



NurseryFootprint

**A carbon footprinting tool for
the Australian nursery and
garden industry**

User Manual

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December 18, 2009

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Introduction.

NurseryFootprint is a carbon footprint calculator designed especially for the Australian production nursery industry. This calculator is designed to be very easy to use and understand. For example:

- It assumes that users may not have a great deal of computing experience.
- It only requires data that is easily available to nursery managers.
- It can deal with the huge number of products and processes in the nursery industry.
- It produces results that are relevant and easy to understand.

The calculator uses a hybrid approach to calculating emissions. It relies on data that can be easily collected from business records and then applies conversion factors to calculate emissions. These conversions are relatively simple for the on-farm emissions (eg. amount of fuel used) but become more complex when considering supply chain emissions (eg. how much raw material, energy, transport emissions etc. were associated with the production of a pot?). For the supply chain emissions, this tool uses emissions factors developed from other complex analyses to convert simple expenditure data into emissions values.

While this tool does not provide a fully standards-compliant life cycle assessment of emissions for single products, it does provide results that *approximate* a life cycle assessment that can be used to identify emissions reduction opportunities, and to compare businesses and practices within the production nursery industry.

Carbon footprinting basics.

A *carbon footprint* is a description of the total amount of greenhouse gases emitted in the life cycle of a product or activity (Wiedmann and Minx, 2007). A carbon footprint is a useful tool to quantify the contribution of a business or product to climate change and to identify areas where emissions can be reduced. Carbon footprints are also increasingly being used by consumers to identify more environmentally-friendly products (Carbon Trust, 2008). Efforts to introduce carbon product labelling (eg. the *Carbon Reduction Label*; Planet Ark, 2009) will reinforce this trend.

The calculation of a carbon footprint should include the emissions from the entire supply chain, including processes that might occur outside of the business boundary (Saunders and Barber, 2008; Sinden, 2009). For example, it should include both *direct* emissions that occur on-site (eg. burning fuel in a tractor or boiler) and *indirect* emissions that occur elsewhere but are still associated with the product (eg. electricity inputs, production of raw materials, or fuel for freight). In this way, a carbon footprint encapsulates all of the emissions resulting from

the production of a product, including the raw materials, manufacturing processes, transport, packaging and distribution. This type of *Life Cycle Analysis* (LCA) is a more robust measure of a product's contribution to greenhouse gas emissions than some calculations that only include emissions that occur within a business boundary (reviewed in Lenzen, 2007).

A carbon footprint is quite different from the greenhouse gas accounting required under an emissions trading scheme (such as the *Carbon Pollution Reduction Scheme*). A carbon footprint is a method for businesses and individuals to measure and reduce their emissions contributions voluntarily, while the CPRS is a policy tool designed to force emission reductions across industries or whole economies. The two methods use different rules to identify and calculate emissions; while a carbon footprint should include all emissions throughout a supply chain, accounting for emissions trading schemes only includes direct emissions from within a business boundary.

The calculation of a carbon footprint includes more than just the emission of carbon dioxide (CO₂), but also includes other greenhouse gases such as methane (CH₄), nitrous oxide (N₂O) and hydrofluorocarbons (HFCs). The six main greenhouse gases vary in their *global warming potentials*. For example, nitrous oxide (a by-product of fertiliser use) has about 300 times the warming potential of carbon dioxide. Because of this variation among the different gases, the amounts of each gas must be weighted according to their warming potential and then combined into a single measurement. The unit used to measure a carbon footprint is *tonnes of carbon dioxide equivalent* (or t CO₂-e).

There are numerous tools that can assist businesses to estimate their carbon footprints, including stand-alone software tools, online calculators and consultancy services. Unfortunately, simple footprint calculators usually only include direct emissions (and sometimes energy inputs) and do not comply with the requirements of emerging standards. In addition, none of the existing simple tools really suit the requirements of the nursery and garden industry. There are also several commercial software packages for performing life cycle assessments, but these packages are both complex and expensive.

Why is carbon footprinting important?

Climate change continues to grow as a global issue of the highest importance to many people. It is a multi-faceted issue with significant economic, market, production, social, and environmental implications.

Within the international scientific community, the majority agree that there is substantial evidence supporting human-induced climate change, and that the increase in atmospheric greenhouse gases is driving global warming and significant shifts in climatic conditions. There are many sources of greenhouse

gas emissions including the burning of fossil fuels (in industry, transport and electricity generation) and some agricultural practices (methane emissions from livestock and nitrous oxide from fertilisers).

The nursery and garden industry already has very low emissions of greenhouse gases in comparison to other agricultural sectors. However, there is scope to further reduce these emissions and lessen the impact of production nurseries on future climate change. Calculating your carbon footprint is the first step in identifying opportunities for reducing these emissions.

Reducing your carbon footprint is directly linked to other management practices that improve farm business efficiency. Many of the steps that can be used to reduce a farm's footprint (improved energy efficiency, reduced on-farm traffic, less fertiliser) will also result in reduced input costs. A small footprint can be used as an indicator of production efficiency.

Importantly, consumer preferences are likely to evolve and drive demand for more environmentally-friendly products. A smaller carbon footprint may provide a distinct marketing advantage for more efficient businesses.

Greenhouse gas emissions in the nursery and garden industry.

The most important GHGs emitted directly from nurseries are carbon dioxide (CO₂) and nitrous oxide (N₂O). CO₂ is released by burning fuels in vehicles, farm machinery, pumps and various heating applications (greenhouses, propagation benches etc.). N₂O emissions result from the use of nitrogenous fertilisers. In addition to these two main gases, small amounts of methane (CH₄) may also be released from waste and waterlogged soils.

