Comparison of Forest Management Software Suites - August 2014

Functionality*[1]	FBRI FPS	USFS FVS	OSU ORGANON	MBG Tools	Woodstock Stanley	USFS DFSIM	BCFS TASS	Cactos /Cryptos
Database Architecture								
Relational Inventory Database	Yes	None	None	Yes	None	None	None	None
Active GIS link to Inventory	Yes	None	None	None	Yes	None	None	None
Stand-based Inventory	Yes	None	None	Yes	None	None	None	None
Lump/Split Polygon Updating	Yes	None	None	None	None	None	None	None
Integrated Road Buffering	Yes	None	None	None	None	None	None	None
Integrated Riparian Buffering	Yes	None	None	None	None	None	None	None
GIS Bio/Geo/Climatic SiteGrid	Yes	None	None	None	None	None	None	None
Habitat Diversity Mapping	Yes	None	None	None	None	None	None	None
Inventory Processing								
Built-in Cruise Selection Tools	Yes	None	None	None	None	None	None	None
Integrated Cruise Compiler	Yes	None	None	Yes	None	None	None	None
Mixed Variable/Fixed Designs	Yes	None	None	Yes	None	None	None	None
Sub-sample Designs Included	Yes	None	None	Yes	None	None	None	None
Snag and Down Woody Designs	Yes	None	None	None	None	None	None	None
Non-tree Vegetation Designs	Yes	None	None	None	None	None	None	None
All-Aged Strata Sub-sampling	Yes	None	None	None	None	None	None	None
Defect Allocation - tree/seg/log	Yes	None	None	None	None	None	None	None
Spatial Clumpiness Index	Yes	None	None	None	None	None	None	None
Off-Stand Plot Unbiased Designs	Yes	None	None	None	None	None	None	None
Off-Plot Subsample Designs	Yes	None	None	None	None	None	None	None
Stem-mapped Plot Compilation	Yes	None	None	None	None	None	None	None
Species-specific Merchandizing	Yes	None	None	Yes	None	None	None	None
Log Sort/Species Valuation	Yes	None	None	None	None	None	None	None

[1] See Definitions of Functionality in Glossary.

Forest Biometrics Research Institute
4033 SW Canyon Road
Portland, Oregon 97221
www.forestbiometrics.com
(503) 227-0622

Functionality	FBRI FPS	USFS FVS	OSU ORGANON	MBG Tools	Woodstock Stanley	USFS DFSIM	BCFS TASS	Cactos /Cryptos
Batch-mode Re-Merchandizing	Yes	None	None	Yes	None	None	None	None
Common Volume/Value Method	Yes	None	None	None	None	None	None	None
Growth Projection & Silviculture								
Integrated Growth Model	Yes	None	None	Yes	None	None	None	None
Distance-Dependent Design	Yes	None	None	None	None	None	Yes	None
Integrated Clumpiness Effects	Yes	None	None	None	None	None	None	None
Integrated Stockability Effects	Yes	None	None	None	None	None	None	None
Direct Database Input/output	Yes	None	None	Yes	None	None	None	None
Localized Natural Regeneration	Yes	None	None	None	None	None	None	None
Localized Site Curve Shape	Yes	None	None	None	None	None	None	None
Localized Taper Profiles	Yes	None	Yes	Yes	None	None	None	None
Thinning Treatment Options	Yes	Yes	Yes	Yes	None	Yes	Yes	Yes
Fertilization Treatment Options	Yes	Yes	Yes	Yes	None	None	None	None
Fill-Planting Treatment Options	Yes	None	None	None	None	None	None	None
Pruning Treatment Options	Yes	None	None	None	None	None	None	None
Batch Processing w/Var Treats	Yes	None	None	Yes	None	None	None	Yes
Batch Processing w/Var Values	Yes	None	None	None	None	None	None	None
Species / Genetic Variation	Yes	None	None	None	None	None	None	None
Biomass - Bole, Crown, Roots	Yes	None	None	None	None	None	None	None
Carbon Sequestration Tracking	Yes	None	None	None	None	None	None	None
Common Volume/Value Method	Yes	None	None	None	None	None	None	None
Harvest Planning & Sustainability								
Integrated Harvest Scheduler	Yes	None	None	Yes	Yes	None	None	None
Solution base - Linear Program	None	None	None	None	Yes	None	None	None
Solution base - Binary Search	Yes	None	None	None	None	None	None	None
1st Pass Spatial Constraints	Yes	None	None	None	None	None	None	None
Unique Stand / Site / Silvics	Yes	None	None	None	Yes	None	None	None
Variable Regimes by Rotation	Yes	None	None	None	None	None	None	None

