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Nursery Footprint — A Carbon Footprinting Tool for the Australian Nursery and Garden Industry[®]

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Carbon footprint is a term used to describe the total amount of greenhouse gas (GHG) emissions generated by a business or product. The term is often discussed in conjunction with climate change and variability and is also increasingly being used by consumers to identify more environmentally friendly products. During 2009, Nursery & Garden Industry Australia (NGIA) commissioned Growcom to develop a carbon footprinting tool for the Australian nursery and garden industry. Growcom developed a stand alone, easy to use calculator called *NurseryFootprint* that was officially launched at the NGIA National Conference in Darwin, 19–22 April 2010. This paper describes the calculator and its application in context with the Australian nursery industry.

INTRODUCTION

Carbon Footprinting Basics. A carbon footprint is a description of the total amount of greenhouse gases (GHG) emitted in the life cycle of a product or activity. Six key GHGs are considered in the calculation of a carbon footprint. These include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and hydrofluorocarbons (HFCs). These GHGs 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. Owing to this variation among the different gases, the amounts of each gas must be weighted according to their warming potential before being combined into a single measurement. The unit used to measure a carbon footprint is tonnes of carbon dioxide equivalent (or t CO₂-e).

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

The Importance of Carbon Footprinting. A carbon footprint is a useful tool to quantify the contribution of a business or product to climate change and to identify areas where GHG emissions can be reduced. The nursery and garden industry has

the capacity to make a significant contribution to reducing GHG emissions and may also play an integral role in the mitigation of climate change. Some of the key challenges arising from predicted climate change and variability include securing adequate water supplies for irrigation of green-life and changes in pest and disease dynamics, such as heightened risk of exotic plant pest incursions.

Currently, the Australian nursery and garden industry has very low GHG emissions in comparison to other agricultural sectors. However, there is scope to further reduce these emissions and lessen the impact of production nurseries on predicted climate change. A carbon footprint is the first step in identifying opportunities for reducing GHG emissions. A reduction in the carbon footprint of a business 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, such as improved energy efficiency, reduced on-farm traffic, and less fertiliser, will also result in reduced input costs. Consequently, a small footprint can be used as an indicator of production efficiency.

It is also important to note that in the coming years, 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 Australian Nursery and Garden Industry. Carbon dioxide released by burning fuels in vehicles, farm machinery, pumps, and various heating applications (greenhouses, propagation benches, etc.) and nitrous oxide released from the use of nitrogenous fertilizers are the key GHGs in the nursery and garden industry. Small amounts of methane may also be released from waste and waterlogged soils. Other sources of potential GHG emissions arise from a variety of inputs and processes including freight, water, packaging, and waste.

Including supply chain emissions brings more gases and processes into consideration. For example, in the case of a plastic pot, GHG emissions may 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 supply 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.

METHODS

The NurseryFootprint calculator was developed in 2009 by Growcom using Microsoft Excel as a platform. This decision was made to ensure that it would run on almost any computer using a Microsoft Windows operating system (XP, Vista, or 7). The calculator is a basic tool that collects emissions data and does not provide a comprehensive life cycle assessment of emissions that complies with emerging standards (e.g., ISO 14040 or PAS 2050). It provides an approximation to a life cycle assessment by applying conversion factors obtained from published data.

The calculator was designed to be very easy to use and understand. For example:

- It assumed that users may not have a great deal of computing experience.

- It only required data that was easily available to nursery managers.
- It dealt with the huge number of products and processes in the nursery industry.
- It produced results that were relevant and easy to understand.

A copy of *NurseryFootprint* can be downloaded by visiting <www.ngia.com.au>. An easy to follow, yet comprehensive, User Manual was developed to accompany the calculator. It can also be downloaded from <www.ngia.com.au>.

RESULTS AND DISCUSSION

When you open up *NurseryFootprint* in Excel, a new custom toolbar will appear at the top of the Excel window. This toolbar features custom buttons to simplify some calculator functions such as printing data and clearing the cell contents. Once open, *NurseryFootprint* is organised into six main worksheets with distinct functions:

- 1) Introduction: Explains the purpose of the calculator and contains basic instructions, etc.
- 2) Data input: This is the form where the user enters all of the data required to calculate a footprint (Fig. 1). The form is arranged into logical sections to ease data entry. There are fields for:
 - General information such as the location and the start and end dates of the period of interest (i.e., financial year, calendar year, month, or quarter).
 - Energy inputs such as the amount of electricity consumed (in kWh).
 - 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.
 - The amount of waste produced.
 - Supply chain components such as freight, plastic products (e.g., pots), chemicals 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.
 - 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.

