Government of the Republic of Trinidad and Tobago

TRINIDAD AND TOBAGO'S FIFTH NATIONAL REPORT TO THE UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY

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Executive Summary

The preparation of Trinidad and Tobago's (T&T's) 5th National Report to the United Nations Convention on Biological Diversity (CBD) began in February 2016 alongside the revision of T&T's National Biodiversity Strategy and Action Plan (NBSAP). The concurrence of these two (2) processes has offered an opportunity to work with a common group of stakeholders to meet their respective and related objectives, thereby giving greater priority and momentum to efforts to manage biodiversity and ecosystem services (BES) in T&T. Additionally, because T&T's 5th Report was prepared during the course of 2016, it includes relevant inputs related to the 2030 Sustainability Agenda and the associated Sustainable Development Goals (SDGs).

The 5th National Report is prepared and presented in a manner that is largely in keeping with the guidelines provided by the CBD Secretariat. To the extent possible, draft national indicators for T&T, developed under the auspices of the Strategic Plan for Biodiversity (2011 – 2020), have been used to assess and present data in Part I. However, because indicator data remains relatively scarce in T&T, other sources of data and information have been used throughout the body of the text to supplement the assessment. Additionally, because the NBSAP revision process (February to October 2016) extends beyond the preparation of the 5th Report (February to August 2016), several NBSAP inputs have not be prepared in time for inclusion in Part II of the 5th Report.

Q1: Why is biodiversity important for your country?

Recent research has highlighted that **several regulating and cultural services in T&T have economic values which, in certain cases, are significant in the context of T&T's national economy**:

- Carbon sequestration services provided by T&T's forests are valued at approximately US$1,088 per hectare per year;
- T&T continues to derive at least 88% of its freshwater from natural sources (ground and surface water); and the ability of T&T's watersheds to deliver water of good quality (water purification services) is valued at approximately US$88 million annually;

Pollinator bee on a flower
Photo courtesy Lena Dempewolf

- The forests in Trinidad's Northern Range provide soil retention services that are valued as high as US$622 million annually, representing as much as 6.8% of central government annual revenues. Intact forests on steep slopes (30 – 50 degrees) can also help to reduce soil erosion by as much as 95%;

- Forests on hillsides provide flood prevention services, valued in T&T at approximately US$5 per hectare per year. Compared to the cost of flooding which could be over US$16 million per (severe) flooding event, there is a good case for protecting the forests in T&T's watersheds to help prevent losses and reduce clean up costs;

Burnt hills in Trinidad's Northern Range
Photo courtesy Robyn Cross

- Pollination plays an important role in agriculture, and its contribution is not effectively reflected in market prices of goods. It is estimated that the economic value of pollination is between 9 and 13% of the annual value of all vegetable production in T&T. The loss of pollinators will not only have impacts on agriculture at the national scale, but will likely be most directly felt by subsistence farmers who can lose as much as US$12,692 per cycle for crops such as cucumbers;

- T&T's coastal ecosystems play an important role in protecting the islands' shorelines. Coastal protection services provided by coral reefs, mangroves and marshes are valued at US$49.6 million annually. These ecosystems have an important role in helping to protect T&T's coasts from natural disasters, especially in the context of climate change;

- Coastal ecosystems also support recreation and tourism-based activities, valued at up to US$390,428 per hectare per year.

Q2. What major changes have taken place in the status and trends of biodiversity in your country?

Despite the overwhelming evidence that biodiversity and ecosystem services support human well-being and the economy of T&T in a variety of ways, several **aspects of biodiversity in T&T, for which data are available, continue to be under threat**:

Biodiversity Components			Status and Trends	Level of Certainty	Indicators
Ecosystems	Forests	Natural	↗	High	*T&T Indicator 5i*
		Plantation	↘	High	*T&T Indicator 5ii*
	Coastal	Mangroves	↘	Medium	*T&T Indicator 5iii*
		Coral Reefs (Tobago)	↘	High	*T&T Indicator 5iv*
		Seagrass beds	↘	High	*T&T Indicator 5v*
		Marshes	↘	High	No indicator
	Freshwater	Rivers	↘	Medium	*T&T Indicators 8i; 8iii*
Species	Diversity & distribution	Flora	→	Low	No indicator
		Fauna	↘	Low	No indicator
	Vulnerable/ Threatened Spp.	Flora	↘	High	*T&T Indicator 12i*
		Fauna	↘	High	*T&T Indicator 12i*
	Spp. of economic importance	Wildlife	↘	Medium	No indicator
		Marine Fisheries	↘	High	*T&T Indicator 6vii*
Ecosystem Services		Freshwater provision	↘	Medium	No indicator
		Sediment retention	NA	Medium	No indicator
		Coastal protection	NA	Medium	No indicator
		Carbon sequestration	NA	Medium	No indicator
		Coastal tourism/ recreation	NA	Medium	No indicator
		Pollination	NA	Medium	No indicator

Notes to table:
1) This qualitative assessment is based on available data and expert opinion.
2) Status refers to the latest known status – for many aspects of biodiversity in T&T, the data do not refer to 2016 status.
3) Trends are assessed using available baseline data and most recent data, and thus dates vary.
4) NA means that the data are not available to perform a trend analysis

Key to table:

Status Assessment

Good	Fair	Poor

Trends Assessment

↑	↗	→	↘	↓
Significant increase	Slight to moderate increase	No change/ Stable	Slight to moderate decline	Significant decline

Q3. What are the main threats to biodiversity?

The factors affecting biodiversity are no different to those presented in the 4th National Report of T&T to the CBD (2010), although the intensity of certain pressures appears to be growing:

- Land use and land cover change is considered the single greatest threat to T&T's biodiversity and associated services – through activities such as urban and built development, unsustainable agricultural practices, and fires. Urban development is increasingly stretching into areas that are not classified for this type of development based on watershed studies; and fires have impacted more than 50,000 Ha of lands (collectively) across T&T since 1998;

- Overharvesting is affecting services such as freshwater, where T&T's freshwater abstraction as a percentage of total renewable resources is almost 9% - one of the highest in Latin America and the Caribbean. This is a very important consideration for T&T as a small island state, especially in the context of a changing climate. Marine, commercial fish stocks are also at risk, given that most species harvested in T&T's waters are beyond safe biological limits;

- Land-based sources of pollution continue to be of concern because of their impacts both on freshwater biota and on coastal ecosystems;

- Climate change is expected to drive further reductions in the diversity and extent of T&T's natural ecosystems – including through impacts on coral reefs because of increasing sea surface temperatures; and changes in terrestrial plant populations because of shifting rainfall and temperature patterns. By 2050, it has been calculated that Trinidad may lose many of its endemic and valuable species. Further, based on the scenario outputs, the floral assemblages of Trinidad's Northern Range are expected to be the most heavily impacted by climate change;

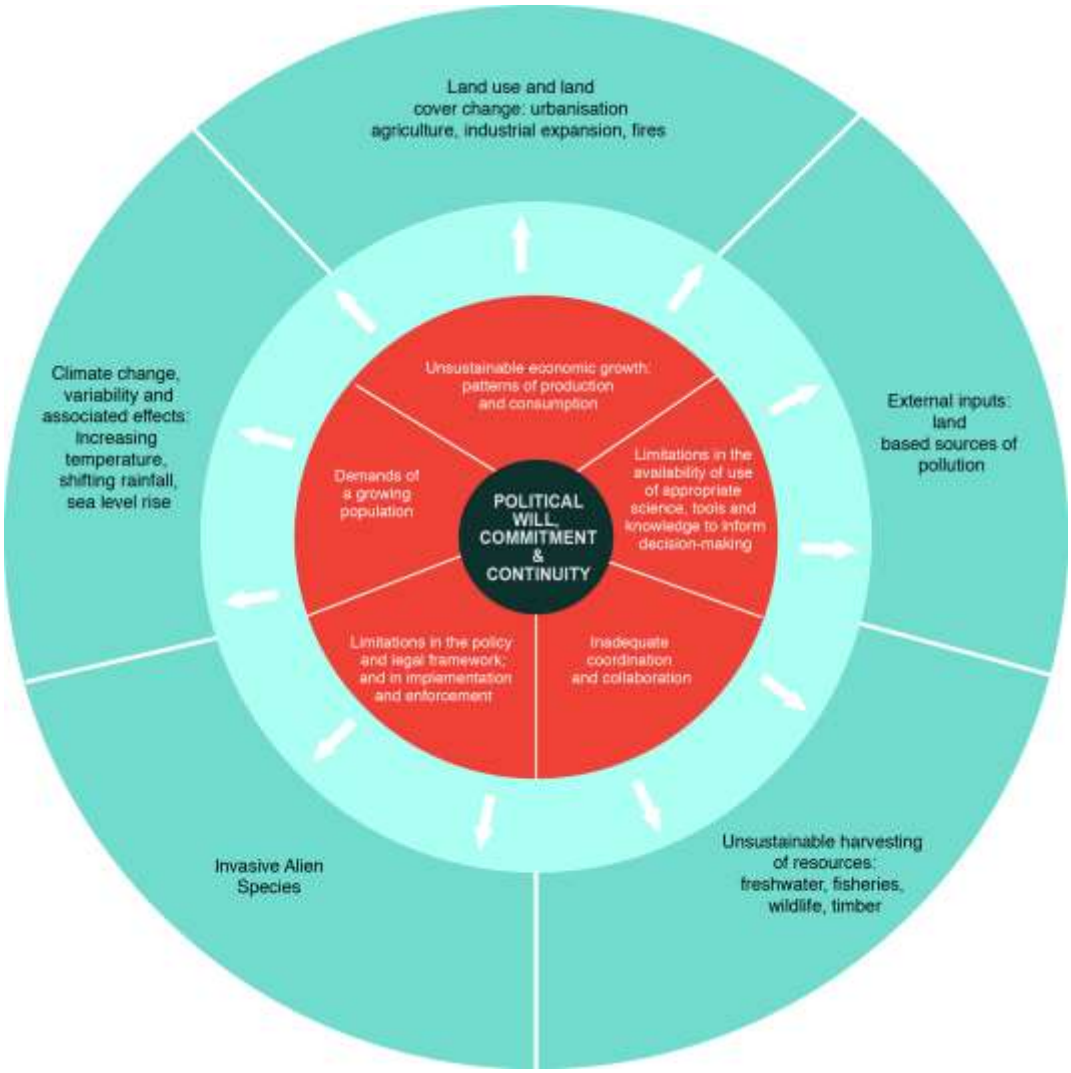
Forest canopy in Trinidad's Northern Range
Photo courtesy Robyn Cross

- The number of Alien Invasive Species that pose a threat has increased since 2010. Certain species are of particular concern, including the Lionfish (*Pterois*), which continues to proliferate, especially on Tobago's northeastern reefs;

- Indirect drivers, such as population growth and distribution, and economic growth appear to be driving patterns in production and consumption that are unsustainable, although it should be noted that these pressures are not evenly distributed across T&T. The policy and legislative framework for biodiversity, while it has been improving, continues to have many gaps, and does not seem to be effective in stemming the loss of biodiversity, partly on account of the lack of enforcement and implementation;

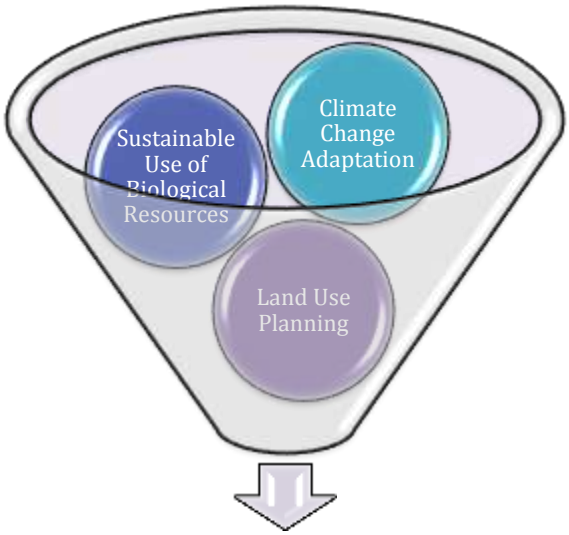
- At the heart of the drivers affecting BES in T&T is political will, commitment and continuity.

The BES Driving Forces of Highest Priority in Trinidad and Tobago



The assessment of driving forces in this assessment points to the need to focus on a few, very high priority pressures over the next 5 to 10 years in order to have any chance of reversing negative trends in BES. These include **land use planning, climate change adaptation, and sustainable use of biological resources (sustainable patterns of production and consumption)**.

Proposed Policy Focal Areas for Addressing Driving Forces Affecting BES in T&T



Biodiversity and Ecosystem Services Management
(National and Sub-national Policies and Plans)

Q4. What are the impacts of the changes in biodiversity for ecosystem services and the socio-economic and cultural implications of these impacts?

The implications of biodiversity loss for human well-being in some cases are clear - **the economic values of ecosystem services presented in Question 1, indicate that the continued impairment or loss of these services will have both national and subsistence-level impacts**. Additionally, the loss of regulating services such as soil erosion, water purification, coastal protection, and flood protection will increase T&T's vulnerability to natural hazards, especially in the context of climate change; and it will increase the country's vulnerability to external shocks. Trinidad and Tobago

(T&T) is a small island developing state whose economy has been very heavily reliant upon a buoyant energy sector for several decades. Given that oil and gas reserves are finite and will eventually be exhausted, it has been recognized that failure to protect ecosystems and the vital services that they provide will likely result in a decrease in the high Human Development Index (HDI) that has characterized T&T since the 1980's. Better investment into protecting vital ecosystems to conserve water resources, regulating services and services that support agriculture and fisheries has been identified as a means to address the growing concerns about boosting T&T's food security and reducing levels of poverty.

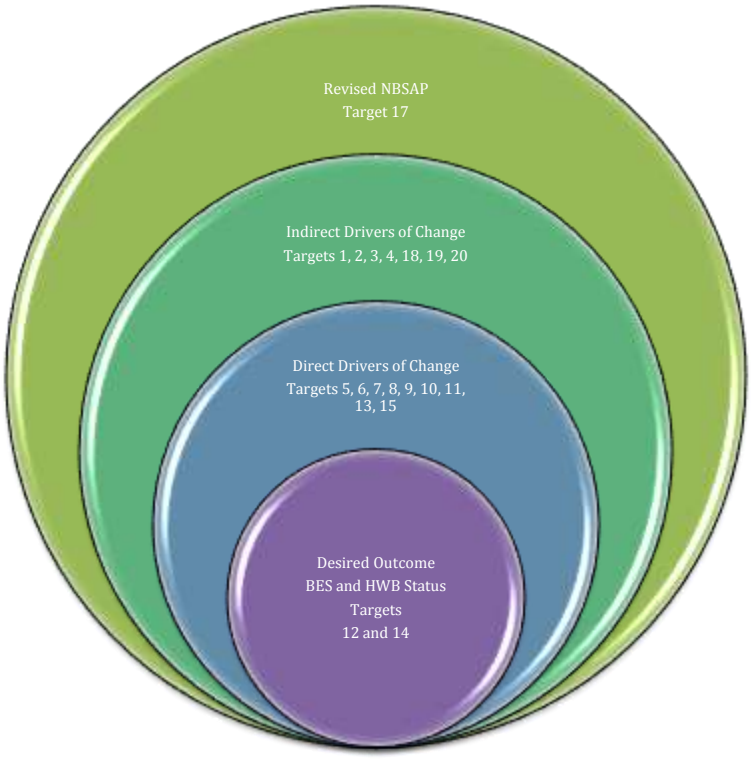
Q5: What are the biodiversity targets set by your country?

In 2014, a draft list of national targets in keeping with the 20 Aichi Targets was developed by stakeholders in T&T. These targets are accompanied by a list of 97 associated indicators. The draft targets were submitted for approval by Cabinet in 2014, and approval is pending.

Q6: How has your national biodiversity strategy and action plan been updated to incorporate these targets and to serve as an effective instrument to mainstream biodiversity?

The draft T&T national (Aichi) Targets form the backbone of the updated NBSAP, and serve as the major input to the NBSAP revision process. The revised NBSAP has prioritized the Targets through a grouping process in order to separate desired outcomes for BES and HWB, from the means by which desired outcomes could be achieved (addressing drivers of change).

Packaging of the Aichi Targets in the Context of T&T's Revised NBSAP



Q7: What actions has your country taken to implement the Convention since the fourth report and what have been the outcomes of these actions?

Since 2010, several measures have been put in place to manage T&T's biodiversity and ecosystem services, including:

- Updating of T&T's NBSAP (2016 ongoing);
- Development of a (draft) list of national BES Targets and indicators for T&T in keeping with the Aichi Targets;
- The development and implementation of a range of policies which address direct drivers affecting BES (e.g. forest, wildlife, protected areas, climate change); and designation of seven (7) additional species under the Environmentally Sensitive Species Rules, 2001;

- Projects to enhance on-the-ground actions (e.g. the National Restoration, Carbon Sequestration, Wildlife and Livelihoods Project [2010 – 2017]; and Improving Forest and Protected Area Management in T&T);

- Investments into research (e.g. the Project for Ecosystem Services; the Darwin Initiative);

- Efforts to build capacity and awareness for BES management;

- Improvements in information access and dissemination, including upgrading of T&T's Biodiversity Clearinghouse;

- A project to advance T&T's efforts to implement the Nagoya Protocol (led by the IUCN as part of a regional initiative).

As the assessment of status and trends in BES, as well as the assessment of drivers presented in this report have established, **the measures outlined above, though they have had benefits and positive impacts in their own right, collectively they have had a limited impact**.

Q8: How effectively has biodiversity been mainstreamed into relevant sectoral and cross-sectoral strategies, plans and programmes?

While biodiversity and ecosystem services continue to be mentioned in a number of cross-sectoral policies, plans, programmes and projects, there are a number of mainstreaming aspects that need to be improved:

- There continues to be a general lack of priority placed on BES management from a development standpoint. BES considerations, even where/when they are mentioned and included in development policy, are often sidelined or traded off with other more high priority considerations;

- While elements of biodiversity (ecosystems, species and genetic diversity) have been mentioned/included in policies for many years, ecosystems services is a relatively new concept in T&T from a BES management standpoint, and appreciation of their value in development planning is hitherto limited;

Residential Development in the Trinidad's Northern Range
Photo courtesy Robyn Cross

- Research and information to support mainstreaming of BES has been improving (albeit at a slow rate); but the science-policy interface still remains weak in T&T. Additionally, there is very limited use of policy support tools to assist in mainstreaming efforts;

- The interagency collaboration and coordination that is required to facilitate the mainstreaming of BES across sectors needs to be enhanced;

- Capacity to mainstream BES needs to be improved among all stakeholder groups.

The recent (2012) effort made by the Government of the Republic of Trinidad and Tobago (GoRTT) to update T&T's land use planning policy framework, through the production of a policy instrument known as the (draft) National Spatial Development Strategy (NSDS), produced some very useful learning with respect to BES (and more broadly environmental) mainstreaming. This process provides a useful blueprint for T&T to consider how other aspects of development planning can address some of the deficiencies outlined above.

Q9: How fully has your national biodiversity strategy and action plan been implemented?

T&T began the process to update its NBSAP in February 2016. It is anticipated that the process will be completed in the last quarter of 2016. As such, the original version of the NBSAP (2001) is the version of the NBSAP currently under implementation. The 2001 NBSAP identified 23 strategies and their associated actions to be implemented. These strategies sought to address five (5) priority areas of interest i.e. Education and Awareness, Legislation and Enforcement, Capacity, Research and Information, and Policy and Commitment. The actions defined for each area were significant for supporting the establishment of a solid framework for long-term biodiversity conservation within T&T. However, by their sheer number they were ambitious, and the assessment of their implementation revealed varying levels of completion in each area. Notable contributions towards

the execution of the strategies and actions came via: the implementation of small and medium sized projects ably supported by various funding agencies including the Global Environment Facility (GEF) Small Grants Programme, which funded over 30 biodiversity related projects between 1995 and 2010; the Green Fund, which funded approximately 16 projects (as at 2013); development of an Integrated Coastal Zone Management (ICZM) Policy Framework for T&T; and participation in regional programmes such as, the Caribbean Regional Fisheries Mechanism. While these achievements are notable, much more could have been accomplished if there was an overarching national framework for biodiversity conservation, effective coordination to guide the implementation of the NBSAP process, and ready access to adequate financial resources to support implementation of the actions.

Q10: What progress has been made by your country towards implementation of the Strategic Plan for Biodiversity 2011 – 2020 and its Aichi Biodiversity Targets?

Strategic Goals	Global Target	T&T Progress
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	**Target 1:** By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	↗
	Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	→
	Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	→
	Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	→
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	**Target 5**: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	↗
	Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits	↘
	Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	↘
	Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	↘
	Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	↗

Strategic Goals	Global Target	T&T Progress
	Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	↘
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	**Target 11:** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes	↗
	Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	↘
	Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	→
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services	**Target 14**: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	↘
	Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	↗
	Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	↗
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	**Target 17**: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	→
	Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	→
	Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	↗
	Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	→

Q11: What has been the contribution of actions to implement the Convention towards achievement of the relevant 2015 Targets?

The 2014 Report on the Millenium Development Goals (MDGs) prepared by the GoRTT, along with available data and information for 2015 indicate that there have been strong synergies between implementation of the CBD and MDG #7. Progress in achieving Goal 7 has, however, been mixed.

Millennium Development Goal	Description of the Contribution of T&T's Actions to Implement the CBD Towards the MDGs
	Target 7.A Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources. • T&T has developed several policies and programmes in order to safeguard biodiversity. Target 7.B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss. • Indicator 7.1 Proportion of land area covered by forest (Target – more than 1996 baseline of 44.85%): The Target has reportedly been met. Based on the 2014 GoRTT MDG report, forest cover increased from 44.1% in 2005 to 48% in 2012. Data from the Forestry Division (2016) indicate that forest cover is currently estimated at 45.7%, (2015). This is higher than the 44.85% Target; • Indicator 7.2 Carbon Dioxide absolute emissions (Target less than 25,397.2Gg). This Target has not been met. CO_2 levels from activities in T&T continue to be high; • Indicator 7.3 Consumption of Ozone Depleting Substances (Target – less than 168.7 tonnes). Consumption of ozone depleting substance dropped from 168.7 tonnes in 1990 to 34.34 tonnes in 2011. This Target was surpassed, but the implications for BES in T&T are unclear; • Indicator 7.4 Proportion of fish stocks within safe biological limits (no specific Target). It has been recognized that the safe biological limits for many commercially important fish stocks has been surpassed, and this Target has therefore not been met; • Indicator 7.6 Proportion of terrestrial and marine Protected Areas (no Target). The most recent quantitative data indicate that 32% of T&T's land and 0.1% of its marine space is protected (GoRTT, 2014). On the basis of the T&T's national Aichi Target #11, it would appear that T&T is doing well in the protection of land area (Aichi Target: 17% land area protected); but that the country is well below its desired Target in terms of coastal and marine areas protected (Aichi Target: 10% coastal and marine area protected); • Indicator 7.7 Proportion of species threatened with extinction (no Target). There has been an increase in the number of threatened species since 2010. Most recently (2015), it is estimated that there are 66 threatened animal species (in the IUCN categories - extinct, extinct in the wild, critically endangered, endangered and vulnerable); and 56 threatened plants (in the IUCN categories - extinct, extinct in the wild, critically endangered, endangered and vulnerable).

Q12 What lessons have been learned from the implementation of the Convention in your country?

T&T has identified a number of lessons from the implementation of the CBD to date:

1. The importance of developing clear goals and targets in order to streamline and focus efforts towards BES management;
2. The importance of developing a few key indicators in keeping with available resources to measure and monitor progress over time;
3. The value of strengthening the science-policy interface to support decision-making at all levels;
4. The value of developing and/or applying a set of policy support tools to bolster mainstreaming efforts;
5. The importance of not trying to deal with every issue related to BES all at once (and certainly not in an ad hoc, disjointed fashion), but rather identifying priorities and using resources and policy instruments strategically to bring about change;
6. How to develop national reporting timeframes for BES in 4 to 5 year cycles in order to reduce reporting burdens yet still have the opportunity to identify important changes in BES that require attention;
7. The importance of champions at the policy level and within other stakeholder groups in order to help catalyse and pursue BES management efforts;
8. The importance of building capacity and awareness about BES in order to support and even expedite policy processes;
9. The importance of building strategic partnerships for BES, especially public-private partnerships which include local communities and civic society;
10. ' ***Implementation of policies/plans/programmes***: A lot of the 'action' that occurs around BES management has often been on paper or in meetings and workshops on BES. These have little value in operational terms; and focus therefore needs to be on the practical issues associated with implementation and enforcement ;

Recreational river-bathing in Trinidad's Northern Range
Photo courtesy Robyn Cross

11. ***Continuous action***: The challenges and complexities that face BES management can sometimes be overwhelming. It is not realistic to expect all of the desired changes in a very short space of time, especially because of development tradeoffs that often need to be made. However, by constantly and systematically working at the problems, especially in a global

framework and partnership such as the one provided by the CBD, it is possible to reduce threats to BES and improve the state of BES and associated HWB.

In moving forward, the GoRTT recognizes the need to find innovative solutions to allow for the decoupling of economic growth and natural resource consumption/destruction in order to reverse persistent negative trends in biodiversity. Additionally, the importance of designing and implementing measures to improve ecosystem-based management in order to increase resilience and lower vulnerability has been recognized. Finally, the Government has taken note of the range of policy support tools for mainstreaming biodiversity and ecosystem services into all sectors of development planning. The Government remains committed to meeting the 2020 Aichi Biodiversity Targets, and will continue to put the necessary measures in place to protect Trinidad and Tobago's natural heritage which will secure human well-being well into the future.

