.000	0.000	0.019
2	2000	0.011	0.000	0.000	0.000	0.000	0.011
3	2010	0.013	0.000	0.000	0.000	0.000	0.013
4	2020	0.012	0.000	0.000	0.000	0.000	0.012
5	2030	0.016	0.000	0.000	0.000	0.000	0.016

Regeneration Acres by Management Intensity for OAK/PINE.

Pd	Year	REGEN / NO THIN	NOT USED	NOT USED	NOT USED	NOT USED	Total
0	1980	0.026	0.000	0.000	0.000	0.000	0.026
1	1990	0.021	0.000	0.000	0.000	0.000	0.021
2	2000	0.012	0.000	0.000	0.000	0.000	0.012
3	2010	0.015	0.000	0.000	0.000	0.000	0.015
4	2020	0.013	0.000	0.000	0.000	0.000	0.013
5	2030	0.017	0.000	0.000	0.000	0.000	0.017

Example 1. File-ATACRE

```
PC-ATLAS Inventories from 11/28/1990  16:10:57
Exanple #1    90.437   105.441    20.928    24.400    24.897    29.027
              86.534   100.891    26.968    31.442    27.985    32.628
              86.064   100.342    27.987    32.630    18.776    21.891
              95.548   111.400    28.972    33.779    23.505    27.405
             101.562   118.412    29.965    34.937    22.841    26.630
             109.096   127.197    31.535    36.767    32.955    38.423
             108.087   126.019
```

Example 1. File-ATINV

Example 2 Input Files

As in the first example, the input files for example 2 are derived from the RPA assessment (Haynes 1990). But this example presents additional options. The input and output files are much larger as a result of the implementation of Ml options and the addition of I Us, MUs, and HUs. Example 2 is configured with three IUs and three MUs that are combined into two HUs (fig. 10). The stratification of forest types by softwood and hardwood fiber type and the addition of Mis for softwoods make figure 10 look much different than figure 9. Because the dimensions of ATLAS are rather large (see fig. 2), the model still has plenty of space for the representation of other ownerships, site classes, forest types, and management regimes. Other than the fact that they both are included in the input files, there is no linkage between the two HUs and their respective inventories. The files in example 1 could be combined with the files presented here, as the values of the projections would not change.

This example shows two methods of placing the acres into the alternative MIs. The strategy presented here involves additional input at both the IU and MU levels. First, the softwood inventory units contain records for acres and volume per acre for MIs 1 through 5. And second, the use of card type 28 in the Douglas-fir and western hemlock MUs will shift acres to alternative management during the simulation. In this example, acres are moved out of MI-1, and once in Ml 2 through 5, they remain there (though some will be lost from the timberland base from area losses that take place via MU card types 11 and 13). The card types 28, 32, 33, 34, 36, and 37 are Ml specific, so additional MIs require the input of additional records. Card type 8 and 24 have entries by MI, but only one of each is allowed.

Inventory unit—The records present in the following inventory units are arranged by forest type, MI, and 10-year age class. As in example 1, all records for acres and volume per acre are in stocking level 1. All volume units are in cubic feet. The five-digit identifying code has no significance to ATLAS; it represents forest type and site class. For simplicity, the IU identifier matches the first five digits of the MU identifier. The three IUs appear as they do in the input file. The double asterisks (**) identify comment records.

```
** EXAMPLE 2 -- file:INVEN
** pnww fi / douglas-fir / medium site class
** MI-1
13102 3 1  0            15089      49.0
13102 3 1  1            33311     255.6
13102 3 1  2            53333    1825.2
13102 3 1  3           136599    3190.8
13102 3 1  4           197271    5138.2
13102 3 1  5            84312    5306.5
13102 3 1  6            48068    6992.7
13102 3 1  7            21413   10229.2
13102 3 1  8            22573   12198.4
13102 3 1  9             8316   11562.0
13102 3 1 10             8574    3283.0
13102 3 1 12            17384   12209.5
13102 3 1 15            40733    7188.2
** MI-2
13102 3 2  0            60355      49.0
13102 3 2  1            22208     255.6
13102 3 2  2            21333     904 0
13102 3 2  3            13660    2862.7
```

```
** MI-3
13102 3 3  0            30177      49.0
13102 3 3  1            44415     255.6
13102 3 3  2            42667    1125.0
13102 3 3  3            54640    3188.2
** MI-4
13102 3 4  0           165976      49.0
13102 3 4  1            99934     255.6
13102 3 4  2            74667    1122.0
13102 3 4  3            54640    3434.5
13102 3 4  4            23208    6239.0
13102 3 4  5             9368    6525.2
13102 3 4  6             5341    8154.6
** MI-5
13102 3 5  0            30177      49.0
13102 3 5  1            22208     255.6
13102 3 5  2            21333    1125.0
13102 3 5  3            13660    3434.5
13102 3 5  4            11604    4196.1

**pnww fi /  western hemlock / medium site class
** MI-1
13202 3 1  0            49877     400.0
13202 3 1  1            34602     757.6
13202 3 1  2            37024    2606.2
13202 3 1  3            60080    4915.3
13202 3 1  4            76243    4581.1
13202 3 1  5            52382    6988.1
13202 3 1  6            15419   10431.5
13202 3 1  7            24675    9601.2
13202 3 1 14             4968    9802.0
13202 3 1 15            13245   11898.3
13202 3 1 17             9068   10574.0
** MI-3
13202 3 3  0            74815     400.0
13202 3 3  1            51902     583.4
13202 3 3  2            55535    1200.0
13202 3 3  3            25749    5178.7
**pnww fi / red alder / medium site class
** MI-1
13452 3 1  0            16778    1540.7
13452 3 1  1            16918     537.5
13452 3 1  2            91121    2569.1
13452 3 1  3            58522    2589.9
13452 3 1  4            86759    4251.3
13452 3 1  5            30040    6252.0
13452 3 1  6             6197    1781.0
13452 3 1  7            14069    3753.0
13452 3 1  9             4831    5681.0
```

Management unit—For every ML) there is one IU. Many of the card types presented here were described in example 1. Just a brief description will be used for those card types repeated here. If you have not done so, it is advisable to first read through input descriptions for example 1.

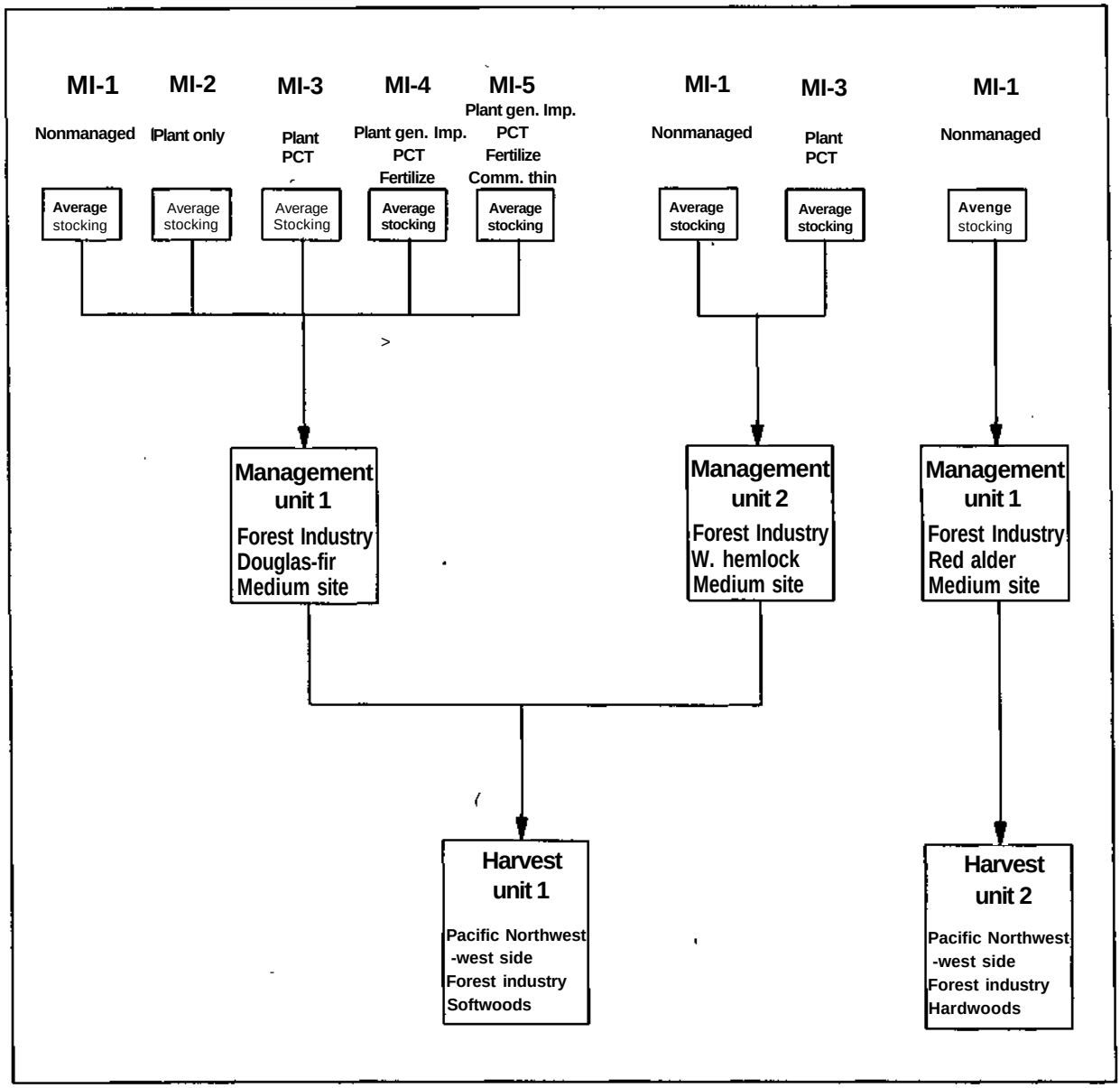

Figure 10—The linkages between the example 2 input files. Each harvest unit and associated inventories are independent, and there is no direct link between the harvest units.

```
** EXAMPLE 2 -- file: MANAGE
** PNW Forest Industry Medium Site Class
** Douglas-fir
13102000  00        FI-DOUG-FIR--MS
13102000   1             13102
13102000   2                              1
13102000   8                  5          5         4         4         4
13102000  11               1.816
13102000  11       0       1.555      1.711     1.813     1.856     1.843     1.816
13102000  12       0       0.500      0.250     0.125     0.065     0.060     0.000
13102000  13       1           0         17     1.000
13102000  23                0.76       0.38      0.25      1.00      0.00      0.00
13102000  24                0.00       0.00      1.00      1.00      1.00      1.00
13102000  28 1 2            0.20
13102000  28 1 3            0.10
13102000  28 1 4            0.55
13102000  28 1 5            0.10
13102000  29 1               .75
13102000  29 2               .75
13102000  30 1              1.00       8.00     17.00         1      0.10      0.90
13102000  32 1    0          0.0        4.1       7.6      10.7      13.3      15.5
13102000  32 1    6         17.3       18.6      19.6      20.3      20.6      20.6
13102000  32 1   12         20.4       19.9      19.2      18.3      17.2      15.9
13102000  32 2    0          0.0        4.1       7.6      10.7      13.3      15.5
13102000  32 2    6         17.3       18.6      19.6      20.3      20.6      20.6
13102000  32 2   12         20.4       19.9      19.2      18.3      17.2      15.9
13102000  32 3    0          0.0        4.1       7.6      10.7      13.3      15.5
13102000  32 3    6         17.3       18.6      19.6      20.3      20.6      20.6
13102000  32 3   12         20.4       19.9      19.2      18.3      17.2      15.9
13102000  32 4    0          0.0        4.1       7.6      10.7      13.3      15.5
13102000  32 4    6         17.3       18.6      19.6      20.3      20.6      20.6
13102000  32 4   12         20.4       19.9      19.2      18.3      17.2      15.9
13102000  32 5    0          0.0        4.1       7.6      10.7      13.3      15.5
13102000  32 5    6         17.3       18.6      19.6      20.3      20.6      20.6
13102000  32 5   12         20.4       19.9      19.2      18.3      17.2      15.9
13102000  33 1    0            0        443      1777      3677      5884      8186
13102000  33 1    6        10415      12451     14215     15904     17492     19002
13102000  33 1   12        20461      21901     23341     24781     26221     27661
13102000  33 2    0            0        443       904      3254      5666      7967
13102000  33 2    6        10107      11878     13294     14492     15526     15526
13102000  33 3    0            0        443      1122      3624      6263      8753
13102000  33 3    6        11004      12732     14151     15360     16405     16405
13102000  33 4    0            0        443      1125      3904      7058      9840
13102000  33 4    6        11947      13650     15045     16245     17291     17291
13102000  33 5    0            0        443      1125      3920      5845      8711
13102000  33 5    6        11285      13547     15215     16509     17566     17566
13102000  34 5    3         1200
```

