

Handbook part one:

Step-by-step guidance



About this manual

This is the first part of a handbook to provide step-by-step support to practitioners in the use of the Nature Smart Cities Business Model. The Business Model is a tool intended to help with the preparation of a convincing business case for a green infrastructure solution, and is based on extensive research both within academic literature and also with officers and practitioners in smaller municipal authorities in the UK, France, Belgium and the Netherlands.

It is accompanied by the second part of the handbook, a Technical Manual, that explains the technical basis of the model and its academic provenance. Both the Business Model and the Technical Manual can be downloaded, free of charge, from the Nature Smart Cities website library at www.naturesmartcities.eu/library.

About the authors

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About the project

Nature Smart Cities is a project funded by the European Union through its Interreg 2 Seas programme. The project brings together city partners from Belgium, the Netherlands, France and the UK, and academic partners from the Universities of Ghent and Antwerp, and Imperial College London, to work together on maximising the potential for smaller cities to engage more fully with nature-based solutions to environmental problems, using green infrastructure. The project is funding several pilot projects exploring green infrastructure solutions in smaller cities, and is also developing a business model aimed at helping officers in smaller cities to make a stronger business case for green solutions, both in terms of ecosystem service delivery and also financial comparison with more traditional approaches. The project is described in more detail at www.naturesmartcities.eu

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Project partners



Den Haag



Table of contents

About this manual	2
Before you start	5
Worksheet S0 – Project description	8
Worksheet S1 – Selection	16
Worksheet S2 – Parameters selection	21
Tab A – Water Retention	24
Tab B – Biodiversity: The Shannon Weaver Index	27
Tab C – Biodiversity: Landscape suitability	29
Tab D – Cultural ecosystem services	34
Worksheet S3 – Quantification	37
Worksheet S4 – Qualification	39
Worksheet S5c – Monetization (Costs)	41
Worksheet S5b – Monetization (Benefits)	48
The Factsheet	50

Before you start

Description

This part of the Nature Smart Cities Guidance offers you step by step guidance on completing and using the Business Model. A second part of the Guidance provides the background to the model, and, the Technical Manual, information on data sources and calculation methods.

The Business Model is a Microsoft Excel file and consists of several worksheets. Many of these need user input to describe your project and what you hope it will achieve. This guidance will help you to do this.

Preparing

Before you start, you'll find it helpful to do some preparation. The info you need depends to some extent on your project's individual characteristics, but most users will need some of this information:

- The surface area of your project
- The different landscape types that make up your project (e.g. grass, water, roads/paths, shrubbery, allotments etc.) and the surface area each of these occupies
- An approximate number of trees within your project area
- The costs associated with your project, in a reasonable amount of detail
- The number of people...
 - Within your project area
 - Living within 100m of the edge of your project area
 - Living within 500m of the edge of your project area
 - Living within 1km of the edge of your project area

You may also need some other information, such as the price of electricity, electricity consumption, and average rainfall figures for your country or region. You might need this data, or you might not, depending on what your project is about.

But first...

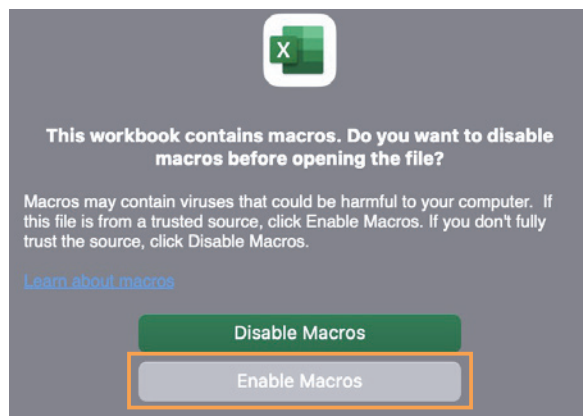
Please save the Business Model on to your PC or laptop. It will work on either Windows or Apple computers. You **MUST** work with a saved version and you may want to save a copy of the Business Model before you start, just in case...

The Business Model contains **macros**, and we've found that some municipalities' IT departments don't allow you to download or use files with macros, for security reasons. If you find you can't open the file, this may be the reason – in which case, please contact your IT helpdesk.

When you open the Business Model in Excel, you may be asked to 'enable macros'. **You MUST enable macros for the Business Model to work properly. If you are asked to 'enable content' you must also do this.**

You may also be asked if you want to make the Business Model a 'Trusted Document'. Of course you do.

The Business Model includes some notes and instructions that you may also find helpful.

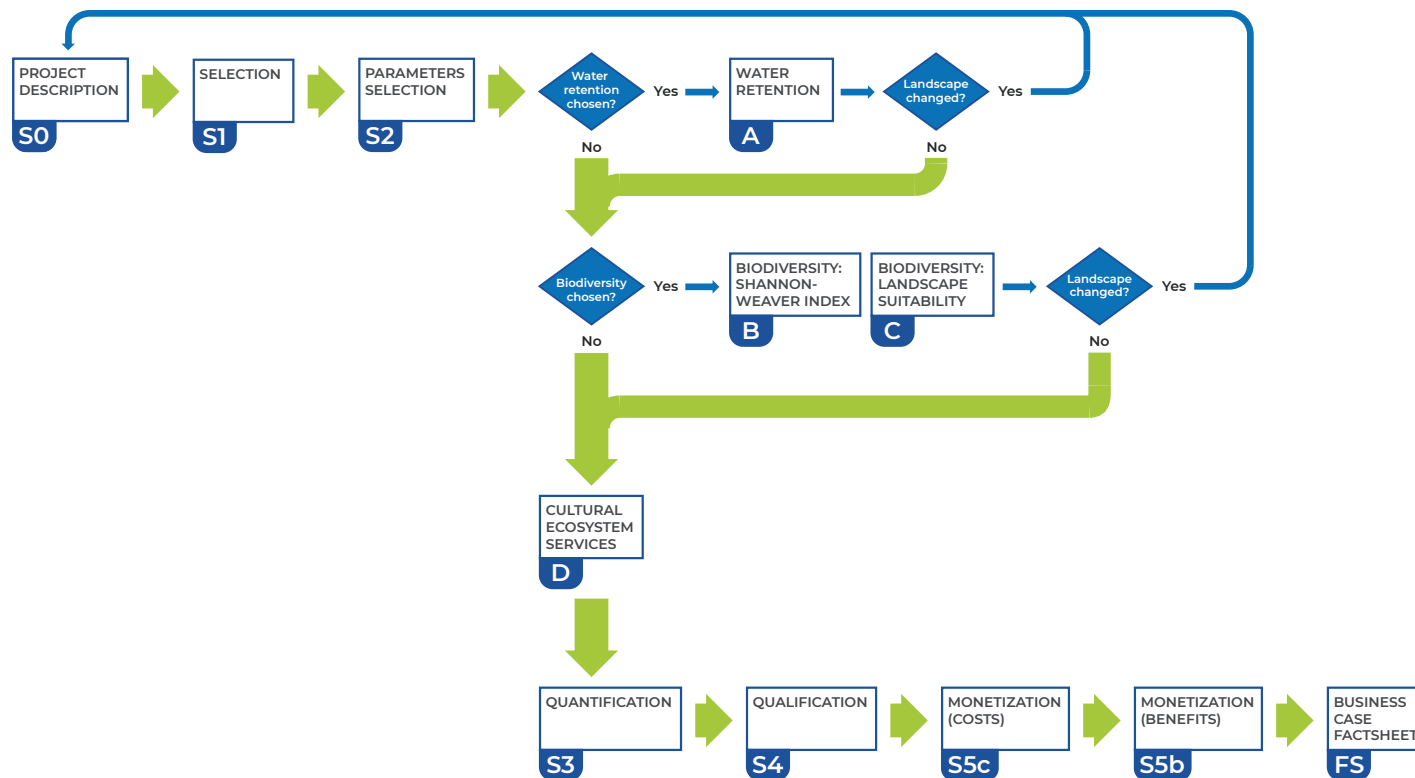


The Nature Smart Cities Business Model flow diagram

This flow diagram sets out the different worksheets of the Business Model. The Business Model is an automated tool and you'll progress through the different worksheets in the order they occur.

Early on, you're asked to select the key priority ecosystem services for your green infrastructure project. Following this selection, different worksheets become available depending on the choices you've made.

The blue diamond boxes represent where your choice of ecosystem services relating to water retention or biodiversity will provide additional worksheets. The process of populating these worksheets may lead you to enhance your GI project design to deliver greater value, in which case you'll need to return to the original worksheet 'S0' to ensure the landscape changes you want to make are reflected in your original project description.



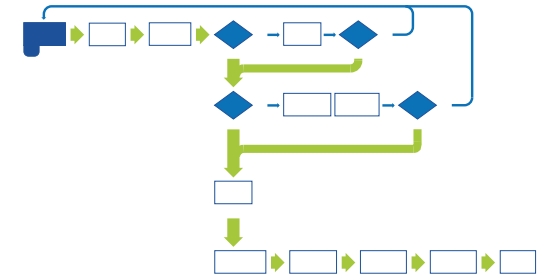
Worksheet S0 – Project description

In this worksheet, users define their green infrastructure project using a baseline scenario, and new or alternative scenario(s) that represent your project and possible options. **Carefully completing this tab is crucial for the application of the business model to your project.**

Background information

You start at cell D9 in the 'Background information' section. Complete these cells as follows (the ones in **bold text** are required, the others are optional). Some of this information appears on the final factsheet, so be careful with language and spelling!

- D9** The country where your project is located
- D10** **The name of your municipality**
- D11** Click on this cell and choose the answer that best describes your project's location
- D12** **The surface area covered by your project. This is really important – your project has a boundary, and this is the land area within that boundary, including land occupied by buildings, water or any other feature.**
- D13** The number of people benefitting from the project (which might be zero)
- F8** **In this box, you can give your project a name or a brief description. You have a maximum of 450 characters for this.** What you put here appears on the final Factsheet.



Background information		Max amount of characters:
Characteristics of the target area	Description of the target area	450
Country Municipality My project area can be qualified as Surface of the project area Number of people benefitting from the project		

- 19** Here you can upload a picture (in .JPG format), such as a project map or plan, that will help your decision-maker to visualise what you're doing. There's a maximum size of 200 pixels x 100 pixels for this. This will also appear on the Factsheet.

Defining your infrastructure

Now you're ready to describe the landscape of your project area. You start with what we call the 'Baseline Scenario', which will be associated with the colour black throughout the model. This might be the landscape as it is now, before you do anything to it, or it might be one of a series of options you want to compare with one another. Either way, we call it the baseline.

