6 TCruise Basics

6.1 TCruise Overview

TCruise is full featured inventory software developed by Dr. Tom Matney of Heuristic Solutions and Mississippi State University.

The TCruise family of applications includes:

- TCruise Desktop
- TCruise WinCE Pro for field data collection
- TVolume for Volume table creation
- TProfile where users can develop their own taper equations for TCruise.

TCruise can report volumes in a variety of standard formats:

- Cubic Feet
- Tons
- Cords
- Cunits
- Doyle, Scribner, and International board feet

TCruise can also accommodate:

- Plot, Point, and Double Point sampling
- Pre and post stratified cruises.
- Re-measurement and audit cruises.
- Sub-merch and reproduction cruises
- Stump Cruises

TCruise utilizes a variety of volume functions:

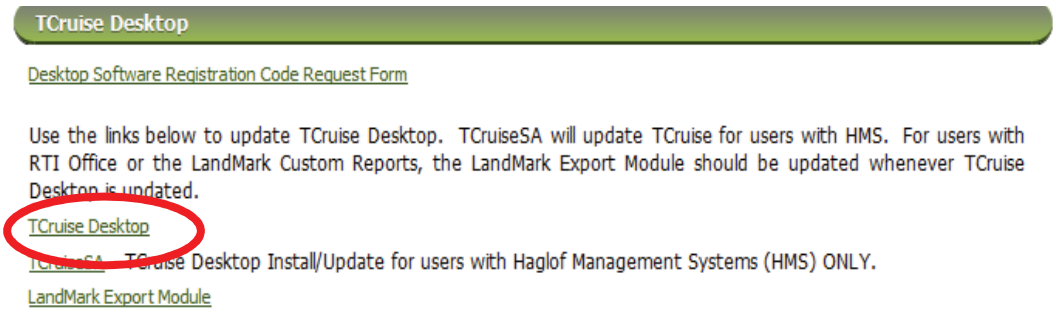
- 360+ different tree profile functions that cover most of the merchantable species in the South Eastern U. S.
- Mesavage & Girard functions developed from the original form class tables.
- User defined volume equations, ratio equations, and tables.

Other features include:

- Provides simple growth projection procedures for all sampling methods, reproduction plot summaries, and site index evaluation for selected key species.
- Automatically performs height sub-sampling.
- Allows creation of user defined fields for custom tract, strata, plot and tree level data
- Complete statistical reports.
- Variety of Save by options to allow data to be saved in sub-sets.
- Custom dll procedures permit the incorporation of user specific custom cruise methods.
- Can be customized to meet almost any inventory need.

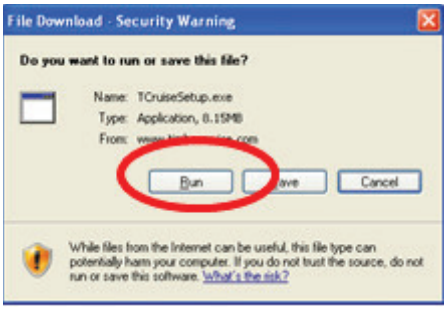
6.2 TCruise Install and Update Procedures

1. To begin the install you should visit the LandMark Spatial Solutions website and select Support > Software Downloads and then click the TCruise Desktop section. Click on the link titled TCruise Desktop.

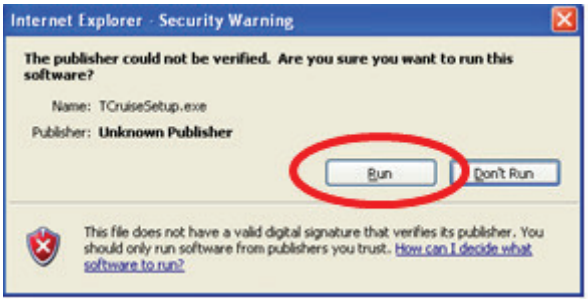


This method is preferable over using an install disk as you will be sure you have the latest build of the program.

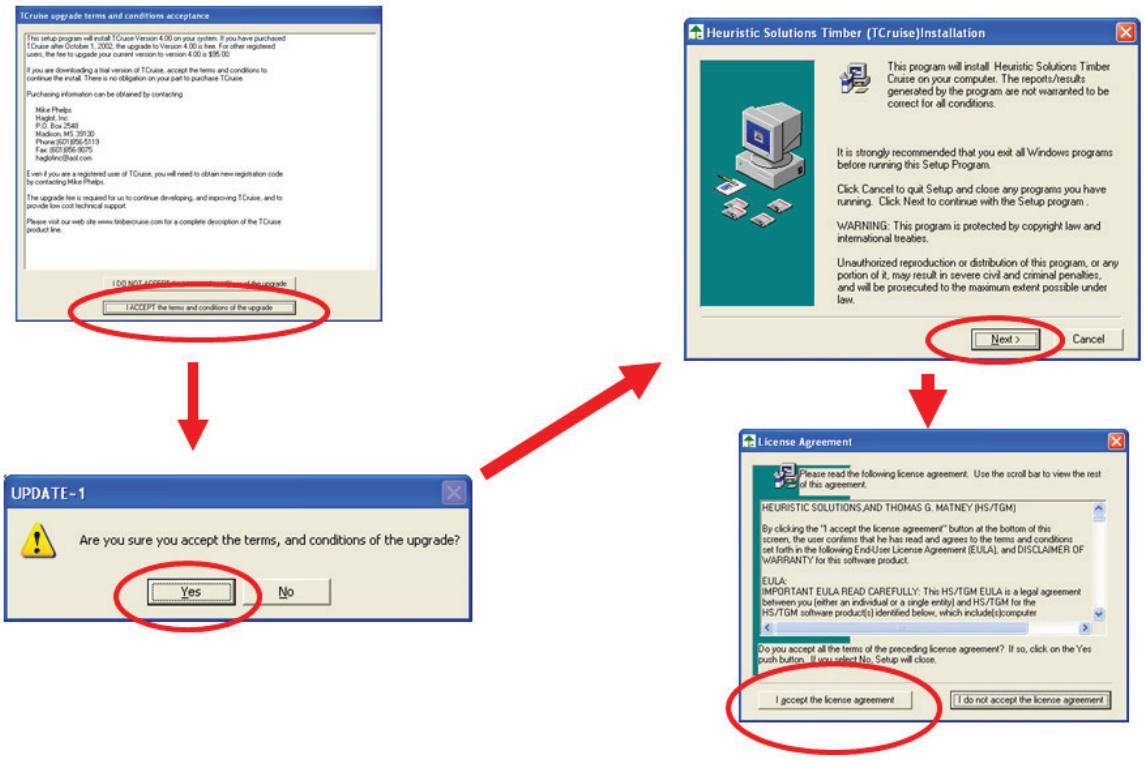
2. Select Run or Open when prompted and wait for the download to complete.



