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Sustainability Benefit Assessment as a financing mechanism for urban wetland protection

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Summary

Wetlands face threat from increasing urbanisation. With increasing population, the pressure on natural wetlands, to be used for more economically beneficial purposes, is very high. In order to protect the urban wetlands, financial resources are required which are often not sufficiently available with the government. Alternative sources of finance can be identified, especially from the private sector. However, since wetlands are not very productive in the 'economic' terms, it is difficult to generate funds for their protection.

The research consists of identification of sustainability benefits of Beddagana Wetlands in Colombo to demonstrate the methodology of SBA and further making use of this assessment to test the feasibility of finance for urban wetlands. The main objective of the research is to explain that to what extent, and in which form, visibility of sustainability benefits can help to make wetland conservation attractive for finance.

Previous researches have been instrumental in forming the basis of this research. The theoretical background helped in identifying concepts within the overall purview of ecosystem services, wetland conservation and financing mechanisms for ecosystem preservation.

The research makes use of a mixed method design that comprises of survey, secondary sources and modelling as means to collect data for SBA and interviews as the main method to collect data for identifying financing mechanisms.

The research found that Beddagana wetland has 23 sustainability benefits to its credit that involve several benefits at individual, local and global scale. These benefits are social, economic and environmental in nature. Further, on testing the application of SBA for financing through CSR, it was found that SBA would be best used as a decision making tool for both private sector as well as the government. By introducing it through government policy, SBA has the potential to emerge as a stronger force being supported by legal mandates to ensure CSR initiatives are directed towards projects like wetlands that are otherwise rarely adopted by corporates. Within the private sector, SBA can be used for internal decision making and for branding.

Future research in this subject can explore SBA as a co-mechanism and can further explore systems for standardisation on assessment method.

Keywords

Urban Wetlands, Ecosystem Services, Sustainability Benefit Assessment, CSR, Government Prioritisation

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Shweta Raghaw

Foreword

Natural environment has always been threatened by human interference. Over-use of the resources has been responsible for deterioration of natural assets since man learned to use nature for his benefit. Though we have realised the consequence of unprecedented urbanisation, the concept of sustainability has been there only for three decades. Since the Brundtland Commision's definition of sustainable development (SD), a lot of work has been done to know how SD can be achieved. This research draws its theme from such previous works that have contributed to the cause of ecosystem preservation.

Abbreviations

AGM	Assistant General Manager
CDM	Clean Development Mechanism
CSO	Civil Society Organisation
CSR	Corporate Social Responsibility
ES	Ecosystem Services
IHS	Institute for Housing and Urban Development
MCUDP	Metro Colombo Urban Development Project
MMTC	Metals and Minerals Trading Corporation of India
NGO	Non Governmental Organisation
PES	Payment for Ecosystem Service
SBA	Sustainability Benefit Assessment
SD	Sustainable Development
SLLRDC	Sri Lanka Land Reclamation and Development Corporation
UDA	Urban Development Authority
WTP	Willingness to pay

Table of Contents

List of Tables

List of Figures

List of Images

List of Maps

Frog Chorus

A swamp in Malaysia produces the most beautiful sound on Earth, according to an online competition. The two minute audio clip of Kubah National Park in Sarawak at dusk beat other global beauty spots and recordings of laughing babies in the competition for online association BeautifulNow. One expert said, "*It was a sound of a swamp with frogs singing. The most amazing, rich recording of just life – teeming life.*"

http://www.beautifulnow.is/sound

Chapter 1: Introduction

1.1 Background

The growth of urban population had been on rise throughout the twentieth century resulting in 50% population of world residing in cities by 2008 with approximately 60% population expected to be living in cities by 2030 (UNFPA 2007; UN Habitat 2011). Urban populations have been dependent on wetland resources throughout history. The Mesopotamian civilization flourished on the flood plains of Tigris and Euphrates. The relatively flat terrain, in addition to easy access to water, makes flood plains an easy target for occupation and then deterioration (McInnes 2013). The increasing population has a direct impact on all natural resources, wetlands being only one of them. According to Ehrenfeld, 2000 a survey by the US Dept. of Agriculture concluded that urbanization was responsible for wetland loss in 96% of surveyed watersheds and may account for as much as 58% of total wetland loss in USA.

Cities have grown considerably over the last century, more so along the water. The magnitude of development along coastal wetlands can be understood by the fact that all of the cities with over 1 million populations in South America are located along coast. Additionally, 75% of all 1 million and above population cities are coastal in nature in Asia and Africa (Ehrenfeld 2000).

Till as recent as mid of 20th century wetlands were considered unhealthy sites that restrict development and consequently economic gains. This lead to neglect reflected in abuse faced by these sites. The consequence was seen in disappearance of wetlands by draining them. The attitudes have however changed since then, on realizing the ecological role played by wetlands (Boyer & Polasky 2004).

Urban ecosystems are often referred as 'green' infrastructure since they play an important role by delivering ecosystem services. The services received from wetlands are classified as provisioning, regulating, cultural and supporting. Provisioning services include direct materials like food, fibre and timber. Regulating services are received in the form of ecosystem processes like air quality regulation, temperature regulation, noise reduction and waste treatment. Cultural services are non-material benefits received in the form of recreation, educational and spiritual values. Supporting services are the vital services that are essential for production of all other services like soil formation, water cycling and photosynthesis (Gómez-Baggethun & Barton 2013; Wallace 2007).

Urbanisation can have devastating impacts on the physical and ecological environment of wetlands which include changes to hydrology, geomorphology, vegetation and fauna. Some of the easily observed changes are increased rainwater runoff, increased flooding, change in water quality, change in shapes of landforms and attack of invasive species whereas some of the less visible impacts include reduction in plant and animal species, changed soil quality, destruction of habitat and reduced ground water recharge.[1]

According to Boyer & Polasky 2004 urbanization is one of the largest reasons for loss of wetland areas. Primary impacts include conversion of land-use into residential/ commercial areas or using the land for road infrastructure. Secondary impacts are consequences of urbanization as a means to impair wetland functions.

[1] See Annex I (a) for detailed impacts

1.1.4 Challenges for wetland restoration

The cost of preserving wetlands is very high and government agencies and private parties tend to ignore restoration due to high resource requirements (Boyer & Polasky 2004). Often, in absence of sufficient funding, the managing organisations are no longer able to maintain ecosystems in desirable status thus turning them into officially designated spaces, without the characteristics of one. (Chen et al. 2014). Thus, lack of financial resources is one of the primary constraints in wetland restoration.

Owing to scarcity and high demands, land prices are high in cities. The profits earned by draining wetlands and converting them into residential/ commercial land uses act as incentives for land owners to seek ways of destroying wetlands and using them for monetary gains. Although wetlands provide important services, the private owners do not receive any returns for them (Boyer & Polasky 2004). In the choice between public and private benefits, in absence of strong regulations, the landowner decides to take decisions in favour of his own gains. However, according to Boyer & Polasky 2004, if it was possible to add up the value of benefits from wetlands for the whole society and then weigh it against the value of development, the social benefits would win. This points a way towards better wetland protection policies.

Further, the benefits of wetland protection are most often descriptive and non quantitative in nature where as the costs are monetary. Boyer & Polasky 2004 explain this by the concept of 'opportunity cost', which is the value of development that was possible without wetland protection. The benefits of wetlands, on the other hand, are not entirely quantifiable. In addition, the traditional accounting does not consider costs of replacing ecosystem services once they deteriorate. According to Gómez-Baggethun & Barton 2013, invisibility of these costs is an important factor for urban ecosystems being converted into built structures. It implies that the non-comparable nature of the costs and benefits is significant challenge.

Since most natural ecosystems are in the public domain, owned by the state, in most cases government holds all the rights. Correspondingly, government is the service provider and is responsible to act for protection of these ecosystems (Lau 2013). Dependence on government to fund protection can lead to problems for wetland conservation as environmental sector receives least priority when revenues are constrained (Baral & Dhungana 2014). Further, according to Jack et al. 2008, sometimes efforts to work towards ecosystem protection may be superseded by other governmental policies. Often, existing policies or tax regimes may conflict in the prioritisation assigned to them. This often leads to encouraging actions that are counter to the goals of ecosystem protection policy. Thus, prioritising other projects by giving them bigger share of budget and creating policies that favour decisions that conflict with wetland conservation are the two ways in which lack of government prioritisation is seen as a challenge in wetland protection.

1.2 Problem statement

As identified in the previous section of this chapter, the main problem is that wetland development and restoration projects lack prioritisation, due to lack of financial resources and because their benefits are not easily observed by decision makers. In the tradeoffs between invisible environmental benefits (due to lack of quantification) and tangible returns from land-use conversion (real estate) or simply abuse (dumping and disposal sites), the environmental benefits usually lose.

This research explains how visibility of benefits can help in attracting finance by identifying suitable financing mechanism for wetland development projects.

1.3 Research Objective

The main objective of the research is to explain that to what extent, and in which form, visibility of sustainability benefits can help to make wetland conservation attractive for finance.

1.4 Provisional research question

How does sustainability benefit assessment help in identifying potential financial mechanisms for urban wetland protection?

1.4.1 Provisional sub research questions

a. How can wetland restoration improve the sustainability of an urban area?

b. How can financing mechanisms be utilised to support sustainable development based on sustainability assessment?

1.5 Significance of the study

The research is significant as a decision making tool that can aid decision makers in government departments to prioritise projects based on their impact. Furthermore, this study may pave way for government to formulate policies for wetland protection based on valuation of wetland benefits. It also has much use for private investors as a decision making instrument in order to make informed choices from a range of projects that need attention by highlighting value of natural resources like wetlands.

Finally, this research intends to increase the already existing scientific knowledge on the ecosystem evaluation techniques by adding to the pool of research on this subject.

Chapter 2: Literature review

This chapter identifies the related theories from existing literature in the field of chosen research. It further reviews the theories and identifies concepts to make a conceptual framework for the proposed research. The structure of the following chapter is based on the following structure.

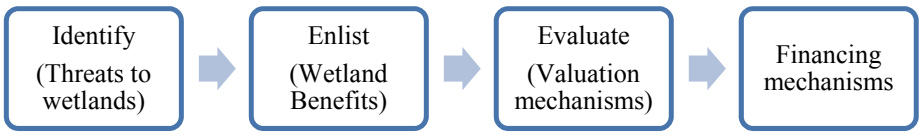


Figure 1 Literature review structure by author

2.1 Wetlands and urbanisation

As per (Ramsar 1971) wetlands are defined, under the text of the Convention (Article 1.1), as: *"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"*

According to Ehrenfeld, 2000 urban areas may have many wetlands, either as an evolved (deteriorated) form of natural wetlands or created wetlands as a consequence of human activities. She further elaborates on differences between wetlands in urban and non-urban context based on plant and animal species observed in both. In addition, urban wetlands constitute of physical features which are direct consequences of human activities like soil dumping, digging etc. Table 1 differentiates between wetlands in urban and non-urban context.

Criteria	***Natural Wetlands***	***Urban Wetlands***
Ecology	Ecological characteristics are primary	Ecological functions may be less important than human values
Level of disturbance	Natural disturbance regimes are critical	Natural disturbance regime may be impossible to restore
Management approach	Watershed based approach is ideal	Municipality based approach ideal
Habitat size	Habitat patches can vary in size and connectedness	Habitat patches are small and isolated. Connections are often lacking
Microclimate	Climate and microclimate reflect regional geography	Climate and microclimate differ significantly from regional climate
Hydrology	Hydrology is a function of regional climate and geology	Hydrology is highly disturbed in terms of amounts, sources and rate of flow

Table 1 Based on Ehrenfeld, 2000

According to Ehrenfeld 2000, p.257, "*urban wetlands need to be defined as reference domains separate from non-urban wetlands*". This stems from the fact that, for urban wetlands, local sites of reference must be established in each urban region to decide on standards of restoration.

2.1.1 Need for wetlands

"Cities depend on ecosystems and their components to sustain long-term conditions for life, health, security, good social relations and other important aspects of human well being." (Gómez-Baggethun & Barton 2013, p.235)

According to Gómez-Baggethun & Barton, 2013, urban ecosystems include all blue and green spaces in urban areas that encompass parks, cemeteries, gardens, urban forests, wetlands, rivers, lakes and ponds. As discussed in 1.1 these ecosystems provide ecosystem services that are essential for human health and survival and are classified as provisioning, regulatory, cultural and supporting.[2]

2.1.2 Need for restoration of wetlands

Wetlands degrade because of disturbances of varied nature. Grayson et al. 1999 classify the 'disturbances' into sustained and pulse types. Sustained disturbances also called as press disturbances are long-term continuous disturbances. These may be urbanization, pollution or urban run-off. Alternatively, pulse disturbances are short term disturbances like oil spill, deforestation for a certain infrastructure project over a short period. More recent publications like Gómez-Baggethun & Barton 2013, acknowledge climate change as a type of sustained/press disturbance that has both sustained and pulse effects.

Sustained/ Press Disturbances				*Pulse/ Short Term Disturbances*	
Example: Urban run-off		Example: Climate Change		Example: Oil Spill	
Sustained Consequences	Pulse Consequences	Sustained Consequences	Pulse Consequences	Pulse Consequences	Sustained Consequences
Change in ground water quality over a period of time	Flooding and damage to surrounding areas			Sudden death of lot of species in a wetland	Change in configuration of specie population but allowing invasive species colonize when number of species were low

Table 2: Author's own elaboration based on Gómez-Baggethun & Barton 2013; Grayson et al. 1999

2.2 Incentives for restoration

According to Boyer & Polasky, 2004 the possibility of quantifying value of the social benefits received by all and then comparing it to individual developmental benefits might pave the way for better wetland management policies. According to Kosoy & Corbera 2010, p.1229 *"Value represents the socially necessary labour time underlying the production of any commodity"*.

Boyer & Polasky 2004 assume that all ecosystem service values can be explained using the economic value approach and consider social, cultural and insurance values as part of economic values which can be either use values or non-use values.

[2] Refer Annex II (a) for detailed classification of ecosystem services

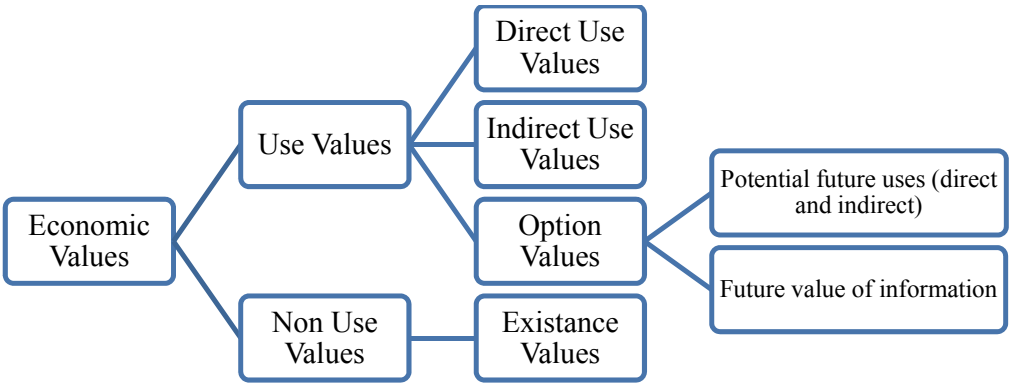


Table 3 Classification of economic values based on Boyer & Polasky, 2004

However, Gómez-Baggethun & Barton, 2013 explain the concept and framework for valuing ecosystem services by classifying them into economic values; social and cultural values; and insurance values.

2.2.1 Economic values

According to Gómez-Baggethun & Barton, 2013, there are various methods developed to quantify the economic benefits accomplished from urban ecosystems. Avoided cost methods are based on the fact that loss of natural systems will require creation of alternate ways to fulfil their functions. The costs incurred on these created systems can help in estimating the economic values. Other methods of calculating the values are hedonic pricing[3] and stated preference methods[4] (Gómez-Baggethun et al. 2010). Boyer & Polasky 2004 also suggest production methods as a means to approximate the value of increased productivity due to presence of wetlands.

2.2.2 Social and cultural values

The moral, spiritual and aesthetic values are part of social and cultural values (Gómez-Baggethun et al. 2010). Bolund & Hunhammar 1999, in their pioneer work on ecosystem services, stress on the importance of green spaces for physical and psychological well being supported by a study that showed that patients in a room facing park had 10% faster recovery and required 50% less strong pain relieving medication as compared to patients with rooms facing a building wall. Giles-Corti et al. 2005 discuss the importance of proximity to public open spaces for use as active and passive recreation spots. The research provides evidence for high usage of nearby spaces for physical activities and distant, more attractive spaces for passive recreation.

2.2.3 Insurance values

In the present day context when climate change is a crucial factor to be considered for each urban decision, it is important to understand the role that urban ecosystems play in improving the resilience and adaptive capacity of urban systems. Presence of urban ecosystems ensures provision of services which increases the ability of cities to self sustain (example: urban agriculture as solution for food security, urban forests to counter heat waves). Insurance values are similar to economic values. However, they are more difficult to quantify as they

[3] "Hedonic method uses observed market prices for composite goods with many characteristics that contribute to its value to uncover the value of particular characteristics for which there is no readily available signal of value." (Boyer & Polasky 2004)

[4] Stated preference methods refer to survey based methods that involve direct interviews regarding the willingness to pay for a certain service, environmental or otherwise (Boyer & Polasky 2004).

may change abruptly in case of crisis (pulse disturbances). Carbon storage as an insurance value is an important service provided by wetlands as they help in maintaining the temperatures by storing the GHGs (Gómez-Baggethun & Barton 2013; Grayson et al. 1999; Keith et al. 2009). In addition, state of urban ecosystems help in indicating the ecological health of urban areas. For examples, lichens help in indicating the air quality as they cannot grow in areas with polluted air.

2.3 Defining 'Sustainability'

The Brundtland commission defines sustainable development as the ability to meet the needs of present without compromising the ability of future generations to meet their own needs (Pope et al. 2004; United Nations 1987).

"Sustainability may be more than the sum of parts"(Pope et al. 2004)

According to CEE, 2007, sustainability is the action oriented variant of Sustainable Development and includes the following principles:

• Protecting Nature
• Thinking long-term
• Understanding systems within which we live
• Recognizing limits
• Practicing fairness
• Embracing creativity

Based on review of definitions and ecosystem values,
"*Sustainability benefits* of an ecosystem may be defined as the benefits harvested from that ecosystem that will contribute to a sustainable development of mankind."

All *'ecosystem services'* derived from nature form part of sustainability benefits.