The possible components of the landscape are described in the model, firstly in broad groups (in column E), then more specifically within the broad group (column F) and then as a land area or quantity (column H).

If you need help finding a particular type of landscape element, there's a list on page 12 of this document.

You'll start with cell E19.

- E19** Here you have a drop-down menu where you choose from a list of different groups of landscape. Choose one that is present in your baseline landscape.

Defining your (public) green/blue/grey infrastructure					
Scenario title	Tot. scenario area	Category	Type	Amount	Unit
Baseline Scenario	4000 m ²	Low Green	Amenity grassland	2000	m2
		(Semi-)permeable surface	Rustic playground	2000	m2
		Fruit and vegetables	Fruit tree (cherry)	100	amount

- F19** The choice you just made produces a further dropdown list of more detailed components. Choose one of these that is present in your landscape.

Defining your (public) green/blue/grey infrastructure					
Scenario title	Tot. scenario area	Category	Type	Amount	Unit
Baseline Scenario	4000 m ²	Low Green	Amenity grassland	2000	m2
		(Semi-)permeable surface	Rustic playground	2000	m2
		Fruit and vegetables	Fruit tree (cherry)	100	amount

C19 And here you enter how much of this element is present within your landscape, using the metric specified in cell H19.

Defining your (public) green/blue/grey infrastructure					
Scenario title	Tot. scenario area	Category	Type	Amount	Unit
Baseline Scenario	4000 m ²	Low Green	Amenity grassland	2000	m2
		(Semi-)permeable surface	Rustic playground	2000	m2
		Fruit and vegetables	Fruit tree (cherry)	100	amount

Repeat this process for rows 20 onwards, describing your baseline landscape in terms of its components. For example, you might have an area of shrubs to add, a paved area such as an access road or footpaths, a pond, a flower meadow, or you might have a building – all of these can be entered.

If you have two areas that are the same landscape type – two paths for instance – you should put these together, they shouldn't be added separately.

In the example we've used as an illustration, we have an area of 4000 m² that is a disused cherry orchard. It's 4000 m², some of which is just waste grassland and some of which is used as a play space. There are 100 fruit trees still standing. So we choose 'Low green' as our first type, to let us describe the grassy area.

As you enter your landscape elements, the total shown in D19 updates so that you can check if you've described the whole area. **When you've finished your data entry, check that this total equals what you put in cell D12. If they're different, something's wrong.**

Tips:

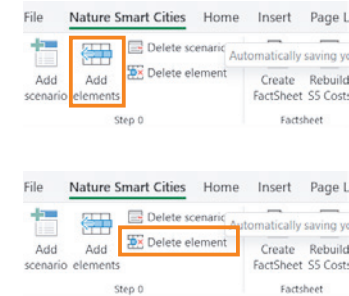
- If you choose trees, note that the metric required is the number of trees, not the area they cover. The model also wants to know the size of the trees (most of which are probably in the middle range).
- If you have a pond, please note that concrete ponds are grey infrastructure, while other ponds are under sustainable drainage.
- If you have a water element, a pop-up will appear asking for the average depth. This isn't the same as the maximum depth. If you're unsure of the depth, insert half of what you think the maximum depth is.
- Standard hedges are listed under green walls (they're vertical, after all) but fruit-bearing hedges (such as elderberries or sloes/blackthorn) are in the fruit and vegetables group.

If you want to see the full list of element groups, and the landscape types within each, it's at the end of this chapter. You may find this helpful in discovering where some harder-to-find landscape components are hidden.

Adding and removing rows

If you need more rows, you can add them as follows:

- Go to a completed cell within your scenario and click once.
- Now go to the 'Nature Smart Cities' menu on the Excel ribbon at the top of your screen, and click on the 'Add Elements' icon.
- If you have empty rows (or have added too many) you can remove the unwanted ones by clicking on the row in question, going to the Nature Smart Cities' menu and choosing 'delete element'.



When you're done, go to cell I19.

I19 Insert a short title for this scenario. Or just leave it as 'Baseline'

Tips:

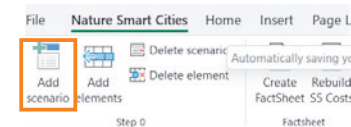
- You might have noticed you can add 'other' landscape elements if what you have isn't on offer. Be warned, though, that this will mean you have a lot more questions to answer and more data to find. Please try and cover your landscape using the terms we provide. You'll be a lot happier.
- When you're happy that you've described your baseline fully, a quick check is useful.** The total of your landscape components' surface area (excluding the trees) should equal the amount you entered in cell D12. If it doesn't, you may have overlooked a component or miscounted something. This will affect your results.
- If your scenario includes a water element, you'll be asked to estimate its average depth. You might not know this, but one possible way to estimate it is to take its maximum depth and halve it.

Adding more scenarios

You've added your baseline scenario, so now you need to add the scenario that will exist when your project (or perhaps your first option) has been implemented.

To add a new scenario, just go to the 'Nature Smart Cities' menu on the Excel ribbon at the top of your screen, and click on the 'Add scenario' icon.

You'll be asked to give this scenario a name (choose one that makes it obvious which scenario this is), and assign a colour to it. You can use the sliders (either alone, or in combination) to choose a colour. Then click on 'Create Scenario'.



Add New Scenario ×

Title:

Select a background color:

Use the scrollbars to change the color. This color will be used as background and for the different series of the charts.

RED:	<input type="text" value=""/>	158	TITLE
GREEN:	<input type="text" value=""/>	156	
BLUE:	<input type="text" value=""/>	0	

Now you go through the process again, but this time you're choosing the elements and landscape components that describe the new landscape you'll be creating. Here you will need to add elements to make room for your new landscape description. Here's an example:

Defining your (public) green/blue/grey infrastructure					
Scenario title	Tot. scenario area	Category	Type	Amount	Unit
Baseline Scenario	4000 m ²	Low Green	Amenity grassland	2500	m2
		Fruit and vegetables	Fruit tree (pear)	40	amount
		Trees and Shrubs	Single tree (6m-12m)	7	amount
		Trees and Shrubs	Shrubby plants	1500	m2
Olive Grove	4000 m ²	Low Green	Amenity grassland	1000	m2
		Low Green	Flower field	2250	m2
		Trees and Shrubs	Single tree (6m-12m)	7	amount
		Trees and Shrubs	Shrubby plants	500	m2
		Fruit and vegetables	Fruit tree (pear)	15	amount
		(Semi-)permeable surface	Semi-permeable grow-through p	50	m2
	Sustainable drainage systems	Wetlands, ponds or retention ar	200	m2	

Our new scenario takes out some of the shrubby plants and old fruit trees, and provides a new mix of land split between a flower meadow and some grassed areas for play. A pond and some permeable footpath have been added, and the deciduous trees have been retained, as have a small number of pear trees.

As before, you can put a brief description into column I, and you should again **check that the total surface area of your new scenario (remember this excludes trees!) is the same as the figure in cell D12**. And yes, we've checked, our example still adds up to 4000 m².

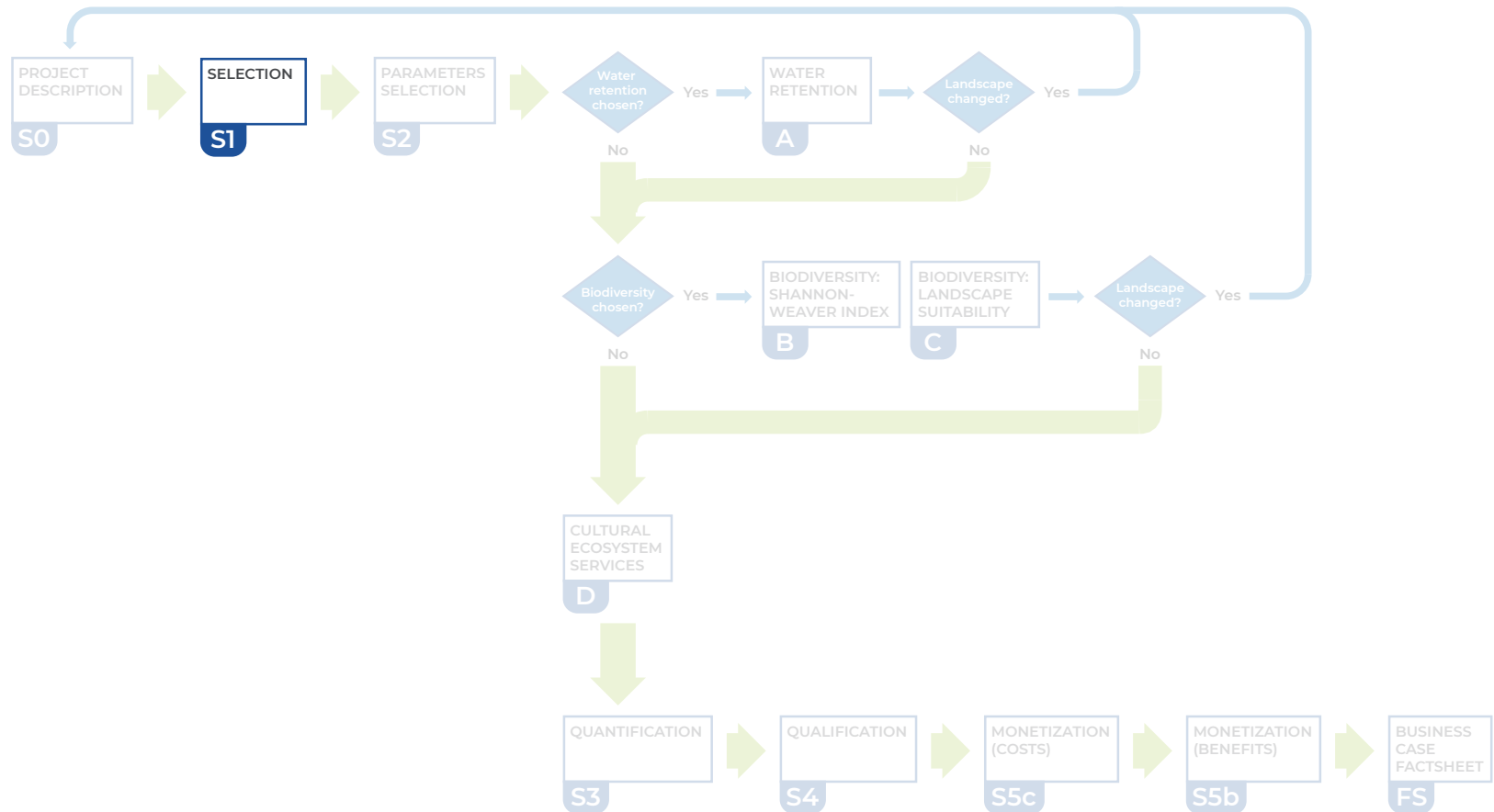
Tips:

Your new scenario may involve removing components of the old one, as in our example where we have to remove some trees and shrubs. Or you may have a hard surface you want to replace with something more permeable. The removal of parts of the baseline scenario will involve costs for removal and disposal, or maybe for plant hire or consultancy fees. If this is the case, add an additional element: 'Other' and choose 'additional costs', leaving the metric as 1. This will create a space for you to enter the costs of removals later on in the Business Model.