FILE MANAGE (cont.)

```
13102000  36 1          0.9189
13102000  36 2          0.9189
13102000  36 3          1.0000
13102000  36 3    0     0.9189    0.9189    0.9189    0.9189    0.9600
13102000  36 4          0.9600
13102000  36 4    0     0.9189    0.9189    0.9189    0.9189    0.9189    0.9189
13102000  36 4    6     0.9189
13102000  36 5          1.0000
13102000  36 5    0     0.9189    0.9189    0.9189    0.9189    0.9189    0.9900
13102000  37 1          1.209
13102000  37 2          1.209
13102000  37 3          1.209
13102000  37 4          1.209
13102000  37 5          1.209
** Western Hemlock
23202000  00       FI-W.HEMLOCK-MS
23202000   1           13202
23202000   2                     3
23202000   8               5               4
23202000  11           0.635
23202000  11    0      0.593     0.627     0.644     0.648     0.644     0.635
23202000  12    0      0.500     0.250     0.125     0.065     0.060     0.000
23202000  13    1          0        17     1.000
23202000  23           0.72      0.36      0.24      1.00      0.00      0.00
23202000  24            .00       .00      1.00      1.00
23202000  28 1 3       0.60
23202000  29 1          .75
23202000  29 2          .75
23202000  30 1          1.00      8.00     17.00         1      0.10      0.90
23202000  32 1    0      0.0       3.7       6.8       9.5      11.7      13.7
23202000  32 1    6     16.3      17.5      18.5      19.5      20.7      22.0
23202000  32 1   12     23.4      24.9      26.7      28.8      31.3      34.1
23202000  32 3    0      0.0       3.7       6.8       9.5      11.7      13.7
23202000  32 3    6     16.3      17.5      18.5      19.5      20.7      22.0
23202000  32 3   12     23.4      24.9      26.7      28.8      31.3      34.1
23202000  33 1    0        0       681      2313      4604      7747     10450
23202000  33 1    6    12785     14812     16583     18141     19523     20754
23202000  33 1   12    21851     22824     23672     24387     24952     25340
23202000  33 3    0        0       681      1441      4774      8805     12574
23202000  33 3    6    15896     18678     20803     22500     24042     24042
23202000  36 1          0.9467
23202000  36 3          1.0000
23202000  36 3    0     0.9467    0.9467    0.9467    0.9467
23202000  37 1          1.184
23202000  37 3          1.184
```

FILE MANAGE (cont.)

```
** Red Alder
13452000  00         FI-RED ALDER-MS
13452000   1              13452
13452000   2                                  7
13452000   8                  4
13452000  11              0.169
13452000  11       0      0.308      0.254      0.205      0.173      0.172      0.169
13452000  12       0      0.500      0.250      0.125      0.065      0.060      0.000
13452000  13       1          0         17      1.000
13452000  23              0.60       0.30       0.20       1.00       0.00       0.00
13452000  29 1            .50
13452000  29 2            .50
13452000  30 1           1.00       5.00      17.00          1       0.10       0.90
13452000  32 1     0      6.0       10.0       12.5       13.0       14.4       15.5
13452000  32 1     6     18.6       17.0       17.0       16.0       15.0       16.0
13452000  32 1    12     17.0       17.0       17.0       17.0       17.0       17.0
13452000  33 1     0        0       1680       3045       4729       6453       8048
13452000  33 1     6     9450      10727      11977      13227      14477      15727
13452000  33 1    12    16977      18227      19477      20727      21977      23227
13452000  36 1          0.3101
13452000  37 1           1.213
```

Card types 00, 01, 02,08, 11, and 12—These perform the same function they did in example 1. The number of entries for minimum harvest age (card type 08) has been increased to match the number of Mis. No card type 14 is present, so by default all area gain will be to MI-1 (the acres gained in age class 0 of MI-1 will be subject to Ml shifting according to card type 28).

Card type 13—*A* check of card type 11 indicates that area loss will occur. As entered here, card type 13 is distributing 1 00 percent of the area loss across all age classes. The acres removed from a specific age class will be based on the relative proportion of acres within that age class (across all Mis). (By default, area loss occurs across all MIs.) Card type 13 must be present for area loss to occur; if total acres on card type 11 decline and card type 13 is not present, the area loss will not take place.

Card type 23—As in example 1, the average stocking proportion is entered followed by the assignment of 100 percent of the regeneration to stocking level 1. This example includes an average stocking proportion for stocking levels 2 and 3, but they will not be used (there is no IU inventory in stocking levels 2 or 3, all regeneration goes to stocking level 1, and the lower stocking bounds are set to 0 on card type 24).

Card type 24—The stocking thresholds entered in data fields 1 and 2 are set to 0 (ensuring that all acres will remain in stocking level 1). The entries in data fields 3 through 6 are the average stocking proportions for Mis 2 through 5. This card type could have been omitted because the entries shown here are the default values.

Card type 28—-The number of entries for this card type reflect the multiple Ml shifts that will occur. There is no card type 07 present, so all shifts occur at regeneration (age class 0). The value entered in column 14 is the Ml to lose acres (for format details, see appendix B).

The value in column 16 is the MI to gain the acres. The value in data field 1 is the proportion of total acres in the donating MI to be shifted to the receiving MI (here the proportion applies to the acres in the zero age class of MI-1). These records are in the user-default format, so the same shift proportion will apply to each period of the simulation. Within each MU, the proportions removing acres from a specific MI must never sum to more than 1.00. (Shift errors sometimes occur in the PC version of ATLAS when exactly 100 percent of the acres are to shift out of a particular MI. If this happens, lower the shift so the sum is 0.9999 or less.) In example 2, 95 percent of acres regenerated in MI-1 of the Douglas-fir MU will shift to another MI (this will include newly regenerated acres and acres entering age class 0 via area gain).

Card type 29—Card type 29 controls the percentage of volume to be recovered as exogenous harvest when area loss occurs. There are two card type 29 entries. The first entry (flagged with a 1) is the percentage of softwood volume to recover, and the second record is for the percentage of hardwood volume to recover. Most acres carry both softwood and hardwood volume, as determined by card type 36. In the first two MUs, 75 percent of the softwood volume and 75 percent of the hardwood volume will be recovered from the acres removed as a result of downward trends in card type 11. The volume plus growth on area change will be counted toward the fulfillment of the harvest request entered in the file HARVEST. For the red alder MU, these ratios are both 50 percent.

Card type 30—In each MU, there is one relative-density-change record. Acres with softwood types moving into age classes 1 through 7 will be subject to the full stocking adjustment. For red alder, the full adjustment is in force up to age class 5. Softwoods forest types moving into the 8th through 17th age classes will get half of the full adjustment. The half adjustment begins in age class 5 for red alder. (Acres in the 17th age class will be subjected to half the full adjustment until harvested. Some growth will continue to occur in age class 17 just due to a change in stocking.)

Card type 32—The average diameters by age class are the same for each MI. When these inputs were developed, not enough data were available to make them differ by MI (that is, one might expect higher averages with genetically selected planting stock and fertilization).

Card type 33—The five yield tables demonstrate the results of alternative management on projected volume. The MI-5 yield table reflects the effects of a thinning in age class 3. For MIs 2 through 5 there was no need for an entry beyond age class 12 because, in a six-period projection, acres would not reach age 120 (to save space, the diameters in age classes 12 through 17 of card type 32 also could have been truncated).

Card type 34—This card is for the commercial thinning target volume (exogenous harvest). The actual removal will be the product of this volume and the average stocking proportion. In this case, the thin will take place in MI-5 as the acres move from age class 3 to age class 4 (average age of 40). Because the average stocking proportion for MI-5 is 100 percent, entry for card type 34 will be the volume per acre removed (after removal there will be growth on the thinning volume via card type 37). Compare the MI-4 and MI-5 yield tables to see the effect of the thinning on posttreatment volume for the residual acres.

Card type 36—The softwood proportions are also by MI. The entries here reflect the use of the user-default format for various age classes.

Card type 37—The growth-on-harvest proportions are by MI. These values were assumed to be the same for all Mis and for all age classes; the user-default format is used.

Harvest unit—The softwood and hardwood harvest units are combined in one HARVEST input file. The individual HUs are made up of card types H1 through H8. They share the same HU title, starting year, and request for output reports found at the top of the file in card types 01 through 05. During the simulation, each harvest unit is processed separately—there is no linkage. (Remember that the input files are processed together, and the program HUSCAN has access to all IUs and MUs and assigns them to the proper harvest unit.) The same simulation results would be obtained if the softwood and hardwood IU, MU, and HUs were separated and run independently. The implementation of MIs does not increase the size of the HU input. The HU card type H6 contains the user-defined labels for each MI; five of these records are required regardless of whether MIs are implemented.

```
** EXAMPLE 2 -  file: HARVEST
** Derived from RPA Simulation: Base 8-Extended.  Model: TAMM90/ATLAS.
01                  EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
02                        1980
**                        DUMP    IFDUMP    LSDUMP    SUMREP     HUREP     MUREP
03                           0         0         0         1         1         2
04 HU Reports         2030
05 MU Reports         1980
**
** PNWW FI OREGON/WASH HWD AND SWD SUBSET:
H001                Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock
H101                EXAMPLE 2         10         5      2.0      0.1      1.9
H201                  13102000
H201                  23202000
H301  3   0           2868.635  3986.800  4530.801  3731.747  3749.302  3253.326
H601  1              GROW / NORM YLDS
H601  2                  PLANT ONLY
H601  3               PLANT AND PCT
H601  4              FERT/GEN W/PCT
H601  5             MI4 + COMM THIN
H801  1                 DOUGLAS-FIR              1
H801  3                PURE HEMLOCK              1
H002                Harvest Unit #2 PNWW Forest Industry Red Alder
H102                EXAMPLE 2         10         5      2.0      0.1      1.9
H202                  13452000
H302  3   0            288.745   318.288   393.889    95.616    49.004    51.212
H602  1              GROW/NORM YLDS
H602  2                        N/A
H602  3                        N/A
H602  4                        N/A
H602  5                        N/A
H802  7                  RED ALDER              2
```

***Card types 01, 02, 03, 04, and 05*—**These card types are described in example 1. They are virtually the same as example 1 except here an HU report is chosen (HUREP) and a more detailed MU report is chosen (level 2). The same simulation components are reported at both levels 1 and 2, but the level 2 report lists the components for each individual MI.

***Card types HO, H1, H2, H3, H6, and H8*—**Because these card types are described in detail for example 1, the description here will be general. The card types are repeated for each of the example 2 HUs. The last two digits (the 01 and 02 in columns three and four) identify the HU by number. Up to 32 HUs can be stacked in this fashion. Card types HO and H1

contain titles and simulation parameters. Card type H2 contains the MU(s) assigned to the harvest unit. Card type H3 is the periodic endogenous harvest request, in million cubic feet (remember, any unit of measure is valid as long as it is consistent with the IU inventory and the MU yield table). Card type H6 reflects the titles chosen to reflect the MIs. And card type H8 contains the names associated with the MU forest types (referenced by MU card type 02).

Example 2 Output Files

The second example is more complex than the first. To save space, fewer output files are presented. With the addition of two MUs and corresponding IUs, the files LIST.IU and LIST.MU will be about three times as large as those in the previous example.

Presented are LIST.HU and TREE from HUSCAN, ATLOG, ATLIST, ATHUR, ATMUR, ATACRE, ATINV, and ATTMU from ATLAS. The LIST.HU file has been expanded by the additional inventory cells in the input file. It might be useful for users to run this example simulation and print the IU and MU list files. It is important to become familiar with the type of information found there.

The HARVEST file has an HU for softwoods and one for hardwoods. In each case, the combined fiber type (both softwood and hardwood) was requested on HU card H3. The harvest values are derived from the RPA timber assessment base simulation (Haynes 1990). In that simulation, the softwood and hardwood harvests were balanced (reduced) by expected "come-along" volume. In other words, the softwood volume harvested from the red alder MU reduced the softwood harvest request from the Douglas-fir and hemlock MUs (and vice-versa).

