Development of a Natural Capital Investment Plan for the Turks and Caicos Islands

Background Study

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Project Summary:

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This Background Study assesses the state and extent of natural capital in the Turks and Caicos Islands and associated opportunities for mobilising investment in natural capital, based on a comprehensive study of the literature, background information and prior research in the field. The project aims to provide a first step towards developing a Natural Capital Investment Plan, presenting pathways for sustainable finance for the protection of the natural environment in the Turks and Caicos Islands.

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1 Executive Summary

Finance Earth and eftec (the "Consultants") have been commissioned by the Joint Nature Conservation Committee (JNCC) to develop a Natural Capital Investment Plan (NCIP) to provide pathways for sustainable finance for the protection of the natural environment in Turks and Caicos (TCI). This Background Study constitutes the first step, followed by a socioeconomic survey analysis, business attitudes survey, options assessment and a final technical report.

Project background

As of 2022, an annual funding gap of $957 billion has been estimated for environmental conservation globally (Deutz et al., 2020). The vast majority (86%) of the current funding comes from public sources, with only 14% from the private sector (United Nations, 2021). Historically, governments and non-profit organizations have been the primary sources of funding for environmental initiatives globally. However, this funding alone cannot address the scale and complexity of environmental challenges that exist today. In order to meet funding requirements for nature initiatives, there needs to be a significant increase in engagement from the private sector.

Natural resources and ecosystems play a vital role in supporting the economy and people of TCI. The diverse ecosystems of the islands provide essential services such as coastal protection, water purification and climate change mitigation. They also support crucial industries such as tourism and fishing, contributing significantly to TCI's economy, as well as providing both sustenance and income to local communities.

However, these natural assets, and therefore the livelihoods that depend on them, are under threat from various human activities and environmental challenges, such as coastal development, overfishing, pollution, and unsustainable tourism. In order To safeguard and manage TCI's protected areas for the long-term, it is estimated that approximately $0.9 million is required annually. This gap represents an essential investment towards the conservation, management and sustainable utilisation of TCI's natural assets, and does not include the required investment in infrastructure and sustainable businesses. Adequate funding in these areas is crucial for safeguarding the environmental integrity, ecological richness, and long-term resilience of these invaluable natural assets.

The government of TCI is dedicated to preserving its significant marine and terrestrial resources and promoting sustainable livelihoods for its residents. Scoping new financing and funding opportunities through a NCIP can provide the necessary resources to support conservation and livelihood activities that protect and preserve the natural capital assets of TCI. The implementation of a NCIP can help to ensure the long-term viability of ecosystems and biodiversity, while also reducing reliance on traditional sectors and creating new income and employment opportunities.

TCI natural capital

Identifying the location, condition and extent of natural capital assets is a necessary input for understanding how to prioritise natural capital investment in TCI. Ecosystem accounts inform natural capital investment planning by prioritising links between assets, benefits, beneficiaries., and their values, which helps identify potential investment opportunities.

TCI is made up of over 90,000 hectares of terrestrial habitat and over 690,000 hectares of marine habitat. That is, the vast majority of TCI natural capital habitat extent is in the marine environment. Across all its natural capital assets, the primary ecosystem services in TCI are fisheries, carbon sequestration, tourism and recreation, and flood protection, which provide annual benefits valued at $156 million (US dollars per year in 2020). These values reflect both benefits that are traded in markets, and non-market values. Based upon available data tourism currently contributes most market value ($38 million per year) and carbon sequestration the most nonmarket value ($65 million per year) but as data collection improves and through the development of the NCIP other ecosystem services may be found to have greater value.

Ecosystem accounts identify beneficiaries, which helps investment plans to determine revenue streams, potential buyers, and impacted communities. These beneficiaries vary from wider society (carbon regulation) to local TCI residents (recreation and cultural services). Key beneficiaries are:

- **Wider society** (carbon sequestration);
- **Local government, business and communities dependent on coastal infrastructure** (avoided costs from flood damages);
- **TCI residents** (recreational benefits);
- **Local businesses** (tourism);
- **Local resource users** (fishers and farmers); and
- **Visitors** (tourists).

The accounts show a strong aggregate picture of natural capital across TCI, but this hides spatial variation in values and beneficiaries. Equally, the accounts provide a baseline reflecting current management, but do not give direct evidence on economic or financial returns from changes to environmental management and specific natural capital propositions. Physical (unit/hectare/year) and monetary ($/hectare/year) flows may not be static and are likely to change over time depending on management actions. While the accounts are a good initial source, more evidence and research are needed to build on existing evidence of the condition of natural capital assets, and to test which management approaches are likely to work, and where, whilst managing trade-offs.

Funding and finance opportunities

Ultimately, for a natural capital project in TCI to be considered a worthwhile investment by the private sector, it must be able to prove its financial viability and the potential to generate a reasonable return on investment. This depends primarily on a project's ability to generate revenue streams of sufficient quality and reliability, surpassing the costs

associated with its setup and ongoing operation. These revenue streams also serve a crucial role in diversifying sources of income and establishing sustainable finance models for preserving and improving natural capital.

The potential for generating revenue streams in TCI spans both marine and terrestrial environments. Projects may rely on either a single revenue stream or a combination of multiple streams structured into more complex models to support project viability and achieve the desired level of return. These can be split into four broad categories:

- **Payments for ecosystems services:** When beneficiaries or users of ecosystem services (e.g. coastal defence, biodiversity and carbon sequestration) are willing to pay for the provision of that service, it creates a revenue stream which can support the cost of preserving or restoring ecosystems (Fripp, 2014).
- **User fees:** A sum of money paid as a necessary condition to gain access to a particular service of facility or the ability to provide a service or facility (e.g. levies, taxes and fees) to protect seascapes and landscapes containing natural capital (Chung et al., 2011).
- **Supply chain fees:** Where there is a willingness to pay for sustainability within a supply chain (e.g. fisheries supply chain), a premium or fee can be applied on a volume or per product basis generating additional revenue which can be deployed to improve the sustainability of the marine and terrestrial environment.
- **Sustainable enterprises:** Entities that rely on and generate revenue based on the sustainability and health of the environment (e.g. tourism) can enable improved business practises to abate threats to natural environments and support livelihoods (Zu, 2013).

It should be noted that although the potential of revenue via payments for ecosystem services should be explored, TCI have already made significant steps to improve environmental outcomes compared to that of other states. As a result, environmental enhancement policies are already embedded in certain areas and “additionality” may be challenging to deliver given this relatively high baseline. As such, a range of other revenue sources that could support natural capital protection and enhancement in the region will be explored.

Financing mechanisms for natural capital

A range of different capital types are available for financing initiatives aimed at preserving and enhancing ecosystems and the associated services they provide. These capital types can be categorised as repayable or non-repayable, with their suitability depending on the specific project's characteristics, revenue generation potential and the risk tolerance of investors and investees.

Grants are funds provided by governments, philanthropic organisations, or international agencies to support natural capital projects. Grants typically don't require repayment, making them suitable for early-stage or pilot projects with high social or environmental

value but limited revenue potential. In some cases, grants may become repayable if certain conditions are met.

Equity financing involves selling ownership shares in a project in exchange for capital. Equity investors become partial owners and may benefit from the project's increased value or receive dividends if it generates profits. Equity financing can attract larger funding amounts, supporting project scalability.

Debt financing entails borrowing funds with an obligation to repay the principal amount plus interest over a specified period. Debt is suitable for projects with predictable cashflows but may not be ideal for those with uncertain returns.

Blended financing combines grants, equity and debt to attract private investors interested in both financial returns and social or environmental impact. This approach helps mitigate risks associated with natural capital projects and transition them to more self-sustaining models.

In accordance with findings from UNEP, the World Economic Forum and The Economics of Land Degradation (2021), the key barriers to investment in natural capital projects in TCI and other Overseas Territories (OTs) include:

- **A lack of reliable cashflows:** Some natural capital projects may struggle with cashflow generation due to limited revenue opportunities, making private sector investment challenging.
- **A lack of suitable funding mechanisms:** Existing funding mechanisms may not align with the unique needs of natural capital projects, requiring more patient and flexible capital.
- **Small-scale project sizes:** Projects in TCI may be smaller and as such less attractive to larger private investors seeking economies of scale.
- **Long payback periods:** Some projects may have extended payback periods, which would deter investors seeking short-term returns.
- **Political and legal uncertainties:** The absence of clear policies and past challenges related to corruption can introduce an element of unpredictability for investors in TCI, leading to their reluctance in engaging with projects that extend across various political cycles (The Guardian, 2009; JNCC, 2015).
- **Climate change vulnerability:** TCI, like many other OTS, face high climate change risks would or could deter investors due to higher perceived risks of projects.
- **Limited local skills base**: A lack of technical expertise may hamper natural capital project development.
- **Limited data availability:** Incomplete or unavailable data on the value of natural capital in TCI and the potential returns on investment can make it difficult for investors to assess opportunities accurately.
- **A lack of sufficient monitoring and verification:** The absence of robust monitoring and verification mechanisms within natural capital projects in TCI can make it difficult for investors to assess the actual environmental and financial impact of their investments.

Addressing these barriers will require a multi-faceted approach, and unlocking opportunities for natural capital investment in TCI will involve leveraging various financial mechanisms and incentives. A number of financing mechanisms have been developed and used globally, which can be explored for applicability in TCI. This (non-exhaustive) list includes:

- **Incubators and accelerators** for capacity building and developing proof-of-concept models.
- **Conservation Trust Funds (CTFs)** to attract funds from various sources and define investment objectives independently.
- **Blended finance** combining different types of capital to reduce risks and attract private finance.
- **Blue and green bonds** for financing marine and terrestrial conservation efforts, respectively.

In summary, various financing mechanisms offer opportunities for scaled and coordinated financing of natural capital projects in TCI. Further exploration of these mechanisms and their potential to support the natural capital and people of TCI will be conducted in the development of the NCIP.

2 Introduction

Project objectives

According to the United Nations and OECD (2023), "natural capital" is the wealth of renewable and non-renewable resources including plants, animals, air, water, soils and minerals that combine to yield flows of benefits to people. The natural capital assets across the Turks and Caicos Islands (TCI) in the Caribbean include a diverse range of resources and ecosystems that provide various ecological, economic, and social benefits. Finance Earth and eftec (the "Consultants") have been commissioned by the Joint Nature Conservation Committee (JNCC) to develop a Natural Capital Investment Plan (NCIP) to provide pathways for sustainable finance for the protection of the natural environment in TCI. This report is the first in a series of work that will include a socioeconomic analysis, and a behaviour/attitudes survey aimed at further understanding the potential of natural capital investment in TCI. This will be followed by an assessment to evaluate natural capital investment opportunities in TCI followed by a final technical report which will provide a roadmap for implementing a NCIP in the region.

This Background Study is based on a comprehensive study of the literature, background information and prior research in the field. The objective of the study is to understand the state and extent of natural capital and the associated opportunities for mobilising investment in natural capital in the TCI region by assessing relevant documentation, initiatives and case studies both from TCI and globally. Section 2 sets out the broader context of the natural capital landscape and need for a NCIP in the Turks and Caicos Islands. Section 3 provides the methodology used to compose this Background Study. Section 4 provides a review of the existing natural capital accounts in TCI, revenue generating opportunities for natural capital protection and enhancement projects in TCI as well as the current natural capital financing mechanisms used in TCI and other Overseas Territories (OTs). Sections 5 provides an evaluation of the markets that can be unlocked using these potential revenue streams. Finally, Section 6 provides an overview of the barriers to financing natural capital in TCI currently as well as financing mechanisms that can be used to unlock investment for nature. Throughout the report, there are a number of case studies that have been collected from the Background Study and previous experiences of the Consultants. Case studies and examples have been selected to showcase opportunities for both public and private sector funding and finance.

Project background

Natural capital investment landscape in the global context

It is estimated that up to $957bn of annual investment is required to safeguard the natural environment globally. However, as of 2022 there is a reported annual spending of ~$133bn (Deutz et al., 2020). Of this current spending, 86% is from public and philanthropic sources, with private finance comprising the remaining 14% (United Nations, 2021). While

governments and non-profit organisations have historically been the main sources of funding for environmental conservation and sustainability initiatives, the scale and complexity of environmental challenges far exceeds the capacity of public and philanthropic grant funding alone. As such, private sector investment will play a crucial role in filling this funding gap, by developing investment opportunities that protect or restore natural capital while generating a return on investment.

Today, the private sector provides approximately $18bn of annual financing for nature-based solutions, representing only 14% of the total funding towards nature-related initiatives. Private sector financial engagement with nature is mostly through investments in sustainable supply chains and environmental offsets (Vivid Economics, 2020). In order to meet funding requirements for nature initiatives, there needs to be a significant increase in financial engagement from the private sector. Globally there are instances where natural capital markets are growing rapidly, however this is not uniform across countries. For example, the UK, Australia, New Zealand and Colombia are rapidly developing biodiversity markets, collectively hosting more voluntary and compliance biodiversity credit schemes than in all other countries combined (Bloom Lans Substack, 2023). Globally, voluntary carbon markets (VCMs) quadrupled from 2021 to 2022 and are valued as high as $2bn (Ecosystem Marketplace, 2022). Although VCMs have been predominantly terrestrial markets, there has been an increase in demand for 'blue' carbon credits derived from marine and coastal projects, with the first fully certified blue carbon credits sold from mangrove restoration in Madagascar in the mid-2000s (Blue Ventures, 2019). Natural coastal defence and risk mitigation through mechanisms such as insurance products are also creating emerging opportunities to generate new incomes for natural capital projects, with initiatives being piloted in the Philippines and Pakistan (Climate Finance Lab, 2019; Earth Security, 2020). Most recently, the Nature Conservancy (TNC) has purchased the world's first coral reefs insurance from Munich Re in Quintana Roo, Mexico with parameters specifically around hurricane damage (see 'Coastal defence' in 'Natural capital funding streams' below for more details). As a result of its success, this mechanism is being expanded through Belize, Guatemala and Honduras (The Nature Conservancy, 2022).

Natural capital investment landscape in Turks and Caicos Islands

As outlined by the Natural Capital Accounting Report from JNCC and eftec (2018), natural resources and ecosystems play a critical role in supporting the communities and economy of TCI. The islands are home to diverse ecosystems, including coral reefs, mangroves, seagrass beds, wetlands, dune systems, pine shrubs and forests which support a wide range of plant and animal species. Healthy ecosystems provide essential services such as coastal protection, water purification, climate change mitigation, and habitats for a diverse array of species, as well as supporting industries such as tourism and fishing (JNCC, 2018). These ecosystem services create opportunities for thriving livelihoods through employment, food security, health and well-being. Specifically in TCI, healthy ecosystems support a strong tourism industry bringing c.$787 million to the region in 2018 equating to c.71% to GDP, underpinning the majority of TCI's economy

(Hagedoorn et al., 2017; JNCC, 2018). In addition, healthy ecosystems are critical to TCI's fishing industry, providing a source of food and income for many local communities. Sustainable fishing practices rely on well-managed marine resources, including healthy coral reefs and seagrass beds that serve as essential marine habitats.