You can add as many **additional scenarios** as you wish, but make sure each has a unique name and a different colour (once chosen, these can't be changed). We point out, though, that the more scenarios you create, the more work you'll have to do, and the more complicated the Business Model will become. The graphics will get a bit congested, and comparison will become more difficult. The model works well with a baseline and up to two, maybe three, additional scenarios.

In the unlikely event that you need to **remove a scenario**, there's an icon for that in the Nature Smart Cities menu at the top of the page.

When you're done adding scenarios, you can go to the next worksheet, '**S1 -Selection**'. And if you find that you've forgotten something, you can always come back to this worksheet and add it in. You can even add another scenario later. The Business Model will rework its calculations each time you amend sheet S0.



Where to find your landscape components

These are the groups listed in column E, and the components that each group contains:

Green wall

- Green façades
- Living wall
- Vegetated mats, felt systems, or modular
- Hydroponic green walls
- Hedges (not fruit hedges)

Trees and shrubs

- Single tree (>12 metres)
- Single tree (6-12 metres)
- Single tree (<6 metres)
- Broad-leaved woodland
- Coniferous woodland
- Mixed woodland
- Herbaceous plants
- Shrubby plants

Fruit and vegetables

- Fruit tree (apple)
- Fruit tree (pear)
- Fruit tree (cherry)
- Fruit tree (citrus)
- Hedge (berries)
- Green façade (grapes)
- Allotment garden (potatoes)
- Allotment garden (onions and garlic)
- Allotment garden (carrot and root vegetables)
- Allotment garden (tomatoes)
- Allotment garden (lettuce and leaf vegetables)
- Allotment garden (strawberry)

Low green

- Flowerfield
- Lawn
- Tall grass
- Amenity grassland

Overgrown

Green roof

- Extensive green roof
- Intensive green roof

Sustainable drainage systems

- Rainwater harvesting
- Filter drain or infiltration trench
- Filter (buffer) strips or swales
- Wetlands, ponds or retention areas
- Soakaways
- Bioretention areas
- Trench-troughs or wadis

(Semi-)permeable surface

- Semi-permeable grow-through pavers
- Permeable stone/pavement
- Wood chips or bark
- Natural playground
- Rustic playground

Grey infrastructure

- Impermeable surface
- Storm sewage
- Brick wall
- Normal roof
- Concrete pond/lake
- Traditional playground

There's more information on what these terms mean, and even some illustrations, in the Technical Manual.

Worksheet S1 – Selection

In this worksheet, you'll choose the Ecosystem Services (known as ES) – essentially, the advantageous outcomes – that you want the Business Model to measure, or calculate, for you. This step allows you to choose the outcomes of your project that you want to emphasise in the Factsheet.

The worksheet consists of a list of 15 different Ecosystem Services which you can choose from. These are labelled in column D, and a brief description of each is provided in column E.

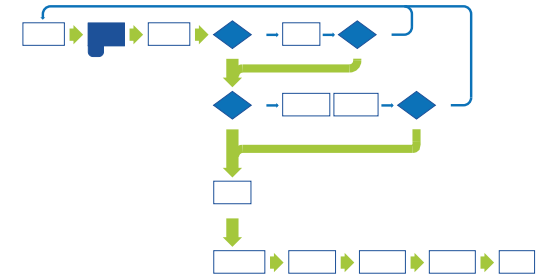
Start at cell F8 and work downwards.

Choose from the list by choosing 'Yes' or 'No' from the dropdown menu in column F. A 'Yes' answer means that the Business Model will include this Ecosystem Service in your results; 'No' means it will be left out of the calculations.

If you want to understand the ES better before you choose, there's a table at the end of this section that summarises each one.

Most GI projects are expected to achieve results in more than one area, and you can therefore choose multiple 'Yes' answers in column F. In fact **we recommend you do so**, as this emphasises the multiple benefits your project will achieve. But the more Ecosystem Services you choose, the more work you have to do, and the greater the risk that your diagrams will look cluttered. **So we recommend that you choose no more than 7 or 8.**

Here's an example. Our project is a small grassed area, subject to flooding, which we want to make into a natural play space, with a wildflower area, a pond, and some trees to provide shade. We'll also be including some benches where people can sit and chat or relax. It's hope we will have an area of green in a part of town that's mostly grey.



The ES we will choose for this project are:

- **Carbon** – because we want the trees in this area to contribute to our wider municipal goal of net zero by 2030.
- **Water retention** – because we want to reduce flooding and divert the water into our pond.
- **Biodiversity** – because we want to see more birds, butterflies and insects – and maybe even some frogs using the pond.
- **Aesthetic appreciation** – because we want to improve the look of the area and make it more attractive.
- **Health** – because encouraging children (and adults) to exercise will improve health and reduce obesity. And because a pleasant green space may help to reduce stress.
- **Recreation** – because this is one of the main purposes of the space in general and the play area in particular.
- **Social cohesion** – because there will be space for events such as fetes, carnivals, and so on, and because there will be space for people to sit together and meet each other.

This makes seven ES chosen, which is fine. We could have argued for others, but they aren't an important focus for the project, so it's better we left them aside. Here's what our worksheet looks like (a 'Yes' answer turns the box green).

Ecosystem services	Short description of ecosystem services	Include in assessment?	
Food	For instance, by implementing allotment gardens or planting fruit trees, residents can benefit from the food that is produced.	YES/NO	
Material	Vegetation is a source of materials such as wood, trimmings, and other vegetable residues. Only select this ESS if you are planning to use the wood from the vegetation.	YES/NO	
Carbon sequestration	For example, by planting more trees and other plants, more carbon can be captured and stored. This can contribute to climate change mitigation.	YES	
Micro climate regulation	On the one hand, nature can serve as a source of cooling in cities on hot (summer) days, and on the other hand, it can reduce heat loss on cold (winter) days.	YES/NO	
Noise pollution	Vegetation can effectively reduce noise levels (from traffic and other sources), and can also have a positive psychological effect.	YES/NO	
Water retention and infiltration	Green infrastructure can contribute to stable groundwater levels since water is better retained and ensure that the water levels in the waterways do not fluctuate too much.	YES	
Air filtering	Green infrastructure can improve air quality by removing pollutants from the atmosphere, including ozone (O ₃), nitrogen dioxide (NO ₂), sulfur dioxide (SO ₂) and carbon monoxide (CO).	YES/NO	
Habitat for biodiversity	Vegetated green infrastructure features can improve and expand the habitat for a wide variety of flora and fauna, which results in more plant- and animal species and thus higher biodiversity.	YES	
Aesthetic appreciation	Aesthetic value refers to the interaction of people with the environment related to natural beauty based on human perception and judgment.	YES	
Physical and mental health	Physical activity (e.g. walking, running, biking, etc.) in the presence of nature leads to positive mental and physical health effects in the short and long term.	YES	
Recreation and tourism (by external visitors)	For instance, specific nature-oriented activities (birdwatching, nature study, etc.), as well as informal recreation such as playing, walking, mountain biking, swimming, boating, and fishing.	YES	
Real estate prices	Nature and green spaces in the city have a positive effect on the value of real estate in the immediate vicinity.	YES/NO	
Education and raising awareness	Green environments allow us to experience nature, to enjoy and take care about nature and the environment. Moreover, the green infrastructure project can aid in raising awareness about current threats (air quality issues, rising sea level, ...), but also about good practices and potential solutions.	YES/NO	
Social cohesion	Green infrastructure improves 'community cohesion' by strengthening the network of (in)formal relationships among neighborhood residents. For example, parks and recreation areas are important meeting places for habitants (children, older people, etc.).	YES	
Attractor for companies and investments	Given that green areas attract people for leisure and recreation purposes, surrounding businesses might experience an increase in revenues.	YES/NO	

Tips:

- **Don't choose everything. Be focussed on the things you think your project is aiming to achieve.**
- **Although green installations can boost land values and house prices, this isn't always what municipalities want – so only choose this if you're trying to achieve higher land values or housing costs.**
- **The ES chosen will be applied to every scenario you identified in Step 0. You can't choose different ES for different scenarios.**

You can always go back and add further ES later if you (or your decision-maker) think you've forgotten something.

Two other things about this worksheet:

- There's a diagram at the top of the worksheet that shows you the impact of different types of landscape on ecosystem services. If you go to cell G3, you can choose from a dropdown menu that shows you how different types of landscape might influence your choice of ES. But it isn't essential and you can easily work without doing this.
- There's space in column G for you to write in a justification for each of the ES you've chosen (and to make a note as to why some others haven't been chosen). This is there purely to help later recall, it doesn't affect any other part of the Business Model, and you can leave it blank if you wish. Why make more work for yourself?

Ecosystem Services table

ES	Description and examples
Food	Does your project produce food? If it's an allotment, or an orchard, you'll probably choose this one.
Materials	Your project may produce timber, or vegetation to be used for biomass, for example. If that's the case, you might choose this one.
Carbon sequestration	Most green projects will improve carbon absorption. Choose this one if carbon is a main goal of your project
Micro-climate regulation	Green infrastructure can be used to provide shade or heat absorption on hot days, by blocking sunlight and by cooling the surrounding air. On cold days, it can slow heat loss. Choose this if your project aims to help regulate the local micro-climate.
Noise pollution	Green infrastructure can be used to reduce noise levels, for instance from traffic or industry. If that's part of what your project hopes to achieve, choose this one.
Water retention and infiltration	Different types of landscape have different potential to retain water. If your project looks to reduce flooding, or to store water for use on hot days, this is one you'll choose.
Air filtering	The vegetation in Green Infrastructure can absorb atmospheric pollutants and so make the air healthier, especially for people with respiratory problems. Choose this if your project targets airborne pollution.
Habitat for biodiversity	Green infrastructure can provide a habitat for plants, animals and insects, increasing both the number and variety of species in the locality. If this is a primary aim of your project, choose this one.
Aesthetic appreciation	Will your project make the locality look nicer? If this is part of what you're aiming for, choose this.
Physical and mental health	Your project might be aiming to increase exercise, improve physical fitness or reduce obesity. It might hope to improve mental health by providing peace and quiet, or contact with the natural world. If so, choose this.
Recreation and tourism by external visitors	If your project increases opportunities for recreation, play or sports, you'll choose this one. You'll also choose this one if your project encourages people from outside the area to visit.
Real estate prices	Green space and nature have been shown to have a positive effect on land values and housing costs in the locality. If you think that's a benefit from your project, choose this one.
Education and awareness	Does your project provide an opportunity for people to learn about nature or climate issues? Will schoolchildren or other groups visit to see your project and learn what it's doing for the climate? If so, choose this one.
Social cohesion	Green infrastructure can be an important part of bringing a community together. It can provide space for meetings, events, festivals... opportunities for socialising, and for volunteering... walking the dog and getting to know your neighbours. If this is an important dimension of your project, choose this one.
Attracting companies and investments	Green environments can be attractive places for businesses to relocate, because they offer nice surroundings in which to work. If they attract people, either from the local area or beyond, small businesses such as cafes may find a market. If you have this as a major aim, choose this one.