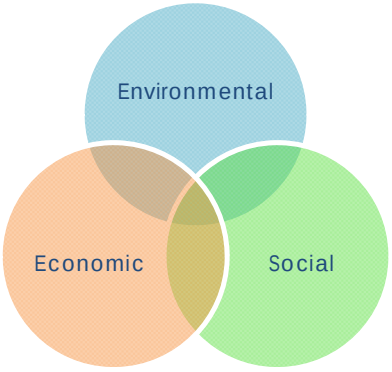


Figure 2 Three pillar model (CEE 2007)

CEE, 2007 explains the three pillar model of sustainability,

It comprises of the three intersecting circles representing social, economic and environmental dimensions which shows SD as being based on these three pillars.

CEE 2007 also considers a second, egg of sustainability model according to which SD is the sum total of human well being and ecosystem well being where both human and ecosystem are interdependent with continuous flows of stresses and benefits between the two.

2.3.1 Barriers in sustainability: Concept of *weak* and *strong* sustainability

According to Málovics et al. 2008s, *weak sustainability* assumes replaceability of natural capital by man-made capital where as *strong sustainability* advocates maintenance of available natural capital and argues that natural capital can only be substituted to a limited extent by man-made capital. The current knowledge on eco-system services like climate regulation, water purification, genetic diversity reinforces the concept of *strong sustainability*. According to Kosoy & Corbera 2010, the idea that all services provided by ecosystems can be accounted for and measured in terms of money encourages replaceability and thus leads to weak sustainability.

In addition, Gómez-Baggethun et al. 2010 explore 'incommensurability' which is the limitation of different values not being represented by a common measurement unit.

2.3.2 Sustainability benefits: Wetlands

Benefits derived from ecosystem services have been classified in different ways in literature. Wallace, 2007 challenges the classification by Millennium Ecosystem Assessment (2005) with an argument of services and processes being placed together. His version of classification distinguishes services from processes that are required to deliver services. However, Costanza, 2008 argues that this classification oversimplifies the classification and fails to acknowledge the complex and dynamic nature of ecosystems and their services. He addresses the possibility of pluralistic ways to classify services based on their spatial characteristics, excludability and rivalness. Spatial characteristics refer to point of usage or consumption of the service as shown in the following table.

Type	*Service*
Local proximal	Storm protection
depends on proximity (Fig. 5a)	Waste treatment
	Pollination
	Biological control
	Habitat
Global non-proximal	Climate regulation
does not depend on proximity (Fig. 5b)	Carbon sequestration
	Cultural/ existence value
Directional flow related	Water regulation/ flood protection
flow from point of production to point of use (Fig. 5c)	Water supply
	Erosion control
	Nutrient regulation
In situ	Soil formation
point of use (Fig. 5d)	Food production/ non timber forest products
	Raw materials
User movement related	Genetic resources
flow of people to unique natural features (Fig. 5e)	Recreation potential
	Cultural/ aesthetic

Table 4 Classification of services based on spatial characteristics Costanza, 2008

Further, following figure graphically depicts the dark core as location of ecosystem and each diagram depicts the different locations of usage of services from that ecosystem.

Alternatively, Boyer & Polasky, 2004 choose to base their classification on the type of value (Refer Table 3).

Figure 3 Classification of benefits based on spatial characteristics (author's illustration based on Costanza, 2008)

Lau 2013 argues that protection of ecosystems often get financed for its carbon sequestration function. However, such methodology ignores the multitude of different ecosystem services that are provided, in addition to carbon sequestration. The research further raises the issue of formation of mechanisms that can help to finance an ecosystem for services apart from carbon sequestration. Sustainability Benefit Assessment (SBA) is a relatively new approach to measure the benefits of a natural ecosystem, more so for urban wetlands which are one of the most abused and neglected urban ecosystems. The methodology is inclusive in nature so it includes a wide range of benefits like social, economic and environmental. Thus it addresses the limitation of previous methodologies. However, it excludes assessment of negative impacts (IHS & World Bank 2014).

IHS & World Bank 2014 uses the following matrix to classify sustainability benefits. The sustainability benefits matrix helps to identify the benefits of an ecosystem based on its characteristic of proximity (individual/ local/ global) and nature (social/ economic/ environmental).

	Individual	*Local*	*Global*
Social	X	X	X
Economic	X	X	X
Environmental	X	X	X

Table 5 SBA matrix

After reviewing the different classification methods, based on literature, sustainability benefits of urban wetlands are identified and classified on the basis of their nature and proximity.[5]

All social benefits have individual zone of influence like recreation, bird watching, culture & heritage, physical & psychological well being and quality of life. Economic benefits like fisheries, revenue from ticketing, agriculture and increased land values also affect primarily individuals. Only certain economic benefits like protection from floods affect both the individual in specific as well as the local area. On the other hand, a majority of environmental benefits have local level influence like microclimate regulation, storm protection and ground water recharge with some causing global impacts like carbon storage and reduction of green house gases (Bolund & Hunhammar, 1999; Boyer & Polasky, 2004; Gómez-Baggethun & Barton, 2013; Wallace, 2007; Zedler & Kercher, 2005).

This classification further reinforces the problem statement that since most environmental benefits are local and global in their reach and do not benefit individuals in specific, they are often overseen when benefits of wetlands are enlisted to be compared to the cost of protection.

2.4 Methods of benefit assessment

As is the case with benefits, the methods of benefit assessment (i.e. valuation methods) have also been classified in different ways. Ghermandi et al., 2006 evaluate the benefits of wetland services based on the following methods.

Figure 4 Methods of evaluating benefits of wetlands based on Ghermandi et al., 2006

These include both market and non-market methods. A second classification is made by NZIER, 2013 which categorises valuation methods in four types.

- Economic impact estimates
- Market based methods
- Non-market based methods
- Benefits transfer techniques

[5] Refer Annex II (b) for sustainability benefits of urban wetlands

2.4.1 Economic impact estimates

Economic impact estimates track the effect of introducing funds for an environmental cause in a local economy. However, they do not address the total economic value of assets.

2.4.2 Market based methods

These are direct methods of valuation where produces of a natural asset can be evaluated based on market prices. However, market based methods do not cover all non-use and non-commercial values therefore understate total economic value of assets.

2.4.3 Non-market based methods

The two categories of these methods include revealed preference methods which help in determining a value for a good or service by comparing value of associated marketed goods and services, and stated preference methods which use surveys to know people's perception.

Although stated preference methods are widely used and adaptable, they do not reveal actual values since they do not involve real trade-offs.

2.4.4 Benefits transfer techniques

This technique applies economic value estimates from one site to a similar project at a different site (NZIER 2013; Tallis & Polasky 2009).[6]

The total benefits received from an ecosystem can be compared to an ecological production function which according to Tallis & Polasky, 2009 is the total possible output of ecosystem services that are provided (*produced*) by an ecosystem. Changes in ecosystem conditions due to natural disturbances or human impact alter the amount of services generated, leading to a change in the amount of various services that can be provided. For example large scale conversion of forest land to agricultural land leads to increased provisioning services (food production) at the expense of regulating, supporting, and cultural services (temperature control, water regulation, storm protection). This changes the total economic value of ecosystems. Since provisioning services can be easily calculated in comparison to regulating/ supporting/ cultural services, change in land uses are often justified by depicting *'visible'* values of provisioning being more than *'invisible'* services.

2.5 Financing Mechanisms for wetland restoration

As concluded from chapter 1 and previous sections of this chapter, there is a need for restoration for wetlands and also challenges for restoration, non-availability of resources being one of them. The following section explores potential financing mechanisms for wetland protection by looking at non-visible and non comparable benefits being one of the most important challenges.

2.5.1 Corporate Social Responsibility (CSR)

"The core idea of the CSR concept is that the business sector should play a deeper (non-economic) role in society than only producing goods and making profits." (Málovics et al. 2008, p.913)

Pop et al. 2011 define CSR as a self regulating mechanism as part of the business model in which the company takes responsibility for the impact of its actions on environment, consumers, community and stakeholders. Though some critics consider CSR as merely a protocol to avoid strong government actions, its advocates argue that CSR is advantageous for long term profits.

CSR activities can be classified into internal and external. Internal practices include regulatory compliance to reduce the undesirable impacts of company's actions, adoption of

[6] Refer Annex II (c) for various valuation techniques and their characteristics

cleaner technologies, recycling and conservation of resources in general. External practices, on the other hand, include incentives for employees involved in environmental projects, philanthropic activities for supporting environmental issues and collaboration for environmental improvement projects. The external activities are more visible, have more focus on absolute sustainability but less followed by businesses, which are also restricted to local level. Research shows that western consumers are more 'green' and socially conscious in their mind (Málovics et al. 2008). This presents an opportunity for businesses to capitalize on their CSR choices. Mazurkiewicz 2005 credits the increased media attention for companies being judged on the basis of their environmental policy. According to him, stakeholders and customers now want to know about what and how companies do businesses. This increased transparency drives businesses to be involved in CSR.

CSR is driven by a mix of incentives and risks prompting the companies to improve standards and the drivers can be classified as economic, social and political as shown in the following table.

Economic Drivers	*Social Drivers*	*Political Drivers*
company image	pressure from NGO/CSOs	improved standing with government
improved risk management	pressure from local communities	legal, regulatory drivers
competitive advantage		political pressure
pressure from business partners		licence to operate
pressure from customers		
pressure from investors		
competitiveness		

Table 6 Drivers of CSR (Mazurkiewicz 2005)

These voluntary initiatives can be undertaken with the help of different vehicles for introducing initiatives.

2.5.1.1 Public sector as vehicle

Government involvement in helping CSR initiatives can help in making the transformation from a strict *"regulate and enforce"* approach to a *"facilitate and verify"* methodology.

Governments are highly interested in promoting voluntary initiatives in addition to their own environmental programs with the support of national and international institutes, NGOs, and corporate. Assistance from governments can be planned and programmed as a component in a national environmental program by stimulating the private sector by

- inform, sensitize and engage business in dialogue and negotiations concerning voluntary initiatives, and institutionalize this process
- offer incentives for and assistance to firms seeking to adopt more environmentally responsible business models
- re-enforce monitoring of environmental conditions and enforce sanctions.

(Mazurkiewicz 2005)

2.5.1.2 Corporate internal approach

Also termed as private sector involvement, Hanson et al. 2012 , in the Corporate Ecosystem Services Review, argue about the importance of ecosystems for businesses specifically. Using examples from Unilever and Potlatch (See Box), they help in understanding the direct

> **Unilever**—an international manufacturer of food, home care, and personal care products with brands such as Lipton, Surf, and Vaseline—experienced a problem at sea. Cod was the main fish used in the company's premium frozen food products. In the 1990s, however, cod stocks declined precipitously and collapsed altogether in the western North Atlantic due to overexploitation. The dramatic price increases that ensued reduced margins on Unilever's cod-related products by 30 %.
> **Potlatch**, a U.S.-based wood products company, did not encounter a threat but rather an opportunity. For years, the company had managed its forests for timber. However, its 270,000 hectares of forest in Idaho were a popular destination for hikers, campers, birdwatchers, and hunters, drawing approximately 200,000 visitor use-days per year. Recognizing an opportunity for a complementary source of revenue, the company introduced user fees in 2007 to capture the recreational value its forests provide.
> (Hanson et al. 2012)

relationship between companies and ecosystems which transform into risks and opportunities respectively.

Table 9 classifies and specifies some of risks and opportunities for businesses.

Type	*Risk*	*Opportunity*
Operational	Higher costs for freshwater due to scarcity Lower output for hydroelectric facilities due to siltation Disruptions to coastal businesses due to flooding	Water use efficiency Building an on-site wetland to circumvent the need for new water treatment infrastructure
Regulatory and Legal	Fines, new user fees, government regulations, or lawsuits by local communities that lose ecosystem services due to corporate activities	Engaging governments to develop policies and incentives to protect or restore ecosystems that provide services to a company
Reputational	Protests due to investments that degrade pristine ecosystems Companies being targeted by NGOs campaigns for purchasing wood or paper from sensitive forests	Communicating sustainable practices in order to differentiate corporate brands
Market and product	Customers switching to other suppliers that offer products with lower ecosystem impacts	Launching new products and services that reduce customer impacts on ecosystems Capturing revenue streams from company owned natural assets
Financing	Banks implementing more rigorous lending requirements for corporate loans	Banks offering more favorable loan terms Investors taking positions in companies supplying products and services that improve resource use

Table 7 Risks and Opportunities (based on Hanson et al., 2012)

2.5.2 Market based methods

Hein et al. 2013 explain different market based methods like eco-tourism, green commodities, payment for hydrological services, carbon markets and markets for biodiversity as means to help finance biodiversity conservation. Some of these means like green commodities are significant but do not guarantee long term funding. However, ticketing for eco-tourism and carbon/biodiversity markets can go a long way in ensuring flow of funding for the conservation. Market based methods like Clean Development Mechanism (CDM) are

one of the ways in which projects like wetlands may be financed. According to Gilbertson & Oscar 2009, carbon trading has two forms: Cap & Trade and Carbon Offsetting. Theoretically, the premise offered by Carbon offsetting, according to Siebel et al. 2013 states that the results from the sale of carbon credits paid for by the developed countries are invested in sustainable projects and technologies. Thus they are potential ways to finance sustainable development projects.

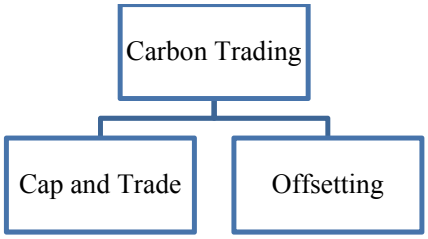


Table 8 Carbon trading: Types

However, there are certain limitations as observed by Pearson 2007; Gilbertson & Oscar 2009. The CDM has a project based market mechanism which prioritises least-cost carbon credits over projects with multiple benefits that are social, environmental and economic in nature. Though it is often referred to as a mechanism in which *"...polluters can pay someone else to clean up their mess so that they don't have to."* (Gilbertson & Oscar 2009, p.7), lessons, like sellable certificates and directing companies towards projects that need attention, can be learnt from CDM that may be developed into more suitable methods for ensuring sustainable development.

2.5.3 Public Private Partnerships (PPP)

According to Mazurkiewicz 2005, p.35,*"PPPs are a form of co-operation in which government and private companies assume co-responsibility and co-ownership for the delivery of negotiated services."* Through a case study of Anglesea Heathlands in Australia, Thackway & Olsson 1999 demonstrate the potential of using PPPs for environment conservation. The initiative involved exchange of development rights for a small part of land with majority of heathlands being protected. This approach is useful in cases where government does not have enough funds to acquire all environmentally sensitive land for protection. According to Thackway & Olsson 1999, following are the benefits of public private conservation:

- involvement of all related stakeholders to ensure social, economic and ecological values are supported by the wider community, industry and the government
- integration of community aspirations for biodiversity conservation with sustainable use of natural resources in the regional context to ensure the long term maintenance of ecological functions and services

2.5.4 Payment for Ecosystem Services (PES)

PES schemes can be defined as *'management tools'* that can help to change exploitive character of economic agents on the ecosystems by compensating for their losses. It can also help in generating revenues that can be utilized for interventions that reduce pressure on ecosystem goods or for overall restoration of degraded ecosystems. PES works on the principle of willingness to pay (WTP) for ecosystem services (Mombo et al. 2014). However, scarce resources are desired more due to increased populations. Higher density of human population leads to a deficit in supply, resulting in increased WTP (Gómez-Baggethun & Barton 2013).

Gómez-Baggethun et al. 2010 and Kosoy & Corbera 2010 criticise the idea of payment for ecosystem services by arguing that ecosystem services emerged as a pedagogical approach conceptualised raise public interest for biodiversity conservation. Kosoy & Corbera 2010 further argue that *'commodification'* and the idea of *'selling nature to save it'* means that markets are the only way to balance conservation and capitalism.

2.6 Sustainability Benefit Assessment and finance

The value of ecosystem benefits is often under-estimated and investing in protection of nature areas is usually still seen as being un-economical. However, according to Bernard et al. 2009, presently there is more scientific evidence that demonstrates that benefits of ecosystem services provided by protected areas are more than the conservation costs making it economically more beneficial to maintain natural systems in its multifunctional state. Although there is an increase in the attention given to use of ecosystem service valuation as a tool to calculate "full" economic value of protected areas, such methodologies are still scarce and more information is needed on how to link these values to financing mechanisms (Bernard et al. 2009).

Bonn et al. 2014 explore the potential to attract finance for peatland conservation in UK and Germany through regional carbon markets under CSR. The research identifies CSR as an important contributor to local peatland conservation projects. It further mentions the success of a template for the first regional carbon market for peatlands – MoorFutures in NE Germany. Thus, we know that CSR has the potential to contribute towards wetland protection projects. Market options vary on the basis that some pay solely for carbon and climate mitigation benefits, or pay for a wider range of ecosystem services derived from restoration.

With the success of regional carbon markets, SBA can be expected to be treated at the level of replacing the carbon market or Ecosystem Services Valuation because SBA is more inclusive since it includes a wide range of benefits like social, economic and environmental and provides both benefits as accounted for in carbon certificates as well as in Ecosystem Services.

However, due to the inter-connected and interdependent nature of ecosystem services, it is important to exhibit extreme care when identifying these services for itemization and valuation since ecosystem services may overlap. An area providing the service of flood protection will also be helping in water purification. Hence it is important to identify which service is being quantified and valued. This is especially important when multiple services are being considered in one geographical location (Lau 2013).

2.7 Conceptual framework

Figure 5 represents the conceptual framework for this research. Sustainability Benefit Assessment and financing mechanisms are the central concepts around which the research is built. SBA is carried out based on its own framework of types of benefits which can be further individual, local or global in influence (IHS & World Bank 2014). Potential financial mechanisms are explored from public, private and PPP and their feasibility is tested based on SBA. The connecting arrow between the concepts of SBA and financial mechanisms signifies that the application of SBA may influence the usage of financial mechanisms.

Figure 5 Conceptual Framework

Chapter 3: Research Design and Methods

The central theme of this chapter is the research design, data collection and data analysis methodologies. The aim of this part of research is to structure the framework for data collection and data analysis methodologies as a preface to facilitate collection of relevant data.[7] This chapter constitutes the detail framework for the data collection methodologies for Sustainability Benefit Assessment and also for subsequent testing of the SBA methodology.

3.1 Revised research question

How does sustainability benefit assessment influence identification of potential financial mechanisms for urban wetland protection?