There are warning messages in file ATLOG. In period 3, the harvest request in the softwood HU was about 3,000 cubic feet more than the volume available. Both the available and requested volume are reported. The request has been reduced by the exogenous volume that came from commercial thinning. This 3,000-cubic-foot deficit also can be seen in the ATLIST report as -0.003 (under Thinning and Final Harvest on the far right in the column titled Com Dif.). See appendix C for interpreting the output files.

```
     P C - H U   S C A N    12/ 3/1990 11: 7:45          PAGE   1

RECORD CT**N***************____*****____*****____*****____*****_____*****____*****

     1  ** EXAMPLE 2 -- file: HARVEST
     2  ** Derived from RPA Simulation: Base 8-Extended.  Model: TAMM90/ATLAS.
     3  01                 EXAMPLE 2 Simulation • PC-ATLAS Base Run 8-Extended Harvest.
     4  02                       1980
     5  **                       DUMP     IFDUMP     LSDUMP     SUMREP      HUREP      MUREP
     6  03                          0          0          0           1          1          2
     7  04 HU Reports          2030
     8  05 MU Reports          1980
(0 10 RECORDS READ FOR GENERAL RUN INFORMATION
     5 COMMENT RECORDS (NOT PROCESSED)
     5 ACTIVE RECORDS


 INFORMATION PAST COLUMN 80 IS NOT PROCESSED

 DEFAULT VALUES USED FOR GENERAL CARD TYPE 06
```

Example 2. File-LIST.HU

HARVEST HEADER REPORT

CARD TYPE

01 RUN TITLE: EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.

02 STARTING YEAR OF SIMULATION 1980

03 DIAGNOSTIC OUTPUT OVERRIDE 0
FIRST AND LAST OUTPUT PERIODS 0 0
REPORT REQUESTS SUM, HU, MU 1 1 2

	REPORT YEARS	1	2	3	4	5	6	7	8	9	10	11	12
04	HU	2030	0	0	0	0	0	0	0	0	0	0	0
05	MU	1980	0	0	0	0	0	0	0	0	0	0	0

06 ALTERNATE VOLUME MEASURE LABEL: NO ALTER. UNIT
MINIMUM DIAMETER FOR CONVERSION TO OTHER VOLUME .00

07 INITIAL SOFTWOOD FRACTIONS OF HARVEST

REGIONS	1	2	3	4	5	6	7	8
IOF 1	.000	.000	.000	.000	.000	.000	.000	.000
IOF 2	.000	.000	.000	.000	.000	.000	.000	.000
IOF 3	.000	.000	.000	.000	.000	.000	.000	.000
IOF 4	.000	.000	.000	.000	.000	.000	.000	.000

0 Error(s) in General Card Types 01 to 06

```
     P C - H U   S C A N    12/ 3/1990 11: 7:45            PAGE   3

RECORD CT*A**|*AOP*********_____*****_____*****_____*****_____*****.....*****.....*****

    9  **
   10  ** PNWW FI OREGON / WASH HWD AND SWD SUBSET
   11  H001               Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock
   12  H101               EXAMPLE 2        10        5      2.0      0.1      1.9
   13  H201                 13102000
   14  H201                 23202000
   15  H301  3   D          2868.635  3986.800  4530.801  3731.747  3749.302  3253.326
   16  H601  1              GROW/NORM YLDS
   17  H601  2                 PLANT ONLY
   18  H601  3              PLANT AND PCT
   19  H601  4              FERT/GEN U/PCT
   20  H601  5              MI4 + COMM THIN
   21  H801  1                 DOUGLAS-FIR             1
   22  H801  3                 PURE HEMLOCK            1
(0 12 RECORDS READ FOR HU NUMBER 01
    0 COMMENT RECORDS (NOT PROCESSED)
   12 ACTIVE RECORDS

 INFORMATION PAST COLUMN 80 IS NOT PROCESSED
```

Example 2. File-LIST.HU

SIMULATION SETUP FOR EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
HU 1 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock

CARD TYPE

H1 HU LABEL EXAMPLE 2
PERIOD LENGTH IN YEARS 10
SIMULATION LENGTH IN PERIODS 5
MAXIMUM STOCKING PERMITTED 2.0000
EXPECTED STOCKING RANGE .1000 1.9000

H2 MUS WITHIN THIS HU

13102000 23202000

H3 COMBINED FINAL HARVEST REQUEST FOR THIS HU

PD	0	1	2	3	4	5
VOL	2868.6	3986.8	4530.8	3731.7	3749.3	3253.3

H4 COMBINED PARTIAL CUTTING REQUEST FOR THIS HU

PD	0	1	2	3	4	5
VOL						

H6 MANAGEMENT INTENSIFICATION LABELS

MI	LABEL
1	GROW/NORM YLDS
2	PLANT ONLY
3	PLANT AND PCT
4	FERT/GEN W/PCT
5	MI4 + COMM THIN

H8 SPECIES LABEL AND REPORT GROUP

SPECIES	REPORT GROUP	LABEL
1	SOFTWOOD	DOUGLAS-FIR
3	SOFTWOOD	PURE HEMLOCK

No errors in HU Card Types H1 to H8

Example 2. File--LIST.HU

MU- 13102000-

Example 2. File--LIST.HU

Note: This page reflects what the user will find in the file or receive from the printer.

INVENTIORY REPORT FOR MUt 13102000 FI-DOUG-FIR--MS

UNSTOCKED ACRES	TOTAL MANAGED ACRES	TOTAL MANAGED VOLUME	CROSS CHECK ACRES
0.	1508547.	4446749.	1508547.

AC	HI 1 TOTAL ACRES	CF/A	MCF	MI 2 ACRES	CF/A	MCF
0	15089.	49.	739.4	60355.	49.	2957.4
1	33311.	256.	8514.3	22208.	256.	5676.4
2	53333.	1825.	97343.4	21333.	904.	19285.0
3	136599.	3191.	435860.1	13660.	2863.	39104.5
4	197271.	5138.	1013618.0			
5	84312.	5307.	447401.6			
6	48068.	6993.	336125.1			
7	21413.	10229.	219037.9			
8	22573.	12198.	275354.5			
9	8316.	11562.	96149.6			
10	8574.	3283.	28148.4			
12	17384.	12210.	212250.0			
15	40733.	7188.	292797.0			
TOTAL	686976.		3463339.0	117556.		67023.3

AC	Ml 1 SL 1 ACRES	CF/A	MCF	MI 1 SL 2 ACRES	CF/A	MCF	MI 1 SL 3 ACRES	CF/A	MCF
0	15089.	49.	739.4						
1	33311.	256.	8514.3						
2	53333.	1825.	97343.4						
3	136599.	3191.	435860.1						
4	197271.	5138.	1013618.0						
5	84312.	5307.	447401.6						
6	48068.	6993.	336125.1						
7	21413.	10229.	219037.9						
8	22573.	12198.	275354.5						
9	8316.	11562.	96149.6						
10	8574.	3283.	28148.4						
12	17384.	12210.	212250.0						
15	40733.	7188.	292797.0						
TOTAL	686976.		3463339.0						

AC	MI 3 ACRES	CF/A	MCF	MI 4 ACRES	CF/A	MCF	MI 5 ACRES	CF/A	MCF
0	30177.	49.	1478.7	165976.	49.	8132.8	30177.	49.	1478.7
1	44415.	256.	11352.5	99934.	256.	25543.1	22208.	256.	5676.4
2	42667.	1125.	48000.4	74667.	1122.	83776.4	21333.	1125.	23999.6
3	54640.	3188.	174203.3	54640.	3435.	187661.1	13660.	3435.	46915.3
4				23208.	6239.	144794.7	11604.	4196.	48691.5
5				9368.	6525.	61128.1			
6				5341.	8155.	43553.7			

Example 2. FIle-LIST.HU

TOTAL	171899.	235034.8	433134.	554589.9	98982.	126761.5

Example 2. File-LIST.HU

Note: This page reflects what the user will find in the file or receive from the printer.

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STOCKING RATIO REPORT FOR MU 13102000 FI-DOUG-FIR--MS

AC	MI1 SL1	MI1 SL2	MI1 SL3	MI1 ALL	MI2	MI3	MI4	MI5
	ER SRATIO	ER SRATIO	ER SRATIO	ER SRATIO	ER SRATIO	ER SRATIO	ER SRATIO	ER SRATIO
0	.760			.760	1.000	1.000	1.000	1.000
1	.577			.577	.577	.577	.577	.577
2	1.027			1.027	1.000	1.003	.997	1.000
3	.868			.868	.880	.880	.880	.876
4	.873			.873			.884	.718
5	.648			.648			.663	
6	.671			.671			.683	
7	.822			.822				
8	.858			.858				
9	.727			.727				
10	.188			.188				
11								
12	.597			.597				
13								
14								
15	.290			.290				
16								
17								

MU- 23202000-

Example 2. File-LIST.HU

PC - HU SCAN 12/ 3/1990 11: 7:45 PAGE 8

INVENTORY REPORT FOR HU 23202000 FI-W.HEMLOCK-MS

UNSTOCKED ACRES	TOTAL MANAGED ACRES	TOTAL MANAGED VOLUME	CROSS CHECK ACRES
0.	585584.	2113417.	585584.

AC	MI 1 TOTAL ACRES	CF/A	MCF	MI 2 ACRES	CF/A	MCF
0	49877.	400.	19950.8			
1	34602.	758.	26214.5			
2	37024.	2606.	96491.9			
3	60080.	4915.	295311.2			
4	76243.	4581.	349276.8			
5	52382.	6988.	366050.7			
6	15419.	10432.	160843.3			
7	24675.	9601.	236909.6			
14	4968.	9802.	48696.3			
15	13245.	11898.	157593.0			
17	9068.	10574.	95885.0			
TOTAL	377583.		1853223.0			

AC	MI 1 SL 1 ACRES	CF/A	MCF	MI 1 SL 2 ACRES	CF/A	MCF	MI 1 SL 3 ACRES	CF/A	MCF
0	49877.	400.	19950.8						
1	34602.	758.	26214.5						
2	37024.	2606.	96491.9						
3	60080.	4915.	295311.2						
4	76243.	4581.	349276.8						
5	52382.	6988.	366050.7						
6	15419.	10432.	160843.3						
7	24675.	9601.	236909.6						
14	4968.	9802.	48696.3						
15	13245.	11898.	157593.0						
17	9068.	10574.	95885.0						
TOTAL	377583.		1853223.0						

AC	MI 3 ACRES	CF/A	MCF	MI 4 ACRES	CF/A	MCF	MI 5 ACRES	CF/A	MCF
0	74815.	400.	29926.0						
1	51902.	583.	30279.6						
2	55535.	1200.	66642.0						
3	25749.	5179.	133346.4						
TOTAL	208001.		260194.0						

Example 2. File-LIST.HU

STOCKING RATIO REPORT FOR MU 23202000 FI-U.HEMLOCK-MS

AC	MI1 SL1 ER	SRATIO	MI1 SL2 ER	SRATIO	MI1 SL3 ER	SRATIO	MI1 ALL ER	SRATIO	MI2 ER	SRATIO	MI3 ER	SRATIO	MI4 ER	SRATIO	MI5 ER	SRATIO
0		.720						.720				1.000				
1		1.112						1.112				.857				
2		1.127						1.127				.833				
3		1.068						1.068				1.085				
4		.591						.591								
5		.669						.669								
6		.816						.816								
7		.648						.648								
8																
9																
10																
11																
12																
13																
14		.414						.414								
15		.488						.488								
16																
17		.417						.417								

No errors found combining IUs and MUs

Example 2. File~LIST.HU

```
     P C - H U   S C A N    12/ 3/199CI 11: 7:45            PAGE  10

RECORD CT*A**I*AOP*********----******-----******..__.*****.....*****....._*****.------******

   23  H002                Harvest Unit #2 PNUW Forest  Industry Red Alder
   24  H102                EXAMPLE 2          10          5       2.0       0.1       1.9
   25  H202                  13452000
   26  H302  3   0            288.745   318.288   393.889    95.616    49.004    51.212
   27  H602  1               GROW/NORM YLDS
   28  H602  2                        N/A
   29  H602  3                        N/A
   30  H602  4                        N/A
   31  H602  5                        N/A
   32  H802  7                    RED ALDER              2
0   10 RECORDS READ FOR HU NUMBER 02
     0 COMMENT RECORDS (NOT PROCESSED)
    10 ACTIVE RECORDS


 INFORMATION PAST COLUMN 80 IS NOT PROCESSED
```

Example 2. File-LIST.HU

SIMULATION SETUP FOR EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
HU 2 Harvest Unit #2 PNWW Forest Industry **Red** Alder

CARD TYPE

H1 HU LABEL EXAMPLE 2
PERIOD LENGTH IN YEARS 10
SIMULATION LENGTH IN PERIODS 5
MAXIMUM STOCKING PERMITTED 2.0000

EXPECTED STOCKING RANGE .1000 1.9000

H2 MUS WITHIN THIS HU

13452000

H3 COMBINED FINAL HARVEST REQUEST FOR THIS HU

PD	0	1	2	3	4	5
VOL	288.7	318.3	393..9	95.6	49.0	51.2

H4 COMBINED PARTIAL CUTTING REQUEST FOR THIS HU

PD	0	1	2	3	4	5
VOL						

H6 MANAGEMENT INTENSIFICATION LABELS

MI	LABEL
1	GROW/NORM YLDS
2	N/A
3	N/A
4	N/A
5	N/A

H8 SPECIES LABEL AND REPORT GROUP

SPECIES	REPORT GROUP	LABEL
7	HARDWOOD	RED ALDER

No errors in HU Card Types H1 to H8

MU- 13452000-

Example2. File-LIST.HU

Note: This page reflects what the user will find in the file or receive from the printer.