Including the supply chain emissions brings more gases and processes into consideration. Taking one input product (a plastic pot) as an example, greenhouse emissions result from the extraction of the raw material (oil and natural gas), transport, processing into intermediate products (polymers), by-products, fugitive emissions from the processing plant, more transport, product manufacture, and even more transport (delivery). In addition to the direct emissions throughout the chain, each step has additional inputs (energy use, other raw materials, construction processes etc.) that must be quantified. In reality, it is a supply *tree* or *network* rather than a supply chain.

Typical production nursery emissions:

Nursery products involve a diverse range of inputs and numerous on-site processes that contribute to emissions. The following list provides a snapshot of the range of inputs and processes involved, with some notes on other factors contributing to emissions:

- Energy inputs:
 - Electricity (pumps, lights, heaters, steamers, potting machines etc).
 - Liquid fuels (petrol, diesel, LPG for vehicles, machinery, pumps, boilers, heaters etc.).
- Fertiliser.
- Water.
- Chemicals: pesticides, fungicides, cleaners etc..
- Plastic products:
 - Pots and trays (numerous sizes, both recycled and virgin material).
 - Irrigation pipes.
 - Shadecloth and weedmat.
 - Crop netting.
 - Bags.
- Soil products.
- Peat.
- Perlite.
- Packaging: boxes, crates etc.
- Bamboo stakes.
- Waste: green waste, plastics, water etc. (to landfill, processing or recycling).
- Construction materials (farm infrastructure – concrete, steel etc.)
- Services (consultants, financial and business services).
- Freight (local, interstate and international deliveries).

While these are common emissions sources within the industry, there is a huge amount of variation in the relative contributions of these sources to total emissions among production nurseries. A nursery's emissions profile may vary with:

- Product range and specialisation.
- The size of the operation.
- Degree of mechanisation (automation versus manual labour).
- Location (eg. the emissions factors related to electricity use vary among the states because of different fuel profiles).
- Target market (eg. local versus interstate freight).
- Adoption of new energy-efficient technology (early versus late adopters).
- Choice of fuel for applications (eg. electric or gas heaters).
- Amount of on-site traffic and fuel use.
- Requirements for artificial heating or cooling (which vary with the product and local climate).
- Efforts in waste reduction and recycling.
- Water use efficiency.

This high degree of variation within the industry presents serious challenges to the calculation of a precise carbon footprint.

How does NurseryFootprint calculate emissions?

The *NurseryFootprint* calculator combines a couple of different methods to estimate emissions. This is because the most efficient method of calculation varies depending on the source of the emissions, i.e. whether they are direct on-farm emissions or supply chain emissions.

For on-farm sources and some indirect sources, emissions can be calculated quite easily using simple conversion factors. For example, the amount of fertiliser applied or the amount of electricity consumed can be converted into emissions values.

Supply chain emissions are more difficult to estimate. There are two main approaches to calculating supply chain emissions in a Life Cycle Analysis: *process analysis* and *economic input-output analysis* (reviewed in Lenzen, 2007). Process analysis requires the emissions from every step of the supply chain for a particular product to be quantified. While this method produces a precise estimate, it has enormous data requirements that make it unrealistic for a typical small business owner who will not have access to emissions and productivity data of upstream suppliers. In contrast, economic input-output analysis has more modest data requirements, and the ease of use far outweighs the slight drop in precision (at least for this application). Economic input-output analysis is based on economy-wide data on emissions and economic activity across all sectors of the economy. The logic is that if you know how much money you spent on a sector's products, and you know that sector's total income and total emissions, then you can calculate the emissions associated with the portion of production that you consumed. This calculator employs input-output analysis for supply chain emissions because of the greater data efficiency.

This calculator relies on published emissions conversion factors or Life Cycle Analyses (LCA) from other studies and industries to quantify emissions for inputs. These results of these LCAs are converted into generalised conversion factors, reducing the volume of data required to run the tool while more closely matching the requirements of the emerging standards.

Sources for emissions factors used in this calculator include:

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006).
- National Greenhouse Accounts Factors (Department of Climate Change, 2008).

- **Balancing Act: A Triple Bottom Line Analysis of the Australian Economy (CSIRO, 2005).**

Using NurseryFootprint.

Installation:

There is no need to “install” the software. Simply copy the *NurseryFootprint* file to a convenient location on your computer (usually in the “*My Documents*” directory).



Operation:

The *NurseryFootprint* calculator runs as an Excel™ spreadsheet, ensuring that it will run on almost any computer and be easy to use for anyone with basic familiarity of spreadsheets. Once you have copied the file to your computer, simply double-click the file’s icon to start the calculator. If a dialog box appears asking whether you should enable or disable macros, please select the option to enable macros. If the calculator fails to start, please refer to the section on *System requirements*.

