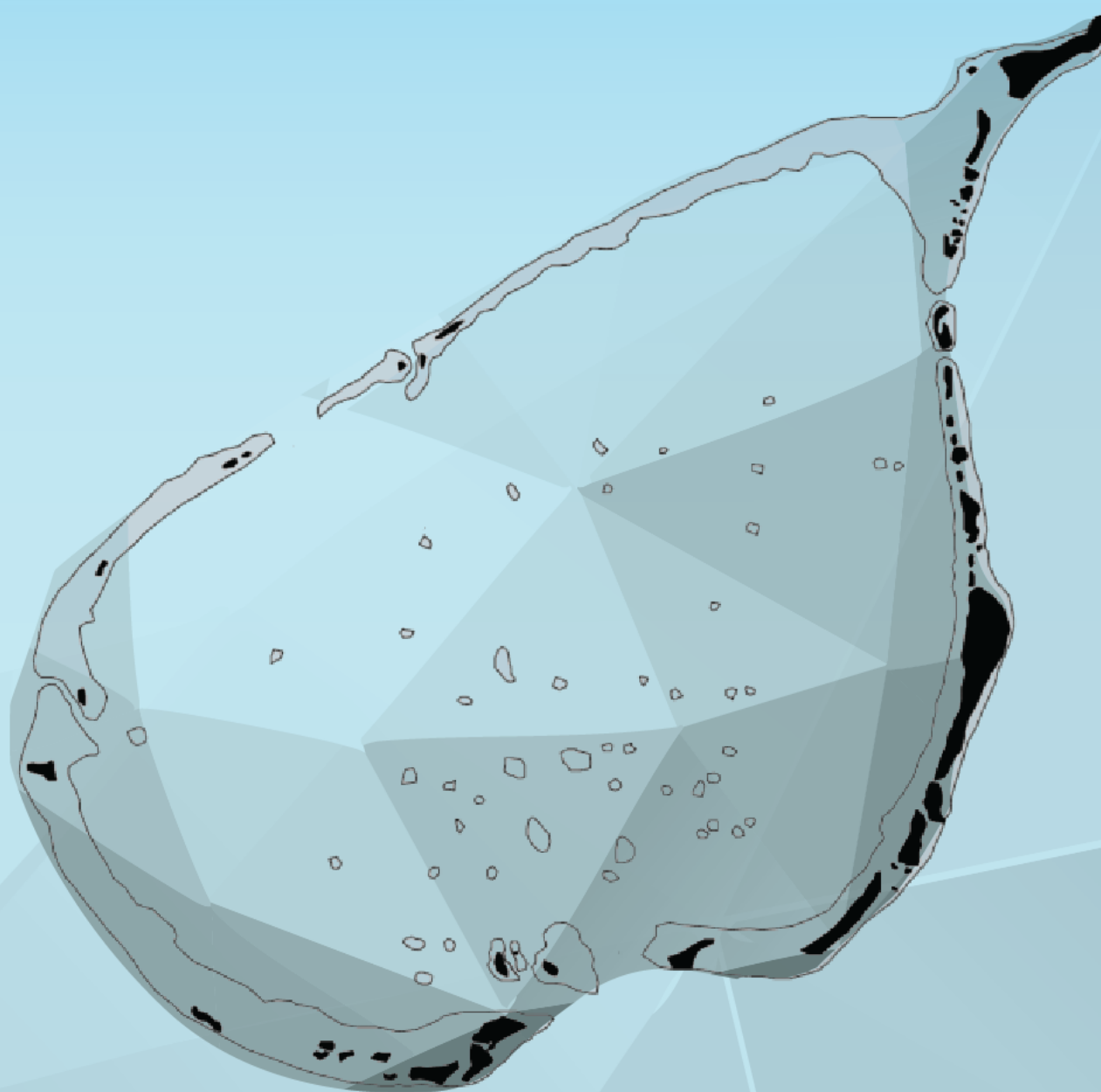


The first Natural Capital Accounts of the Maldives (Laamu Atoll)

High level summary report for decision makers



Ministry of Tourism
and Environment



ENDhERI



Global Ocean
Accounts
Partnership

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The report addresses the following deliverables:

- Economic valuation for selected NC of Laamu Atoll,
- NCA in accordance with SEEA EA based on agreed scope (compiled for 2 different years),
- Selected NC accounts of Laamu Atoll linked to the national accounts maintained and reported on by MBS,
- Documents developed for NCA implementation support – Guides and Operation manuals.

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Headline messages

Marine and coastal ecosystems in the Maldives provide a foundation for economic activities and coastal livelihoods. Through ecosystem services, these habitats play a crucial role both in climate change mitigation and adaptation strategies, while also contributing to community resilience and food security. Coral reefs, mangroves, and seagrass beds act as natural barriers protecting islands from storms and erosion, while also contributing to tourism and fishing industries. Marine ecosystems need to be recognized as the natural wealth (or capital) of the Maldives, which requires careful measurement and management to ensure long-term sustainability and maximize benefits for the Maldivian people.

Many efforts exist globally in valuing natural capital. Standards are needed to align with existing economic accounts and indicators maintained within the Maldives. Most analyses provide a snapshot of nature's contribution to society and the economy. A more informative understanding, however, requires clear definitions and repeat measures over time, much like how financial assets are assessed and managed. The UN System of Environmental-Economic Accounting (SEEA) and the Ocean Accounting Framework provide internationally recognized guidance for linking environmental and social data with existing economic indicators.

Standardized natural capital accounts support effective governance and increased access to sustainable finance. By integrating environmental and social information with economic data, accounts provide evidence for policies and evaluate their effectiveness over time. Accounts can support area-based strategic planning (e.g., marine spatial planning, marine protected area designation) by identifying high-value ecosystems and optimal locations for different ocean uses. Structured reporting of natural assets creates opportunities to access emerging financial mechanisms that provide the transparent, standardized metrics required by investors and donors to verify environmental outcomes and assess project risks.

A pilot study of Laamu Atoll addressed challenges and provides lessons for Maldives' first natural capital accounting. Limited capacity, fragmented data collection systems, and resource constraints hinder comprehensive ecosystem measurement and valuation. Placing a monetary value on ecosystem services is difficult due to a lack of key economic survey data. The Enhancing National Development through Environmentally Resilient Islands (ENDhERI) project advances each of these aspects, providing guidance and capacity building to Maldivian stakeholders in developing the first set of Natural Capital Accounts for the Maldives and a template for national expansion.

Extent, condition and service accounts for mangrove, seagrass and coral reef ecosystems were compiled. The accounts provide a baseline, which documented minor reductions in coral reef and seagrass extent, while tracking crucial indicators of ecosystem health such as live coral cover and fish abundance. Physical values enabled estimates of the monetary values of ecosystem services, including coastal protection, wild fish provisioning, nursery services, sediment supply, carbon sequestration and recreational values for tourism.

A comprehensive national ocean accounting system would provide a powerful tool for evidence-based policy making and evaluation. Further work is needed to:

1. Centralize data management across projects and institutions,
2. Increase the spatial and temporal resolution of data collection, and
3. Compile accounts over time and produce regular reports to facilitate their use.

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Abbreviations

ENDhERI	Enhancing National Development through Environmentally Resilient Islands
EPA	Environmental Protection Agency
GDP	Gross Domestic Product
GBF	(Kunming-Montreal) Global Biodiversity Framework
GEF	Global Environment Facility
GOAP	Global Ocean Accounts Partnership
JICA	Japan International Cooperation Agency
MBS	Maldives Bureau of Statistics
MoTE	Ministry of Tourism and Environment
MTCC	Maldives Transport & Contracting Company Plc
MVR	Maldivian Rufiyaa
NBS	Nature Based Solution
NCA	Natural Capital Accounts
SCC	Social Cost of Carbon
SEEA	UN System of Environmental-Economic Accounting
SEEA EA	UN System of Environmental-Economic Accounting - Ecosystem Accounting
SNA	UN System of National Accounts
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Program
USD	United States Dollar

1. Introduction

Our economies, livelihoods, and well-being fundamentally depend on nature. From coastal fisheries supporting local communities to coral reefs protecting shorelines and attracting tourism, nature provides the foundation for continued economic development and prosperity. Yet the natural wealth of countries continues to decrease, with decisions continuing to look over our dependencies on natural assets. There is a need to go beyond traditional measures of economic success that ignore nature's role, such as Gross Domestic Product, to better understand the interdependencies between environment, society and the economy.

As a large ocean state, the Maldives is particularly dependent on nature and its resources. Healthy marine ecosystems provide essential services that underpin critical economic sectors, such as fisheries and tourism. For example, many commercially important fish species rely on seagrass and coral reef ecosystems as “nursery areas” as juveniles, before moving offshore. Coral reefs protect infrastructure and homes from wave energy and storm surges. As climate change intensifies, the role of nature in supporting adaptation and protecting communities is critical. The degradation of nature directly impacts economic prosperity and community resilience.

There is a growing recognition that nature is not external to our economies but fundamental to its functioning. Nature provides services that would be extremely costly or impossible to replace with human-made alternatives. This understanding has sparked international momentum to incorporate nature into decision-making, in shaping policies and investments that strengthen nature and the communities that depend on it.

Advancing measurement of nature's value in the Maldives

The evidence for nature's contribution must be timely and relevant, to inform decisions across different sectors and levels of government. The Enhancing National Development through Environmentally Resilient Islands (ENDhERI) project, led by the Ministry of Tourism and Environment, and funded by the Global Environment Facility (GEF), seeks to integrate sustainable practices into national development strategies. Focusing on preserving natural capital and strengthening the resilience of reef ecosystems, ENDhERI advances the measurement and management of sustainable ocean development in the Maldives.

At the heart of the ENDhERI project is the integration of Natural Capital Accounting (NCA) into decision-making processes, with Laamu Atoll serving as the pilot site. By developing NCA, the project provides the first measurements of ecosystem services, aligned with international accounting standards. This approach enables policymakers and stakeholders to align economic activities with environmental sustainability, reducing pressures on reef ecosystems while promoting green growth. Lessons from Laamu Atoll will inform a national framework for sector transformation and spatial planning, creating a replicable model for sustainable development across the Maldives.

This chapter explores the fundamental concepts to understand and measure nature's contributions to society and the economy, with a focus on practical applications for public sector decision-making. It focuses specifically on the evolution of natural capital accounting as a key tool to measure economic dependencies on natures, linked to existing accounts maintained by most National Statistical Offices (e.g., Maldives Bureau of Statistics). It then identifies the advancements made through the ENDhERI project in developing the first natural capital accounts for the Maldives. Subsequent chapters explain the international standard used to compile the accounts, followed by a presentation of the accounts.

1.1.Natural capital and ecosystems

Conceptualizing aspects of nature as “capital” helps communicate its importance to a wider audience (society, economists and decision-makers). Natural capital represents the stocks of environmental assets, from coral reefs and fisheries to soils, minerals and water resources, that generate benefits to society and the economy. This framework tracks changes in these assets over time to better understand how they contribute to economic activity and human well-being, much like how we monitor other forms of capital such as infrastructure or financial assets.

While all natural resources could be considered natural capital (both living and non-living components), there is growing recognition of the particular importance of ecosystems and biodiversity. Complex living systems (i.e., ecosystems) like coral reefs derive their value not just from individual components, but from the interactions between species and their environment that make them resilient and productive. Like other forms of capital, natural capital can be built up or depleted over time based on how it is managed. However, unlike human-made capital such as roads or buildings, ecosystems can be self-regenerating when healthy and can provide multiple benefits simultaneously. This ecological complexity means that not all services can be fully replaced by human-made alternatives, making their preservation particularly important for long-term sustainability.

Box 1: Key definitions and concepts

Natural Capital: The stock of natural assets, both living systems (e.g., coral reefs) and non-living resources (e.g., sand, minerals), that provide benefits to people and the economy. This capital can be considered the “natural wealth” of a country.

Biodiversity: The variety of life at genetic, species and ecosystem levels. Biodiversity acts as nature's "risk management system" - just as diversity in a financial portfolio reduces risk, biodiversity within ecosystems increases their resilience to disturbances. Biodiversity enhances the ability of natural capital to function effectively.

Ecosystem Services: The flow of benefits from natural capital to society and the economy, which are commonly grouped into:

- Provisioning services (food, raw materials),
- Regulating services (flood protection, carbon storage), and
- Cultural services (recreation, aesthetic value).

There are many classification systems for ecosystem services. For the present accounting framework, services must strictly benefit humans or their activities.

Key Relationships

- Natural capital is the stock, while ecosystem services are the flow of benefits from the capital,
- The quality and quantity of services depend on the extent and condition (health) of natural capital,
- Biodiversity underpins the stability and productivity of ecosystems, which typically increases the continued supply of services.

1.2. Nature risks and dependencies

The relationship between different forms of capital shapes how economies function and develop. Produced capital includes human-made assets like roads, buildings, and machinery. Human capital comprises health, knowledge, and skills. Natural capital, however, differs fundamentally from these other forms because it provides the foundation that makes all other economic activity possible. Without clean air, productive oceans, and stable climate systems, produced and human capital cannot generate sustainable economic value.

