

Citizen Perceptions of the Socio-Ecological Value of the Eastern Hills of Bogota: A Place-Based Ecosystem Service Assessment

by

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Candidate's Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of the author's knowledge, it contains no material previously published or written by another person, except where due reference is made in the text.

Eleanor Mona Robson

26 October 2016

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Abstract

Due to widespread deterioration of ecosystems and their subsequent reduced capacity to provide for human wellbeing, decision makers seek to understand how to better manage natural resources to produce a more sustainable future. Integrated assessment of natural and human systems is regarded as a way to facilitate such change, and effective engagement of stakeholders is recognised as a key requirement of such an assessment. Although there are many engagement processes, for special interest groups, there is difficulty in understanding how a broader citizenry may understand and value natural areas.

Participatory, place-based ecosystem service analysis is one framework for inclusive, contextually relevant and integrative knowledge building. This thesis reports on a place-based participatory study that identifies the way that urban citizens conceptualise the socio-ecological value of a nearby protected area. It takes place in Bogota, the capital of Colombia, a rapidly growing, developing country. This aims to contribute to a multifaceted, integrated understanding of the ecological, social and economic services the Eastern Hills Protected Forest Area provide to the city.

The study used a mixed qualitative-quantitative survey method involving a ranking exercise and a semi-structured conversational component. It showed that, in quantitative terms, the biophysical and ecological services of fresh water and habitat provision, biodiversity, carbon sequestration, erosion control and climate and air quality were the most highly prioritised ecosystem services due to their fundamental importance for the maintenance of human life and wellbeing. The conversational component facilitated the communication of emotive and cultural facets of value that the Hills hold for Bogotans. For example, citizens hold a strong pro-conservation stance, and believe the Hills are important in their contribution to Bogotan identity. The divergent character of the results according to qualitative and quantitative elements confirms the importance of using a multi-faceted method that can capture different conceptions of value to generate a more holistic picture.

This study testifies that the Eastern Hills embody potent socio-ecological significance for Bogotans. There is enthusiasm on the part of the citizenry to be included in determining the future of the Hills and the city, and widespread support and concern for greater education about the ecology, history, change and current use of the area. These findings indicate that managers should consider citizen values and respond to citizen input. Methodologically, this study demonstrates that the place-based ecosystem service approach can be developed as a practical tool for developing an integrated understanding of citizen values for local natural areas.

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List of Acronyms

ANU	The Australian National University
CAR	Autonomous Regional Corporation of Cundinamarca (in Spanish, la Corporación Autónoma Regional de Cundinamarca)
DAMA	The Administrative Department of the Environment (in Spanish, el Departamento Administrativo del Medio Ambiente)
DSE	District Secretary of Environment
DSP	District Secretary of Planning
ES	Ecosystem Services
MA	Millennium Ecosystem Assessment
NGO	Non-Government Organisation
PBESA	Place-Based Ecosystem Service Assessment
POMCO	The Eastern Hills Management Plan (in Spanish, el Plan de Ordenamiento y Manejo de los Cerros Orientales)
POT	Territorial Urban Plan (in Spanish, el Plan de Ordenamiento Territorial)
TEEB	The Economics of Ecosystems and Biodiversity

Chapter 1: Introduction

Widespread deterioration of ecosystems and their subsequently reduced capacity to provide for human societies have led analysts, decision makers and citizens seek to understand how humans relate to the natural world, to enable a more sustainable future. Integrated assessment of natural and human systems is regarded as a way to facilitate change. This is especially pertinent in the urban arena given that by 2050 it is projected that two-thirds of the world's population will live in cities worldwide (United Nations, 2014). Population concentration and demand to increase standards of living, especially in developing countries, will increase pressures on natural areas in urban settings. Accordingly, it is important to gain an understanding of values associated with protected and natural areas for natural resource management.

Effective engagement of stakeholders is recognized as a key requirement for integrated assessment of environment and society. This emerges for ethical and pragmatic reasons. In terms of distributive and procedural justice, those who are affected by how resources and land are managed should have input into how this occurs (Bingham, 2006). Practically, it has been argued that including stakeholders increases the likelihood of policy acceptance and adoption, the creation of governance that responds more sensitively to citizen needs and increases understanding of the temporal and spatial variation of environmental benefits within society (Paavola and Hubacek, 2013). Consideration of stakeholder values associated with natural areas speaks to both the ethical and pragmatic agendas, and forms part of a broader effort to conduct interdisciplinary, integrated management of natural resources.

Participatory, place-based ecosystem service assessment (PBESA) is one framework for inclusive, contextually relevant and integrative knowledge building (Potschin and Haines-Young, 2012). This framework combines the strengths of place-based analysis, which facilitates the expression of socio-ecological value associated with a specific natural place, and ecosystem services, where benefits of ecosystem and biophysical functionality that maintain human life are conceptualised as 'services'.

This thesis reports on a PBESA that identifies the way that urban citizens conceptualise the socio-ecological value of a nearby protected area. The case study of the PBESA takes place in Bogota, the capital of Colombia, a rapidly growing, developing country. It is used to explore the how citizens, a principle stakeholder in natural resource management, conceptualise and justify the significance of natural areas, and as a continuation, how these value systems contribute to management priorities. The study aims to contribute to a multifaceted, integrated understanding of the ecological, social and economic services the Eastern Hills Protected Forest Area (known henceforth as 'the Eastern Hills' or 'the Hills') provide to Bogota.

Colombia is a country in social and political flux, with globally important natural systems and increasing economic aspirations. Understanding the dynamic relationship between the people and natural areas and the trade-offs inherent to their management are central to this research. The Eastern Hills is a focal place through which to explore local values. These aspects must be understood if the area is to be managed as a principal ecological feature and common inheritance for Colombians. This is especially pertinent in the context of population growth, climate change and the presence of chronic socioeconomic inequality, which will further increase pressures on benefits that the Eastern Hills provide.

The involvement of citizens in planning, use and conservation of the Hills is important for a suite of reasons. Population growth and urbanisation have had major effects on the health of ecosystems of the Hills, and these drivers will continue to play critical roles in determining the future of the area given that the population is growing rapidly (Secretaría Distrital de Planeación, 2013). Bogota's inhabitants require at a base level, for example, land upon which to live, along with consistent provision of water, clean air, green space and opportunities for recreation. These will be accompanied by other, more subjective values such as aesthetic inspiration, spiritual fulfilment and a value for connection to nature. The way that prioritisation of these needs plays out will have consequences for the management of the Hills, given that they are a major provider of all of these values. In the context of an ever more complex urban-environmental relationship, the proactive elucidation of citizen values can cast a light on areas of potential conflict and also misunderstood synergies, and opportunities for collaboration and involvement with citizens. Stakeholder engagement in conservation and land use planning represents the potential to create trust and exchange between local and State actors which can assist in recuperation of the social, ecological and cultural value embedded in the Eastern Hills of Bogota (Garzón Díaz, 2014).

1.1. Aim and Question

The aim of this research is to investigate the way that Bogotan citizens conceptualise and value the Eastern Hills of Bogota. As such, the research questions of this study are:

- 1. How do citizens of the city of Bogota perceive, value and prioritise the ecosystem services associated with the Eastern Hills protected forestall area?**
- 2. Do variables of age, gender, economic level and area of residence, which inform a citizens' experience of urban life in Bogota, affect attitudes towards the Hills?**

Collaboration with local environmental groups, consultation with interested local specialists and treating participants as co-producers of knowledge are key epistemological facets of the thesis. It is

hoped that this thesis will then be a tool for empowering Bogotans in advocating for inclusion of citizens and their values in natural resource management.

This research does not set out to identify the key failings in governance of the Hills, nor prescribe measures for sustainable use of the area. However, understanding of values and place-meaning associated with the Eastern Hills can meaningfully advance collaborative planning (McIntyre *et al.*, 2008).

This research seeks to produce a base-level understanding of the way Bogotan citizens value the Eastern hills, through a place-based ecosystem services assessment. This framework offers a promising approach for understanding the multi-faceted value associated with a natural area, and the way that these values can be integrated into practical management of ecosystems and natural resources.

1.2. Scoping

Given the constraints of the Honours program, this is intended to be a preliminary, exploratory study. It will test a methodology used to create a base-level of primary evidence which may be elaborated upon by other actors. It focuses on collecting simple quantitative and qualitative data from diverse groups of participants to investigate citizens' values in relation to the Hills, and examine if these change according to different experiences of life in Bogota.

1.3. Thesis Structure

After this introduction, a literature review will be presented as the second chapter to provide a foundation for the study. This will include contextualising the participatory, place-based ecosystem service framework in the broader literature and examining the existing participatory studies on the Eastern Hills. Chapter 3 will introduce the case study, giving information on the relationship between Bogota and the Eastern Hills. Chapter 4 will explain the methodology, method and data analysis. Chapter 5 will contain the results of the thesis. The broader interpretation of results and methodological criticism will be presented in the discussion in Chapter 6. The thesis will conclude by looking to future research directions and evaluation in Chapter 7.

Chapter 2: Literature Review

The practice of citizen consultation in environmental management will be introduced and current arguments and issues in the literature will be outlined. The conceptual framework of participatory, place-based ecosystem service analysis will be illustrated and justified. I will then examine existing studies in participatory evaluation of the Hills and their management from the perspective of Bogotans, and clarify how this study will contribute in the local context.

2.1. Participatory approaches to natural resource management

Engagement with stakeholders has become a cornerstone of contemporary approaches to tackle complex issues from which environmental problems arise. It has developed in different geographical and disciplinary contexts, in response to failure of management efforts based in single disciplines or reductionist knowledge sets to deliver sustainability (Raymond *et al.*, 2010). The emergence of the post-normal paradigm has seen the mainstreaming of participatory research as one way to grapple with the complexity of contemporary environmental problems. Incorporating interdisciplinary information and stakeholder perspectives is perceived to be an essential part of adaptive, effective management for problems where “facts are uncertain, values are in dispute, stakes are high and decisions are urgent” (Funtowicz and Ravetz, 1991).

Blackstock, Kelly & Horsey (2007) write that participatory research and governance is believed to be constructive due to a combination of the normative, substantive and instrumental benefits arising from active involvement of citizens, which result in tangible improvements in the governance of natural resources. Reed (2008) elaborates on the positive outcomes which are often believed to result from participatory processes, and categorises them as normative or pragmatic (though they are rarely mutually exclusive). In terms of normative motivations, many (e.g. Stringer *et al.*, 2006; Martin and Sherington, 1997; Beierle, 2002) argue that stakeholder participation has benefits for democratic society and equity, and ultimately improves power relations and fairness in environmental management. For example, by involving citizens and stakeholders, the likelihood that those on the periphery of decision-making are excluded is reduced, public trust in decisions can be increased and social learning can be encouraged (Reed, 2008). Pragmatists assert that the involvement of stakeholders can make decisions and research more robust by providing higher quality information inputs (e.g. Fischer, 2000; Guijt, 1999; Dougill *et al.*, 2006). This leads to more resilient communities, acceptance of implementation, and compliance with measures (Reed, 2008; Menzel and Teng, 2010). The relationship between these conceptual and applied motivations for participatory methods are shown in Table 1.

While there are many advantages to engagement of stakeholders, it can also to increase complexity in management. For example, conflict can be inadvertently encouraged by providing a legitimate platform

for exposing differences in opinion or tensions. Unintended biases or poorly-developed critical thinking can lead stakeholders to give an under-informed contribution (Sheedy *et al.*, 2008). For these reasons, stakeholder and citizen views, like all knowledge contributions, must be treated as one perspective of many that inform decision making within the problem space.

Table 1: Conceptual and applied motivations for participatory research and governance

Reasons for Participatory Research (Blackstock, Kelly & Horsey, 2007)	Advantages in Application (examples) (Reed, 2008)
<u>Normative</u> : encouraging social and individual learning enriches society and citizens	→ <u>Normative</u> : improves equity and power relations in a society
<u>Substantive</u> : encouraging multiple perspectives improves understanding of the issues and therefore selection of appropriate solutions	→ <u>Pragmatic</u> : provides higher quality information inputs
<u>Instrumental</u> : encouraging collaborative relationships assists with implementation and diffusing conflict	→ <u>Pragmatic</u> : leads to more resilient communities, acceptance of implementation, and compliance with measures

Participatory ideas have contributed to the development of fields such as adaptive co-management, trans-disciplinary planning, community-based natural resource management and sustainability science (Raymond *et al.*, 2010). It has also been reflected in processes of governance institutions at multiple scales worldwide; such as in the Water Framework Directive in the European Union (Newig and Fritsch, 2008), initiatives like the Community Cabinet in Queensland, Australia (Reddel and Woolcock, 2004), city-level programs such as the Cape Action Plan for People and Environment in South Africa (Reyers *et al.*, 2010), along with numerous others.

Grasping the multiple understandings of an environmental management issue acknowledges that “many natural resource conflicts are more about values than they are about facts” (Yankelovich, 1991 in McIntyre *et al.*, 2008:658). In tangent with the emergence of participatory, values-based ontological trends in sustainability has been the epistemological development of frameworks to look at the multi-faceted reality of natural resource management issues.

Various citizen-oriented approaches to natural resource management exist. The most common form of participation is a public hearing or forum, however, it has been noted that these can be ineffective or tokenistic if consultation is done too late in the decision-making process (Marshall and Jones, 2005). Deliberative democracy is advocated to be a means of creating a longer-term, socially-oriented understanding of environmental issues, encouraging a sense of communal care for common resources (Ward *et al.*, 2003). Citizen’s juries are an example of a method for institutionalising the deliberative

approach to governance of natural resources by engaging a group of participants to deliberate on an environmental issue. While these are valuable methods, I have chosen a participatory, place-based ecosystem service approach for the framework of this research as it facilitates construction of a broader socio-ecological narrative about environmental value, as opposed to focusing on a narrower problem or objective.

2.2. Place-based ecosystem service assessment

This section will introduce the place-based ecosystem service assessment as the approach this study uses to explore socio-ecological values associated with the Eastern Hills on the part of the Bogotan citizenry.

Ecosystem services has grown in popularity as a framework for integrated assessment of the links between natural systems and human wellbeing. Ecosystem services is a term which refers to the benefits supplied to human societies by natural ecosystems (Daily *et al.*, 1997). By expressing the complexity of ecosystem and biophysical functionality as services for human life, the healthy functionality of ecosystems implies a direct link and imperative to preserve human-environmental systems. This constitutes a functionally meaningful way to understand a range of ecosystem values (Raymond *et al.*, 2009).

The ecosystem services concept has advanced in areas of technical analysis such as economics and the physical sciences, but not so far in the social aspects (Potschin and Haines-Young, 2012). The framework has not yet evolved to such an extent that it engages local communities in identification and valuation of ecosystem services at place-specific scale (Raymond *et al.*, 2009). Without being directed by understanding of social value, some argue it is unlikely that highly technical analyses done will have a “trickle-down effect” and be implemented in reality (Cowling *et al.*, 2008). While contributory expertise can play a valuable role in demonstrating divergent scenarios and management options, it is only one form of expertise in a suite that can contribute to deciding environmental policy (Carolan, 2006). Being a mission-oriented approach, post-normal scientific analyses should respond to stakeholder needs from the outset by collaborating and empowering stakeholders in development and implementation of ecosystem service management (Cowling *et al.*, 2008).

Potschin and Haines-Young (2012) emphasise the utility of place-based analysis as a way in which the socio-ecological value of a landscape, as understood by divergent stakeholders, can contribute to ecosystem and natural resource governance. Focusing on place provides context in which problems can be articulated and different values can be understood, and consequentially, provide greater insight into how conflicts can be processed. Conducting place-based studies into social values associated with

natural areas has increased (e.g. Borrie *et al.*, 2002; McFarlane and Boxall, 2000). However, some landscape value approaches only have a limited scope for incorporating biophysical and ecological value (Raymond *et al.*, 2010). For an integrated assessment, social and human value must be linked to landscape functionality to be meaningful in management strategy.

Place-based value analysis is a powerful tool for understanding the human value associated with a natural asset, and is a useful structure for the facilitation of participatory studies. The ecosystem services framework is an accessible, integrative tool that can ground value studies by translating the notion of value into a lucid management direction. In combination, PBESA represents a meaningful way to engage a variety of stakeholders to demonstrate the multifaceted ecological and social value of a natural area, and how this value applies to management of biophysical characteristics and ecosystem functionality in a place (Table 2).

Potschin & Haines-Young (2012) assert that PBESA is sparse, despite Carpenter *et al* (2009) suggesting that long term place-based research has become a principal tool for managing ecosystem services. Despite this, Raymond *et al* (2009) in their study of community values associated with places in the Murray-Darling Basin in South Australia is an example of a participatory PBESA. Methodological advancement within this framework that has been tested in practice is, I suggest, currently limited.

Table 2: Characteristics, strengths and weaknesses of place-based ecosystem service approach

Characteristic	Advantages	Disadvantages
• Services assessed as a bundle across units that have strong social relevance or resonance • Deliberative and temporally sensitive by giving attention to past change and future visions	• Allows better understanding of local contexts, and therefore priorities and values • Can be used to look at patterns of use and demand as well as adequacy of supply of service • Allows issues of trade-offs and any associated conflicts to be identified and potentially resolved, and local scenarios to be examined as part of developing management visions • Allows implications of alternative management of policy options to be tested easily through participatory methods; can support adaptive management approaches • Local buy-in	• Difficult to generalise results because of uniqueness of place • Difficult to measure model services at local levels because of uncertainties and lack of base-line data • Needs many different kinds of skills and competencies to be combined to accomplish the inter- and transdisciplinary challenges required by the analysis of place • Time consuming • Expensive

Source: Potschin & Haines-Young, 2012: 1058

2.3. Citizen values associated with the Eastern Hills of Bogota

Few studies have engaged with a wide variety of Bogotan citizens to elicit nuanced information about the socio-ecological value attributed to the Hills. There has been a surge in research concerning the Eastern Hills since 2001, with 46 percent of works produced in that period (Franco, 2013). Of knowledge created, 98 percent is expert or scientific, and only 2 percent corresponds to local knowledge (ibid: 108). Governmental institutions have created 30 percent of work, academia has made 31 percent, community, NGOs and the church have written a combined 4 percent, and the remaining 35 percent is comprised of unpublished works (like theses) and mixed public-private entities (ibid: 112).

Existing analyses are focused on socio-ecological conflict associated with the Hills (e.g. Ramírez Hernández, 2009; Gómez Lee, 2009), public policy (e.g. Bohórquez Alfonso, 2008b; Garzón Díaz, 2014), urban planning (e.g. Carrillo Flóres, 2011; Toro Vasco, 2005) or examine generally the sources of difficulty in governance of the area (e.g. Meza, 2008).

Studies that examine socio-ecological value associated with the Hills from the perspective of stakeholders focus on specific communities living within the Hills or on the urban fringe. These studies are often done by Government bodies and these stakeholders are chosen as they are highly affected by consequences of planning and policy. For example, in 2015, the District Secretary for Planning (DSP), District Secretary for the Environment (DSE) and Natural Heritage Fund published a work called *That's how we live in the Hills! Experiences of Habitability* in which primary qualitative information collected from communities in the Hills regarding their way of life was presented. This kind of information assists in spatially specific tasks such as zoning, and governance of one segment of the urban population that has unique characteristics. This study focus is chosen to better understand particular situations of conflict and vulnerability. Government consultation with a broader section of the population for planning purposes is done through stakeholder engagement forums, which are conducted with those living in municipalities that share a border with the Hills.¹

The tendency of Government process to focus solely on citizens with direct ties to the area is beginning to change. Mesa and Ramírez from the DSP published a study that enquired about the preferences that citizens hold for use of the Hills, called *Governance at a Larger Scale* (2016). This marks a novel approach to participatory planning in Bogota, where the City Administration engages with the broader Bogotan public. The employment of such approaches by local institutional actors confirms the demand for information with a broader participant scope that is not defined by proximity or regular direct use of the Eastern Hills.

¹ Schedule updated continuously at: <http://www.sdp.gov.co/portal/page/portal/PortalSDP/ParticipacionCiudadana>

While institutional actors often focus on the practical preferences that people hold for planning, others look at the perceptions of citizens in a more conceptual and intangible way. An example of a work that features primary information regarding perceptions of value is *Socio-spatial relationships in the Eastern Hills: Practices, values and forms of territorial appropriation in the La Vieja and Delicias Gullies*, an undergraduate thesis written in 2013 by Jamie Andrés Tamayo Buendía. This examines the perceptions that people have when they interact with two specific gullies in the Eastern Hills. It provides in-depth qualitative information but has a much smaller sample size and is based on the experience of two areas instead of the Hills as a whole. Ordóñez & Duinker (2014) look at urban forest values held by the citizenry of Bogota, Cali and Pereira. This is an illuminating study that demonstrates broad, contextually relevant socio-ecological value information and the way that forest values change according to local context. This is a valuable study which can provide an overview of different value systems. This thesis will provide more comprehensive information to enrich this multi-city study.

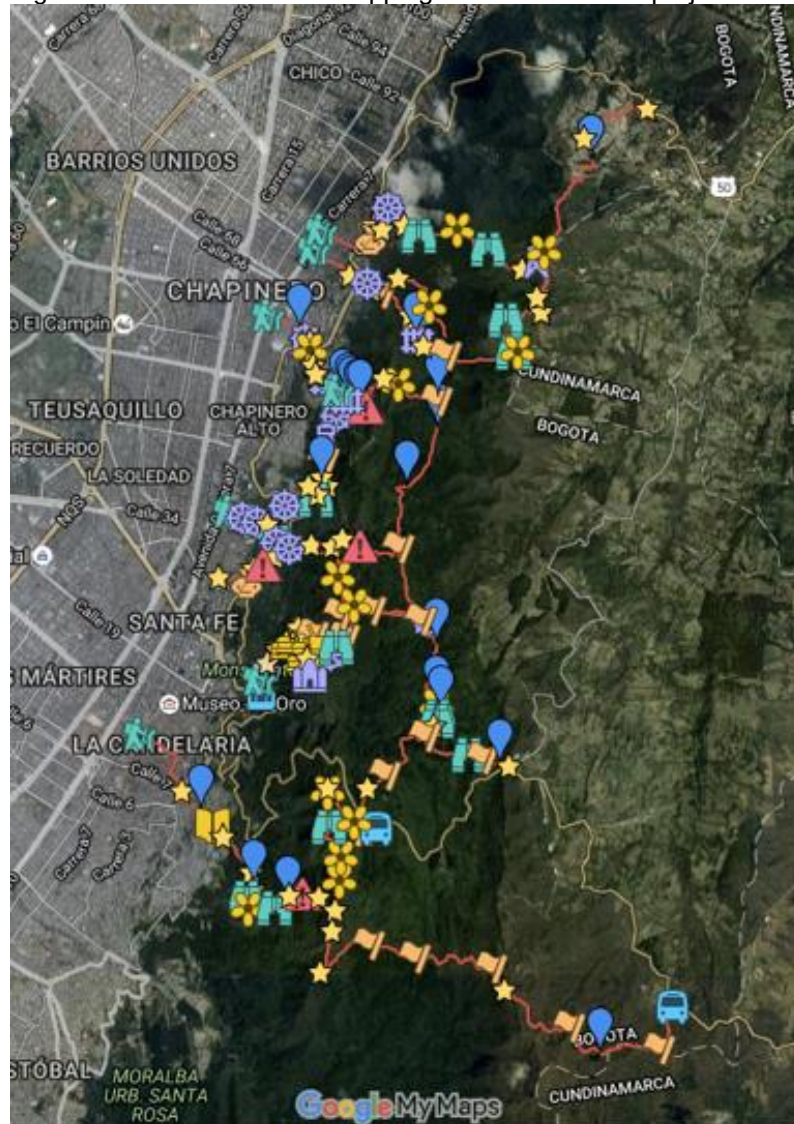
Outside the governmental and scholarly arenas, participatory and citizen knowledge about the Hills is being created through community groups, NGOs and advocacy organisations. One example is the Environmental Roundtable of the Eastern Hills, an organisation that represents the views, interests and needs of vulnerable communities living in the Hills through public forums, protests and public debates. In 2008, it published *Public Territories, Environment and Habitat: Proposals for Public Policy from the Eastern Hills of Bogota*, a document which serves as a manifesto of the approach and perspectives of communities living in the Hills to governance of the area. Such efforts have had a significant impact on the management approach, instruments and territorial planning paradigm of the Hills, raising issues about the rights of citizens to be included (Mendoza Leon, 2013). Production of knowledge by citizen groups is a continuous process and occurs on many scales by different means and for different ends. For example, in mid-September 2016, a group comprised of citizens who advocate conservation of the Hills following an enjoyment of walking in the area called Friends of the Mountains, documented part of the participatory, citizen-directed mapping exercise of the Hills. This document provides a cartographical representation of the important parts of the Hills in Usaquén and Chapinero municipalities to participants, and is a tool that is created through collaboration between participants, the DSP and the Friend of the Mountains (Figure 1). Such projects represent the ongoing integration of innovative citizen knowledge into planning and policy in Bogota.

While strides are being made by academic and institutional actors in understanding the different dimensions regarding the way that Bogotans value the Eastern Hills, this thesis aims to fill the knowledge gap that exists in terms of:

1. The scope of participants engaged: this study seeks primary information from citizens of the broadest variety in terms of economic level, age, gender and place of residence. Other studies focus on a specific stakeholder group or experience.

2. The way the Hills are conceptualised: this thesis understands the Hills as a larger landscape element, as opposed to looking at a small zone or specific use or feature.
3. Understanding attitudes, values and perceptions of the Hills by categorising responses according to a place-focused, ecosystem services framework. This will create an exploratory study that is not defined by a specific conflict, issue or planning goal.

Figure 1: “Count on me for mapping the Eastern Hills” project



Source: (Amigos de la Montaña, 2016)

Chapter 3: Case Study Background

This section presents an overview of the relationship between Bogota and the Eastern Hills according to historical, demographic, planning and environmental information, in order to justify citizen engagement in this context. An overview of the history of Bogota and how it has affected the Hills, a characterisation of the types of benefits and goods provided by the Hills to the city and an exploration of the importance of stakeholder engagement in management of this relationship will follow.

Bogota is the capital of Colombia, a developing country in the North-Western of South America (Figure 2 & Figure 3). Bogota is situated on a savannah in the North Andean mountain range that, before urbanisation, was defined by a system of wetlands. To the west and the south, it is flanked by the Bogota River, and to the East, a series of mountains. The forested area of these mountains are known as the Eastern Hills of Bogota (Figure 4).

Figure 2: South America



Source: (McNally, 2016)

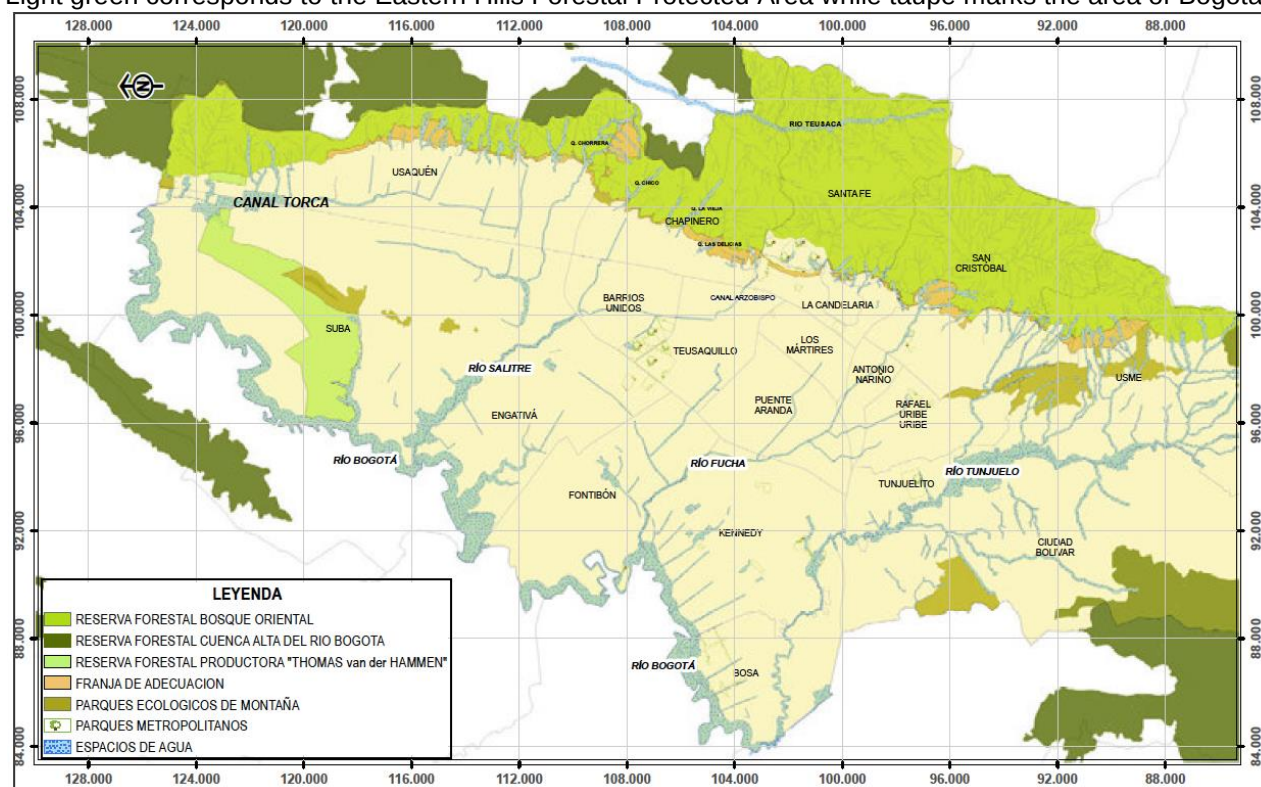
Figure 3: Colombia



Source: (Unknown, 2016)

Figure 4: The Principal Ecological Structure of Bogota

Light green corresponds to the Eastern Hills Forestal Protected Area while taupe marks the area of Bogota



Source: (Secretaria Distrital de Planeacion *et al.*, 2015:21)

The management of the Hills has major consequences for the city of Bogotá, as they form a major part of the ecological structure of the city. Historic use preferences of natural resources and services offered by the Hills, like material extraction and as human settlement area, have affected the Hills' capacity to provide other ecosystem services to Bogotá, and consequentially, has impacted on the wellbeing of the city's population (Jiménez Ramos, 2011). Subsequently, efforts for the conservation of natural areas like the Eastern Hills have increased.

The area represents a variety of values to a multitude of stakeholders on local, regional and national levels (Mendoza Leon, 2013). Following its biophysical and ecological significance, the area is protected under national and city conservation law. Despite this, some parts are occupied by informal settlements, subject to illegal resource extraction and harbour criminal activity. The Hills embody an area of urban socio-ecological conflict as pressures of population growth, quality of living, fulfilment of basic needs, socio-economic equality and justice all play a role in governance of the space.

Despite this, management decisions regarding the Hills have been characterised by a lack of consultation with important actors, one being Bogotan citizens. While community groups representing vulnerable settlements in the Hills (e.g. Environmental Roundtable for the Eastern Hills), local

environmental groups (e.g. Bogotan Hills Foundation) and other non-government groups are increasingly included in governance of this area, no study elucidates the opinions, values and conceptualisations of value that the Hills have for the broader Bogotan population.

3.1. Character of the Eastern Hills of Bogota

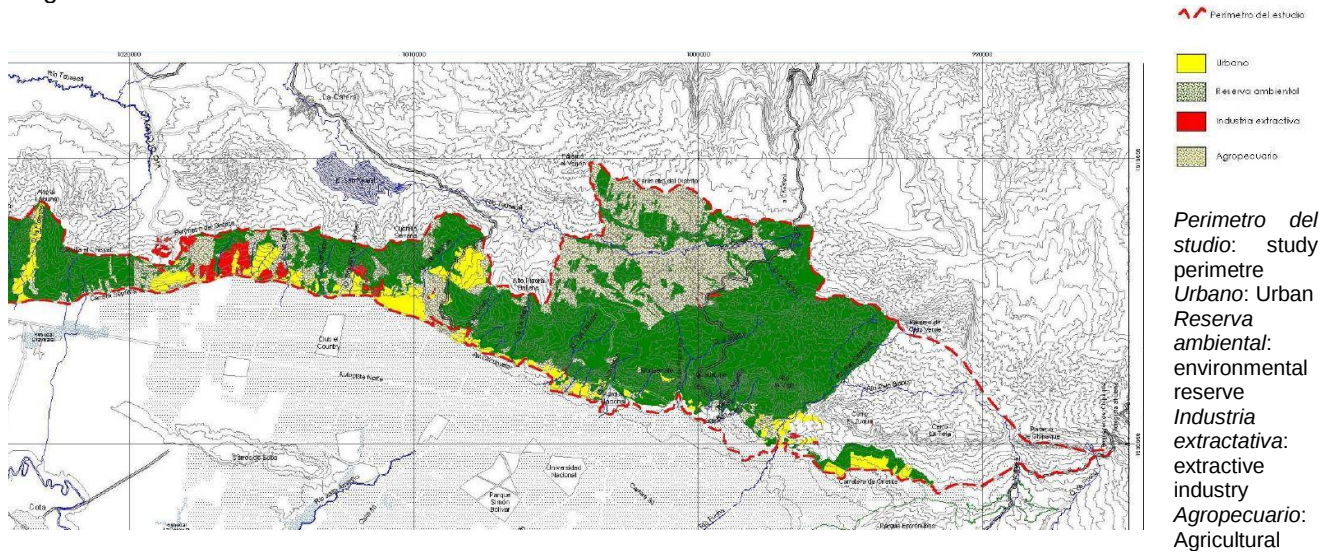
The Eastern Hills are characterised by their situation close to the equator and as part of the Andean mountain range. Soils are mostly fragile given their composition of clay and sand gravels in combination with steep inclines (Corporacion Ambiental de Cundinamarca, 2006). Altitude of the Hills ranges between 2575 and 3650 MASL, and form part of the equatorial region, resulting in a cool tropical climate with temperature vacillation that averages 14°C (Alcaldía Mayor de Bogotá, 2016). The existence of gorges and peaks, in combination with the variable rainfall and mild temperatures, produces various microclimates and subsequent species richness. Being part of the Andean range, they form part of a larger regional biodiversity structure and link other reserves to one another. While there is high heterogeneity, vegetation communities can generally be classified in three ways: as Páramo, High Andean Forest or Low Andean Forest (Corporacion Ambiental de Cundinamarca, 2006). The vegetation profile of the area (see Figure 5) has been strongly influenced, and will continue to be defined by, a disturbance regime enacted primarily by people. Urbanisation processes, especially over the past 200 years, have seen the indiscriminate felling of trees, introduction of exotic species, urban developments in the foothills, and religious and recreational use of particular peaks (Secretaria Distrital de Planeacion *et al.*, 2015). Vegetation cover is in good condition in areas of steep incline and where access is difficult. Conversely, degradation is most intense in flatter areas on the urban fringe due to accessibility by humans.

Human activities, like the clearing of vegetation cover, have the potential to result in wide ranging consequences for the provision of almost every ecological and human benefit derived from the Hills. For example, vegetation cover is essential for (ibid):

- Stable soils and the subsequent services provided by the soil, such as aquifer recharge and the prevention of landslides and flooding
- Biodiversity and habitat provision
- Regulation and release of large quantity of water received by Hills
- Air quality
- Climatic regulation
- Aesthetic, cultural and recreation value

The negative consequences for provision of previously mentioned ecosystem services can be ameliorated by good management, and these trade-offs should be considered when making land-use decisions.

Figure 5: Land use in the Eastern Hills



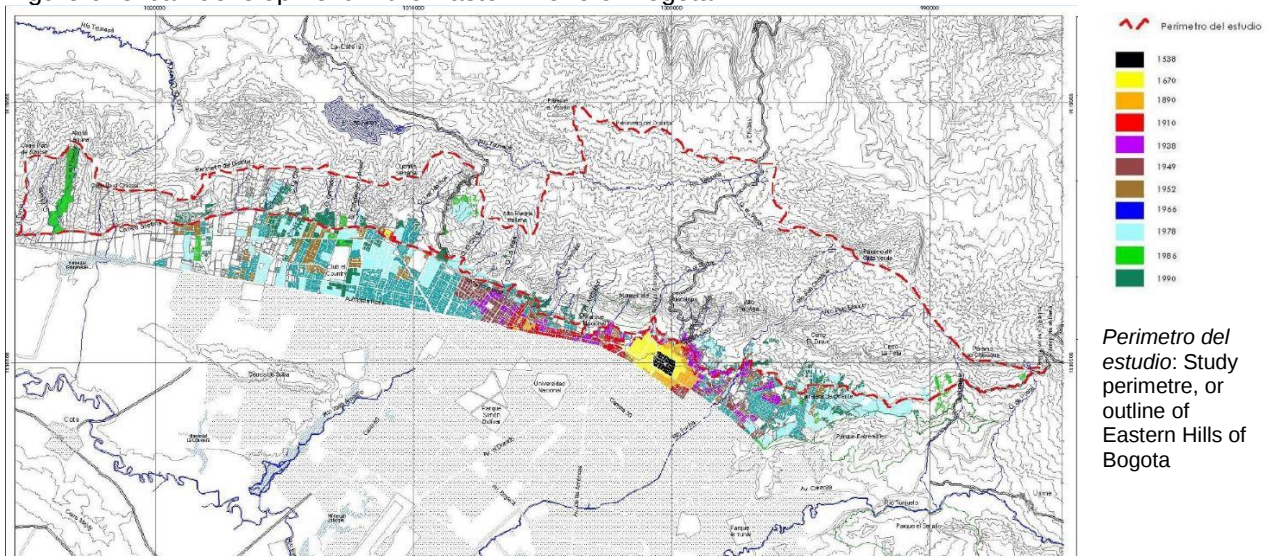
Source: (Fundación Cerros de Bogotá, 2009a)

3.2. Urbanisation

Just as the Hills have been the spine upon which the city has grown, the economic, social, political and demographic characteristics of Bogotá define the contemporary drivers of change in the landscape.

