Woodland Valuation Tool (WVT) User Guide

Version 1.0

12 January 2016

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The Woodland Valuation Tool (WVT) was developed in 2015 as part of *the Scoping study on valuing the social and environmental benefits of trees and woodlands in England, Scotland and Wales*, funded by the Forestry Commission. The authors would like to thank members of the steering group for their invaluable contributions and comments. The authors remain responsible for any errors and/or omissions.

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Introduction

The invitation to tender for the scoping study on valuing the social and environmental benefits of trees and woodlands in England, Scotland and Wales set out a number of key objectives for the work, three of which are addressed by the Woodland Valuation Tool (WVT):

(i) Identify the uses to which forest ecosystem service values may be applied in order to understand future data requirements.

(ii) Assess the technical validity of current value estimates, and identify gaps, spatial techniques and models available to support the estimation and analysis of social and environmental values from forests.

(iii) Assess whether and how values can be estimated to satisfy the purposes identified in (i) above.

The research team at CSERGE undertook a comprehensive analysis of how technical and methodological developments are transforming the potential for ecosystem service related research and decision-making. The methods, data and modelling techniques which underpin the existing evidence base on the value of woodlands and trees were critically evaluated so as to provide a practical set of actionable options for enhancing that evidence base and improving decision-making.

The results of the scoping study are organised in the tool to enable users to search for and cross-reference appropriate methods, existing literature and gaps in the literature with particular types of final environmental goods and services, beneficiaries and production functions related to trees and woodlands.

The tool is intended for use by analysts involved in forest management decisions. It has been designed to be easy to use, multiplatform, accessible using open source software, and simple to update and extend. The tool is provided in Microsoft® Excel 2007 and above as Excel is a familiar and easily accessible program for the target users. All instructions are for Microsoft® Office 2013 but should be very similar in earlier versions.

Contents of the toolkit

The toolkit was developed with input from the project's steering group. The literature included within the tool is not an exhaustive review; instead it provides a foundation able to be expanded by other users in the future. Furthermore, the scoping study has focused on areas of priority identified by the steering group. These priority areas are outlined in Table 1.

Table 1 FEGS and production functions included in the scoping study and tool

		Production functions																	
		Timber products	Food (agriculture and subsistence)	Industrial production	Pharmaceuticals	Hydropower	Drinking water	Transportation	Flood alleviation	Urban heat islands	Carbon sequestration	Housing	Physical health	Mental health	Recreation	Artistic	Learning	Spiritual and cultural	Non-use value
Final environmental goods and services	Water quality		X	X		X	X	X				X	X		X	X	X	X	X
	Water quantity		X	X		X	X	X	X			X			X	X	X	X	X
	Air quality			X															
	Climate		X	X					X	X	X	X	X		X				
	Flora, fauna and fungi	X	X		X							X	X	X	X		X	X	X
	Environmental amenity											X	X	X	X	X	X	X	X
	Sound and scent											X	X	X	X	X	X	X	X
	Views			X								X		X	X	X	X	X	X
	Soil		X	X								X			X		X	X	X
	Timber and fibre	X	X	X	X							X			X	X	X	X	

Final environmental goods and services

The first column is headed FEGS (final environmental goods and services). The categories in the tool are used to organise the environmentally produced goods and services that enter household or firm production functions without further biophysical translation; they are based on the categories used in Landers and Nahlik (2013). FEGS are those particular subsets of environmental goods and services that have direct and immediate consequences for productive activities in the (human) economy.

All of the economic and social benefits of trees and woodlands have been categorised by the FEGS that they provide. Nine individual categories have been identified and are detailed in column 2 of Table 1 and described in Table 2.

Table 2 Descriptions of FEGS categories

FEGS categories	Description
Water quality	The condition of water in terms of its chemical, physical, biological, radiological and/or aesthetic characteristics.
Water quantity	The volume and flow of water.
Air quality	The condition of the air including chemical composition, e.g. NO_X, SO_2, and scent.
Climate	Temperature, rainfall and greenhouse gas concentrations
Flora, fauna and fungi	Plant and animal life.
Environmental amenity	Characteristics of the surroundings and/or conditions in which a beneficiary lives, works or recreates.
Sound and scent	Sources of sounds and scents as well as the magnitude of the emission.
Views	Visible characteristics in which a beneficiary lives, works or recreates.
Soil	Measures of the condition of the soil including soil type (e.g. clay, loam, sand), acidity (pH), moisture.
Timber and fibre	Measures of the direct timber and fibre produced by trees and woodlands.

Production functions

Table 1 also provides information on the particular household or firm production function that the FEGS enter and through which they provide value to beneficiaries. For example, improved water quality enters the drinking water production function and can provide value to water companies by reducing the costs of water treatment. At the same time, improved water quality can also enter the industrial production function through providing an industrial producer with water suitable for utilisation in some form of industrial production or opportunities to dispose of or dilute waste. The same type of final environmental goods and services can therefore enter multiple household or firm production functions. The production function categories used in the tool are detailed in the first rows of Table 1 and are described in Table 3.

