

Treefarmer

User Manual

Introduction

- Treefarmer has been developed with Forest Growers Levy funds for free use by all. It has been sponsored through the Small and Medium Enterprise Levy Committee and is aimed at helping small scale forest growers. It is intended to provide knowledge and awareness of forest operations and from that, improve forest investment outcomes. It also provides a mechanism to deliver a variety of research results that are site specific (i.e., spatial) by using an easy-to-use format acceptable to novice foresters. The development of the tool has been guided by an industry steering group and now improved by an active User Group. You may be interested to join this group by contacting the Product Manager.
- These notes relate to **version 4.0 (released in Dec 2023)** and are aimed at getting novice users started and providing detail on functionality for existing users. There are also some tutorial videos that may be easier to follow.
- The tool has so far been developed to provide users with an initial awareness of the two key areas: forest establishment and harvesting. It provides indicative costs and yields for a range of species and tending options. It is not intended to be used to identify optimum silvicultural or harvesting practices. For harvesting, it gives limited harvest planning functionality with indicative results of costs and returns. It does not provide a full operational plan nor replace the need to involve professional forest consultants and harvest management companies.
- Treefarmer will help you determine the woodlot area, its productivity by species, and estimate costs for forest establishment and tending. For forest harvesting, it will raise awareness of key issues that drive costs. It will help you examine roading options and indicate harvesting and transport costs. Outputs are driven by terrain, woodlot location, harvested volume, and your input information. Net profits calculations are now offered for a range of species in version 4.0. These require user consideration of various tree to log conversion factors and log prices. Harvesting and transport costs are based on radiata pine data and may need adjustment for species that involve additional processing steps such as in field debarking, or manual measurement.
- The interface also provides a checklist of on farm and off farm factors to consider. These can be printed and ticked off to ensure nothing is missed – See “Helpful Checks” at the top of the screen.
- With funding, further development is occurring every year. Suggestions for improvement are welcome.
- Further information will be available from Forest Growers Research at: <https://fgr.nz/>

Access

See the following link to start the application from the Forest Growers Research web site. Note that this version may change when software bugs are remedied, and new functions are added.

<https://treefarmer.fgr.nz/>

Treefarmer is best used on a PC with a large screen but will run on late model Android phones.

Start up

On clicking the web link (it may need Ctrl + click from this document), you first see an introductory screen with a short explanation about Treefarmer. Click “Continue” to start the main interface. The first interface is simply a map and options on the right for “Planting trees” or “Tree Harvesting”. Each option will allow you to choose “Inputs” or “Estimated Costs”.

Interface structure

We have attempted to keep the interface as simple as possible and primarily operated through two side by side panels. It has mapping functionality on the left panel and input options and outputs on the right panel. When the mouse pointer is over the left panel it will zoom the map in and out. Moving the mouse wheel while pointed to the right side will move this panel up or down. Also, on the right side (and sometimes at the bottom) grey scroll bars will do the same. By clicking on the bar and holding the mouse button down you can drag these bars to see more of what is on the screen.

At the top of the screen is a banner containing various web site links, documents, and the “Print Results” option. If you click on any of the options in the top banner they will “pop out” and use most of the screen. You can “Print” or “Save” them, “Cancel” will close them. Web site links will open a new web site in your browser. Treefarmer will remain running in the previous tab.

Mapping tools

At the top left of the screen is the Zoom Level or magnification. Try zooming in and out with the wheel on your mouse. Symbols in the top left of the screen also allow you to zoom in and out with “+” and “-”, also you can change the map to full screen (the four-arrow symbol) to better explore the map layers manually. Move the map by holding the left mouse button down and dragging the map like a rug. Click the reversed four arrows button, or Esc on your keyboard, to exit Full Screen view.

If you click on the map with the right mouse button, you can rotate the image or tilt the image to gain an oblique or fly overview. To return the image to horizontal with a north orientation (to the top of your screen) you just need to click on the little arrow symbol (like a compass) in the top left of the screen.

Symbols in the top right of the map (but below where you enter your address) are short cuts for mapping actions and are explained if you hover your mouse symbol over them. This functionality is also covered later under “Inputs”.

