The Forester's Quick Steps to Building an Annual Harvest Schedule

Based on an FPS-based Working Forest Inventory – by James D. Arney, Sept. 2018

Building the Harvest Planning database:

1) Build the complete Year-end Stand-based Inventory & GIS matched databases
    a. Make two copies – First for Working Inventory, Second for Planning
    b. Use the Planning copy for all Steps to follow.
2) Review and Revise the SPECIES & SORTS tables for your standard series of species-specific merchandizing and log values.
    a. Use the Basis column within these tables and ADMIN table for locally different values and costs across the Working Forest.
3) Review and Revise the HARVEST table for your standard set of silvicultural and operating costs. Populate the Inflation, Real-wood Appreciation and Discount Rate parameters for your Discounted Cash Flow analyses.
4) Review and Revise the CLASS table values for 2 – 6 levels of Elevation, Growing Season Days, Annual Precipitation and Soil Depths. These parameters define Habitat Classes for stratifying the expected species and abundance of natural regeneration in all growth projections.
5) From previous Silvicultural case studies which you have done on this forest, design and populate the SILVICS table with 3 – 6 preferred silvicultural regimes. This should always include the "GROW" regime as the default un-treated growth projection.
    a. Populate the ADMIN table, Origin column with the appropriate silvicultural regime which has been applied to each stand in the <u>past</u>. This distinguishes plantations from natural stands at a minimum. This regime label must match a regime label in the SILVICS table. (Regime labels are any 4-characters)
    b. Regime labels in SILVICS beginning with "SL" in the 4-charaacter label are assumed to be "Selection harvest" only silvicultural regimes. These never invoke the YIELD table, which is designed only for even-aged silviculture where a final harvest is scheduled.
6) Verify that ADMIN table, Gis_ID column has a one-to-one link to the VegPoly table, Gis_ID column in the GIS database. There should be a matching row in each table for every Stand in the inventory.
    a. Compute the Xgis and Ygis centroid points for each Stand in the inventory and pass these locations from VegPoly to ADMIN. Values should be in US feet if Stand areas are in acres.
    b. Populate the NESTSITE table with GIS centroids for each active nest site if Wildlife habitat will be invoked in this Planning analysis. One row per nest site.

7) Populate the ADMIN table with appropriate values in LOG_SYS and HAUL_LEN columns. The LOG_SYS labels must match a label in the HARVEST table (typically based on slope percent – SKID versus LINE or HELO). Any user-defined label may be included for other harvesting methods.
8) Populate the HABRULE table with Code, Circle, Radius, MinPct, MinDbh, and MinDen for codes "OWLS", "EAGL", SHED" and "LDBH". Later, the FPS Growth Model will populate the HABDENS table with Stand parameters which meet or exceed these levels.
9) Set the ADMIN table, Hab_Grp column to "1" as a default linkage to the 2nd rotation YIELD table. Break this down into as many additional groups as you desire. Each of these identifies a different 2nd rotation silvicultural regime and species planting combination. The linkage is based on Region, Hab_Grp and Site_Phy (in 10-foot classes) between ADMIN and YIELD.
10) Update the SCHEDULE table for mid-points of each Period in the Planning Horizon.
    a. Establish a Planning Horizon at least 40% longer in years than the expected harvest age of stands on this forest.
    b. Five-year planning periods provide the best periodic step for a balance between a Strategic Plan and a Tactical Plan result from this harvest analysis.
    c. Review and revise all min/max thresholds in the SCHEDULE table. Especially important are Area_Min and Area_Max for even-aged harvest opening sizes and Age_Min and Age_Max for harvest ages (age should be set very wide).
11) Build and populate the YIELD and YLDSPP tables for all potential even-aged silvicultural regimes which may occur in the 2nd rotation and beyond.
    a. Grow the YIELD table using the linkage to the SCHEDULE table.
    b. Always check the "Update the HABDENS table" box if Wildlife or Basin constraints may be invoked in the final harvest scheduling analyses.
    c. After invoking the Growth Model, always review and adjust the single value of "2" in the YIELD table, Flag_Yr column for your selected age for the final harvest. There should be only one row per Site Class with the Flag_Yr value set to "2". This is an important parameter to monitor.
    d. Values of "1" indicate thinnings which were automatically assigned when the silvicultural regime was invoked. Do not adjust these.
12) Flag all stands in the ADMIN table to be included in this Harvest Scheduling Analysis. This will include stands with limited or no availability for harvest removals. All stands contribute to the forest-wide evaluation of Habitat stocking parameters when Wildlife or Basin constraints are invoked.