Table 3 Description of production functions

Production function	Description
Timber products	The physical timber and fibrous material. This includes timber for extraction (e.g. wood for construction, fuel) and timber used for subsistence (e.g. wood for construction, fuel).
Food (agriculture and subsistence)	The edible substances as well as indirect benefits (e.g. pollination). This includes the extraction of edible substances from trees or woodlands both commercially and for subsistence (e.g. mushrooms, fruits and nuts) and indirect benefits, such as habitat for healthy populations of pollinators or trees providing shelter for crops.
Industrial production	The benefits trees provide to commercial and industrial businesses. This includes the impact on water and the atmosphere, for example providing industry with the opportunity to discharge waste.
Pharmaceuticals	The medicinal products and inputs. This includes the extracted wood, bark, roots, leaves, flowers, fruits or seeds used in medicines.
Hydropower	The benefits trees provide through the impact on the water environment for hydroelectric power producers.
Drinking water	The benefits trees provide through the impact on the water environment for water suppliers.
Transportation	The benefits trees provide through the water environment for the transporters of goods or people.
Flood alleviation	The benefits trees provide through the water environment for the alleviation of floods.
Urban heat island	The benefits trees provide in terms of shade, temperature regulation and energy savings
Carbon sequestration	Carbon storage and sequestration, and greenhouse gas emissions
Housing	The benefits trees provide to residential households. This includes the benefits through the impact on water and the atmosphere (including health benefits), opportunities for recreation and amenity value.
Physical health	The benefits trees provide to the physical health of the population through improvements in air quality, water quality, opportunities for exercise and so on.

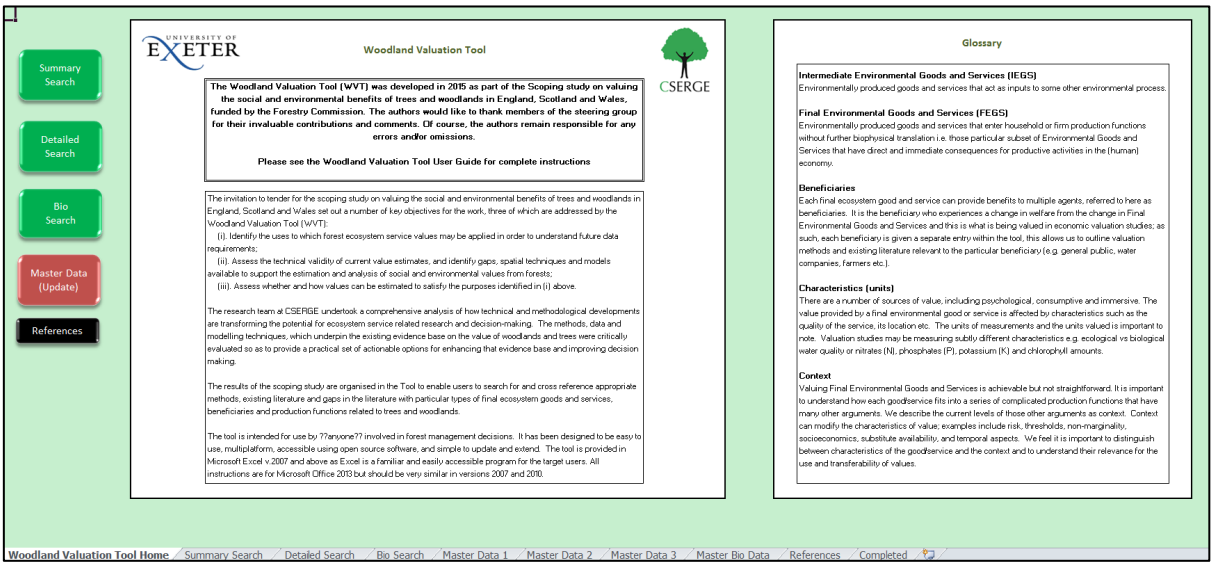
Mental health	The benefits trees provide to the mental health of the population.
Recreation	Opportunities for recreation activities. This includes nature viewing (e.g. bird watching), hiking, and the opportunities to experience views, sounds and scents.
Artistic	Opportunities for amateur and professional artists. This includes the use of the environment to produce art such as the opportunities to experience views, sounds and scents.
Learning	Opportunities for educators, students and researchers to learn from and experience the environment.
Spiritual and cultural	The benefits trees provide for spiritual, ceremonial or celebratory purposes.
Non-use value	The benefits trees provide for people who care about existence value of the environment (those who think it is important to preserve the environment for moral/ethical connection or fear of unintended consequences) or bequest values (those who think it is important to preserve the environment for future generations).

