

# OnyxTREE™ BROADLEAF

Manual 6.0



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### **OnyxTREE BROADLEAF 6.0**

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# Contents

<b>Title</b>	1
<b>Copyright Notice</b>	2
<b>Contents</b>	3
<b>License Agreement</b>	6
<b>Introduction</b>	10
About OnyxTREE BROADLEAF	10
User Interface	11
Meet the Current Technology	11
WIN Minimum System Requirements	13
MAC Minimum System Requirements	13
Registration	14
Installation	14
Technical Support	14
<b>OnyxTree BROADLEAF Overview</b>	15
Preview Panel	15
Structure Selection	15
Preview Selection	15
Sun	16
Shadow	19
Zoom	20
Drag	20
Chain Saw Tool	21
Render	21
Tree Height and Crown Spread	21
Eye Position	22
Rotational Cursors	22
Parameters Panel	23
Wind Time Control Panel	25
Wind	25



Wind Parameters	25
FPS Section	29
Frame Advance Section	29
Time Line	30
Communication Panel	30
Status Field	30
Polygons	31
Send	31
Cancel	31
<b>What is on the Menu</b>	32
OnyxTREE BROADLEAF	32
File	32
Edit	34
Background	34
Special	35
Help	36
<b>Broadleaf Tree Parameters</b>	37
Basic Definitions	37
Trunk and Bough Parameters	38
Branch and Twig Parameters	43
Volume Parameters	51
Foliage Parameters	55
<b>3D Model Export</b>	60
3DS File Export	62
C4D File Export	68
DXF File Export	74
FACT File Export	80
LWO File Export	86
OBJ File Export	92
How To Make 3D File Smaller	98





<b>Image Export</b>	100
BMP/PICT Tree Image Export	100
TGA Tree Image Export	103
TGA Tree's Shadow Image Export	107
 <b>Edition</b>	 109



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H 4.97 m S 3.57 m A 0° E 1°



Tr Bg B1 B2  
B3 T S F



C 24 25 30  
5 0



Acer saccharum 1

13 Random Seed  
2.5 m Trunk Height "  
20 % Bottom Height  
100 % Crown Center  
1.6 m Bough Length "  
Length Change  
77 ° Bough Angle "  
75 % Angle Change "  
49 % Bough Curving "  
19 cm Bough Density "  
0 ° Bough Twist "

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# Introduction

## About OnyxTREE BROADLEAF

**OnyxTREE BROADLEAF**, referred to as **BROADLEAF** in this manual, is a procedural tree generator dedicated for modeling and rendering photorealistic broadleaf trees. Once a tree has been generated, you can save it as a \*.BRO file in a custom library of tree parameters, the tree image can be saved as a BMP (PICT on Mac) file and a TGA file, and the tree 3D model exported as a 3DS, C4D, DXF, FAC, LWO, and OBJ file.

Those who inquire about BROADLEAF may be confused in thinking that BROADLEAF is a library of broadleaf trees. It is very important to clarify this misconception. Although, the software package comes with extensive libraries of pre-modeled broadleaf trees and bushes, this program is neither a data library nor a procedural library of broadleaf trees.

**BROADLEAF is a true tree modeler** that allows you to model virtually any kind of broadleaf tree thanks to the powerful parametric modeling technique that the program implements. The beauty of parametric modeling lies in the presence of precoded knowledge about the anatomy and growth of a tree you are going to model so that you do not have to start from scratch as is the case with conventional modeling.

**With BROADLEAF, you model a tree by simply manipulating its essential characteristics (parameters)** such as the height, the curvature and density of branches, the type and color of foliage, and many more. By adjusting the values of parameters, you can model a broad range of broadleaf trees and bushes: different species, variations of the



same species, trees in different stages of growth, trees in different seasons. Each parameter adjustment is recorded on the model instantly so that you have full awareness of the changes during the modeling process.

## User Interface

In spite of numerous parameters, it is very easy to command BROADLEAF because of its extremely well thought user interface. **The parameters are logically grouped and can be easily accessed on different levels of modeling detail.** The levels of modeling detail (or abstraction) allow you to concentrate on one class of tree elements at a time which, taking into account an inherent complexity of trees, helps tremendously in the modeling process.

The user interface is structured to reflect clearly the BROADLEAF's internally encoded principles of modeling so that you can get an understanding of these processes and achieve easily complete control. For all these years of our software developments, we have striven to make the communication between the user and our vegetation creators so fluent that, in the user's mind, it looks as if the interface has almost disappeared.

## Meet the Current Technology

A good program is distinguished not only by its features, but also by how well does the program balance its performance with the current technology. This is of particular importance for modeling and rendering trees since high demands on processing power and memory space tend to push a computer to its limits. We have invested tremendous amounts of



time and energy in the research to achieve this balance and to make our vegetation creators truly functional and useful.

**BROADLEAF can save a created tree as a parametric model, as a rendered image, and as a 3D geometric model** depending on the way you wish to use the data. In the parametric model, the tree is described by a set of parameters whose values determine its characteristics. **It is almost like a “DNA file” of the tree.** The trees saved in a parametric form will take the least space thus making it the ideal format for creating your own library of trees. Besides its compact size, the parametric format allows you to create infinite variations of a master tree that will depart slightly or substantially from its original, or you may show the same tree in different seasons. A parameter file can be opened by BROADLEAF which then generates the tree's 3D geometry according to the instructions written in the file.

If you wish to use a tree in 2D imaging work, or as a background tree in a complex 3D scene, you would want to use our rendering engine to create the tree image and then save this image as a BMP or TGA file. **By implementing innovative approaches to modeling and rendering, we have substantially speeded up tree generation**, lowered memory requirements for both, tree generation and tree storage, and achieved exceptional quality of rendered trees.

The algorithms we have developed for sun lighting are capable of depicting all the nuances of sun reflection, translucency, changes in color, and multiple shadow depths that occur when the sun casts its light on a tree. Our algorithms capture all these natural effects with unmatched fidelity. **And all of this is done in seconds and without any additional RAM requirements.**

For animation work, you would want to use **the BROADLEAF's 3D polygonal models that are exported in 3DS, C4D, DXF, FAC, LWO, and OBJ file formats**. When creating a 3D model, BROADLEAF gives you complete control over the size of the model. For a given tree, the number of polygons can be adjusted, so that you can achieve the best compromise between the model's size and the level of detail shown without sacrificing the tree's look and feel. Even with the small number of polygons, our models preserve graciousness of natural trees.

The combination of parametric modeling, powerful rendering, and the three different formats (parameter, image, and object) for saving the trees **makes BROADLEAF the ultimate tree creator** which successfully balances today's constraints of the computer processing power, and, at the same time, reaches far beyond the current state of technology into the future.

### **WIN Minimum System Requirements**

- Computer with Intel Pentium or equivalent processor
- 10 MB of RAM
- 30 MB of disk space
- 800 x 600 pixels, 24-bit color display support
- Windows XP/2000/NT/98/95 operating system

### **MAC Minimum System Requirements**

- 10 MB of RAM
- 30 MB of disk space



- 800 x 600 pixels, 24-bit color display support
- MacOS X operating system

## **Registration**

OnyxTREE BROADLEAF requires a password. Please follow the registration procedure written in Rregistration.rtf file.

## **Installation**

Installation of OnyxTREE BROADLEAF package is a simple process. Please follow the installation procedure written in Installation.rtf file.

## **Technical Support**

To ask a technical question, please send email to:

Support@OnyxTREE.com

The subject line must contain the BROADLEAF serial number and the registrant name. The question must be clearly stated and supported with a parameter file and/or screen image if necessary. We will do our best to respond to you in a timely manner. The inquiries that do not contain the BROADLEAF serial number and the registrant name will not be responded to.

# OnyxTree BROADLEAF Controls Overview

OnyxTree BROADLEAF window is divided into four areas:

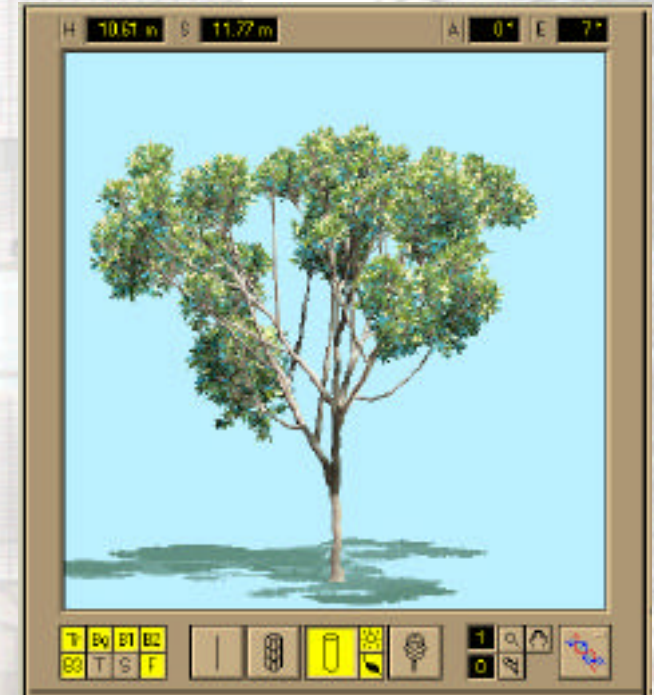
- Preview Panel in the center left area of the window
- Parameter Control Panel on the right
- Wind time control in the lower left area of the window
- Communication Panel in the lower right area of the window

**Preview Panel** - Preview Panel consists of the canvas on which the rendering occurs and a set of buttons and displays.

**Structure Selection** - The leftmost group of buttons at the bottom within Preview Panel called Structure buttons enable you to preview a tree on different levels of detail. The letters on these buttons designate different classes of tree elements: **Tr** (trunk), **Bg** (boughs), **B1** (branches of the first generation), **B2** (branches of the second generation), **B3** (branches of the third generation), **T** (twigs), **S** (stems), and **F** (foliage - leaves).

If you wish a tree rendered in full detail, select all the buttons. By deselecting any of the buttons, the tree will be rendered without the corresponding class of elements. Such selective viewing of the model speeds-up the design process tremendously because one is able to see only those parts of the model that are of interest at the particular moment.

**Preview Selection** - The four large plus two small buttons at the bottom middle portion of Preview Panel allow you to select the preferred rendering mode. You can choose to preview a tree in **linear** (LIN), **wireframe** (WF), or **full-shading rendering** (FSR) mode. By pressing the small **sun**

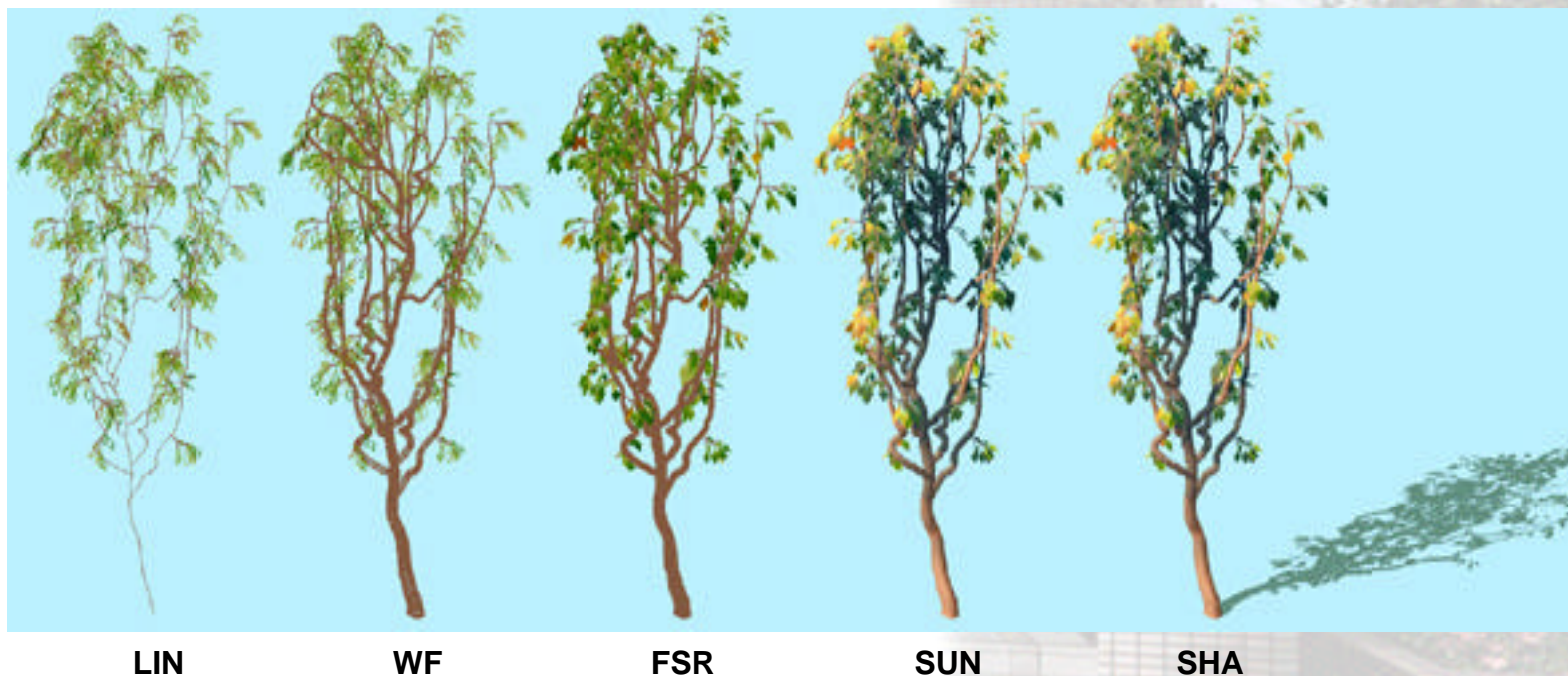




button, you activate the sun lighting (SUN) on the tree and by pressing the small **shadow** button right below the **sun** button, you enable the rendering of shadow (SHA). With the rightmost button called **Envelope**, you build the tree's crown envelope. You can export 3D tree envelopes as 3DS, C4D, DXF, FAC, LWO, OBJ, and W3O objects and use them for preliminary scene setups, preliminary design studies, or for tree massing where the file size is critical and the detail is not important.

**Sun** - The algorithms we have developed for sunlight are capable of depicting all the nuances of sun reflection, translucency, changes in color, and multiple shadow depths that occur when the sun casts its light on a tree. Our algorithms capture all these natural effects with unmatched fidelity. And all of this is done in seconds and without any additional RAM requirements.

When rendering with sun light, the user can either select one of five light pre-sets that capture different sun light conditions during the day





or choose to customize a light setting to his or her own liking. If you prefer using light presets, bring up **Light presets** dialog by right clicking the small sun button. There you can select one of five light presets: Early Morning, Late Morning, Early Afternoon, Late Afternoon, and Overcast. If you wish to create your own light setting, pressing **Custom...** while in **Light presets** dialog will get you to the custom light dialog with the following parameters:

**Light settings - Load** loads a previously saved custom setting LIG file.

**Light settings - Save** saves a custom setting as a LIG file.

**Sun azimuth** sets the sun azimuth angle. You adjust the azimuth by rotating the red vector in increments of 1 degree. 0 degrees is east (E), 90 degrees is north (N), etc.

**Sun elevation** sets the sun elevation angle. You adjust the elevation by rotating the red vector in increments of 1 degree. 0 degrees is a horizon, 90 degrees is a zenith, etc. When the elevation is set below 0 degrees, a tree does not cast any shadow on horizontal surface.

**Sun loss/gain** sets the amount of light received by the sun. The value is a qualitative one. You can get a pitch-black tree if you set the slider to -50 or overlit tree if you set it to +50. Usual values are somewhere between -5 and +15, these will depict overcast and clear sky, respectively.

**Sun color effect** swatch and the slider set the sun color and the extent of its contribution on those parts of a tree that are exposed to the sun. The most obvious use of this parameter would be for depicting a tree at



dusk on the clear day when objects pick-up the redness of sun.

**Sun reflection** swatch and the slider set the reflected light color and the extent of its reflection from the leaves exposed to the sun. It is used for controlling the shimmering effect.

**Sky reflection** swatch and the slider set the reflected sky color and the extent of its reflection from the leaves in shade.

**Shadow depth** slider sets the level of darkness of tree elements that are in the deepest shadow. The higher the value, the darker is the deepest shadow of a tree. The trees with denser crowns will have higher shadow depth than the ones with sparse crowns.

**Shadow color effect** swatch and the slider set the shadow color and the extent of its contribution on those parts of a tree that are in shade.

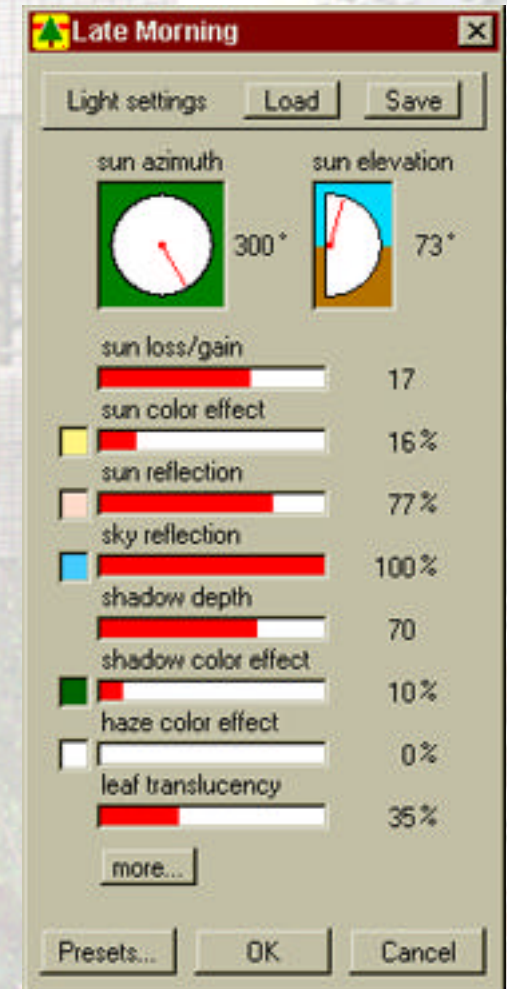
**Haze color effect** swatch and the slider set the color and intensity of the haze filter.

**Leaf translucency** sets the value of translucency. When zero (0), the leaves are totally opaque, otherwise they will allow certain amount of sun light to pass through.

**Presets...** button brings you back to five light presets.

**More...** button opens **Light more...** dialog with additional light parameters.

**Shadow resolution** sets the shadow map size. The lower the value the larger the map. The most “real situation effects” values are between 5 and 15. The default value of 10 works well for majority of trees.



**Shadow depth spread** sets the steepness of color transition between the tree elements exposed to the sun and those in the deepest shadow. Low values of shadow depth spread will sharpen the contrast between the lit and non-lit tree elements considerably. Higher values will result in softer transitions between the lit and non-lit parts of the tree.

**Random seed** introduces slight variations in the settings of light parameters.

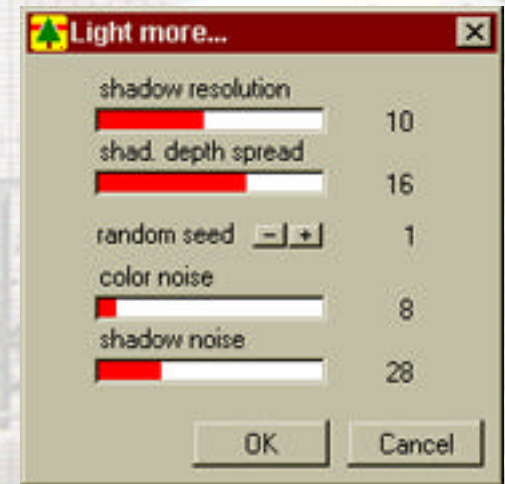
**Color noise** adds slight variations in color to the parts of tree exposed to the sun.

**Shadow noise** adds slight variations in color to the parts of tree in shade.

**Shadow** - To have a tree cast its shadow on the horizontal surface, activate the full shading rendering mode (if not already activated) and press the small shadow button located under the sun button. The shadow size and angle will be governed by the sun and viewpoint angles. By right-clicking the shadow button, you bring up the **Shadow...** dialog with the following parameters:

**Color** swatch displays the current shadow color. If you wish to change it, click the color swatch and the system's color picker dialog will show up enabling you to choose a desired color.

**Shadow intensity** is a double slider which controls the intensity of shadow of a particular tree element as a function of its thickness. The further the blue slider is to the right, the lighter is the shadow of thin branches. The red slider controls the visibility limit of thin branches. The further it is to the right, the thicker a particular element of a tree has to be in order to





cast its shadow. The default setting gives you a shadow casting pattern prevalent in majority of “earthly” trees.