Map Layers

Click on any of the listed Map Layer Categories on the lower left and they will expand to show the individual layers. Each layer appears on the screen at different levels of Zoom, typically they are visible between Zoom Level 11 to 22. This is necessary to improve the loading speed of the layers and may get changed from time to time depending on the speed that multiple concurrent users are experiencing. As you Zoom in (to Zoom levels above the minimum) the layer selected begins to be displayed and the Layer name goes from grey to black. Once it has turned black, and you hover your mouse over the layer name in the menu, it will tell you what Zoom Level it operates at.

Tip: Try Zooming in to level 15 then run your mouse down over the Layers, this will quickly inform you of the Zoom range you will need to operate at to see the layer displayed.

If you wish to see more of the layer when displayed, turn on Full Screen using the Four Arrow symbol at top left.

When a layer is displayed, a layer opacity bar occurs at the top left. Click and hold the round symbol on the opacity bar and drag it left and right to alter opacity. This will help you see what features underly the colour ranges. On the bottom right is the map legend giving the range of values represented by each colour.

Find your property.

Get started by navigating to your property. Enter your street address in the search box at top right. It will begin to offer a list of similar addresses below the box. To shortcut the process, you can click on any that are your address as soon as it appears. Or if it's at the top of the list, just push Enter. The map will then pan and zoom to that address (stopping at Level 16) and you will need to adjust the Zoom level to suit the view of your property you wish to examine. By default, the "Land Parcels (LINZ) layer is left on and gives you the legal boundaries of all properties.

The aerial imagery you will view is the latest complete national set provided by Land Information NZ (LINZ). This may consist of a patchwork of photos from different times, hence, it may show colour changes between images because of seasons. Aerial imagery will be updated by LINZ from time to time and without notice. You may wish to turn off the "Basemap: Aerials (LINZ)" to see the older underlying aerial imagery available. Also turn on the "Basemap: Street (OSM)" (Open Street Map) to get street names and street numbers.

Infrastructure

Roads and street names, property numbers, aerial imagery, powerlines, road metal quarries, can all be seen by clicking on these layer names. The mapping of Powerlines comes from two sources (LINZ and OSM) and may not be complete, so please do a visual inspection for these as back up. Powerline setbacks for trees are enforced by line companies.

Turning off Basemap Aerials (LINZ) gives an older set of aerial imagery that is sometimes clearer. NB: Aerial imagery may not be the very latest and can vary in quality across the country. You may wish to also look at the imagery in Google Earth, it is sometimes more recent.

Environment

Waterways (rivers, streams, creeks – ex NIWA), ground slope, erosion risk (ex NES_PF) are now provided in this group as a separate category. We hope to add more layers such as wetlands, SNAs, and overland flow paths, as they come available.

Planting Trees

Under the "Planting Trees" tab there are two further tabs for "Inputs" and "Estimate Costs"

Inputs

Within the Inputs tab each input is numbered.

Step 1 is Map Search. This is covered in Find your property, above, and gives another option to enter your address.

Step 2 is Draw Woodlot Boundary.

Move to the area of your property you are considering for planting and zoom in so that the area is magnified to fill most of the screen. Then scroll down the right-side pane, you can put the mouse over the panel and roll the mouse wheel backwards or use grey bar on right. Clicking on "Use Area Drawing Tool" button, will activate the drawing tool. You can then use your mouse to click on the corners and angles of the paddock or any area you wish to plant. It's best to click in a clockwise direction. When the boundary line you are creating is almost complete, and only one step away from the starting point, double click the last point. This will close the boundary. You can also press "Enter" on your keyboard at this point if it's easier. To confirm the Woodlot

just click on the map beside it. To edit it, click on the boundary and the corners will be highlighted and can be moved. There is greater detail on editing lines in the Tree Harvesting section of this manual.

To remove a woodlot totally just click on the boundary and use “Delete” on keyboard or the small rubbish bin symbol in the top right of the map.

The “Woodlot Boundary” table will now be showing “Woodlot 1” with the area and labels for this mapped area. The blue map symbol allows you to return to the map of the woodlot at any time.