Despite their importance, natural capital assets in TCI are under threat from various human activities and environmental challenges, including coastal developments, habitat destruction, overfishing, rising sea levels, ocean acidification, pollution, unsustainable tourism and water scarcity (Pound and Whittlesea, 2015). These pressures are resulting in damages to the natural capital and ecosystems within TCI. Over time, these pressures can lead to negative impacts to the incomes and livelihoods of the TCI population (UNEP 2017). Safeguarding and managing the natural capital and ecosystems of TCI can ensure the sustainable provision of various ecological, economic, and social benefits to the people and nature of TCI.

In a manner that is similar to the global state of nature funding, current efforts to safeguard TCI's natural assets are underfunded, with most of this funding being provided from public sources. It is estimated that $2.6 million is needed each year to facilitate the effective management of TCI's protected areas; however, as of 2015/16 the Department of Environmental and Coastal Resources (DECR) had an annual budget allocation of $1.7 million (Wolfs Company, 2016). Despite being proportionally higher than the global average of funding allocated to nature recovery, there is still a 35% deficit to effectively safeguard and manage the natural capital and ecosystems of TCI. As such, additional funding streams need to be established and developed to bridge the funding gap. These funding streams can help to unlock additional private finance, which is essential in order for nature protection and restoration efforts to be scaled and sustainably delivered.

The need for a NCIP in Turks and Caicos

The government of TCI is dedicated to preserving its significant marine and terrestrial resources and promoting sustainable livelihoods for its residents. Previous efforts by the JNCC in TCI have highlighted a strong interest in exploring sustainable livelihoods and economic diversification that prioritise positive impacts on the local environment (Pound and Whittlesea, 2015). Unlocking external investment for TCI's natural capital is a key route for enabling local populations to more effectively preserve and safeguard critical ecosystems, whilst also having the ability to generate returns.

Scoping new financing and funding opportunities through a NCIP can provide the necessary resources to support conservation projects that protect and preserve the natural capital assets of TCI. Sustainable funding can ensure the long-term viability of ecosystems, biodiversity, and unique habitats, safeguarding them for future generations. In addition, by investing in sustainable industries and projects that enhance and protect the value of the natural environment, the region can reduce its reliance on traditional sectors and create new sources of income and employment opportunities.

3 Methodology

Approach

The Background Study undertaken as part of this work used a rapid evidence assessment (REA) approach, aiming to provide informed conclusions and associated implications based on a reviewed evidence base. This involved:

- Using a combination of key words and terms to refine search efforts and retrieve appropriate literature;
- Screening literature according to pre-determined inclusion and exclusion criteria (i.e. the evidence fits within the Scope outlined below);
- Extracting relevant datapoints and information from selected studies and articles including study characteristics (e.g. author, type of source, geographical focus) and subsequently using an evidence log to refine search criteria;
- Synthesising and assimilating extracted data and research findings in the context of the research questions, with key findings, implications and key findings summarised.

The approach taken in this study is detailed further in Appendix 1.

Scope

The Background Study scope covers:

- **Evidence which describes the value of natural capital in TCI** and its various relevant characteristics which inform a NCIP (e.g. when benefits arise, where they occur, and for whom (i.e., the beneficiaries).
- **Evidence specific to TCI and other island states** (e.g. the TCI ecosystem accounts); however, where evidence is lacking, other relevant global sources may be considered.
- **Financial mechanisms** which include revenue streams and financing opportunities that can be applied to a NCIP for TCI as well as case study examples from relevant local regions and global contexts.
- **No set period**. Preference (i.e. assessment of accuracy and uncertainty) will be given to most recent literature, evidence and methods.

Search protocol

The focus of this Background Study was to a review of available evidence related to financial and market mechanisms, socio-economic benefits, and monetary values related to the natural assets and their associated benefits in TCI.

Key research questions included:

- What are the monetary, ecological and societal benefits from natural environment and resources in TCI?
- What is the scale of opportunity for investment in natural capital in TCI?

- What is the scale of benefits realisable through increased investment levels?
- What is the approximate investment need in natural capital in TCI?
- What are the ecosystem service markets and revenue streams available from natural capital in TCI?
- What are the key barriers to the development of ecosystem service markets in TCI?
- What are the financial mechanisms that can be used to enable investment in TCI?
- What are some example case studies of ecosystem market participation and investment mechanisms relevant to TCI?

Evidence was collected and reviewed over two key stages:

- **Stage One** involved the review of pre-identified priority sources of literature, including previous publications from JNCC, TCI's national Ecosystem Accounts and others.
- **Stage Two** involved gathering evidence through online sources using agreed search criteria developed during Stage One (sources included: Google Scholar, Environmental Valuation Reference Inventory (EVRI), ResearchGate).

A list of sources used by Finance Earth and eftec is provided in the References section.

This work builds on an extensive scientific evidence base on TCI's natural capital. TCI has collated its natural capital assets in national ecosystem accounts (eftec and JNCC, 2022). The accounts capture a wide range of evidence on the extent, condition, and provision of benefit attributable to the terrestrial and marine environments of TCI. The ecosystem accounting framework has been utilised to generate ecosystem accounts, as well as to determine the beneficiaries and recipients of these benefits. This has, in turn, informed subsequent analysis on the potential to generate revenue streams and resulting financing opportunities from TCI's natural capital. A summary of this framework can be seen in Figure 1.

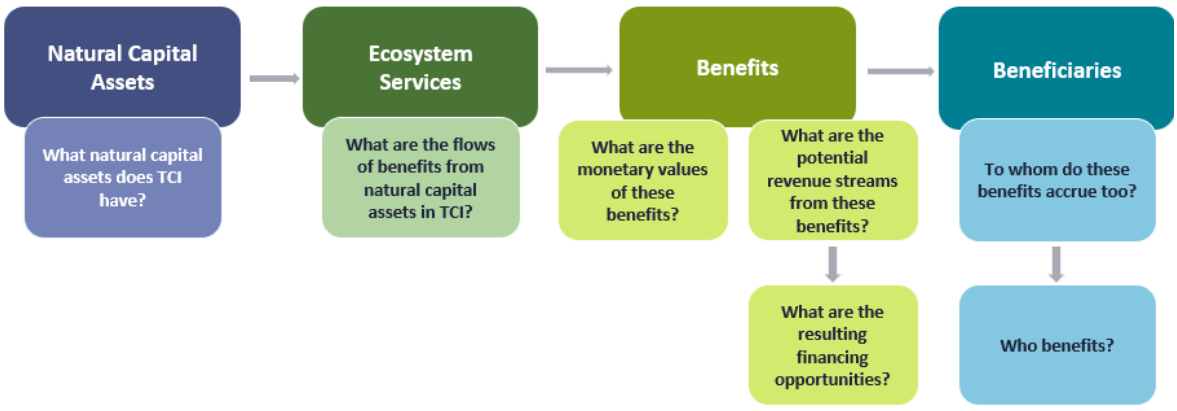

Figure 1. The ecosystem accounting framework used to inform the work of this report. Sources: Finance Earth (2023) and eftec (2023)

State of the evidence review

Implementation of the search protocol resulted in 70 documents being included in the evidence base. An overview of sources identified by project team members, and number reviewed is shown in Table 1.

Documents identified through JNCC refer to those sent directly by JNCC to the project team and does not include evidence found through the JNCC data portal. These documents were recorded and reviewed according to the search protocol (Appendix 1).

Under the search protocol's inclusion and exclusion criteria, any document that did not specifically relate to TCI or to the Caribbean more widely and which were not transferable to TCI were excluded from review. . For other sources, evidence was further filtered by excluding documents published prior to 2008 unless these includes values of TCI natural capital benefits specifically. In the latter case, there was no temporal filter. Evidence was reviewed if it contained TCI specific valuation evidence not already included in the 2020 ecosystem account and/or discussed distribution of benefits and beneficiaries that could be relevant to TCI. For the funding and finance opportunities, evidence was collated using both the search protocol and through utilising prior research, experience and stakeholder engagement in the field. The management and conservation of natural resources to generate financial returns and positive environmental outcomes, is a relatively emerging concept, as such, evidence found through the search protocol was all published after 2015. Where no specific evidence was found for TCI, research was extended to the Caribbean. Relevance was determined through analysis of the abstract or introductory text.

Table 1: Potential sources identified and sources reviewed

Identified through	Number of sources identified		Duplicates	Number reviewed
	Stage 1	Stage 2		
JNCC	4	0	0	4
eftec	12	58	7	32
Finance Earth	6	97	4	48

4 TCI Natural Capital

Summary

- Ecosystem accounts inform natural capital investment planning by cataloguing links between assets, benefits, and their values which helps identify potential investment opportunities.
- The vast majority of TCI natural capital habitat extent is in the marine environment. The primary ecosystem services in TCI are fisheries, carbon sequestration, tourism and recreation, and flood protection.
- Ecosystem accounts identify beneficiaries, which helps investment plans to determine revenue streams, potential buyers and impacted communities. These beneficiaries vary from wider society (carbon regulation) to local TCI residents (recreation and cultural services).
- The accounts show a strong aggregate picture of natural capital across TCI, but this hides spatial variation in values and beneficiaries. Equally the accounts do not give direct evidence on economic or financial returns from environmental management and specific natural capital propositions. More evidence and research are needed to test which approaches are likely to work, and where, whilst managing trade-offs.

Linking ecosystem accounts with natural capital investment

Identifying the location, condition and extent of natural capital assets is a key starting point for understanding how to prioritise natural capital investment in TCI.

Extensive data about TCI's natural capital assets are collated in its national ecosystem accounts (eftec and JNCC, 2022). The accounts capture a wide range of evidence on the extent, condition, and provision of benefits from the terrestrial and marine environment. Table 2 presents a summary of the relevance information captured by the accounts can have for NCIPs.

Table 2: How ecosystem accounting informs natural capital investment planning

Information captured	Ecosystem account component	Relevance for NCIP
Which natural capital assets exist in TCI	Ecosystem extent and condition account	Natural capital assets are the candidate assets which could be protected, enhanced or restored within a NCIP.
The extent and condition of these assets		Evidence of extent, condition and location of TCI's natural capital assets helps determine which assets are most likely to benefit from environmental management and deliver long-term benefits suitable for natural capital finance.
Which natural capital assets are impacted or depended upon by TCI	Materiality assessment	This assessment informs the initial stages of investment scoping. It identifies a long-list of assets which are expected to deliver multiple benefits to people (e.g., carbon sequestration or tourism). This is then assessed for incorporation into financing and revenue models.
The benefits and beneficiaries of these assets	Ecosystem flow accounts (Physical term)	Different natural capital assets deliver different benefits to people. These people may be TCI-residents, but also local businesses, tourists, or wider society. Understanding who benefits, and how, from ecosystem services helps link benefits with revenue streams, potential buyers, whilst understanding the wider impacts of environmental management on TCI society.
The value of these benefits	Ecosystem Service Flow Accounts (Monetary terms) and Ecosystem Asset Accounts	The monetary accounts quantify, in monetary terms, the flow and stock values of TCI's natural capital assets. Whilst these values may not be the same as those traded in environmental markets, it highlights the highest asset values and potential annual streams of value against which economic and financial modelling of sustainable finance opportunities can be benchmarked.

There are several categories of component accounts which make up an ecosystem account under the System of Environmental Economic Accounting – Ecosystem Accounting (SEEA-EA). Each of these provide important information to inform a sustainable NCIP (see Figure 2). These are discussed in more detail in the following sections.

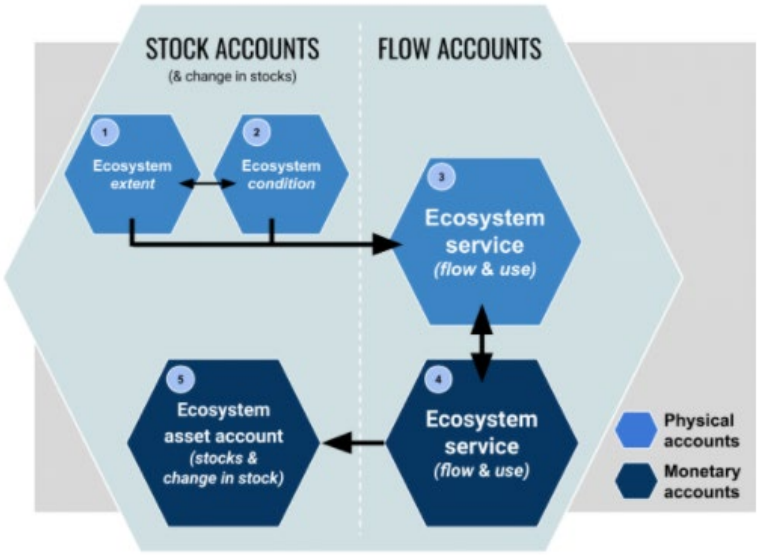

Figure 2.Ecosystem accounting structure under SEEA-EA. Source: UN (2021)

Ecosystem extent and condition account

The ecosystem extent and condition account records data and information about the stock of ecosystem assets within a given area. It is an inventory of information which characterises these assets by their quality (i.e., condition) and quantity (i.e., extent). The compilation of extent and condition accounts also describes *where* the assets are. This is important because the location of ecosystem assets (i.e., where the ecosystem service is supplied) is not always the same as where the beneficiaries receive the benefit (i.e., where the demand for ecosystem service is). Mapping therefore helps determine to whom and from where benefits accrue, and therefore any distributional consequences (positive and negative) from the investment in protection, creation and enhancement of TCI natural capital.

The ecosystem account asset register is shown in Table 3. Details of TCI protected areas and species counts are included in Appendix 2. In aggregate they show:

- **The main habitats present on island by extent** (hectares). These are categorised using the IUCN Global Ecosystem Typology.[1]

[1] The International Union for Conservation of Nature (IUCN) Global Ecosystem Typology (GET) Ecosystem Functional Groups (EFG) was used in the accounts.

- **Key species count indicators** e.g., IUCN red list species.[2]
- **Extent of terrestrial land protected** under various local and international designations (e.g., Ramsar designations).