Structure of the Woodland Valuation Tool (WVT)

The Home tab

The Home tab (Figure 1) provides a brief introduction to the Woodland Valuation Tool including details of the scoping study objectives, the user guide and a summary of the current software version and compatibility. A glossary of key terms is also provided on the Home tab to provide an accessible point of reference for users of the tool without requiring them to have access to the user guide.

Figure 1 Home tab



The Home tab also contains a series of buttons down the left-hand side that can be used to navigate to different search pages, the master dataset and the full set of references.

Summary Search – allows users to search for and view a summary of the literature organised by FEGS, production function and beneficiaries.

Detailed Search – allows users to search for and view characteristics for each individual piece of literature reviewed under the scoping study (2015) organised by FEGS, production function, and beneficiaries.

Bio Search – allows users to search and view the biophysical/natural science literature collected as part of the scoping study (2015) organised by FEGS.

Column headings and their meanings

Final environmental goods and services

The first column in the Summary Search and Detailed Search tabs is headed final environmental goods and services. The categories in the tool are used to organise the environmentally produced goods and services that enter household or firm production

functions without further biophysical translation; they are based on the categories used in Landers and Nahlik (2013).

All of the economic and social benefits of trees and woodlands have been categorised by the final environmental goods and services that they provide. Nine individual categories have been identified and are detailed in Table 1.

Production functions

The right-hand side of Table 1 provides information on the particular household or firm production function that the final environmental good or service enters and through which they provide value to beneficiaries. For example, improved water quality enters the drinking water production function and can provide value to water companies by reducing the costs of water treatment. At the same time, improved water quality can also enter the industrial production function through providing an industrial producer with water suitable for utilisation in some form of industrial production or opportunities to dispose of and dilute waste. The same type of final environmental goods and services can therefore enter multiple production functions.

Beneficiaries

Each final environmental good and service can provide benefits to multiple agents, referred to here as beneficiaries. It is the beneficiary who experiences a change in welfare from the change in final environmental goods and services and this is what is being valued in economic valuation studies; thus, each beneficiary is given a separate entry within the tool, this allows us to outline valuation methods and existing literature relevant to the particular beneficiary (e.g. general public, water companies, farmers).

Characteristics (units)

There are a number of sources of value, including psychological, consumptive and immersive. The value provided by a final environmental good or service is affected by characteristics such as the quality of the service or its location. The units of measurements and the units valued is important to note. Valuation studies may be measuring subtly different characteristics (e.g. ecological vs. biological water quality or nitrates, phosphates and potassium (N, P, K) and chlorophyll amounts).

Context

Valuing final environmental goods and services is achievable but not straightforward. It is important to understand how each FEGS fits into a series of complicated production functions that have many other arguments. We describe the current levels of those other arguments as context. Context can modify the characteristics of value; examples include risk, thresholds, non-marginality, socio-economics, substitute availability and temporal aspects. We feel it is important to distinguish between characteristics of the good/service and the context and to understand their relevance for the use and transferability of values

Valuation methods

Many different valuation methods exist. The valuation method that is most suitable for a given purpose depends on what the purpose of the valuation is, the values to be estimated and the information available. Broadly, valuation methods can be grouped into market valuation, cost based, revealed preference, stated preference and secondary or transfer methods.

Literature and urban tree literature

The final columns (H and I) in the tool provide a summary of relevant literature identified during the scoping study. This is divided into general literature and urban tree specific literature. The Detailed Search was performed by first taking resources provided by the projects steering group and existing studies such as Willis *et al.* (2003), Eftec (2011), UK NEA (2011) and UK NEAFO (Albon *et al*., 2014) and searching on relevant authors and cited studies. In addition, a Web of Science search on newer studies using the keywords 'forest' (OR woodland/trees) AND 'ecosystem' AND 'value' (OR valuation) was performed with relevant papers added to the reference list. Details of the author, date and publication are provided.

Review of the literature

Individual studies have been reviewed and recorded in the Detailed Search tab. In reviewing each piece of literature we report the details for a number of study attributes; these attributes are described in Table 4.