Worksheet S2 – Parameters selection

In this worksheet, you'll answer some further questions about your project, linked to the Ecosystem Services you selected in the previous step.

Background information

Each ecosystem service generates its own additional information requirement. You won't have all of these, but here's what's needed for each one, in the order they appear on this worksheet. Cells shown in pale yellow should be answered, those in black can be ignored.

Food

No additional info is required. You get a free pass on this one!

Materials

You need to say whether you plan to harvest the wood from your installation (a 'Yes/No' dropdown answer for each scenario). If Yes, you also have to give a number of years before the wood is harvested, using the dropdown menu.

Carbon sequestration

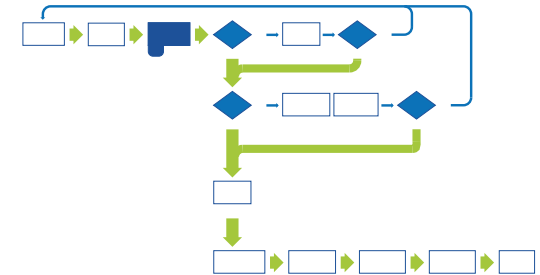
No additional info is required. Another free pass on this one!

Micro-climate regulation

Here you need to enter, for both the baseline and any new scenario:

- the number of houses (or other occupied buildings) within a 100m radius of the project area (N.B. This is houses, not people).
- The average price of electricity in your locality. You'll have to look this up on the internet.
- The average household electricity consumption in your locality, in kWh. Again, this is fairly easy to find on the internet.

If you've got a green wall or a green roof in your scenario, you'll also be asked whether you want to calculate the effect of this on the indoor temperature of the building(s) concerned. If you do, you simply have to say how many buildings are able to benefit from the green roof.



Noise pollution

Decide what the current level of ambient noise is in your baseline, using the dropdown. The business model does not need to know the level for your scenarios, it will calculate this. But you should insert the number of people living around the project area, within a maximum distance of 100m (these are the people most affected by the noise).

Water retention

You'll need to know the average annual precipitation in your locality, in cubic metres of rain per square metre of land. This is easily found on the internet, but be careful to use a local rather than a national figure, because rainfall varies hugely across the UK and France for example. The figure will be somewhere in the region of 0.5 to 0.9 m³/m².

You'll also need to indicate, using a Yes/No dropdown, whether you plan to collect water from surrounding roofs or streets, or indeed fields or open land. If you do, you'll need to provide the surface area you'll be collecting from.

Air filtering

No additional info is required.

Biodiversity

No questions on this worksheet, but we'll pick this up later if it's one of your selected ecosystem services.

The remaining four ecosystem services on this worksheet are part of the cultural ES built into the Business Model. *There are seven of these altogether, but only four of them need additional information in this worksheet.*

Aesthetic appreciation

The model needs to know how many people live in, or within 100m, of the project area.

Physical and mental health

The model needs to know how many people live in, or within 1000m, of the project area.

Recreation, and tourism by external visitors

You will need to tell the model whether your project is intended to promote tourism. Answer the question by choosing 'Correct' or Incorrect' for both the baseline and the new scenario(s).

If your project is focussed on tourism, the model asks for the number of overnight stays booked for the baseline scenario and the forecast for after implementing the new scenario. If you aren't looking for tourists, leave these lines blank.

You will need to tell the model whether your project is intended to promote recreation for local people. Answer the two questions by choosing 'Correct' or Incorrect' for both the baseline and the new scenario(s).

If you know how many people use these facilities for recreation now, and what the forecast is for your new scenario, insert the numbers, and move on. If you don't know, then use the numbers of people living at different distances.

Real estate prices

For the baseline, you only need to know the average house price in the area where your project will take place.

For the new scenario, you need to say **how many extra** houses will have the different advantages listed, that don't have these at the moment. The factors listed here have been shown to influence the resale price of homes. The model only wants to know the extra ones, **so don't include houses that already overlook water, for instance, or that are already in a street with trees.**

Now move on to your next Tab.

Tab A – Water Retention

This worksheet will only appear if you chose the 'Water Retention' ES in Worksheet S1. It sets out the water retention capabilities of each of your scenarios. You don't need to modify this worksheet at all.

About this worksheet

This worksheet uses the landscape elements you defined in Worksheet S0 to calculate the water retention capabilities of each of your scenarios. This allows you to compare your scenarios as far as their water retention potential is concerned.

Each of the landscape elements you defined is listed in column E. Some of them have been grouped together, so the descriptions may not match, but they are all there, and the areas they occupy are listed in column G.

Cell N39 shows the precipitation you entered in worksheet S2.

Column I lists a typical Retention Co-efficient for each element group. This is basically its capacity to retain water, on a scale of 0 to 1, where 1 is the highest retention capability.

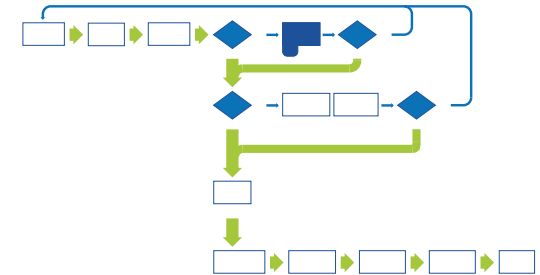
Cell I41 uses this data to calculate the amount of water that this scenario expects to absorb.

Tip:

- On worksheet S2, you might have chosen to 'collect water from surrounding properties' as well. That isn't taken into account in Tab A, so the result you see here might not be the whole story for your scenario's water retention. The two calculations are added together further on in the Business Model, however.

The total result for water retention (i.e. the Tab A result, plus any additional amount collected from surrounding properties), is reported in the Factsheet.

The same calculations are done for each scenario.



Here's an example:

COUNTRY PARK			
Green/blue elements	Area (m ²)		RC
Short grass	100000		0.72
Tall grass	1000		1.00
Flowerfield	170000		1.00
Middle green	20000		0.78
Trees	7400		0.51
Water elements	17500		1.00
Semi-permeable	3500		0.70
Impermeable	0		0.02
Green wall	0		0.18
Allotment garden	9700		0.90
Mean	291054		
Precipitation			0.568 m ³ /m ²
Total	165318.67 m ³ /year		

Here you can see that this scenario includes some landscape elements with high retention co-efficients – such as the flower field. But there is also a large area with a more modest retention – the short grass. Overall, this scenario expects to retain over 165,000 m³ a year. That's the equivalent of 66 Olympic size swimming pools – a lot of water!

Modifying your results

You don't need to do anything to this worksheet. But if you want to, you can modify the entries in column G to see how much this changes your results.

You might do this because you think the water retention in one of your scenarios is not as good as you expected. Changing your landscape to include more elements with high Retention Coefficients will improve your results. So in our example, if we increase the size of the flower field, and make a corresponding reduction to the short grass, we'll see a better result:

COUNTRY PARK			
Green/blue elements	Area (m ²)		RC
Short grass	80000		0.72
Tall grass	1000		1.00
Flowerfield	190000		1.00
Middle green	20000		0.78
Trees	7400		0.51
Water elements	17500		1.00
Semi-permeable	3500		0.70
Impermeable	0		0.02
Green wall	0		0.18
Allotment garden	9700		0.90

Mean	296654	Precipitation	0.568 m ³ /m ²
Total	168499.47 m ³ /year		

Taking 20000 m² of short grass and adding it to the flower field results in an increased retention of around 3,500 m³ per year.

Of course, you may decide this isn't enough to justify losing grassed play space. But you can at least use this worksheet to see what effect a change like this would make.

Two things you **MUST** remember though...

If you change the structure of your landscape, you need to make sure that the total area still adds up to the same total as before.

If you change your landscape here, you MUST go back to Worksheet S0 and change the landscape for this scenario there too. The Business Model can't do this automatically.

On to your next tab...

Tab B – Biodiversity: The Shannon Weaver Index

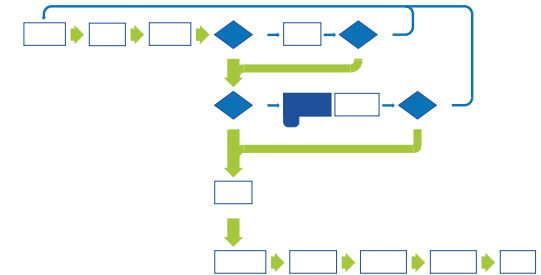
This worksheet will only appear if you chose the 'Biodiversity' ES in Worksheet S1. It calculates a Biodiversity Index known as 'Shannon-Weaver', which can be used to compare scenarios. A full explanation of this index is contained in the Technical Manual.

About this worksheet

This worksheet uses the landscape elements you defined in Worksheet S0 to calculate the structural biodiversity potential of each of your scenarios. This allows you to compare your scenarios for their biodiversity potential.

Each of the landscape elements you defined is listed in column C. Some of them have been grouped together, so the descriptions may not match, but they are all there, and the areas they occupy are listed in column D.

This worksheet uses both the number of green elements and the proportion of your landscape they occupy, to produce the result labelled 'D', in cell J 25 for the Baseline, and further down in column J for your other scenarios.