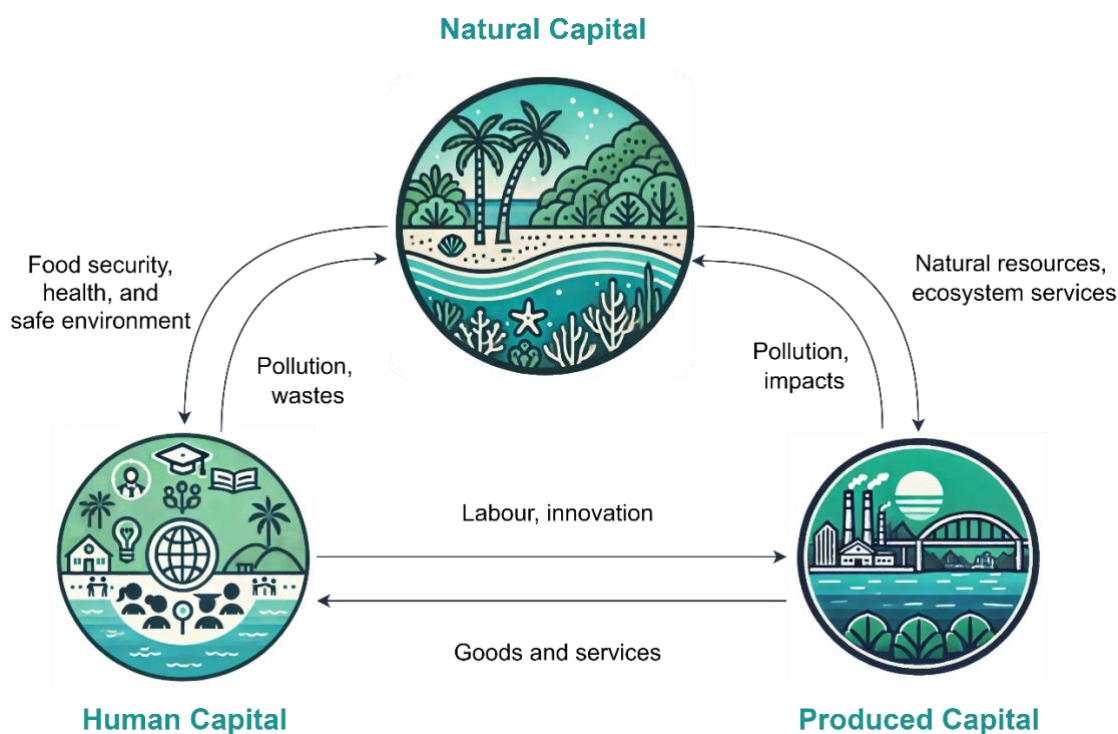


Figure 1.1 Relationship between natural, human and produced capitals.

Current metrics used to manage ecosystems face significant limitations in capturing nature's true value. Traditional measures like Gross Domestic Product (GDP) track the change of flows of goods and services within the economy, although omit nature's contribution. It also does not reflect any changes in the underlying stock of natural capital that enables economic growth through supporting existing sectors or enabling the growth of novel sectors.

This creates a distorted picture where depleting natural resources appears as economic gain, while investing in conservation shows up as a cost rather than an investment in future prosperity. Many of nature's important contributions, from coastal protection to climate regulation, occur outside market systems and thus remain invisible in existing economic accounts maintained by most countries.

1.2.1. Direct dependencies and risks

Tourism and fisheries sectors contribute significantly to the Maldivian economy, contributing 18.7% and 4% of nominal GDP in 2023 (MBS, 2024). The continued growth of these sectors is influenced, in part, by the health of coral reefs and other marine ecosystems.

The tourism sector is influenced by perceptions of clear waters and vibrant coral reefs to attract visitors and maintain its status as a high-value tourism destination. Many tourists may choose the Maldives as a destination due to the reputation of its reefs and clean water, or for recreational activities (e.g., sport fishing, snorkelling, diving etc.). Tourism operators face potential revenue losses from coral bleaching events, which can reduce the aesthetic value of the reef.

The fishing sector is critical for food security, with an estimated 72 kg of fish consumed per person in the Maldives annually (2022, FAO 2024). The sector relies on productive marine ecosystems to sustain fish stocks for both pelagic and reef fishing activities, representing one of the few sectors that captures nature's contribution to GDP (Figure 1.2).¹ Fisheries businesses face risks from changing fish migration patterns and potential stock depletion due to ocean warming. These risks extend throughout supply chains, affecting related industries such as hospitality, transportation, and food processing.

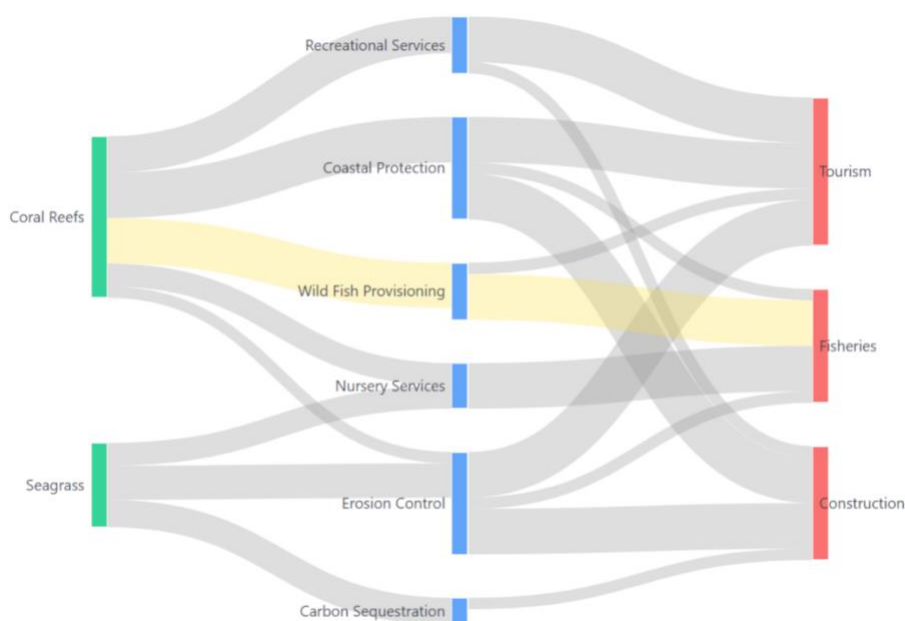


Figure 1.2 Sankey diagram showing theoretical dependencies between ecosystems (coral reefs and seagrass), their multiple ecosystem services, and key economic sectors within the Maldives. The yellow flow (wild capture fisheries of coral fish) shows the only measures that are captured within traditional economic accounts and indicators (e.g., GDP).

¹ There is limited coverage of reef fishing and catch landed within the Maldives. There is limited coverage of the sub-sector in GDP.

1.2.2. Indirect dependencies

Several sectors of Maldives economy are indirectly connected with natural capital through the use of ocean-related products and services across their supply chain. For example:

- The manufacturing and processing sector, related to fish processing facilities, ice production, and boat building services, all dependent on continued fish landings,
- Transportation and logistics operations, including port activities, cargo handling, and domestic transport services, are influenced by tourism demand,
- Similarly, the construction industry relies on the continued health of coral reefs to ensure the stability of built assets,

The loss of natural assets could trigger cascading effects throughout the Maldivian economy. If tourism demand and fisheries catch are negatively impacted by the loss of ecosystems, flow on effects could be expected for these industries.

Further, a wide range of support services are indirectly exposed to ecosystem health through their relationships with primary nature-dependent industries.

- Financial institutions, especially related to insurance, face climate and environmental risks to their portfolios,
- Wholesale and retail trade flows are also influenced by the performance of the tourism sector,
- Real estate remains vulnerable to increased coastal erosion and flooding risks,
- Professional service firms providing marketing, consulting and other business services to these sectors also have indirect exposure to environmental risks.

The social implications of ecosystem degradation could be equally severe. Employment losses would likely occur across nature-dependent sectors and their supporting industries, reducing local income. Food security could be threatened by fisheries decline, while traditional livelihoods and cultural practices tied to marine resources may be disrupted.

1.3. Mainstreaming nature's value in decisions

The most useful analyses to embed nature into decision making involve frameworks that assess nature consistently and over time. Many approaches focus on the **absolute value** of nature, placing a single monetary figure on the value within an atoll, the country, or the entire world.

While attempts to value the absolute value of nature may draw attention to their importance, they raise logical contradictions. People depend on nature for a healthy climate and living environment. Converting all the natural capital to financial capital in the world (as suggested by absolute valuation) would not leave anyone to benefit – and doing so at atoll or country scale would lead to negative outcomes and significantly reduce development (see Box 2).

Instead, what matters for policy and planning are the **relative values and marginal changes** in natural capital, in measuring how specific decisions or investments might enhance or degrade the benefits provided by ecosystems in specific contexts.

Box 2: Absolute vs relative change

When evaluating policies affecting coastal ecosystems, it is important to focus on measuring marginal changes and relative trade-offs. An absolute valuation may state "Laamu's coral reefs are worth \$500 million", and while these numbers seem compelling, they do not provide actionable guidance for choosing between these specific policy options. The more relevant analysis examines the marginal changes in ecosystem condition and service flows under each scenario.

Consider two illustrative policy scenarios for **coastal resort development**:

Policy Scenario 1 – Traditional reclamation:

- Planned reclamation will impact approximately 15% of existing coral reef and seagrass areas,
- Lower initial cost (USD 15 million) and projected to generate USD 5 million in annual tourism revenue,
- Projected to reduce the supply of ecosystem services to adjacent residential islands, with replacement cost valued at USD 1.5 million annualized.

Policy Scenario 2 – Informed by natural capital:

- Structural redesign to avoid reclamation, with higher initial capital cost of USD 20 million,
- Projected to have minimal impact to reef and maintain ecosystem services, worth USD 1.5 million annualized,
- Projected to generate USD 5 million in annual tourism revenue, although potential for marketing price premium as measured by natural capital and ecosystem services.

Policy Scenario 2 offers better long-term outcomes through preserving ecosystem function, while still enhancing tourism potential, despite higher upfront costs. In contrast, Policy Scenario 1's lower initial investment must be weighed against permanent ecosystem degradation and reduced long-term revenue potential.

1.4. The need for a consistent and reliable approach

To produce justifiable values for the value of nature and its services, the methods must be appropriate to the decision-making context. This requires standardized approaches that are comparable across jurisdictions (e.g., between atolls, or national scale) and over time.

Accounts have long been used to standardize and centralize financial information within countries. The UN and other stakeholders have developed an international accounting standard that extends these measurements towards nature, whilst aligning with the existing national accounts (that produce indicators such as GDP) maintained by most countries. The System of Environmental Economic Accounts (SEEA), explained in more depth in Chapter 2, recognizes market values (e.g., fish catch) and non-market values (e.g., coastal protection) (see Box 3) of ecosystems and their services, and provides guidance specifically on how these should be measured.

More specifically, the SEEA provides guidance on, among other concepts:

1. Organizing the complex relationships between environment and economy into specific accounting modules,
2. Monetary valuation methods for ecosystem services that align with national accounts, and
3. Untangling the value produced by nature with other forms of capital.

1.4.1. Exchange and welfare values

Exchange values capture actual market transactions and prices that are observable in the economy (like tourist expenditure or fisheries revenue), while welfare values measure the full benefits people derive from resources (e.g., willingness to pay for conservation or values for these resources existing). Mixing these two types of values in decision-making creates inconsistencies and can lead to double-counting and misrepresentation of benefits, particularly when comparing costs and benefits of different policy options.

Over the last decade, there have been many attempts to value nature. The methods used to report on values have been poorly explained, leading to confusion in representing these monetary values and their distinct purposes for decision making. For example, within the Maldives, a report in 2009² reported both values simultaneously, finding:

- **Exchange:** Between MVR 20 - 34 billion building seawalls around 195 inhabited islands of the Maldives, depending on the type of replacement measure.³
- **Welfare:** MVR 1.8 million per year from Maldivian willingness to pay and MVR 230 million existence value from global overseas willingness to pay.

Not only do these figures differ dramatically in scale, but they also measure different things: one represents potential expenditure in markets while the other captures perceived psychological benefits. Without clear explanation of these distinctions, the meaning of these values can be lost, reducing their effectiveness in informing policies or investment decisions.

The System of Environmental-Economic Accounting (SEEA) exclusively uses exchange values to maintain consistency with national accounting frameworks like GDP calculations. This approach

² Emerton L., Baig S., and Saleem M. (2009) *Valuing Biodiversity. The economic case for biodiversity conservation in the Maldives*. AEC Project, Ministry of Housing, Transport and Environment, Government of Maldives and UNDP Maldives.

³ The assessment of shoreline of all 195 islands is flawed, as not all shorelines require protection.

ensures that environmental assets and ecosystem services are valued using the same principles as other economic goods and services—based on observable market transactions or their closest equivalents. By focusing solely on exchange values, SEEA creates environmental accounts that can be directly integrated with traditional economic accounts, enabling meaningful comparison of trade-offs between development and conservation.

1.4.2. Untangling the contribution of nature with other capitals

Placing natural capital within an accounting framework helps clarify how natural assets work together with other forms of capital to create economic value. Consider marine tourism in Laamu Atoll - its success depends on:

- Natural capital (coral reefs, marine biodiversity),
- Produced capital (boats, hotels, infrastructure), and
- Human capital (tour guides, hospitality staff).

Without comprehensive accounting, policymakers might attribute economic benefits solely to investments in infrastructure or workforce development, overlooking the crucial foundation provided by marine ecosystems. The SEEA framework, by using exchange values consistent with national accounts, allows for direct comparison of these different capital inputs and helps reveal how degradation of natural capital can undermine returns from other investments. For instance, coral bleaching events might significantly reduce tourism revenue despite continued investment in hotels and staff training, highlighting the complementary relationship between these capital types.

By establishing standardized approaches, such as accounting structures, that are consistently applied over time, decision-makers can monitor trends, assess policy effectiveness, and make informed choices to ensure that economic development enhances rather than depletes the natural assets on which sustainable prosperity depends.

Box 3: Market and non-market values

Market Value: the economic worth of goods or services that are traded in markets and have a defined monetary value based on prices and quantities. These values are typically derived from direct transactions and are observable through economic activities.

Example: Fish Catch

The market value of fish catch is determined by the revenue generated from selling harvested fish in local or national (or imported / exported internationally). It includes factors such as the quantity of fish landed, the price per unit (e.g., per kilogram), and any associated costs of production (e.g., labour, fuel, and equipment). Market values are directly reflected in economic measures like Gross Domestic Product (GDP) because they involve transactions recorded in financial systems.

Non-Market Value: the economic worth of ecosystem services or goods that are not directly traded in markets. These values often represent benefits such as environmental services, cultural significance, or recreational use, which are not captured in traditional economic transactions or measures like GDP.

Example: Coastal Protection

The non-market value of coastal protection stems from the natural ability of ecosystems like mangroves, coral reefs, and seagrasses to reduce the impact of storms, prevent erosion, and protect human settlements and infrastructure. While there may be no direct financial transactions for these services, their value can be estimated through methods specific to each value. For instance, coral reefs reducing storm damage annually could be costed as the avoided cost of constructing seawalls.

Why non-market values are excluded from GDP

Non-market values, such as those provided by most ecosystem services, are not traditionally included in economic measures like GDP because they do not involve direct monetary transactions. GDP primarily captures market-based activities and fails to account for the significant contributions of ecosystems to societal well-being and economic stability. For example, the protective role of mangroves in preventing flood damage may save millions of dollars, but this benefit is not reflected in GDP unless the avoided costs are explicitly valued and included in broader economic assessments.