**Shadow opacity** sets the opacity level of the shadow. The value of 100% will result in a fully opaque shadow and the value of 0% in a fully transparent one.

**Leaf color correction** is provided so that you can correct the shadow color of thin leaves on a tall tree. These leaves are so thin and far away from the ground that, without the color correction, they would cast very light shadow or completely disappear. By increasing the correction value, the shadows of these leaves become more pronounced.

The rightmost group of buttons at the bottom of Preview Panel includes the **Zoom**, **Drag**, **Chain Saw**, and **Render** buttons.

**Zoom** (designated with a magnifier icon) allows you to zoom-in and to examine a tree in detail. When you press the Zoom button and position the cursor anywhere on the BROADLEAF's canvas, you will see the cursor changing to a magnifier with a plus sign. Press the mouse to zoom-in on a specific part of the tree. To zoom-out, hold the Option key and press the mouse. Please note that when the zoom level is higher than 1 (one), Auto Scale is inactive. Auto Scale will become active again when you zoom all the way out. The display adjacent to the Zoom button shows the current zoom level or magnification factor.

**Drag** (designated with a hand icon) activates the translate mode which allows you to grab and drag a tree. When you press the Drag button and position the cursor anywhere on the BROADLEAF's canvas, you will see the cursor changing to a hand. Press the mouse and drag the tree in any



direction. Note that you cannot drag the tree when the zoom level (magnification factor) equals 1.

**Chain Saw Tool** (just below the Zoom button, designated with a saw icon) allows you to cut off any element of a tree. People are doing that all the time with street trees and the trees in their garden. With BROADLEAF, you can hand prune your tree as well. Simply press the Chain Saw button and position the cursor anywhere on the BROADLEAF's canvas, you will see the cursor changing to a saw. Press and drag the mouse over the branch you wish to cut. See the cutting line appearing as you drag the mouse. As soon as you release the mouse, BROADLEAF searches for the cut and rerenders the tree without the pruned branch. You can un-cut this branch by holding the Option key and pressing the mouse. There are total of fifty cuts available. The display right to the left of the Chain Saw button shows the current number of cuts performed on the tree.

**Render** (the rightmost button in the group, designated with a paintbrush icon), when pressed, initiates the rendering. Note that the rendering is initiated also whenever you switch to a different rendering mode or select/deselect any of the Structural Abstraction buttons. The rendering can be stopped by clicking the mouse anywhere in the content area of the window, including the buttons.

**Tree Height and Crown Spread** - Right above the canvas, there are four displays. The two displays on the left designated as **H** (Height) and **S** (Spread) show the height and spread of the currently rendered tree in meters.



**Eye Position** - The **A** (Azimuth) and **E** (Elevation) displays on the right show the elevation and azimuth angles of the current viewpoint. The elevation angle is the angular distance of the eye from the horizontal plane. The azimuth angle is the horizontal angular distance of the eye from Y axis.

**Rotational Cursors** - You can change the viewpoint by positioning the cursor anywhere on the BROADLEAF's canvas, pressing the mouse and moving the cursor to the left, to the right, upwards, or downwards.

As you start moving to the left, for example, the cursor will change to a left arrow, the tree will rotate clockwise around Z-axis (which is the principal direction of the trunk growth), and the A display will continuously update the azimuth angle. If you change the direction of movement from left to right, the cursor changes to a right arrow and the tree rotates counter clockwise.

By pressing the mouse and moving the cursor upwards, the cursor will change to an upward arrow, the tree will rotate around the axis lying in the XY plane (ground plane), and the E display will continuously update the elevation angle. If you change the direction of movement from upwards to downwards, the cursor changes to a downward arrow and the tree rotates in the opposite direction.

If you hold the Option key while you are moving the cursor, the tree will rotate in both directions simultaneously, and the A and E displays will be continuously updated.





**Parameter Control Panel** - Parameter Control Panel consists of the parameter buttons, the windows for the display of their current values, and the slider that enables you to change these values. Not all of the parameters that describe a tree are displayed at the same time. They are grouped in four main groups:

- Trunk and bough parameters
- Branch and twig parameters
- Volume parameters
- Foliage parameters.

The buttons at the bottom of the panel set the associated groups of parameters to be the currently active and visible.

The first button from the left enables you to access the parameters that describe the trunk and main boughs and the second button accesses the parameters for branches and twigs. By pressing the third button, you can access the parameters that control the widths and color of the trunk, boughs, branches, and twigs. The fourth, foliage button accesses the parameters for controlling the leaf types, their size, color, and positioning, and the foliage distribution across the tree crown.

The parameter **buttons with double quotation marks** at the top right hand corner, as, for example, Trunk Height, have associated sub-group of parameters and these parameters can be accessed by **double clicking** the corresponding parent button. The parameter buttons without the window display of their current values as, for example, Length Change, serve only as access buttons to the associated sub-group of parameters.



BROADLEAF can create virtually infinite number of different trees. There is a vast search space in front of you. The key to using BROADLEAF most effectively is acquiring a good grasp of its behavior. Begin by playing with the software. Once you comprehend the effects that a parameter or group of parameters have upon the tree, it is much easier to define purposeful actions that will lead to the desired results. Here are some tips for making your exploration of BROADLEAF more productive:

1. Use the trees from libraries as templates. It is much easier to grasp BROADLEAF's behavior by changing a tree template than by starting from scratch.
2. Concentrate on one group of parameters at a time. Play with the trunk and bough parameters first, and pretend for now that the rest of the parameters do not exist. Once in control of the trunk and bough parameters, proceed to other parameter groups.
3. Examine the trunk, bough, branch and twig parameters in the linear mode. The linear mode is the fastest, and it shows most clearly how a parameter affects the tree structure.
4. Read Broadleaf Parameters chapter. It will give you better understanding of the parameters and how they work.
5. Take a photograph of a tree and try to model the same tree by visually referencing the photograph. For most of us, it is easier to model a tree by copying it from the photograph than by visualizing it in our heads.

## Wind Time Control Panel - Wind Time Control Panel consists of:

Wind button

Wind Parameters button

Custom Frames Per Second button

Custom Frames Per Second display

24, 25, and 30 Frames Per Second buttons

Current Frame Number display

Frame Advance buttons

Jump to Beginning, Reverse Step, Reverse,  
Stop,

Forward, Forward Step

Time Line bar

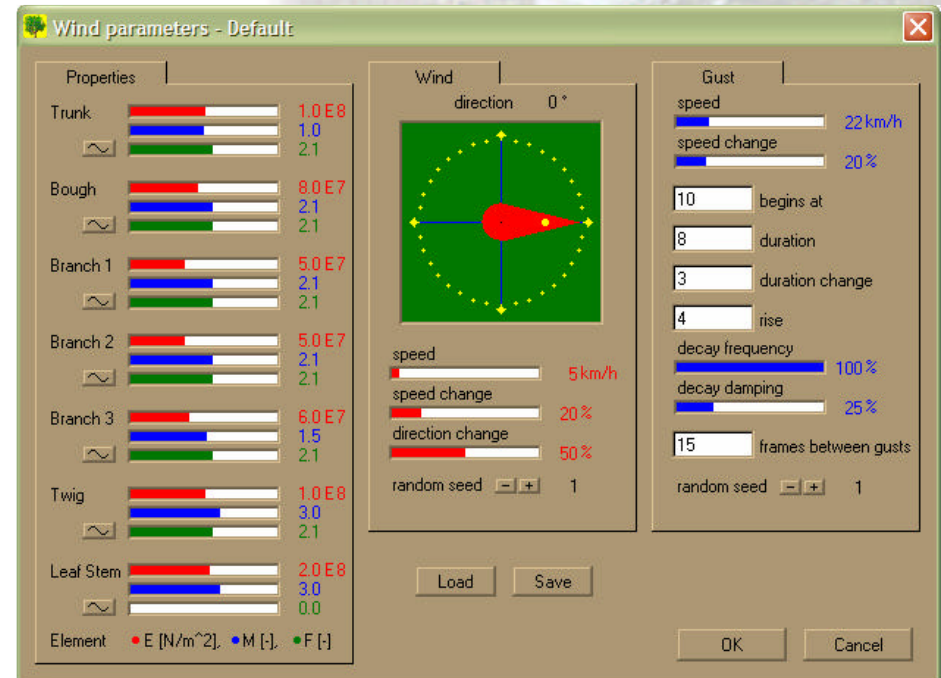


**Wind** button, when pressed, enables you to see the effect that wind has on a tree.

**Wind Parameters** button, when pressed, brings up Wind Parameters window. The window contains Property, Wind, and Gust parameters in their respective tabs. It also has Load/Save buttons to load previously saved wind parameters or to save the current ones.

### Property tab section

Each in the series of EMF slider triplets in this section controls the elasticity (E), the mass (M), and the force (F) for the corresponding class of tree or palm elements.



**The elasticity (E, red slider)**, measured in Newton per



square meter ( $\text{N/m}^2$ ), is the characteristics of a branch that determines the extent of its bending under wind force. The lower the elasticity value, the more the branch will bend under the same wind force. See the EMF table for the recommended elasticity settings.

Each **mass slider (M, blue slider)** enables you to adjust the mass of a particular class of tree elements. If you wish to add more mass to the trunk, for example, you set the corresponding blue slider to the value greater than zero. This value will influence how certain tree element moves on the wind. The higher the mass factor, the slower the movement (movement frequency).

Each **force slider (F, green slider)** enables you to adjust the force on a particular class of tree elements. If you wish to add more force on the trunk, for example, you set the corresponding green slider to the value greater than zero. This value will influence how certain tree element moves on the wind. The higher the force factor, the higher the extent of movement (movement amplitude).

**Wave** button (to the left of the force sliders, with the red wave icon) when checked will activate the waving of the corresponding class of elements. We suggest checking wave on the twigs if you animate a weeping willow, for example. Note that if this button is unchecked, the red wave icon does not appear. Wave buttons are available for broadleaf and conifer trees, they are not available for palms.

**Wind tab section**

The series of sliders in this section enable you to set the wind parameters.

Properties

Trunk	<div><div></div><div></div><div></div></div>	1.0 E8 1.0 2.1
<div><div></div></div>		
Bough	<div><div></div><div></div><div></div></div>	8.0 E7 2.1 2.1
<div><div></div></div>		
Branch 1	<div><div></div><div></div><div></div></div>	5.0 E7 2.1 2.1
<div><div></div></div>		
Branch 2	<div><div></div><div></div><div></div></div>	5.0 E7 2.1 2.1
<div><div></div></div>		
Branch 3	<div><div></div><div></div><div></div></div>	6.0 E7 1.5 2.1
<div><div></div></div>		
Twig	<div><div></div><div></div><div></div></div>	1.0 E8 3.0 2.1
<div><div></div></div>		
Leaf Stem	<div><div></div><div></div><div></div></div>	2.0 E8 3.0 0.0
<div><div></div></div>		

Element    • E [ $\text{N/m}^2$ ]    • M [-]    • F [-]

- Elasticity slider 'E' adjusts the characteristic of a branch that determines the extent of its bending under a wind force. Suggested values:

Element	Broadleaf	Conifer	Palm
Trunk	1E8 ... 1E9	5E8 ... 5E9	1E8 ... 1E9
Bough	5E7 ... 5E8	5E7 ... 5E8	-
Branch1	5E7 ... 5E8	5E7 ... 5E8	-
Branch2	5E7 ... 5E8	1E7 ... 1E8	-
Branch3	1E7 ... 1E8	5E6 ... 5E7	-
Twig	1E7 ... 1E8	5E7 ... 1E7	-
Stem	1E6 ... 1E7	-	1E7 ... 1E8
Leaf	-	-	1E7 ... 1E8
Needle	-	1E6 ... 5E6	-

- Mass 'M' slider sets the rate of element movement on the wind. The higher the mass factor, the slower the movement.
- Force 'F' slider sets the extent of element movement on the wind. The higher the force factor, the higher the extent of movement.

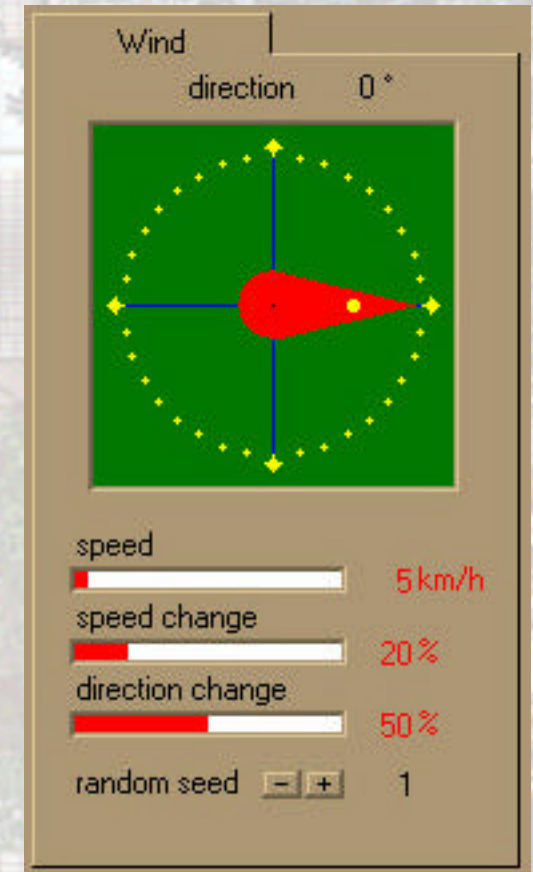
EMF table here shows the basic definitions and recommended elasticity, mass, and force settings.

**Wind direction** vane sets direction the wind is blowing at.

**Wind speed** sets the speed of wind. See Wind table for various wind speeds and their meaning.

**Wind speed change** and **Wind direction change** slider set the extent of wind turbulence on a tree.

**Wind random seed** sets random seed for wind behavior on a particular tree. If two instances of the same tree have the same random seeds, the trees will behave in exactly the same way. Unless you have a specific reason to keep the random seeds the same, it is a good practice to vary



random seed for each tree on the scene.

### Gust tab section

The series of sliders in this section enable you to set the wind gust parameters.

**Gust speed** sets the average speed of gusts. If the speed is zero, there are no gusts.

**Gust speed change** sets the extent of speed variation for the gusts. If the change is zero, all gusts will have the speed set by Gust speed.

**Gust begins at** field holds the frame number of the first gust occurrence.

**Gust duration** field holds the number of frames for which the gust duration lasts.

**Gust duration change** field holds the number of frames for which the duration may vary. If the change is zero, all gusts will have the duration as set in Gust duration field.

**Gust rise** field holds the number of frames that sets an average gust rise.

**Gust decay frequency** sets the frequency rate at which the gust decays.

**Gust decay damping** sets the speed of gust decay.

The 'Gust' settings panel includes the following controls:

- speed**: A slider set to 22 km/h.
- speed change**: A slider set to 20%.
- begins at**: An input field with the value 10.
- duration**: An input field with the value 8.
- duration change**: An input field with the value 3.
- rise**: An input field with the value 4.
- decay frequency**: A slider set to 100%.
- decay damping**: A slider set to 25%.
- frames between gusts**: An input field with the value 15.
- random seed**: A control with minus and plus buttons and a value of 1.



**Frames between gusts** field holds average number of frames between the two successive gusts.

**Gust random seed** sets random seed for gust behavior on a particular tree. If two instances of the same tree have the same gust random seeds, the trees will behave in exactly the same way. If you wish the gusts occurring at the precisely same times on all trees in the scene, keep the random seeds the same.

Wind	Beaufort	km/h	m/s	mph
Calm	0	0.5	0	1
Light air	1	5	1	3
Light breeze	2	10	3	7
Gentle breeze	3	15	5	12
Mod. breeze	4	25	8	18
Fresh breeze	5	35	11	24
Strong breeze	6	45	14	31
Moderate gale	7	55	17	38
Fresh gale	8	70	21	46
Strong gale	9	80	24	53
Whole gale	10	95	28	63
Storm	11	110	33	75
Hurricane	12	160	56	124

**FPS** buttons and fields.

**Custom Frames Per Second [C]** button when pressed directs BROADLEAF to take FPS number entered in **Custom Frames Per Second** field for wind animation.

**24**, **25** and **26** buttons when pressed directs BROADLEAF to take 24, 25 or 30 frames per second rate for wind animation.

**Current Frame Number** field shows the current frame for displayed tree. You can also enter the desired frame at which you wish to see the tree and press **Draw** button. Max number that can be entered is 999999.

**Frame Advance** buttons enable you to view a tree affected by wind. There are seven controls in that group:

**Jump to Beginning** - brings you to the beginning of the animation.

**Reverse Step** - steps back in time for one frame interval.

**Reverse** - continuously steps back in time at the given frame interval rate until it reaches the beginning. It can be stopped at any time by pressing the **Stop** button.

**Stop** - Stops forward and reverse actions.

**Forward** - continuously steps forward in time at the given frame interval rate. It can be stopped at any time by pressing the **Stop** button.

**Forward Step** - steps forward in time for one frame interval.

**Time Line** bar under the Frame Advance buttons gives you a qualitative information about the time. You can see where on the time line does the currently displayed tree lay.

- 000 -

**Communication Panel** - Communication Panel consists of:

- Status field
- Polygons button
- Send button
- Cancel button

Note that Communication Panel is active when OnyxTREE BROADLEAF modeler is linked to OnyxTREE STORM plugin for EI Universe. When this link is not established, Communication Panel elements are grayed-out.

**Status Field** displays “Universe Connected” when OnyxTREE



BROADLEAF is linked to OnyxTREE STORM plugin for EI Universe.

**Polygons** button, when pressed, opens up Adjust Polygons and Detail window where you can set up modeling detail, resolution, units, etc. prior to sending a tree model to OnyxTREE STORM. These controls are, in essence, the same as Save As FACT window. Thus to find out about its features, go to page 123 and read FACT File Export.

**Send** button, when pressed, sends a tree model to OnyxTREE STORM.

**Cancel** button, when pressed, cancels any changes made in OnyxTREE BROADLEAF and returns the control to OnyxTREE STORM.





# What is on the Menus

Menu bar holds 5 menus (Win only), 6 menus (Mac only):

- OnyxTREE BROADLEAF (Mac only)
- File
- Edit
- Background
- Special
- Help

## OnyxTREE BROADLEAF menu (Mac Only)

OnyxTREE BROADLEAF > **About BROADLEAF...** - Brings up the title screen.

OnyxTREE BROADLEAF > **Hide OnyxTREE BROADLEAF...** - Hides the main window.

OnyxTREE BROADLEAF > **Quit OnyxTREE BROADLEAF...** - Quits BROADLEAF application.

## File menu

File > **Load Parameters...** - Opens a chosen BRO file and loads its parameter values into BROADLEAF modeler.

File > **Save Parameters...** - Saves current broadleaf tree parameter values on a disk as BRO file.

File > **Save Image as BMP...** - Saves the tree image into a specified BMP file (Win only).

File > **Save Image as PICT...** - Saves the tree image into a specified PICT file (Mac only).

File > **Save Image as TGA...** - Saves the tree image into a specified TGA file.

File > **Save Shadow as TGA...** - Saves the tree shadow into a specified \*SH TGA file. It is not grayed out if **Shadow** button is pressed.

File > **Save Model as 3DS...** - Saves the tree model into a specified 3DS file.

File > **Save Model as C4D...** - Saves the tree model into the a specified C4D file.

File > **Save Model as DXF...** - Saves the tree model into a specified DXF file.

File > **Save Model as FAC...** - Saves the tree model into a specified FAC file.

File > **Save Model as LWO...** - Saves the tree model into a specified LWO file.

File > **Save Model as OBJ...** - Saves the tree model into a specified OBJ file.

File > **Save Model Part** - Enables you to select a part of the tree you wish to export out as a 3DS, C4D, DXF, FAC, LWO, OBJ model. Simply select Save Model Part and position the cursor anywhere on the BROADLEAF's canvas, you will see the cursor changing to a cross. Note that, in order for the cross to show, the Zoom, Drag, and Chain Saw

have to be unselected. Press and drag the mouse over this part of the tree you wish to export. See the rectangle enclosing the selection area as you drag the mouse. As soon as you release the mouse, the **Save Model Part** dialog appears allowing you to select the desired file format. If you do not wish to save this tree part, just press **Cancel**, the Model Part dialog will disappear and you will find yourself on the BROADLEAF's canvas. You can exit the Save Model Part mode by unchecking Save Model Part on the File menu. Note that Save Model Part is automatically disabled if you select Save Model as 3DS...OBJ.