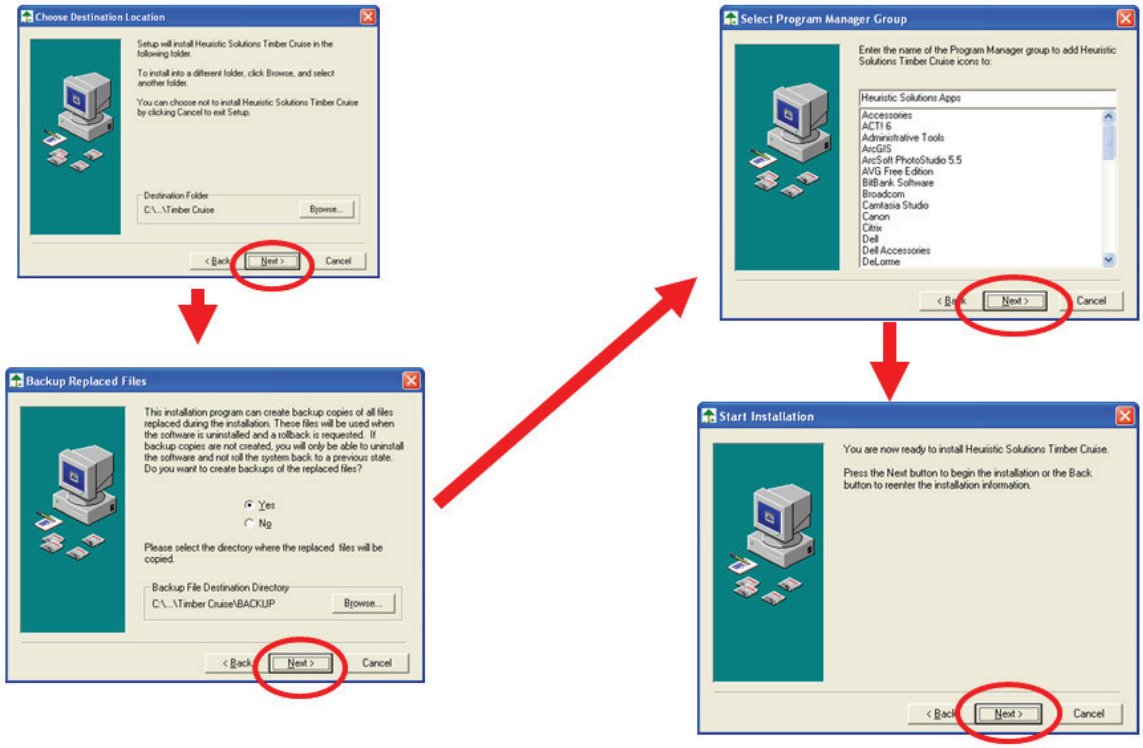
3. If you are prompted with a message "The publisher could not be verified…" don't worry. Select Run to start the install.



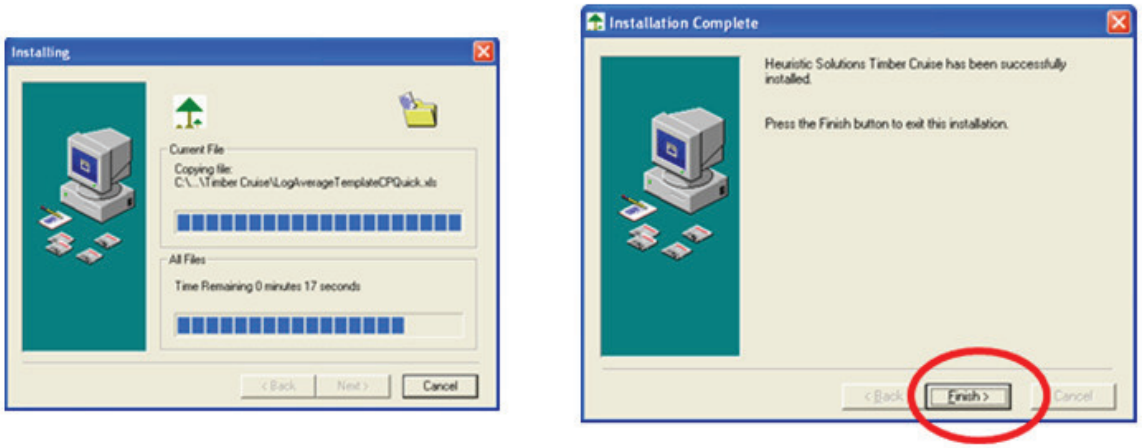
4. Select the appropriate items as you are guided thru the Install Wizard.