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LIST OF ACRONYMS

%	Percentage
°C	Degrees Celsius
ACP	African, Caribbean and Pacific (group of states)
AESA	Agro-eco-system-analysis
AMCHAM	American Chamber of Commerce
AQUASTAT	Global Water Information System of the Food and Agriculture Organization
AR5	Fifth Assessment Report of the Intergovernmental Panel on Climate Change
ASPT	Average Score Per Taxon
BAU	Business as Usual
BES	Biodiversity and Ecosystem Services
BMP	Biodiversity Management Project
CABI	Centre for Agriculture and Biosciences International
CANARI	Caribbean Natural Resources Institute
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CBD	Convention on Biological Diversity
CBOs	Community Based Organisations
CDIAC	Carbon Dioxide Information Analysis Center (of the United States Department of Energy)
CEC	Certificate of Environmental Clearance
CEDP	Comprehensive Economic Development Plan
CITES	Convention on International Trade in Endangered Species
CNIRD	Caribbean Network for Integrated Rural Development
CO_2	Carbon Dioxide
COP	Conference of the Parties
COPE	Council of Presidents of the Environment

CONABIO	Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (Mexico)
CSO	Central Statistical Office
CXC	Caribbean Examinations Council
DAMME	Division of Agriculture, Marine Affairs, Marketing and Environment (of the Tobago House of Assembly)
DNRE	Department of Natural Resources and the Environment (of the Tobago House of Assembly)
Eco-DRR	Ecological Disaster Risk Reduction
EE	Environmental Education
EEZ	Exclusive Economic Zone
EMA	Environmental Management Authority
EMAct	Environmental Management Act Chapter 35:05
EN	Endangered
ENGOs	Environmental Non-governmental Organisations
EPPD	Environmental Policy and Planning Division (of the Ministry of Planning and Development)
ES	Ecosystem Services
ESA	Environmentally Sensitive Areas
ESS	Environmentally Sensitive Species
EU	European Union
FAO	Food and Agriculture Organization
FD	Forestry Division
FRA	Forest Resources Assessment (of the Food and Agriculture Organization)
GAS	Giant African Snail
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEF-SGP	Global Environment Facility- Small Grants Programme (of the United Nations Development Programme)
GEO-6	Sixth Global Environment Outlook (of the United Nations Environment Programme)

GFEU	Green Fund Executing Unit
GHG	Greenhouse Gas
GIS	Geographic Information System
GLOBE	Global Learning and Observation for the Benefit of the Environment
GoLoCarSce	Global-Local Caribbean Climate Change Adaptation and Mitigation Scenarios
GoRTT	Government of the Republic of Trinidad and Tobago
Ha	Hectares
HDI	Human Development Index
HWB	Human Well-Being
IAS	Invasive Alien Species
ICCAT	The International Commission for the Conservation of Atlantic Tunas
IDB	Inter-American Development Bank
IMA	Institute of Marine Affairs
InVest	Integrated Valuation of Ecosystem Services and Tradeoffs
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IRO	The Inter-religious Organisation (of Trinidad and Tobago)
ICZM	Integrated Coastal Zone Management Policy
IUCN	International Union for Conservation of Nature
KAP	Knowledge, Attitudes and Practices
km^2	Square kilometers
LAC	Latin America and the Caribbean
LBS	Land-based Sources of Pollution
LIDAR	Light Detection and Ranging
LULC	Land Use Land Cover Change
m	Meter
M2M	Matura to Matelot network

MALMR	Ministry of Agriculture, Land and Marine Resources
MEEOP	Matura National Park Environmentally Sensitive Area Education and Outreach Programme
MDG	Millennium Development Goals
MEAU	Multilateral Environmental Agreement Unit
MEWR	Ministry of the Environment and Water Resources
MNP	Matura National Park
mm	Millimeters
MNS	Ministry of National Security
MOU	Memorandum of Understanding
MSL	Mean Sea Level
Mt	Million tonnes
MTIASIC	Mitigating the Threats of Invasive Alien Species in the Insular Caribbean
N/A	Not applicable
NAP/ IFS	National Action Plan/ Integrated Financial Strategy
NBATT	National Biodiversity Assessment of Trinidad and Tobago
NBIS	National Biodiversity Information System
NBSAP	National Biodiversity Strategy and Action Plan (Trinidad and Tobago)
NEP	National Environmental Policy
NGOs	Non-governmental Organisations
NIHERST	The National Institute for Higher Education, Research, Science and Technology
NO_3 – N	Nitrate Nitrogen
NOAA	National Oceanic and Atmospheric Administration
NOC	National Oversight Committee
NRCSWLP	National Reforestation, Carbon Sequestration, Wildlife and Livelihoods Project
NRWRP	National Reforestation and Watershed Rehabilitation Programme
NSDS	National Spatial Development Strategy

NT	Near Threatened
OCPs	Organochlorine pesticides
ORMACC	Regional Office for Mexico, Central America and the Caribbean (of the International Union for the Conservation of Nature)
PAs	Protected Areas
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated Dibenzo-p-dioxins
PCDFs	Polychlorinated Dibenzofurans
PES	Payment for Ecosystem Services
PFDA	Planning and Facilitation of Development Act
PO_4^{3-}	Phosphate Phosphorus
PPP	Gross Domestic Product per Capita
ProEcoServ	Project for Ecosystem Services (2011 – 2015)
RUSLE	Revised Universal Soil Loss Equation
SDGs	Sustainable Development Goals
SEAs	Strategic Environmental Assessments
SGA	Sub-Global Assessments
SIDS	Small Island Developing States
SOD	Second Order Draft
SOS	Save Our Seas
SusTrust	Trust for Sustainable Livelihoods
TT$	Trinidad and Tobago Dollar
T&T	Trinidad and Tobago
TCP Act	Town and Country Planning Act
TCPD	Town and Country Planning Division (of the Ministry of Planning and Development)
TEMA	Tobago Emergency Management Agency
THA	Tobago House of Assembly

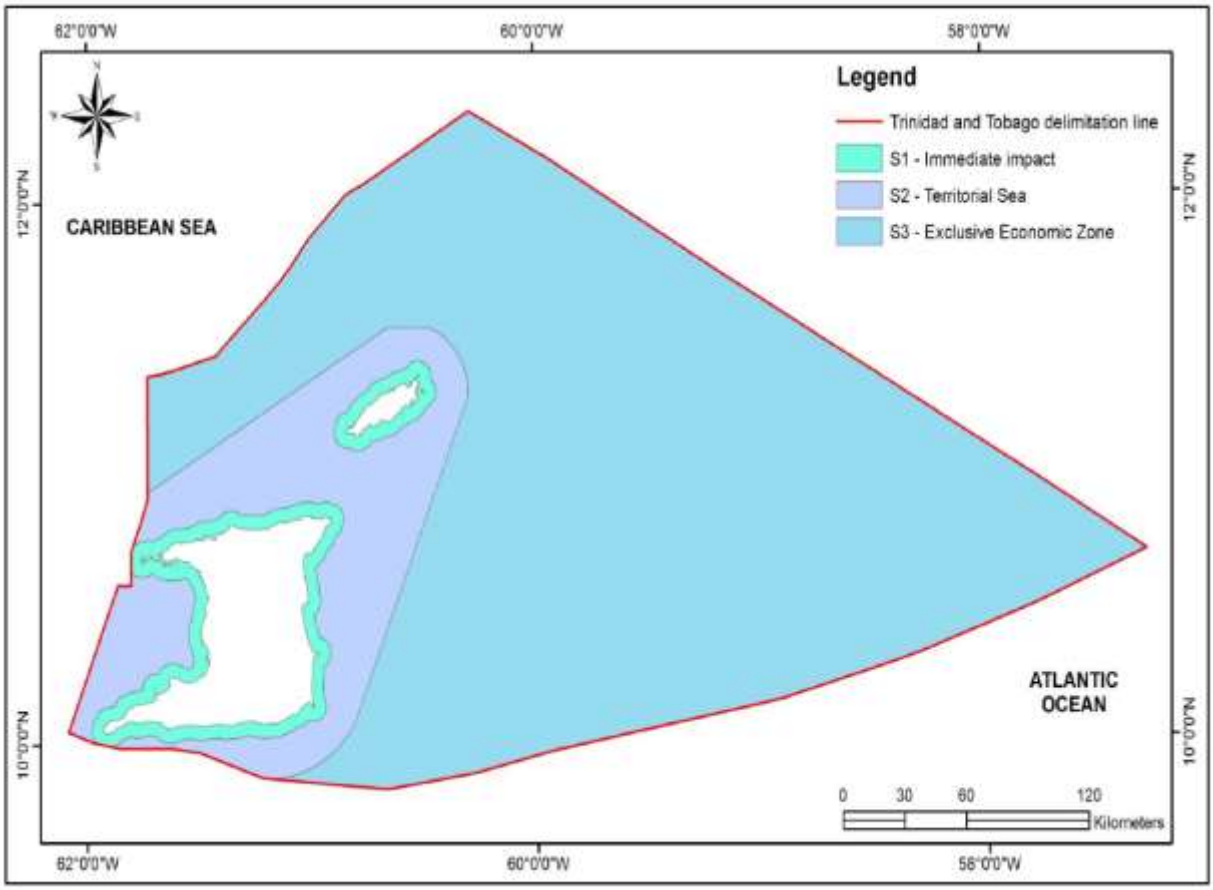
$tha^{-1}yr^{-1}$	Tonnes per hectare per year
TIDCO	Tourism Development Company
TTHTI	Trinidad and Tobago Hospitality and Tourism Institute
TTMA	Trinidad and Tobago Manufacturers Association
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme – World Conservation Monitoring Center
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
US$	United States Dollar
UTT	University of Trinidad and Tobago
UWI	The University of the West Indies
VU	Vulnerable
WASA	Water and Sewerage Authority of Trinidad and Tobago
WRA	Water Resources Agency
WTTC	World Travel and Tourism Council
yr	Year
YWCATT	Young Women Christian Association of Trinidad and Tobago

General Introduction to the 5th Report

1.0 Opening Remarks

T&T are the two (2) main islands of an archipelagic state situated between 10 – 11° North Latitude and 60-61° West Longitude at the southern end of the chain of Caribbean islands known as the Windward Islands. Trinidad is the larger of the two islands, with an area of approximately 4,827 km^2 while Tobago has an area of 303 km^2. The Exclusive Economic Zone (EEZ) of the country covers an area of approximately seventy-five thousand square kilometers (75,000 km^2) – almost 15 times as large as the land area of the islands combined (Figure 1), and this has special implications for the management of the country's marine biological resources. The total population of the country is estimated to be 1,349,667 persons (CSO, 2016).

Figure 1: Map Showing Trinidad and Tobago Within its Exclusive Economic Zone



Source: Ministry of the Environment and Water Resources (2014)

2.0 Background and Context for the 5th Report

2.1 Main Findings and Conclusions of the 4th Report

The 4th National Report of T&T to the CBD, submitted in 2010, reported the following main findings and conclusions based on research and stakeholder perceptions:

- The two (2) most important ecosystem services derived from biodiversity at a national level in T&T were considered to be freshwater provision (from natural watersheds) and flood regulation/erosion control - both of which are provided by forested ecosystems. Other important services included tourism/ecotourism (coral reefs, bird watching), recreation, shoreline protection (provided by coastal ecosystems such as mangroves, coral reefs and seagrasses) and the provision of food (fisheries, aquaculture, wild game meat, crops and livestock). Certain other services were found to be of importance to the livelihoods of local communities, including small-scale fisheries and subsistence agriculture; ecotourism activities such as turtle watching; and the use of non-timber forest products for producing goods for sale. While data and information on regulating services - such as carbon sequestration, pollination and biodiversity support - were relatively scarce (in some cases totally absent), their importance was still recognised locally;

Photo courtesy Lena Dempewolf
Intensive farming in the Nariva Swamp, Trinidad

- There was a causal and integrated relationship noted in the manner in which both direct and indirect driving forces affected biodiversity and consequently human well-being. The major cause-effect thread reported was as follows:

    - Rapid economic growth on account of the oil and gas industry in T&T drives changes in demographics and land use/land cover especially (though not exclusively) in western Trinidad and in southwestern Tobago. These were exacerbated by lack of

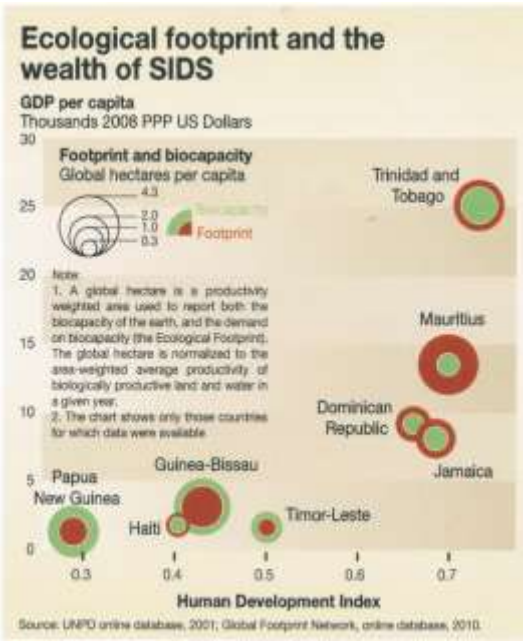
effective governance and implementation of laws/policies, as well as by other stressors such as overharvesting, climate change and alien invasive species;

- On account of these changes, there were found to be significant modifications especially in the country's forests and coastal systems;
- Pollution of inland freshwater systems and coastal regions on account of land based activities (principally housing/urbanisation, agriculture, industrialisation and quarrying) was also noted as a pressing issue;
- Data indicated that T&T's ecological footprint was well in excess of its biocapacity, and this sets the country apart from many other SIDS, notably those in the Caribbean (Figure 2).

- As a result of the increasing pressures on biodiversity, loss of ecosystem integrity resulted in some very direct and severe consequences, the most pressing included:

  - Greater severity of flooding in areas most modified by human activities. These also coincided with areas of highest urban and residential development;
  - Lower quantities of good-quality potable water from inland water sources;
  - Loss of suitable habitats for wildlife, resulting in reductions in the abundance and distribution of species on both islands, as well as a higher vulnerability of certain species to endangerment and extirpation;
  - Economic losses in tourism and fisheries in Tobago associated with extensive coral reef degradation;
  - Higher fish prices due in part to depleted marine stocks.

Figure 2: Trinidad and Tobago's Ecological Footprint



- The recommendations for improving management remained largely unchanged since the production of the first NBSAP for T&T in 2001, and included placing more focus on addressing issues such as political priority, lack of coordination of efforts, capacity, and financing.

2.2 Considerations for Preparation of the 5th Report

Since the preparation of the 4th National Report of T&T to the CBD (2010), there have been a number of important advancements in efforts to manage the country's biodiversity. These range from research efforts to fill important gaps in data and knowledge; to capacity building workshops and events; to the development of a draft set of national indicators under the Aichi Targets; to the development/revision of policies and legislation that are either directly focused on BES, or that indirectly impact the management of BES. In 2012, T&T also became a member of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) – an important step in the country's efforts to keep track and report on changes in its biological diversity.

The current report, the 5th National Report of T&T to the CBD, will focus on updates and major changes since the 4th Report. This report is being developed in tandem with the revision of T&T's NBSAP – See Appendix I. The convergence of these parallel processes has offered an opportunity to work with a common group of stakeholders to take stock of BES management across T&T and bolster current efforts, thereby giving greater priority and momentum to efforts to manage BES in T&T. Because the NBSAP revision process (February to October 2016) extends beyond the preparation of the 5th Report (February to October 2016), several NBSAP inputs have not be prepared in time for inclusion in Part II of the 5th Report.

As requested by the CBD Secretariat, **this report attempts to use key indicator datasets to track changes in biodiversity in T&T where possible**. In 2014, T&T developed a draft list of local indicators in keeping with the Aichi Targets, which provide a national framework for systematically monitoring and measuring changes in biodiversity and its management. These indicators are included throughout the current report. **It should be noted however that these indicators have not yet been approved by T&T's Cabinet, and are therefore not yet fully adopted and operationalised** by the GoRTT and other stakeholders[1].

[1] The full list of draft indicators is also being examined in the context of the process to update the NBSAP to ensure that the national indicators are consistent and supportive of the 2030 Sustainability Agenda, which includes the Sustainable Development Goals (SDGs).

Insofar as the current report tries to apply T&T's indicators to the assessment of BES especially in Part I, it must be highlighted that **for the majority of these indicators, official baselines and systematic monitoring data do not yet exist in a quantified/quantifiable form. This significantly limits the extent to which these indicators are effective in providing an assessment; and other datasets are thus included throughout the report to ensure the most comprehensive coverage of the changes in BES and attendant impacts in T&T is provided.** Table 1 provides an overview of the state of knowledge of biodiversity and ecosystem services in T&T – see Appendix II (a) for more information.

Table 1: Qualitative Assessment of the State of Knowledge About Biodiversity and Ecosystem Services in Trinidad and Tobago (2016)

Aspect of Assessment	Status and Trends in…..	2020 Aichi Target Indicator for T&T: indicator developed & data available*	Current state of understanding (2016)	State of scientific understanding compared with the 4th report (2010)
Ecosystem Services	Water provision	No, Yes	Good	↑
	Soil Retention	No, Yes	Good	↑
	Coastal protection	No, Yes	Fair	↑
	Carbon sequestration	No, Yes	Fair	↑
	Coastal Tourism and Recreation	No, Yes	Fair	↑
	Pollination	No, Yes	Fair	↑
Ecosystems	Forests	Yes, Yes	Good	↗
	Coastal ecosystems	Yes, Yes	Good	↗
	Freshwater	Yes, Yes	Fair	→
Species	Fauna	Yes, Yes	Fair	→
	Flora	Yes, Yes	Good	↑
Genetic	Genetic diversity	Yes, No	Poor	→
Direct Drivers	Land Use/ Land Cover Change	Yes, Yes	Good	↑
	External inputs - pollution	Yes, Yes	Fair	→
	Harvest and resource consumption	No, Yes	Fair	→
	Climate change, variability and associated effects	No, Yes	Good	↗
	Invasive Alien Species	Yes, Yes	Fair	↗
Indirect Drivers	Economic forces	No, Yes	Fair	→
	Demographic changes	No, Yes	Fair	↗
	Governance and legal framework	Yes, Yes	Good	→

*Note: In this column, the First answer = Is an Indicator developed for T&T based on the Aichi Targets?; the Second Answer = Is data available for this aspect of biodiversity?

Legend	
↑	Significant increase in data/ information base
↗	Moderate increase in data/ information base
→	No change

PART I

An Update on Biodiversity Status, Trends, and Threats; and Implications for Human Well-being

Lionfish on a Reef in Tobago
Photo courtesy Jahson Alemu I

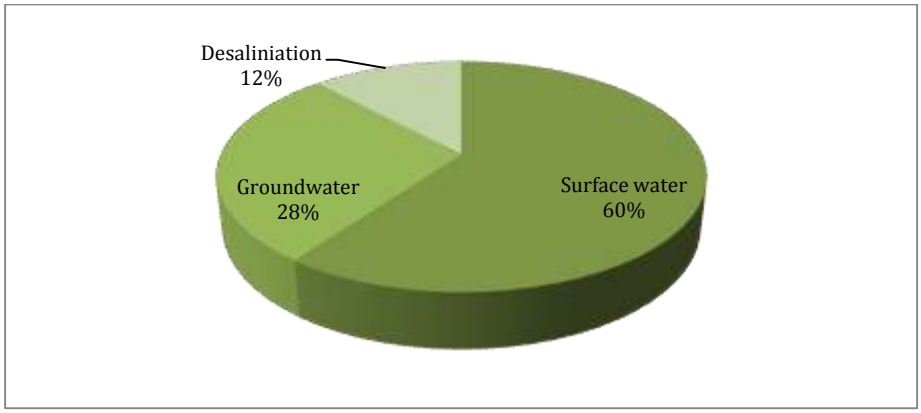
3.0 Links Between Biodiversity and Human Well-being: Important Ecosystem Services

Q1: Why is biodiversity important for your country?

3.1 Provision of a Clean, Reliable Supply of Freshwater *(no T&T Aichi Target indicator)*

T&T continues to be heavily reliant on freshwater from natural sources to meet the needs of all sectors. In 2011, 383 million cubic metres of freshwater were abstracted for human use, the majority of which (88%) was derived from natural sources – surface and groundwater (Figure 3).

Figure 3: Freshwater Abstraction from Different Sources as a Percentage of Total Abstraction in Trinidad and Tobago (2011)



Source: FAO (2015a).

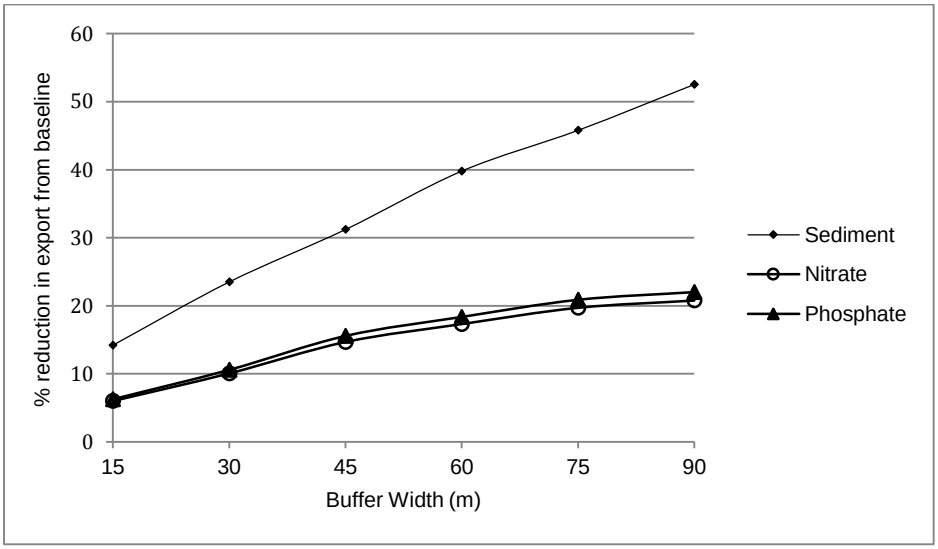
Water quantity is not the only factor that is of importance - the ability of watersheds to provide good quality water has social and economic implications. A recently concluded study of ecosystem services as a part of the Project for Ecosystem Services (ProEcoServ)[2] estimated that the annual value of water purification provided by Trinidad's Northern Range is TT$520 Million or approximately US$84 Million (Girvan & Teelucksingh, 2012).

Rawlins (2015), as a part of ProEcoServ, modeled and demonstrated the extent to which forests in and around riparian zones play a role in reducing nutrient and sediment flows into rivers thereby preserving/improving freshwater quality (Figure 4). It was calculated that forests, up to a 90 metre buffer limit, can reduce sediment export into rivers by as much as 53%; and nitrate nitrogen (NO_3-

[2] See http://www.proecoservtt.org

N) and phosphate phosphorus (PO_4^{3-}) by over 20%. These are important planning considerations, especially in the context of hillside development.

Figure 4: Percentage Reduction in Export of Sediment, Nitrates and Phosphates Against a Baseline (no Buffer) for the Caura/ Tacarigua Watershed in Trinidad's Northern Range



Source: Rawlins 2015

3.2 Soil Retention Services (no T&T Aichi Target indicator)

ProEcoServ calculated that the soil retention services provided by the forests of the Northern Range of Trinidad are worth up to US$622 million annually, or the equivalent of about 6.8% of central government annual revenues – Table 2 (UNEP 2015).

Photo courtesy Robyn Cross
Fire degraded forest in Trinidad's Northern Range

Table 3 highlights the relative contribution of forests to soil retention services when compared with other land use types based on data from two (2) Northern Range watersheds. What is evident is that intact forests can reduce soil loss by up to 95%, and are especially effective at preventing erosion on steep slopes – between 30° and 55° (Rawlins 2015).

Table 2: Value of Soil Erosion Prevention Provided by the Forests of Trinidad's Northern Range Watersheds

Watershed Name	Replacement Cost			
	Eroded Sediment retained due to forest (tonnes)	Lower Value (million US$)	Upper Value (million US$)	Value of erosion prevention (US$/ha/year)
Toco	479,644	26.5	44.00	1,306
Yara	104,265	6.5	9.5	1,391
Madamas	146,810	8.17	13.5	978
Marianne	12,690	0.67	1.17	148
Rest North	105,464	5.83	9.67	1,263
North Oropouche	1,534,457	84.83	141.00	11,531
Salybia	369,732	20.50	34.00	3,383
Matura	828,189	45.83	76.00	8,689
Chaguaramas	661,181	36.50	60.67	3,602
Santa Cruz	208,004	11.50	19.17	1,730
Maraval	236,929	13.17	21.83	5,094
Maracas	69,451	3.83	6.33	786
Caura/Tacarigua	247,614	13.67	22.67	2,801
Guanapo	106,253	5.83	9.83	1,187
Arima	177,960	9.83	16.33	2,228
Hollis	749	0.00	0.00	29
Arouca	684,911	37.83	62.83	6,365
Aripo	275,641	15.17	25.33	2,903
Quare	241,522	13.33	22.17	1,450
Rest North Oropouche 1	99,412	5.50	9.17	831
Port of Spain	86,870	4.83	8.00	1,237
Tunapuna	8,665	0.50	0.83	270
Mausica	30,053	1.67	2.83	782
El Mamo	36,534	2.00	3.33	901
Orupuna	19,497	1.00	1.83	538
Total	**6,772,497**	**374.33**	**622.17**	**(average) 2,457**

Source: UNEP (2015)

Table 3: Soil Erosion Values for Different Land use/ Cover Types Found in the Maracas and Caura Valleys, Northern Range, Trinidad

Slope (degrees)	Pine	Bamboo	Broken Forest (sparse)	Forest	Grassland	Agriculture	Scrub fire burnt	Residential	Face stone	Clear-felled	Disrupted Combination	Broken Forest (scrub)
0 – 5	N/A	0.49 – 0.69	0.29 – 0.33	0.05 – 0.1	0.13 – 0.16	6.69 – 8.19	0.09 – 0.11	0.17 – 0.21	N/A	0.88 – 1.28	N/A	N/A
5.1 – 10	0.09 – 0.11	0.57 – 0.71	0.27 – 0.31	0.09 – 0.11	0.21 – 0.27	9.95 – 12.7	0.24 – 0.31	0.23 – 0.28	16.1 – 20.3	1.69 – 2.26	1.76 – 2.58	0.41 – 0.62
10.1 – 15	0.43 – 0.62	0.63 – 0.86	0.21 – 0.27	0.08 – 0.09	0.3 – 0.38	15.5 – 17.6	0.27 – 0.34	0.25 – 0.33	19.3 – 24.2	1.98 – 2.57	3.19 – 4.48	0.24 – 0.34
15.1 – 20	1.54 – 1.65	0.85 – 1.10	0.33 – 0.48	0.09 – 0.11	0.34 – 0.45	18.2 – 20.5	0.35 – 0.45	0.31 – 0.39	11.4 – 15.9	4.13 – 5.59	5.58 – 7.04	0.4 – 0.49
20.1 – 25	1.26	1.66 – 2.01	0.49 – 0.63	0.08 – 0.1	0.45 – 0.6	N/A	0.61 – 0.77	0.41 – 0.52	34 – 50.5	6.46 – 7.82	6.35 – 7.8	0.5 – 0.63
25.1 – 30	2.26	1.5 – 1.88	0.45 – 0.58	0.08 – 0.1	0.6 – 0.81	N/A	1.01 – 1.28	0.46 – 0.61	N/A	N/A	10.5 – 13.5	0.54 – 0.7
30.1 – 35	N/A	N/A	0.63 – 0.79	0.09 – 0.12	0.91 – 1.21	N/A	1.02 – 1.2	N/A	N/A	N/A	N/A	0.73 – 0.91
35.1 – 40	N/A	N/A	1.05	0.1 – 0.13	0.95 – 1.18	N/A	0.44 – 0.53	N/A	N/A	N/A	N/A	N/A
40.1 – 45	N/A	N/A	0.53	0.14 – 0.19	1.22 – 1.82	N/A	N/A	N/A	N/A	N/A	N/A	N/A
45.1 – 55	N/A	N/A	N/A	0.12 - 0.17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Min – Max	0.09 – 2.26	0.49 – 1.88	0.29 – 1.05	0.05 – 0.19	0.13 – 1.82	6.69 – 20.5	0.09 – 1.28	0.17 – 0.61	16.1 – 50.5	0.88 – 7.82	1.76 – 13.5	0.24 – 0.7

Notes:

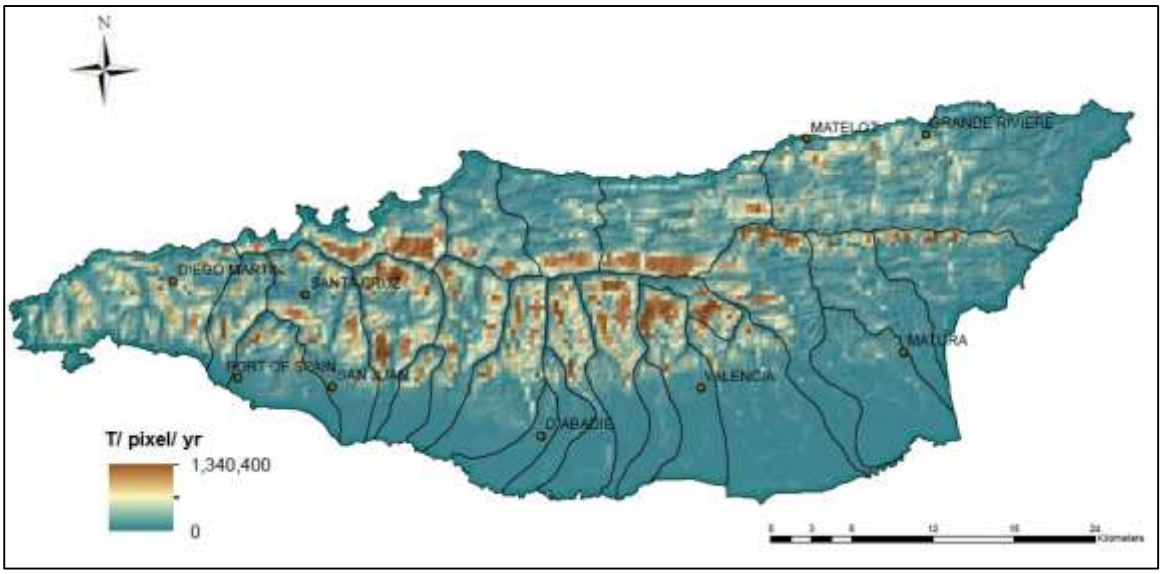
Erosion rates are given in t ha^{-1} yr^{-1}

N/A indicates where LULC does not occur within the particular slope range.

Source: Rawlins, 2015

Using the InVEST Sediment Retention model, the soil regulation services in the Northern Range are shown in Figure 5.