File > **Quit** - Quits BROADLEAF application (Win only).

### Edit menu

Edit > **Copy** - Copies broadleaf image from the canvas onto the clipboard.

### Background menu

Background > **Sunny skies blue** - Sets the background color to R187, G240, B255.

Background > **New England blue** - Sets the background color to R15, G201, B255.

Background > **Joshua desert beige** - Sets the background color to R201, G170, B114.

Background > **Woodlands green** - Sets the background color to R30, G100, B10.



Background > **Overcast** - Sets the background color to R153, G153, B153.

Background > **White** - Sets the background color to R255, G255, B255.

Background > **Black** - Sets the background color to R0, G0, B0.

Background > **Other...** - Pick your custom color.

## Special menu

Special > **Auto Draw** - If checked, then the rendering is auto-initiated after each parameter adjustment.

Special > **Auto Scale** - When checked, Auto Scale fits the image to the BROADLEAF's canvas. The scaling factor for the tree image is auto-adjusted to that of the last tree image. If unchecked, the scaling factor is constant and has the value of the last tree image rendered with Auto Scale checked.

***TIP** If you want to see the whole tree on the canvas do the following:*

- 1. set Zoom to 1*
- 2. set Auto Scale to active*
- 3. press Draw button and wait for it to bounce back*
- 4. press Draw button again*

*Result -- the whole tree is being redrawn and fits the canvas.*

Special > **Continuous Update** - If checked, the tree image will be continuously updated as you rotate (change the viewpoint) or drag the tree. This will work only with smaller trees and on fast computers. As the technology progresses further and computers become more powerful, this feature will become much more useful.



## Help menu

Help > **Manual...** - Starts Adobe Acrobat Reader and displays BROADLEAF's manual title page.

Help > **Broadleaf Nursery...** - Starts a web browser and displays the OnyxNursery chapter web site.

Help > **ONYX Web Site...** - Starts a web browser and displays www.OnyxTree.com web site.

Help > **Email Us...** - Starts an email application.

Help > **About BROADLEAF...** - Displays the BROADLEAF's title screen (Win only).

# Broadleaf Tree Parameters

## Basic Definitions

**Trunk** is the main stem of a tree.

**Trunk segment** is the simplest building block of the trunk.

**Bough** is a branch that is attached to the trunk.

**Bough segment** is the simplest building block of the bough.

**Branch** is that branch that is attached to a bough or to another branch.

**Branch segment** is the simplest building block of the branch.

**Twig** is the terminal generation branch that carries leaves.

**Twig segment** is the simplest building block of the twig.

**Crown center** is that point on the trunk where the longest bough stems out.

**Phyllotaxy** defines the arrangement of branches and leaves that grow along the same, parent branch. These arrangements have profound impact on the tree form.

**Stem segment** is the simplest building block of the leaf stem.







## Trunk and Bough Parameters

**Random Seed** sets the randomization pattern for a tree model. It allows BROADLEAF to generate a number of different instances of the same tree type. Since it affects the values of all parameters, Random Seed is accessible on all four modeling levels.



**Trunk Height** sets the height of the trunk. On double click this button, the Trunk Height dialog box appears.

**Winding step** sets the winding period of the trunk.

**Winding angle** and **Winding twist** set the winding amplitude of the trunk.

**Random seed** sets the randomization pattern for the trunk winding.

**Curving resolution** sets the number of segments (longitudinal resolution) for the trunk. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures.

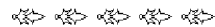
**Trans. resolution** sets the number of polygons (transversal resolution) for each cylindrical segment of the trunk.



**Bottom Height** sets the position of the first bough along the trunk.



**Crown Center** sets the position of the longest bough along the trunk.



**Bough Length** sets the length of the longest bough. On double click this button, the Bough Length dialog box appears.

**Min. length** sets the minimum length for boughs.



**Length Change** button brings up the Bough Length Change dialog box.

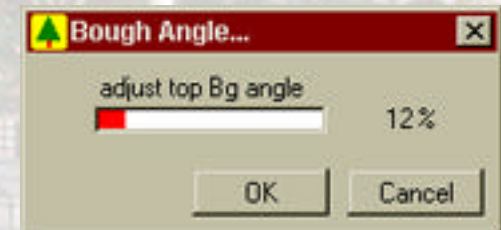
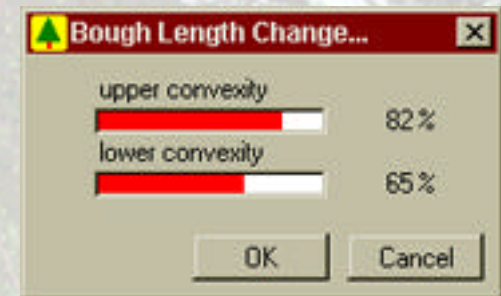
**Upper convexity** sets the pattern of bough length change from the crown center to the top of the trunk.

**Lower convexity** sets the pattern of bough length change from the crown center down to the bottom of the tree crown.



**Bough Angle** sets the bough-to-trunk angle of the first bough along the trunk. On double click this button, the Bough Angle dialog box appears.

**Adjust top Bg angle** adjusts the bough-to-trunk angle of the top bough.



If the adjustment is 100%, the angle of the top bough with respect to the trunk will be zero degrees, i.e. the top bough will grow as if it is in effect a top part of the trunk. For the adjustment of 0%, the top bough assumes the angle as set by the Bough Angle and Angle Change parameters.



**Bough Angle Change** sets the pattern of bough angle change along the trunk. On double click this button, the Bough Angle Change dialog box appears.

**Change starts at** sets the height along the trunk at which the bough angle starts to change.



**Bough Curving** sets the pattern of curving for boughs. On double click this button, the Bough Curving dialog box appears.

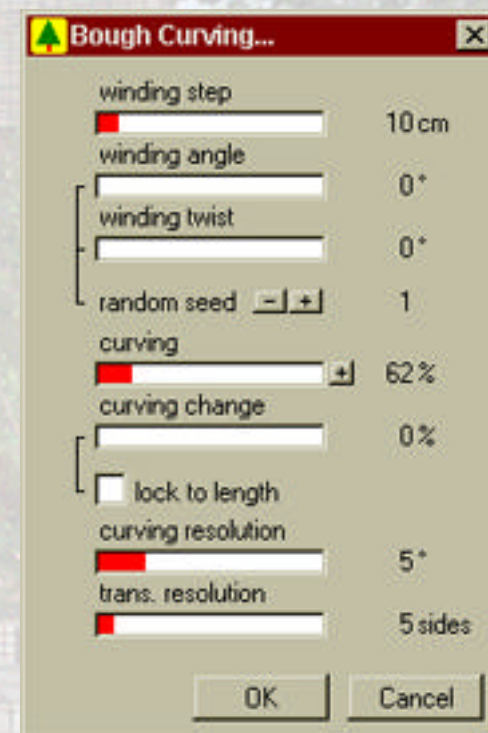
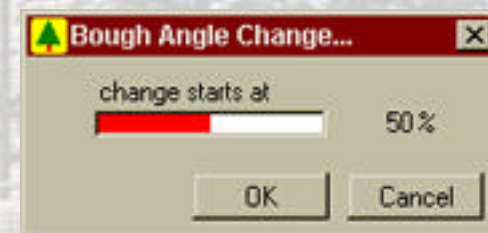
**Winding step** sets the winding period for boughs.

**Winding angle** and **Winding twist** set winding amplitudes for boughs.

**Random seed** sets the randomization pattern for the bough winding.

**Curving** sets the pattern of curving for boughs.

**Curving change** sets the pattern of bough curving change along the trunk.

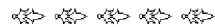




**Lock to length**, when checked, causes the amount of curving to vary for boughs with different lengths, the curving is dependent on the bough's length. If it is not checked, all boughs have the same curving factor.

**Curving resolution** sets the number of segments (longitudinal resolution) for the boughs. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures.

**Trans. resolution** sets the number of polygons (transversal resolution) for each cylindrical segment of the bough.



**Bough Density** sets the extent of population for boughs. On double click this button, the Bough Density dialog box appears.

**Max. group of** sets the maximum number of boughs in the same group.

**Random offset** sets the extent of deviation in the number of boughs per group from the maximum number.

**Pruning** sets the amount of boughs to be pruned.



**Bough Twist** sets the angle of rotation of the first bough around the trunk. On double click this button, the Bough Twist dialog box appears.



**Randomize** when checked causes random change of Bough Twist whenever Random Seed changes its value. If unchecked, Bough Twist will always have the same value without respect to the current value of Random Seed.





## Branch and Twig Parameters

**Random Seed** sets the randomization pattern for a tree model. It allows BROADLEAF to generate a number of different instances of the same tree type. Since it affects the values of all parameters, Random Seed is accessible on all four modeling levels.



**Branch Length** sets the length of the longest branch relative to its parent branch. On double click this button, the Branch Length dialog box appears.

**B1 length** sets the length of the longest branch relative to its parent branch for the first generation branches.

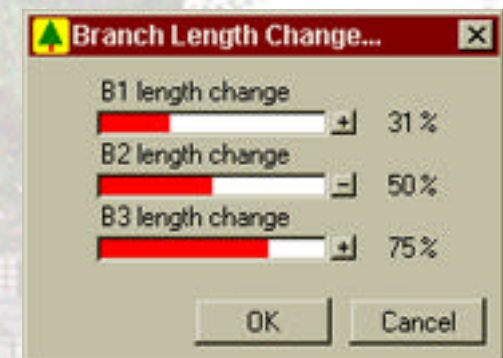
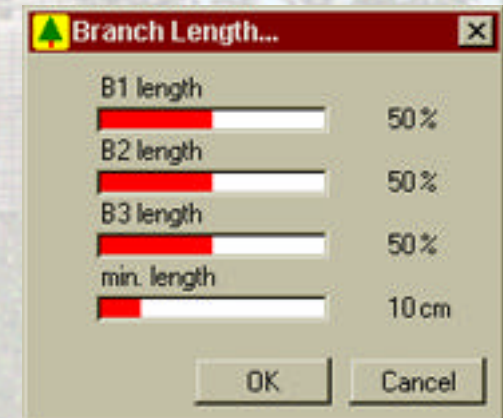
**B2 length** sets the length of the longest branch relative to its parent branch for the second generation branches.

**B3 length** sets the length of the longest branch relative to its parent branch for the third generation branches.

**Min. length** sets the minimum length for branches.



**Branch Length Change** sets the pattern of branch length change for a succession of branches of the same parent branch for all three genera-





tions of branches. On double click this button, the Branch Length Change dialog box appears.

**B1 length change** sets the pattern of branch length change for a succession of branches of the same parent branch for the first generation branches.

**B2 length change** sets the pattern of branch length change for a succession of branches of the same parent branch for the second generation branches.

**B3 length change** sets the pattern of branch length change for a succession of branches of the same parent branch for the third generation branches.

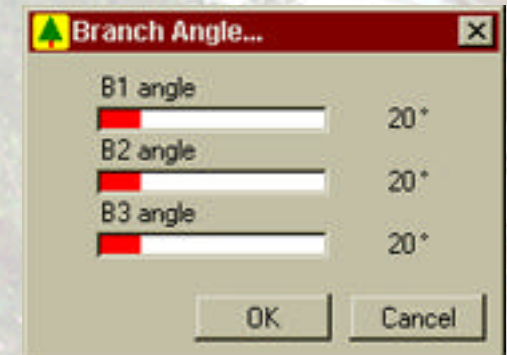


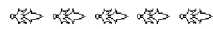
**Branch Angle** sets the maximum branch-to-parent branch angle for all three generations of branches. On double click this button, the Branch Angle dialog box appears.

**B1 angle** sets the maximum branch-to-parent branch angle for the first generation branches.

**B2 angle** sets the maximum branch-to-parent branch angle for the second generation branches.

**B3 angle** sets the maximum branch-to-parent branch angle for the third generation branches.





**Branch Angle Change** sets the pattern of branch angle change for a succession of branches of the same parent branch for all three generations of branches. On double click this button, the Branch Angle Change dialog box appears.

**B1 angle change** sets the pattern of branch angle change for a succession of branches of the same parent branch for the first generation branches.

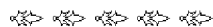
**B2 angle change** sets the pattern of branch angle change for a succession of branches of the same parent branch for the second generation branches.

**B3 angle change** sets the pattern of branch angle change for a succession of branches of the same parent branch for the third generation branches.

**B1 twist offset** sets the maximum deviation from the nominal twist angle as set by phyllotaxy for the first generation branches.

**B2 twist offset** sets the maximum deviation from the nominal twist angle as set by phyllotaxy for the second generation branches.

**B3 twist offset** sets the maximum deviation from the nominal twist angle as set by phyllotaxy for the third generation branches.



**Branch Curving** button brings up the Branch Curving dialog box.

Press **B1**, **B2** or **B3** button for an access to the branch curving and winding parameters for the first, second or third generation branches, respectively.

**Winding step** sets the winding period for branches of the selected generation.

**Winding angle** and **Winding twist** set the winding amplitude for branches of the selected generation.

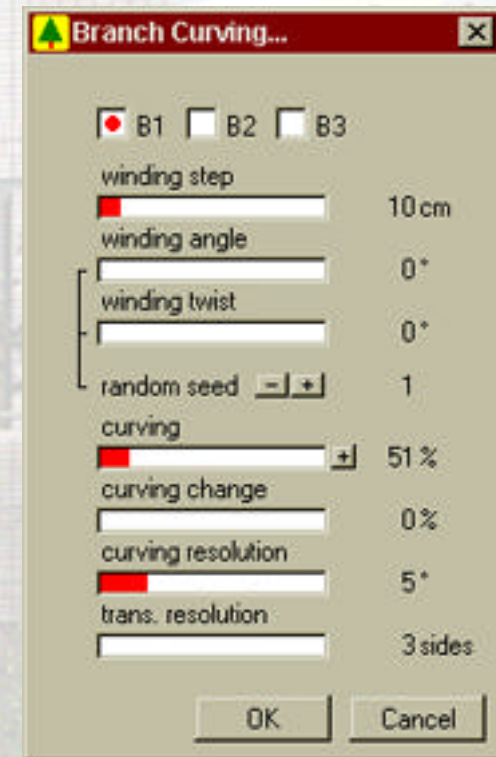
**Random seed** sets the randomization pattern for the branch winding of the selected generation branches.

**Curving** sets the pattern of curving for branches of the selected generation.

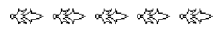
**Curving change** sets the pattern of branch curving change across the tree crown for the selected generation branches.

**Curving resolution** sets the number of segments (longitudinal resolution) for branches of the selected generation. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures.

**Trans. resolution** sets the number of polygons (transversal resolution) for each cylindrical segment of the selected generation branch.







**Branch Density** button brings up the Branch Density dialog box.

**B1 density** sets the extent of population for the first generation branches.

**B1 growth starts at** sets the position of the first branch along its parent branch for the first generation branches.

**B1 pruning** sets the amount of the first generation branches to be pruned.

**B2 density** sets the extent of population for the second generation branches.

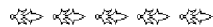
**B2 growth starts at** sets the position of the first branch along its parent branch for the second generation branches.

**B2 pruning** sets the amount of the second generation branches to be pruned.

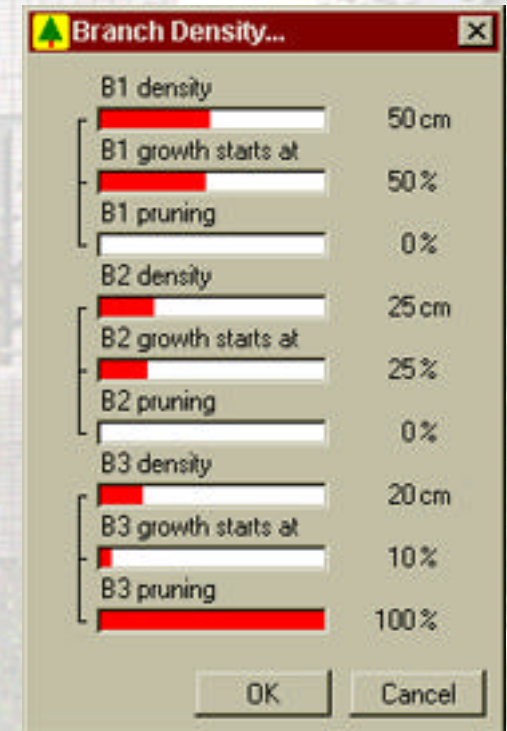
**B3 density** sets the extent of population for the third generation branches.

**B3 growth starts at** sets the position of the first branch along its parent branch for the third generation branches.

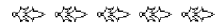
**B3 pruning** sets the amount of the third generation branches to be pruned.



**Twig Length** sets the average length for twigs. On double click this button, the Twig Length dialog box appears.



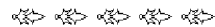
**Random length** sets the extent of deviation in lengths from the average twig length.



**Twig Angle** sets the average twig-to-parent branch angle for twigs. On double click this button, the Twig Angle dialog box appears.

**Random angle** sets the extent of deviation in twig-to-parent branch angles from the average twig angle.

**Twist offset** sets the maximum deviation from the nominal twist angle as set by phyllotaxy for the twigs.



**Twig Curving** sets the pattern of curving for twigs. On double click this button, the Twig Curving dialog box appears.

**Winding step** sets the winding period for twigs.

**Winding angle** and **Winding twist** set the winding amplitude for twigs.

**Random seed** sets the randomization pattern for the twig winding.

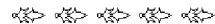
**Curving** sets the pattern of curving for twigs.

**Curving change** sets the pattern of twig curving change across the tree crown.



**Curving resolution** sets the number of segments (longitudinal resolution) for the twigs. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures.

**Trans. resolution** sets the number of polygons (transversal resolution) for each cylindrical segment of the twig.



**Twig Density** sets the extent of population for twigs. On double click this button, the Twig Density dialog box appears.

**Pruning** sets the amount of twigs to be pruned.



**Phyllotaxy** button brings the Phyllotaxy dialog box.



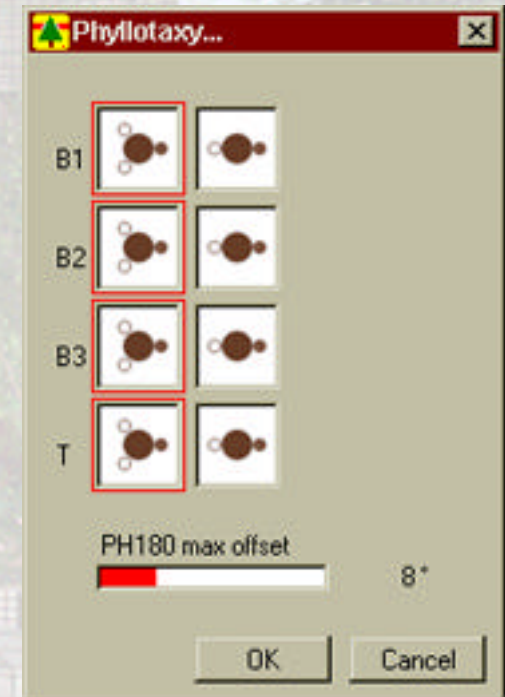
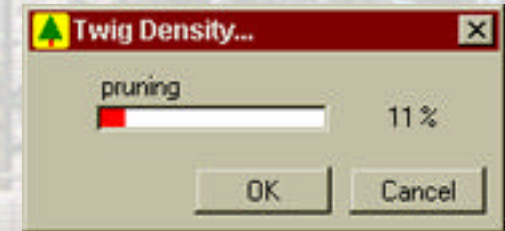
stands for Phyllotaxy 120.

If Phyllotaxy 120 is selected, child branches spring from three sides of the parent branch. Each successive branch is rotated with respect to the previous branch for 120°. Phyllotaxy 120 causes branches to grow in all directions thus resulting very often in not so regular crown shapes.



stands for Phyllotaxy 180.

If Phyllotaxy 180 is selected, child branches spring from opposite sides





of the parent branch. Each successive branch is rotated with respect to the previous branch for  $180^\circ$ . Phyllotaxy 180 tends to spread branches in flat planes facing the sky and produces very often well-ordered crown shapes commonly found in conifers.

**PH180 max offset** sets the maximum deviation twist angle for the first branch of the same parent. It applies to Phyllotaxy 180 only.

### COMMENT!

In nature, the trees follow a number of different Phyllotaxy patterns (120 and 180 being very common), and Phyllotaxy is one of the characteristics that differentiates species. Phyllotaxy arrangements are the most apparent on shoots, leaves, and very young branches. As the tree grows, these arrangements deviate more and more to accommodate a variety of impacts from the environment. In order to capture these changes, we have taken the freedom to allow you to set Phyllotaxy patterns on different classes of tree elements independently.