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Variable Regimes per Stand	Yes	None	None	None	None	None	None	None
Variable Logging System/Stand	Yes	None	None	None	None	None	None	None
Variable Log Values / Stand	Yes	None	None	None	None	None	None	None
Full-Range Silviculture Options	Yes	None	None	None	None	None	None	None
Common Volume/Value Method	Yes	None	None	None	None	None	None	None
Technical Support & Ongoing Research								
Windows PC Certified Software	Yes	None	None	None	None	None	None	None
Localized over Multiple Regions	Yes	Yes	Yes	Yes	Yes	None	None	None
Ongoing Technical Support	Yes	None	None	Yes	Yes	None	None	None
Local On-site Tech Support	Yes	None	None	None	None	None	None	None
Annual Workshops	Yes	None	None	None	Yes	None	None	None
User's Manual & Tutorials	Yes	Yes	Yes	Yes	Yes	Yes	None	Yes
Maintenance & Updating	Yes	None	None	None	Yes	None	None	None
Full Microsoft Windows Function	Yes	None	None	Yes	Yes	None	None	None
External Parameter Libraries	Yes	None	None	Yes	None	None	None	None
Scheduled Software Updates	Yes	None	None	None	Yes	None	None	None
Scheduled Library Updates	Yes	None	None	None	None	None	None	None
Research Database Archives	Yes	None	None	None	None	None	None	None
On-site Field Research Assist	Yes	None	None	None	None	None	None	None
On-site Field Inventory Assist	Yes	None	None	None	None	None	None	None
On-site Year-end Reports Assist	Yes	None	None	None	None	None	None	None
On-site Harvest Planning Assist	Yes	None	None	None	None	None	None	None
On-site Biometrics Reviews	Yes	None	None	None	None	None	None	None
Annual User's Meetings	Yes	None	None	None	Yes	None	None	None
Structure - Non-profit Research	Yes	Yes	Yes	None	None	Yes	Yes	Yes
Structure - For-profit Consulting	None	None	None	Yes	Yes	None	None	None
Total Ranking of All 73 Attributes	71	5	6	20	13	3	3	4
%Availability - # of Attributes	97%	7%	8%	27%	18%	4%	4%	5%

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Descriptions of Models in Comparison

FBRI – FPS

The Forest Biometrics Research Institute (FBRI), Forest Projection and Planning System (FPS Version 7) is a western United States fully-integrated forest management package. It was designed and developed by Dr. James D. Arney. It includes stand-based inventory cruise compilation, updating, GIS linkages, silvicultural growth projections, economic analyses, carbon sequestration accounting and long-term sustained yield planning. It is the only fully-integrated inventory, growth and planning system publically available in North America. FPS is available from FBRI in Portland, Oregon. It is an individual tree, distant-dependent model structure (Monro, 1973).

USFS – FVS

The United States Forest Service (USFS), Forest Vegetation Simulator (FVS) is a package of regional variant growth models based on the original Prognosis Growth Model developed by Dr. Al Stage at the Intermountain Research Station in Moscow, Idaho. While the input / output structure is common, each individual variant is based on independent analyses and datasets. It is available from the USFS office in Fort Collins, Colorado. It is an individual tree, distant-independent growth model structure.

OSU – ORGANON

The Oregon State University (OSU), ORGANON growth model was designed and developed by Dr. David Hann. It was built for coastal Oregon with limited range of tree species and geographic area. The author has retired and it is no longer supported. It is an individual tree, distant-independent growth model structure.

MBG – Tools

The Mason, Bruce & Girard (MBG) Tools package is primarily an inventory compiler and growth model operating against a Microsoft Access database. There is a broad range of site, taper and growth equations included for various species and regions. It relies on a knowledgeable forester to determine the best consortium of components for any given application. The Stand Projection System (SPS) was the original growth model and architecture for linkages to a relational inventory database as applied in MBG Tools. SPS is an individual tree, distant-independent growth model structure designed and developed by Dr. James D. Arney in 1981 - 1986. MBG Tools is available from Mason, Bruce & Girard, Inc. in Portland, Oregon.