Table 3: TCI ecosystem account asset register for reporting year 2020/2021

Total area of TCI ecosystem assets hectares)	**Reporting Year 2020/21**	**Proportion of terrestrial or marine habitat**
Total terrestrial habitats	**90,677**	**100%**
Algal flat	11,257	12%
Canals, ditches and drains	43	0%
Coastal saltmarshes and reedbeds	3,991	4%
Coastal shrublands and grasslands	6,238	7%
Intertidal forests and shrublands	24,311	27%
Invasive species	130	0%
Permanent marshes	3,204	4%
Plantations	3,595	4%
Pyric tussock savannas	238	0%
Sandy shorelines	1,142	1%
Small permanent freshwater lakes	1,786	2%
Tropical flooded forests and peat forests	9,417	10%
Tropical-subtropical dry forests and scrubs	21,422	24%
Urban and industrial ecosystems	3,901	4%
Total marine habitats	**690,591**	**100%**
Photic coral reefs	60,786	9%
Seagrass meadows	229,610	33%
Subtidal mud plains	2,780	0%
Subtidal rocky reefs	78,280	11%
Subtidal sand beds	319,135	46%

Source: TCI 2020 Ecosystem Account (eftec, JNCC 2022)

[2] The IUCN Red List of Threatened Species, also known as the IUCN Red List or Red Data Book, founded in 1964, is an inventory of the global conservation status and extinction risk of biological species.

The majority of total TCI habitat by extent are benthic habitats (88%). The largest benthic habitats are subtidal sand bed (~319,000ha; 46% of benthic habitat extent) and seagrass meadows (~229,000 ha; 33% of benthic habitat extent). The largest terrestrial habitats are intertidal forests and shrubland (i.e., mangroves) (~24,000 ha; 26% of terrestrial habitat extent) and tropical-subtropical dry forests and shrubs (~21,000 ha; 23% of terrestrial habitat extent). The largest protected area is the North, Middle and East Caicos Nature Reserve (~59,000 ha; 87% of protected area extent), which is a Ramsar site. Protected areas are 9% of total terrestrial and benthic habitats (~780,000).

Data on species and abundance is also collated in the accounts (Appendix 2). The register contains reptile species threat status using the IUCN Red List Status and their status as invasive or naturalised (Department of Environment and Coastal Resources, 2020a). The register also includes bird richness (e.g., number of species that are common (104) or rare (101)) (Department of Environment and Coastal Resources (DECR), 2020b) and flora count (DECR, 2020c).

The terrestrial and marine ecosystem of TCI are mapped in Figure 3. This map indicates where TCI's natural assets are located. As discussed, benthic habitats are a significant share of TCI's total area across all islands. The ecosystem accounts do not break down habitat types and extent (ha) by island, but the mapping below helps visualise habitat distribution of the natural capital assets in the asset register. This gives an idea of the candidate sites for environmental management, although (as mentioned) this does not necessarily correlate with the location of all beneficiaries.

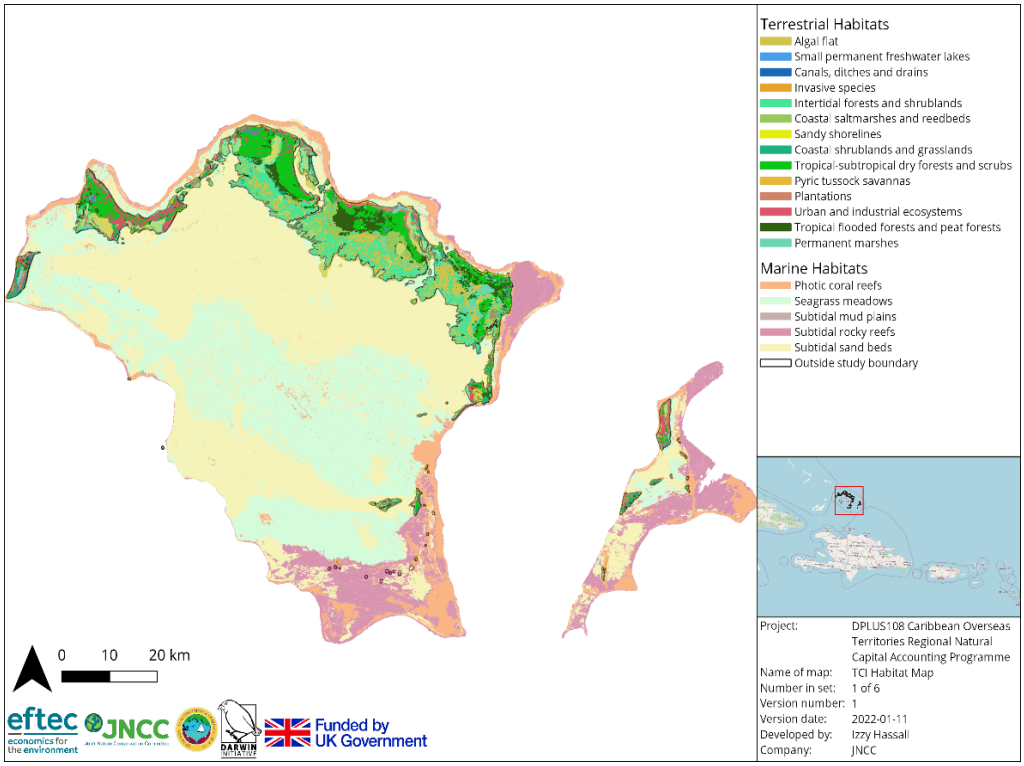

Figure 3. Terrestrial and marine ecosystems in TCI: Sources: DECR (2020d); The Nature Conservancy Caribbean Division (2020)

The **Marine Spatial Planning Tool for Turks and Caicos Islands (SAERI, 2021)** provides a key data input into understanding the extent and condition of the TCI environment. It is a web-based GIS tool which allows users to interrogate and overlay various data layers which describe aspects of the marine environment. **The TCI data portal** was created as part of the same project, providing a compendium of datasets to input into the mapping tool functionality.

Together, the GIS tool and the datasets document the spatial distribution of the use of the marine environment across several different themes:

- **Conservation areas,** including protected areas, proposed changes to these, and Important Bird and Biodiversity Areas.
- **Developmental pressures,** including location of buildings, ferry routes, road networks and artificial developments along the coastline.
- **Tourism and cultural use data,** including kitesurfing, snorkelling, and dive locations, as well as survey data regarding time spent at beach and most frequented beaches in TCI
- **Environmental data,** including species distribution and habitat maps
- **Impact assessment mapping,** noting locations which are susceptible to threats from development, marine pollution, overfishing and watershed pollution.

These datapoints are useful for planning investment since they allow spatial analyses which correlate:

1. Terrestrial and marine habitats (environmental data) which provide benefits (against which revenue streams can be attached);
2. Expected location of beneficiary populations (e.g., tourism and cultural use data); and
3. Areas susceptible to threats from environmental degradation (impact assessment mapping).

Table 4 and Table 5 show the materiality assessment included in the 2020 ecosystem account for terrestrial and marine habitats. This assessment tabulates material ecosystem services against the natural capital assets expected to provide these services. In other words, these are the ecosystem services which are impacted by human development and activities on TCI, and upon which TCI residents (and wider society) depend for their welfare.

This assessment informs the initial stages of investment scoping as it identifies a long-list of assets which a) are expected to deliver multiple benefits to people (e.g., carbon sequestration or tourism), and b) can be assessed, alongside condition and economic appraisal evidence, for incorporation into financing and revenue models.

In Table 5 and Table 6, cells are coloured according to how assets could be linked to ecosystem services. Blank cells indicate where there is not expected to be a material link

between an asset and an ecosystem service. [3] Pink cells indicate that a material link was identified but not assessed due to lack of information. Light blue cells with a dot indicate that the link was assessed in both physical and monetary terms. The values of these flows are covered in the next section.

Table 4: Materiality assessment for terrestrial habitats as captured in the TCI 2020 Ecosystem Account

Ecosystem service	Algal flat	Urban and industrial ecosystems	Sandy shorelines	Small permanent freshwater lakes	Canals, ditches and drains	Plantations	Coastal shrublands and grasslands	Coastal saltmarshes and reedbeds	Intertidal forests and shrublands	Tropical-subtropical dry forests and scrubs	Pyric tussock savannas	Invasive species	Permanent marshes	Tropical flooded forests and peat forests
Extent, hectares	11,257	3,901	1,142	1,786	43	3,595	6,238	3,991	24,311	21,422	238	130	3,204	9,417
Fisheries														
Agriculture										.	•			
Carbon sequestration						•		•	•	•				
Coastal protection														
Surface hydrology														
Local recreation			•				•	•	•					
Tourism	•		•	•	•	•	•	•	•	•	•	•	•	•
Key:														
	Blank cells indicate that there is no identified material service provision.													
	Pink shaded cells indicate where an asset has an identified material benefit, but it was not assessed due to lack of data.													
•	Light blue cells indicate that a material benefit was identified and were estimated in quantitative and/or monetary metrics													

Source: TCI 2020 Ecosystem Account (eftec, JNCC, 2022)

[3] Note that the materiality matrix maps TCI habitats to 'final' ecosystem services which are valued in line with UN SEEA-EA. It does not map supporting services e.g., pollination services.

Table 5: Materiality assessment for marine habitats as captured in the TCI 2020 Ecosystem Account

Ecosystem service	Photic coral reefs	Subtidal mud plains	Subtidal rocky reefs	Subtidal sand beds	Seagrass meadows
Extent, hectares	60,786	2,780	78,280	319,135	229,610
Fisheries	•	•	•	•	•
Agriculture					
Carbon sequestration					•
Coastal protection					
Surface hydrology					
Local recreation	•	•	•	•	•
Tourism	•	•	•	•	•

Source: TCI 2020 Ecosystem Account (eftec, JNCC, 2022)

In TCI, terrestrial and marine habitats provide a wide array of ecosystem benefits. Both terrestrial and benthic habitats provide carbon sequestration, recreation, and tourism benefits. The combination of all habitat types is expected to contribute to the large tourism value of the natural environment in TCI (see next section). All benthic habitats are linked to fisheries benefits. Coral reefs and seagrass provide coastal protection, and terrestrial habitats provide inland flooding protection (wood, 2022). As valuation evidence suggests (see Section other natural capital valuation evidence), these benefits are expected to be significant in value. Coral reefs and seagrass provide the most ecosystem services by count, highlighting a strong initial case for environmental management (whether that be protection, restoration or enhancement).

In addition to those ecosystem services described as material in the materiality matrix, other possible ecosystem services from TCI habitats may also include the following:

- Fishery nursery benefits from saltmarshes, reedbeds and mangrove forests
- Coastal protection from sandy shorelines
- Inland flooding benefits from freshwater lakes, canals, ditches, and marshes.
- Carbon sequestration and storage by marine sediments.

Ecosystem flow accounts (physical and monetary terms)

Benefit flows

As the materiality matrix demonstrates, the natural capital assets of TCI deliver a range of benefits. The ecosystem flow accounts seek to quantify these in two separate ways, physical and monetary flows, both of which are important for NCIPs. This is outlined in Table 6.

Table 6: Description of flow and stock accounts and relevance for investment planning

Flow account	Description	Usefulness for investment planning
Physical flow account	Measures the physical flow of goods and services assessed as material (see above) from natural capital assets in the asset register. Flows are assessed on an annual basis, with assumptions made around future trends	The physical flow accounts identify benefit flows against which revenue streams can be appraised and evaluated for suitability.
Monetary flow account	Measures the annual monetary value of the flows of benefits in the physical account. It aims to measure the exchange value of both market and non-market ecosystem services.	The account demonstrates the annual monetary value of material ecosystem services. It can be used to highlight a long list of potential investment opportunities for environmental management in TCI. It can also be used to measure and/or compare impact from investment over time and between the two flow types.
Ecosystem asset account	Measures the asset values of the benefit flows in the monetary account over a defined period of assessment. It is the aggregated discounted value of the expected annual stream of benefits over that timeframe.	

Each ecosystem service is allocated a confidence rating, reflecting the robustness of the evidence assumptions used. The process of undertaking this assessment is described in Appendix 2

The flows included in the account are listed in Table 7. This includes a summary description of the likely beneficiaries by ecosystem service and benefit type. The next section discusses beneficiaries in more detail.

Note that the evidence presented in the summary table should be interpreted as a partial valuation of the total contribution of the environment to TCI. The environment provides additional benefits, such as beach deposition and erosion prevention, cultural values, and biodiversity which cannot be accurately quantified or valued at this time due to data limitations.

Table 7: TCI Ecosystem flow and asset account

Ecosystem services	Ecosystem service typology	Physical terms			Monetary terms			Ecosystem asset account (US$m)	Direct beneficiaries
		Quantity /year	Confidence	Physical indicator (unit/year)	US$m/year (2023 prices)	Confidence	Valuation metric		
Fisheries	Provisioning service	2,905	🟤	Total weight of fish (tonnes/yr)	28	🟤	Market price	427	Businesses in the fishing industry and employees
Agriculture	Provisioning service	44,520	🟢	Total weight of agricultural production (lbs/yr)	0.1	🟤	Market price	2	Farmers
		360	🟢	Total egg production (flats/yr)	0.004	🟢		0	
Carbon sequestration	Regulating service	961,953	🔴	Total carbon sequestered (tCO2e/yr)	65	🔴	Cost of achieving emission reductions	1,623	Wider society
Local recreation	Cultural service	7,289,479	🟤	Total number of local recreational visits (visits/yr)	25	🟤	Expenditure on local recreation	500	TCI residents, Businesses near frequented sites and employees
Tourism	Cultural service	1,161,097	🟢	Total number of visits (visits/yr)	38	🟢	Value added to tourism industry attributed to ecosystems	1,467	Tourists, Businesses in the tourism industry and employees
Total					**156**		Mix of values	**4,019**	
Material non-monetised benefits									
Coastal protection	Regulating service	11,370	🟤	Total infrastructure at risk of storm surge (number/yr)	N/A	⚫	N/A	N/A	Properties and infrastructure in flood-vulnerable zone

Of the values presented, certain values stand out as having significant value (physical and monetary) for TCI. Physical flows are difficult to compare as the units are not consistent between material flows. The largest market value ecosystems provide is through the value added to tourism ($38 million per year). The largest non-market value provided by ecosystems is carbon sequestration ($65 million per year).

Despite its high monetary value, carbon sequestration has the lowest confidence rating for both physical and monetary flows (symbolised by a red dot) since a) there is a lack of available evidence on carbon sequestration rates (tCO2e) and b) the correct carbon values to apply (in the accounts, the UK social cost of carbon were used to value annual sequestration flows due to lack of TCI-specific or regional carbon values). Two ecosystem services, fisheries and local recreation, have medium confidence levels (symbolized by a yellow dot) due to limitations in the availability of current data. These confidence levels should not deter investment but rather indicate where a) there are currently uncertainties regarding potential natural capital investment opportunities, and b) further evidence, data and monitoring is required and should be prioritised.

Beneficiaries

Ecosystem accounting can be used to link flows of benefits from ecosystems to people. Understanding the distribution of these benefits across space and beneficiary types is a key consideration for investment planning since it highlights a) potential stakeholders willing to pay for environmental outcomes, and b) beneficiaries which would be impacted by environmental management under the investment plan. Different habitats are dispersed across a given land (or sea) area and their benefits have varying levels of accessibility and benefit flow to population(s).