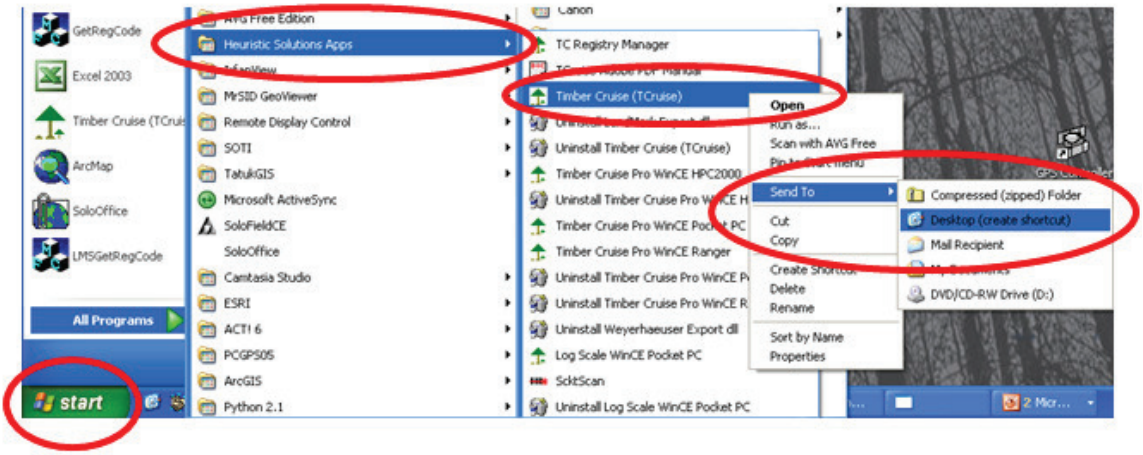
5. Accept the program install defaults by selecting ***Next*** all the way through.



6. When the install has completed select ***Finish***.



7. **Create a Desktop Shortcut for TCruise.**
   TCruise doesn't automatically create a desktop shortcut so you'll have to make your own. To accomplish this simply left click on the Windows Start Menu and select All Programs and then Open Heuristic Solutions Applications. Right Click on Timber Cruise (TCruise) and select ***Send To - Desktop (create shortcut).***

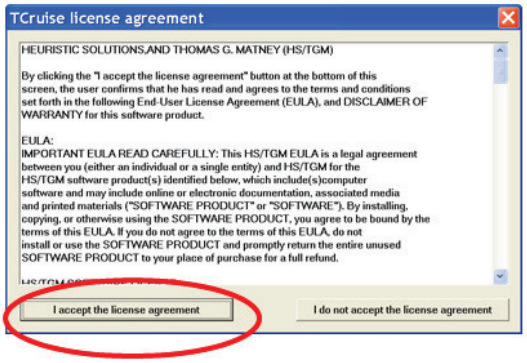


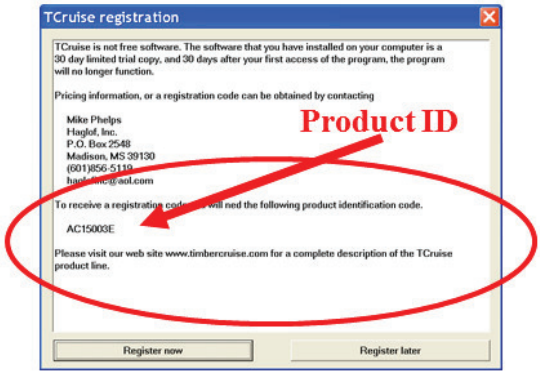
8. Registering TCruise Desktop

If you've purchased TCruise you can use the next section to demonstrate the registration process. If you are just going to demo TCruise, you can run the program with full functionality for 30 days from the time of installation. After 30 days the program will not open until you enter registration codes. During the demo period you may be prompted to register, simply press the Register Later button to get around this. **Do not request a registration code unless you have purchased the program, otherwise you will be invoiced.**

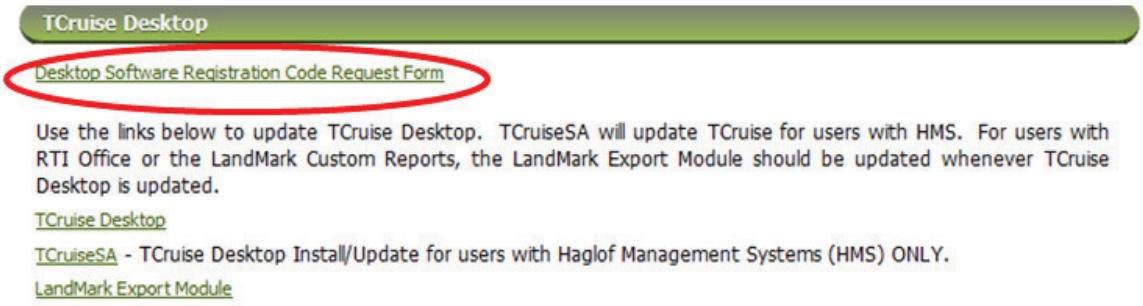
- Double Click the TCruise desktop icon 

to open up TCruise. You will once again be prompted to accept the license agreement. Next, find the TCruise Product ID on the TCruise registration window. This code is unique to each PC and will be needed to register the program.