[Note: You can clear or print your data at anytime using the "clear data" or "print results" buttons on the custom toolbar.]

- 3) Your carbon footprint: The results are all presented on this single sheet (Fig. 2). This sheet provides an estimate of the business's total carbon footprint, and also provides a breakdown of the emissions data into useful categories (energy, fuel, fertiliser, freight, plastics, services, etc.).
- 4) Conversion factors: This sheet contains all of the emissions conversion factors used in the calculations.
- 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.

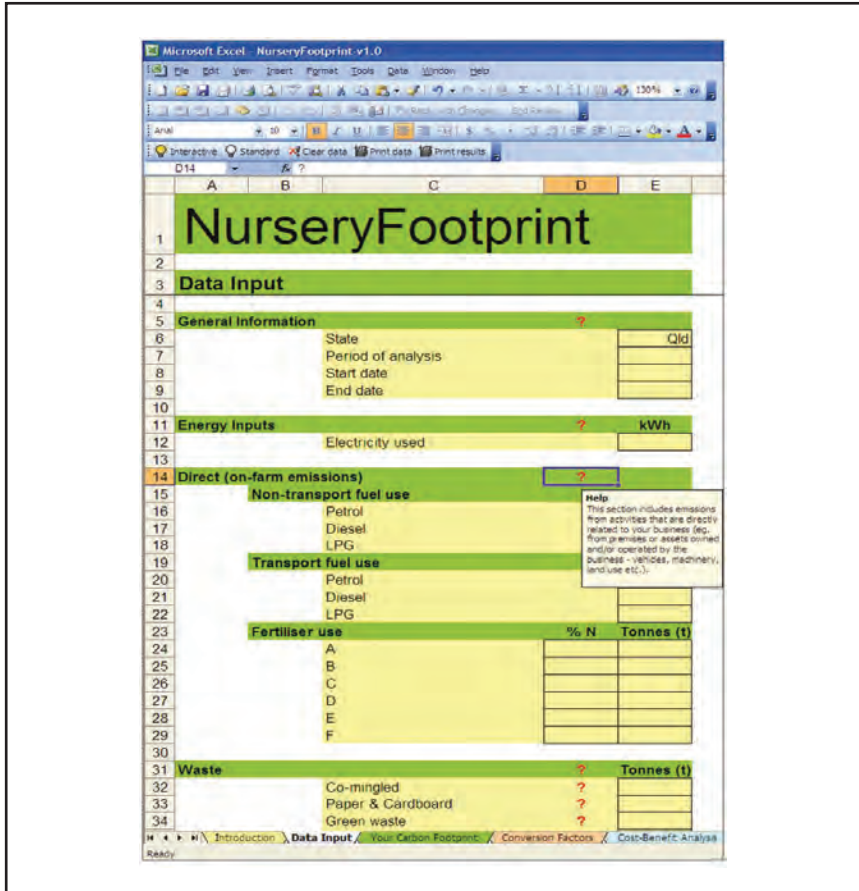


Figure 1. An example of the data Input worksheet showing a pop-up help box. The calculator will only allow you to enter or change values in the cells with the black borders.

Data Input. *NurseryFootprint* 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. Data can be entered in the Data Input worksheet (second tab from the left). For each category within the calculator, further details can be found by clicking the “?” or clicking each data entry box.

Viewing Your Results. Once all the business data is entered the user can simply click on the worksheet “Your Carbon Footprint” to view their results. This worksheet presents the total carbon footprint (in tonnes CO₂-e), and also provides a breakdown into general emission sources and product categories. This enables the business to clearly identify the emissions contributions of particular activities or products. There are tool tips to clarify what products or activities are included in each category.

