

Introduction

The Business Model (BM) created within the Nature Smart Cities (NSC) project is a methodol that aims at assisting local authorities considering a green infrastructure (GI) project. It provides you with a tool to demonstrate how a GI project can generate different types of benefits (qualitatively, quantitatively, and monetarily) and how these returns compare to the more traditionally-chosen grey infrastructure. Moreover, it allows to compare the costs different scenarios entail.

Although the Business Model can be used during any stage of your project, we believe that the added value will be the highest when applied in the initial stages. The Business Model is based on evidence that was collected through interviews with local authorities and analysis of a wide range of peer-reviewed geographical, biophysical, and economic data. It has been tested, refined, and validated through interaction with seven new GI projects in Southend-On-Sea, Cambridge, The Hague, Kapelle, Antwerp, Bruges, and Lille. The outcome is the result of co-creation and co-operation between academic partners (theory) and city partners (targeted end-users).

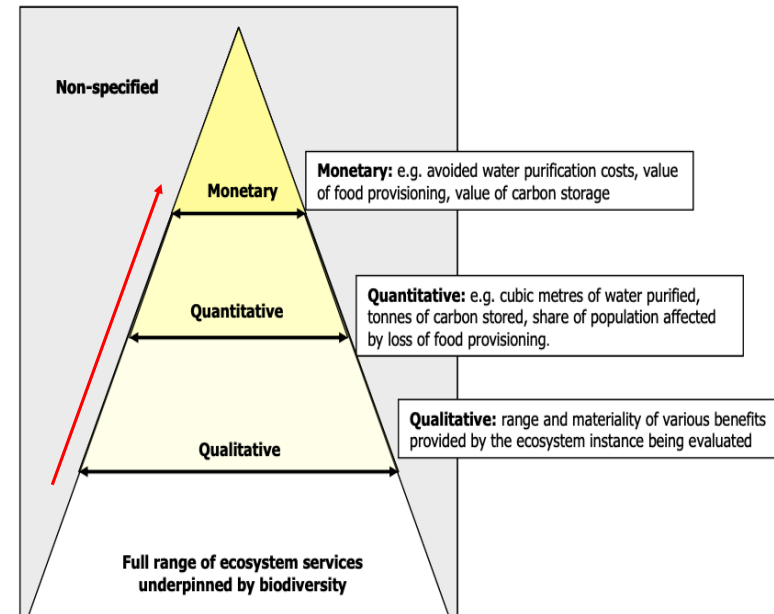
The business model consists of four elements:

- (1) a Step-by-Step Guidance: with more detailed information about how to use the BM and how to complete every step.
- (2) a Technical Manual in which all used methods are explained into detail.
- (3) a multi-criteria analysis (MCA) tool (in Excel): this tool will allow you to compare different scenarios qualitatively, quantitatively, and monetarily
- (4) a factsheet that summarizes the outcomes of the analysis and can be generated through the Excel-tool.

You will need to prepare some information to apply the MCA tool:

- Information on the types and amounts (e.g. how many square metres of grass?) of green, grey and blue infrastructure in the current scenario and (possible) future scenario(s). The more precise your data are, the more accurately the tool can estimate the costs and benefits.
- Precise information about the targeted area, these could include: number of inhabitants who will benefit, average price of a house, average annual rainfall, average price of electricity, etc. This case specific information depends on the ecosystem services you will choose to evaluate.
- Information/Estimation about the costs of your proposed installation(s) are advised but not obligatory to use the tool, ball-park figures are provided.

By following the next steps, you will be able to estimate the value of any green infrastructure project. In case of doubt or if anything is unclear, please consult the Guiding Document.



This pyramid shows a hierarchy of different types of results used in our tool. From the full range of ecosystem services present, it can be seen that most can be expressed in qualitative terms, such as impact on human well-being. Some can be measured quantitatively, and some of these can be converted into monetary terms. Our tool uses this approach, with results at each level that the ecosystem service in question permits. The hierarchy is not based on importance or significance, but rather on the feasibility of valuating ecosystem services and the probable risk of double counting. And in addition to the results our tool calculates, there may be further added value from other ecosystem services that you have not chosen to measure.