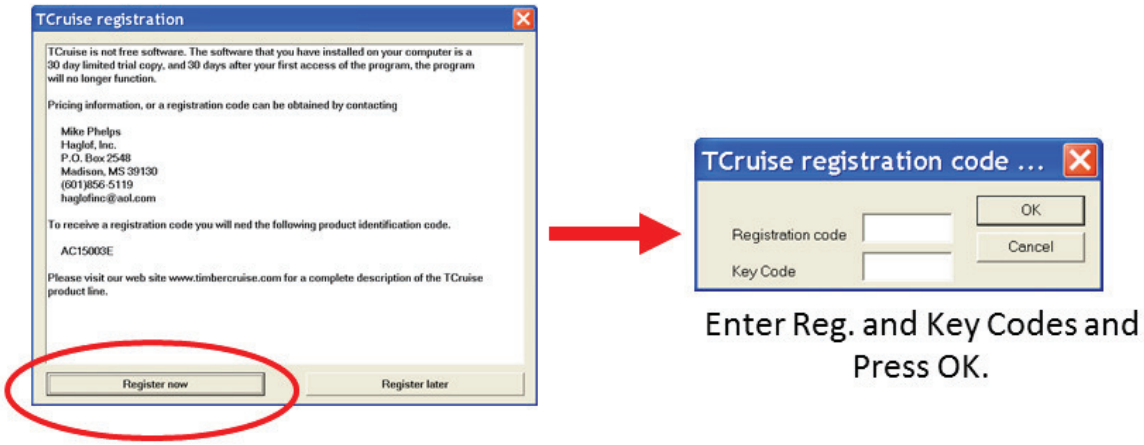




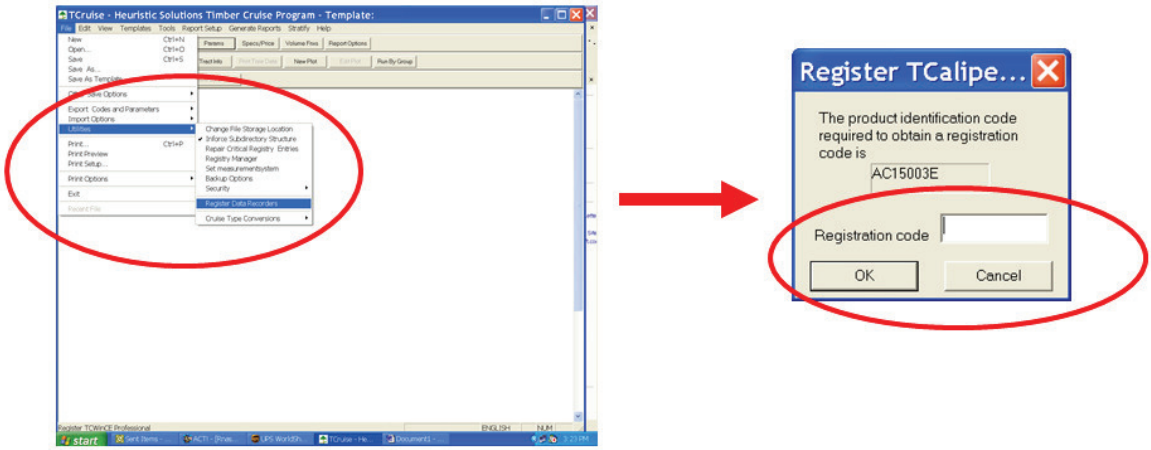
- Use the Desktop Software Registration Request form on the LandMark Spatial Solutions Support > Software Downloads page to submit your registration code request. This is the on the same page and section that you used to download the TCruise Installer.



When you have received the registration codes select the ***Register Now Button***. Enter the Registration and Key Codes that you received from LandMark Spatial Solutions and press ***OK***.



Register TCWinCEPro to be able to import field cruise data into the Office version. Click ***File menu, Utilities, Register Data Recorders***. Next, simply input the WinCEPro code supplied by LandMark Systems and press OK and you're done with Installation and Registration for the basic program features. (Note: If you purchased RTI Office and/or TCruise Custom Reports you will need additional downloads, installs, and registration codes.)



9. Updating/Transferring TCruise Desktop

From time to time it is recommended to update your TCruise Desktop Software. Simply follow the same procedure used for installation. This will overwrite the existing program files. It is not necessary to uninstall a previous version, backup any of your TCruise data files, or re-register the program.

If you get a new PC and wish to transfer your TCruise license to it, you must follow the install procedure and request new registration codes as your old codes will no longer be valid. You must also uninstall TCruise from the old machine as the TCruise license agreement states that the single user license can only be used on one machine.

6.3 How TCruise Works

The TCruise Process is simple:

- The forester creates a TCruise Template that defines all of the specifications for cruising and calculations. Multiple templates can be created to adjust to the different tract types and cruising needs (i.e. 1/10th acre Plot cruise vs. BAF 10 Point cruise vs. BAF 20 Point cruise).