INVENTORY REPORT FOR MU 13452000 FI-RED ALDER-MS

UNSTOCKED ACRES	TOTAL MANAGED ACRES	TOTAL MANAGED VOLUME	CROSS CHECK ACRES
0.	325235.	1068540.	325235.

AC	HI 1 TOTAL ACRES	HI 1 TOTAL CF/A	HI 1 TOTAL MCF	MI 2 ACRES	MI 2 CF/A	MI 2 MCF
0	16778.	1541.	25849.9			
1	16918.	538.	9093.4			
2	91121.	2569.	234099.0			
3	58522.	2590.	151566.1			
4	86759.	4251.	368838.5			
5	30040.	6252.	187810.1			
6	6197.	1781.	11036.9			
7	14069.	3753.	52801.0			
9	4831.	5681.	27444.9			
TOTAL	325235.		1068540.0			

AC	MI 1 SL. 1 ACRES	MI 1 SL. 1 CF/A	MI 1 SL. 1 MCF	MI 1 SL 2 ACRES	MI 1 SL 2 CF/A	MI 1 SL 2 MCF	MI 1 SL 3 ACRES	MI 1 SL 3 CF/A	MI 1 SL 3 MCF
0	16778.	1541.	25849.9						
1	16918.	538.	9093.4						
2	91121.	2569.	234099.0						
3	58522.	2590.	151566.1						
4	86759.	4251.	368838.5						
5	30040.	6252.	187810.1						
6	6197.	1781.	11036.9						
7	14069.	3753.	52801.0						
9	4831.	5681.	27444.9						
TOTAL	325235.		1068540.0						

Example 2. File-LIST.HU

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STOCKING RATIO REPORT FOR MU 13452000 FI-RED ALDER-MS

AC	MI 1 SL1 ER	SRATIO	MI 1 SL2 ER	SRATIO	MI 1 SL3 ER	SRATIO	MI 1 ALL ER	SRATIO	MI2 ER	SRATIO	MI3 ER	SRATIO	MI4 ER	SRATIO	MI5 ER	SRATIO
0		.600						.600								
1		.320						.320								
2		.844						.844								
3		.548						.548								
4		.659						.659								
5		.777						.777								
6		.188						.188								
7		.350						.350								
8																
9		.430						.430								
10																
11																
12																
13																
14																
15																
16																
17																

No errors found combining IUs and MUs

No errors found.

Example 2. FILE~LIST.HU

ATLAS TREE FOR
EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
12/ 3/1990 11: 7:45

HARVEST UNIT EXAMPLE 2 CONTAINS

MANAGEMENT UNIT FI-DOUG-FIR--MS				
IU 13102	.000 UNS M AC	1508.547 REG M AC	4446.749000 VOL MMCF	
TOTAL MU	.000 UNS M AC	1508.547 REG M AC	4446.748000 VOL MMCF	
MANAGEMENT UNIT FI-W.HEMLOCK-MS				
IU 13202	.000 UNS M AC	585.584 REG M AC	2113.417000 VOL MMCF	
TOTAL MU	.000 UNS M AC	585.584 REG M AC	2113.417000 VOL MMCF	
TOTAL HU	.000 UNS M AC	2094.131 REG M AC	6560.166000 VOL MMCF	

HARVEST UNIT EXAMPLE 2 CONTAINS

MANAGEMENT UNIT FI-RED ALDER-MS				
IU 13452	.000 UNS M AC	325.235 REG M AC	1068.540000 VOL MMCF	
TOTAL MU	.000 UNS M AC	325.235 REG M AC	1068.540000 VOL MMCF	
TOTAL HU	.000 UNS M AC	325.235 REG M AC	1068.540000 VOL MMCF	

```
   P C - A T L A S     EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest,
   Run on  1/29/1991   at 13:13:27

Period  0
     HU  1 EXAMPLE 2    Reports 0  1
    Harvest Unit #1 PNW Forest  Industry  Douglas-fir/Hemlock
     HU  2 EXAMPLE 2    Reports 0  1
    Harvest Unit #2 PNW Forest Industry Red Alder

Period  1
     HU  1 EXAMPLE 2    Reports 0   0
    Harvest Unit #1 PNWW Forest Industry DougIas-fir/Hemlock
     HU  2 EXAMPLE 2    Reports 0   0
    Harvest Unit #2 PNWW Forest Industry Red Alder

Period  2
     HU  1 EXAMPLE 2    Reports 0   0
    Harvest Unit #1 PNWW Forest Industry DougIas-fir/Hemlock
     HU  2 EXAMPLE 2    Reports 0   0
    Harvest Unit #2 PNWW Forest Industry Red Alder

Period  3
     HU  1 EXAMPLE 2    Reports 0   0
    Harvest Unit #1 PNWW Forest  Industry DougIas-fir/Hemlock
Warning Error in APPORT  during period  3  year 2010  for HU  1 EXAMPLE 2   final  harvest
Avail         3687.963     Req        3687.966     Exog          43.781
Total         3731.747     Prop       1.000
Uarning Error in APPORT  during period  3  year 2010  for HU  1 EXAMPLE 2       HU    13102000 FI-DOUG-FIR--MS
Insufficient volume        2379.639  for harvest  request        2379.642
Uarning Error in APPORT  during period  3  year 2010  for HU  1 EXAMPLE 2       HU    23202000 FI-U.HEMLOCK-MS
Insufficient volume        1308.323  for harvest  request        1308.325
     HU  2 EXAMPLE 2    Reports 0   0
    Harvest Unit #2 PNWW Forest  Industry Red Alder

Period  4
     HU  1 EXAMPLE 2    Reports 0   0
    Harvest Unit #1 PNWW Forest  Industry  DougIas-fir/Hemlock
     HU  2 EXAMPLE 2    Reports 0   0
    Harvest Unit #2 PNWW Forest  Industry Red Alder

Period  5
     HU  1 EXAMPLE 2    Reports 1   0
    Harvest Unit #1 PNWW Forest  Industry  DougIas-fir/Hemlock
     HU  2 EXAMPLE 2    Reports 1   0
    Harvest Unit #2 PNWW Forest  Industry Red Alder

Normal exit from PC-ATLAS
```

Example 2. File-ATLOG

PC - A T L A S **EXAMPLE** 2 Simulation - PC-**ATLAS Base Run 8-Extended Harvest.**
Run on 12/ **3/1990 11: 7:49** Using RAF from **12/ 3/1990 11: 7:45**

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1**I PNWW Forest Industry Douglas-fir/Hemlock**

Inventory at start of period. Area Loss, ancI Volume Recovered from area loss.

Pd	Year	Acres	SW Inv	HWInv	Com Inv	AvD Inv	Acres	SW Loss	HW Loss	Com Loss	SW IRec	HW Rec	Com Rec
0	1980	2.094	6086.889	473.276	6560.166	8.636	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	1990	2.148	6670.172	486.411	7156. 584	8.659	0.000	0.000	0.000	0.000	0.000	0.000	-0.000
2	2000	2.338	6440.310	402. 892	6843.202	7.437	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	2010	2.457	5846.601	383. 450	6230.051	6.991	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	2020	2.504	5957.134	414. 416	6371. 550	7.182	0.017	48.058	3.418	51.476	36.044	2.563	38.607
5	2030	2.487	6283.793	461. 440	6745.232	7.568	0.036	108.989	8.071	117.060	81. 742	6.053	87.795
6	2040	2.451	7519.079	527. 037	8046.115	8.267							

Thinning and Final Harvest.

Pd	Year	Acres	SW Thin	HW Thin	Com Thin	Acres	SW FH	HW FH	Com FH	AvD FH	Com Req	Com Dif
0	1980	0.014	18.211	1.607	19.818	0.268	2643.222	205.595	2848.817	19.163	2868.635	0.000
1	1990	0.021	28.440	2.510	30.950	0.450	3675.215	280.635	3955.850	15.447	3986.800	0.000
2	2000	0.022	29.606	2.613	32.219	0.455	4260.273	238.308	4498.582	14.486	4530.801	0.000
3	2010	0.030	40.230	3.551	43.781	0.422	3497.096	190.866	3687.963	13.898	3731. 747	-0.003
4	2020	0.020	27.295	2.409	29.704	0.415	3468.450	212.541	3680.991	13.459	3749.302	0.000
5	2030	0.047	63.155	5.574	68.729	0.342	2899.871	196.931	3096.802	13.912	3253.326	0.000

Partial Cutting and Total Harvest.

Pd	Year	Acres	SW PC	HW PC	Cont PC	AvD PC	Com Req	Com Dif	SW Har	HWHar	Com Har
0	1980	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2661.433	207.202	2868.635
1	1990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3703.655	283.145	3986.800
2	2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4289.880	240.921	4530.801
3	2010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3537.327	194.417	3731.744
4	2020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3531.789	217.513	3749.302
5	2030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3044.768	208.558	3253.326

Growth, **Area Gain,** and Gain Adjusted for growth.

Pd	Year	SU Gro	HW Gro	Com Gro	Acres	SW Gain	HW Gain	Com Gain	SW Adj	HWAdj	Com Adj
0	1980	3219.257	218.228	3437.485	0,.054	36.190	2.996	39.186	25.460	2,.109	27,.569
1	1990	3382,.981	192.245	3575..226	0,.190	129.119	10.490	139.609	90.810	7,.380	98,.191
2	2000	3639..849	216.826	3856..675	0,.119	80.062	6.613	86.675	56.322	4,.654	60..976
3	2010	3625..965	223.525	3849..490	0,.047	31.111	2.639	33.750	21.895	1,.858	23..753
4	2020	3870..353	265.382	4135..735	0,.000	0.000	0.000	0.000	0.000	0.000	0.000
5	2030	4306..771	276.126	4582.896	0..000	0.000	0.000	0.000	0.000	0.000	0.000

Inventory at end of period, Jnstocked and Regeneration Acres, and BF/CF Ratios for Inventory and Harvest.

Pd	Year	Acres	SW Inv	HWInv	Com Inv	AvD Inv	Un End	Un Sta	Regen	Reg Ad	Inv Rat	Har Rat
0	1980	2.148	6670.172	486.411	7156.584	8.659	0.000	0.000	0.295	0.268	0.000	0.000
1	1990	2.338	6440.310	402.892	6843.202	7.437	0.000	0.000	0.545	0.450	0.000	0.000
2	2000	2.457	5846.601	383.450	6230.051	6.991	0.000	0.000	0.515	0.455	0.000	0.000
3	2010	2.504	5957.134	414.416	6371.550	7.182	0.000	0.000	0.445	0.422	0.000	0.000
4	2020	2.487	6283.793	461.440	6745.232	7.568	0.000	0.000	0.415	0.415	0.000	0.000
5	2030	2.451	7519.079	527.037	8046.115	8.267	0.000	0.000	0.342	0.342	0.000	0.000

Inventory Identity.

Pd	Year	Acres	SW Inv	HWInv	Com Inv	Acres	SU Dif	HU Dif	Con Dif	SU Gro	HU Gro	Com Gro
0	1980	2.148	6670.173	486.411	7156.584	0.000	-0.001	0.000	0.000	2763.577	182.373	2945.951
1	1990	2.338	6440.309	402.892	6843.201	0.000	0.001	0.000	0.001	2722.082	141.158	2863.240
2	2000	2.457	5846.601	383.450	6230.051	0.000	0.000	0.000	0.000	2899.216	173.952	3073.168
3	2010	2.504	5957.134	414.416	6371.550	0.000	0.000	0.000	0.000	3027.613	189.623,	3217.235
4	2020	2.487	6283.683	461.430	6745.114	0.000	0.109	0.010	0.118	3279.851	2281.114	3507.965
5	2030	2.451	7518.548	526.990	8045.538	0.000	0.530	0.047	0.577	3793.430	24GI.333	4033.764

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock

Available Softwood Final Harvest Volume.

Pd	Year	1	2	3	
0	1980	2450.125	0.000	1194.847	3644.972
1	1990	3333.205	0.000	1275.172	4608.376
2	2000	3248.158	0.000	1620.927	4869.084
3	2010	2216.698	0.000	1280.399	3497.097
4	2020	2223.419	0.000	1245.032	3468.451
5	2030	2135.888	0.000	1045.731	3181.620

Available Hardwood Final Harvest Volume.