Figure 5: Map of Potential Soil Retention (Erosion Regulation Service) Across the Northern Range



Note: Modelled with vegetation cover for the period 1993 - 2008
Source: Rawlins 2015

3.3 Coastal protection (no T&T Aichi Target indicator)

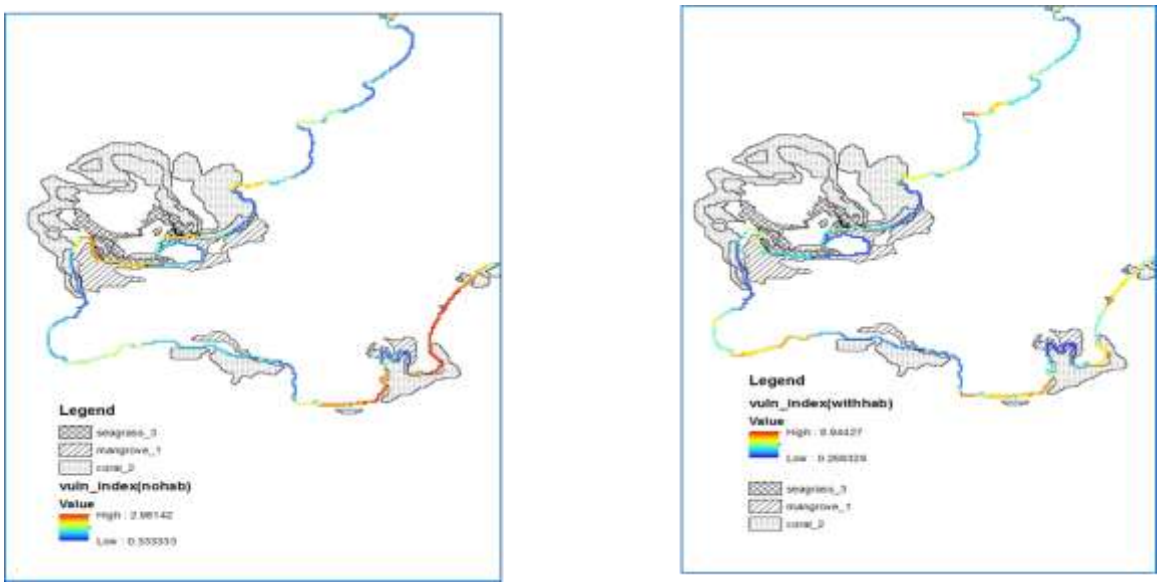
Four (4) main coastal ecosystem types are present around T&T that are known to provide some degree of coastal protection – coral reefs, mangroves, wetlands, and seagrass beds. As a part of ProEcoServ, several studies were conducted to calculate and demonstrate the contribution of coastal ecosystems to protecting T&T's coastlines.

Using the InVEST Coastal Vulnerability model, the coastal ecosystem complex (coral reef/seagrass beds and mangrove swamp) in the Buccoo Reef area in southwest Tobago was modeled. The model outputs indicate that the presence of the intact coastal ecosystems provides significantly more protection than in a scenario where the coastal ecosystems are absent (Figure 6). These results will be updated in the near future with new bathymetric and wave data collected as a part of ProEcoServ.

Research was also undertaken to determine the value of coastal ecosystems to protecting T&T's shorelines. In the 4th National Report (2010), it was reported that the value of coral reefs in providing shoreline protection in T&T was between US$18 and US$33 million annually. This was based on a study conducted by the World Resources Institute (2008) using 2006 data from Tobago only. More up-to-date estimates put the value of shoreline protection from coral reefs in T&T at US$49.6 million annually[3].

Figure 6: Coastal Protection Provided by the Coastal Ecosystem Complex in Southwest Tobago

Coastal ecosystems absent *Coastal ecosystems present*



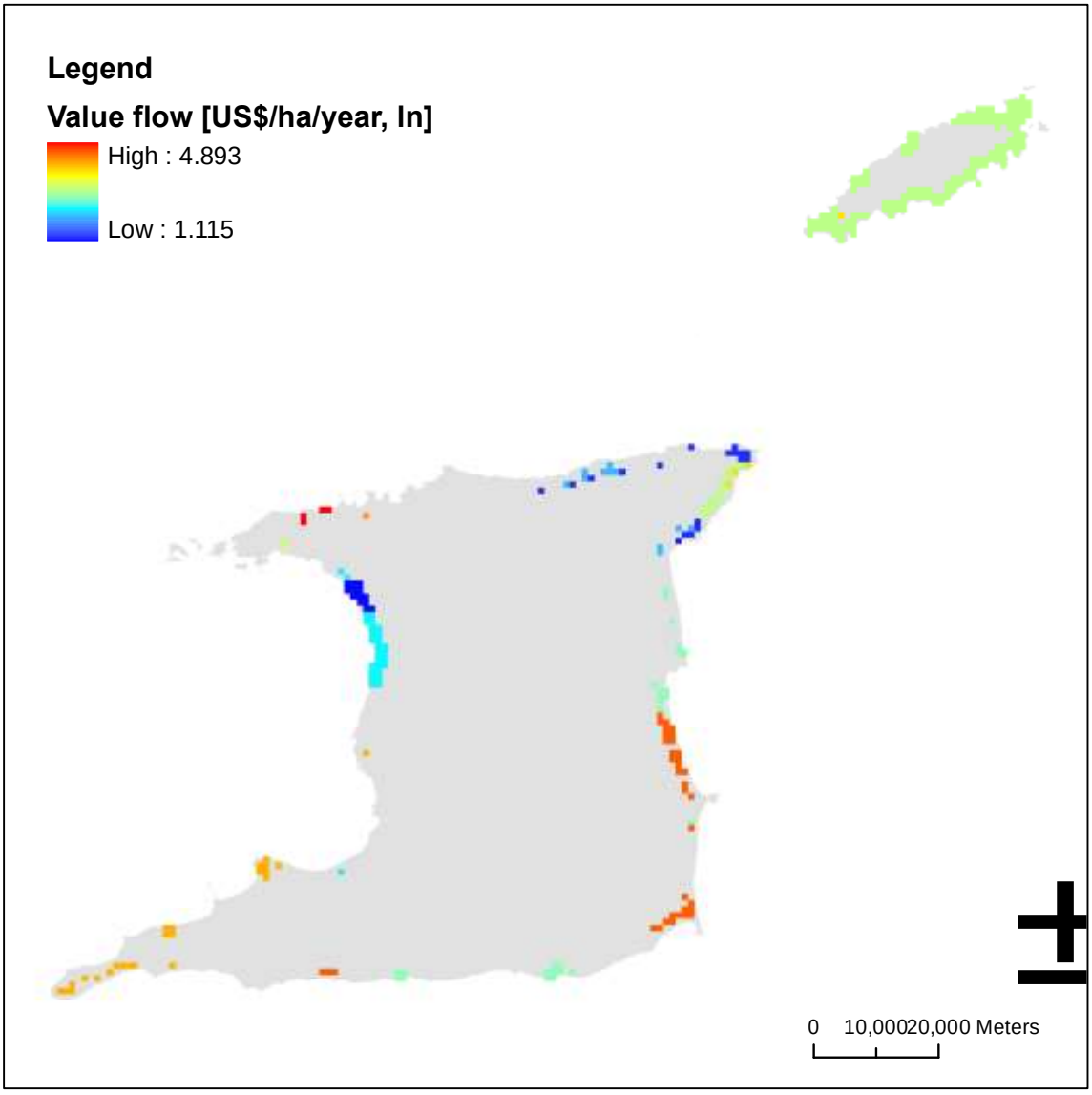
Source: Alemu 2012

Using Geographic Information System (GIS)-based valuation, another exercise was conducted as a part of ProEcoServ to demonstrate the economic contribution of coastal ecosystems (coral reefs, mangroves and wetlands) to the protection of T&T's shores. Because of the paucity of data on the economic contribution of seagrass beds to coastal protection, this ecosystem type was not included in the study (Ghermandi, 2015).

[3] See http://unep.org/newscentre/default.aspx?DocumentID=26851&ArticleID=35477#sthash.kqQQViw1.dpuf

The data show that almost the entire length of Tobago's coastline is dependent on coastal ecosystems for some type of protection. In Trinidad, exposed areas along the east coast, as well as pockets of land along the other coastlines demonstrate high values (Figure 7). This study also indicated that the value of shoreline protection provided by coastal ecosystems ranges between US$3 and US$133 per hectare per year.

Figure 7: Map of Coastal Protection Values in Trinidad and Tobago (US$/ha/year)



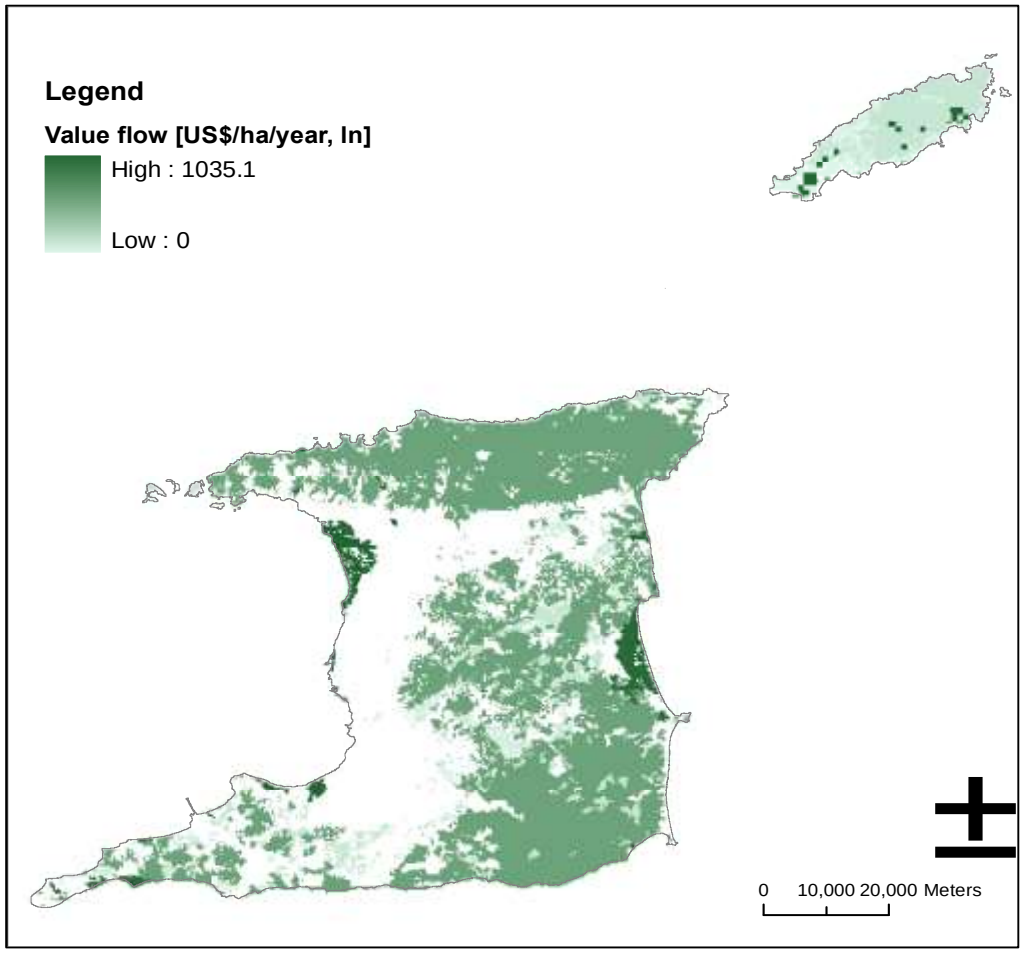
Source: Ghermandi 2015

3.4 Carbon Sequestration/ Climate Regulation *(no T&T Aichi Target indicator)*

It has been estimated that tropical forests and coastal ecosystems in T&T contribute between US$3 and US$1,035 in carbon sequestration services per hectare per year (Ghermandi 2015); although Girvan and Teelucksingh (2012) provided an estimate as high as US$1,088 for tropical forests alone, the latter based on 2010 figures.

GIS-based valuation (Figure 8) indicate that climate regulation services are highest in wetland areas such as the Caroni and Nariva swamps in Trinidad (which are both Ramsar sites), as well as in the forested ecosystems across Trinidad. In Tobago, the mangrove swamps and seagrass beds, especially in the southwestern portion of the island demonstrate the highest climate regulation service values.

Figure 8: Map of Carbon Sequestration Values from Coastal Ecosystems and Tropical Forests in Trinidad and Tobago

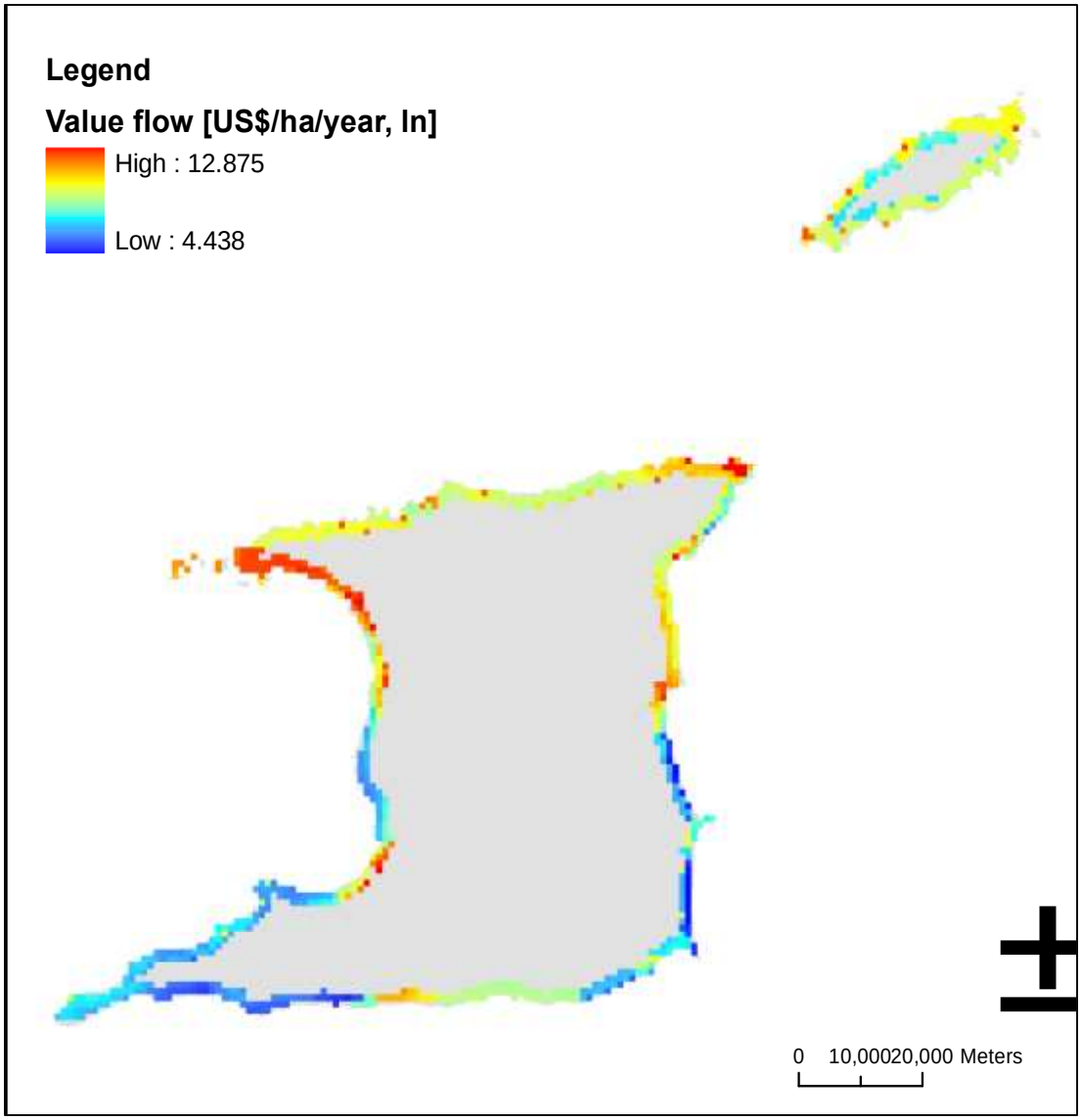


Source: Ghermandi 2015

3.5 Coastal Tourism and Recreation (no T&T Aichi Target indicator)

The recreation value of T&T's coastal and marine ecosystems is estimated to be worth between US$85 and US$390,428 per hectare per year (Ghermandi, 2015). Figure 9 shows that these services are concentrated close to coastal urban settlements, and along the north and northeast coasts in Trinidad. In Tobago, these services are most prevalent on the southwestern tip of the island.

Figure 9: Map of Coastal Recreation Values in Trinidad and Tobago

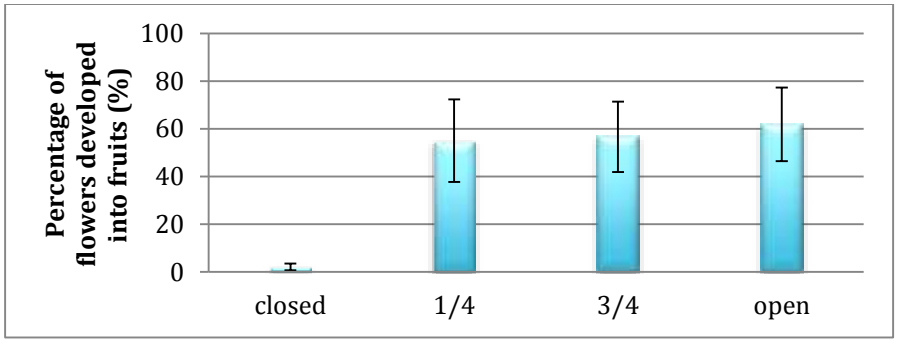


Source: Ghermandi 2015

3.6 Pollination (no T&T Aichi Target indicator)

A pilot study on the importance of pollinators to agriculture in T&T focused on two (2) crops – Cucumbers (*Cucumis sativus*) and Hot peppers (*Capsicum chinense*). Results from biophysical exclusion experiments indicated that the reduction in yield in each of these two (2) crops in the complete absence of pollinators was 96.5% and 76.9% respectively (Dempewolf, 2015). In the case of cucumbers, the importance of pollinators was demonstrated very clearly in the pollinator exclusion exercises (Figure 10).

Figure 10: Percentage of Tagged Cucumber Flowers Developed into Fruits Under Different Exclusion Conditions



Source: Dempewolf 2015

The valuation outputs of the pollinator pilot study, shown in Table 4, indicate a very strong economic dependence on pollinators in the production of cucumbers and hot peppers in T&T (UNEP, 2015).

Table 4: Economic Value of Pollination for Cucumbers and Hot Peppers

	2010	2011	2012
Production of Cucumbers (tonnes)	1,300	1,193	1,355
Market value (US$)	838,279	1,054,744	1,059,209
*Pollination (US$)**	*153,699 808,940*	*193,387 1,017,829*	*193,387 1,022,121*
Production of Hot peppers (tonnes)	700	491	250
Market value (US$)	3,466,400	2,468,297	2,837,051
Pollination (US$)	*1,226,204 2,665,662*	*873,135 1,898,120*	*1,003,578 2,181,692*

Note: Two (2) values are shown for pollination each year for each of the two (2) crops. The lower estimate is calculated based on a scenario where there is total exclusion of pollinators. The value therefore reflects the agricultural value with no pollination. The second value indicates the value when pollinator activity is reduced to ¼ of the current situation.
Source: UNEP, 2015

The results of the pollination pilot exercise were scaled up in order to obtain an estimate of the value of pollinators to national vegetable production in T&T. Using a production function approach, the benefits of pollination to national agriculture, was estimated to be up to TT$65 Million or 31% of the value of agricultural goods produced in T&T in 2012. Over the period 2010 – 2012, it was estimated that percentage of agricultural Gross Domestic Product (GDP) underpinned by pollinators was about 12% on average (Table 5).

Table 5: Economic Contribution of Pollination to Agricultural Production in Trinidad and Tobago

Green Vegetable	Annual production (tonnes)			Value of product (TT$)			D-Dependence on wild pollinators	Value attributable to pollination (TT$) (proportion of the value of all green vegetable production in Trinidad)		
Year	2010	2011	2012	2010	2011	2012		2010	2011	2012
Tomato	2,144	1,510	1,470	24,250,168	29,462,925	15,333,080	N/A			
Cabbage	291	787	1,123	1,936,399	470,606	7,809,535	N/A			
Cucumber	1,300	1,193	1,355	5,239,248	6,592,154	6,620,060	0.965	5055875	6361429	6388358
Melongene	533	1,577	1,285	3,327,549	9,890,746	6,911,867	N/A			
Bodi	958	314	1,260	7,222,005	3,183,496	8,422,343	N/A			
Ochro	926	1,400	1,383	20,408,084	12,724,388	34,285,410	0.862	17591769	10968422	29554023
Lettuce	1,394	1,927	2,188	39,641,843	23,666,431	59,623,486	N/A			
Pumpkin	1,773	4,818	2,537	7,358,638	21,199,640	9,424,567	0.9	6622775	19079676	8482110
Patchoi	518	1,037	1,970	4,443,600	5,283,146	18,503,822	N/A			
Water Melon	564	818	376	2,055,555	50,530	1,487,442	0.7	1438888	35370.79	1041209
Sweet Pepper	343	526	245	6,066,154	8,829,636	3,025,462	N/A			
Celery	585	2,163	1,330	1,473,217	1,766,862	5,489,717	0.95	1399556	1678519	5215231
Cauliflower	171	127	132	1,128,473	1,143,900	1,218,013	0.9	1015626	1029510	1096212
Chive	3,779	4,284	2,255	14,127,566	1,999,169	7,596,932	N/A			
Hot Pepper	700	491	350	21,665,000	15,426,855	17,731,569	0.769	16660385	11863252	13635576
Dasheen Bush	329	381	245	4,378,787	2,298,483	3,787,095	N/A			
Sorrel	130	441	55	642,244	1,684,856	425,308	N/A			
TOTAL				**165 M TT$**	**146 M TT$**	**208 M TT$**		**49 M TT$ (30%)**	**51 M TT$ (34 %)**	**65 M TT$ (31$%)**
% of total Agricultural GDP underpinned by pollination								12.5%	11.3%	11.9%

Source: Girvan 2015

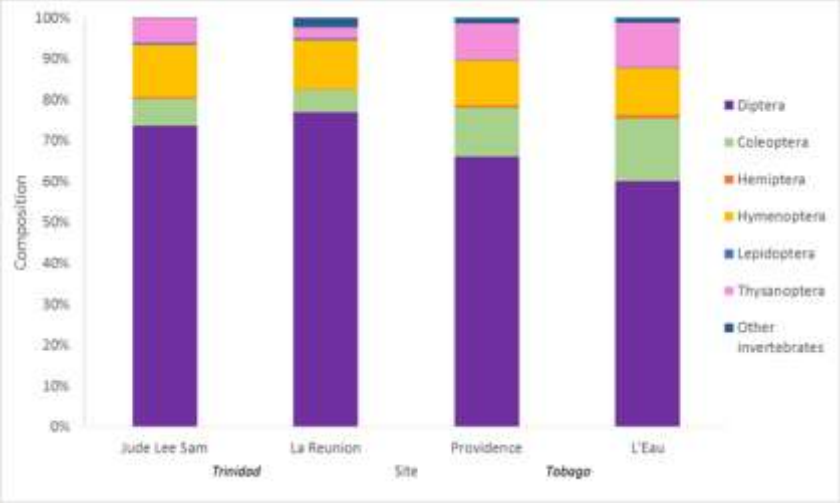
This type of work is very important because strategically, agriculture is of high importance to T&T for increasing food security, improving rural livelihoods and reducing the food import bill (Girvan, 2015). Work has also been conducted to determine the importance of pollinators to cocoa – an important commercial crop (See Box 1).

Box 1: Importance of Pollination in Cocoa Production

Cocoa is pollinated by midges (Diptera: Ceratopogonidae); many clones in the Caribbean depend on insect pollination for pod-set. The CocoaPOP project, led by the University of Trinidad and Tobago (UTT) and with the Centre for Agriculture and Biosciences International (CABI) as a partner, sought to enhance current knowledge of the pollination ecology of cocoa. The project undertook invertebrate surveys of cocoa plantations to understand the diversity and population dynamics of major and minor cocoa pollinators. Static suction traps were deployed on cocoa estates in Trinidad, Tobago and Jamaica, monthly over the course of a year, and typically caught 92 ± 2 insects per trap in each 24-hour period.

Over 86,000 insects were captured and identified to Family level. The majority (69%) of insects caught by this method in T&T were Diptera, with Cecidomyiidae, Drosophilidae, Phoridae and Psychodidae being particularly abundant. Typically only 1.9% of the total insects caught were Ceratopogonidae (cocoa midges), but over 1800 specimens, including at least seven (7) species of Ceratopogonidae: *Forcipomyia* and *Dasyhelea*, were captured from the cocoa farms. Most of the other insects comprised Coleoptera of diverse families including Lampyridae, Coccinellidae and Bostrichidae; Hymenoptera (particularly ants and parasitoid wasps); and thrips. Observations from these sites have also revealed a range of insects less well-represented in traps, including Lepidoptera, Phasmatodea and Orthoptera.

On the cocoa plantations, survey work found correlations between rainfall and overall insect abundance, including cocoa midge populations, indicating the importance of soil moisture for supporting insect diversity (especially as cocoa midge larvae develop in moist detritus). The importance of rainfall highlights the need to plan farm management to take into account future unpredictable climatic patterns, in order to safeguard the invertebrate biodiversity on cocoa farms and maintain sustainable pollination services in years to come.



Source: Arnold, S. (2016). Insect biodiversity in cocoa estates: Building ecological survey capacity, and lessons learned. Presented at Cocoa Pollination for Optimized Yields and income Generation Closing workshop April 5th 2016, UTT Chaguanas, Campus.

3.7 Bundling the Ecosystem Services Provided by T&T's Tropical Forests (no T&T Aichi Target indicator)

Foregoing sections have highlighted that in various ways, the tropical forests in T&T provide a range of important ecosystem services across the islands. Based on 2010 data, Girvan and Teelucksingh (2012) calculated the estimated value of the bundle of key services provided by T&T's forested ecosystems – including climate regulation, erosion control, flood prevention, water purification, and sustainable timber.

Based on the estimates, it appears as if the carbon sequestration/climate regulation services provided by forests are, by far, the most economically important – a service that was not given significant prominence in the 4th Report. Taken together with other services such as erosion control, water purification, flood protection and the provision of sustainable timber, the ecosystem services provided by T&T's forests are estimated to be worth at least US$2,195 per hectare per year – a figure which is by no means insignificant (Table 6).

Table 6: Estimated Values of Ecosystem Services from Trinidad and Tobago's Tropical Forests

Ecosystem Service	Ecosystem Service Value (2010) (US$ per Ha per Year)
Climate regulation/ carbon sequestration	1,088
Erosion Control	346
Flood Prevention	5
Water Purification	359
Sustainable Timber	397
TOTAL Value	**2,195**

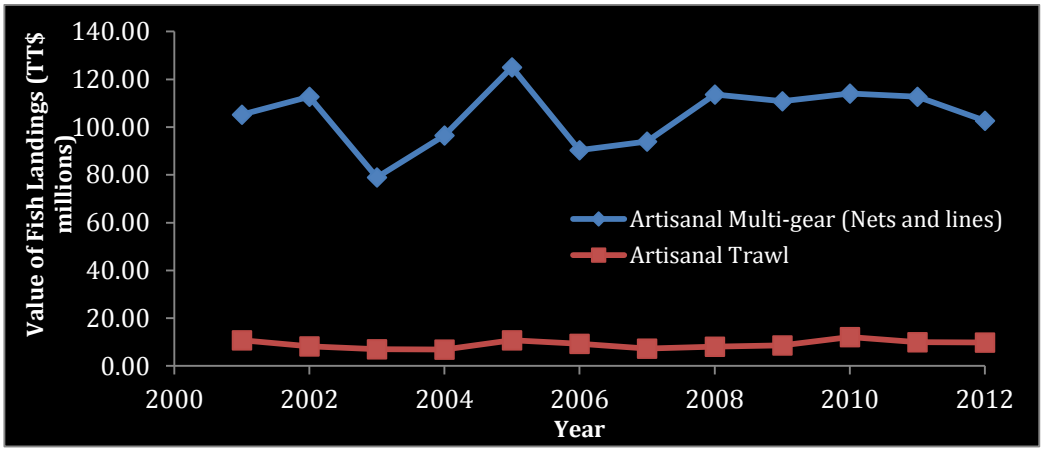
Source: Girvan and Teelucksingh (2012)

3.8 Biodiversity Supporting Local Livelihoods *(no indicator available in T&T)*

Biodiversity supports local livelihoods across T&T in a number of ways, and as such helps to reduce poverty especially in rural areas. Through activities such as subsistence fishing (Figure 11); subsistence agriculture (for example in the Nariva Swamp where over 20% of the local residents are involved in farming activities – Bynoe [2014]); local tourism-based activities (including turtle

watching on Trinidad's northeast coast, and providing tours to ecosystems such as the Caroni and Nariva swamps, the Buccoo Reef and the Asa Wright Nature Centre); and the production of craft materials from non-timber products for sale (NBATT, 2012), local communities are able to derive supplementary – and in some cases stable – sources of income. Noteworthy is the fact that approximately 60% of small-scale economic activities that contribute to livelihoods in T&T are concentrated in the coastal areas (Ministry of Environment and Water Resources, 2014). This information points to the critical need for ensuring proper management of T&T's coastal ecosystems so that they can continue to support HWB into the future. Boxes 2 and 3 highlight the economic contribution of two (2) types of biodiversity-related subsistence activities in T&T – Oyster sale, and turtle-based eco-tourism respectively.