- A "mini" version of the office template called a tcc or "code param" file is transferred to a Windows Mobile handheld device to facilitate field data collection.

- After the field data is collected, it is transferred and joined with the template for calculating volume estimates.

- The finished product is a TCruise tcd file also known as a tcd file. This file has the template and tree data. The user has the ability to change the merch specs, volume functions, add/remove plots, re-stratify, etc. to run different scenarios and save each as a separate tcd document. This makes TCruise a very flexible inventory application.

6.4 File Types in TCruise

- **.tct** = TCruise Template. This file contains all of the codes and parameters for cruising and workup.

- **.tcc** = TCruise Codes. The codes and parameters file is a scaled down version of the desktop TCruise template that is exported to the field data recorder.

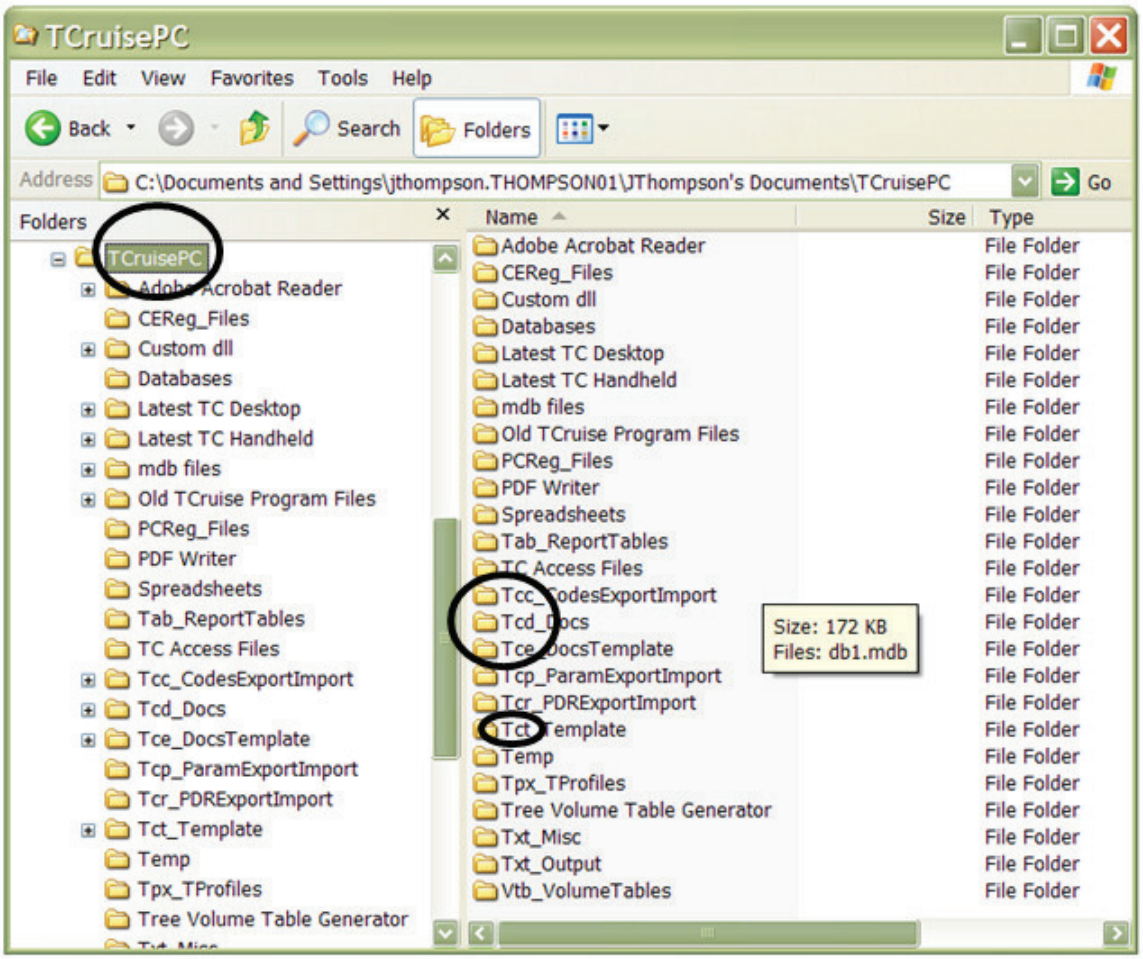
- **.tce** = Field data. This is the plot data in Windows CE file format.

- **.tcd** = TCruise Document. This is a finished cruising job that consists of the template with the field data.