Pd	Year	1	2	3	
0	1980	216.242	0.000	67.271	283.513
1	1990	270.623	0.000	55.527	326.150
2	2000	226.150	0.000	42.010	268.161
3	2010	162.942	0.000	27.925	190.866
4	2020	186.085	0.000	26.455	212.541
5	2030	181.676	0.000	30.735	212.411

Forest (Species) Type.

1	DOUGLAS-FIR
2	NO SPECIES 2
3	PURE HEMLOCK

Example 2. File-ATLIST

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11:: 7:49 Using RAF from 12/ 3/1990 11 : 7:45

Harvest Unit 2 **EXAMPLE 2** Harvest Unit *Mi!* PNUU Forest Industry Red Alder

Inventory at start of period. Area Loss, and Volume Recovered from area loss.

Pd	Year	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	Acres	SW Loss	HW Loss	iCom Loss	SW Rec	HW Rec	Com Rec
0	1980	0.325	331.354	737. 186	1068.540	13.271	0.017	21.299	47.386	68.686	10.650	23.693	34. 343
1	1990	0.308	347.905	774. 008	1121.913	12.908	0.054	73.989	164.607	238.596	36.994	82.304	119. 298
2	2000	0.254	325.199	723. 491	1048.690	13.706	0.049	76.098	169.300	245.398	38.049	84.650	122. 699
3	2010	0.205	257.709	573. 341	831.050	13.354	0.032	48.796	108.560	157.356	24.398	54.280	78. 678
4	2020	0.173	275.404	612. 709	888.113	14.938	0.001	1.931	4.296	6.227	0.966	2.148	3.114
5	2030	0.172	322.889	718. 352	1041.240	15.109	0.003	6.831	15.198	22.030	3.416	7.599	11. 015
6	2040	0.169	369.446	821. 931	1191.377	15.299							

.Thinning and Final Harvest.

Pd	Year	Acres	SW Thin	HW Thin	Com Thin	Acres	SW FH	HW FH	Com FH	AvD FH	Com Req	Com Dif
0	1980	0.000	0.000	0.000	0.000	0.043	78.890	175.512	254.402	16.431	288.745	0.000
1	1990	0.000	0.000	0.000	0.000	0.027	61.707	137.283	198.990	16.326	318.288	0.000
2	2000	0.000	0.000	0.000	0.000	0.033	84.096	187.094	271.190	18.600	393.889	0.000
3	2010	0.000	0.000	0.000	0.000	0.002	5.252	11.685	16.938	17.000	95.616	0.000
4	2020	0.000	0.000	0.000	0.000	0.005	14.231	31.660	45.890	17.000	49.004	0.000
5	2030	0.000	0.000	0.000	0.000	0.004	12.465	27.732	40.197	17.000	51.212	0.000

Partial Cutting and Total Harvest.

Pd	Year	Acres	SW PC	HW PC	Com PC	AvD PC	Com Req	Com Dif	SW Har	HW Har	Com Har
0	1980	0.000	0.000	0.000	0.000	0.000	0.000	0.000	89.540	199.205	288.745
1	1990	0.000	0.000	0.000	0.000	0.000	0.000	0.000	98.701	219.587	318.288
2	2000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	122.145	271.744	393.889
3	2010	0.000	0.000	0.000	0.000	0.000	0.000	0.000	29.651	65.965	95.616
4	2020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15.196	33.808	49.004
5	2030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	15.881	35.331	51.212

Growth, Area Gain, and Gain Adjusted for growth.

Pd	Year	SW Gro	HW Gro	Com Gro	Acres	SW Gain	HW Gain	Com Gain	SW Adj	HW Adj	Com Adj
0	1980	116.741	259.721	376.461	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	1990	112.989	251.374	364.362	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2	2000	92.704	206.244	298.948	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	2010	71.744	159.613	231 .357	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4	2020	63.646	141.599	205.245	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5	2030	65.854	146.510	212.364	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Inventory at end of period, Unstocked and Regeneration Acres, and BF/CF Ratios for Inventory and Harvest.

Pd	Year	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	Un End	Un Sta	Regen	Reg Ad	Inv Rat	Har Rat
0	1980	0.308	347.905	774.008	1121.913	12.908	0.000	0.000	0.043	0.043	0.000	0.000
1	1990	0.254	325.199	723.491	1048.690	13.706	0.000	0.000	0.027	0.027	0.000	0.000
2	2000	0.205	257.709	573.341	831.050	13.354	0.000	0.000	0.033	0.033	0.000	0.000
3	2010	0.173	275.404	612.709	888.113	14.938	0.000	0.000	0.002	0.002	0.000	0.000
4	2020	0.172	322.889	718.352	1041.240	15.109	0.000	0.000	0.005	0.005	0.000	0.000
5	2030	0.169	369.446	821 .931	1191.377	15.299	0.000	0.000	0.004	0.004	0.000	0.000

Inventory Identity.

Pd	Year	Acres	SW Inv	HW Inv	Com Inv	Acres	SW Dif	HW Dif	Com Dif	SW Gro	HW Gro	Com Gro
0	1980	0.308	347.905	774.008	1121.913	0.000	0.000	0.000	0.000	99.148	220.580	319.728
1	1990	0.254	325.199	723.491	1048.690	0.000	0.000	0.000	0.000	89.161	198.362	287.523
2	2000	0.205	257.709	573.341	831.050	0.000	0.000	0.000	0.000	64.574	143.662	208.236
3	2010	0.173	275.404	612.709	888.113	0.000	0.000	0.000	0.000	62.253	138.498	200.751
4	2020	0.172	322.889	718.352	1041.240	0.000	0.000	0.000	0.000	60.809	135.285	196.093
5	2030	0.169	369.446	821 .931	1191.378	0.000	0.000	0.000	0.000	62.466	138.971	201.437

Example 2. File-ATLIST

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base **Run 8- Extended Harvest.**
Run on 12/ **3/1990 11**: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 2 EXAMPLE 2 Harvest Unit #2 PNWW Forest Industry Red Alder

Available Softwood Final Harvest Volume.

Pd	Year	1	2	3	4	5	6	7	
0	1980	0.000	0.000	0.000	0.000	0.000	0.000	230.805	230.805
1	1990	0.000	0.000	0.000	0.000	0.000	0.000	228.070	228.070
2	2000	0.000	0.000	0.000	0.000	0.000	0.000	289.954	289.954
3	2010	0.000	0.000	0.000	0.000	0.000	0.000	226.208	226.208
4	2020	0.000	0.000	0.000	0.000	0.000	0.000	276.040	276.040
5	2030	0.000	0.000	0.000	0.000	0.000	0.000	340.160	340.160

Available Hardwood Final Harvest Volume.

Pd	Year	1	2	3	4	5	6	7	
0	1980	0.000	0.000	0.000	0.000	0.000	0.000	513.487	513.487
1	1990	0.000	0.000	0.000	0.000	0.000	0.000	507.401	507.401
2	2000	0.000	0.000	0.000	0.000	0.000	0.000	645.080	645.080
3	2010	0.000	0.000	0.000	0.000	0.000	0.000	503.259	503.259
4	2020	0.000	0.000	0.000	0.000	0.000	0.000	614.124	614.124
5	2030	0.000	0.000	0.000	0.000	0.000	0.000	756.777	756.777

Forest (Species) Type.

1	NO SPECIES	1
2	NO SPECIES	2
3	NO SPECIES	3
4	NO SPECIES	4
5	NO SPECIES	5
6	NO SPECIES	6
7	RED ALDER	

Example 2. File - ATLIST

P C - A T L A S EXAMPLE 2 Simulation • PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 ENWW Forest Industry Douglas-fir/Hemlock
Period 5 Year 2030 Total over Management Intensities

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.415	0.000	0.000	0.000		0.000	0.000	0.000
1	0.442	204.515	15.753	220.268		190.686	14.610	205.296
2	0.523	586.015	45.958	631.973		287.217	22.456	309.673
3	0.577	2048.340	162.358	2210.697		1304.781	103.882	1408.663
4	0.358	2193.562	141.872	2335.435		1873.776	90.289	1964.065
5	0.172	1251.361	95.499	1346.859		650.311	44.889	695.199
6	0.000	0.000	0.000	0.000		0.000	0.000	0.000
7	0.000	0.000	0.000	0.000		0.000	0.000	0.000
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	2.487	6283.793	461.440	6745.232	7.568	4306.771	276.126	4582.896
Unst	0.000							
Total	2.487							

	Harvest during period						Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SU Net	HU Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		-0.006	0.000	0.000	0.000
1	0.000	2.654	0.206	2.860	0.000		-0.006	-0.885	-0.069	-0.953
2	0.000	7.627	0.602	8.229	0.000		-0.008	-2.542	-0.201	-2.743
3	0.000	89.861	7.702	97.563	0.000		-0.008	-8.902	-0.709	-9.612
4	0.172	1448.826	85.663	1534.490	0.485		-0.005	-9.514	-0.624	-10.138
5	0.169	1495.800	114.385	1610.185	0.515		-0.002	-5.405	-0.415	-5.820
6	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.342	3044.768	208.558	3253.326	1.000	13.912	-0.036	-27.247	-2.018	-29.265
Req				3253.326						
Regen	0.342									

	Inventory at start of period				
MI	Acres	SW Inv	HW Inv	Com Inv	MI Identification
1	0.413	1772.079	124.996	1897.076	GROW/NORM YLDS
2	0.292	914.395	80.702	995.097	PLANT ONLY
3	0.683	1387.937	60.746	1448.683	PLANT AND PCT
4	0.912	1865.942	164.684	2030.626	FERT/GEN U/PCT
5	0.186	343.439	30.311	373.750	MI4 + COMM THIN

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock
Period 6 Year 2040 Total over Management Intensities

Inventory at start of period

AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv
0	0.342	0.000	0.000	0.000	
1	0.409	190.095	14.563	204.659	
2	0.436	487.078	37.845	524.924	
3	0.515	1865.956	147.776	2013.732	
4	0.569	3595.436	230.768	3826.204	
5	0.180	1380.512	96.085	1476.597	
6	0.000	0.000	0.000	0.000	
7	0.000	0.000	0.000	0.000	
8	0.000	0.000	0.000	0.000	
9	0.000	0.000	0.000	0.000	
10	0.000	0.000	0.000	0.000	
11	0.000	0.000	0.000	0.000	
12	0.000	0.000	0.000	0.000	
13	0.000	0.000	0.000	0.000	
14	0.000	0.000	0.000	0.000	
15	0.000	0.000	0.000	0.000	
16	0.000	0.000	0.000	0.000	
17	0.000	0.000	0.000	0.000	
Stock	2.451	7519.079	527.037	8046.115	8.267
Unst	0.000				
Total	2.451				

Inventory at start of period

MI	Acres	SW Inv	HW Inv	Com Inv	MI Identification
1	0.322	1498.701	105.880	1604.580	GROW/NORM YLDS
2	0.299	841.690	74.286	915.975	PLANT ONLY
3	0.713	2124.937	79.475	2204.412	PLANT AND PCT
4	0.929	2565.709	226.444	2792.152	FERT/GEN U/PCT
5	0.189	488.043	40.953	528.996	MI4 + COMM THIN

Example 2. File-ATHUR

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 2 EXAMPLE 2 Harvest Unit #2 PNWW Forest Industry Red Alder

Period 5 Year 2030 Total over Management Intensities

		Inventory at start of period				Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.005	0.000	0.000	0.000		0.000	0.000	0.000
1	0.002	0.597	1.328	1.925		1.529	3.402	4.931
2	0.028	17.889	39.799	57.688		0.603	1.341	1.944
3	0.018	18.996	42.261	61.257		11.100	24.694	35.794
4	0.024	35.842	79.740	115.582		7.986	17.767	25.752
5	0.009	16.914	37.629	54.543		10.330	22.982	33.313
6	0.009	15.105	33.606	48.711		3.253	7.237	10.490
7	0.048	143.816	319.956	463.772		3.160	7.030	10.189
8	0.029	73.730	164.033	237.763		19.833	44.124	63.957
9	0.000	0.000	0.000	0.000		8.061	17.933	25.993
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.172	322.889	718.352	1041.240	15,.109	65.854	146.510	212.364
Unst	0.000							
Total	0.172							