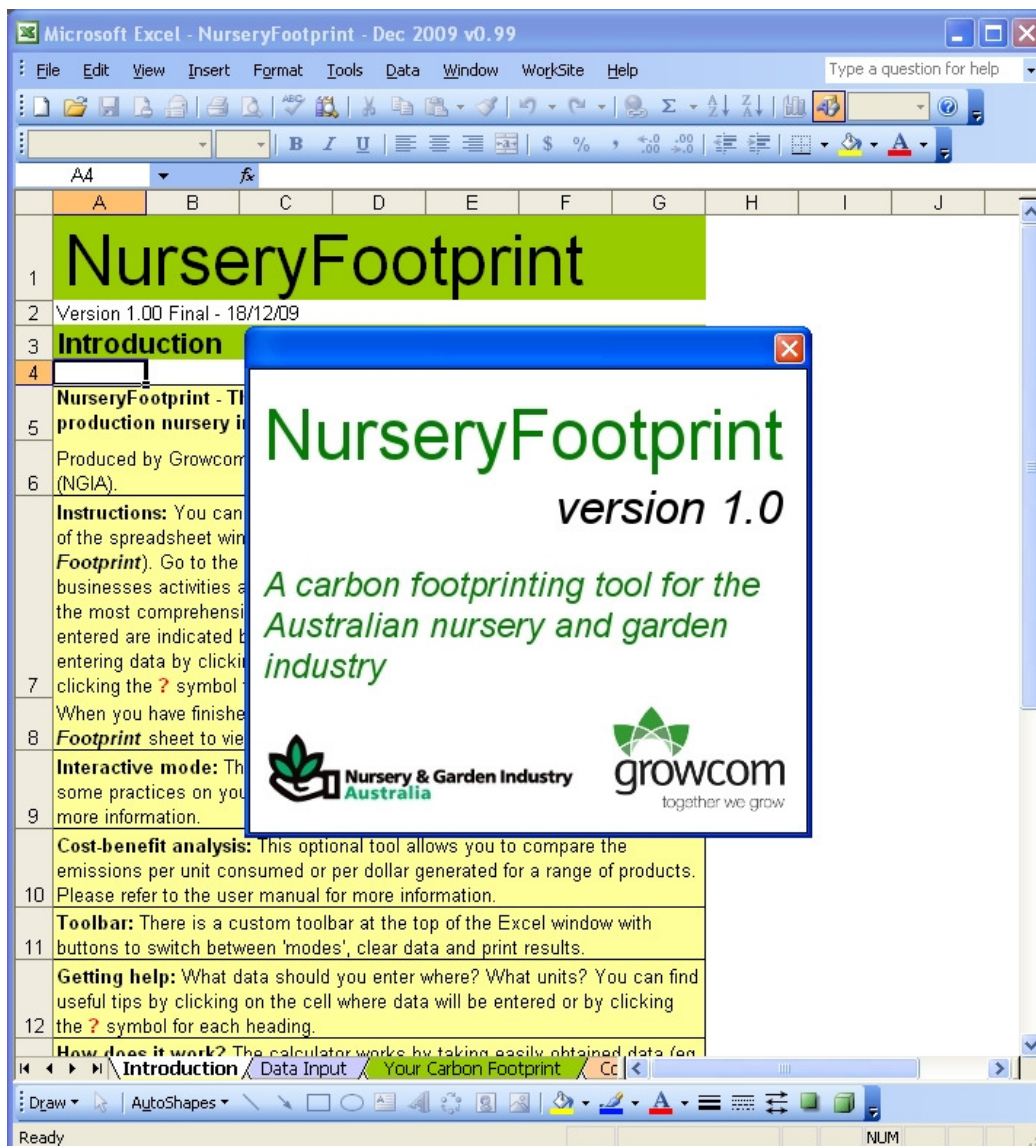


Figure 1: The *Introduction* sheet and start-up splash screen that appears when the calculator is started. The tabs at the bottom of the window can be used to switch between the worksheets. The splash screen indicates that macros are enabled and all calculator functions are working correctly. If it doesn't appear, please refer to the *System requirements* and *Troubleshooting* sections for more information.

The calculator will add a new toolbar to the top of the Excel window (figure 2). This toolbar features custom buttons to simplify some calculator functions. These specific functions will be described in more detail in later sections.



Figure 2: The custom toolbar that will appear near the top of the Excel window.

The calculator features ‘tooltips’ to provide help during use. For example, when a user clicks on a data entry cell, a tooltip pops up to explain the type of data that should be entered into that cell. In addition, there are help icons (?) adjacent to major headings to provide explanations and assistance.

The Excel workbook is organised into six main worksheets with distinct functions: Introduction, data entry, carbon footprint results, conversion factors, cost-benefit analysis and background information. There are two additional hidden sheets that contribute to functions or calculations, such as the drop-down menu lists and calculations for the graphical output. The workbook is protected so that users can enter data and view results, but not modify the structure of the workbook.

1. *Introduction:* This sheet explains the purpose of the calculator and contains basic instructions, tips, disclaimers etc..
2. *Data Input:* This is the form where the user enters all of the data required to calculate a footprint. The form is arranged into logical sections to ease data entry. There are fields for:
 - a. General information such as the location (because some conversion factors vary among the states), and the start and end dates of the period of interest.
 - b. Energy inputs such as the amount of electricity consumed (in kWh).
 - c. Direct emissions resulting from fuel use and the application of fertilisers. Data on the amount of fuel and fertiliser used should be relatively easy to extract from business records.
 - d. The amount of waste produced.
 - e. Supply chain components such as freight, plastic products (eg. pots), chemicals, consumables etc.. For these components, the user is required to enter data on the business’s expenditure for a range of product, activity or service categories.
 - f. Product information, including the total number of items sold in a number of different product classes (trays, tubes, small pots etc.) and the relative contribution of each of these product classes to the total business income.

You can clear or print your data using the buttons on the custom toolbar.

3. *Your Carbon Footprint:* The results are all presented on this single sheet. As well as providing an estimate of the business’s total carbon footprint, it also provides a breakdown of the emissions data into useful categories (energy, fuel, fertiliser, freight, plastics, services, etc.). There is a graphical representation of the emissions profile to enable the user to easily identify

areas that may require attention. The calculator also produces estimates of the amount of emissions associated with each unit in a number of different product categories. These estimates are calculated using an Economic Input-Output approach. You can print the results on this sheet using the 'Print results' button on the custom toolbar.