Spanish colonisers arrived to the plateau in 1538, which had been inhabited by the Indigenous Muisca people, and a settlement was created as a military post (Martínez, 1976). The Hills were important to the new settlement both as a barrier for physical security and as a primary resource base upon which the city was built and maintained (Centro de Investigaciones de la Facultad de Arquitectura, 1999:51). From the beginning, the Eastern Hills served as the most important landscape feature for orientation and physical development of the city (Figure 6) (Mejía Pavony, 2000:53).

Figure 6: Urban development in the Eastern Zone of Bogotá

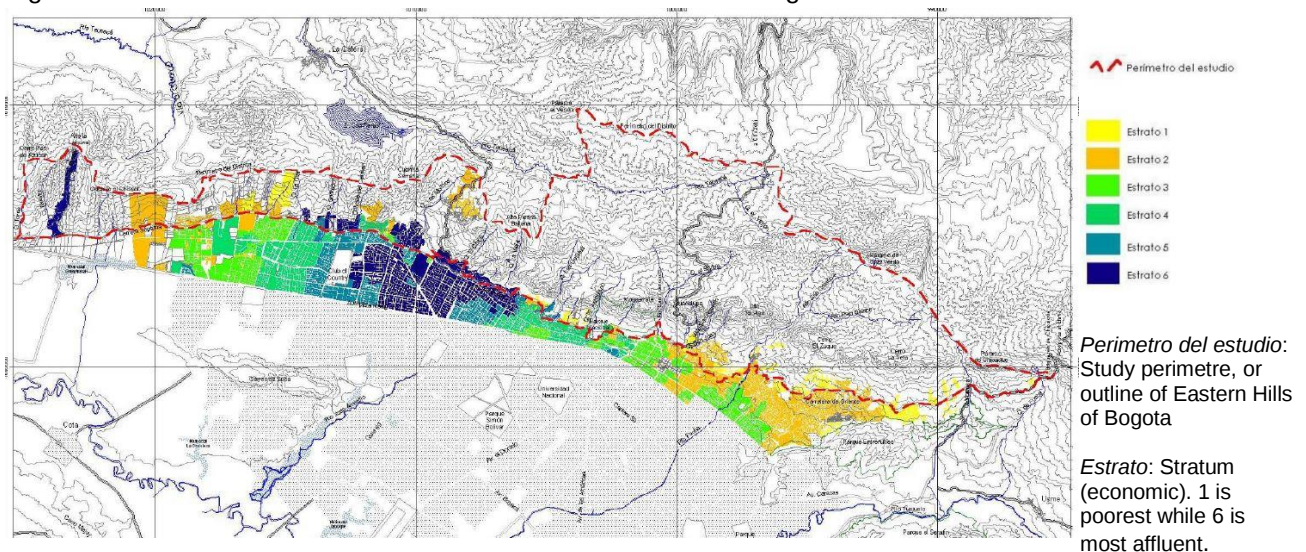


Source: (Fundación Cerros de Bogotá, 2009a)

Exponential growth in population and the shifting urban form resulted in a radical change in relationship between the Hills and Bogota. During the 1900s, the population grew due to rural displacement caused by social unrest and economic deprivation, resulting in unplanned and informal urban growth (Andrade *et al.*, 2013). At the beginning of the 20th Century, Bogota had approximately 100,000 inhabitants, in 1951 715,000 were counted, in 1985 there were 4.2 million and by the last census in 2005, Bogota had 6.7 million inhabitants (Secretaria Distrital de Planeacion *et al.*, 2015). The capital is projected to have a population of 9.5 million people in 2050 (Secretaría Distrital de Planeación, 2013). Exponential migration from rural areas to major cities, particularly Bogota, during the late 20th Century was a result of a confluence of factors. These included violence as part of political rebellion and narcotics conflict, and economic deprivation due to industrialisation and diminishing work opportunities in the agricultural sector (Ramírez and Parra-Peña, 2013).

The urban limit has expanded on all sides including into the Eastern Hills (Centro de Investigaciones de la Facultad de Arquitectura, 1999). The Hills have attracted two main groups of people who continue to live in the area. One group is comprised of a highly affluent population and make up 18 percent of the total population living in the Hills (Secretaria Distrital de Planeacion *et al.*, 2015). The other group consists of the very poor and victims of rural displacement, and of the total population living in the Hills, they make up 80 percent (*ibid*) (Figure 7). Urbanisation has been a defining force in defining the functionality and capacity of ecosystems in the zone to provider of benefits to the city. Physical growth of Bogota also created demand for primary materials for construction and the needs of everyday life, which included firewood, timber, sand and stone (Centro de Investigaciones de la Facultad de Arquitectura, 1999). Mining activity was prohibited in the 1940s due to erosion problems but still exists today in a much reduced, illegal capacity (*ibid*).

Figure 7: Economic level of communities on the Eastern urban fringe and in the Eastern Hills



Source: (Fundación Cerros de Bogotá, 2009a)

3.3. Population distribution in Bogota

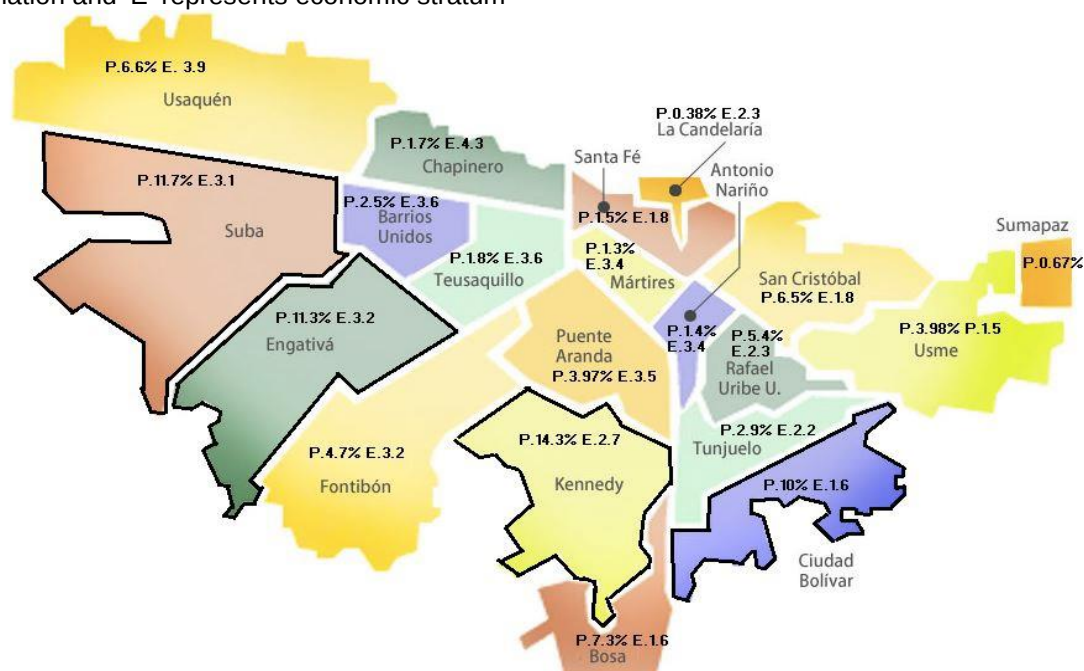
In 2016, Bogota's population is approximately 8 million people, with a growth rate of 24 percent (projected by Departamento Administrativo Nacional de Estadística, 2011). Spontaneous and disordered population growth in Bogota particularly over the last century has resulted in particular distributional and demographic patterns. The population in nine of the twenty localities has remained stable, and of those which are growing, the most dynamic are Bosa (8.1% above the annual average), Fontibón and Ciudad Bolívar (4.4% each), Suba (3.2%) and Usme (2.8%) (Secretaría Distrital de Tránsito y Transporte, 2006). In 2006, Kennedy was the locality with the greatest population concentration (14.3%), followed by Suba (11.7%), Engativá (11.3%) and Ciudad Bolívar (10%). Together, 47.3 percent of the population lives in these localities (ibid). As observed in Figure 8, the population in these areas are usually associated with lower to medium socioeconomic strata,² however, it is important to note that the average stratum does not accurately represent high heterogeneity of economic level within areas.

Bogota has a population density of around 3912 inhabitants per square kilometre (Gómez Lee, 2009). As previously mentioned, almost half of the city's population resides in Ciudad Bolívar, Kennedy, Engativá and Suba (Secretaría Distrital de Tránsito y Transporte, 2006), which are all situated on the opposite side of the city to the Eastern Hills. This is significant in that half the citizenry has much less direct contact with the Hills on an everyday basis than the 22 percent of the population that lives in the seven municipalities on the urban fringe with the Hills (ibid:8).

² Any mention of "economic strata" throughout the thesis refers to the official measurement used by the Bogotan City Administration. Economic stratification is determined by the National Department of Statistics and used by the District Secretary for Planning in order to understand the needs of people and affects the rate at which city services and rates are charged. There are six (6) strata, 1 being the lowest (poorest) and 6 being the highest (richest). The District Secretary for Planning says: "Socioeconomic stratification is a mechanism that allows the classification of the population in different stratum or groups that have similar social and economic characteristics, and is determined by an assessment of the physical characteristics of a persons dwelling, the immediate surroundings and urban (or rural) context." For more information see:

http://www.sdp.gov.co/portal/page/portal/PortalSDP/InformacionTomaDecisiones/Estratificacion_Socioeconomica/QueEs

Figure 8: Population and Socioeconomic Strata Distribution by Locality
 Outlined localities are the most heavily populated in Bogota. 'P' represents percentage of overall population and 'E' represents economic stratum



Source: Information sourced from Secretaría Distrital de Tránsito y Transporte, 2006

It is important to emphasise that values, needs and conflict in relation to the Hills are not restricted spatially to those urban areas that share a border with the Hills. It follows that urban processes which are spatially diverse also affect the way the goods and services offered by the Hills are managed, and as such, it is of critical importance to consider these dynamics.

3.4. Management of Eastern Hills

Development of the legal status of the Eastern Hills has occurred in response to the declining health of the Hills as the city has expanded over the second half of the 20th Century. The 1960s saw the beginning of protection of natural resources by law at the national level. The Autonomous Regional Corporation of Cundinamarca (the CAR) was created in 1961, the purpose of which was to supervise and protect the natural resources of the province of Cundinamarca (within which Bogotá and the Hills are found). The area of the Hills was converted into the Protected Forest Reserve of the Eastern Hills by the Ministry of Agriculture through Resolution 76 of 1977, and the CAR was put in charge of its care in the same year (Centro de Investigaciones de la Facultad de Arquitectura, 1999:98).

At city level, the Administrative Department of the Environment (DAMA) was created by the Council of Bogotá in 1990 (Alcaldía Mayor de Bogotá, 1990). Law 388 of 1997 produced the Territorial Urban Plan (POT) (Alcaldía Mayor de Bogotá, 1997), which integrated the concept of the Territory's ecological structure in its workings (Andrade, Remolina & Wiesner, 2013). In 2003 the Eastern Hills

Management Plan (POMCO) was created by DAMA. The creation of these protective bodies and plans signified the beginnings of integrated ecological-urban planning and governance. Despite this, the proliferation of laws and bodies at all levels has led to confusion about who has responsibility for enforcement. Consequentially, the CAR, DAMA and Ministry for Environment were successfully challenged by a popular legal action in 2006 which asserted that these government actors were not fulfilling their obligation to protect the Hills from deterioration (Alcaldía Mayor de Bogotá, 2006). Complexity in legal status and enforcement of the Hills is compounded by the fact that around two-thirds of the area is privately owned following rights gained before protective legal status was imposed (Maldonado, 2002 in Bohórquez Alfonso, 2008a). Use of privately owned land in a way that conflicts with conservation zoning at national and local jurisdictional level is considered illegal, resulting in confusion, frustration and inconsistent enforcement of the law.

In more recent times, more hands-on management initiatives to improve citizen access to the Hills have been developed. This has seen the establishment of a cable car and walking trail to Monserrate peak, policing of popular walking tracks and the proposal for an ecological corridor that spans the length of the Hills. Such projects signify a shift the conceptualisation of the Hills as a public asset to be engaged with, improved and cared for through direct relations with the citizenry.

Due to the multiplicity of actors, needs and opinions about what should occur in the Hills, the area has become a focal point in the public domain for conflict about private versus public rights to land use or non-use; raising questions of socioecological justice and the extent of effective representation of the citizenry in public policy and enforcement (see El Tiempo, 2015 for example). Ramírez Hernández (2009) emphasises that one of the major problems has been the lack of adequate environmental accountability to the greater part of the citizenry, and that environmental issues are derived from the increase in social and environmental conflict. Garzón Díaz (2014: 90) asserts what he sees as the essence of difficulty in effective governance of the Eastern Hills:

“The principal problem in the conservation and preservation of the Eastern Hills is bad governance; which has unfolded through a centralised scheme and the authoritative imposition of decisions. This is evidenced in the lack of understanding of the local reality, the great lack of confidence [on the part of the citizenry] in actions taken by decentralised public entities, entities of control and of civil society, and a State perspective that omits the citizenry and which sees the citizenry as a cause of degradation regardless of circumstance.”

These significant and ongoing challenges will be augmented into the future by population growth and the corresponding increase in demand for space, materials, and other intangible benefits. Not only will these tangible drivers change land use and the Hills, but changes in values of the Hills will create

demand for certain benefits over others. Predicting these changes is critical in predicting how trade-offs will affect some groups in favour of others, where conflict may occur into the future and how this will have repercussions for management. Garzón Díaz (2014: 88) expounds that,

“...it is necessary to understand the dynamics that the Hills experience from an inter- and transdisciplinary vision, so as to demonstrate how the problem of the Hills responds to issues of dignity and quality of life in general.”

Ramírez Hernández (2009) echoes this, emphasising that understanding socio-ecological systems is just as important as studying the physical place in which environmental conflicts occur, in order to approach the issue in an integrated manner.

These calls for more integrated approaches that incorporate the views of citizens in management of the Hills motivates to selection of the place-based ecosystem services framework to guide this study. Given that the ecological and social functions of the areas are diverse, that governance of the Hills is highly politicised, and involves the interests of many stakeholders of varying level of socio-ecological vulnerability, this study aims to examine the complex values which define the relationship between the city and the Hills, and the health of both.

Chapter 4: Methods

4.1. Approach

The objective of this thesis is to provide broad, base level information about the citizen values associated with the Eastern Hills. I sought greater quantity of basic information in order to understand patterns of value and the variables that influenced them, rather than an in-depth understanding of socioecological worldviews. As such, the methodology is designed to engage with a population sample that demonstrates highly diverse experience of urban life.

Justification for participatory and lay approaches to knowledge building can be based in the epistemological arguments put forward in the post-normal paradigm. As more is learnt about the complexity of social and environmental issues, it becomes clear that scientific knowledge is limited and that it is value-laden. Backstrand (2003) asserts that the incorporation of multiple stakeholders in knowledge building is a way to ensure quality control and make science more effective in the face of uncertainty. This is not to assume that lay knowledge is better or greener, however, “due to the uncertainty of future environmental outcomes, possible surprises and ecological catastrophes, a multiplicity of perspectives can prevent the narrowing of alternatives” (32). This epistemological foundation contributes to the mission of sustainability science, which advocates a pro-active, interdisciplinary, transparent science that works in tandem with the needs of a society (ibid: 36), and a logical base for the PBESA approach to examine individual and social values.

4.2. Ecosystem services framework

This section will elaborate on how the concept of Ecosystem Services (ES) is used as the framework by which to define and categorise the benefits produced by the ecological and biophysical systems of the Eastern Hills of Bogota. In addition to the generic advantages introduced previously, ES has been chosen as the framework for this study as it complements the efforts of local actors to create integrative assessments of the relationship between the Hills and Bogota. For example, the Alexander von Humboldt Institute for Investigation in Biological Resources, the principal scientific body of the Colombian State, dedicates one branch of investigation to analysis of ecosystem services in the context of Colombian biodiversity and its management.³

Ecosystem services is a term that refers to the benefits supplied to human societies by natural ecosystems (Daily *et al.*, 1997). These services are the products of interaction between ecological, physical and human systems. ES was first mentioned in works by scholars during the 1970s (e.g.

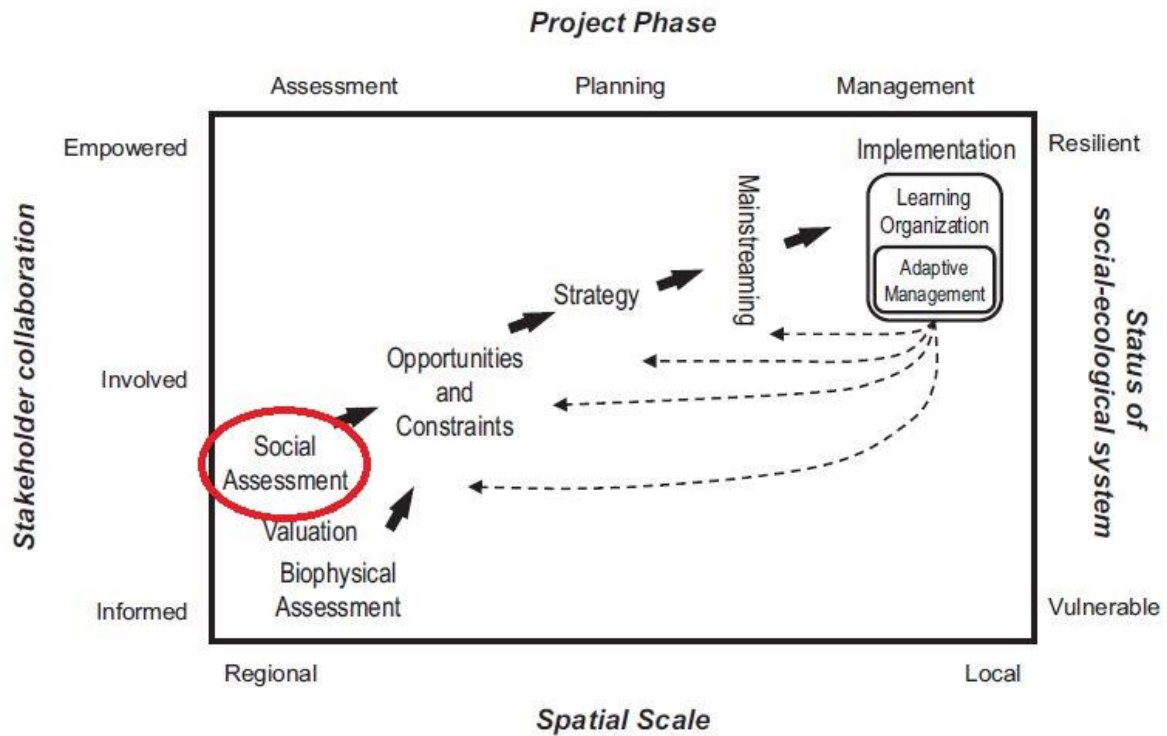
³ For more information, see: <http://www.humboldt.org.co/es/investigacion/programas/dimensiones-socioeconomicas>

Westman, 1977) but not taken up worldwide until the early 2000s with the Millennium Ecosystem Assessment (MA) (Daily *et al.*, 2009). Advances made by the MA were extended by other collaborative projects such as The Economics of Ecosystems and Biodiversity (TEEB) project which began in 2007 (The Economics of Ecosystems and Biodiversity, 2016b). While originally used as a metaphor, the adoption of ES as an environmental management concept occurred as part of efforts to create more integrative tools to reduce environmental degradation, particularly in the developing world (Norgaard, 2010).

ES has become popular for several reasons. It provides a framework within which diverse disciplines can collaborate and enables the valuation of the multiple services from ecosystems, facilitating the identification of trade-offs between different land use scenarios (Schaich *et al.*, 2010). ES distils the importance of ecological and biophysical functionality into a simpler concept that makes the complexity of environmental value easier to conceptualise and communicate to diverse stakeholder groups (Hauck *et al.*, 2013). While simplification of ecological functionality is considered a significant drawback in some critiques (e.g. Norgaard, 2010), the framework has the capacity to improve the outcomes of environmental policies by facilitating integrative assessments of ecological, social and economic value of resources.

In this work, I use ES as a way to investigate the values associated with the Eastern Hills from the perspective of Bogotans, using the typology created by TEEB (Appendix 1). This clarification is important, as ES is employed differently according to different disciplines and stage of analysis (Figure 9). For example, ecological economists focus on the intricacies of monetary valuation of ecosystem services (e.g. Costanza *et al.*, 1997), while scientists of the natural world do biophysical and ecological studies to understand how the functionality of systems generates services for human society (e.g. Davies *et al.*, 2011). While these kinds of assessments contribute valuable information in a complete ecosystem service assessment, this thesis will not undertake a monetary valuation of ecosystem services provided by the Eastern Hills from a stakeholder perspective, nor does it evaluate the capacity of the Hills to provide ecosystem services. Instead, it looks at ecosystem services as a way of capturing diverse expression of values through the lens of place, as determined by Bogotans (Figure 9).

Figure 9: This thesis within Ecosystem Services Operational Model



Source: Adapted from (Cowling et al., 2008)

4.3. Research Design

The methodology is based fundamentally in a collaborative approach to the creation of knowledge that is relevant, responsive and unique to the Bogotan-Hills relationship. Local specialists, volunteers and participants were considered to be co-producers of this study. The thesis topic emerged from contemplation of the gaps in knowledge pertaining to the Bogota-Hills relationship with Bogotan urban ecology networks I formed through doing an internship in an urban environmental consultancy in Bogota in 2015. The topic, adoption of ES as the conceptual framework, iterative research design, data collection and analysis of the results was done in collaboration with Bogotan contacts in the field of urban ecology. This imparts legitimacy through genuine consultation, local ownership and creates a study that is demonstrably responsive to local issues and needs. In addition, I consider the iterative and multi-actor process of creating this thesis as being a benefit and an end in itself inherent to participatory research, and the formation and engagement with non-government and institutional actors as a learning process for all involved.

4.3.1. Ethics

This research was approved by the Human Research Ethics Committee at the Australian National University (ANU). Participants' names remained anonymous and personal information was accessible

only by me and my supervisors. Details of the purpose, nature of participation and ethics of the study on the information sheet were explained to participants during recruitment, and consent for participation was given verbally (Appendix 1). Participants were advised of the availability of a physical information sheet that could be read and taken home (Appendix 2).

4.4. Method

Semi-structured surveying was chosen as the method, as it is able to balance finding the highest possible quantity of base level data, with having the capacity to incorporate both a quantitative and qualitative component. Using a mixed qualitative-quantitative method was important, as it allows participants to express their conceptions of value in different ways.

4.4.1. Physical survey

I aimed to survey at least 500 people to be as adequate representation of the 7.9 million person population of Bogota, while being a realistic target within the resource restraints of the project.

Collaboration with the The Bogotan Hills Foundation ('the Foundation') was critical to the success of data collection. Through the Foundation's social media and mailing networks, I advertised surveying volunteerships. In return for help in devising and executing the method, volunteers were given a certificate of volunteership from the ANU and a reference letter.



Juan surveying

The Foundation provided us with their T-shirts to wear while surveying, to impart a sense of legitimacy when approaching potential respondents on the street. Without being seen as a team representing a formal organisation, we would have been viewed with some suspicion and had less success in recruitment. While the branding may have influenced the answers given by respondents, this was deemed a necessary bias for the overall success of surveying. Additionally, being affiliated with the Foundation meant that participants who wanted greater involvement in advocacy action for the Hills, more information or any enquiries had an avenue to pursue them through. This by-product of the survey becoming a means of promoting education and involvement of citizens in participation in management of the Hills was congruous with the participatory motivation and nature of the study.

I created a survey tool to assist the decision-making process for participants. The tool was a table of ecosystem service names accompanied by a small illustration for each (Figure 10) (sourced from The Economics of Ecosystems and Biodiversity, 2016a) (see Appendix 3). These ecosystem services were

most generic but two others (Identity and Belonging; Symbol of the City-Region) were added after discussions with local actors, as they felt that these were particularly important in the way Bogotans relate to the Hills. They did not have a corresponding illustration as they were not on the TEEB website.

Figure 10: Survey tool (in Spanish and English)

1  Inspiración estética	2  Control de carbono	3  Control de erosión	4  Comida
5  Agua fresca	6  Calidad climática y del tiempo	7  Hábitat	8  Biodiversidad
9  Recursos medicinales	10  Prevención de eventos extremos	11  Polinización	12  Materiales
13  Recreación	14  Espiritualidad	15  Turismo	16  Tratamiento de residuos
17 Símbolo de la ciudad-región	18 Identidad y pertenencia		

1  Aesthetic Inspiration	2  Carbon sequestration and control	3  Erosion control	4  Food
5  Fresh water	6  Air quality and climatic regulation	7  Habitat	8  Biodiversity
9  Medicinal resource	10  Moderation/prevention of extreme events	11  Pollination	12  Raw materials
13  Recreation	14  Spirituality	15  Tourism	16  Water treatment
17 Symbol of the city-region	18 Identity and belonging		

I designed the survey to be as simple as possible in order to avoid confusing participants who had varying degree of understanding of the Hills and their value. Specifically, the use of symbols helped minimise any adverse impact of any technical terms, and was more inclusive of participants with low literacy level, than a text only version may have been.

The survey steps were:

1. Quantitative component: participants were asked, “Of the services [demonstrated on the survey tool], please choose up to five (5) of those you consider most important.” The respondent was then asked to rank the five that they had chosen in order of importance.
2. Qualitative component: Surveyors enquired to the rationale for having chosen those ecosystem services
3. Information about the respondent: The participants’ gender, age, locality of residence and economic stratum were collected

As we did not have permission to survey within the shopping centres, we surveyed on sidewalks and outside the shopping centre entrances. Often those who were easiest to recruit were people who were idle (for example, commuters waiting for their bus, a smoker, or someone eating at a street stall). At times, couples or groups would be recruited. People were generally receptive and we received no confrontation or negative interactions with those who did not want to participate. Reasons for not participating included being in a hurry to go somewhere else, not trusting us with personal details, general suspicion, or a lack of interest in the topic. A number of participants approached us to be surveyed upon seeing our routine with other respondents. My Colombian counterparts believed that I was more positively received by respondents or those I tried to recruit as being a foreigner, as I was viewed with less suspicion and with more curiosity. Once recruited, most participants completed the survey in around 2 to 5 minutes, all conducted in Spanish.

With local volunteers, we decided to conduct surveys in a conversational style to elicit the issues of major importance to the participant. When asking respondents to rank the importance of ecosystem services, phrasing of the question was intentionally ambiguous so that respondents could interpret the matter in their own way. This was phrased as, “Why did you choose these services? Why are they significant?” (In Spanish, “¿Por qué eligió estos servicios? ¿Por qué son significantes?”).

Physical surveys were done between 4pm and 7pm on Fridays, and 10am to 12pm on Saturdays. Friday and Saturday were the most convenient days for volunteers to give their time, and these times of day were when most people were leaving work and out in public, or doing shopping.

Sites

Survey sites were chosen in collaboration with local volunteers according primarily to the following requisites:

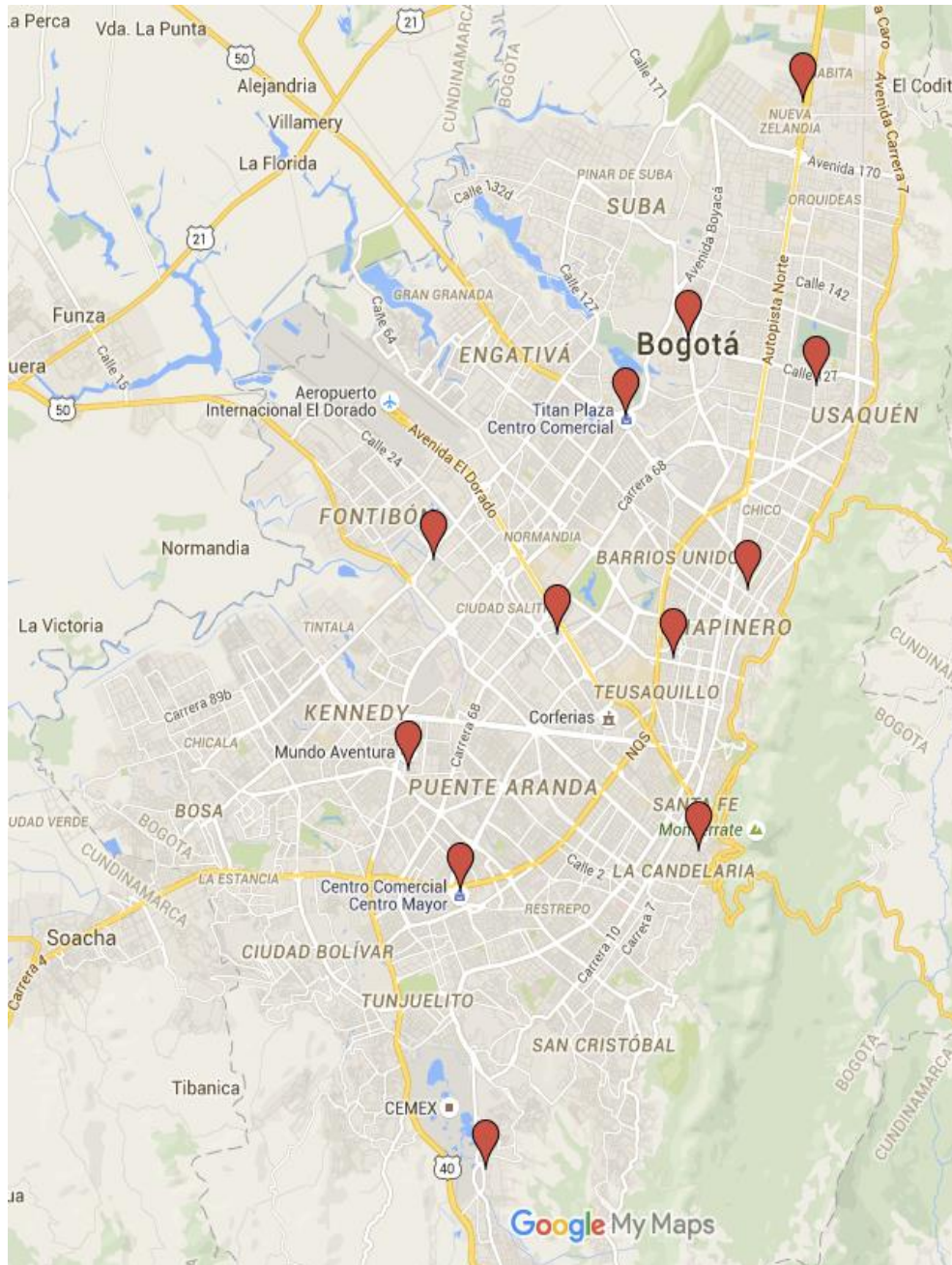
- Surveyor safety
- Areas that could give the most varied sample possible according to factors of economic level, gender, age and place of habitation
- Areas that represented geographical variation across the city and appropriately represented population distribution

Accordingly, the sites chosen (and the locality they are found in) (Figure 11) were:

- Bulevar Niza (Suba)
- Titán Plaza (Engativá)
- Hayuelos (Fontibón)
- Galerías and Gran Estación (Teusaquillo)

- Unicentro and Santafé (Usaquén)
- Avenida Chile (Chapinero)
- Plaza de las Américas (Kennedy)
- Parque de los Periodistas (Santa Fé)
- Centro Mayor (Antonio Nariño)
- Altavista (Usme)

Figure 11: Survey sites



Created using Google MyMaps

Illustration 1: Parque de los Periodistas (with the Monserrate Sanctuary in Eastern Hills in background)



Illustration 2: Bulevar Niza Shopping Centre



Source: (Skyscraper City, 2016)

4.4.2. Online survey

In addition to physical surveys undertaken, the questionnaire was distributed online through the mailing list of the Foundation. To account for any potential bias and extend the reach of the survey, recipients

of the email containing the survey were asked to find five other people to participate that were not direct supporters of the Foundation. Online surveys were done at the time and day of the respondents' discretion.

4.5. Data Analysis

Physical survey responses were recorded on paper while the survey was being conducted, and later entered into an electronic database. Responses to online surveys were organised by the survey software, Google Forms, and delivered as a spreadsheet that I then collated with the manually recorded data. In total, there were 480 street surveys done and 91 online participants. Online responses tended to have longer, more coherent statements in the qualitative section given that the respondent had more time to form their answer. Despite this difference, given the small proportion of online surveys relative to the overall number, they were analysed together with the physical surveys.

4.5.1. Quantitative Analysis

Quantitative analysis involved analysing the ranking of importance of ecosystem services. Microsoft Excel was used for this part of the analysis.

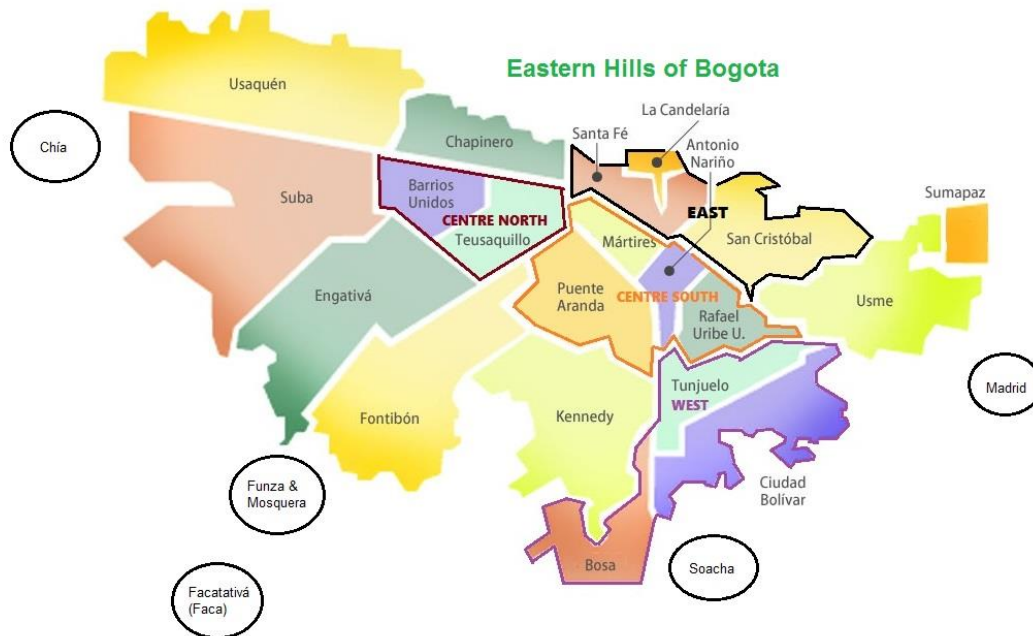
Firstly, I considered overall account of ranking of ecosystem services, without considering demographic variables. Secondly, I considered the ranking of ecosystem services according to groups within the variables (gender, age, locality of residence and economic stratum). This explored whether different perceptions of value might be related to experiences of urban life. To avoid bias due to low sample sizes, data for neighbouring localities considered to have similar socio-economic characteristics were combined where less than 15 respondents were recorded (Figure 12). Economic strata were also grouped together to create larger 'economic levels' for analysis, and similarly, 10-year age groups used during the data collection phase were combined to represent 'stage of life' brackets. Accordingly, the groups were the following:

Table 3: Analysis groups

Variable	Groups	Number of participants in group
Gender	• Male	285
	• Female	286
Economic Level	• Lower (Strata 1 and 2)	174
	• Middle (Stratum 3)	229
	• High (Strata 4, 5 and 6)	150
Age	• Youth (18-30)	280
	• Middle-aged (31-50)	186
	• Mature (51-80)	103
Locality (Place of residence)	• Usaquén	58
	• Chapinero	31
	• Usme	52

	• Suba	85
	• Kennedy	70
	• Fontibón	32
	• Engativá	44
	• East (Santa Fé, San Cristóbal, La Candelaria)	31
	• Centre-North (Teusaquillo, Barrios Unidos)	47
	• Centre-South (Los Mártires, Puente Aranda, Antonio Nariño, Rafael U. Uribe)	50
	• West (Tunjuelito, Ciudad Bolívar, Bosa)	49
	• Outer municipalities (Soacha, Funza, Chia, Faca, Madrid, Mosquera)	21

Figure 12: Groupings of localities for analysis



For each group, two analyses were done. Firstly, the frequency at which each ecosystem service was said to be the 1st, 2nd, 3rd, 4th or 5th most important was recorded (Table 4 as example for one group of participants, males). Secondly, each position within the ranking was attributed a different number points. For example, ES1 (the most important ecosystem service according to the respondent) was attributed 5 points, while ES5 (the fifth-most important ecosystem service) was attributed 1 point. Accordingly, the relative importance of each ecosystem service was calculated using Equation 1:

Equation 1: Raw score to relative importance score

$$Relative\ Importance = (ES1 \times 5) + (ES2 \times 4) + (ES3 \times 3) + (ES4 \times 2) + (ES5 \times 1)$$

The frequency at which each ecosystem service was considered to be in the top-five ranking of most important (seen in Table 4) is converted by the relative importance equation into the table seen in Table 5. This equation produces one number for each ecosystem service, allowing for easy comparison (Figure 13).