		Harvest during period					Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
1	0.000	0.006	0.014	0.020	0.,000		0.000	-0.006	-0.014	-0.020
2	0.000	0.189	0.421	0.610	0.000		0.000	-0.189	-0.421	-0.610
3	0.000	0.201	0.447	0.648	0.000		0.000	-0.201	-0.447	-0.648
4	0.000	0.379	0.844	1.223	0..000		0.000	-0.379	-0.844	-1.223
5	0.000	0.179	0.398	0.577	0..000		0.,000	-0.179	-0.398	-0.577
6	0.000	0.160	0.355	0.515	0..000		0.,000	-0.160	-0.355	-0.515
7	0.000	1.521	3.385	4.906	0.,000		-0.001	-1.521	-3.385	-4.906
8	0.004	13.245	29.467	42.712	1..000		-0..001	-0.780	-1.735	-2.515
9	0.000	0.000	0.000	0.000	0..000		0..000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0..000		0..000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0,.000		0..000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0,.000		0,.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0..000		0,.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0..000		0,.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0..000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.004	15.881	35.331	51.212	1.000	17'.000	-0.003	-3.416	-7.599	-11.015
Req				51.212						
Regen	0.004									

	Inventory at: start of period				
MI	Acres	SW Inv	HW Inv	Com Inv	MI Identification GROW/NORM YLDS
1	0.172	322.889	718.352	1041.240	
2	0.000	0.000	0.000	0.000	N/A
3	0.000	0.000	0.000	0.000	N/A
4	0.000	0.000	0.000	0.000	N/A
5	0.000	0.000	0.000	0.000	N/A

PC • A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 2 EXAMPLE 2 Harvest Unit #2 RNWW Forest Industry Red Alder
Period 6 Year 2040 Total over Management Intensities

Inventory at start of period

AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv
0	0.004	0.000	0.000	0.000	
1	0.005	1..527	3.397	4.924	
2	0.002	1..123	2.498	3.621	
3	0.028	28..606	63.642	92.248	
4	0.018	26..517	58.994	85.511	
5	0.024	45..484	101.191	146.676	
6	0.009	19.,816	44.085	63.901	
7	0.009	17.,467	38.860	56.328	
8	0.047	158.,678	353.021	511.699	
9	0.024	70.,229	156.242	226.471	
10	0.000	0..000	0.000	0.000	
11	0.000	0..000	0.000	0.000	
12	0.000	0..000	0.000	0.000	
13	0.000	0..000	0.000	0.000	
14	0.000	0..000	0.000	0.000	
15	0.000	0,.000	0.000	0.000	
16	0.000	0..000	0.000	0.000	
17	0.000	0..000	0.000	0.000	
Stock	0.169	369,.446	821.931	1191.377	15.299
Unst	0.000				
Total	0.169				

Inventory at start of period

MI	Acres	SW Inv	HW Inv	Com Inv	MI Identification GROW/NORM YLDS
1	0.169	369..446	821.931	1191.377	
2	0.000	0..000	0.000	0.000	N/A
3	0.000	0..000	0.000	0.000	N/A
4	0.000	0.000	0.000	0.000	N/A
5	0.000	0.000	0.000	0.000	N/A

Example 2. File-ATHUR

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNW Forest Industry Douglas-fir/Hemlock
Period 0 Year 1980 Management Unit 1 F1-DOUG-FIR--MS Total over Management Intensities

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.302	13.588	1.199	14.787		0.000	0.000	0.000
1	0.222	52.159	4.603	56.763		109.726	9.684	119.410
2	0.213	250.313	22.092	272.405		102.238	9.023	111.261
3	0.273	812.073	71.672	883.744		489.779	43.227	533.006
4	0.232	1109.208	97.896	1207.104		593.532	38.734	632.266
5	0.094	467.288	41.242	508.530		486.423	37.095	523.518
6	0.053	348.887	30.792	379.679		199.354	17.595	216.948
7	0.021	201.274	17.764	219.038		42.066	3.713	45.779
8	0.023	253.023	22.331	275.354		52.882	4.667	57.549
9	0.008	88.352	7.798	96.150		18.466	1.630	20.095
10	0.009	25.866	2.283	28.148		5.406	0.477	5.883
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.017	195.036	17.213	212.250		40.763	3.598	44.360
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.041	269.051	23.746	292.797		56.232	4.963	61.195
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	1.509	4086.117	360.631	4446.748	8.753	2196.865	174.405	2371.271
Unst	0.000							
Total	1.509							

	Harvest during period						Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.023	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.012	3.593	0.317	3.910
2	0.000	0.000	0.000	0.000	0.000		0.006	7.206	0.636	7.842
3	0.000	18.211	1.607	19.818	0.000		0.003	7.754	0.684	8.438
4	0.000	0.000	0.000	0.000	0.000		0.003	11.453	1.011	12.464
5	0.018	106.535	9.403	115.938	0.060		0.000	0.000	0.000	0.000
6	0.053	421.804	37.227	459.032	0.237		0.000	0.000	0.000	0.000
7	0.021	243.340	21.477	264.817	0.137		0.000	0.000	0.000	0.000
8	0.023	305.905	26.998	332.904	0.172		0.000	0.000	0.000	0.000
9	0.008	106.817	9.427	116.245	0.060		0.000	0.000	0.000	0.000
10	0.009	31.272	2.760	34.031	0.018		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.017	235.799	20.811	256.610	0.133		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.041	325.283	28.709	353.992	0.183		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.190	1794.966	158.420	1953.386	1.000	18.330	0.046	30.005	2.648	32.654
Req				1953.386						
Regen	0.213									

	Inventory at start of period				
MI	Acres	SW Inv	HW Inv	Coni Inv	MI Identification
1	0.687	3182.462	280.877	34621.339	GROWNORMYLOS
2	0.118	61.588	5.436	67.023	PLANT ONLY
3	0.172	215i.973	19.061	235i.O35	PLANT AND PCT
4	0.433	509•.613	44.977	554.590	FERT/GEN U/PCT
5	0.099	116..481	10.280	126>.761	MI4 + COMM THIN

Example 2. File-ATMUR

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock
Period 0 Year 1980 Management Unit 1 FI-DOUG-FIR--MS Management Intensity 1 GROW / NORM YLDS

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.015	0.679	0.060	0.739		0.000	0.000	0.000
1	0.033	7.824	0.691	8.514		5.933	0.524	6.456
2	0.053	89.449	7.895	97.343		28.597	2.524	31.121
3	0.137	400.512	35.348	435.860		97.220	8.580	105.801
4	0.197	931.414	82.204	1013.618		252.434	22.279	274.713
5	0.084	411.117	36.284	447.402		399.409	35.251	434.660
6	0.048	308.865	27.260	336.125		178.419	15.747	194.166
7	0.021	201.274	17.764	219.038		42.066	3.713	45.779
8	0.023	253.023	22.331	275.354		52.882	4.667	57.549
9	0.008	88.352	7.798	96.150		18.466	1.630	20.095
10	0.009	25.866	2.283	28.148		5.406	0.477	5.883
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.017	195.036	17.213	212.250		40.763	3.598	44.360
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.041	269.051	23.746	292.797		56.232	4.963	61.195
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.687	3182.462	280.877	3463.339	13..176	1177.825	103.952	1281.777

	Harvest: during period						Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.023	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.012	3.593	0.317	3.910
2	0.000	0.000	0.000	0.000	0.000		0.006	7.206	0.636	7.842
3	0.000	0.000	0.000	0.000	0.000		0.003	7.754	0.684	8.438
4	0.000	0.000	0.000	0.000	0.000		0.003	11.453	1.011	12.464
5	0.016	93.729	8.272	102.001	0.053		0.000	0.000	0.000	0.000
6	0.048	373.418	32.957	406.375	0.210		0.000	0.000	0.000	0.000
7	0.021	243.340	21.477	264.817	0.137		0.000	0.000	0.000	0.000
8	0.023	305.905	26.998	332.904	0.172		0.000	0.000	0.000	0.000
9	0.008	106.817	9.427	116.245	0.060		0.000	0.000	0.000	0.000
10	0.009	31.272	2.760	34.031	0.018		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.017	235.799	20.811	256.610	0.133		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.041	325.283	28.709	353.992	0.183		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.183	1715.563	151.412	1866.975	0.966	18..388	0.046	30.005	2.648	32.654
Regen	0.010									

Example 2. File-ATMUR

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock
Period 0 Year 1980 Management Unit 1 FI-DOUG-FIR--MS Management Intensity 2 PLANT ONLY

		Inventory at start: of period				Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.060	2.718	0.240	2.957		0.000	0.000	0.000
1	0.022	5.216	0.460	5.676		21.851	1.929	23.780
2	0.021	17.721	1.564	19.285		6.208	0.548	6.756
3	0.014	35.933	3.171	39.104		46.067	4.066	50.133
4	0.000	0.000	0.000	0.000		27.490	2.426	29.917
5	0.000	0.000	0.000	0.000		0.000	0.000	0.000
6	0.000	0.000	0.000	0.000		0.000	0.000	0.000
7	0.000	0.000	0.000	0.000		0.000	0.000	0.000
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.118	61.588	5.436	67.023	3.397	101.617	8.968	110.585

		Harvest during period					Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Regen	0.041									

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock
Period 0 Year 1980 Management Unit 1 FI-DOUG-FIR--MS Management Intensity 3 PLANT AND PCT

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.030	1.359	0.120	1.479		0.000	0.000	0.000
1	0.044	10.432	0.921	11.352		10.925	0.964	11.890
2	0.043	44.108	3.893	48.000		17.926	1.582	19.508
3	0.055	160.075	14.128	174.203		98.319	8.677	106.997
4	0.000	0.000	0.000	0.000		132.891	-1.921	130.970
5	0.000	0.000	0.000	0.000		0.000	0.000	0.000
6	0.000	0.000	0.000	0.000		0.000	0.000	0.000
7	0.000	0.000	0.000	0.000		0.000	0.000	0.000
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.172	215.973	19.061	235.035	6.347	260.062	9.303	269.365

	Harvest during period						Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH IProp	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Regen	0.021									

Example 2. File-ATMUR

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock
Period 0 Year 1980 Management Unit 1 FI-DOUG-FIR--MS Management Intensity 4 FERT/GEN W/PCT

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SUWGro	HW Gro	Com Gro
0	0.166	7.473	0.660	8.133		0.000	0.000	0.000
1	0.100	23.472	2.072	25.543		60.091	5.303	65.395
2	0.075	76.982	6.794	83.776		40.505	3.575	44.080
3	0.055	172.442	15.219	187.661		190.234	16.790	207.024
4	0.023	133.052	11.743	144.795		143.576	12.672	156.247
5	0.009	56.171	4.957	61.128		57.093	5.039	62.132
6	0.005	40.022	3.532	43.554		20.935	1.848	22.783
7	0.000	0.000	0.000	0.000		0.000	0.000	0.000
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.433	509.613	44.977	554.590	4.867	512.434	45.226	557.660

	Harvest during period						Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
5	0.002	12.806	1.130	13.936	0.007		0.000	0.000	0.000	0.000
6	0.005	48.386	4.270	52.656	0.027		0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.007	61.192	5.401	66.593	0.034	16.853	0.000	0.000	0.000	0.000
Regen	0.121									

Example 2. File-ATMUR

PC-ATLAS EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNW Forest Industry Douglas-fir/Hemlock
Period 0 Year 1980 Management Unit 1 FI-DOUG-FIR--MS Management Intensity 5 MI4 + COMM THIN

		Inventory at start of period				Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.030	1.359	0.120	1.479		0.000	0.000	0.000
1	0.022	5.216	0.460	5.676		10.925	0.964	11.890
2	0.021	22.053	1.946	24.000		9.001	0.794	9.796
3	0.014	43.110	3.805	46.915		57.938	5.113	63.052
4	0.012	44.743	3.949	48.692		37.142	3.278	40.420
5	0.000	0.000	0.000	0.000		29.921	-3.195	26.727
6	0.000	0.000	0.000	0.000		0.000	0.000	0.000
7	0.000	0.000	0.000	0.000		0.000	0.000	0.000
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.099	116.481	10.280	126.761	5.594	144.928	6.956	151.883

		Harvest during period					Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
3	0.000	18.211	1.607	19.818	0.000		0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.000	18.211	1.607	19.818	0.000	0.000	0.000	0.000	0.000	0.000
Regen	0.021									

Example 2. File-ATMUR

p c - A T L A s EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hemlock
Period 0 Year 1980 Management Unit 2 FI-W .HEMLOCK-MS Total over Management Intensities

		Inventory at start of period				Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.125	47.218	2.658	49.877		0.000	0.000	0.000
1	0.087	53.483	3.011	56.494		25.498	1.436	26.933
2	0.093	154.439	8.695	163.134		92.152	5.188	97.341
3	0.086	405.810	22.847	428.658		238.951	13.453	252.404
4	0.076	330.660	18.616	349.277		306.160	3.499	309.659
5	0.052	346.540	19.511	366.051		158.926	8.948	167.874
6	0.015	152.270	8.573	160.843		106.800	6.013	112.813
7	0.025	224.282	12.627	236.910		41.268	2.323	43.591
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.005	46.101	2.596	48.696		8.483	0.478	8.960
15	0.013	149.193	8.400	157.593		27.452	1.546	28.997
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.009	90.774	5.111	95.885		16.702	0.940	17.643
Stock	0.586	2000.772	112.645	2113.417	8.335	1022.391	43.823	1066.214
Unst	0.000							
Total	0.586							