Step 0: Project Description	Before starting the MCA, you will need to describe some important characteristics of the target area as well as the current scenario and one or more future scenarios.
Step 1: Selection	This step will allow you to select the desired ecosystem services, which will be used during the next steps of the MCA to evaluate your scenarios.
Step 2: Parameters Selection	This step serves to gather specific information on the targeted area and green infrastructure project, which will be used for calculating the costs and benefits.
Step 3: Quantification	This step allows to quantify the impacts of different scenarios on ecosystem services in biophysical terms. You can choose to use generic data (based on the parameters you provided in the previous step) or case specific data (which you can calculate with support of the guiding document).
Step 4: Qualification	This step will allow you to compare the different scenarios using an intuitive 5-point scale to assign scores to the impact of the different scenarios on each of the ecosystem services. Give a description of the impact as argumentation of the score.
Step 5: Monetization	This step will convert the biophysical values into monetary terms. This will provide an estimation of the project's costs and the monetized benefits over 20 years and 40 years.
Step 6: Summary	This step gives the user an understanding of the estimated total impact of a project including green infrastructure. From this tab, users are able to compile their factsheet, which is an easily interpretable and visually enhanced overview of the project.

Instruction box

The purpose of this step is twofold. First, we want to gather some general information about the targeted area and to describe the situation as it is (baseline) as well as the (possible) future scenario(s) in some detail. When we use the concept of 'scenarios', we are referring to the (various) infrastructural plan(s) or design(s) you have in mind. These scenarios can contain small differences (e.g. a scenario with a park without trees vs. a park with trees) or large differences (e.g. constructing an impermeable parking lot vs. a green park). You can add, and thus compare, as many scenarios as you want, but note that the more scenarios you add, the more complicated this exercise will become.

The second objective of this step is to describe the baseline scenario (the current situation or situation before the infrastructural changes) and other (future) scenarios in as much detail as possible. When describing these different scenario(s), please calculate/estimate the total number or surface area of different infrastructure categories and types (the infrastructure present in the baseline and the new infrastructure). Infrastructural elements that are not present in the drop down list can be added manually, but note that you will need to make the necessary calculations concerning the costs and benefits of that new infrastructural type, yourself.

The background information and scenario descriptions will be featured on the factsheet.

Detailed information on how to complete this step can be found in the **Step-by-Step Guidance**.

The **Technical Manual** provides descriptions and illustrations of every green, blue, and grey infrastructural element available in the drop down list.

Background information

Characteristics of the target area		Description of the target area	Max amount of characters: 450
Country	<input type="text"/>		
Municipality	<input type="text"/>		
My project area can be qualified as	<input type="text"/>		
Surface of the project area	<input type="text"/>		
Number of people benefitting from the project	<input type="text"/>		

Defining your (public) green/blue/grey infrastructure

Scenario title	Tot. scenario area	Category	Type	Amount	Unit	Scenario descriptions
Baseline Scenario	4000 m ²	Low Green	Amenity grassland	2000	m2	
		Grey infrastructure	Rustic playground	2000	m2	
		Fruit and vegetables	Fruit tree (cherry)	100	amount	

Instruction box	Select an element to see the correct radar chart
<p>The purpose of this step is to select the ecosystem services that you'd like to evaluate during the next steps (for more information about ecosystem services, we refer to the Technical Manual). Preferably choose the ecosystem services that will be impacted the most in the greener scenarios and please describe the reasoning behind your choices. The spider diagrams featured in the top right corner can support you in choosing the ecosystem services that will be impacted by your envisaged infrastructural changes. For each category of green, blue, and grey infrastructure the spider diagrams will show the most relevant ecosystem services. Note that all other ecosystem services, which were not selected, will not be considered in further calculations. This does not mean that their benefits are negligible.</p> <p>Our list summarises the most common and relevant ecosystem services. Please, note that not all possible ecosystem services are displayed in this list and that you can add further ecosystem services specifically relevant to your green infrastructure project. Also note that the more ecosystem services you select, the more you will need to calculate in the next steps. We would recommend choosing between 4 and 6 ecosystem services.</p> <p>Detailed information on how to complete this step can be found in the Step-by-Step Guidance.</p>	<p style="text-align: center;">Green roof</p>