TCI's 2020 ecosystem account identifies beneficiaries at a high-level and the results are recorded in Table 8. These beneficiaries include:

- **Wider society** (carbon sequestration);
- **Local government** (avoided costs from flood damages);
- **TCI residents** (recreational benefits);
- **Local businesses** (tourism);
- **Local resource users** (fishers and farmers); and
- **Visitors** (tourists).

Direct beneficiaries of ecosystem services are recorded in Table 6 (e.g., tourists, fishers), but there are also many indirect beneficiaries (e.g., consumers of seafood) which are difficult to capture fully in ecosystem accounting structures. Beneficiaries are discussed more in the Discussion section.

Other natural capital valuation evidence

The accounts are the most up-to-date, relevant and consistently organised evidence describing the value of the benefits delivered by natural capital. However, there are a couple of material exceptions which the accounts don't cover which are particularly conducive to natural capital investment opportunities – biodiversity and flood protection. The details of these studies are summarised in Table 8 with more details provided in the case studies below.

Table 8: Ecosystem service flows and beneficiaries

Benefits	Value (unit/yr)	Physical indicator	Value US$'000/ yr (2023 prices)	Valuation metric	Beneficiaries	Sources
Tourism	263,720	Number of rock iguana-related tours	6,149	Tourism expenditure dependent on rock iguanas (central figure)	Tourists, Businesses	(eftec, 2022a)
	14,000	Number of visits to Little Water Cay	158	Tourism expenditure dependent on rock iguanas (central figure)	Tourists, Businesses	
	160	Number of people employed by tour companies	797	Wages dependent on rock iguanas (central figure)	Employees	
Non-use value	18,440	Number of households	1,205	Willingness to pay to maintain rock iguana population	Residents	
Education	450	Number of rock iguana-related school trips	5	Expenditure on tickets	Students	
Coastal flooding	8,000	Additional area flooded (building footprint), m^2/yr	7,391-91,271	Property loss + Business interruption loss	Residents, Businesses and their employees	(Wood, 2022)
Inland flooding	6,000	Additional area flooded (building footprint), m^2/yr	3,642	Property loss + Business interruption loss	Residents, Businesses and their employees	

Source: eftec, 2022a; Wood, 2022

Case study – The benefits of rock iguanas on TCI (eftec, 2022a)

Purpose

The TCI rock iguana is a unique globally Endangered species on TCI. These species are valuable to TCI and globally in numerous ways, for example

- supporting economic industries (through tourism and employment);
- recreational enjoyment of observing the species in the wild;
- supporting a sense of national identity, and
- option values relating to the existence of iguanas for future generations to enjoy.

The study estimated the value of these benefits as a means of justifying the case for public investment in conservation management. Note that the study did not value all aspects of iguanas e.g., potential use values. The value provided should be seen as a more complete subset of its total value to society.

Key findings

Sustaining the current level of conservation funding for rock iguanas ($200,000 per year) is needed to maintain the current tourist expenditure of $2.2 to $7.3 million per year estimated to be dependent on rock iguanas.

Over the past 10-years, rock iguana conservation has attracted an inward investment of $2.4 million to TCI, through external grants. The scale of this investment is significantly outweighed by the value of tourism dependent on rock iguanas: approximately $50 million of tourism spend over 10 years, which supports 160 permanent jobs.

The non-use value of rock iguanas for residents of TCI is estimated at $9 million, and their educational benefits are at least $40,000, which are also significant benefits in relation to the costs of conservation programmes.

Key notes for investment planning

- ⇨ Values of iconic endemic species can significantly exceed the costs of sustaining the benefits in the long-term.
- ⇨ Conservation spending to support rock iguana species represents a good use of public money and likely private monies (through benefits to the tourism industry).
- ⇨ High recreation values for local TCI residents would suggest strong community support for sustainable conservation management actions.

Case study – Developing disaster resilience in the Turks and Caicos Islands: coastal and inland flood risk modelling, opportunity mapping and indicators (wood, 2022)

Purpose

The study assesses the role of natural capital in mitigating the impacts of natural capital on built infrastructure and local business. The assessment summarises flood modelling outcomes from different scenarios, looking at impact arising from wind direction and categories of storms.

Key findings

Over the long term, the further degradation of natural capital assets providing protection may generate an annual cost of $6.6m arising directly from reduced coastal protection and associated damages. If there was severe degradation, the annual long-term cost rises significantly to $91m per year. This is consistent across all storm categories. Losses arising from degradation are greatest for East and Southeast direction storms, but Southerly winds generate the most significant damages in the baseline. For inland flooding the level of annual benefit in relation to surface water flooding is $3.4m in a degraded scenario. Damages are highest for the most intense rainfall events but are only slightly higher than less intense rainfall events when the natural assets are degraded.

Key recommendations for NCIP

- ⇨ Depending on the scenario under comparison, annualised flood protection benefits may be the most significant natural capital benefit in £ terms.
- ⇨ Benefits are measured as avoid damages of real monies, representing a tangible financial opportunity, in particular for business and tourism industries.
- ⇨ Not all restoration efforts are effective; the location of the habitats, direction of windspeed and severity of weather event all determine effectiveness of intervention. Linking investment plans to restoration efforts which deliver real flood protection benefits must consider therefore which specific natural capital assets have the largest opportunity for enhancement or recovery, whilst protecting key businesses and local communities.

Together, these studies demonstrate the large values attributable to rare species and flood protection in TCI. In particular, flood protection benefits may comprise around 5% – 40% of the total annual benefits when compared with other ecosystem services and generate the largest value of all ecosystem services. The tourism value of iguanas is already included in the tourism values in the accounts but highlights the significant contribution of nature and endemic species to tourism.

Recommendations for natural capital investment planning

Use of benefit values for TCI natural capital investment

The ecosystem accounts and materiality assessments together highlight the largest value ($/yr) ecosystem services and their linkages with TCI's natural capital assets. It therefore serves as a good starting point for identifying potential environmental management actions which generate benefits around which revenue streams and financial models can be structured. Mapping the material benefits in the TCI ecosystems accounts to revenue streams is discussed in the next Section of the report.

In terms of value ($ annual and stock value), the most significant benefits relate to **tourism**, **carbon regulation** and **coastal protection**. As described above, seagrass meadows and coral reefs provide the most *types* of ecosystem services in the TCI benthic habitat, and seagrass is the most common habitat by extent. These habitats generate fishery, carbon regulation, coastal protection, recreation and tourism benefits. On the terrestrial side, grasslands, saltmarshes (e.g., Salinas), mangrove and tropical forests are expected to provide significant carbon sequestration, coastal protection, surface hydrology, local recreation and tourism benefits.

However, further work is required to build on the ecosystem accounts and generate successful and targeted ecosystem market propositions.

Firstly, different habitats provide different quantities of benefit flows (unit/hectare/yr). For example, carbon sequestration rates vary between (and within) habitat types, as do nursery habitat benefits from seagrass species. The materiality assessment outlines which habitats are likely to deliver which benefits. It does not, for each benefit, outline the level of the provision of these benefits by habitat (either by physical or monetary flow). Some of this evidence exists in the account (e.g., carbon sequestration rates by habitat) but not for all (e.g., splitting out number of recreation visitors or tourism value for each component of the TCI natural environment).

On this basis, the accounts don't directly show the value of each individual natural capital asset. That said, the data can be repurposed to financially appraise the suitability of targeted environmental actions which generate measurable and robust benefits for society and investors (i.e., additional benefit streams generated from environmental management of a given habitat and species). Use of the data in this way will likely require some assumptions to reflect the proportion of each benefit type value attributed to a given habitat e.g., contribution of coral reef habitats to total tourism value.

Secondly, physical (unit/hectare/yr) and monetary ($/hectare/yr) may not be static. It is likely to change over time depending on management and maintenance actions (e.g., annual carbon sequestration rates of both marine and terrestrial ecosystem vary in a non-linear manner depending on the age and other geographical factors.). The value of a given benefit delivered by a certain habitat is therefore variable, and for those habitats which generate multiple benefits, the proportional mix of these benefit values may vary over time depending on the maturity of the habitat in question. For investment planning purposes, this will require a proportionate balance of environmental-economic modelling, and qualitative comparison and judgement when choosing between environmental management actions which deliver different benefits at different times in the future.

Thirdly, the accounts do not contain a wide range of condition indicators for the natural capital assets. Some information may be instrumental to support investment planning (e.g., species counts and categorisation). The accounts do not describe whether specific environmental action taken in targeted locations across TCI to protect, enhance, restore or create natural capital would generate a marketable revenue stream. This is not the principle aim of accounting. Other indicators and data sources (e.g., TCI data portal, DPLUS119) are needed to better understand where the best opportunities lie. Part of this process will also require testing with local communities and stakeholders. The NCIP business attitudes survey will seek to build on the recent socio-economic and business attitudes surveys to better understand opportunities and perceptions around natural capital investment and environmental management.

Finally, the accounts in isolation do not describe the economic or financial returns to be achieved from environmental management of TCI natural capital. Generally, there is good evidence to suggest that investment in ecosystem restoration and protection of the natural environment is good value of money in a variety of contexts (De Groot et al., 2012; Rao et al., 2013; Sinclair Stewart et al, 2022 and eftec, 2023), but the picture is complex:

- There are large variations in benefit value;
- Environmental management which achieves positive impacts in one location will not necessarily be successful in another (Rohr et al, 2018);
- As well as benefits, the costs of undertaking environmental management can vary significantly (Bayraktarov *et al.,* 2016). This is particularly driven by the levels of degradation, competing land use and stakeholder interests.
- There is little ex-post evidence of economic returns on investment from ecosystem restoration to support investment planning (eftec, 2023).

That said, economic and financial returns can be modelled and tested using benefit values derived from the ecosystem accounts. Financial profiling of proposed revenue

streams and financing activities will be undertaken in the upcoming stages of the project.

Data needs

Ecosystem accounts organise environmental and economic evidence, the accuracy of which is dependent on data availability and regularity of updates to the accounts. Since the baseline year (2017), extent and condition data has been updated but continuous development is necessary to maintain suitability for guiding long-term investment opportunities and decision-making.

The TCI Data portal contains much of the evidence that was used in the accounts, and is updated on a semi-regular (albeit ad-hoc) basis (SAERI and DECR, 2023). Though the accounts offer a centralised source for much of the relevant information regarding TCI's natural capital assets (e.g., extent and ecosystem service provision), they should be viewed alongside the Data portal and concurrent research initiatives (e.g., Darwin PLUS 119 [JNCC, 2023]) for the most up-to-date snapshot of TCI environmental data, in particular regarding condition indicators to inform market-ready investment opportunities.

Understanding these data gaps within the 2020 ecosystem account can inform a NCIP by identifying a) where more evidence may be needed, and b) where regular monitoring and evaluation is necessary to support payments for demonstrable environmental outcomes.

Distributional implications of natural capital investment

As described previously (see Table 8), the natural capital assets of TCI generate a wide range of types of benefits for different groups of people. These include local residents, direct users of ecosystems, businesses, and wider society. A high-level assessment of the beneficiaries from natural capital was undertaken in the 2020 ecosystem accounts, aggregating benefit values across space, and allocating high level (e.g., wider society) or direct user groups (e.g., fishers) allocated to these specific benefits.

Aggregation of values across space is necessary for a national set of accounts used for influencing decision-making or describing the stock of TCI natural assets at a large scale. However, this approach hides various elements of the localised impacts of natural capital which should be considered when planning investment and environmental management.

Firstly, it hides spatial variation in values ($/ha) of a given benefit type. Benefit values do vary based on the location of specific habitats, or the location of beneficiaries. Since ecosystem accounts often do not capture where the ecosystem services flow, this

distinction is particularly important since there is often a spatial mismatch between a) the location of natural capital asset where the ecosystem service is supplied, and b) the recipient of the benefit from the ecosystem service flow. The extent of this spatial mismatch varies; some ecosystem services provide benefits to global society (e.g., carbon regulation), whereas other benefit types are highly localised to the socio-economic and ecological conditions of TCI e.g., flood protection, recreation benefits. This also relates to the impact of environmental management e.g., benefits from reducing losses arising from climate change in TCI.

Secondly, since there are likely variations in value distribution by natural capital asset and ecosystem service across the different islands, it follows that different types of beneficiaries are likely to value benefits from nature differently. High level (e.g., wider society) or direct user group (e.g., fishers) categorisation in accounting is unlikely to fully capture these dynamics. It likely excludes indirect users of ecosystem services (e.g., consumers), or potentially vulnerable or disadvantaged groups in society, which either a) hides significant variation between users captured in high level groups, or b) excludes certain beneficiaries from the accounting framework.

This is particularly important where variation is expected to arise in the values within certain stakeholder or societal groups, but also between beneficiary groups (e.g., cultural aspects of local fisheries, species etc.). For example, Rudd (2001) and Rudd et al. (2002) describe how the types of benefit and values derived from fish species (Nassau and spiny lobster) differ between fishers (as a provisioning service), and tourists and local residents (as a cultural service). Since benefits manifest differently in different stakeholder groups, the risks of trade-offs arising from environmental management actions need to be carefully managed, since an improvement in one benefit flow (e.g., increase in fishing activity and landings for fishers) may reduce benefit flows elsewhere (fewer to be enjoyed by tourists and locals).

Thirdly, there is evidence that different socio-economic groups (e.g., by income, age, gender) have varying degrees of dependency on the benefits from TCI natural capital. Often the most vulnerable can be reliant on natural capital (often its provisioning services) for financial wellbeing and have fewer alternative opportunities for income or livelihood (Suich, Howe and Mace, 2015). Which socio-economic groups and households stand to gain or lose from natural capital investment will vary by natural capital benefit type (e.g., subsistence fishing and farming) and location (e.g., most tourism activity is located on Providenciales). The socio-economic and business attitudes surveys dig deeper into the specifics of the impact of COVID-19 on local communities, businesses, and subsequently perceptions of impacts on, and reliance upon, the environment. Further analysis of the socio-economic survey, business attitudes survey, along with the development of the NCIP business attitudes survey, will delve deeper into the beneficiaries of natural capital investment in TCI.

Identification of beneficiary types and disaggregating analyses at these different levels can therefore be used to:

- **Investigate which groups may be the best placed to support environmental management (both financially and non-financially) and which groups could be the most active in stimulating or driving environmental protection**. Van Beukering (2011) argues that identifying beneficiary groups that stand to gain the most from natural capital may be the best placed to support its conservation or restoration. Further, education and information sharing amongst these groups may be the best course of action to find support for improved management.