## Volume Parameters

**Random Seed** sets the randomization pattern for a tree model. It allows BROADLEAF to generate a number of different instances of the same tree type. Since it affects the values of all parameters, Random Seed is accessible on all four modeling levels.



**Trunk Width** changes all characteristic trunk widths relative to their respective, current values. On double click this button, the Trunk Width dialog box appears.

**Hs** (heights) value slider defines the positions of six, characteristic widths along the trunk.

**Widths** value sliders allow you to set these six, characteristic widths. Each width value and its corresponding position are designated by the same color.

**Curving resolution** sets the number of segments (longitudinal resolution) for the trunk. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures.



**Trunk Mold** button accesses the trunk molding and spiraling parameters.





sets the wave molding pattern.



sets the lattice molding pattern.

**Mold angle** sets the density of trunk waviness.

**Mold width** sets the extent of trunk waviness.

**Mold height** sets this height along the trunk where the mold terminates.

**Mold convexity** sets the pattern of mold width change along the trunk.

**Random seed** sets the randomization pattern for the trunk molding.

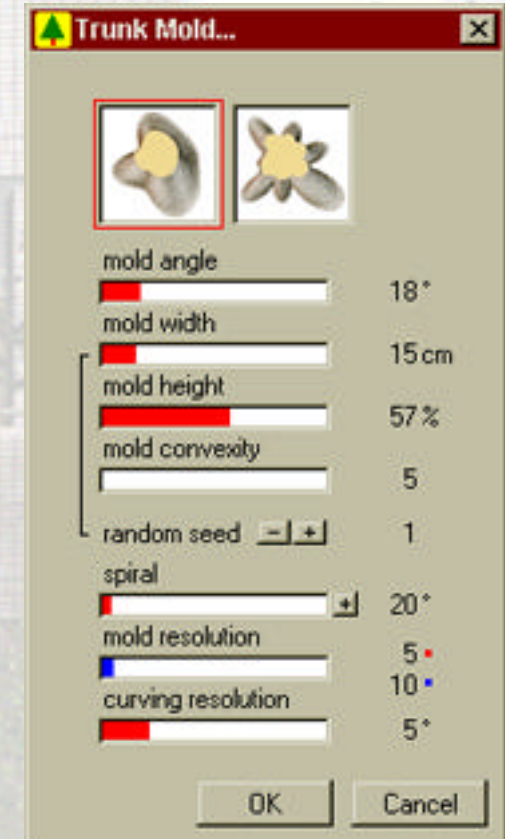
**Spiral** sets the extent and direction of trunk spiraling.

**Mold resolution** sets the number of polygons (transversal resolution) for each cylindrical segment of the trunk mold.

**Curving resolution** sets the number of segments (longitudinal resolution) for the trunk. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures.



**Branch Width** sets the transversal growth pattern for boughs and all





successive generation of branches and twigs. On double click this button, the Branch Width dialog box appears.

**Min. width** sets the minimum width for boughs, branches, and twigs.

**Enforce change** enforces transversal growth of the top bough to be the one set by Branch Width. If it is not checked, the transversal growth of the top bough may vary and it depends on the top width of the trunk.

**Lock top Bg to Tr**, if checked, locks the initial width of the top bough to equal the top width of the trunk. If unchecked, the width of the top bough will assume the value set by the Branch Width parameter.



**Color** button brings up the Trunk, (Bough, ) and Branch Color dialog box.

Here is where you set the color palette for the trunk, boughs, and branches. The current palette is displayed in the top of the window.

The **primary color slider** that slides along the palette sets the value of the primary color for the trunk, boughs, and branches. This color is displayed in the box on the left side of the palette. The trunk, boughs, and branches assume the primary color if no contrast is set. If set, the primary color defines the upper boundary of the contrast.

The **five color sliders** - red, green, blue, black and white which are displayed below are the principal tools for composing the palette. You get

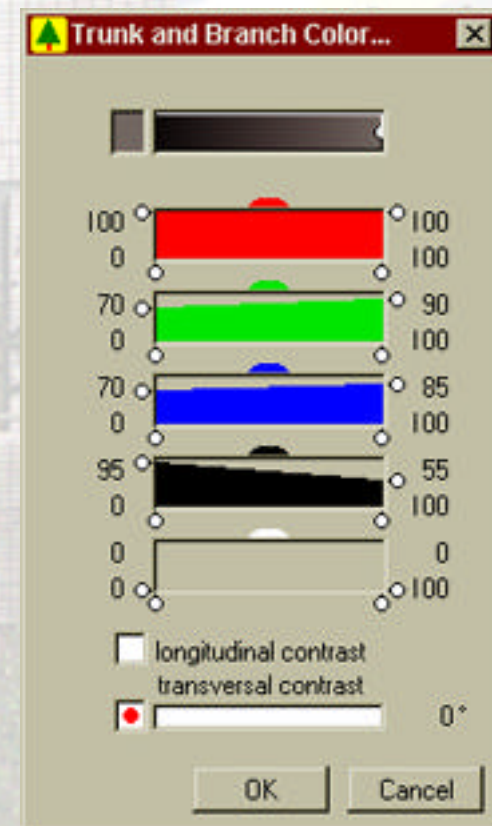


the resulting color palette by mixing the chosen amounts of red, green, blue, black, and white color components for each entry of the palette. The two vertical sliders set the amounts of corresponding color component in the mixture for the two boundary entries of the palette. The amounts for all other entries in the palette are calculated automatically. The two horizontal sliders define this part of the palette which will be affected by the chosen amounts of the particular color component.

**Longitudinal contrast** check box activates or deactivates color change along the trunk in longitudinal direction. If active, the trunk color will change from the leftmost color in the palette at the bottom of the trunk to the primary color at the top of the trunk. All successive boughs, branches, and twigs will be affected as well.

**Transversal contrast** check box activates or deactivates color change along the trunk in transversal direction. If active, the trunk color will change from the leftmost color in the palette to the primary color around its perimeter. All successive boughs, branches, and twigs will be affected as well.

**Transversal contrast** slider allows you to set the position of the primary color on the perimeter of the trunk.





## Foliage Parameters

**Random Seed** sets the randomization pattern for a tree model. It allows BROADLEAF to generate a number of different instances of the same tree type. Since it affects the values of all parameters, Random Seed is accessible on all four modeling levels.



**Leaf Type** lets you select different leaf forms and different leaf sizes. The leaf forms and their size options conform closely to the forms and sizes of those found in nature. Leaf Type button brings up the Leaf Type dialog box.

**oblong** - as in Chestnut, Laurel Oak - 1 polygon

**ovate** - as in Apple, Beech, Birch, Dogwood, Linden - 1 polygon

**fan-shaped** - as in Ginkgo - 2 polygons

**palmately compound** - as in Horse Chestnut - 5 polygons

**rounded lobed** - as in Japanese Maple - 5 polygons

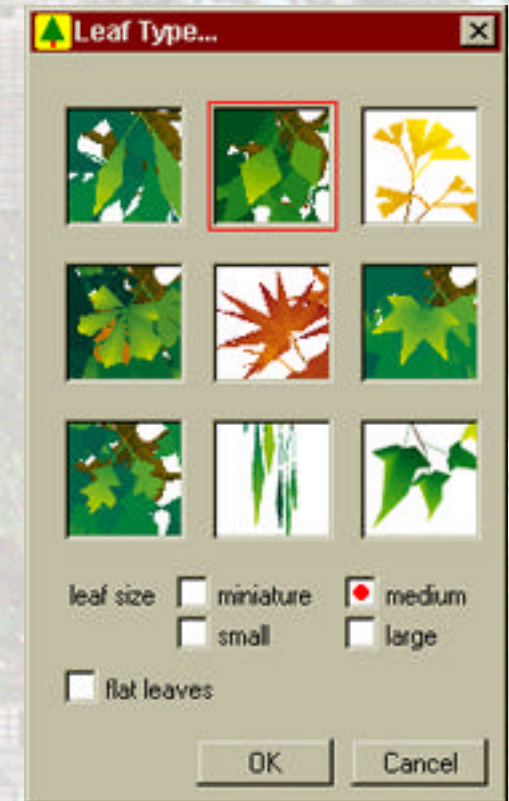
**palmately lobed** - as in Maple, Sycamore - 5 polygons

**ovate lobed** - as in Oak - 6 polygons

**lanceolate** - as in Willow - 1 polygon

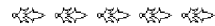
**ovate with three lobes** - as in Hawthorn Maple - 3 polygons

**Leaf size** lets you select four characteristic sizes of each leaf type.



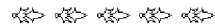


**Flat leaves** check box allows you to choose whether to model each leaf as a planar or non-planar object.



**Leaf Density** sets the extent of population for leaves. On double click this button, the Leaf Density dialog box appears.

**Pruning** sets the amount of leaves to be pruned.



**Stem Length** sets the average length for stems. On double click this button, the Stem Length dialog box appears.

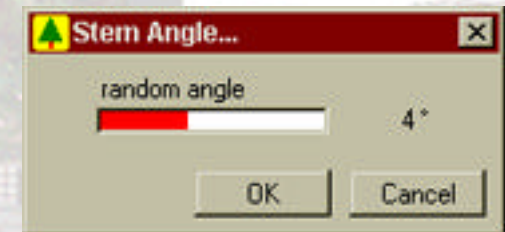
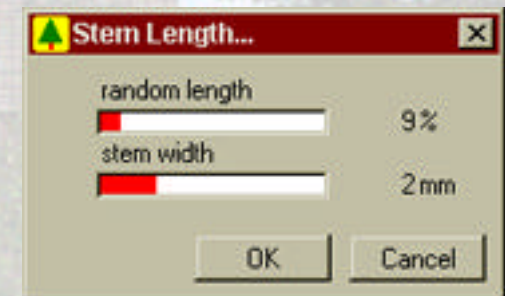
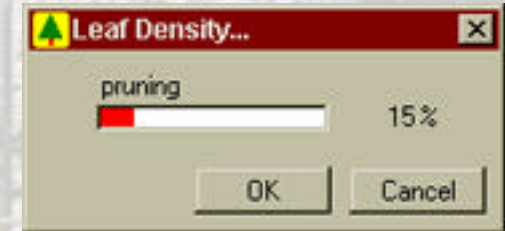
**Random length** sets the extent of deviation in lengths from the average stem length.

**Stem width** sets the width for stems.



**Stem Angle** sets the average stem-to-parent twig angle for stems. On double click this button, the Stem Length dialog box appears.

**Random angle** sets the extent of deviation in stem-to-parent twig angles from the average stem angle.

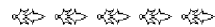


**Stem Curving** sets the pattern of curving for stems. On double click this button, the Stem Curving dialog box appears.

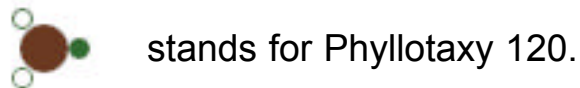
**Random curving** sets the extent of deviation in stem curving across the tree crown.

**Curving resolution** sets the number of segments (longitudinal resolution) for the stems. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures.

**Trans. resolution** sets the number of polygons (transversal resolution) for each cylindrical segment of the stem.



**Phyllotaxy** button brings up the Phyllotaxy dialog box.



stands for Phyllotaxy 120.

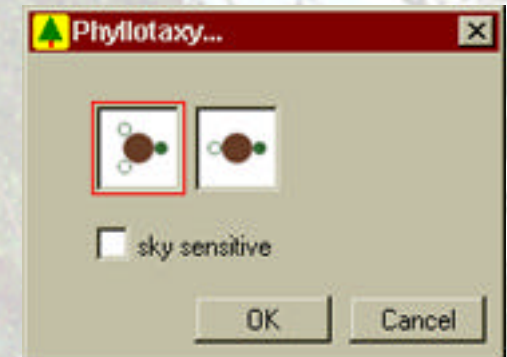
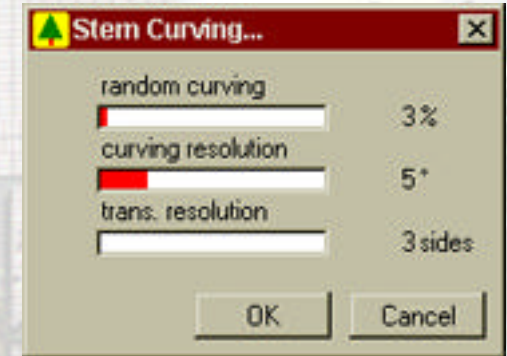
If checked, the leaves spring from three sides of the parent twig. Each successive leaf is rotated with respect to the previous leaf for 120°.



stands for Phyllotaxy 180.

If checked, the leaves spring from opposite sides of the parent twig. Each successive leaf is rotated with respect to the previous leaf for 180°.

**Sky sensitive** check box allows you to position the leaves across the



tree crown with the special sensitivity to the sky (light).



**Color** button brings up the Foliage Color dialog box.

Here is where you set the color palettes for the foliage. The current palettes are displayed in the top of the window. You choose to work on either of the two palettes by checking the corresponding check box on the right side of each palette.

The **primary color sliders** that slide along each palette set the values of the primary colors for the leaves. These colors are displayed in the boxes on the left side of the palettes. The leaves assume the primary colors if no contrast is set. If set, the primary colors define the upper boundaries of the contrasts.

**Mix** allows you to assign the two color palettes to different groups of leaves in designated proportions.

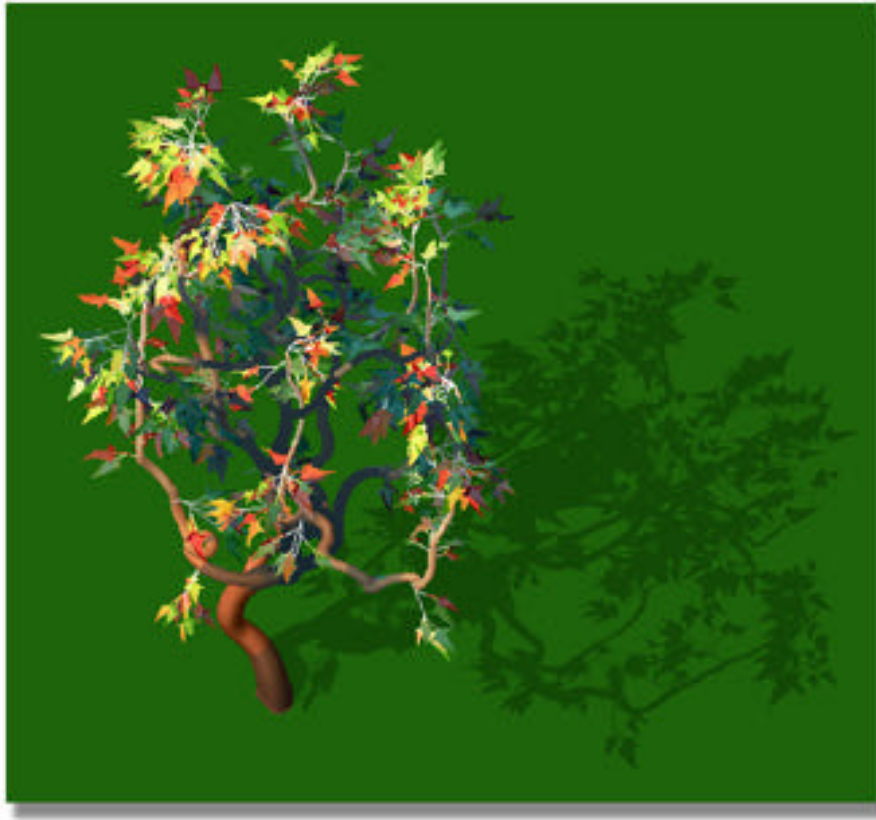
The **five color sliders** - red, green, blue, black and white which are displayed below are the principal tools for composing the palette. You get the resulting color palette by mixing the chosen amounts of red, green, blue, black, and white color components for each entry of the palette. The two vertical sliders set the amounts of corresponding color component in the mixture for the two boundary entries of the palette. The amounts for all other entries in the palette are calculated automatically. The two horizontal sliders define this part of the palette which will be affected by the chosen amounts of the particular color component.





**Random contrast** assigns the colors from the designated range to the leaves randomly.

**Directional contrast** assigns a particular range of shades to a leaf with respect to this leaf's position on the crown.



## 3D Model Export

BROADLEAF exports a 3D model of a tree with structural layers. Once a tree is imported into a 3D application these layers may be represented in different ways.

A **broadleaf tree** tree has up to 27 layers, their respective names are:

1. **Trunk** (**TR** in DXF) carries the trunk.
2. **Bough** (**BG** in DXF) carries the boughs.
3. **Branch1** (**B1** in DXF) carries the first generation branches.
4. **Branch2** (**B2** in DXF) carries the second generation branches.
5. **Branch3** (**B3** in DXF) carries the third generation branches.
6. **Twig** (**TW** in DXF) carries the twigs.
7. **Cuts\_TR** (**CP** in DXF) carries the trunk cut.
8. **Cuts\_BG** (**CP** in DXF) carries the cuts of boughs.
9. **Cuts\_B1** (**CP** in DXF) carries the cuts of G1 branches (Branch1).
10. **Cuts\_B2** (**CP** in DXF) carries the cuts of G2 branches (Branch2).
11. **Cuts\_B3** (**CP** in DXF) carries the cuts of G3 branches (Branch3).
12. **Cuts\_TW** (**CP** in DXF) carries the cuts of twigs.
13. **Stem1** (**ST** in DXF) carries the leaf stems of L color group.
14. **Stem2** (**ST** in DXF) carries the leaf stems of R color group.
15. **Leaf1** (**LF** in DXF) carries the leaves of L color group.
16. **Leaf2** (**LF** in DXF) carries the leaves of R color group.
17. **Leaf01** (**Lf01es** or **Lf01vs** in DXF) carries the group 1 leaf plates.
18. **Leaf02** (**Lf02es** or **Lf02vs** in DXF) carries the group 2 leaf plates.
19. **Leaf03** (**Lf03es** or **Lf03vs** in DXF) carries the group 3 leaf plates.
20. **Leaf04** (**Lf04es** or **Lf04vs** in DXF) carries the group 4 leaf plates.
21. **Leaf05** (**Lf05es** or **Lf05vs** in DXF) carries the group 5 leaf plates.



- 22. **Leaf06** (**Lf06es** or **Lf06vs** in DXF) carries the group 6 leaf plates.
- 23. **Leaf07** (**Lf07es** or **Lf07vs** in DXF) carries the group 7 leaf plates.
- 24. **Leaf08** (**Lf08es** or **Lf08vs** in DXF) carries the group 8 leaf plates.
- 25. **Leaf09** (**Lf09es** or **Lf09vs** in DXF) carries group 9 leaf plates.
- 26. **Leaf10** (**Lf10es** or **Lf10vs** in DXF) carries group 10 leaf plates.
- 27. **Envelope** (**EV** in DXF) carries the tree crown's envelope.