2. Accounting and its use cases

Accounting is a fundamental information system that helps organizations and societies understand their activities, resources, and performance through systematic identification, recording, and analysis of financial and economic events. At the national level, accounting helps governments understand economic activity, allocate resources, and evaluate policy effectiveness. The systematic nature of accounting facilitates performance comparisons across entities and time periods. However, traditional accounting focusing solely on economic metrics fails to capture nature's importance to society and the economy. To address this gap, international frameworks like the UN System of Environmental-Economic Accounting (SEEA) and Ocean Accounting Framework – technical guidance have emerged.

Ocean Accounts describe the interactions between the economy and the environment, the stocks and flows of environmental assets (natural capital) that provide benefits to people (ecosystem services), and the social and governance factors that influence and are affected by these assets and benefits. Ocean Accounts are structured into five interconnected modules pursuant to UN SEEA and guidance maintained by the Global Ocean Accounts Partnership (GOAP)⁴. Ecosystem Accounting, a key SEEA component, standardizes data across environmental and economic domains. This integration enables policymakers to better understand development-conservation trade-offs, make informed resource decisions, and track sustainability progress.

Box 4: Natural Capital Accounting, the SEEA and Ocean Accounting.

Distinguishing between these frameworks is important because while they share common principles, each serves different purposes. NCA represents the conceptual approach, SEEA provides the standardized international framework, and Ocean Accounting offers specialized methodologies for the ocean, allowing policymakers to select the most appropriate tools for their specific context and policy questions.

1. **Natural Capital Accounting (NCA)** is the broad umbrella term for all approaches that measure and value natural assets and ecosystem services. The various methodologies vary in definition and whether beneficiaries are strictly humans and economic activities.
2. **The System of Environmental-Economic Accounting (SEEA)** is an internationally standard within NCA, adopted by the UN Statistical Commission in 2012. The SEEA consists of two complementary frameworks: the SEEA Central Framework, which focuses on individual environmental assets (water, energy, minerals); and the SEEA Ecosystem Accounting, which takes a spatial perspective, measuring the extent, condition, and services of ecosystems. The SEEA follows national accounting principles (exchange), to maintain consistency with GDP calculations.
3. **Ocean Accounting Framework** extends both the SEEA and national accounting to reflect the unique considerations of the ocean economy and ecosystems. It provides guidance to measuring governance and social accounting. For coastal nations like the Maldives, ocean accounting offers particularly valuable insights by highlighting the economic importance of healthy marine ecosystems to national prosperity.

⁴ Ocean Accounts Framework - Technical guidance: <https://www.oceanaccounts.org/technical-guidance-on-ocean-accounting-2/>

Just as financial accounting helps businesses track changes in their assets and make informed decisions, natural capital accounting can help governments and organizations understand how their choices affect the natural assets that underpin economic activity. A system of natural capital accounts integrated with existing national accounts could:

- **Track economic dependencies of Maldivian sectors on ocean resources:** Traditional economic metrics demonstrate the importance of tourism and fisheries to GDP. Beyond these conventional measures, the accounts provide further value by tracking both direct and indirect dependencies of GDP and Gross Value Added (GVA) on ocean resources.
- **Strengthen links between ecosystems and sustainable finance:** By providing standardised metrics and comparable data needed by investors, financial institutions, and regulators (See Section 2.2.1).
- **Deliver verifiable metrics for stakeholders involved in marine resource management:** Accounts facilitate the valuation and risk assessment of marine and coastal areas, supporting marine spatial planning and integrated coastal management.

The development of accounts in Laamu Atoll supports the implementation and monitoring of several key national and international policies and commitments, including:

1. The Maldives National Strategy for Sustainable Development,
2. The Maldives Climate Change Policy Framework,
3. The Maldives Fifth Tourism Plan 2023–2027,
4. The National Biodiversity Strategy and Action Plan (Updated),
5. Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water),
6. Commitments under the Convention on Biological Diversity, and
7. Nationally Determined Contributions under the Paris Agreement.

2.1.1. Alignment with the Global Biodiversity Framework

Natural Capital Accounts can support the implementation and monitoring of the Kunming-Montreal Global Biodiversity Framework (GBF) by providing a standardized approach to measuring ecosystem extent, condition, and services. Accounts structure data and compile indicators for monitoring biodiversity loss, ecosystem restoration, and conservation efforts. It can also help in assessing the economic impacts of biodiversity-related policies and measuring the contributions of ecosystems to human well-being.

The GBF sets ambitious global targets, including conserving 30% of the planet's land and marine areas by 2030 (Target 3). Marine Protected Areas (MPAs) are central to achieving the GBF's conservation and restoration goals. Natural Capital Accounts could support effective MPA design, implementation, and monitoring by:

- **Identifying priority areas:** Ecosystem extent and condition accounts pinpoint areas with high ecological value or biodiversity loss, helping target locations for protection and restoration.
- **Tracking conservation outcomes:** Changes in ecosystem health and biodiversity are monitored through Ocean Accounts, enabling adaptive management and evaluation of MPAs' effectiveness.

- **Highlighting benefits:** Ecosystem service accounts quantify the economic and social benefits of MPAs, such as fisheries recovery, tourism revenue, and climate regulation, strengthening the case for their expansion.

While MPAs are a key focus, Ocean Accounts contribute to the achievement of many other GBF targets by providing a unified framework to manage marine ecosystems holistically. For example, they support the sustainable management of fisheries (Target 10) through tracking and valuing the supply and use of marine resources. Accounts could also monitor pollution and its impacts on ecosystem health, helping address Targets 7 (Reduce Pollution) and 8 (Minimize Climate Change and Ocean Acidification Impacts). Accounts also enhance equitable benefit-sharing (Target 9) by identifying the distribution of ecosystem service benefits among communities, supporting inclusive policies.

2.2. Enabling access to climate and nature finance

Sustainable finance encompasses a range of mechanisms, including investment, lending, non-financial return focused instruments (e.g., policy-based guarantees) and grants, that integrate environmental and social outcomes alongside economic considerations. This rapidly growing field encompasses innovative blended finance structures, carbon markets, and nature-based financing solutions. However, the current absence of standardised and robust metrics impedes proper performance and risk management evaluation in this sector.

The NCA provide an essential foundation by compiling environmental data and translating it into metrics that financial institutions can utilise in decision-making processes. The NCA strengthen the development of sustainable financing instruments by providing:

- Clear, environmental metrics to structure performance-linked financing mechanisms (e.g., coral area and health),
- Systematic monitoring data to verify environmental outcomes and demonstrate compliance with financing terms, creating transparency and accountability in instrument performance,
- Standardized valuation of ecosystem services such as coastal protection, fisheries production, and tourism value, enabling accurate pricing of environmental assets and associated financial products, and
- Quantifiable measures of conservation success that align ecological improvements with financial returns, demonstrating the effectiveness of investments in natural capital.

The NCA provide metrics that support a range of financial decisions. For grant funding, it tracks environmental outcomes to measure effectiveness, while for commercial investors, it helps assess financial risks and returns. By creating a standardized way to evaluate both environmental impacts and dependencies, these metrics support a range of financing approaches, from concessional loans to market-rate investments. This consistency also strengthens blended finance models, ensures accountability in performance-based payments, and integrates environmental factors into mainstream investment strategies.

Further, NCA helps bridge the gap between financial timelines and ecological changes. It captures both short-term ecosystem services and long-term shifts in natural assets, recognizing that environmental improvements often unfold over years or even decades. By providing regular progress updates, NCA aligns these long-term ecological changes with the reporting cycles that are familiar to investors and funders.

Table 2.1. Alignment between Ocean Accounts and Kunming-Montreal Global Biodiversity Framework.

Target	Description	Relevant accounts	Alignment with Ocean Accounts
1	Plan and manage all areas to reduce biodiversity loss	Ecosystem extent accounts, condition accounts	Extent accounts can track changes in key ecosystems of importance (e.g., coral reef coverage, seagrass beds, and key marine habitats). Condition accounts can monitor ecological integrity including coral health indices, fish population diversity, and marine ecosystem connectivity.
2	Restore 30% of all degraded ecosystems	Ecosystem extent, condition and services flow accounts	Extent and condition accounts can measure progress in ecosystem restoration efforts and could further track the return of ecosystem services in restored areas.
3	Conserve 30% of land, waters and seas	Ecosystem extent accounts	Extent accounts can track the coverage of marine protected areas, locally managed marine areas, and other effective conservation measures.
7	Reduce pollution to levels that are not harmful to biodiversity	Ecosystem condition accounts	Condition accounts can monitor marine pollution levels including plastic waste, chemical pollutants, and water quality parameters.
11	Restore, maintain and enhance nature's contributions to people	Ecosystem service accounts	Ecosystem services accounts can quantify and value nature's contributions including coastal protection, carbon sequestration, tourism value, and cultural services.
14	Integrate biodiversity in decision-making at every level	Ecosystem service accounts, asset accounts	Ocean Accounts assist in highlighting links between biodiversity into national accounting through standardized metrics linking ecosystem health to economic activities. Monetary accounts enable cost-benefit analysis of conservation measures.
15	Businesses assess, disclose and reduce biodiversity-related risks and negative impacts	Ecosystem service accounts, asset accounts	Ocean Accounts provide standardized approach for businesses to assess dependencies and impacts through tracking resource use, ecosystem service dependencies, and environmental protection activities. Enables comparison across sectors and time.
19	Mobilize \$200 billion per year for biodiversity from all sources	Ecosystem extent, condition and services flow accounts	Extent and condition accounts can measure progress in ecosystem restoration efforts by tracking coral reef rehabilitation, seagrass replanting success rates, and recovery of degraded marine areas.

Table 2.2 Comparison of traditional financial metrics, and metrics enabled by natural capital accounting.

Traditional financial metrics	Metrics enabled by Natural Capital Accounting
Return on Investment (ROI)	Socio-economic and environmental impacts, including changes to ecosystem extent and health, ecosystem service supply, and beneficiaries (communities).
Asset Value	Natural Asset value related to ecosystem services (net present value over time).
Operating Costs	Resource dependency costs, accounting for the cost of degradation and environmental compliance.
Risk Ratings	Environmental risk indicators related to climate resilience and vulnerability, food and water security, and others.
Cash Flow	Sustainable resource flow: <ul style="list-style-type: none"> • Service stability, • Resource availability • Enhanced cash flow pattern projection
Market Position	“Green” and “blue” market performance with metrics that could support sustainability certifications and taxonomies.

2.2.1. Enabling financial innovation

Standardized NCA creates opportunities for innovative financing mechanisms that can assist the Maldives in exploring novel streams which also enhance natural resource management. Detailed assessments of the extent and condition of coral reef, mangrove, and seagrass ecosystems combined with an analysis of the dependency of economic sectors could be used to:

- Design performance-based instruments like blue sukuk and debt-for-nature swaps by providing measurable ecological indicators,⁵ and
- Quantifying the sustainability of investment opportunities that enhance both natural capital and dependent industries, strengthening the business case for conservation finance.

These financial innovations allow the Maldives to monetise the protection and restoration of its natural capital, creating new funding sources for environmental management while potentially reducing debt burdens.

Tourism is an existing stream that generates significant revenue through taxes and fees. The NCA data enhances this revenue stream by quantifying the economic value that healthy ecosystems contribute to tourism, enabling evidence-based optimisation of existing fees and the development of new ecosystem-linked revenue mechanisms. A data-driven approach supports the design of targeted conservation fees that reflect both ecosystem use and the tourism sector's environmental dependencies, ensuring that revenue collection adequately supports the natural capital that underpins tourism's success.

⁵ A **Sukuk** is an Islamic financial instrument, similar to bonds but does not pay interest (riba). Sukuk holders earn returns based on the underlying asset's performance (e.g., profit-sharing, lease, or partnership structures). A **Debt-for-Nature Swap** is a financial mechanism where a country's external debt is reduced in exchange for commitments to environmental conservation.

2.2.2. Enabling access to international climate and nature finance

The Maldives, while benefiting from significant tourism revenue, faces challenges in accessing development-linked financing. Many international financing mechanisms rely on traditional GDP metrics, which often overlook the vulnerabilities and environmental priorities of Small Island Developing States (SIDS).

Multilateral Development Banks including the World Bank, Asian Development Bank (ADB), Islamic Development Bank (IsDB), and Asian Infrastructure Investment Bank (AIIB) offer various financing mechanisms to support the management of natural resources.⁶ These include concessional loans, grants, and technical assistance, often linked to specific environmental outcomes. In order to access such financing mechanisms, each institution has a set of requirements.

The NCA helps meet such requirements for baseline data, monitoring frameworks, and results verification. Results-based financing mechanisms are becoming increasingly important, where funding disbursement is tied to verified environmental outcomes. The NCA provide the measurement framework needed for such programs by:

- Establishing clear environmental baselines,
- Tracking progress against specific targets,
- Verifying achievement of milestones, and
- Quantifying environmental benefits.

⁶ Among others: Global Environment Facility (GEF) funding for biodiversity and climate initiatives, Green Climate Fund (GCF) support for climate adaptation and mitigation, Adaptation Fund resources for climate resilience projects, and Global Fund for Coral Reefs for reef conservation and restoration.

3. Mainstreaming natural capital accounting

One of the significant components of the ENDhERI project is the development of NCA for the Maldives, through a pilot study of Laamu Atoll. By testing accounting standards, the project seeks to enhance reef ecosystem integrity and resilience through sustainable management. Pillar 3 of the ENDhERI project focuses on the mainstreaming of NCA, with specific objectives to:

- Raise awareness of NCA and international guidance on its compilation with relevant stakeholders,
- Establish natural capital accounts for marine and coastal ecosystems, linked to local industries,
- Strengthen collection of scientific and socio-economic data to establish baselines and enable the compilation of NCA, and
- Demonstrate the utility of accounts to Maldivian stakeholders.

3.1. Building on previous valuation studies

To date, only one comprehensive ecosystem valuation study has been performed in the Maldives, based on ecosystems and their services. The report, “Valuing Biodiversity: The economic case for biodiversity conservation in the Maldives” (2009)⁷ was conducted as part of the Atoll Ecosystem Conservation (AEC) Project. The primary objective was to demonstrate and quantify the economic value of biodiversity conservation to strengthen the case for sustainable resource management. The study provided a “snapshot” assessment to provide evidence to help mainstream biodiversity considerations into economic decision-making and sector policies.