The next input required is the “Vegetation/Land cover (%)”. First click on the up & down arrow symbols in the box that currently displays “Pasture”. This brings up a pick list of different ground cover conditions. Click on one, then click the “+” symbol to the right. An additional input box is created to allow you to enter the percentage of ground cover you estimate. Use the aerial photography to help. If the first land cover % is less than 100%, click the Up/down arrows in the next vegetation/land cover type box (it will be showing “Pasture”), select another land cover type and enter the % cover. If you wish to delete landcover %, click on the red “-” beside the box.

Repeat this for each land cover present to achieve a total of 100%. Note that if the % of cover for a woodlot does not equal 100%, the calculations will not proceed. These selections will affect the establishment costs.

Species Options

In the Species Options area below, click the box to the left of the species you wish to test as an option. If you want to, you can test all of them by clicking on the box at the top and left of “Species”. Next, click the arrows in the “Tending options” boxes that currently show “No thin or prune”.

Select one of the three options for tending. This will affect costs and yields.

Next, set the age of harvest for each species. Currently a range between 10 years and 50 years is allowed.

For Poplar species we currently do not have a productivity layer to estimate a value for your woodlot, please enter an estimated value for height at age 20 years. The allowable range is 16 to 34m. 16 – 20m is low, 21 to 28m is medium, and 29 to 34m is high.

If in doubt consult the NZ FFA web site or a Poplar species expert.

Next, click “Calculate costs”. This will use your inputs to calculate costs and then take you to the Estimated Costs table to review results. Use the bar at the bottom of the table to move the information left and right to view the complete table.

Results and Print/Save options.

The calculations may take a few seconds or more, depending on the size of the woodlot area and the number of species chosen. A table of results will appear on the right side of the screen, and this has scroll bars to view more of the results that are not on the screen. Click on the bottom scroll bar and drag it to the right, you should be able to see Costs, Standing volume, and Carbon values for each species selected. Use the mouse wheel to move up and down quickly.

To see more, click “Print Results” in top right of the screen banner. This loads a preview of results, probably as two pages, that you may need to scroll down to see using grey vertical bar in middle of screen or roll the mouse wheel. Under the “Destination” options (Top Right) you can select your printer (e.g., EPSON L365) and then the Print button at the bottom, or Save as PDF, to store the file. Storing the file requires you to navigate to the folder you want to use for this result. A stored file allows you to view the results later and expand the viewing. Files can also be sent to others for review or comments.

To change the input selections or add another woodlot go back up the panel and click on “Inputs”. This will allow you to reuse the Area Drawing Tool to add woodlots or change land cover in existing woodlots, plus alter species and tending options. Then click “Calculate Costs” again. If needed, the “Reset” button allows you to clear all that you have entered and start again.

Wind Risk

Just above the “Calculate costs” button (at the bottom) is the option to turn on wind risk modelling by clicking on the box beside “Enable Wind risk”. This is to assist with decisions on locating woodlots and the

risk of losing a tree crop to wind damage. A useful description is given on screen and more is available as a report from the FGR web site <https://fgr.nz/> and at <https://www.nzffa.org.nz/farm-forestry-model/resource-centre/tree-grower-articles/august-2014/wind-damage-to-forests-and-the-consequences/>

Wind risk mapping is available by clicking on the “Risk” category of layers and offers different maps for high or low stockings of radiata pine. Currently these risks are only for viewing and their implications are not built into the costings and yields.

Fire Risk

With the greater acceptance that Climate Change is occurring, the potential changes in future fire risk are mapped by future scenarios out to 2090. The basis of risk is the annual frequency of Very High and Extreme Forest fire danger during Oct-Apr. These were developed from an analysis in 2011: [Forest fire danger \(1990s, 2040, 2090\) - Climate change Forest fire risk \(2022, 2040, 2090\) - Whitiwhiti Ora: Land Use Opportunities](#)

The maps give coarse categorisations (hence appear at Zoom level 6) and further work on this issue is due to be delivered as a more detailed map. Currently these risks are only for viewing and their implications are not built into the costings and yields. Also see <https://www.nzffa.org.nz/farm-forestry-model/resource-centre/tree-grower-articles/february-2014/drought-and-the-increased-risk-of-fire/>

Estimated Costs

The estimated costs tab is where you are taken when the calculations are finished and allows you to view and print or save results or return to the “Inputs” tab to make changes.