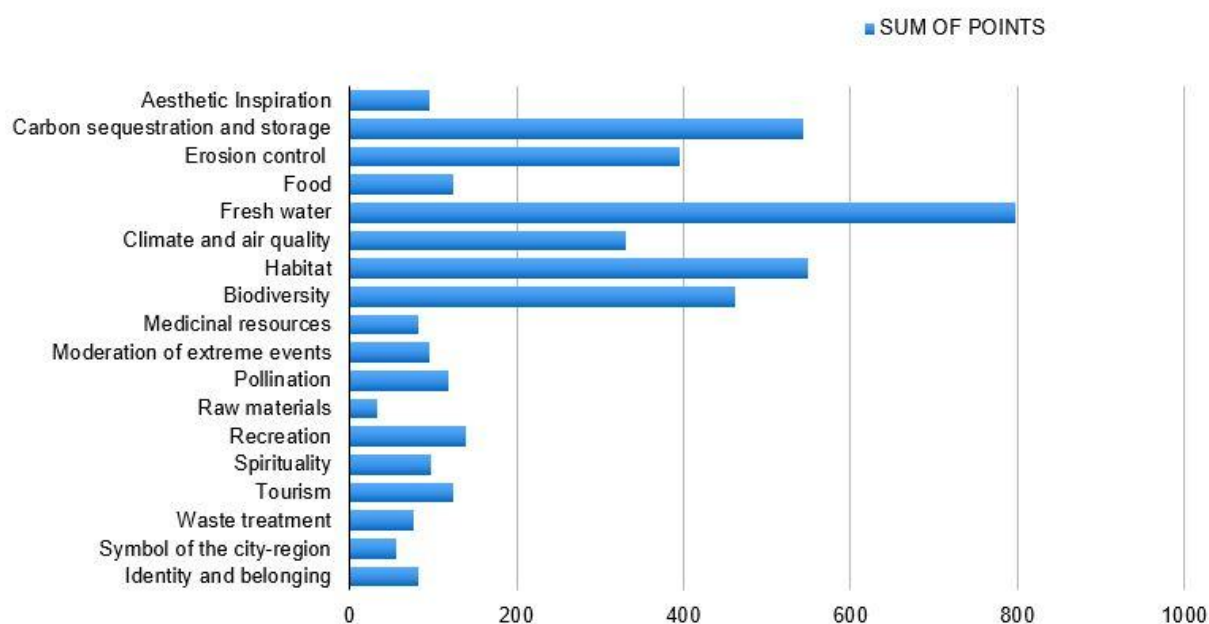
Table 4: An illustration, using one group of participants, of how raw data were initially assessed: Frequency that each ecosystem service was considered in top 5 most important by male respondents (see text for explanation of the score and the Results chapter for full data on all groups)

	RANK OF IMPORTANCE				
	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	10	4	3	5	11
Carbon sequestration and storage	50	39	23	29	10
Erosion control	28	33	18	25	20
Food	6	13	8	1	9
Fresh water	89	42	44	17	19
Climate and air quality	14	30	27	22	15
Habitat	32	46	48	26	8
Biodiversity	23	35	37	34	27
Medicinal resources	1	3	12	10	10
Moderation of extreme events	2	5	10	12	12
Pollination	3	11	7	11	16
Raw materials	1	2	2	4	6
Recreation	6	6	6	24	20
Spirituality	4	3	11	12	8
Tourism	3	5	9	17	29
Waste treatment	4	3	4	12	8
Symbol of the city-region	4	2	3	4	11
Identity and belonging	5	1	7	8	17

Table 5: Illustration of how raw data were aggregated: Relative importance of ecosystem services for male respondents (see text for explanation of the score and the Results chapter for full data on all groups)

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	50	16	9	10	11	96
Carbon sequestration and storage	250	156	69	58	10	543
Erosion control	140	132	54	50	20	396
Food	30	52	32	2	9	125
Fresh water	445	168	132	34	19	798
Climate and air quality	70	120	81	44	15	330
Habitat	160	184	144	52	8	548
Biodiversity	115	140	111	68	27	461
Medicinal resources	5	12	36	20	10	83
Moderation of extreme events	10	20	30	24	12	96
Pollination	15	44	21	22	16	118
Raw materials	5	8	6	8	6	33
Recreation	30	24	18	48	20	140
Spirituality	20	12	33	24	8	97
Tourism	15	20	27	34	29	125
Waste treatment	20	12	12	24	8	76
Symbol of the city-region	20	8	9	8	11	56
Identity and belonging	25	4	21	16	17	83

Figure 13: Relative importance of ecosystem services for male respondents



The last analysis I did was demonstrating which ecosystem services were considered least important, in the sense that they were not included in the top five selected by participants. To do this, I made a tally of the three ecosystem services which achieved the lowest score in terms of relative importance.

This was executed for all groups within all variables, and then a count was made of each time that an ecosystem service was considered to be in the three of the least important.

4.5.2. Qualitative Analysis

Thematic analysis of comments made during conversations with participants comprised the qualitative component of the study.

Qualitative data was manually organised into themes by the surveyors, whose summary of the conversations held with participants were noted in the field as brief statements and key words. The quick, informal nature of street surveying means that it was practically and culturally inappropriate to record or transcribe entire conversations. As there were between 2 to 4 surveyors assisting in the collection of data, the personal bias brought by each person to the process of interpretation of themes was diffused, increasing the reliability of results. QSR NVivo 11 software was used at a later stage to examine commonly occurring themes.

I adopted two approaches to analyse the qualitative data. Firstly, I examined participants' justification for choosing some ecosystem services as more important than others. Analysis was only done for the six ecosystem services (fresh water, habitat, biodiversity, carbon sequestration and storage, erosion control and climate and air quality) that occurred most frequently as the five highest scoring ecosystem services (following the relative analysis process described above). As these six were exceptionally highly prioritised relative to the other ecosystem services, it was indicated that these are considered especially important. Secondly, I conducted thematic analysis to identify any other frequently-occurring themes. Thirdly, I discuss the implications of the thematic analysis to a current management proposal in the Eastern Hills, to explore their practical relevance.

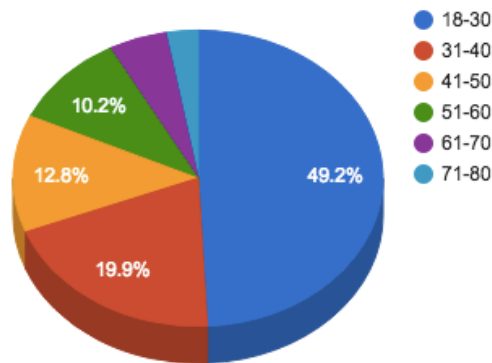
I chose not to analyse the commonalities and differences in the qualitative data according to the demographic variables tested in the quantitative section, as I did not consider them comprehensive enough to be able to extract a reliable result given that the data was recorded as short field notes and key words. As such, comments made in this section had the function of providing a richer understanding of quantitative information and of the broader ways that people perceive the Hills, but should not be regarded as providing a comprehensive qualitative account.

Chapter 5: Results

5.1. Participants

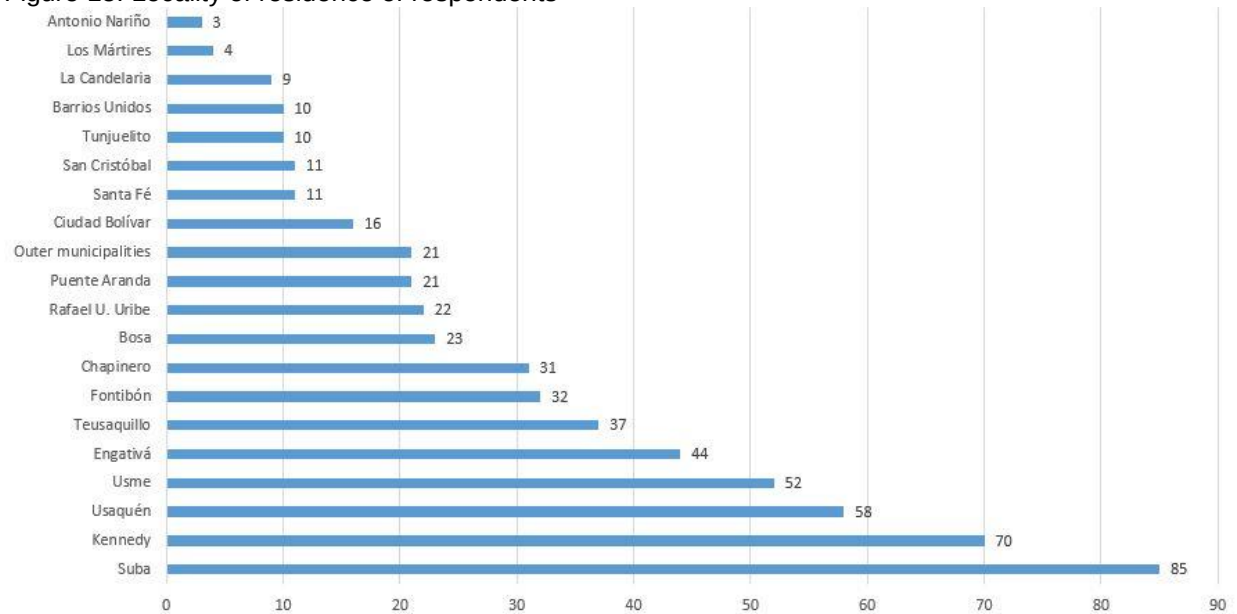
Participants were asked to provide basic demographic information relating to gender, age, locality of residence and economic level. The demographic breakdown of respondents was as follows. In terms of gender, 49.9 percent of respondents were male, while the remaining 50.1 percent were female and no respondent identified as being of another gender. Youth (18-30 years of age) was the most commonly surveyed age group (49.2%), and the number of participants declined as age increased (see Figure 14). As the surveyors are all under 30 years of age, a subconscious preference to engage with a participant of the same age group may have contributed to this tendency, however, it was most probably occurred due to the day and time we surveyed, and because we surveyed in shopping centres where there was a greater number of younger adults.

Figure 14: Age group of respondents



Of all the localities of Bogota, the four in which most respondents lived were Suba (14.8%), Kennedy (12.2%), Usaquén (10.2%) and Usme (9.1%) (Figure 15 and Figure 16). As Suba and Kennedy are two of the most populous districts in the city (11.7% and 14.3% respectively), it is expected that they should feature so prominently. The incidence of so many respondents from Usaquén (6.6% of city's population) and Usme (3.9%) is not so obvious. The inhabitants of these localities may be more mobile than others, though it is more probable that the survey sites chosen happened to be close to the place of residence of these participants. Data collection was successfully undertaken in a diversity of localities, fulfilling the objective to represented variation in place of residence of participants.

Figure 15: Locality of residence of respondents

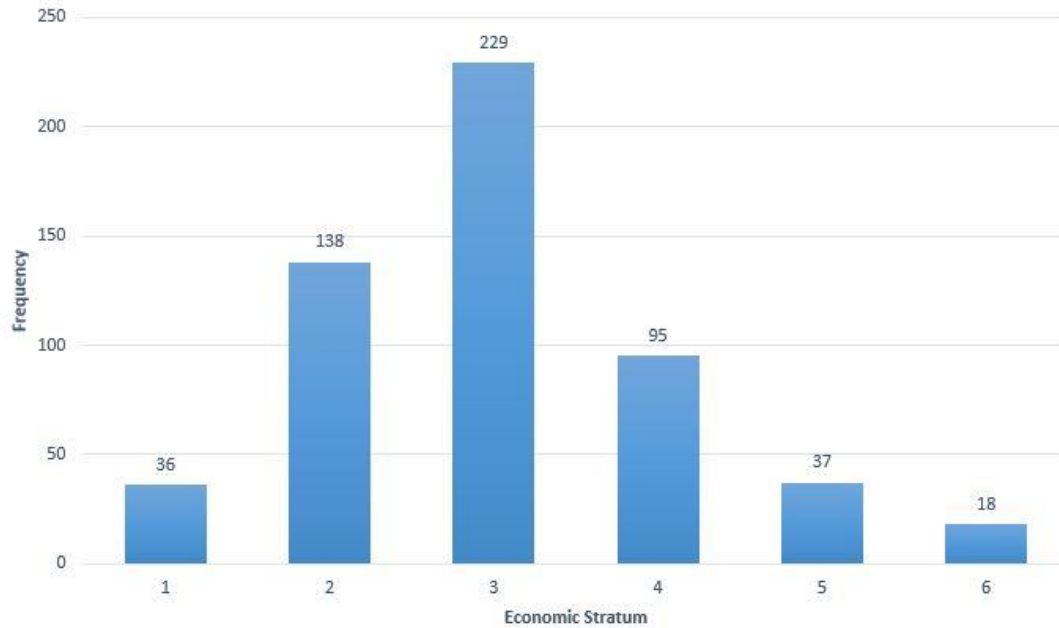


Note: 'Outer municipalities' include Soacha, Funza, Mosquera, Chia, Faca and Madrid

Figure 16: Map of four largest localities of respondents



Figure 17: Economic strata of respondents



Economic strata of participants almost followed a normal distribution, as the modal stratum was 3, followed by 2, 4, 5, 1 and finally 6. Bogota is home to a large lower-middle class and as such, the study features a correspondingly large proportion of 2 and 3 stratum respondents (Figure 17). A diverse sample of respondents from different economic levels was achieved, fulfilling part of the aim to test whether values changed according to economic experience of life in Bogota.

5.2. Quantitative Results

In choosing the five most important ecosystem services and ranking them, participants gave a clear indication of the way Hills have value to them. Figure 18 shows the frequency that each ecosystem service was selected as 1st to 5th most important ecosystem service.

When analysing whether there was a difference in the way that variables of age, gender, locality of residence and economic level affect responses, there were, in various combinations, six services that always feature as the top five most highly valued (once their relative value had been calculated) (Figure 19). According to all groups within the variables, fresh water features as the most important ecosystem service. Habitat and carbon sequestration also appeared in the top five for all groups. Biodiversity, erosion control and climate and air quality did not feature in every top five ranking, but consistently shifted positions amongst them.⁴

⁴ For expanded results and analysis of ecosystem service rankings across groups in separate variables, see Appendices 4 to 23

Figure 18: Frequency at which each ecosystem service was selected as 1st to 5th most important ecosystem service offered by the Eastern Hills of Bogota to the city (data for all participants combined)

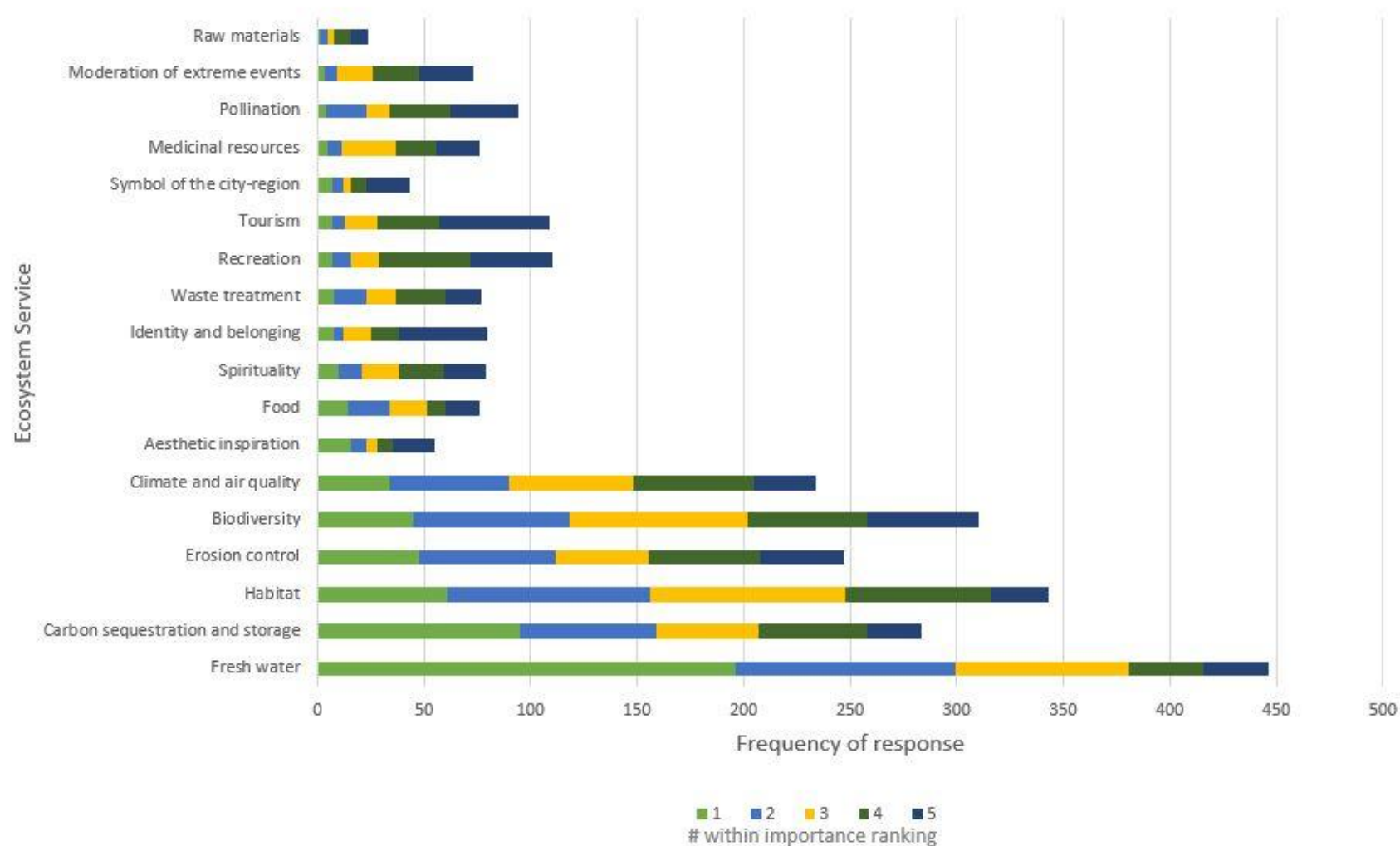
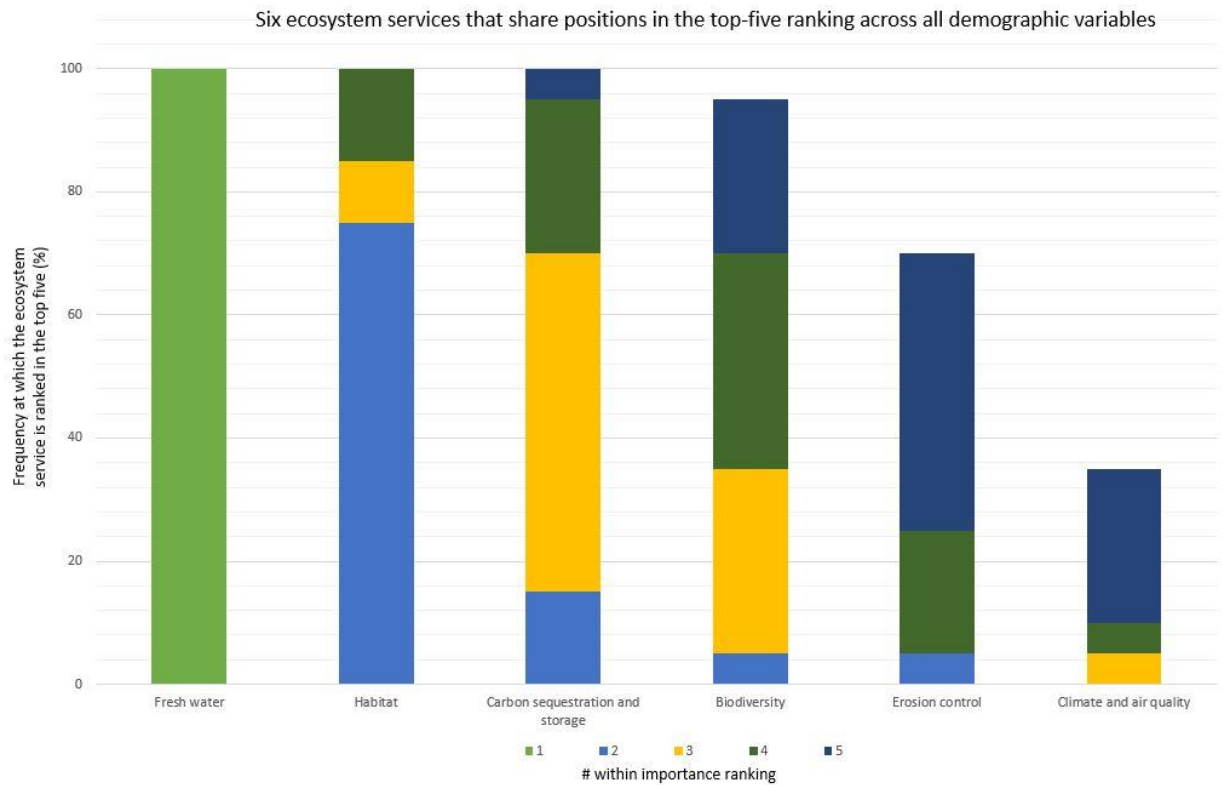
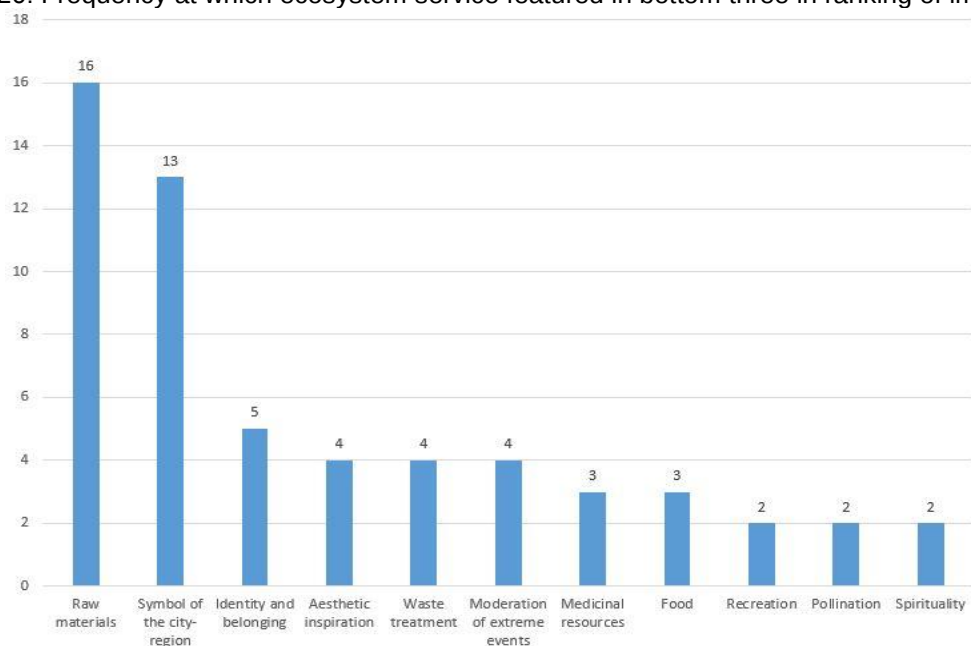


Figure 19: Six ecosystem services that share position in the top five ranking across all groups in the variables tested



In terms of the ecosystem services which were ranked least important, the two which were outstanding were raw materials and symbol of the city-region. The three ecosystem services which had the least relative importance (by points) in each group for each variable were tallied to give the graph found in Figure 20.

Figure 20: Frequency at which ecosystem service featured in bottom three in ranking of importance



5.3. Qualitative Results

Qualitative data were analysed firstly in order to understand why prominently high-ranking ecosystem services were chosen by participants, and secondly, to understand broader perceptions about the Hills on the part of Bogotans.

5.3.1. Justification for choice in ranking section

Relative to the overall quantity of opinions given, justification for giving priority to the major six ecosystem services comprised only a small component. As can be seen in Table 6, the most common motivation for attributing importance to particular ecosystem services was their perceived importance for the maintenance of human life.

Table 6: Major justifications for choosing highest ranking ecosystem services

Ecosystem Service	Theme	Quote from respondent indicative of theme	Number of references
Overall	For (or as) nature and the environment (Where participant has justified their choice of important ecosystem services “for nature” or “for the environment”. Includes statements that specifically refer to the intrinsic (or existence) value of nature)	“I chose these because they are directly related to the environment”	50
Fresh water	Vital for life and survival	“Without water, there can be no life”	52
	Hills as important water source in regional water system	“The Hills and páramos are the birthplace of fresh water”	17
	Water valuable scarce resource	“I chose water because there is a lack of it right now”	9
Habitat	Chosen in the interest of animals (life and wellbeing)	“The vegetation has to be maintained for the animals and species”	43
	Vital for human life and survival	“This is a service that keeps us alive”	12
	Chosen in the interest of plants	“The mountains guard the life of plants”	10
Carbon sequestration and storage	Vital for life and survival	“This is a service that keeps us alive”	16
Biodiversity	Vital for life and survival	“The conservation of biodiversity and ecosystems are necessary for the preservation of life”	16
	Endemism and native species	“The páramos have a large diversity of flora and fauna”	6
Erosion control	Vital for life and survival	“This is a service that keeps us alive”	11

Climate and air quality	For the provision of pure air and oxygen	"The Hills provide pure air to the city"	32
	Hills referred to as "lungs of the city"	N/A	23
	Vital for life and survival	"The climate impacts on our life and health"	16

Fresh water was particularly emphasised for its critical basis for life. Reference was made to the Eastern Hills as playing an important role in the regional water cycle within which Bogota functions. Some respondents demonstrated a particularly specialised knowledge of the regional water cycle by referring to the importance of páramo ecosystems, which are alpine tundra ecosystems found in the high tropical Andes. The Sumapaz páramos play a major role in the storage and provision of water to the Bogota savannah below (Mesa Ambiental de los Cerros Orientales, 2008). In addition, water scarcity (both perceived and real) played a role in its prioritisation for some respondents.

Habitat was the only ecosystem service which was chosen predominantly for non-human reason, which was for the life and survival of animals. Additionally to its importance for human life, the survival of plants (which was for some linked to the intrinsic right of plants and animals to exist in their habitat) was a justification given for deeming habitat one of the most important services. Habitat and biodiversity were at times considered synonymous or closely linked. Biodiversity was at times chosen in the interest of preserving native and endemic species.

The regulation of air quality was seen to be important, and this was commonly mentioned concurrently with a perception of high air pollution in the city. As such, the particular conditions of Bogota contributed lucidly to the high ranking of this ecosystem service and makes it highly contextually relevant. Interestingly, the Hills were often referred to as "the lungs of the city", indicating that this is a common metaphor used by the Bogotan community as a way of conceptualising the service.

5.3.2. Broader themes and cultural ecosystem service reflections

Themes which were considered commonly important are crucial in understanding the way that Bogotans more broadly conceptualise the Hills and their importance. Relative to the number of comments that gave a rationale for ecosystem services chosen in the ranking section, there were many more reflections made on more general themes which included opinions on the health of ecosystems in the Hills, positions held on current topics (such as recent fires and management), reflections on the way that Bogota treats the Hills and explanations of human and cultural value of the Hills. Table 7 shows the most prominent themes of conversation in general sense.

Even though cultural ecosystem services were not highly ranked in the quantitative section, comments made in the qualitative part often referred to the value of cultural, psychological and well-being aspects that the Hills lend to Bogota. As such, these were expanded upon in analysis (Table 8).

The most common element was a ‘pro-conservation’ stance, expressing concern for the conservation of the Hills. The second was an ‘anti-invasion’ stance, where participants expressed positions against the exploitation of the area. While these themes were separated in analysis for the sake of clarity, they are often interlinked and some express the same (or similar) sentiment in a different way. Themes conceivably relate and contribute to one another to form a more coherent picture of value and conceptualisation of the Hills. Figure 21 demonstrates some pertinent themes and the way they can be organised together.

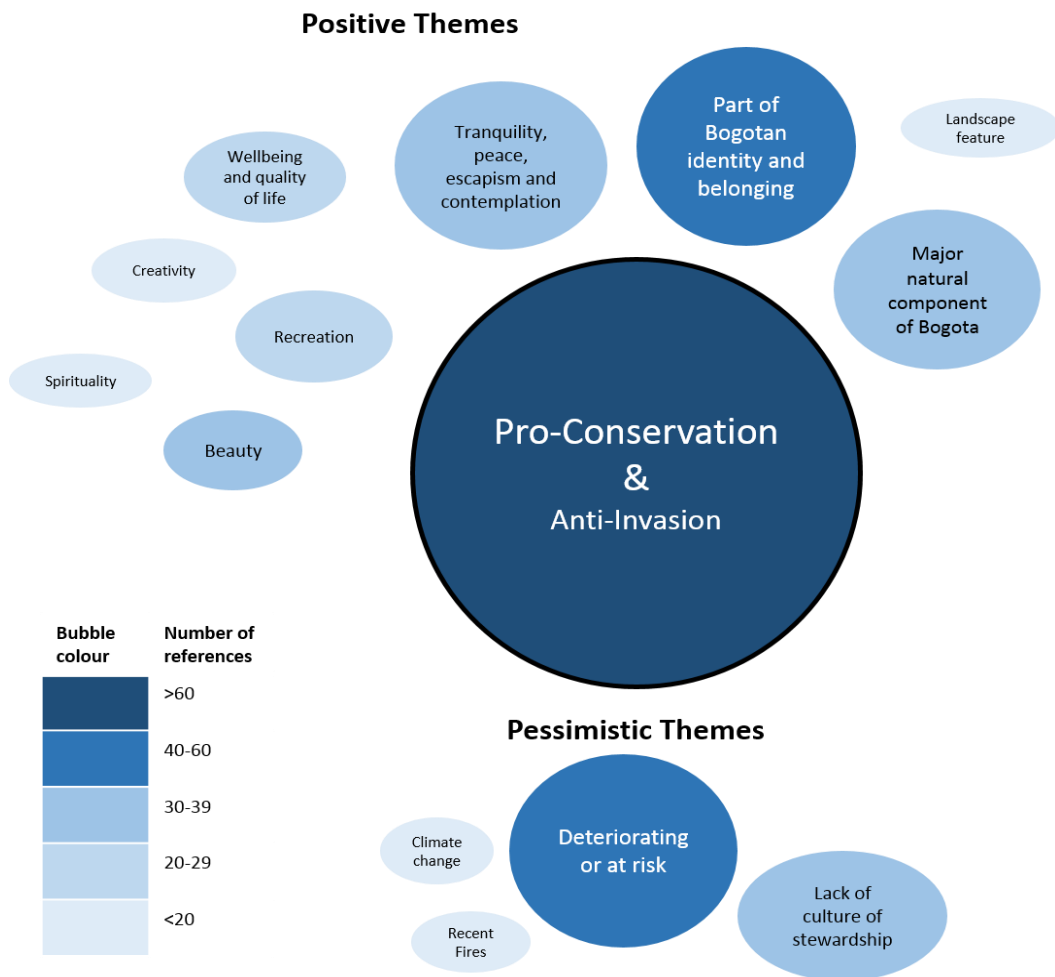
Table 7: Frequently occurring themes in qualitative analysis

Theme	Description	Number of references
Pro-conservation	Includes statements that are in favour of nature and resource conservation in the Eastern Hills	78
Anti-invasion	Includes statements that are in opposition to construction, mining, harmful tourism.	46
Deterioration and/or at risk	Statements asserting that the state and/or health of the Hills is worsening and/or are at risk of further deterioration	41
Lack of culture of stewardship and education	Includes statements asserting that people are not educated or caring enough about the health of the Hills	37
Major natural component of city	Instances where respondents see the Hills as the natural component of the city. This includes statements where the natural characteristics of the Hills are directly contrasted with the conditions of Bogota (e.g. dirty, concrete, unnatural)	33
Systemic functionality and behaviour	Asserting that the values and functions of ecosystem services (deemed most important or not) are linked to one another as part of a system	23
Pollution produced by city	Statements where pollution produced by or affecting the city are referenced	17
Fires	Statements in which recent fires in the Hills are referenced	15
Insecurity as ecosystem disservice	Statements in which insecurity (mostly due to criminal activity) is explicitly considered a disservice of the Eastern Hills	10
Climate change	Statements in which climate change are explicitly referenced	8

Table 8: Major emergent cultural and human ecosystem service themes in qualitative analysis

Theme	Description	Number of references
Part of Bogotan identity and belonging	Statements which allude to the Hills being a symbol of Bogota, as contributing the the Bogotan identity and where a sense of belonging is imparted by the Hills.	45
Tranquillity, peace, escapism and contemplation	Statements in which these sentiments are expressed to be experienced when relating to the Hills	34
Beauty	Value associated with the positive aesthetic that the Hills impart to the city	32
Recreation	Where people have expressed an appreciation for recreational opportunities, or reference having done recreation in the Hills	29
Wellbeing and quality of life	Where people have expressed that the Hills impart wellbeing and positive quality of life	26
Spirituality	Statements in which respondents associate the Hills with a spiritual experience, which may or may not be in reference to God	20
Geographic landmark	Statements in which respondents reference the Hills as a point for orientation, as a geographic landmark	12

Figure 21: Major themes that emerged in qualitative component (excepting references made to ecosystem services chosen in ranking exercise)



The results demonstrate that the value associated with the Eastern Hills is multifaceted and that obtaining holistic understanding is greatly aided by employing a method with qualitative and quantitative components. The ranking exercise and semi-structured conversational parts of the survey method were complimentary in demonstrating the many facets of value.

Chapter 6: Discussion

Consultation with non-expert groups, such as citizens and other stakeholders, has become an important instrument in grappling with the complexity of societies' issues whence environmental degradation often springs. This thesis provides a snapshot into the ways that Bogotan citizens perceive the value of the Eastern Hills, so that local actors can incorporate such information into urban natural resource planning into the future. This knowledge is not only being demanded in the Bogotan context, but in cities worldwide, as growing urban populations shape the immediate and regional landscapes they are situated in (Grimm *et al.*, 2008).

Firstly, findings regarding the way that citizens value the Eastern Hills of Bogota will be discussed. Secondly, a methodological evaluation will be done.

6.1. Value of Eastern Hills to Bogotans

The values associated with the Eastern Hills are rich and multifaceted, incorporating ecological, cultural and social significance. This section will first explore the results of the ranking exercise, and then will look at some of the prominent themes which emerged from the qualitative conversations held with participants.

When asked to indicate the importance of the Hills by ranking the importance of ecosystem services provided by the area, citizens from all backgrounds gave consistently strong preference to six of the eighteen services suggested. These were the provision of fresh water and habitat, erosion control, carbon sequestration, biodiversity and maintenance of a stable climate and air quality. Additionally, raw materials and symbolism of the city-region were most consistently ranked as the least important of the eighteen. Conversations revealed that choices were most often made according to a conception of what was most critical in the maintenance of human life in the city, incorporating supporting, provisioning and regulating ecosystem services. 'The environment' or 'nature' as an entity with importance in itself served as a potent motivation to choose highly ranking services. When asked to explain the ecosystem services that were ranked highly, one respondent answered, "It's easy – those are directly related to nature." The association of the Hills with strong socio-ecological value for all people, regardless of gender, economic level, proximity of residence and age demonstrates that value is not restricted to those who live close by or to those who have regular direct contact with the Hills. This justifies the continued involvement of a broad range of actors in management of the Hills, not only those stakeholders that are traditionally thought to have a stronger association or stake in the wellbeing of the area.

Many respondents, when questioned about the motivation for choosing the ecosystem services they prioritised, were not able to give a specific answer past general statements pertaining to the importance

of the environment. This suggests that respondents either had little insight into their attachment to the notion of 'nature', or could not articulate their theory of value, or both. It may indicate a low level of education about ecological concepts and their relevance in everyday life, or a common mental model based on messages received in mass media. The survey design may also have contributed, as the open nature of the qualitative questions may have been too broad to elicit this kind of critical reflection on the formation of value.

Some respondents gave high prioritisation to ecosystem services as a set. Value was attributed to the holistic system that was represented by the ecosystem services chosen, and the good that was ultimately created by the interaction between them. One respondent says, "All these services are connected. By protecting those services, you protect the Hills as a whole entity." The ecosystem service concept is valuable in its capacity to categorise complex socio-ecological functionality into a simpler concept, though, the aforementioned finding demonstrates that even to the lay person, the value of ecosystem services is believed to be more than the sum of its parts. Indeed, many respondents mentioned how difficult it was to choose only five ecosystem services. This demonstrates the difficulty in making a decision in the face of value-based trade-offs. While many considered all services to be important, the prioritising process forced participants to exclude other important values in favour of those services which were fundamentally important.

The second area of interest of the thesis is how experience of urban life, expressed in this study as the variables of age, gender, place of residence and economic level, affect value perceptions in Bogota. There was high uniformity of response in the ranking exercise between groups in all variables, which was unexpected. The data suggests that these variables do not have a significant effect on the way Bogotans value the Hills. This may have occurred because there is little difference in the way that urban life affects value attributed to the Hills. However, it is more likely that given the thesis aim to collect a large quantity of broad data, the method devised is not as suitable to demonstrate subtle differences in value according to the variables tested. Finer grain analysis and inclusion of in-depth methods like focus groups could reveal more subtle differences (see Future Research). Socio-ecological value mapping is an area of enquiry that is dedicated to demonstrating the way that value changes over space. Various studies have demonstrated in other places that variation exists (e.g. Alessa *et al.*, 2008; Raymond *et al.*, 2009). This reaffirms the need to use of a mixed methodology that is capable of discovering information expressed best in divergent ways.

