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St. Helena Natural Capital Accounting

Briefing report

eftec/JNCC

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Disclaimer

Document evolution

Final report	May 2019	Reviewed by Rob Tinch
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Summary

As a small island, the fortunes of St. Helena are fundamentally linked to its natural environment. This environment provides a broad variety of benefits: from a healthy marine environment that draws tourists, acts as habitat to sea life, and supplies food and nourishment to the population; to terrestrial habitats that provide pasture for raising farm animals, defence against erosion and regulation of the water cycle of the island.

However, human activity on land or in the sea have unintended negative consequences, as impacts on the environment can fundamentally alter the very assets which help support St. Helena's ability to develop and prosper. St. Helena's airport opened in 2017, providing a new and more regular mode of transport to visit the island. Higher visitor numbers will eventually be a source of development and prosperity for the island but could also contribute to the deterioration of St. Helena's unique natural environment if not carefully managed.

This increased pressure drives a need to better understand the linkages between human activity and the environment, and the numerous ways that the environment contributes to people's wellbeing. The aim of this work is to establish a preliminary national "Natural Capital Account" (NCA) for St. Helena, which is a structured way to measure and monitor the benefits provided by the natural environment.

Natural Capital Accounting uses the language of economics to convey the value of the environment. It's an approach used to measure the benefit of a nations' natural capital by building a series of accounts to provide data similar to other national accounts, and indicators derived from them, such as GDP, which measures the size of a nation's economy. This project has developed a preliminary NCA for St. Helena and establishes the processes by which Natural Capital Accounting can develop in the future.

The initial accounts provide a baseline and structure on which to build future iterations. Due to data limitations, described in more detail in Section 3.1, the results are incomplete and only offer an indication as to the scale of values. **Table ES1** presents the results from the 2018 NCA. The uncertainty associated with each measure is indicated by colour coding in, and the uncertainties in several key values means that the total estimated values have a moderate degree of uncertainty.

Table ES1 2018 natural capital account results for St. Helena

Benefit	Physical flow (Annual)	Monetary value (Annual)	Asset value (25yr)
Fisheries	307,747 kilos	£1.49 million	£25.38 million
Agriculture	*Not available*	£0.02 million	£0.42 million
Meat Production	132 kilos	£0.001 million	£0.02 million
Forest Products	441 tonnes	£0.08 million	£1.38 million
Carbon sequestration and storage	11,558 tCO2e	£0.78 million	£5.48 million
Tourism	2,065 visitors	£1.51 million	£25.75 million
TOTAL		**£3.51 million**	**£62.65 million**

High uncertainty	Low uncertainty reflects confidence in the evidence to support decisions. High uncertainty reflects results that may be inaccurate by more than an order of magnitude. Some data may be marked as 'moderate' where the data used are themselves accurate, but do not provide a full measure of the services' value.
Moderate uncertainty	
Low uncertainty	All values in Pound Sterling at 2018 values.

Over time, with more robust and additional data, the accuracy and comprehensiveness of the account can be improved. Accounting for natural capital is an effective means of combining ecological and economic data to produce accounts which can be used to inform better planning and policy decision making. Better environmental management can help support benefits such as coastal protection, tourism, fish populations, erosion control, sustainable material production, and water quality.

The methods employed to investigate natural capital values help to create an understanding of how the natural environment provides benefits to people through the provision of goods and services. The report shows how these benefits can be consistently measured, valued and monitored to assist better management of the environment. Recommendations are made as to how current limitations can be addressed to improve confidence in the accounts and further develop them over time.

A fully developed national NCA would measure and monitor the benefits St. Helena receives from the natural environment and provide valuable information to decision makers. This would allow policy makers and planners to manage better the human social-political-economic relationship with natural capital, this could improve both the status of the island's environment and the prosperity of its people.

Contents

1. Introduction

1.1 Context on St. Helena

St. Helena is located in the South Atlantic Ocean and is one of the most remote islands in the world; Ascension Island, the nearest land, is 703 miles (1,125km) to the North West. Its remoteness has provided St. Helena with a unique set of natural assets and a large number of endemic species, hosting 1/3 of the endemic species identified on British Territories worldwide[1]. Unfortunately, many native species have been lost due to deforestation and animal grazing as a result of the land management practices of earlier populations[2]. Community efforts to protect and preserve St. Helena's unique flora led to the launch of the Millennium Forest reforestation project in 2000, aimed at restoring the Great Wood forest in the north-east of the island.

St. Helena provides locals and visitors with fantastic landscapes and beautiful scenery, attracting hiking enthusiasts from around the world. Popular sites include Diana's Peak National Park, home of the island's cloud forest, the Heart Shaped Waterfall and the Great Stone Top. Visiting the historical enclave of Lemon Valley is a social occasion among locals, and popular activities include hiking, swimming, fishing and snorkelling.

Due to its remoteness and isolation, St. Helena is also home to a rich and healthy marine environment, with 750 different marine species recorded, of which at least 50 are endemic[3]. The islands ecosystems act as habitat for the growth of fish stocks for harvest for the domestic and small export markets. The marine environment supports numerous activities for tourists and locals. Whale-sharks and bottlenose dolphins are a common sight in St. Helena, and watching these animals is a seasonal activity that draws tourists to the island. Diving is also a popular activity thanks to the abundant marine life and other attractive sights below water, including the multiple wrecks that are found in the north of the island, such as the SS Papanui and the Witte Leeuw, which recall the seafaring history of St. Helena.

1.2 Natural Capital and Ecosystem Services

Over recent years, several ways have emerged of describing and implementing the concept of the environment in economic terms as 'natural capital' and 'ecosystem services'. The Natural Capital Committee (2013) proposes that natural capital should be defined as: "the elements of nature that directly and indirectly produce value or benefits to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions".

If natural capital is the 'elements of nature', or natural assets, then the value or benefits they produce are derived from the goods and services that they provide, also known as 'ecosystem services'[4]. In the Common International Classification of Ecosystem Services (CICES), ecosystem services are defined as: "the contributions that ecosystems make to human well-being" (Haines-Young & Potschin, 2018). They are seen as arising from the interaction of biotic and abiotic processes and refer specifically to the 'final' outputs or

[1] *According to online resources available at:* http://sainthelenaisland.info/endemics.htm#treesfernsmossesetc
[2] *According to online resources available at:* http://sainthelenaisland.info/millenniumforest.htm#q_f.4
[3] *According to online resources available at:* https://sainthelenaisland.info/tourism2016diving.pdf
[4] As well as ecosystem services, natural capital includes non-living resources, such as minerals, oil, gas and aggregates. Most of these resources are measured and valued through market economic data. Therefore, a focus of natural capital accounting is to measure and value the benefits from ecosystem goods and services that are not traded.

products from ecological systems. That is, the things directly consumed or used by people. Ecosystem services are therefore the flows of benefits which people gain from natural ecosystems, and natural capital is the stock (or wealth) of natural ecosystems from which these benefits flow. Ecosystem services can be subdivided into provisioning, regulating, cultural and supporting services, see **Box 1**.

Box 1 Natural Capital Accounting – types of ecosystem services

The most widely used definition of ecosystem services is from the Millennium Ecosystem Assessment: "the benefits people obtain from ecosystems". It further categorised ecosystem services into four types:

Provisioning services: Material outputs from nature (e.g., seafood, water, fibre, genetic material).