Tree Harvesting

Selecting the “Tree Harvesting” tab takes you into a different interface in the right panel. You can start your analysis here if you have an existing woodlot, or you can examine the harvesting implications of the Woodlot/s you have just modelled in “Tree Planting”. This interface has three Tabs “Inputs”, “Estimate Costs” and “Generate Report”.

Inputs

1. Map Search,

This has probably been completed as an initial step or can be done here to navigate to your property by entering the street/road address.

2. Draw Access Roads

Drawing roads and woodlot boundaries on the map may take some practice but will become intuitive with use. If you are a first-time user, it is best to turn off the “Land Parcels Layer” while you use it, as it is easy to activate this layer unnecessarily while you try to click on a road line.

Click on “**Draw Access Road**” tool, then the location where you want to start the road (usually at a public road access point where trucks would enter). Move the screen pointer to the first corner (vertex) of the road then click again, repeat this along a desired path for the road to locate the full extent of access road or track required to cart the logs out. When finished, double click the last point or it may be easier to use Enter on the keyboard.

If you wish to **add a branch** to the road or extend its length, click on the road and continue clicking in a new direction to add to it. You can add multiple branches to the road.

When all edits are done, click “Recalculate” and the line will be redrawn, and costs will change.

After the results are calculated you will notice the road line has different coloured sections. These indicate the estimated slope of the road line, and a legend is given on the bottom right. Red indicates the slope of the current line of the road is too steep for the transport type selected. To improve this, you may wish to move the road to run along the contour more rather than up or down it. You will need to recalculate after each

improvement to get an updated road line slope. Changing the transport option changes the thresholds for colour scheme of the road slope and changes costs.

Scenarios

Treefarmer allows you to test multiple roading scenarios for the woodlot/s you have drawn. This allows you to try different routes and access point to find cheaper options. Each roading scenario is given a unique number and applies to all woodlots in the current Project, and not just the one that may have an access road drawn. If a woodlot is not to be included in a roading scenario, it will need to be deleted. The scenario tool allows you to manage multiple numbered scenarios and can “Add” or “Delete” scenarios. Separate tables of results will be shown for each selected scenario. Reports for printing or saving will include the results for all scenarios.

3. Draw Woodlot Boundary

Locate the stand or stands you wish to harvest by using the woodlot boundary tool. Click on the “**Drawing Woodlot Boundary**” then click along the stand boundary to complete a full loop back to the start. Double click when one step away from the start position to close the loop or use Enter to finish. Multiple woodlots can be tested for a single roading scenario.

As above, a scenario is determined by the road line. It is assumed the road line drawn will be part of the costs for all the woodlots currently drawn.

Both roads and woodlot boundaries can be changed. Click on the line to activate the corners (or vertices). When activated they become enlarged yellow dots. If you just want to edit one point, move the mouse to it, click on it and it will change to a “+” sign with four arrow heads and by holding the mouse button down allow you to move the vertex to another location. On a woodlot boundary, double clicking on a vertex adds two intermediate vertexes on both sides for finer line shifts.

If you wish to move the whole road or woodlot, click on the line where there is no dot, hold the mouse button down and move the mouse to shift the whole line or woodlot. Nominal woodlot areas can also be moved around the property to quickly try different locations quickly.

All the above options for inputs have a shortcut symbol in the top right of the map interface. When moving to full screen mode these are still available to initiate the same operations.

4. Draw Skids location(s)

Skids are where logs are accumulated and generally where trucks are loaded. Consideration needs to be given to how the harvest operation wood flows are optimised and costs are minimised. Skids generally need to be 50m x 50m in size depending on how much storage space for logs is required. It is wise to engage a Harvest Management company if a large or complex plan is needed.

To locate skids on the map, select “**Draw Skid Location(s)**” and click the centre of where you want it. To add another skid, select “Draw Skid Location(s)” again and repeat the process.

A recommendation on the number of skids required is given in the report along with the average slope for the sites selected. Skid costs are affected by ground slope because they generally require earth works to make level and remove topsoil.

Skids can be moved by clicking on the centre and dragging to a preferred location. Recalculate after changes are made to a scenario.