Woodstock – Stanley

Remsoft Corporation in Fredericton, New Brunswick, Canada developed and distributes these harvest scheduling component software tools. The Woodstock component is a linear programming solution package using forest stands or groups of stands in a time series analysis for harvest scheduling. The Stanley component provides near-term shifts in selected harvest units from Woodstock to mitigate conflicts with spatial constraints due to wildlife corridors, riparian buffers and previously-harvested neighboring stands. A forest

inventory database and regional growth model are required to build the inputs for this scheduling package.

USFS – DFSIM

The United States Forest Service (USFS), Douglas-fir Simulator (DFSIM) was designed and developed by Dr. Robert O. Curtis of the Pacific Northwest Experiment Station in Olympia, Washington. It was developed in 1973 – 1985 for coastal Douglas-fir in Oregon, Washington and British Columbia. Dr. Curtis has retired and DFSIM is no longer supported. It is a DOS operating system utility which requires text input and output structures only. DFSIM is a whole stand-only, single-species growth model with fixed log merchandizing based on Scribner long-log board volumes. Documentation is available through the USFS Fort Collins Research Station.

BCFS – TASS

The British Columbia Forest Service (BCFS), Tree and Stand Simulator (TASS) was designed and developed by Dr. Ken Mitchell in Victoria, British Columbia. It has been under continual development since 1972, but never released for public use. Dr. Mitchell and many others involved over the years have retired. TASS was an individual-tree, distant-dependent growth model which iteratively grew the complete profile for each tree and branch in the simulation run. It could not be initiated from existing inventories. It was a model for research analysis rather than a model for operational planning.

Cactos / Cryptos

The University of California Cactos / Cryptos growth models were designed and developed by Dr. Lee Wensel as part of a regional growth and yield cooperative research program in the mid-1970s. Some site and taper components were incorporated from other sources for some tree species. The primary species of interest were Redwood and Douglas-fir in Northern California. The model structure was updated in 2000 – 2006 by Dr. Bruce Krumland to facilitate applications in Microsoft Windows. The original model structure was solely a DOS-operating system application with text file input and output. This model structure is an individual tree, distant-independent design allowing for mixed species and size classes but only applying average stand density for constraining growth.

Others

No other growth models or integrated forest management packages have been developed or are known to be under development as of this date. University and Experiment Station research into computerized forestry applications began in 1971 – 1973. Computer-based, dynamic forest inventories began in mid 1970s followed by linear programming systems for harvest scheduling in the late 1970s. Early 1980s saw the expansion of Geographic Information Systems (GIS) due to the development of questions regarding spatial constraints due to wildlife, riparian zones and neighbor green-up from previous harvest units. While the importance of sustained yield planning continues to rise, the budgets and staffing in quantitative forestry R&D methods and tools has declined significantly.

Glossary of Functionality Items

Database Architecture – type of data structure for input / output to software suite

Relational Inventory Database - A relational database is a database that stores information about both the data and how it is related. The software for a relational database is called the Relational Database Management System (RDBMS); it controls reading, writing, modifying, and processing the information stored in the databases. Each database is a collection of related tables. Each table is a physical representation of an entity or object that is in a tabular format consisting of columns and rows. Columns are the fields of a record or the attributes of an entity. The rows contain the values or data instances; these are also called records. Relationships exist both among the columns within a table and among the tables. These relationships take three logical forms: one-to-one, one-to-many, or many-to-many. Most relational databases are designed so there is only one value per cell (an intersection of a column and row); in this design pattern, there are only one-to-one relationships within a table. Each table is named according to the data it contains, such as people or addresses.

Active GIS link to Inventory – The Geo-database is directly linked to the Inventory attribute database by a unique stand identity. There is only one polygon in the GIS database per stand polygon in the Inventory database. The GIS database and the Inventory database are most commonly two separate and distinct physical files. These two databases are usually managed and maintained by separate individuals or departments which operate under separate timetables. Spatial updates usually are initiated in the GIS database while attribute updates usually are initiated in the attribute database. An example is a new road versus a new cruise, respectively.

Stand-based Inventory – This is an inventory design where the forest cover is stratified into unique spatial polygons typically from 5 to 100 acres in size. These stratifications are usually based on differences in tree species, size classes of diameter and height, and stocking levels of tree frequency or a density index. Stand-based designs replaced grid-plot designs known as Continuous Forest Inventory (CFI) designs. The CFI design traditionally provided good information for the forest as a whole. However, the CFI design was incapable of providing spatially explicit detail when riparian buffers, green-up buffers and nesting sites became management constraints.