Figure 11: Annual Value of Fish Landings From the Artisanal Fleet in T&T (2001 – 2012)



Source: Data provided by the Fisheries Division (2016)

Box 2: Oysters Providing Subsistence Income in T&T

Oysters (*Crassostrea rhizophorae*) are collected in T&T primarily for local consumption in the form of a popular cocktail, with a locally made, specialty pepper sauce. Oysters grow on the roots of mangroves and are collected mainly within the Claxton bay wetland and the Caroni swamp. Shellfish collection is primarily a form of subsistence income for collectors, who typically tend to re-sell oysters outside bars and near recreational areas, or sell wholesale to vendors. Like many other subsistence or small-scale activities, due to the open access nature of the resource, no data on the number of individuals involved in oyster harvesting is available.

However, an Oyster Vendors Association of T&T is in existence, indicating that the number of people involved in this trade is likely not negligible. Due to this, the economic importance of this activity is likely significantly underestimated (Mohammed, 2010). Assuming a 5-day workweek and sale of 65 cocktails per day, the monthly earning of an oyster vendor was estimated to be approximately TT$2,980 per month

(Mohammed, 2010), a healthy form of supplementary, subsistence income. This value, of course, varies significantly depending on the location of the vendor, which influences customer traffic and sales.

Source: Adapted from NBATT (2012)

Box 3: Sea Turtle Based Tourism in Trinidad

One of the most unique and popular tourist products offered by Trinidad and to a lesser extent Tobago, is the tour of sites frequented by the Leatherback turtle (*Dermochelys coriacea*) - the critically endangered sea turtle, the largest living sea turtle and the fourth largest modern reptile. Visitors come for the opportunity to see these turtles lay eggs and/or watch hatchlings emerge from the nest and make their way to the sea. Following many a long history of strong human predation, communities have realised the economic potential of tourism activities far exceeds the potential economic gains from harvesting turtle products.

At least five (5) coastal communities around Trinidad rely to some extent on turtle nesting and hatching related tourism. Two (2) of the most popular nesting sites, Grand Riviere and Matura, are also home to the two (2) communities that benefit the most from the cultural/aesthetic service provided by nesting turtles. Direct income is earned through the provision of guide services, employment and numerous indirect benefits.

Between 2005 and 2011, Grand Riviere experienced a 300% increase in the number of visitors, with 21,000 individuals visiting in 2011 (Bachan, 2012). This resulted in receipts of TT$105,000 to the government through the sales of permits. Direct economic benefits felt by tour operators were estimated to be approximately TT$660,000 (*ibid*). In addition, 32 individuals are employed as data collectors and local tour guides who are not attached to a tour operator within the community by the Forestry Division. Some of the most important benefits derived from this tourism activity are spin off or indirect benefits. Over the last decade there has been a growth from one (1) major hotel and a few guest houses to five (5) small resorts and 12 guesthouses with a total of 150 rooms (*ibid*). In total the various accommodations options employ 92 persons during the turtle season.

Four (4) food establishments (bars and small shops that are solely driven by tourists and those involved in related activities) now operate within the community. The total of all the average annual revenues for each of these establishments primarily driven by tourist activity was TT$$31 Million (Bachan, 2012). Increased tourism has also resulted in a revival of the agriculture sector, which had declined significantly over a decade ago due to the difficulty of accessing markets and high transportation costs. The revival is a response to increasing local demand by hotels and restaurants for fresh goods again driven by the seasonal influx of tourists. Within the community this sector employs around 70 farmers (Bachan, 2012).

Matura is another community which has built up a strong socio-economic relationship with turtle nesting activities. Nature Seekers, the local non-governmental organization (NGO) involved in Leatherback turtle research, protection and tourism reported 15,637 tour taking individuals in 2009. Tours offered by Nature Seekers range in cost from TT$30 to TT$96 putting estimated revenue at between TT$0.4 to $1.5 million (Bachan, 2012). This figure does not begin to capture the added value of associated activities and services from accommodation to food to improved transportation and construction, and thus significantly underestimates the economic value of the tourism provided by biodiversity.

This is not a unique case as a community that derives significant income from turtle watching activities. For Tobago, the beaches of Turtle beach, Grafton beach, and Mt Irvine Back bay are also visited by local and international tourists, with 3,252 non-resident visitors recorded as visiting this beach (Lalsingh, 2011), the estimated value of these visits was between TT$512,190 to $819,504 per year (*ibid)*. Like estimates for Matura, this figure only partially captures the value of tourism since it excludes a number of direct and indirect benefits.

Source: Adapted from NBATT (2012)

4.0 Status and Trends in T&T's Biodiversity

Q2. What major changes have taken place in the status and trends of biodiversity in your country?

This section on status and trends in ecosystems will focus on the following important ecosystem types:

Terrestrial forests
- Natural forests *(T&T Indicator: 5i)*
- Plantation forests *(T&T Indicator 5ii)*
- Number and acreage of degraded forests *(T&T Indicator 14i)*

Coastal ecosystems
- Mangroves and other wetlands *(T&T Indicator 5iii)*
- Coral reefs *(T&T Indicator 5iv)*
- Seagrass beds *(T&T Indicator 5v)*

Freshwater ecosystems *(T&T Indicators 8i and 8iii)*

4.1 Ecosystems

4.1.1 Terrestrial Forests

General Introduction

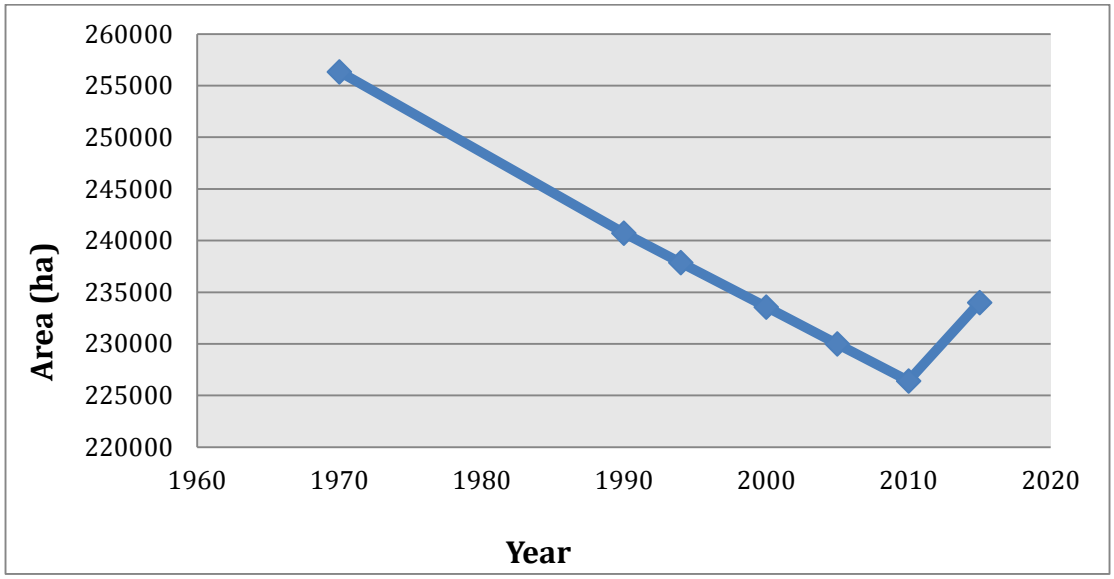
There are several, different accounts of the area (and percentage area) covered by forests in T&T. According to the GoRTT (2013), total forested area in T&T declined from 256,346 Ha in 1970 to 226,413 Ha in 2010 – an approximate 12% decrease. Between 2010 and 2015, there was a reported increase in forested area on both islands to approximately 234,000 Ha (Figure 12; FAO 2010; FAO 2015). The increase in forest cover in T&T (Figure 12) over the 2010 – 2015 period is attributed (at least in part) to regeneration of secondary forest on abandoned sugar cane lands, abandoned cocoa and coffee plantations, and the increase in the cultivation of timber (Carlton Roberts pers. comm., 2016).

According to the Forestry Division (2016), it is estimated that forests now cover approximately 45.7% of the total land area in T&T; of this, primary forests account for 26.6%. Of the total forested area, 55.94% belongs to the state, and 44.06% are private lands *(ibid)*. Based on figures presented in T&T's 2014 MDG report (GoRTT, 2014), total forest cover in in T&T in 2012 was reported to be

approximately 48%. Helmer *et. al.* (2012) provide an estimate of forest cover in T&T as high as 73.2% of total land area, but this is likely an overestimate attributable to the methodology used.

From a regional standpoint, it is worth noting that the overall decrease in the extent of T&T's forests between 1990 and 2015 is not in keeping with similar trends for the Caribbean islands as a whole where, in 2015, forest cover was reported to have increased by approximately 43% over the 1990 baseline of 50,170km^2 (Keenan *et al*, 2015; FAO, 2015). Despite the increase in forested area in T&T between 2010 and 2015 therefore, T&T is lagging behind regional (net) reforestation rates.

Figure 12: Change in Total Forested Area in Trinidad and Tobago (1970 – 2015)



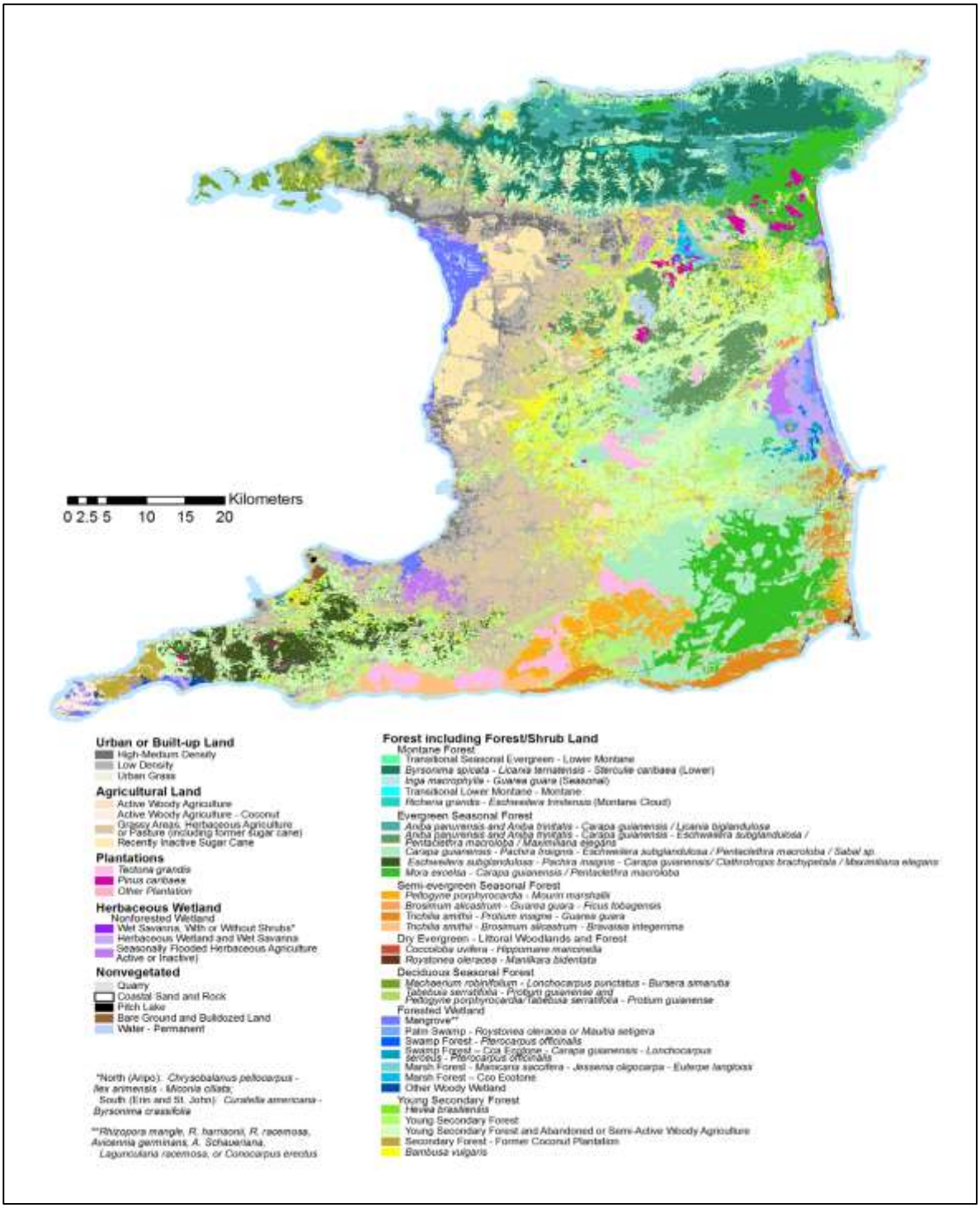
Data sources: FAO Forest Resources Assessment (FRA) Trinidad and Tobago Country Report (2010); FAO Global FRA (2015)

Figures 13 and 14 show the most recent, published, and readily available account of the geographical distribution of different forest types across T&T based on 2007 Landsat imagery (Helmer *et al* 2012). It has been recognized that there are a few scientific inconsistencies in this published data, and the Forestry Division is currently working to bring greater accuracy to the results. Additionally, a survey of T&T's land use and land cover was conducted in 2015 using Light Detection and Ranging (LIDAR) Radar

Scenic forests in Trinidad's Northern Range
Photo courtesy Maurice Rawlins

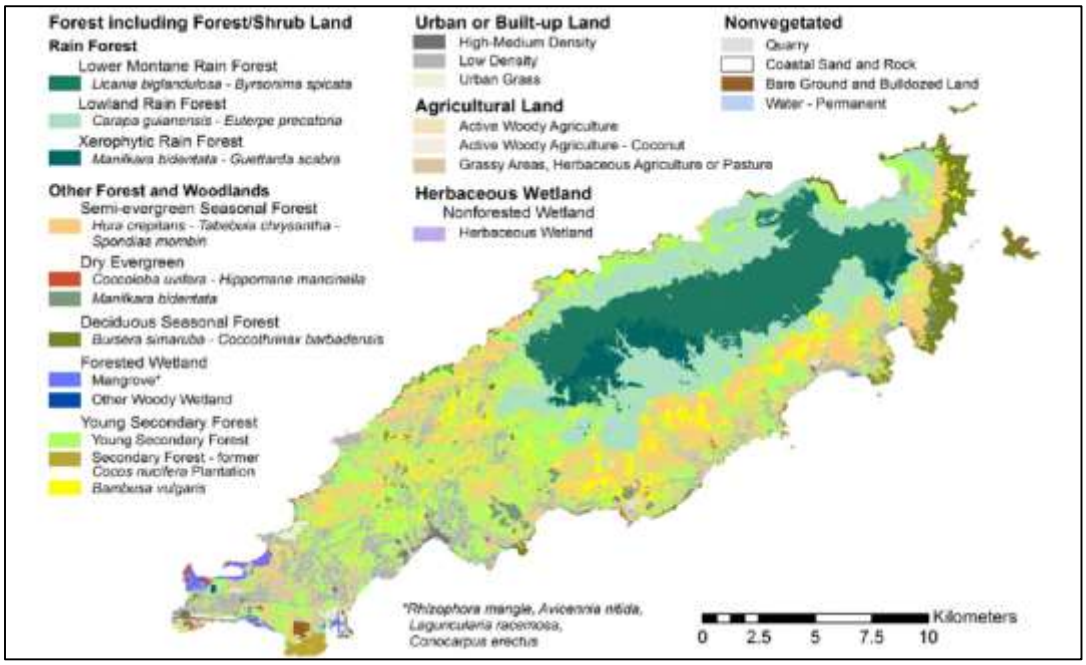
technology, but the results of this survey are not yet available.

Figure 13: Trinidad Land Use/ Land Cover Map (updated 2007)



Source: Helmer *et al* (2012)

Figure 14: Tobago Land Use/ Land Cover Map (updated 2007)



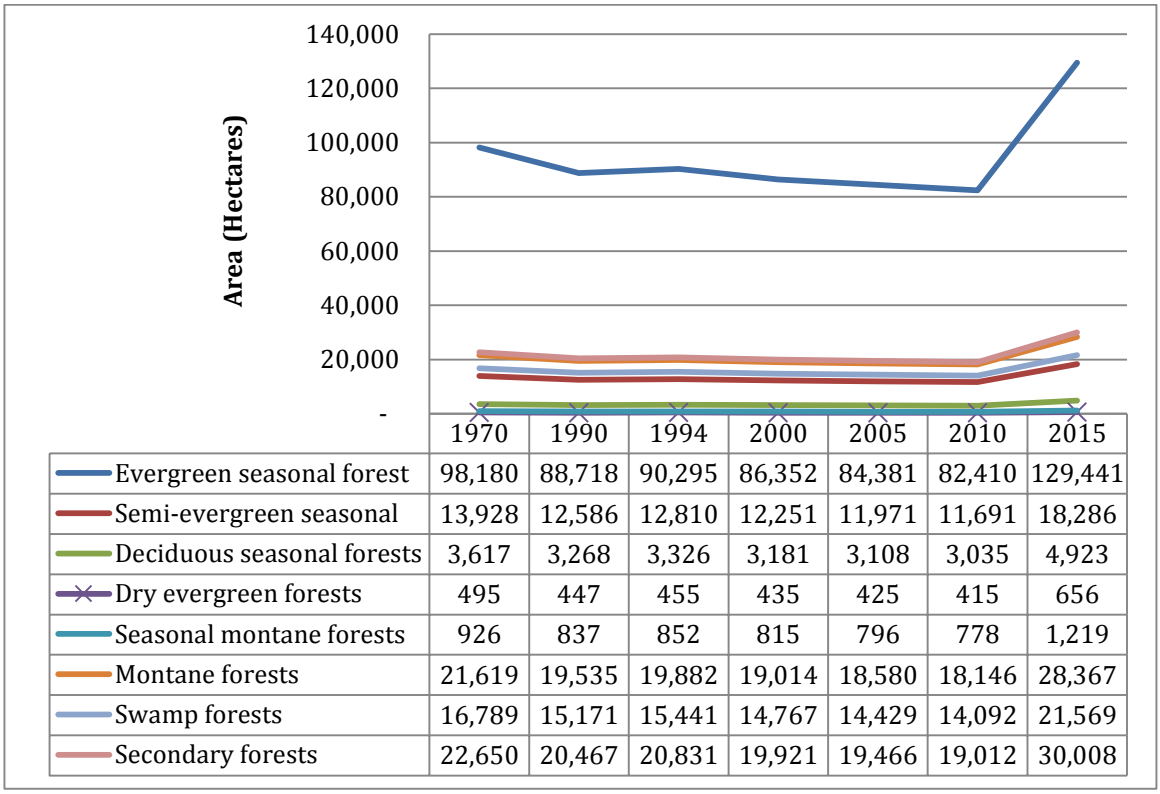
Source: Helmer *et al* (2012)

Indicator 5i: Change in the area of natural forest, by type of forest

Figure 15 shows the change in the area of natural forest in T&T between 1970 and 2015 by forest type. Up until 2010, all natural forest types – evergreen seasonal forest, semi-evergreen seasonal forest, deciduous seasonal forest, dry evergreen forest, seasonal montane forest, montane forest and swamp forest - showed a decline in extent. However, between 2010 and 2015, there was a reported increase in the extent of all forests (not including plantation forests).

The percentage composition of forests in T&T by type as of 2015 (based on the 45.7% total forest cover in T&T) is shown in Table 7. As is evident, evergreen seasonal forest continues to account for the greatest percentage of forested area in the country. Although evergreen seasonal forest was the forest type that showed the greatest increase in extent between 2010 and 2015, deciduous seasonal forest showed the greatest percentage increase in 2015 over its 2010 extent.

Figure 15: Forested Area in Trinidad and Tobago by Forest Classes (1970 – 2015)



	1970	1990	1994	2000	2005	2010	2015
Evergreen seasonal forest	98,180	88,718	90,295	86,352	84,381	82,410	129,441
Semi-evergreen seasonal	13,928	12,586	12,810	12,251	11,971	11,691	18,286
Deciduous seasonal forests	3,617	3,268	3,326	3,181	3,108	3,035	4,923
Dry evergreen forests	495	447	455	435	425	415	656
Seasonal montane forests	926	837	852	815	796	778	1,219
Montane forests	21,619	19,535	19,882	19,014	18,580	18,146	28,367
Swamp forests	16,789	15,171	15,441	14,767	14,429	14,092	21,569
Secondary forests	22,650	20,467	20,831	19,921	19,466	19,012	30,008

Note: the forest classes included in this Figure are a sub-set of the full range of the forest classes that are included in the FAO statistics. Classes such as plantation forests and bamboo are not included in this figure.
Data Sources: (1970 – 2010 data): FAO Global FRA, Country Report for T&T (2010)
(2015 data): Calculated based on data in Table 7 (Forestry Division, 2016)

Table 7: Forest Cover by Type in T&T as a Percentage of Total Forest Cover (2015)

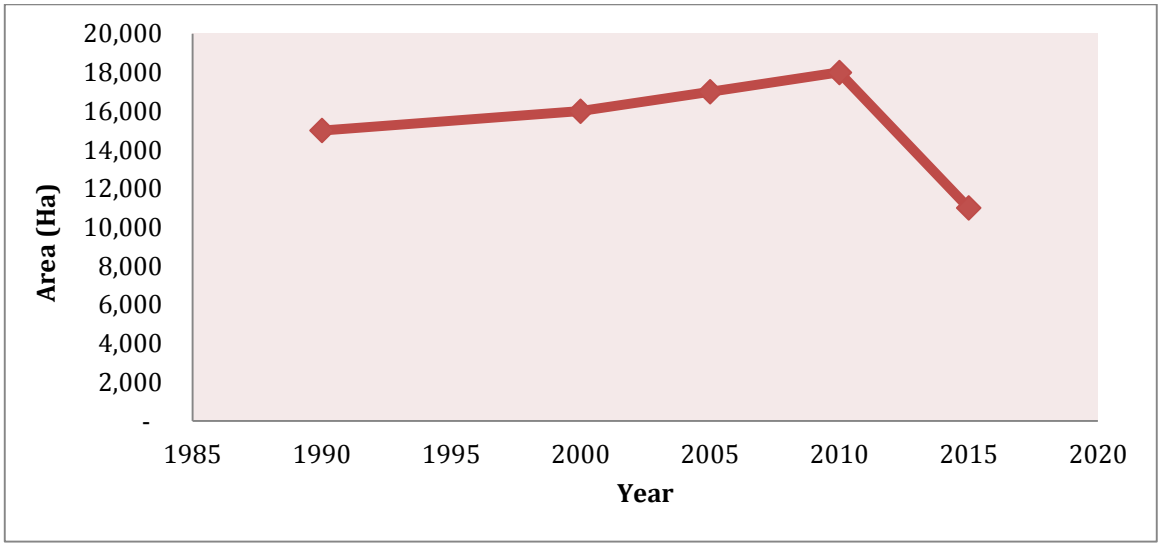
Indigenous Forest Types	Percentage Cover	Location
Evergreen Seasonal	55.2	North East
Semi- Evergreen Seasonal	7.8	Southern Extremes
Deciduous Seasonal	2.1	Western Northern Range
Dry Evergreen	0.28	East Coast
Seasonal Montane	0.52	Northern Range
Montane	12.1	Northern Range
Swamp	9.2	Coastal
Secondary	12.8	Widely Distributed
TOTAL	**100**	

Source: Forestry Division (2016)

Indicator 5ii: Change in the area of plantation forest

Based on FRA (2015) data, the total area of plantation forests in T&T in 2015 was estimated to be 11,000 Ha. The change in the area of plantation forest between 1990 and 2015 is shown in Figure 16; and the percentage change over the 1990/2015 period is estimated at –26.6%.

Figure16: Area Covered by Plantation Forests in T&T (1990 – 2015)



Source: FAO 2015

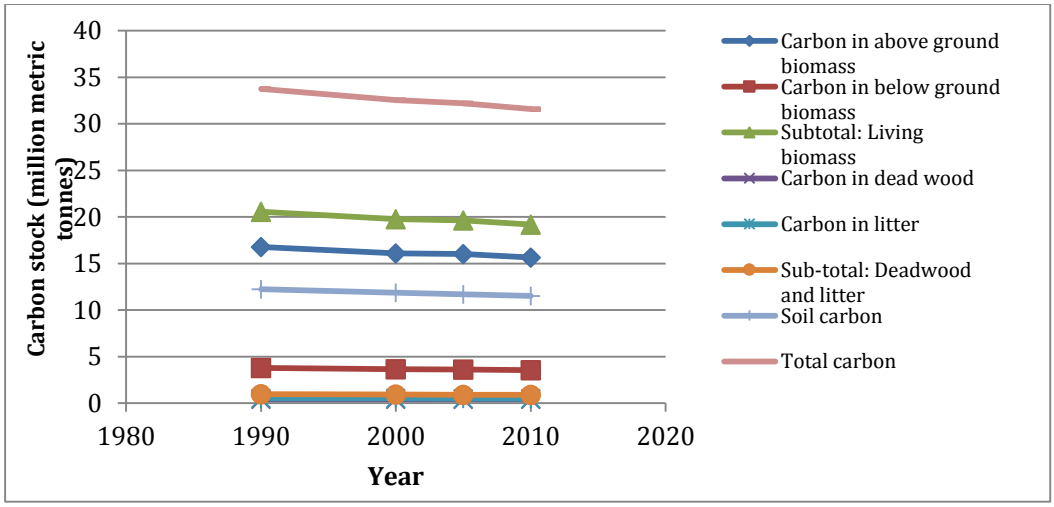
Indicator 14i: Change in the number and acreage of degraded forests

There is no single direct measure for this indicator. However, according to the FRA (2010), between 1970 and 2010, the area of forests in T&T that were converted to other uses increased from 53,729 Ha to 83,662 Ha – a 55% increase over the 1970 baseline.

T&T Indicator 15i: Contribution of natural forests to carbon stock AND T&T Indicator 15ii: Contribution of plantation forests to carbon stocks

At present, it is calculated that the carbon stored in both above and below ground biomass and soil is 116 Mt – 35% of which is found in Protected Areas across T&T (UNEP-WCMC, 2016). Of this, it is estimated that in 2015, there were 19 million metric tonnes of carbon stored in living forest biomass in T&T (GoRTT, 2015). Based on data from the FAO FRA for T&T (2010), Figure 17 shows the change in carbon stored in forests (both natural and plantation) between 1990 and 2010. Over the period, there was an overall decrease in carbon stored in living biomass, dead wood and litter, and soil in forests.

Figure 17: Carbon Stocks in Forests in T&T (1990 – 2010)



Data Source: FAO (2010)

The relative contributions of natural (Indicator 15i) and plantation forests (Indicator 15ii) to carbon stocks are shown in Appendix II (c). There was a larger decrease in the carbon available in natural forests when compared with plantation forests, and this is largely in keeping with the trends in forest cover recorded in Figure 15.