All the above options for inputs have a shortcut symbol in the top right of the map interface. When moving to full screen mode these are still available to initiate the same operations.

5. Select Roothing Type

There are four roading options offered.

1.Existing. This may be where farm roads are adequate or harvesting roads from a previous crop are already established and don't need further expenditure.

2.Trucking (up to 7° incline). Roads for use by logging trucks need to be wider, straighter, with no more than 7° incline. They generally require significant quantities of metal and adequate culverts or bridges to be compliant with NES_CF. Roads for trucking are the most expensive type but allow all weather logging. If the road line crosses a stream or river, the costs of culverts or bridging of streams is automatically included in the costing.

3. Forwarder (up to 15° incline). If the total access road distance suits a Forwarder operation (i.e., approximately 600m (or less) to the log dump) and you have chosen to have an un-metalled track (incline 15° or less) this roading option assumes some earthworks are required but less metal and is costed at 55% of a Trucking Road.

4. Forwarder (on existing track, up to 15° incline). If the access for the Forwarder follows a well-formed existing farm track, this option is costed at 25% of a Trucking Road. Choosing to use a Forwarder will currently incur an extra cost of \$6 /t for the extra equipment and driver costs involved. This option has created the opportunity to look at the trade-off between building Truck roads versus using Forwarders with cheaper tracks. The optimum is very dependent on the volume of wood harvested, the length of the access road and the terrain.

6. Calculate net return.

If you wish to calculate a Net return/ha (i.e. Log revenues less harvest costs) click the box adjacent to item 6. A configuration file labelled "Config" will popup, click on that and a table of options will open. Select species of interest by clicking the left side box. This will activate options you can set for Tending (click the down arrow or v), then put the mouse pointer over Harvest age and it will allow you to change this setting up or down (limited to 20 to 50 years), the same for Conversion Merchantable (this is the % of saleable wood you expect from a standing tree). For each log grade type the % is estimated (using the FGR Calculator if available for each species) and is adjusted automatically by the harvest age. These can be changed by the user. Commonly accepted log grade specifications only exist for radiata pine. They are generally set by the log small end diameter (sed) and whether it is pruned or not pruned. Radiata pine is also graded on branch size, but this is not common for other species. To accommodate a range of species a simplified version of log grades has been adopted that are based on pruning and log sed. Log prices by species and log grade have been derived using a range of industry sources. Radiata pine prices are set on historic log sales. We have used the average for the last two years for prices reported by AgriHQ.

As mentioned previously, the harvest cost estimation routines are based on radiata pine operations. The "Harvest cost adjustment" has been set by industry consultation and allows you to increase or decrease harvesting costs for each species.

To run numerous scenarios in the Config options like harvest age, or log prices, when the first calculations are finished go up to and click on "Inputs" again, go down and click on "Config", make changes in the table, click "OK", go down and click on "Calculate Costs". Each time you do this loop you will add another set of results on the screen under tabs and added into the Output file. They are labelled Net Return #1, #2, #3 etc.

Estimate costs.

After clicking on "Calculate" you are taken to the Estimate Costs tab and "Inputs that affect harvest costs" screen.

Here you can set the age of the woodlot (this has no impact in the current version), also set the estimated **merchantable volume** per ha, this affects costs per tonne. Merchantable volume is approximately 75% to 85% of total standing volume given in the Tree Planting report.

The proportion of the harvest area that will be **harvested in summer** can also be set. If set to 100% (Harvest only in summer) this reduces harvest costs by 5% because of fewer delays from rain and drier working conditions. On some soil types this factor could be more important.

Log quality varies significantly within a woodlot. Some logs receive the best price when graded for the Export market and hence will be transported to the nearest port. Except for the Export Pruned grade, these logs have larger branches (> 10cm) and can be less straight.

Logs with branches <7cm are graded for the domestic sawlog market and are required to be reasonably straight.

For farm woodlots generally, 65% of logs go to the **export market** and 35% **domestic**. This may have an impact on transport costs. If your woodlot has a low stocking or poorer form, or the converse, you may wish to alter these percentages to make the transport estimates more realistic.

Carting distance for **road metal** or aggregate also influences roading costs. Answer yes or no to “Is there a source of suitable road metal withing 20-30km?” Answering “Yes” currently reduces Truck Road costs by \$6,000/km.