The limitations of one-off valuation studies have led to the development of more systematic approaches through the SEEA. The move toward standardized NCA through SEEA represents an important evolution, with several advancements:

- All statistics and accounts are aligned with the national accounts maintained by the Maldives Bureau of Statistics and the framework includes clear methods for avoiding double counting and enables regular updating of accounts,
- It is based on international standards that promote consistent measurement and comparison across time,
- The values of ecosystem services are grounded in scientific data of ecosystem extent and composition, which further allows for a comprehensive understanding of environmental change, while its spatial explicit approach allows for detailed geographical analysis of ecosystem services.

The present SEEA approach provides a comprehensive coverage of ecosystem services, combined with its standardized approach and clear connection to national accounts, makes it a more reliable and practical tool for supporting policy decisions over time.

⁷ Emerton, L., Baig, S., Saleem, M. (2009). *Valuing Biodiversity: The economic case for biodiversity conservation in the Maldives*. <https://portals.iucn.org/library/node/9776>.

Table 3.1 Comparison of Maldives' first ecosystem valuation study with methods outlined in the UN SEEA framework.

Value Category	Similarities with SEEA	Differences/Limitations
Direct Values (Tourism and Fisheries)	<ul style="list-style-type: none"> Based on observable market transactions, with some links to national accounts data Captures key productive uses of ecosystems 	<ul style="list-style-type: none"> Attributes entire sectors rather than ecosystem-specific value added Does not systematically separate ecosystem contribution from other inputs Lacks standardized classification of ecosystem services and/or a spatial dimension May double count some benefits across sectors
Indirect Values (Coastal Protection)	<ul style="list-style-type: none"> Based on replacement cost (recommended by the SEEA) 	<ul style="list-style-type: none"> Assumes all inhabited coastlines need protection Does not account for varying ecosystem condition
Existence Values (Willingness to Pay)	<ul style="list-style-type: none"> Considers local and tourist perspectives, although willingness to pay surveys are incompatible with accounting 	<ul style="list-style-type: none"> Based on hypothetical scenarios rather than actual observable behaviour Subject to various survey biases Not tied to specific ecosystem assets or conditions and no clear connection to national accounts

3.2. Implementing accounting for nature

A significant challenge to NCA is data access and integration. Data gaps exist, and available data vary in spatial resolution, temporal frequency, and purpose. Key issues include:

- Spatial overlap: Economic data may cover entire islands, while environmental data focus on specific reefs or seagrass meadows.
- Temporal overlap: Some datasets are updated annually, while others are one-time or project based.
- Thematic overlap: Inconsistent classifications hinder compatibility.

Maldives faces additional challenges due to its dispersed geography and limited technical expertise. Effective coordination across stakeholders and decentralized data collection are needed to reduce monitoring costs.

To ensure NCA meets governance and monitoring needs, clear scoping and strategic direction are essential. The ENDhERI project accounts were developed under the Technical Working Group on NCA, led by the Ministry of Tourism and Environment (MoTE),⁸ with input from key ministries, the tourism sector, Environmental Protection Agency (EPA) and academia.

Pilot efforts in Laamu Atoll leveraged lessons from 15 existing pilot projects supported by the Global Ocean Accounts Partnership (GOAP). Expanding geographic coverage, incorporating more ecosystems, and integrating ocean accounts into national statistical systems will help mainstream the Ocean Accounts approach.

⁸ The Ministry of Tourism and Environment is a member of the Global Ocean Accounts Partnership (GOAP).

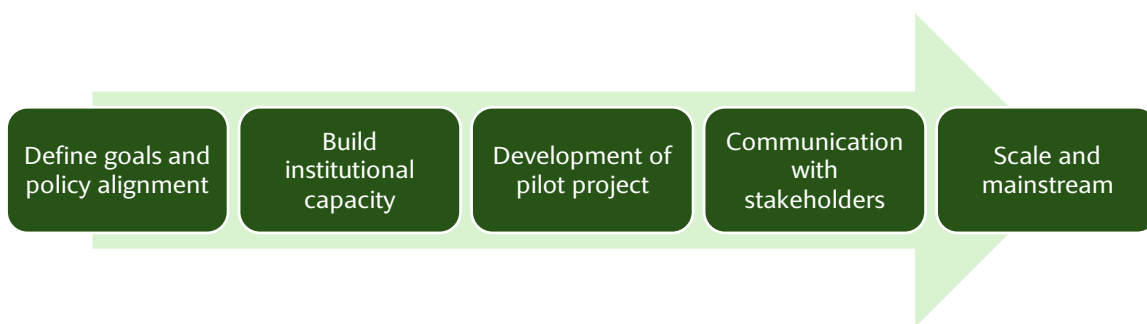


Figure 3.1. Suggested process for Ocean Accounts development.

Within this structure, the SEEA EA first establishes physical measures (see Figure 3.2, Table 3.2). Extent accounts quantify the area of ecosystems (in hectares or square kilometres), condition accounts measure ecosystem health through various indicators (like species diversity or habitat quality), and ecosystem service accounts initially measure physical flows (such as tons of fish harvested or number of visitors). Ecosystem services can then be valued in monetary terms (e.g., market value of fish harvested), and these service values can be used to estimate the overall monetary asset value of the ecosystem.

Following the SEEA and Ocean Accounting Framework, three modules were produced for Laamu Atoll:

1. Extent Accounts: Measure the spatial distribution and changes in marine and coastal ecosystems.
2. Condition Accounts: Assess the health and quality of marine and coastal ecosystems over time.
3. Service Accounts (Physical): Quantify ecosystem services provided by marine and coastal ecosystems.
4. Service Accounts (Monetary): Assign economic value to ecosystem services and their contributions to the economy.
5. Asset Accounts (Carbon value only): Measure and value carbon storage and sequestration in marine and coastal ecosystems.

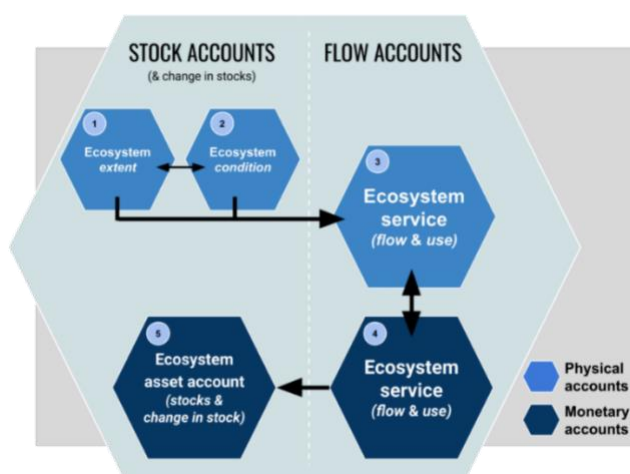


Figure 3.2. Ecosystem accounting structure and flows, from SEEA EA (2021).

Table 3.2 Accounting modules of Ecosystem Accounts, aligned with Ocean Accounting guidance and SEEA EA (2021).

Account name	Type	Definition	Example	Example Units
Extent Account	Physical (Stock)	Measures the size and geographic distribution of ecosystem types within an accounting area, tracking changes over time	Area of ecosystems (coral, seagrass)	Hectares (ha), Square kilometres (km ²)
Condition Account	Physical (Stock)	Assesses the quality/health of ecosystem assets using various biophysical indicators specific to each ecosystem type	Condition measures: Canopy cover, tree density, species composition	Percentage (%), Trees per hectare, Number of species
Ecosystem Services Account (Physical)	Physical (Flow)	Records the flows of ecosystem services from ecosystems to economic and social beneficiaries in physical terms	Physical measures of services: Fish nursery, habitat, coastal protection, carbon sequestration	Biomass (kg/year), Buildings protected, Tons carbon/year
Ecosystem Services Account (Monetary)	Monetary (Flow)	Values the flows of ecosystem services in monetary terms using various exchange-based valuation techniques	Monetary valuation: commercial fisheries supported by nursery habitat, Coastal protection replacement cost, Value of carbon sequestration	Currency/year (e.g., USD/year, MVR/year)
Asset Account	Monetary (Stock)	Measures the overall value of ecosystem assets based on the expected flow of services over time (net present value)	Asset values derived from expected service flows, asset life, discount rate and changes in condition/extent	Currency (e.g., USD, MVR)

3.3. Laamu Atoll project scope

Pilot projects play a critical role in developing practical, implementable accounting frameworks by providing field sites to test and implement methodologies and approaches. The NCA pilot for Laamu Atoll was conducted to identify data gaps, technical challenges, and institutional barriers that need to be addressed to enable full-scale nation-wide implementation.

Challenges and barriers identified include:

- Building capacity within institutions, including decision makers, data collectors and institutions maintaining relevant datasets,
- Identifying and developing standardized data collection protocols, and
- Establishing coordination mechanisms between different agencies and stakeholders.

This practical experience is particularly valuable for refining international standards and guidelines to ensure they are applicable across different contexts and capabilities.

This report presents the SEEA and Ocean Accounting frameworks and its alignment with policy, including the Global Biodiversity Framework, in the Maldives. It then provides an overview of its application to Laamu Atoll, covering three ecosystems (seagrass, mangrove and coral reefs) and condition measures to monitor their health. The accounts presented include:

- **Ecosystem Extent:** size and location of the ecosystem measured in hectares.
- **Ecosystem Condition:** health of the ecosystem defined using ecological metrics aligned with key ecosystems.
- **Ecosystem Services:** related to value of ecosystem contributions in physical and monetary terms.
- **Ecosystem Asset accounts:** related to the value of the ecosystem asset through discrete provision of specific services.

The following chapters provide an understanding of the accounting framework used for the Laamu Atoll pilot, drawing on SEEA Ecosystem Accounting and Ocean Accounting. It explores

The report will focus on two accounting years (2017 and 2020), although incorporates data collected between 2016 and 2024. The accounts are also subset for existing protected areas across Laamu atoll. The scope for each account conducted for Laamu Atoll is provided in Table 4.1 below.

4. Ecosystem assets: Extent and condition

The first Natural Capital Accounts for the Maldives were compiled in Laamu Atoll. These accounts provide a structure to measure ecosystem assets (extent and condition) and their contribution to the economy and society through ecosystem services (see following chapter). This section provides results for ecosystem extent (area), and indicators of condition. The methods for calculation are provided in exhaustive detail within the accompanying “Compiling the first Natural Capital Accounts in the Maldives: Methods report” (2025).

4.1. Ecosystem Extent

Ecosystem accounts provide a structured way to measure and monitor changes in natural assets over time, integrating environmental data into decision-making processes. Identifying ecosystem changes using maps alone can be challenging due to variations in spatial resolution, classification methods, and potential errors in satellite imagery (see Figure 4.1). Small-scale fluctuations in habitat extent may not be immediately visible or easily interpreted, making it difficult to track long-term trends and assess ecosystem health effectively. The NCA address these challenges by summarizing changes in a structured and standardized format, allowing for clear comparisons across time periods.

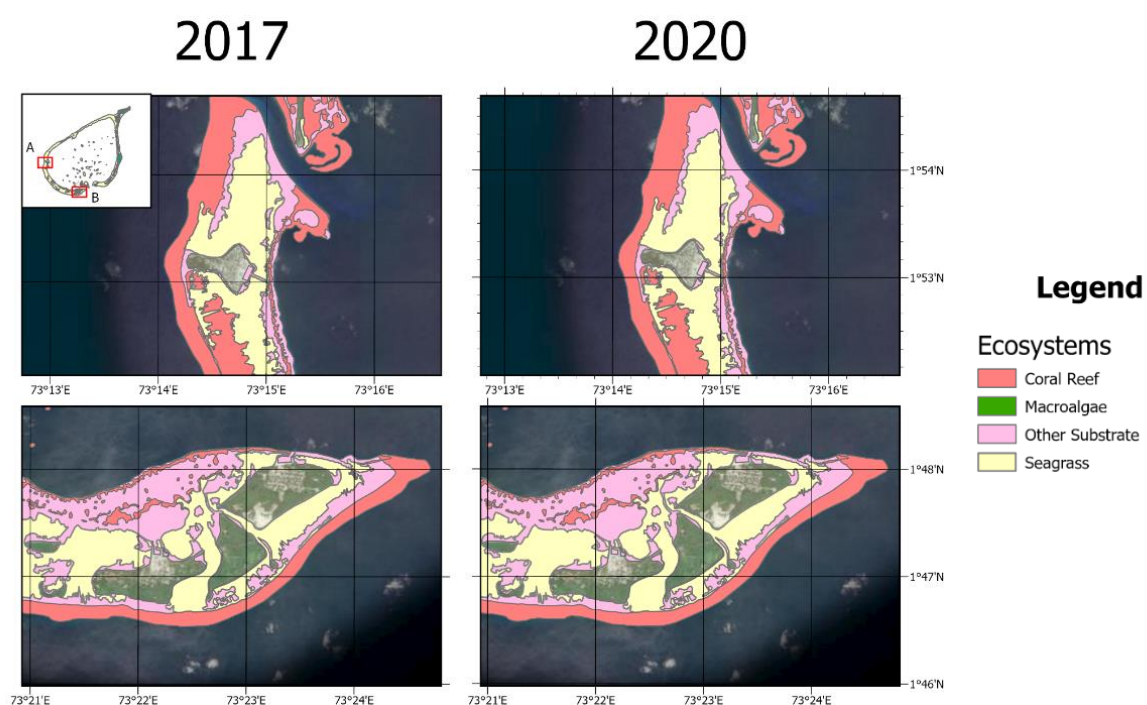


Figure 4.1 Ecosystem extent in Maavah (above) and Kunahandhoo, Medhoo and Hithadhoo (below), Laamu Atoll, comparing 2017 (Opening) and 2020 (Closing) for key ecosystems. Mangroves in Hithadhoo are presented in Figure 4.2.

For Laamu Atoll, ecosystem accounts were developed using two complementary approaches: a whole-of-atoll assessment (at 10 m resolution) and a high-resolution analysis focused specifically on seagrass, mangroves, and coral reefs (between 0.3 – 3 m resolution, see Section 1.1.2). The whole-of-atoll approach used a standardized spatial grid to classify and compare ecosystem extent between 2017 and 2020, enabling broad-scale tracking of changes. The high-resolution method applied more detailed mapping techniques to assess ecosystem-specific trends with greater accuracy.

The accounts were compiled by first classifying ecosystem types, overlaying spatial grids, and ensuring consistency between time periods. Data from satellite imagery was validated through field surveys, and results were analysed using statistical tools to quantify net changes, additions, and reductions.

Table 4.1 Ecosystems extent, condition and asset value accounts produced, aligned with SEEA EA guidance.