Regulating services: Indirect benefits from nature generated through regulation of ecosystem processes (e.g., mitigation of climate change through carbon sequestration, water filtration by wetlands, erosion control and protection from storm surges by vegetation, crop pollination by insects).

Cultural services: Non-material benefits from nature (e.g. spiritual, aesthetic, recreational, and others).

Provisioning, regulating and cultural services are referred to as final ecosystem services underpinned by **Supporting services:** Fundamental ecological processes that support the delivery of other ecosystem services (e.g. nutrient cycling, primary production, soil formation).

Analysis of benefits from natural capital also includes **abiotic services**, the benefits arising from fundamental geological processes (e.g. the supply of minerals, metals, oil and gas, geothermal heat, wind, tides, and the annual seasons).

Source: Based on Natural Capital Coalition (2016) Natural Capital Protocol, and Millennium Ecosystem Assessment (2005): Ecosystems and human wellbeing. *Biodiversity Synthesis*. Washington DC: Island Press.

1.3 Natural Capital Accounting

Natural capital accounting is the process of compiling data on the quantity and quality of a region's natural capital assets as well as the physical and monetary values of the benefits they provide. The data are presented in a structured way to measure and monitor the benefits consistently over time. These accounts provide a source of information for policy makers to aid them resolve matters pertaining the natural environment. Additionally, these datasets can support other national accounts to inform policy and planning decisions. In the same way that the structured recording of other national statistics in conventional national accounts can potentially inform and improve a country's policy making, natural capital accounts can enable more informed decisions to be made regarding the natural environment.

Natural capital accounts are a set of interrelated component accounts that aim to answer the following key questions:

- **What natural capital assets do we have? → Natural capital asset register** is an inventory that holds details of the stocks of natural capital assets within the geographical boundary of the country. This is usually based on the extent of the main habitats, but can also include their condition or quality, and other relevant factors such as extent of different land uses or protected areas. For example, the extent of various habitats may be measured with mapping data, while the actual quality of those habitats, such as the functioning of their ecosystem processes, may be measured through ecological surveying. The asset register helps track trends in the extent and quality of habitats but does not give any information about their use or value.
- **What benefits do these assets provide? → Physical flow account** reports the flow of goods and services which are provided by the assets in the register. This can include benefits related to abiotic natural capital resources (e.g. aggregates extraction) and final ecosystem services. This account provides information on the benefits provided by natural capital, with the flows measured in different physical units (e.g. number of recreational visits or visitors, weight of produce) that are not comparable in a common unit of value.
- **What is the value of these benefits? → Monetary account** which calculates two values. Firstly, the annual values of the flows of goods and services that are captured in the physical flow account. Secondly, asset values which are the sum of the expected flows of discounted[5] values over time. This account values benefits in a common metric, money, for ease of interpretation and comparison.

In a practical sense, the goal of natural capital accounting is to bring together data from different sources into one framework which can be reported in a consistent format, and regularly updated to provide information that can support policy and planning decision making. The interconnected nature of the accounting structure demonstrates trends in benefit provision through changes in extent or condition, changes in the flow of services, or changes in their value. This helps inform discussion of the importance of natural capital to a wider range of stakeholders. It can also help identify key sectors which are reliant on natural capital and point out various risks and opportunities associated with it.

[5] *HM Government Green Book guidance on discounting available at:* https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

As with other data analysis and decision-support tools, the quality of natural capital accounting is as robust as the quality of the inputs that feed in to it. The accounts are designed to complement, not replace, existing environmental management approaches, and present monetary values alongside physical data as explained above. The evidence base should be formed on sound scientific understanding of ecosystems, robust methods of data collection, and transparent reporting of gaps and uncertainties. The accounts are a tool, and only as valuable as the proficiency with which they are utilised; they require careful interpretation of results and specialist training. However, even when data are limited, natural capital accounting can be a useful process to communicate the links between natural capital assets, the benefits they provide, and the values these have to people, provided users understand the limitations.

1.4 Approach to data collection

The following government bodies were consulted during the process of data gathering:

- GIS Office of St. Helena
- Office of Statistics of St. Helena
- St. Helena Environment and Natural Resources Directorate
- South Atlantic Environmental Research Institute (SAERI)
- Communications with JNCC and the Office of Statistics

The official website of the Office of Statistics of St. Helena[6] provides useful datasets for the physical and monetary flow for provisioning ecosystem services such as fish, meat and firewood production. The Habitat Map of St. Helena developed through the Darwin Plus 052[7] project (SHG DPLUS henceforth) by St Helena Government in partnership with Environment Systems, SAERI and Aberystwyth University is available through the SAERI website[8], and provides useful information on the extent and condition of St. Helena's habitats, soil productivity and erosion. Information from these datasets was included in the account's asset register and provided the foundation to calculate values for soil carbon storage and carbon sequestration.

1.5 Structure of document

The structure of the document is as follows;

- Section 1: Introduction - provides an overview of St. Helena's natural assets and ecosystem services. It gives a general background on the concepts and methodology of Natural Capital Accounting and how it can benefit St. Helena.

- Section 2: Benefits - lists and describes St. Helena's ecosystem benefits included in the national NCA. These benefits are fisheries, agriculture, meat production, forest products, carbon sequestration and retention, and tourism.

- Section 3: Findings - presents results from the accounting calculations and data availability and limitations encountered during the assessment are provided in the findings section.

[6] *According to the St. Helena government website, available at*: http://www.sainthelena.gov.sh/statistics/
[7] *According to the Darwin Initiative website, available at:* http://www.darwininitiative.org.uk/project/DPLUS052/
[8] *Online mapping tool available at:* https://data.saeri.org/saeri_webgis/lizmap/www/index.php/view/map/?repository=01sh&project=saint_helena_web

- Section 4: Discussion – reflects on the use of the NCA and possible next steps and draws conclusions.

2. Benefits

A brief overview of the benefits included in the NCA is provided in this section. Greater detail on the methodologies adopted to measure and value these benefits is contained within the accompanying Excel workbook for the 2018 NCA, while an overview of each benefit is also provided in the respective experimental 'scorecard' found in Appendix B. In general, a simple expenditure-based approach is adopted, with the contribution of other factors of production (labour and physical capital) not explicitly considered due to lack of data. Due to the high values associated with tourism expenditure, an attempt to estimate a 'factor of ecosystem dependence' is made to not overestimate the contribution of natural capital to this benefit.

2.1 Fisheries

Natural Capital provides habitat for the growth of fish species for harvest for domestic and export markets. The predominant commercial species in St. Helena are Scombridae, notably yellowfin tuna, but also bigeye tuna, skipjack tuna, wahoo and mackerel.

Production data in kilos for the physical flow was retrieved from the Office of Statistics website, from data gathered by the Environment and Natural Resources Directorate of St. Helena. Market prices for tuna and wahoo, used for the monetary flow, were provided by communication with the St. Helena Government. A 20% uplift was added to total landings to account for shadow market and subsistence fishery activity.

Due to uncertainty of market prices for fish other than tuna and wahoo, an average of the price for both species was used as the market price for the other species. It is worth noting this approach likely overestimates the value of the other species and should be updated with real prices. Ideally, market data as well as landings for every species caught and sold in St. Helena should be updated annually to detect variations in market value and fish production. Conducting marine scientific surveys to measure fish stocks directly could provide valuable information on the sustainability of the fishing industry in St Helena.