If you change any of the above, please click Recalculate before viewing results. View the mapping of Quarries etc under Infrastructure to see if road metal is nearby.

Having worked through the above you have the option to “Recalculate”. This should be clicked if you have made changes to the inputs above.

Output

Each Scenario creates a separate report and is accessed by clicking on Roding #1, or Roding #2, etc.

Click on “**Print Results**” and “**Helpful Checks**”, both are printable or can be saved to a file on your computer.

Generate Report

This produces a NES_PF report. It can take a long time to be generated and is very dependent on speed of the NES_PF web site. It produces erosion susceptibility classification report and a Fish Spawning Habitat report, both can be printed. To achieve this, use the “Generate Report” option and select to have the Erosion or Fish Spawning (or both) reports, click “Submit” and a report is built and a “Download report” option appears, this will give you a PDF report on the screen that can be printed if downloaded to your PC.

Project Details

All the above inputs and settings can be stored as a “Project” on your computer and used again later.

It is suggested after setting up all the above details for your analysis, you create a project by filling in the “Project Name”, a brief “Description” and clicking “Save Project”. A default filename will use the Project Name and current date. Click “OK” and you will go to a location on your computer to store a file. If needed, navigate to a location or folder you wish to use for this purpose. Then click “Save” at the bottom of the screen and a .JSON file will be stored.

When revisiting this analysis, you can “Load existing project” and Treefarmer should return to the same folder location on your PC. If you double click on the file, you will return to running that project. Woodlots can now be added into the project, new roading scenarios added or existing ones amended. Log grades % maybe changed and log prices updated, etc. Remember to “Save Project” after any changes or give it a new project name, then save it to create a different scenario.

You can set the location where you save files in your settings for the Web Browser. Click on the three vertical dots in the top right corner of the screen. Click on Settings, then Downloads, click on “Change” to set the file Location, or turn on “Ask where to save each file before downloading” to set it for each Project.

Tips

- Different woodlot planting scenarios also need to be saved as different Projects.
- You generally need to make each scenario a different Project.
- The exception is in Tree Harvesting option that allows you run multiple roading scenarios within a Project.
- If you are examining planting options, try evaluating the harvesting costs at the same time. If they are high per tonne, try moving the woodlot closer to the road or enlarging the planted area to take in more adjacent land. Examine the cost reductions to see what location or planting area is required to meet your profit expectations.
- Look for roading lines that minimise slope, avoid streams, or use existing tracks. When drawing an access road line, try turning on the slope layer (appears at Zoom level 8 -16) and set the Layer Opacity to about 40%. You will get some guidance on where the steep areas are and can go around them where possible.
- Consider gaining access through your neighbour’s property (possibly for a fee), especially if they have developed logging roads.
- Some key metrics to get right are the merchantable volume/ha at harvest. This is often based on previous crops or local knowledge. Another is total harvest and transport costs/t, again local experience and previous crops will be a useful guide. Net returns are very influenced by harvest age and hence volume. Different species require longer growing periods to be at their best. To account for older harvest ages, we have calculated a simple metric of Net revenues/ha/yr. Building in a full discounted cash flow analysis would make Treefarmer too complicated. If large investments are being made, this type of in-depth analysis, that better adjusts for investment period and cost of borrowing, should be sought from a registered forestry advisor.
- View the “Helpful Checks” (top right of the screen) to get a check list of 20+ things to consider that may have an impact on your harvest. Many also have links to web sites that provide answers and more information.
- The Farm Forestry **Species selection tool** can also be reached from a link at the top right of the screen. To use it you simply select the site factors that represent your planting site, and it will remove species from a starting list that do not meet the criteria. It is possible to have a site that none of the species listed would suit.

Improvements

Comments and feedback on improvements are welcome and are best communicated by email please. Further development is planned subject to Forest Grower Levy Trust funding. Cost libraries and spatial layers will be updated when data is available. Layers provided as web services (e.g. LINZ) are the latest currently available on the day of usage and are subject to change.

Group tutorials or demonstrations can be arranged by Zoom as required.

We hope you enjoy using Treefarmer.

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