Ecosystem	Extent		Condition		Asset value
	Resolution	Years	# variables	Years	
Coral reef	S + HR	2017, 2020 (S), 2020 – 2024 (HR)	6	2019, 2021, 2022, 2024	-
Seagrass	S + HR	2017 – 2020 (S), 2018 - 2024 (HR)	5	2023, 2024	Yes (carbon only, 2023)
Mangrove	S + HR	2017 - 2020 (S) & 2014, 2016 - 2024 (HR)	6	2023, 2024	Yes (carbon only, 2023)
Macroalgae	S	2017, 2020 (S)	-	-	-
Other substrate	S	2017, 2020 (S)	-	-	-

S = Standard resolution (10 m), HR = High resolution (< 1.5 m)

4.1.1. Summary of ecosystem accounts

The total ecosystem area assessed in Laamu Atoll was 164,263 ha, covering five types (coral reefs, seagrasses, mangroves, macroalgae, and other substrates), presented in Table 4.2. Key findings include:

- Coral reef area declined by 0.62%, shrinking from 6,734 ha to 6,692 ha.
- Seagrass meadows reduced by 0.87%, from 4,257 ha to 4,220 ha.
- Mangrove forests remained stable, with no recorded loss.
- Other substrates showed slight increases in area.

These marginal changes could be explained by errors within satellite imagery, which must contend with conditions such as clouds, shadows, water quality, sun glint and others. The findings provide a baseline for the area of each ecosystem within Laamu Atoll but do not show a significant change within the two years.

Table 4.2 Total area and change (%) of coastal ecosystems for 2017 and 2020 in Laamu Atoll, Maldives.

Entry	Units	Coral Reef	Seagrass	Mangrove	Macroalgae	Other Substrate	Totals
Opening (2017)	ha	6734.0	4257.4	4.9	42.9	150910.2	161949.4
Additions		0.5	0.5	0.0	0.0	74.5	75.6
Reductions		-42.4	-37.6	0.0	-2.1	4.8	-77.3
Closing (2020)		6692.1	4220.4	4.9	40.8	150989.5	161947.7
Net Change		-41.9	-37.1	0.0	-2.1	79.4	-6.4
Net Change (%)	%	-0.6	-0.9	0.0	-4.9	0.0	0.0

4.1.2. Comparison between whole-of-atoll and high-resolution approach

A high-resolution approach focused on detailed, habitat-specific analysis of seagrass, mangrove, and coral reef ecosystems over a longer time series (2013–2024). This method provided a more granular assessment of ecosystem variability, capturing small fluctuations in extent that may be more relevant for planning and environmental monitoring. Key insights include:

- Mangroves showed a gradual increase from 2.77 ha in 2014 to a peak of 2.93 ha in 2020 and 2022, followed by a slight decline in 2024.
- Seagrass extent exhibited greater variability, ranging from 4,049 ha in 2018 to a low of 3,473 ha in 2022, then rebounding to 3,831 ha in 2024. These fluctuations suggest potential influences from seasonality, water temperature changes, and nutrient availability.
- Coral reef extent showed minor declines, with deeper reefs (>25 m) decreasing from 506,662 ha in 2020 to 504,203 ha in 2024.

The differences observed in seagrass and coral reef extent across the whole-of-atoll and high-resolution approaches may partly stem from variations in satellite imagery quality, resolution, and potential classification. The whole-of-atoll approach recorded larger total areas compared to the high-resolution approach. These variations suggest that while the whole-of-atoll method provides a broad-scale perspective useful for regional planning, the high-resolution approach may offer more precise habitat delineation by capturing finer-scale ecosystem features. The differences underscore the importance of selecting the appropriate method based on the specific policy or management objective.

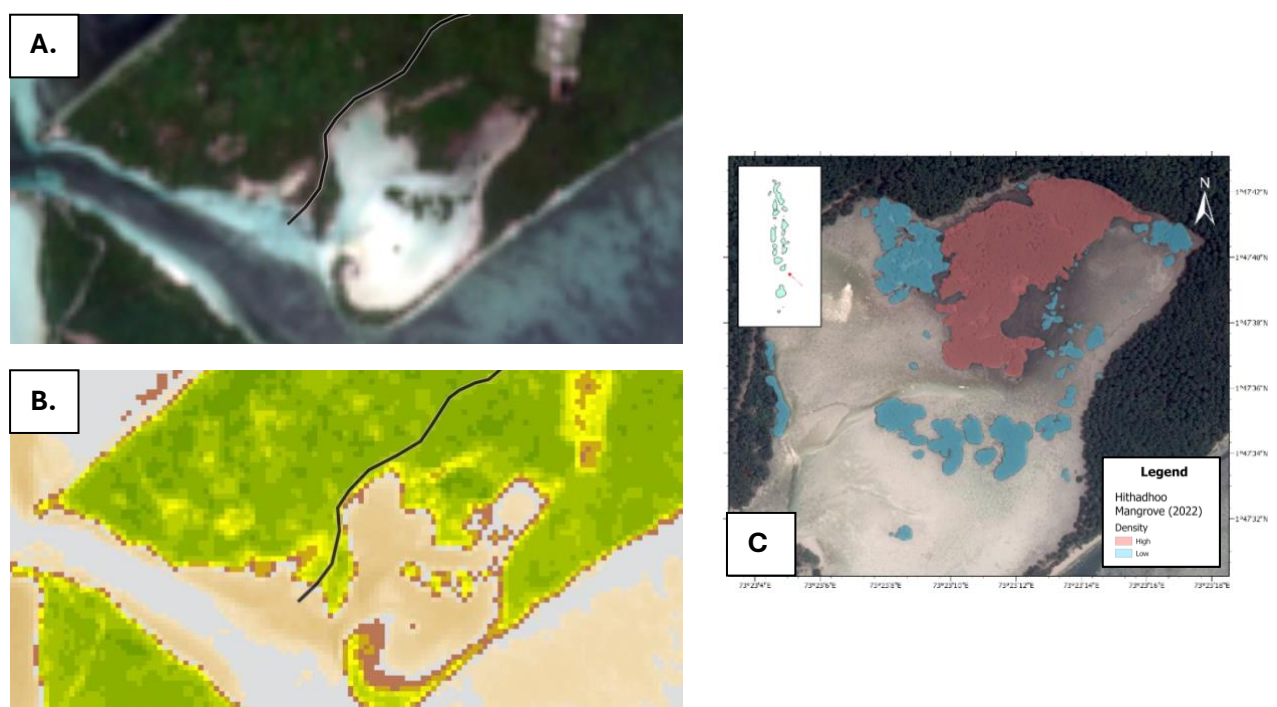


Figure 4.2. Comparison of Sentinel 2 (10 m) natural-colour imagery (A) and vegetation product (B), against (C) Pleiades ultra-high resolution satellite imagery (0.3 m) for mapping Hithadhoo mangrove.

Table 4.3. Comparison between whole-of-atoll and high-resolution approach to three key coastal ecosystems in 2020 within Laamu Atoll, Maldives.

Analysis	Units	Mangroves	Seagrass	Coral Reef*
Whole-of-atoll	ha	4.88	4257.42	6734.12
High resolution		2.84	3894.91	6374.73
Difference		2.04	362.51	359.39
	%	41.8	8.51	5.34

4.2. Ecosystem Condition

Ecosystem condition accounts provide a structured assessment of the health and functionality of ecosystems. Condition is linked to the ability of ecosystems to provide services to the economy and society (Czúcz et al, 2021). The presence of an ecosystem alone does not guarantee the continuous provision of ecosystem services, particularly if it is degraded. The Laamu case study focused on the condition of coral reefs, seagrasses, and mangroves, selecting indicators that best reflect their capacity to support coastal protection, fisheries, and carbon sequestration.

4.2.1. Coral reef condition

Coral reef condition was assessed through belt transect surveys with 17 sites containing data over multiple years (Fischer, M. & Shephard, A., 2023). The surveys recorded live coral cover, benthic composition, fish abundance and biomass, invertebrate diversity, and signs of environmental stress (e.g., bleaching, disease, and anthropogenic impacts). Observers identified key fish families, including commercial (jacks, trevallies, emperor fish, snappers, and groupers) and ecologically significant species (surgeonfish, triggerfish, angelfish, parrotfish, and butterflyfish).

- Live coral cover was stable, between 17% and 19% (2019 to 2024) for the same sites.
- Bleaching incidence rose sharply from 0.3% in 2019 to 11% in 2024, highlighting the 2024 event which led to coral stress.
- Fish biomass trends varied, with commercial species increasing in abundance but ecological species declining from 355 kg per ha in 2021 to 76 kg per ha in 2022.
- Macroalgae cover increased significantly from 1.4% in 2019 to 13.3% in 2024, possibly indicating increased stress of ecologically important fish stocks.

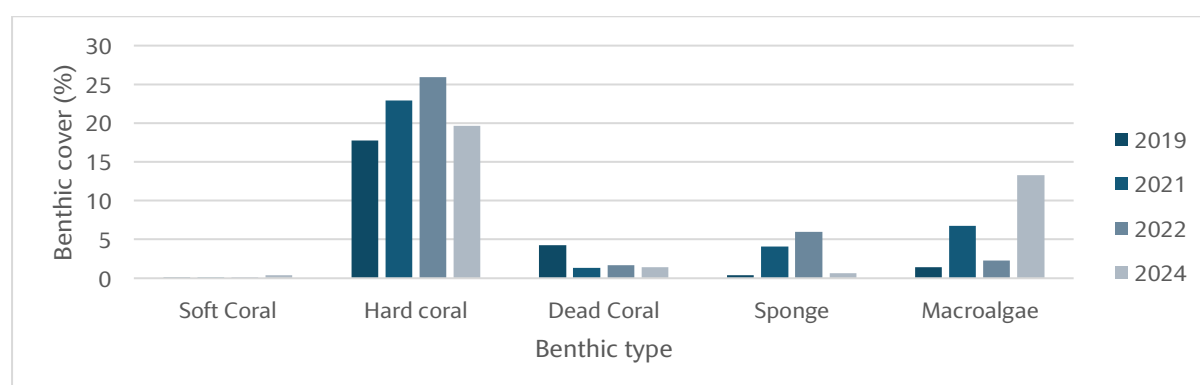


Figure 4.3. Benthic cover (%) averaged across seven sites visited over four years.

4.2.2. Seagrass Condition

Seagrass condition was monitored at 28 sites using standardized transects and quadrats, recording species composition, percent cover, blade density, and epibenthic cover. Key findings included:

- Six seagrass species were recorded, with *Thalassia hemprichii* and *Cymodocea rotundata* being the most dominant.
- Seagrass cover varied, with the highest at Dhanbidhoo (76%) and lowest at Berasdhoo (7%).
- Maavah exhibiting the highest number of species and density of seagrass.
- Density varied significantly, from 11 to 844 stands/m², reflecting localized environmental differences.



Figure 4.4. Images of dominant seagrass species *Cymodocea rotundata* (left) and *Thalassia hemprichii* (right) from Laamu Atoll, Maldives.

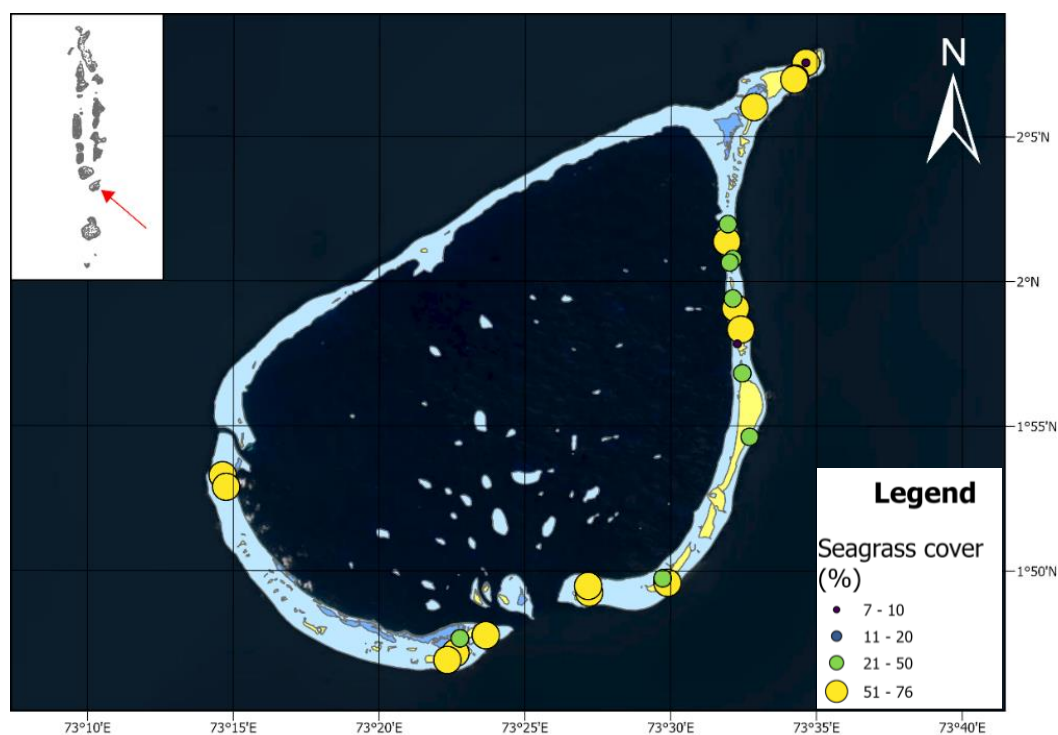


Figure 4.5. Map of seagrass coverage (%) in Laamu Atoll, Maldives.

4.2.3. Mangrove Condition

Mangrove assessments were conducted using 10x10 m quadrat plots across several sites, recording species composition, canopy cover, tree height, basal area, and biomass estimates. A hemispherical camera was used for canopy density analysis, and GIS mapping helped identify spatial distribution and density variations.

Key Findings

- Hithadhoo contained the largest and only mangrove-dominated intertidal forest, dominated by *Rhizophora mucronata* and *Ceriops tagal*.
- Mangrove biomass in Hithadhoo remained stable, with aboveground biomass at 168.45 Mg and belowground biomass at 184.66 Mg in 2024.
- Maavah's mangroves have been converted to agricultural land.



Figure 4.6. Images of dominant mangrove species *Rhizophora mucronata* (above), mangrove sampling (bottom left) and *Ceriops tagal* (bottom right) from Laamu Atoll, Maldives.

Table 4.4. General information on mangrove ecosystem in sites survey.