4. *Conversion Factors*: This sheet contains all of the emissions conversion factors used in the calculations. These factors can easily be updated by the author as new data is available to provide more precise results.
5. *Cost-Benefit Analysis*: This optional tool allows you to compare the emissions per unit consumed, per dollar spent or per dollar generated for a range of products.
6. *Information*: This sheet contains brief notes and links to external information sources (web pages).

What data do you need to calculate your footprint?

The calculator has modest data requirements thanks to the hybrid approach. It requires data on energy use (electricity and liquid fuels), fertiliser use, waste produced and expenditure on a range of products or services. All of the data should be relatively easy to extract from business records and accounts, and there should be no need for the user to obtain additional information from upstream suppliers.

Ideally, a farm owner or manager should be able to sit down with the records and accounts, and produce a greenhouse footprint in about 1 to 2 hours.

Entering your data:

You can enter your data in the *Data Input* worksheet (second tab from the left). Within the calculator, the descriptions of each category are fairly brief but more details are available in the tool-tips for each data entry box and in table 1 below.

NurseryFootprint

Data Input

General Information		
State		Qld
Period of analysis		1 year
Start date		
End date		

Energy Inputs		kWh
Electricity used		10000

Direct (on-farm emissions)		
Non-transport fuel use		Litres (L)
Petrol		2000
Diesel		3000
LPG		1000
Transport fuel use		Litres (L)
Petrol		1000
Diesel		2000
LPG		
Fertiliser use		% N Tonnes (t)
A	40	1
B		
C		
D		
E		
F		

Waste		Tonnes (t)
Co-mingled		50.00
Paper & Cardboard		
Green waste		
Concrete/metal/plastic/glass		

[Introduction](#) \
 [Data Input](#) \
 [Your Carbon Footprint](#) \
 [Conversion Factors](#)

Help
 This section includes emissions from activities that are directly related to your business (eg. from premises or assets owned and/or operated by the business - vehicles, machinery, land use etc.).

Figure 3: An example of the *Data Input* worksheet showing a popup help box. The calculator will only allow you to enter or change values in the cells with the black borders.

Table 1 (below) provides a complete list of the nursery products, supplies and services that should be included in each category.

Table 1: A list of the products, supplies and services that should be entered under each category in the *Data Input* sheet of the calculator.

General Information	
State	It's important to select the state in which your business is located from the drop down list. The emissions related to electricity use vary among the states because of the different methods of generation as a proportion of the total (eg. coal, gas, or renewables).
Period of analysis	Select the time period for the analysis from the drop down list. Options are 1 month, 1 quarter or 1 year. One year is the most useful period to use.
Start date	Please enter the start date for the period of interest in the format dd/mm/yy (for eg. 01/01/08).
End date	Please enter the end date for the period of interest in the format dd/mm/yy (for eg. 31/12/08).
Energy Inputs	
Electricity used	Enter the total amount of electricity consumed by the business during the period of analysis (in kilowatt-hours, kWh). Only include electricity sourced from the grid from non-renewable sources. If you purchase accredited <i>GreenPower</i> from your supplier, where a proportion is generated from renewable sources, adjust this value to reflect the proportion of fossil fuel generation. For example, if you purchase 10% <i>Greenpower</i> , then enter 90% of your total electricity consumption.
Direct (on-farm) emissions	
<i>Non-transport fuels</i>	<i>Liquid fuels used in non-transport or stationary farm machinery (pumps, generators, boilers etc.).</i>
Petrol	Enter the total volume of all variants of petrol (unleaded, standard, premium, E10 etc.) used for non-transport applications. In litres (L).
Diesel	Enter the total volume of diesel used in non-transport machinery. In litres (L).
LPG	Enter the total amount of LPG used in non-transport applications. In kilograms (kg).
<i>Transport fuels</i>	<i>Liquid fuels used in vehicles or mobile machinery (eg. utes, tractors etc.).</i>
Petrol	Enter the total volume of all variants of petrol (unleaded, standard, premium, E10 etc.) used in transport applications. In litres (L).
Diesel	Enter the total volume of diesel used in vehicles or

	mobile machinery. In litres (L).
LPG	Enter the total amount of LPG used in transport applications. In kilograms (kg).
Fertilisers	<i>Nitrogen-based fertilisers applied to plants or mixed with potting media.</i>
A	This section provides room for up to 6 different fertiliser types. For each type, please enter the total amount used (in tonnes) and the percent nitrogen content according to the manufacturer's data (between 0 and 100, do not include the '%' symbol). If you use multiple types or brands with the same or similar nitrogen levels, the amounts can be combined into a single total for each level.
B	
C	
D	
E	
F	

Waste	<i>Waste or by-products from business activities that are buried or used on the farm. Do not include waste that was sent for recycling or off-farm processing – this should be included in the Waste disposal section under Supply chain components.</i>
--------------	---

Co-mingled	Please enter the amount of co-mingled or mixed waste (in tonnes). As a general approximation, 1 cubic metre of co-mingled waste weighs about 0.21 tonne.
Paper & Cardboard	Please enter the amount of paper and cardboard waste (in tonnes). 1 cubic metre of paper & cardboard waste weighs about 0.09 tonne.
Green waste	Please enter the amount of green or organic waste buried as fill or used as mulch / compost (in tonnes). 1 cubic metre of green waste weighs about 0.24 tonne.
Concrete/metal/plastic/glass	Please enter the amount of building/construction/product waste, eg. concrete, metal, glass, plastic, synthetic fabrics etc. (in tonnes). 1 cubic metre of mixed construction waste weighs about 1.5 tonne.