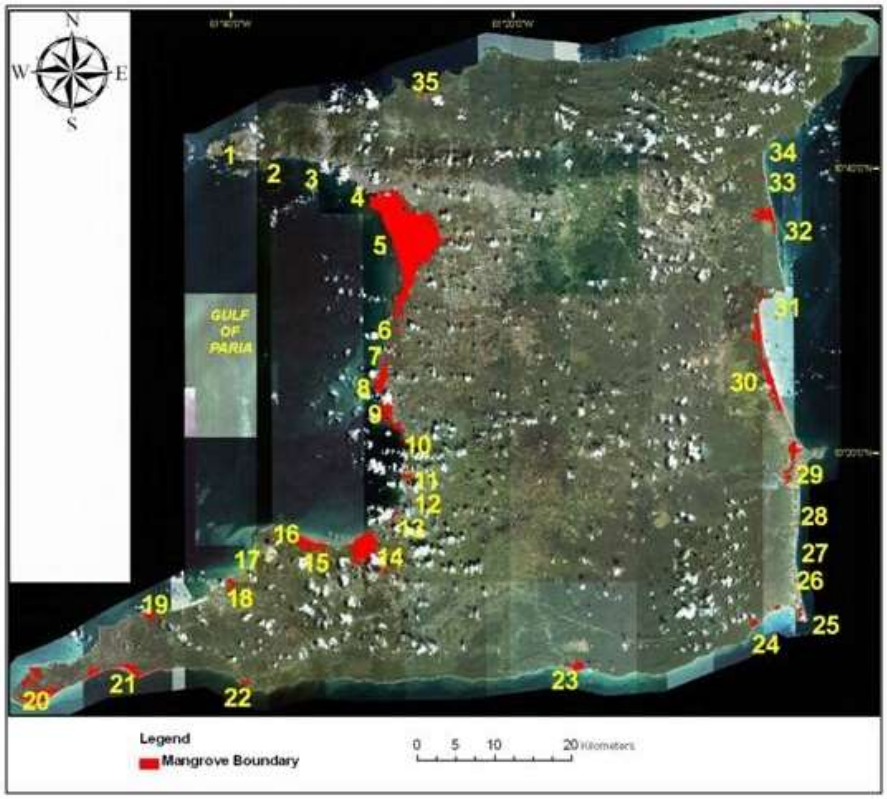
4.1.2 Coastal ecosystems

T&T Indicator 5iii: Change in wetlands by type of wetlands

Mangrove forests are found on both the islands of T&T (Figures 18 and 19). Data from 2007 (the most recent and accurate) indicate that at that time, total mangrove coverage in Trinidad was 9,146.4 Ha, and 222.9 Ha in Tobago – a combined total of 9,369.3 Ha (Juman and Ramsewak, 2013b). The distribution along the coastlines in Trinidad was found to be West coast – 7,532 Ha; East coast – 1,132.8 Ha; South coast – 481.3 Ha; and North coast – 0.3 Ha. In Tobago, the mangrove forests include 11 systems, and most are in the Winward coast.

Photo courtesy Oswin Browne
Tobago's Mangrove Swamps

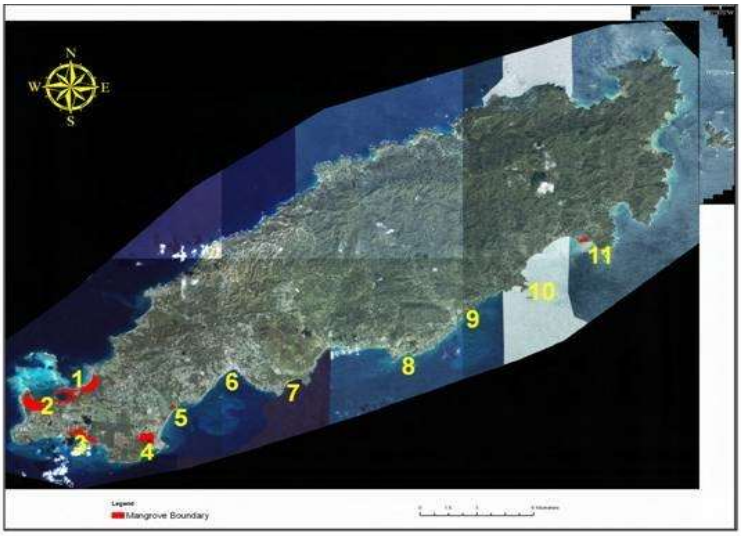
Figure 18: Map of Mangrove Forests in Trinidad (2007)



1. Scotland Bay
2. Hart's Cut
3. Cuesa River
4. Sea Lots
5. Caroni
6. Waterloo
7. Orange Valley
8. Couva River
9. North Claxton Bay
10. South Claxton Bay
11. Guaracara River
12. Marabella River
13. Cipero River
14. Godineau
15. Rousillac
16. La Brea
17. Vessigny
18. Guapo
19. Irois Bay
20. Icacos
21. Los Blanquizales
22. Frank's Bay
23. Moruga Bay
24. Guayaguayare Bay
25. Pt Galeota
26. Southern Mayaro
27. Central Mayaro
28. North Mayaro
29. Ortoire
30. Nariva
31. Manzanilla Bay
32. Fishing Pond
33. Matura Bay
34. Rincon Bay
35. Maracas Bay

Source: Juman and Ramsewak, 2013b

Figure 19: Map of Mangroves in Tobago (2007)



1. Buccoo Bay
2. Bon Accord Lagoon
3. Kilgwyn Friendship
4. Petit Trou
5. Little Rockly Bay
6. Scarborough
7. Minster's Bay
8. Fort Gransby
9. Goldsborough Richmond
10. Belle Garden
11. Louis Dor

Source: Juman and Ramsewak, 2013b

Although data on mangrove extent prior to 2007 exist (Bacon, 1993; FAO, 2005), it is important to note that these earlier measures were limited by the lack of appropriate technological tools, and may therefore not be accurate (Juman and Ramsewak, 2013b). Trying to establish trends in mangrove extent using these earlier data will likely provide trends that are not credible. Box 4 provides an overview of the status of various mangrove systems across T&T, along with an account of the major pressures that are driving changes in these mangrove systems.

Marsh swamp – There are no aggregate, national-level data that indicate changes in marsh swamp area in T&T. However, data from the Nariva Swamp indicate that over the period 1942 to 2003, the area covered by marsh decreased from 4,414 Ha to 3,166 Ha (Carbonell *et. al.,* 2007); and in the Caroni Swamp, between 1942 and 2007, marshlands decreased by an area of 523 Ha (Juman and Ramsewak, 2013). In both cases, changes were largely on account of hydrological changes in the swamps.

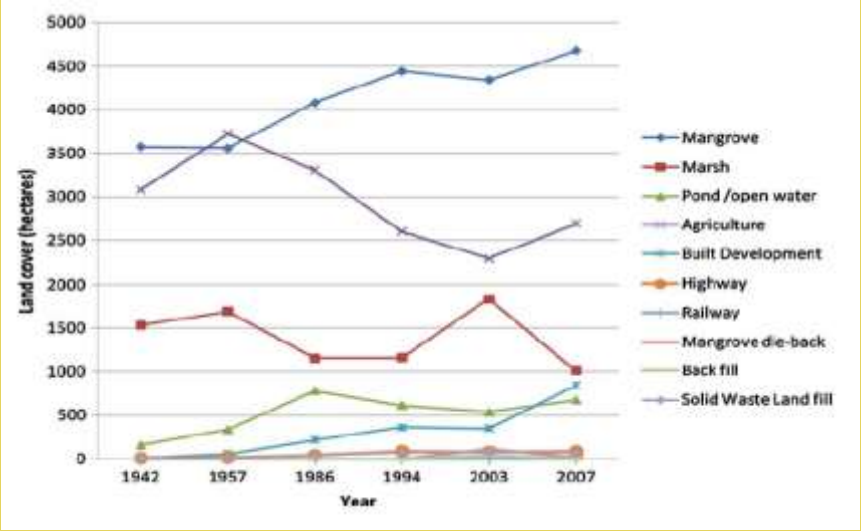
The 4th National Report to the CBD (2010) placed special emphasis on the Nariva Swamp in the assessment of T&T's wetlands. Box 4 highlights the major land use changes that have occurred in the Caroni Swamp, another Ramsar site in T&T, between 1942 and 2007 (Juman and Ramsewak, 2013a).

Box 4: The Caroni Swamp: A Wetland of International Importance

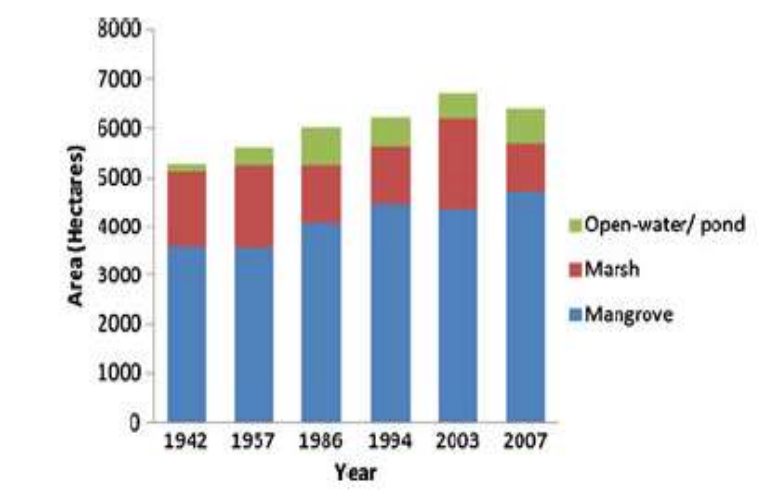
The Caroni Swamp is the largest mangrove swamp in T&T, stretching 21.7 km along the coast of the Gulf of Paria in the northwestern section of Trinidad, and covering an area of 52.6 km^2 (Juman and Hassanali, 2013). Seventy per cent of the mangrove forest area on the west coast of Trinidad is found in the Caroni swamp (Juman and Ramsewak, 2013a). In 2005, the swamp was declared a Ramsar Site because of the importance of the flora and fauna found there.

For many decades, the Caroni swamp has undergone alterations to accommodate activities such as agriculture; and saltwater intrusion, on account of human actions, continues to shape the distribution of species. Mapping of the changes in land use in the Caroni Swamp was undertaken by Juman and Ramsewak (2013a), and several important changes are worth noting in the 65-year period between 1942 and 2007 (Juman and Hassanali 2013):

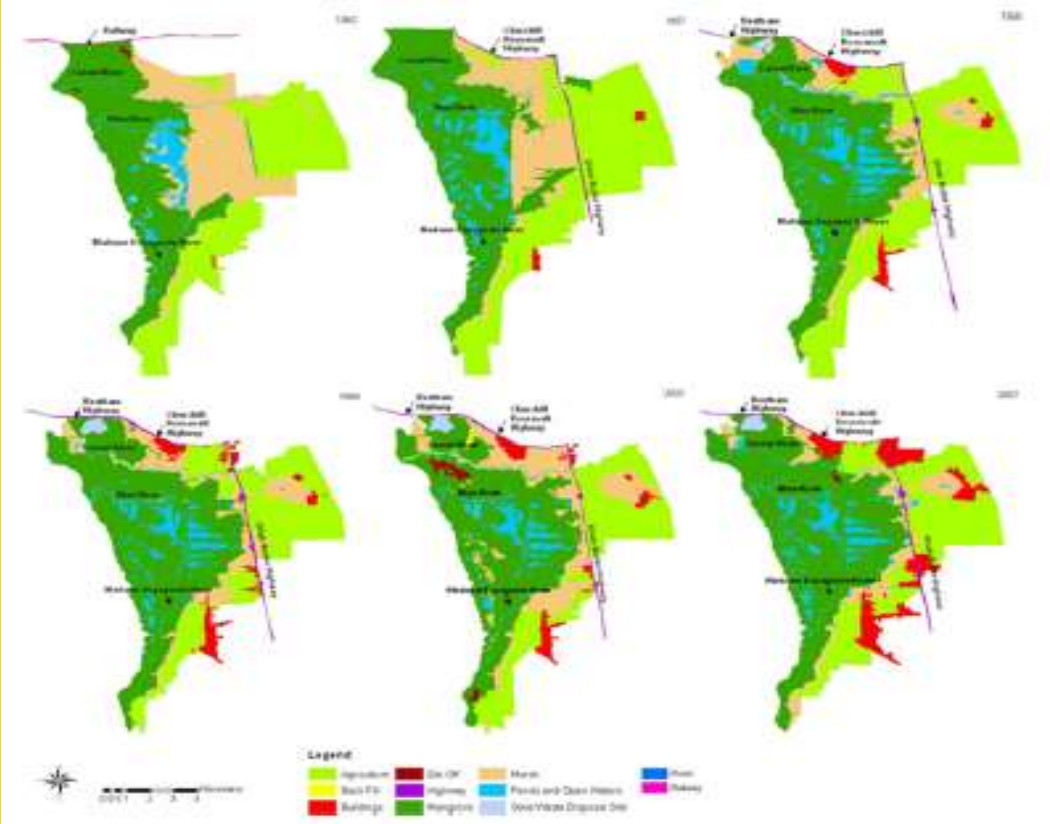
- An increase in mangrove extent by 11.1 km^2;
- A decrease in the area of marsh by 5.2 km^2;
- A decrease in the area covered by agriculture by 3.9 km^2;
- An increase in build development by an area of 8.3 km^2.



Between 1942 and 2003, there was an overall increase in the area of the natural swamp communities – mangroves, marshes and open-water/ponds – because of the contraction of agricultural activity in the swamp. However, between 2003 and 2007, built development began to drive reductions in the area covered by these natural communities.



Overall trends in land use and land cover in the Caroni Swamp are shown in the maps below.



Data Sources: Juman and Hassanali (2013); and Juman and Ramsewak (2013a)

T&T Indicator 5iv: Change in the area, rugosity and diversity of coral reefs

Figure 20 shows the areas where coral reefs are found around T&T. Trends in area and diversity of Tobago's benthic reefs have been documented principally through studies undertaken at selected locations in Tobago in 1985, 2009 and 2013 at Buccoo, Arnos Vale, Culloden, Man-o-War Bay and Speyside (Hassanali 2009). Data on the impacts of coral bleaching in Tobago over the period 2010 – 2012 are also provided by Alemu and Clement (2014). For this indicator, there is no information on rugosity, as this aspect of T&T's coral reefs is not measured.

The data indicate that although hard coral cover declined at all sites in Tobago by approximately 33% over the 1985 – 2013 period, coral cover remained relatively stable ($p>0.05$). This would seem to indicate that the reefs in Tobago did not conform to the overall decrease of 80% in hard coral cover that was reported by Gardner *et. al.* (2003) since the late 1970s. There was a decline in soft coral cover between 1985 and 2009; but this negative trend subsequently stabilized. Macroalgae cover in the reefs increased by a factor of 50 over the 1985-2013 period. The increases in algal and sponge cover on some reefs suggest coral-algal shifts and coral-sponge shifts/co-dominance may be occurring.

Selected results from the studies of Tobago's coral reefs are given in Tables 8 & 9, and in Figure 21, in order to highlight that although general trends have been reported across Tobago's reefs, there are differences in the trends in coral cover between and among various sites, species and water depth. One emerging observation is that hard coral decline appears to be higher in the shallower areas around Tobago (Figure 21).

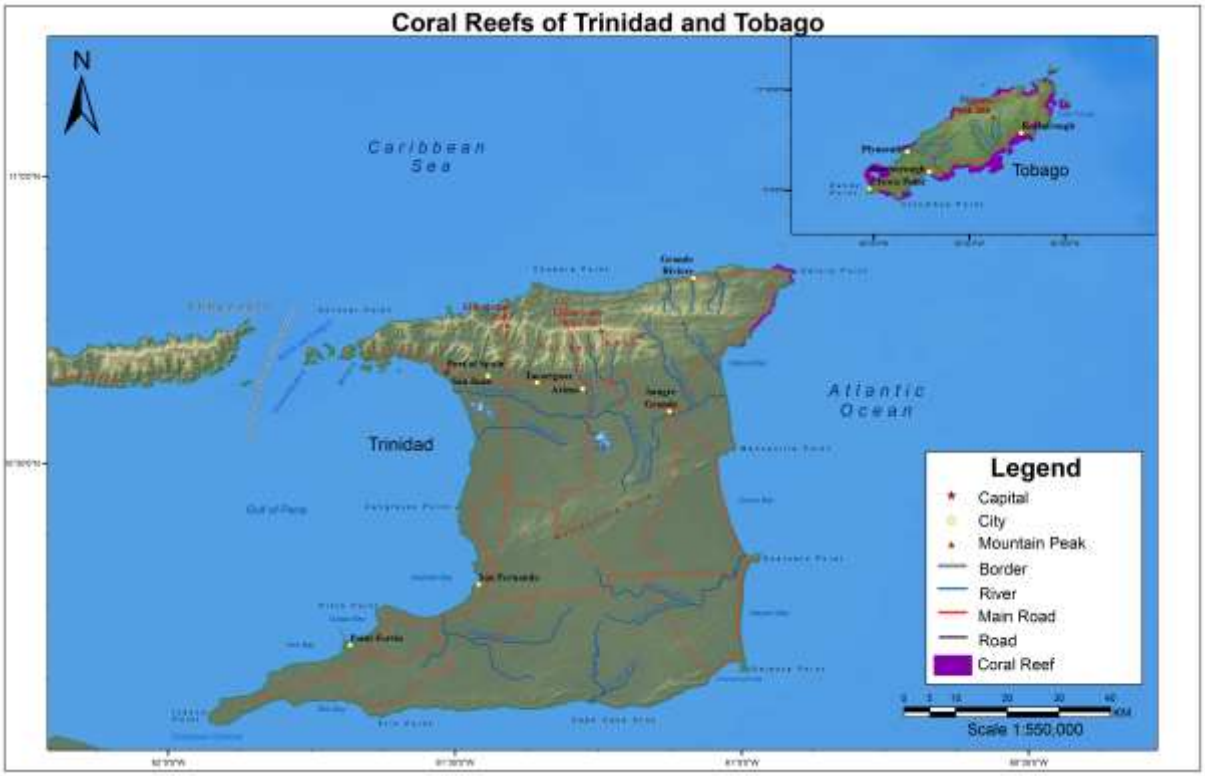
Coral Reef Sidebar

Hitherto, Tobago's reefs are reported to be some of the most understudied reefs in the Caribbean (Alemu and Clement, 2014). Recent research has indicated that the coral reefs around Tobago are known to be biologically diverse ecosystems, and support a range of faunal species. A study undertaken between 2011 and 2013, found that there are at least 96 species of fish in 23 families on Tobago's reefs (Alemu, 2014).

Tobago's reefs are impacted by occasional bleaching events (1998, 2005, 2010); invasion from the lionfish; spear fishing/harvesting activities, and land-based sources of pollution. Currently, coral reef management in T&T is not effective (Juman, 2016).

For information on the biodiversity of the Salybia Reef in Toco, Trinidad, see http://ttfnc.org/photojournals/2011-4.pdf.

Figure 20: Coral Reef Locations Around T&T



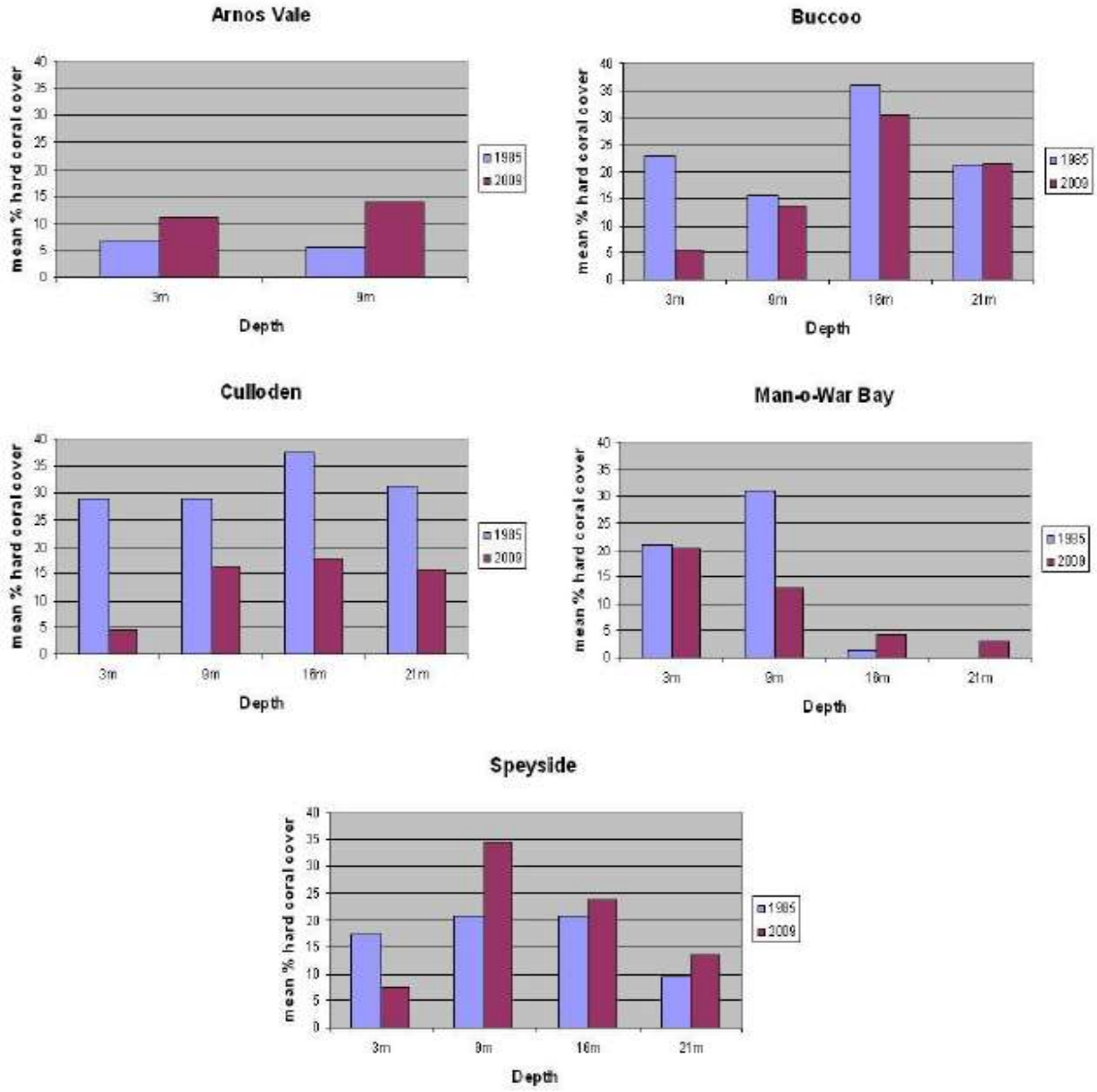
Source: Map produced by the IUCN (2106) based on data from UNEP-WCMC (2010)

Table 8: Percentage Change in Cover of *Siderastrea siderea* in Tobago Reefs Between 1985 and 2009

Survey Locations	Mean *Siderastrea siderea* % cover		
	1985	2009	% Reduction in cover
3m Speyside	3.87	1.61	58
16m Culloden	7	2.58	63
9m Buccoo	5.7	0.46	92
16m Buccoo	27.33	2.89	89
21m Buccoo	10.75	1.17	89
9m Man-o-War Bay	16.2	1.11	93

Source: Hassanali (2009)

Figure 21: Changes in Hard Coral Cover in Sites Around Tobago (1985 and 2009)



Source: Hassanali (2009)

Not all species are equally vulnerable to bleaching. According to Alemu and Clement (2014), *Colpophyllia natans*, *Montastraea faveolata* and *Siderastrea sidereal* appear to be the most susceptible to bleaching (Table 9), and these are the species that together account for the highest composition on the reefs studied.

Table 9: Change in the Percentage of Hard Coral Cover in Tobago's Reefs (2010 – 2012)

	Buccoo			Culloden			Speyside	
	2010	2011	2012	2010	2011	2012	2010	2011
Hard coral taxa	25.19	16.17	16.38	26.28	14.65	13.77	17.55	11.97
Acropora palmata	0.00	0.01	0.14	0.00	0.45	0.29	-	-
Agaricia agaricites	0.21	0.22	0.23	0.31	0.16	0.09	0.10	0.11
Agaricia fragilis	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Agaricia lamarcki	0.21	0.00	0.00	0.10	0.07	0.00	<0.01	<0.01
Colpophyllia natans	6.98	2.77	3.50	1.90	1.50	1.96	1.41	1.05
Dendrogyra cylindrus	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Dichocoenia stokesi	<0.01	<0.01	<0.01	0.05	0.11	0.01	-	-
Diploria clivosa	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Diploria labyrinthiformis	0.31	0.28	0.36	0.35	0.11	0.15	<0.01	<0.01
Diploria strigosa	1.13	0.85	0.73	1.80	1.77	1.97	<0.01	<0.01
Eusmilia fastigiata	0.32	0.21	0.05	-	-	-	0.20	<0.01
Favia fragum	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Isophyllastraea rigida	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Leptoseris cucullata	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Madracis decactis	0.31	0.02	0.02	0.10	0.04	0.03	0.10	0.00
Madracis mirabilis	<0.01	<0.01	<0.01	0.26	0.39	0.10	0.50	0.00
Meandrina meandrites	0.01	0.02	0.05	0.29	0.18	0.46	1.01	0.00
Millepora alcicornis	0.31	0.12	0.14	1.57	0.80	0.68	<0.01	<0.01
Montastraea franksi	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Montastraea cavernosa	0.99	0.17	0.29	0.91	0.31	0.51	0.31	0.10
Montastraea faveolata	11.88	10.13	9.65	17.51^{ab}	7.59^{a}	6.74^{b}	10.97	8.32
Mussa angulosa	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mycetophyllia aliciae	<0.01	<0.01	<0.01	0.10	0.04	0.01	<0.01	<0.01
Mycetophyllia ferox	0.01	0.02	0.07	0.01	0.01	0.01	<0.01	<0.01
Porites astreoides	0.11	0.23	0.10	0.26	0.25	0.17	0.52	0.32
Porites furcata	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Scolymia wellsi.	0.02	0.02	0.02	0.01	0.05	0.02	<0.01	<0.01
Siderastrea radians	0.10	0.01	0.00	0.01	0.04	0.02	<0.01	<0.01
Siderastrea siderea	2.32	1.12	1.05	0.77	0.81	0.56	2.43	2.08
Stephanocoenis intercepta	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-
Macroalgae	15.87^{a}	26.65	37.90^{a}	20.68^{a}	41.85	54.50^{a}	4.08^{a}	9.57^{a}

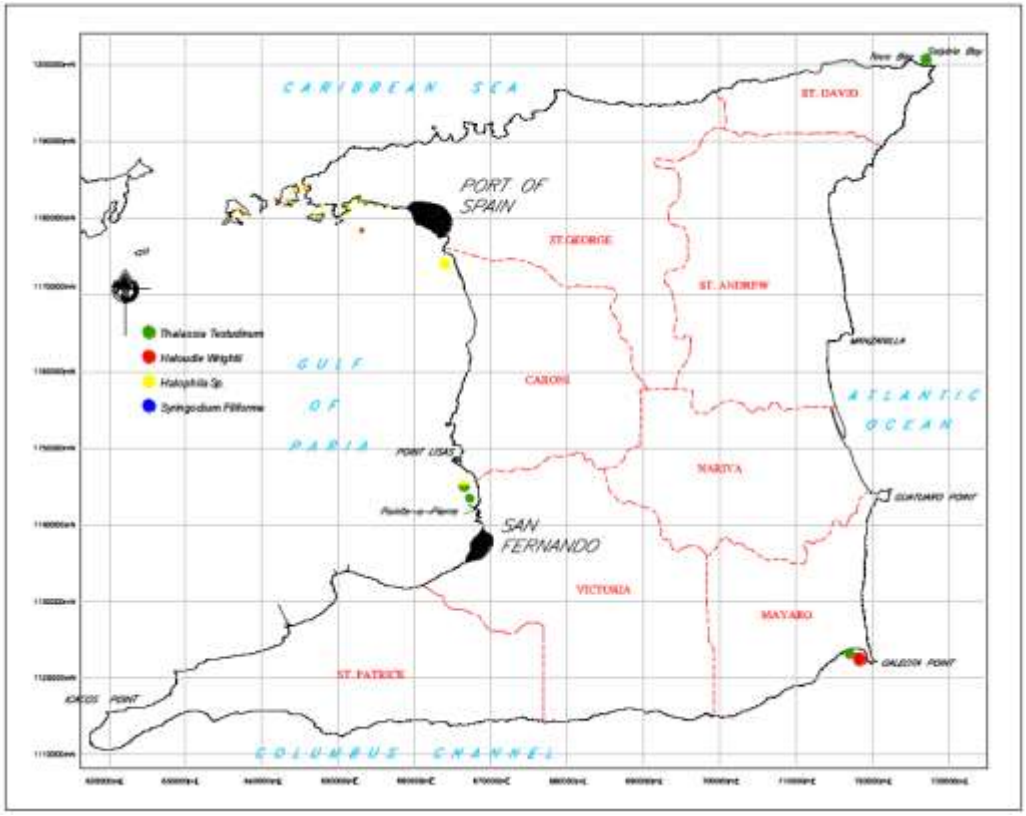
The same superscript indicate significant pairwise comparisons ($p<0.05$) for reef taxa (bold print).
doi:10.1371/journal.pone.0083829.t003

Source: Alemu and Clement (2014)

T&T Indicator 5v: Change in the area of seagrass beds[4]

Seagrass communities in T&T are comprised of one or various combinations of four (4) particular species of seagrasses – Turtle grass (*Thalassia testudinum),* Shoal grass (*Halodule wrightii), Halophilia sp*. and Manatee grass (*Syringodium filiforme)*. Figures 22 and 23, which are based on data from 2001, provide a general idea of the location of seagrass beds around T&T, and indicate how the four (4) species of seagrasses are found in combinations around the islands.