The Saint Helena Fisheries Corporation was able to export fresh fish for the first time in 2018[9] thanks to the opening of the airport in the island. The development of a fresh fish export market can potentially increase the value of the fisheries but could also put pressure on local fish populations. Data from scientific surveys could help determine whether fish stocks are underfished, overfished or fished sustainably, and would assist decision makers in understanding the impact of human activities on the marine environment.

2.2 Agriculture

Natural Capital provides the necessary components to support agriculture for local consumption. Although agricultural production in St. Helena is primarily limited to subsistence use, coffee exports are expanding due to the exclusiveness[10] of the St. Helena coffee brand. There are also aspirations for a honey market, though currently only informal trade is practiced, and a local distillery, St. Helena Distillery, makes and markets spirits with reference to locally available ingredients[11].

The Statistics Office of St. Helena provided the total exports value for coffee for the year 2017 from data

[9] *According online resources available at:* http://sainthelenaisland.info/fishprocessing.htm#q_i.d
[10] *According to online resources available at:* https://www.little-temptations.com/2014/07/strong-words-about-saint-helena-coffee.html
[11] *According to online resources available at:* http://sthelenatourism.com/connoisseurs-guide-to-st-helenas-spirits/

collected by the Customs Service of Corporate Finance. These values were updated to 2018 prices using the Retail Price Index (RPI) for St Helena. No other data on agricultural production or market prices were available.

The St. Helena national Natural Capital Account could be improved through collection of direct data on agricultural production quantities and prices for the domestic as well as export markets.

2.3 Meat production

Natural Capital provides habitat and sustenance for animal farming for the domestic consumption of meat. In St. Helena, the main livestock for human consumption is cattle, sheep and pigs.

Production data were retrieved from the Office of Statistics website, with data gathered by the Environmental Health Section, Health and Social Welfare Directorate and Solomons, a local business. The datasets provide annual production in tonnes. A 20% uplift was added to total production to account for the shadow market and subsistence activity[12]. Market prices for meat were provided by communication with the St. Helena Government.

2.4 Forest products

Natural Capital provides habitat and nourishment for the growth of trees that are used in St. Helena for firewood and as a construction material. The main species grown are oak, cape yew, cyprus and pine for timber, and wattle and lower quality pine for firewood. Other species grown include cedar, eucalyptus and blackwood.

The physical data were retrieved from the Office of Statistics website from data gathered by the Environment and Natural Resources Directorate. A 20% uplift was added to total production to account for the shadow market and subsistence use[13]. Production datasets provide trees sold for firewood in tonnes. Market prices for firewood were provided by communication with the St. Helena Government. Values were converted from market prices for 2 bundles to £/tonne.

2.5 Carbon sequestration and retention

Natural capital (vegetation) regulates and reduces the amount of carbon dioxide in the atmosphere as part of the carbon cycle. Carbon can be stored in vegetation's biomass above and below ground as well as in soils. For example, the Millennium Forest acts as a potential carbon sink absorbing carbon from the surrounding air. SHG DPLUS provides useful data on soil organic carbon stocks, classed in ranges from <20tC/Ha to >65 tC/Ha, which is an indication of soil condition as recorded by the asset register.

Carbon sequestration rates have been estimated for Subtropical/Tropical Dry Forest and Subtropical/ Tropical Moist Lowland Forest based on Soepadmo (1993, p. 1025). Carbon sequestration rates of 5.5 tC/ha/year and 36 tC/ha/year respectively are adopted. The values are converted to tCO2e by multiplying the carbon sequestration rate by the tC:tCO2e conversion factor 3.67 as per IPCC (Intergovernmental Panel

[12] A 20% uplift for meat production to account for the shadow market and subsistence production was suggested as a reasonable assumption by stakeholders within the St. Helena Government.
[13] A 20% uplift for forest products to account for the shadow market and subsistence production was suggested as a reasonable assumption by stakeholders within the St. Helena Government.

on Climate Change, 2018) giving a carbon sequestration rate of 20.19 tCO_2e/ha/year and 132.12 tCO2e/ha/year respectively. These values are applied the UK central non-traded price of carbon starting at £67.25 per tonne of tCO_2e per year in 2018. A UK: St Helena GDP per capita ratio is used to adjust UK £/tCO2 e prices to St Helena's economy. It is worth noting that Subtropical/Tropical Dry Forest and Subtropical/ Tropical Moist Lowland Forest are not the only habitats found in St Helena (refer to the Asset Register in the accounts for further information) that could sequester carbon from the atmosphere. However, these are the only habitats valued in the current accounts due to data availability on carbon sequestration rates.

Due to substantial deforestation rates in the past, large amounts of soil have been lost in St Helena. Soil degradation due to changes in land management are considered as one of the main causes of carbon release and CO2 build-up in the atmosphere (Albrecht & Kandji, 2003, p. 16). Additionally, soil disturbance leads to the discharge of nutrients into the ocean, increasing the likelihood of eutrophication (excess of minerals and nutrients) of coastal areas (Ontl & Schulte, 2012). The question remains whether this carbon content could also be recycled through the food chain. It is worth noting that despite everything, large quantities of carbon stocks have been found in the soil of the Millennium Forest (Ellick, 2015, p. 85).

Due to data unavailability for land use management in St Helena, soil carbon release is not calculated. However, it is included in the accounts as a one-off potential soil carbon release to illustrate how the calculations could be made in future accounts, and how this could affect soil carbon stocks in the island. Note that in reality soil carbon storage is a function of land use management, and changes in carbon stocks (either positively or negatively) can occur over a long period of time depending on the land use in place. For instance, certain types of agroforestry systems such as silvopastoral and agrosilvicultural can potentially increase carbon stocks in soils (Albrecht & Kandji, 2003, p. 17).

Based on Guo and Gifford (2002), a decrease of 13% in soil carbon stocks is used in the calculations to address land use changes from native forest to plantation. Assuming that native forests are converted to plantation, a one-off carbon release cost is estimated by multiplying the number of hectares (3,7267 ha, based on tier 50-65 tC Ha-1) times 211 tCO2 e C stocks in soil (based on tier 50-65 tC Ha-1 midpoint) times -13%.

2.6 Tourism

The natural capital of St. Helena provides an attraction for tourists, which is a source of income and employment on the island. Landscape, historical sites and marine fauna play a key role in bringing tourists to the island.

Data for tourist flow (arrivals and departures) is retrieved from the Office of Statistics website, from records collected by the Immigration Section, Police Directorate. The total arrivals for tourism or holidays are used, broken down in figures for St Helenians living abroad and visiting the island ('St Helenians' in the datasets) and foreign visitors ('Non-St Helenians' in the datasets).

The "Total Leisure visitors arriving by air expenditure" data provided by the Office of Statistics and broken down in figures for St Helenians and non-St Helenians- to be consistent with the physical flow, is used for the monetary account. However, it is important to note that only expenditure from visitors "arriving by air" was provided. Expenditure values for visitors arriving by yacht or boat are not available, which would

increase total expenditure values[14].