Supply chain components	<i>In this section, simply enter how much money your business spent on each type of product or service.</i>
--------------------------------	--

Plastic products (incl. pots)	All moulded plastic products, including pots, seedling trays, bags, tanks, bottles, pipes, labels etc.. There is no need to distinguish between different types of moulded plastic – eg. polypropylene, polyethylene etc..
Road freight	Road freight transport services, including long-distance haulage, local deliveries and everything in between. This should also include freight for inbound deliveries if the information is available.
Air freight and transport	Air freight transport (both in and out) and passenger services.
Rail freight	Rail freight transport services (both in and out).

Sea freight	Sea freight transport services (both in and out).
Textile products	Fabrics and woven plastic products such as rope, shadecloth, weedmat, insect screens, tarpaulins, carpet etc..
Sawmill products	Bark, woodchips, sawdust, dressed timber, treated timber etc..
Other wood products	Wooden boxes, crates, pallets, plywood, veneers, particle board, MDF, panels, mouldings etc..
Paper products and containers	Paper products, including copy paper, card, toilet paper, tissues, paper towels, cardboard trays, paper sleeves, plates, decorations etc..
Stationery	Stationery and printed paper products (letterhead, invoices etc.).
Agricultural chemicals	Agricultural chemicals such as insecticides, pesticides, herbicides, fungicides etc.. Do not include fertilisers in this section as the emissions from fertiliser are dealt with directly.
Cleaning chemicals	Soaps, detergents, bleach etc..
Rubber products	Hoses, foam, fan belts, conveyor belts, pipes, tyres, gloves etc..
Lime	Agricultural lime.
Concrete and mortar	Ready mix concrete and mortar.
Concrete products	Manufactured concrete products, such as bricks, tiles, concrete pipes, plasterboard etc..
Mining products	Products of simple extraction processes, such as sand, gravel, soil, peat, limestone, clay, gypsum etc.. This category also includes simple products derived from these materials, such as <i>Jiffy</i> pots.
Mineral products (non-metallic)	Processed mineral products, including perlite, vermiculite, fibre insulation etc..
Basic iron & steel	Fencing wire, tie wire, chain etc..
Non-ferrous metal products	Manufactured metal products made from aluminium, copper, lead, zinc, etc. and their alloys). This includes sheets, tubes, plate, sections and pipes.
Structural metal products	Steel construction products such as reinforcing mesh, rods, frames, doors, windows etc..
Sheet metal products	Metal products manufactured from steel sheet, eg. tanks, drums, reservoirs, guttering, gas bottles etc..
Fabricated metal products	Machined and/or hardened steel products, such as nuts, bolts, nails, locks, hardware, hand tools etc..
Motor vehicles and parts	Complete road vehicles, and parts for vehicles and other road transport equipment such as trailers or floats.
Scientific	Scientific or technical equipment used for survey,

equipment	navigation, monitoring and/or analysis (eg. GPS, weather stations, data loggers, cameras etc.).
Electronic equipment	Radios, telephones (fixed line and mobile), data processing equipment, TV, video, alarms, photocopiers etc..
Electrical equipment	Light bulbs, light fittings, electrical wire, motors, transformers, batteries etc..
Agricultural machinery	Farm-specific machinery, including tractors, slashers, conveyors, potting machines, excavators, bobcats, forklifts etc..
Other machinery / equipment	General machinery such as pumps, air conditioners, power tools, welding equipment, processing and packing equipment etc..
Prefabricated buildings	Prefabricated or kit sheds, carports, garages etc..
Furniture	All hard and soft furniture. This includes office furniture, desks, filing cabinets, mattresses, cushions etc..
Water supply and sewerage	Water supply and sewerage services (eg. tankers).
Mechanical repairs	All repair services for vehicles and farm machinery.
Communications	Telecommunications (phone and internet services), post and courier services.
Banking	Banking and other financial services (eg. fees and charges).
Insurance	Insurance services (eg. policy premiums).
Technical services	Technical or scientific consulting services.
Business services	Business management services, such as accounting, taxation, administrative, legal and other services.
Waste disposal	Waste processing and disposal, eg. recycling services, garbage removal and other sanitary services.

Product Information *In this section, enter the number of units sold in each general product category, and the percentage of your total farm income that is generated by each product category. This data will be used to estimate the footprint associated with each unit produced.*

Seedling tray	Seedling trays, propagation trays or similar.
Tube	40mm tubes (either round or square).
Small pot	Pots with a diameter of approx. 140mm.
Med pot	Pots with a diameter of approx. 200mm.
Large pot	Pots with a diameter of approx. 300mm.
Extra large pot	Pots with a diameter of approx. 400mm or larger.
Plant parts - roots	Plants parts grown below ground, such as corms etc..

Plant parts - foliage	Cut foliage, stems, flowers etc..
Trees - in ground	Mature trees grown in the ground.
Other 1	These categories are for any products that don't fit neatly into any of the listed categories.
Other 2	

Where should you enter a particular product?

The following table provides a quick reference to where you should enter data for some common nursery products. This will be particularly helpful for the supply chain emission categories.

Table 2: Data categories for specific nursery inputs and products.