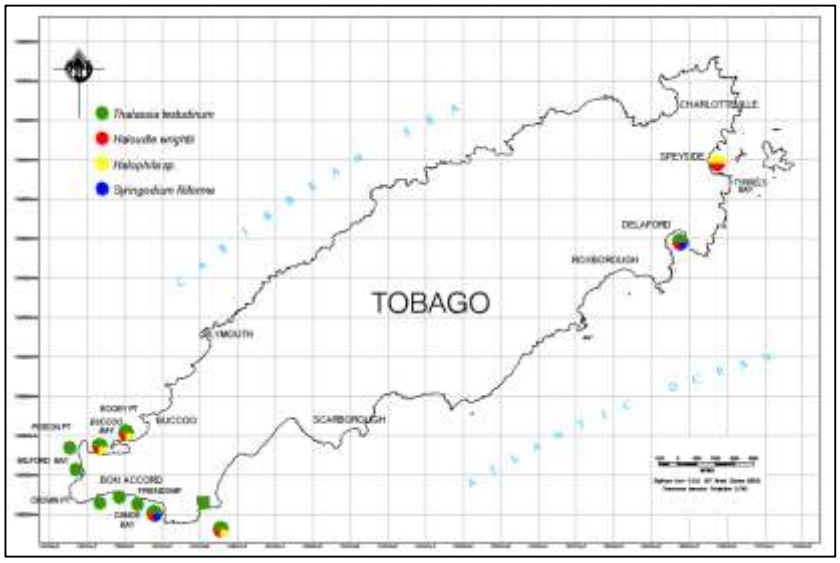
Figure 22: Seagrass Communities Around Trinidad and its Offshore Islands (2001)



Source: Juman and Alexander (2006)

[4] T&T's 4th National Report to the CBD did not include an assessment of seagreass communities in T&T, and the current report has therefore used all available (relevant) data to provide an assessment of trends in this ecosystem type – even though it is recognized that much of this information is outdated.

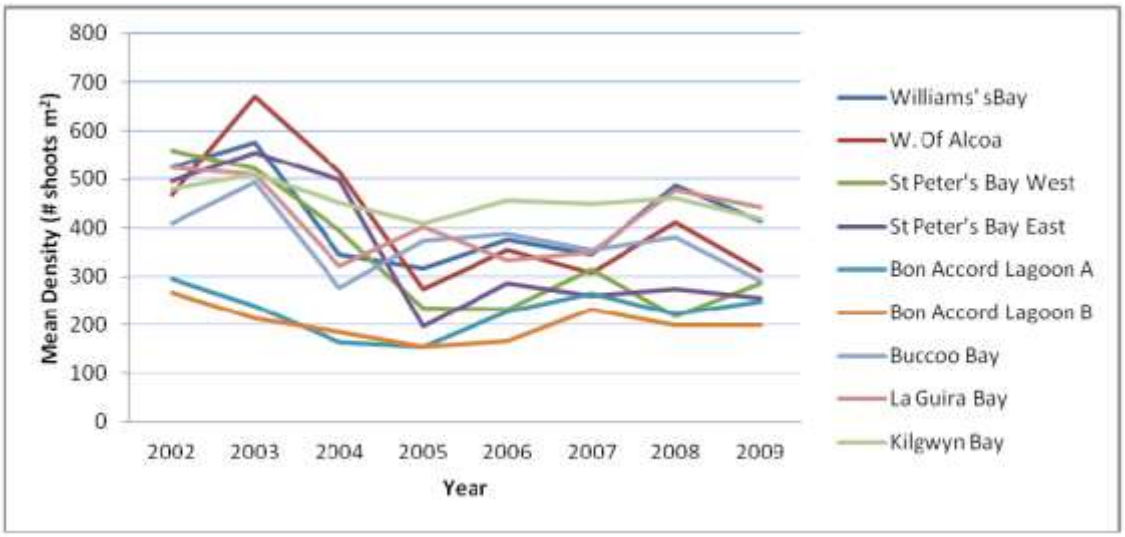
Figure 23: Seagrass Communities Around Tobago (2001)



Source: Juman and Alexander (2006)

Based on available data, it is not possible to provide a national aggregate figure for the current status or historical change in the area of seagrass beds around T&T. What is currently known is that the seagrass beds in the Buccoo Reef/Bon Accord Lagoon Marine Protected Area doubled in extent to 104 Ha between 1997 and 2010 (Juman, 2004; Juman 2012). However, Thalassia dominated seagrass beds in many areas declined in extent between 2002 and 2009 (Figure 24). Based on the latest research (currently underway), there is evidence that Thalassia beds in La Guira/Kilgwyn, Tobago and along the northwest peninsula, Trinidad have now disappeared (Juman pers. comm., 2016). Human impacts – either by way of the degradation of coastal water quality, or through the removal/smothering of seagrass beds to accommodate built development – are the main forces that drive change in seagrass communities. Research is currently underway to update the inventory of seagrass communities around T&T (Juman pers. comm. 2016).

Figure 24: Mean *Thalassia testudinum* Shoot Density Measured at Monitoring Stations Around T&T between 2002 and 2009



Source: Juman 2011

4.1.3 Freshwater ecosystems

T&T Indicator 8i: Change in the level of all types of pollution at key sites

Systematic monitoring of the trends in freshwater ecosystems across T&T is not done, and it is therefore difficult to report on Indicator 8i. A river-monitoring programme undertaken between 2001 and 2006 (Surujdeo-Maharaj, 2010), which focused on selected heavy metals and a number of other physico-chemical parameters, indicated that the water quality and sediments in most rivers across T&T are of poor quality (Table 10).

Table 10: Assessment of the Biological and Physico-chemical Parameters of Rivers in T&T (2006)

Parameters	% of sites with negative impacts	Status of the rivers of T&T
(High) Habitat impairment	83	**Poor**
(Low) Biotic Diversity	78	**Poor**
(High) Nitrates	84	**Poor**
(Poor) pH	7	**Good**
(Low) Dissolved Oxygen	40	**Fair**
(High) Total Suspended Solids*	64	**Poor**
(High) Phosphates	92	**Poor**

Parameters	% of sites with negative impacts	Status of the rivers of T&T
(High) Biological Oxygen Demand	20	**Fair**
(High) Heavy metals in sediments	63	**Poor**
(High) Heavy metals in water	100	**Poor**

Source: (Surujdeo-Maharaj, 2010)

While Cadmium, Chromium and Nickel levels were generally found to be in moderate concentrations at river sampling sites, Zinc, Lead and Copper concentrations were often well above acceptable limits (Figure 25; Surujdeo-Maharaj, 2010). Concentrations of heavy metals also appeared to increase along the length of many rivers due to pollution loading. Along with the inputs of other pollutants (Mohammed et. al, 2009; 2011), this has implications for the coastal environment.

Figure 25: Heavy Metal Index for Aqueous Metals in Rivers Across T&T

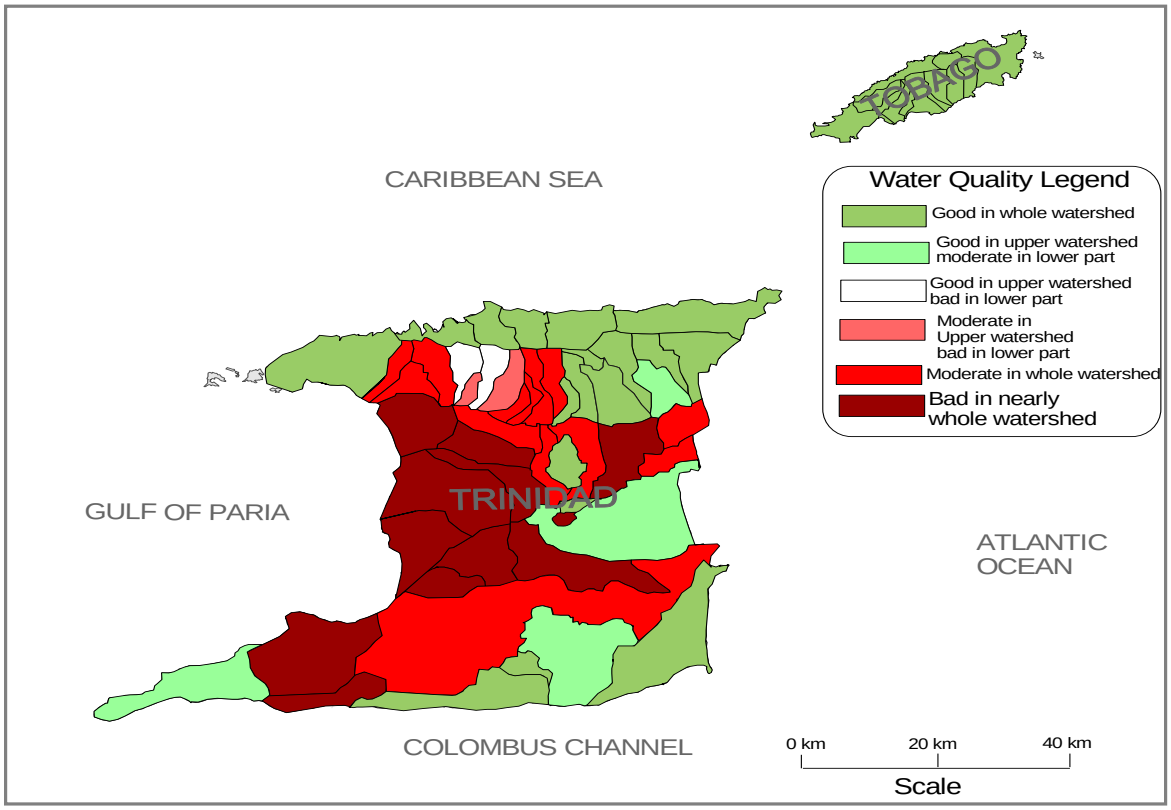
Source: (Surujdeo-Maharaj, 2010)

When the findings of this study are compared with the results of watershed quality assessment conducted in 1999 (Figure 26), which was presented in T&T's 4th National Report (2010) and provides a baseline, there are a number of noteworthy differences:

- Overall, there seems to be a decline in water quality across the entire country;
- In 1999, watershed quality in the northwestern and southeastern regions of Trinidad was reported to be good in entire watersheds. However, the heavy metal study (2010) indicates that there has been moderate to severe impact in these watershed areas due to heavy metal pollution;

- In 1999, watersheds across Tobago were reported to be in good condition, but the 2010 study highlighted areas where there are high levels of heavy metal pollution.

Figure 26: Surface Water Quality in T&T (1999)



DHV Consultants/Delft Hydraulics/Lee Young and Partners, Government of Trinidad and Tobago (1999) in GoRTT (2010)

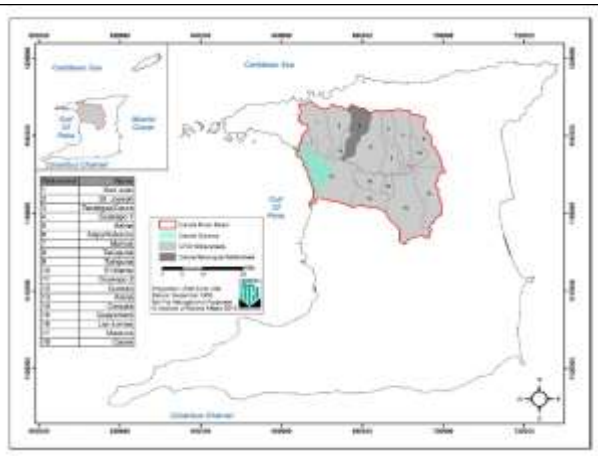
The pollutants in T&T's rivers are derived from a range of land use activities, including agriculture, industrial activity, transporation, and domestic runoff. A case study on the impacts of land use on the water quality in the Caura River (Northern Range, Trinidad) is provided in Box 5.

Box 5: Case Study on Land Use Change and Water Quality in the Caura Valley, Trinidad

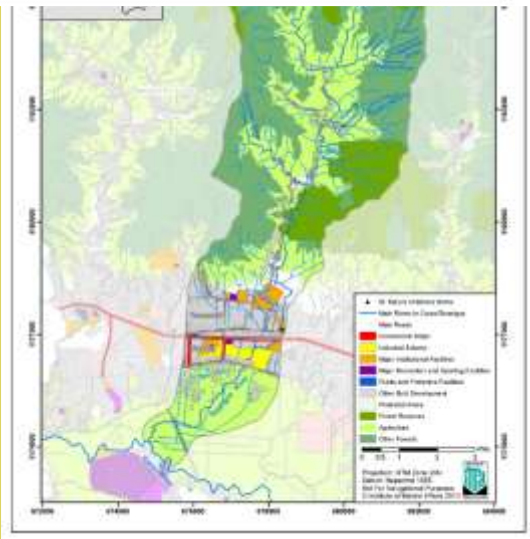
The Caura Valley is one of the most-studied valleys in the Northern Range (see location in figure).

Like many other valleys in the Northern Range, Caura attracts a variety of land use activities that have negatively affected the functioning of the ecosystems in the Valley. Residential, agricultural and recreational activities dominate the upper part of the Caura Valley; the lower part is a mix of residential, commercial, and agricultural activities (see figure).

Information provided by Lucas and Alkins-Koo (2004) and IMA (2010) indicate a significant reduction in water quality in the lower reaches of the Caura River compared to the upper reaches of the Caura River; and demonstrate the impact that various driving forces, working in combination, have on the water quality of the Caura River.



Within the Caura Valley, certain areas are designated for agriculture based on topography and soil type. Population pressure and the difficulties in securing land tenure have led to agricultural squatting in some forested areas, especially along the riverbank. A study undertaken by the IMA between 1997 and 1998 with follow-up testing in 2004 and 2005 found that most of the water pollution in the watershed is attributed mainly to runoff from farm lands, livestock and poultry farms. These problems arise because of:



- ✓ Crop production in ecologically sensitive areas;
- ✓ Use of toxic pesticides including herbicides, mineral fertilizers and un-composted pen manure;
- ✓ Failure to relate pesticide application to agro-eco-system-analysis (AESA);
- ✓ Failure to implement buffer zones;
- ✓ Failure to adopt a more comprehensive ecological crop management approach where non-chemical production strategies take precedence;
- ✓ The failure to implement appropriate soil conservation techniques when farming on hillsides.

The Caura River is an important source of recreation in the Caura Valley, and attracts about 100,000 visitors to the Valley per year, and as many as 1,160 visitors per day on weekends and holidays (TCPD, 2011). A study conducted Phillips et al (2009) on the influence of recreation on microbiological water quality in the Caura River found that sites along the river with recreational activities had poorer water quality than those without, and that water quality was generally poorer where there were high numbers of recreational users. The study also suggests that significant levels of the bacteria *E.Coli* are contained in river sediments, and that activity such as wading stirs up these sediments and re-introduces the bacteria into the water.

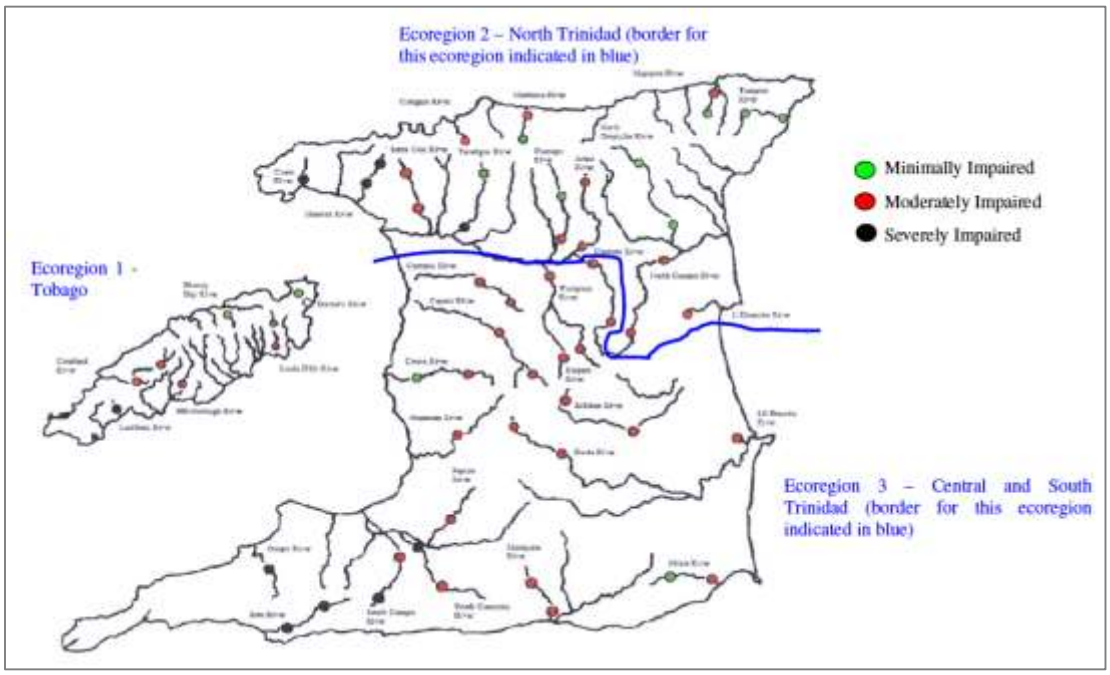
Pollution of the Caura River is a significant problem because residents of Caura extract water directly from the river for their personal/domestic use. Additionally, water is extracted by the Water and Sewerage Authority (WASA) for distribution to other areas of Trinidad; and accounts for approximately 4% of the national supply.

Source: ProEcoServ 2015

T&T Indicator 8iii: Change in biodiversity at key sites affected by pollution

The historical data which would allow for tracking of Indicator 8iii do not exist. However, based on a study conducted by Maharaj and Alkins-Koo (2007), which would likely set the baseline for monitoring changes in biodiversity in T&T's rivers due to pollution, it is evident that the biodiversity in most of T&T's rivers is moderately to severely impaired (Figure 27; Surujdeo-Maharaj, 2010). The correlation between heavy metal pollution (shown in Figure 25) and impacts on biological diversity (Figure 27) is also very strong.

Figure 27: Biotic Impairment in Rivers of T&T Based on an Average Score Per Taxon (ASPT) Score



Source: Maharaj and Alkins-Koo (2007) in Surujdeo-Maharaj (2010)

4.2 Species diversity and vulnerability

4.2.1. General status of species in Trinidad and Tobago (no T&T Aichi Target indicator)

It is estimated that T&T has lost approximately 8% of species from natural ecosystems around the country (UNEP-WCMC, 2016). Table 11 provides an update of the number of species (total and endemic in T&T) based on most recent available data.

Table 11: Number of Species in T&T

Major Categories of Plant and Animal Species	Number of Species	Number of Endemics	Source
Plants	3,638	53 plants	Comeau *et. al.* 2016
Mammals (land and marine)	100 including 67 bat species	Two (2) mammals: - One (1) rodent: Trinidad spiny rat - Proechimys trinitatus; - One (1) deer: Trinidad Red Brocket - Mazama trinitatis.	Kenny, 2008 Gomes, 2015 IUCN, 2016 McKnight & Emmons, 2008
Birds	433	Two (2) birds: - Pawi/Piping Guan (*Pipile pipile*); - Trinidad motmot (*Momotus bahamensis*).	ffrench, 1991 Kenefick et al., 2011
Fish (Freshwater) - Stream	66	Three (3) freshwater fish: - *Hemibrycon taeniurus OC* (Characidae); - *Ancistrus maracasae* (Loricariidae); - *Poecilia boesemani* (Poeciliidae).	Phillip et al, 2013
Fish (Freshwater) - Coastal	60	Not available	Phillip et al, 2013
Fish (Marine)	1,013 coastal and marine finfish species Up to 957 species	Four (4) marine fishes: - *Acanthemblemaria johnsoni OC (Chaenopsidae)*; - Tawny Blenny (*Starksia rava [Labrisomidae])*; - Darksaddle Blenny (*Starksia sella [Labrisomidae])*; - Tobago Coralbrotula *(Ogilbichthys tobagoensis [*Bythitidae]).	Ramjohn, 1999
Amphibians	38 species	Seven (7) frogs: - Bloody Bay Fragrant Frog *(Mannophryne olmonae [*Anura Dendrobatidae]); - Yellow-throated Frog *(Mannophryne trinitatis* [Anura Dendrobatidae]); - El Tucuche Golden Tree Frog *(Phyllodytes auratus* [Anura –Hylidae]); - Trinidad Thin-toed Frog *(Leptodactylus nesiotus [*Anura –Leptodactylidae]); - Charlotteville Litter Frog *(Pristimantis charlottevillensis [*Anura - Strabomantidae]); - Bloody Bay Litter Frog *(Pristimantis turpinorum* [Anura –Strabomantidae]); - Urich's Litter Frog *(Pristimantis urichi* [Anura – Strabomantidae]).	Murphy, 1997 Living Natural Treasures, n.d.

Major Categories of Plant and Animal Species	Number of Species	Number of Endemics	Source
Reptiles	98 species including marine turtles (93 according to Murphy, 1997)	Four (4) reptiles: - Tobago False Coral Snake (*Erythrolamprus ocellatus* [Squamata Ophidia – Colubridae]); - Gray Lora (*Leptophis stimsoni* [Squamata Ophidia-Colubridae]); - Trinidad Worm Snake (*Typhlops trinitatus* [Squamata Ophidia – Typhlopidae]); - Luminous Lizard (*Proctoporus shrevei* [Squamata Sauria – Gymnophthalmidae]).	Boos, 2001 Living Natural Treasures, n.d.
Marine Invertebrates	523 species	One (1) endemic marine benthic amphipod *Ampelisca paria*	IMA, 1999; Gobin, 2007; Gobin, 2010
Mollusc	56 molluscs	One (1) land snail *Drymaeus mossi*	IMA, 1999
Annelida (marine)	201 polychaetes	One (1) endemic polychaete *Johnstonia duplicate*	Gobin, 2010
Nematoda (marine)	70 nematodes	Not available	Gobin, 2007
Echinodermata (marine)	55 echinoderms	Not available	
Porifera (marine)	56 sponges	Not available	Hubbard, 1990
Arthropoda (terrestrial)	212 chelicerata 43 crustacea (freshwater and terrestrial) 11 myriapoda 4,154 insecta 296 spiders	Six (6) endemic scorpions and five (5) endemic butterflies - Wasp (*Mischocyttarus baconi);* - Butterflies (The Trinidad Metalmark [*Nymphidium* Trinidad]i, and *Calospila urichi);* - Ant (*Pheidole aripoensis);* - Longhorned beetle (*Piruapsis antennatus);* - Tortoise beetles (*Cephaloleia rubra* and *Cephaloleia brunnea);* - Stonefly (*Anacroneuria isleta);* - Katydid (*Cocconotus unicolor);* - Tarantulas (*Psalmopoeus cambridgei* and *Lasiodora trinitatis);* - Wall crab spider (*Selenops willinki);* - Goblin spider (*Scaphiella simla);* - Scorpions (*Microtityus rickyi* and *Tityus trinitatis);* - Velvet worm (*Macroperipatus torquatus);* - Freshwater crab (*Microthelphusa odaelkae);* - Ghost shrimp (*Pseudobiffarius caesari).*	Rostant, 2005; Barcant, 1970; Sewlal, 2011
Cnidaria	41 corals	Not available	Kenny, 1988; Laydoo, 1990; Juman, 2010

4.2.2 Threatened species

T&T Indicator 12i - Number of threatened species

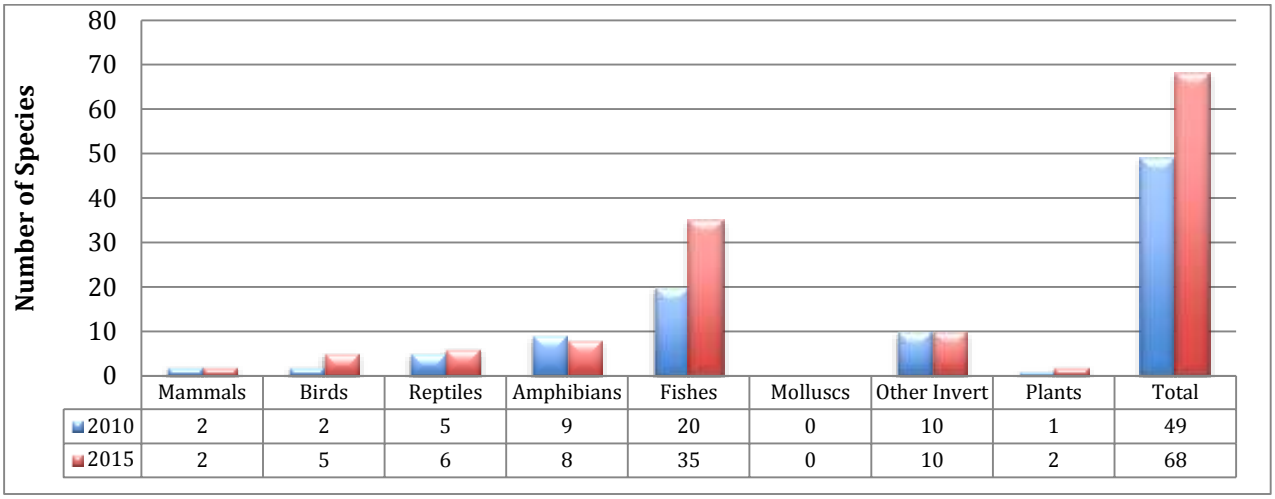
According to the IUCN Red List (2015a), there were a total of 68 threatened species in all categories in T&T in 2015 (Figure 28). This represents an increase of 19 species over what was reported in 2010. Of all the taxonomic categories, fishes are the group with the largest number of threatened species, followed by invertebrates and amphibians. Data on the levels of threat amongst the 66 animal species in the IUCN database, indicate that eight (8) species are critically endangered, 12 are endangered and 46 are vulnerable (Figure 29 - IUCN 2015b; 2015c). The recently published annotated checklist of vascular plants in T&T (Baksh-Comeau *et. al.* 2016) indicates that there may be some inaccuracies in the 2015 IUCN Red List, as well as with previously published accounts of T&T's threatened plant species. According to the new data, there may be more species of vascular plants in the Endangered (EN), Vulnerable (VU) and Near Threatened (NT) categories than previously reported (Figure 30).