3.1.1 Revised sub research questions

What are the sustainability benefits of urban wetland restoration that influence the sustainability of a city?

What are the key considerations of investors for financing wetland development projects?

What are the different ways in which SBA can be used to attract finance for urban wetland protection?

3.2 Operationalisation of concepts

Following table comprises of concepts identified in previous chapter and their respective definitions. These definitions help in translation of complex concepts into measurable values by first identifying the variable and then defining relevant indicators.

Concept	*Definition*	*Source*
Sustainability benefits	Sustainable development *"to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs"*	United Nations, 1987
	"Sustainability generally refers to a balance of economic, social and environmental goals, including those that involve long-term, indirect and non-market impacts."	Litman, 2014
	"the ability to meet the needs of present without compromising the ability of future generations to meet their own needs"	Pope et al., 2004
	"Sustainability may be more than the sum of parts"	
	Sustainability benefits of an ecosystem may be defined as the benefits harvested from that ecosystem that will contribute to a sustainable development of mankind.	Author
Ecosystem service	*''the benefits people obtain from ecosystems.''*	Wallace, 2007
	"Ecosystems provide businesses with numerous benefits or ecosystem services."	Hanson et al., 2012
	"ecosystem services can be understood as those benefits obtained from nature that satisfy human needs and simultaneously fulfil other species requirements"	Kosoy & Corbera, 2010

[7] Refer Annex III (a) for schedule for fieldwork

Evaluation	*"The making of a judgment about the amount, number, or value of something; assessment"*	Oxford Dictionary
	"monetary valuation are considered so useful and persuasive as a sign of ultimate worth"	Kosoy & Corbera, 2010
Corporate Social Responsibility	*"The core idea of the CSR concept is that the business sector should play a deeper (non-economic) role in society than only producing goods and making profits."*	Málovics et al., 2008
	"CSR is a form of corporate self-regulation integrated into a business model. CSR policy functions as a built-in, self-regulating mechanism whereby business monitors and ensures its active compliance with the spirit of the law, ethical standards, and international norms."	Pop et al., 2011
Market based methods	*"…are marketable just as any other commodity on the market and have an economic value."*	(Siebel et al. 2013)
Public Private Partnership (PPP)	*"PPPs are a form of co-operation in which government and private companies assume co-responsibility and co-ownership for the delivery of negotiated services."*	Mazurkiewicz 2005

Table 9 Key concepts: Definitions

3.3 Research Strategy

In theory, there are several assessment methods available (as reviewed in chapter 2), however, this research utilised the Sustainability Benefits Assessment methodology. The methodology comprises of quantification of benefits from an ecosystem. One of the limitation of SBA is non-uniform methods of assessment for different benefits. Thus, in order to address this constraint, the research strategy employed a mixed method design for benefit assessment that primarily incorporated survey as its main strategy with part use of modelling for data analysis. Further, in order to answer the main research question on identifying financial mechanisms interviews were used as the primary research strategy. An impact study was done in the second part of the research that included recording the responses of potential financers for wetland protection, based on their understanding of SBA as performed in the first part of the research.

Beddagana Wetland Project in Colombo, Sri Lanka was taken as a case example to demonstrate the use of SBA methodology and for further identification of potential financing mechanism.

Following section discusses the variables identified with respect to their indicators (and sub variables). Researchers in field of ecosystem valuation in the past researches have often used below mentioned variables to evaluate ecosystems. de Groot et al. 2010 present a list of potential indicators for services received from ecosystems.

The variables identified for SBA include recreation, physical & psychological well being, income, land value, flood protection, storm water storage, bird habitat, urban temperature and carbon storage. Each of these variables is essential to answer the first sub research question about sustainability benefits of urban wetlands. Further, these variables are defined by indicators and sometimes sub-variables followed by indicators.[8]

[8] Refer Annex III (b) for Variables, Indicators and respective strategies identified

Variable	*Sub-variable*	*Indicator*
Recreation	-	Number of users
Well being	Physical	Number of users for physical activities
	Psychological	Number of users for passive recreation activities
Quality of life	-	Perception
Income	Income from ticketing	Willingness to pay
		Number of users
Land value	-	Price of land
Flood protection	Infrastructure affected	Length and area of roads
	Built structures affected	Number and area of built structures
Storm water storage		Cost of drainage system
Habitat for birds		Number of bird species
Urban temperature		Temperature difference
Carbon storage		Canopy cover of vegetation

Figure 6 Variable and Indicators

The data collected on the basis of above table was used to understand the present scenario of the urban wetland area in Beddagana, Colombo. The present value of benefits was assessed to demonstrate 'value' of urban wetlands when they are in a degraded form.

The next step, as part of the research, was to use the present condition and estimate the changes assuming the scenario when Beddagana wetlands are restored. GIS modelling was used to analyse and present data collected on the basis of surveys and interviews. Since the research deals with a project that is expected to happen in future and will have an impact that will only be visible once the project is complete, modelling is the appropriate method for estimation of changes and impacts.

The second part of the research comprises of an analysis of what attracts organisations to invest in certain environmental programmes. These investments could be attracted from two sources:

1. From private sector
2. From local government as part of departmental funding

The research evaluated the willingness of local government and private sector to invest in urban wetland protection. It also attempted to understand tools and measures to make urban wetlands more conducive for investment by the above sources. Following table identifies variables and indicators for data collection on potential from finance from private sector:

Variable	*Indicator*
Role in CSR	Type of initiatives (internal/ external)
	Type of participation
	Preferred sector for involvement
Decision making on CSR	Procedure for selecting projects
	Influence of media/ market research
	Decision making body
	Importance of legal mandates
	Importance of branding
	Preferred zone of influence

Interest in market mechanisms	Previous experience with CDM or Carbon markets Willingness to invest in market mechanisms

Table 10 Private sector as financer: Variables

3.3.1 Scope and limitations of research strategy

The following table identifies the scope of research from within the list of sustainability benefits (also ecosystem service), which also helped in defining the variables for the research:

	Individual	*Local*	*Global*
Social	Recreation	Quality of life	-
	Physical and psychological well being	-	-
Economic	Income for government	Increase in land value	-
	-	Flood protection	-
Environmental	-	Sink for storm water	Carbon storage
	-	Habitat for birds	Urban temperature regulation

Table 11 Sustainability Benefits: Identification of scope

A major limitation to ensure accurate results of modelling was the availability of data. Effective surveys and interviews were instrumental in ensuring effective results. Moreover, modelling exercises mainly depend on quantitative data. However, wetland benefit assessment comprises of perception based qualitative data. Survey questions were designed, as far as possible, to obtain quantitative data from the respondents. Due to the assessment challenges representative indicators were shortlisted for which data is available. In order to overcome the challenges of accurate assessment, GIS based models were used, for example, to measure exact number of built structures that can be saved from flooding if the wetland project is successfully executed.

The second part of the research consisted of semi-structured and open interviews as means to collect data. The study, unlike traditional approach, did not comprise of a control group and test group, though, the study gave insights towards perception of wetland projects. In that respect, this impact study lacks, the 'with-without' and 'before-after' criteria. Thus, this was an ex-ante impact study.

In addition, collecting enough number of responses to ensure a valid experiment via interviews was also a limitation. The aim was to collect responses from maximum possible organisations to ensure the validity of the experiment. Since local government is unique in its role, only one response can be measured to understand government's perception. However, in terms of corporates, more respondents were interviewed to know the perception. [9]

3.4 Data collection instruments

The primary data collection for the sustainability benefit assessment was done with the help of survey questionnaires and secondary sources. The data required for quantification of social benefits was obtained primarily from survey of people near the Beddagana area. The survey group included two sub-groups of: residents that visit Beddagana to fulfil their recreation

[9] Refer Annex III (c) for list of respondents

needs and; the ones that visit other green spaces in the city. This was done in order to understand the park visiting habits of residents and to estimate the potential for use.

The data received from these sub-groups focuses on opinions and perceptions of people towards the wetland. Survey was appropriate for collecting data from larger sub groups which are necessary for identification of social benefits because reliability of data from large sub groups is higher. Non-probability purposive sampling method was chosen to carry out surveys of people in project area to ensure representation of both types of respondents. The total population of the study area, known as Sri Jayawardenepura Kotte, is over 100,000 persons. However, the study focuses on residents living in the vicinity of Beddagana. Different groups of sample included (refer figure 7).

- People living in the vicinity of the wetland and using Beddagana area for recreation
- People living in the vicinity of the wetland and visiting other open spaces for recreation

Figure 7 Sub groups for survey

Simple random sampling method was used to select respondents from the households in vicinity and users of park as observed during peak usage times (morning and evening). Following table elucidates on the type of questions that were addressed through survey.[10]

Survey	
Number of users	Local users using Beddagana Local users with potential to use Beddagana (current users of other open spaces)
Type of use	Active recreation Passive recreation
Perception	Importance of wetlands Importance of greenery Importance of lakeside

[10] Refer Annex III (d) for survey questionnaire

Willingness to use	Importance of recreation facilities Perception towards the change Expected increase in usage
Willingness to pay for facilities	
Views on expected changes due to park	Change in flooding Change in property values Change in pollution levels

Table 12 Data collected through survey

In continuation with the data collection instruments, information for economic benefits was also collected from secondary sources. Data about potential advertising income, land values and area prone to flooding was obtained from secondary data sources. This includes data from meteorological department regarding rainfall (http://www.meteo.gov.lk/#) and data on land prices from online portals for sale and purchase of property (example: http://www.lankapropertyweb.com/land/sale-Western_Kotte-bare+land.html). However, validity of this data was cross-checked by interviewing local respondents for land values and extent of flooding in the vicinity of project area. Real estate professionals were also interviewed for prevailing market rates of land in similar context elsewhere. Non-structured interviews were carried out with advertising agencies and advertisers to know about prevailing advertising rates and costs. GIS models were used to predict the extent of flooding based on which value of flood protection was deduced. Following table mentions the agenda for market survey and type and sources for secondary data collection.

Market Survey	***Secondary Data***	
Value of property in wetland area	Value of infrastructure protected from floods :	Number of built structures affected (GIS) Length of road affected (GIS)
Advertising costs	Human life protected from floods :	Area affected (GIS) Population density (Secondary data)
	Bird species diversity:	Environmental Screening Report for Establishment of Beddagana and Kotte Ramparts Parks (2011)
	Vegetation:	Canopy size of vegetation(GIS)
Observation		
Temperature variation		

Table 13 Secondary Data Collection

The second part of the research, which involved identification of potential financing mechanisms for urban wetland protection, employed interviews as the main data collection method. The two types of respondents were identified that can help to prioritise financing at two different levels. Since local government provided unique information on its views about financing priorities and potentials, it is categorised as 'Key informant'. Corporate interviews, on the other hand were carried out with different organisations in various locations. Purposive sampling methodology was employed to select respondents for these interviews. Thus, in-depth semi-structured interviews were carried out with different type of potential donor/ financing agencies and different respondents were tested for their willingness to finance urban wetland projects.

The interviews were structured to collect data on financing policies of organisations, especially in the environment sector. The variables included role in CSR, decision making in CSR, interest in market mechanisms and interest in direct investments. The indicators of

respective variables are specified in table 10. The structure of interview was based on following[11]:

1. Sectors in which donations are made as part of CSR
2. Criteria for deciding
3. Why not wetlands?
4. Check willingness to donate for wetland conservation

Following respondents were identified based on purposive sampling:

Private sector involvement

1. Cheminova India, Mumbai
2. MMTC, New Delhi
3. Samsung, New Delhi

Local Government prioritisation

1. Sri Lanka Land Reclamation and Development Corporation

Local government representative was interviewed in a non-structured interview in order to gain information about the budgetary allocations, system of project application and approval and involvement of other organisations for wetland conservation.

3.4.1 Pre-testing

Both, the survey questionnaires and interview questions were pre-tested and changes were made before the beginning of the fieldwork. However, on being more familiar with the site and after evaluating the responses of first few respondents for survey, some necessary changes were made to the questionnaire to ensure it comprised of most relevant questions.

For interviews with corporate, questionnaires were provided in advance (before fieldwork) and feedback was used to revise questions for final interview

3.5 Validity

Internal validity refers to the inference of the independent variable being responsible for the observed result. The previous section on variables and the literature review help in identification of a list of benefits and corresponding variables. Though, the list is non-exhaustive it includes a wide range of sustainability benefits. The variables chosen for research, however, are only a part of the large variety observed.

As far as the external validity is concerned, the research results hold true for other similar contexts as well. The sustainability benefits of urban wetlands are similar, with variations for special contexts. Thus, the experiment on identifying potential financing mechanisms is applicable for other situations as well.

3.6 Reliability

Reliability of a research refers to the ability of the instruments to produce same results each time it is used under same conditions. Data was obtained from multiple locations to check irregularities.

[11] Refer Annex III (e) and (f) for detailed interview questions and hand out that helped in presenting the research.

For survey, all respondents were asked the same questions to ensure reliable results for data collection on social benefits of the park. Different respondents were posed with same questions on different days and at different times of the day.

Data triangulation was done from different sources like primary sources (survey, interviews) and secondary sources (project reports, GIS data, commercial websites) to ensure credibility of data to ensure all sources provided analogous data. Data on property values was cross-checked from three sources, two being real estate companies and the third being local residents. Data on advertising costs was obtained from an advertising company and also from a client who used the services of advertising. The ground reality of all factual data obtained from newspaper articles and reports was checked by interviewing local residents and personal observation.

3.7 Scope and limitations of the research

The limitation of this research corresponds to the limited number of variables chosen for study due to limited time period for data collection. The criteria of choosing variables is based on the aim to make a comprehensive list of variables that include benefits at each scale of influence (individual, local, global) and represent the three attributes of sustainability (social, economic, environmental). Due to the time constraints, two related benefits from each matrix are chosen to complete the sustainability benefit assessment framework (refer table 12).

Although the research addresses the quantification techniques and methods in Chapter 5 by quantifying some of the benefits, detailed and overall quantification for assessment of benefits was not possible as there is no one standard method. Each benefit requires its unique technique, some of which are shown as examples. Due to short time period, the research needs to rely on secondary data to a certain extent for validating existing situation.

Regarding the sampling of respondents for corporate interviews, purposive sampling technique was incorporated based on corporate that are involved in environmental initiatives. However, the sampling was largely governed by the response rate of selected respondents. Thus it is closer to convenience sampling based on availability of respondents.

True picture revealing regarding the government willingness is somewhat limited because of the unwillingness of the government officials

Limitations in terms of primary data collection also include language barrier since part of research was carried out in non-home country. The native language of the region is Sinhalese though English is a commonly understood language as well. The researcher ensured presence of a native language speaker during survey/conversations with respondents.

Chapter 4: Background and context

This chapter presents a brief overview of the study area which includes context of the site, climate, natural drainage system, eco system. It has also attempted to identify typology of the study area.

4.1 Location

Sri Jayawardenapura Kotte is in continuation with the Colombo Municipal Council and Dehiwala Mt.Lavinia Municipal Council that together form the most urbanized part of the core area of the Colombo Metropolitan Region.

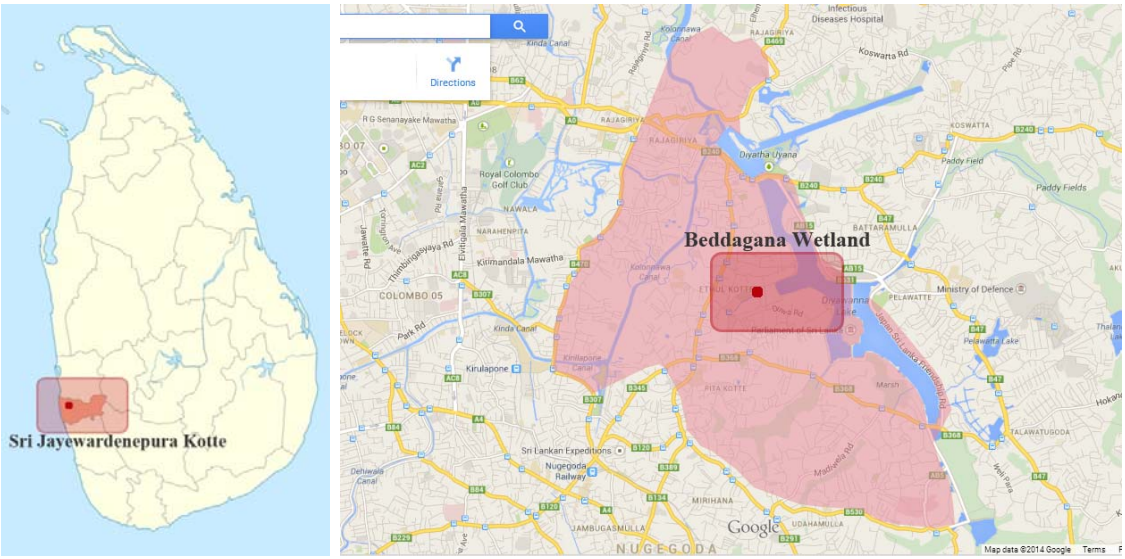


Image 1 Sri Jayewardenapura Kotte Location
(Source: Google Maps and
http://en.wikipedia.org/wiki/Sri_Jayawardenepura_Kotte#mediaviewer/File:Sri_Lanka_location_map.svg)

An important aspect of this region is its topography that is characterized by presence of low-lying, water logged and marshy areas. These local freshwater marshlands provide potential for open spaces. These wetlands also act as retention areas for the heavy rainfalls during the South West Monsoon from May to August. In Ethulkotte ward, in which Beddagana is located, approximately one-third (32%) area is covered by these marshy lands. The land form is undulating at an average of 2 m above MSL to + 10 m MSL (Uni-Consultancy Services 2011; Wijayapala 2003; Wijayapala 2013).

4.2 Climate

Located in the wet zone of the country the area receives an average annual rainfall (30 yr period) of 2400 mm. The mean average day temperature is 30 C and mean average night temperature is 27 C. The average maximum and minimum temperatures are 31ºC and 24ºC respectively (Climatemps 2009; Wijayapala 2003).

4.3 Project area

The Beddagana urban wetland, which is part of the flood plains of the Diyawanna Lake (Image 2), has been a habitat and breeding site for local bird population. Habitats as diverse as ponds, wet shrub lands, seasonally flooded grasslands and mud flats are found in this vicinity (World Bank 2013). Additionally, the wetlands are also responsible for flood prevention and temperature control in the Colombo city. The wetlands face threat from

uncontrolled access and development activities in the vicinity (Uni-Consultancy Services 2011). The identified area is approximately 32 Hectares and is bound by residential land on North, South and West with Eastern edge bound by Diyawanna lake as shown in Image 2.