Species	Islands containing the species	Common Name	Divehi Name
<i>Rhizophora mucronata</i>	Hithadhoo, Maavah, Maabaidhoo	Red mangrove	Randoo
<i>Ceriops tagal</i>	Hithadhoo, Maabaidhoo	Yellow mangrove	Karamana
<i>Lumnitzera racemosa</i>	Hithadhoo, Maavah	Black mangrove	Burevi
<i>Derris trifoliata</i>	Hithadhoo	Mangrove vine	Thelaviyo
<i>Sonneratia caseolaris</i>	Maavah	Mangrove apple	Kulhavah
<i>Brugueira cylindrica</i>	Maavah	Small-leafed orange mangrove	Kan'doo
<i>Pemphis acidula</i>	Maabaidhoo	Shrubby coral mangrove	Kuredhi
<i>Brugueira ghymnorhiza</i>	Gan	Large-leafed orange mangrove	Bodavaki

4.2.4. Condition accounts

To integrate findings across ecosystems, condition accounts were structured to highlight trends in key indicators. While coral cover showed some recovery, bleaching increased, indicating ongoing climate vulnerabilities. Seagrass health remained stable, though epibenthic cover increased, suggesting competitive dynamics. Mangrove biomass and canopy cover remained largely unchanged, but localized losses were recorded due to human activities. These trends emphasize the need for targeted conservation strategies, long-term monitoring, and integrated management approaches to safeguard Laamu Atoll's ecosystems and the essential services they provide.

The structured condition accounts allow policymakers to track ecosystem health over time, evaluate the effectiveness of MPAs and conservation programs, and report on national and international biodiversity commitments, including Sustainable Development Goals (SDGs) and the Kunming-Montreal Global Biodiversity Framework. Future monitoring should focus on establishing consistent reference sites, improving longitudinal data collection, and expanding linkages between condition metrics and ecosystem service valuation for informed decision-making.

Table 4.5 Condition account for mangrove, seagrass and coral reefs of Laamu Atoll. #Difference due to site selection.

Entry	Units	2019	2020	2021	2022	2023	2024
Coral reef							
Live cover	%	17.44	-	22.93	25.90	-	19.67
Bleached	%	0.34	-	0.04	0.83	-	10.97
Diseased	%	0	-	0	0.6	-	0
Fish biomass (commercial families)	Kg / 100 m ²	-	-	1.4	4.72	-	-
Fish biomass (ecological families)	Kg / 100 m ²	-	-	3.55	0.76	-	-
Mangrove							
Average tree height*	m	-	-	-	-	4.5	4.05
Basal area*	cm	-	-	-	-	529	479
Above ground biomass	Mg	-	-	-	-	168.90	168.45
Below ground biomass	Mg	-	-	-	-	185.47	184.66
Seagrass							
Live cover	%	-	-	-	-	53.98	51.29
Epibenthic cover	%	-	-	-	-	10.51	13.42

5. Ecosystem services

Ecosystem services are the benefits that natural ecosystems provide to people, supporting economic activities, environmental sustainability, and human well-being. These services are classified into three main groups:

1. **Provisioning Services** – The tangible goods that ecosystems supply, such as food (through wild fish capture).
2. **Regulating Services** – The processes that ecosystems perform to regulate environmental conditions, such as coastal protection, carbon sequestration and retention, sediment production and fisheries enhancement.
3. **Cultural Services** – The non-material benefits people obtain from ecosystems, such as recreational opportunities, commonly used by tourists and visitors.

Ecosystem service accounts track the supply and use of these services, ensuring they are incorporated into national decision-making and resource management. This section presents key findings from the ecosystem service accounts for Laamu Atoll, highlighting the role of its coastal and marine ecosystems in sustaining fisheries, regulating climate, and supporting tourism and local livelihoods. The methods for calculation are provided in exhaustive detail within the accompanying “Methodology report for accounting practitioners and technical specialists” (2025). An overview of the ecosystem services measured and if monetary value was performed is provided in **Error! Reference source not found.**

Table 5.1 Ecosystems services accounts produced, aligned with international guidance. All services were based on factors from 2023 and 2024. Macroalgae and other substrate were not assessed for ecosystem services.

Ecosystem	Provisioning	Regulating				Cultural
	Wild fish provision	Coastal protection	Sediment supply	Carbon sequestration	Nursery services	Recreational value
Coral reef	P	P+M	P+M	-	P	P+M
Seagrass	-	-	P+M	P+M	P	P
Mangrove	-	-	-	P+M	-	P+M

#P = Physical value, M = Monetary value.

5.1.Provisioning Services

5.1.1. Wild fish provisioning (coral reefs)

Marine ecosystems in Laamu Atoll, particularly coral reefs, provide critical fish stocks that support local fisheries, food security, and livelihoods. Fishing is among the most important socio-economic activities in the Maldives. For Laamu Atoll, wild fish provisioning from coral reefs was assessed. For this service, the reef fish caught on or adjacent to coral reefs were measured, as opposed to pelagic fish (e.g., tuna).

Measurement: The quantity of fish harvested was recorded using landing data at ports within Laamu Atoll, which detailed weight by species composition, fishing method, fishing effort (number of trips), and location of trips. This was combined with surveys of fisherfolk, accessing data related to capital and operational expenses.

Valuation: The resource rent approach was used to isolate the contribution of the ecosystem by subtracting human inputs from the total value of the catch. The total market value of the fish catch was estimated by multiplying catch volumes by market prices. The costs of fishing operations (e.g., fuel, maintenance, labour) were deducted from the total market value.

Table 5.2. Resource rent calculation for reef fishery in Laamu Atoll.

Component	Value (MVR)	Calculation Notes
Total revenue	1,126,640	Catch volume × first-sale price for reef species
Intermediate costs	2,938,231	Fuel, maintenance, gear, etc.
Gross operating surplus	-1,811,591	Revenue - intermediate costs
Compensation of employees	1,109,397	Number of workers × wage rate × days worked
Consumption of fixed capital	513,608	Annual depreciation of vessels and gear
Return on fixed capital	201,728	Value of vessels and gear × return rate
Resource Rent of sector	<u>-3,636,324</u>	Final calculation

What this monetary value represents: The deeply negative resource rent indicates that the reef fishery appears economically unviable. However, this outcome likely indicates a **significant underreporting of catch volumes**. In small-scale fisheries with vessels <10 meters, landings are unrecorded due to informal sales, inadequate monitoring infrastructure, and limited incentives for reporting. The fishery is still delivering significant food supplies and livelihoods even while showing no net profit in economic terms. In the reef fishery example, the ecosystem is still producing fish and fishers are harvesting them. It indicates that significant measurement is needed to understand remaining reef fish stocks and landed catch.

5.2.Regulating Services

5.2.1. Fisheries nursery services (seagrass, coral reefs)

Healthy fish populations depend on more than just the availability of adult fish; they require nursery habitats where juvenile fish can grow and develop before entering a fishery. In Laamu Atoll, seagrass meadows and coral reefs provide these nursery functions. As this service contributes to wild fish capture, it is not valued in monetary terms to avoid double counting.

Measurement: Seagrass meadows and coral reefs were assessed as nursery habitats for juvenile fish. Scientific studies were used to estimate the increase in fish populations due to these habitats, compared to non-structured ecosystems (e.g., sand bed). The percentage increase was combined with observed juvenile densities from Laamu Atoll. Survival rates were applied to estimate how many juveniles reach adulthood and contribute to the fishery.

Table 5.3 Estimate of additional adults entering the fishery due to enhancement from coral reef and seagrass. Mg = Metric ton. An estimated 95% mortality for individuals was estimated before entering the fishery (see Lefcheck et al, 2019).

Family	Seagrass			Coral reef		
	Annual enhancement (Individuals)	Export to fishery (Individuals)	Export to fishery (Mg)	Annual enhancement (Individuals)	Export to fishery (Individuals)	Export to fishery (Mg)
Travelly	1,451	73	1	-	-	-
Emperor	131,932	6,597	20	65,102	3,255	10
Snapper	29,596	1,480	7	265,640	13,282	66
Grouper	8,750	438	9	127,464	6,373	127
Rabbitfish	74,958	3,748	4	-	-	-
		Total	41		Total	204

What this monetary value represents: The physical value measures the increase in fisheries stock due to these ecosystems. These findings indicate that the coral reef and seagrass increase the stock (by weight) by 204 and 41 tonnes (Mg) every year. Without these ecosystems, fish stocks would decline, leading to lower catches, reduced income for fishers and food insecurity.

5.2.2. Carbon sequestration (seagrass, mangroves)

Seagrass and mangroves play a crucial role in **mitigating** climate change impacts by absorbing carbon dioxide from the atmosphere and storing it in biomass and sediments. This natural process supports both local and global climate resilience.

Measurement: The amount of carbon added to ecosystems (“sequestered”) in plant material (i.e., biomass) and soils was estimated per year. The amount per hectare was estimated from scientific literature studies from both the Maldives and similar contexts.

Valuation: The **Social Cost of Carbon (SCC)** was used, which represents the avoided damage from climate change in the future by removing a tonne of carbon removed from the atmosphere. The SCC of USD 185 per tonne of CO₂ was applied, reflecting the vulnerability of the Maldives to climate change impacts (Rennert et al, 2022). The value was adjusted for inflation and converted to Rufiyaa.

Table 5.4 Monetary value of carbon sequestration by mangrove and seagrass for given years. Inflation adjusted to 2024.

Year	Mangrove total seq.	Seagrass total seq.	Total seq.	Monetary value	Monetary value (Inflation adjusted)
Unit	Mg C	Mg C	Mg C	MVR	MVR
2020	24.6	3,460	3,485	9,934,387	10,657,028
2022	24.8	3,087	3,111	8,858,546	9,243,060
2023	24.7	3,120	3,144	8,958,306	9,083,722
2024	24.68	3,404	3,429	9,768,622	9,768,622

What this monetary value represents: The valuation reflects the financial benefits of avoided climate damages due to carbon storage per year, if the extent and condition of these ecosystems are maintained. While these values are not eligible for carbon trading, they can support national commitments under the Paris Agreement. For instance, the Maldives can use this data to strengthen its Nationally Determined Contributions (NDCs), demonstrating the climate mitigation benefits of conserving seagrass and mangrove habitats.

These valuations also provide a compelling economic rationale for attracting sustainable finance. Development banks, donors, or governments can reference them when structuring blue bonds or green investment instruments tied to nature-based solutions. Similarly, insurance and risk reduction initiatives may invest in coastal ecosystem restoration, recognizing its dual role in mitigating climate risk and delivering carbon benefits. The private sector, particularly tourism operators, could be encouraged to support conservation through voluntary contributions, using these non-market values to demonstrate environmental responsibility for maintaining seagrass meadows.

5.2.3. Coastal protection (coral reefs)

Coral reefs act as natural breakwaters, reducing wave energy and protecting island shorelines from erosion and storm surges. In the Maldives, where the very existence of islands depends on sediment stability, this service is fundamental to infrastructure protection and climate resilience.

Measurement: Coastlines with 100 m of homes and infrastructure were identified. The potential rate of coastal erosion was applied to measure the number of homes and tourism infrastructure that are under threat if corals were degraded within the accounting period.

Valuation: The **replacement cost method** was used to estimate the amount of finance required to build artificial coastal defences (e.g., seawalls) to provide the same level of protection as coral reefs. The annual cost of maintaining these artificial defences was calculated using straight-line depreciation over 25 years.

Table 5.5 Estimated coastal protection value, based off cost estimates in 2024. Note that only coastline length was valued if homes and infrastructure were within 100 m. *For residential islands, census blocks were used. Tourism used building footprints.

Island type	Physical value		Monetary value (Annual depreciation)	
	Buildings / census blocks protected*	Coast length protected (m)	Quaywall (MVR, millions)	Sheetpile (MVR, millions)
Residential	599	29944	74.86	203.63
Tourism	179	3196	7.99	21.73
Totals	778	33140	82.85	225.36

What this monetary value represents: The estimated protection value does not show that coral reefs are better than seawalls but highlights the potential financial burden the government could face if reefs were to degrade and artificial coastal defences like quaywalls or sheet piles became necessary. These figures provide strong justification for reef protection investments. Government agencies can use this data to guide the development of policies and programs that maintain or restore reef health, thereby avoiding future capital expenditures on engineered defences. Potential responses include coral conservation initiatives and sustainable tourism regulations. For the tourism sector especially, where reef degradation could trigger costly infrastructure losses, this valuation supports targeted partnerships and co-financing arrangements between public authorities and private operators.

5.2.4. Sediment supply (coral reef, seagrass)

The islands of the Maldives are built and maintained by natural sediment production, primarily from coral reefs, although other ecosystems contribute. These ecosystems continuously supply carbonate sand that replenishes beaches and prevents coastal erosion. Without this natural sediment supply, many islands would face accelerated erosion, increasing the need for sand replenishment (Live & Learn Environmental Education, 2006).

Measurement: The natural production of sand by coral reefs and seagrass epibionts (carbonate-producing organisms) was estimated using scientific studies from the Maldives. This included the production of sand sized particles and their transport onto Laamu’s beaches.

Valuation: The cost of **artificial beach nourishment** (importing sand for beach replenishment) was used as a proxy for the value of natural sediment production. The local price of sand replenishment per cubic meter was adjusted for inflation and used to estimate annual sediment replacement costs.

Table 5.6 Nourishment from coral reefs and seagrass per island type on Laamu Atoll for 2024. *Relevant seagrass meadows were estimated within 100 m of residential and tourism islands (East et al., 2023).

Island	Coastline (m)	Annual nourishment from coral			Annual nourishment from seagrass		
		Physical (m ³)	Monetary (MVR, thousand s)	Monetary (USD, thousand s)	Physical (m ³)	Monetary (MVR, thousand s)	Monetary (USD, thousand s)
Residential Island	87746	4314.66	445.60	28.94	88.88	4.43	0.29
Tourism Island	4277	210.32	21.72	1.41	0.02	0.00	0.00
Grand Total	92023	4524.98	467.32	30.35	88.9	4.43	0.29

What this monetary value represents: The valuation estimates the cost savings from natural sediment supply, demonstrating the financial benefits of reef and seagrass conservation. This insight can be used to support coastal management policies that prevent activities, such as sand mining and dredging, that impact ecosystems and disrupt sediment production.