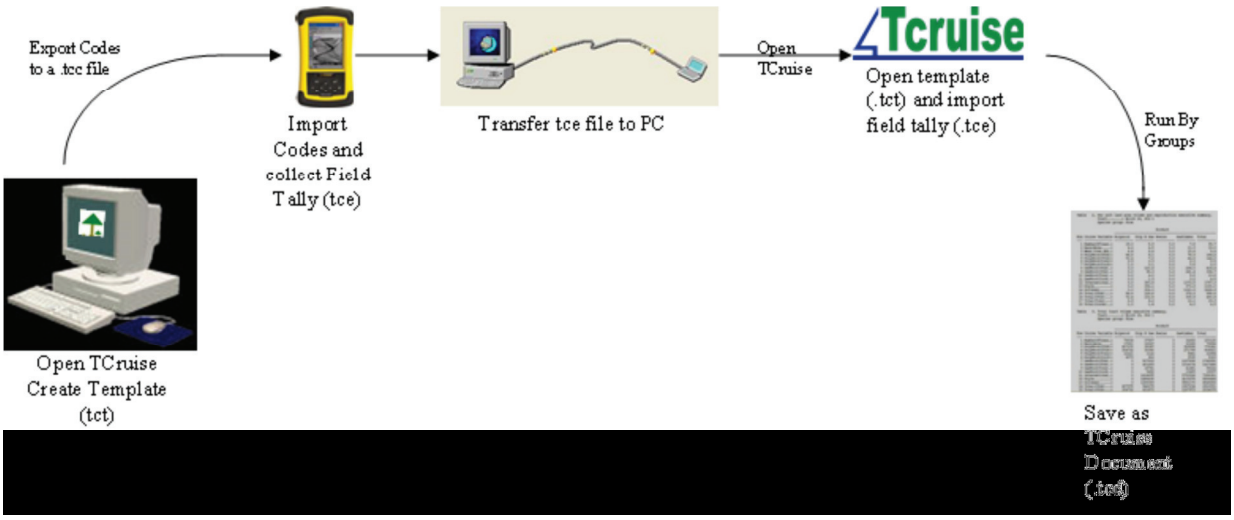
6.5 TCruise File Management

After you load TCruise and execute the program for the first time, the following file folders will automatically be created under the ***My Documents\ TCruisePC*** Directory.

Note the .Tcc, .Tcd, .Tce, and .Tct folders. TCruise will automatically direct you to these folders when you open or save these files on the PC. Also not that most folders have a prefix with the file extension in the name to help you tell which folder a certain file type should be stored.



TCruise Workflow Diagram:



6.6 Species Grouping Concept

A "Species Group" is a group of tree species that share the same products, merchandising specs, and pricing. This group has its volume reported as a whole. The individual species that make up the group can have their own volume functions applied, however. For example, you could lump your Loblolly, Slash and Longleaf pines in a group called "Pine." The volumes for the group would be reported together, but you could use your individual volume functions for each species to calculate the volume.

6.7 Volume Functions in TCruise

TCruise can use a variety of functions to estimate volumes. These include:

- Profile Functions aka Taper Functions
- Mesavage & Girard Volume Functions
- User Defined Volume Tables, Equations, and Ratio Equations

Remember that trees are not perfect cones, cylinders, or parabaloids. For this reason cruises are just estimates and no function will make you 100% correct 100% of the time. Each type of volume function has advantages and disadvantages and all require that you work within a set of parameters. Here's an explanation of each.

Profile Functions (Taper Equations)

- Profile functions are species specific taper equations that calculate cubic foot volume of trees. The cu ft. volume can then be multiplied by a lbs/cubic foot conversion for that species to get weight.

- Profile functions allow the cruiser to "build" a tree based on dbh and total height measurements. This creates a model of the stem. From this model diameters can be estimated all the way up the stem. This makes it easy for automatic product merchandising based on the Merch Specs in the template. Sawlog and pulpwood "stopper" heights can also entered to over-ride the default auto merchandising specs when appropriate.

- Cruisers need not enter total heights on every tallied tree. TCruise automatically performs height subsampling to estimate the heights of unmeasured trees. Stopper heights can still be entered even if total heights aren't measured on a particular tree.

- Profile functions allow the cruiser maximum flexibility by allowing changes in merchandising specs after the cruise because measurements aren't tied to preset top diameters.

- TCruise includes over 300 profile functions for a variety of pine and hardwood species throughout the Southeast and other regions US.