T&T has its own system of designating threatened species for management. Under the Environmental Management Act Chapter 35:05, the Environmentally Sensitive Species Rules (2001) has named 10 species for protection - an increase of seven (7) species since the 4th National Report in 2010. The Environmentally Sensitive Species (ESS) are – the Pawi (*Pipile piplie*; 2005); Manatee (*Trichechus manatus manatus*; 2005); White-tail Sabrewing Hummingbird (*Campylopterus ensipennis*; 2005); Golden Tree Frog (*Phyllodytes auratus*; 2013); Ocelot (*Leopardus pardalis*; 2013); Leatherback Turtle (*Dermochelys coriacea*; 2014); Loggerhead Turtle (*Caretta caretta*; 2014); Green Turtle (*Chelonia mydas*; 2014); Hawksbill Turtle (*Eretmochelys imbricata*; 2014); and the Olive Ridley Turtle (*Lepidochelys olivacea*; 2014)[5]

Environmentally Sensitive Species – Golden Tree Frog and Ocelot
Photos from EMA website

[5] Photos taken from http://www.ema.co.tt/new/index.php/sensitive-species

Figure 28: Number of Species Considered Threatened in Each Taxonomic Group in Trinidad and Tobago (2015)

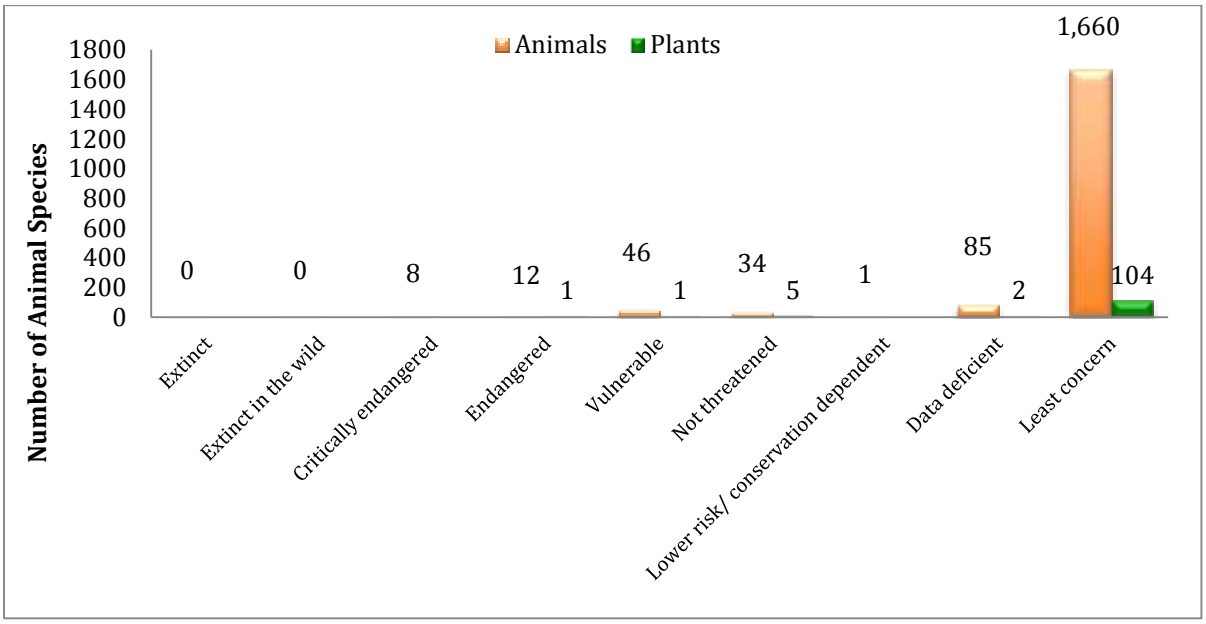


	Mammals	Birds	Reptiles	Amphibians	Fishes	Molluscs	Other Invert	Plants	Total
2010	2	2	5	9	20	0	10	1	49
2015	2	5	6	8	35	0	10	2	68

Source: IUCN (2015a)

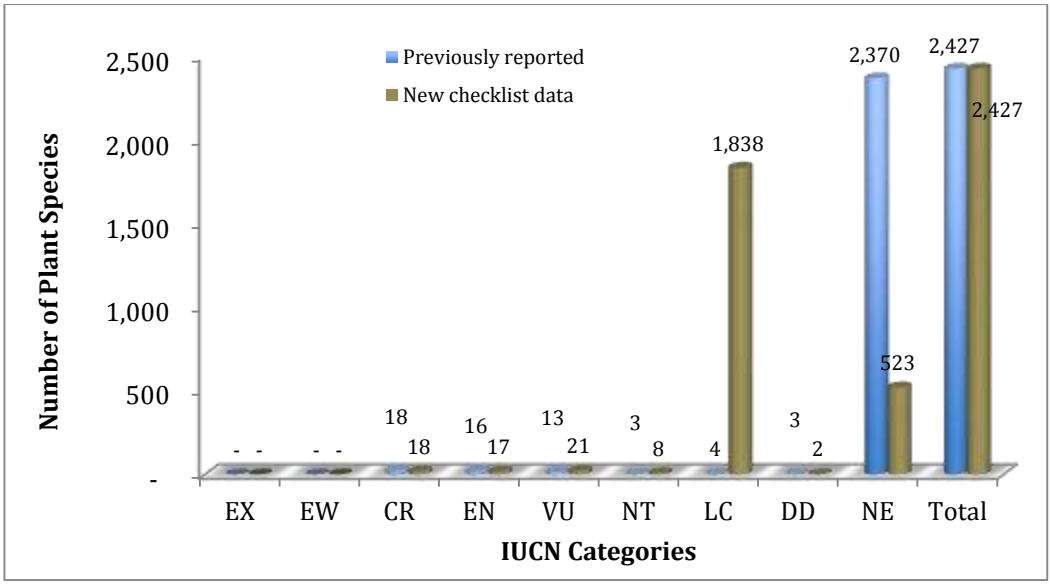
Note: This figure does not distinguish between the different levels of threat used in the IUCN classification system

Figure 29: Levels of Threat to Species in T&T Based on the IUCN Red List Categories (2015)



Source: IUCN (2015b; 2015c)

Figure 30: Previous and Proposed Levels of Threat to Vascualr Plants in T&T



Source: Baksh-Comeau *et. al.* (2016)

The Convention on International Trade of Endangered Species (CITES) lists a total number of 165 species that are under threat from trade in T&T – 82 birds; 37 invertebrates; 22 mammals; 16 reptiles, and eight (8) fish (UNEP-WCMC, 2016)[6].

T&T Indicator 12iii - Change in the population of threatened species

Data for this indicator (which measures the number of individuals per threatened species) are not systematically collected in T&T, and trends are therefore not available.

[6] Data accessed from: http://www.unep-wcmc.org/#?country=TT&dashboard=show (Accessed April 2016).

4.2.3 Species of economic importance (no T&T Aichi Target indicator)

Photo courtesy Robyn Cross
Red-Brocket Deer in Trinidad's Northern Range

Wildlife Species: There are a number of terrestrial species that are hunted in T&T, and concerns of overhunting led to a two-year moratorium being placed on hunting beginning October 2013. In order to determine the impact of harvesting on wildlife species, a three-year wildlife survey was initiated in 2014. It focuses on the five (5) most popular game species in T&T - the Lappe *(Agouti paca),* the Red-Rumped Agouti *(Dasyprocta leporine),* the Tatoo *(Dasypus novemcinctus),* the Red-Brocket Deer (*Mazama americana trinitatis)* and the Wild-hog or Quenk *(Pecari tajacu).* Up until June 2015, 271 Agouti, three (3) Quenk, three (3) Lappe**,** 67 Deer and five (5) Tatoo were sighted. Though preliminary, the results of the survey might indicate that the Agouti populations are faring well under the pressure of hunting, but other species may not be. Further results will be required to draw more conclusive results (EMA and GFEU, 2016).

Commercial Fish Species:

T&T Indicator 6vii: Change in the status of key species of commercial fish and invertebrate stocks

There are a number of fish species that are of commercial importance in T&T. The current status of selected commercial species is shown in Table 12. The data indicate that most species are fully exploited to overexploited, most fish species found in T&T are thus under threat.

Table 12: Status of Selected Commercial Fish Species in Trinidad and Tobago

Fish Species	Data sources	Description of stock status	Ranking of stock status*[7]
Carite or Spanish Mackerel (*Scomberomorus brasiliensis*)	1972-2002 (Trinidad); 1977- 2002 (Southern Caribbean & nearby Atlantic)	Fully exploited to overexploited	2/3 (Poor)
	1991-1992 (Trinidad: artisanal gillnet & line)	Fully exploited	3 (Poor)
Kingfish or King Mackerel (*Scomberomorus cavalla*)	2006-2007 (Trinidad: a la vive, troll, switchering & banking)	There has not been a significant change in fishing mortality in the last 10 years	5 (Fair)

[7] 0 = Unknown; The lower the number, the higher the level of threat to the species (see key at the end of the table).

Fish Species	Data sources	Description of stock status	Ranking of stock status*[7]
	1996-1998; 2004 (Trinidad: artisanal a-la-vive, banking, switchering, troll)	Overexploited	2 (Poor)
	1995-2003 (Trinidad: artisanal troll & a-la-vive); 1950-2003 (Gulf of Mexico to Guianas)	Fully exploited to overexploited	2/3 (Poor)
	1987 (Trinidad: artisanal gillnet & line)	Fully exploited	3 (Poor)
Cavalli *(Caranx hippos)*	1995 to 2007 (Trinidad artisanal multi-gear fleet)	The catch per unit of effort has remained stable between 1995 and 2007 suggesting similar stability in population size	5 (Fair)
Shark (*Carcharinus porosus*)	1992 (Trinidad)	Underexploited	6 (Good)
Four-winged flyingfish (*Hirundichthys affinis*)	1989/90 – 1990/91 (Tobago)	Heavily exploited	4 (Fair)
	1988 to 2008 (Eastern Caribbean)	Regionally the stock is not overfished and overfishing is not occurring. Catch rates have remained stable since 1988. However, this does not imply that local depletion may not be occurring.	5 (Fair)
All shrimp species: Brown (*Farfantepenaeus subtilis*); White (*Litopenaeus schmiti*); Pink (*F. notialis*); Honey or Seabob (*Xiphopenaeus kroyeri*); Red-spotted (*F. brasiliensis*).	1975, 1988-2009 (Trinidad & Venezuela: trawl); ParFish (Participatory Fisheries Stock Assessment) interviews (43 conducted with fisherfolk in the Trinidad artisanal, semi-industrial and industrial trawl fleets, Apr-Oct 2008)	Overall stock biomass likely to be stable or increasing. However, local depletion in Trinidad waters could still be taking place. It should be noted that there are severe and increasing limitations on the available data.	5 – 7 (Fair to Good ?)
All shrimp species: Brown (*Farfantepenaeus subtilis*); White (*Litopenaeus schmiti*); Pink (*F. notialis*); Honey or Seabob (*Xiphopenaeus kroyeri*); Red-spotted (*F. brasiliensis*).	1975, 1988-2004 (Trinidad & Venezuela: trawl)	Overexploited. Stock biomass is declining.	2 (Poor)
Pink shrimp (*F. notialis*); Honey or seabob (*X. kroyeri*)	1992-2002 (Trinidad: trawl)	Fully exploited to overexploited	2/3 (Poor)
Brown shrimp (*F. subtilis*)	1988-2001 (Trinidad: trawl); 1973-2001 (Venezuela: trawl)	Severely overfished, with overfishing taking place since the 1970s.	1 (Poor)
	1988-1996 (Trinidad: trawl); 1973-1996 (Venezuela: trawl)	Overfished	2 (Poor)
Shrimp fishery	1995-1996 (Trinidad: trawl); 1995-1998 (Venezuela: trawl)	Fully exploited to overfished, over-capitalised	2/3 (Poor)

Fish Species	Data sources	Description of stock status	Ranking of stock status*[7]
Cro-cro or Croaker (*Micropogonias furnieri*)	1987, 1989-1997 (Trinidad: artisanal trawl, gillnet & line; Venezuela: trawl) 1995-2006 (Trinidad: artisanal gillnets & lines; artisanal, semi-industrial & industrial trawl)	Fully exploited to overfished	2/3 (Poor)
Salmon or Weakfish (*Cynoscion jamaicensis*)	1989-1997 (Trinidad: artisanal trawl, gillnet & line)	Fully exploited to overfished	2/3 (Poor)
Lane Snapper (*Lutjanus synagris*)	1963, 1975, 1995 - 2004 (Trinidad: artisanal gillnet, line, fishpot & all trawl fleets)	Overall stock biomass does not appear to be affected by the high local fishing mortality. It is theorized that this may be due to relatively constant recruitment to the fishery in Trinidad from an external source of the stock in the region.	5 (Fair)
Groundfish fishery	1989-1997 (Trinidad artisanal trawl & gillnet)	Fully exploited to overfished	2/3 (Poor)
Snapper Plumhead (*Rhomboplites aurorubens*)	1992 (Trinidad: artisanal fishpot on North & East coast)	Fully exploited	3 (Poor)
Lane snapper (*Lutjanus synagris)*	1980-1981 (Trinidad: artisanal fishpot on North & East coast)	Underutilized but the species may be currently fully exploited to overexploited	2/3 (Poor)
Redfish (*L. purpureus*)	1992 (Trinidad: artisanal fishpot on North & East coast)	Fully exploited	3 (Poor)
Yellowedge Grouper (*Epinephelus flavolimbatus*) Sweetlip (*Mycteroperca interstitialis*)	1992 (Trinidad: artisanal fishpot on North & East coast)	Fully exploited or overexploited	2/3 (Poor)
*Yellowfin tuna (*Thunnus albacares*)	ICCAT database – annual submissions from countries and entities exploiting the resources and findings of scientific research papers	Fully exploited.	3 (Poor)
*Bigeye tuna (*Thunnus obesus*)	ICCAT database – annual submissions from countries and entities exploiting the resources and findings of scientific research papers	Fully exploited.	3 (Poor)
*Skipjack tuna (*Katsuwanus pelamis*)		Indeterminate, however there may be overexploitation within the FAD fisheries	0
*Albacore (North Atlantic stock) (*Thunnus alalunga)*		Fully exploited to overexploited	2/3 (Poor)
*Albacore (South Atlantic stock) (*Thunnus alalunga)*		Fully exploited to overexploited	2/3 (Poor)

Fish Species	Data sources	Description of stock status	Ranking of stock status*[7]
*Marlin: Atlantic blue marlin (*Makaira nigricans*) Atlantic white marlin (*Tetrapturus albidus*) Roundscale Spearfish (*Tetrapturus georgii*) Longbill Spearfish (*Tetrapturis pfluegeri*)		Atlantic blue marlin overfished. Atlantic white marlin overfished.	2 (Poor)
*Swordfish (North Atlantic stock) (*Xiphias gladius)*		The stock is considered rebuilt, consistent with the 2009 evaluation.	5 (Fair)
*Swordfish (South Atlantic stock) (*Xiphias gladius)*		The stock is not believed to be overfished.	5 (Fair)
*Atlantic sailfish (West Atlantic stock) (*Istiophorus albicans*)		Indeterminate. Production models suggest a possibility that West Atlantic stocks are overfished.	0
*Atlantic sailfish (East Atlantic stock) (*Istiophorus albicans*)		Fully exploited and overfished.	2/3 (Poor)
*Small Tunas: Blackfin Tuna (*Thunnus atlanticus*) Bullet Tuna (*Auxis rochei*) Atlantic Bonito (*Sarda sarda*) Frigate Tuna (*Auxis thazard*) Little Tunny (*Euthynnus alletteratus*) Wahoo (*Acanthocybium solandri*) Dolphinfish (*Coryphaena hippurus*)		Indeterminate	0
Sharks: *Blue shark *(Prionace glauca)*		North and South Atlantic stocks suggest stability but results are uncertain.	5 (Fair - ?)
Sharks: *Shortfin mako *(Isurus oxyrinchus)*		Catch levels in both North and South Atlantic stocks considered sustainable.	5 (Fair)
Sharks: *Longfin mako *(Isurus paucus)*	2006 (IUCN Red List Assessment)	Fully exploited to overfished	2/3 (Poor)

Fish Species	Data sources	Description of stock status	Ranking of stock status*[7]
Sharks: *Oceanic Whitetip (*Carcharhinus longimanus*)	2006 (IUCN Red List Assessment)	Fully exploited and overfished.	2/3 (Poor)
Sharks: *Blacktip Shark *(Carcharhinus limbatus)*	2009 (IUCN Red List Assessment)	Overfished.	2 (Poor)
Sharks: *Tiger shark *(Galeocerdo cuvier)*	2009 (IUCN Red List Assessment)	Overfished.	2 (Poor)
Sharks: *Sharks:Silky shark *(Carcharhinus falciformis)*	ICCAT database – annual submissions from countries and entities exploiting the resources and findings of scientific research papers	Fully exploited and overfished.	2/3 (Poor)
Sharks: *Bigeye Thresher (*Alopias superciliosus*)	ICCAT database – annual submissions from countries and entities exploiting the resources and findings of scientific research papers	Fully exploited and overfished.	2/3 (Poor)
Sharks: Hammerheads *Scalloped Hammerhead (*Sphyrna lewini*) *Great Hammerhead (*Sphyrna mokarran*) *Smooth Hammerhead (*Sphyrna zygaena*)	ICCAT database – annual submissions from countries and entities exploiting the resources and findings of scientific research papers	Fully exploited and overfished	2/3 (Poor)

Source: Fisheries Division (2016)

*Key

Rank	Status description	Summary Status
0	Unknown	Unknown
1	Severely overfished	Poor
2	Overexploited/ overfished	
3	Fully exploited	
4	Heavily exploited	Fair
5	No change/ stable stock	
6	Underexploited	Good
7	Increasing stock	

4.3 Summary of Status and Trends in T&T's biodiversity

Based on the foregoing assessment, Table 13 provides a qualitative assessment of the status and trends in the main components of T&T's biodiversity.

Table 13: Qualitative Assessment of the Status and Trends in T&T's Biodiversity

Biodiversity Components			Status and Trends	Level of Certainty	Comments
Ecosystems	Forests	Natural	↗	High	Based on FAO FRA data (1990 – 2015)
		Plantation	↘	High	Based on FAO FRA data (1990 – 2015)
	Coastal	Mangroves	↘	Medium	Based on 2007 data. Earlier data not sufficient to be certain about historical trends
		Coral Reefs (Tobago)	↘	High	Based on several studies (1985 – 2013)
		Seagrass beds	↘	High	Based on ongoing research (up to 2016 pers. comm.)
		Freshwater marshes	↘	High	Based on monitoring from 1942 up to 2003 and 2007 depending on location
	Freshwater	Rivers	↘	Medium	Based on 2006 data compared with 1999 information
Species	Richness abundance and distribution	Flora	?	?	Based on Baksh-Comeau *et. al.* (2016)
		Fauna	↘	Low	Based on one-off studies, many of which are outdated
	Vulnerable/ Threatened	Flora	↘	High	Based on Baksh-Comeau *et. al.* (2016)
		Fauna	↘	High	Based on the IUCN Red List 2015
	Spp. of economic importance	Wildlife	↘	Medium	Wildlife survey still ongoing and interim results limited
		Marine Fisheries	↘	High	Based on monitoring data from Fisheries; varying years
Ecosystem Services		Freshwater provision	↘	Medium	Based on proxy data up to 2011
		Hillside sediment retention	?	Medium	Baseline data recently established (2015)
		Coastal protection	?	Medium	Baseline data recently established (2015)
		Carbon sequestration	?	Medium	Baseline data recently established (2015)
		Coastal tourism/ recreation	?	Medium	Baseline data recently established (2015)

	Pollination	?	Medium	Baseline data recently established (2015)

Notes to table: 1) This qualitative assessment is based on available data and expert opinion.
2) Status refers to the latest known status – for many aspects of biodiversity in T&T, the data do not refer to 2016 status.
3) Trends are assessed using available baseline data and most recent data, and thus dates vary.

Key to table:

Status Assessment

Good	Fair	Poor

Trends Assessment

↑	↗	→	↘	↓
Significant increase	Slight to moderate increase	No change/ Stable	Slight to moderate decline	Significant decline

5.0 Drivers of Change Affecting Trinidad and Tobago's Biodiversity

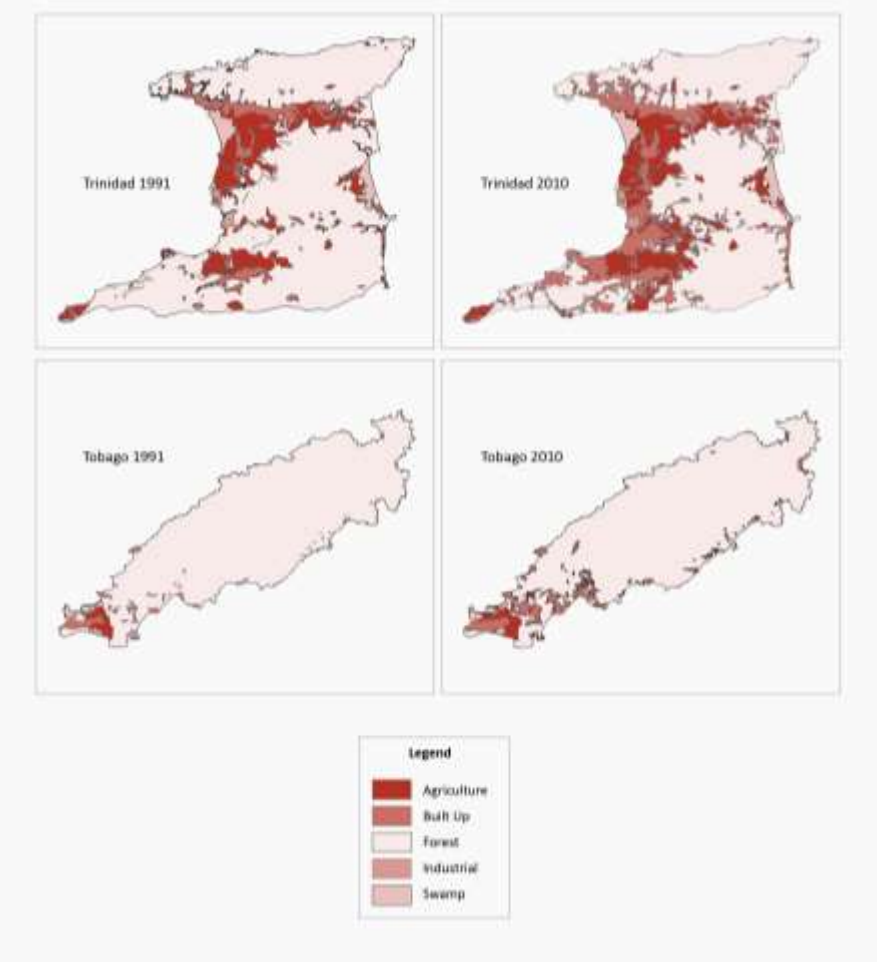
Q3. What are the main threats to biodiversity?

5.1 Direct Drivers of Change

5.1.1 Land Use and Land Cover Change

Changes in land use and land cover continue to be an important threat to biodiversity in T&T. Figure 31 shows the changes in land use over the period 1991 to 2010; and indicates significant expansion of built up and industrial areas especially along the west coast and the northwestern section of the Northern Range. In Tobago, there has been expansion of built development in the southwestern tip of the island.

Figure 31: Changes in Land Use Between 1991 and 2010

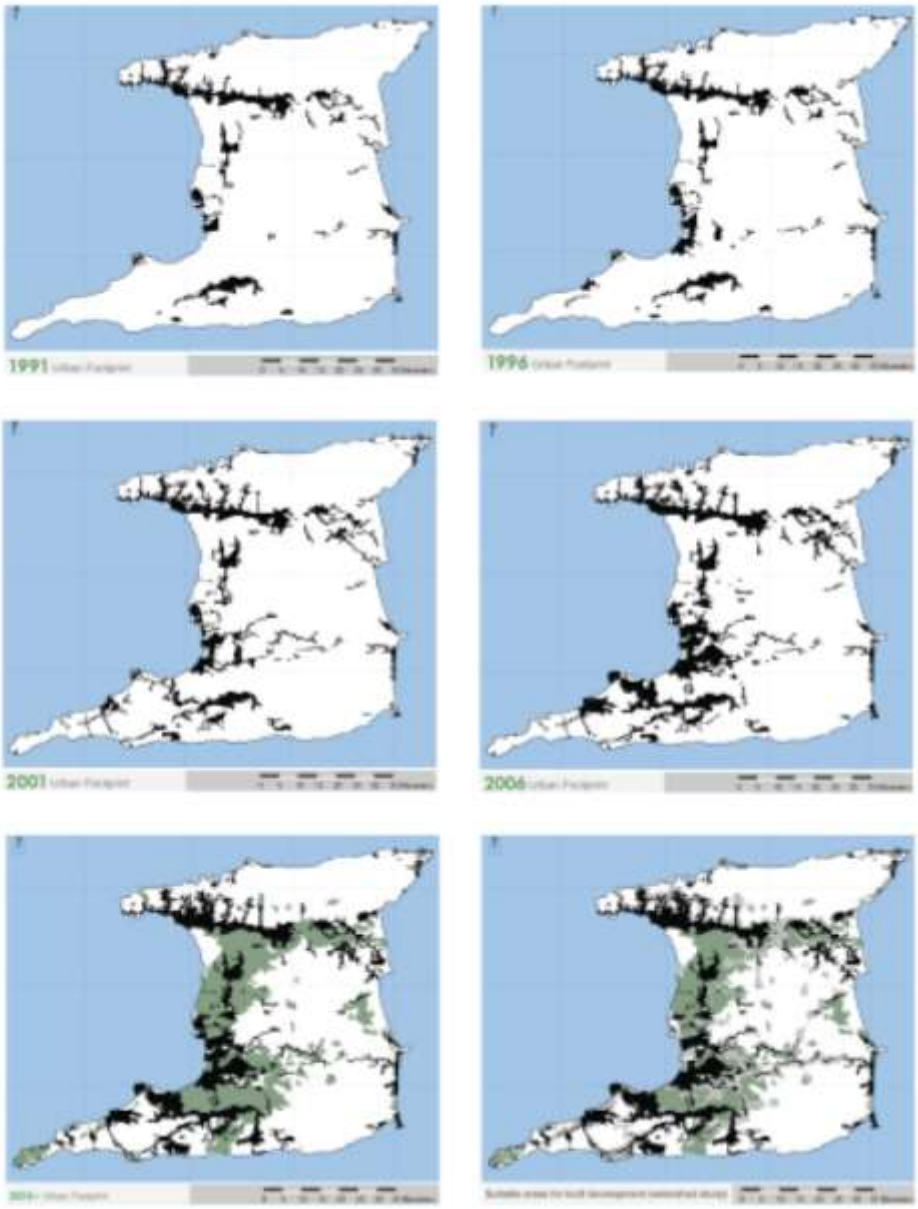


Source: GoRTT (2012a)

Urban and Build Development *(no T&T Aichi Target indicator)*

Figure 32 shows the changes in the expanse of urban areas between 1991 and 2010. Urban areas grew rapidly over the period, and extended into portions of the island that were not classified as suitable for this type of development (GoRTT, 2012b).

Figure 32: Evolution of T&T's Urban Footprint (1991 – 2010)



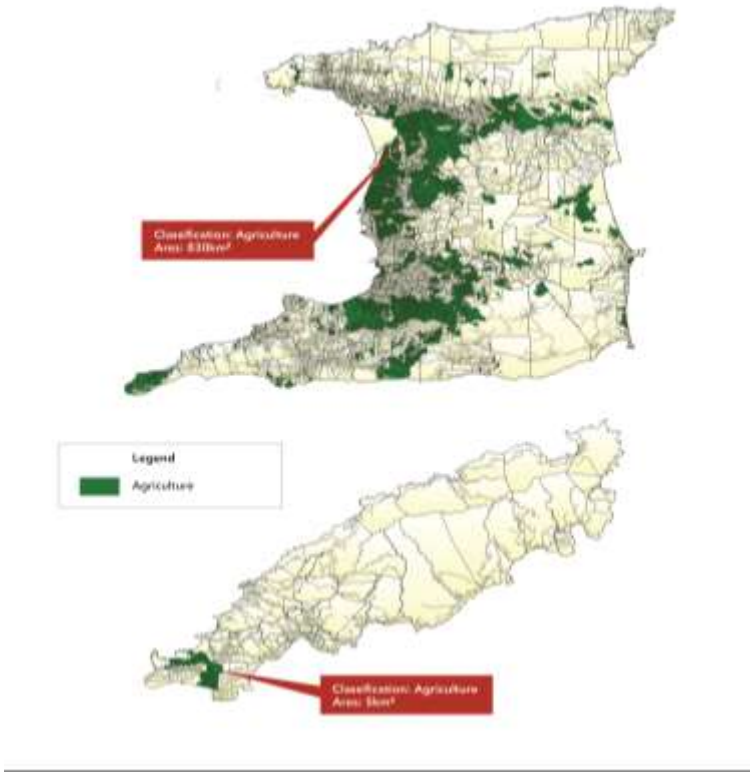
Source: GoRTT (2012b)
Note: the Figure at the bottom right shows the suitable areas for built development based on a watershed study.

Agriculture: T&T Indicator 5i: Area under agriculture

It is reported (GoRTT 2013) that farmland accounts for 25% of the land area of T&T (or 131, 572 Ha) – with the majority (62.1%) under cultivated cropland. However, based on another account, in 2010, agricultural land covered 830 km^2 in Trinidad and 5km^2 in Tobago – a total of 835 km^2 across both islands (GoRTT 2012 – Figure 33). These two (2) accounts of area under agriculture in T&T are

significantly different and likely do not represent the increase in agricultural land over the 2010/2013 period.