While the ranking exercise induced consideration of the Hills in a clinical-type assessment of fundamental needs, the conversations in the qualitative component added depth of understanding in how they relate to the Hills on an everyday basis. As these conversations were less structured than the ranking exercise, it gave respondents a free-form space in which to express value on their own terms,

as opposed to according to the ecosystem services framework. Accordingly, while many discussed ecological importance, there were also many references made to the cultural or human value, and responses were framed in a more emotive manner. This reflection aligns with Satterfield's (2001:335) argument that personal, place-based narratives are useful information sources given that notions of value are commonly embedded in "every day, impassioned and storied talk about nature and meaning."

Consistent with the perception of ecological and cultural value, Bogotans are strongly in favour of the preservation of the health of the Hills. This is expressed by some in a general pro-conservation stance, while others go further by focusing on particular examples of endangerment (such as construction, mining or invasive tourism) and take an anti-invasion stance. I interpret these themes as being two sides of the same coin, and together, the pro-conservation and anti-invasion comments were the most frequently occurring by a sizeable margin. These stances provide insight into the especially low rank attributed to the raw materials ecosystem service, as the use of the Hills for materials implies practices like mining or deforestation. This reiterates the pragmatic benefit of valuation exercises in natural resource management, as it can indicate potential areas of tension or conflict where there are strong management preferences.

The Hills are understood as the natural component of the city; the clean to the dirty, the pure to the corrupt. This was put simply, for example, by one person: "Bogota pollutes. The Hills clean and protect us." This contrast is both a practical perception, in the ways that the Hills provide environmental services for the functionality of the city, and in a conceptual way in that the Hills are seen as a green space that counterbalances the mechanised, grey concrete of Bogota. One participant says, "The Hills are the only nature left in the city – green space is diminishing all the time."

Given the conceptual contrast that many perceive between the Hills and the city, the Hills serve as inspiration for escapism and contemplation. Many expressed that the Hills generate a feeling of peace and tranquillity. One participant commented that, "...the Hills are an ideal place to connect with nature, and to feel free from the stresses of urban life. They represent a chance to find unexplored places." This is an interesting contrast to the low ranking of aesthetic and spiritual values in the ranking exercise.

Linked to the idea of the Hills being the natural component of Bogota is the notion that the Hills play a role in defining what it is to be Bogotan. Indeed, for some participants, the sense of belonging imparted by the Hills was considered the most crucial service offered, as it was seen as the source of motivation to care for the landmark as a common resource. Overall, however, it was amongst the less important services in the ranking, suggesting these subtleties are difficult to capture in the 'trade-off' required by the ranking exercise.

Many see problematic events, such as the incidence of wildfires or pollution of waterways as being the consequence of human invasion and misuse of the area. Misuse is conceived to be a result of a lack of environmental stewardship and lack of education about the Hills, and respondents believe the health of the Hills is declining. Respondents say that the Hills are forgotten about and that people aren't conscious of the importance of the landmark. One respondent focuses on education, stating that, "In Bogota there is a lack of information, and little depth of debate and education about the Hills. One only learns about the Hills through the press, and they are only mentioned when something goes wrong, like the recent fires." As this person points out, the conventional education about the Hills is delivered through the media when a detrimental event occurs. Deficiency of positive or even neutral information about the area on a consistent basis could contribute to the perception that the Hills are in a state of deterioration. While there is a tendency for respondents to judge the lack of culture of stewardship of the Hills in a pessimistic way, such a judgement is not necessarily true given that such a strong, passionate preference for conservation and nurturing of the Hills is expressed as one of the most salient themes. This is an expression for desire of improved stewardship, and as such, has a management implication to pursue initiatives that can conserve the ecosystems and biophysical characteristics that offer important ecosystem services.

6.1.1. Consequences for management of the Hills

The insights uncovered about socio-ecological value associated with the Hills demonstrate that the value of the Hills is environmental, social and related to ideas about public benefit. Awareness of these opinions can contribute to natural resource management.

In this part, I will examine a recent proposal pertaining to land use in the Hills and reflect on how the findings of this survey might inform its development. I reiterate that the purpose of this thesis is not to provide prescriptive suggestions for management of the area, however, this section gives some examples of how this knowledge can be used.

A major infrastructure project which has been in planning and development over the past decade is an Ecological Corridor through the Eastern Hills. In 2007, the DSP proposed this corridor as a strategy to recuperate the social and biophysical value of the Hills, along with creating a barrier to urban expansion on the eastern limit to the city. According to the Foundation (2009b), the envisioning and delivery of this corridor should, "...include initiatives and proposals that contribute to the culture of care for the Hills and create a concerted, collaborative vision that includes people of all backgrounds, including academics, inhabitants of all economic levels and the general public of Bogota." This project has been adopted, abandoned and re-adopted by leaders of the City Administration since, with the current Mayor, Enrique Peñalosa, in favour of the plan. As part of his election campaign for Mayor in September 2015,

he released a video promoting the development of an 80 kilometre trail that would traverse the whole forest reserve from Usme in the South to Usaquén in the North. It was promoted as endowing recreational opportunities, serving as firefighting routes, and providing educative experiences regarding the ecology of the Hills. Ecological recuperation efforts would be included in the project (Peñalosa, 2015).

In light of the information generated by this thesis, some observations can be made about how the development could include citizen values:

- There are a number of participants that believe human intervention of any type in the Hills is destructive and should be avoided. Some of these people took an anti-tourism stance, seeing existing trails as having a negative impact on the health of the Hills. Accordingly, the development of an ecological and recreative corridor would have to include a comprehensive plan to ameliorate negative environmental impacts on the landscape as much as possible. This involves strategic positioning of rest stops, toilet facilities and lighting. A plan for managing waste and the prevention of users straying from the designated path would be necessary. In addition, education and awareness of human impacts on the landscape would have to be implemented, so as to promote respectful and careful use of the trail.
- Given that citizens of all parts of Bogota believe that the Hills are valuable in ecological and cultural terms, regardless of proximity of residence to the area, economic level, gender or age, the design would need to consider aspects pertaining to equal access and input in the development process. For example, Peñalosa's design includes trails that are wide and smooth, so that wheelchair and bicycle users have access. Appropriate public transport to the proposed cable car stations would need to work with the existing TransMilenio bus system to ensure Bogotans from other parts of the city had best possible access.
- The ecological trail can be integrated into a broader existing management strategy that involves revegetation and restoration of ecosystem health being undertaken by actors such as the Jose Mutis Botanical Garden and the Foundation. Continuing the propagation of native species, for example, can fortify the ecosystems that generate many of the highly prioritised ecosystem services identified by citizens, such as the provision of fresh water and habitat for animals, and regulation of air quality. Strengthening the current focus on native species will mark a departure from past decades when exotic Eucalyptus and Acacia species were planted for their aesthetic appeal and quick provision of raw materials (Secretaria Distrital de Planeacion *et al.*, 2015), which this thesis demonstrates, are values which are considered much less valuable to citizens.

These observations demonstrate how citizen values can inform urban environmental and resource management. In the case of Bogota and the Eastern Hills, a cross examination of the results of this

research could be done with other studies (see the Literature Review) to give a more holistic picture about the conceptualisation of socio-ecological value, use preferences and needs of particularly vulnerable communities.

6.2. Methodological findings

The discovery of citizen values was facilitated by the use of a combined quantitative and qualitative survey method guided by a place-based, ecosystem service framework. By expressing their views in different ways, respondents provided a more comprehensive understanding of their perceptions than would have been seen by either a qualitative or quantitative method in isolation.

6.2.1. Assessment of conceptual framework and approach

Potschin & Haines-Young (2012) assert that a disadvantage of the place-based approach is its high demand for time, energy and resources. While the data collection process was demanding as part of an Honours project, the methodology could be cost-effectively replicated by an institutional actor that sought to collect information about the socio-ecological significance of a natural area. Given the advantages inherent to participatory or consultative planning, I consider this a readily applicable and transferrable methodology. Especially for engaging academics, government institutions and citizens in collaborative projects, resourcing and disciplinary limitations in the place-based approach to ecosystem service assessment can be overcome. Government departments with more consistent funding and human resources can be positioned to overcome the time-costliness and expense issues, while academics can provide variety and specialisation to assist in inter and transdisciplinary endeavour.

One aspect that is not highlighted by Potschin & Haines-Young (2012) is the need to revisit the same study to monitor whether perceptions of socio-ecological value have changed after a management strategy has been implemented. Engaging in consistent monitoring is difficult for both public offices and academics, which are constrained by a short to medium time frame and inconsistent resourcing alike. Ongoing, learning-based programs that involve consistent monitoring is called for in initiatives that use the ecosystem service framework for management (Carpenter *et al.*, 2009). Ideally, medium to long term monitoring of stakeholder meaning associated with natural areas could be incorporated into management plans. In Colombia, such monitoring could be situated in the ecosystem services research branch of the Alexander von Humboldt Institute, or the DSP, or a combination of entities.

6.2.2. Assessment of method

The major methodological finding pertains to the effectiveness of the qualitative and quantitative sections in eliciting different information about value. The ranking exercise demonstrated a clear, strong value for biophysical ecosystem services that maintain life in Bogota, while the explicative component was dominated by expression of social and cultural value, and gave more insight into the way that value



Maria Jose, Jose and Eleanor surveying

is conceptualised. This finding confirms the importance of using a multifaceted method that facilitates the communication of value in different ways.

The questions were intended to be broad so that respondents could interpret them according to their own conceptions of value and notion of *cui bono*. Table 9 demonstrates that there are degrees that value can be held in a conceptual sense at a broad scale, which at a smaller scale becomes more specific as it pertains to a particular place or object.

Respondents in my study conceptualised the value of the Hills according to their understanding of general conceptual value of nature, captured largely by the ranking exercise. Others focused on unique value of the Eastern Hills (expressed as ‘Assigned values’ in Table 9), indicated by making reference to contextually relevant features. The ranking exercise and conversations used together helped to broach the different levels of value attribution and abstraction.

Table 9: Facets of value associated with forests

Values				
	Value	Held values	↔	Assigned values
	Realm	Conceptual	↔	Object
Dimensions				
	Scale	Forests (generic)	Forests (specific)	Forest site
	Level of abstraction	High (‘economic’, ‘aesthetic’)	↔	Low (“a good place to walk”)
This Study		Ecosystem service ranking exercise (quantitative)	Both ranking and conversational components	Conversational component (qualitative)

Source: Adapted from McIntyre et al, 2008: 660

The survey design made questions easy to engage with for people of different educational levels and backgrounds. As such, question design was successful in eliciting the desired information and engaging people of varied life experience, which was a key aim of the study. The simplicity of the survey design also lent itself to be easily taught to the volunteer surveyors, whose help in my case was critical in the successful conduct of data collection. It also suggests that it may be transferrable to other contexts as it does not require experienced researchers or context-specific methods.

Ease of engagement with the study was significantly assisted by the use of the survey tool. Having a tactile tool gave respondents something to focus on apart from the surveyor, making many people feel more comfortable to talk to a stranger. Having pictures of each ecosystem service meant that many people could contrast the many services which would have been confusing to process in an oratory or written-word fashion. Pictures also facilitated engagement with complex ideas, overcoming barriers of illiteracy both generally and in ecological concepts. For example, some respondents commented that without seeing a picture of a tree's roots holding a sloping soil profile together, they would not have prioritised erosion control in their ranking.

As the aim of the study was to conduct brief surveys with as large a number of participants as possible in order to create broad, foundational level information, the survey was somewhat superficial as it was created to be quick and easy to respond to by people of all backgrounds and executable on the street. While this delivered the information it was intended to, it disadvantaged the qualitative component in that we were unable to record nuanced responses or have in-depth conversations. As such, it was impossible to do more sophisticated analysis that requires extensive transcripts, such as Key Words in Context (KWIC) analysis or meta-coding (Ryan and Bernard, 2003), which could deliver a more nuanced understanding of the way that themes and values relate to one another, for example. The ranking of ecosystem services was a valuable method for giving broad stroke numbers about priorities for participants, but may have revealed more fine grain differences between groups.

I found that as we focused almost entirely on street surveying, there were segments of the population that were difficult to represent properly. For example, despite our best efforts, elderly citizens were not as willing to participate as other age groups, and there were fewer elderly citizens in shopping centres on Friday afternoons than younger citizens. Accordingly, it is important to have more than one round of surveying and to experiment in different locations so as to be able to adapt the approach to take an appropriate sample for difficult-to-access groups.

Chapter 7: Conclusion

This participatory, place-based ecosystem service study contributes to the integrative assessment of the Eastern Hills and the way they should be managed as a natural public asset for posterity.

It discovered that in quantitative terms, biophysical and ecological services such as fresh water and habitat provision, biodiversity, carbon sequestration, erosion control and climate and air quality were the most highly prioritised ecosystem services due to their fundamental importance for the maintenance of human life and wellbeing. These ecosystem services were most highly ranked regardless of age, gender, area of residence or economic level. The conversational component allowed participants to express their conception of value in their own terms. This facilitated the communication of emotive and cultural facets of value that the Hills hold for Bogotans. For example, citizens hold a strong pro-conservation stance, and believe the Hills are important in their contribution to Bogotan identity. They see them as the natural, pure counterpart to the industry of the city and they offer a sense of tranquillity and peace to people. The divergent character of the results according to qualitative and quantitative elements confirms the importance of using a multi-faceted method that can capture different conceptions of value for forging a holistic picture.

The participatory, place-based framework for ecosystem service evaluation was found to be an effective conceptual framework for the elucidation of socio-ecological value associated with a natural place. Using the ecosystem services concept meant that participants could incorporate the notion of trade-offs into the process of prioritisation and that values have ramifications for management. By focusing on the Eastern Hills as the place, as opposed to an ecosystem or a technical concept, participants of all backgrounds were able to meaningfully engage with the idea that the Hills provide many varied benefits. As such, the place-based ecosystem service framework constitutes a valuable way to engage with a variety of people, obtain meaningful information about socio-ecological value, encourage participation as a means of empowerment and education, and connect values to real-world systems for directing natural resource management. The method devised for this study is highly transferrable, requires little training and specialist input, is inexpensive and produces insights which are valuable to natural resource management projects.

7.1. Future directions

There are several directions that can be pursued to improve understanding of the Bogotan relationship with the Hills.

Given the increase in participatory studies that have been done in the Bogota-Hills space in the past decade, a study that triangulates the findings to create a comprehensive overview of socio-ecological values associated with the Hills could be done. Examining the commonalities, differences and unexplored spaces can provide a state-of-knowledge report, and constitute a potent tool for policy and planning development.

It would be a natural step to expand the richness of information found in this study by using more in-depth methods, like focus groups and KWIC analysis, in a subsequent study. For example, a key question that emerged from the results of this thesis was whether variation in educative level of participants in relation to the Hills. Lack of education is believed by many to contribute to a lack of care about the Hills, or knowledge about how to contribute to their conservation in everyday life. As such, a study oriented at education about the Hills within the Bogotan community would represent a valuable tool for understanding the empowerment and engagement of Bogotans with the Hills through formal knowledge.

To gauge the extent that actors like environmental NGOs, institutions and citizens are able to mobilise participatory information like that created by this thesis, a study into the avenues for citizen participation in the Bogotan and Colombian environmental governance framework and institutions would be useful.

In terms of ecosystem service literature, this study can form part of a larger ecosystem service assessment that incorporates participatory (this study), biophysical (next study) and valuation (monetary or not) at a later stage. Such a study can contribute a transdisciplinary understanding of value of this natural area, and evaluate the broader effectiveness of the concept as a framework for natural resource management.

7.2. Significance in broader problem space

Management of the Hills as a public resource requires grappling with complexity and confronting many issues. For example, housing and social policy must effectively assist the assimilation of rural poor migrants into city life, so as to ethically relocate vulnerable communities out of the Hills. Ambiguous environmental protection laws must be clarified and enforced, requiring genuine evaluation of the functionality, resourcing and structure of several government bodies at different jurisdictional levels. Security must be improved by dealing with criminal activity in the area, so citizens feel safe recreating and engaging with the Hills. These cannot be dealt with a quick fix, and involve solutions that arise from considering the Hills-Bogota relationship holistically. It is appropriate to consider the extent to which this study can help decision-makers confront key problems, and the usefulness of the findings. While this study is not intended to address the social, economic and demographic problems that cause

degradation to the Hills, it has shown that there is enthusiasm on the part of the citizenry to be included in determining the future of the Hills and the city. There is widespread support and concern for greater education about the ecology, history, change and current use of the area. This social capital is, I argue, a valuable management asset that is currently under-utilised, but increasing. Involving the citizenry in management can illuminate areas where conflict can arise, or where social synergies exist but were previously unseen. It can contribute complexity by increasing the number of motivated and potentially opposing actors, or create positive outcomes like pressure for reform of environmental law in the area. Given that the Eastern Hills are considered a public area as a forest reserve under national law, the future of this place should respond to input of the public it is conserved for.

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Appendix 1: Oral consent script



ORAL CONSENT SCRIPT for Participants

Values and Perceptions of the Eastern Hills of Bogota on the part of normal Bogotan citizens

I have read to you the Information Sheet about the research project. Was this information clear? Do you have any questions about the project?

Do you agree to participate in this project? (Record the answer as Yes/No)

Your name will not be collected and as such will NOT be attributed to the response you give to this survey.

May we start the interview now?

Appendix 2: Information Sheet (Spanish version used in the field)



Participant Information Sheet

Researcher:

My name is Eleanor Robson and I am an Honours student at College of Science at the Australian National University (this is like a specialisation degree in Colombia). In 2015, I worked in an environmental consultancy in Bogota to do a study into the way that Bogota affects the Eastern Hills, and how the Hills benefit Bogota.

Project Title: Values and Perceptions of the Eastern Hills of Bogota on the part of Bogotan citizens

General Outline of the Project:

Description and Methodology: This project aims to understand how Bogotan citizens value and perceive the Eastern Hills, and whether this changes according to sex, age, occupation and where you live in the city. I am going to ask you whether you think the Hills are important, and if you say yes, I will ask you to explain why they are important to you by getting you to choose from a list of different types of benefits.

Participants: I am conducting surveys in two ways; 1) asking around 500 people in shopping malls in different parts of Bogota, and 2) through an online survey distributed through the mailing list of the Bogotan Hills Foundation. It is hoped that around 100-150 people will participate online.

Use of Data and Feedback: My data will be used in my Honours thesis, which I will aim to publish in an academic journal in 2017. I may also publish an article with my findings for a local magazine such as La Semana. I will collect your email address to send you the report once it has been finished in October, 2016.

Participant Involvement:

Voluntary Participation & Withdrawal: Your participation in this project is voluntary and you may decline to take part in or withdraw your participation at any point without negative consequence. You do not have to answer any question if you do not want to. If you choose to withdraw, I will not use your response in my data.

What does participation in the research entail? I will begin by asking, "Do you think the Eastern Hills of Bogota are important for the city?" If you answer yes, I will ask you to identify up to five of most important reasons why you think they are important from a typology of values which was created by the Millennium Ecosystem Assessment. I will also ask you to rank these values in terms of greatest importance. If you answer no to the initial question, I will still record this a response, but you will not be required to continue with the other stages of choosing and ranking values. At the end, I will ask whether you would like to add any comments of your own that you think are relevant to the research. Lastly, I will collect some details about you, such as age, sex, occupation and which locality you live in within Bogota.

Location and Duration: Data will be collected in different shopping malls about Bogota or online. The survey takes around 5 minutes.

Benefits: It is unlikely that you will derive a personal benefit from this research, however, it is intended that by collecting information from a wide range of Bogotans about the way they value the Eastern Hills, these values will be better represented in urban planning and conservation governance of the Hills. This is in an effort to increase participation and consultancy of the general public in urban ecological policy and governance.

Confidentiality:

The responses you give will only be accessible by Eleanor, the other data collectors and Eleanor's supervisor, Dr Lorrae Van Kerkhoff. Your name will not be collected and attached to your responses; instead you will be attributed a number. As such, you will not be identifiable both in the data collection phase and in publishing.

Data Storage:

Where: All data will be kept confidential, as far as the law allows, and securely stored with access only to the researchers. Digital files will be password protected and deleted from the recording device once they have been backed up. Data will be kept securely for five years after the completion of the research, and then destroyed, in compliance with ANU policy.

How long: Data will be kept until the end of October, 2017.

Handling of Data following the required storage period: Data will be archived after October 2017.

Queries and Concerns:

Contact Details: If you have any questions or comments that you would like to contact me about, you can email Eleanor at u4840474@anu.edu.au or +61 0448780651 (on WhatsApp or iMessage). You can also contact Eleanor's supervisor, Lorrae Van Kerkhoff, at lorrae.vankerkhoff@anu.edu.au or on +61 2 612 52748.

Contact in Colombia: If you are unable to contact Eleanor or Lorrae, you may contact Maria Paula Hernandez at +57 315 279 9975.

Ethics Committee Clearance:

The ethical aspects of this research have been approved by the ANU Human Research Ethics Committee. If you have any concerns or complaints about how this research has been conducted, please contact:

Ethics Manager
The ANU Human Research Ethics Committee
The Australian National University
Telephone: +61 2 6125 3427
Email: Human.Ethics.Officer@anu.edu.au

Appendix 3: TEEB Ecosystem Service Typology

	Habitat for species: Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.	Support
	Genetic Diversity: Genetic diversity is the variety of genes between and within species populations. Genetic diversity distinguishes different breeds or races from each other thus providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock. Some habitats have an exceptionally high number of species which makes them more genetically diverse than others and are known as 'biodiversity hotspots'.	
	Local climate and air quality: Trees provide shade whilst forests influence rainfall and water availability both locally and regionally. Trees or other plants also play an important role in regulating air quality by removing pollutants from the atmosphere	Regulation
	Carbon sequestration and storage: Ecosystems regulate the global climate by storing and sequestering greenhouse gases. As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues. In this way forest ecosystems are carbon stores. Biodiversity also plays an important role by improving the capacity of ecosystems to adapt to the effects of climate change.	
	Moderation of extreme events: Extreme weather events or natural hazards include floods, storms, tsunamis, avalanches and landslides. Ecosystems and living organisms create buffers against natural disasters, thereby preventing possible damage. For example, wetlands can soak up flood water whilst trees can stabilize slopes. Coral reefs and mangroves help protect coastlines from storm damage	
	Waste-water treatment: Ecosystems such as wetlands filter both human and animal waste and act as a natural buffer to the surrounding environment. Through the biological activity of microorganisms in the soil, most waste is broken down. Thereby pathogens (disease causing microbes) are eliminated, and the level of nutrients and pollution is reduced.	
	Erosion prevention and maintenance of soil fertility: Soil erosion is a key factor in the process of land degradation and desertification. Vegetation cover provides a vital regulating service by preventing soil erosion. Soil fertility is essential for plant growth and agriculture and well-functioning ecosystems supply the soil with nutrients required to support plant growth.	
	Pollination: Insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds. Animal pollination is an ecosystem service mainly provided by insects but also by some birds and bats. Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee.	
	Biological control: Ecosystems are important for regulating pests and vector borne diseases that attack plants, animals and people. Ecosystems regulate pests and diseases through the activities of predators and parasites. Birds, bats, flies, wasps, frogs and fungi all act as natural controls.	

	Food: Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems but marine and freshwater systems or forests also provide food for human consumption. Wild foods from forests are often underestimated.	Provision
	Raw materials: Ecosystems provide a great diversity of materials for construction and fuel including wood, biofuels and plant oils that are directly derived from wild and cultivated plant species.	
	Fresh water: Ecosystems play a vital role in the global hydrological cycle, as they regulate the flow and purification of water. Vegetation and forests influence the quantity of water available locally.	
	Medicinal resources: Ecosystems and biodiversity provide many plants used as traditional medicines as well as providing the raw materials for the pharmaceutical industry. All ecosystems are a potential source of medicinal resources.	
	Aesthetic appreciation and inspiration for culture, art and design: Language, knowledge and the natural environment have been intimately related throughout human history. Biodiversity, ecosystems and natural landscapes have been the source of inspiration for much of our art, culture and increasingly for science.	Culture
	Recreation and mental and physical health: Walking and playing sports in green space is not only a good form of physical exercise but also lets people relax. The role that green space plays in maintaining mental and physical health is increasingly being recognized, despite difficulties of measurement.	
	Tourism: Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits and is a vital source of income for many countries. In 2008 global earnings from tourism summed up to US\$ 944 billion. Cultural and eco-tourism can also educate people about the importance of biological diversity.	
	Spiritual experience and sense of place: In many parts of the world natural features such as specific forests, caves or mountains are considered sacred or have a religious meaning. Nature is a common element of all major religions and traditional knowledge, and associated customs are important for creating a sense of belonging.	

Source: The Economics of Ecosystems and Biodiversity (TEEB), 2016

Appendix 4: Ecosystem service ranking according to young-adult respondents (18-30)

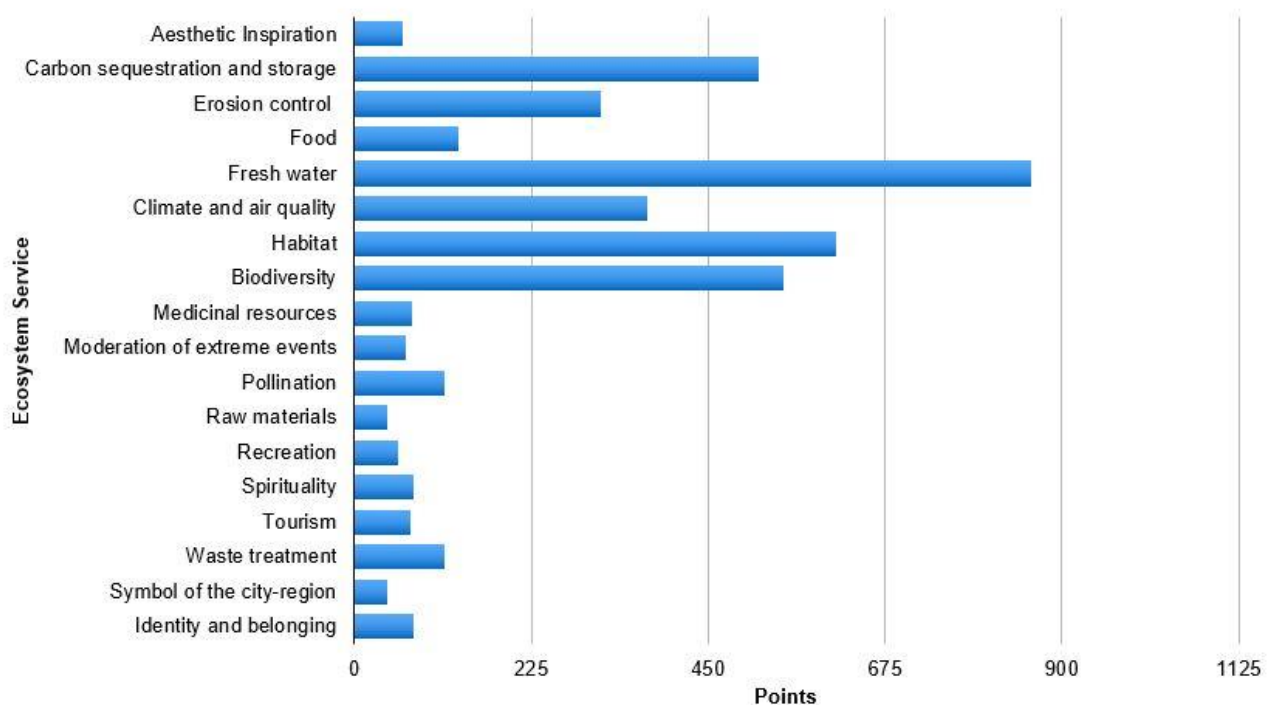
Raw responses: Frequency that youth ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	7	1	2	4	8
Carbon sequestration and storage	49	32	27	26	8
Erosion Control	18	26	18	24	18
Food	8	8	12	7	11
Fresh water	95	53	38	21	17
Climate and air quality	17	28	32	32	15
Habitat	30	51	54	42	13
Biodiversity	28	46	43	32	28
Medicinal resources	3	2	11	3	11
Moderation of extreme events	2	1	6	12	10
Pollination	2	10	6	13	20
Raw materials	1	1	3	5	5
Recreation	1	1	3	11	16
Spirituality	3	2	7	10	11
Tourism	5	2	2	9	24
Waste treatment	5	9	7	12	8
Symbol of the city-region	3	3	1	3	5
Identity and belonging	2	2	6	7	25

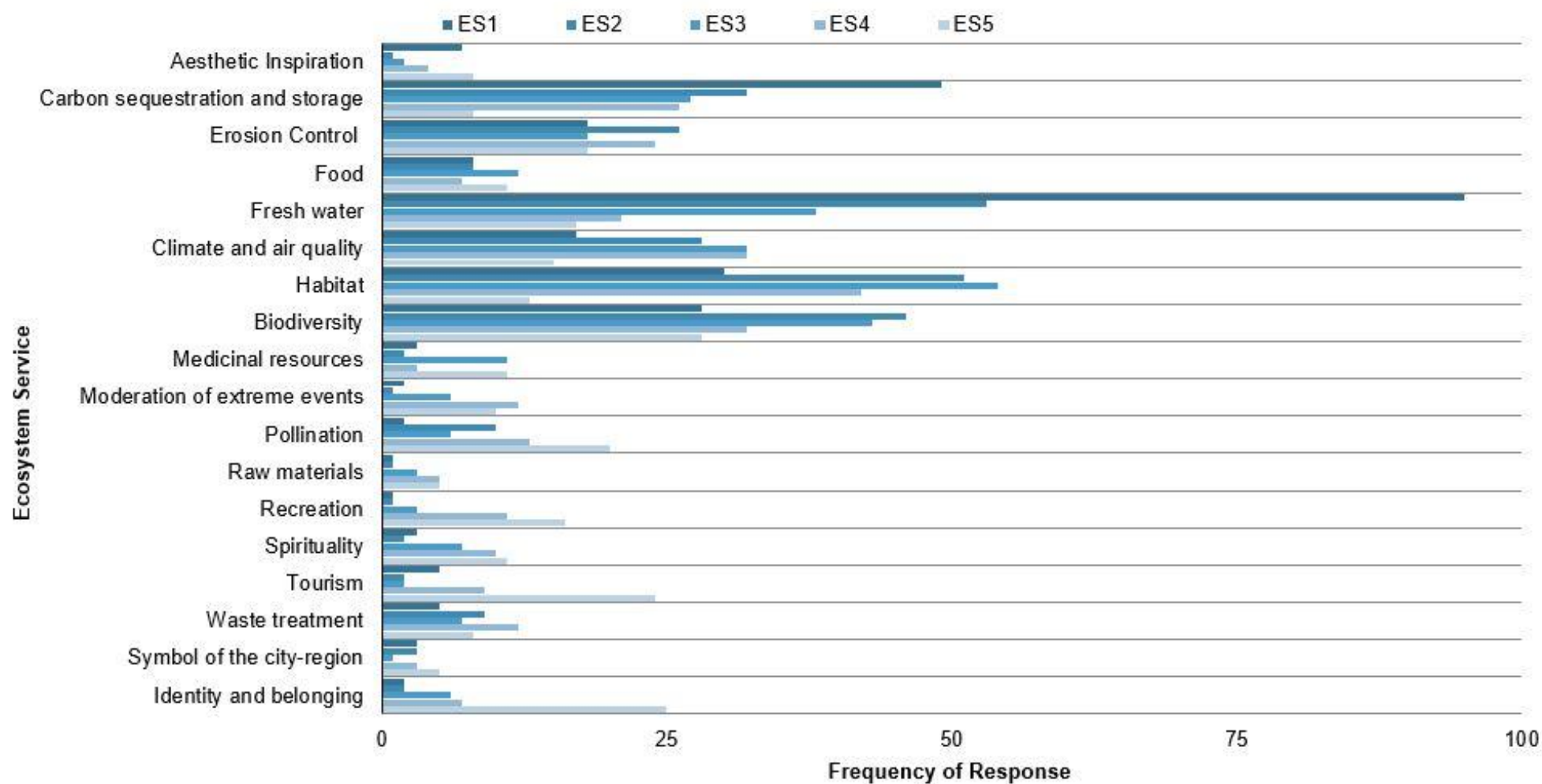
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	35	4	6	8	8	61
Carbon sequestration and storage	245	128	81	52	8	514
Erosion control	90	104	54	48	18	314
Food	40	32	36	14	11	133
Fresh water	475	212	114	42	17	860
Climate and air quality	85	112	96	64	15	372
Habitat	150	204	162	84	13	613
Biodiversity	140	184	129	64	28	545
Medicinal resources	15	8	33	6	11	73
Moderation of extreme events	10	4	18	24	10	66
Pollination	10	40	18	26	20	114
Raw materials	5	4	18	10	5	42
Recreation	5	4	9	22	16	56
Spirituality	15	8	21	20	11	75
Tourism	15	8	6	18	24	71
Waste treatment	25	36	21	24	8	114
Symbol of the city-region	15	12	3	6	5	41
Identity and belonging	10	8	18	14	25	75

Relative importance (points score) graph



Raw responses graph



Appendix 5: Ecosystem service ranking according to middle-aged respondents (31-50)

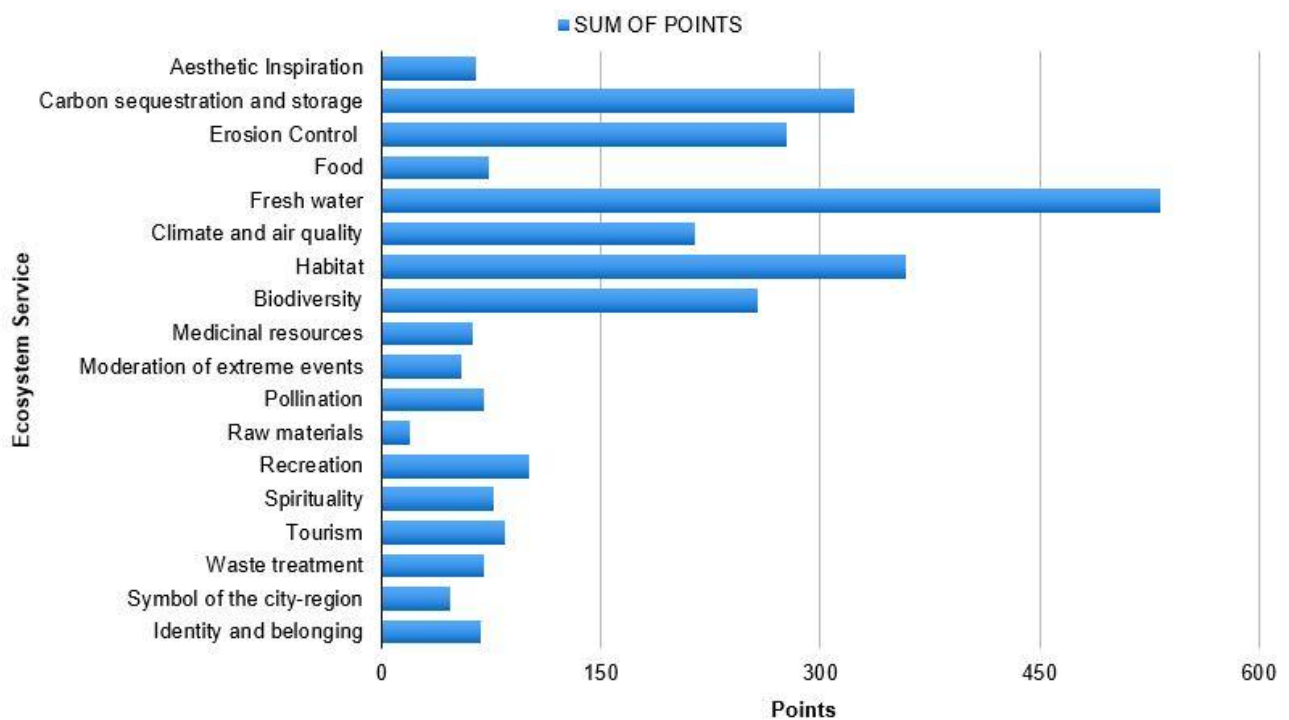
Raw responses: Frequency that middle-aged respondents ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	6	3	3	2	9
Carbon sequestration and storage	29	22	15	16	13
Erosion Control	16	24	17	18	14
Food	4	8	5	1	4
Fresh water	63	25	30	10	7
Climate and air quality	11	18	16	14	11
Habitat	20	34	24	21	8
Biodiversity	12	17	29	17	11
Medicinal resources	1	4	7	7	6
Moderation of extreme events	0	5	6	5	7
Pollination	2	7	2	10	6
Raw materials	0	3	0	2	3
Recreation	3	2	6	21	18
Spirituality	5	6	3	7	5
Tourism	1	1	9	15	18
Waste treatment	3	5	5	8	4
Symbol of the city-region	4	0	2	4	13
Identity and belonging	5	2	5	4	12