Image 2 Location of Beddagana Wetland
(Source: Google Maps)

4.4 Beddagana Biodiversity Park Project

Metro Colombo Urban Development Project (MCUDP), an initiative of Ministry of Defence and Urban Development (Government of Sri Lanka), is a city wide project that aims to tackle the issues of urban drainage and flooding by improving the drainage infrastructure and management system of the Colombo water basin.

The MCUDP comprises of two parts,

1. Flood and drainage management
2. Institutional strengthening for sustainable metropolitan and local infrastructure and service provision and implementation support

Beddagana Project is one of the 8 sub-projects that are part of MCUDP.[12] The proposed project aims to create a Bio Diversity park and bird sanctuary which will include recreational facilities like jogging tracks, eco recreation areas, and walking trails (Image 3).

> *"Subproject is aimed to be implemented as an integrated development plan by the UDA, which will improve, rejuvenate, and protect the existing bio-diversity park, provides green recreational opportunities, ensure that swamps and marsh areas of the park functions as a flood retention area around the parliament lake."*
>
> (Ministry of Defence and Urban Development 2012, p.XVIII)

The Beddagana Wetland Project seeks to conserve the wetlands which includes removing waste from the water channels, restoring the open space next to the wetlands which includes removing waste from the water channels, restoring the open space next to the wetlands and

[12] Refer Annex IV (a) for a list of sub-projects under MCUDP

ensuring the wetlands are restored closer to their natural form (Uni-Consultancy Services 2011).

According to the report by Ministry of Defence and Urban Development, 2012, there is a high demand and pressure to develop these lands since the adjoining residential areas have infrastructure facilities and command high land values. There is threat of encroachment by private developers and squatters. UDA aims to preserve the flood retention, high ecological quality of the area.

Image 3 Proposed Beddagana Biodiversity Park (Uni-Consultancy Services 2011)

Chapter 5: Research Findings

The following chapter presents the findings of the first part of research carried out in field in Colombo city and the findings from interviews with potential funding agencies for the second part of research.

5.1 Sustainability benefits of Beddagana Wetland area

> *"The value of wetlands depends on the circumstances and the services provided. Wetlands that provide flood control near urban areas, water filtration near sources of urban drinking water, bird watching or other wildlife watching opportunities near urban centers, nursery grounds for commercial or sport fisheries, or habitat for endangered species are likely to be quite valuable."* (Boyer & Polasky 2004).

This section of findings aims to identify the benefits of Beddagana as per SBA methodology. The research scope it includes an assessment of change (increase or decrease) in the services received from Beddagana. The values have been quantified for some benefits, whereas for others, it only specifies the direction of change in values.

Part of findings comprise of results from a questionnaire based survey for the residents for park usage habits. The second part comprises of information from open interviews carried out in Colombo to collect information. An important component of findings is based on GIS models which include assessing the losses from floods and certain environmental benefits.

5.1.1 Social Benefits

Social benefits were primarily assessed by the means of survey that was carried out near Beddagana wetland. This was done in order to identify the current users of the area. Out of a total 56 (N) respondents, only about one third (18) of the users choose to visit Beddagana for recreation. Subsequently, the study is based on two categories of users, first being the actual current users of Beddagana and the second being the residents that visit other parks for their recreational needs. This study of groups helped to identify future potential of its usage based on park visiting habits for other parks.

5.1.1.1 Recreational benefits

Type of use

	Active recreation		Passive recreation		
	n	Active %	n	Passive %	N
Beddagana Wetland Area	14	77.8%	4	22.2%	18
Others	8	21.6%	29	78.4%	37

Table 14 Physical and Psychological well being

In the Beddagana area, more than three-fourth (78%) of users visit the area for active recreation like running and sports for physical fitness. Less than one-fourth (22%) visitors use the area for passive recreation. On the other hand, people who visit other parks primarily visit for passive recreation (78%) like strolling, meeting friends and spending time with family.

Frequency of use

	Beddagana Wetland Area		Others	
	n	Beddagana %	n	Others N %
Everyday	11	61.1%	3	8.1%
Every week	3	16.7%	17	45.9%

Every month	3	16.7%	7	18.9%
Rarely	1	5.6%	10	27.0%

Table 15 Frequency of use

When the frequency of visiting a park was analysed on the basis of the park that people visit, a large variation in frequency was observed. More than half (61%) users of Beddagana visit every day. On the other hand, people visiting other parks have much less (8%) daily visitors. This can be attributed to the proximity of open space from the user.

In order to study the impact of distance on frequency of visit, specific questions were posed to understand the relation. It was realised that nearly three-fourth (74%) respondents identified distance as the reason for choosing the open space. Distance from the park plays an important role in the frequency of usage and thus affects the value of recreational benefits that residents derive out of an open space. More number of visitors would visit park if it was within 3 km distance of their residence, thereby increasing the recreational benefits provided by a park. This is in conformation with the findings of Giles-Corti et al. 2005 that open space use is sensitive to distance and local users of a large, attractive park visit daily whereas users who lived farther away visited the park infrequently as a family and for passive recreational pursuits.

This is further confirmed on observing table 16. Nearly all visitors from within 3 kms visit the parks at regular basis where as only two-third (63%) visitors from more than 3 kms are regular visitors with a low number (7.4%) of daily visitors .

Frequency of use: Distance from park

	Live near the park		Live more than 3 km from park	
	n	Column Total N %	n	Column Total N %
Everyday	12	42.9%	2	7.4%
Every week	9	32.1%	11	40.7%
Every month	6	21.4%.	4	14.8%
Rarely	1	3.6%	10	37.0%

Table 16 Proximity v/s frequency

An independent t-test was conducted to study the difference in frequency of use based on proximity to the park. It was shown that there was a significant difference in frequency of use between visitors that lived near the park and those that lived more than 3 km from the park, $t(53) = -3.674$, $p < .05$.

In order to forecast the future use of Beddagana park, factors like improved greenery, improved lakeside and overall development of park were posed as future conditions of Beddagana to understand increased usage on improving the infrastructure and developing the biodiversity park. It was observed that an improvement in greenery would make almost two-third (62%) of the respondents to visit more often. Improvement in lakeside would have a better impact on increased usage as nearly three-fourth (73%) respondents would visit more often. The overall development of the park would lead a large majority of the respondents (85%) to increase the frequency of visits.

Further, in order to see if new users would be attracted towards the park, respondents that visit parks other than Beddagana were surveyed about their willingness to use Beddagana. A

majority (82%) agreed that they would visit Beddagana if it was developed, which would lead to an eventual increase in number of users for Beddagana.

According to Bolund & Hunhammar, 1999, presence of open spaces enhances physical and psychological well being. Since residents in the vicinity of Beddagana are observed to visit the area more regularly than residents that live far, it is understood that the physical and psychological well being level would be higher for residents in the vicinity. Further, as the research findings point towards an increase in the number of users for Beddagana on completion of the biodiversity park, it is concluded that the increased footfall will also result in increased physical and psychological well being.

ΔX_1 (change) is the increase in number of users

ΔX_2 is the increase in frequency of visits by current users

ΔX_3 is the increase in physical and psychological well being of residents

5.1.1.2 Perceptions

As per the Public Consultation section of the report by Uni-Consultancy Services, 2011 the perception towards the wetland area is that of neglect. The area is used by anti social groups of people that engage in alcohol consumption, narcotics usage and gambling. A number of illegal activities also carried out by these groups. Hence people agree on developing the area in order to put an end to these activities.

According to the survey, only 17% respondents were found to be satisfied with the cleanliness in the Beddagana area. Some residents even complained of other residents using this area as a place to discard their domestic waste.

	Beddagana Wetland Area		Others	
	Count	Column N %	Count	Column N %
Strongly Agree	1	5.6%	11	29.7%
Agree	2	11.1%	22	59.5%
Neutral	6	33.3%	0	.0%
Disagree	6	33.3%	4	10.8%
Strongly Disagree	3	16.7%	0	.0%

Table 17 Satisfaction of cleanliness

In order to understand people's perception towards the open space in the post-project stage, the survey questionnaire assessed the importance they assign to it as a natural resource.

For this, the survey included people's perception on pollution and flood reduction capabilities of Beddagana area. Two-third (65%) of the population agreed that pollution reduction was an important function carried out by Beddagana area where as the percentage was less than two-third (59%) for flood reduction functions of Beddagana. It is interesting to note that a considerable section of respondents did not know about the pollution reduction (25%) and flood reduction (30%) properties of wetlands. Yet nearly everyone (96%) agreed that the Beddagana area was an important part of the city with three-fourth (74%) of the respondents strongly agreeing to the statement that Beddagana wetland is an essential part of the city.

Some respondents said that they were looking forward to the upcoming park as it will increase the importance of the Ethulkotte area by housing an important biodiversity park.

ΔX_4 is the change from a –ve opinion of the area to a +ve, resourceful perception

5.1.2 Economic benefits

Literature shows evidence of several economic benefits of urban wetlands. Some of these economic benefits are production of direct marketable commodities like timber, fish, tickets for entrance (Bernard et al. 2009; Bolund & Hunhammar 1999; Boyer & Polasky 2004) and others are indirect economic benefits that are a consequence of presence of wetlands like flood protection, water treatment and water drainage (Boyer & Polasky 2004; Gómez-Baggethun & Barton 2013; Hartwell et al. 2010). Currently there are no direct economic benefits observed from Beddagana wetlands. However, after the completion of Beddagana project, there is an opportunity to enforce a fee for entrance. This would be the direct economic benefit received from Beddagana. Moreover, indirect benefits like flood protection, and storm water drainage are primary functions that are already performed by Beddagana wetlands. Post-project, the efficiency of wetlands would be improved to perform these functions. The area will also witness an increase in land value for surrounding properties. The following section aims to assess the potential of Beddagana to provide the above discussed economic benefits.

5.1.2.1 Income generation: through ticketing[13]

At present, the user activity in Beddagana is low. Although the size of the park is large, there are not many activities for users. According to (Giles-Corti et al. 2005) larger parks with more diverse attributes that provide more satisfying experiences for the user attract more visitors.

The results of questionnaires performed with 56 respondents gave an impression of the interest of visitors in the development of biodiversity park such as bird watching decks, dedicated tracks for jogging and information center on biodiversity. A large number of respondents also advocated introduction of children's play area, meditation areas and food kiosks. The survey further helped in assessing the willingness of the visitors to pay for tickets for entrance and/or for these services. The questionnaire provided different ranges of money-values respondents could choose from. Bernard et al. 2009 uses a similar methodology to assess the willingness to pay for a National Park in Costa Rica and concludes that by introducing new services the willingness to pay by the users increases and offers a potential source of finance for protection and maintenance.

Willingness to pay for ticket

		I would visit if there is an entry fee					
		Yes		Doesn't matter		No	
		n	%	n	%	n	%
I would visit more often if it is developed as a park	Strongly Agree	9	45.0%	1	5.0%	10	50.0%
	Agree	14	58.3%	2	8.3%	8	33.3%
	Neutral	2	25.0%	1	12.5%	5	62.5%
	Disagree	0	.0%	0	.0%	0	.0%
	Strongly Disagree	0	.0%	0	.0%	0	.0%

Table 18 Potential for ticketing

As observed in the above table, majority of respondents agreed to visit the Beddagana area if it is developed as a usable open space. With reference to those that agree to visit the area, nearly half of the respondents agreed to visit even with an entry fee.

[13] It should be noted that the incremental change ΔX_5 is the actual income generated, and not the increase, since the current income through sale of tickets and payment for services is non-existent (0).

When it comes to paying for using the open space, the following table shows that nearly half of the respondents (49%) that currently visit other parks are willing to pay if Beddagana entrance is by a ticket.

An independent t-test was conducted to study the significance of the results. The difference in willingness to pay was found to be significant, $t(25) = -2.074$, $p=0.049$, with more people using far away parks willing to pay for the park. This helps in knowing the ability of the Beddagana area to attract users that are also willing to pay for the use. This also leads to a conclusion that people who do not have proximity to a park are willing to pay for a park if they could have better access to one.

The study considered the responses of respondents who do not wish to pay for entrance charges. It showed that even if a section of users is unwilling to pay for a ticket, they are willing to pay for services that they use in the proposed park, thus ensuring the economic feasibility of those services. Only a small number (10%) does not wish to pay neither for entrée or service charges for facilities.

5.1.2.2 Revenue from advertising

Revenue from advertising has not been identified as a potential source of income in the literature reviewed in chapter on theoretical framework. However, during the fieldwork, it was realised that development of the park may have an influence on the costs of outdoor advertising due to increased visibility. In order to identify potential increase in income for government, open interviews were carried out to assess the change due to development of Beddagana.

An interview with Mr. Punith Saparamadu from Grace Advertising (Pvt.) Ltd. helps in understanding how outdoor advertising in such locations is priced. The total cost of advertising includes cost of the signage board/ hoarding, rent paid to the owner of the site and government taxes like visibility tax (paid to Urban Development Authority) and road tax (paid to Road Development Authority or Provincial Road Development Authority). In the present situation, the visibility tax at Beddagana is around LKR 100-150 per sq. ft. per annum. However, with an increased footfall in the event of development of Beddagana, the visibility tax could go up to LKR 1000-1500 per sq. ft. per annum.

A second interview with Mr. Arosh Pradeep Perera from Home Lands Holdings (Pvt.) Ltd. also revealed the prices paid by advertisers. For an average size hoarding (30'x20'), LKR 1 million per annum are paid to the owner of the site (government, in case of Beddagana). These prices are for developed areas with high visibility. In present situation, with less visibility, Beddagana can command a value of LKR 100,000 per month per hoarding which includes the local taxes.

5.1.2.3 Increase in land value

As per Boyer & Polasky 2004, wetlands have a positive impact on land value. Their study found that by *"decreasing the distance to the nearest wetland by 300 meters from an initial distance of 1.6 kilometers resulted in an estimated increase in property value of $436 (1994 dollars)"*. NZIER 2013 makes use of hedonic pricing method to value proximity of houses to open spaces. The incremental value of a similar house in a similar context without the proximity to the environmental resource helps in valuing that environmental resource.

The current research assessed the present values of land in the vicinity of Beddagana and the anticipated prices on development of Beddagana park. Local residents were also part of the survey for their perception on increase in values. One of the respondent confirmed that the

land values have been a maximum of 1.5 million LKR[14] per perch[15]. On being surveyed, nearly all respondents (95%) replied in affirmative to the question if real estate values would increase on development of the Beddagana area.

Further, based on interviews with representatives of two local real estate companies, the expected increase in land values was as follows.

Prime Lands (Pvt.) Ltd.	
Current prices (within 100-200 m from Beddagana)	LKR 1.4 million per perch
Expected prices after development (within 100-200 m from Beddagana)	LKR 2.5 million per perch
Expected prices (for green/lake facing)	LKR 2.5 to 3.0 million per perch

Table 19 Land Value 1

Home Lands Holding (Pvt.) Ltd.	
Current prices	LKR 1.3 million per perch
Expected prices after development	LKR 2.6 million per perch (doubled)

Table 20 Land Value 2

The results of the interviews are in conformation with the literature on increased land values for proximity to urban greens (Bolund & Hunhammar 1999; NZIER 2013) and revealed that there is an expected increase of 80-100% in the prices of land after the Beddagna park is completed.

5.1.2.4 Increase in marketability

In continuation with increased land values, literature also has evidence of increased willingness of people to live close to urban open spaces (Bolund & Hunhammar 1999; Giles-Corti et al. 2005). 15 respondents from Colombo city were interviewed about their willingness to relocate to Sri Jayewardenapura Kotte if Beddagana was developed as the Biodiversity Park. More than half respondents (60%) were willing to relocate even without the above mentioned development. *"That area is less crowded and very close to the beautiful Diyawanna Lake. Who would not want to live there."* said Mr. Lacksitha. This reinforces the ability of urban greens to attract more residents for better quality of living. Nearly one-fourth (26%) said that they would like to move there provided the transport connectivity was good from the main city of Colombo. Very few respondents (2) did not wish to move to the area, citing non-proximity to their work places. In all, most respondents wished to live in the Beddagana area due to its cleaner and natural surroundings.

ΔX_5 is the income generated by ticketing and payment for facilities

ΔX_6 is the increased income of government from better advertising potential

ΔX_7 is the increase in income through land value

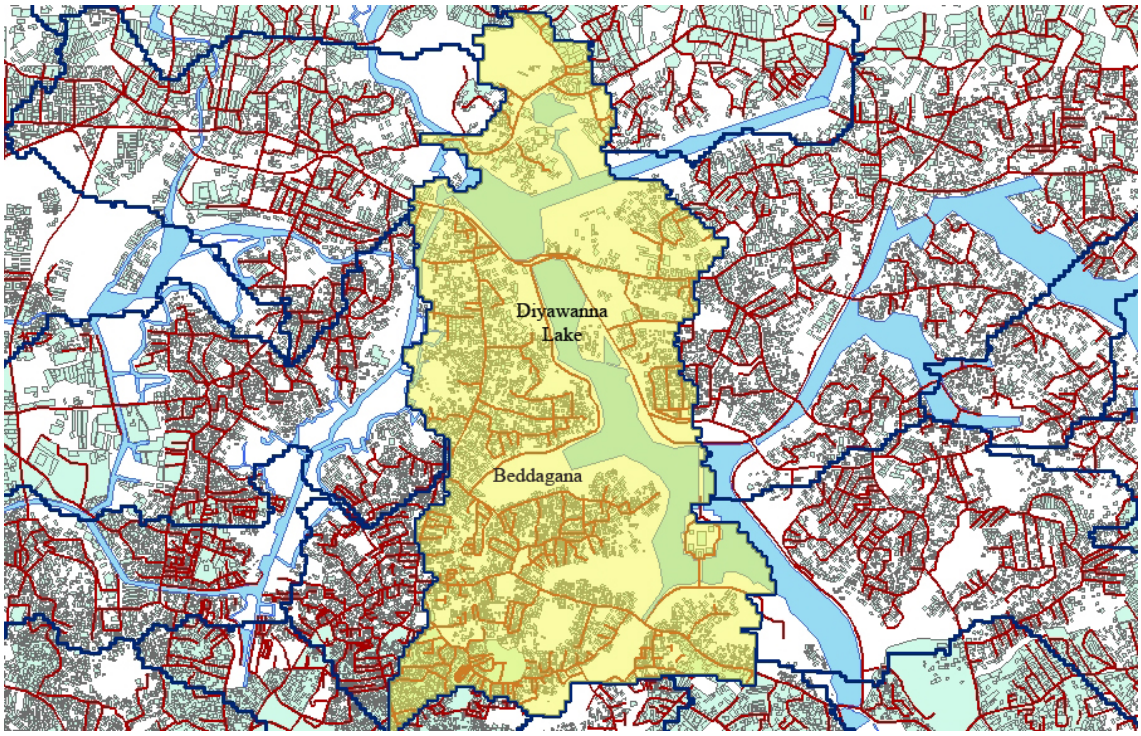
ΔX_8 is the increase in income due to increased attractiveness of the neighbourhood (willingness to relocate)

[14] € 1 = LKR 174.79 (5th August 2014)
[15] 160 Perch = 1 acre

5.1.2.5 Flood Protection

With 188 wet days throughout the year and an approximate total precipitation of 2400 mm, Colombo is one of the wettest places in Sri Lanka.[16] The region has s a tropical wet climate with no predominant dry or cold season as it is constantly moist with year-round rainfall (Climatemps 2009) which makes it more prone to flooding.