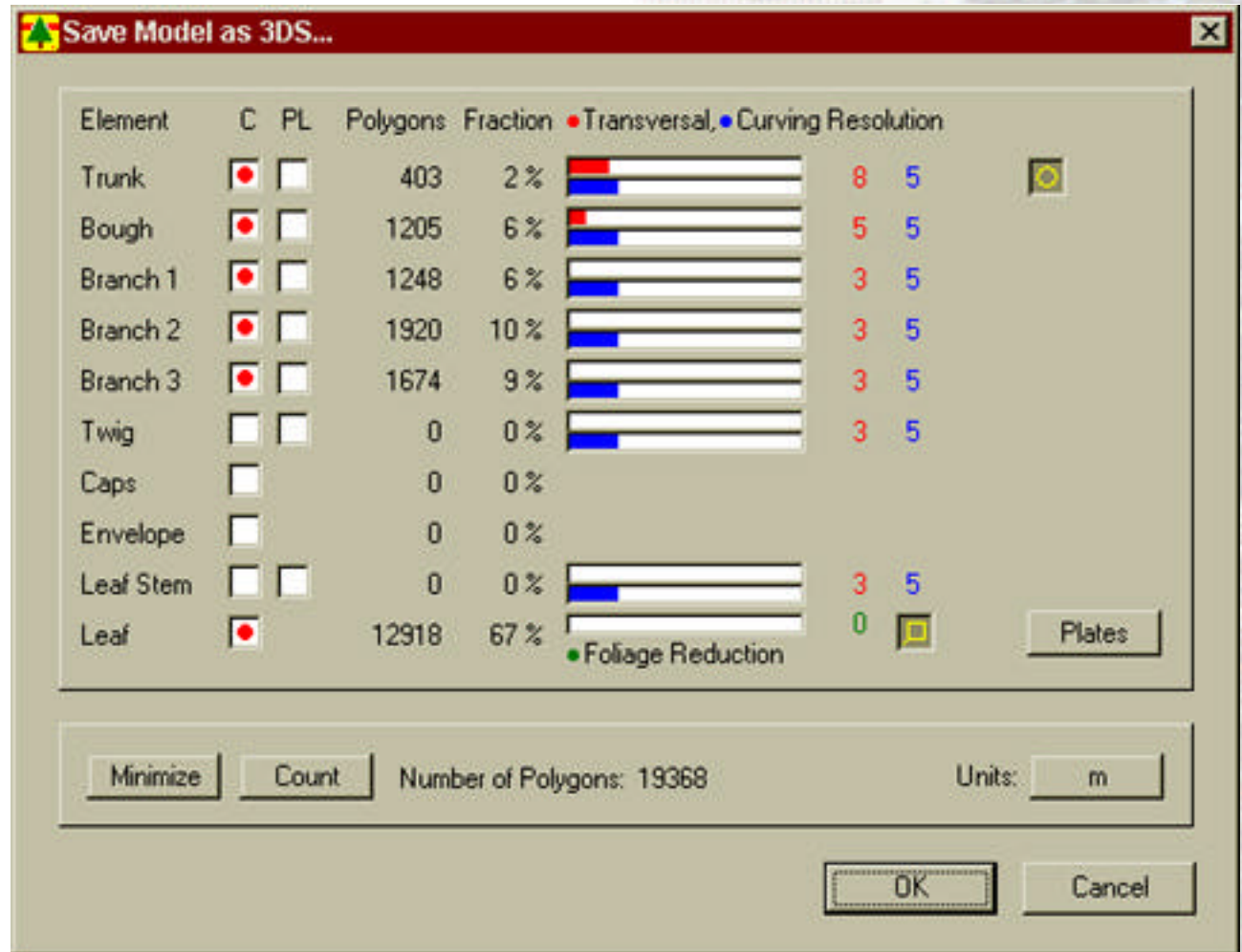


## 3DS File Export

3DS is the AutoDesk 3D Studio binary file format widely used for transferring 3D data among CAD and other 3D graphic applications including rendering and animation programs. The BROADLEAF's 3DS files carry full 3D geometry, the color per material information and the UV information for these materials.

BROADLEAF is building the polygonal model as it is saving it in a 3DS file. Thus, the rendering on the canvas is just a preview. Once you have the correct parameter settings for a particular tree, you can interrupt the rendering anytime and proceed with saving the tree as a 3DS file, or you can skip the rendering all together and proceed directly with the saving.

**Detail and Resolution** - Each class of tree elements can be modeled at up to two different levels of detail, or it can be excluded from the model all together. For example, if you check **C** (complex) for the



Broadleaf 3DS dialog

trunk, the trunk will be modeled as a sequence of cylindrical segments of the chosen transversal and curving resolutions. By checking **PL** (poly-line), the trunk will be modeled as a sequence of one-polygon segments. If both check boxes are unchecked, the trunk will not be modeled. You can choose to model or not to model the caps on the top of branches by checking or unchecking the **C** for Caps. The caps on branches may be important for close-ups, but for average camera movements, you can get away without modeling the caps and save some polygons.

When you select any of the modeling options for any class of tree elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular tree.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given tree.

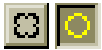
**Count** button commands BROADLEAF to count the polygons for a particular tree model and displays the overall size of the file in polygon numbers.

**Transversal Resolution** defines for each cylindrical segment of a particular class of tree elements the number of polygons it is composed of. You can adjust the transversal resolution of each class of tree elements

independently (red sliders). The transversal resolution may vary depending on the fidelity requirements for a particular tree model.

**Curving Resolution** sets the number of segments (longitudinal resolution) for a particular class of tree elements. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures. You can adjust the curving resolution of each class of tree elements independently (blue sliders).

**Foliage Reduction** reduces the amount of leaves on the model. If the amount of leaves on a particular tree contributes substantially to the overall size of the file, you can reduce the foliage amount by entering the reduction percentage in the Foliage Reduction field and see instantly how it affects the overall size of the model.



### Simplify Trunk

Simplify Trunk, when pressed, will cause a molded trunk to be modeled as unmolded thus saving a substantial number of polygons. If the trunk is not molded, Simplify Trunk is disabled.



### Simplify Leaf

Simplify Leaf, when pressed, will cause the leaf type to be changed to the ovate type, with the smallest number of polygons. If the leaves are already ovate, Simplify Leaf button is disabled.



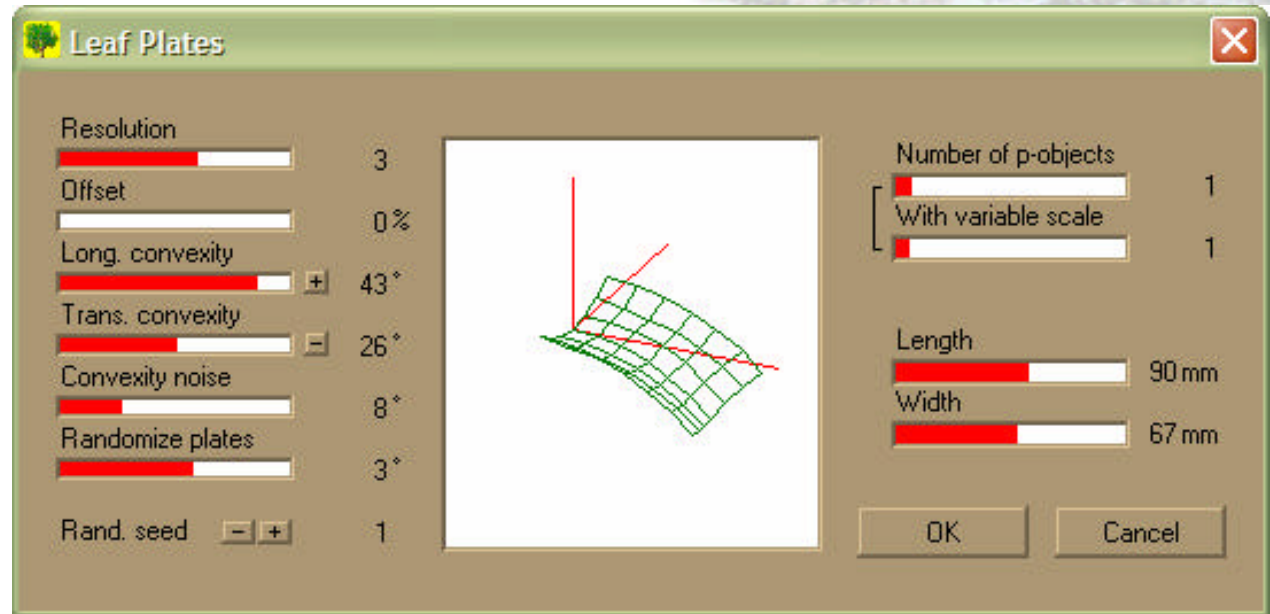


**Plates** button brings up the Leaf Plates dialog. The plate is a rectangular surface which replaces a leaf to allow a simple and effective texture mapping with images of real leaves. Use the leaves from our Leaf Library with the plates. Leaf Library, a collection of texture-map ready leaves which is a part of BROADLEAF package, was created to complement this export feature.

**Number of p-objects** allows you to model the leaves as plates. You can set the number of plates to up to ten (10). If the number of plates is zero (0), then the leaves will not be modeled as plates.

**With variable scale** allows you to set the number of plates with variable scale. If you decide to have, say, seven (7) plates for the leaves and, out of these seven, have five (5) plates with variable scale, you need to adjust the blue slider to five (5). This means that all the leaves referenced by the first five plates will be positioned on the tree in slightly different sizes, and the leaves referenced by the subsequent two plates will have the same size.

**Length** allows you to adjust the length of plates in the range of 1 to 500 mm.



Leaf Plates dialog

**Width** allows you to adjust the width of plates in the range of 1 to 500 mm.

**Resolution** sets the number of polygons for the plate.

**Offset** allows you to offset the plate with respect to the leaf stem. By default, the plate meets the leaf stem at the center of its left edge. Offsetting the plate will have an effect of moving the plate to the left and offsetting the point where the leaf stem touches the plate. When you open such a plate in your rendering program, you will see that the plate has an extra, very thin segment which marks the offset line where the connection point with the leaf stem lies. Use plate offset for the leaves whose stem protrudes into the main body of the leaf as in maple leaf, for example.

**Long. convexity** sets the curving pattern for the longitudinal direction of the plate.

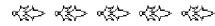
**Trans. convexity** sets the curving pattern for the transversal direction of the plate.

**Convexity noise** sets the extent of irregularities on the surface of the plate.

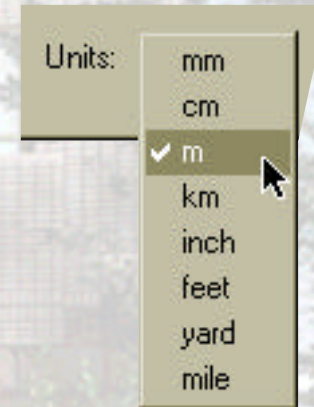
**Randomize plates** allows you to randomize the plates that will be replacing the leaves. For example, if you decide to have your leaves modeled as ten (10) slightly different plates, then you will have to set the Randomize plates slider to a value other than zero (0). The value of five

(5) degrees will have the greater impact on the differences among the plates than the value of one (1) degree.

**Rand. seed** sets the randomization pattern for the plates.



**Units** button brings up the Scene units floating menu which allows you to choose the units in which your tree will be exported out.

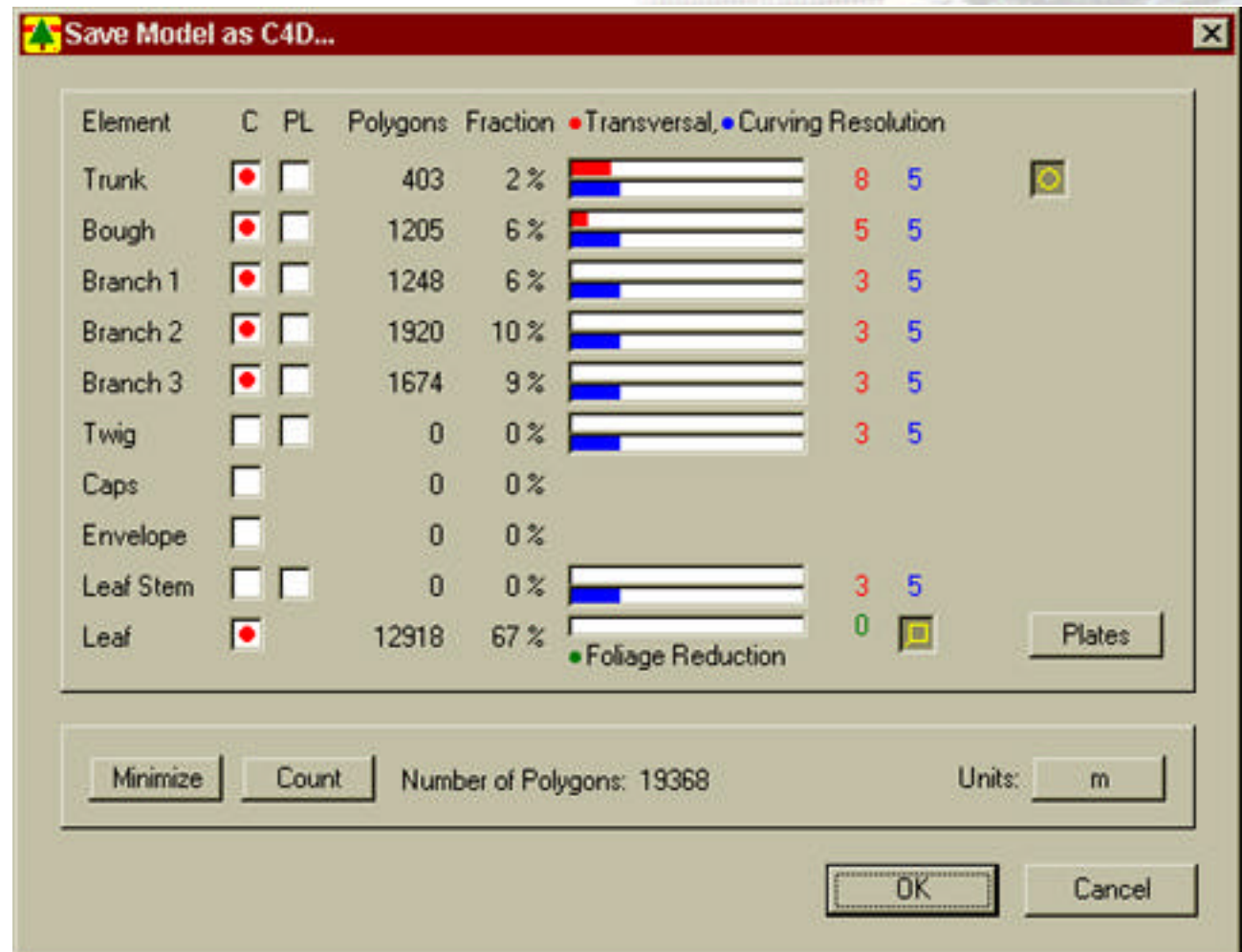




C4D is Maxon Computer Cinema 4D file format. It is used for transferring 3D data to and from Cinema 4D modeling, rendering and animation program. The BROADLEAF's C4D files carry full 3D geometry, layers, color per layer information, and UV information for these layers.

BROADLEAF is building the polygonal model as it is saving it in a C4D file. Thus, the rendering on the canvas is just a preview. Once you have the correct parameter settings for a particular tree, you can interrupt the rendering anytime and proceed with saving the tree as a C4D file, or you can skip the rendering all together and proceed directly with the saving.

**Detail and Resolution** - Each class of tree elements can be modeled at up to two different levels of detail, or it can be excluded from the model all together. For example, if you check **C** (complex) for the trunk, the trunk will be modeled as a sequence of cylindrical segments of



Broadleaf C4D dialog

the chosen transversal and curving resolutions. By checking **PL** (poly-line), the trunk will be modeled as a sequence of one-polygon segments. If both check boxes are unchecked, the trunk will not be modeled. You can choose to model or not to model the caps on the top of branches by checking or unchecking the **C** for Caps. The caps on branches may be important for close-ups, but for average camera movements, you can get away without modeling the caps and save some polygons.

When you select any of the modeling options for any class of tree elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular tree.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given tree.

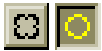
**Count** button commands BROADLEAF to count the polygons for a particular tree model and displays the overall size of the file in polygon numbers.

**Transversal Resolution** defines for each cylindrical segment of a particular class of tree elements the number of polygons it is composed of. You can adjust the transversal resolution of each class of tree elements independently (red sliders). The transversal resolution may vary depend-

ing on the fidelity requirements for a particular tree model.

**Curving Resolution** sets the number of segments (longitudinal resolution) for a particular class of tree elements. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures. You can adjust the curving resolution of each class of tree elements independently (blue sliders).

**Foliage Reduction** reduces the amount of leaves on the model. If the amount of leaves on a particular tree contributes substantially to the overall size of the file, you can reduce the foliage amount by entering the reduction percentage in the Foliage Reduction field and see instantly how it affects the overall size of the model.



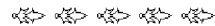
### Simplify Trunk

Simplify Trunk, when pressed, will cause a molded trunk to be modeled as unmolded thus saving a substantial number of polygons. If the trunk is not molded, Simplify Trunk is disabled.



### Simplify Leaf

Simplify Leaf, when pressed, will cause the leaf type to be changed to the ovate type, with the smallest number of polygons. If the leaves are already ovate, Simplify Leaf button is disabled.



**Plates** button brings up the Leaf Plates dialog. The plate is a rectangular surface which replaces a leaf to allow a simple and effective texture



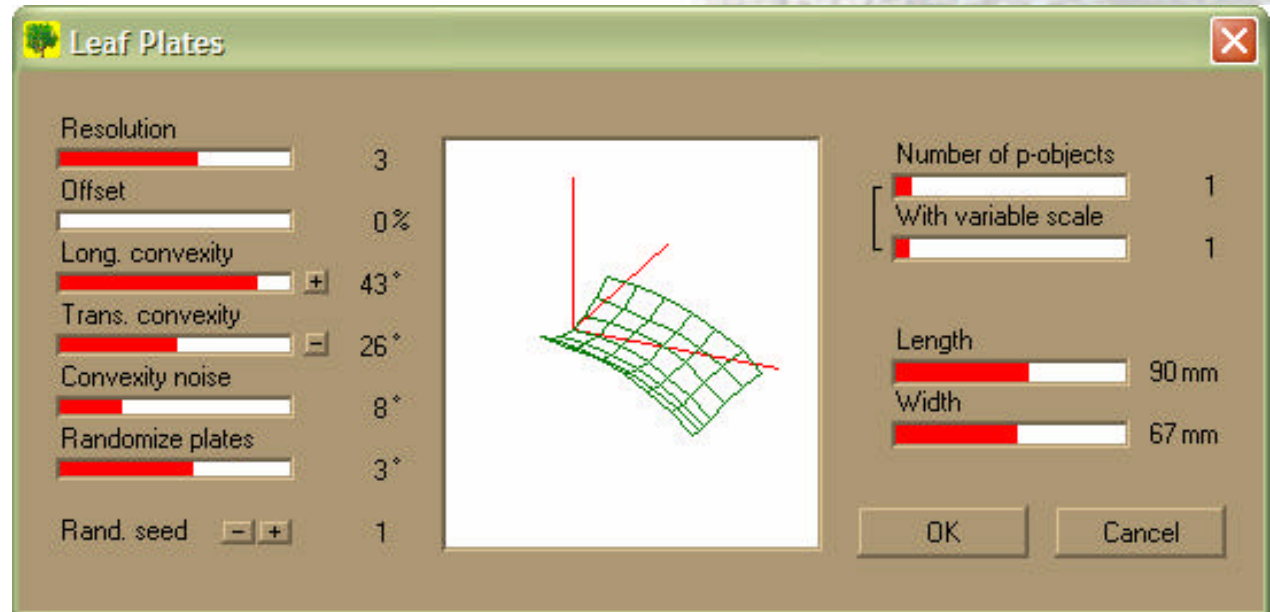
mapping with images of real leaves. Use the leaves from our Leaf Library with the plates. Leaf Library, a collection of texture-map ready leaves which is a part of BROADLEAF package, was created to complement this export feature.

**Number of p-objects** allows you to model the leaves as plates. You can set the number of plates to up to ten (10). If the number of plates is zero (0), then the leaves will not be modeled as plates.

**With variable scale** allows you to set the number of plates with variable scale. If you decide to have, say, seven (7) plates for the leaves and, out of these seven, have five (5) plates with variable scale, you need to adjust the blue slider to five (5). This means that all the leaves referenced by the first five plates will be positioned on the tree in slightly different sizes, and the leaves referenced by the subsequent two plates will have the same size.

**Length** allows you to adjust the length of plates in the range of 1 to 500 mm.

**Width** allows you to adjust the width of plates in the range of 1 to 500 mm.



Leaf Plates dialog

**Resolution** sets the number of polygons for the plate.

**Offset** allows you to offset the plate with respect to the leaf stem. By default, the plate meets the leaf stem at the center of its left edge. Offsetting the plate will have an effect of moving the plate to the left and offsetting the point where the leaf stem touches the plate. When you open such a plate in your rendering program, you will see that the plate has an extra, very thin segment which marks the offset line where the connection point with the leaf stem lies. Use plate offset for the leaves whose stem protrudes into the main body of the leaf as in maple leaf, for example.

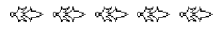
**Long. convexity** sets the curving pattern for the longitudinal direction of the plate.

**Trans. convexity** sets the curving pattern for the transversal direction of the plate.

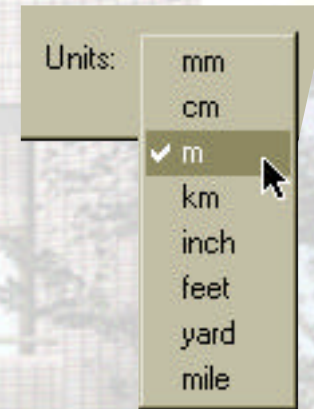
**Convexity noise** sets the extent of irregularities on the surface of the plate.

**Randomize plates** allows you to randomize the plates that will be replacing the leaves. For example, if you decide to have your leaves modeled as ten (10) slightly different plates, then you will have to set the Randomize plates slider to a value other than zero (0). The value of five (5) degrees will have the greater impact on the differences among the plates than the value of one (1) degree.