Lump/Split Polygon Updating – The software suite provides a set of tools to automate the update of the inventory attribute database to match any changes in the number and/or size of stand polygons in the GIS database. All attributes in the updated inventory database are either weighted by component acres from contributing polygons for continuous variables or assigned the discrete variable from the largest contributing polygon. The resulting inventory attribute database maintains the one-to-one relational structure to the updated GIS database as existed prior to the update. However the number, size and unique numbering of polygons (stands) may have changed.

Integrated Road Buffering – The software suite provides an automated update utility to accumulate all overlaps of road right-of-way acres on each stand polygon. These accumulated road acres are subtracted from the GIS gross acres of each subject stand polygon to compute a net-of-roads forested polygon. This update occurs in both the GIS database and the Inventory database.

Integrated Riparian Buffering – The software suite provides an automated update utility to accumulate all overlaps of riparian buffer acres on each stand polygon. These accumulated riparian acres are subtracted from the GIS net-of-roads acres in each subject stand polygon to compute a net-of-riparian forested polygon. This update occurs in both the GIS database and the Inventory database.

GIS Bio/Geo/Climatic SiteGrid – Growth capacity of trees is bounded by the length of the growing season, the amount of incoming precipitation, and the soil properties of water holding capacity and nutrient content. Each tree species responds differently to these bounds across the geographic range of that species. This growth capacity was traditionally indexed by an observed total tree height at a specified age (such as fifty years at breast height). However, silvicultural treatments and genetics have confounded these traditional indexes resulting in an array of heights at the index age. Also, the traditional assumption of a single height/age profile across all bio/geo/climatic zones has been found to be false. The site grid method provides: a) a standardized growth capacity index; as well as b) differential early silvicultural response; and c) long-term differential asymptotes.

Habitat Diversity Mapping – The software suite provides an automated tool to compute response surfaces across the forest landscape for variations in vegetation, soils, topography, climate and temporal responses to silvicultural regimes.

Inventory Processing – the suite of software tools and methods to maintain a working forest inventory

Built-in Cruise Selection Tools – The suite provides a tool to sort and select unique stands for the next field sampling exercise. The selection may be designed for specific subsets of the forest in both stand structure and history.

Integrated Cruise Compiler – This is a stand cruise compiler which automatically reads and writes to the inventory attribute database with the capacity to handle one to many stands with independent parameters.

Mixed Variable/Fixed Designs – This is a cruise compiler which accepts an array of different sampling designs for variable-radius and fixed-area sampling methods. The fixed-area design is usually invoked up to a maximum tree diameter threshold while the variable radius design is assumed above that threshold. The threshold may be any positive value.

Sub-sample Designs Included – Sub-sampling in this context refers to the kind and number of field measurements required within a single sample plot. While all trees may be required to be tallied, not every tree observation must have a

recorded height, defect, taper, age or crown measurement. The cruise compiler has built-in methods to approximate missing observations.

Snag and Down Woody Designs – The cruise compiler has the ability to calculate an array of statistics about snag and down woody characteristics based on a unique set of field sampling parameters, if captured in the field sample.

Non-tree Vegetation Designs – The cruise compiler has the ability to calculate an array of statistics about non-tree vegetation characteristics based on a unique set of field sampling parameters, if captured in the field sample.

All-Aged Strata Sub-sampling – Traditional cruise compilers were designed assuming even-aged, single-story stands. These traditional compilers applied a single relationship (ratio or regression line) to estimate missing parameters such as height or taper. The current methodology for cruise compilation uses non-parametric frequency distributions of field observed parameters for estimating missing observations in sub-sampling designs.

Defect Allocation – tree/seg/log – The cruise compiler has the built-in functionality to extrapolate tree defect from sampled to un-sampled trees using any combination of tree defect, segment defect and/or log defect sampling designs.

Spatial Clumpiness Index – The cruise compiler has the built-in functionality to compute the spatial and structural variation between tree observations in the stand cruise sample. This functionality has no effect on standing tree characteristics of stocking, volume or value. However, it may have significant effect on the future growth dynamics unique to this stand.