Preliminary results from a stakeholder workshop on the direct effects of tourism expenditure on St Helena businesses and households, conducted as part of the wider NCA project and provided by the St. Helena Government, were used to calculate the percentage each expenditure category is of total expenditure. These percentages were applied to the total expenditure of £4 million, and broken down for non-St Helenians (£1.6 m) and St Helenians (£2.4 m). It is assumed that Saint Helenians living abroad and visiting the island don't take the natural environment into consideration when deciding to travel to St Helena. To calculate what portion of tourism expenditure is dependent on Natural Capital, a percentage factor of ecosystem dependence per each expenditure category is assumed, using a 5-point scale:

- **25%** - These activities are a small part dependent on local ecosystems, but degradation of the local ecosystem would not affect the experience of these activities very much.
- **50%** - These activities are 50% dependent on local ecosystem. For example, a beach visit for relaxation where the sand and the water is enjoyed. The presence of the sand and opportunity to swim is dependent on the local ecosystem but relaxation is also part of the experience, which can also take place on other locations.
- **75%** - These activities have a very high level of interaction with the natural environment and the experience of the activity is almost fully dependent on the local ecosystem. Degradation of the local ecosystem would have a great effect on the experience of the activity.
- **100%** - These activities are 100% dependent on the local ecosystem, for example: diving and snorkelling are totally dependent on the local coral ecosystem, without a healthy coral ecosystem the activity will not take place.

The St. Helena NCA could be improved through data collection on activity participation, visitor expenditure, and the attribution of the value to the environment. Information on walking and land and marine tour participation, or a visitor motivation/activity survey, could also improve the accuracy of the estimate of benefits provided to tourism in the NCA.

2.7 Other benefits - Local cultural services

The environment plays an important cultural role on St. Helena, and although this was not able to be quantified within the NCA at this time, it is worth noting the value that natural capital has as an important contributing factor to the individual and social wellbeing of the people of St. Helena. Benefits from natural capital that contribute cultural value include landscape aesthetics, iconic species, local recreation, health and wellbeing, and the value of education and research opportunities.

Work on cultural services currently being conducted (Bormpoudakis, et al., 2019), but unpublished at the time of this study, is using resident surveys to examine St. Helenians relationship with their environment, including recreational use, exposure through work, and the role of nature in contributing to the 'essence' of place. Future iterations of the NCA could explore how to capture these benefits further within the accounting framework, by adopting the approaches employed by Bormpoudakis *et al.* and the data that they produce, or by conducting bespoke surveys or making novel use of other existing data sources (see Appendix A Recommendations).

[14] For example, visitor arrival numbers by private yacht are approximately one fifth of the total of number of visitor arrival by air for the most recent 12 month for which data is available.

3. Findings

3.1 Results

The national natural capital accounts demonstrate the considerable value that St. Helena benefits from its natural environment on an annual basis. A total annual value of £3.51 million (roughly 8.28% of an estimated £42.4 million GDP for St Helena in the year 2017/2018[15]) was estimated for the modelled benefits for 2018. Note that as an initial NCA, the results are subject to limited data availability and are therefore incomplete, but still give an indication of the scale of the value that the environment provides to St. Helena (issues around data availability and limiatations are disucssed in Section 3.2).

A 25-year assessment was also conducted to determine the asset value of natural capital from each of these benefits based on the future value stream they will provide, accounting for the renewable physical flows of benefits and their monetary value, projected for 25 years and aggregated and presented in present value[16]. The 25 year asset value is estimated at £62.65 million. It important to note that as the data is incomplete, such as the flow of agricultural production over time, the results are likely an understimation of the total benefit flow from natural capital.

The results for the St. Helena NCA (2018) are presented in **Table 3.1**.

Table 3.1 2018 natural capital account results for St. Helena

Benefit	Physical flow (Annual)	Monetary value (Annual)	Asset value (25yr)
Fisheries	307,747 kilos	£1.49 million	£25.38 million
Agriculture	*Not available*	£0.02 million	£0.42 million
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TOTAL		**£3.51 million**	**£62.65 million**

High uncertainty
Moderate uncertainty
Low uncertainty

Low uncertainty reflects confidence in the evidence to support decisions. High uncertainty reflects results that may be inaccurate by more than an order of magnitude. Some data may be marked as 'moderate' where the data used are themselves accurate, but do not provide a full measure of the services' value.

All values in Pound Sterling at 2018 values.

Data availability and limitations

As previously stated, the initial accounts are a starting point from which to set up the structure that future iterations will build upon. They are a first attempt using available data, and therefore are partial accounts;

[15] *According to the St. Helena Government website, available at:* http://www.sainthelena.gov.sh/st-helena-gdp-for-2017-18-estimated-at-42-million/

[16] *Present value* (PV) is the current *value* of a future sum of money or stream of cash flows given a specified rate of return. Future cash flows are *discounted* at the discount rate, and the higher the discount rate, the lower the *present value* of the future cash flows.

however, they offer an indication as to the scale of value provided. Improved robustness in input data and methodological approach will enhance future iterations of the account. Key limitations in the current set of accounts primarily stem from issues around the availability and reliability of data. For the specific benefits included in the St. Helena NCA, various limitations in the data were identified. Addressing them could improve the accounts as they develop over time. These are discussed individually in Section 2, with recommendations made in Appendix A.

Furthermore, creating an understanding of how different governmental bodies use data also may build awareness of the types of challenges being faced by different government departments and in different sectors, and help identify ways to exploit data for different decision-making purposes. For example:

- Fisheries data is collected as economic data for national economic accounts but can also be used by natural capital accounts to demonstrate part of the value of marine habitats, and by environmental departments to help monitor the health of fishing stocks.
- Data collected by St Helena Tourism to assist hotels in planning for, and managing, the economically important hospitality sector, can also provide evidence for the value that the natural environment provides to the tourism sector, and help justify investment in its maintenance to provide this benefit sustainably to the sector.

Ideally, as the Natural Capital Accounting process develops, much of the data collection can become streamlined or even semi-automated over time.

Another limitation is the comprehensiveness of the accounts. While a set of six priority benefits is a good starting point, they do not capture the overall value of natural capital to St. Helena and it is expected that some key benefits have been omitted, such as cultural values, health and wellbeing, water quality regulation, landscape aesthetics and iconic species. Although these benefits were excluded from the assessment due to current lack of quantifiable data, future iterations of the accounts should aim to include them as the NCA develops and additional evidence is generated.

4. Discussion

4.1 Use of the NCA and next steps

It is hoped that this initial NCA acts as a foundation on which to build future iterations. As the accounts are a structure for systematic understanding of the value of the environment, they can accommodate and be improved on by revised data as better sources become available, and new methods are made possible.

NCA can help support the following:

- Bringing together data from different sources
- Building a framework of data for reporting
- Enabling monitoring change over time
- Enabling better understanding of values of goods and services provided by the natural environment
- Presenting data in a consistent format that can be used by economists and decision makers
- Supporting policy development
- Assisting long-term planning processes for sustainable economic growth and prosperity
- Feeding into better environmental management
- Informing planning
- Providing better evidence to policy makers
- Integrating with, and supports other national accounts

4.2 Conclusion

The project has acted as a 'proof of concept' for natural capital accounting in St. Helena, demonstrating its potential, and creating a basis for further development. The results from the accounts also give an indication of the scale of the value that natural capital contributes to St. Helena. It is estimated that a significant annual value of £3.51 million is provided by the natural environment, which accounts for 8.28% of St Helena GDP[17], feeding in to an estimate of the asset value of natural capital on St Helena of £62.65 million over a 25-year assessment period. These should be considered partial estimates based on existing data, with the actual values expected to be much higher.