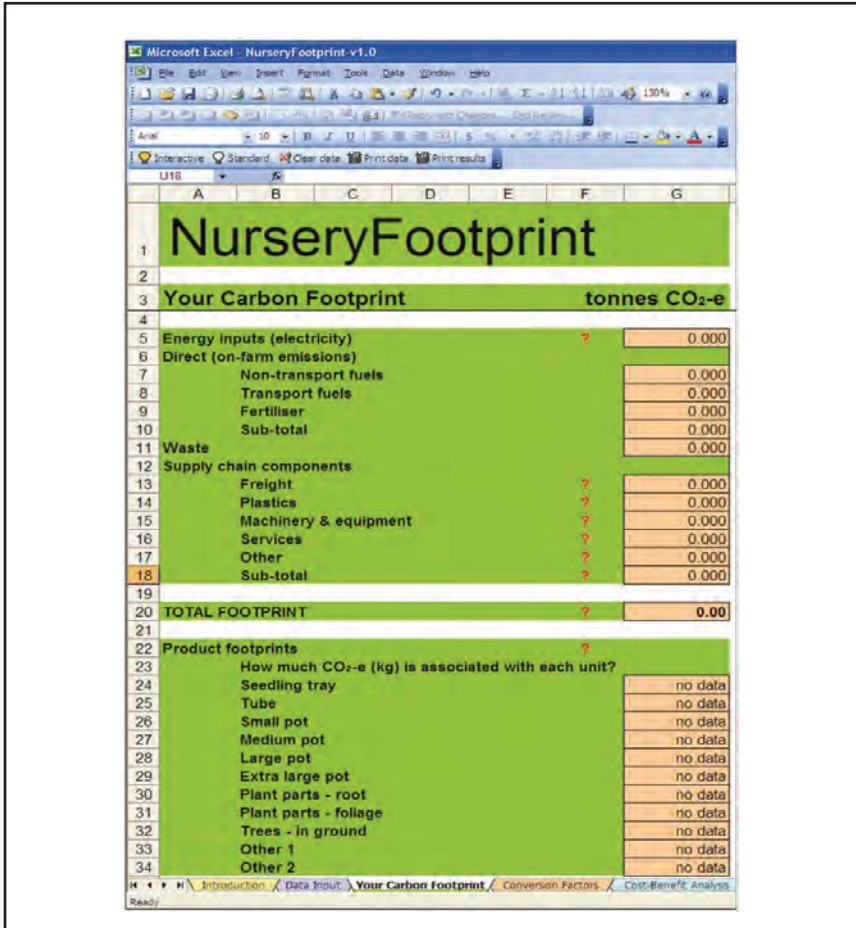


Figure 2. An example of the Your Carbon Footprint worksheet.

A graph at the bottom of this sheet provides a quick visual overview of the emissions profile by showing the proportion of the total emissions that are contributed by each category. Users can “hover” the mouse over a section of the chart to view a pop-up box that will display the name of the source of the emissions and the amount in tonnes. 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. The results can be printed on this sheet using the “Print results” button on the custom toolbar.

Business Decisions Based on Carbon Footprinting. Calculating your businesses carbon footprint is smart business. *NurseryFootprint* will identify what areas of a business are generating the most greenhouse gases and help identify where efforts should be focussed to improve efficiencies and consequently reduce

emissions. Emission targets and goals could be set to assist in this process. For example, the results may indicate that electricity consumption is a major emissions source because the business relies heavily on electrical inputs (e.g., pumps, heaters, potting machines etc.). The business may then decide to switch to an alternate energy provider specialising in green energy or implement non-renewable technologies on-farm.

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

NurseryFootprint can also target the footprints of individual products or activities. To achieve this, data that relates to a specific product or activity of interest should only be entered. This can provide a business with an estimate of the carbon footprint for the targeted product and could also be used in carbon labelling. The emission information could be placed on plant labels to provide customers with pertinent information about the product allowing them to make smarter shopping decisions.

CONCLUSION

Calculating the carbon footprint associated with a business or product can create tremendous opportunity for that business to showcase its green credentials and demonstrate its commitment to the environment. Not only will this commitment deliver a tangible benefit to the environment and the wider community, but it will also drive efficiencies within a business. Carbon footprinting will also provide a business with a marketing opportunity that can appease consumer's appetite for information on how sustainable that business or product is.

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ADDITIONAL READING

Department of Climate Change, 2008. National Greenhouse Accounts Factors.

Australian Government, Canberra.

Department of Climate Change, 2009. National Carbon Offset Standard.

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