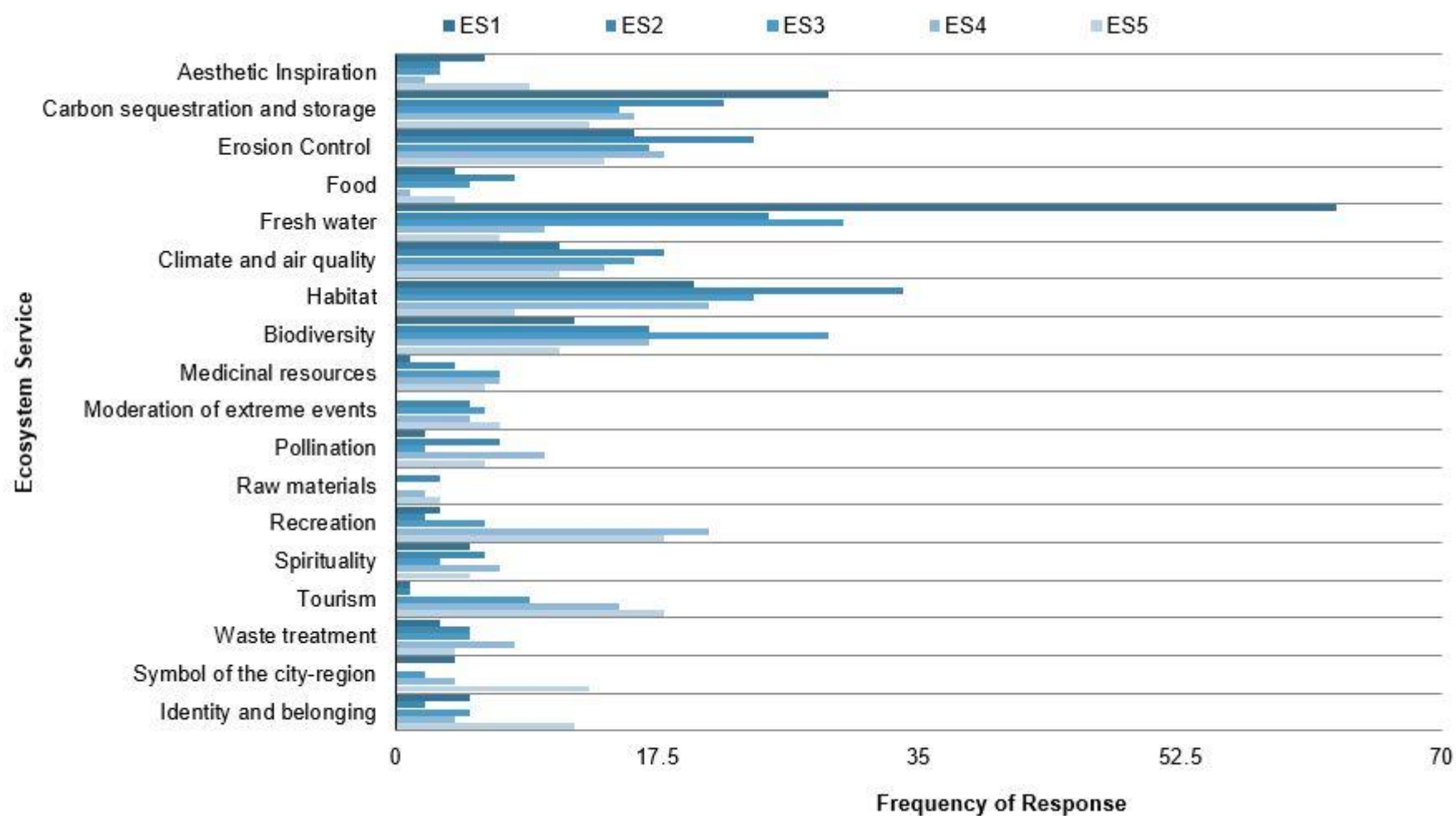
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	30	12	9	4	9	64
Carbon sequestration and storage	145	88	45	32	13	323
Erosion Control	80	96	51	36	14	277
Food	20	32	15	2	4	73
Fresh water	315	100	90	20	7	532
Climate and air quality	55	72	48	28	11	214
Habitat	100	136	72	42	8	358
Biodiversity	60	68	87	31	11	257
Medicinal resources	5	16	21	14	6	62
Moderation of extreme events	0	20	18	10	7	55
Pollination	10	28	6	20	6	70
Raw materials	0	12	0	4	3	19
Recreation	15	8	18	42	18	101
Spirituality	25	24	9	14	5	77
Tourism	5	4	27	30	18	84
Waste treatment	15	20	15	16	4	70
Symbol of the city-region	20	0	6	8	13	47
Identity and belonging	25	8	15	8	12	68

Relative importance (points score) graph



Raw responses graph



Appendix 6: Ecosystem service ranking according to mature respondents (31-50)

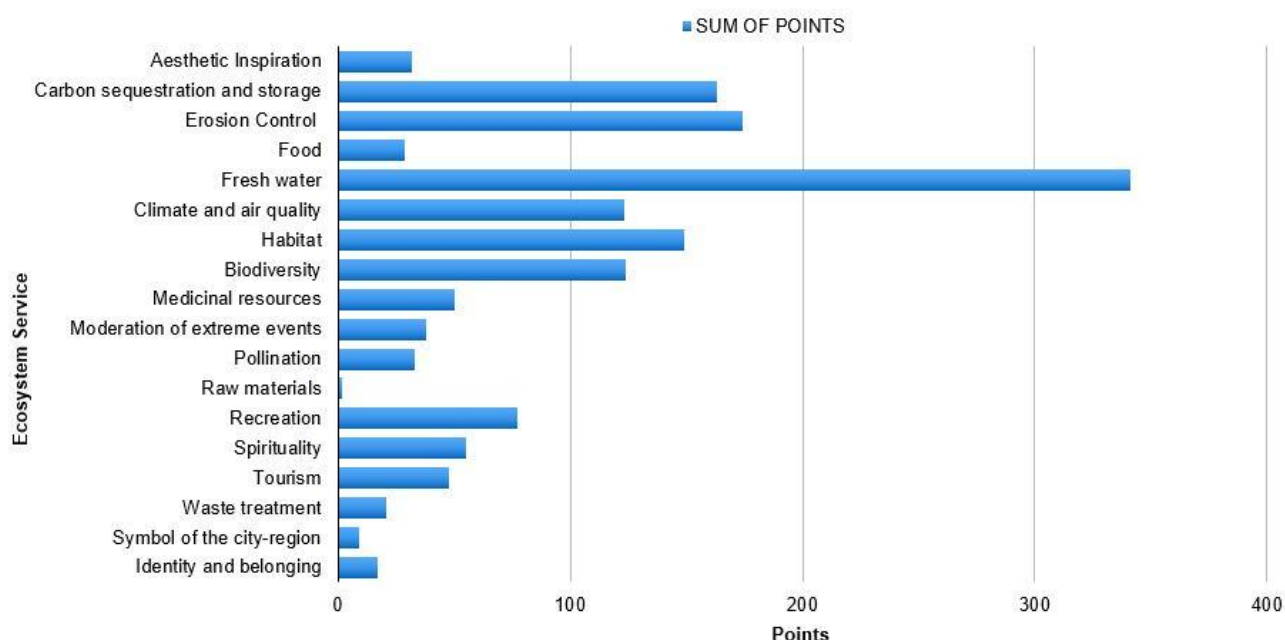
Raw responses: Frequency that mature respondents ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	3	3	0	1	3
Carbon sequestration and storage	17	10	6	8	4
Erosion Control	13	14	8	11	7
Food	2	4	0	1	1
Fresh water	37	25	14	4	6
Climate and air quality	6	10	10	10	3
Habitat	11	10	13	5	5
Biodiversity	5	9	12	7	13
Medicinal resources	1	0	8	9	3
Moderation of extreme events	1	0	5	5	8
Pollination	0	2	3	5	6
Raw materials	0	0	0	1	0
Recreation	3	6	4	11	4
Spirituality	2	3	7	4	4
Tourism	1	3	4	5	9
Waste treatment	0	1	2	3	5
Symbol of the city-region	0	1	1	0	2
Identity and belonging	1	0	1	2	5

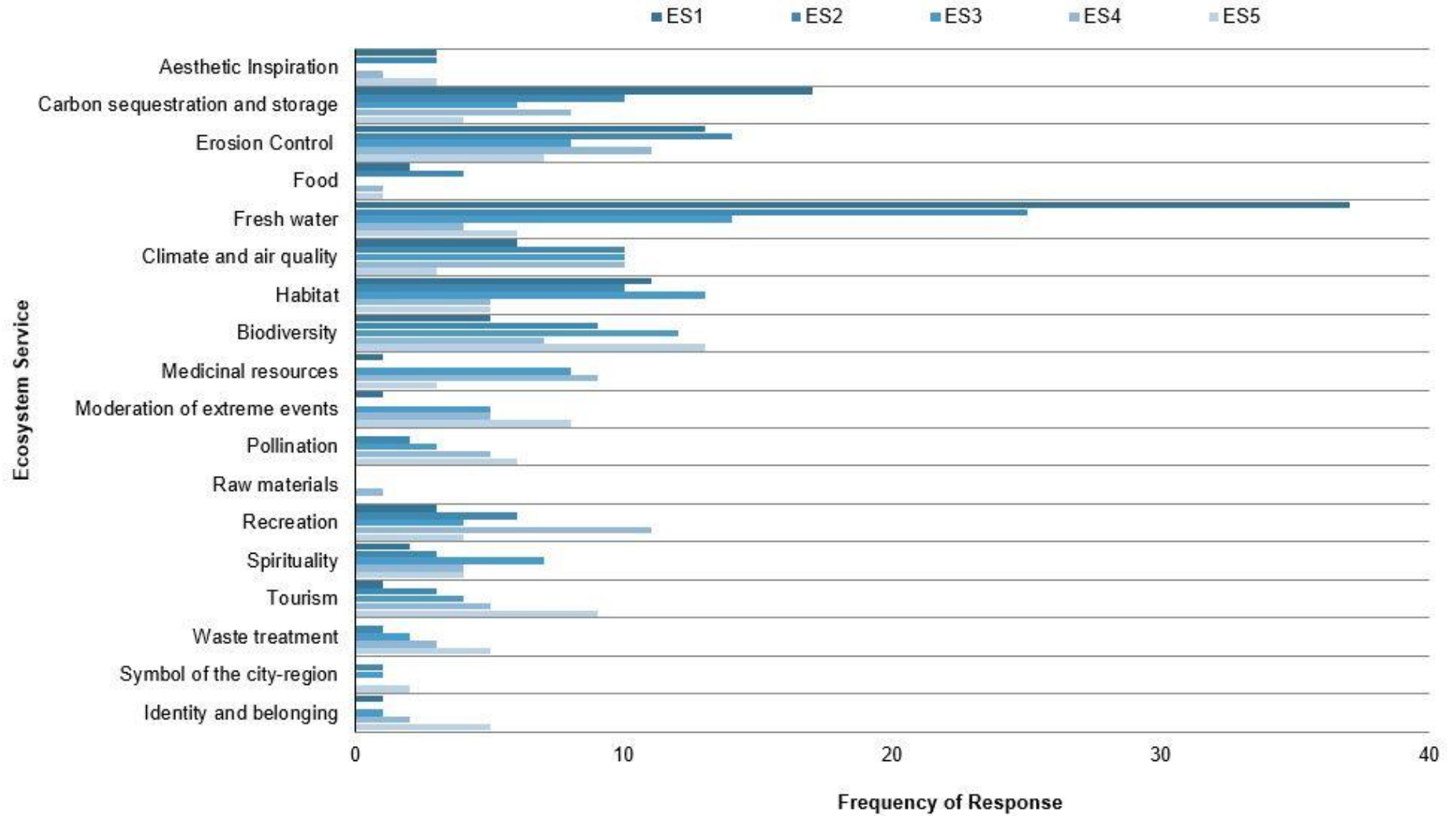
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	15	12	0	2	3	32
Carbon sequestration and storage	85	40	18	16	4	163
Erosion Control	65	56	24	22	7	174
Food	10	16	0	2	1	29
Fresh water	185	100	42	8	6	341
Climate and air quality	30	40	30	20	3	123
Habitat	55	40	39	10	5	149
Biodiversity	25	36	36	14	13	124
Medicinal resources	5	0	24	18	3	50
Moderation of extreme events	5	0	15	10	8	38
Pollination	0	8	9	10	6	33
Raw materials	0	0	0	2	0	2
Recreation	15	24	12	22	4	77
Spirituality	10	12	21	8	4	55
Tourism	5	12	12	10	9	48
Waste treatment	0	4	6	6	5	21
Symbol of the city-region	0	4	3	0	2	9
Identity and belonging	5	0	3	4	5	17

Relative importance (points score) graph



Raw responses graph



Appendix 7: Ecosystem service ranking according to male respondents

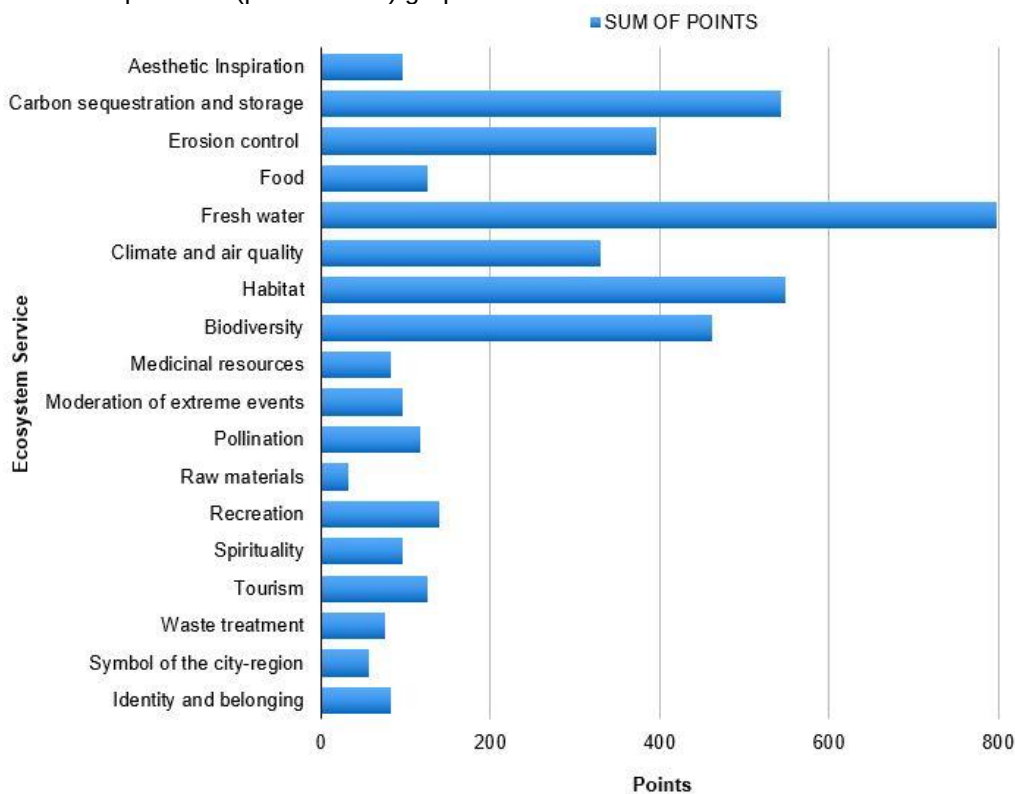
Raw responses: Frequency that males ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	10	4	3	5	11
Carbon sequestration and storage	50	39	23	29	10
Erosion control	28	33	18	25	20
Food	6	13	8	1	9
Fresh water	89	42	44	17	19
Climate and air quality	14	30	27	22	15
Habitat	32	46	48	26	8
Biodiversity	23	35	37	34	27
Medicinal resources	1	3	12	10	10
Moderation of extreme events	2	5	10	12	12
Pollination	3	11	7	11	16
Raw materials	1	2	2	4	6
Recreation	6	6	6	24	20
Spirituality	4	3	11	12	8
Tourism	3	5	9	17	29
Waste treatment	4	3	4	12	8
Symbol of the city-region	4	2	3	4	11
Identity and belonging	5	1	7	8	17

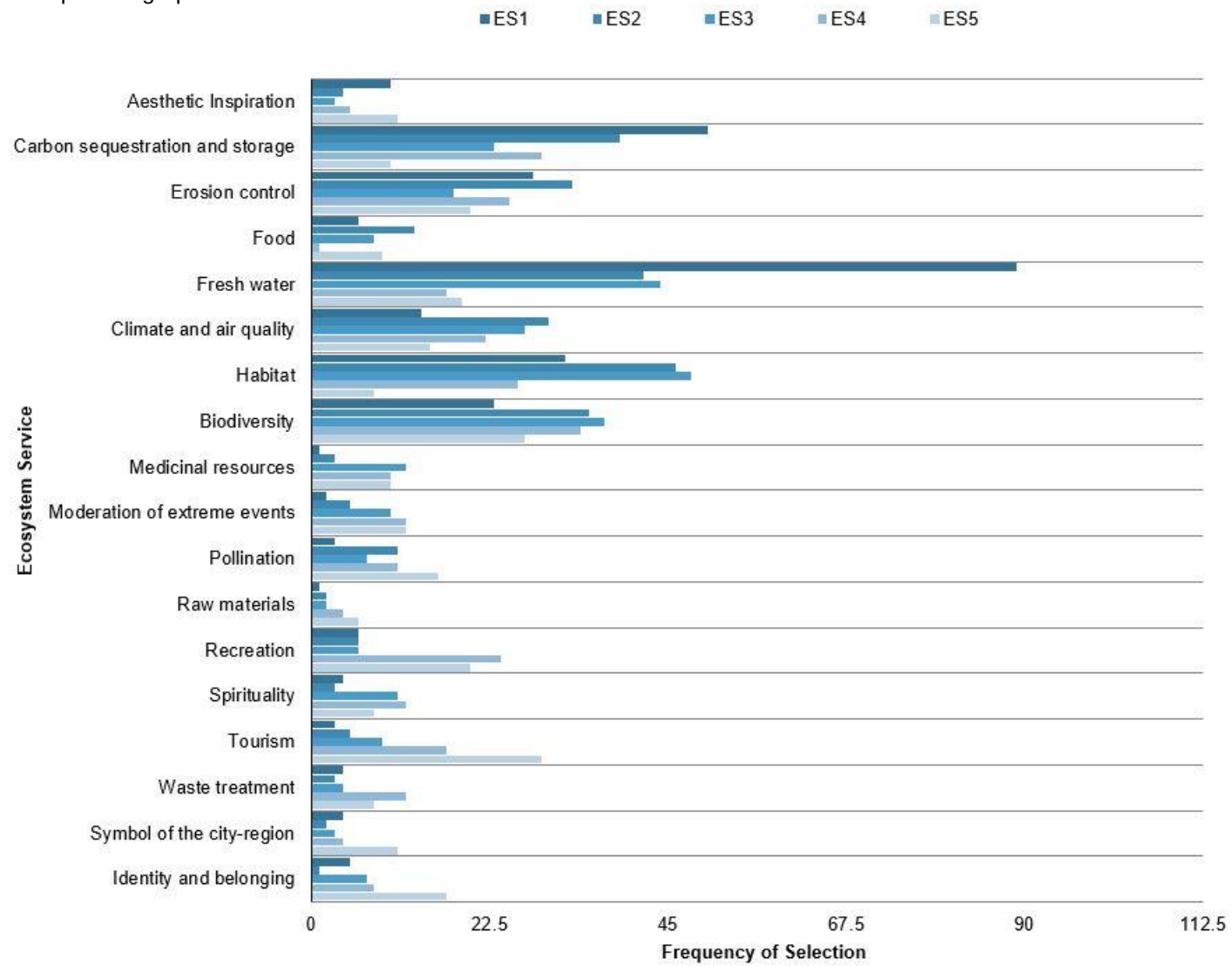
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	50	16	9	10	11	96
Carbon sequestration and storage	250	156	69	58	10	543
Erosion control	140	132	54	50	20	396
Food	30	52	32	2	9	125
Fresh water	445	168	132	34	19	798
Climate and air quality	70	120	81	44	15	330
Habitat	160	184	144	52	8	548
Biodiversity	115	140	111	68	27	461
Medicinal resources	5	12	36	20	10	83
Moderation of extreme events	10	20	30	24	12	96
Pollination	15	44	21	22	16	118
Raw materials	5	8	6	8	6	33
Recreation	30	24	18	48	20	140
Spirituality	20	12	33	24	8	97
Tourism	15	20	27	34	29	125
Waste treatment	20	12	12	24	8	76
Symbol of the city-region	20	8	9	8	11	56
Identity and belonging	25	4	21	16	17	83

Relative importance (points score) graph



Raw responses graph



Appendix 8: Ecosystem service ranking according to female respondents

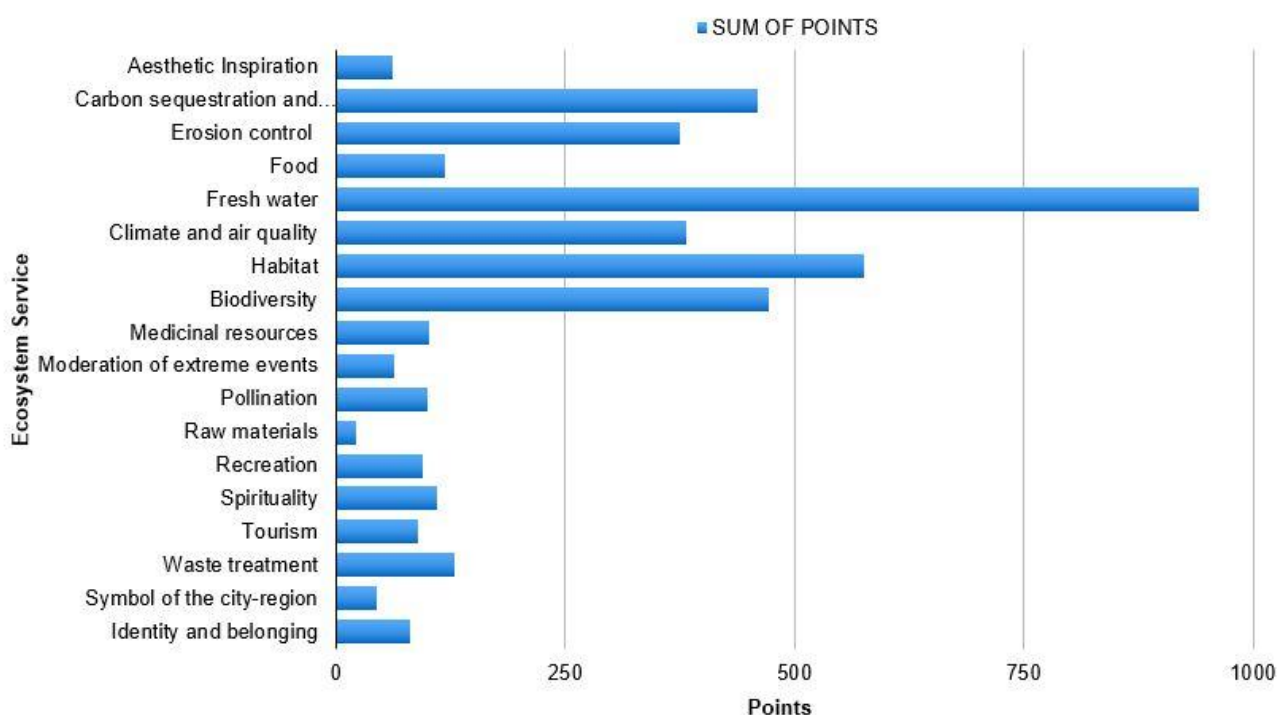
Raw score: Frequency that females ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	6	3	2	2	9
Carbon sequestration and storage	45	25	25	22	15
Erosion control	20	31	25	28	19
Food	8	7	9	8	7
Fresh water	107	61	38	18	11
Climate and air quality	20	26	31	35	14
Habitat	29	49	44	42	19
Biodiversity	22	38	47	22	25
Medicinal resources	4	3	14	9	10
Moderation of extreme events	1	1	7	10	13
Pollination	1	8	4	17	16
Raw materials	0	2	1	4	2
Recreation	1	3	7	19	18
Spirituality	6	8	6	9	12
Tourism	4	1	6	12	23
Waste treatment	4	12	10	11	9
Symbol of the city-region	3	3	1	3	9
Identity and belonging	3	3	6	5	25

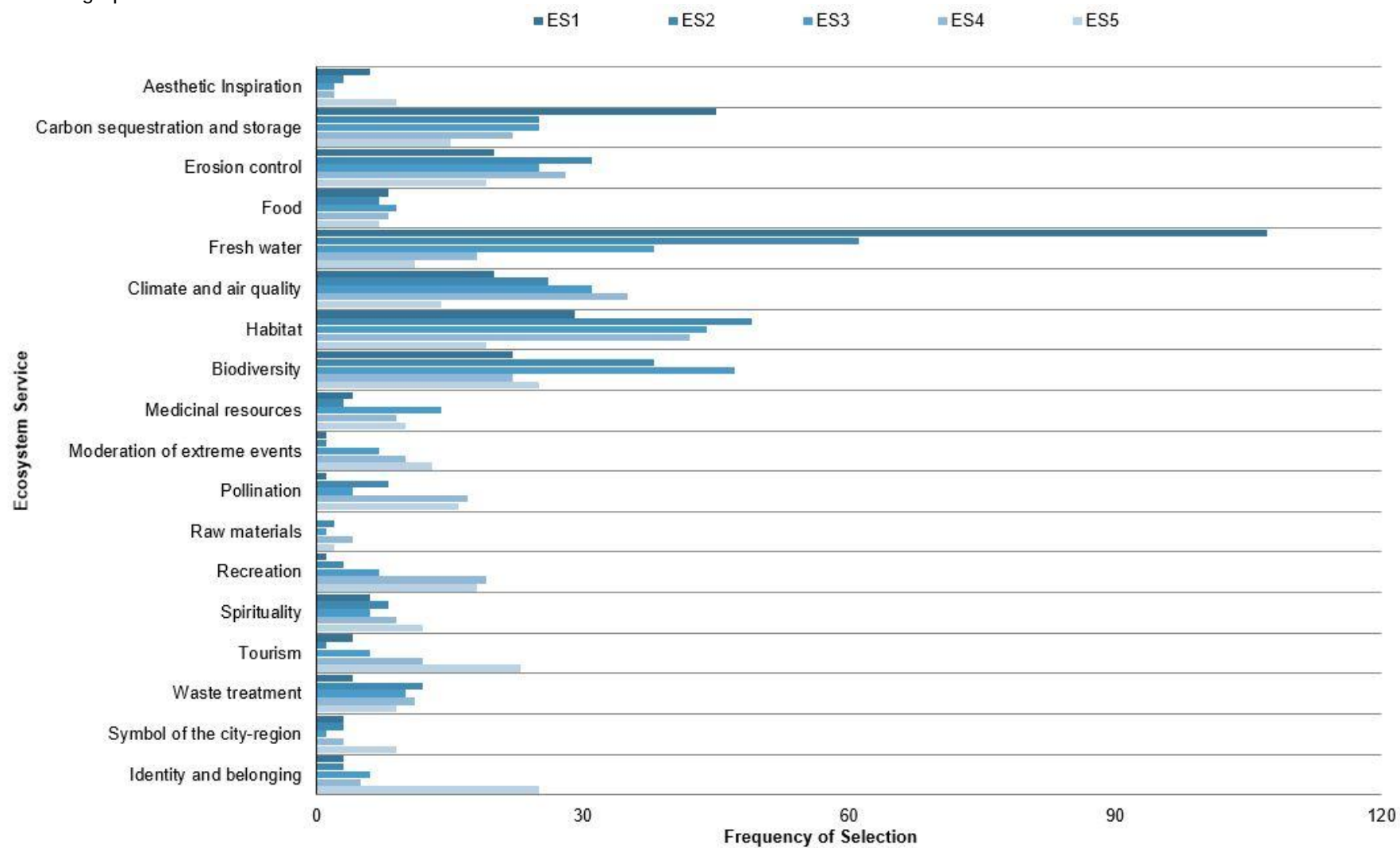
Relative importance: raw score attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	30	12	6	4	9	61
Carbon sequestration and storage	225	100	75	44	15	459
Erosion control	100	124	75	56	19	374
Food	40	28	27	16	7	118
Fresh water	535	244	114	36	11	940
Climate and air quality	100	104	93	70	14	381
Habitat	145	196	132	84	19	576
Biodiversity	110	152	141	44	25	472
Medicinal resources	20	12	42	18	10	102
Moderation of extreme events	5	4	21	20	13	63
Pollination	5	32	12	34	16	99
Raw materials	0	8	3	8	2	21
Recreation	5	12	21	38	18	94
Spirituality	30	32	18	18	12	110
Tourism	20	4	18	24	23	89
Waste treatment	20	48	30	22	9	129
Symbol of the city-region	15	12	3	6	9	45
Identity and belonging	15	12	18	10	25	80

Relative importance (points score) graph



Raw score graph



Appendix 9: Ecosystem service ranking according to respondents of a lower economic level (Strata 1 and 2)

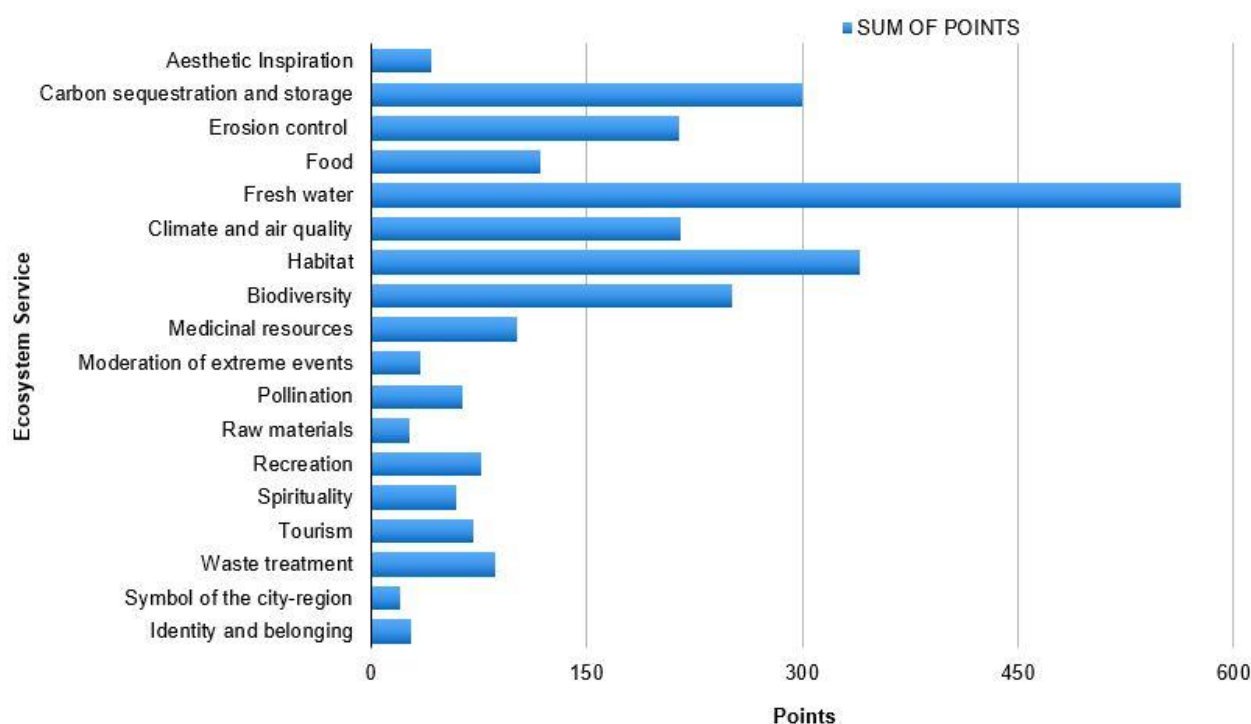
Raw responses: Frequency that lower economic level respondents ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	5	2	0	2	5
Carbon sequestration and storage	31	18	14	12	7
Erosion control	14	20	11	10	11
Food	6	11	9	6	5
Fresh water	63	33	28	13	6
Climate and air quality	5	15	16	17	8
Habitat	17	28	28	26	7
Biodiversity	13	18	22	15	18
Medicinal resources	4	3	14	9	10
Moderation of extreme events	0	1	4	5	8
Pollination	2	6	1	7	12
Raw materials	0	3	1	4	4
Recreation	2	3	6	14	8
Spirituality	1	5	4	8	6
Tourism	3	2	5	7	19
Waste treatment	4	4	7	10	9
Symbol of the city-region	3	0	1	0	2
Identity and belonging	0	1	1	6	9

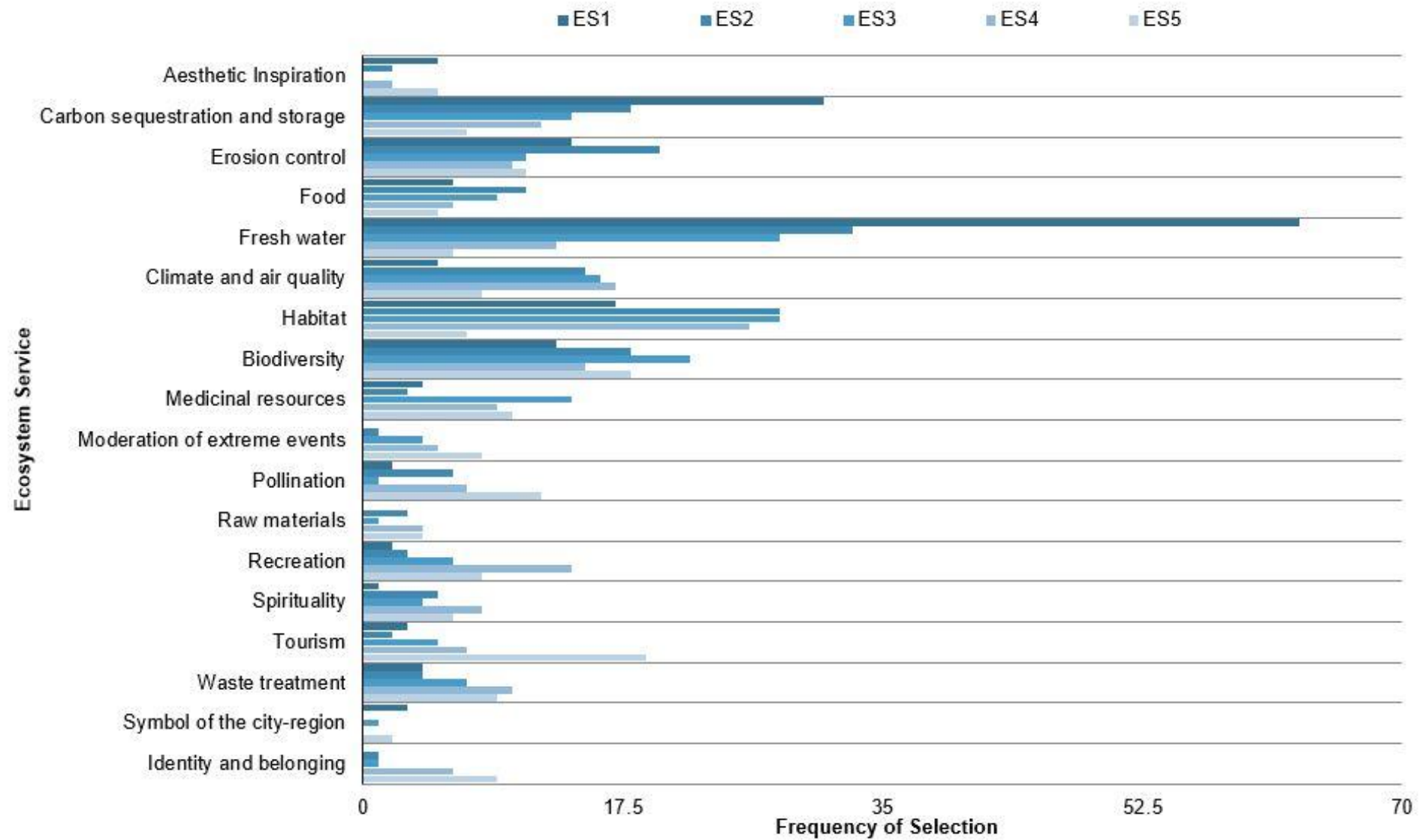
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	25	8	0	4	5	42
Carbon sequestration and storage	155	72	42	24	7	300
Erosion control	70	80	33	20	11	214
Food	30	44	27	12	5	118
Fresh water	315	132	84	26	6	563
Climate and air quality	25	100	48	34	8	215
Habitat	85	112	84	52	7	340
Biodiversity	65	72	66	30	18	251
Medicinal resources	20	12	42	18	10	102
Moderation of extreme events	0	4	12	10	8	34
Pollination	10	24	3	14	12	63
Raw materials	0	12	3	8	4	27
Recreation	10	12	18	28	8	76
Spirituality	5	20	12	16	6	59
Tourism	15	8	15	14	19	71
Waste treatment	20	16	21	20	9	86
Symbol of the city-region	15	0	3	0	2	20
Identity and belonging	0	4	3	12	9	28

Relative importance (points score) graph



Raw responses graph



Appendix 10: Ecosystem service ranking according to respondents of a middle economic level (Stratum 3)