The methods employed to investigate these values help to create an understanding of how the natural environment provides benefits to people through goods and services. It shows how these benefits can be consistently measured, valued and monitored to assist better management of the environment. A more developed national NCA will measure and monitor the benefits St. Helena receives from the natural environment more completely and provide increasingly valuable information to decision makers. This will allow policy makers and planners to manage the human social-political-economic relationship with natural capital better, to support real and sustainable prosperity for St. Helena through a flourishing natural environment.

[17] Note that this number is based on a GDP value of £42.4 million for the year 2017/2018, as quoted on the St. Helena government website, retrievable at: http://www.sainthelena.gov.sh/st-helena-gdp-for-2017-18-estimated-at-42-million/. Data on 2018/2019 GDP is not yet available.

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Appendix A: Recommendations

The current national natural capital accounts lay the groundwork for further development to build upon over time. With more robust and additional data, the accuracy and comprehensiveness of the account can be improved. Ideally, the relevant raw data would be collected directly and on an annual basis through consistent processes by the national statistical authority, as is the case for indicators of other national accounts, such as GDP. This section makes recommendations to feed in to this process.

Ecosystem extent and condition should be monitored on a regular, even ongoing, basis, and the asset register reproduced annually, through the identification and measurement of key natural capital indicators:

- **Extent –** the extent of ecosystems can be measured through mapping and analysis tools such as GIS and Earth Observation (e.g. satellite imagery), and ecological surveying. These should be updated regularly to measure changes in the footprint of various habitats. GIS and EO data can be collected relatively easily and analysed to produce estimates for extent, but where feasible these estimates should be verified on the ground with ecological surveying, as they will be based on assumptions of habitat type which need to be confirmed. This will enable the accurate monitoring of changes in land use of time.
- **Condition –** there is available information on the condition of St. Helena's soils such as soil carbon stocks, salinity, soil pH, hydraulic conductivity, productivity and stability. However, detailed data on the condition of habitats and biodiversity are currently unavailable. The health of an ecosystem will greatly determine its ability to provide ecosystem services, and thus how much humans are able to benefit from them. Ecological surveying focused on key indicators of condition, aided by GIS and Earth Observation analysis, conducted on an intermittent basis to monitor trends in ecosystem health, would help to estimate and track natural capital's capacity to provide ecosystem services.

The six benefits currently assessed can be updated and improved with further data collection. Some suggestions as to how to approach this include:

- **Fisheries –** The current assessment of the fisheries benefit makes use of landings values for the local and exports markets, as well as market prices for wahoo and tuna. The accuracy of the account would be improved by tracking the prices for all species caught in St. Helena. Data on landings and prices paid to fishermen should also be updated annually to detect variations in production. If possible, conducting scientific surveys to detect variations in fish stocks will provide an indicator of the health of marine ecosystems and whether stocks are overfished with catches above the maximum sustainable yield. The use of vessel monitoring, and tracking devices could also be used to understand the value of the fishery relative to the effort expended on fishing.
- **Agriculture –** Currently, there are limited data on agricultural production in St. Helena, both for subsistence and exports, only total values for coffee exports are available. Tracking annual

production data for all agricultural products, as well as market prices, would improve the accuracy of the account.

- **Meat Production –** The Office of Statistics provides detailed information for the three main animals used for meat production in St. Helena: cattle, sheep and pigs. Production data should be updated annually to detect variations.
- **Forest Products –** Production units are recorded by local authorities as "trees sold for firewood" in tonnes, while market prices for firewood is recorded in £/two bundles. Units for physical and monetary flows should be recorded by local authorities in the same units and updated annually.
- **Carbon sequestration and retention –** The approach to carbon sequestration and retention applies broad transfer values due to gaps within the academic literature of appropriate rates more specific to St Helena's habitat characteristics. For carbon sequestration, only two habitats could be assessed. For carbon retention, an indicator of condition, placeholder values were applied as a way to demonstrate the methodology, producing proxy results for the asset register. This results in a large degree of uncertainty in the valuation of the benefits, and so there is a need for more robust evidence to increase the confidence in the values produced. Additionally, data on the impact to carbon storage from land use management changes can inform monitoring of carbon stocks in soil, and support decision making in regard to its impact on carbon release and retention.
- **Tourism –** Tourism data on visitor numbers, types of visits, length of stay and expenditure is available and updated regularly. Improvements should focus on greater breakdown of the tourism statistics to be able to refine the approach to valuation. Surveys could be used to provide more accurate estimates on the degree of ecosystem dependence of various activities, the value added of the tourism sector, and tourist consumer surplus or willingness to pay for the environment. Information on activity participation, such as in walking and land and marine tours, or a visitor motivation survey, can also contribute to the accuracy the this benefit in the NCA.

Another limitation is the comprehensiveness of the accounts, while a set of six priority benefits is a good starting point, they do not capture the overall value of natural capital to St Helena. It is expected that some key benefits have been omitted, such as terrestrial hazard protection, regulation of water supplies and cooling from tree shading. This may be a particular concern if trying to disaggregate the findings to particular habitats or locations, as doing so will be based on an incomplete understanding of value, as such it is recommended to not use the accounts in this way. Used on its own, the results will only give a partial view of the value of the St Helenian environment and so are open to misinterpretation and therefore should be used in combination with other components of the account, and other sources of information.

Potential data that would be needed to build physical or monetary accounts for additional benefits are presented in **Table A.1**[18].

Table A.1 Data types for additional benefits

Benefit	Data for physical account[19]	Data for monetary account
Building material	• Quantity of material by use	• Market price of material bought for specific use
Arts and crafts material	• Quantity of material by use	• Market price of material bought for specific use

[18] *A prioritisation exercise could identify which benefits are most valuable and feasible to include in future iterations of the account.*
[19] *An additional challenge to data collection occurs due to the subsistence use of many environmental goods and services.*

Medicinal value	• Frequency of use, perceived effectiveness of medicine	• Cost of equivalent pharmaceutical medicine
Aggregates and mineral extraction	• Types and quantities of aggregates and minerals extracted	• Market price of aggregates and minerals
Local climate regulation	• Level of shade provided • Cooling impact of shade on productivity and comfort	• Value of improved productivity
Erosion control	• Incidents of mudslides • Modelled level of sedimentation reaching property or coastal waters	• Cost of cleaning property • Cost of marine dredging
Historical/heritage value	• Sites of historical / heritage interest on St. Helena • Frequency of visits to sites	• Travel cost to visit sites
Iconic species	• Presence of iconic species • Number of occurrences of species	• Funding available to protect iconic species
Landscape aesthetics	• Number of people regularly enjoying views • Social media analysis • Households with pleasant site lines	• Price uplift of property with views from limited property market
Local recreational use	• Frequency of use of outdoor space for recreation	• Price of alternative forms of recreation • Cost of participation (including travel and opportunity cost)
Health and wellbeing	• Health impacts due to increased physical activity • Benefits of environment on stress and anxiety levels	• Estimated cost avoided from adverse physical health (medical costs) • Estimated cost avoided of adverse wellbeing (lost work days due to stress and anxiety)
Education and research	• Presence of sites used for education or research	• Cost of education or research programmes
Biodiversity and habitat provision	• Amount of flora and fauna • Variety of species • Health and functionality of ecosystems	• A function of all other values to capture supporting services