STRUCTURAL VARIATION						
BASELINE SCENARIO						
	Surface area		Log(surface area)	H'	Hmax	D
Layers				1.086768705	1.609437912	2.964678827
Lawn	0	FALSE	FALSE			
Flowerfield	10000	0.345847736	4			
Tall grass	1000	0.09172088	3			
Middle green	24100	0.307463153	4.382017043			
Trees	3700	0.21924737	3.568201724			
Water elements	0	FALSE	FALSE			
Semi-permeable	0	FALSE	FALSE			
Impermeable	1500	0.122489567	3.176091259			
Allotment garden	0	FALSE	FALSE			
Other	0	FALSE	FALSE			
SOUTHSIDE COUNTRY PARK						
	Surface area		Log(surface area)	H'	Hmax	D
Layers				0.716452002	1.945910149	2.047157001
Lawn	0	FALSE	FALSE			
Flowerfield	254100	0.158273698	5.405004665			
Tall grass	1000	0.018614198	3			
Middle green	20000	0.177629496	4.301029996			
Trees	3700	0.053145336	3.568201724			
Water elements	17500	0.16301775	4.243038049			
Semi-permeable	3500	0.050904501	3.544068044			
Impermeable	0	FALSE	FALSE			
Allotment garden	8000	0.094867022	3.903089987			
Other	0	FALSE	FALSE			

This is the Shannon-Weaver Index, and is an indicator of species richness within the landscape of your scenario. **The higher the value of D, the more species you are likely to be supporting in your scenario.**

The more landscape diversity you are able to create in your scenario, the higher the 'D' result will be. This is because you will have a greater variety of habitats and food sources to support a more diverse range of life.

It's important to remember, though, that **this is about potential, not actual numbers of species.**

The results from this calculation are carried through to the Factsheet, allowing comparison between scenarios.

Modifying your results

You don't need to do anything to this worksheet. But if you want to, you can modify the entries in column D to change your results. We don't recommend you do this unless you are very familiar with the calculation of this index.

Two things you **MUST** remember though...

If you change the structure of your landscape, you need to make sure that the total area still adds up to the same total as before.

If you change your landscape here, you MUST go back to Worksheet S0 and change the landscape for this scenario there too. The Business Model can't do this automatically.

Tab C – Biodiversity: Landscape suitability

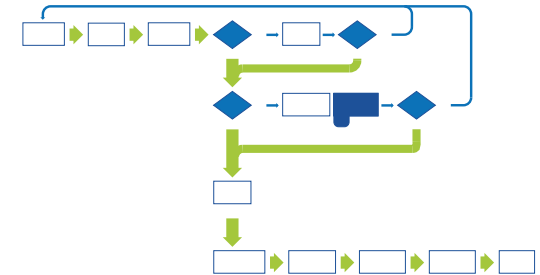
This worksheet will only appear if you chose the 'Biodiversity' ES in Worksheet S1. It explores the detailed composition of your landscape to assess its potential for different species of wildlife, looking for the natural elements that different species need in order to survive and thrive.

About this worksheet

This worksheet generates results that tell you the **potential** of each of your scenarios to support different wildlife species. For each scenario, you'll need to break down your landscape into more detailed components. The worksheet will then calculate how suitable your landscape is for different species, and report this as a set of charts.

What you need to do

In column D, you'll see a long list of landscape elements, in much more detail than you've used up to now. For each of these, you need to indicate whether or not it is present in your landscape.



Start with cell E69, and use the drop-down menu to indicate the presence of this element ('Yes') or its absence ('No'). Then work downwards, answering for each element. Note that we're only interested in whether an element is present or not, and not in the quantity of that element (the impact of that was addressed in Tab B). Any answer left as YES/NO will be interpreted as NO.

BASELINE SCENARIO	Green elements	Presence: YES/NO
	Lawn	YES
	Tall grass	YES
	Flower field/meadow	YES
	Flowerboard	NO
	Planter	NO
	Herbaceous/shrubby plan	YES
	Hedge	NO
	Tree	YES
	Forest	NO
	Allotment garden	NO
	Berry garden	NO
	Green roof	NO
	Compost heap	NO
	Dead wood	NO
	Beehive/beehotel	NO
	Birdshouse	NO
	Bird feed	NO
	Overgrown	YES
	Leaves	YES
Green façade	NO	
Blue elements	NO	
Bare land (acre/fallow lan	NO	
Blue elements (if present):		
Conditions		
Standing water	NO	
Population of fish present	NO	
Elements		
Eutrophic	NO	
Oligotrophic	NO	
Shaded water feature	NO	
Water element with direct li	NO	
Water without vegetation	NO	
Water with vertical vegetatio	NO	
Water with horizontal vegetat	NO	

Tips:

- **'Lawn'** includes any short-cut grass, not necessarily a lawn.
- **'Flowerboard'** includes any border planted with flowers.
- **'Bird feed'** means the presence of bird feeders filled by humans.
- **'Standing water'** means more than just puddles on a path. It means an area of water that is permanently present.
- **'Eutrophic'** means that the water contains nutrients, and will normally mean that it has plants or algae in it, but that other life is limited.
- **'Oligotrophic'** means that the water has few or no nutrients and will normally mean only specialised life is present.

Now do the same for your next scenario, starting at cell E122, and working downwards as before.

Understanding your results

The worksheet generates a set of four charts for each scenario, one each for birds butterflies, bees and amphibians.

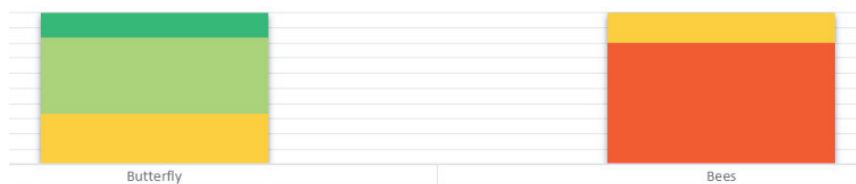
The more red you see in these charts, the less suited your scenario is as a habitat for this group of wildlife. The more green you see, the more suited your scenario is to this type of species. This example, taken from cell F108, illustrates the scale we're using to measure the suitability of the habitat:



In this example, around 45% of the bird species dislike this habitat (red colours), while only 10% of species (green colours) find it attractive. Remember this is the proportion of species, not the proportion of the actual birds.

But the main impact of the charts generated in this worksheet is visual. Here's another example:

Potential habitat for some target species



In this example, the worksheet calculates that the scenario is well suited to butterflies – there is a significant proportion of the landscape that is well suited to butterflies (lots of green in the chart) – but is much less well suited to bees (lots of red on the chart, and no green at all).

Both the scale and the visual presentation go through to the Factsheet.

BIRDS	Presence	% of habitat requirements met
House Sparrow	2.00	25.00
Wren	3.00	30.00
Dunnock / Finch	3.00	33.33
Greenfinch	3.00	42.86
Blackbird	5.00	41.67
Robin	3.00	27.27
Song Thrush	5.00	55.56
Jay	1.00	33.33
Magpie	4.00	50.00
Collared dove	4.00	80.00
Wood Pigeon	5.00	55.56
Green Woodpecker	4.00	57.14
Great spotted woodpecker	1.00	16.67
Blackcap	3.00	60.00
Chiffchaff	4.00	66.67
Moorhen	1.00	50.00
Common Coot	0.00	0.00
Great Tit	3.00	33.33

You can also see some more detailed results above the charts. The higher the value shown against each species in column I, the more supportive the landscape is of that species.

Here we have a landscape that is much more supportive of wood pigeons, which score 55% of habitat requirements met, than of house sparrows, which only score 25% of requirements met. It is also potentially supportive of song thrushes (score 55%), but as these are in decline you may not see them; **this is about potential, not actual presence.**

The charts generated in this worksheet will carry through to the Factsheet.

Manipulating the data

You can use this worksheet to explore what kind of environment you need to support a particular type of species you want. For example, if you want more bees, you can change your 'Yes' and 'No' answers to see what changes you might need to make to create an environment more suited to bees. These changes might be minor, but remember that changes you make here might affect your overall landscape composition that you set in Worksheet S0.

If you're changing the overall composition of a scenario's landscape, go back to sheet S0 and make sure it still represents your landscape accurately. For instance, if you decide to introduce water in Worksheet C, you must modify your landscape in S0 to include water elements.

Tips:

- **It's important to understand that this is about potential, and not automatic presence. A pond may be a good environment for frogs, but having a pond doesn't automatically mean you'll get frogs. As shown above, an environment that would support the song thrush doesn't guarantee their presence.**
- **Fish and amphibians don't mix (fish eat the tadpoles). So if you want amphibians, don't introduce fish into your water elements!**

Tab D – Cultural ecosystem services

This worksheet will only appear if you chose one or more cultural ecosystem services in Worksheet S1. It attempts to bring a quantifiable measurement into the assessment of aspects of your project that might be resistant to more empirical measurement.

About this worksheet

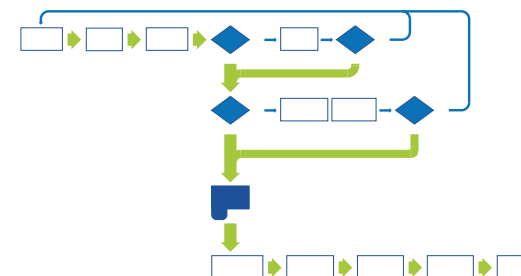
In this worksheet, you're presented with a list of statements for each cultural ES you chose. For each statement, there are four things you have to do:

- Assign a weight to the statement, that reflects its importance to you (this might, for example, reflect a corporate priority or a funder's objective);
- Assign a score to this statement for your baseline scenario;
- Assign a score to each statement for your new scenario (s)
- Select the statements that you want to emphasise in your presentation to the decision-maker

Here's how you do this.

Assigning weights and scores

You attach a weight to each statement by going to column F. Against each statement, use the dropdown menu to assign a weight between 5 (incredibly important to this municipality or funder) to 1 (not really important to this municipality or funder).



Choose the questions per ecosystem service that are displayed on the factsheet.	Questions	Importance for your project? (1-5, with 5 being the highest)	Baseline Scenario	OLIVE GROVE
	Physical and mental health		0	0
	Does this scenario provide an environment that help people relax and reduce stress?	3	0	
x	Does this scenario provide opportunities for people to socialise with neighbours?	5	0	
	Does this scenario provide opportunities for volunteering and 'giving back'?	2	0	
	Does this scenario encourage active outdoor exercise?	2	0	
	Does this scenario reduce ambient noise, promote peace, quiet and tranquillity, and so contribute to people's mental health?	2	0	
x	Does this scenario provide space for sport and active play?	5	0	
x	Does this scenario provide green elements in a densely urban area?	5	0	
	Does this scenario improve shading in the area to improve thermal comfort?	2	0	

Not everything is as important as everything else, and your weights should reflect this. In this example, stress reduction is a funder’s priority, and active outdoor exercise is an important corporate priority, so those statements get a weighting of five. Important as the others might be in your eyes, they are less fundamentally important in the overall scheme of things.