The area immediately surrounding Beddagana wetland is low lying and is affected by the frequent flooding in the Diyawanna Lake (Uni-Consultancy Services 2011). Map 1 highlights the watershed under which Beddagana is located.



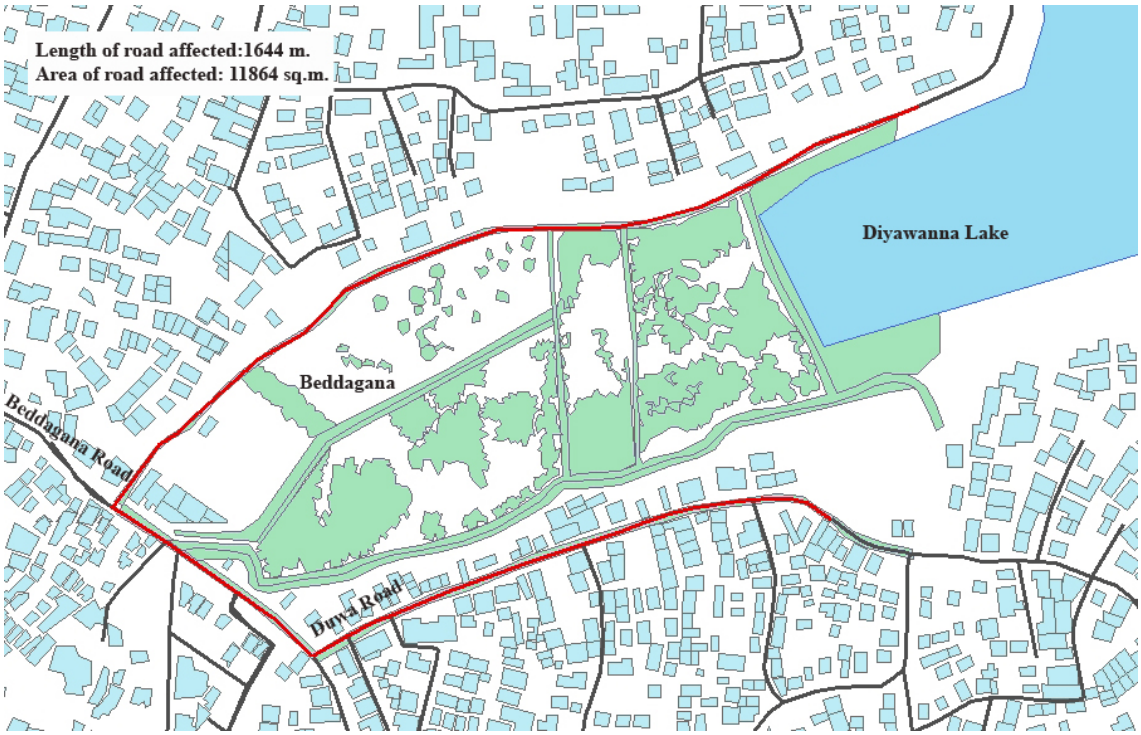
Map 1 Beddagana: Location within the watershed

Further, respondents in the Beddagana Wetland area reported that there is frequent flooding in the area. Each year, as many as, 5 times the road from Beddagana road (as shown in map 2 and 3) is flooded leaving it unusable by the residents. Further, the area near Duwa Road is also frequently flooded.

Boyer & Polasky 2004 emphasize that flood protection service provided by wetlands is likely to be of greatest value in urban areas with high populations so that the service can limit damage to properties and human beings. According to (Bolund & Hunhammar 1999), cities with a high risk of flooding benefit more from green areas that take up water than other cities.

Maps 2 and 3 show (in red) the roads and properties affected by the flooding respectively that will benefit from the protection of Beddagana wetlsand.

[16] See Annex V (a) for rainfall distribution



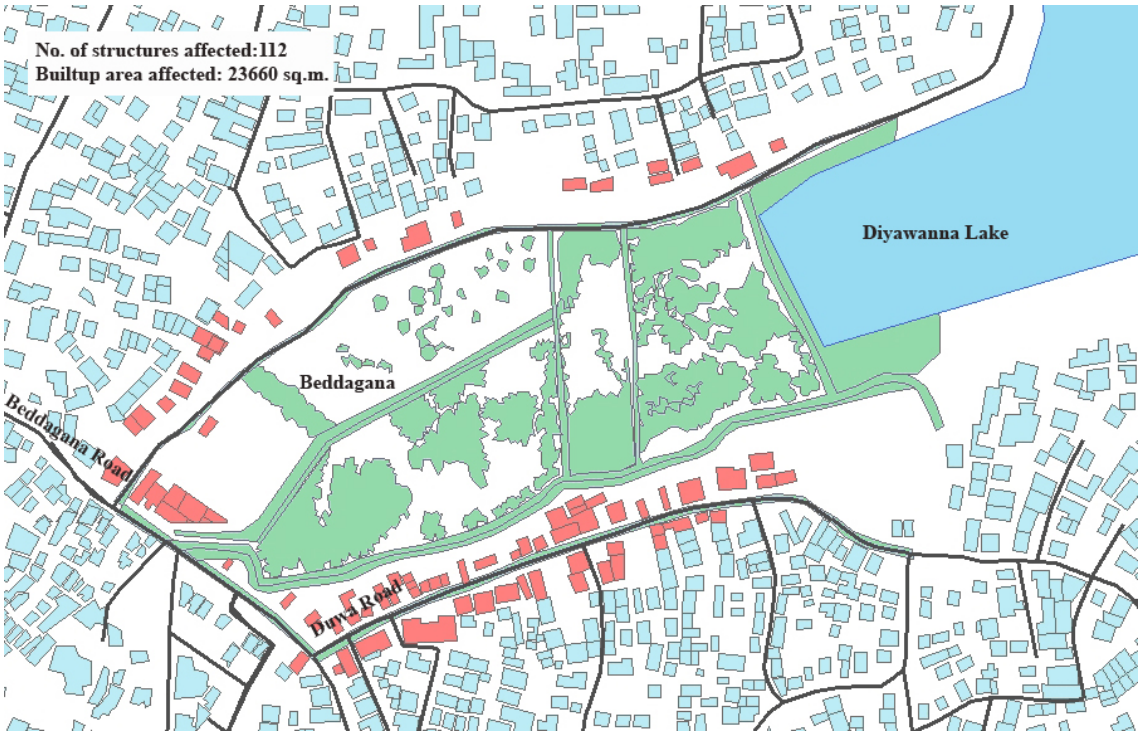
Map 2 Roads affected by floods

Road	*Length(m)*	*Width (m)*[17]	*Area (sq.m.)*
Road 1(Road from Beddagana Road)	882	6	5292
Road 2 (Beddagana Road)	238	10	2380
Road 3 (Duwa Road)	524	8	4192
Total	**1644**		**11864**

Table 21 Roads affected by floods

As observed in map 3, the private built structures on the periphery of the wetland are prone to damage by floods. The total number of such structures is 112 and the total area of built structures affected is 23,660 sqm. By developing the Beddagana biodiversity park, the vulnerability to flooding will be reduced for 112 structures.

[17] Based on on-site measurement



Map 3 Built area affected by floods

On the south side of the site, a section of the area is not suitable for construction as it is prone to frequent flooding. Since it is unusable for any permanent structure, it is being used by encroachers for making temporary dwellings. There is potential for that area to be used as recreational/ residential land use, which can either add to the available recreational area or contribute to increased available land for real estate.

As per the Sri Jayewardenepura City Profile by S. Wijayapala, 2003, p. 12 the population density of the Ethulkotte area, in which Beddagana wetland lies, is 75 persons per Hectare. With an approximate area of 16.3 Hectares being affected by floods, the approximate number of human lives that will have reduced vulnerability to flooding is 1222.[18]

ΔX_9 is the reduced flood risk to infrastructure (roads)

ΔX_{10} is the reduced flood risk to private property

ΔX_{11} is the increased usable land due to reduced flood risk

ΔX_{12} is the reduced number of human lives prone to be affected by flooding

5.1.3 Environmental benefits

5.1.3.1 Sink for rain water

As discussed in 5.1.2.5, Beddagana wetlands help in preventing the damage to infrastructure and human life. Ecosystem services are often overlapping, and the service as sink for rain water is the environmental aspect of the service as flood protector.

[18] Although classified as economic benefits under benefit from flood protection, reduction of vulnerability for population is more of a social benefit, since author considers it unfair to put a price on human life

According to a report in Sunday Observer by Wijayapala, 2013 high intensity rains within short time period, inefficient drainage network owing to reduced carrying capacity of canals and decrease in retention areas due to waste dumping are responsible for increased flooding in Colombo city. As per the Environment Screening report by Uni-Consultancy Services, 2011 the surface water bodies connected with the wetland play an important role in conveying surface drainage and flood waters in Beddagana area.

However, upon site observation, canals were found to be filled with plastic bags, bottles and other waste. On undertaking the restoration project, the canals devoid of solid waste will be able to carry more water thereby acting as sinks for rain water. According to the Social Screening Report by Ministry of Defence and Urban Development, 2012, once preserved, the swampy and marshy area of Beddagana will function as sponge for absorbing excess rain water and will help in preventing flooding.

Increased vegetated areas further contribute to solving this problem in two ways. The pervious ground under vegetation allows water to seep through and the vegetation takes up water and releases it into the air through evapotranspiration (Bolund & Hunhammar 1999).

5.1.3.2 Habitat for birds

The opportunity to see birds and other wildlife is typically limited in urban areas due to limited existence of open space and natural habitat (Boyer & Polasky 2004). Thus the value of spotting bird life is more in urban locations. Beddagana is one such location in the urban Colombo that consists of habitats for a wide variety of birds. According to a report by the Environment Screening report by Uni-Consultancy Services, 2011 for Beddagana, the wetland area is identified as sensitive zone where 18 migrant bird species and 34 resident species have been recorded. The area is also found to be rich in butterfly sightings.

The proposed biodiversity park aims to create feeding and breeding grounds for both birds and butterflies, thereby enhancing the natural habitat for birdlife which will eventually lead to an increased number of bird life in the region. Refer annex V (b) for detailed list of bird species observed in Beddagana.

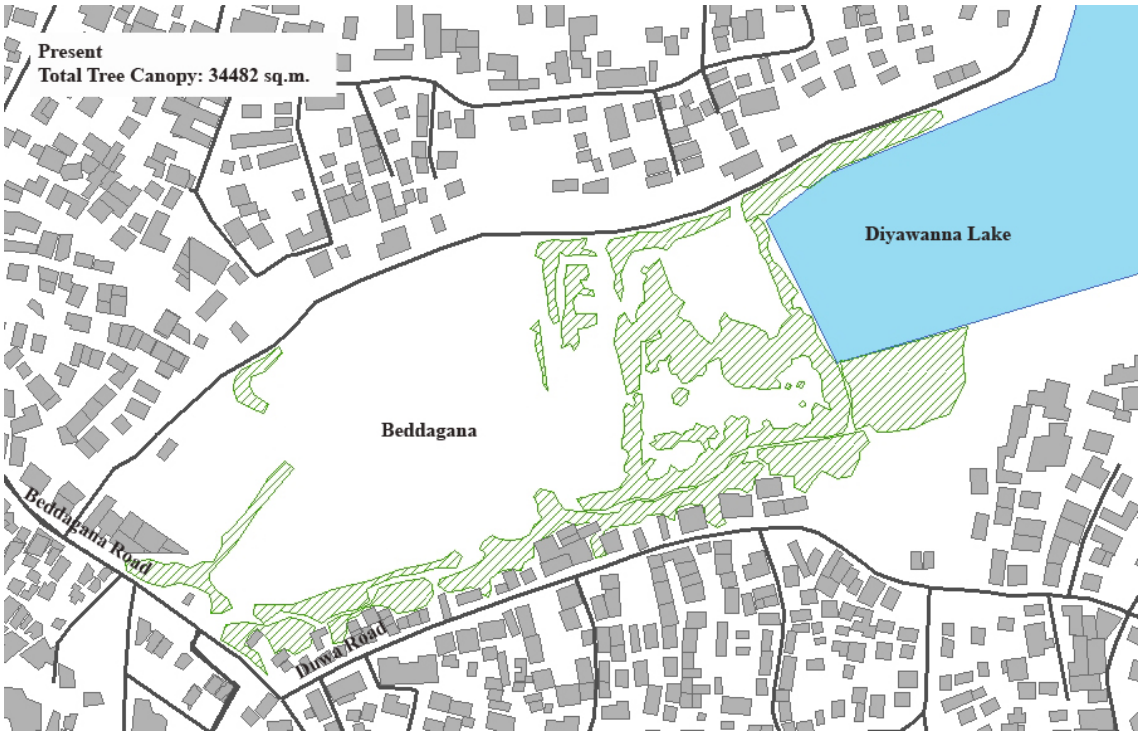
5.1.3.3 Sink for carbon

Wetlands provide many important ecosystem services, including climate regulation through carbon sequestration and storage, (Bonn et al. 2014)

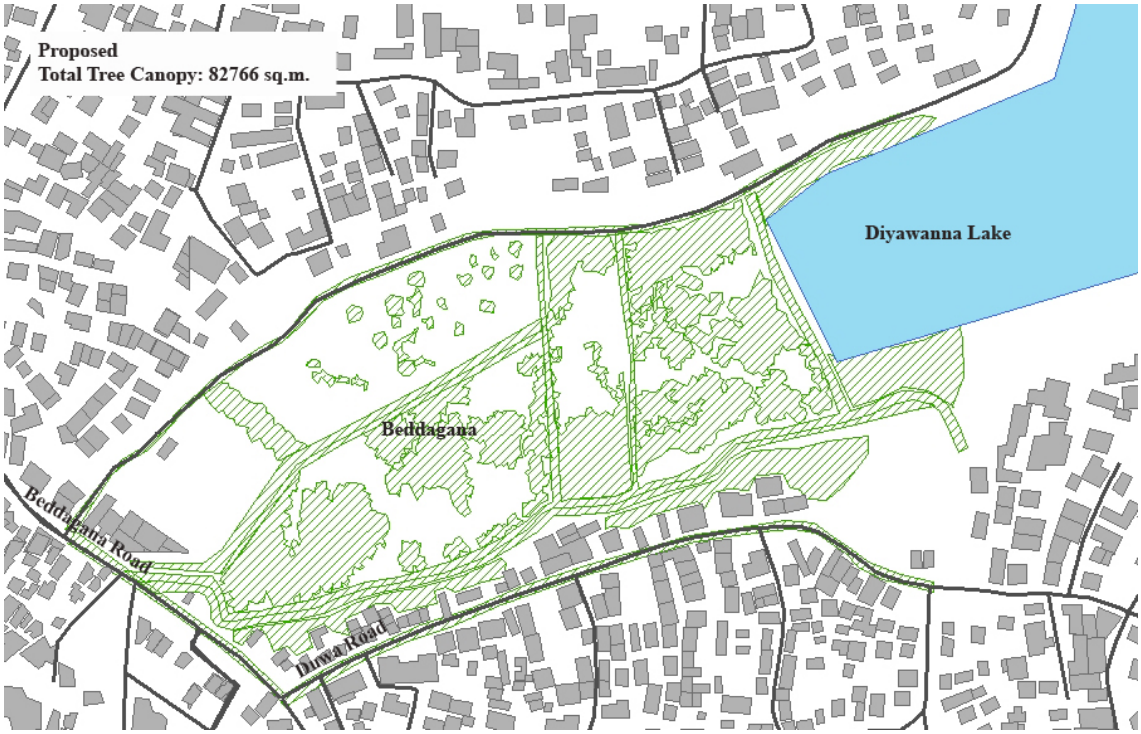
Carbon carrying capacity of an ecosystem is defined as the mass of carbon stored in a forest ecosystem under prevailing environmental conditions and natural disturbance regime (Keith et al. 2009). The climate of Colombo is Tropical-Wet (Eriyagama et al. 2010) and hence the corresponding capacity of vegetation to store carbon, as per Keith et al. 2009 is 213 tC/Hectare.

Presently, the Beddagana site area has a total of 34,482 sq.m. under vegetation (as shown in Map 5), which would go up to 82,766 sq.m. once the project is realised (as shown in Map 6).[19]

[19] Refer Annex V (c) for a list of native tree species



Map 4 Existing tree cover



Map 5 Proposed Tree Cover (Uni-Consultancy Services 2011)

An increase in forested area will lead to increase in the amount of carbon stored within the wetland.

	Case	*Area under vegetation (sq.m.)*	*Area (Hectare)*	*Capacity (tC/Hectare)*	*Carbon Stored (t)*
X_{14o}	Present	34482	3.45	213	734.85
X_{14f}	Proposed	82766	8.28	213	1763.64
ΔX_{14}	Change	48284	4.83	213	**1028.79**

Table 22 Carbon storage capacity

5.1.3.4 Urban temperature regulation

Urban parks help in urban climate regulation by moderating the weather extremes (Bolund & Hunhammar 1999; Boyer & Polasky 2004; Gómez-Baggethun & Barton 2013). A single large tree can transpire 450 l of water per day. This consumes 1000 MJ of heat energy to drive the evaporation process. In this way city trees can lower summer temperatures of the city markedly (Bolund & Hunhammar 1999).