Nursery product	Category
Electricity	Energy inputs – Electricity.
Liquid fuels	Direct emissions – Transport and Non-transport fuels. There are separate categories for diesel, petrol and LPG.
Fertiliser	Direct emissions – Fertilisers. There is room to enter up to 6 different fertiliser types and you can combine data for fertilisers with similar nitrogen levels.
Freight	There are separate categories for road, rail, sea and air freight. This includes freight for your products as well as inputs (if the information is available).
Pesticides, fungicides, etc.	Agricultural chemicals.
Cleaning chemicals	Cleaning chemicals.
Plant pots and trays	Plastic products.
Jiffy pots	Mining products – basic extraction.
Plant labels and tags	Plastic products.
Irrigation pipes	Plastic products.
Shadecloth and weedmat	Textile products.
Crop netting	Textile products.
Plant bags	Plastic products.
Water	Water supply and sewerage.
Soil products	Mining products – basic extraction.
Peat	Mining products – basic extraction.
Bark	Sawmill products.
Perlite	Mineral products (non-metallic).
Vermiculite	Mineral products (non-metallic).
Cardboard boxes	Paper containers and products.
Bamboo stakes	Sawmill products.

Viewing your results:

Once you have finished entering your data, switch to the *Your Carbon Footprint* sheet to view the results (eg. figure 4).

This sheet presents your total footprint, and also provides a breakdown into general emission sources and product categories. This allows you to identify the emissions contributions of particular activities or products. There are tool tips to clarify what products or activities are included in each category.

The graph at the bottom of this sheet provides a quick visual overview of your emissions profile by showing the proportion of your total emissions that are contributed by each category. If you 'hover' the mouse over a section of the chart, a pop-up box will display the name of the source of the emissions and the amount in tonnes.

Printing your results:

The custom toolbar provides buttons to print your data and results. These buttons will provide a preview of the relevant sheet for your default printer. It is not necessary to have the data or results sheets open. Once the preview is visible, simply select "Print" to complete the task. Alternatively, just use the normal print commands for your spreadsheet application. The calculator will automatically add the date, worksheet name and version information to the bottom of printed pages to assist with record-keeping.



Saving your results for future reference:

Once you have calculated your footprint, it's a good idea to save your entered data and results so that you can track your improvement over time. Simply select 'File', 'Save as', then select a location and useful file name that indicates the time period of the calculated footprint (such as 'Farm name - Footprint results – 2008.xls').

NurseryFootprint

Your Carbon Footprint tonnes CO₂-e

Energy inputs (electricity)	?	15.600
Direct (on-farm emissions)		
Non-transport fuels		14.150
Transport fuels		7.700
Fertiliser		5.208
Sub-total		27.058
Waste		45.000
Supply chain components		
Freight	?	5.700
Plastics	?	10.000
Machinery & equipment	?	0.000
Services	?	0.000
Other	?	0.000
Sub-total	?	15.700
TOTAL FOOTPRINT	?	103.36

Product footprints		?
How much CO ₂ -e (kg) is associated with each unit?		
Seedling tray		0.517
Tube		1.034
Small pot		no data
Medium pot		no data
Large pot		no data
Extra large pot		no data
Plant parts - root		no data
Plant parts - foliage		no data
Trees - in ground		no data
Other 1		no data
Other 2		no data

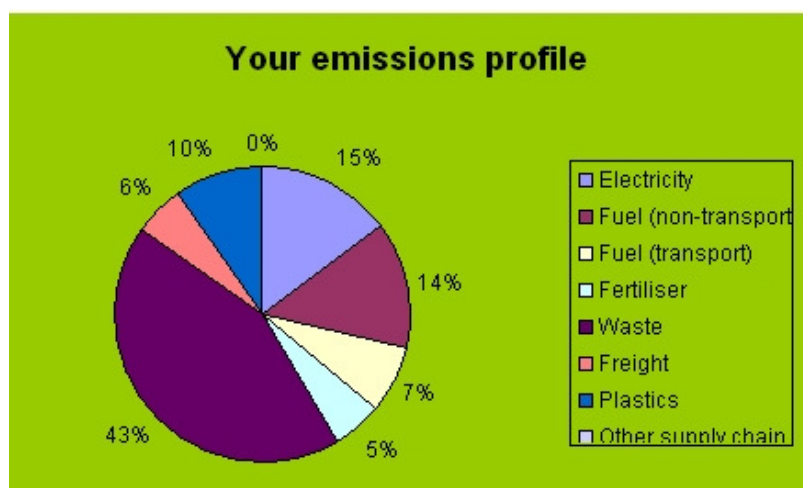


Figure 4: An example output of results on the *Your Carbon Footprint* worksheet, including a graphical representation of the emissions profile.

Further analysis.

So you've calculated your carbon footprint. Now what?

Identifying areas for improvement:

The footprint results will show you which areas of your enterprise are generating the most greenhouse gases, and this will indicate where you should focus your attention to improve efficiencies. However, more specific information on targeted responses may require further investigation. For example, perhaps the results show that electricity consumption is a major emissions source because you rely on electrical equipment for the majority of farm operations (pumps, heaters, potting machines etc.). The next question is: which of the operations or particular pieces of equipment are contributing to those emissions?

These further investigations may start with a simple audit of the specified power consumption figures for each device and by keeping records of the hours of operation for each piece of equipment. More accurate information could be collected by placing meters on individual pieces of equipment. Similar audits will reveal the fuel consumption of your machinery powered by liquid fuels.

If you identify a major culprit contributing to your footprint, it is not necessary to race out and replace it with new, more-efficient technology the very next day. But, this item should be marked as a high priority to be replaced in the normal upgrade process.

Targeting individual products or activities:

You can target the footprints of individual products or activities if you have data available on a finer scale and you are prepared to make some manual adjustments. To do this, you simply need to enter data that relates only to the product or activity of interest.