		Harvest during period					Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.004	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.002	0.861	0.048	0.909
2	0.000	0.000	0.000	0.000	0.000		0.001	1.462	0.082	1.544
3	0.000	0.000	0.000	0.000	0.000		0.000	1.513	0.085	1.598
4	0.000	0.000	0.000	0.000	0.000		0.000	2.350	0.132	2.482
5	0.010	81.923	4.612	86.535	0.095		0.000	0.000	0.000	0.000
6	0.015	180.288	10.150	190.438	0.208		0.000	0.000	0.000	0.000
7	0.025	265.550	14.951	280.501	0.306		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.005	54.583	3.073	57.656	0.063		0.000	0.000	0.000	0.000
15	0.013	176.645	9.945	186.590	0.204		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.009	107.477	6.051	113.528	0.124		0.000	0.000	0.000	0.000
Total	0.078	866.466	48.783	915.249	1.000	21.196	0.007	6.184	0.348	6.533
Req				915.249						
Regen	0.082									

	Inventory at: start of period				
HI	Acres	SW Inv	HW Inv	Com Inv	MI Identification
1	0.378	1754.446	98.777	1853.223	GROW/NORM YLDS
2	0.000	0.000	0.000	0.000	PLANT ONLY
3	0.208	246.326	13.868	260.194	PLANT AND PCT
4	0.000	0.000	0.000	0.000	FERT/GEN U/PCT
5	0.000	0.000	0.000	0.000	MI4 + COMM THIN

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNWW Forest Industry Douglas-fir/Hem lock
Period 0 Year 1980 Management Unit 2 FI-W.HEMLOCK-MS Management Intensity 1 GROW/NORM YLDS

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.050	18.887	1.063	19.951		0.000	0.000	0.000
1	0.035	24.817	1.397	26.214		5.595	0.315	5.910
2	0.037	91.349	5.143	96.492		59.147	3.330	62.477
3	0.060	279.571	15.740	295.311		88.827	5.001	93.828
4	0.076	330.660	18.616	349.277		188.381	10.606	198.988
5	0.052	346.540	19.511	366.051		158.926	8.948	167.874
6	0.015	152.270	8.573	160.843		106.800	6.013	112.813
7	0.025	224.282	12.627	236.910		41.268	2.323	43.591
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.005	46.101	2.596	48.696		8.483	0.478	8.960
15	0.013	149.193	8.400	157.593		27.452	1.546	28.997
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.009	90.774	5.111	95.885		16.702	0.940	17.643
Stock	0.378	1754.446	98.777	1853.223	10.770	701.581	39.500	741.081

	Harvest during period						Net Area Change:			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.004	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.002	0.861	0.048	0.909
2	0.000	0.000	0.000	0.000	0.000		0.001	1.462	0.082	1.544
3	0.000	0.000	0.000	0.000	0.000		0.000	1.513	0.085	1.598
4	0.000	0.000	0.000	0.000	0.000		0.000	2.350	0.132	2.482
5	0.010	81.923	4.612	86.535	0.095		0.000	0.000	0.000	0.000
6	0.015	180.288	10.150	190.438	0.208		0.000	0.000	0.000	0.000
7	0.025	265.550	14.951	280.501	0.306		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.005	54.583	3.073	57.656	0.063		0.000	0.000	0.000	0.000
15	0.013	176.645	9.945	186.590	0.204		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.009	107.477	6.051	113.528	0.124		0.000	0.000	0.000	0.000
Total	0.078	866.466	48.783	915.249	1.000	21.196	0.007	6.184	0.348	6.533
Regen	0.033									

Example 2. File-ATM.UR

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 PNW Forest Industry Douglas-fir/Hemlock
period 0 Year 1980 Management Unit 2 FI-W. HEMLOCK-MS Management Intensity 3 PLANT AND PCT

		Inventory at start of period				Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.075	28.331	1.595	29.926		0.000	0.000	0.000
1	0.052	28.666	1.614	30.280		19.902	1.121	21.023
2	0.056	63.090	3.552	66.642		33.006	1.858	34.864
3	0.026	126.239	7.107	133.346		150.123	8.452	158.575
4	0.000	0.000	0.000	0.000		117.778	-7.107	110.671
5	0.000	0.000	0.000	0.000		0.000	0.000	0.000
6	0.000	0.000	0.000	0.000		0.000	0.000	0.000
7	0.000	0.000	0.000	0.000		0.000	0.000	0.000
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.000	0.000	0.000	0.000		0.000	0.000	0.000
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.208	246.326	13.868	260.194	3.915	320.810	4.324	325.134

		Harvest during period					Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvD Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
1	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
2	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
3	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
4	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
5	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
6	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Regen	0.049									

Example 2. File-ATMUR

PC - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 2 EXAMPLE 2 Harvest Unit #2 PNWW Forest Industry Red Alder
Period 0 Year 1980 Management Unit 1 FI-RED ALDER-MS Total over Management Intensities

		Inventory at start of period				Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvO Inv	SW Gro	HW Gro	Com Gro
0	0.017	8.016	17.834	25.850		0.090	0.201	0.292
1	0.017	2.820	6.274	9.093		-2.262	-5.032	-7.294
2	0.091	72.594	161.505	234.099		4.018	8.939	12.957
3	0.059	47.001	104.565	151.566		40.528	90.165	130.693
4	0.087	114.377	254.462	368.839		22.534	50.133	72.667
5	0.030	58.240	129.570	187.810		42.569	94.706	137.276
6	0.006	3.423	7.614	11.037		3.963	8.816	12.778
7	0.014	16.374	36.427	52.801		3.488	7.759	11.247
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.005	8.511	18.934	27.445		1.813	4.033	5.846
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.325	331.354	737.186	1068.540	13.271	116.741	259.721	376.461
Unst	0.000							
Total	0.325							

		Harvest during period					Net Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH Prop	AvO Har	Acres	SW Net	HW Net	Com Net
0	0.000	0.258	0.573	0.831	0.000		-0.001	-0.258	-0.573	-0.831
1	0.000	0.091	0.202	0.292	0.000		-0.001	-0.091	-0.202	-0.292
2	0.000	2.333	5.191	7.524	0.000		-0.005	-2.333	-5.191	-7.524
3	0.000	1.511	3.361	4.871	0.000		-0.003	-1.511	-3.361	-4.871
4	0.000	3.676	8.178	11.854	0.000		-0.005	-3.676	-8.178	-11.854
5	0.020	48.245	107.335	155.580	0.588		-0.002	-1.872	-4.164	-6.036
6	0.006	4.042	8.991	13.033	0.050		0.000	-0.110	-0.245	-0.355
7	0.013	19.335	43.016	62.351	0.238		•0.001	-0.526	-1.171	-1.697
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.005	10.050	22.359	32.409	0.124		0.000	-0.274	-0.609	-0.882
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
Total	0.043	89.540	199.205	288.745	1.000	16.431	-0.017	-10.650	-23.693	-34.343
Req				288.745						
Regen	0.043									

	Inventory at start of period					
MI	Acres	SW Inv	HW Inv	Com Inv	MI	Identification
1	0.325	331.354	737.186	1068.540		GROW/NORM YLDS
2	0.000	0.000	0.000	0.000		N/A
3	0.000	0.000	0.000	0.000		N/A
4	0.000	0.000	0.000	0.000		N/A
5	0.000	0.000	0.000	0.000		N/A

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 2 EXAMPLE 2 Harvest Unit #2 **PNWW** Forest Industry **Red Alder**
Period 0 Year 1980 Management Unit 1 FI-RED ALDER-MS Management Intensity 1 GROW/NORM YLDS

	Inventory at start of period					Growth during period		
AC	Acres	SW Inv	HW Inv	Com Inv	AvD Inv	SW Gro	HW Gro	Com Gro
0	0.017	8.016	17.834	25.850		0.090	0.201	0.292
1	0.017	2.820	6.274	9.093		-2.262	-5.032	-7.294
2	0.091	72.594	161.505	234.099		4.018	8.939	12.957
3	0.059	47.001	104.565	151.566		40.528	90.165	130.693
4	0.087	114.377	254.462	368.839		22.534	50.133	72.667
5	0.030	58.240	129.570	187.810		42.569	94.706	137.276
6	0.006	3.423	7.614	11.037		3.963	8.816	12.778
7	0.014	16.374	36.427	52.801		3.488	7.759	11.247
8	0.000	0.000	0.000	0.000		0.000	0.000	0.000
9	0.005	8.511	18.934	27.445		1.813	4.033	5.846
10	0.000	0.000	0.000	0.000		0.000	0.000	0.000
11	0.000	0.000	0.000	0.000		0.000	0.000	0.000
12	0.000	0.000	0.000	0.000		0.000	0.000	0.000
13	0.000	0.000	0.000	0.000		0.000	0.000	0.000
14	0.000	0.000	0.000	0.000		0.000	0.000	0.000
15	0.000	0.000	0.000	0.000		0.000	0.000	0.000
16	0.000	0.000	0.000	0.000		0.000	0.000	0.000
17	0.000	0.000	0.000	0.000		0.000	0.000	0.000
Stock	0.325	331.354	737.186	1068.540	13..271	116.741	259.721	376.461

	Harvest: during period						**Net** Area Change			
AC	Acres	SW Har	HW Har	Com Har	FH **Prop**	AvD Har	Acres	SW **Net**	HW Net	Com Net
0	0.000	0.258	0.573	0.831	0.000		-0.001	-0.258	-0.573	-0.831
1	0.000	0.091	0.202	0.292	0.000		-0.001	-0.091	-0.202	-0.292
2	0.000	2.333	5.191	7.524	0.000		-0.005	-2.333	-5.191	-7.524
3	0.000	1.511	3.361	4.871	0.000		-0.003	-1.511	-3.361	-4.871
4	0.000	3.676	8.178	11.854	0.000		-0.005	-3.676	-8.178	-11.854
5	0.020	48.245	107.335	155.580	0.588		-0.002	-1.872	-4.164	-6.036
6	0.006	4.042	8.991	13.033	0.050		0.000	-0.110	-0.245	-0.355
7	0.013	19.335	43.016	62.351	0.238		-0.001	-0.526	-1.171	-1.697
8	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
9	0.005	10.050	22.359	32.409	0.124		0.000	-0.274	-0.609	-0.882
10	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0..000		0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.,000		0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.,000		0.000	0.000	0.000	0.000
Total	0.043	89.540	199.205	288.745	1.,000	16 .431	-0.017	-10.650	-23.693	-34.343
Regen	0.043									

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit #1 ENWW Forest Industry Douglas-fir/Henlock

Inventory Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 + COM4 THIN	Total
0	1980	1.065	0.118	0.380	0.433	0.099	2.094
1	1990	0.874	0.159	0.449	0.547	0.120	2.148
2	2000	0.656	0.228	0.565	0.736	0.154	2.338
3	2010	0.553	0.266	0.625	0.840	0.173	2.457
4	2020	0.492	0.283	0.659	0.888	0.182	2.504
5	2030	0.413	0.292	0.683	0.912	0.186	2.487
6	2040	0.322	0.299	0.713	0.929	0.189	2.451

Harvest Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 • COMM THIN	Total
0	1980	0.261	0.000	0.000	0.007	0.000	0.268
1	1990	0.384	0.000	0.012	0.041	0.014	0.450
2	2000	0.200	0.014	0.127	0.090	0.024	0.455
3	2010	0.105	0.021	0.136	0.129	0.031	0.422
4	2020	0.094	0.022	0.104	0.165	0.030	0.415
5	2030	0.110	0.059	0.056	0.100	0.017	0.342

Regeneration Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 + COMM THIN	Total
0	1980	0.043	0.041	0.070	0.121	0.021	0.295
1	1990	0.071	0.069	0.127	0.230	0.048	0.545
2	2000	0.037	0.052	0.188	0.195	0.043	0.515
3	2010	0.021	0.039	0.170	0.177	0.039	0.445
4	2020	0.018	0.033	0.133	0.195	0.035	0.415
5	2030	0.025	0.070	0.095	0.129	0.022	0.342

Inventory Acres by Management Intensity for DOUGLAS-FIR.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 * COMM THIN	Total
0	1980	0.687	0.118	0.172	0.433	0.099	1.509
1	1990	0.538	0.159	0.193	0.547	0.120	1.555
2	2000	0.367	0.228	0.227	0.736	0.154	1.711
3	2010	0.288	0.266	0.246	0.840	0.173	1.813
4	2020	0.248	0.283	0.255	0.888	0.182	1.856
5	2030	0.194	0.292	0.258	0.912	0.186	1.843
6	2040	0.140	0.299	0.260	0.929	0.189	1.816