**Rand. seed** sets the randomization pattern for the plates.



**Units** button brings up the Scene units floating menu which allows you to choose the units in which your tree will be exported out.



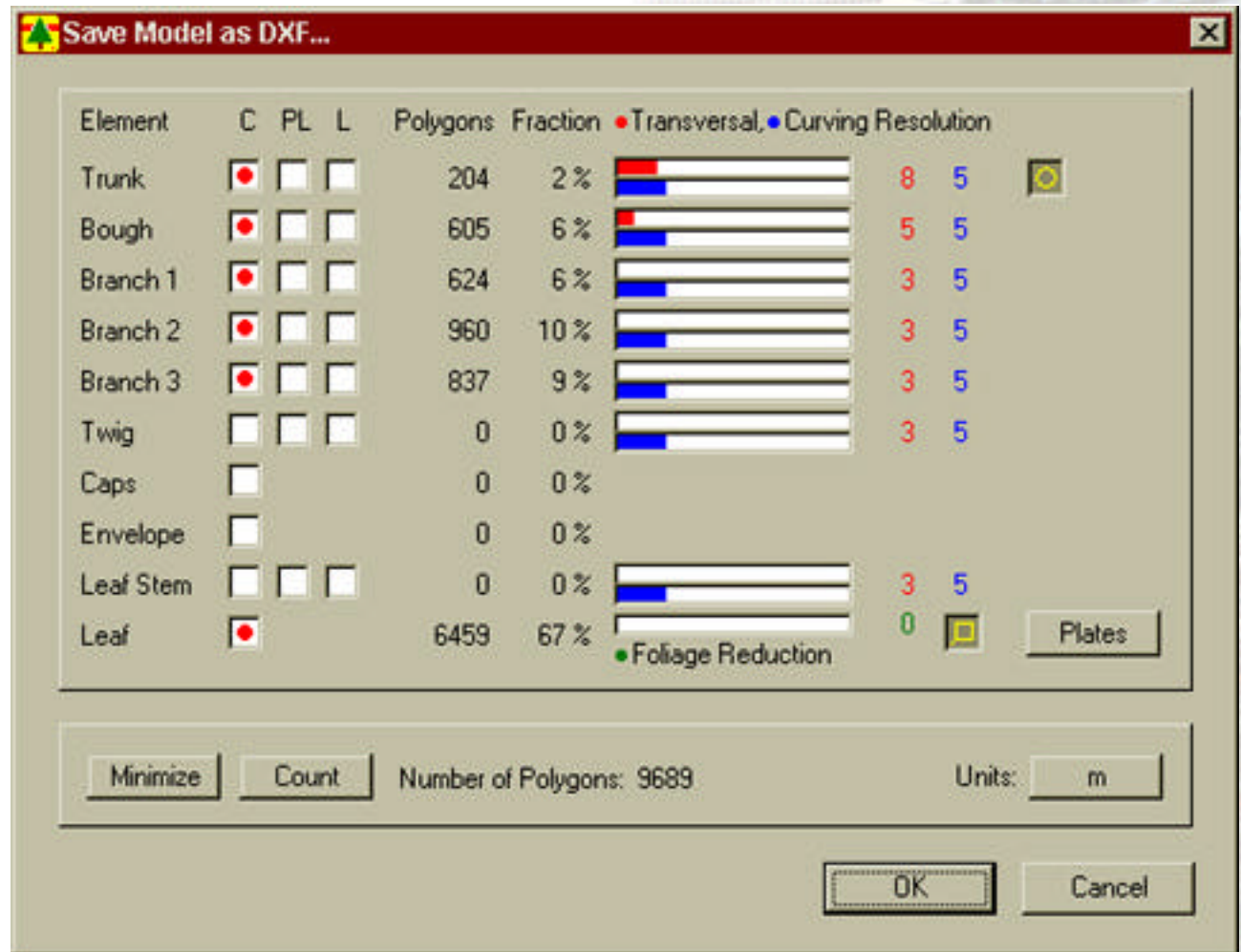


## DXF File Export

DXF or Drawing Interchange File is a standard ASCII text file format widely used for transferring 3D data among CAD and other 3D graphic applications including rendering and animation programs. The BROADLEAF's DXF files carry full 3D geometry and color information on up to fifteen (15) structural layers.

BROADLEAF is building the polygonal model as it is saving it in a DXF file. Thus, the rendering on the canvas is just a preview. Once you have the correct parameter settings for a particular tree, you can interrupt the rendering anytime and proceed with saving the tree as a DXF file, or you can skip the rendering all together and proceed directly with the saving.

**Detail and Resolution** - Each class of tree elements can be modeled at up to three different levels of detail, or it can be excluded from the model all together. For example, if you check **C** (complex) for the trunk, the trunk will be modeled as a



Broadleaf DXF dialog

sequence of cylindrical segments of the chosen transversal and curving resolutions. By checking **PL** (polyline), the trunk will be modeled as a sequence of one-polygon segments. By checking **L** (line), the trunk will be modeled as a sequence of line segments. If three trunk check boxes are unchecked, the trunk will not be modeled. You can choose to model or not to model the caps on the top of branches by checking or unchecking the **C** for Caps. The caps on branches may be important for close-ups, but for average camera movements, you can get away without modeling the caps and save some polygons.

When you select any of the modeling options for any class of tree elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular tree.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given tree.

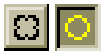
**Count** button commands BROADLEAF to count the polygons for a particular tree model and displays the overall size of the file in polygon numbers.

**Transversal Resolution** defines for each cylindrical segment of a particular class of tree elements the number of polygons it is composed of.

You can adjust the transversal resolution of each class of tree elements independently (red sliders). The transversal resolution may vary depending on the fidelity requirements for a particular tree model.

**Curving Resolution** sets the number of segments (longitudinal resolution) for a particular class of tree elements. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures. You can adjust the curving resolution of each class of tree elements independently (blue sliders).

**Foliage Reduction** reduces the amount of leaves on the model. If the amount of leaves on a particular tree contributes substantially to the overall size of the file, you can reduce the foliage amount by entering the reduction percentage in the Foliage Reduction field and see instantly how it affects the overall size of the model.



### Simplify Trunk

Simplify Trunk, when pressed, will cause a molded trunk to be modeled as unmolded thus saving a substantial number of polygons. If the trunk is not molded, Simplify Trunk is disabled.



### Simplify Leaf

Simplify Leaf, when pressed, will cause the leaf type to be changed to the ovate type, with the smallest number of polygons. If the leaves are already ovate, Simplify Leaf button is disabled.



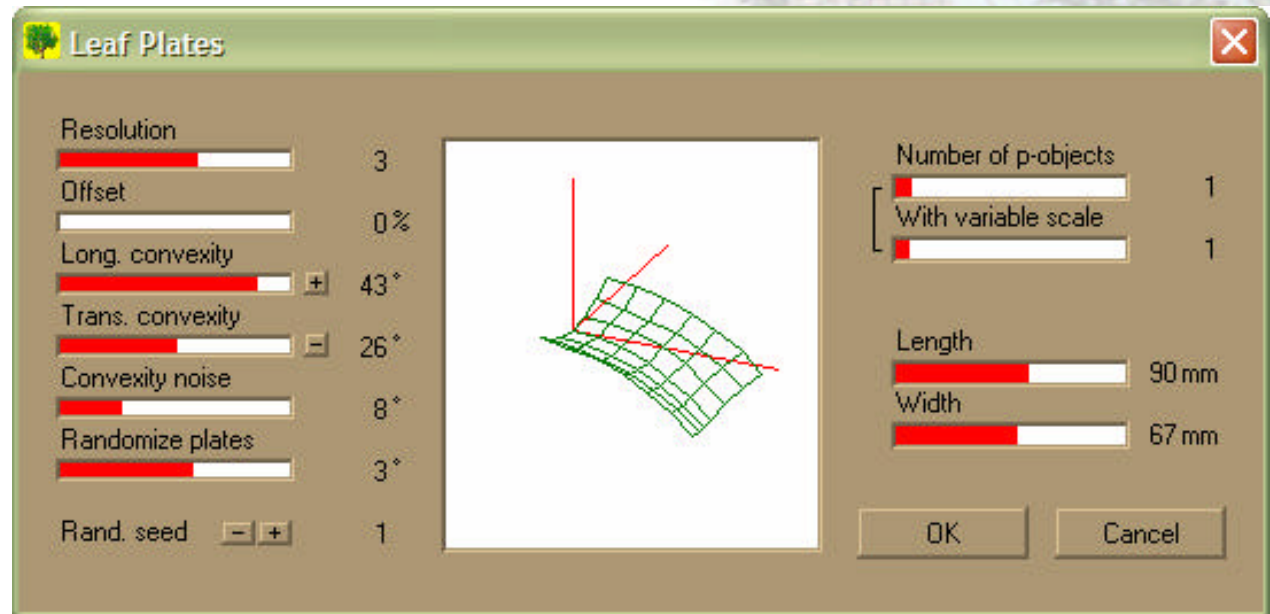


**Plates** button brings up the Leaf Plates dialog. The plate is a rectangular surface which replaces a leaf to allow a simple and effective texture mapping with images of real leaves. Use the leaves from our Leaf Library with the plates. Leaf Library, a collection of texture-map ready leaves which is a part of BROADLEAF package, was created to complement this export feature.

**Number of p-objects** allows you to model the leaves as plates. You can set the number of plates to up to ten (10). If the number of plates is zero (0), then the leaves will not be modeled as plates.

**With variable scale** allows you to set the number of plates with variable scale. If you decide to have, say, seven (7) plates for the leaves and, out of these seven, have five (5) plates with variable scale, you need to adjust the blue slider to five (5). This means that all the leaves referenced by the first five plates will be positioned on the tree in slightly different sizes, and the leaves referenced by the subsequent two plates will have the same size.

**Length** allows you to adjust the length of plates in the range of 1 to 500 mm.



Leaf Plates dialog

**Width** allows you to adjust the width of plates in the range of 1 to 500 mm.

**Resolution** sets the number of polygons for the plate.

**Offset** allows you to offset the plate with respect to the leaf stem. By default, the plate meets the leaf stem at the center of its left edge. Offsetting the plate will have an effect of moving the plate to the left and offsetting the point where the leaf stem touches the plate. When you open such a plate in your rendering program, you will see that the plate has an extra, very thin segment which marks the offset line where the connection point with the leaf stem lies. Use plate offset for the leaves whose stem protrudes into the main body of the leaf as in maple leaf, for example.

**Long. convexity** sets the curving pattern for the longitudinal direction of the plate.

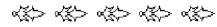
**Trans. convexity** sets the curving pattern for the transversal direction of the plate.

**Convexity noise** sets the extent of irregularities on the surface of the plate.

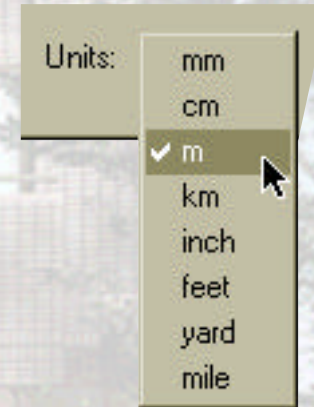
**Randomize plates** allows you to randomize the plates that will be replacing the leaves. For example, if you decide to have your leaves modeled as ten (10) slightly different plates, then you will have to set the Randomize plates slider to a value other than zero (0). The value of five (5) degrees will have the greater impact on the differences among the

plates than the value of one (1) degree.

**Rand. seed** sets the randomization pattern for the plates.



**Units** button brings up the Scene units floating menu which allows you to choose the units in which your tree will be exported out.





FAC or FACT is a 3D file format specified by ElectricImage. It is used for transferring 3D data to and from ElectricImage modeling, rendering and animation program. The BROADLEAF's FACT files carry full 3D geometry, layers, color per vertex information, and UV information for these layers.

BROADLEAF is building the polygonal model as it is saving it in a FACT file. Thus, the rendering on the canvas is just a preview. Once you have the correct parameter settings for a particular tree, you can interrupt the rendering anytime and proceed with saving the tree as a FACT file, or you can skip the rendering all together and proceed directly with the saving.

Element	C	PL	L	Polygons	Fraction	Transversal	Curving	Resolution	UV
Trunk	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	403	2 %	8	5	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Bough	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1205	6 %	5	5	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Branch 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1248	6 %	3	5	<input type="checkbox"/>	<input type="checkbox"/>
Branch 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1920	10 %	3	5	<input type="checkbox"/>	<input type="checkbox"/>
Branch 3	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1674	9 %	3	5	<input type="checkbox"/>	<input type="checkbox"/>
Twig	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	0 %	3	5	<input type="checkbox"/>	<input type="checkbox"/>
Caps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	0 %			<input type="checkbox"/>	<input type="checkbox"/>
Envelope	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	0 %			<input type="checkbox"/>	<input type="checkbox"/>
Leaf Stem	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0	0 %	3	5	<input type="checkbox"/>	<input type="checkbox"/>
Leaf	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	12918	67 %	0		<input checked="" type="checkbox"/>	<input type="checkbox"/>

Number of Polygons: 19368

Units: m

Plates

OK Cancel

Broadleaf FACT dialog

## Detail and Resolution - Each

class of tree elements can be modeled at up to three different levels of detail, or it can be excluded from the model all together. For example, if you check **C** (complex) for the trunk, the trunk will be modeled as a sequence of cylindrical segments of the chosen transversal and curving

resolutions. By checking **PL** (polyline), the trunk will be modeled as a sequence of one-polygon segments. By checking **L** (line), the trunk will be modeled as a sequence of line segments. If three trunk check boxes are unchecked, the trunk will not be modeled. You can choose to model or not to model the caps on the top of branches by checking or unchecking the **C** for Caps. The caps on branches may be important for close-ups, but for average camera movements, you can get away without modeling the caps and save some polygons.

When you select any of the modeling options for any class of tree elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular tree.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given tree.

**Count** button commands BROADLEAF to count the polygons for a particular tree model and displays the overall size of the file in polygon numbers.

**Transversal Resolution** defines for each cylindrical segment of a particular class of tree elements the number of polygons it is composed of. You can adjust the transversal resolution of each class of tree elements



independently (red sliders). The transversal resolution may vary depending on the fidelity requirements for a particular tree model.

**Curving Resolution** sets the number of segments (longitudinal resolution) for a particular class of tree elements. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures. You can adjust the curving resolution of each class of tree elements independently (blue sliders).

**UV** column of buttons are here to, when checked, replace Color-Per-Vertex texture with custom texture guided by UV information. If you wish to apply a bark texture onto a trunk, check UV mark for the trunk.

**Foliage Reduction** reduces the amount of leaves on the model. If the amount of leaves on a particular tree contributes substantially to the overall size of the file, you can reduce the foliage amount by entering the reduction percentage in the Foliage Reduction field and see instantly how it affects the overall size of the model.



### Simplify Trunk

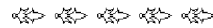
Simplify Trunk, when pressed, will cause a molded trunk to be modeled as unmolded thus saving a substantial number of polygons. If the trunk is not molded, Simplify Trunk is disabled.



### Simplify Leaf

Simplify Leaf, when pressed, will cause the leaf type to be changed to the ovate type, with the smallest number of polygons. If the leaves are already ovate, Simplify Leaf button is disabled.

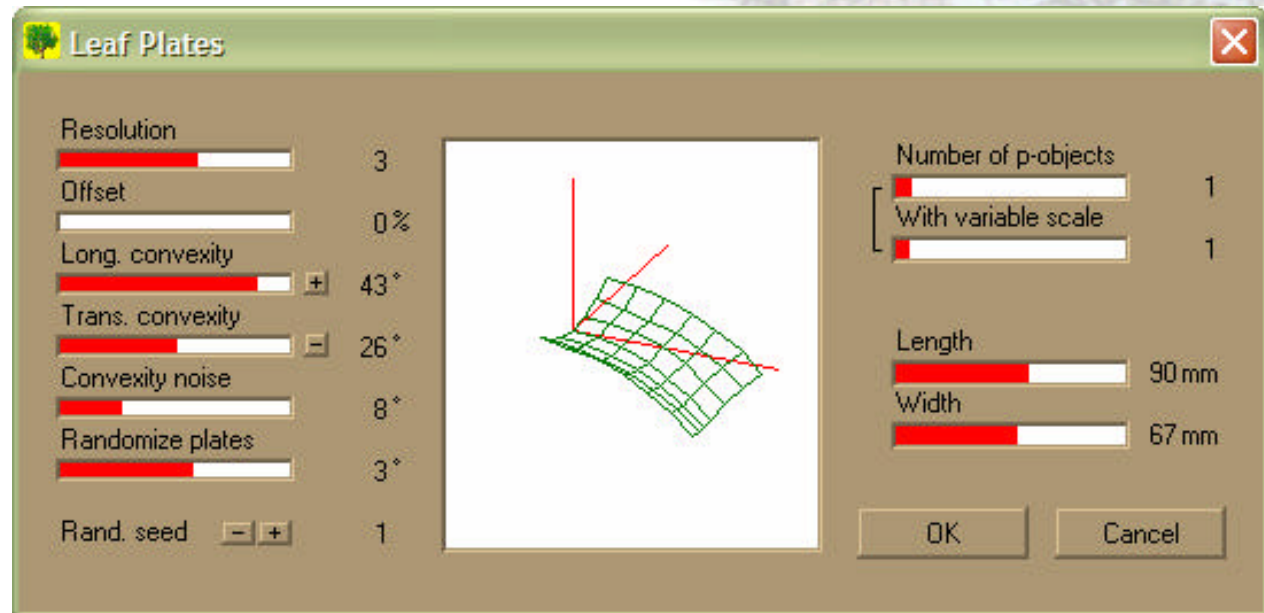




**Plates** button brings up the Leaf Plates dialog. The plate is a rectangular surface which replaces a leaf to allow a simple and effective texture mapping with images of real leaves. Use the leaves from our Leaf Library with the plates. Leaf Library, a collection of texture-map ready leaves which is a part of BROADLEAF package, was created to complement this export feature.

**Number of p-objects** allows you to model the leaves as plates. You can set the number of plates to up to ten (10). If the number of plates is zero (0), then the leaves will not be modeled as plates.

**With variable scale** allows you to set the number of plates with variable scale. If you decide to have, say, seven (7) plates for the leaves and, out of these seven, have five (5) plates with variable scale, you need to adjust the blue slider to five (5). This means that all the leaves referenced by the first five plates will be positioned on the tree in slightly different sizes, and the leaves referenced by the subsequent two plates will have the same size.



Leaf Plates dialog

**Length** allows you to adjust the length of plates in the range of 1 to 500 mm.

**Width** allows you to adjust the width of plates in the range of 1 to 500 mm.

**Resolution** sets the number of polygons for the plate.

**Offset** allows you to offset the plate with respect to the leaf stem. By default, the plate meets the leaf stem at the center of its left edge. Offsetting the plate will have an effect of moving the plate to the left and offsetting the point where the leaf stem touches the plate. When you open such a plate in your rendering program, you will see that the plate has an extra, very thin segment which marks the offset line where the connection point with the leaf stem lies. Use plate offset for the leaves whose stem protrudes into the main body of the leaf as in maple leaf, for example.

**Long. convexity** sets the curving pattern for the longitudinal direction of the plate.

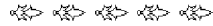
**Trans. convexity** sets the curving pattern for the transversal direction of the plate.

**Convexity noise** sets the extent of irregularities on the surface of the plate.

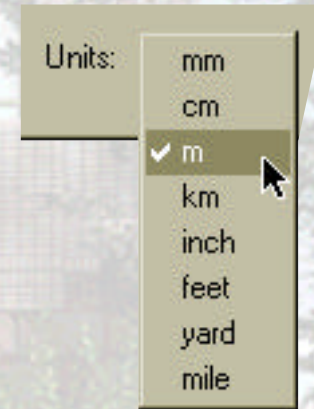
**Randomize plates** allows you to randomize the plates that will be replacing the leaves. For example, if you decide to have your leaves modeled as ten (10) slightly different plates, then you will have to set the

Randomize plates slider to a value other than zero (0). The value of five (5) degrees will have the greater impact on the differences among the plates than the value of one (1) degree.

**Rand. seed** sets the randomization pattern for the plates.



**Units** button brings up the Scene units floating menu which allows you to choose the units in which your tree will be exported out.