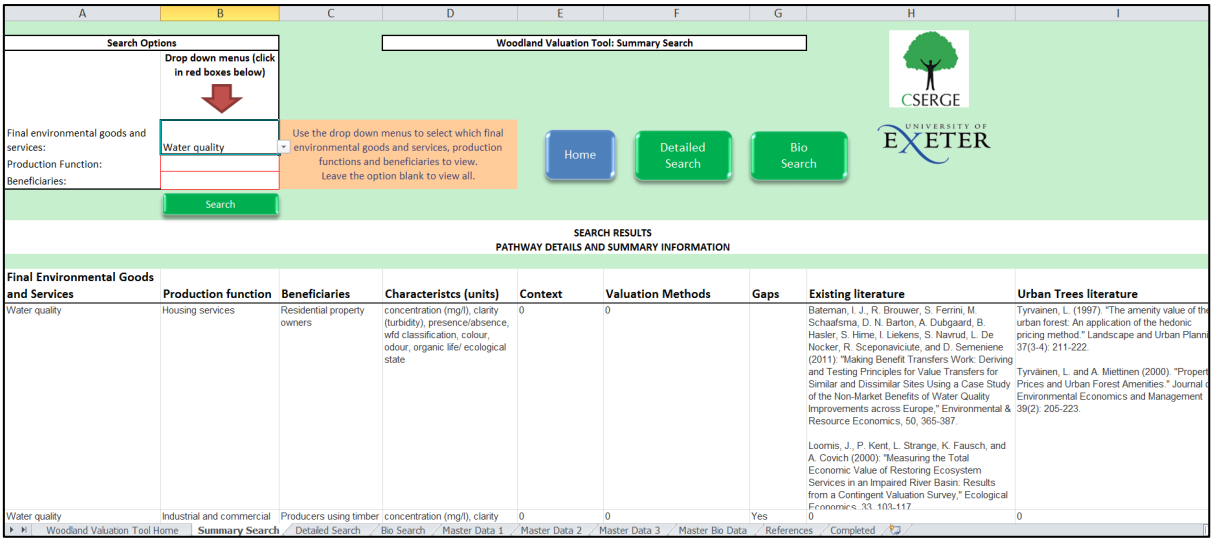
Table 4 Description of study attributes

Attribute	Description
Year of publication	The year that the study was published in
Notes	Additional notes, including whether the study contains value estimates or theory
Good/service	The final environmental good or service examined in the study
Country	Name of the country that the study relates to
Region	Name of the region that the study relates to, in some cases this will be national
Method	Method of value estimation used
Scale	Scale at which the analysis was applied
Beneficiaries	Beneficiaries examined by the study
Sample	Sample size and unit
Value currency	Currency in which values were reported
Values	Value estimates
Value unit	Unit in which values were measured
Value period	Period over which the value is measured
Value year	Base year for the currency as reported
Payment vehicle	The method of payment specific in studies of willingness to pay and cost-based methods
Characteristics	Features of the final environmental good/service that are specific to the study or which have been controlled for
Context	Features of the other inputs to the production function that are specific to the study or which have been controlled for

Searching and viewing results

The Woodland Valuation Tool (WVT) contains two summary sheets for users which appear under the Summary Search and Detailed Search tabs at the bottom of the document as shown in Figure 2).

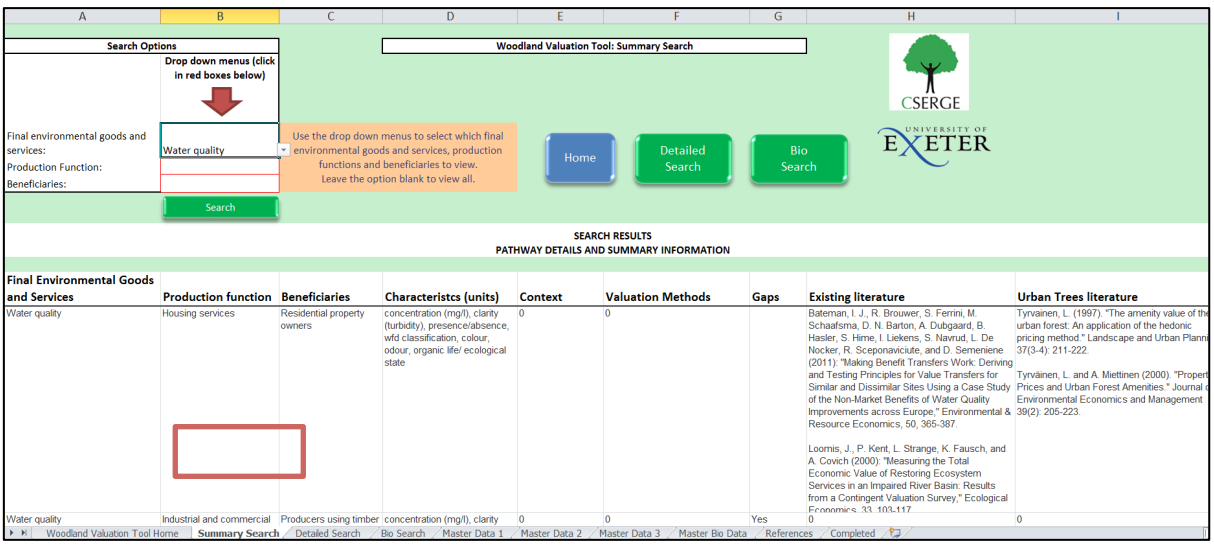
Figure 2 The Summary Search and Detailed Search tabs