- **Map benefit distribution to beneficiaries** depending on different decision rules and priorities, each of which have different implications for management needs. For example, Ghermandi et al (2018) categorise three main ways to identify benefit distribution for management, 1) where the highest value for an asset is located, 2) where the highest combined value is in a given area, and 3) where the demand for the services is greatest. By understanding distribution patterns, i.e., areas of highest value or greatest vulnerability to impacts of habitat loss or climate change, decision-makers can better understand where different management options should be implemented, such as conservation or restoration. This can then inform investment needs.

As an example, Figure 4 presents the distribution of main recreational activities from the JNCC-funded cultural use survey (eftec, 2020), the data from which is included in TCI's ecosystem account. The map shows that there is greater recreational activity in certain areas of the country than others. Overlaying beaches and population on this map would help inform which beneficiaries, such as tourists, residents, and businesses near the activities, would be impacted by management changes in these recreational activities.

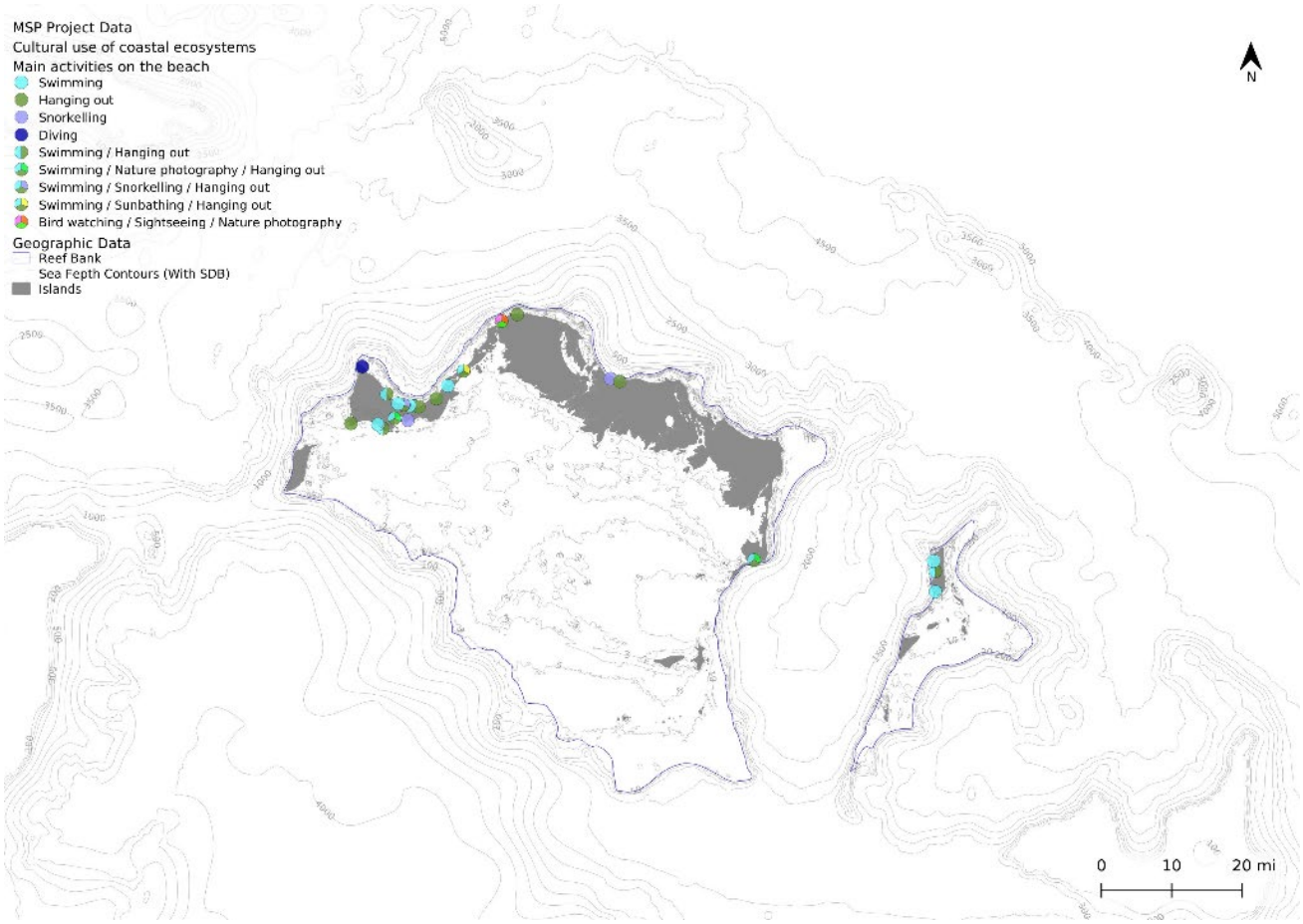

Figure 4: Map of recreational activities across TCI

In summary, identification and mapping of beneficiaries by location and socio-economic characteristics is a key consideration for a NCIP. It outlines not only who may be willing to pay in environmental markets, but also who is likely to be impacted by the environmental management actions, and where. This may include those who benefit positively through direct employment, and indirectly from improved quantity or quality of ecosystem services generated from environmental actions. It also helps highlight trade-offs, for whom and how. This creates the opportunity up-front to create investment structures which promote the protection, enhancement and creation of natural capital whilst minimising negative impacts on local communities or other stakeholders.

5 Funding and Finance Opportunities

Summary

- Any investable natural capital project in TCI needs to demonstrate financial viability and the potential for a reasonable return on investment; this is primarily demonstrated by the availability of long-term revenue streams. The generation of revenue streams can serve to diversify project income in addition to helping to attract finance to bridge any gaps between project implementation and cashflow generation.

- The potential for generating revenue streams in TCI spans both marine and terrestrial environments, categorised into four main types: payments for ecosystem services; user fees; supply chain fees; and sustainable enterprises. These revenue sources encompass payments from beneficiaries of ecosystem services, access fees, sustainability premiums within supply chains, and environmentally conscious business ventures, all of which have the potential to contribute to the preservation and enhancement of TCI's natural environment.

Natural capital revenue streams

Concept of ecosystem service markets

Fundamentally, any investable natural capital project in TCI should be able to demonstrate financial viability and the potential for a reasonable return on investment. In general, the primary criteria that define whether a natural capital project is financially viable or not is the availability and quality of its revenue streams and the ability for these to generate a surplus above its setup and operational costs. Revenue streams can also serve to diversify sources of funding and create sustainable models for the protection and enhancement of natural capital. When assessing a potential investment decision, an investor will initially seek to confirm that the project has the potential to generate reliable revenue stream(s) that can help to secure repayable investment and provide a target rate of return based on the perceived level of risk taken. A given project may rely on a single or multiple revenue streams stacked together into a more complex models to target a minimum expected level of return.

Nature-based interventions (e.g. the protection of fisheries, mangrove planting, habitat creation or restoration) can produce a range of revenues through sale of commodities (e.g. seafood, aquaculture products and agricultural goods), service provision, rental income, and payment for ecosystem services (e.g. carbon or biodiversity credits). The generation of revenue streams from ecosystem service

provision creates the potential for an ecosystem service market, where an ecosystem service or services can be quantified and, equally, there are buyers and sellers of the quantified ecosystem service. So too, the development of ecosystem service markets can facilitate the development of further revenue streams as ecosystem service benefits are traded.

Ecosystem service markets can be voluntary, or compliance driven, typically mandated through regulation, or a combination of both depending on the incentives and regulations that drive or govern them. Examples of voluntary markets include voluntary carbon and biodiversity credits. Examples of compliance driven markets could include tourism levies or biodiversity compensation payments from developers. In both cases, the markets are facilitated by payments in return for the provision of ecosystem services, which in turn can be delivered through a range of interventions (Ecosystem Marketplace, 2015).

Overview of natural capital revenue streams

There is potential to generate multiple revenue types in from both marine and terrestrial environments in TCI. These can be split into four broad categories:

- **Payments for ecosystems services:** When beneficiaries or users of ecosystem services (e.g. coastal defence, biodiversity and carbon sequestration) are willing to pay for the provision of that service, it creates a revenue stream which can support the cost of preserving or restoring ecosystems (Fripp, 2014).
- **User-based fees:** A sum of money paid as a necessary condition to gain access to a particular service of facility or the ability to provide a service or facility (e.g. levies, taxes and fees) (Chung et al., 2011).
- **Supply chain fees:** Where there is a willingness to pay for sustainability within a supply chain (e.g. fisheries supply chain), a premium or fee can be applied on a volume or per product basis generating additional revenue which can be deployed to improve the sustainability of the marine and terrestrial environment.
- **Sustainable enterprises:** Entities that rely on and generate revenue based on the sustainability and health of the environment (e.g. tourism) can enable improved business practises to abate threats to natural environments and support livelihoods (Zu, 2013).

A summary of these revenue types and how these in turn can lead to the generation of revenue streams is provided in Figure 5.

Revenue Type	Ecosystem Services	Example Revenue Streams	Buyers
Payment for ecosystem services	• Carbon sequestration & storage • Biodiversity • Coastal protection • Surface hydrology	• Carbon credits • Risk mitigation & avoided costs • Biodiversity payments • Water quality payments • Natural flood management	• Corporate offsetting • Government • Developers • Infrastructure provider • Insurance companies
User-based fees	• Local recreation • Tourism	• Tourism & licensing fees	• Tourists • Tourist operators
Supply chain fees	• Fisheries • Agriculture • Commodities	• Volume-based fees	• Off-takers
Sustainable enterprises	• Fisheries • Agriculture • Commodities • Local recreation • Tourism	• Sustainable aquaculture & fisheries • Sustainable agriculture • Sustainable timber • Sustainable tourism • Other sustainable enterprises	• Developers • Infrastructure provider • Consumers

Figure 5 Illustrates the identified revenue streams from TCI ecosystem accounts: Sources: Finance Earth (2023) and eftec (2023)

Revenue streams from natural capital in TCI

Payments for ecosystem services:

The natural capital landscape in TCI may offer the potential to generate revenue through the sale of ecosystem services such as carbon sequestration (through carbon credits or offsets), biodiversity payments (through biodiversity credits or compensation/mitigation payments) and natural coastal defence (risk mitigation and avoided costs). These services require robust scientific evidence and clear metrics to establish standards for quantifying and verifying the outcomes. Ensuring the credibility of outcomes involves addressing the concept of “additionality”, wherein credits are only generated through ecosystem restoration or creation efforts that would not have happened otherwise without the incentive. Although the potential for payments for ecosystem services should be explored, TCI have already made significant steps to improve environmental outcomes compared to that of other states. As a result, environmental enhancement policies are already established in certain areas and, as such, “additionality” may be difficult to achieve. Other incentives may have to be offered to generate further environmental uplifts in the region.

Carbon credits

Carbon sequestration or avoided emissions can be quantified as carbon credits through rigorous process of measurement, verification and certification. This involves calculating the amount of carbon dioxide (or its equivalent in other greenhouse gases) captured or prevented from being released into the atmosphere. Verified methodologies and standardised protocols are used to ensure accuracy and consistency in the calculations. Once verified, these carbon credits can be sold to buyers who seek to offset their emissions and contribute to climate mitigation efforts. This is mainly on a voluntary basis, however there are some compliance carbon markets that do support nature-based solutions. For example, California's cap-and-trade program has spurred climate action in the forest sector through offsets, directing auction funds towards various nature-based solutions, such as preventing deforestation or promoting reforestation (The Nature Conservancy, 2020). Nature-based projects can deliver wider societal benefits like employment, skills development and community empowerment through active involvement in decision-making and resource management.

TCI is known for its diverse marine and terrestrial ecosystems. Extensive coverage of tropical-subtropical dry forests and shrubs, intertidal forests and shrublands and seagrass meadows could offer potential for carbon sequestration if there are opportunities for restoration or evidence of significant threats to these ecosystems. For example, mangroves span roughly 24,000 ha; however, their extent in TCI has decreased by 4,400 since 1996 (Global Mangrove Watch, 2023). Protection and restoration of mangrove habitats present the opportunity for blue carbon projects, specifically as they demonstrate a proven capacity to sequester and store carbon at a rate 10 times more efficient than terrestrial carbon (NOAA, 2022). Additionally, seagrass habitats in TCI have been shown to be declining globally (Baker et al., 2015) and as such hold untapped restoration potential for carbon sequestration, albeit the seagrass carbon market is in the early stage of development. Pioneering initiatives like the VCS seagrass methodology by Verra and feasibility studies conducted by organisations such as TNC in Chesapeake Bay, Virginia, are actively exploring the commercialization of carbon credits from seagrass (ekos, 2022).

Biodiversity payments

Globally, over 100 countries have established biodiversity laws or polices that mandate or allow the use of biodiversity offsets (OECD, 2016). Biodiversity remediation payments serve as compensation mechanisms for impacts such as property and infrastructure development on natural ecosystems, with a 'polluter' like a property developer paying for biodiversity mitigation, primarily aiming for a 'no net loss' outcome. This generates a revenue stream for habitat enhancement projects located near to the development.

Companies are facing growing pressure to counteract the adverse effects on the environment though compensation. Several initiatives are being developed to quantify the biodiversity benefits of ecosystem protection and restoration and enable the sale of biodiversity credits to voluntary buyers. However, the establishment of standards and metrics for assessing biodiversity value and issuing credits is still in its infancy and market demand is uncertain. The biodiversity registry Biotrust has revealed its partnership with five certification standards, encompassing 40 projects aspiring to issue credits in Colombia within the next three years. Presently, the sole active project is El Globo Natural Reserve, which has successfully issued 62,000 credits through Terrasos (Carbon Pulse, 2023). These are priced at $30 per credit, representing small plots of 10m^2 of forest (ClimateTrade, 2022) and are generally bought by individuals (Carbon Pulse, 2023).

Risk mitigation and avoided costs

As demonstrated above, TCI hosts diverse and vibrant coral reefs, seagrasses and mangroves. These ecosystems collectively serve as highly effective and interconnected natural coastal defences, providing essential protection against coastal erosion flooding and damage from natural disasters. TCI benefits from some of the world's healthiest photic coral reefs (Wolfs Company, 2019), which act as barriers, absorbing and dissipating wave energy and reducing the impact of wave impact on shorelines. TCI is highly vulnerable to natural disasters, in particular hurricanes which have a devastating impact on the country's economy. For example, in 2017 the county was hit by Hurricane Irma and Hurricane Maria, with damages estimated at $289 million, representing c.26% of GDP in 2017 (gov.tc, 2021; ECLAC, 2018). Protecting and restoring marine ecosystems such as mangroves, seagrasses, saltmarshes and coral reefs helps provide coastal protection against the impacts of erosion, storm surges and flooding. Coastal defence mechanisms also benefit coastal infrastructure, such as hotels and restaurants, protecting local businesses and livelihoods from the impacts of natural disasters.