Next, you score your baseline scenario on the difference it makes to this statement, using column J. These scores are again on a drop-down menu, and here you rate your scenario from 3 (makes a big difference) to 0 (makes no difference at all). A lot of baseline scenarios will be low scoring, like in this example.

Choose the questions per ecosystem service that are displayed on the factsheet.		Questions	Importance for your project? (1-5, with 5 being the highest)	Baseline Scenario	OLIVE GROVE
		Physical and mental health		0	0
		Does this scenario provide an environment that help people relax and reduce stress?	3	0	
x		Does this scenario provide opportunities for people to socialise with neighbours?	5	0	
		Does this scenario provide opportunities for volunteering and 'giving back'?	2	0	
		Does this scenario encourage active outdoor exercise?	2	0	
		Does this scenario reduce ambient noise, promote peace, quiet and tranquillity, and so contribute to people's mental health?	2	0	
x		Does this scenario provide space for sport and active play?	5	0	
x		Does this scenario provide green elements in a densely urban area?	5	0	
		Does this scenario improve shading in the area to improve thermal comfort?	2	0	

My baseline scenario offers very little against any of these statements except insofar as it provides a bit of relief to the urban environment.

And now, you rate your new scenario against what it offers to each of these statements, again, using values from 0 to 3 in column K.

Choose the questions per ecosystem service that are displayed on the factsheet.		Questions	Importance for your project? (1-5, with 5 being the highest)	Baseline Scenario	OLIVE GROVE
		Physical and mental health		0	2
		Does this scenario provide an environment that help people relax and reduce stress?	3	0	2
x		Does this scenario provide opportunities for people to socialise with neighbours?	5	0	1
		Does this scenario provide opportunities for volunteering and 'giving back'?	2	0	2
		Does this scenario encourage active outdoor exercise?	2	0	3
		Does this scenario reduce ambient noise, promote peace, quiet and tranquillity, and so contribute to people's mental health?	2	0	3
x		Does this scenario provide space for sport and active play?	5	0	1
x		Does this scenario provide green elements in a densely urban area?	5	0	3
		Does this scenario improve shading in the area to improve thermal comfort?	2	0	3

My new scenario isn't perfect, but it delivers some important changes on some of these statements, and my scores reflect this.

Finally, go to column D. You'll see a series of little x marks, one for each statement. This is where you choose which of the statements listed you really want to emphasise to the person reading the Factsheet. Each statement with an x beside it goes through to the Factsheet.

Choose the questions per ecosystem service that are displayed on the factsheet.	Questions	Importance for your project? (1-5, with 5 being the highest)	Baseline Scenario	OLIVE GROVE
	Physical and mental health		0	2
	Does this scenario provide an environment that help people relax and reduce stress?	3	0	2
x	Does this scenario provide opportunities for people to socialise with neighbours?	5	0	1
	Does this scenario provide opportunities for volunteering and 'giving back'?	2	0	2
	Does this scenario encourage active outdoor exercise?	2	0	3
	Does this scenario reduce ambient noise, promote peace, quiet and tranquility, and so contribute to people's mental health?	2	0	3
x	Does this scenario provide space for sport and active play?	5	0	1
x	Does this scenario provide green elements in a densely urban area?	5	0	3
	Does this scenario improve shading in the area to improve thermal comfort?	2	0	3

I've chosen the three statements I think are crucial to getting approval.

Tip:

Before you're tempted to choose all the statements, bear this in mind. Feedback during the testing phase was that decision-makers were not impressed by lengthy lists of statements, however supportive they might be of the project. **Being selective is important to your success; less is more!**

Follow this procedure for each Ecosystem Service that appears on this worksheet, then go to Tab S4.

Worksheet S3 – Quantification

This worksheet sets out the results for those Ecosystem Services you chose that can be measured empirically.

About this worksheet

This worksheet uses the calculation algorithms in the model to calculate the results for each ES you chose (other than the cultural ES) and sets them out for each of your scenarios.

You can overwrite these results if you think you know better. If you do, the new result you enter will be taken forward into the remaining calculations and the Factsheet.

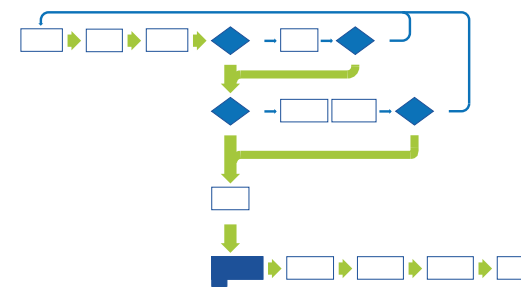
But in reality you don't need to do anything here except form an assessment of whether the change you can see for each ES is a major, minor or inconsequential change.

Interpreting the results

The results for **food** show the weight of produce delivered by each type of food chosen in worksheet S0. For **materials**, the sheet shows the product of the site in cubic metres.

Carbon sequestration results are shown in kg of **carbon captured per year**. To translate this into Kg of CO₂, multiply by 3.67. For comparison, you may be interested to know that the average carbon footprint of a UK resident is 5,500 Kg of CO₂ a year. In the Netherlands, it's a lot higher, at 9,600 Kg a year, and in Belgium it's 8,340 Kg a year. And in France, it's lower still at just 5,130 Kg of CO₂ per person per year.¹

Micro climate regulation shows the **reduction in temperature** offered by each of your scenarios. The result shown is the reduction in temperature compared to an all-grey scenario. These results are **not** cumulative. Each degree of temperature reduced could save 1% of the total heating bill. Different figures are shown for the outdoor effect and the indoor effect; the indoor calculation makes no allowance for insulation or other temperature reduction measures other than those you identified in Worksheet S0.



¹ [CO2 Emissions by Country - Worldometer \(worldometers.info\)](https://www.worldometers.info) [Accessed 13 February 2022].

The **noise pollution** results show the difference each scenario makes to ambient noise, measured in decibels. A normal restaurant or (pre-COVID) office environment has a decibel rating of around 60 db. 85db is normally considered dangerously uncomfortable, and because noise is measured logarithmically, it's around 25 times louder than the restaurant – dangerously uncomfortable.² The results shown are **the reduction in noise levels** achieved by your scenarios, compared with an all-grey scenario, not the absolute noise level. **The results are not cumulative.**

We saw the **water retention** results already, in Tab A, but this time the collection of water from surrounding roofs, streets, etc. has been added in.

The **air quality** results are based on the amount of **pollution being removed** from the air by each of your scenarios. This includes particulates, nitrogen dioxide, ozone, ammonia and sulphur dioxide. In the countryside, vegetation typically removes 60-70 Kg of pollutant per hectare; in cities, vegetation might only remove 5-7 Kg per hectare. This result is shown in Kg for the whole of your project area.³

The **biodiversity** results show the charts you prepared earlier in Tab C.

The results for **health** are shown in DALYs, short for Disability-Adjusted Life Years. The result shows the number of **additional** years of good health a person can expect to enjoy, on average, as a result of your scenarios. They reflect both mental and physical illness. One DALY means a **gain** of one year of good health shared between those living in or near the project area; 0.02 DALYs means a gain of one week.

DALYs are often used as a measure of life expectancy lost, so remember that in this case it's about gain.

Tip:

- **It will help you when you get to Worksheet S4 to have some understanding of the impact each of your scenarios is having in each of these result areas – major impact, some impact, little or no impact.**

² [How Loud Is 60 Decibels | What Does 60 Decibels Sound Like \(decibelpro.app\)](#) [Accessed 13 February 2022].

³ [UK air pollution removal: how much pollution does vegetation remove in your area? - Office for National Statistics \(ons.gov.uk\)](#) [Accessed 13 February 2022].

Worksheet S4 – Qualification

In this worksheet, all the scores from your different ecosystem services are presented side by side, and you can use this sheet to emphasise those you think are especially significant.

About this worksheet

This worksheet uses the results so far to generate a spider diagram that allow you to illustrate the changes your new scenario will make, in terms of the different ES you chose in Worksheet S1. The diagram is carried through to the Factsheet, and feedback suggests it offers a powerful picture of the impact your new scenario could have.

Making this work

You have a row of results for each of your scenarios, one result for each chosen ecosystem service. Many of these will start out as zeros, the default value.

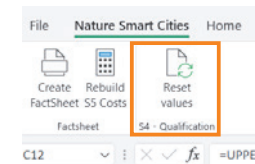
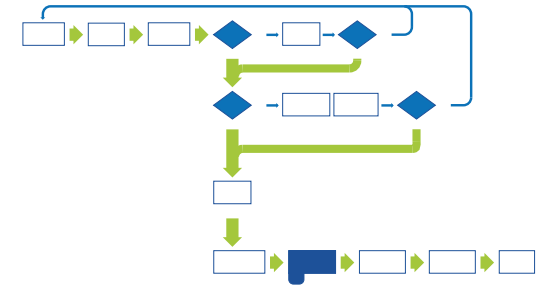
The first thing you need to do is to click on 'reset values' in the Nature Smart Cities menu. This will summarise the scores from Tab D against the cultural ecosystem services in this worksheet.

Next, you need to assess the other ecosystem service results for both the baseline (row 10) and the new scenario(s) (row 12, and perhaps other rows also). You choose from a dropdown that offers you a choice from between 3 (a great impact) and 0 (no impact at all).

In many cases the baseline score will be a zero, because the baseline landscape offered very little to that ecosystem service. If there was no food production in this landscape before, and now there is, the Baseline score must be a zero. But for some ES, the baseline score might be higher, perhaps because there is biodiversity in the existing landscape, or there are some trees providing carbon sequestration.