Most improvements are dependent on data and data collection, some general steps to establishing and improving data collection processes include:

- **Conducting regular surveys –** once a survey has been trialled and proven that it is able to deliver quality data, it can be reused regularly. By collecting data in a consistent format, valuable information can be produced demonstrating trends over time. Surveys can be administered in several different formats as feasible, such as online, at point of interest, or by volunteer or student surveyors. Once a survey has been conducted a few times, the knowledge of how to do so will become embedded and it should become easier and less resource intensive.
- **Developing remote sensing capabilities –** GIS and Earth Observation offer a great opportunity to collect data remotely, reducing resource requirements and aiding in consistency and repeatability. The skillsets required to operate these tools could be developed for regular data collection and analysis.
- **Creating a register of where data are held –** identifying who holds various datasets is one of the most challenging aspects of developing the accounts. Many different bodies, including various governmental departments, hold valuable data but it is often hard to know where they are located. A central, easily searchable register of what data exist, what they contain, when they were produced, and how they may be obtained would greatly facilitate the data collection process and help to remove

barriers between the various bodies which hold data. This could take the format of a national metadata catalogue, such as has been developed for other UK overseas territories (e.g. Falkland Islands, Montserrat, and Anguilla).

- **Placing authority in one government body –** a central authority with the power and responsibility to collect and hold data from across government departments, and from other sources, and to produce the accounts, would provide a valuable resource and first point of contact for conducting all types of research. This could take the form of an online portal that is easily accessible to everyone.
- **Forming pathways for data transfer** – As these processes are used repeatedly, they become embedded and form pathways for transferring data through the various tools and networks that are established. If supported, this can become a self-reinforcing system for the collection and dissemination of information.

Along with continual updates and improvements in data, there are a few other areas of focus that could be improved on over time:

- **Value layer –** While care must be taken in spatially disaggregating value and interpreting the results, future developments might make valid spatial disaggregation more feasible. A possible route to explore would be in creating value layers for each benefit by habitat type, and then effectively imposing them onto each other to create an overall natural capital value layer.
- **Monitor trends** – one of the most useful aspects of Natural Capital Accounting is its ability to compare results year on year and thereby monitor trends. These trends can reflect changes in the extent of St. Helena's Natural Capital, improvement or degradation in its condition, changes in the uses of the goods and services provided, changes in the characteristics of users and the appreciation or depreciation in the value placed upon them. When taken together, these trends will emerge as the overall trend in the wealth provided by St. Helena's natural environment, and point to which factors are driving these trends.
- **Refine methodologies** – Natural Capital Accounting is an emerging field, and environmental economic approaches to valuation are subject to testing, reflection, and revision. As the practice evolves, the methodological approaches to valuing the benefits in the St. Helena accounts can evolve with them, ensuring the most rigorous assessment possible and building increasing confidence in the results.
- **Integrate with policy and planning –** over time, Natural Capital Accounting should play not just a supporting role in policy and planning, but become an integral part of the policy and planning process. As robustness and confidence in the accounts grow, they should become embedded tools to be consulted regularly to inform decision making, and to measure the progress and accountability of specific policy and planning decisions.
- **Investment and enhancement of the natural environment –** Natural Capital Accounting can not only measure value and monitor trends, but it can also be used to advise on investment to maintain or restore natural capital to increase future benefits. Much like investing in built capital in the present can increase revenue in the future, investing in natural capital can yield future increases in the provision of essential environmental goods and services. Natural Capital Accounting is a tool to strategically inform those investment decisions, and where enhancements will be most beneficial.

This version of the accounts can be used to:

- Provide a foundation for improvements to the St. Helena natural capital accounts, discussed above;
- Demonstrate the significant value of natural capital in supporting St. Helena's economy and society;
- Give planners a clearer picture of how built development might impact these benefits, helping them to manage development and preserve the value of the natural environment, and its ability to sustainably provide benefits;
- Make clear to policy makers that decisions which impact the environment can have significant economic and social implications; and,
- Justify investing in environmental protection and/or enhancement to secure and/or increase values of ecosystem services.

If these and other advantages are recognised at an early stage, support will grow for the adoption of the Natural Capital Accounting process, leading to further integration in the policy and planning process as the accounts develop.

Appendix B: Benefit scorecards

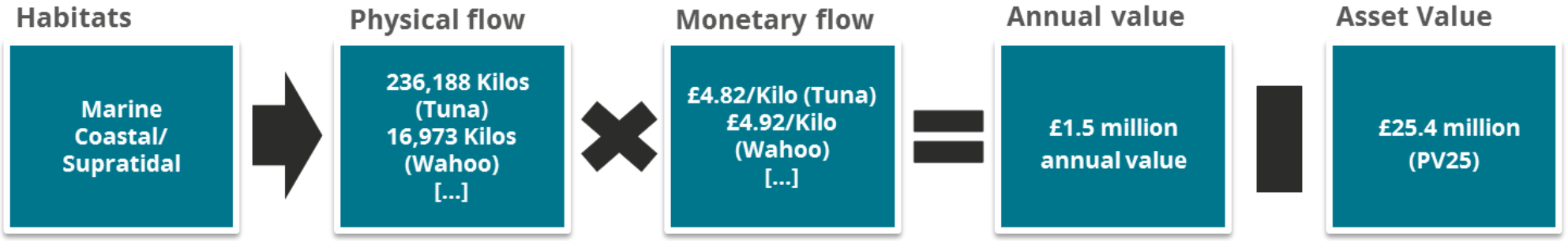
The following scorecards are a summary of each ecosystem benefit analysed for St. Helena national Natural Capital Accounts. They are experimental to test a different approach to presenting summary information from the national NCA. They include a general description of what the benefit is, what type of habitat is providing the benefit, the physical and monetary flows, results for annual value for the year 2018 and an asset value over a 25-year assessment period. It is also included sources of data, how the data are used, how data should be updated and finally, data gaps and assumptions, and suggestions on how the accounts can be improved in the future.

FISHERIES –

Natural Capital provides habitat for the growth of fish species for harvest for domestic and export markets

In St Helena, marine waters stretch up to 200 nautical miles from shore, and Tuna is the predominant species for export

QUALITY OF DATA
- High confidence
- Moderate confidence
- Low confidence



Source of data:
- GIS
- EO

Use of data:
- Data on the area of each habitat is identified spatially and then aggregated

Updating data:
- Data should be updated every few years, unless rapid change is occurring, in which case annual updates may be necessary

Source of data:
- Landings data
- Export data
- Production data
- From Environment and Natural Resources Directorate

Use of data:
- Annual fish landing data for the fish species is compiled to get total quantities

Updating data:
- Fish landings data should be updated annually

Source of data:
- Price paid to fishermen
- Market price of fish

Use of data:
- Unit price is applied to total quantity to get annual value
- Discount factors are applied to value stream
- Sum the totals to get PV

Updating data:
- Market price should be checked and updated annually
- Apply the appropriate discount rate

Data gaps, omissions and assumptions:
- Assume annual landing values per species to be equal throughout the year
- It is important to update the data annually to detect variations in production and species biomass, an indicator of healthy/ unhealthy marine NC
- Prices for species other than tuna and wahoo are not recorded. An average of tuna and wahoo prices have been used for the calculations

Notes and other data needs:
- Discount rates and discount factors for the monetary account