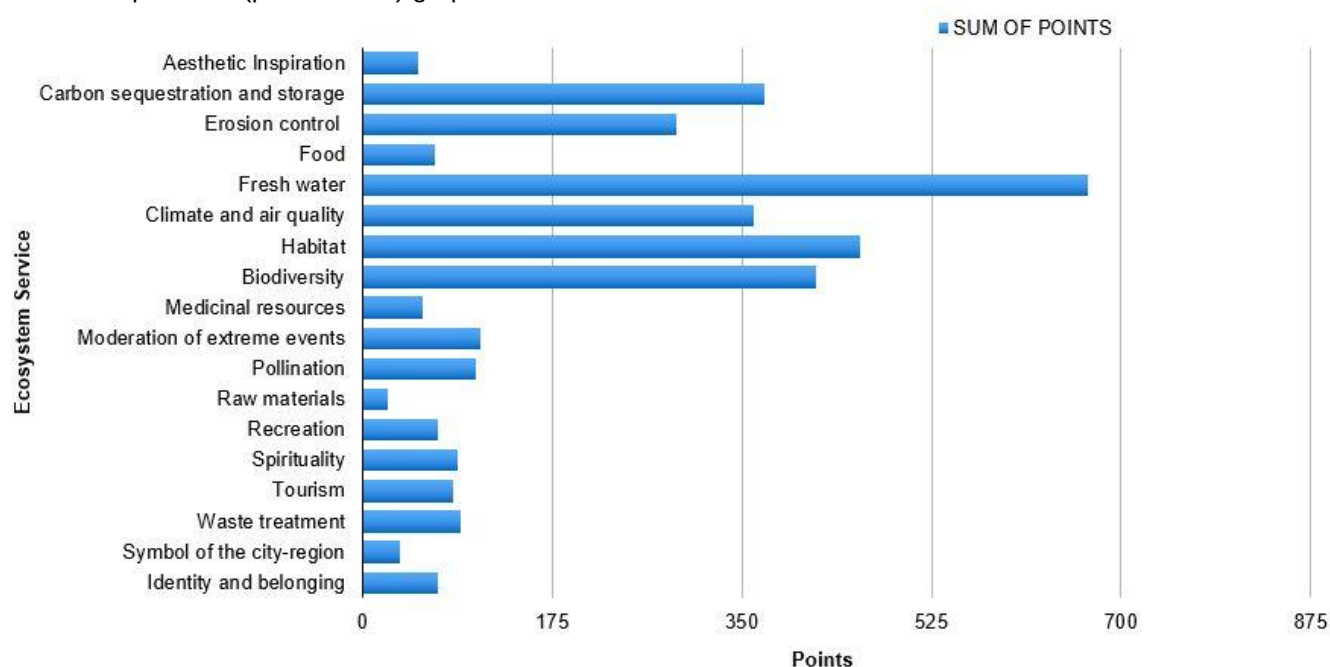
Raw responses: Frequency that medium economic level respondents ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	4	3	3	4	2
Carbon sequestration and storage	31	26	21	19	11
Erosion control	17	19	20	26	17
Food	2	7	5	3	8
Fresh water	78	36	32	12	15
Climate and air quality	20	31	24	28	9
Habitat	28	42	30	24	13
Biodiversity	22	31	37	28	18
Medicinal resources	1	1	8	7	8
Moderation of extreme events	3	6	12	12	10
Pollination	2	10	5	13	13
Raw materials	1	1	2	2	4
Recreation	1	3	4	12	17
Spirituality	7	1	9	6	9
Tourism	3	3	5	12	18
Waste treatment	4	8	6	8	4
Symbol of the city-region	2	2	1	2	9
Identity and belonging	3	1	9	2	20

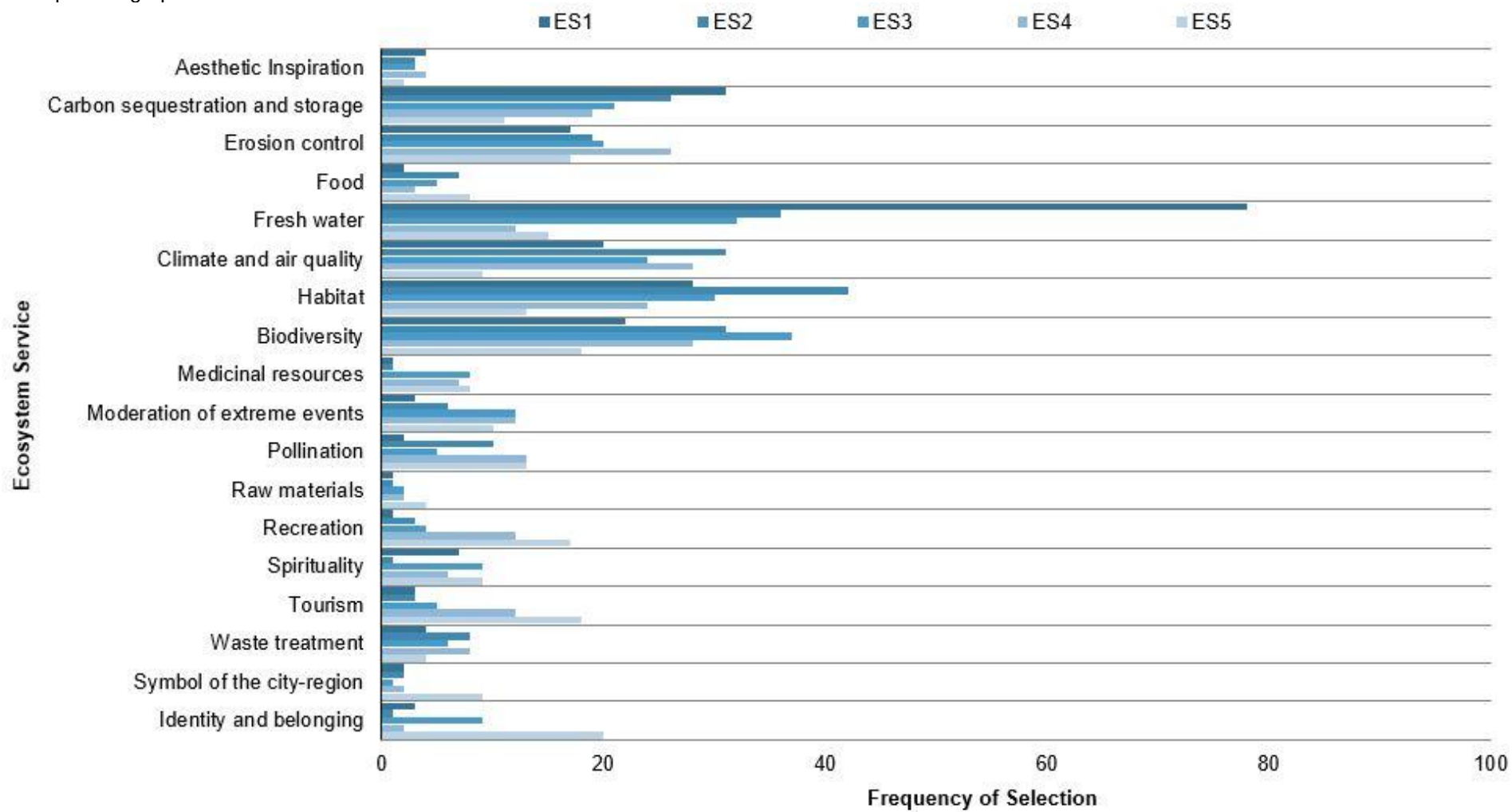
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	20	12	9	8	2	51
Carbon sequestration and storage	155	104	63	38	11	371
Erosion control	85	76	60	52	17	290
Food	10	28	15	6	8	67
Fresh water	390	144	96	24	15	669
Climate and air quality	100	124	72	56	9	361
Habitat	140	168	90	48	13	459
Biodiversity	110	124	111	56	18	419
Medicinal resources	5	4	24	14	8	55
Moderation of extreme events	15	24	36	24	10	109
Pollination	10	40	15	26	13	104
Raw materials	5	4	6	4	4	23
Recreation	5	12	12	24	17	70
Spirituality	35	4	27	12	9	87
Tourism	15	12	15	24	18	84
Waste treatment	20	32	18	16	4	90
Symbol of the city-region	10	8	3	4	9	34
Identity and belonging	15	4	27	4	20	70

Relative importance (points score) graph



Raw responses graph



Appendix 11: Ecosystem service ranking according to respondents of a higher economic level (Strata 4, 5 and 6)

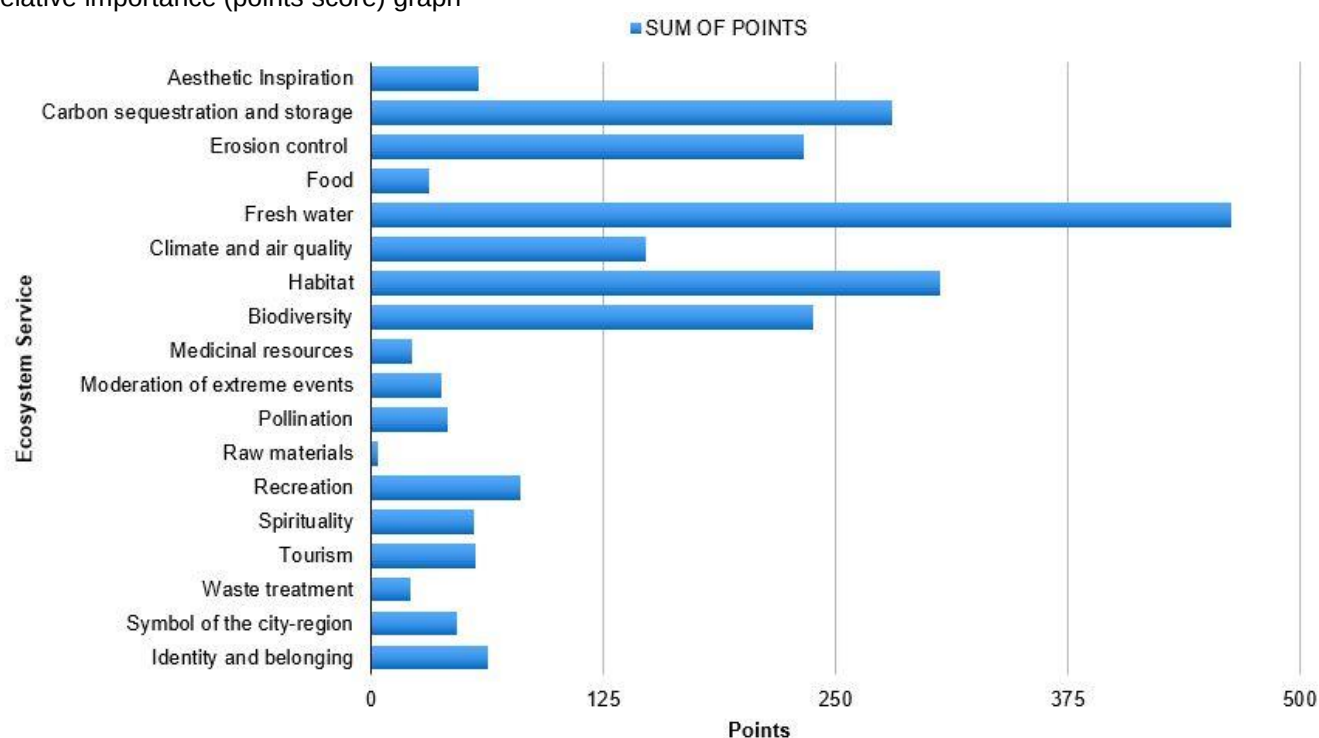
Raw responses: Frequency that high economic level respondents ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	6	2	2	1	12
Carbon sequestration and storage	29	16	12	19	7
Erosion control	15	21	11	16	9
Food	3	1	3	0	3
Fresh water	51	31	20	8	8
Climate and air quality	7	8	15	12	12
Habitat	16	25	31	14	5
Biodiversity	9	23	21	12	14
Medicinal resources	0	1	4	2	2
Moderation of extreme events	0	2	5	4	7
Pollination	0	2	4	8	5
Raw materials	0	0	0	2	0
Recreation	3	3	3	16	12
Spirituality	2	4	4	6	5
Tourism	1	1	4	10	15
Waste treatment	0	3	1	2	2
Symbol of the city-region	2	3	2	5	8
Identity and belonging	5	2	3	4	13

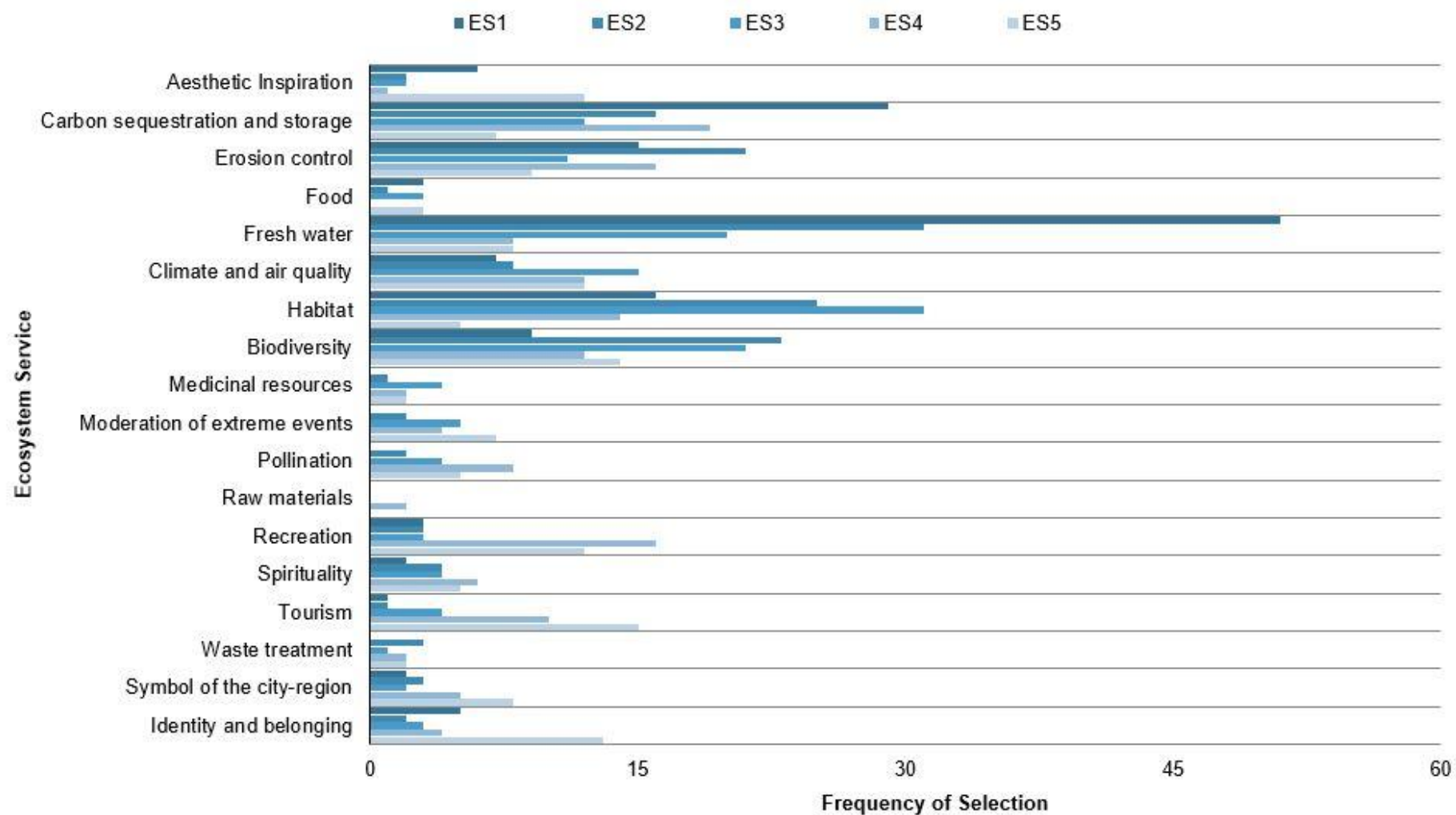
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	30	8	6	2	12	58
Carbon sequestration and storage	145	64	26	38	7	280
Erosion control	75	84	33	32	9	233
Food	15	4	9	0	3	31
Fresh water	255	124	60	16	8	463
Climate and air quality	35	32	45	24	12	148
Habitat	80	100	93	28	5	306
Biodiversity	45	92	63	24	14	238
Medicinal resources	0	4	12	4	2	22
Moderation of extreme events	0	8	15	8	7	38
Pollination	0	8	12	16	5	41
Raw materials	0	0	0	4	0	4
Recreation	15	12	9	32	12	80
Spirituality	10	16	12	12	5	55
Tourism	5	4	12	20	15	56
Waste treatment	0	12	3	4	2	21
Symbol of the city-region	10	12	6	10	8	46
Identity and belonging	25	8	9	8	13	63

Relative importance (points score) graph



Raw responses graph



Appendix 12: Ecosystem service ranking according to respondents from Usaqué

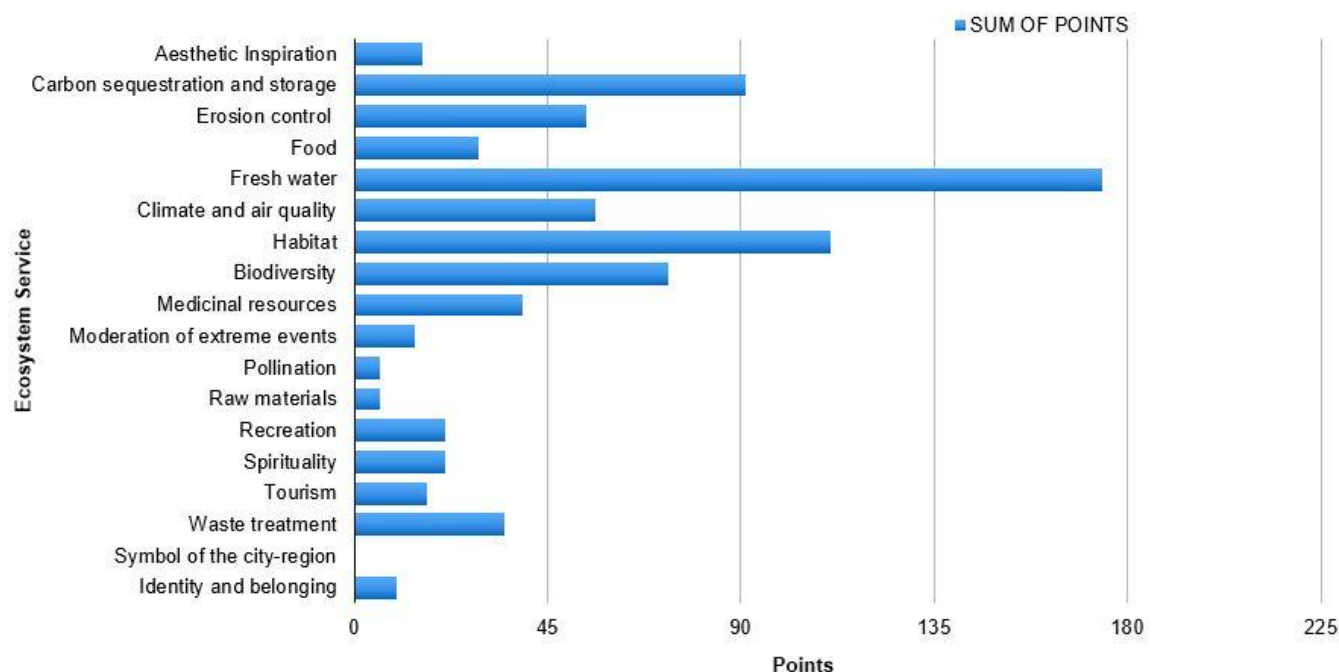
Raw responses: Frequency that respondents that reside in Usaqué ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	3	0	0	0	6
Carbon sequestration and storage	12	7	2	4	1
Erosion control	4	8	3	2	5
Food	1	0	1	1	1
Fresh water	17	15	10	3	1
Climate and air quality	3	6	4	5	3
Habitat	6	8	9	9	2
Biodiversity	4	5	12	2	2
Medicinal resources	0	0	2	3	2
Moderation of extreme events	2	0	1	1	1
Pollination	0	0	2	3	6
Raw materials	0	0	0	1	0
Recreation	1	2	3	9	2
Spirituality	1	1	1	2	0
Tourism	0	1	2	4	8
Waste treatment	0	3	2	0	1
Symbol of the city-region	1	1	0	2	4
Identity and belonging	2	0	2	1	5

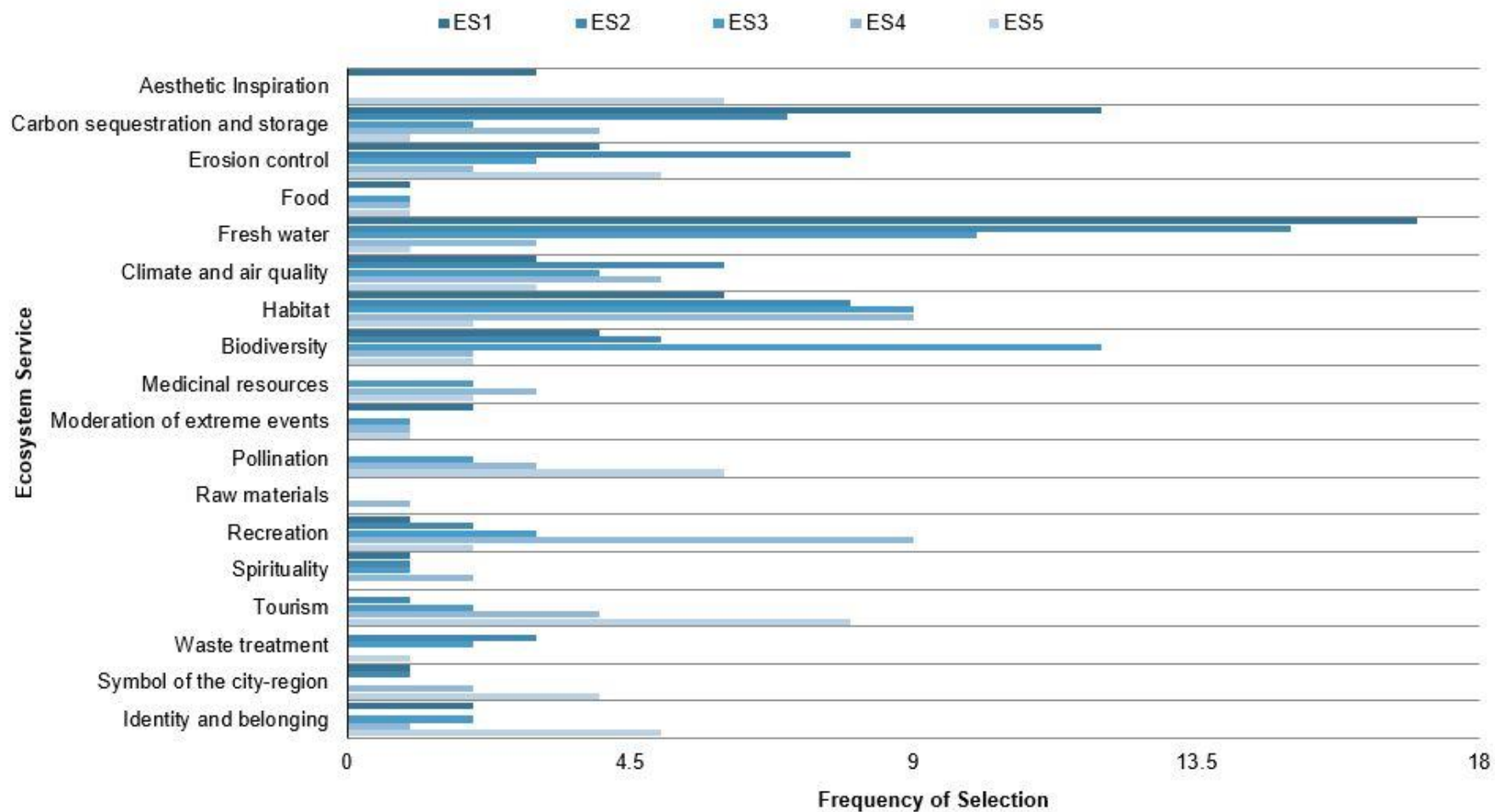
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	15	0	0	0	6	21
Carbon sequestration and storage	60	28	6	8	1	103
Erosion control	20	32	9	4	5	70
Food	5	0	3	2	1	11
Fresh water	85	60	30	6	1	182
Climate and air quality	15	24	12	10	3	64
Habitat	30	32	27	18	2	109
Biodiversity	20	20	36	4	2	82
Medicinal resources	0	0	6	6	2	14
Moderation of extreme events	10	0	3	2	1	16
Pollination	0	0	6	6	6	18
Raw materials	0	0	0	2	0	2
Recreation	5	8	9	18	2	42
Spirituality	5	4	3	4	0	16
Tourism	0	4	6	8	8	26
Waste treatment	0	12	6	0	1	19
Symbol of the city-region	5	4	0	4	4	17
Identity and belonging	10	0	6	2	5	23

Relative importance (points score) graph



Raw responses graph



Appendix 13: Ecosystem service ranking according to respondents from Chapinero

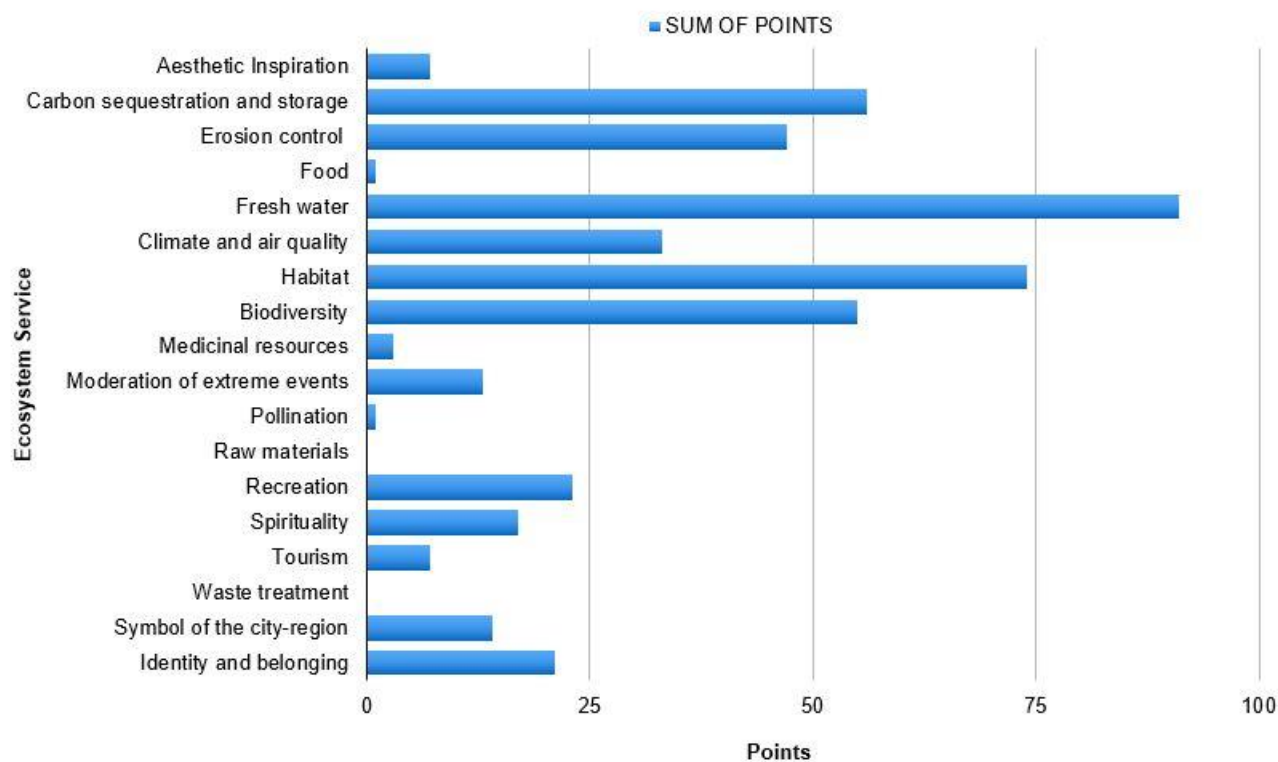
Raw responses: Frequency that respondents that reside in Chapinero ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	1	0	0	0	2
Carbon sequestration and storage	8	2	0	3	2
Erosion control	2	7	0	4	1
Food	0	0	0	0	1
Fresh water	8	7	6	2	1
Climate and air quality	2	1	3	4	2
Habitat	4	5	9	3	1
Biodiversity	2	4	7	3	2
Medicinal resources	0	0	0	1	1
Moderation of extreme events	0	1	1	2	2
Pollination	0	0	0	0	1
Raw materials	0	0	0	0	0
Recreation	1	1	0	6	2
Spirituality	1	1	2	0	2
Tourism	0	0	0	2	3
Waste treatment	0	0	0	0	0
Symbol of the city-region	0	1	1	1	5
Identity and belonging	2	0	2	1	3

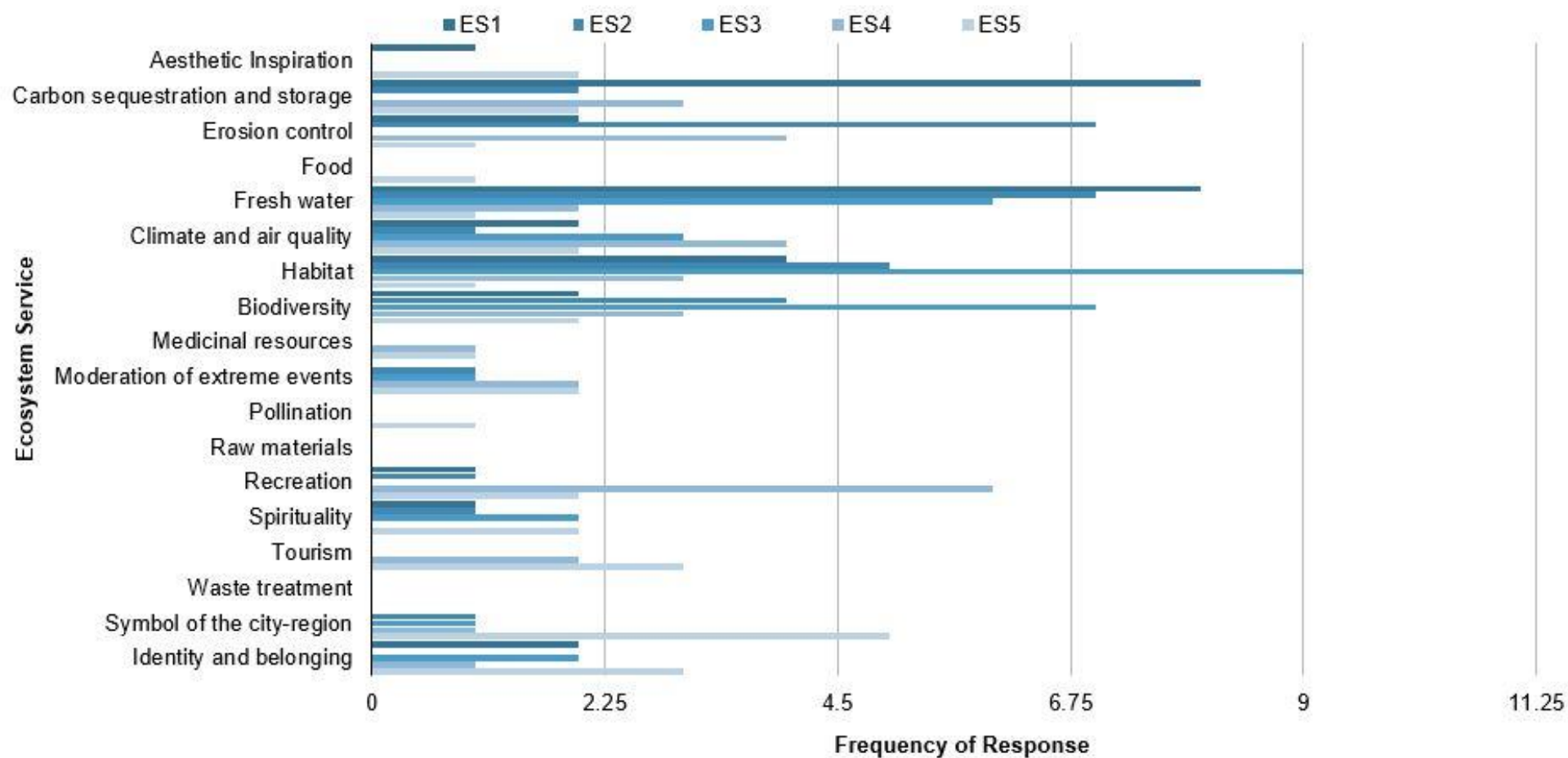
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	5	0	0	0	2	7
Carbon sequestration and storage	40	8	0	6	2	56
Erosion control	10	28	0	8	1	47
Food	0	0	0	0	1	1
Fresh water	40	28	18	4	1	91
Climate and air quality	10	4	9	8	2	33
Habitat	20	20	27	6	1	74
Biodiversity	10	16	21	6	2	55
Medicinal resources	0	0	0	2	1	3
Moderation of extreme events	0	4	3	4	2	13
Pollination	0	0	0	0	1	1
Raw materials	0	0	0	0	0	0
Recreation	5	4	0	12	2	23
Spirituality	5	4	6	0	2	17
Tourism	0	0	0	4	3	7
Waste treatment	0	0	0	0	0	0
Symbol of the city-region	0	4	3	2	5	14
Identity and belonging	10	0	6	2	3	21

Relative importance (points score) graph



Raw responses graph



Appendix 14: Ecosystem service ranking according to respondents from Usme

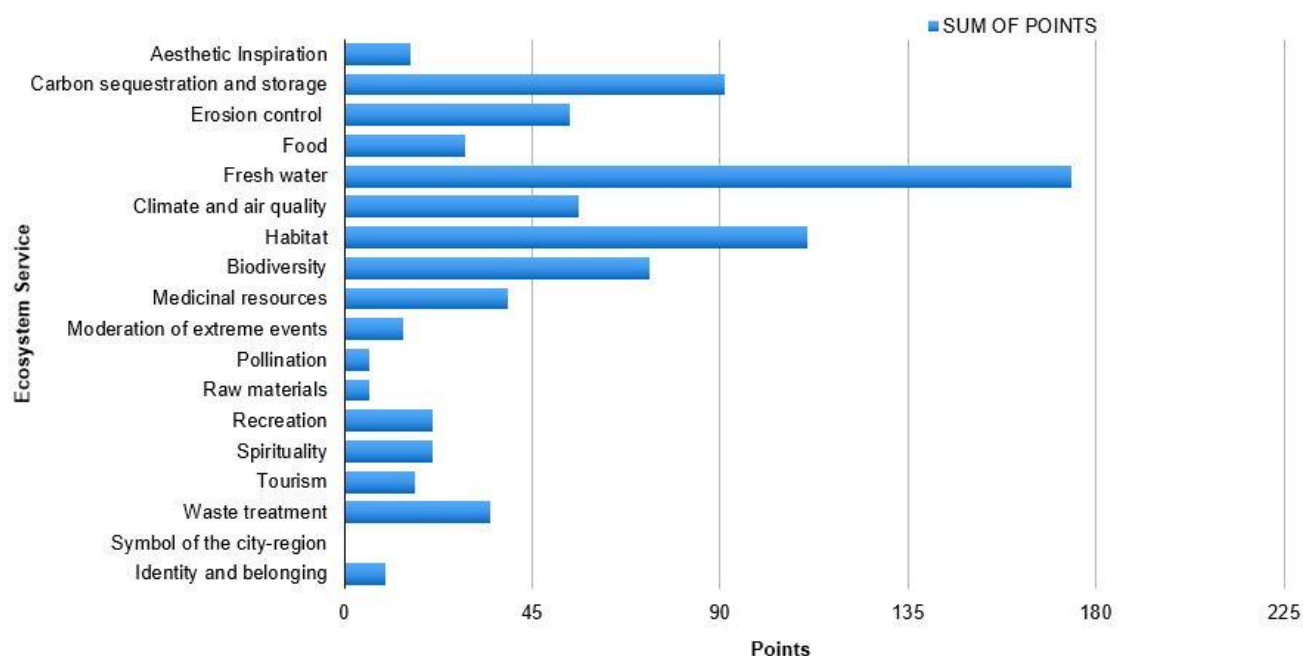
Raw responses: Frequency that respondents that reside in Usme ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	2	1	0	0	2
Carbon sequestration and storage	10	6	3	3	2
Erosion control	5	5	1	1	4
Food	0	3	3	3	2
Fresh water	20	9	10	4	0
Climate and air quality	1	4	7	6	2
Habitat	6	10	4	6	1
Biodiversity	3	5	8	5	4
Medicinal resources	2	1	6	2	3
Moderation of extreme events	0	0	2	3	2
Pollination	1	0	0	0	1
Raw materials	0	1	0	0	2
Recreation	0	1	3	3	2
Spirituality	0	3	0	4	1
Tourism	1	0	1	3	3
Waste treatment	1	2	3	5	3
Symbol of the city-region	0	0	0	0	0
Identity and belonging	0	0	1	2	3