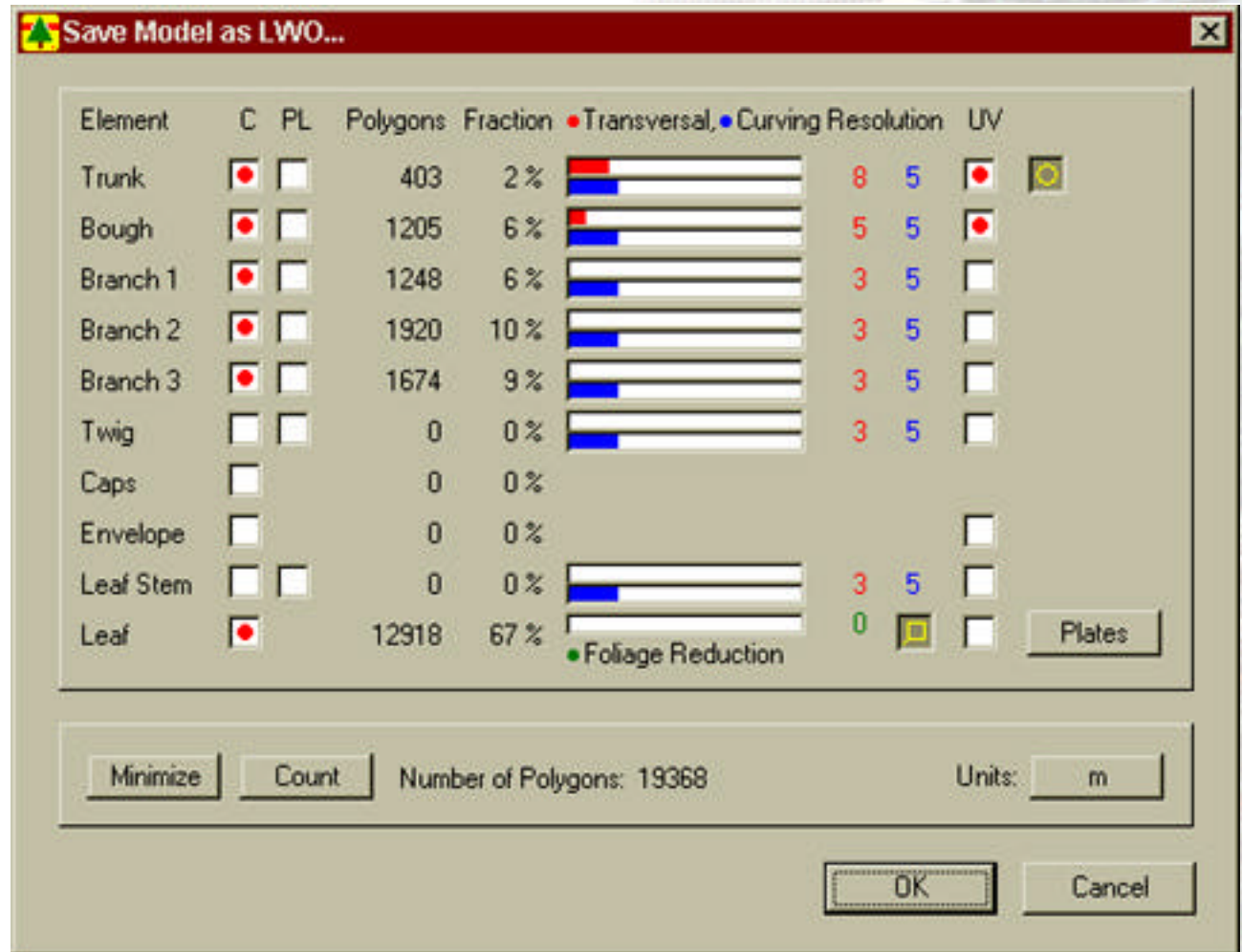




LWO is the NewTek 3D file format. It is used for transferring 3D data to and from Lightwave6 or newer modeling, rendering and animation program. The BROADLEAF's LWO files carry full 3D geometry, layers, color per vertex information, and UV information for these layers.

BROADLEAF is building the polygonal model as it is saving it in a LWO file. Thus, the rendering on the canvas is just a preview. Once you have the correct parameter settings for a particular tree, you can interrupt the rendering anytime and proceed with saving the tree as a LWO file, or you can skip the rendering all together and proceed directly with the saving.

**Detail and Resolution** - Each class of tree elements can be modeled at up to two different levels of detail, or it can be excluded from the model all together. For example, if you check **C** (complex) for the trunk, the trunk will be modeled as a sequence of cylindrical segments of



Broadleaf LWO dialog

the chosen transversal and curving resolutions. By checking **PL** (poly-line), the trunk will be modeled as a sequence of one-polygon segments. If two trunk check boxes are unchecked, the trunk will not be modeled. You can choose to model or not to model the caps on the top of branches by checking or unchecking the **C** for Caps. The caps on branches may be important for close-ups, but for average camera movements, you can get away without modeling the caps and save some polygons.

When you select any of the modeling options for any class of tree elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular tree.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given tree.

**Count** button commands BROADLEAF to count the polygons for a particular tree model and displays the overall size of the file in polygon numbers.

**Transversal Resolution** defines for each cylindrical segment of a particular class of tree elements the number of polygons it is composed of. You can adjust the transversal resolution of each class of tree elements independently (red sliders). The transversal resolution may vary depend-

ing on the fidelity requirements for a particular tree model.

**Curving Resolution** sets the number of segments (longitudinal resolution) for a particular class of tree elements. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures. You can adjust the curving resolution of each class of tree elements independently (blue sliders).

**UV** column of buttons are here to, when checked, replace Color-Per-Vortex texture with custom texture guided by UV information. If you wish to apply a bark texture onto a trunk, check UV mark for the trunk.

**Foliage Reduction** reduces the amount of leaves on the model. If the amount of leaves on a particular tree contributes substantially to the overall size of the file, you can reduce the foliage amount by entering the reduction percentage in the Foliage Reduction field and see instantly how it affects the overall size of the model.



### Simplify Trunk

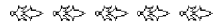
Simplify Trunk, when pressed, will cause a molded trunk to be modeled as unmolded thus saving a substantial number of polygons. If the trunk is not molded, Simplify Trunk is disabled.



### Simplify Leaf

Simplify Leaf, when pressed, will cause the leaf type to be changed to the ovate type, with the smallest number of polygons. If the leaves are already ovate, Simplify Leaf button is disabled.

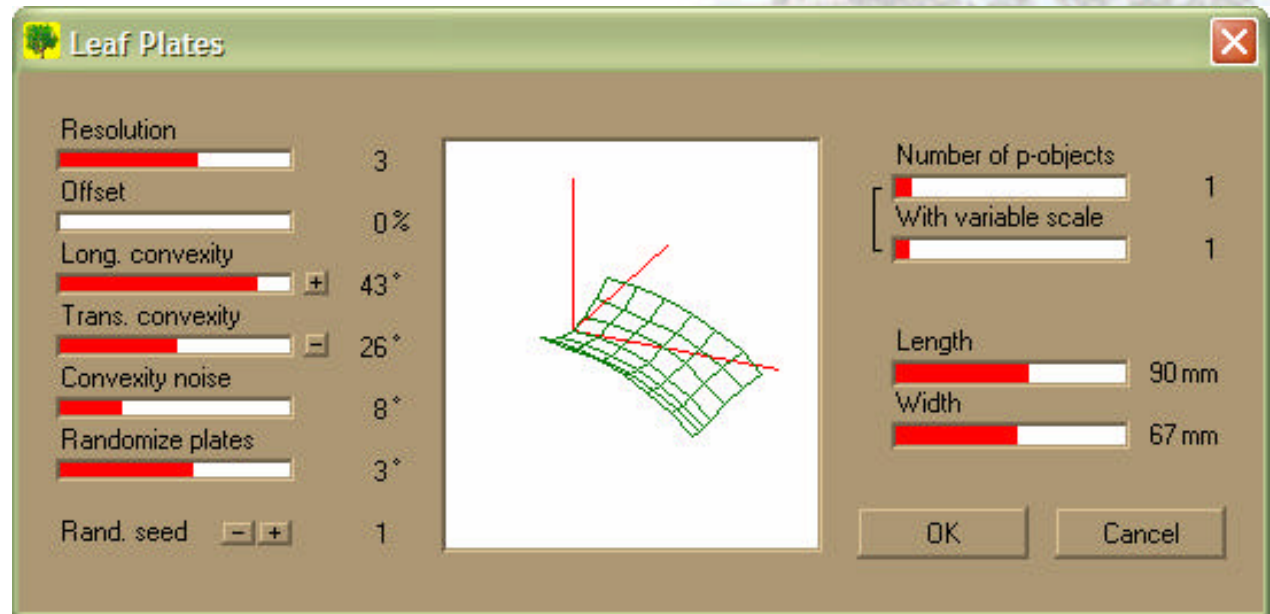




**Plates** button brings up the Leaf Plates dialog. The plate is a rectangular surface which replaces a leaf to allow a simple and effective texture mapping with images of real leaves. Use the leaves from our Leaf Library with the plates. Leaf Library, a collection of texture-map ready leaves which is a part of BROADLEAF package, was created to complement this export feature.

**Number of p-objects** allows you to model the leaves as plates. You can set the number of plates to up to ten (10). If the number of plates is zero (0), then the leaves will not be modeled as plates.

**With variable scale** allows you to set the number of plates with variable scale. If you decide to have, say, seven (7) plates for the leaves and, out of these seven, have five (5) plates with variable scale, you need to adjust the blue slider to five (5). This means that all the leaves referenced by the first five plates will be positioned on the tree in slightly different sizes, and the leaves referenced by the subsequent two plates will have the same size.



Leaf Plates dialog

**Length** allows you to adjust the length of plates in the range of 1 to 500 mm.

**Width** allows you to adjust the width of plates in the range of 1 to 500 mm.

**Resolution** sets the number of polygons for the plate.

**Offset** allows you to offset the plate with respect to the leaf stem. By default, the plate meets the leaf stem at the center of its left edge. Offsetting the plate will have an effect of moving the plate to the left and offsetting the point where the leaf stem touches the plate. When you open such a plate in your rendering program, you will see that the plate has an extra, very thin segment which marks the offset line where the connection point with the leaf stem lies. Use plate offset for the leaves whose stem protrudes into the main body of the leaf as in maple leaf, for example.

**Long. convexity** sets the curving pattern for the longitudinal direction of the plate.

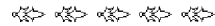
**Trans. convexity** sets the curving pattern for the transversal direction of the plate.

**Convexity noise** sets the extent of irregularities on the surface of the plate.

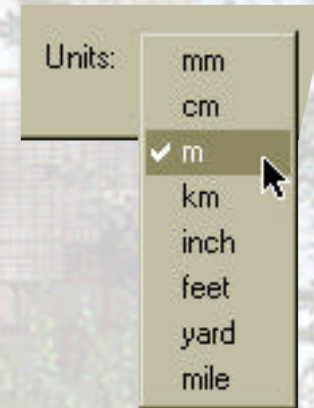
**Randomize plates** allows you to randomize the plates that will be replacing the leaves. For example, if you decide to have your leaves

modeled as ten (10) slightly different plates, then you will have to set the Randomize plates slider to a value other than zero (0). The value of five (5) degrees will have the greater impact on the differences among the plates than the value of one (1) degree.

**Rand. seed** sets the randomization pattern for the plates.



**Units** button brings up the Scene units floating menu which allows you to choose the units in which your tree will be exported out.

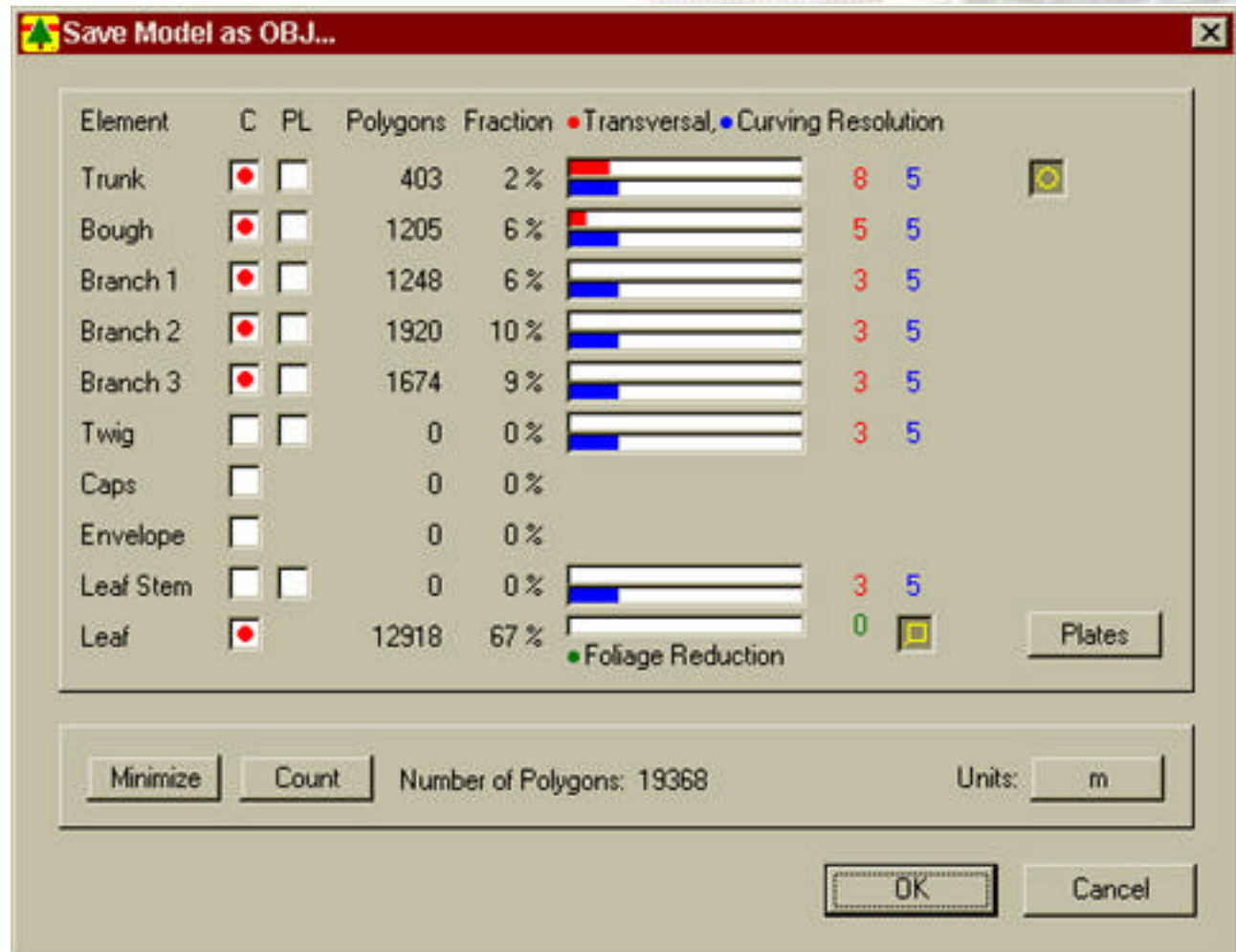




OBJ is the Alias|Wavefront 3D file format. It is used for transferring 3D data to Maya and to and from other modeling, rendering and animation programs. The BROADLEAF's OBJ files carry full 3D geometry, layers, color per layer information, and UV information for these layers.

BROADLEAF is building the polygonal model as it is saving it in a OBJ file. Thus, the rendering on the canvas is just a preview. Once you have the correct parameter settings for a particular tree, you can interrupt the rendering anytime and proceed with saving the tree as a OBJ file, or you can skip the rendering all together and proceed directly with the saving.

**Detail and Resolution** - Each class of tree elements can be modeled at up to two different levels of detail, or it can be excluded from the model all together. For example, if you check **C** (complex) for the trunk, the trunk will be modeled as a sequence of cylindrical segments of



Broadleaf OBJ dialog

the chosen transversal and curving resolutions. By checking **PL** (poly-line), the trunk will be modeled as a sequence of one-polygon segments. If two trunk check boxes are unchecked, the trunk will not be modeled. You can choose to model or not to model the caps on the top of branches by checking or unchecking the **C** for Caps. The caps on branches may be important for close-ups, but for average camera movements, you can get away without modeling the caps and save some polygons.

When you select any of the modeling options for any class of tree elements, you get an instant feedback on the number of polygons for this particular layer (**Polygons** column) and its fraction relative to the overall size of the file (**Fraction** column). Thus you see not only the size of this layer in terms of absolute polygon numbers, but also its impact on the overall size of the file. And this information will help you to choose the most effective strategy in lowering the number of polygons for a particular tree.

By pressing **Minimize** button, all the relevant export parameters will be adjusted automatically to give you the smallest number of polygons for a given tree.

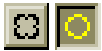
**Count** button commands BROADLEAF to count the polygons for a particular tree model and displays the overall size of the file in polygon numbers.

**Transversal Resolution** defines for each cylindrical segment of a particular class of tree elements the number of polygons it is composed of. You can adjust the transversal resolution of each class of tree elements independently (red sliders). The transversal resolution may vary depend-

ing on the fidelity requirements for a particular tree model.

**Curving Resolution** sets the number of segments (longitudinal resolution) for a particular class of tree elements. Measured in degrees, it defines the maximum allowable angle between two neighboring segments. Smaller angle means higher curving resolution and will result in smoother curvatures. You can adjust the curving resolution of each class of tree elements independently (blue sliders).

**Foliage Reduction** reduces the amount of leaves on the model. If the amount of leaves on a particular tree contributes substantially to the overall size of the file, you can reduce the foliage amount by entering the reduction percentage in the Foliage Reduction field and see instantly how it affects the overall size of the model.



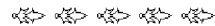
### Simplify Trunk

Simplify Trunk, when pressed, will cause a molded trunk to be modeled as unmolded thus saving a substantial number of polygons. If the trunk is not molded, Simplify Trunk is disabled.



### Simplify Leaf

Simplify Leaf, when pressed, will cause the leaf type to be changed to the ovate type, with the smallest number of polygons. If the leaves are already ovate, Simplify Leaf button is disabled.



**Plates** button brings up the Leaf Plates dialog. The plate is a rectangular surface which replaces a leaf to allow a simple and effective texture



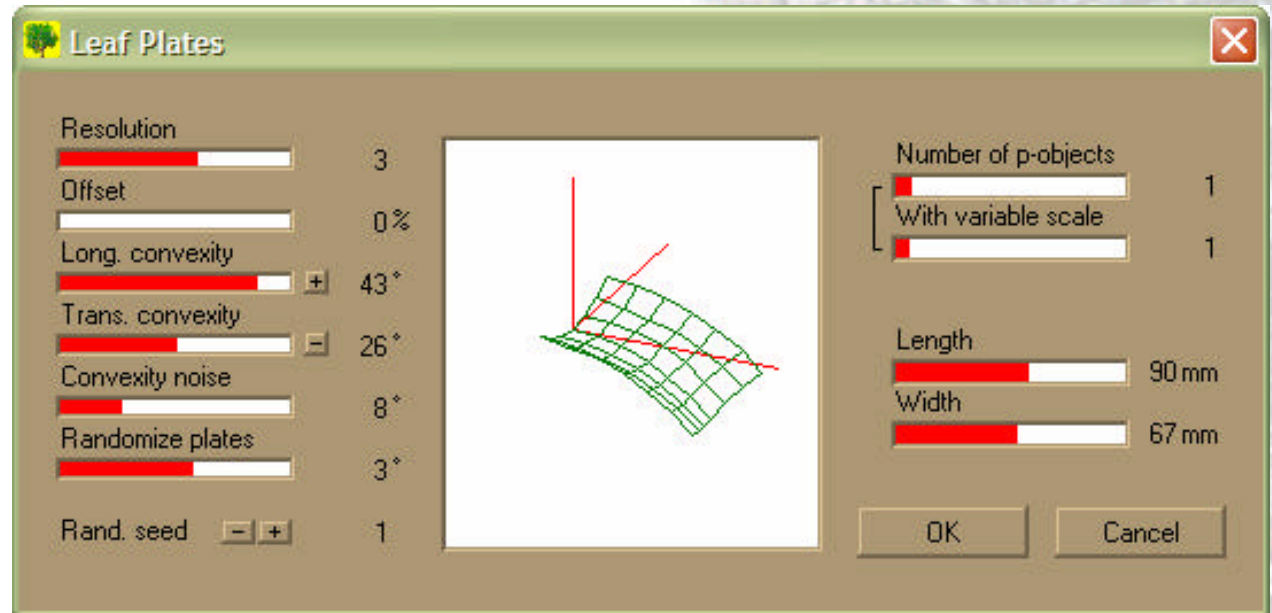
mapping with images of real leaves. Use the leaves from our Leaf Library with the plates. Leaf Library, a collection of texture-map ready leaves which is a part of BROADLEAF package, was created to complement this export feature.