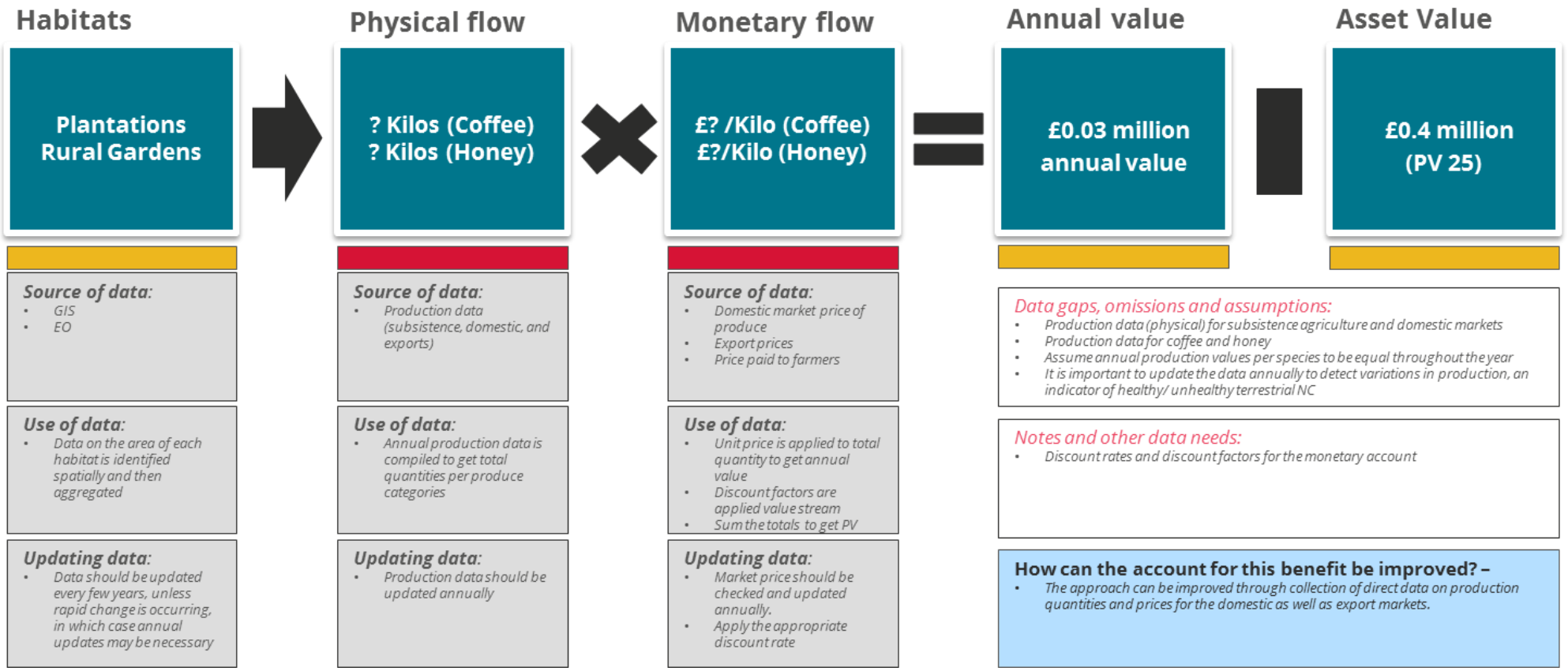
How can the account for this benefit be improved? –
- The approach can be improved by through direct data on market prices for fish

AGRICULTURE –

Natural Capital provides the necessary components to support agriculture for local consumption and exports

Although agricultural production is primarily limited to domestic subsistence, coffee exports are expanding considerably

QUALITY OF DATA
- High confidence
- Moderate confidence
- Low confidence

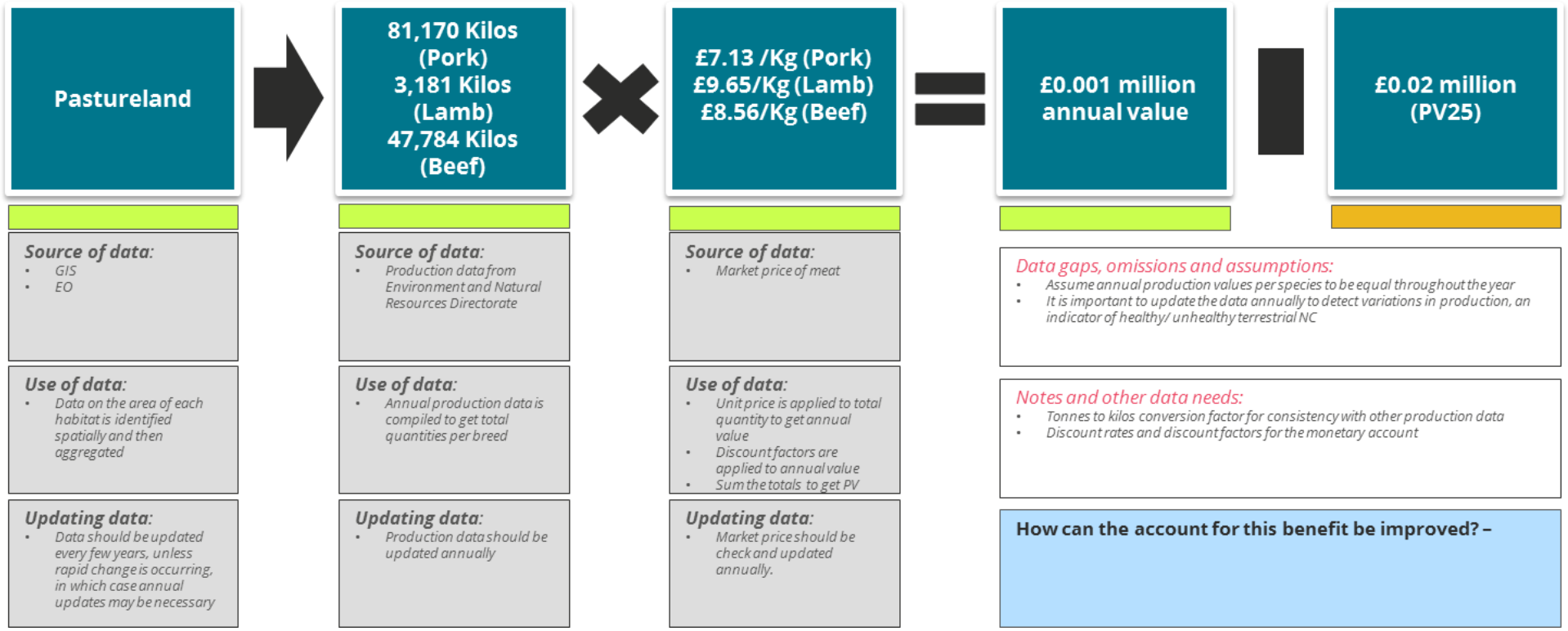


MEAT PRODUCTION –

Natural Capital provides habitat and sustenance for animal farming for the domestic consumption of meat