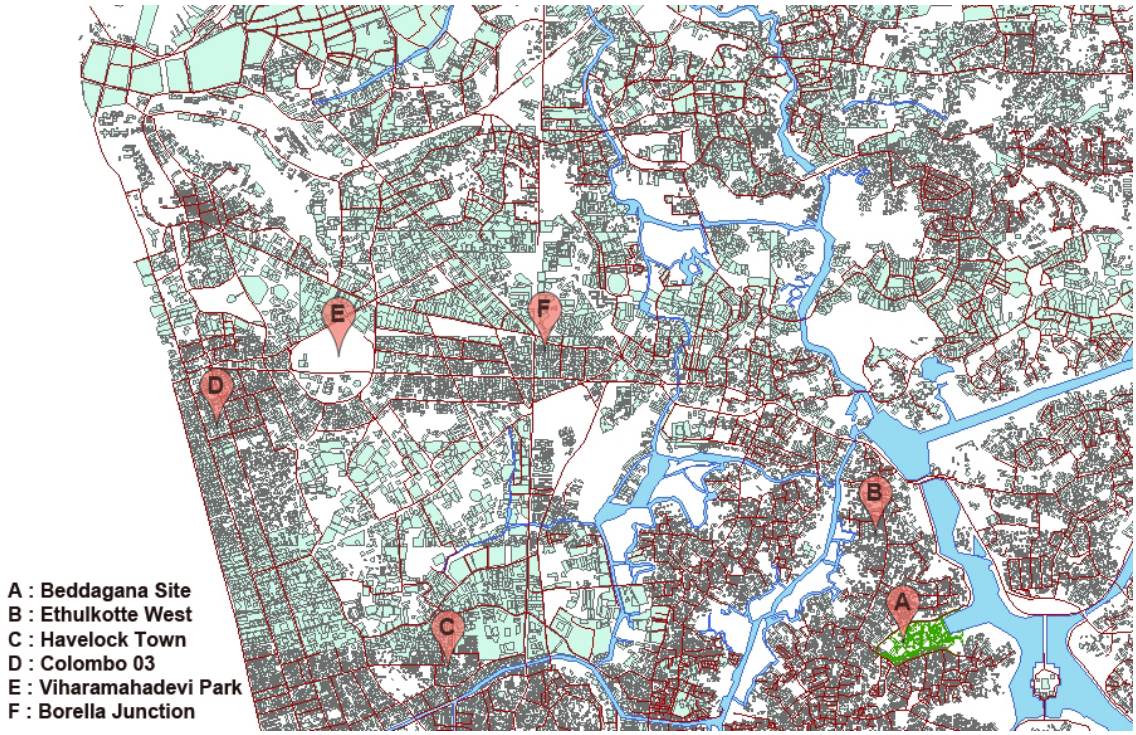
Observation and measurements were done on 6 locations in Colombo city, one of them being Beddagana. Temperature differences as much as 0.8ºC were observed.[20]

Following table elucidates the temperature variation observed at six varied observation points in the city within a time span of 50 minutes.

Location	*Lat.*	*Long.*	*Description*	*Temp.*	*Time*	*ΔT (from A)*
1	6°53'26.73"N	79°54'32.64"E	Beddagana Site	31.4 ºC	11:45	-
2	6°54'6.77"N	79°54'16.66"E	Ethulkotte West	31.7 ºC	11:50	+0.3 ºC
3	6°53'14.87"N	79°52'13.41"E	Havelock Town	31.8 ºC	12:07	+0.4 ºC
4	6°54'35.46"N	79°51'2.89"E	Colombo 03	32.2 ºC	12:15	+0.8 ºC
5	6°54'46.13"N	79°51'44.71"E	Viharamahadevi Park	31.3 ºC	12:25	-0.1 ºC
6	6°54'51.12"N	79°52'41.08"E	Borella Bus Stand	32.0 ºC	12:35	+0.6 ºC

Table 23 Temperature Observation

[20] Temperature measurements were taken on 24th June 2014 between 11:45 and 12:35.



Map 6 Temperature observation points

Images 4-9 show the satellite images of areas where temperature observations were made. As is clear from the image 4 and 8, areas which are predominantly covered with vegetation tend to have lower temperatures as compared to areas with high density of built structures. Observation point 4 at Colombo 03 with high built up areas witnessed highest temperature of 32.2 ºC.

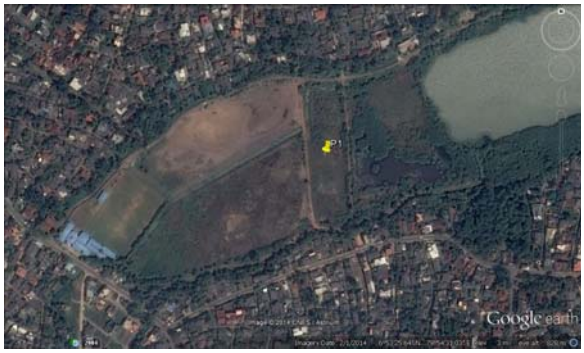


Image 4 Observation Point 1 (Beddagana Site)

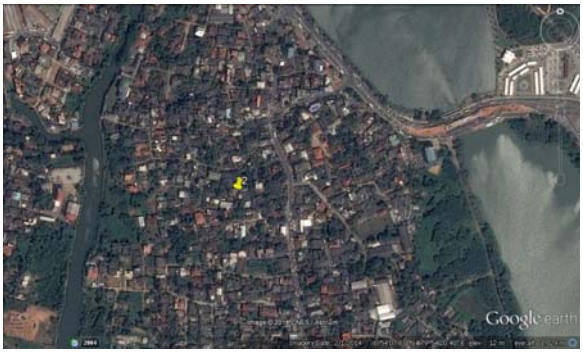


Image 5 Observation Point 2 (Ethulkotte West)

Image 6 Observation Point 3 (Havelock Town)

Image 7 Observation Point 4 (Colombo 03)

Image 8 Observation Point 5 (Viharamahadevi Park)

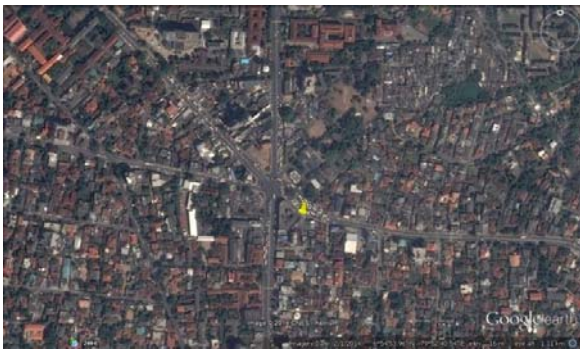


Image 9 Observation Point 6 (Borella Bus Stand)

However, there is a limitation to the observation on temperature variation. Since, the observations involve only temperature measurements done once, the presence of Beddagana wetland might not be the only cause for lower observed temperature. There might be other causes like presence of less motor vehicles, proximity to Diyawanna lake or general topography. Additionally, the temperature measurements were only taken once over a period of 50 minutes, which is not sufficient to generalise the findings. Thus the temperature difference cannot be attributed to only presence of Beddagana wetland.

However, since literature finding have proved that wetland vegetation does contribute to lowering of urban temperature, it is fair to attribute lower observed temperatures to Beddagana.

ΔX_{12} is the increased capacity of wetland to absorb rain water

ΔX_{13} is the increased population and types of native and migratory bird species

ΔX_{14} is the increased capacity of the area to store carbon

ΔX_{15} is the reduction in urban heat

5.1.4 Sustainability Benefit Assessment of Beddagana

See Annex V (d) for a detailed table that enlists all the sustainability benefits obtained from urban wetlands in general as well as specific to the case of Beddagana wetlands with corresponding sources of data.

Following table summarises the identified social, economic and environmental contributions that will be made to the city by protection of Beddagana wetlands.

Change		*Description*
ΔX_1	Social	Increase in number of users of the park
ΔX_2		Increase in frequency of visits by current users
ΔX_3		Increase in physical in psychological well being of residents
ΔX_4		Change from a –ve opinion of the area to a +ve, resourceful perception
ΔX_5	Economic	Income generated by ticketing and payment for facilities
ΔX_6		Increased income of government from better advertising potential
ΔX_7		Increase in income through land value escalation
ΔX_8		Increase in income due to increased attractiveness of the neighbourhood
ΔX_9		Reduced flood risk to public infrastructure
ΔX_{10}		Reduced flood risk to private property
ΔX_{11}		Increased usable land due to reduced flood
ΔX_{12}		Reduced flood risk to human lives
ΔX_{13}	Environmental	Increased capacity of wetland to absorb rain water
ΔX_{14}		Increased population and types of native and migratory bird species
ΔX_{15}		Increased capacity of the area to perform as a carbon sink
ΔX_{16}		Reduction in urban heat

Table 24 Changes anticipated

The first part of research results in a sustainability benefit scorecard (See table 35). The table employs the SBA methodology by IHS & World Bank 2014 and comprises of a matrix of type of benefit and scale of benefits received. Each row total score demonstrates benefits of different types whereas each column total score represents benefits at different scales of influence. As clearly observed in the matrix, the wetlands have maximum influence at individual (10) and local (11) levels. The global benefits, though existing, are very few (2). On the other hand, they have maximum benefits in the environmental sector (12) followed by social (8). As is clearly evident, the economic benefits are less in number (3), thus confirming the initial premise (See Section 1.2 Problem Statement) that wetlands have limited visible benefits.

The matrix can help in demonstrating the number and type of benefits. Further applications of this matrix, however, will be explored in section 5.2 and 5.3.

The following table mentions the number of benefits of restoring Beddagana wetlands.

	Individual	*Local*	*Global*	*Type Total*
Social	7	1	0	8
Economic	3	0	0	3
Environmental	0	10	2	12
Scale Total	10	11	2	23

Table 25 Sustainability Benefit matrix for Beddagana

5.2 Key considerations of investors

According to Málovics et al. 2008, primary industries like manufacturing based companies are confronted by wider range of environmental challenges in comparison with service or retail based companies. This makes. Thus, manufacturing companies are more liable to be targeted by NGOs and local communities for actions that degrade environment (Hanson et al. 2012).

Semi-structured interviews were used as data collection instrument to identify key considerations of corporate organisations for investing as part of CSR. Three organisations were selected based on their primary function and representatives from respective CSR department were interviewed.

Organisation	*Type*	*Representative*	*Position*
Cheminova, Mumbai	Manufacturing	Dr. A. S. Indulkar	Stewardship Development
Samsung India, NOIDA	Manufacturing and Retail	Mr. Abhishek Kumar	Head, CSR
MMTC, New Delhi	Manufacturing and Services	Mr. Subhash Bhasker	Asst. General Manager

Table 26 Interview respondents

5.2.1 Role in CSR

Organisations have both internal and external initiatives as part of their CSR strategy. However, in the interviewed organisations, external initiatives take precedence over internal initiatives in the importance given to them. It was observed that organisations prefer to be involved directly with the cause that they support. Social and education sectors are preferred to be invested in, as companies like to involve themselves directly with the communities, which gives more visibility to their brands.

Cheminova refrains from making donations or monetary investments citing their interest in being associated with the cause at grassroot level. MMTC also prefers to identify the exact capital equipment required for a cause and then be involved with the specific project rather than undertaking recurring expenses. According to Subhash Bhasker from MMTC, *"We define CSR as Catalysing Socio Economic Rejuvenation"* The statement further shows that environmental concerns are not one of the prime focus for the company's policy on CSR. Samsung prefers to work in their area of core competence: technology and skill development.

Projects are often identified that are closest to the products/ services that the companies produce. Samsung prefers educational sector where they can use their expertise with laptops and computers to impart knowledge for students in rural areas. Cheminova, an agrochemical producer, selects projects in agricultural areas.

5.2.2 Decision making on CSR

According to Hanson et al. 2012 risks such as new fines and government regulations make companies invest in ecosystem related activities. Thus, government rules are an important cause for decision making. This was confirmed during the fieldwork as the scale of projects is governed at present by the CSR act which states that the company must spend 2% of the average net profit of the last three financial years or any part thereof in prescribed sectors for social or environmental welfare (Ministry of Corporate Affairs 2013). However, MMTC has been involved in CSR activities from before the act and contributes 3% of its profit towards the social and environmental causes.

The sectors of involvement are chosen by the companies and it is not governed by the law since the law designates 9 broad categories of possible intervention with 'environment sustainability' being one of them. So companies invest in most convenient and not necessarily most crucial sectors. This reaction of companies is in accordance with the statement by Mazurkiewicz 2005 which says that some companies take responsibility for difficult sectors like environment only if they have to and thus better legal framework must be present to ensure participation.

MMTC, which has pan India presence, was the only organisation that accepts applications for projects from needy organisations and decides after the CSR committee reviews the pros and cons. Other organisations prefer to identify projects based on their through their own judgement as per convenience of geographical location.

Bonn et al. 2014 identify the increased efficiency of regional carbon markets over global markets and stress on local interventions as better mechanisms to protect ecosystems. The field research confirms their finding as local projects are seen to be prioritised over distant projects because companies often seek to advertise their brand through CSR and local visibility helps with the promotion of the brand making it more attractive to invest in local projects.

5.2.3 Interest in market mechanisms

Respondents were questioned on their willingness to invest in market mechanisms through an example of carbon market. According to Samsung, Carbon offsetting decisions are part of Samsung global policy. Regional offices are not involved in these and prefer to choose projects that are more local in nature. MMTC, although primarily a trading company, is also involved in steel manufacturing in Orissa and had been previously involved in carbon trading due to surplus of carbon credits to their account. However, citing the collapse of the carbon exchange market, the company no longer intends to be involved in such market mechanisms. Bonn et al. 2014 also cites the collapse of carbon exchange market as an important reason why global markets have not been successful which conforms with the unwillingness of companies to be involved in carbon markets.

Cheminova was unwilling to take up any CSR activities that involve direct monetary contribution. According to the respondent,

"Investing money in this cause is of no use as it just goes [and] *we do not know the results. Being involved in these* [agricultural skill development and health facilities] *causes at the grassroot level is more important for us as an organization instead of investing."*

They believe in using their own resources and manpower for their initiatives and thus are not open to the idea of market mechanisms at all. However, the respondent did agree that government needs to prioritise wetland protection and make policies accordingly.

"Government has to promote the awareness [about alternatives for wetland protection*] with some campaigns. The campaign has to emerge.* [Also] *Center* [national government] *may have n number of policies but till the time states* [state government] *are not implementing the same it doesn't help."*

(Interview with Dr. A S Indulkar, Stewardship Development, Cheminova).

5.3 Application of SBA to attract finance for urban wetland protection

After applying the sustainability benefits approach for identification of urban wetland benefits, the second part of the research was to analyse ways in which SBA can be used to attract attention and investment for urban wetland protection. In order to identify the suitable

Following were the alternates to use of SBA:

5.3.1 SBA as a market instrument

According to Pearson, 2007, market instruments like CDM focus on producing the commodity (Carbon) within the boundaries of a project at the most economical costs which directs investors away from projects that have more overall benefits. Further, he states that since the co-benefits that are provided by some projects are not commodified, it is difficult to find investors for them. SBA proposes an approach that counters this limitation of CDM by including Social, Economic and Environmental benefits in its scope.

The research explored the possibility of SBA to be used as a tradable commodity. However, in an interview with Subhash Bhasker (AGM), MMTC it was found that the company, previously having been involved in Carbon trading, witnessed an excess in the market leading to the collapse and eventual market failure.

Other interviewed respondents (Cheminova, Mumbai; Samsung India) exhibited limited knowledge about the subject of Carbon market which posed as a limitation in understanding their perception. In addition, they stressed on taking internal measures for their CSR policies that involve volunteer work by their employees; adoption of schools, villages; medical infrastructure; farmer skill development rather than direct financial investment. Further, limitations include insufficient knowledge of respondents about the carbon markets.

Thus the potential is expected to be limited especially due to the unwillingness of the company to invest in products similar to carbon credits.

5.3.2 SBA as a certification tool

The study explores the possibility of SBA to be used as a certification that includes sustainability benefits attained by investing in an urban wetland project was projected as a possibility to the respondents. However, only one respondent, with previous experience in Carbon certification, understood SBA well enough which goes on to show that prior experience with such concepts is required in order to grasp the concept well enough to make a decision.

Firms prefer to be associated with causes that are related to their businesses. Cheminova (manufacturer of agrochemicals like pesticides and insecticides) focuses on investing in rural population by the means of educational, skill development, women upliftment and health programmes. In doing so, they advertise their products and popularize their brand amongst their prime users.

Further, firms like Cheminova preferred to be involved directly as volunteers with CSR projects that they formulate themselves. *"Investing or donating money in this cause is of no use as it just goes [where] we do not know the results. Being involved in these causes at the grassroot level is more important for us as an organization instead of investing."* (Interview with Dr. A S Indulkar, Stewardship Development, Cheminova)

Samsung, with its most initiatives involving technology, helps in making smart classrooms, providing laptops and e-learning centers in villages. Thus, they also base their CSR policies that help in promoting their brand.

MMTC (Metals and Minerals Trading Corporation), which is involved in environmental projects like revival of a historical and environmentally important water body, does focus on environmental projects owing to the nature-affecting functions which include mining and steel manufacturing. However, it was understood that firms like to invest closest to their area of operation.

"Now when the policy makers are so blind that they cannot see what is outside their doorstep do you think they have the vision to see something that is far from their sight." (Interview with Mr. Subhash Bhasker, Addl. General Manager, MMTC)

Since MMTC has 14 regional offices, they have pan India influence which helps them in location projects that are spread across the country. This is not true for most companies and hence they prefer to locate their CSR projects in their vicinity.

5.3.3 SBA as a decision making tool

According to an interview with Mr. N. S. Wijayrathne (Asst. Gen. Manager, Special Projects, SLLR&DC) several wetlands in Colombo city have been identified to be restored and developed as biodiversity parks. In 2014, the government allocated LKR 150 million for wetland protection. As per the respondent, several environmentalists propose studies to be undertaken for wetland protection. These environmentalists either approach government or private investors to fund their research. Since these studies lack direct implementable measures, government often does not sanction funds for them.

"…only strong projects get funded."(N. S. Wijayrathne)

As a standalone instrument, SBA is not the solution as it cannot attract investment. However, SBA can be used to add credibility to project reports by value addition in terms of quantified benefits from a wetland.