Natural coastal protection through healthy marine ecosystems, such as mangroves and coral reefs, has seen the development of innovative coastal management and risk mitigation funding mechanisms. One such mechanism is parametric insurance. TNCs coral reef insurance is an example of parametric insurance for the protection of natural capital in the Caribbean. The policy is purchased by the Coastal Management Zone Trust who allocates funds from private and public entities into coral reef conservation and the purchasing of parametric coral reef insurance. The policy is triggered when winds reach over 115mph releasing payments that are used for coral reef restoration work. As such, the damage to coastal infrastructure is minimised and repair costs avoided (Green Finance Institute, 2018). Work by AXA, TNC and the

University of California is also looking at how insurance can further support mangrove restoration, reducing future risk and build resilience (The Nature Conservancy, 2020).

Water quality payments and natural flood management

Due to intensive resource extraction for the purposes of economic growth, many water-scarce OTs, including TCI, are increasingly vulnerable to acute shocks in freshwater availability. The small land area of TCI means that there are relatively few aquifers and that the surface water circulation cycle is short, limiting the availability of groundwater (eftec and JNCC, 2022). Competing demands of agriculture, consumption, urbanisation and tourism also drive an increasing pollution problem in many OTs, reducing water quality and supply (Gheuens, Nagabhatla, & Perera, 2019). So too, losses in wetland habitats arising from development reduces natural rainfall absorption capacity and displaces floodwater, which increases the likelihood of additional detrimental impact from heavy rainfall. Due to intensive resource extraction for the purposes of economic growth, many water-scarce OTs, including TCI, are increasingly vulnerable to acute shocks to freshwater availability (United Nations, 2021). Water scarcity poses a significant risk to both essential drinking water supply and vital economic activities, particularly agriculture, in addition to freshwater-based environmental services like flood control, biodiversity conservation, and recreation.

There may be a number of ways to generate revenue streams from the enhancement of water quality and mitigation against flood risks in TCI. For instance, natural flood management (NFM) involves measures that improve the ability of nature to regulate water flow and reduce flood risk. In addition, converting hard surfaces to soft and landscaped habitats can reduce the speed of water run-off and increase permeation though the ground, thereby reducing the risk of flash flooding and sewer overflows. So too, water quality or nutrient management payments can be made in return for interventions that reduce pollution and nutrient run-off into water systems.

User-based fees:

User-based fees represent a revenue type generated by charging individuals or entities for using or providing specific services or resources. These include access to conservation areas, such as MPAs, or permissions to participate in activities such as fishing. This approach involves charging users, such as tourists, industries, or stakeholders benefiting from ecosystem services, a fee in exchange for accessing, providing or utilising these resources. The revenues generated from these fees can then be directed towards conservation, restoration and sustainable management of natural capital, ensuring a self-sustaining cycle of investment.

Economically, TCI relies heavily on tourism, with an annual contribution of c.70% of GDP in 2018 (worlddata, 2023) with $38 million coming directly from ecosystem services (see Table 8). User-based fees are already in use in TCI, with tourist accommodation, restaurant and tourism-related services taxed at a rate of 12% (GSL, 2023). Overall, they present a promising avenue for revenue opportunities and natural capital investment within the tourism and recreation sectors in TCI.

Tourism fees

Fees paid by tourists for accessing and utilising a region's diverse and pristine environments, such as marine protected areas and national parks, go towards supporting the management, maintenance and conservation efforts in these areas. These can include tourist entrance fees and activity fees for recreations such as snorkelling, scuba diving and fishing, which create on-going revenue for the conservation, monitoring and regulation of MPAs. In 2000, the Turks and Caicos Islands (TCI) instituted a National Conservation Fund, funded by a 1% tax on tourism-related services and accommodation. Unfortunately, as a result of economic crises and concerns with ringfencing, the Trust Fund was dissolved by the British Foreign Office in 2008 to address accumulated national debts. Since then, no substitute mechanism has been implemented, leaving a gap in sustainable conservation funding (Sheppard, 2019).

Licensing fees

Permit and licensing fees are required in specific instances to acquire permission for participating in designated activities within conservation areas. Certain businesses providing services may also be obliged to pay fees for permits within these zones, covering activities like fishing and tourism. The fee structure is contingent upon variables such as business type, operational scale and the precise regulation the conservation area. For example, in Belize, to engage in legal fishing activities, obtaining a fishing license is essential. License fees cost BZ$20 for a daily license and BZ$50 for a weekly license. For an annual license priced at BZ$100, acquisition requires a direct visit to the Coastal Zone Management Authority and Institute (Rhys, 2014).

Supply chain fees

A supply chain fee model operates through payments made by participants within the supply chain to achieve agreed-upon sustainability goals. This model can be structured in various ways, but its fundamental concept involves an additional fee added to the price of a product within supply chain, in exchange for meeting specific criteria or adopting new practices. It also enables the integration of sustainability costs more seamlessly into the end product's overall cost.

Supply chain fees revenues could be applied to commodities produced on TCI where there are pressures on the supply chain, for example fisheries. Fisheries play a substantial role within TCI economy contributing $28 million per year (see Table 5). It is estimated that globally 60% of the fishing industry is sourced from unsustainable practices (UNEP, 2019). An estimated additional $60 bn could be generated globally through sustainable fishing practices (The Nature Conservancy, 2021). Supply chain fees present the opportunity to engage with supply chain actors and assess the willingness to collaborate and pay a product premium fee to supporting the transition to sustainable supply chains. For example, a partnership between WWF and Finance Earth has developed a Fisheries Improvement Fund which generates revenues based on a volume-based fee mechanism charged to supply chain actors for marine product purchased, in order to support the transition to sustainable fisheries globally (Finance Earth, 2023).

Sustainable enterprises

Developing sustainable enterprises can help support the livelihoods of local populations whilst supporting the restoration and protection of natural capital efforts within TCI. There are a range of enterprise opportunities that exist throughout TCI and wider region that include ecotourism, aquaculture, sustainable agriculture and renewable energy.

Sustainable energy

There are a range of opportunities to capitalise on renewable resources like solar, wind and hydro power to generate sustainable energy. Clean energy generation reduces environmental impact and dependence on fossil fuels energy, contributing to long-term ecological health. Simultaneously, the sale of excess energy or participation in green energy markets creates a consistent revenue source, promoting economic stability while aligning with environmental targets, such as Nationally Determined Contributions.

As part of its 'Vision 2040' TCI has pledged to achieve 33% renewable energy by 2040 (globalotec, 2023). TCI has substantial potential for solar, hydro and wind energy. In particular, the regions amble sunshine offers significant solar energy potential (Energy Snapshot Turks and Caicos, 2020). Additionally, TCIs coastal location lends itself to harnessing wind energy from consistent ocean breezes, providing energy for wind turbine installations. Furthermore, the presence of water bodies offers hydroelectrical potential (Energy Snapshot Turks and Caicos, 2020). However, the national electricity supply is under the control of a monopoly held by Fortis, operating under a 20-year contract that grants the exclusive authority over electricity supply and distribution in the region. Past initiatives from Fortis, such as UORE, aimed to integrate solar power by allowing Fortis to lease rooftop space for solar panels in

exchange for reduced tariffs (FortisTCI, 2021). More recently, Fortis has announced a $8 million investment to establish the nation's first solar plus battery microgrids (FortisTCI, 2023). However, as of 2022, renewable energy still only represented c.2% of power consumer in TCI (Visit Turks and Caicos Islands, 2023). As such, there is a significant scale of opportunity for renewable energy in TCI, however, this will require a collaboration between Fortis and the government.

Sustainable agriculture, fisheries and aquaculture

Like many OTs, TCI is becoming increasingly vulnerable to environmental externalities as a result of exploiting fragile natural resources for economic growth. In particular, there has been an emerging trend towards agricultural expansion, particularly in a handful of export-orientated crops as part of the economic development strategy from the government of TCI (UN, 2021). Enhancing agriculture and fishing practices provides an opportunity to improve the livelihoods for a significant portion of the population in TCI. Despite only ~1% of land being used for agricultural purposes, approximately 20% of the labour force in TCI are employed within agriculture or fishing (CIA, 2023).

Aside from tourism and financial services, fishing is one of the largest sources of employment for the people of TCI (CIA, 2023). Sustainable aquaculture and fisheries is a growing sector in the Caribbean region and where done well, can deliver multiple revenue opportunities while supporting a healthy marine environment. Improving fisheries and aquaculture can generate various revenue streams through sustainable practices, value-added products, and market expansion. For example, enhancing fishery management, stock assessment, and sustainable fishing practices can lead to greater yields or catches, resulting in increased sales of fish and seafood products.

In addition, there are multiple potential opportunities to generate revenues from ecosystem services on farmed land in TCI today, from regenerative agriculture, biodiversity-focused conservation measures and water quality management. Uptake of regenerative agricultural techniques (such as reduced fertiliser use and reduced soil tillage) can be encouraged through providing outcome-based payments in return for outcomes related to carbon emissions, biodiversity conservation and improved water quality. Furthermore, incentives (such as improved access to finance) can be provided to encourage investment in technologies such as those that facilitate precision and vertical agriculture. These initiatives could be implemented on a targeted and aggregated basis so as to improve food security and nutrition for the people of TCI and the livelihoods of farmers, in addition to building new skills and encouraging knowledge transfer.

Sustainable tourism

TCI, known for its pristine beaches, crystal-clear waters, and diverse marine life, offers significant opportunities for revenue generation through sustainable tourism. With eco-tourism initiatives already in place across TCI as in South Caicos (East Bay Resort, 2023), there is potential for initiatives to be scaled across the islands. Eco-tourism is a rapidly growing industry across the world, worth approximately $300 billion in annual revenues in 2019 and predicted to double to 2025 (McKinsey, 2020).

6 Financing mechanisms for natural capital

Summary

- A range of different capital types are available for financing initiatives aimed at preserving and enhancing ecosystems and the associated services they provide. Capital types can be repayable or non-repayable, with the suitability of each dependent on the specific characteristics of the natural capital project in question, its revenue- and return-generating potential, and the risk appetite of both investors and investees.
- A number of barriers exist for financing natural capital projects in TCI and other OTs, including a lack of reliable cashflows, small-scale project sizes, political and climate risks, limited local skill availability and a lack of financing mechanisms being available.
- To address these barriers, a range of financing mechanisms can be used to aggregate funding instruments and deliver investment across a portfolio of projects. A number of financing mechanisms can be explored for use in TCI, including incubators and accelerators, Conservation Trust Funds (CTFs), blended finance mechanisms, and green bonds.

Overview of capital types for natural capital

A range of different capital types are available for financing initiatives aimed at preserving and enhancing ecosystems and the associated services they provide. Capital types can be repayable or non-repayable, with the suitability of each dependent on the specific characteristics of the natural capital project in question, its revenue- and return-generating potential, and the risk appetite of both investors and investees. An overview of capital types available for natural capital projects, covering grants, equity and debt, is provided in Figure 6.

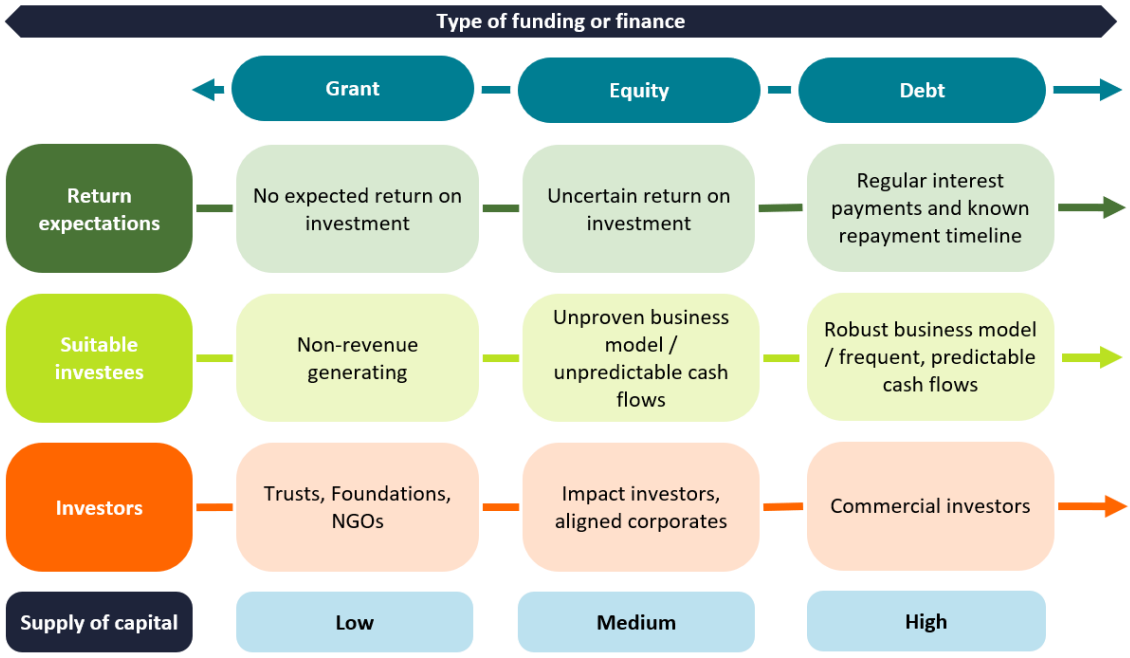

Figure 6 provides an overview of capital types for natural capital projects. Sources: Finance Earth (2023)

Grants are funds that are usually provided by governments, philanthropic organisations, or international agencies to support natural capital projects. Grants typically provide funding without the burden of repayment, making them ideal for early- or pilot-stage projects and those with high social or environmental value but limited revenue or cashflow generation potential. The majority of funding for natural capital projects in TCI is currently sourced through public and third-party grants, such as those from the Darwin Initiative for biodiversity conservation (Turks and Caicos Weekly, 2023). Grants can also be repayable under certain conditions, such as if the project generates a certain level of return or achieves certain social or environmental goals. Repayable grants have been used for sustainability initiatives across the world. For example, Sustainability Victoria deployed $1m of repayable grants under their Social Impact Investment for Sustainability Fund to community-owned clean energy project. The grant proceeds were to be repaid within a 5-year period following the generation of a certain level of income or cost savings from projects (Sustainability Victoria, 2022).

Equity financing involves selling ownership shares in a project in exchange for capital. Equity investors become partial owners in a project or entity and benefit from any increase in the value of the asset or company, and they might receive dividends or distributions if the project or entity generates profits. Although equity investors may expect higher rates of return given higher levels of repayment risk, the use of equity

financing can help to unlock larger funding amounts, providing capital for scaling up or expanding natural capital projects (Cambridge, 2023).

Finally, debt financing involves borrowing funds with a commitment to repay the principal amount plus interest over a specified period. Debt is often suited to projects with predictable cashflows and so may be less suited to natural capital projects with uncertain return profiles.