In St. Helena, the main breeds for human consumption are cattle, sheep and pigs

QUALITY OF DATA
- High confidence
- Moderate confidence
- Low confidence



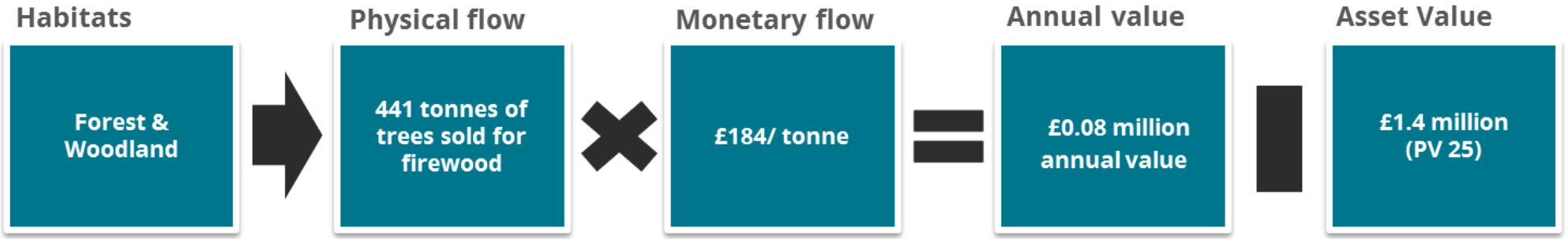
FOREST PRODUCTS –

Natural Capital provides habitat and nourishment for the growth of trees that are used in St Helena

In St Helena, firewood is used as a source of energy and for construction material

QUALITY OF DATA

- High confidence
- Moderate confidence
- Low confidence



Source of data:
- GIS/EO
- Environment and Natural Resources Directorate

Use of data:
- Data on the area of each habitat is identified spatially and then aggregated

Updating data:
- Data should be updated every few years, unless rapid change is occurring, in which case annual updates may be necessary

Source of data:
- Production data

Use of data:
- Annual production data is compiled to get total quantity

Updating data:
- Production data should be updated annually

Source of data:
- Market price for firewood

Use of data:
- Unit price is applied to total quantity to get annual value
- Discount factors are applied to value stream
- Sum the totals to get PV

Updating data:
- Market price should be updated annually.

Data gaps, omissions and assumptions:
- Assume annual production values per to be equal throughout the year
- It is important to update the data annually to detect variations in production, an indicator of healthy/ unhealthy terrestrial NC

Notes and other data needs:
- Discount rates (monetary account)
- Discount factors (monetary account)

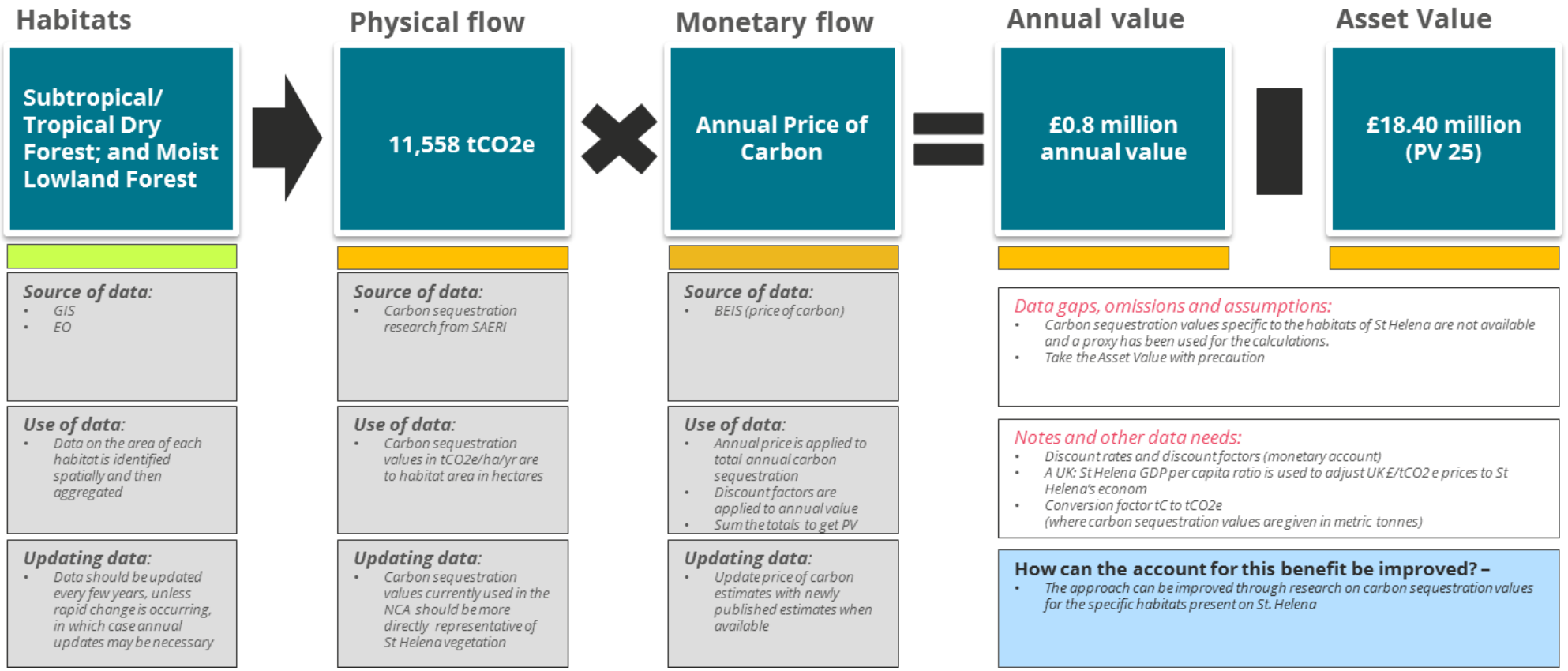
How can the account for this benefit be improved? –

CARBON SEQUESTRATION –

Natural Capital (vegetation) regulates and reduces the amount of carbon dioxide in the atmosphere

The Millennium Forest sequesters carbon from the atmosphere which mitigates emissions from St Helena's airport

QUALITY OF DATA
- High confidence
- Moderate confidence
- Low confidence



TOURISM–

Natural Capital provides an attraction for tourism, which is a source of income and employment

Landscape, historical sites and marine fauna play a key role in driving tourists to the island

QUALITY OF DATA

- High confidence
- Moderate confidence
- Low confidence

Source of data:
- GIS
- EO

Use of data:
- Data on the area of each habitat is identified spatially and then aggregated

Updating data:
- Data should be updated every few years, unless rapid change is occurring, in which case annual updates may be necessary

Source of data:
- Tourism arrivals and length of stay data from visitor surveys

Use of data:
- Calculate total visitor nights for different visitor categories

Updating data:
- Visitor data should be updated annually

Source of data:
- Expenditure data, from statistics and economic accounts and visitor surveys

Use of data:
- Expenditure data to disaggregated by visitor type to various activities
- A 'factor of ecosystem dependence' for various activities is applied

Updating data:
- Expenditure and activity data should be updated annually

Data gaps, omissions and assumptions:
- Data on tourism activity participation rates
- Detailed expenditure breakdown
- More refined types of visitor data
- There is an assumption of 50% of non-Saints total expenditure is NC-dependent and 25% for Saints tourists

Notes and other data needs:
- Discount rates (monetary account)
- Discount factors (monetary account)

How can the account for this benefit be improved? –
- The approach can be improved through data collection on activity participation, expenditure and the attribution of the value to the environment.
- Data on walking and land and marine tour participation, or a visitor motivation/activity survey

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