For example, perhaps you produce 140mm and 200mm pots that you distribute locally and interstate, and you want to calculate the footprint of the 200mm pots that you distribute interstate.

For direct emissions, you will need to enter data on the amount of fuel, electricity and fertiliser used only in the production of this product. In most cases, the simplest way to do this will be to adjust the levels based on the proportion of your

business income. For example, if this product contributes 20% of your income, then enter 20% of the total values for these inputs.

The supply chain data is fairly straight forward provided the data is available in your records. For example, rather than the total amount spent on pots, you will need to know the amount you spent on the quantity of 200mm pots that were sent interstate. Similarly, only enter the amount you spent on interstate freight rather than the total that included local deliveries. If you don't have product-specific information for some categories, then simply adjust the level based on the proportion of business income (as described in the paragraph above).

At the end of this process, you will have an estimate of the carbon footprint for the targeted product.

Cost-benefit comparison:

The *NurseryFootprint* calculator also includes a simple cost-benefit analysis tool on a separate sheet (figure 5). This is an optional function and is not a necessary part of calculating the carbon footprint of your business.

This tool allows you to compare the emissions generated per dollar spent on selected inputs (electricity, fuel and fertiliser) or emissions generated per dollar of income across your product range. These results will allow you to weigh up the various options for cutting emissions within your business and optimising your profit to emissions ratio. For example, the results might suggest that you could consider alternative fuel sources for some operations or an adjustment to your product mix.

The only additional data required for these calculations is the current price that you pay for the inputs and that you obtain per unit for each product. The calculator will present the results as kg CO₂-e / \$ of expenditure or income.

Disclaimer: The results of this comparison tool should not be regarded as business advice. These results are intended to provide additional information that you might consider in business planning decisions alongside other issues such as available resources, product profit margins, market opportunities, and your personal business goals.

NurseryFootprint

Cost-benefit analysis



Products consumed	unit	current \$ per unit	kg CO ₂ -e / \$
Electricity	kWh	0.15	6.93
Petrol : transport	L	1.40	1.64
Diesel : transport	L	1.50	1.80
LPG : transport	L		no data
Petrol : non-transport	L	1.40	1.64
Diesel : non-transport	L	1.50	1.79
LPG : non-transport	kg		no data
Fertiliser	t	500.00	5.21

Products sold	\$ income per unit	kg CO ₂ -e / \$
Seedling tray	2.00	0.24
Tube	1.50	0.64
Small pot		no data
Medium pot		no data
Large pot		no data
Extra large pot		no data
Plant parts - root		no data
Plant parts - foliage		no data
Trees - in ground		no data
Other 1		no data
Other 2		no data

Figure 5: An example of the cost-benefit comparison results.

Interactive mode:

When you are conducting some of these more detailed analyses, it may be useful to view multiple sheets at the same time. For example, you might want to view changes to your footprint or cost-benefit results as you alter the input data. This is particularly helpful for “What if?” scenarios. For example: what will be the change in the carbon footprint if you can reduce electricity consumption by 10%?

The *NurseryFootprint* calculator provides an “*Interactive*” mode to enable you to explore these types of questions (figure 6).



The calculator features two additional buttons on the Excel toolbar to switch between modes. The button on the left enters interactive mode while the button on the right switches back to standard mode.

Interactive mode opens with the *Data Input* and *Your Carbon Footprint* sheets by default, but you can switch to view any sheets within each window.