Summary Search

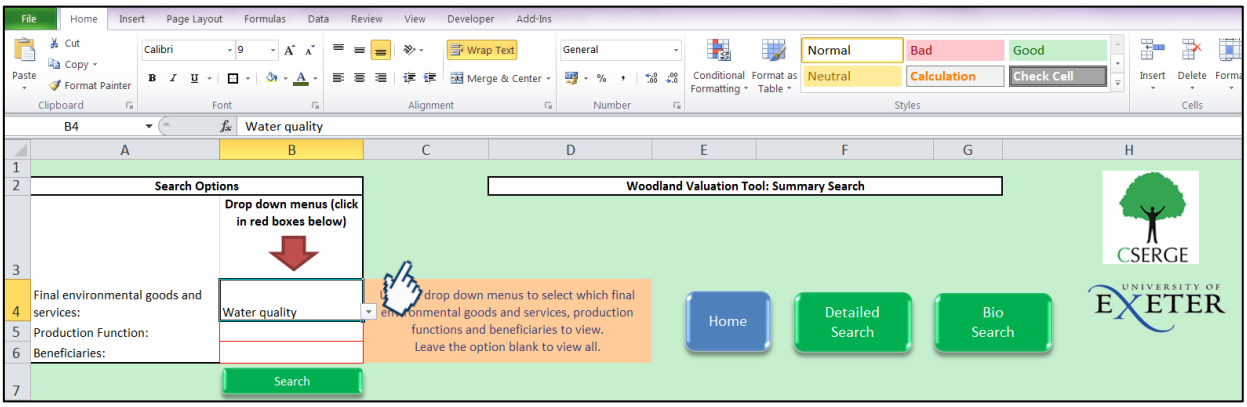
The Summary Search tab allows users to view a summary of the literature organised by final environmental goods and services, production function and beneficiaries. The layout of this tab is shown in Figure 3. The tab also contains buttons that can be used to navigate back to the Home tab or to the Detailed Search or Bio Search tabs.

Figure 3 The layout of results in the Summary Search tab



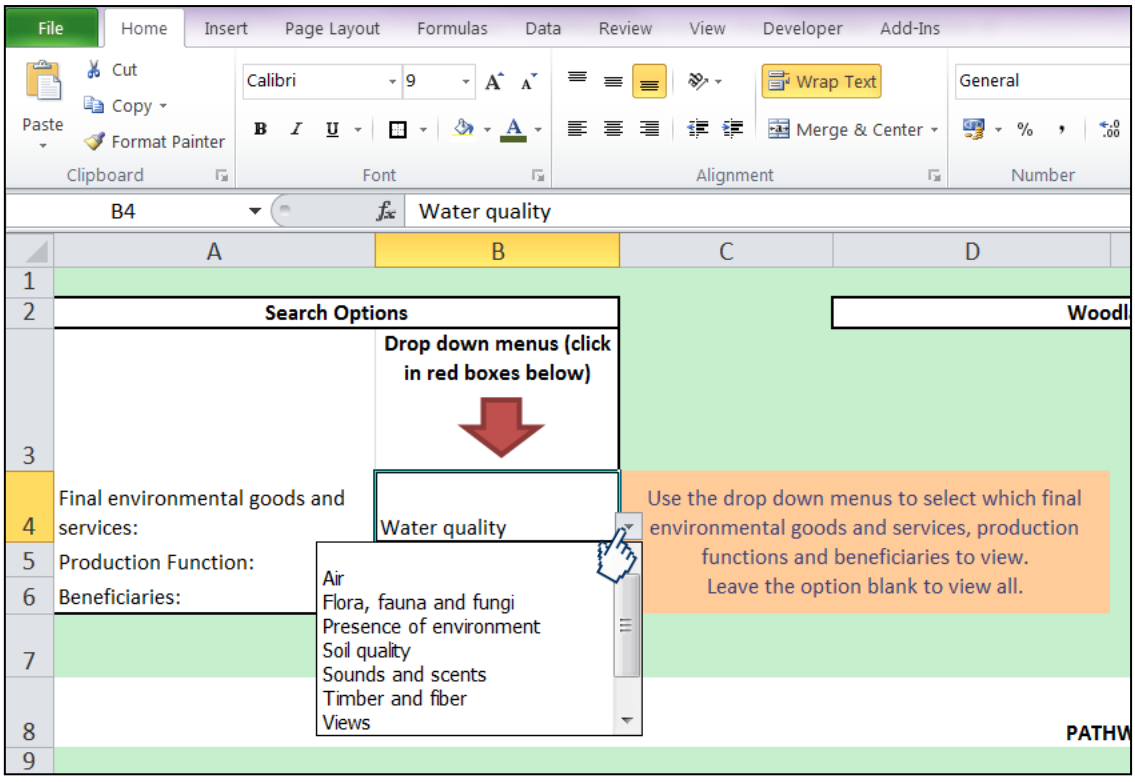
Options in the Search Options box can be used to view a selection of results. Click on the drop-down boxes in cells B4, B5 and B6 (Figure 4). If you cannot see an arrow to the right of the cell please click on the cell, in column B, to make it appear.