Tip:

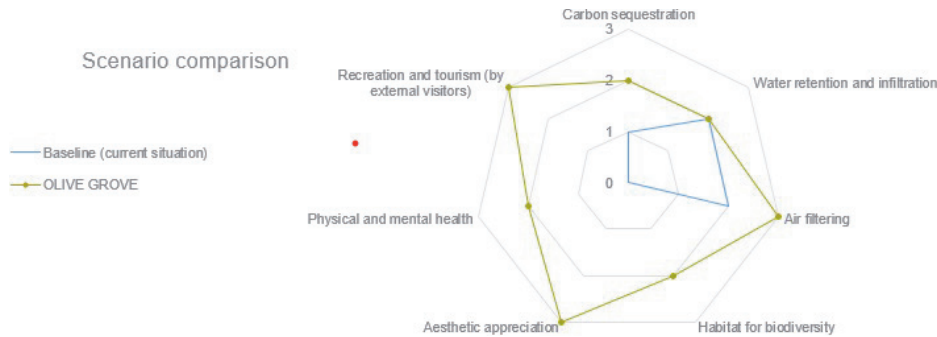
- **Although you're right to try to be honest, a row of zeros in the baseline will not produce a spider diagram to compare with your new scenario. Where you can honestly allow your baseline a score of 1, a diagram can appear.**



Here are some scores from a different project:

E	G	K	M	N	O	R	T
Qualitative assessment							
visioning ecosystem serv	Regulating ecosystem services		Cultural ecosystem services				
Food	Carbon sequestration	Air filtering	Aesthetic appreciation	Physical and mental health	Recreation and tourism (by external visitors)	Social cohesion	
0	1	1	1	0	0	0	
2	3	2	3	3	1	2	

And the diagram they produce:



The diagram shows that my new scenario (the green line) outperforms the baseline (the blue line) on every ES, and in some cases by a considerable margin. I've been generous to the baseline but this allows the comparison to be made; if I'd left the baseline as zeroes, there would be no blue line in this diagram at all.

Worksheet S5c – Monetization (Costs)

This worksheet is where you set out the capital costs (creating your landscape) and revenue costs (maintaining it year by year), for each of the scenarios you are working on.

About this worksheet

This worksheet uses the landscape elements you defined in Worksheet S0 to calculate the costs associated with each of your scenarios.

Your scenarios appear in column D, and each of the landscape elements you defined in Worksheet S0 is listed in column E. You can now calculate the costs for each of these elements.

IMPORTANT: Before you begin, though, go to the Nature Smart Cities menu at the top of the page and click on the icon labelled 'Rebuild SS Costs'. Then confirm your choice by choosing 'Yes'. This is necessary to bring the data you entered earlier into this worksheet.

You'll need to do this again every time you modify data in earlier worksheets.

IMPORTANT: Every time you 'Rebuild SS costs', you lose any data you've input. So do it first, not as an afterthought!

ALSO IMPORTANT: If you added a line for additional costs in Worksheet S0, you'll see this line appear on this page. If it doesn't, and you need it, go back to S0 and add it now, before you start entering any cost data.

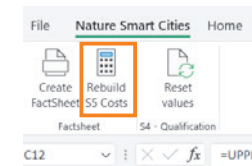
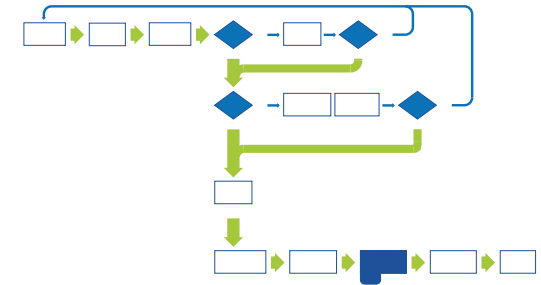
You'll need to rebuild SS costs again if you've done this.

Choosing your cost base

The worksheet is pre-programmed with typical cost ranges for the elements you've chosen. You can use these figures if you wish, or you can override any or all of them with your own cost figures if you know them.

If you want to use the pre-programmed cost figures, you'll need to choose whether you want to use the minimum cost in each of the ranges, the average cost in each range, or the maximum in each range.

To set the cost base, go to cell F6 and choose from the drop-down menu. Your choice will apply to the whole worksheet, unless you override any or all the figures. But you can always go back and change it.



The worksheet calculates costs in Euro. **If you want to calculate costs in a different currency, go to cell F5** and insert the amount a Euro represents in your currency.

Capital costs (Construction costs)

Columns F to I show the construction costs associated with your chosen elements. In Column F you can see a value called the 'lower bound', while in column G is the 'upper bound'. Column I shows how the value you choose is applied, usually in currency per square metre.

If you've chosen 'MIN' in cell F6, the 'lower bound' costs will be used to make the calculation. 'MAX' uses the 'upper bound' figure, and 'Average' sets the costs exactly halfway between the lower and upper figures.

You can override the calculation for any element by inserting a 'Custom value' in column H. You would do this if you already know your costs, or if you are uncertain that the pre-programmed costs are accurate enough. **We recommend you do this wherever possible as it will improve your cost comparisons.**

Here's an example. In my scenario in step S0, I had an element of 3,500 sq m of grow-through pavers (this is actually shown again in column T). The cost range shown here in Sheet S5 for grow-through pavers is between 83.5 and 150 euro per square metre. But I've had a quote to do this work for 122 euro per square metre, so I can override the Worksheet and insert my quote value into the custom value column.

Choose an exchange rate (if not 1)		1				
Cost calculation		MIN				
		Construction Costs				
Scenario	Element	Lower bound	Upper Bound	Custom Value	Units	Le
Baseline Scenario	Impermeable surface	100.00	112.00		[currency]/m ²	
	Amenity grassland	11.00	20.00		[currency]/m ²	
	Wetlands, ponds or retention areas	16.30	32.59		[currency]/m ²	
New scenario	Normal roof	30.00	80.00		[currency]/m ²	
	Flower field	10.00	30.00		[currency]/m ²	
	Wetlands, ponds or retention areas	16.30	32.59		[currency]/m ²	
	Allotment garden (Carrot and root vegetables)	17.29	19.29		[currency]/m ²	
	Permeable stone/pavement	83.54	150.00	132.00	[currency]/m ²	
	Amenity grassland	11.00	20.00		[currency]/m ²	
	Additional costs	0.00	0.00			0

I can do this for any element where I have better knowledge than the worksheet already holds.

Now go to column U. Here you have to specify how much of your new scenario is newly built. This is because you won't be paying again for parts of your scenario that already exist.

In this example, I already have 25 square metres of pond in my baseline scenario. My new scenario has 50 square metres of pond, but some of this already exists, so I insert 25 into column U as the amount of pond I need to create.

Element	Lower bound	Upper Bound	Custom Value	Units	Lower Bound	Upper Bound	Custom Value	Units	In which year should the maintenance cost start	maintenance	Quantity	Of which newly built	Units
Impermeable surface	100.00	112.00		{currency}/m²	0.23	0.27		{currency}/m	1	821.33	3500		m2
Amenity grassland	11.00	20.00		{currency}/m²	0.39	0.39		{currency}/m²	1	6045.00	15500		m2
Wetlands, ponds or retention areas	16.30	32.59		{currency}/m²	0.56	1.68		{currency}/m²	1	7.00	13		m3
Normal roof	30.00	80.00		{currency}/m²	3.00	3.60		{currency}/m²	1	540.00	180		m2
Flower field	10.00	30.00		{currency}/m²	0.31	0.31		{currency}/m²	1	796.70	2570		m2
Wetlands, ponds or retention areas	16.30	32.59		{currency}/m²	0.56	1.68		{currency}/m²	1	28.00	50	25	m3
Allotment garden (Carrot and root vegetables)	17.29	19.29		{currency}/m²	1.30	2.50		{currency}/m²	1	260.00	200		m2
Permeable stone/pavement	83.54	150.00	132.00	{currency}/m²	3.35	3.35		{currency}/m²	1	11725.00	3500		m2
Amenity grassland	11.00	20.00		{currency}/m²	0.39	0.39		{currency}/m²	1	4875.00	12500		m2
Additional costs	0.00	0.00		0	0.00	0.00		0.00	1	0.00	1		other

Tips:

- If your Baseline Scenario is a pre-existing landscape (as it often will be), **there won't be any construction costs**. The landscape is already there and you don't have to create it! Just ignore these calculations for your baseline scenario.
- There are no construction costs for the biggest trees, because we assume you would never try to plant these!
- But you may well have maintenance costs to pay, even if you leave the landscape as it is, so don't forget to add these in.
- Column T reminds you of what you said on Worksheet S0, to save you going back and rechecking.

However, if your costs for a new scenario include costs of **removing** unwanted parts of your baseline scenario (such as excess shrubs, or unwanted surfacing), you need to factor these in as capital costs.

Remember you allowed for this when you built your landscape in sheet S0.

<i>Element</i>	<i>Lower bound</i>	<i>Upper Bound</i>	<i>Custom Value</i>	<i>Units</i>	<i>Lower Bound</i>	<i>Upper Bound</i>	<i>Custom</i>
Impermeable surface	100.00	112.00		[currency]/m ²	0.23	0.27	
Amenity grassland	11.00	20.00		[currency]/m ²	0.39	0.39	
Wetlands, ponds or retention areas	16.30	32.59		[currency]/m ²	0.56	1.68	
Normal roof	30.00	80.00		[currency]/m ²	3.00	3.60	
Flower field	10.00	30.00		[currency]/m ²	0.31	0.31	
Wetlands, ponds or retention areas	16.30	32.59		[currency]/m ²	0.56	1.68	
Allotment garden (Carrot and root vegetables)	17.29	19.29		[currency]/m ²	1.30	2.50	
Permeable stone/pavement	83.54	150.00	132.00	[currency]/m ²	3.35	3.35	
Amenity grassland	11.00	20.00		[currency]/m ²	0.39	0.39	
Additional costs	0.00	0.00	8325.00	0	0.00	0.00	

Here's an example:

In my baseline I have 5,500 sq m of concrete surfacing. I'm going to replace this with 3,500 sq m of permeable pavers. The 3,500 figure will go into column U as newly built, but I need to build in the cost of removing the concrete and getting rid of it. Again, I have a quote for this, of 8,325 euro. That figure goes into column H, and again into column U exactly as it is.

Element	Lowerbound	Upperbound	Custom Value	Units	Lowerbound	Upperbound	Custom Value	Units	in which year should the maintenance cost start	maintenance cost	Quantity	is it already built	Units	Costs
Impermeable surface	100.00	112.00		{currency}/m	0.23	0.27		{currency}/m	1	821.33	3500		m2	
Amenity grassland	11.00	20.00		{currency}/m	0.39	0.39		{currency}/m	1	6045.00	15500		m2	
Wetlands, ponds or retention areas	16.30	32.53		{currency}/m	0.56	1.68		{currency}/m	1	7.00	13		m3	
Normal roof	30.00	80.00		{currency}/m	3.00	3.60		{currency}/m	1	540.00	180		m2	
Flower field	10.00	30.00		{currency}/m	0.31	0.31		{currency}/m	1	796.70	2570		m2	
Wetlands, ponds or retention areas	16.30	32.53		{currency}/m	0.56	1.68		{currency}/m	1	28.00	50	25	m3	407.43
Allotment garden (Carrot and root vegetables)	17.23	19.23		{currency}/m	1.30	2.50		{currency}/m	1	260.00	200		m2	
Permeable stonepavement	83.54	150.00	132.00	{currency}/m	3.35	3.35		{currency}/m	1	11725.00	3500		m2	
Amenity grassland	11.00	20.00		{currency}/m	0.39	0.39		{currency}/m	1	4875.00	12500		m2	
Additional costs	0.00	0.00	8325.00		0.00	0.00		0.00	1	0.00	1	8325	other	8325.00

Revenue costs (Maintenance costs)

Columns K to P show the annual maintenance costs associated with your chosen elements. These calculations work the same way as the construction costs discussed above. If you've chosen 'MIN' in cell F6, the 'lower bound' costs will be used to make the calculation. 'MAX' uses the 'upper bound' figure, and 'Average' sets the costs exactly halfway between the lower and upper figures.