It is also possible to use a blended financing approach, combining grants, equity and debt. By combining equity with grants and debt, natural capital projects can attract private investors who seek both financial returns and social or environmental impact. Equity investment can support the project's long-term growth and sustainability, while the grants and debt mitigate some of the risks associated with investing in such projects. By blending different funding sources, natural capital projects can gradually transition from dependency on grants to more self-sustaining financial models. Blended financing remains underutilised in nature-based solutions; however, adoption is becoming more widespread. For example, the Global Fund for Coral Reefs (GFCR) was launched in 2020, bringing together grant funding alongside debt and equity capital from private and institutional investors in order to mobilise action and resources to protect and restore coral reef ecosystems. The GFCR currently operates across coral reefs around the world, including those in OTs (Global Fund for Coral Reefs, 2023).

Barriers to financing natural capital

In accordance with findings from UNEP, the World Economic Forum and The Economics of Land Degradation (2021), the key barriers to investment in natural capital projects in TCI and other OTs include:

- **Lack of reliable cashflows:** Natural capital projects may face cashflow challenges due to limited revenue-generating opportunities. For instance, projects focused on habitat creation or coastal restoration may not have immediate revenue streams due to underdeveloped offset or mitigation markets, making it challenging to attract private sector investment.
- **Lack of suitable funding mechanisms:** There is currently a lack of funding mechanisms that align with the unique needs of natural capital projects, especially those without immediate revenue generation opportunities. Due to the early stage nature of natural capital markets globally, a provision of more patient, flexible capital combined with aggregation mechanisms may be required.
- **Small-scale project sizes:** Many natural capital projects in OTs may be smaller in size compared with those in larger nations in terms of the extent of area involved or the potential for benefit generation, making

them less attractive to larger private investors seeking economies of scale through reduced transaction costs.

- **Long payback periods:** Some natural capital projects, such as those related to biodiversity enhancement and coastal resilience, may have longer payback periods (e.g. 10+ years). This can deter investors seeking shorter-term returns.
- **Political and legal uncertainties:** The absence of well-defined policy backing and past challenges related to political impropriety can introduce an element of unpredictability for investors in TCI, leading to their reluctance in engaging with extended projects that extend across various political cycles (The Guardian, 2009; JNCC, 2015).
- **High vulnerability to effects of climate change:** TCI is particularly vulnerable to the impacts of climate change, including rising sea levels, extreme weather events, and coastal erosion (World Bank, 2023). The potential risks associated with these vulnerabilities can deter investors and lenders from financing projects in TCI.
- **Limited local skills base:** As a whole, there is limited technical expertise and resources to develop and implement complex projects related to natural capital investments in TCI, as highlighted by previous research from Invest Turks and Caicos (Invest Turks and Caicos, 2017).
- **Limited data availability:** Incomplete or unavailable data on the value of natural capital in TCI and the potential returns on investment can make it difficult for investors to assess opportunities accurately.
- **Lack of sufficient monitoring and verification:** The absence of robust monitoring and verification mechanisms within natural capital projects in TCI can make it difficult for investors to assess the actual environmental and financial impact of their investments.

Overview of financing mechanisms for natural capital

Addressing the aforementioned barriers will require a multi-faceted approach, and unlocking opportunities for natural capital investment in TCI will involve leveraging various financial mechanisms and incentives. Evidence suggests that potential natural capital projects in TCI may have cashflow profiles that are unpredictable due to their nascent stages (JNCC, 2015). This means that many of them may be unsuitable for purely debt-based financing due to repayment and return uncertainties; so too, they may also struggle to attract mainstream private investment without some means of reducing these risks to a certain extent. To address this, a range of financing mechanisms can be used to aggregate funding instruments and deliver investment across a portfolio of projects. A number of financing mechanisms have been developed and used globally, which can be explored for applicability in TCI. These include incubators and accelerators, Conservation Trust Funds (CTFs), blended finance mechanisms, as well as green bonds.

Incubators and accelerators can be used to provide technical assistance and capacity building to develop and scale a range of nascent business ventures and pilots (Scottish Government, 2022). This mechanism is typically most suited for testing early-stage and higher risk ventures to develop 'proof-of-concept' business models which can then be replicated and scaled. Examples of accelerator funding include the Natural Environment Investment Readiness Funding in England, UK, where grants of up to £100,000 were provided to prepare nature recovery projects for private investment (UK Government, 2022).

In addition, as highlighted by JNCC (2017), Conservation Trust Funds (CTFs) have been implemented in nearly all OTs in the Caribbean, as well as regionally as with the Caribbean Biodiversity Fund (2023) and the Dutch Caribbean Nature Alliance (DCNA) Trust Fund (DCNA, 2023). CTFs have the ability to attract funding from a range of sources to be used for different purposes, with the ability to attract funding from a variety of streams such as government budgets, endowments, grants and donations, and debt (Bladon et al, 2014). They tend to be independent from government influence, often having greater freedom to define investment objectives. In addition, they can often serve as a platform to bring together different stakeholders and networks with various capabilities and interests from across public and private sectors.

Blended finance mechanisms, as discussed above, can be a useful tool in combining different types of capital to mitigate risks through public or philanthropic funds, thus allowing for the crowding in of private finance. The use of blended finance is still focused within the more developed energy, infrastructure and financial service sectors; however, its adoption is growing with nature-based-solutions (WWF, 2021).

Finally, blue and green bonds can be implemented for financing marine and terrestrial conservation efforts, respectively. Blue bonds are modelled on green bonds, which have been implemented at scale over the past decade. However, blue bonds have only been issued by a handful of countries and financial institutions, and remain in their nascency (United Nations, 2021). Green and blue bonds are becoming an efficient way to raise capital for projects at scale; however, they tend to target larger, cashflow generating projects, and are therefore only a solution for projects that are investment ready.

In summary, various new financing mechanisms have emerged over recent years, offering opportunities for scaled and coordinated financing for natural capital projects in TCI. Initiatives such as accelerators and venture builders have become crucial in supporting local community enterprises and creating a pipeline of investment-ready projects. So too, debt-for-nature swaps, although complex in structure, can be used to fund initial project costs. Blended finance represents a key opportunity to attract more private funding for natural capital projects yet remains underutilised as a whole.

Blue and green bonds offer a chance to finance a wide range of projects; however, due to uncertain and volatile incomes from nascent business models, combining them with more stable projects via a CTF or other fund structure may be necessary.

Opportunities related to the deployment of these mechanisms in TCI will be explored further as part of the development of the NCIP for TCI.

7 Conclusion

Summary of findings

As the Background Study demonstrates, the most significant benefits in terms of stock value are currently generated from natural capital assets in TCI relating to **tourism**, **carbon regulation** and **coastal protection**. Seagrass meadows and coral reefs dominate TCI's underwater habitats, contributing to fish stocks, carbon regulation, coastal safeguarding, and tourism. On the land and coastline, grasslands, saltmarshes (like salinas), mangroves, and tropical forests are anticipated to offer notable benefits such as carbon capture, coastal protection, hydrological control, local recreation, and tourism.

However, TCI's natural assets face a multitude of threats such as habitat destruction, overfishing, and pollution, resulting in negative impacts on both livelihoods and the environment. Adequate funding for natural asset management is lacking, and additional funding sources, including private finance, are needed to bridge the funding gap to sustainably protect and restore TCI's natural capital.

A range of potential opportunities were identified to unlock long-term diversified revenue streams for natural capital in TCI based on emerging ecosystem service markets. A review of natural capital assets in TCI highlighted potential revenue streams, including payments for ecosystem services, user fees, supply chain contributions, and sustainable enterprises, presenting a diverse range of opportunities to bridge funding gaps for project delivery and long-term maintenance. In accordance with findings from UNEP, the World Economic Forum and The Economics of Land Degradation (2021), there are a number of key barriers to investment in natural capital projects in TCI and other OTs. These include uncertain cashflows, underdeveloped markets, long payback periods, a prevalence of small projects as well as a lack of local expertise.

Evidence suggests that by employing financing mechanisms such as incubators, accelerators, Conservation Trust Funds (CTFs), blended finance approaches, in addition to blue and green bonds, it may be possible to unlock a pathway towards robust and viable funding for initiatives aimed at preserving and enhancing natural capital in TCI. Ultimately, financing mechanisms should be designed based on the underlying revenue streams of natural capital projects, and the applicable regulatory environment in TCI. This unlocking of financial support, combined with the establishment of ecosystem service markets, has the potential to drive conservation efforts, boost sustainable economic growth, and ensure the long-term health and preservation of TCI's precious ecosystems.

Key gaps

Further work is needed to enhance ecosystem accounts and create marketable proposals for ecosystems. Not all habitats or species provide uniform ecosystem services; differences in factors like carbon sequestration rates and seagrass species benefits must be considered. The current accounts lack a comprehensive range of condition indicators for natural capital assets, requiring additional data sources, like species counts, for investment planning. The accounts do not determine if specific environmental actions in TCI generate marketable revenue. While evidence generally supports investing in ecosystem restoration, the economic and financial outcomes are complex, as shown in studies by De Groot et al. (2012), Rao et al. (2013), Sinclair Stewart et al. (2022), and eftec (2023).

There is also a general lack of historical evidence and analysis of information on current natural capital projects and initiative from the historical evidence in TCI, which limits the potential to identify a potential project pipeline and its stage of development. Primary research in the form of stakeholder engagement will be carried out in subsequent stages of the project to identify the maturity of revenue streams and markets in TCI and subsequently the suitability of associated financing mechanisms.

Next steps

This Background Study constitutes the first step of this project to develop a NCIP for TCI. Subsequent stages will include a socioeconomic survey analysis, business attitudes survey, options assessment and a final technical report.

Specifically, future research efforts will concentrate on assessing the maturity of revenue streams, potential project pipeline opportunities and suitable financing and aggregation mechanisms to inform the development of a NCIP. Opportunities will be assessed against key criteria to refine opportunities and highlight risks and mitigating factors for investment and delivery. Additionally, the further research will focus on identifying effective and targeted means to promote capacity building and collaboration among government entities, businesses, and communities to drive natural capital preservation and a broad-based economic recovery in TCI post-Covid 19.

Glossary

Term	Definition
Aggregator	A vehicle that packages together multiple similar investments to increase the transaction size and deliver cost efficiencies .
Biodiversity	The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.
Biodiversity offsets	A measurable nature conservation outcome from actions designed to compensate for adverse biodiversity impacts arising from project development, after appropriate prevention and mitigation measures have been undertaken.
Blended finance	Blended finance is a financing approach that involves the strategic use of public or philanthropic funds to attract private investment for development projects or initiatives. In blended finance, different types of investors pool their resources together to fund a project, including commercial investors, development finance institutions, and donor organisations. Blended finance can take many different forms, such as concessional loans, revenue guarantees, or equity investments. The goal is to create a mix of financing that balances risk and return for all parties involved, while also achieving positive social and environmental outcomes.
Carbon credit	A tradeable security that corresponds to one tonne of CO_2 equivalent (tCO_2e) which can be purchased on voluntary or regulated carbon markets.
Carbon offsets	A method of compensating for emissions of carbon dioxide, or other greenhouse gasses, by funding equivalent carbon dioxide saving elsewhere.
Ecosystem	The complex of living organisms, their physical environment, and all their interrelationships within a particular geographic area.
Ecosystem services	The benefits that are obtained from ecosystems, including provisioning, regulating, cultural and supporting services.

Equity	Funds provided in exchange for an ownership interest and a share of profits based on project performance and the level of risk take.
Finance gap	The difference between finance supply and finance demand, also called funding gap.
Green finance	A structured financial investment created to ensure a beneficial environmental outcome.
Guarantees	An agreement that guarantees a debt will be repaid to a lender by another party if the borrower defaults .
Impact	The outcomes for nature and societies created by undertaking target activities (such as delivery of NbS). Impact can be positive (for example, mitigating climate change) or negative (for example, displacing local communities).
Investment	The act of providing capital in return for repayment and profit. Investment utilises repayable capital, unlike non-repayable capital typically provided by grant and philanthropic funders.
Marine Protected Areas (MPAs)	Marine Protected Areas (MPAs) are designated areas in the ocean or coastal waters that are managed and protected to conserve and sustainably manage marine ecosystems, biodiversity, and resources. These areas are established to achieve specific conservation goals, such as protecting sensitive habitats, preserving marine biodiversity, restoring degraded ecosystems, and supporting sustainable fisheries.
Natural capital	The environmental resources (e.g. plants, animals, air, water, soils) that combine to yield a flow of benefits to people.
Nature-based solution (NbS)	The actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.
Overseas Territories (OTs)	Overseas territories (OTs), also known as dependent territories or dependent areas, refer to regions or areas that are governed and administered by a sovereign state but are located geographically outside its mainland or core territory. These territories are considered an integral part of the governing state but are distinct in terms of their location, legal status, and often unique historical, cultural, or geographical characteristics.

Payment for Ecosystem Services (PES)	Monetary compensation for securing delivery of certain ecosystem services, where suppliers who manage the flow of services are paid by beneficiaries.
Project developers	The individuals, organisations, or businesses involved in designing and implementing nature-based solutions projects (e.g. woodland creation and peatland restoration projects).
Repayable grants	Funds disbursed with the expectation of repayment subject to project performance.
Sustainable Finance Mechanisms (SFMs)	Financing mechanisms or revenue sources that contribute to the overall goal of financial sustainability.

About the Consultants

Finance Earth is the UK's leading environmental impact investment boutique, providing financial advisory and fund management services across the natural and built environment. Finance Earth helps to create projects – and the investment vehicles to fund them – that balance positive outcomes for nature, communities and investors.

Finance Earth works in partnership with a broad range of clients including NGOs, government, social enterprises, foundations and aligned corporates to create investable environmental and social projects. At the same time, Finance Earth works with a range of investors to structure financial products that can accelerate the protection and restoration of nature.

The team currently manages over £50million of blended social and environmental impact funds and has designed over £500 million of impact investment structures.

Finance Earth is a wholly employee-owned social enterprise, with 51% of profits recycled into on mission activities and investments. Finance Earth is a trading name of Environmental Finance Limited, which is authorised and regulated by the Financial Conduct Authority (registration number: 831569).

Since its foundation in 1992, eftec has specialised in research on the economic value of natural capital assets and ecosystem services; selecting the appropriate economic evidence from the literature, and using such evidence in economic appraisal, evaluation, and natural capital accounts. eftec has a long track record of delivering natural capital evaluation, including identifying opportunities for enhancing natural capital, informing investment plans and aiding policymaking.

eftec's history on natural capital includes being one of the authors of the Natural Capital Protocol, producing the UK's Natural Capital Risk assessment with the Natural Capital Committee, and chairing the BSI panel that published the 8632 standard (Natural Capital Accounting for Organisations) in 2022. We have applied this technical knowledge in projects across many sectors, ecosystems and countries, including the Caribbean countries since 2017.