Off-Stand Plot Unbiased Designs – The cruise compiler has the built-in functionality to compute additions to tree, snag, down woody and non-tree stocking characteristics when the plot center falls outside of the stand polygon boundary. This functionality was discovered, detailed and documented by Dr. Kim Iles in his 2003 textbook, "A Sampler of Inventory Topics", in Chapter 14 – Edge Effect on pages 641-647. Dr. Iles refers to this method as the "Toss-back Method".

Off-Plot Subsample Designs – The cruise compiler has the built-in functionality to compute sub-sample contributions from tree measured outside of the plot boundaries. This design facilitates adding missing heights, ages, taper, defect, etc. observations for tree species or dimensions not well sampled within the plots for a stand. These off-plot observations do not add to the per acre statistics of stocking, volume or value. However, they do contribute to sub-sampled parameter estimates.

Stem-mapped Plot Compilation – The cruise compiler may be applied to permanent research plots which include stem-mapped tree coordinates. The software suite may include additional functionality to convert polar coordinates, provide slope corrections and compute individual tree density measures, such as Competitive Stress Index (CSI) per tree.

Species-specific Merchandizing – The cruise compiler has the built-in functionality and linkage to a database table to facilitate species-specific merchandizing methods which may include differences among species and/or among stands.

Log Sort/Species Valuation – The compiler has the functionality to compute values and costs associated with the unique combination of species, log dimensions, defect, log grade, merchandizing, harvesting systems and operational access.

Batch-mode Re-merchandizing – The software suite has the functionality to re-run individual stands or groups of stands without re-compiling from plot datasets. These batch runs may update all attributes for volume, value, log sorts and/or costs associated with each stand.

Common Volume/Value Method – All volume, taper and valuation factors are drawn from the background relational inventory database where the stand resides. This results in all inventory, growth, silviculture and harvest scheduling tools to use a common set of localized site, taper, growth and valuation parameters.

Growth Projection & Silviculture

Integrated Growth Model – This is a growth model which automatically reads and writes to the inventory attribute database with the capacity to handle one to many stands with independent parameters.

Distance-dependent Design – Traditional growth models used only a stand-level observation of density to calibrate the density effects on growth and to project future growth of a stand. This was satisfactory when the assumption of even-aged, single-story stands was acceptable. Stand structures under current silvicultural treatments are much more complex than assumed in traditional growth models. Current practices of thinning a few trees and leaving clumps is a practice which invalidates traditional distant-independent growth models. The spatial pattern of removals and residual trees has a significant impact on future growth dynamics. Thinning a few trees does not provide increased growing space to all residual trees as is the underlying default assumption in the distant-independent model architecture.

Integrated Clumpiness Effects – The growth model applies an index of clumpiness obtained from the inventory database which is unique to each stand and year of observation. The spatial structure of the trees within the stand is localized based on this index prior to all growth projections.

Integrated Stockability Effects – The growth model applies an index of stockability obtained from the inventory database which is unique to each stand. The spatial structure of the trees within the stand is localized based on this index prior to all growth projections.

Direct Database Input/Output – The growth model reads and writes directly to the inventory database. This facilitates year-end inventory growth updates for reporting and populating alternative silvicultural regimes for harvest planning.

All parameters for site, taper, growth, mortality, costs, values and silviculture are obtained directly from the inventory database on a stand-by-stand basis.

Localized Natural Regeneration – The growth model localizes the species composition and abundance of natural regeneration available to the stand in each growth step depending on the local habitat (growing season days, precipitation, topography and soils) and silvicultural treatments.

Localized Site Curve Shape – The growth model localizes the projected species-specific height/age profile for each stand in each growth step depending on the local habitat (growing season days, precipitation, topography and soils).

Localized Taper Profiles – The growth model localizes the projected species-specific taper profile and trends for each stand in each growth step depending on the local habitat (growing season days, precipitation, topography and soils) and silvicultural treatments.

Thinning Treatment Options – The growth model may optionally apply thinning prescriptions on a fixed or dynamic basis using a broad array of alternative methods and intensities of removal.

Fertilization Treatment Options – The growth model may optionally apply nutrient prescriptions on a fixed or dynamic basis using a broad array of alternative timings and intensities of application.

Fill-planting Treatment Options – The growth model may optionally apply fill-planting prescriptions on a fixed or dynamic basis using a broad array of alternative species mixtures and stocking levels.