5.3.Cultural services

5.3.1. Reef-based recreation

Tourism is a significant sector within the Maldivian economy, with coral reefs serving as the foundation for activities such as diving, snorkelling, and marine excursions. A proportion of tourists visit Maldives with the interest in visiting these ecosystems to experience vibrant corals and abundant marine life. However, the sustainability of reef tourism depends on ecosystem health and degradation may negatively affect tourist numbers and spending.

Measurement: Visitor surveys were designed to estimate the number of tourists per year engaging in coral reef-based activities, including snorkelling, diving and recreational fishing of coral fish. Spatial mapping of popular reef sites was conducted to understand usage patterns.

Valuation: A consumer expenditure survey was conducted for 1 month on Laamu Atoll, calculating total tourist spending on reef-related activities, incorporating accommodation, excursions, and transport. This monetary value captures the direct economic benefits derived from healthy reef ecosystems. It does not, however, account for broader economic dependencies, such as employment in tourism-related sectors.

Table 5.7. Estimated total spend and coral-related spend. Conversion to Ruffiya of 15.41 (MMA, 2024). Errors due to rounding.

Type	Visitors to Laamu Atoll	Total spend (USD millions)	Total coral-related spend (USD millions)	Total spend (MVR millions)	Total coral-related spend (MVR millions)
Guest house	3,532	4.92	3.61	75.77	55.65
Resort	10,595	63.27	24.28	974.98	374.11
All	15,356	68.66	30.43	1058.04	468.93

What this monetary value represents: The estimated coral-related tourism expenditure in Laamu Atoll demonstrates the significant direct economic value that healthy reef ecosystems contribute to the tourism sector. This includes spending on accommodation, excursions, and transport by over 15,000 visitors in a one-month period, with particularly high contributions from resorts. While this valuation does not capture indirect economic benefits such as employment, it clearly reflects the financial importance of maintaining reef quality for visitor satisfaction and revenue generation.

These figures can inform tourism planning and investment strategies by both businesses and government agencies. If reef health declines and visitor interest wanes, substantial revenue losses may follow, prompting the need for more costly interventions. It provides a compelling case for involving the tourism industry in funding or co-managing reef conservation initiatives.

5.3.2. Mangrove-based recreation

There is a growing market to visit coastal mangroves within the Maldives. Mangroves provide unique tourism opportunities, offering an alternative to reef-based activities. In Laamu Atoll, the Hithadhoo Mangrove Adventures initiative has created an emerging ecotourism sector, showcasing the island's saltwater mangrove ecosystem to visitors.

Measurement: The number of visitors participating in guided kayak tours of the Hithadhoo mangrove was recorded. Tour duration, group size, and visitor motivations were documented through local consultation.

Valuation: Revenue was calculated based on ticket prices for kayak rentals and other associated spending. The potential for expanding ecotourism services was identified, including additional revenue from guided tours and photography packages.

Table 5.8 Calculation of additional revenue generated from mangrove-related tourism activities (Hithadhoo mangrove adventures).

Avg. tourists (month)	Unit cost (USD, per kayak tour)	Annual revenue (USD)
10	20	2,400

What this monetary value represents: The valuation highlights the emerging potential of mangroves (i.e., conservation) as a tourism asset.

5.3.3. Recreational seagrass gleaning (Traditional Marine Harvesting)

Gleaning is a traditional small-scale fishing practice in Laamu Atoll, where community members collect invertebrates such as gastropods and octopuses from shallow seagrass meadows. Unlike commercial fisheries, gleaning is primarily a social and recreational activity, providing cultural and subsistence benefits. Due to a lack of data, it was not valued in monetary terms.

Measurement: Community surveys were conducted to estimate the frequency and duration of gleaning activities. The number of individuals participating and the amount of marine resources collected were recorded.

The number and time spent reflects the cultural and subsistence importance of gleaning. These insights can support policies that protect seagrass habitats, ensuring that traditional fishing practices remain viable for future generations.

Table 5.9 Number of hours spent gleaning in seagrass within Laamu Atoll (McGowan, 2022).

Factor	Units	2023
Participants in gleaning across trips	# participating (cumulative)	1440
Gleaning effort	Hours	3960

5.4. Supply and use tables

Ecosystem service accounts are structured in supply and use tables, which record the flows of ecosystem services to sectors of the economy, household and government. These tables are extensions of the traditional supply and use tables found in the System of National Accounts (SNA), adapted to include non-market services provided by ecosystems (e.g., coastal protection, recreation). The supply table records the provision of services per ecosystem, while the use table identifies the beneficiaries, including industries, households, and governments. Table 5.10 provides definitions for each beneficiary type.

Table 5.10 Beneficiaries as defined by UN System of National Accounts (SNA) and UN System of Environmental Economic Accounting.

Beneficiary	Description	Example
Economic sectors	Industries and enterprises that derive direct or indirect benefits from ecosystem services in their production processes or outputs	The fisheries industry benefits from the provisioning service of fish stocks
Households	Individuals or groups of people living together who consume ecosystem services directly for their well-being and livelihoods	A family living near the shoreline is protected from storm surge and wave energy from coral reefs
Government	Benefits from ecosystem services in its role as a steward of public goods and as an entity responsible for providing public services	Governments benefit from regulating services such as coastal protection provided by coral reefs, which mitigates the need for expensive infrastructure investments

5.4.1. Physical value tables

The tables are first presented in physical values in non-monetary units such as tons, cubic meters, or hectares. These tables quantify the physical supply of services provided by ecosystems (e.g., the carbon sequestered by mangroves, or the number of recreational visits to a park) and their corresponding use by beneficiaries, including industries, households, and governments. They are particularly valuable for tracking changes in ecosystem health and performance over time.

Table 5.11 Ecosystem service supply table, in physical values. Grey cells null by definition.

Ecosystem service	Year (data)	Units	Economic units	House holds	Government	Ecosystems			Total supply
						Coral reef	Seagrass	Mangrove	
Final ecosystem services									
Wild fish provisioning (reef fish)	2022	Tonnes landed (Mg)				28			28
Global climate regulation (Carbon sequestration)	2020	Carbon sequestered (MgC)					3460	25	3485
Coastal protection	2023	Coastline protected (m)				33,142			33,142
Recreational value	2023	Visitor nights / Participants (#)				53,250	1440 (gleaning)	120	
Intermediate ecosystem services									
Nursery and habitat maintenance service*	2020	Tonnes of enhancement (Mg)				204	28		232
Sediment production	2023	Natural sediment nourishment (m³)				4,525	89		4,614

*For species with data available.

Table 5.12 Ecosystem service supply table, in physical values. Grey cells null by definition.

Ecosystem service	Year (data)	Units	Economic units (ISIC code)			Households	Government	Ecosystem	Total use
			Marine fishing (0311)	Short-term accommodation activities (5510)	Others				
Wild fish provisioning (reef fish)	2022	Tonnes landed (Mg)	28						28
Global climate regulation (Carbon sequestration)	2020	Carbon sequestered (MgC)					3,485		3,485
Coastal protection	2023	Coastline protected (m)		3,196			29,946		33,142
Recreational value	2023	Visitor nights / Participants (#)		53,250					53,250
Nursery and habitat maintenance service*	2020	Tonnes of enhancement (Mg)	232						232
Sediment production	2023	Natural sediment nourishment (m ³)		210			4,404		4,614

5.4.2. Monetary value tables

The tables are then presented in monetary values to express the value of ecosystem services in economic terms, enabling their integration into national accounts and policy frameworks. Monetary tables allow for the comparison of ecosystem services with other economic sectors, highlighting their contribution to GDP and overall societal well-being. These tables quantify the economic benefits derived from ecosystem services, whether through the market prices and non-market valuation techniques described throughout this Section. They are essential for cost-benefit analyses, investment decisions, and policy-making processes that aim to balance economic development with environmental sustainability. Highlights are provided below:

Coral reef fisheries show economic losses but likely underestimate true value

- The reef fishery shows a negative resource rent, suggesting underreporting of small-scale landings, not actual lack of benefit.
- Despite low measured profit, reef ecosystems continue to provide food and livelihoods.
- Improved data collection is essential to understand true catch volumes and stock status.

Coral reefs provide substantial coastal protection benefits

- In 2023, the coastal protection value from coral reefs (MVR 82.85 million)
- represents the cost of replacement to artificial defences.
- The valuation supports policy and investment in reef conservation to prevent future infrastructure expenses.
- It also encourages partnerships between government and tourism sectors to co-invest in reef health.

Tourism revenue is strongly dependent on healthy reefs

- Coral-related tourism spending in Laamu atoll (2025) is valued at MVR 469 million.
- This spending includes accommodation, excursions, and transport, driven largely by resort visitors.
- Declines in reef health could lead to substantial revenue losses and costly corrective actions. This justifies integrating reef conservation into tourism planning and private sector engagement.

Carbon sequestration benefits across ecosystems

- In 2020, carbon sequestration from seagrass and mangroves provided an estimated benefit of MVR 10.66 million.
- These ecosystems support global climate regulation and contribute to the Maldives' climate goals. The valuation supports their inclusion in Nationally Determined Contributions (NDCs) and climate resilience planning.

Table 5.13 Ecosystem service supply table, in monetary values (MVR, millions). Grey cells null by definition. NV = Not valued, data insufficient to perform monetary valuation of service.

Ecosystem service	Year (data)	Economic units	Households	Government	Ecosystems			Total supply
					Coral reef	Seagrass	Mangrove	
Wild fish provisioning (reef fish)	2022				NV	-	-	NV
Global climate regulation (Carbon sequestration)	2020				-	10.58	0.08	10.66
Coastal protection*	2023				82.85	-	-	82.85
Recreational value	2025				640.91	NV	0.00	640.91
Nursery and habitat maintenance service	2020				NV	NV	-	NV
Sediment production	2023				0.47	<0.01	-	0.47

*Quaywall replacement cost

Table 5.14 Ecosystem service use table, in monetary values (MVR, millions). Grey cells null by definition. ISIC code = International Standard Industrial Classification

Ecosystem service	Year (data)	Economic units (ISIC code)			Households	Government	Ecosystem	Total use
		Marine fishing (0311)	Short-term accommodation activities (5510)	Others				
Wild fish provisioning (reef fish)	2022	NV						NV
Global climate regulation (Carbon sequestration)	2020					10.66		10.66
Coastal protection	2023		7.99			74.86		82.85
Recreational value	2025		640.91					640.91
Nursery and habitat maintenance service	2020	NV						NV
Sediment production	2023		0.02			0.45		0.47

6. Using accounting values for decision making

The Maldives' first Natural Capital Accounts reveal the links between the health of the atoll's ecosystems with households and economic sectors in Laamu Atoll. Below are several examples of how statistics generated from these pilot studies support several policy applications.

6.1. Strategic, spatial and economic planning

The ecosystem extent, condition, and services provide a baseline to guide development pathways that promote continued economic growth by considering environmental resilience and functioning. They can be considered the “knowledge foundation” that gathers existing information in a structured manner to support policies, plans and enable finance. These policies and plans can then be enacted through “implementation frameworks” including strategic and spatial planning.

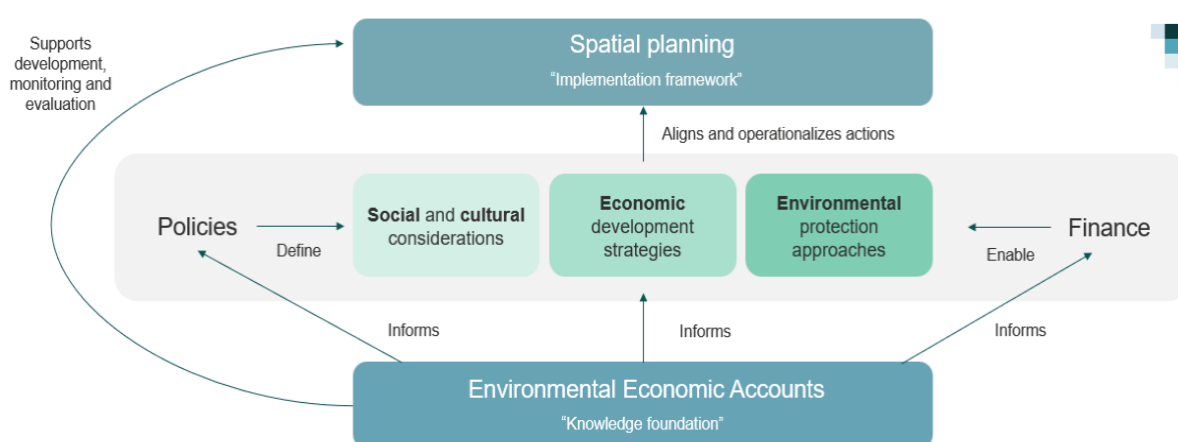


Figure 6.1 Relationship between Environmental Economic Accounts (SEEA) and spatial planning, through different considerations, policies, and finance.

6.1.1. Spatial planning

Spatial planning is the process of managing land use and development to balance economic, social, and environmental goals within a defined area. It involves analysing a diverse range of data, policies, and coordinating activities to optimize space and resource use while minimizing conflicts.

The planning process can be informed by accounts to identify and balance policies and development targets with ecosystem conservation, by identifying areas where ecosystem services provide the highest economic and social benefits. For example, Laamu's NCA revealed the value of ecosystems to coastal protection, fisheries support, and carbon sequestration, allowing planners to identify priority areas for conservation and sustainable development.

A critical application of the accounts is assessing trade-offs between development and environmental benefits for specific areas. Ecosystem extent and condition maps provided a spatial baseline for planning. Laamu's accounts show the location of key ecosystems (coral reefs,

mangroves, seagrass beds, etc.) and their health and functioning. Planners can identify high-value service areas and compare the potential impact to the value of these services with development.⁹

By quantifying these ecosystem services, spatial planners can make informed decisions on whether to proceed with development, modify project designs, or explore alternative locations with lower environmental costs. For example, the accounts provided the following statistics which could be relevant to a hypothetical expansion in tourism infrastructure for two tourist islands in Laamu Atoll (Olhuveli and Fares):

- Coral reefs provided recreational opportunities that could be linked to MVR 374.11 million annually in tourism spend,
- Coastal protection from coral reefs were valued annually between MVR 8.0 and 21.7 million annually,
- Benefits from carbon sequestration, in avoided damages due to climate change, for the two tourists islands was valued at MVR 0.3 million.

The hypothetical expansion of harbours to service these two islands threatens the continued provision of these services, which should be weighed against the long-term economic benefit of the harbours (see also Section 6.4). Similar analyses could be applied at the atoll scale for conducting cost-benefit analyses with marine spatial planning (MSP) or designating marine protected areas (MPAs).