Figure 4 Drop-down box location



The categories that you can search by are predefined and will appear in the drop-down menu (Figure 5). Leaving the box blank allows you to view all entries.

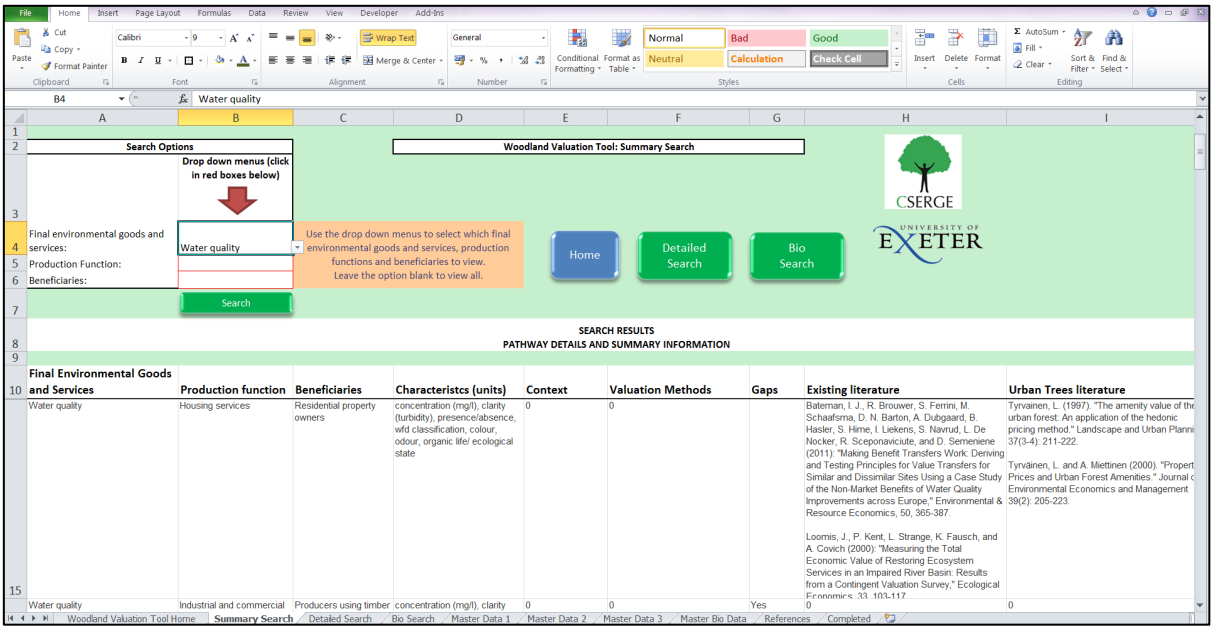
Figure 5 Drop-down menu



Once you have selected the categories that you would like to view the results will automatically update and appear below row 10, which contains the column headings (Figure 6). Use the scroll bar to navigate between entries. Make sure you click the Search button (or

scroll to the top again) when you perform a new search to avoid not being able to see entries that are in the rows above; the first entry will always appear in row 11.

Figure 6 Viewing the Summary Search results



To clear a search select the blank option at the top of each drop-down menu. This will allow you to view all entries in the database.

Detailed Search

The Detailed Search tab, which like the Summary Search can be accessed via the tabs at the bottom of the screen (Figure 2) or via buttons on other pages, allows users to view characteristics for each individual piece of literature that was reviewed under the scoping study (2015). As with the Summary Search the results can be searched to view literature relating to particular final environmental goods and services, production functions and beneficiaries. The tab also contains buttons that can be used to navigate back to the Home tab or to the Summary Search or Bio Search tabs.

Again, as with the Summary Search, options in the Search Options box can be used to view a selection of results. Click on the drop-down boxes in cells B4, B5 and B6. The categories that you can search by are predefined and will appear in the drop-down menu. Leaving the box blank allows you to view all entries. Once you have selected the categories that you would like to view the results will automatically update and appear below row 10, which contains the column headings. Use the scroll bar to navigate between entries. Make sure you click the Search button (or scroll to the top again) when you perform a new search to avoid not being able to see entries that are in the rows above, the first entry will always appear in row 11.