Pruning Treatment Options – The growth model may optionally apply pruning prescriptions on a fixed or dynamic basis using a broad array of alternative timings and height removals.

Batch Processing w/Var Treats – The growth model may be applied to one or many stands in one run. This batch process may include alternative silvicultural treatments and regimes between stands.

Batch Processing w/Var Values – The growth model may be applied to one or many stands in one run. This batch process may include alternative merchandizing, and/or alternative costs and values.

Species / Genetics Variations – The growth model is designed and applied to include not only species growth dynamic differences but also differences due to variation in clones and genetic background.

Biomass – Bole, Crown, Roots – The growth model produces outputs which provide details in species composition of specific gravity and biomass factors. These factors are broken down among bole, bark, crown and root components.

Carbon Sequestration Tracking – The growth model produces outputs which provide details in species composition of specific carbon sequestration factors. These factors are broken down among bole, bark, crown and root components.

Common Volume/Value Method – All volume, taper and valuation factors are drawn from the background relational inventory database where the stand resides. This results in all inventory, growth, silviculture and harvest scheduling tools to use a common set of localized site, taper, growth and valuation parameters.

Harvest Planning & Sustainability

Integrated Harvest Scheduler – This is a harvest scheduler which automatically reads and writes to the inventory attribute database with the capacity to handle one to many stands which may include independent parameters and constraints.

Solution base – Linear Program – This harvest scheduler uses an equation-based solution designed to maximize a goal or minimize a residual. The forest is stratified into an array of factors (such as site, stand type, age and silvicultural regime). The solution details the distribution of acres at each level of each factor throughout the planning horizon. If the forest is small enough or the number of stands is low, then this scheduler may be stand-specific. The scheduler architecture is limited by the size of the multi-dimensional array in memory.

Solution base – Binary Search – This harvest scheduler uses an optimized search solution designed to assign each stand to the silvicultural regime and harvest period which provides the greatest contribution to the pre-defined goal. The scheduler relies on the relational inventory database to provide the range of silvicultural options, periods in the planning horizon, and number of stands included. The scheduler architecture is limited by the size of the computer hard drive to track individual stands and associated parameters.

1st Pass Spatial Constraints – The binary search architecture provides for simultaneous solution of attribute (e.g., volume, value, cost) parameters and spatial (e.g., green-up, nest sites, riparian buffers) parameters. Thus all values and constraints are brought to bear in each step of a single-pass solution. The linear program equation-based array solution is applied against the attribute factors only in the first pass. A second pass is necessary to apply this solution to stand-specific polygons without: a) significant impact on spatial constraints; and b) significant disturbance to the solution obtained in the first pass. The second pass is usually only applied to a few initial time-steps in the full planning horizon.

Unique Stand / Site / Silvics – The harvest scheduler is completely stand-specific in tracking and scheduling individual stands based on specific size, site, stand composition, operability, values, costs, silviculture, habitat, and spatial constraints due to neighbor green-up, habitat cover, riparian zones and wildlife nesting sites.

Variable Regimes by Rotation – The harvest scheduler may combine any combination of even-aged regimes from the first rotation to following rotations, including clearcuts, seed-tree, and shelterwood regimes over natural regeneration or planted regeneration. Selection harvest regimes may be included in the available mix of

optional silvicultural systems throughout the entire planning horizon regardless of the length of the even-aged rotations. Even-aged rotation lengths in years may be invoked independently by stand resulting in a wide array of rotation ages.

Variable Regimes per Stand – Each stand may have a wide array of alternative silvicultural regimes available for evaluation by the harvest scheduler. These alternative regimes are not limited in scope, kind or intensity of treatment. A regime may be a single or series of individual treatments through time.

Variable Logging System/Stand – The harvest scheduler will invoke only the values and costs to each stand which the access, operability and logging system parameters allow.

Variable Log Values / Stand – The harvest scheduler will invoke differential market values to similar stand, species, stocking and log dimensions based on localized, spatial proximity to those markets. For example, a stand on the north end of the forest may have access to a different market than a similar stand on the south end of the forest.

Full-range Silvicultural Options – The scheduler may evaluate alternative silvicultural systems simultaneously with the evaluation of alternative stands for any target time period and planning objective.

Common Volume/Value Method – All volume, taper and valuation factors are drawn from the background relational inventory database where the stand resides. This results in all inventory, growth, silviculture and harvest scheduling tools to use a common set of localized site, taper, growth and valuation parameters.