Ecosystem services	Short description of ecosystem services *	Include in assessment? Yes/No	Justification
Food	For instance, by implementing allotment gardens or planting fruit trees, residents can benefit from the food that is produced.	YES/NO	
Materials	Vegetation is a source 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/NO	
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 losses 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/NO	
Air filtering	Green infrastructure can improve air quality by removing pollutants from the atmosphere, including ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2) 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/NO	
Aesthetic appreciation	Aesthetic value refers to the interaction of people with the environment related to natural beauty based on human perceptions and judgments.	YES/NO	
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/NO	
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/NO	
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 to learn 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 networks of (in)formal relationships among neighborhood residents. For example, parks and recreation areas are important meeting places for inhabitants (children, older people, etc.).	YES/NO	
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	

Instruction box

This step serves to gather important information to accurately estimate the costs and benefits for each scenario you described. Based on the selected ecosystem services (step 1), a table will appear where you will need to fill in some general and more specific data/parameters.

Note that the maximum level of valuation in which the ecosystem services assessment is executed (qualitative, quantitative, monetary) is indicated by colours as is explained below.

Detailed information on how to complete this step can be found in the **Step-by-Step Guidance**.

In the **Technical Manual**, you find how these parameters contribute to the results.

Legende

Monetary

Quantitative

Qualitative

ESS

Necessary data for calculations

BASELINE SCENARIO

BASELINE SCENARIO

Instruction box

Based on the information provided in the previous steps, this table offers an overview of the biophysical values of ecosystem services created in each scenario. The calculations are based on generic

BASELINE SCENARIO

Instruction Box

This step focusses on the cultural ecosystem services. For each cultural ecosystem service chosen in step 1 (selection) a set of questions will appear where the user will have to denote the importance of the question (a score from 1 (no importance) to 5 (very important)) and to what extent the different scenarios relate to the question. This scoring is done below for every scenario and the scale ranges from 0 'not at all', over 1 'to a limited extent', and 2 'to some extent', to 3 - the highest score - meaning 'to a great extent'. The importance scoring can be used to adapt the calculations to features that are deemed more relevant than others in your municipality, thus putting extra weight on some questions. Based on this exercise, an overall score for each cultural ecosystem service will be proposed in the next step (step 4, qualification), which will enable comparisons between different scenarios.

In addition, the user should 'flag' or choose a maximum of 3 questions per ecosystem services that will appear on the Factsheet.

Detailed information on how to complete this step can be found in the **Step-by-Step Guidance**.

Information on how these questions are used to score the cultural ecosystem services and on the method itself can be found in the **Technical Manual**.

Legend:
Not at all=0
To a limited extent=1
To some extent=2
To a great extent=3

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

Instruction box

The purpose of this step is a qualitative assessment of the impact of different scenarios on the selected ecosystem services. Thus, based on the number of scenarios you described (step 0) and the selected ecosystem services (step 1) a table will appear. First describe the expected changes in ecosystem services qualitatively (in words) for each scenario. Then continue by giving a score for every ecosystem service in every scenario. To help you with this:

A) the tool provides suggested values for the cultural ecosystem services based on worksheet 'D - Cultural ecosystem services'. Press the 'Reset values' button in the 'Nature Smart Cities' tab in the top-left corner for this.

B) other ecosystem services were quantified in worksheet 'S3 quantification', these results can guide you to give a relevant score.

These scores will be denoted on a spider diagram which will also be featured in the fact sheet.

Detailed information on how to complete this step can be found in the **Step-by-Step Guidance**.

Theoretical explanations on ecosystem services that should help in scoring objectively can be found in the **Technical Manual**.

Qualitative assessment

	Scenario description
<i>BASELINE SCENARIO</i>	0

Scale

0
1
2
3

Legend

No contribution to Ecosystem Service level/outcome
Some contribution to desired Ecosystem Service level/outcome
Good contribution to desired Ecosystem Service level/outcome
Excellent contribution to desired Ecosystem Service level/outcome

Instruction box

This step makes an estimation of how much each scenario will cost. Since these are based on default values, but we strongly advise to use more specific figures if they are at your disposition. Such location specific values for construction/maintenance costs can be inserted in every 'custom value' cell. When the 'custom value' cells are used, they overwrite our generic data, when they are left blank, the generic data is used. The generic data will be filled in based on the scenarios and infrastructure types described in step 0 (project description). These data are average costs based on the literature.