"…since policymakers are controlled by politicians. They [policy makers] *are the ones who have to take necessary steps towards it."* (Interview with Dr. A S Indulkar, Stewardship Development, Cheminova)

"When it is not there on their [government] *agenda, it is not going to be on corporate agenda."* (Interview with Mr. Subhash Bhasker, Addl. General Manager, MMTC)

"Government policy is very important." (Interview with Mr. Abhishek Kumar, Manager-CSR, Samsung)

All interviews respondents agreed that SBA could be a good decision making tool. However, the willingness to use can only be ensured by the means of policy.

This conforms with Mazurkiewicz 2005, who stresses on the government's role as the driver and facilitator by informing, sensitizing and offering incentives for businesses to invest in environmental initiatives as part of CSR. The finding of fieldwork are in absolute conformity with the literature as all respondents exhibited willingness but called for a policy at governmental level in order to make wetland conservation a priority.

As discussed earlier, Mazurkiewicz 2005 also calls for a regulatory framework for corporate self regulation of CSR pursuits. He advocates for a minimum requirement as per law which must be above voluntary initiatives. Thus, fieldwork confirms the needs for alegal framework, at the same time proving that SBA is a good decision making tool.

Chapter 6: Conclusions and future discussion

The following chapter presents the conclusive remarks for this research by answering the research question and sub questions. The conceptual framework (See 2.7) demonstrates financing mechanism being influenced by SBA and thus, this conclusive section establishes the interrelationship of the two concepts identified in the framework.

It also includes the contribution of this research by explaining its place in way forward for SBA as a decision support tool. Final parts of this chapter include the discussion and scope for further research.

6.1 Answer to the research questions

Based on review of previous literature on financing of ecosystem preservation, a need for more inclusive and holistic methodology like SBA was identified. The purpose of this study was to identify the influence of SBA on identification of financing mechanisms for urban wetland protection.

The main research question was: *How does sustainability benefit assessment influence identification of potential financial mechanisms for urban wetland protection?* This section answers the main research question after having answered the sub questions. It was expected that visibility of benefits of urban wetlands through the SBA methodology would be an encouraging factor for private sector to invest in wetland protection.

6.1.1 Answer to research sub question 1

Q. What are the sustainability benefits of urban wetland restoration that influence the sustainability of a city?

The question has been answered by addressing the four aspects of sustainability benefits for Beddagana wetlands as mentioned below.

How many benefits?
What type of benefits?
Where are the benefits observed?
How much are the benefits (future of this research)?

The SBA matrix (See table 25) shows that there are a total of 23 sustainability benefits recorded for Beddagana that can be further classified under different categories. The different types of benefits are social (8), economic (3) and environmental (12). To understand the zone of influence of these benefits, they have been also classified as having an individual (10), local (11) or global (2) impact. The fourth aspect of quantification is addressed in this research for a limited number of benefits (See table 27). The limited time of the research only allows for the study of different methodologies and application of some of them to quantify the anticipated changes in the services provided by the Beddagana wetlands. However, this research paves way for future researchers to work on the foundation built by the present work and forge ahead to arrive at detailed quantification of benefits for the comprehensive value of an ecosystem.

A system is expected to be sustainable when the social-economic-environment triangle is balanced and all three different types of sustainability are in harmony. Literature shows that wetland areas like Beddagana site have several Social, Economic and Environmental benefits. The SBA exercise at Beddagana reaffirms the notion of benefits from the wetlands. The flow of services and stresses between the ecosystem and people as discussed by CEE 2007 needs to be balanced. For each service that humans derive out of wetlands, the wetland

ecosystem receives stress. For the social benefits like recreation, the wetlands receive stresses like increased disturbance to natural ecosystem due to rise in footfall. For economic benefits like increased land values, the wetlands will witness increased construction activities, increased water and air pollution levels. Restoration of wetland will ensure that the urban ecosystem is healthy and efficient enough to take those stresses in order to provide services to the people.

Beddagana being an important part of the urban fabric in Colombo city contributes to all three types of sustainability. Thus restoration of the same and by maintaining its robust character, it would improve the sustainability of the urban area as a whole.

6.1.2 Answer to research sub question 2

Q. What are the key considerations of investors for financing wetland development projects?

The research identified government legal framework as one of the most important concerns for organizations when they consider investments in wetland development. Existence of a policy highly affects the way investments are made for environmental protection. Presence of clearly defined sectors for investment in CSR laws can coerce companies to efficiently make decisions on initiatives. Further, granting incentives on investing in wetland development can encourage more organisations to consider them for investment.

Both, literature and fieldwork, have uniform outlook towards the proximity of projects to be financed. Organisations prefer local projects to distant projects. Thus, instead of a global approach, a regional approach would be more beneficial in attracting investments. This is also supported by Bonn et al. 2014 which argues for regional carbon markets. This also means that projects with higher local benefits as per SBA matrix have higher chances of being financed for their protection.

Companies seek to build goodwill with their target group of customers. Thus they invest in areas where they can gain maximum visibility amongst the target population. This is the reason why an agrochemical industry invests in rural development and an electronics company chooses to invest in education and skill development. Wetland protection can gain from industries that cause degradation of habitat and can use SBA to compensate for their actions, thereby maintaining a good reputation as also discussed by Hanson et al. 2012.

6.1.3 Answer to research sub question 3

Q. What are the different ways in which SBA can be used to attract finance for urban wetland protection?

The research establishes that there is potential to utilise SBA in three different forms (See 5.3). To summarise the concluding remarks on identified financial mechanism:

SBA as a market instrument has a better potential to address sustainability issues since it addresses the weaknesses exhibited by Carbon market. Clean Development Mechanisms have been criticised for ignoring projects that have more social, environmental and economic benefits in order to favour cheaper projects that only help in dealing with Carbon emissions. However, the inability of interviewed respondents to understand the concepts of Carbon market completely posed a limitation in further identifying the actual potential of SBA as a market instrument.

SBA as a certification tool has limited scope since firms tend to use CSR to contribute to their image and brand by using their own products. Investing in a new product does not interest firms for the lack of willingness.

Image 10 Use of SBA for finance

SBA as a decision support tool attracted interest and further discussions on ways in which it can be used to address the issue of finance for wetland protection. SBA finds its application in both private sector as well as government.

SBA in private sector can be used in two ways:

1. It can be used as an internal decision making instrument to decide which projects should the company invest in as part of their external CSR initiatives. The SBA matrix can help in quantifying the number and type of benefits which can further help in ranking projects in based on their most far reaching and diverse benefits thus helping the company to choose projects.
2. Private sector can also use SBA to demonstrate how much they have contributed to sustainable development by releasing SBA reports as part of their annual reports. This will not only help them quantify their contribution but will also work as a branding strategy for their own company.

SBA can be used by government in the following way:

1. Government can introduce SBA as a pre-requisite for all CSR initiatives at policy level to ensure that all CSR initiatives are assessed by the SBA method leading to firms choosing projects with maximum benefits instead of just undertaking projects for the sake of fulfilling a legal mandate.

6.1.4 Answer to main research question

Q. How does sustainability benefit assessment influence identification of potential financial mechanisms for urban wetland protection?

SBA helps in building a case for Beddagana project. It enlists benefits in a sustainability benefit checklist. The checklist helps in identifying the key locations/ sectors in which the primary benefits of a wetland can be classified.

As a starting point, government can identify organisations/ firms with CSR intentions closest to the type of benefits identified. A real estate company may focus on increased land values or a chemical industry may focus on water purification functions.

Wetland restoration may be prioritised by including it in list of sectors where CSR involvement is preferred by encouraging firms to carry out SBA analysis of their CSR actions.

The research shows that SBA methodology, while holding significant promise, may not be sufficient to build financing mechanisms. Given the urgent need to increase funding for urban wetland conservation there is a need to contemplate a mechanism that makes use of SBA methodology in design of government policy for wetland protection financing through CSR.

Interviews with respondents made it very clear that everyone recognizes SBA to be an excellent decision making tool. The intentions of formulating a SBA matrix were welcomed by respondents. However,

1. The willingness to use SBA comes only with policy

Most companies do not undertake CSR initiatives for social or environmental reasons. It is their quest to brand and present their organisation as 'good and responsible', propelled by the legal mandates laid out by governments that makes them involve themselves in the activity. thus the driving force for companies to embrace SBA would be possible by making it part of government policies.

2. The entry point for SBA is policy

SBA as a standalone instrument is insufficient to attract finance. By introducing it through government policy, SBA emerges as a stronger force being supported by legal mandates to ensure CSR initiatives are directed towards sensitive and deprived projects like wetlands that are otherwise rarely adopted by corporate.

6.2 Discussion

The following section discusses factors that affected the research in the past, as well as what is the potential for future researchers in the field of sustainability benefit assessment

6.2.1 What influenced the findings?

Quantification challenges are the greatest limitations of SBA. Since each benefit requires its own unique method of quantification, the scope is considerably limited due to insufficient resources that are required for the quantification process.

An important aspect for studying impact of SBA on willingness to finance is the circumstances in which interviews were conducted. There is insufficient knowledge and awareness about the concept of sustainability and market based methods like CDM. Hence, the test of impact stopped at the point where the respondents stopped understanding the concepts.

Further, the ones who did exhibit knowledge were unwilling to accept SBA due to failure of carbon market.

6.2.2 Future of SBA

Although SBA can be introduced in 3 forms as discussed in section 5.2 but CSR, which was seen as an important financing mechanism during the literature review, can only be a co-mechanism. CSR can be made more credible through use of SBA as a supporting mechanism. Future researches may delve into the compatibility and inter-dependence of both with each other.

Success of SBA will depend on the extent to which standardisation of the mechanism is possible. There are various possibilities, out of which one is 'Number of benefits'. Detailed

quantification using standard methods can further help in adding credibility to the methodology.

Moreover, SBA may not only be used for wetlands but for other ecosystem conservation projects as well that do not have overtly visible benefits.

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Annex I (a) Impact of urbanisation on wetlands

Following table elaborates on likely effects of urbanization on physical environment and ecology of wetlands.

Physical Environment	*Hydrology*	Decreased surface storage of stormwater results in increased surface runoff (increased surface water input to wetland)
		Increased stormwater discharge relative to baseflow discharge results in increased erosive force within stream channels, which results in increased sediment inputs to recipient coastal systems
		Changes occur in water quality (increased turbidity, increased nutrients, metals, organic pollutants, decreased O2, etc)
		Culverts, outfalls, etc. replace low-order streams; this results in more variable baseflow and low-flow conditions
		Decreased groundwater recharge results in decreased groundwater flow, which reduces baseflow and may eliminate dry-season streamflow
		Increased flood frequency and magnitude result in more scour of wetland surface, physical disturbance of vegetation
		Increase in range of flow rates (low flows are diminished; high flows are augmented) may deprive wetlands of water during dry weather
		Greater regulation of flows decreases magnitude of spring flush
	Geomorphology	Decreased sinuousity of wetland:upland edge reduces amount of ecotone habitat
		Decreased sinuosity of stream and river channels results in increased velocity of stream water discharge to receiving wetlands
		Alterations in shape of slopes (e.g. convexity) affects water-gathering or water-disseminating properties
		Increased cross-sectional area of stream channels (due to erosional effects of increased flood peak flow) increases erosion along banks
Wetland Ecology	*Vegetation*	Large numbers of exotic species present; large and numerous sources for continuous re-invasion of exotics
		Large amounts of land with recently disturbed soils suitable for weedy, invasive species
		Depauperate species pool
		Restricted pool of pollinators and fruit dispersers
		Chemical changes and physical impediments to growth associated with the presence of trash
		Small remnant patches of habitat not connected to other natural vegetation
		Human-enhanced dispersal of some species
		Trampling along wetland edges and periodically unflooded areas
	Fauna	Species with small home ranges, high reproductive rates, high dispersal rates favored
		Large predators virtually non-existent
		'Edge' species favored over forest-interior species
		Absence of upland habitat adjacent to wetlands
		Absence of wetland:upland ecotones
		Human presence disruptive of normal behaviors

Table 27 Likely effects of urbanization (Ehrenfeld 2000)

Annex II (a) Classification of ecosystem services

Following is the classification of ecosystem services received from urban ecosystems:

Type	*Service*	*Source*
Provisioning Services	Food	Wallace, 2007
	Fibre	
	Genetic Resources	
	Bio-chemicals, Natural medicines	
	Ornamental resources	
Regulating Services	Air quality regulation	Wallace, 2007
	Climate regulation	
	Water regulation	
	Erosion regulation	
	Disease regulation	
	Pest regulation	
	Pollination	
	Urban temperature regulation	Gómez-Baggethun & Barton, 2013
	Noise reduction	
	Regulation of climate extremes	
	Waste treatment	
Cultural Services	Cultural diversity	Wallace, 2007
	Spiritual and religious values	
	Recreation and ecotourism	
	Aesthetic values	
	Knowledge systems	
	Educational values	
	Animal sightings	Gómez-Baggethun & Barton, 2013
Supporting Services	Soil formation	Wallace, 2007
	Photosynthesis	
	Primary production	
	Nutrient cycle	
	Water cycling	

Table 28 Classification of Ecosystem services based on Gómez-Baggethun & Barton 2013; Wallace 2007

Annex II (b) Sustainability benefits of urban wetlands

Urban wetlands are comprised of three physical components: the aquatic ecosystem, the surrounding vegetated/ forested areas and often some part of designed parks. Each component produces specific services. Further, according to the SBA methodology, the benefits are classified as

Components	*Type*	*Benefit*	*Individual*	*Local*	*Global*
Lake side/ water edges*	Social	Recreation	**X**		
		Fishing	**X**		
		Bird watching	**X**		
		Boating	**X**		
	Economic	Fisheries	**X**		
		Revenues from ticketing	**X**		
	Environmental	Micro climate regulation		**X**	
		Sink for waste water		**X**	
		Sinks for carbon			**X**
Vegetated areas**	Social	Culture and heritage	**X**		
		Future value of information		**X**	
		Recreation	**X**		
		Bird watching	**X**		
		Hiking	**X**		
		Cognitive development	**X**		
	Economic	Fisheries	**X**	**X**	
		Agriculture	**X**	**X**	
		Timber	**X**		
		Energy/ Fuel wood	**X**		
		Water purification (wetlands created for sewage treatment)		**X**	
	Environmental	Flood control		**X**	
		Storm protection		**X**	
		Ground water recharge		**X**	
		Microclimate stabilization		**X**	
		Shoreline stabilization		**X**	
		Water filtration from pollutants		**X**	
		Sink for carbon			**X**
		Biodiversity			**X**
		Noise reduction		**X**	
		Air pollution reduction			
		Moderation of environmental extremes		**X**	
		Urban temperature regulation			**X**

		Pollination and seed dispersal			**X**
		Environmental indicators (lichens as indicators of pollution)			**X**
		Control of potential agricultural pests		**X**	
Designated park areas***	Social	Recreation	**X**		
		Quality of life	**X**	**X**	
		Physical and psychological well being	**X**		
	Economic	Increased property prices (WTP for houses near parks)	**X**		
		Revenues from entrance fees			
	Environmental	Micro climate regulation		**X**	
		Rain water drainage		**X**	
		Habitat for birds			

* Component I: The aquatic ecosystem, comprising of lakes, streams and water edges
** Component II: The surrounding forested/ vegetated area
*** Component III: The designed/ designated parks associated with urban wetlands

Table 29 Sustainability benefits of wetlands (based on Bolund & Hunhammar, 1999; Boyer & Polasky, 2004; Gómez-Baggethun & Barton, 2013; Wallace, 2007; Zedler & Kercher, 2005)

Annex II (c) Ecosystem valuation methods

Method	Approach	Applications	Data requirements	Limitations	Application
Market methods					
Value of outputs	Estimate volume and value of marketable output	Any marketable output: timber, hunting rights, water rights, tourist services	Sales volume and representative prices	Confined to marketable goods and services	Provisioning
Cost based methods					
Productivity change	Trace impact of change in environmental services on goods produced	Any impact that affects production of goods and services	Change in service; impact on production; net value of goods and services produced	Data on change in service and link to impact on production often deficient	Provisioning
Cost of illness; human capital	Trace impact of change in environmental services on morbidity and mortality	Any impact that affects health (e.g. air or water quality) or the likelihood of accident	Change in service; impact on health (dose-response function); cost of illness; value of life	Dose-response functions often lacking; under-estimates by omitting health preferences	Regulating
Replacement costs (and variants e.g. Relocation cost)	User cost of replacing the lost good or service; next best alternative	Any loss of goods or services	Extent of loss of goods or services; cost of replacing them; risk of less than full success in replacing service	Tends to over-estimate actual value in many circumstances especially if building in contingent for risk	Provisioning, Regulating, Supporting, Cultural
Revealed preference methods					
Hedonic pricing	Extract effect of environmental factors on price of goods that reflect those factors	Property price analysis with respect to air quality, scenic beauty, open space, cultural benefits; also analysis of risk premiums in wages	Prices and characteristics of goods	Requires large data sets to control for all variables influencing the price; very sensitive to model specification	Regulating, Cultural
Travel cost	Derive	Recreation	Survey site	Limited to	Cultural

analysis	demand curve from data on actual travel costs between origins and a single site		users to collect monetary and trip time costs and distance travelled	recreational benefits; problematic when applied to multi-site trips	
Hedonic travel cost method	Derive demand curve from data on actual travel costs between an origin and several sites	Recreation (or any other origin-destination travel)	Data on travel patterns and costs across the district of interest	Requires extensive data on both travel activity and characteristics of different sites that affect their demand	Cultural
State preference methods					
Contingent valuation method	Ask respondents directly their willingness-to-pay for a specified service (e.g. Protection of species, landscape, water supply)	Any service	Survey that presents scenario and elicits willingness-to-pay for specified service	Many sources of bias in responses; guidelines exist to improve reliability, but critically depends on framing the right question	Provisioning, Regulating, Supporting, Cultural
Choice modeling (and variants like con-joint analysis, contingent ranking)	Ask respondents to choose their preferred option from sets of multi-attribute alternatives to derive a price for each attribute	Any service	Survey of respondents that presents the options and variation in key attributes	Analysis of data generated is complex; critically depends on how the question is framed	Provisioning, Regulating, Supporting, Cultural
Other methods					
Benefits transfer	Use results obtained in one context in another similar setting	Any for which suitable comparison studies are available	Valuation exercises at another similar site; using any of the above methods	Can be wildly inaccurate as many factors can vary even when contexts seem similar	Provisioning, Regulating, Supporting, Cultural

Figure 8 Ecosystem valuation methods (NZIER 2013)

Annex III (a) Fieldwork schedule

The work for fieldwork was distributed in such a way so as to ensure enough time was available for each activity. Primary data collection like surveys requiring ore time were spread across larger time whereas interviews were conducted in later part of fieldwork to use knowledge gained from surveys for better and more efficient responses.