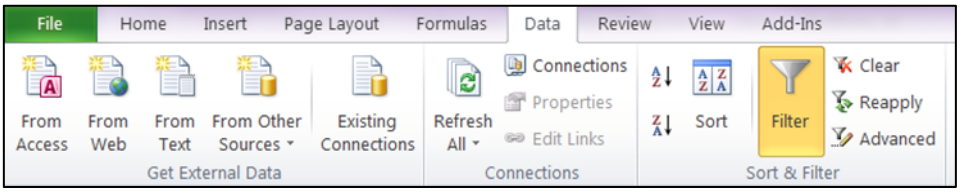
Master Data

To avoid problems with erroneous deletion of entries a master copy of the data is stored separately in additional sheets (labelled Master Data 1, 2 and 3). If an entry is unintentionally deleted or edited, the original content can be retrieved from these backup sheets. A master copy of the data will also be kept on file and is available from the Forestry Commission/steering group/corresponding author upon request. Please contact the Forestry Commission for further information.

Using the filter options

If more detailed searching or sorting is required the data can be examined using filtering. The filter function is activated by navigating to the Data tab at the top of the window and selecting the Filter button, as shown in Figure 7.

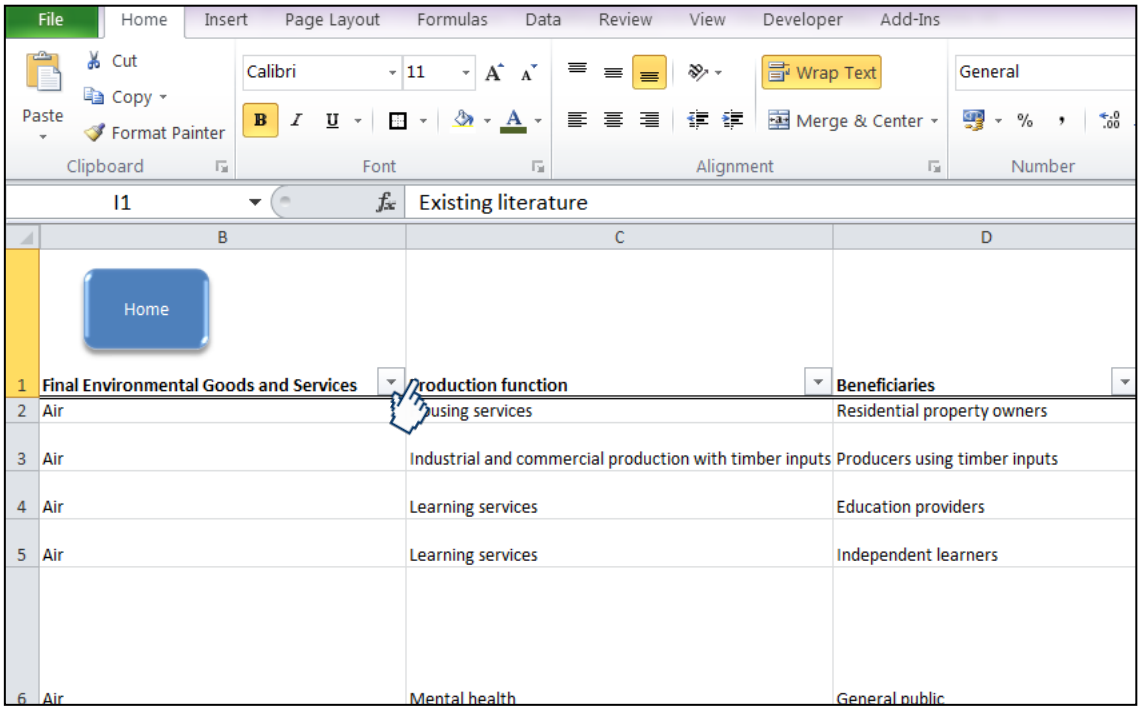
Figure 7 Selecting the Filter option under the Data tab