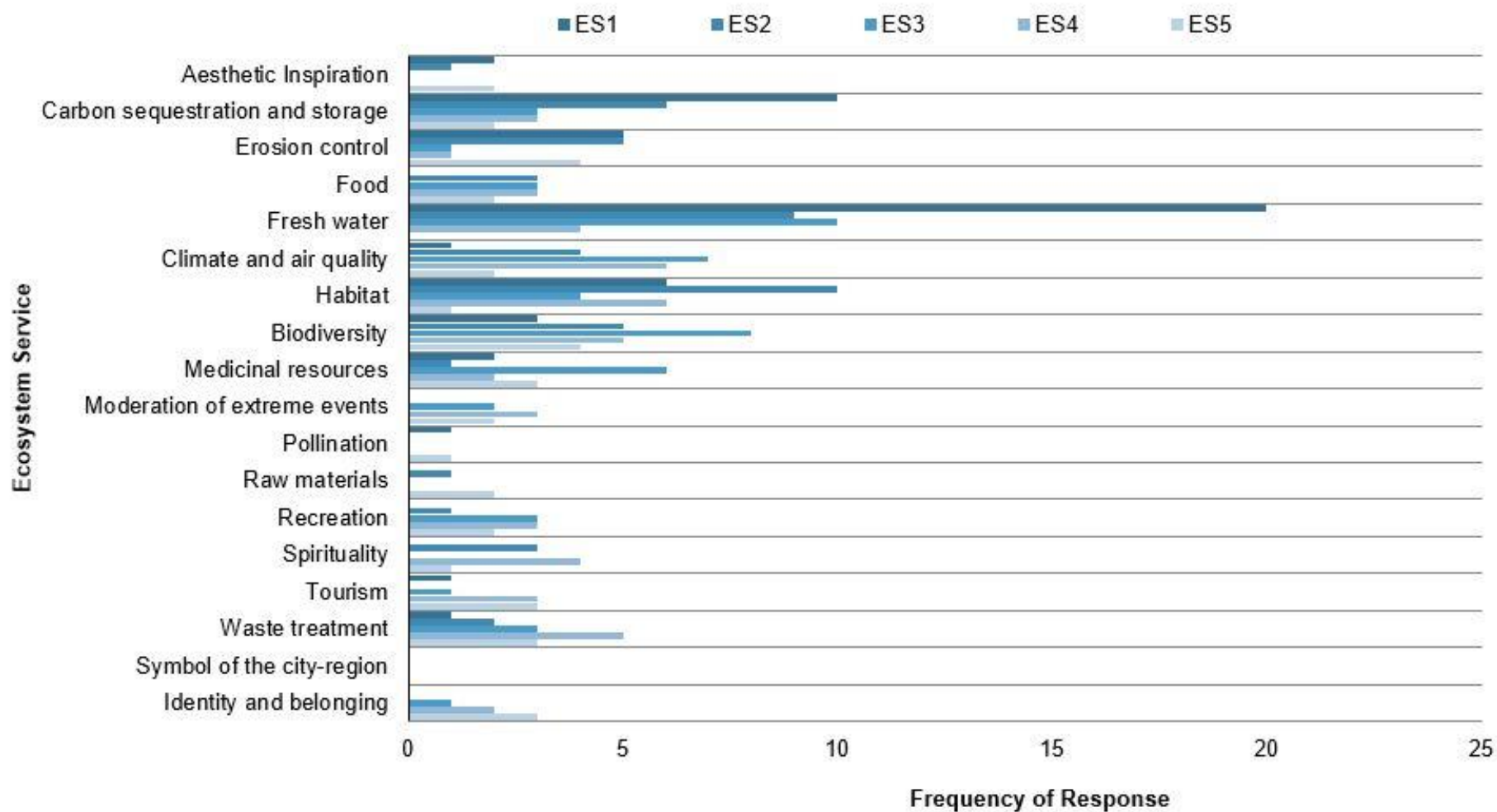
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	10	4	0	0	2	16
Carbon sequestration and storage	50	24	9	6	2	91
Erosion control	25	20	3	2	4	54
Food	0	12	9	6	2	29
Fresh water	100	36	30	8	0	174
Climate and air quality	5	16	21	12	2	56
Habitat	30	40	28	12	1	111
Biodiversity	15	20	24	10	4	73
Medicinal resources	10	4	18	4	3	39
Moderation of extreme events	0	0	6	6	2	14
Pollination	5	0	0	0	1	6
Raw materials	0	4	0	0	2	6
Recreation	0	4	9	6	2	21
Spirituality	0	12	0	8	1	21
Tourism	5	0	3	6	3	17
Waste treatment	5	8	9	10	3	35
Symbol of the city-region	0	0	0	0	0	0
Identity and belonging	0	0	3	4	3	10

Relative importance (points score) graph



Raw responses graph



Appendix 15: Ecosystem service ranking according to respondents from Suba

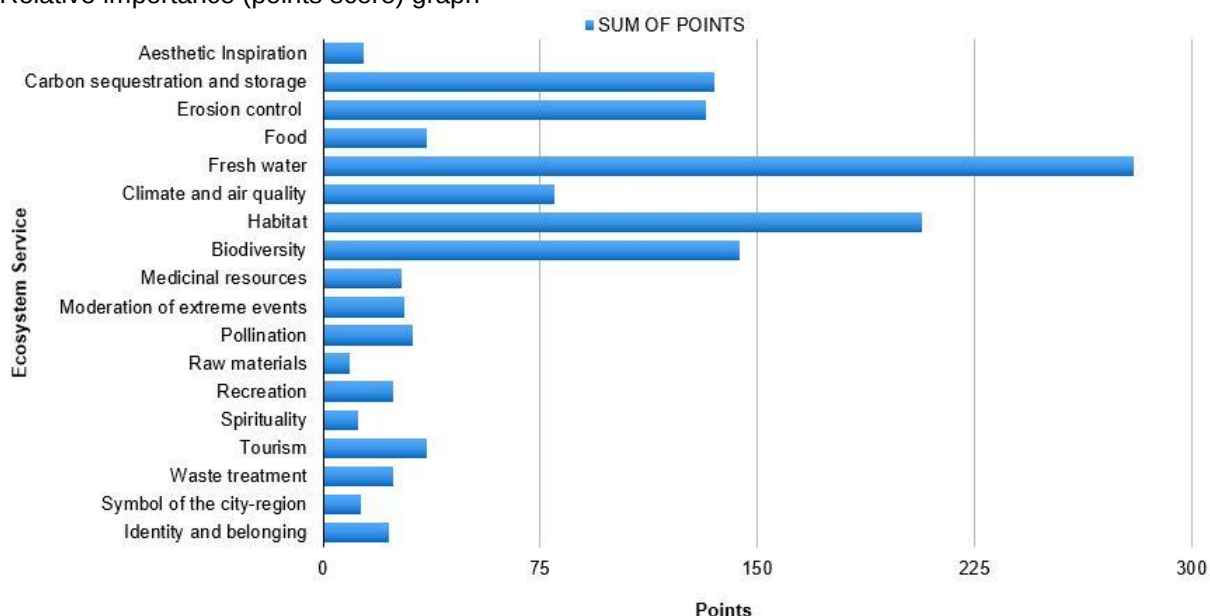
Raw responses: Frequency that respondents that reside in Suba ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	0	1	1	2	3
Carbon sequestration and storage	9	9	12	8	2
Erosion control	11	9	7	6	8
Food	2	2	5	1	1
Fresh water	34	16	9	8	3
Climate and air quality	0	8	10	6	6
Habitat	15	14	18	10	2
Biodiversity	8	14	8	8	8
Medicinal resources	0	2	4	2	3
Moderation of extreme events	0	2	1	6	5
Pollination	1	2	0	5	8
Raw materials	0	1	0	2	1
Recreation	1	1	0	4	7
Spirituality	0	0	2	1	4
Tourism	2	1	4	2	6
Waste treatment	0	2	1	5	3
Symbol of the city-region	0	1	2	1	1
Identity and belonging	2	0	0	4	5

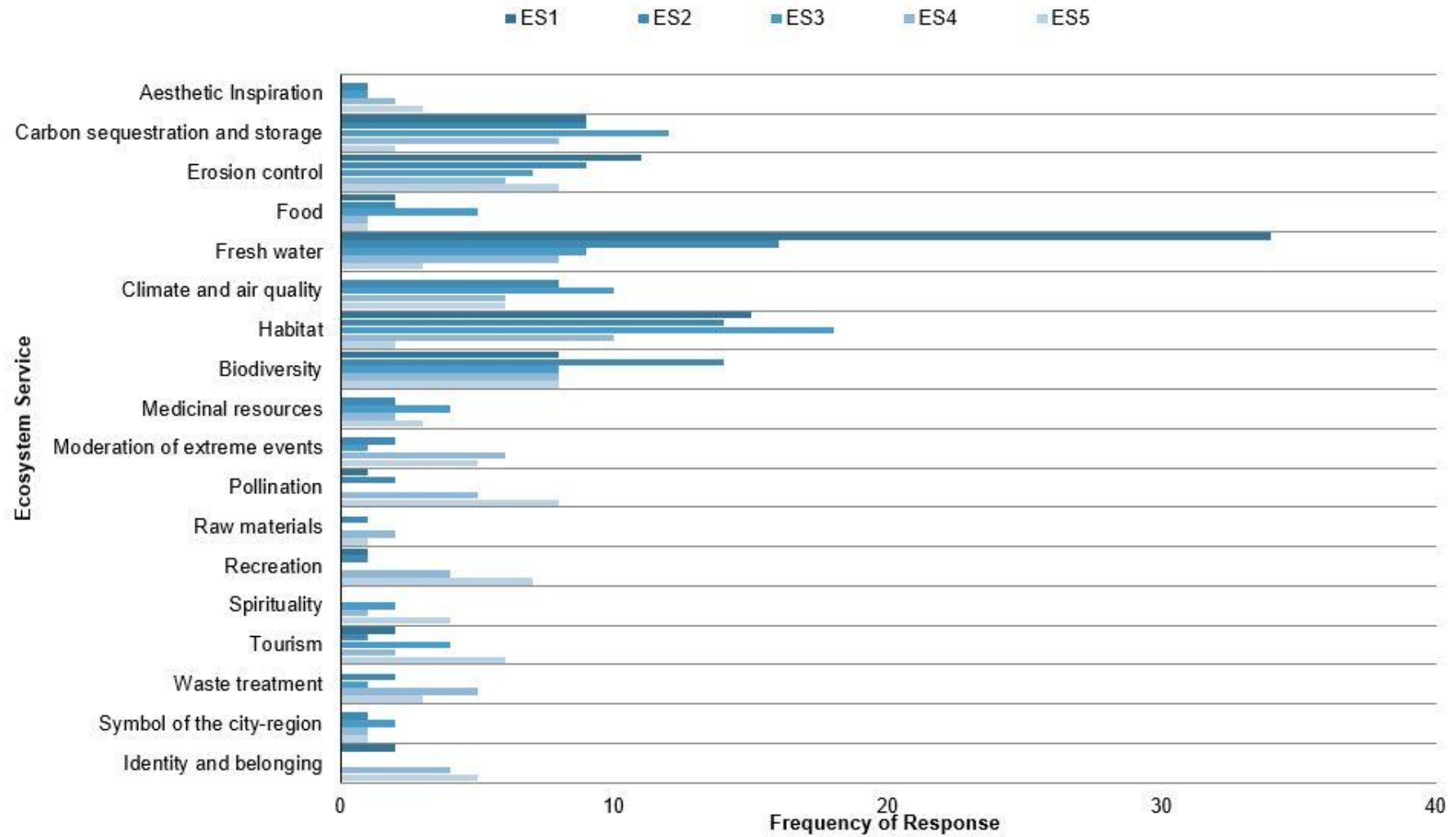
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	0	4	3	4	3	14
Carbon sequestration and storage	45	36	36	16	2	135
Erosion control	55	36	21	12	8	132
Food	10	8	15	2	1	36
Fresh water	170	64	27	16	3	280
Climate and air quality	0	32	30	12	6	80
Habitat	75	56	54	20	2	207
Biodiversity	40	56	24	16	8	144
Medicinal resources	0	8	12	4	3	27
Moderation of extreme events	0	8	3	12	5	28
Pollination	5	8	0	10	8	31
Raw materials	0	4	0	4	1	9
Recreation	5	4	0	8	7	24
Spirituality	0	0	6	2	4	12
Tourism	10	4	12	4	6	36
Waste treatment	0	8	3	10	3	24
Symbol of the city-region	0	4	6	2	1	13
Identity and belonging	10	0	0	8	5	23

Relative importance (points score) graph



Raw responses graph



Appendix 16: Ecosystem service ranking according to respondents from Kennedy

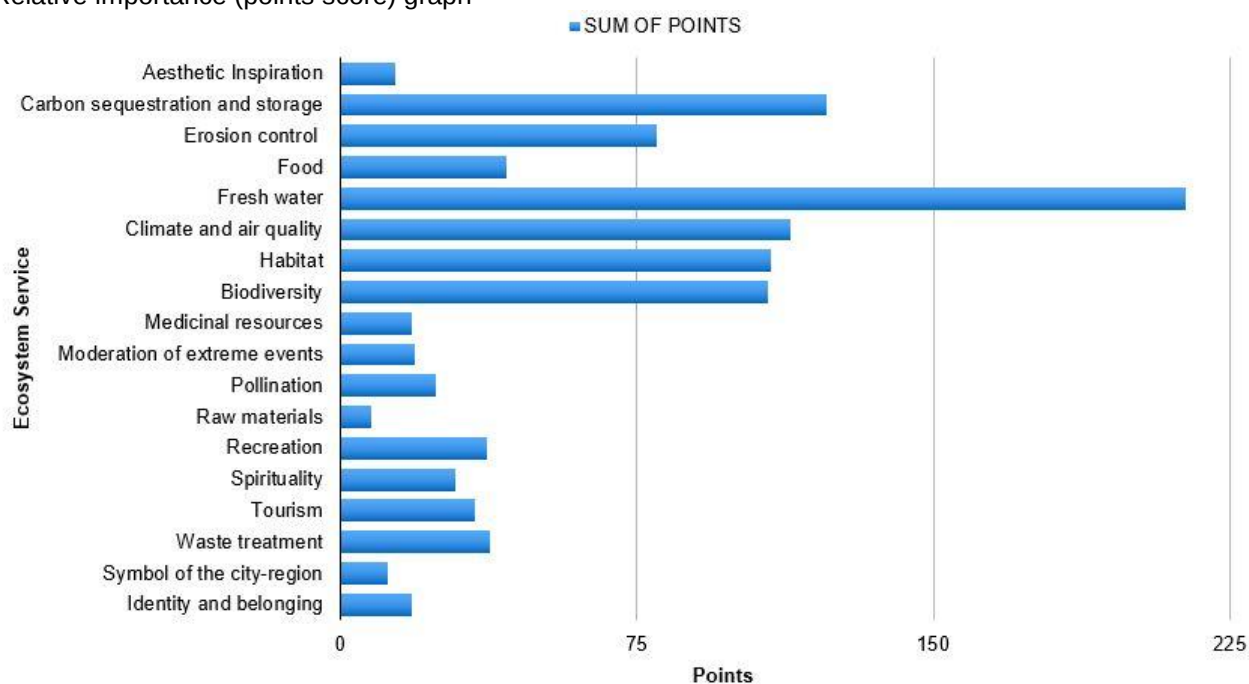
Raw responses: Frequency that respondents that reside in Kennedy ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	2	0	1	0	1
Carbon sequestration and storage	11	7	7	8	3
Erosion control	3	8	6	6	3
Food	2	4	3	1	5
Fresh water	27	11	7	5	4
Climate and air quality	4	11	8	11	4
Habitat	5	11	6	9	4
Biodiversity	5	7	12	6	7
Medicinal resources	1	0	2	3	1
Moderation of extreme events	0	1	2	3	3
Pollination	0	3	1	3	3
Raw materials	0	1	1	0	1
Recreation	3	1	1	5	5
Spirituality	1	1	6	0	2
Tourism	1	1	1	7	8
Waste treatment	3	3	2	2	1
Symbol of the city-region	1	0	1	1	2
Identity and belonging	1	0	3	0	4

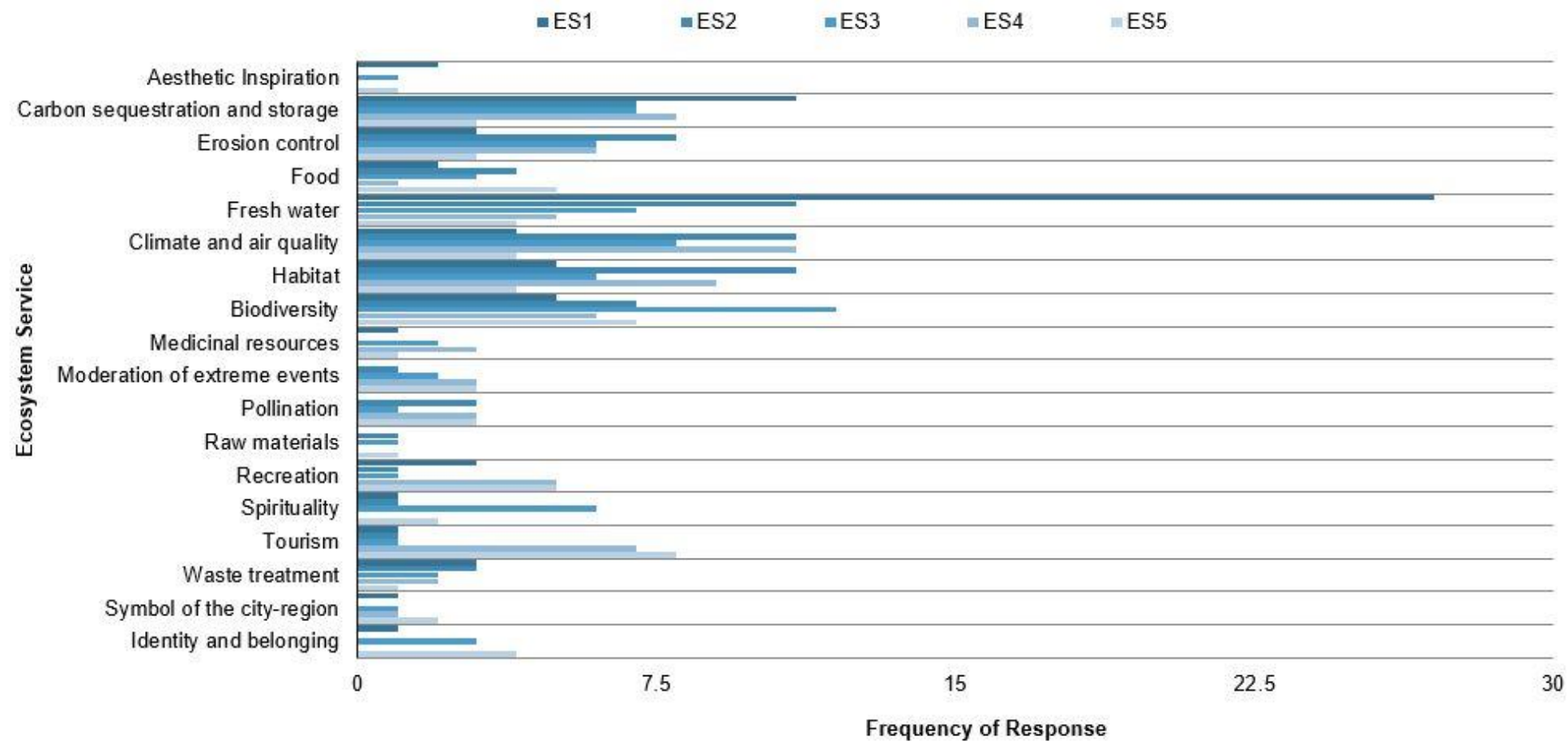
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	10	0	3	0	1	14
Carbon sequestration and storage	55	28	21	16	3	123
Erosion control	15	32	18	12	3	80
Food	10	16	9	2	5	42
Fresh water	135	44	21	10	4	214
Climate and air quality	20	44	24	22	4	114
Habitat	25	44	18	18	4	109
Biodiversity	25	28	36	12	7	108
Medicinal resources	5	0	6	6	1	18
Moderation of extreme events	0	4	6	6	3	19
Pollination	0	12	3	6	3	24
Raw materials	0	4	3	0	1	8
Recreation	15	4	3	10	5	37
Spirituality	5	4	18	0	2	29
Tourism	5	4	3	14	8	34
Waste treatment	15	12	6	4	1	38
Symbol of the city-region	5	0	3	2	2	12
Identity and belonging	5	0	9	0	4	18

Relative importance (points score) graph



Raw responses graph



Appendix 17: Ecosystem service ranking according to respondents from Fontibón

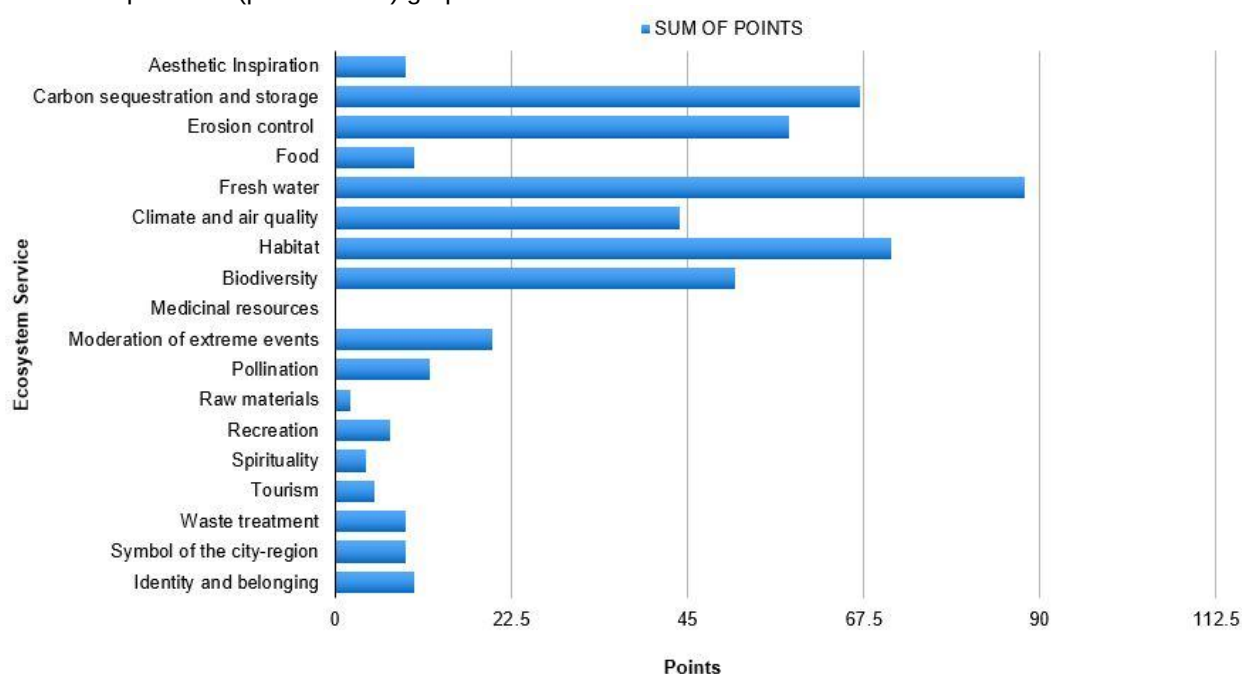
Raw responses: Frequency that respondents that reside in Fontibón ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	1	0	1	0	1
Carbon sequestration and storage	7	3	2	5	4
Erosion control	5	2	4	6	1
Food	1	1	0	0	1
Fresh water	8	6	5	3	3
Climate and air quality	3	4	3	2	0
Habitat	3	8	6	2	2
Biodiversity	3	4	4	2	4
Medicinal resources	0	0	0	0	0
Moderation of extreme events	0	0	5	1	3
Pollination	0	0	2	2	2
Raw materials	0	0	0	1	0
Recreation	0	0	0	1	5
Spirituality	0	0	0	2	0
Tourism	0	0	0	2	1
Waste treatment	0	1	0	1	3
Symbol of the city-region	1	1	0	0	0
Identity and belonging	0	2	0	1	0

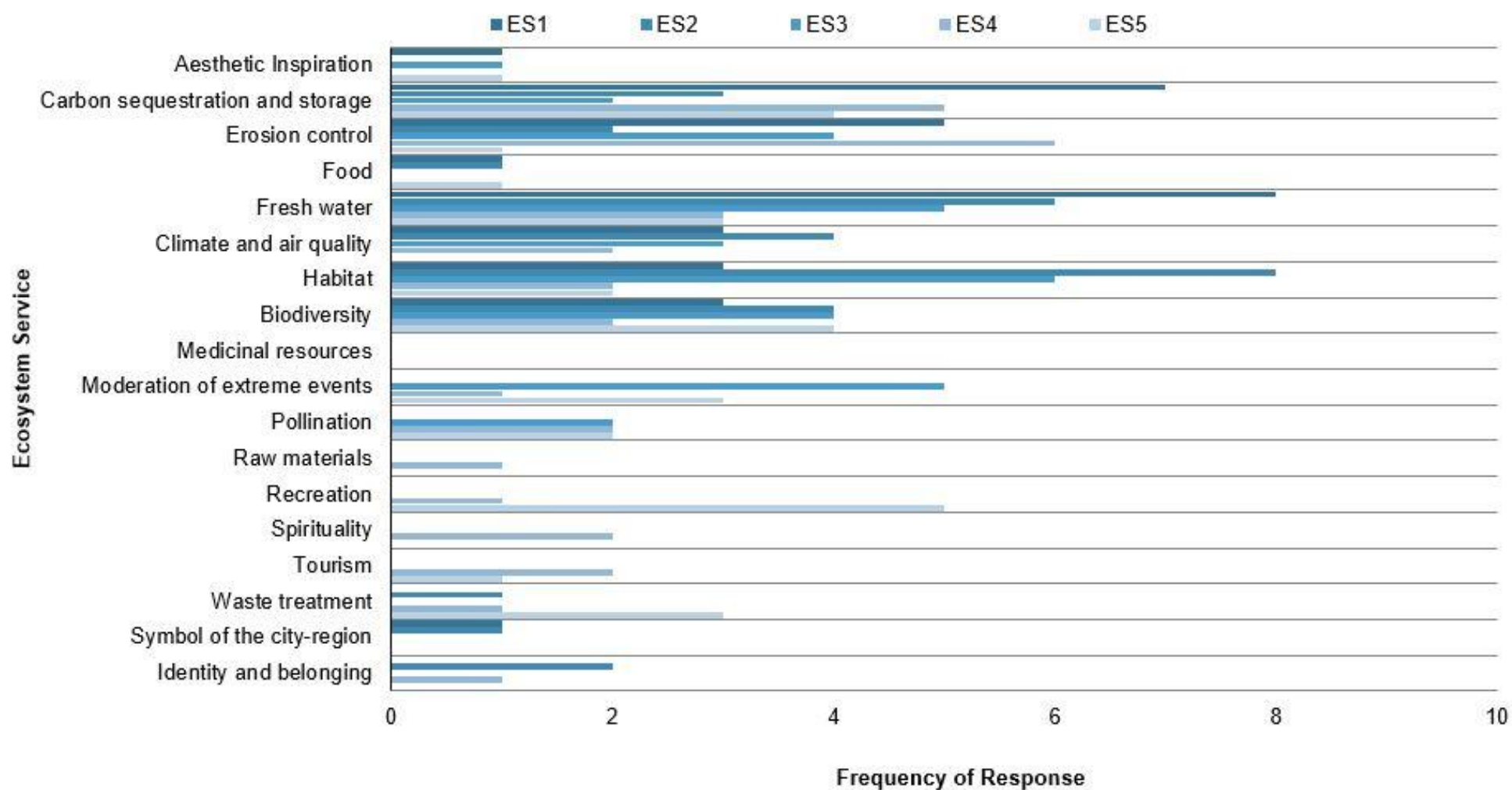
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	5	0	3	0	1	9
Carbon sequestration and storage	35	12	6	10	4	67
Erosion control	25	8	12	12	1	58
Food	5	4	0	0	1	10
Fresh water	40	24	15	6	3	88
Climate and air quality	15	16	9	4	0	44
Habitat	15	32	18	4	2	71
Biodiversity	15	16	12	4	4	51
Medicinal resources	0	0	0	0	0	0
Moderation of extreme events	0	0	15	2	3	20
Pollination	0	0	6	4	2	12
Raw materials	0	0	0	2	0	2
Recreation	0	0	0	2	5	7
Spirituality	0	0	0	4	0	4
Tourism	0	0	0	4	1	5
Waste treatment	0	4	0	2	3	9
Symbol of the city-region	5	4	0	0	0	9
Identity and belonging	0	8	0	2	0	10

Relative importance (points score) graph



Raw responses graph



Appendix 18: Ecosystem service ranking according to respondents from Engativá

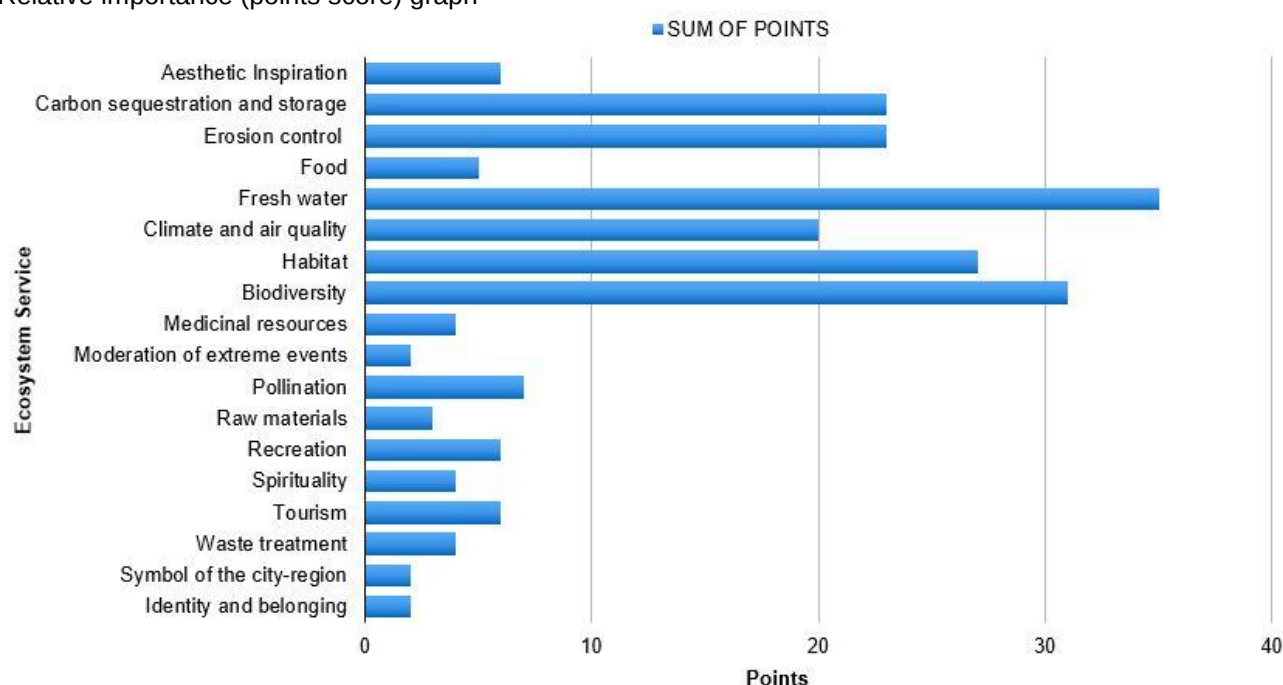
Raw responses: Frequency that respondents that reside in Engativá ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	1	1	0	2	2
Carbon sequestration and storage	5	8	5	4	1
Erosion control	3	3	5	9	3
Food	1	1	1	0	2
Fresh water	15	9	5	3	3
Climate and air quality	4	2	6	6	2
Habitat	5	10	5	4	3
Biodiversity	5	4	12	6	4
Medicinal resources	0	1	0	1	2
Moderation of extreme events	0	0	0	1	1
Pollination	0	2	1	3	1
Raw materials	1	1	1	0	0
Recreation	0	0	1	2	3
Spirituality	2	0	0	1	1
Tourism	0	0	0	0	6
Waste treatment	1	1	1	0	1
Symbol of the city-region	1	0	0	0	1
Identity and belonging	1	0	0	0	1

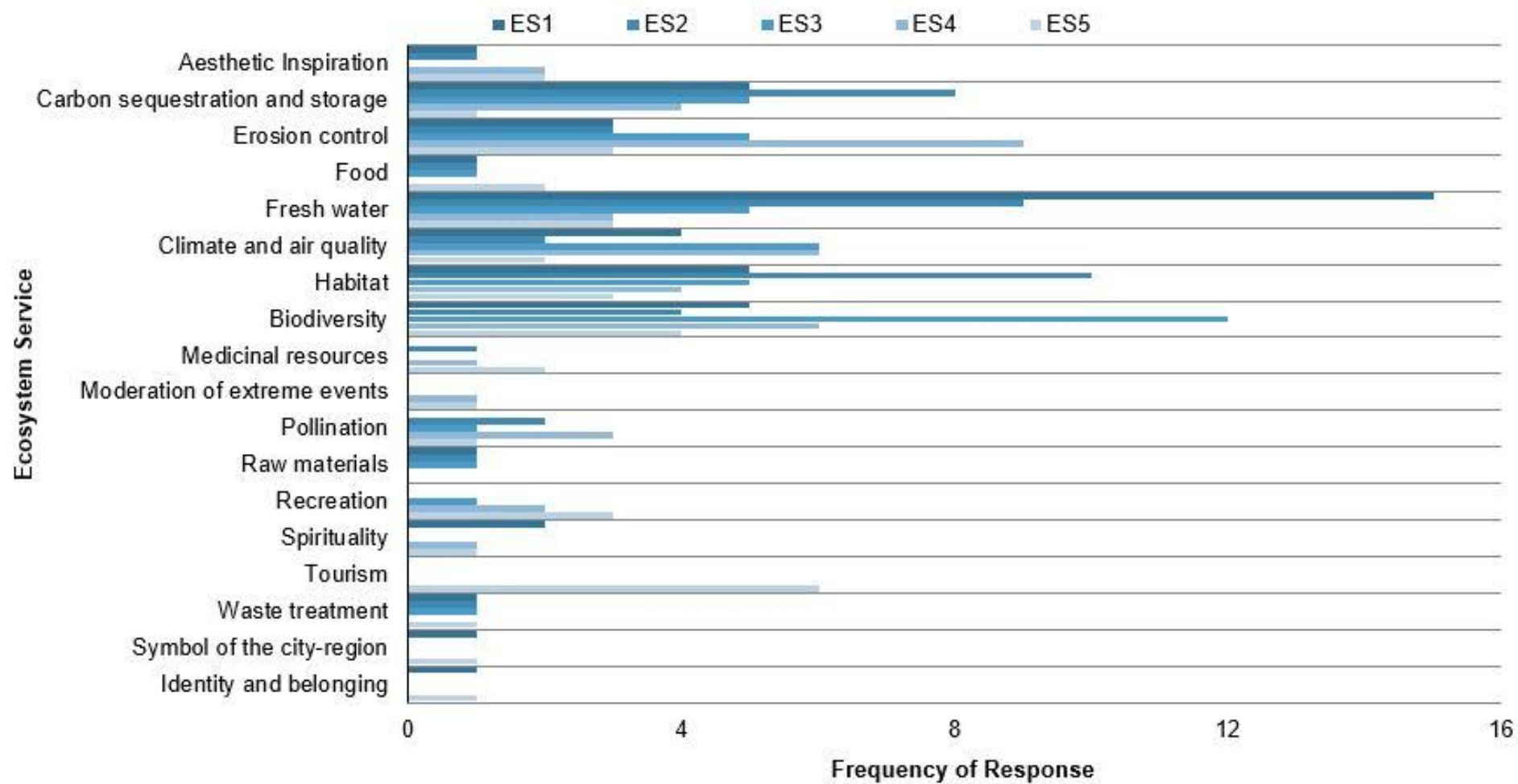
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	1	1	0	2	2	6
Carbon sequestration and storage	5	8	5	4	1	23
Erosion control	3	3	5	9	3	23
Food	1	1	1	0	2	5
Fresh water	15	9	5	3	3	35
Climate and air quality	4	2	6	6	2	20
Habitat	5	10	5	4	3	27
Biodiversity	5	4	12	6	4	31
Medicinal resources	0	1	0	1	2	4
Moderation of extreme events	0	0	0	1	1	2
Pollination	0	2	1	3	1	7
Raw materials	1	1	1	0	0	3
Recreation	0	0	1	2	3	6
Spirituality	2	0	0	1	1	4
Tourism	0	0	0	0	6	6
Waste treatment	1	1	1	0	1	4
Symbol of the city-region	1	0	0	0	1	2
Identity and belonging	1	0	0	0	1	2

Relative importance (points score) graph



Raw responses graph



Appendix 19: Ecosystem service ranking according to respondents from East Section (Santa Fé, La Candelaria, San Cristóbal)