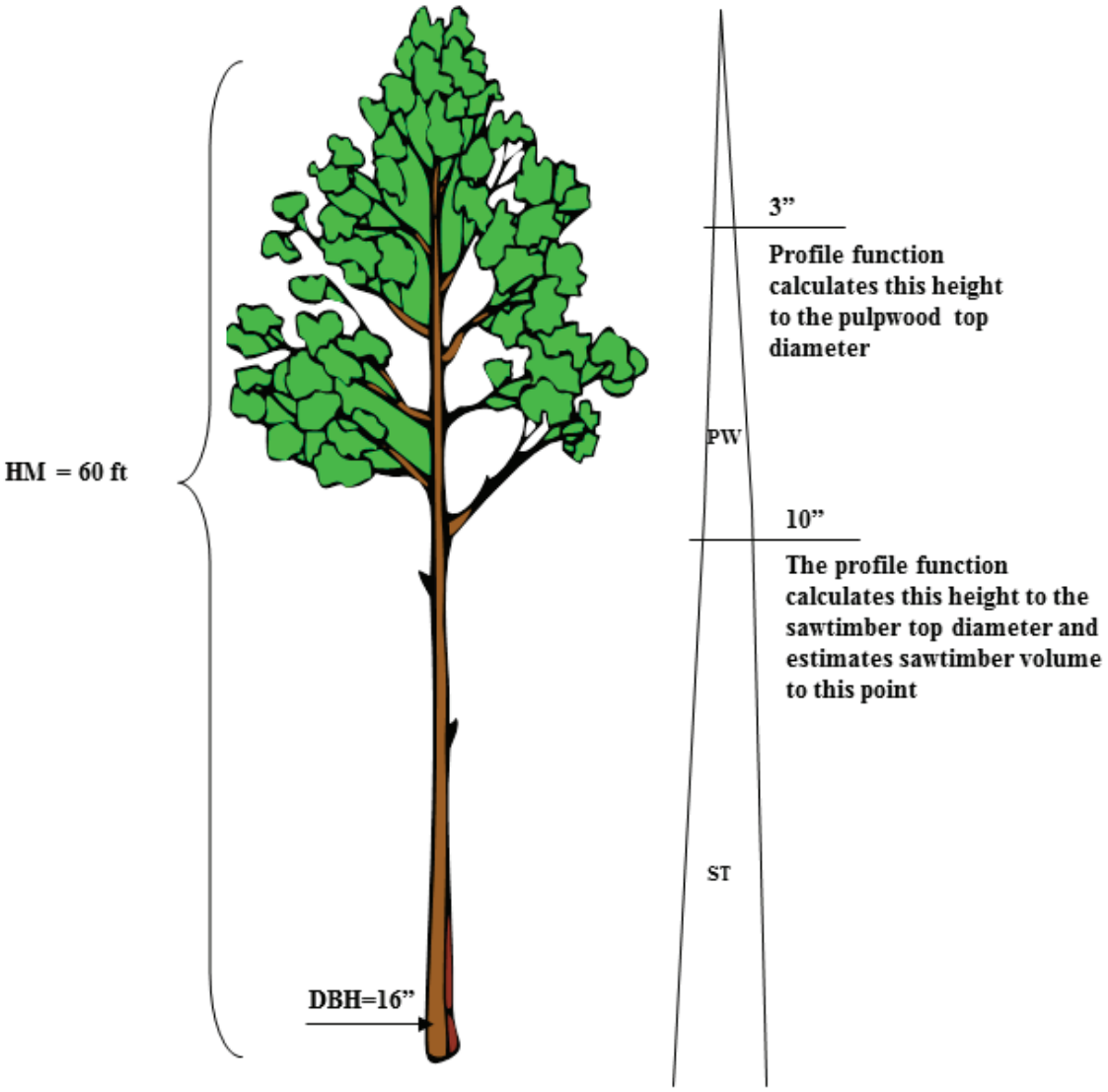
- The major downside to profile functions is that they aren't available for all species in all regions. They are also less well known and most foresters/cruisers are slow to change.

Profile Function Example:

Assuming the merchandising specs in TCruise were setup for:

- Min ST top dia = 10"
- PW top = 3 in.

The program could auto merchandise this tree by using the taper model to predict the heights at which the min top diameters were reached.



Height Subsampling is done automatically in TCruise. This is especially helpful when using taper functions. Here's more info on this topic:

TCruise requires for each species group encountered that a sub-sample of at least 20 trees be carefully measured for dbh and total height. The sample trees should be well distributed spatially within the tract and evenly distributed within dbh class. A consistent method for obtaining height sub-sample trees is to measure for each target species group the on plot tree nearest plot center. To avoid over sampling when visiting a large number of plots/points, only measure sub-sample trees on 1 out of every r plots/points. For example, if 50 trees are to be measured for height

and 200 plots/points are to be visited, sub-sample trees would be measured on 1 out of every 4 plots.

Towards the end of the cruise for each species group, a minimum of two to three sub-sample trees should have been measured for each encountered dbh class. If this requirement is not met, the sub-sampling rate should be increased and as a last resort off plot trees should be measured to fill in the gaps. Do not forget about the o column which allows you to specify that a tree is an off-plot measurement so they will be used in the height regression and not in the volume calculation. If you fail to collect at least 12 trees, Tcruise will calculate the volumes of the dhb-only trees using a default regression.

On sub-sample trees, measure dbh to the nearest 0.1 inch and height to the nearest 1 foot. Do not round sub-sample tree dbh to the nearest inch or ocular estimate height. The purposes of sub-sampling are to reduce the amount of time spent in the field and to avoid the bias caused by calling (ocular estimating) merchantable heights. Do not defeat the intent of height sub-sampling by using sloppy measurement technique.

Mesavage & Girard Volume Functions

These are functions built from the old Message & Girard tables developed in the 1930's. These tables are well known and commonly used across the Eastern US. The original tables output Board foot volumes for Scribner, Doyle, and International based DBH, Merch Height, and a form class assumption. These tables did not assume any top diameters and the tree sizes ranged in diameter from 10-40 inches in one inch classes and in height from 1 - 6 logs in half log intervals. See example below. Each table contained data for one log rule and one form class (Scribner Form Class 78 in the example).