Category filters

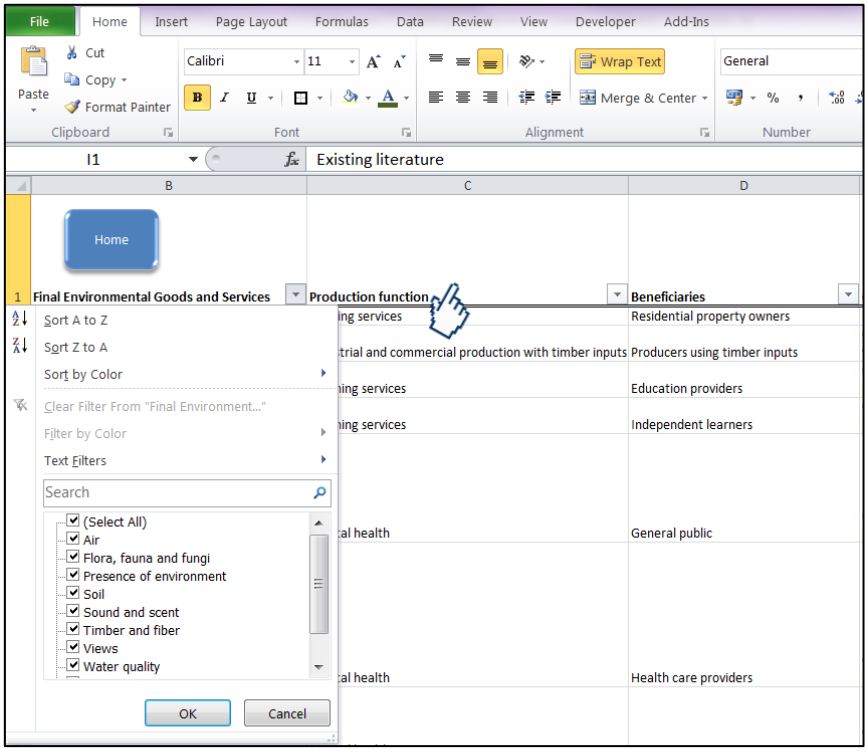
Results can be filtered by selecting the tab to the right of each column heading (Figure 8); for example, results can be filtered by final environmental goods and services by selecting the tab in cell B1.

Figure 8 Using the drop-down filter tab



Clicking on the tab opens a drop-down menu containing filter options (Figure 9). The results can be filtered by categories appearing in column A, these are listed at the bottom of the drop-down menu. Options for filtering can be chosen by selecting and de-selecting the checkboxes to the left of each category label.

Figure 9 Filter options by category are displayed in the drop-down menu that appears



Multiple filters can be applied at once within a column and across columns. For example, column A (FEGS) can be filtered to display goods and services related to *Views* and column C (Beneficiaries) can be filtered to *Residential property owners*, to provide cross-referenced results.

View all results

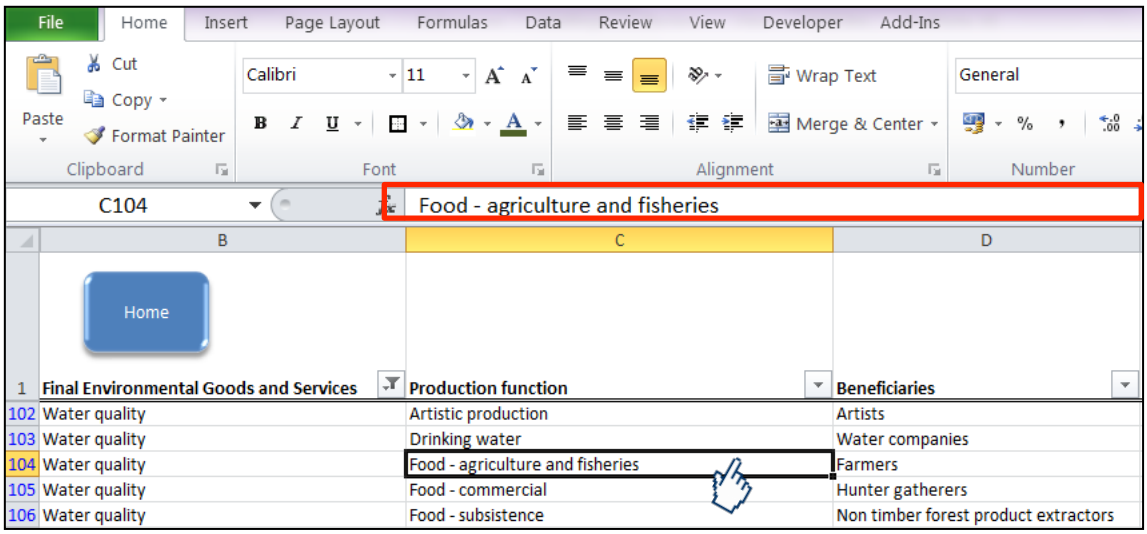
To return to viewing all of the results in the tool you need to turn off the filter option by navigating to the Data tab and de-selecting the Filter button (**Figure 7**).

Editing the tool

Updating entries

Entries can be edited in the sheet labelled Master Data 1 by selecting the cell to be edited using the cursor and entering the new text in the formula bar, highlighted in red in Figure 10.

Figure 10 Editing entries in the formula bar



If you are editing final environmental goods and services, production function or beneficiaries you should make sure to enter the new contents using the same category labels that have been used previously (these are listed on the Master Data 3 tab). This will ensure that filtering continues to work within the tool.

Adding new entries

New entries can be added to the tool by entering the data manually into the Master Data 1 tab by selecting the first empty cell at the bottom of column A. Care should be taken to use the same category labelling in columns A, B, C and F to ensure the filter options continue to work.

Adding new literature

New literature can be added to the tool by entering the information into the Reference sheet and manually copying the references to the appropriate cell in the Tool sheet.

Note: to place text on a new line within a cell press Alt+Enter.