You can override the calculation for any element by inserting a 'Custom value' in column M. You would do this if you already know your costs, or if you are uncertain that the pre-programmed costs are accurate enough. Just as you did with your capital costs a few minutes ago.

Column O assumes that you will start paying maintenance after the first year of installation, but you may have an agreement with your contractor that they will do the maintenance for a few years. In this case, change the number in column O to show how many years will elapse before you start paying.

Column P shows the results of the calculation for annual maintenance costs. In this example, I've got a custom value for the cost of maintaining my paving. But I also have a ten year guarantee on the roof, and a 5 year guarantee on the paving, so I won't be [paying maintenance costs straight away. I've adjusted the entries in column O to reflect this.

Completing your cost calculations

Now scroll across to column U. Here you have to specify how much of your scenario is new, and therefore incurs a cost. None of your baseline is new (obviously) but some of your new scenario may already exist and won't therefore need to be paid for. So review the entries in column T for your new scenario, and insert next to each, in column U, the amount of that figure that is actually new. You should now have all your construction costs in column W, and your annual maintenance in column Y.

Your work here is done!

		1		Construction Costs					Maintenance cost / year		
		MIN									
<i>Element</i>	<i>Lower bound</i>	<i>Upper Bound</i>	<i>Custom Value</i>	<i>Units</i>	<i>Lower Bound</i>	<i>Upper Bound</i>	<i>Custom Value</i>	<i>Units</i>	<i>In which year should the maintenance cost start</i>		
Impermeable surface	100.00	112.00		[currency]/m ²	0.23	0.27		[currency]/m	1		
Amenity grassland	11.00	20.00		[currency]/m ²	0.39	0.39		[currency]/m ²	1		
Wetlands, ponds or retention areas	16.30	32.55		[currency]/m ²	0.56	1.68		[currency]/m ²	1		
Normal roof	30.00	80.00		[currency]/m ²	3.00	3.60		[currency]/m ²	11		
Flower field	10.00	30.00		[currency]/m ²	0.31	0.31		[currency]/m ²	1		
Wetlands, ponds or retention areas	16.30	32.55		[currency]/m ²	0.56	1.68		[currency]/m ²	1		
Allotment garden (Carrot and root vegetables)	17.29	19.29		[currency]/m ²	1.30	2.50		[currency]/m ²	1		
Permeable stonepavement	83.54	150.00	132.00	[currency]/m ²	3.35	3.35	4.00	[currency]/m ²	6		
Amenity grassland	11.00	20.00		[currency]/m ²	0.39	0.39		[currency]/m ²	1		
Additional costs	0.00	0.00	8325.00	0	0.00	0.00		0.00	1		

Worksheet S5b – Monetization (Benefits)

This worksheet calculates the annual monetized benefit of each of your scenarios. It's mainly for information – you don't need to do anything here, although you may want to change the Discount Rate used in the calculations.

About this worksheet

This worksheet calculates the monetary value of the benefits associated with each of the Ecosystem Services (ES) you chose in Step S1. It takes all the results you have generated thus far, and applies a monetary value to each of these (where a value can be calculated). The values used for this calculation are based on peer-reviewed academic literature that has allowed us to pre-programme this worksheet. There is more info in the Technical Manual.

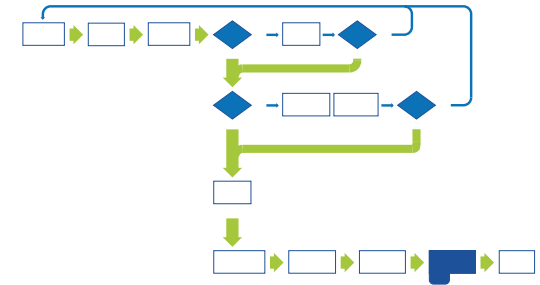
The calculation uses a **Discount Rate, which is in cell F6**. This is set at a default 3.5%, but you can change it if you wish. It's an accounting term that is explained more fully in the Technical Manual, but basically represents the present value of a future cash flow.

In the UK the discount rate is currently 3.5%, but is reduced to 1.5% for projects focussing on health outcomes.⁴ In the EU, it is customary to use a rate of 4%. You may want to find out what your local social discount rate is, and use that.

Check that the Discount Rate being used is the right one for your area, and **if necessary adjust the rate in cell F6**.

Each of your chosen ES is listed in column E, and the result you generated for that ES is in column F. Column G shows the unit value that will be applied to your result, and column I shows the annual monetary benefit of the result of your figures.

In this example, our water retention calculation produced a result of 2,277 m³ of water retention per year. Academic research suggests that each m³ of water retained has a monetary value of €0.52, so our project is worth over €1,180 per year in this respect alone. In the Baseline scenario, our water retention was worth just over €1,000, so we've added very little to the monetary worth of the project through the new scenario.



⁴ Freeman et al., *Reviewing Discount Rates in ONS valuations* (London, ONS, 2017) p. 2

STANDARD DISCOUNT RATE OF	3.50%		Custom value if not 3,50%			
BASELINE SCENARIO	Quantified result	Unit value	One-time benefit	Annual benefit	Total Benefit (20yr life span)	Total benefit (40yrs life span)
Carbon sequestration	1.61 tonnes/yr	69.80		112.62	1047.00	1047.00
Water retention and infiltration	2190.71 m3/yr	0.52		1139.17	16586.50	45566.84
Air filtering		CAN NOT BE MONETIZED		-	-	-
Habitat for biodiversity		CAN NOT BE MONETIZED		-	-	-
Aesthetic appreciation	0.00	0.00		0.00	0.00	0.00
Physical and mental health	0.00 DALY	105000.00		0.00	0.00	0.00
Recreation and tourism (by external visitors)	0 visits	1.50		0.00	0.00	0.00
TOTAL MONETARY BENEFITS BASELINE SCENARIO				1251.79	17633.50	46613.84
OLIVE GROVE	Quantified result	Unit value	One-time benefit	Annual benefit	Total Benefit (20yr life span)	Total benefit (40yrs life span)
Carbon sequestration	1.10 tonnes/yr	69.80		76.61	712.23	712.23
Water retention and infiltration	2277.76 m3/yr	0.52		1184.43	17245.53	47377.40
Air filtering		CAN NOT BE MONETIZED		-	-	-
Habitat for biodiversity		CAN NOT BE MONETIZED		-	-	-
Aesthetic appreciation	0.00	0.00		0.00	0.00	0.00
Physical and mental health	0.00 DALY	105000.00		0.00	0.00	0.00
Recreation and tourism (by external visitors)	0 visits	1.50		0.00	0.00	0.00
TOTAL MONETARY BENEFITS OLIVE GROVE				1261.05	17957.77	48089.63

It's important to recognise, though, that this isn't money that will come into the municipal coffers. But it might be a cost saved, because there would be a cost associated with sewage water treatment, that we've now reduced (even if only a little)..

Many ES can be valued in this way, and these values go through to the Factsheet. But not all can, and this worksheet shows those that have no assignable value. **This does not mean that the ES are not worth having, just that their value is more arbitrary.** You may want to highlight these additional, non-monetised ES to your decision-maker – perhaps alongside other ES benefits you decided not to highlight in your use of the Business Model.

The Factsheet

The factsheet presents all the results you have secured in your work on the Business Model, and allows you to compare the results between your scenarios. It has been designed to allow you to use it as a guide for your decision-maker.

About the factsheet

All your results are here, presented in a systematic way. You can compare up to two scenarios at a time.

Choose the scenarios you want to compare using the two drop-down menus in row 39. Now go to cell F69 and use the dropdown to choose the currency symbol you want to use in the Factsheet.

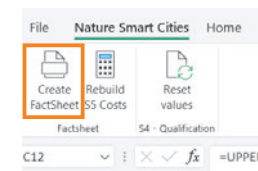
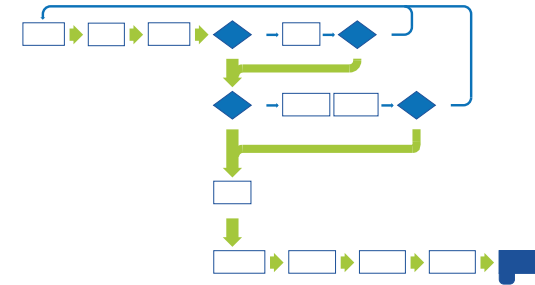
The next section shows the ecosystem services you chose in worksheet S1, highlighted, and those you left out of your calculations are greyed out.

A diagram of your results comparison from worksheet S4 is next, and then come the figures (and, for biodiversity, the charts) that show your numerical results for each chosen ES.

Finally, the financial information produced in worksheet S5 C and S5 B is presented in graphical form.

And then there's a box you can use to add any further relevant information, to clarify the results, or to note other impacts not covered by your ES choices. For example, a noise abatement scheme on a new road might have ES of noise reduction, biodiversity and higher land values, but might also have space available for a future project to introduce a new cycle or footpath.

You can produce a PDF of the Factsheet by pressing the 'Create Factsheet' icon in the Nature Smart Cities menu. It will be saved, as a six digit number with a pdf suffix, wherever you stored the Business Model at the start of this process. You can produce multiple Factsheets if you wish, comparing different scenarios. Just choose the two you want on Row 39.



Modifying your results

You don't need to do anything to this worksheet other than choose your scenarios for comparison. But if you're dissatisfied with your results, you can always go back to earlier worksheets and change the data you've used.

If you do this, you must remember to

- **Change the landscape composition on sheet S0, if you are making changes to your landscape elements.**
- **Use the 'Reset Values' in worksheet S4 to rebuild your scores for the spider diagram.**
- **Use the 'Rebuild S5 Costs' icon to update the financial data in worksheets S5 C and S5 B.**

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