FORM CLASS 78

TABLE 47.—*Gross volume of tree, Scribner log rule*

Tree diameter (inches)	VOLUME (board feet) BY NUMBER OF USABLE 16-FOOT LOGS										
	1	1½	2	2½	3	3½	4	4½	5	5½	6
10	28	36	44	48	52	-----	-----	-----	-----	-----	-----
11	38	49	60	67	74	-----	-----	-----	-----	-----	-----
12	47	61	75	85	95	100	106	-----	-----	-----	-----
13	58	76	94	107	120	128	136	-----	-----	-----	-----
14	69	92	114	130	146	156	166	-----	-----	-----	-----
15	82	109	136	157	178	192	206	-----	-----	-----	-----
16	95	127	159	185	211	229	247	-----	-----	-----	-----
17	109	146	184	215	246	268	289	-----	-----	-----	-----
18	123	166	209	244	280	306	331	-----	-----	-----	-----
19	140	190	240	281	322	352	382	-----	-----	-----	-----
20	157	214	270	317	364	398	432	459	486	-----	-----
21	176	240	304	358	411	450	490	523	556	-----	-----
22	194	266	338	398	458	504	549	588	626	-----	-----
23	214	294	374	441	508	558	607	652	698	-----	-----
24	234	322	409	484	558	611	665	718	770	-----	-----
25	258	355	452	534	617	678	740	799	858	-----	-----
26	281	388	494	585	676	745	814	880	945	-----	-----
27	304	420	536	636	736	811	886	959	1,032	-----	-----
28	327	452	578	686	795	877	959	1,040	1,120	1,190	1,261
29	354	491	628	746	864	953	1,042	1,132	1,222	1,306	1,389
30	382	530	678	806	933	1,028	1,124	1,224	1,325	1,421	1,517
31	411	571	731	871	1,011	1,117	1,223	1,328	1,434	1,541	1,648
32	440	612	784	936	1,089	1,206	1,322	1,432	1,543	1,661	1,779
33	469	654	838	1,001	1,164	1,289	1,414	1,534	1,654	1,783	1,912
34	498	695	892	1,066	1,239	1,373	1,507	1,636	1,766	1,906	2,046
35	530	742	954	1,141	1,328	1,473	1,618	1,757	1,896	2,044	2,192
36	563	789	1,015	1,216	1,416	1,572	1,728	1,877	2,026	2,182	2,338
37	596	836	1,075	1,290	1,506	1,670	1,835	1,998	2,160	2,324	2,488
38	629	882	1,135	1,366	1,596	1,769	1,942	2,118	2,295	2,466	2,637
39	666	935	1,204	1,449	1,694	1,881	2,068	2,251	2,434	2,616	2,799
40	703	988	1,274	1,532	1,791	1,993	2,195	2,384	2,574	2,768	2,961

In TCruise, these original tables had a regression fitted to them to develop a volume function. This allows for faster interpolation of the table. The new volume functions also include a conversion to cubic feet which allows better conversion to tons or cords. The values computed using the M&G functions very closely approximate the values in the original tables. If you need exact values from the tables you can manually input them using the TCruise Equation Manager (Tools > Equation Manager).

Another point to note about using a Mesavage & Girard function is that the Minor pulpwood tables are used to estimate volumes for pulpwood trees. All heights entered for species groups assigned to this type of function is a merch height to the PW or sawlog top depending on the highest product class of the tree. For sawlog

sized trees there is a means to estimate the topwood component. It is a very rough estimate since it is a difficult endeavor without any upper stem measurement. To accomplish this TCruise splines a Sweetgum taper equation on top of the sawlog. Using the form class and upper stem taper tables it estimates what the upper stem of the tree looks like and calculates the volume to the PW min top diameter assuming that a minimum piece length has been met.

User Defined Volume Tables, Equations, and Ratio Equations

TCruise allows users to input their own volume equations or tables. The output from these will be exactly what is input. For example, a volume table that has just weight can only output weight so board feet will not be included unless the user includes board feet in the table. Topwood cannot be calculated for user defined functions either. For these reasons it is recommended that users experiment with the built in volume functions to find one whose output is close to their old program or spreadsheet. They will allow much greater flexibility in the long run.

Which profile functions should I use?

There are a lot to choose from. See the appendix for a complete list along with sources for each. If you intend to measure total heights (or heights near total height) for a certain species such as pine, you should use one of the many taper functions in TCruise. Don't be concerned with measuring heights on every tree because TCruise automatically performs height subsampling and can estimate the missing heights. Measuring one or two total heights per plot or point should be sufficient.

If you prefer measuring or calling merch height for trees of a certain species or group you should choose one of the Mesavage & Girard functions.

Comparing volume function output using Tvolume

TVolume is a sister program to TCruise Desktop that is free to all users. It allows for the preparation of standard, and local volume equations from the each of the profile/taper equations built into TCruise. These equations/tables can be used as input to other programs such as cruise processors or spread sheets. One major benefit is that it can allow new users to compare the volume output of their old

cruise program/processor to one in TCruise. The setup and functionality is easy for anyone who has created a TCruise template and understands the merchandising specs and volume functions. LandMark Spatial Solutions can help with this as well if needed. Just give us a call.

6.8 Cruise Workup Workflow

Cruise workup in TCruise is designed to be simple. The Workup Toolbar will guide you through the entire process.

Steps:

1. **Load tct** – Load your desktop template.
2. **Import tce** – import your field data that has been transferred to the PC. This will allow the user to import one tce file at a time. The ability to import multiple files is available under the Batch TCE Import function in the ***File menu> Import Options***.
3. **Tract Info** – input tract acres, cruiser, and other tract information here.
4. **Print Tree** Data – (optional step) for users who need a hard copy of tree data sent to a printer or exported to an excel spreadsheet.
5. **New Plot – (optional step)** allows users to enter paper tallied data into TCruise if needed.
6. **Edit Plot – (optional step)** edits any plot to verify data, make changes to tree data, or fix errors.
7. **Run By Group** – processes cruise and calculates volumes by Species Group. The ability to run all groups combined is found under the Generate Reports menu.

Other Workup toolbar functions:

- **GIS** – placeholder not currently used.
- **View Errors** – allows user to view errors after a cruise is ran where errors are encountered.
- **View Report / Page up / Page Down** – allows users to navigate through the built in TCruise reports.

6.9 TCruise Data Output Options

TCruise also allows for other output rather than the built in report module.

The LandMark Export dll is custom add –on top TCruise that creates a custom Access database whenever a cruise is processed. This database is used to feed the LandMark Custom Reports for TCruise as well as other application such as SilvAssist.