Technical Support & Ongoing Research – This functionality pertains to the current static or dynamic nature of the organization providing the software tools. A significant number of the original public organizations which provided the original forestry methods and tools have compacted or closed.

Windows PC Certified Software – Conforms to the Symantec Verisign Certification protocol for Microsoft Windows Applications in Xp, Windows 7 and Windows 8 Operating Systems. Certification Certificates are valid through 2014 – 2015.

Localized over Multiple Regions – The methods and tools are applicable over a wide geographic range of geography, species and silviculture.

Ongoing Technical Support – There is an ongoing commitment from the host organization to provide one-on-one technical support for all methods and tools provided by that organization.

Local On-site Tech Support – Any user of the software suite may request and receive on-site technical support when requested with a reasonable lead time.

Annual Workshops – The hosting organization of the software suite provides annual meetings and/or workshops where users may personally interact with members of the hosting organization. These meetings may provide new or altered functionality to be incorporated into the software suite.

User's Manual & Tutorials – Each software suite user has current user's manuals and tutorials to assist in the application of the methods and tools when working from their own home office.

Maintenance & Updating – The methods and software suite are monitored on a regular basis to provide adjustments or corrections due to: a) third-party changes in computer hardware or software; or b) discovery of bugs or limitations which may be corrected.

Full Microsoft Windows Function – The methods and software suite is maintained for the full spectrum of Microsoft Windows operating systems publically available.

External Parameter Libraries – All parameters for site, taper, growth, mortality, specific gravity, biomass and carbon estimated values are stored and maintained in a stand-alone database separate from the forest inventory database or GIS database. This functionality is important for minimizing the amount and frequency of maintenance on the software suite. These external libraries also facilitate the ability of all software tools (cruise compiler, stand expander, re-merchandizer, growth model and harvest scheduler) to apply the identical biometric relationships for compilation, growth and planning.

Scheduled Software Updates – The hosting organization provides regular reviews and updates to the software suite as needs and functionality evolve through time.

Scheduled Library Updates – The hosting organization provides regular reviews and updates for the biometrics relationships behind the site, taper, growth and mortality functions.

Research Database Archives – The hosting organization maintains a complete research database of felled-trees, temporary plots and permanent growth plots to provide validation, review and potential revision of all Library parameters, functions and response surfaces.

On-site Field Research Assist – The hosting organization maintains an active participation in ongoing and new field research trials. This participation includes research designs, distribution of installations, types and timing of re-measurements, and cooperative analyses of response surfaces.

On-site Field Inventory Assist – The hosting organization maintains an active participation in ongoing and new inventory processes. This participation includes designs for stand-based inventories, GIS database structures and linkages, sampling frequency and intensities, sample plot designs and parameters and field workshops with operational foresters on their ownerships.

On-site Year-end Reports Assist – The hosting organization maintains an active and ongoing availability for assisting inventory foresters in updating the year-end inventory for harvest depletions, GIS updates, growth and new field sampling additions. This interaction provides both confidence in correct practices and verification that all components of the software suite are functioning appropriately.

On-site Harvest Planning Assist – The hosting organization maintains an active and ongoing availability for assisting planning foresters in updating the long-term sustained yield plan and short-term silvicultural plan. This interaction provides both confidence in correct practices and verification that all components of the software suite are functioning appropriately.

On-site Biometrics Reviews – The hosting organization maintains an ongoing service on request to provide an annual on-site review of all operational inventory and planning activities which invoke the use of the inventory database and software suite. The objective is to instill confidence in: a) the methods and tools used by the operational forestry staff; and, b) the operational forestry staff by senior management decision-makers.

Annual User's Meetings – The hosting organization maintains an open dialogue with all users of their methods and software suite by holding at least an annual meeting for feedback, recommendations and identification of future developments.

Structure Non-profit Research – The hosting organization is a public service organization which is either: a) government sponsored such as a US Forest Service Experiment Station; or b) a tax-exempt research corporation with a service mission written into its bylaws. These structures are likely to be more resilient through time and changes in senior management, but not guaranteed.

Structure For-profit Consulting – The hosting organization is a for-profit private corporation, a limited-liability corporation or sole proprietor. The service mission is based on the desires of the current senior management, whom are not limited in scope or direction by bylaws or other outside factors. These structures are likely to be less resilient through time and changes in senior management.