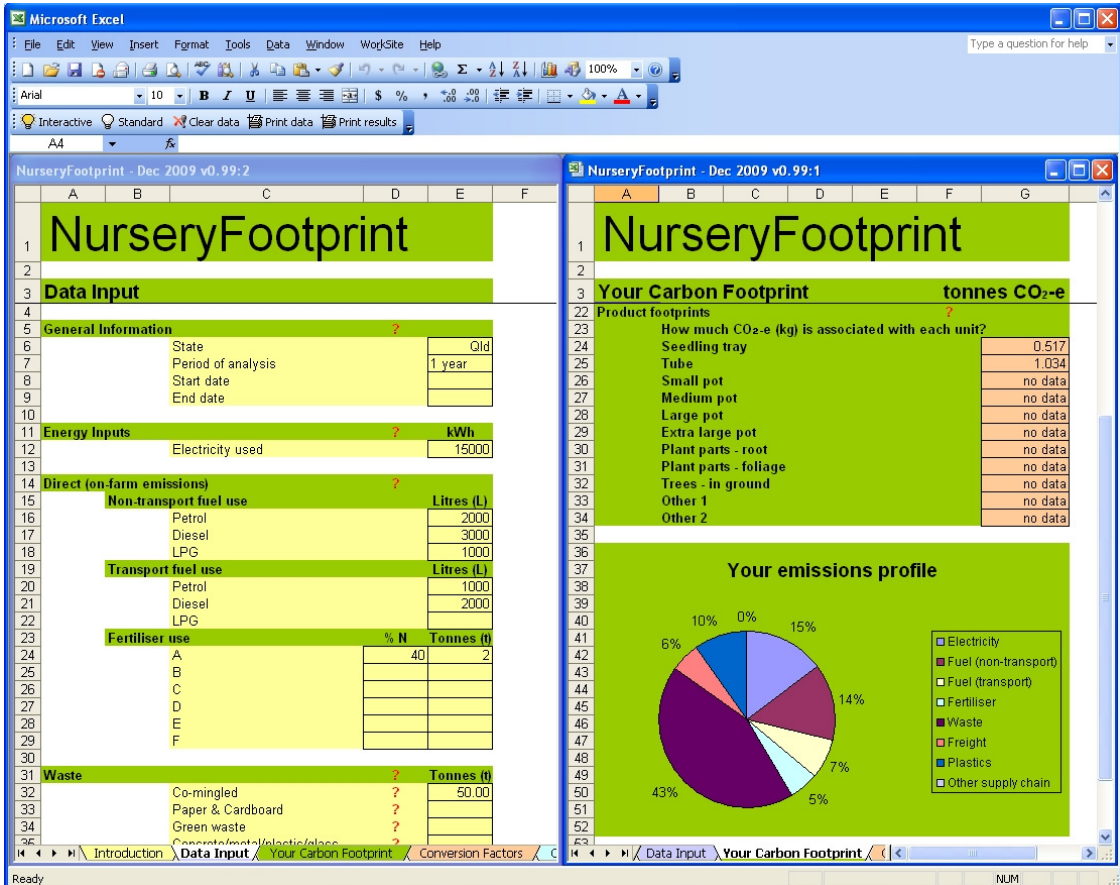


Figure 6: The calculator running in interactive mode with both the *Data Input* and *Your Carbon Footprint* sheets visible.

System requirements.

For best results, *NurseryFootprint* should be run using Microsoft Excel™ (2003 or newer) on computers using the Microsoft Windows™ operating system (XP™, Vista™ or 7).

NurseryFootprint was developed on Microsoft Excel 2003 running on Windows XP. It has been extensively tested on similar systems and all features work correctly when running the tool using all recent versions Microsoft Excel on Windows.

Other operating systems:

By using standard spreadsheet functions, the tool *should* also work with other spreadsheet applications and on other operating systems. Limited testing shows that all major functions work with Microsoft Excel 2004 on an Apple Macintosh™ (OS 10.4) and OpenOffice.org (version 3.1) on Ubuntu™ Linux (version 8.04).

Some of the functions rely on macros using the *Visual Basic for Applications* (VBA) language (eg. the custom buttons for switching modes, printing results or clearing cells). These functions may not work properly on non-Windows systems. While these functions simplify some tasks, they are not necessary for the main calculator functions. For example, printing can be performed using the normal built-in commands in your software.

Troubleshooting.

What if the calculator fails to run on your computer?

In some rare cases, the calculator may start but produce error messages or perhaps not start at all. There are several possible reasons for this.

1. You may have a corrupt version of the file. If you think this may be the reason, please obtain a newer version.
2. The file may be missing the .xls extension. This may happen if the file has been copied between different computer systems. The .xls file name extension tells the computer that it is an Excel file and should be opened by a spreadsheet program. If your version of the file doesn't have this

- extension, you can simply rename the file to include it. Alternatively, right-click on the file, select 'Open with' and then select Excel (or another spreadsheet application) from the list.
3. Your security setting might be disabling some functions. If you have security settings set to *high*, Excel may treat the macro functions within this file as a potential risk. If this is the case, simply lower your security settings to *medium* or *low*. In Excel, select 'Tools' from the menu, then 'Macro', then 'Security' and adjust the setting. If a dialog box appears asking whether you should enable or disable macros, please select the option to 'Enable macros'. The appearance of the splash screen on startup (figure 1) is a good indication that all macro functions are working correctly.
 4. You may not have suitable spreadsheet software installed. If you don't have Microsoft Excel installed, you have a couple of options. Obviously, you can purchase a copy of Excel and install it. Or, if you would rather not spend any money, you can download and install *OpenOffice* (www.openoffice.org), a free and open source office suite. As mentioned above, some of the more complex functions only work on Excel; however the main calculator functions will work perfectly well on OpenOffice and other spreadsheet applications.

If you have checked all of these possibilities and are still experiencing problems, please report the problem to the author via email. In the report, please provide a detailed description of the problem and information about your operating system and spreadsheet software (including version details. eg. Excel 2003 Service Pack 2).

Error messages:

1. **no data.** This means that some data that is required to calculate the result have not been entered. This message will be replaced with the result when the relevant data is entered.
2. **#VALUE!** This may appear in some cells in the calculator. This is an Excel error message that simply means that some data is not available to calculate the value. For example, you may not have completed entering all of your data that is required for some of the calculations. As you enter your data, these messages will be replaced with the correct values.
3. **#DIV/0!** This may also appear in some cells. This is another Excel error message that indicates that a formula is unable to calculate a result if one of the required cell values is zero. As above, these messages will be replaced by correct values as more data is entered.

Warnings and disclaimer.

The *NurseryFootprint* calculator is a basic tool to collect emissions data. It does not provide a comprehensive life cycle assessment of emissions that complies with emerging standards (eg. ISO 14040 or PAS 2050). It provides an *approximation* to a life cycle assessment by applying conversion factors obtained from published data.

The software is updated on a regular basis, so you should ensure that you are using the latest available version.

There is **no warranty** (actual or implied) and users apply the results at their own risk. Your mileage may vary. You are free to copy and distribute this software as required (but not to modify).

Acknowledgments.

The development of this calculator was funded by the Nursery and Garden Industry Australia Ltd (NGIA). Technical assistance and advice was provided by Barry Naylor, Steve Hart and John McDonald from the Nursery and Garden Industry Queensland (NGIQ). The following nurseries and suppliers kindly donated their time, input and advice:

- Garden City Plastics (Brian Durham).
- Harts Nursery Pty Ltd (Kerrie Hart)
- HighSun (Steve Walters and Cameron Nunn)
- Marlborough Nursery (Terry Spink)
- Redlands Nursery (John Bunker)
- Wallum Nurseries Pty Ltd (Luke Dent)

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