13) Verify that all Stands have been grown to the current base year for this planning analysis.
    a. The ADMIN table should have the current road and riparian buffer acreages applied to the Area_Gis, Area_Net, Area_Rpt and Area_Buf columns.
    b. No ADMIN table, Site_Phy column should have a value less than 35 (if site defined as traditional height levels) or less than 0.5 if defined as 10-meter site levels.
    c. The ADMIN table, Site_Shp column should be zero or a value populated from the SiteGrid GIS layer for limiting soil or climate restrictions. This parameter sets the Culmination of Mean Annual Increment potential for this stand. It is a significant parameter in long-term planning.
14) Archive a copy of this database. It is the basis for all subsequent analyses, regardless of silvicultural options being evaluated.
15) Select the FPS drop-down menu "Growth", "Build/Edit/Switch Silvics Regimes".
    a. Tab over to the Silviculture Regime label to be grown.
    b. Click the bar in the lower-right of the dialog form "Save updates and Close" to assign this Regime to all Flagged stands.
    c. Select the "Grow Stands" option under "Growth"
    d. Click the radio button "Select Years from Schedule Table"
    e. Click the radio button "Grow Stand Table"
    f. Check the box "Update HABDENS Table"
    g. Click "Start" button and wait for all stands to be grown through the Planning Horizon.
16) In the Access FPS database, click "File", then "Compact and Repair Database".
    a. Your first optional silvicultural regime for the entire length of the Planning Horizon has been built. This is the most time-consuming phase in FPS planning steps. It may take 15 minutes to 15 hours to grow a full inventory database for each Regime depending on the number of stands and treatments.
    b. Archive this version of the FPS database.
    c. Repeat this Step for each Silvicultural Regime to be included in these analyses.
17) Now it is optional to "hard-wire" some stands to be harvested in a pre-specified period. Just enter a value between 100 and 999 in the STAND table, Flag_Yr column for the Regime and Plan_Yr which the Stand will be harvested (it should be the row with Status = 0).
    a. If this Flag_Yr is set to zero for any Std_ID, Rpt_Yr, Regime combination in the STAND table, then this is no longer an option for the Harvest Scheduler to consider. The Habitat contribution from this Stand is included, but it cannot be harvested in this Planning Period. An example is a set-aside for grizzly bear habitat at a given location and point in time.

18) All-aged Selection harvest regimes are the most time-consuming and database bloating options to build. This is due to thinning treatments being tied to dynamic combinations of stand-specific site index, density and treatment parameters.
    a. Always set the first treatment in a Selection harvest regime to be invoked in a specified Period. Subsequent treatments within a Regime may be invoked dynamically based on density or age.
    b. Always repeat this same Selection harvest regime for starting in each Period in the Planning Horizon. The treatment may be optimal, but the timing may shift due to harvest status of other Stands.
19) Where Seed-tree or Shelterwood Regimes are considered, the YLDSPP table must include estimates of the average "leave-tree" stocking and dimensions (Dbh & Height) from the previous stand.
    a. A reasonable "leave-tree" pair of dimensions for each Site Class in the YLDSPP table is the site index height in feet and a Dbh in inches = 0.20 * Height.
    b. A reasonable "leave-tree" stocking is 8 trees per acre for Seed-trees and 20 trees per acre for Shelterwood. This "leave-tree" stocking will be invoked in the Planning Period selected by the FPS Harvest Scheduler when you provide the SILVICS table, Trt_Val column with a year = "9999" (this is a dynamic year).
    c. There must be a Regime in the SILVICS table for Seed-tree treatments and/or a Regime for the Shelterwood treatments. This is demonstrated in the Puget FPS database.
20) After all Regimes have been grown out through the Planning Horizon (with the "Update HABDENS Table" option), select FPS drop-down "Scheduler", "Compute Wildlife Constraints" and click "Start". This will build the contribution each Stand and Regime provides to mitigating each Wildlife and/or Basin constraint defined in the HABRULE table. These habitat summations by Regime are now computed for each nest site and basin.
21) Compact and Archive your Planning database once more. This is the database to be used for all subsequent Harvest Scheduling analyses. Log merchandizing, valuation, costs and discount rates cannot be changed in this database without re-growing all Stands.