Secondary data collection was spread in two parts, first in the beginning as a preparation for field work and second towards the end to make use of primary data collected through surveys and interviews for triangulation.

Market surveys were scheduled during the second week to ensure that the researcher was familiar with the site, had enough background knowledge and awareness about context before proceeding with market surveys.

	Week 1 **15th June to 21st June**	**Week 2** **22nd June to 28th June**	**Week 3** **29th June to 5th July**	**Week 4** **6th July to 12th July**
Secondary data				
GIS based data				
Survey				
Residents				
Non-Residents				
Market survey				
Real estate companies				
Advertising company				
Interview				
Local government				
Interview				
Cheminova, Mumbai				
Interview				
MMTC, Delhi				
Samsung, Delhi				

Table 30 Fieldwork Schedule

Annex III (b) Variables, Indicators and Strategies

Variable	*Sub variable*	*Indicator*	*Strategy*	*Data Collection Method*
Social				
Recreation	-	Number of users (local)	Survey	Questionnaire
	-	Number of users (visitors)	Survey	Questionnaire
Physical and psychological well being	-	Number of users for physical activities (sports/ running/ jogging)	Survey	Questionnaire
	-	Number of visitors for passive recreation	Observation	Questionnaire
Quality of life	Access to green space	Distance from a park/ green space	Survey	Questionnaire
	Perception of quality of life	Perception	Survey	Questionnaire
Economic				
Income generation for owners	Revenue from ticketing	Number of visitors	Survey	Questionnaire
		Willingness to pay	Survey	
	Revenue from advertisement	Advertisement rates	Interview	Unstructured Interview
		Cost paid by advertisers	Interview	Unstructured Interview
Increase in land value	-	Prices of land near project area	Interview	Unstructured Interview
			Secondary data	Internet
	-	Increase in marketability	Opinion survey (non residents)	Unstructured interview
Flood protection	Infrastructure affected by floods	Length and area of roads in flood prone area	Secondary data	GIS/ modelling
	Built up structures affected by floods	Number and area of structures in flood prone area	Secondary data	GIS/ modelling
	Human life affected by floods	Population in flood prone area	Secondary data	GIS/ modelling
Environmental				
Sink for storm water	-		Secondary data	Data on rainfall and floods
Habitat for birds	-	Number of native bird species	Secondary data	Data on bird populations
	-	Number of migratory bird species	Secondary data	Data on bird populations
Urban temperature regulation	-	Temperature difference between locations	Observation on site	Temperature measurements
Carbon storage	Quantity of carbon stored	Canopy cover of vegetation	Secondary data	GIS/ modelling Data on canopy cover

Table 31 Variables, Indicators and Strategies

Annex III (c) List of selected respondents

Respondents	*Representing*	*Sample Size*	*Sampling technique*	*Research Technique*
Open space users	Residents of Kotte	56	Simple random	Questionnaire
Residents in other parts of city	Residents of Colombo	15	Simple random	Opinion Poll
Punith Saparamadu (MD)	Grace Advertising (Pvt.) Ltd.	1	Purposive	Interview as key informant
Lasantha Prasad (Asst. Manager)	Prime Lands (Pvt.) Ltd	1	Purposive	Interview as key informant
Arosh Pradeep Perera (AGM)	Home Lands Holding (Pvt.) Ltd	1	Purposive (Snowball)	Interview as key informant
N. S. Wijayrathne (AGM)	SLLR&DC, Colombo	1	Purposive	Interview as key informant
Dr. A. S. Indulkar (Stewardship Development)	Cheminova, Mumbai	1	Purposive	Semi-Structured Interview
Abhishek Kumar (Head, CSR)	Samsung India	1	Purposive	Semi-Structured Interview
Subhash Bhasker (AGM)	MMTC, New Delhi	1	Purposive	Semi-Structured Interview

Table 32 List of selected respondents

Annex III (d) Beddagana Survey Questionnaire

NOTE: All responses to the questions will be treated anonymously and will only be used for the purpose of academic research.

1. Gender
   - ☐ Male
   - ☐ Female
2. Age
   - ☐ _____ years
3. Which is the park that you visit usually?
   - ☐ Beddagana Wetland Area
   - ☐ Others
4. How far is the park that you usually visit from your house
   - ☐ I live near the park (less than 3 km)
   - ☐ I live more than 3 km from the park
5. If you live far (more than 3 km), state your reason to visit
   - ☐ It is the nearest open space from my house
   - ☐ It is better than parks closer to my house
   - ☐ Others
6. What is your prime reason to visit the area?
   - ☐ Recreation: Active (sports, jogging, exercise)
   - ☐ Recreation: Passive (strolling, meeting friends, bird watching)
   - ☐ Work
   - ☐ Others
7. How often do you visit the park?
   - ☐ Everyday
   - ☐ Every week
   - ☐ Every month
   - ☐ Rarely

To what extent do you agree/disagree with the following statements? (8-14)

8. I visit because it is the most easily reachable open space
   - ☐ Strongly agree
   - ☐ Agree
   - ☐ Neutral
   - ☐ Disagree
   - ☐ Strongly disagree
9. I visit because of the greenery in the area.
   - ☐ Strongly agree
   - ☐ Agree
   - ☐ Neutral
   - ☐ Disagree
   - ☐ Strongly disagree
10. I would visit more often if the greenery in the area was improved
    - ☐ Strongly agree
    - ☐ Agree
    - ☐ Neutral/ doesn't matter
    - ☐ Disagree
    - ☐ Strongly disagree
11. I visit because of the lakeside.
    - ☐ Strongly agree
    - ☐ Agree
    - ☐ Neutral
    - ☐ Disagree
    - ☐ Strongly disagree
12. I would visit more often if the lakeside was improved
    - ☐ Strongly agree
    - ☐ Agree
    - ☐ Neutral/ doesn't matter
    - ☐ Disagree
    - ☐ Strongly disagree
13. I am satisfied with the cleanliness in the area
    - ☐ Strongly agree
    - ☐ Agree
    - ☐ Neutral/ doesn't matter
    - ☐ Disagree
    - ☐ Strongly disagree
14. I would visit more often if the cleanliness was improved
    - ☐ Strongly agree
    - ☐ Agree
    - ☐ Neutral/ doesn't matter
    - ☐ Disagree
    - ☐ Strongly disagree

Following questions refer to development of Beddagana Biodiversity Park and Bird Sanctuary (15-20)

15. I would like this area (Beddagana Wetland Area) to be developed for recreation
    - ☐ Strongly agree
    - ☐ Agree
    - ☐ Neutral/ doesn't matter
    - ☐ Disagree
    - ☐ Strongly disagree
16. I would visit more often if Beddagana Wetland Area is developed as a park
    - ☐ Strongly agree
    - ☐ Agree
    - ☐ Neutral/ doesn't matter
    - ☐ Disagree
    - ☐ Strongly disagree
17. I would like the following facilities to be introduced in the area (you can choose more than one option)
    - ☐ Boating facilities
    - ☐ Children's play area
    - ☐ Sports facilities
    - ☐ Meditation areas
    - ☐ Bird watching decks
    - ☐ Area for strolling/ jogging
    - ☐ Food kiosks
    - ☐ Information center on biodiversity and fisheries
    - ☐ Fishing decks
    - ☐ Others, please specify _____
18. I would visit the park if there is an entry fee to the park
    - ☐ Yes
    - ☐ Doesn't matter
    - ☐ No
19. If yes, I would be willing to pay the following amount for entry ticket
    - ☐ < Rs 25
    - ☐ < Rs 50
    - ☐ < Rs 100
    - ☐ > Rs 100
20. If no, I would only be willing to pay for the facilities and services when I use them
    - ☐ Yes
    - ☐ Doesn't matter
    - ☐ No

Following questions are about your perception towards a developed Beddagana Biodiversity Park (21-24)

21. I think the parks like Beddagana are essential for the city
    - ☐ Strongly agree
    - ☐ Agree
    - ☐ Neutral/ doesn't matter
    - ☐ Disagree
    - ☐ Strongly disagree
22. I think the development of this park will increase the price of nearby property
    - ☐ Yes
    - ☐ Can't say
    - ☐ No
23. I think the development of this park will reduce the pollution
    - ☐ Yes
    - ☐ Can't say
    - ☐ No
24. I think the development of this park will reduce the risk of flooding
    - ☐ Yes
    - ☐ Can't say
    - ☐ No

Thank you

Annex III (e) Interview Guide: Corporate Organisations

NOTE: All responses to the questions will be treated anonymously and will only be used for the purpose of academic research.

(Questions in italics are the cue questions to help respondent answer the main question)

Corporate organisations

1. What type of role does your company play in CSR?

Type of initiative? Internal initiatives/ External initiatives

Type of participation? Investments/ donations/ loans

Preference for sector? Social/ environmental

Preference for beneficiary/ target group? Children/ poor/ animals/ old

2. What is the procedure to decide on your CSR initiatives?

Procedure? Company's own initiative to find sectors/ applications invited

Type of decision making? Higher authority/ influenced by media/ market research

3. What are your key considerations while deciding on a CSR initiative?

Legal mandate/ policy/ tax saving/ advertising/ social work

Local level influence/ global impact/ certifications valid both locally and globally

4. What are some of the examples of projects that are part of your initiatives?

What is the scale of initiatives?

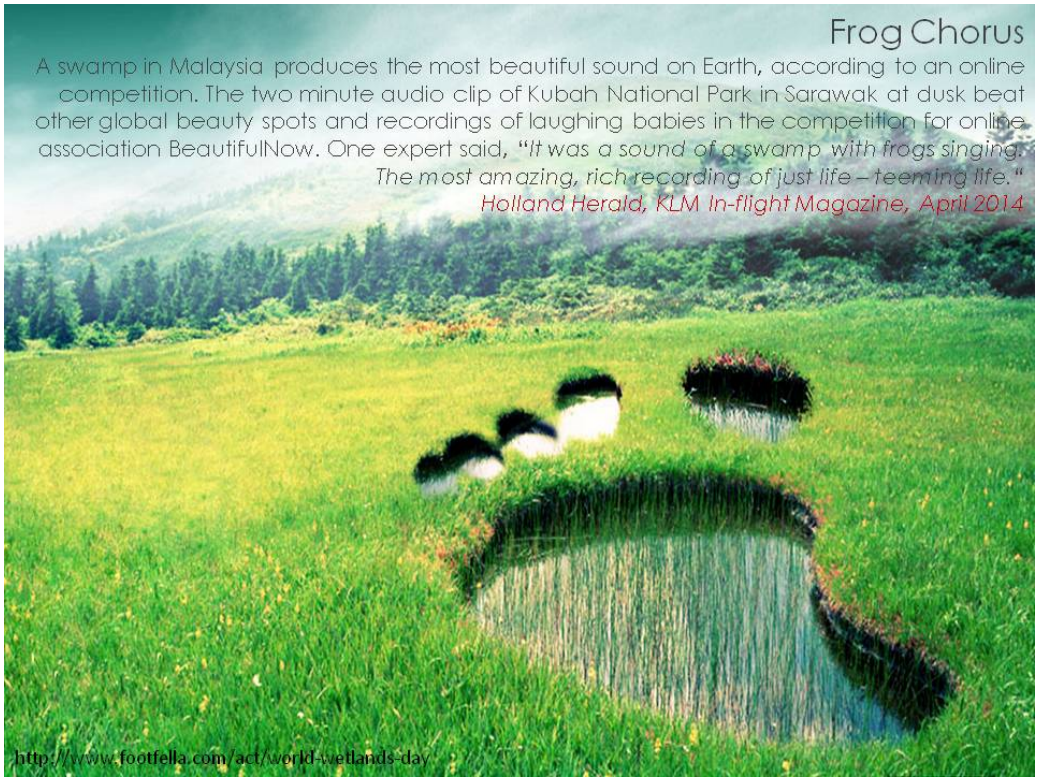
5. Have you ever invested in carbon offset credit or other such Clean Development Mechanisms?
6. Have you ever participated in initiatives for wetland management issues? In what ways?
7. If no, why not?
8. Are you aware of social/ environmental/ economic benefits of urban wetlands?

Explanation about SBA

9. Would you prefer to invest in wetland management if the benefits were more visible?
10. Do you have any suggestions to make it more favourable for your investment?

Annex III (f) Data collection instrument

A handout was given out to the respondents to make them aware of the intention of the interview to explain context and research objective.



Annex IV (a) Sub-projects under MCUDP

1. Walkability and parking improvements along key Colombo roads
2. Improvement to Public Conveniences in Colombo municipal area
3. Model Zone Development of Town Hall Square of Colombo
4. Marine Drive Storm Water Drainage (section 2,4,5) Improvement in Colombo
5. Upgrading / Rehabilitation of Main Drain, Mutwal Tunnel and Aluth Mawatha Culvert
6. Dehiwala Canal Upgrading Sub Project (Bank Protection and Rock outcrop removal)
7. Beira lake restoration (gabion walls along 2.5 km and rehabilitation of McCollum Gates)
8. Beddagana Biodiversity Park and Bird Sanctuary with Rampart Nature Park

Annex V (a) Rainfall data, Colombo

Month	*Average Precipitation (mm)*	*No. of wet days*
January	62	8
February	69	7
March	130	11
April	253	18
May	382	23
June	186	22
July	125	15
August	114	15
September	236	17
October	369	21
November	310	19
December	168	12
Annual	**2404**	**188**

Table 33 Rainfall data, Colombo (Climatemps 2009)

Annex V (b) Bird species data

Following tables give a detailed report of bird species found in Beddagana.

Migratory Bird Species	
Common Name	**Botanical Name**
Kentish plovers	*Charadrius placidus*
Pacific golden plovers	*Pluvialis fulva*
Grey plovers	*Pluvialis squatarola*
Little stints	*Calidris minuta*
Pintail snipes	*Gallinago stenura*
Yellow bitterns	*Ixobrychus sinensis*
Grey wag tail	*Motacilla cineria*
Yellow wag tails	*Motacilla flava*
Common Sand piper	*Actitis hypoleucos*
Marsh Sand piper	*Tringa stagnatilis*
Greenshank	*Tringa nebularia*
Black wing stilt	*Himantopus himantopus*
Green bee eater	*Merops orientalis*
Blue tailed Bea Eater	*Merops philippinus*
Barn swallow	*Hirundo rustica*
Whiskered tern	*Chlidonias hybridus*
Brown shrike	*Lanius cristatus*
Asian paradise fly catcher	*Terpsiphone paradise*

Table 34 Migratory Bird Species in Beddagana (Uni-Consultancy Services 2011)

Resident Bird Species	
Common Name	**Botanical Name**
Asian open bill	*Anastomus oscitans*
Lesser whistling duck	*Dendrocygna javanica*
Cattle egret	*Bubulcus ibis*
Indian cormorant	*Phalacrocorax fuscicollis*
Purple swamphen	*Porphyrio porphyrio*
Common coot	*Fulica atra*
White breasted water hen	*Amaurornis phoenicurus*
Little grebe	*Tachybaptus ruficollis*
Pond heron	*Ardeola grayii*
Night heron	*Nycticorax nycticorax*
Purple heron	*Ardea sumatrana*
Grey heron	*Ardea goliath*
Brown headed barbet	*Megalaima zeylanica*
Crimson fronted barbet	*Megalaima rubricapilla*
Spotted dove	*Streptopelia chinensis ceylonensis*
White throated kingfisher	*Halcyon smyrnensis*
Orange billed babbler	*Turdoides affinis*
Asian koel	*Eudynamys scolopaceae*
Greater coucal	*Centropus sinensis*

Rose ringed parakeet	*Psittacula Krameri*
Brown fish owl	*Ketupa zeylonensis*
White bellied drongo	*Dicrurus caerulescens*
Common iora	*Aegithina tiphia*
Common myna	*Acridotheres tristis*
Magpie robin	*Copsychus saularis*
Red vented bulbul	*Pycnonotus cafer*
Ashy prinia	*Prinia socialis*
Plain prinia	*Prinia inornata*
Pesent tailed jacana	*Hydrophasianus chirurgus*
House crow	*Corvus splendes*
Black hooded oriole	*Oriolus xanthornus*

Table 35 Resident Bird species in Beddagana (Uni-Consultancy Services 2011)

Annex V (c) Plant species data

Following tables give a detailed report of native tree species for Beddagana.

Common name	***Scientific name***
Bowitiya	*Osbeckia parvifolia*
Kirilla	*Glochidion stellatum*
Nuga/ Banyan	*Ficus bengalensis*
Mango	*Mangifera indica*
Madan/ Jamun	*Syzygium cumini*
Madatiya	*Adenanthera pavonina*
Na	*Mesua ferrea*
Mara/ Rain Tree	*Samanea saman*
Jak/ Jackfruit Tree	*Artocarpus heterphyllus*
Ehala/ Amaltas	*Cassia fistula*

Table 36 Native Vegetation Species (Uni-Consultancy Services 2011)

Annex V (d) Sustainability benefits of Beddagana

Type of benefit	Benefit	Literature			Field Research			
		Individual	Local	Global	Survey	Interview	Secondary	Observation
Social	Recreation	X			X		X	
	Fishing	X					X	
	Bird watching	X					X	
	Boating	X						
	Culture and heritage	X					X	
	Future value of information		X		X			
	Recreation	X					X	
	Hiking	X						
	Cognitive development	X						
	Quality of life	X			X			
	Physical and psychological well being	X			X		X	
Economic	Fisheries	X					X	
	Revenues from ticketing	X			X			
	Agriculture	X						
	Timber	X						
	Energy/ Fuel wood	X						
	Water purification (wetlands created for sewage treatment)		X					
	Increased property prices (WTP for houses near parks)	X			X	X		
Environmental	Micro climate regulation		X					X
	Sink for waste water		X				X	
	Sinks for carbon			X			X	
	Flood control		X			X	X	
	Storm protection		X		X		X	
	Ground water recharge		X				X	
	Shoreline stabilization		X				X	

	Water filtration from pollutants		X				X	
	Biodiversity			X			X	X
	Noise reduction		X					
	Air pollution reduction						X	
	Urban temperature regulation		X					X
	Pollination and seed dispersal			X				
	Environmental indicators (lichens as indicators of pollution)			X				
	Control of potential agricultural pests		X					
	Rain water drainage		X			X	X	
	Habitat for birds						X	X

Table 37 Benefits and corresponding methods of data collection