**Number of p-objects** allows you to model the leaves as plates. You can set the number of plates to up to ten (10). If the number of plates is zero (0), then the leaves will not be modeled as plates.

**With variable scale** allows you to set the number of plates with variable scale. If you decide to have, say, seven (7) plates for the leaves and, out of these seven, have five (5) plates with variable scale, you need to adjust the blue slider to five (5). This means that all the leaves referenced by the first five plates will be positioned on the tree in slightly different sizes, and the leaves referenced by the subsequent two plates will have the same size.

**Length** allows you to adjust the length of plates in the range of 1 to 500 mm.

**Width** allows you to adjust the width of plates in the range of 1 to 500 mm.



Leaf Plates dialog

**Resolution** sets the number of polygons for the plate.

**Offset** allows you to offset the plate with respect to the leaf stem. By default, the plate meets the leaf stem at the center of its left edge. Offsetting the plate will have an effect of moving the plate to the left and offsetting the point where the leaf stem touches the plate. When you open such a plate in your rendering program, you will see that the plate has an extra, very thin segment which marks the offset line where the connection point with the leaf stem lies. Use plate offset for the leaves whose stem protrudes into the main body of the leaf as in maple leaf, for example.

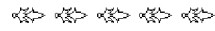
**Long. convexity** sets the curving pattern for the longitudinal direction of the plate.

**Trans. convexity** sets the curving pattern for the transversal direction of the plate.

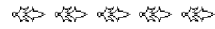
**Convexity noise** sets the extent of irregularities on the surface of the plate.

**Randomize plates** allows you to randomize the plates that will be replacing the leaves. For example, if you decide to have your leaves modeled as ten (10) slightly different plates, then you will have to set the Randomize plates slider to a value other than zero (0). The value of five (5) degrees will have the greater impact on the differences among the plates than the value of one (1) degree.

**Rand. seed** sets the randomization pattern for the plates.



**Units** button brings up the Scene units floating menu which allows you to choose the units in which your tree will be exported out.



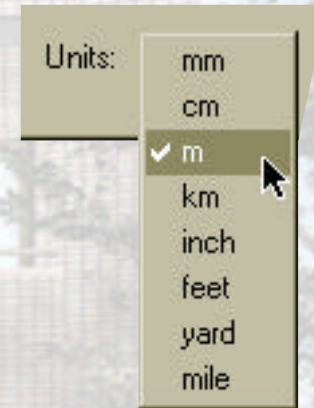
#### Task:

*Import a tree into **Maya** - an Alias|WF program. Take for example a broadleaf tree named *Acer Palmatum* saved in BROADLEAF as *Acer palmatum.obj*.*

#### Solution:

- File > Import “Acer palmatum.obj”;
- Outliner window shows five tree objects: Trunk, Bough, Branch1, Stem2, and Leaf2;
- To parent the tree, in Outliner window click Leaf2;
- Press and hold [Shift] key;
- Click Trunk;
- All five tree objects become highlighted gray;
- Under Modeling main menu > Edit > Parent;
- in Outliner window there is a parent named Trunk with children named Leaf2, Stem2, Branch1, and Bough;

*At the time of this writing Maya did not tolerate obj file names with spaces. Therefore, when you import, for example, *Acer palmatum.obj*, Maya will import the tree and change its name to *Acer\_palmatum.obj*.*





## How to Make a 3D File Smaller

Once you create a tree you like, you will probably want to save it as a 3D model. You may find that the model may take too much space and may take too long to render, but you do not want that. The only solution then is to reduce the polygon count. There are numerous ways to cut down the number of polygons in the file. The strategy you take will depend greatly on your priorities with respect to the model. You may have to compromise on, at least, one of the three fronts: the modeling quality and detail, the amount of branches and leaves, and the size of a tree.

Keep in mind that the effectiveness of any of the moves you make to reduce the size of your file will depend greatly on the polygon spread in your model. Thus, if your biggest problem are the branches, it will be prudent to concentrate on them as opposed on, for example, leaves, and vice versa.

Below are our general recommendations on how one might go about making the tree 3D file with smaller number of polygons.

1. Do not model twigs and leaf stems.
2. Model branches of the second and third generation (Branch 2 and Branch 3) as polylines.
3. Model the trunk with the transversal resolution of maximum twelve (12) sides.
4. Model the boughs and branches of the first generation with the trans-



versal resolution of maximum five (5) sides.

5. Do not model the caps on branches.

6. Choose ovate or oblong leaves. Those two leaf types are modeled with one polygon.

7. If, after you have selected ovate or oblong leaf type, you still have a problem with the leaves, reduce the foliage amount accordingly. Try to find the best compromise between the most desirable amount of leaves and the size of the file. You may even consider the tree without leaves. Our models are as photorealistic without the leaves as they are with the leaves.



## Image Export

### BMP/PICT Tree Image Export

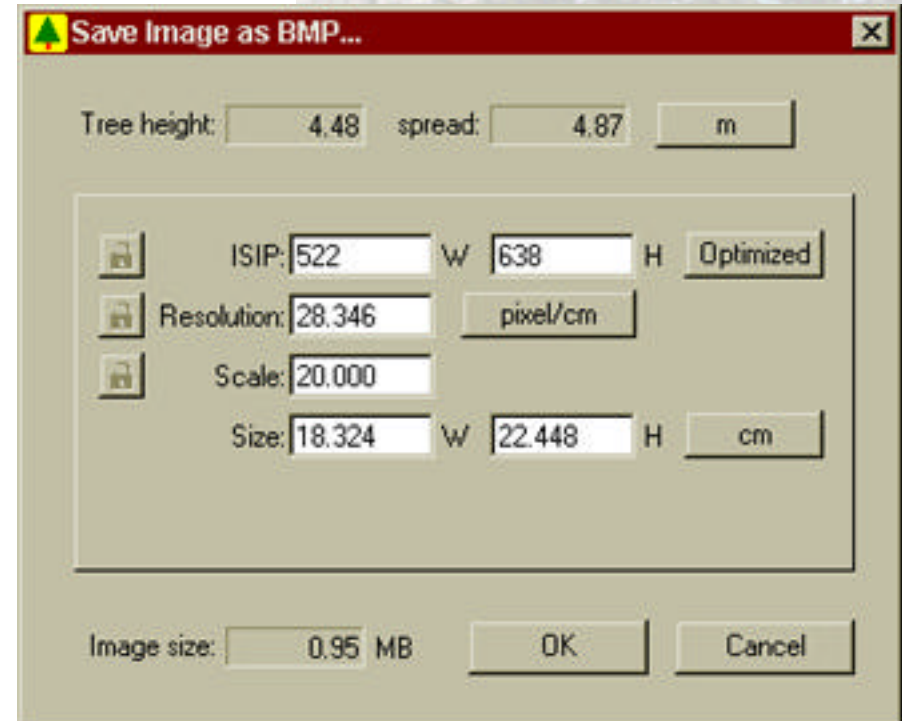
You can save an image of the whole tree, at the elevation and azimuth angles as previewed on the canvas, as a 24bit BMP file on WIN or PICT file on MAC by selecting “Save Image as BMP...” or “Save Image as PICT...” respectively, under File menu. The dialog box “Save image as BMP...” contains the following fields and buttons:

**Tree height** and **spread** fields are non editable and they display the current tree height and tree spread in meters. The height and spread can be displayed in **m** - meters or **ft** - feet.

You can set the size of the image or **ISIP** (Image Size In Pixels) to up to 30,000 by 30,000 pixels. The **W** (width) and **H** (height) fields are linked by the tree image aspect ratio. Thus if you change the **W** value, the **H** value will follow proportionally and vice versa.

The **Optimize** button calculates the final aspect ratio of the image. Press this button to optimize the image. The button remains down while BROADLEAF calculates the size and when it is done, the button bounces back and reads **Optimized**.

Why the **Optimize** button? If you change any of the tree's parameters and do not wait for the tree to be redrawn fully, the image size for this





tree will not be calculated correctly. Therefore you must optimize the image size before saving it. Otherwise the image ratio applied to this particular tree image will be the one of the previously created tree so the image might be clipped or with too much white border.

When opening “Save Image as BMP...” dialog, you will immediately know whether the image you are going to save needs to be optimized or not. If the image is already optimized, the optimize button will display **Optimized** and if it is not, the button will display **Optimize**. In the latter case, press the button to optimize the image size.

The **Resolution** field allows you to enter the resolution for the image. The resolution units are selectable to be **pixels/cm** or **pixels/inch**. The default resolution is 28.364 pixels/cm or 72 pixels/inch.

The **Scale** and **Size** fields are interlinked. They enable you to set the physical size of the image in **cm** or **inches**.

**Image size** field is non editable and it displays approximate file size in MB.

#### *Task:*

*Save the top view (0 degrees azimuth and 90 degrees elevation) of “Ulmus americana 2” broadleaf tree as a BMP image or (PICT on MAC). The image height should be 2000 pixels and the desired image resolution should be 300 pixels/inch;*

#### *Solution:*

- Load “Ulmus americana 2.bro”;*
- Change the elevation angle by pressing the mouse on the tree and*



*pulling it down until the E displays 90 degrees;*

- Select "Save Image as BMP..." under File menu;*
- Click "Optimize" button;*
- Click the mouse in the H "ISIP" field, notice that the lock buttons are activated and the Resolution is locked (the lock on the left of the Resolution field). Type in 2000;*
- Change the resolution units from pixels/cm to pixels/in;*
- Click the mouse in the Resolution field and lock the ISIP (by pressing the lock on the left of the ISIP field). Type 300 in the Resolution field;*
- Now we have an image that is 2000 pixels wide by 2071 pixels high, at 300 pixels/in. The physical size at this resolution will be 16.883 cm by 17,501 cm and it will occupy approximately 12 MB of disk space;*
- Press "OK" and select the location where you want this file to be saved; The file "Ulmus americana 2.bmp" will be saved in the desired location after several seconds.*

When saving a tree as a BMP or PICT file you have the following six possibilities.

- IRS** Adjust ISIP while the resolution is locked and the scale/size slides.
- ISR** Adjust ISIP while the scale/size is locked and the resolution slides.
- RIS** Adjust the resolution while ISIP is locked and the scale/size slides.
- RSI** Adjust the resolution while the scale/size is locked and ISIP slides.
- SIR** Adjust the scale/size while ISIP is locked and the resolution slides.
- SRI** Adjust the scale/size while the resolution is locked and ISIP slides.

## TGA Tree Image Export

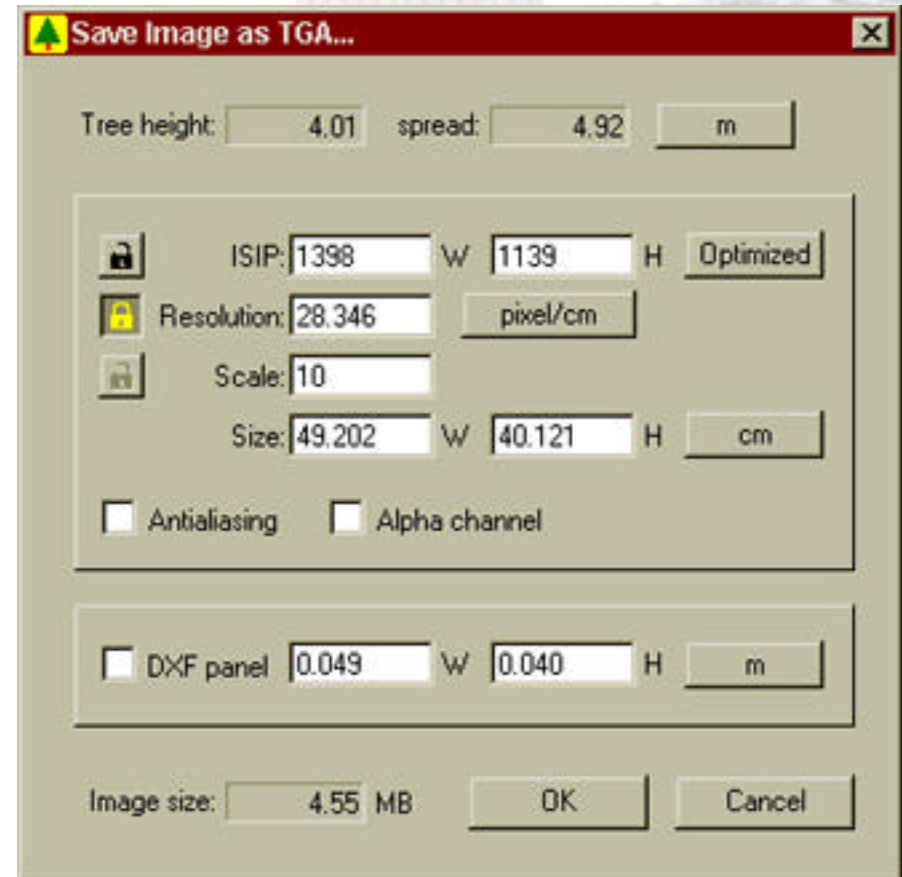
You can save an image of the whole tree, at the elevation and azimuth angles as previewed on the canvas, as a 24bit TGA file by selecting “Save Image as TGA...” under File menu. The dialog box “Save image as TGA...” contains the following fields and buttons.

**Tree height** and **spread** fields are non editable and they display the current tree height and tree spread in meters. The height and spread can be displayed in **m** - meters or **ft** - feet.

You can set the size of the image or **ISIP** (Image Size In Pixels) to up to 30,000 by 30,000 pixels. The **W** (width) and **H** (height) fields are linked by the tree image aspect ratio, thus if you change the **W** value, the **H** value will follow proportionally and vice versa.

The **Optimize** button calculates the final aspect ratio of the image. Press this button to optimize the image. The button remains down while BROADLEAF calculates the size and when it is done, the button bounces back and reads **Optimized**.

Why the **Optimize** button? If you change any of the tree's parameters and do not wait for a tree to be redrawn fully, the image size for this tree will not be calculated correctly. Therefore you must optimize the image size before saving it. Otherwise the image ratio applied to this particular





tree image will be the one of the previously created tree so the image might be clipped or with too much white border.

When opening “Save Image as TGA...” dialog, you will immediately know whether the image you are going to save needs to be optimized or not. If the image is already optimized, the optimize button will display **Optimized** and if it is not, the button will display **Optimize**. In the latter case, press the button to optimize the image size.

The **Resolution** field allows you to enter the resolution for the image. The resolution units are selectable to be **pixels/cm** or **pixels/inch**. The default resolution is 28.364 pixels/cm or 72 pixels/inch.

The **Scale** and **Size** fields are interlinked. They enable you to set the physical size of the image in **cm** or **inches**.

The **Antialiasing** checkbox allows you to choose the antialiasing for the image. The antialiasing will smooth-out sharp edges in the image.

The **Alpha channel** checkbox, when set, commands BROADLEAF to create an 8 bit black and white channel where the pixels of the tree are white and the pixels of the background are black. The resulting image looks like a tree silhouette in negative. The alpha channel allows you to put the tree image on a scene without having to worry about its background. If the tree image has been antialiased then its alpha channel file, besides consisting of black and white pixels, will also have gray pixels which will occupy antialiased portions of the image.

The **DXF panel** check box allows you to export a one polygon DXF



panel for the tree image you are going to save. This will assure a perfect fit of the image and the polygon if you wish to place this tree as a “panel tree” on your scene. This way you can generate beautiful single polygon trees - “panel trees” - for your CAD renderings and animation. Utilizing one polygon trees has been a proven technique for minimizing the polygon size of scenes with a lot of vegetation and we are sure that many of you will wish to do that if a tree is in the background and/or if it is simply not feasible to use the 3D model. If **DXF panel** is checked, BROADLEAF will generate two files, one will be a TGA image file and the other a DXF panel file. Both files will have the same name with different extensions, i.e. \*.tga and \*.dxf respectively.

**Image size** field is non editable and it displays approximate file size in MB.

#### *Task:*

*Load the broadleaf tree “Acer platanoides” from the library and save its front view (0 degrees azimuth and 0 degrees elevation) as an antialiased TGA image with alpha channel and a DXF panel. The image should be 1024 pixels high, the desired image resolution is 28.354 pixels/cm, the DXF panel should have the same height as the tree.*

#### *Solution:*

- Load “Acer platanoides.bro”;
- Select “Save Image as TGA...” under File menu;
- Click “Optimize” button;
- Click the mouse in the H “ISIP” field, notice that the lock buttons are activated and the Resolution is locked (the lock on the left of the Resolution field). Type in 1024;
- Click the mouse in the Resolution field and lock the ISIP (by pressing



*the lock on the left of the ISIP field). Type 28.354 in the Resolution field;*

- Now we have an image that is 528 pixels wide by 1024 pixels high and it will occupy approximately 2 MB of disk space;*
- Check Antialiasing;*
- Check Alpha channel;*
- Check DXF panel and enter tree height of 3.29 m into the DXF panel H field;*
- Press “OK” and select the location where you want the file to be saved;*
- The files “Acer platanoides.tga” and “Acer platanoides.dxf” will be saved in the desired location after several seconds. During the saving process the cursor changes indicating the tasks being executed..*

When saving a tree as a TGA file you have the following six possibilities.

- IRS** Adjust ISIP while the resolution is locked and the scale/size slides.
- ISR** Adjust ISIP while the scale/size is locked and the resolution slides.
- RIS** Adjust the resolution while ISIP is locked and the scale/size slides.
- RSI** Adjust the resolution while the scale/size is locked and ISIP slides.
- SIR** Adjust the scale/size while ISIP is locked and the resolution slides.
- SRI** Adjust the scale/size while the resolution is locked and ISIP slides.



## TGA Tree's Shadow Image Export

You can save an image of the tree's shadow, at the elevation and azimuth angles as previewed on the canvas, as a 24bit TGA file by selecting "Save Shadow as TGA..." under File menu. The dialog box "Save Shadow as TGA..." contains the following fields and buttons.

**Tree height** and **spread** fields are non editable and they display the current tree height and tree spread in meters. The height and spread can be displayed in **m** - meters or **ft** - feet.

You can set the size of the image or **ISIP** (Image Size In Pixels) to up to 30,000 by 30,000 pixels. The **W** (width) and **H** (height) fields are linked by the tree's shadow image aspect ratio, thus if you change the **W** value, the **H** value will follow proportionally and vice versa.

The **Optimize** button calculates the final aspect ratio of the image. Press this button to optimize the image. The button remains down while BROADLEAF calculates the size and when it is done, the button bounces back and reads **Optimized**.

Why the **Optimize** button? If you change any of the tree's parameters and do not wait for a tree to be redrawn fully, the image size for this tree shadow will not be calculated correctly. Therefore you must optimize the image size before saving it. Otherwise the image ratio applied to this par-

**Save Shadow as TGA...**

Tree height: 3.85 spread: 3.98 m

☐ ISIP: 255 W: 107 H: 107 **Optimized**

☐ Resolution: 72.000 pixel/inch

☐ Scale: 40.586

Size: 8.784 W: 3.620 H: 3.620 cm

☐ Antialiasing ☒ Alpha channel

☐ DXF panel 3.565 W: 1.469 H: 1.469 cm

Image size: 0.10 MB **OK** **Cancel**

ticular tree's shadow image will be the one of the previously created tree so the image might be clipped or with too much white border.

When opening "Save Image as TGA..." dialog, you will immediately know whether the image you are going to save needs to be optimized or not. If the image is already optimized, the optimize button will display **Optimized** and if it is not, the button will display **Optimize**. In the latter case, press the button to optimize the image size.

The **Resolution** field allows you to enter the resolution for the image. The resolution units are selectable to be **pixels/cm** or **pixels/inch**. The default resolution is 28.364 pixels/cm or 72 pixels/inch.

The **Scale** and **Size** fields are interlinked. They enable you to set the physical size of the image in **cm** or **inches**.

The **Antialiasing** checkbox allows you to choose the antialiasing for the image. The antialiasing will smooth-out sharp edges in the image.

The **Alpha channel** checkbox is always enabled.

The **DXF panel** check box allows you to export a one polygon DXF panel for the tree's shadow image you are going to save. This will assure a perfect fit of the image and the polygon. If **DXF panel** is checked, BROADLEAF will generate two files, one will be a TGA image file of the shadow and the other a DXF panel file. Both files will have the same name with different extensions, i.e. \*\_SH.tga and \*\_SH panel.dxf respectively.

**Image size** field is non editable and it displays approximate file size in MB.

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**OnyxTREE BROADLEAF 6.0**

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