Harvest Acres by Management Intensity for DOUGLAS-FIR.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 + COMM THIN	Total
0	1980	0.183	0.000	0.000	0.007	0.000	0.190
1	1990	0.266	0.000	0.010	0.041	0.014	0.330
2	2000	0.139	0.014	0.071	0.090	0.024	0.339
3	2010	0.066	0.021	0.061	0.129	0.031	0.308
4	2020	0.055	0.022	0.030	0.165	0.030	0.302
5	2030	0.054	0.059	0.017	0.100	0.017	0.247

Regeneration Acres by Management Intensity for DOUGLAS-FIR.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 + COMM THIN	Total
0	1980	0.010	0.041	0.021	0.121	0.021	0.213
1	1990	0.017	0.069	0.044	0.230	0.048	0.408
2	2000	0.010	0.052	0.090	0.195	0.043	0.390
3	2010	0.004	0.039	0.070	0.177	0.039	0.329
4	2020	0.003	0.033	0.035	0.195	0.035	0.302
5	2030	0.003	0.070	0.022	0.129	0.022	0.247

Example 2. File-ATACRE

P C - A T L A S EXAMPLE 2 Simulation - **PC-ATLAS Base Run 8-Extended Harvest.**
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 1 EXAMPLE 2 Harvest Unit **#1 PNWW Forest Industry Douglas-fir/Henlock**

Inventory Acres by Management Intensity for PURE HEMLOCK.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 + COMM THIN	Total
0	1980	0.378	0.000	0.208	0.000	0.000	0.586
1	1990	0.336	0.000	0.257	0.000	0.000	0.593
2	2000	0.289	0.000	0.338	0.000	0.000	0.627
3	2010	0.265	0.000	0.379	0.000	0.000	0.644
4	2020	0.244	0.000	0.404	0.000	0.000	0.648
5	2030	0.219	0.000	0.425	0.000	0.000	0.644
6	2040	0.182	0.000	0.453	0.000	0.000	0.635

Harvest Acres by Management Intensity for IPURE HEMLOCK.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 • COMM THIN	Total
0	1980	0.078	0.000	0.000	0.000	0.000	0.078
1	1990	0.118	0.000	0.002	0.000	0.000	0.120
2	2000	0.061	0.000	0.056	0.000	0.000	0.117
3	2010	0.040	0.000	0.075	0.000	0.000	0.114
4	2020	0.039	0.000	0.074	0.000	0.000	0.113
5	2030	0.056	0.000	0.039	0.000	0.000	0.095

Regeneration Acres by Management Intensity for PURE HEMLOCK.

Pd	Year	GROW/NORM YLDS	PLANT ONLY	PLANT AND PCT	FERT/GEN U/PCT	MI4 + COMM THIN	Total
0	1980	0.033	0.000	0.049	0.000	0.000	0.082
1	1990	0.054	0.000	0.083	0.000	0.000	0.137
2	2000	0.028	0.000	0.098	0.000	0.000	0.125
3	2010	0.017	0.000	0.100	0.000	0.000	0.116
4	2020	0.015	0.000	0.097	0.000	0.000	0.113
5	2030	0.022	0.000	0.073	0.000	0.000	0.095

P C - A T L A S EXAMPLE 2 Simulation - PC-ATLAS Base Run 8-Extended Harvest.
Run on 12/ 3/1990 11: 7:49 Using RAF from 12/ 3/1990 11: 7:45

Harvest Unit 2 EXAMPLE 2 Harvest Unit #2 PNWW Forest Industry Red Alder

Inventory Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	GROW/NORM YLOS	N/A	N/A	N/A	N/A	Total
0	1980	0.325	0.000	0.000	0.000	0.000	0.325
1	1990	0.308	0.000	0.000	0.000	0.000	0.308
2	2000	0.254	0.000	0.000	0.000	0.000	0.254
3	2010	0.205	0.000	0.000	0.000	0.000	0.205
4	2020	0.173	0.000	0.000	0.000	0.000	0.173
5	2030	0.172	0.000	0.000	0.000	0.000	0.172
6	2040	0.169	0.000	0.000	0.000	0.000	0.169

Harvest Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	GROW/NORM YLOS	N/A	N/A	N/A	N/A	Total
0	1980	0.043	0.000	0.000	0.000	0.000	0.043
1	1990	0.027	0.000	0.000	0.000	0.000	0.027
2	2000	0.033	0.000	0.000	0.000	0.000	0.033
3	2010	0.002	0.000	0.000	0.000	0.000	0.002
4	2020	0.005	0.000	0.000	0.000	0.000	0.005
5	2030	0.004	0.000	0.000	0.000	0.000	0.004

Regeneration Acres by Management Intensity for all Forest (Species) Types.

Pd	Year	GROU/NORM YLDS	N/A	N/A	N/A	N/A	Total
0	1980	0.043	0.000	0.000	0.000	0.000	0.043
1	1990	0.027	0.000	0.000	0.000	0.000	0.027
2	2000	0.033	0.000	0.000	0.000	0.000	0.033
3	2010	0.002	0.000	0.000	0.000	0.000	0.002
4	2020	0.005	0.000	0.000	0.000	0.000	0.005
5	2030	0.004	0.000	0.000	0.000	0.000	0.004

Inventory Acres by Management Intensity for RED ALDER.

Pd	Year	GROU/NORM YLDS	N/A	N/A	N/A	N/A	Total
0	1980	0.325	0.000	0.000	0.000	0.000	0.325
1	1990	0.308	0.000	0.000	0.000	0.000	0.308
2	2000	0.254	0.000	0.000	0.000	0.000	0.254
3	2010	0.205	0.000	0.000	0.000	0.000	0.205
4	2020	0.173	0.000	0.000	0.000	0.000	0.173
5	2030	0.172	0.000	0.000	0.000	0.000	0.172
6	2040	0.169	0.000	0.000	0.000	0.000	0.169

Harvest Acres by Management Intensity for RED ALDER.

Pd	Year	GROU/NORM YLDS	N/A	N/A	N/A	N/A	Total
0	1980	0.043	0.000	0.000	0.000	0.000	0.043
1	1990	0.027	0.000	0.000	0.000	0.000	0.027
2	2000	0.033	0.000	0.000	0.000	0.000	0.033
3	2010	0.002	0.000	0.000	0.000	0.000	0.002
4	2020	0.005	0.000	0.000	0.000	0.000	0.005
5	2030	0.004	0.000	0.000	0.000	0.000	0.004

Regeneration Acres by Management Intensity for RED ALDER.

Pd	Year	GROU/NORM YLDS	N/A	N/A	N/A	N/A	Total
0	1980	0.043	0.000	0.000	0.000	0.000	0.043
1	1990	0.027	0.000	0.000	0.000	0.000	0.027
2	2000	0.033	0.000	0.000	0.000	0.000	0.033
3	2010	0.002	0.000	0.000	0.000	0.000	0.002
4	2020	0.005	0.000	0.000	0.000	0.000	0.005
5	2030	0.004	0.000	0.000	0.000	0.000	0.004

Example 2. File-ATACRE

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PC-ATLAS Inventories from  1/29/1991  13:13:27
EXAMPLE 2  6086.889   473.276  3219.257   218.228  2661.433   207.202
            6670.172   486.411  3382.981   192.245  3703.655   283.145
            6440.310   402.892  3639.849   216.826  4289.880   240.921
            5846.601   383.450  3625.965   223.525  3537.327   194.417
            5957.134   414.416  3870.353   265.382  3531.789   217.513
            6283.793   461.440  4306.771   276.126  3044.768   208.558
            7519.079   527.037
EXAMPLE 2   331.354   737.186   116.741   259.721    89.540   199.205
             347.905   774.008   112.989   251.374    98.701   219.587
             325.199   723.491    92.704   206.244   122.145   271.744
             257.709   573.341    71.744   159.613    29.651    65.965
             275.404   612.709    63.646   141.599    15.196    33.808
             322.889   718.352    65.854   146.510    15.881    35.331
             369.446   821.931
```

Example 2. File-ATINV

Output file ATTMU—This MU-level output file was added to example 2 in a second simulation. It was selected with the entry of the value 3 for the MU level report (in HARVEST, card type 03). This file was produced instead of ATMUR; the period selection option on card type 05 is not associated with ATTMU.

Output is year at beginning period, MU name, acres at beginning of period, softwood inventory, hardwood inventory, softwood growth, hardwood growth, softwood harvest, hardwood harvest, acres gained or lost over the period, softwood volume gained or lost over the period, and hardwood volume gained or lost over the period.

File ATTMU:

1980	FI-DOUG-FIR--MS	1.809	4086.117	360.631	2196.865	174.405	1794.966	158.420	0.046	30.005	2.648
1980	FI-W.HEMLOCK-MS	0.586	2000.772	112.645	1022.391	43.823	866.466	48.783	0.007	6.184	0.348
1980	FI-REO ALDER-MS	0.325	331.354	737.186	116.741	259.721	89.540	199.205	-0.017	-10.650	-23.693
1990	FI-DOUG-FIR--MS	1.555	4509.146	378.482	2241.427	157.239	2692.405	227.618	0.186	100.765	8.893
1990	FI-U.HEMLOCK-MS	0.593	2161.026	107.929	1141.554	35.006	1011.251	55.527	0.034	28.354	1.596
1990	FI-RED ALDER-MS	0.308	347.905	774.008	112.989	251.374	98.701	219.587	-0.054	-36.994	-82.304
2000	FI-DOUG-FIR-MS	1.711	4129.129	314.366	2412.270	181.026	2875.690	198.911	0.102	65.885	5.815
2000	FI-U.HEMLOCK-MS	0.627	2311.180	88.526	1227.580	35.800	1414.190	42.010	0.017	14.177	0.798
2000	FI-RED ALDER-MS	0.254	325.199	723.491	92.704	206.244	122.145	271.744	-0.049	-38.049	-84.650
2010	FI-DOUG-FIR-MS	1.813	3712.106	300.576	2423.189	199.759	2256.928	166.492	0.043	27.775	2.451
2010	FI-U.HEMLOCK-MS	0.644	2134.495	82.874	1202.776	23.766	1280.399	27.925	0.004	3.336	0.188
2010	FI-RED ALDER-MS	0.205	257.709	573.341	71.744	159.613	29.651	65.965	-0.032	-24.398	-54.280
2020	FI-DOUG-FIR—MS	1.856	3897.927	335.569	2688.244	229.756	2275.470	190.625	-0.013	-8.252	-0.710
2020	FI-U.HEMLOCK-MS	0.648	2059.208	78.847	1182.109	35.626	1256.319	26.887	-0.004	-3.762	-0.144
2020	FI-RED ALDER-MS	0.173	275.404	612.709	63.646	141.599	15.196	33.808	-0.001	-0.966	-2.148
2030	F1-DOUG- FIR-MS	1.843	4302.558	373.998	3017.921	249.571	2068.720	176.737	-0.027	-19.052	-1.656
2040	Fi-DOUG-FIR-MS	1.816	5233.237	445.223							
2030	FI-U.HEMLOCK-MS	0.644	1981.235	87.441	1288.849	26.555	976.048	31.821	-0.009	-8.196	-0.362
2040	FI-U.HEMLOCK-MS	0.635	2285.841	81.814							
2030	FI-RED ALDER-MS	0.172	322.889	718.352	65.854	146.510	15.881	35.331	-0.003	-3.416	-7.599
2040	FI-RED ALDER-MS	0.169	369.446	821.931							

Example 2. File-ATTMU

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Mills, John R.; Kincaid, Jonna C. 1992. The aggregate timberland assessment system—ATLAS: a comprehensive timber projection model. Gen. Tech. Rep. PNW-GTR-281. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 160 p.

The aggregate timberland assessment system is a time-based deterministic timber projection model. It was developed by the USDA Forest Service to address broad policy questions related to future timber supplies for the 1989 Renewable Resources Planning Act timber assessment. An open framework designs allows for customizing inputs to account for regional and subregional growth and yield characteristics, predictions of change in land use, assumptions of future timber management practices, and projections of future demand for stumpage. As inputs, timberland inventories are aggregated into strata by age class, growth, yield, and management characteristics. Strata are projected through time with the use of yield tables and density change functions. Simulations can differ in size and complexity from a single stratum to over 10,000. The projection system will be of benefit to those requiring knowledge of current and future timber situations, including analysts, planners, economists, and policy makers. This publication is intended to help users gain knowledge and understanding necessary to make both basic and complex timber projections.

Keywords: Timber projection model, harvest scheduling, economic analysis, forest sector analysis, forest policy.

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