Running the Harvest Planning database:

1) First run a Baseline reference for all subsequent runs and evaluation of all basic assumptions and parameters.
    a. Use FPS drop-down menu "Reports", "Update Area Basis for Reports", "Convert to Area_Net (Net of roads)". This will include all forest cover acres in all flagged Stands.
    b. Run "Scheduler", "Run Harvest Scheduler", "Forest Biometrics Harvest Scheduler". Select "# Planning Periods" to equal number of Periods in SCHEDULE table. Allow defaults for "Maximum Harvest" on a "Net Board" basis. Do not invoke any constraints on the right side of the dialog form. Provide a useful description in the dialog window at the bottom left. Then click "Start".
    c. Scroll to the top of the window to view progress when the blue screen appears.
    d. Click "Yes" in "Replace and Update Sustained Yield Plan in Database" dialog form if you wish to write this solution to your Planning database (otherwise it only produces a text file report).
    e. Select "Scheduler", "View Harvest Schedule Report" to see the text file report of the harvest removal by period, Schedule table assumptions, dialog options and residual inventory summaries by period. The third line of the Report may show more acres harvested than in the total inventory due to re-entries into the same Stand across the entire Planning Horizon. This FPS Scheduler has the capacity to go out as far as six rotations.
    f. All harvest values in the "Harvest.Rpt" are on an annual basis.
    g. Click FPS drop-down menu "Reports", "Update Area Basis for Reports", Convert to Area_Rpt (Net of Riparian)". This will shift the acreage basis back to the working acres in all Stands and setting the Riparian acres outside of harvest. All other scenarios may now be evaluated in reference to this baseline schedule.
2) Repeat the same series of actions taken in the Baseline Harvest Schedule run for acres minus riparian buffers.
    a. The difference between these first two runs is the volume and value loss due to the current constraints of riparian buffer set asides. This is a significant piece of information for senior managers and owners. The riparian buffers are an administrative set aside which has not been shown to enhance water quality, fish habitat, forest health or economic well-being.
    b. This is the scenario to re-run at any time an alternative set of riparian buffer rules are considered. The series of FPS Growth projections do not need to be re-run. The forester only needs to assign different buffer widths by stream class to the ADMIN table. Then re-run all Harvest Schedules of interest which were previously built.

3) Now shift to an incremental sequence of Harvest Schedule runs with accumulative additions of constraints and options. This provides the analyst with a more complete understanding of this forest ownership capacity for alternative silvicultural scenarios.
    a. As described in the initial "Building the Harvest Scheduling database", there should be 3 – 6 alternative silvicultural scenarios which are in the scope of the forest ownership mission and goals.
    b. Due to a general mis-conception of the tradeoffs between major silvicultural systems, a reasonable first series is Clearcut, Seed-Tree, Shelterwood and Single-tree Selection. These are commonly identified with Regime labels of "GROW", "SEED", "SHTR" and "SL01", respectively.
    c. If all four optional silvicultural regimes are in a single database, then allow the first run of this series to choose from all Stands for all Silviculture in all Periods. Saving the result to the FPS database causes the ADMIN table, Regime and Plan_Yr columns to be populated from the Harvest Scheduler output. A review of these Regimes and years assigned to the ADMIN table will guide the analyst in identifying the most relevant silvicultural regimes for further analysis. The FPS drop-down menu "Scheduler", "Harvest Removal Summary" and "Harvest Residual Inventory" provide additional insight to results (and Chart options).
4) Make additional runs where the Wildlife and Neighbor Green-up constraints are invoked independently and in combinations. These options will cause significant shifts in which Stands are harvested in which Periods and which Regimes are selected within Stands.
    a. Changing the SCHEDULE table values for minimums and maximums will also cause significant shifts in Stand and Regime assignments through the Planning Horizon.
    b. Changing the Harvest Scheduler "Primary Goal" in the dialog form will also cause significant shifts in outcomes.
    c. Where differential harvest levels are desired by Period, the analyst may switch to dialog "Method", "Set targeted harvest level by Period". This will invoke the SCHEDULE table columns – Brd_Goal, Cub_Goal, and Val_Goal. These Period-specific goals may be adjusted for each run by the analyst to achieve any desired level of harvest within the capacity of this forest ownership (limited by standing inventory stocking, site index and silvicultural options previously built).
    d. Always theme these results over to the GIS database to display spatial distributions of Regimes and Periods by Stand (Defaults to the Theme column in the VEGPOLY table).

5) Once a final set of Regimes and constraints are selected, Compact and Archive this database along with the associated GIS database. This will preserve all parameters for merchandizing, valuation, stratifications, constraints and standing inventory characteristics.
6) Select all Stands and Regimes which have active silvicultural treatments in the first five-year Period of the Planning Horizon. Allow the operational foresters to select any Stands (with associated Regimes) for action in the current year. They may not exceed the Annual Harvest Level of the Plan. Their local decisions will bring in local markets, available contractors, road access, weather conditions and current budget options. None of these considerations are available in the Planning Horizon for the whole forest. However, this provides the foresters with the ability to stay within the Strategic Plan while they may attempt to achieve their Tactical Plan.
7) At the end of the current year, update the forest inventory with all actual harvest actions. Then re-run this Plan on an Annual Basis with annually refined information, inventory updates and silvicultural prescriptions.