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Appendix 1

The evidence review undertaken as part of this work will use a rapid evidence assessment (REA) approach. It follows the Environment Agency, Defra and Natural Environment Research Council (NERC) guidance (Collins et al., 2015) which defines a REA as "a type of evidence review that aims to provide; an informed conclusion on the volume and characteristics of an evidence base, a synthesis of what that evidence indicates and a critical appraisal of that evidence" (p. xi).

The review is focused on financial mechanisms most relevant to TCI's natural capital and the socio-economic benefits it delivers. The evidence review will reflect the latest evidence on sustainable finance and market mechanisms and monetary valuation of TCI natural assets using the TCI ecosystem accounts.

The below table sets out our approach and the structure for the review.

Table 9: Evidence review process

Section	**Explanation**
Scope	The review scope covers: **Financial mechanisms that can be applied to a national natural capital (NC) investment plan for TCI.** **Evidence which explains how the value of natural capital**, and its various characteristics (e.g., time, space, distribution of beneficiaries) **can be included in TCI NC investment planning**. **Time period of source**: No set time period. Preference (i.e., assessment of accuracy and uncertainty) given to most recent literature, evidence and methods unless there are good reasons to suggest otherwise. **Geography**: priority will be given to evidence specific to TCI, though where evidence is lacking, other regional sources may be considered where evidence is deemed relevant and transferable to TCI in the given context.
Objective	Questions for review: · What are the monetary, ecological and societal benefits from natural environment and resources in TCI? · What is the scale of opportunity for investment in natural capital in TCI? · What is the scale of benefits realisable through increased investment levels?

Section	Explanation
	· What is the approximate investment need in natural capital in TCI? · What are the ecosystem service markets and revenue streams available from natural capital in TCI? · What are the key barriers to the development of ecosystem service markets in TCI? · What are the financial mechanisms that can be used to enable investment in TCI? What are some example case studies of ecosystem market participation and investment mechanisms relevant to TCI?
Evidence Search Strategy	<u>Evidence sources</u> For Stage 1 of the review, the priority sources of literature will be: • FE's report to the MMO on Sustainable Financing Opportunities for the Blue Belt Overseas Territories • TCI's national Ecosystem Account • The JNCC socio-economic and business attitudes survey • NC finance mechanisms in the Caribbean • JNCC documents relating to finance mechanisms In Stage 2 of the review, evidence will be gathered through online searches using the agreed search criteria from Stage 1 (see below). These are expected to be the below databases: • Google Scholar: https://scholar.google.com/ • Environmental Valuation Reference Inventory (EVRI): https://www.evri.ca/en • Ecosystem Services Valuation Database (ESVD): https://www.esvd.net/ • National Ocean Economics Program (NOEP) Non-Market Valuation: https://www.oceaneconomics.org/nonmarket/ Other evidence known to the review team, including from the bibliography of the aforementioned texts.

<table>
<tr><th>Section</th><th>Explanation</th></tr>
<tr><td></td><td>Search terms

Based on the Stage 1 review, the search terms will be:

<table>
<tr><th>Priority Search Terms</th><th>Extended Search Terms</th></tr>
<tr><td>Sustainable finance

Natural capital

Revenue stream

Payments for ecosystem service

Blue economy

Green Finance

Nature-based solutions

Economic value of [TCI natural assets]

Beneficiaries</td><td>Ecosystem services

Natural coastal defence

Carbon sequestration

Agriculture

Aquaculture

Mariculture

Market-based solutions

Temporal

Spatial variation</td></tr>
</table>
</td></tr>
<tr><td>Methods</td><td>Logging relevant information in the literature:

The evidence review will start by identifying a list of ecosystem assets and benefits within scope for this project (i.e., from the TCI 2020 ecosystem account) and reviewing financial mechanisms and case studies known to the project team. The review of financial mechanisms and examples of investment opportunities (i.e., case studies) will be refined by the list of benefits provided by TCI's ecosystem account.

The research team? will also review the other priority sources (see above).

Additional benefits not included in the accounts will be considered based on potential relevance for TCI (e.g., biodiversity). Potential relevance will be determined based on an iterative process during review of evidence known to the project team.

A set of search terms will be developed and used to systematically log and manage the additional literature search (see above). These will focus on key aspects of the literature which are of most importance and relevance for developing a TCI NCIP. It is not intended to be a systematic review of all benefits and investment types.</td></tr>
</table>

Section	Explanation
	The second stage of the review will follow a two-step process: **Step 1:** Log high-level summary information about the documents such as the author, year of publication, type of source, the keywords/phrases used to find it and the origin of the source (e.g., provided by JNCC or EVRI) for each document **Step 2:** Review documents which pass the screening criteria in more detail (see Inclusion and Exclusion criteria) From our review of the Evidence Sources (see Evidence Search Strategy), we will undertake the following approach to information collection. Develop an evidence log which captures the key information from each piece of priority evidence The evidence log will, in the first instance, document summary information of all evidence in FE's report and the TCI national Ecosystem Account, such as title, authors, and date of publication. The evidence log will also document key parameters of interest which will: - help answer the project questions, and - refine the key search criteria Of particularly interest and focus will be evidence, at both a physical and economic level, which describes: For economic data: The type of valuation method Range of monetary values (US$/ha/yr) of each benefit within scope. Where possible, US$/ha/yr. For physical flow data: Physical flow metric of the benefit within scope Range of physical flow of benefits (physical unit/yr). Where possible, physical unit/ha/yr i.e., including spatial element. The following characteristics of the benefits assessment: - The location of beneficiaries for each benefit - The temporal profile of the benefits over time - Which habitats deliver which key benefits - How these match up to financial mechanisms - The reliability and robustness of this evidence - Where there are data tables which describes the ranges of physical units and values over space, or are relevant

Section	Explanation
	for the purpose of describing variation, then these tables will also be recorded in the backing tabs of the evidence log. Data sources and methods of collection Confidence in robustness of the physical evidence
Inclusion and exclusion criteria	***Inclusion and exclusion criteria for benefits under scope*** <u>Inclusion</u> Literature that meets the scope set out above will be included in the review. <u>Exclusion</u> Literature which does not fit within the scope (see above) will not be included in the review. If the benefits do not meet the above criteria, then they will not be included in the review.

Appendix 2

This section presents evidence that was used in the 2020 ecosystem account (eftec, JNCC, 2022), including the asset register, confidence rating, and sources used.

Table 9 presents the communities and species data that are captured in the asset register.

Table 10: Ecological communities and species from the TCI 2020 Ecosystem Account

Asset	Category	Number
Count of Native Reptiles and Amphibians, classified by IUCN Red List Status	Total	17
	Critically Endangered	3
	Endangered	2
	Vulnerable	5
	Near Threatened	1
	Least Concern	2
	Not yet assessed	4
Count of Introduced Reptiles and Amphibians, classified by status	Total	13
	Invasive	8
	Naturalised	3
	Unknown	2
Bird richness, classified by status (#)	Total	210
	None	104
	Rare	101
	Near-threatened	2
	Introduced species	1
	Extirpated	1
	Extirpated Endangered	1
Flora count, classified by abundance (#)	Total	669
	Common	84
	Occasional	199
	Rare	113
	Unclassified	273

Source: TCI 2020 Ecosystem Account (eftec, JNCC, 2022)

Table 10 presents the description of confidence used in the ecosystem account. The confidence rating is based on the robustness of the evidence and assumptions used.

Table 11: Description of confidence used in the TCI 2020 Ecosystem Account

Level of confidence	Symbol	Description of confidence
Low	●	Evidence is partial and significant assumptions are made so that the data provides only order of magnitude estimates of value to inform decisions and spending choices.
Medium	●	Science-based assumptions and published data are used but there is some uncertainty in combining them, resulting in reasonable confidence in using the data to guide decisions and spending choices.
High	●	Evidence is peer reviewed or based on published guidance so there is good confidence in using the data to support specific decisions and spending choices.
No colour	●	Not assessed

Source: eftec, JNCC, 2022

Table 11 defines the terms used to describe the frequency of updates for each data source in the ecosystem account.

Table 12: Definitions of frequency of input data updates used in the TCI 2020 Ecosystem Account

Frequency	Definition
Annually	The source should be updated on an annual basis and the accounts should reflect the most up to date data.
As source is updated	The source is expected to be updated in the future (and the accounts should be updated when new data is available.
As new evidence becomes available	The source is not expected to be updated; a new source would be required to update this data input

Source: eftec, JNCC, 2022

Table 12 summarises the data sources used in the 2020 ecosystem account and the frequency of updates.

Table 13: Data sources used in the TCI 2020 Ecosystem Account by asset and benefit type and frequency of update

Category	Description	Primary source	Frequency of update
Assets			
Habitats	Terrestrial ecosystem map	Department of Environment and Coastal Resources (DECR) (2020a) TCI_HabitatMap_v220200416.	As source is updated
Habitats	Marine ecosystem map	The Nature Conservancy Caribbean Division (2020) Turks and Caicos Bethnic Habitat Map. Available at: https://storymaps.arcgis.com/collections/58321fb0f35f4659a1f508630d45c76c?item=1	As source is updated
Animal species	Richness of native reptiles and amphibians	Department of Environment and Coastal Resources (DECR) (2020b) Reptiles and Amphibians of TCI	As source is updated
Animal species	Richness of introduced reptiles and amphibians		
Animal species	Richness of birds	Department of Environment and Coastal Resources (DECR) (2020c) MasterspecieslistRWcommentsFeb	As source is updated
Animal species	Abundance of birds	Department of Environment and Coastal Resources (DECR) (2020d) Bird count checklist	As source is updated
Protected areas	Protected areas	Department of Environment and Coastal Resources (DECR) (2020e) Protected Areas	As source is updated
Benefits			
General	TCI GDP per capita	Statistics Department (2021b) National Accounts. Available at: https://www.gov.tc/stats/statistics/economic/10-national-accounts	Annually
General	TCI GDP deflator - inflation rate to 2020	Statistics Department (2021d) Inflation Rate. Available at: https://www.gov.tc/stats/statistics/economic/38-inflation-rate-2005-2017	Annually
General	TCI population	Statistics Department (2021a) Population. Available at: https://www.gov.tc/stats/statistics/social/5-population	Annually
General	TCI population projection	Statistics Department (2021a) Population. Available at: https://www.gov.tc/stats/statistics/social/5-population	Annually
Fisheries	Export quantity for Spiny Lobster, Queen Conch and Scalefish	Department of Environment and Coastal Resources (DECR) (2020f) Fisheries 2015 – 2019, spreadsheet; Department of Environment and Coastal Resources (DECR) (2017) Fisheries productivity 2012 – 2016, spreadsheet.	Annually
Fisheries	Price of Spiny Lobster, Queen		

Category	Description	Primary source	Frequency of update
	Conch and Scalefish		
Fisheries	Domestic quantity	Ulman, A., Burke, L., Hind, E., Ramdeen, R. and Zeller, D. (2015) Reconstruction of total marine fisheries catches for the Turks and Caicos Islands (1950-2012).	As new evidence becomes available
Fisheries	Tourist consumption		
Fisheries	Tourist number of meals		
Fisheries	Weight conversions (Spiny Lobster, Queen Conch, Scalefish)		
Fisheries	Imported quantity		
Fisheries	Number of land based arrivals	Statistics Department (2021c) Tourism. Available at: https://www.gov.tc/stats/statistics/economic/41-tourism	Annually
Agriculture	Weight of agricultural produce	Department of Agriculture (2018) Turks and Caicos Islands Farmer's Survey Report.	As source is updated
Agriculture	Price of each agricultural item	Department of Trade (2020) Supermarket prices, spreadsheet; primary research at local supermarkets	As source is updated
Coastal protection	Number of properties at risk	EnvSys (2017) Using radar based terrain mapping to model the vulnerability of 5 UK OTs. Prepared for the government of Anguilla.	As new evidence becomes available
Carbon sequest-ration	Carbon sequestered in ecosystems	Murray et al (2011) Green Payments for Blue Carbon Economic Incentives for Protecting Threatened Coastal Habitats; as cited in IUCN (2017) Blue carbon issues. Available at: https://www.iucn.org/resources/issues-briefs/blue-carbon; Alongi, D. M. (2014) Carbon sequestration in mangrove forests. Carbon Management, 3 (3), p.313-322. Available at: https://www.researchgate.net/publication/274116107_Carbon_sequestration_in_mangrove_forests	As new evidence becomes available
Carbon sequest-ration	Carbon prices	Department for Business, Energy & Industrial Strategy (BEIS) (2019) Green Book supplementary guidance: valuation of energy use and greenhouse gas emission for appraisal, Table 3. Available at: https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal	As source is updated
Tourism	Number of land based and cruise arrivals	Statistics Department (2021c) Tourism. Available at: https://www.gov.tc/stats/statistics/economic/41-tourism	Annually

Category	Description	Primary source	Frequency of update
Tourism	Number of cruise crew visits	Business Research and Economic Advisors (BREA) (2018) Economic Contribution of Cruise Tourism to the Destination Economies. Available at: https://www.f-cca.com/downloads/Caribbean-Cruise-Analysis-2018-Vol-I.pdf	As source is updated
Tourism	Proportion of cruise visitor onshore visits that include shore excursions (all Caribbean destinations)		
Tourism	Purpose of visit for overnight visitors	Statistics Department (2019) Departing visitors survey - September 2018. Available at: https://drive.google.com/file/d/1NctSGjNq6vUmgPfOYLEYNRPbuIq6rw05/view?usp=sharing; Statistics Department (2017) Departing visitors survey - March 2017	As source is updated
Tourism	Average length of stay for overnight visitors		
Tourism	Daily expenditure by main purpose of visits for overnight stays		
Tourism	Total number of dives	Nautilus Consultants Ltd. (2005). Economic Valuation of Environmental Resource Services in the Turks and Caicos Islands. Prepared for the government of the Turks and Caicos Islands.	As new evidence becomes available
Tourism	Diving expenditure		
Tourism	Cruise visitor and crew expenditure	Business Research and Economic Advisors (BREA) (2018) Economic Contribution of Cruise Tourism to the Destination Economies. Available at: https://www.f-cca.com/downloads/Caribbean-Cruise-Analysis-2018-Vol-I.pdf	As source is updated
Tourism	Factor of ecosystem dependence	Wolf's Company (2016). TCI Sustainable Finance Project – Phase 2: Tourism value of Nature in the Turks and Caicos Islands. Prepared for the government of the Turks and Caicos Islands.	As new evidence becomes available
Tourism	Estimate the value added by the tourism sector		
Local recreation	Number of local visits	eftec (2020) TCI Cultural Use of Coastal Ecosystems.	As source is updated
Local recreation	Expenditure of local visits		

Source: TCI 2020 Ecosystem Account (eftec, JNCC, 2022)

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