Table 6.1. Key statistics from Laamu and example policy implication

Key statistics from Laamu Atoll	Policy implications
<ul style="list-style-type: none"> • Extent: Between 2017 and 2020, coral reefs declined by 0.62% and seagrass meadows reduced by 0.87%. • Condition: Coral bleaching rose sharply from 0.3% in 2019 to 11% in 2024, signalling increased stress. • Service Impact: Coral reefs provide coastal protection, valued at MVR 82.85 million annually in avoided damages to infrastructure. 	<p>Scenario: A harbour expansion is proposed near a degraded (recently bleached) reef adjacent to homes and critical infrastructure.</p> <p>The statistics indicate potential worsening of erosion risks and could guide decision-makers toward alternative site selection.</p> <p>Spatial planning activities may consider the loss of the reef and the cost of replacement through seawalls.</p>

6.1.2. Sectoral planning

Beyond conservation and risk mitigation, Laamu's Natural Capital Accounts also enhance economic planning. The accounts equip countries with tools to go beyond GDP and benefit sectoral and economic planning by:

⁹ This aligns with international best practice: the Kunming-Montreal Global Biodiversity Framework (GBF) Target 14 calls for the *full integration of biodiversity values into policies, planning processes, strategic environmental assessments and environmental impact assessments*.

- Understanding of the economic and social value of ecosystem services, enabling policies that consider ecosystem dependencies of specific sectors,
- Insights into the economic contributions of different sectors and their interdependence, supporting diversification strategies,
- Tracking of changes in ocean asset health and their effects on the economy.

Tourism in the atoll generates significant revenue, with coral reef-related tourism alone contributing an estimated MVR 469 million per year. Degradation of reef condition can directly impact visitor numbers, revenues, and jobs. The Laamu Atoll accounts demonstrate how the area, state could be quantified as a form of capital and further measuring the relative value of specific services.

Integrating natural capital data into spatial planning ensures that tourism development aligns with ecosystem resilience, avoiding overexploitation while maximizing long-term economic gains. This economic lens strengthens the case for investing in environmental management, such as wastewater treatment to protect reefs or restrictions on destructive practices. Furthermore, by linking these accounts with existing frameworks such as the Maldives' National Biodiversity Strategy and Action Plan (NBSAP) and the Sustainable Development Goals (SDGs).

6.1.3. Climate change adaptation

The accounts support climate adaptation and resilience strategies, by recognizing the extent and condition of ecosystems that buffer against climate impacts (i.e., Nature-based Solutions, NbS). These accounts help identify vulnerable areas and prioritize interventions.

Laamu's accounts make coastal protection services visible and measurable. They can show how much coastline is shielded by intact reef systems and estimate the flood protection value (in avoided damages) that seagrass beds and mangroves provide. This information allows decision-makers to:

- Identify coastlines most at risk from sea-level rise and storm surges,
- Quantify the economic value of Nature-based Solutions (NbS) for climate adaptation, and
- Compare natural infrastructure with engineered alternatives (seawalls, breakwaters), and the range of green-grey solutions that could be implemented.¹⁰

Additionally, time-series data on reef condition can inform coral bleaching action plans. When accounts reveal declining trends following mass bleaching events, policymakers can implement targeted interventions such as:

- Reducing non-climate stressors (pollution, overfishing) to enhance recovery
- Developing early warning systems for bleaching events

At the atoll level, ecosystem accounts also link ecosystems to community resilience through livelihoods and food security. Laamu's coastal waters provide food and jobs to a significant proportion of the 18,000 residents through fishing activities. Ecosystem extent and condition

¹⁰ Green-grey infrastructure is a hybrid approach that combines natural (green) and engineered (grey) solutions to enhance ecosystem resilience and provide sustainable services, such as flood protection, water purification, and climate adaptation. Green infrastructure includes natural elements like wetlands, forests, and green roofs, while grey infrastructure refers to traditional built structures like seawalls, stormwater pipes, and roads.

indicators (like seagrass coverage, coral health, or fish habitat quality) inform how well the environment can support fish stocks. The accounts, if further maintained over time, could:

- quantify how many livelihoods (e.g., employment and income statistics) are supported by reef fisheries, and
- how coral reef quality affects resort occupancy rates.

Policymakers can use such information to justify measures like seasonal closures or gear restrictions, showing stakeholders how short-term limits secure long-term yields.

6.2. Reporting for international commitments

By systematically tracking ecosystem extent and condition, the accounts provide quantifiable evidence that directly supports reporting for commitments including Nationally Determined Contributions (NDCs), Sustainable Development Goals (SDGs), and the Global Biodiversity Framework (GBF).

6.2.1. Global Biodiversity Framework Reporting

For the GBF, the accounts support reporting towards a range of targets,¹¹ such as:

- Plan and manage all areas to reduce biodiversity loss (Target 1): the accounts provide a baseline and further identify changes in ecosystem extent and condition. In Laamu, the accounts identified slight declines in coral reef and seagrass extent between 2017-2020, highlighting areas that may require enhanced protection.
- Conserve 30% of land, waters and seas (Target 3): the accounts could track progress toward the GBF "30x30" and further also monitor the effectiveness of those MPAs over time. Ecosystem accounts in Laamu provided baseline data on ecosystem extent for 6 protected areas.
- Restore, maintain and enhance nature's contributions to people (Target 11): the accounts demonstrate the contribution of nature to people, and further identify areas that may require further conservation to ensure continued provision of ecosystem services.

6.2.2. Supporting SDG Reporting Requirements

The compilation of these ecosystem accounts directly contributes to SDG target 15.9, which urges countries to integrate ecosystem and biodiversity values into national frameworks. Indicator 15.9.1(b) specifically tracks the "integration of biodiversity into national accounting and reporting systems, defined as implementation of the SESA." Laamu's SESA-compliant accounts provide concrete evidence of the Maldives' progress on this indicator. The accounts also support reporting on multiple other SDGs:

- SDG 14 (Life Below Water): Providing quantitative data on marine ecosystem extent and condition
- SDG 13 (Climate Action): Evidence of ecosystem health relevant to climate resilience and carbon sequestration.

¹¹ <https://www.cbd.int/gbf/targets>

6.2.3. Supporting Maldives' Updated NDC

The Nationally Determined Contributions (NDCs) represent each country's efforts to reduce national emissions and adapt to climate change impacts under the Paris Agreement. The Maldives, submitted its first NDC in 2015, followed by two updates in 2020 and 2025. The enhanced NDC reflects the Maldives' recognition that nature-based solutions and ecosystem protection are important actions for climate resilience. There are several themes within Maldives' Third NDC that are supported by accounts.¹²

The NDC aims to safeguard coral reefs and biodiversity, recognizing the importance of nature-based solutions and ecosystem-based management. Accounts tracking ecosystem condition (such as mangrove biomass of 168.90 Mg above-ground and 185.47 Mg below-ground) provide evidence of carbon sequestration potential and the baseline against which nature-based solution effectiveness can be measured. As explored in earlier sections, the accounts further:

- strengthen evidence-based coastal adaptation planning and national coastal management policy development (Section 6.1.1),
- strengthen financial mechanisms, particularly, in justifying nature's role in coastal protection investments (e.g., Section 6.1.2)

Future works could extend the accounts to coastal vegetation, which are recognized in the Third NDC as a nature-based solution and resilience buffer. The accounts could track the preservation of coastal vegetation and the impact of the 5 Million Tree Planting Programme.

6.3. Enabling sustainable finance

Robust environmental-economic data from Laamu Atoll can play a critical role in unlocking sustainable finance opportunities, providing investors and donors with the quantitative and standardized data feeding into established impact frameworks. This could be done by exploring three different sources of finance, namely:

1. Donors and philanthropists only expecting social and environmental impacts,
2. Investors expecting a financial return on investment, and
3. Impact investors that may expect a mix of financial, social and environmental outcomes.

For donors and philanthropists focused solely on environmental and social outcomes, the Laamu Accounts provide baseline and case for conservation funding. This funding can be tracked using SEEA indicators, ensuring transparency and accountability in delivering ecological benefits. For instance, grants or conservation trust funds could be designed to:

- Enhance coastal protection, leveraging the 2023 valuation of MVR 82.85 million in protective services provided by coral reefs,
- Fund the conservation of seagrass as a major carbon sink, with the accounts estimating 3484.7 tonnes of carbon sequestered in 2023.

Impact-focused finance approaches, such as impact investment funds or resilience bonds, seek a balance of financial, environmental, and social returns. Laamu's SEEA accounts support these models by demonstrating clear linkages between ecosystem health and economic resilience.

¹² Maldives Third Nationally Determined Contribution (NDC): <https://unfccc.int/sites/default/files/2025-02/Maldives%E2%80%99Third%20Nationally%20Determined%20Contribution.pdf>

- A reef resilience bond could tie investor returns to measurable improvements in reef condition and fisheries productivity, ensuring sustainable livelihoods for local communities.
- Payments for ecosystem services (PES) schemes could incentivize conservation while ensuring long-term ecosystem stability.
- Parametric insurance products could be linked to key environmental indicators, providing financial protection against climate-related losses while fostering ecosystem resilience.

By embedding SEEA-based statistics into impact assessment and monetisation of natural capital in financial mechanisms, Laamu Atoll can attract and optimize sustainable finance, ensuring that conservation actions are effectively monitored, reported, and aligned with investor and donor expectations.

6.4. Hypothetical scenario

A proposal has been put forward to construct a new harbor facility near a protected reef system in Laamu Atoll. The project aims to enhance shipping access and is estimated to generate approximately **MVR 3 million** in annual gross economic benefits for the island. However, such a development could have significant environmental and economic trade-offs, particularly concerning the loss of ecosystem services provided by natural capital.

Applying Natural Capital Accounting

If natural capital accounts have been compiled for the area, such as through the ENDhERI project, their data can be used to inform a cost-benefit analysis. By recognizing the ecosystem services that would be affected, decision-makers can gain a clearer picture of the project's true economic impact.

Benefit of accounts:

The project might appear to create MVR 3 million in net economic benefits. **With natural capital accounts**, the project could identify a net annual loss of MVR 2,512,997 in ecosystem services, significantly reducing the apparent economic benefit.

When considering replacement of natural assets over the long term:

- I. Artificial coastal protection to replace lost ecosystem services could cost MVR 48-136 million to construct, in replacing degraded coral reef to mitigate erosion and storm damage, depending on the number of homes and infrastructure under protection.
- II. The release of carbon from seagrass is estimated at MVR 42.5 million in one-time damage.

This analysis demonstrates how natural capital accounts reveal otherwise hidden costs and enabling informed development decisions that consider the importance of Maldives' natural assets.

Table 6.2. Hypothetical scenario – tradeoffs between ecosystem damage due to infrastructure development, using ecosystem service values.

Ecosystem impacted	Ecosystem Service	Social and economic considerations	Annual value per service	Value at risk (annual)
Coral reef (800 m of reef)	Coastal protection	50 homes and infrastructure (generator)	MVR 2,500/meter/year	MVR 2,000,000
	Sediment production	800 meters	MVR 103/cubic meter × 99 cubic meters	MVR 10,197
	Tourism recreation	0	MVR 0 (no tourists visit this area)	MVR 0
Seagrass	Fisheries enhancement	15 hectares	MVR 31,000/hectare/year	MVR 465,000
	Carbon sequestration	15 hectares	MVR 2,520/hectare/year	MVR 37,800
Total Annual Ecosystem Service Value				MVR 2,512,997

7. Suggested next steps

The development of Laamu Atoll's Natural Capital Accounts represents a significant milestone for understanding the contribution of Maldives' natural assets to society and the economy. As the first accounts in the country, they demonstrate the utility of how extent, condition, and service data could be organized in a consistent framework. The methods used to estimate those services can be used to develop further pilots and scale the accounting framework nationally. To continue the advance of NCA in the Maldives, three themes are proposed:

I. Continued scaling and thematic testing

The Laamu Atoll accounts provide a foundation to understand the process of account compilation and its use. Further pilot projects could be undertaken to test other thematic uses of accounts, focusing specifically on thematic challenges such as fisheries and tourism within other strategic locations. As further pilots are established, the Maldives could move towards the national implementation of accounts, covering other economically important atolls.

The continued testing of NCA should be guided by a national framework, to avoid fragmentation of methods and ensure consistency with international standards while addressing Maldives-specific contexts. This could be achieved by a national roadmap and framework document.

II. Strengthen data systems

The compilation of Laamu Atoll accounts generated new data, while also centralizing significant amounts of data generated. These data are stored in a central, standardized repository that could be extended nationally to provide an authoritative source for environmental-economic statistics, overcoming challenges in fragmentation.

This database requires further technical development, to ensure long-term sustainability of accounting efforts. This includes capacity building in:

- Data sharing between key stakeholders,
- specialized data storage, geospatial analysis, and economic valuation techniques, and
- representative long-term monitoring programs for the extent and condition of key ecosystems.

III. Mainstreaming and sustainable finance integration

To ensure the utility of accounts, a dashboard platform could be developed to assist users in accessing and gaining insights from the data. This enables enable practical decision-support functionality for ministries and stakeholders, that could integrate with existing government statistical platforms.

This platform could assist in mainstreaming natural capital into existing policy frameworks, including the strategic plans, sector-specific policies, and budgeting processes. This could be achieved through applying the accounts to specific policy challenges, including:

- Area-based planning: Marine spatial planning, protected area designation,
- Sectoral planning: fisheries and tourism development, and
- Climate adaptation strategies.

The accounts quantify the return on investment from conservation and restoration activities using the accounting framework to demonstrate economic as well as ecological benefits. Thus, they could facilitate:

- The development of financial mechanisms that leverage natural capital accounts to attract investment in conservation and sustainable use, including blue sukuk / bonds, carbon credits, and biodiversity offset schemes.
- novel financial products that require specific information of natural capital (e.g., parametric insurance), and
- access to international climate and biodiversity finance mechanisms (e.g., Global Environmental Facility and Green Climate Fund).

The Laamu Atoll Natural Capital Accounts have laid the groundwork for integrating nature's value into the heart of decision-making in the Maldives. By implementing these next steps, the country can move from pilot to practice, creating a system that recognizes the contribution of ocean ecosystems that underpin its economy, culture, and future prosperity. As climate change and other pressures intensify, these accounts will become increasingly vital tools for navigating toward the Maldives' vision for development while maintaining its natural wealth for future generations.

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