In the 'Nature Smart Cities' tab in the top left corner, the button 'Rebuild 55 costs' should be pushed to actualize your costs.

The construction and maintenance cost for 20 and 40 years will be calculated automatically. You also have the option to let the maintenance costs start at a later point in time by filling in the column 'In which year should the maintenance cost start?'. Be aware that the cost of disposing/removing infrastructural types is not included in the calculations.

Detailed information on how to complete this step can be found in the **Step-by-Step Guidance**.

More information of how calculations are made can be found in the **Technical Manual**.

Choose an exchange rate (if not €)	1
Cost calculation	AVERAGE

Scenario	Element	Construction Costs				Maintenance cost / year				Quantity	Quantity Of which newly built	Units	Total Construction Costs	Total Maintenance Costs		
		Lower bound	Upper Bound	Custom Value	Units	Lower Bound	Upper Bound	Custom Value	Units					In which year should the maintenance cost start	Yearly maintenance	Long term (40 years)
Baseline Scenario	Amenity grassland	11,00	20,00		[currency]/m ²	0,39	0,39		[currency]/m ²	1	280,00	2000	m2		#NOM?	#NOM?
	Rustic playground	10000,00	100000,00		[currency]/pc	450,00	450,00		[currency]/pc	1	450,00	2000	m2		#NOM?	#NOM?
	Fruit tree (cherry)	14,00	32,00		[currency]/pc	160,00	160,00		[currency]/pc	1	16000,00	100	amount		#NOM?	#NOM?

Instruction box

This step monetizes (most of) the benefits provided by the selected ecosystem services for each scenario. You can choose to use generic data or fill in case specific data , if they are at your disposition (e.g., obtained through case specific research that was conducted). As was set out in step 2 (parameter selection) not all ecosystem services can be monetized (e.g. habitat for biodiversity, air filtering, education and raising awareness, social cohesion, and attraction to companies and investments).

You can choose to use the 'standard discount rate' of 3,50% or fill in another discount rate under 'custom value'. Note that only the selected ecosystem services will be monetized, which does not mean that the other ecosystem services have no value.

Detailed information on how to complete this step can be found in the **Step-by-Step Guidance**.

For more information about the monetization of ecosystem services, and methods please consult the **Technical Manual**.

STANDARD DISCOUNT RATE OF	3,50%	Custom value if not 3,50%	Used Exchange rate (S5 - Costs)	1,00
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BASELINE SCENARIO	Quantified result	Unit value	One-time benefit	Annual benefit	Total Benefit (20yr life span)	Total benefit (40yrs life span)
TOTAL MONETARY BENEFITS BASELINE SCENARIO				0,00	0,00	0,00



Business Case Factsheet

CITY OR MUNICIPALITY



Landscape



Project Area



Number of inhabitant
Image of project area

Description

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Scenario Comparison

BASELINE SCENARIO

BASELINE SCENARIO

Ecosystem Services

- Food
- Materials
- Education and raising awareness
- Habitat for biodiversity
- Carbon sequestration
- Physical and mental health
- Noise pollution
- Aesthetic appreciation
- Attractor for companies and investors
- Air filtering
- Micro climate regulation
- Recreation, and Tourism by external visitors
- Social cohesion
- Real estate prices
- Water retention and infiltration

Selected Parameters

Currency:

BASELINE SCENARIO

BASELINE SCENARIO

Financial Information

	BASELINE SCENARIO	BASELINE SCENARIO
Initial investment	€ 0,00	€ 0,00
<p>Initial Investment per selected scenario (μ 2020)</p>		
Maintenance Costs (currency/yr)	€ 17 230,00	€ 17 230,00
<p>Maintenance Costs per selected scenario (μ 2020)</p>		
Monetary Benefits (currency/yr)	€ 0,00	€ 0,00
<p>Monetary Benefits per selected scenario (μ 2020)</p>		

Conclusion

Free text box