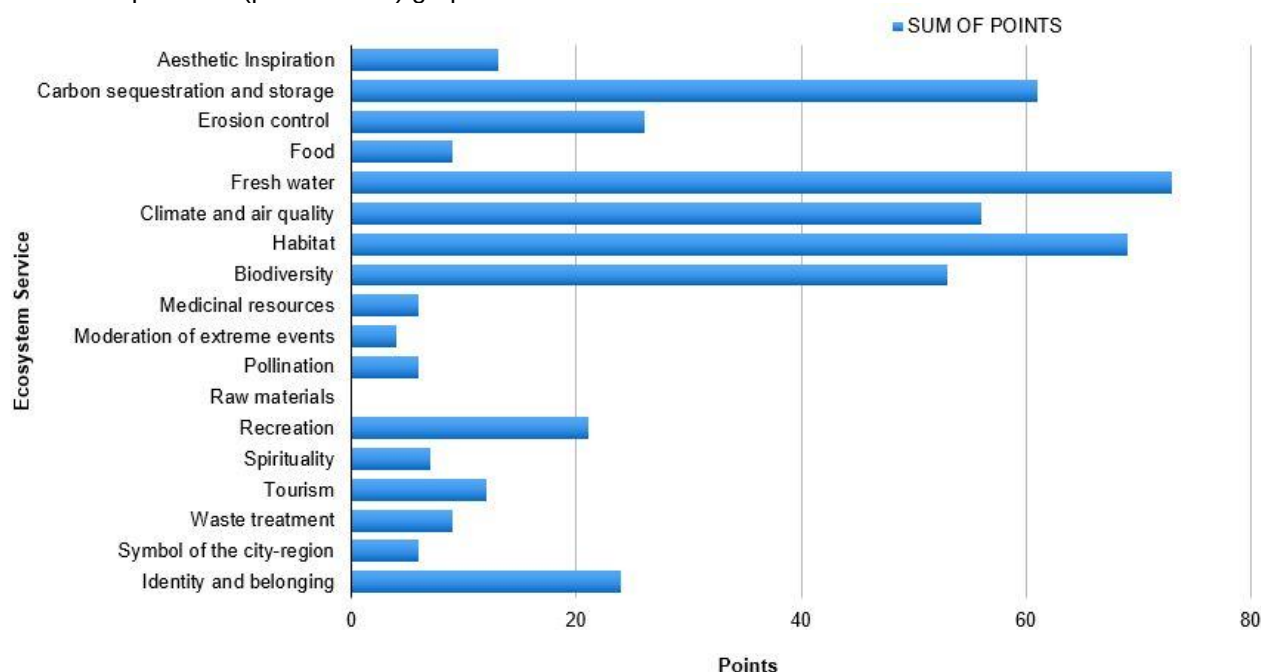
Raw responses: Frequency that respondents that reside in East section ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	2	1	0	2	0
Carbon sequestration and storage	4	6	5	1	0
Erosion control	1	2	1	2	6
Food	1	1	0	0	0
Fresh water	9	3	3	2	3
Climate and air quality	5	5	2	2	1
Habitat	3	6	7	4	1
Biodiversity	2	5	4	3	5
Medicinal resources	0	0	1	1	1
Moderation of extreme events	0	1	0	0	0
Pollination	0	0	1	1	1
Raw materials	0	0	0	0	0
Recreation	0	0	2	6	3
Spirituality	0	0	2	0	1
Tourism	0	0	0	5	2
Waste treatment	1	0	0	1	2
Symbol of the city-region	1	0	0	0	1
Identity and belonging	0	0	4	4	4

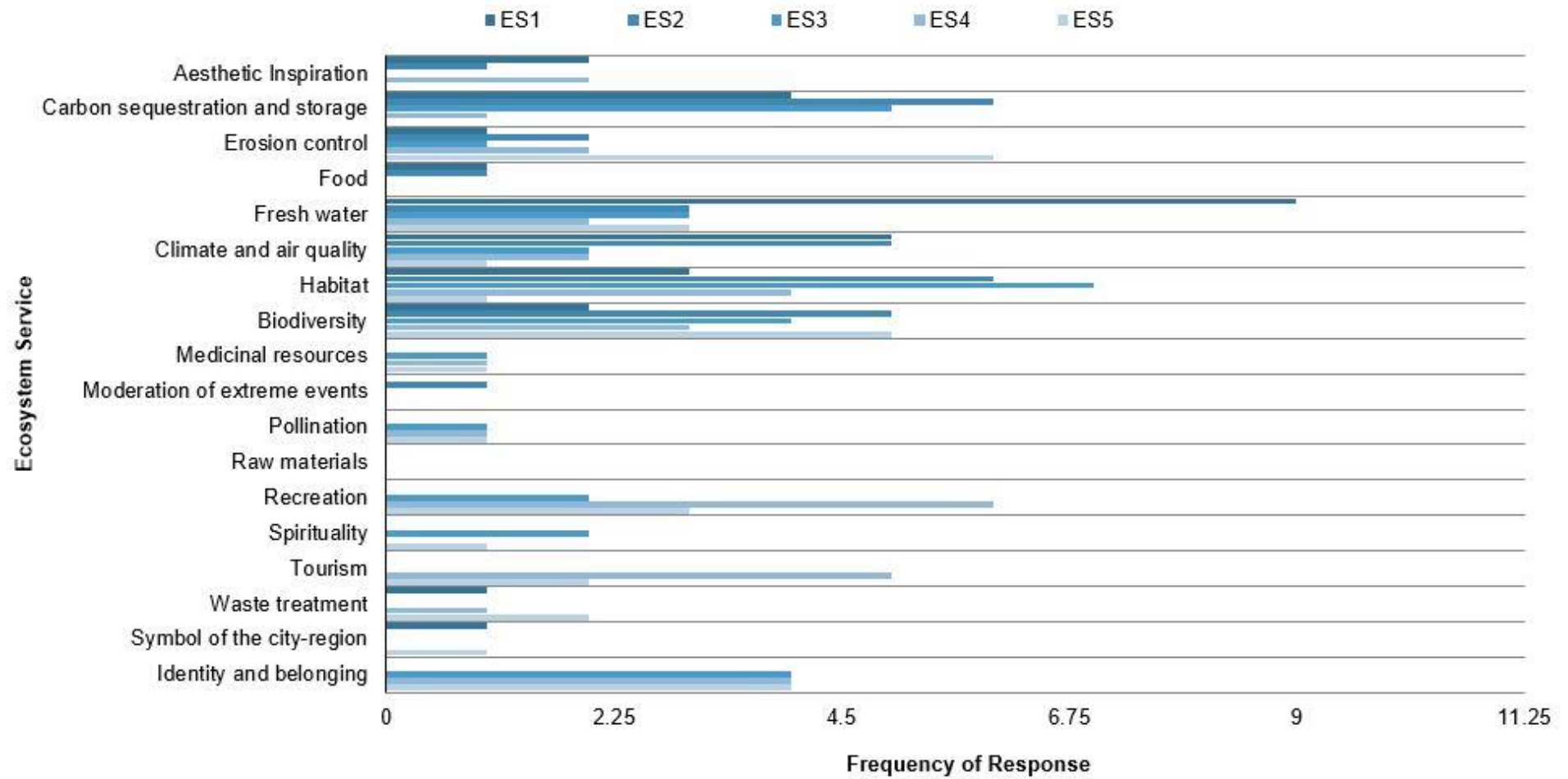
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	5	4	0	4	0	13
Carbon sequestration and storage	20	24	15	2	0	61
Erosion control	5	8	3	4	6	26
Food	5	4	0	0	0	9
Fresh water	45	12	9	4	3	73
Climate and air quality	25	20	6	4	1	56
Habitat	15	24	21	8	1	69
Biodiversity	10	20	12	6	5	53
Medicinal resources	0	0	3	2	1	6
Moderation of extreme events	0	4	0	0	0	4
Pollination	0	0	3	2	1	6
Raw materials	0	0	0	0	0	0
Recreation	0	0	6	12	3	21
Spirituality	0	0	6	0	1	7
Tourism	0	0	0	10	2	12
Waste treatment	5	0	0	2	2	9
Symbol of the city-region	5	0	0	0	1	6
Identity and belonging	0	0	12	8	4	24

Relative importance (points score) graph



Raw response table



Appendix 20: Ecosystem service ranking according to respondents from Centre-North Section (Teusaquillo, Barrios Unidos)

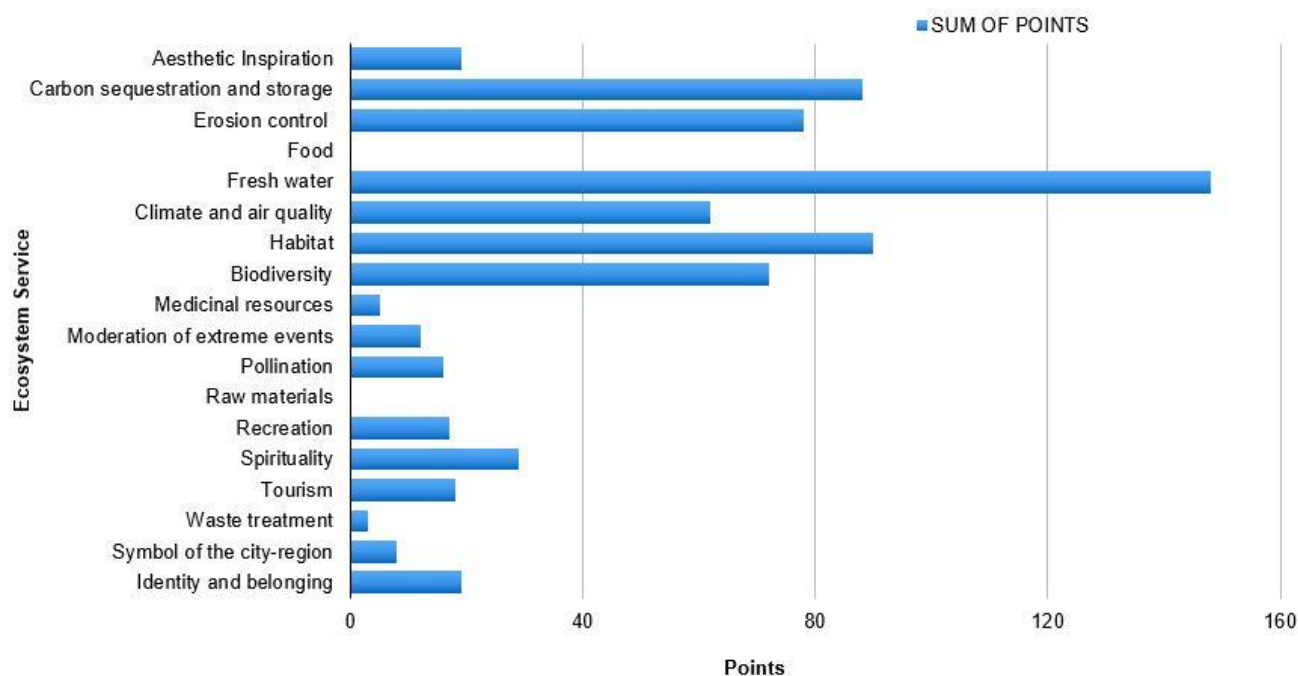
Raw responses: Frequency that respondents that reside in Centre-North section ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	2	1	1	0	2
Carbon sequestration and storage	7	7	4	5	3
Erosion control	5	6	4	8	1
Food	0	0	0	0	0
Fresh water	19	8	5	1	4
Climate and air quality	4	4	7	1	3
Habitat	4	6	10	7	2
Biodiversity	1	8	6	7	3
Medicinal resources	0	0	1	1	0
Moderation of extreme events	1	0	1	1	2
Pollination	0	2	1	2	1
Raw materials	0	0	0	0	0
Recreation	1	0	1	3	3
Spirituality	2	2	1	2	4
Tourism	0	2	1	1	5
Waste treatment	0	0	0	1	1
Symbol of the city-region	0	0	0	2	4
Identity and belonging	1	1	1	1	5

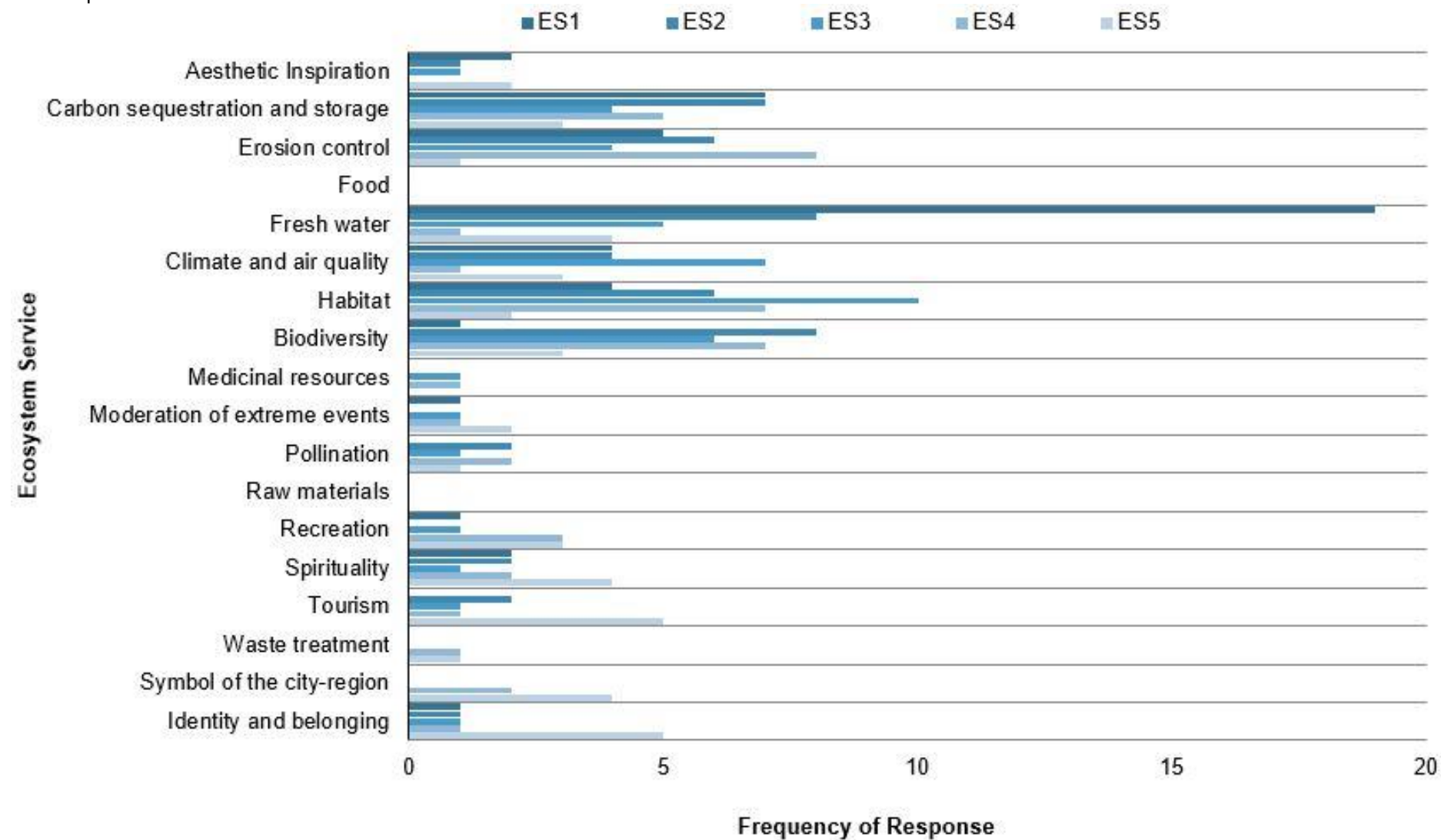
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	10	4	3	0	2	19
Carbon sequestration and storage	35	28	12	10	3	88
Erosion control	25	24	12	16	1	78
Food	0	0	0	0	0	0
Fresh water	95	32	15	2	4	148
Climate and air quality	20	16	21	2	3	62
Habitat	20	24	30	14	2	90
Biodiversity	5	32	18	14	3	72
Medicinal resources	0	0	3	2	0	5
Moderation of extreme events	5	0	3	2	2	12
Pollination	0	8	3	4	1	16
Raw materials	0	0	0	0	0	0
Recreation	5	0	3	6	3	17
Spirituality	10	8	3	4	4	29
Tourism	0	8	3	2	5	18
Waste treatment	0	0	0	2	1	3
Symbol of the city-region	0	0	0	4	4	8
Identity and belonging	5	4	3	2	5	19

Relative importance (points score) graph



Raw response table



Appendix 21: Ecosystem service ranking according to respondents from Centre-South Section (Los Mártires, Puente Aranda, Antonio Nariño, Rafael U. Uribe)

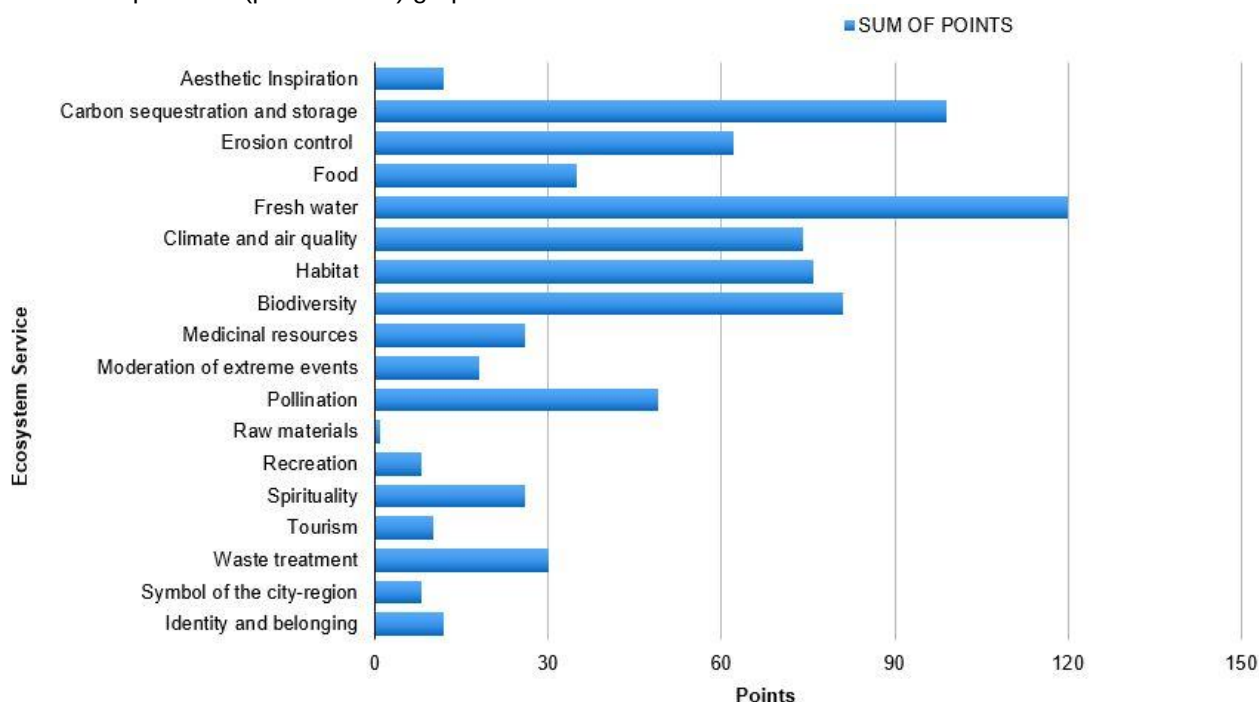
Raw responses: Frequency that respondents that reside in Centre-South section ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	2	1	1	0	2
Carbon sequestration and storage	7	7	4	5	3
Erosion control	5	6	4	8	1
Food	0	0	0	0	0
Fresh water	19	8	5	1	4
Climate and air quality	4	4	7	1	3
Habitat	4	6	10	7	2
Biodiversity	1	8	6	7	3
Medicinal resources	0	0	1	1	0
Moderation of extreme events	1	0	1	1	2
Pollination	0	2	1	2	1
Raw materials	0	0	0	0	0
Recreation	1	0	1	3	3
Spirituality	2	2	1	2	4
Tourism	0	2	1	1	5
Waste treatment	0	0	0	1	1
Symbol of the city-region	0	0	0	2	4
Identity and belonging	1	1	1	1	5

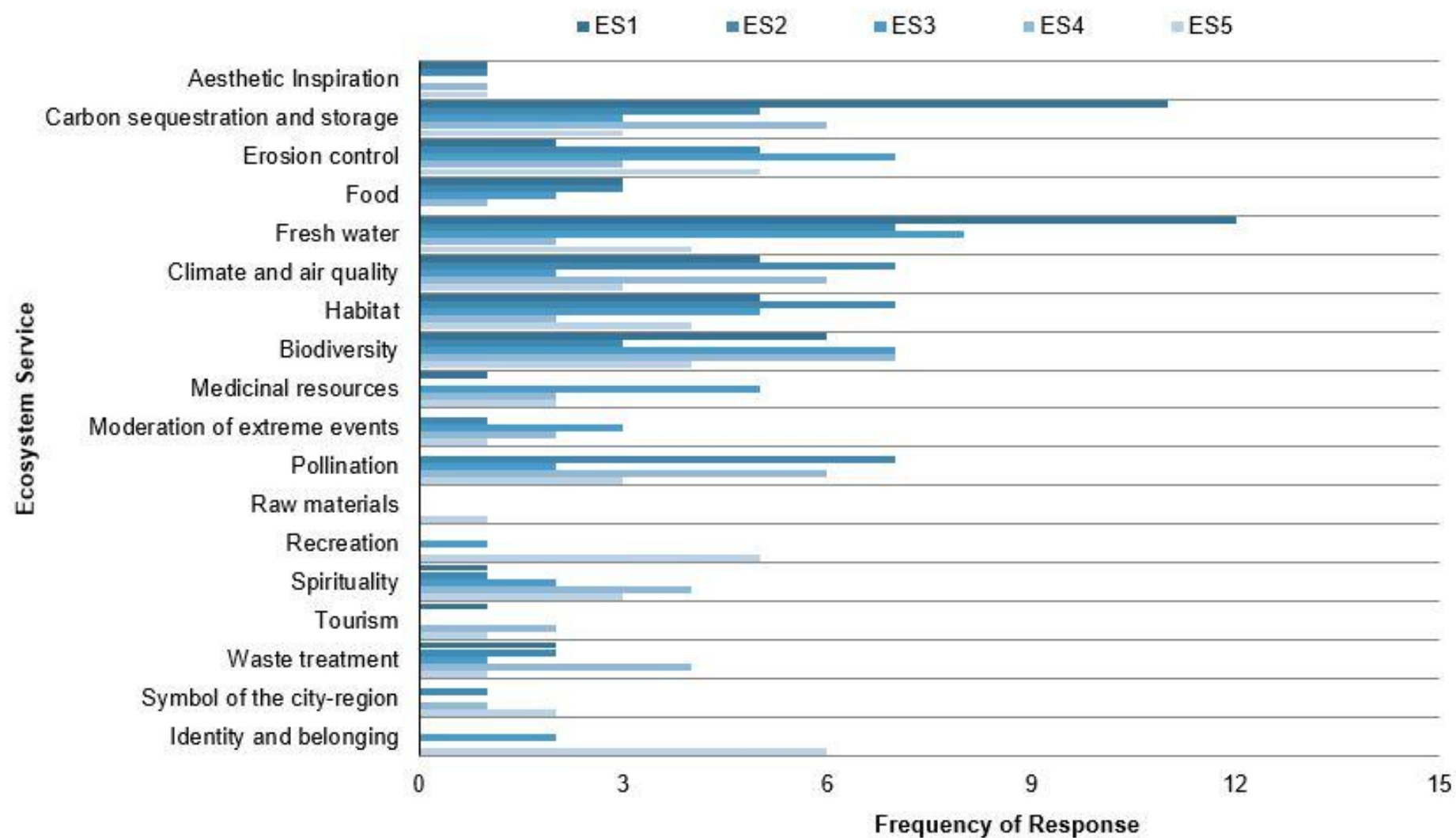
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	5	4	0	2	1	12
Carbon sequestration and storage	55	20	9	12	3	99
Erosion control	10	20	21	6	5	62
Food	15	12	6	2	0	35
Fresh water	60	28	24	4	4	120
Climate and air quality	25	28	6	12	3	74
Habitat	25	28	15	4	4	76
Biodiversity	30	12	21	14	4	81
Medicinal resources	5	0	15	4	2	26
Moderation of extreme events	0	4	9	4	1	18
Pollination	0	28	6	12	3	49
Raw materials	0	0	0	0	1	1
Recreation	0	0	3	0	5	8
Spirituality	5	4	6	8	3	26
Tourism	5	0	0	4	1	10
Waste treatment	10	8	3	8	1	30
Symbol of the city-region	0	4	0	2	2	8
Identity and belonging	0	0	6	0	6	12

Relative importance (points score) graph



Raw response table



Appendix 22: Ecosystem service ranking according to respondents from West Section (Tunjuelito, Ciudad Bolívar, Bosa)

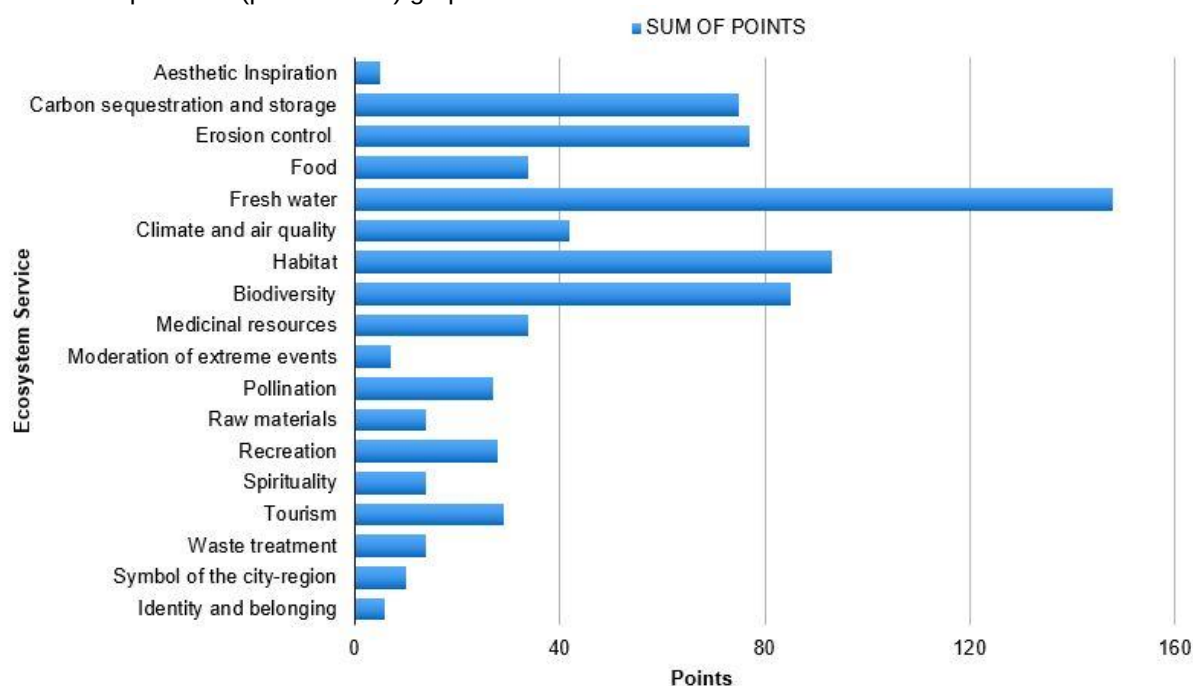
Raw responses: Frequency that respondents that reside in West section ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	1	0	0	0	0
Carbon sequestration and storage	10	2	4	1	3
Erosion control	6	8	1	5	2
Food	2	3	2	2	2
Fresh water	15	8	11	2	4
Climate and air quality	0	4	4	6	2
Habitat	3	6	11	9	3
Biodiversity	5	9	2	5	8
Medicinal resources	1	1	5	3	4
Moderation of extreme events	0	0	0	1	4
Pollination	2	2	1	1	3
Raw materials	0	0	1	3	2
Recreation	0	2	2	4	2
Spirituality	0	1	1	3	1
Tourism	2	1	2	2	5
Waste treatment	0	1	2	2	0
Symbol of the city-region	2	0	0	0	0
Identity and belonging	0	1	0	0	2

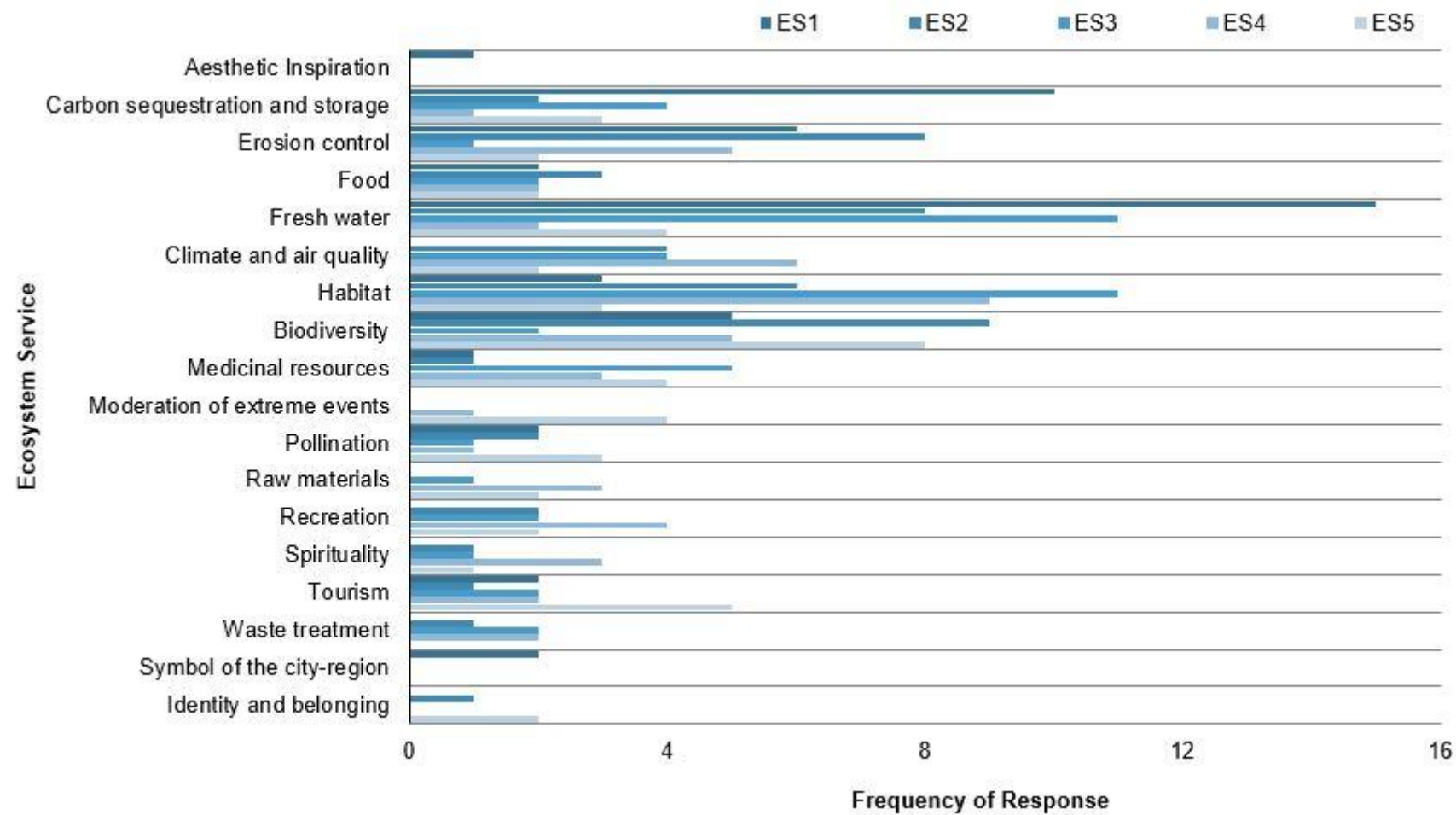
Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	5	0	0	0	0	5
Carbon sequestration and storage	50	8	12	2	3	75
Erosion control	30	32	3	10	2	77
Food	10	12	6	4	2	34
Fresh water	75	32	33	4	4	148
Climate and air quality	0	16	12	12	2	42
Habitat	15	24	33	18	3	93
Biodiversity	25	36	6	10	8	85
Medicinal resources	5	4	15	6	4	34
Moderation of extreme events	0	0	0	3	4	7
Pollination	10	8	3	3	3	27
Raw materials	0	0	3	9	2	14
Recreation	0	8	6	12	2	28
Spirituality	0	4	3	6	1	14
Tourism	10	4	6	4	5	29
Waste treatment	0	4	6	4	0	14
Symbol of the city-region	10	0	0	0	0	10
Identity and belonging	0	4	0	0	2	6

Relative importance (points score) graph



Raw response table



Appendix 23: Ecosystem service ranking according to respondents from outer municipalities (Soacha, Funza, Mosquera, Faca, Madrid, Chía)

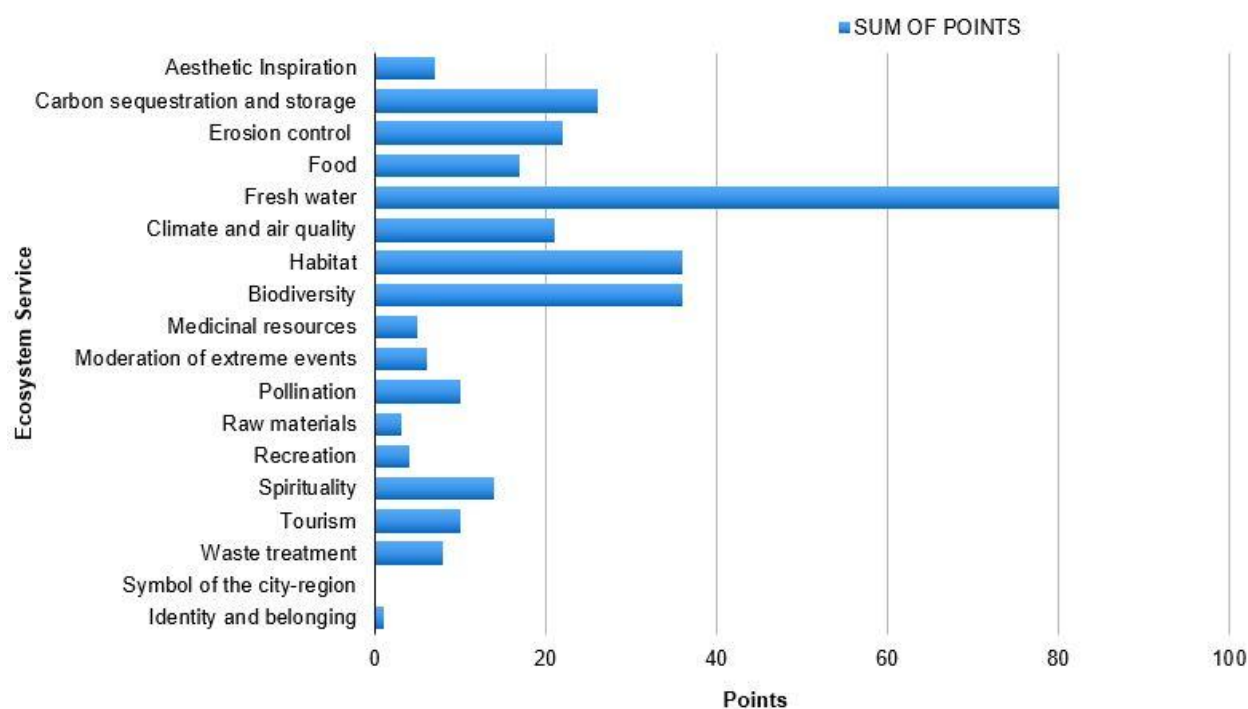
Raw responses: Frequency that respondents that reside in outer municipalities ranked each ecosystem service from 1st to 5th most important

	ES1	ES2	ES3	ES4	ES5
Aesthetic Inspiration	0	1	1	0	0
Carbon sequestration and storage	2	2	1	2	1
Erosion control	1	1	4	0	1
Food	1	2	1	0	1
Fresh water	11	4	3	0	0
Climate and air quality	2	0	2	2	1
Habitat	2	3	2	3	2
Biodiversity	1	5	2	2	1
Medicinal resources	0	1	0	0	1
Moderation of extreme events	0	0	1	1	1
Pollination	0	1	0	2	2
Raw materials	0	0	0	1	1
Recreation	0	0	0	2	0
Spirituality	1	1	0	2	1
Tourism	0	0	2	1	2
Waste treatment	0	0	1	2	1
Symbol of the city-region	0	0	0	0	0
Identity and belonging	0	0	0	0	1

Relative importance: raw responses attributed points according to ranking place for a relative importance score

	ES1	ES2	ES3	ES4	ES5	SUM OF POINTS
Aesthetic Inspiration	0	4	3	0	0	7
Carbon sequestration and storage	10	8	3	4	1	26
Erosion control	5	4	12	0	1	22
Food	5	8	3	0	1	17
Fresh water	55	16	9	0	0	80
Climate and air quality	10	0	6	4	1	21
Habitat	10	12	6	6	2	36
Biodiversity	5	20	6	4	1	36
Medicinal resources	0	4	0	0	1	5
Moderation of extreme events	0	0	3	2	1	6
Pollination	0	4	0	4	2	10
Raw materials	0	0	0	2	1	3
Recreation	0	0	0	4	0	4
Spirituality	5	4	0	4	1	14
Tourism	0	0	6	2	2	10
Waste treatment	0	0	3	4	1	8
Symbol of the city-region	0	0	0	0	0	0
Identity and belonging	0	0	0	0	1	1

Relative importance (points score) graph



Raw response table