Figure 33: Agricultural Land Area in Trinidad and Tobago (2010)

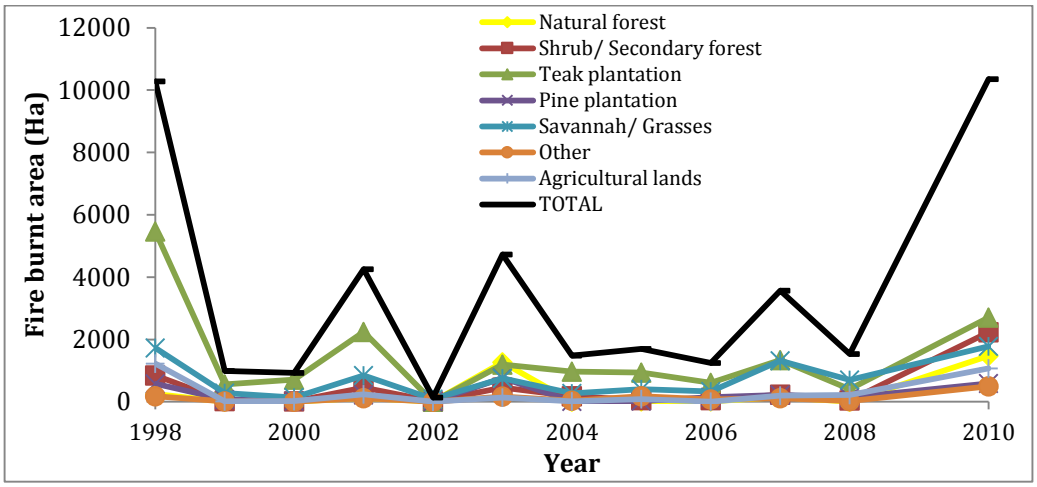


Source: GoRTT (2012a)

Fires: T&T Indicator 5vi: Change in the area of fire degraded habitats

The 4th National Report (2010) included data on the areas affected by fire in T&T (1998 – 2008) by land use type (natural forests; shrub and secondary forest; Teak plantations; Pine plantations; Savannah and grasslands; and agricultural lands). The National Biodiversity Assessment (NBATT, 2012) included data for 2010. This type of data was important because it provided a clear indication of the extent to which different ecosystems/habitat types across the country were being affected by human-induced fires (Figure 34).

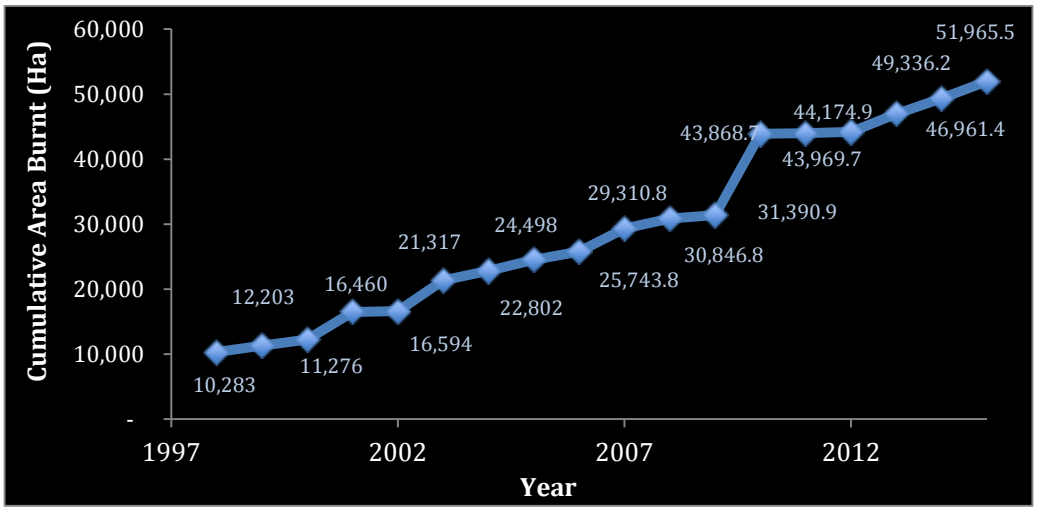
Figure 34: Fire Affected Habitats/Ecosystems in T&T (1998 – 2010)



Data sources: GoRTT (2010) and NBATT (2012)

However, since 2010, the aggregation of data by habitat types is not available, and fire data is now aggregated by geographical distribution only (conservancy). The newest data do not therefore provide an indication of the change in the area of fire-degraded habitats by habitat type; and it is difficult to accurately assess the impact of fires on biodiversity and its associated services. What Figure 35 indicates however is that a cumulative total of over 50,000 Ha of terrestrial ecosystems (in all categories – forests, plantations, savannahs and agricultural lands) was burnt between 1998 and 2015.

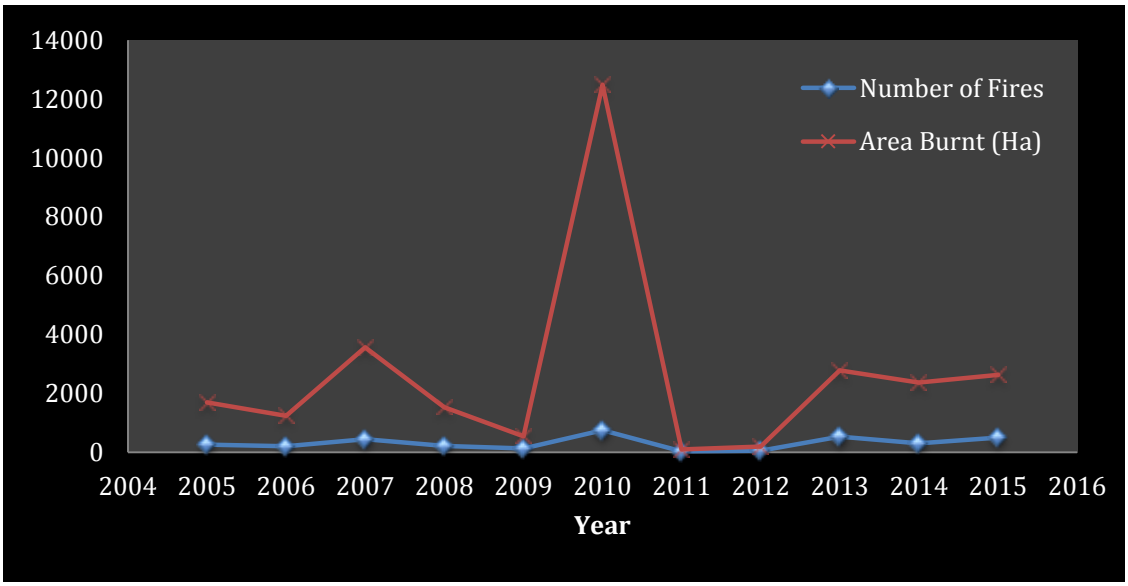
Figure 35: Cumulative Area Burnt in T&T (1998 – 2015)



Data sources: GoRTT (2010); NBATT (2012) and Forestry Division (2016)
Notes: The cumulative area burnt is calculated by adding the total area affected by fires on an annual basis. It does not take into account whether the same area (geographical space) was burnt in different fires in different years
There is a slight discrepancy with 2010 data; Forestry (2016) data is used as the source in the Figure

What current annual data also indicate is that there is no long-term discernable annual trend in fires – the numbers and size of fires are largely determined by rainfall, topography and vegetation; and thus fire impacted areas vary from year to year (Figure 36).

Figure 36: Number of Fires and Area Burnt in Trinidad (2005 – 2015)



Source: Forestry Division (2016b)

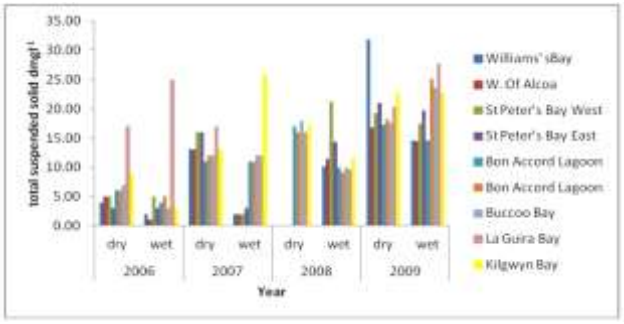
5.1.2 External Inputs – Chemical and Solid Waste Pollution

Indicator 8i: Change in the level of all types of pollution at key sites

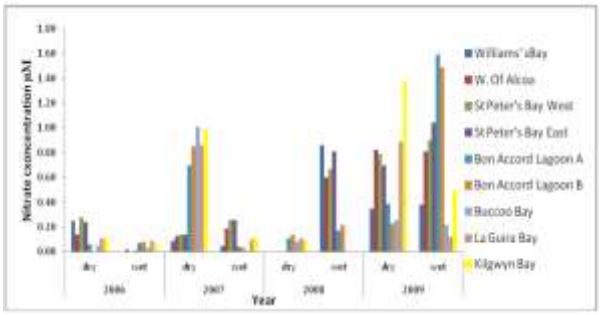
As indicated in Table 10 and Figure 25, there appears to be increasing levels of pollution in rivers around T&T. The increasing threats to T&T's coastal waters from land-based sources of pollution (LBS) – as outlined in the Draft Integrated Coastal Zone Management (ICZM) Policy Framework document (2014), is therefore not surprising. Research in seagrass monitoring sites has shown that there has been an increase in the coastal concentrations of pollutants such as suspended solids and nitrates (Figure 37). Pollution (nutrient enrichment) has also been shown to affect mangrove communities around T&T in areas such as the Godineau Swamp, Buccoo Bay and the Bon Accord Lagoon, Sea Lots, and the Moruga River (Juman and Ramsewak, 2013).

Polluted river discharge in northwestern Trinidad
Photo courtesy: Robyn Cross

Figure 37: Water Quality Parameters at Selected Seagrass Monitoring Stations (2006 – 2009)



Total Suspended Solids

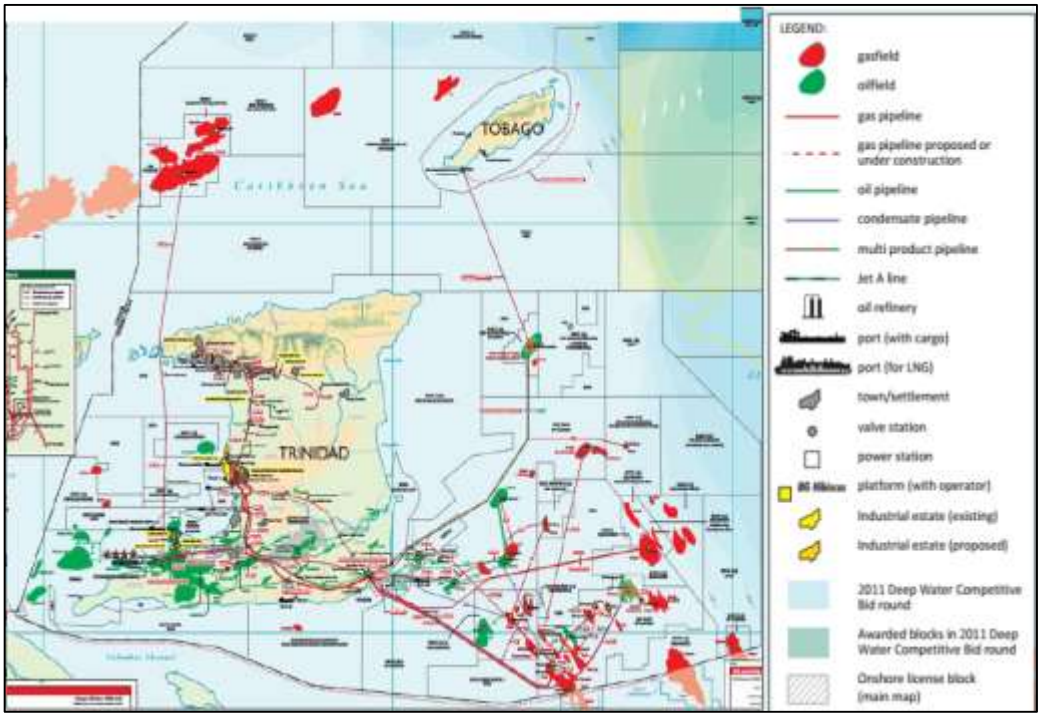


Nitrates

Source: Juman (2011)

Another threat to the coastal/marine environment in T&T are the offshore oil and gas operations. As demonstrated in Figure 38, there are many areas where exploration and production areas are occurring. Oil pollution is known to affect coastal ecosystems such as the mangrove communities in the Godineau Swamp, Irois Bay, and Scotland Bay (Juman and Ramsewak, 2013).

Figure 38: T&T Offshore Concession Map (2.20)

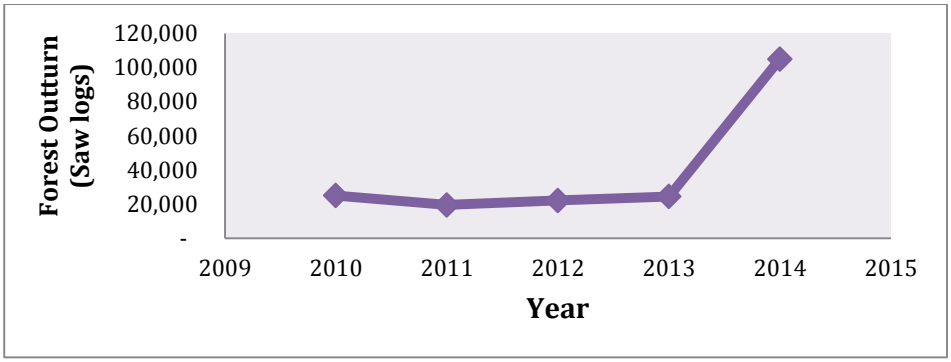


Source: Ministry of Energy and Energy Industries (2012) in NBATT (2012)

5.1.3 Harvest and Resource Consumption (no T&T Aichi Target indicator)

Timber removal: T&T's forests continue to be impacted by logging activities, and special attention needs to be paid to primary forests. Figure 39 shows the forest outturn from natural forests (on state lands) over the period 2010 – 2014, and indicates that there was a significant increase in the removal of timber from natural forests in 2014. It is important for T&T to ensure that its timber harvesting is sustainable, especially in natural forests, to guard against impacts to BES.

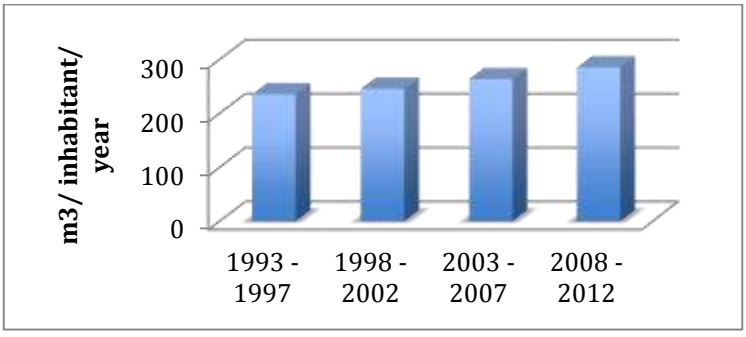
Figure 39: Forest Outturn From Natural Forests (2010 – 2014)



Data source: Forestry Division (2016a)

Freshwater extraction: There has been increasing pressure on the freshwater resources in T&T for human consumption. Data show that per capita water withdrawal in T&T increased by approximately 20% over the period 1997 to 2011 (Figure 40).

Figure 40: T&T's Water Withdrawal Per Capita

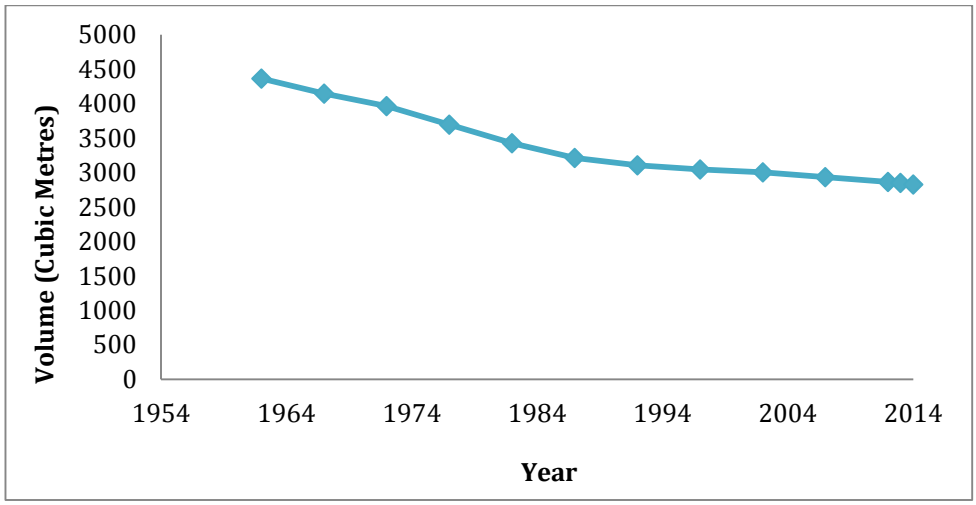


Source: FAO AQUASTAT[8] (Accessed February 2016)

8 http://www.fao.org/nr/water/aquastat/data/query/results.html?regionQuery=false&showCodes=true&yearRange.fromYear=1960&yearRange.toYear=2015&varGrpIds=4250,4251,4252,4253,4254,4255,4256,4257,4260,4261,4262,4263,426

As a result, renewable internal freshwater resources per capita have been decreasing (Figure 41).

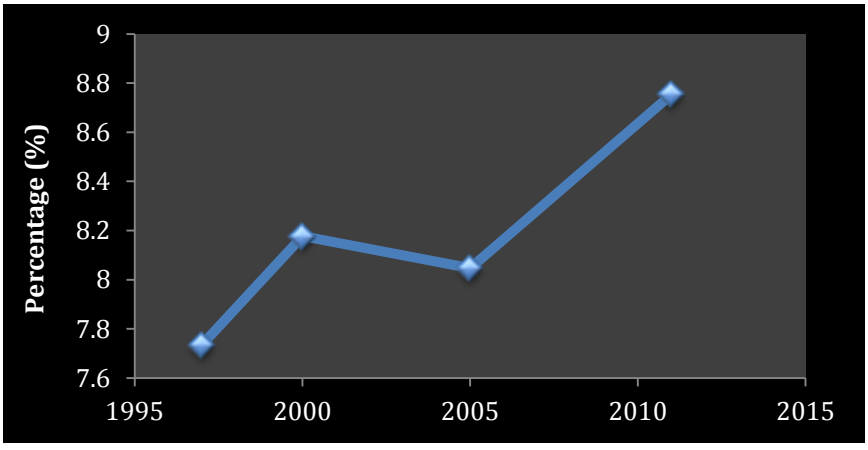
Figure 41: Renewable Internal Freshwater Resources Per Capita in T&T (1962 – 2014)



Compiled from various sources: World Bank (1982 – 2014 data) and Index Mundi (1962 – 1977 data)

T&T is now one of the countries in Latin America and Caribbean (LAC) with the highest freshwater withdrawals as a percentage of total renewable water resources, and this indicates that extraction levels may be approaching unsustainable limits (Figures 42 and 43).

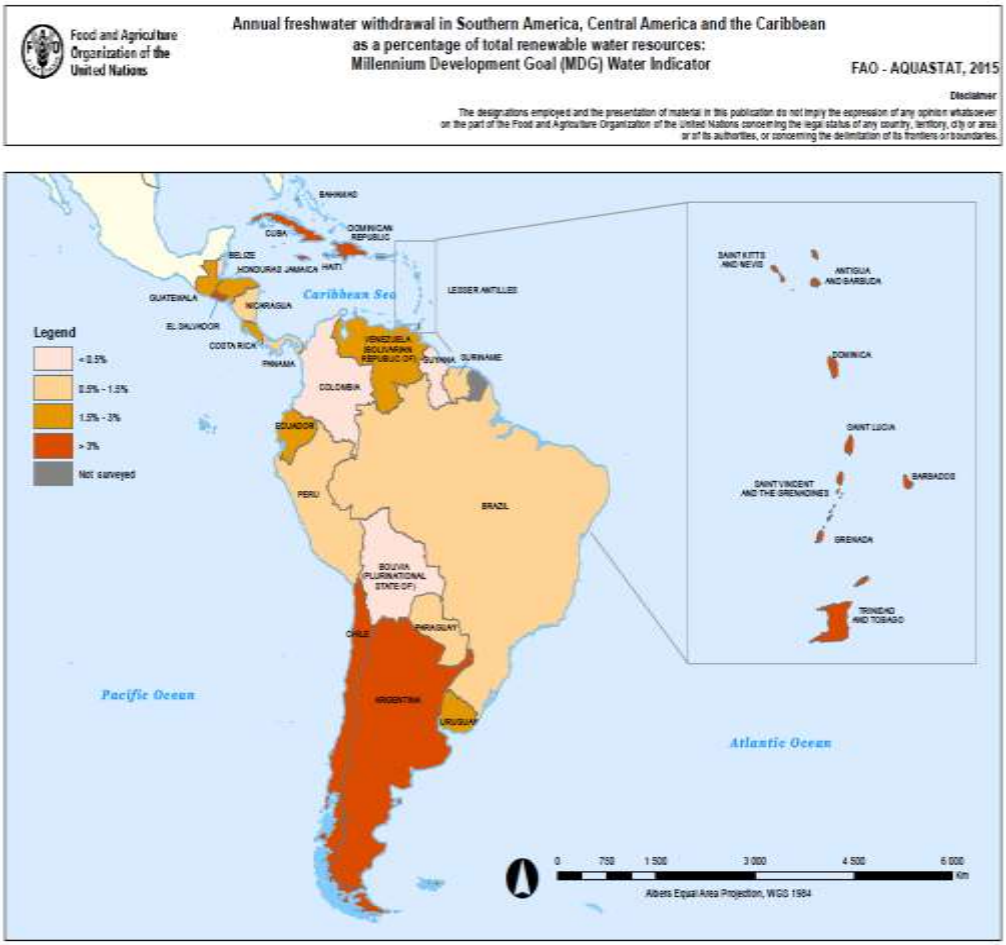
Figure 42: Freshwater Withdrawal as a Percentage of Total Renewable Freshwater Resources (1997 – 2011)



Source: FAO AQUASTAT (2016). Available at http://www.fao.org/nr/water/aquastat/data/query/results.html (Accessed April 2016)

4,4265,4269,4270,4275,4451,4475,4490,4491,4493,4510,4512,4515,4516,4517,4535&cntIds=220&newestOnly=false&showValueYears=true&categoryIds=-1&XAxis=YEAR&query_type=CP&YAxis=VARIABLE&hideEmptyRowsColoumns=true

Figure 43: Annual Freshwater Withdrawal in LAC as a Percentage of Total Renewable Water Resources (2015)



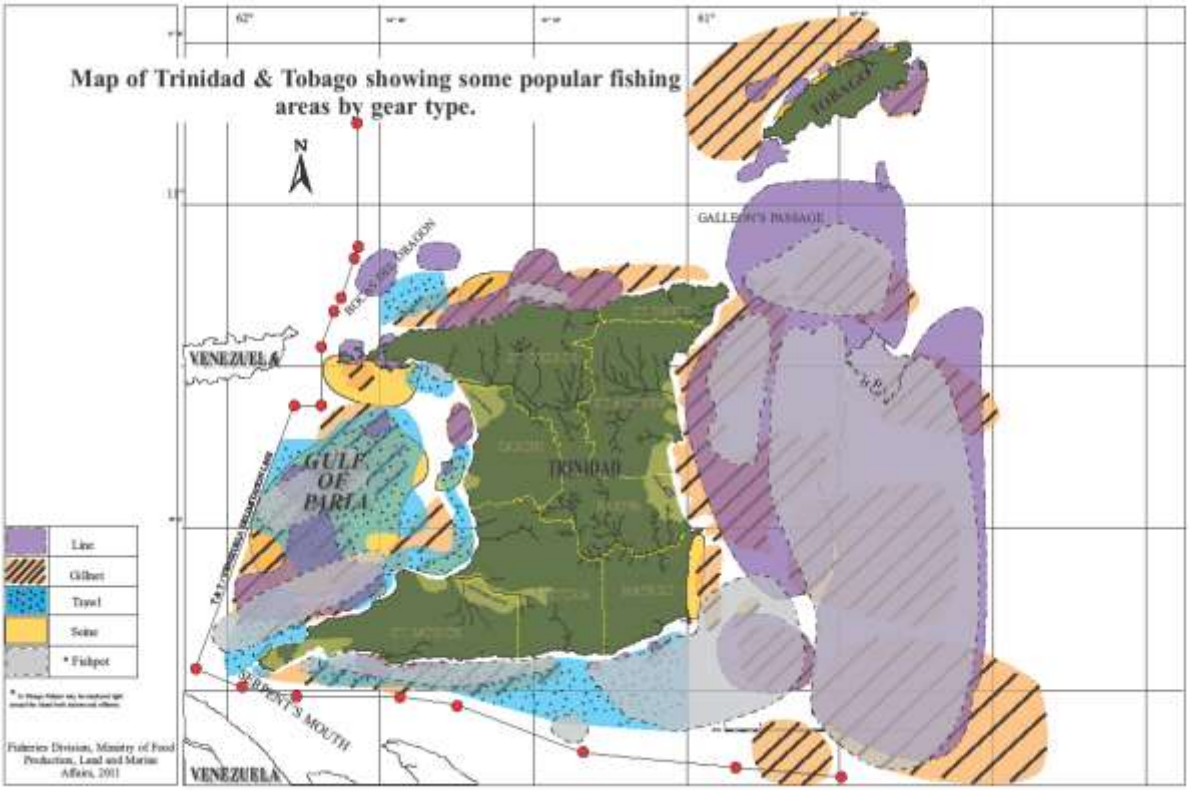
Source: FAO AQUASTAT (2015) in UNEP (2016)[9]

Fisheries: As indicated in Table 12, many commercial fish species are being overexploited locally. Figure 44 shows the distribution of fishing grounds in the coastal and marine waters around T&T, and indicates the areas exploited for fisheries are extensive.

Artisanal fish catch in Trinidad
Photo courtesy Robyn Cross

[9] Taken from the GEO-6 Regional Report for Latin America and the Caribbean.

Figure 44: Map of T&T Showing Popular Fishing Areas by Gear Type



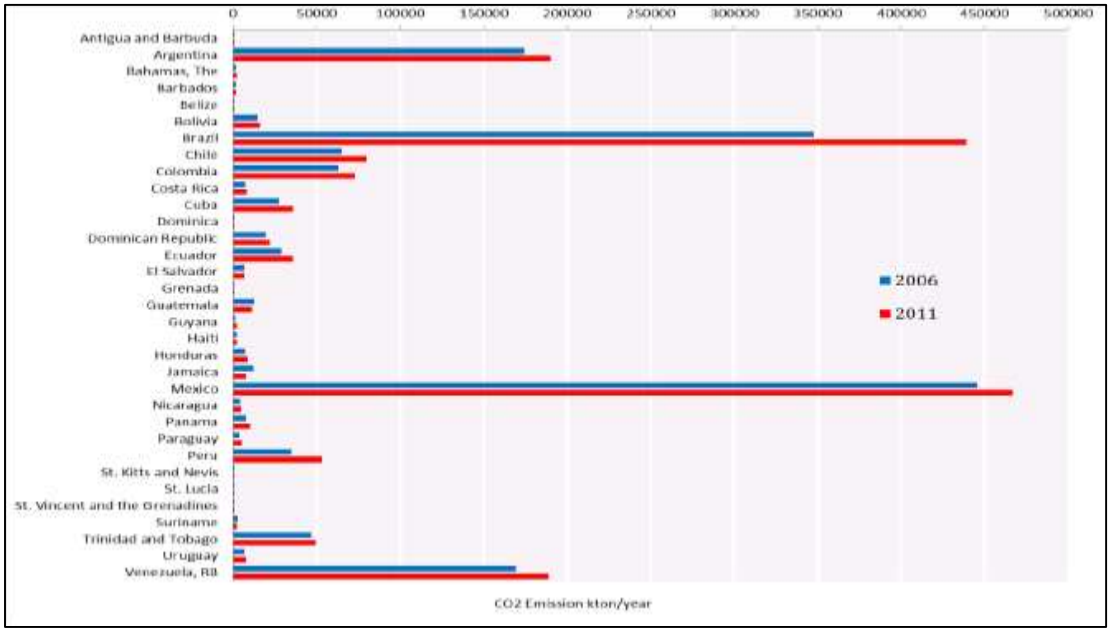
Source: Fisheries Division (2011)

5.1.4 Climate Variability, Change and Associated Effects (no T&T Aichi Target indicator)

T&T's heavy reliance on an energy-based economy, coupled with growing unsustainability in patterns of production and consumption locally, continue to render T&T as one of the highest emitters of carbon dioxide in the LAC region; and the highest CO_2 emitter in the eastern Caribbean (Figure 45). From a global perspective however, in 2013, T&T was ranked 62nd out of all countries in terms of its greenhouse gas (GHG) emissions (GoRTT 2015), and T&T is therefore not considered to contribute significantly to worldwide GHG emissions.

Loss of property due to coastal erosion in Trinidad
Photo courtesy Robyn Cross

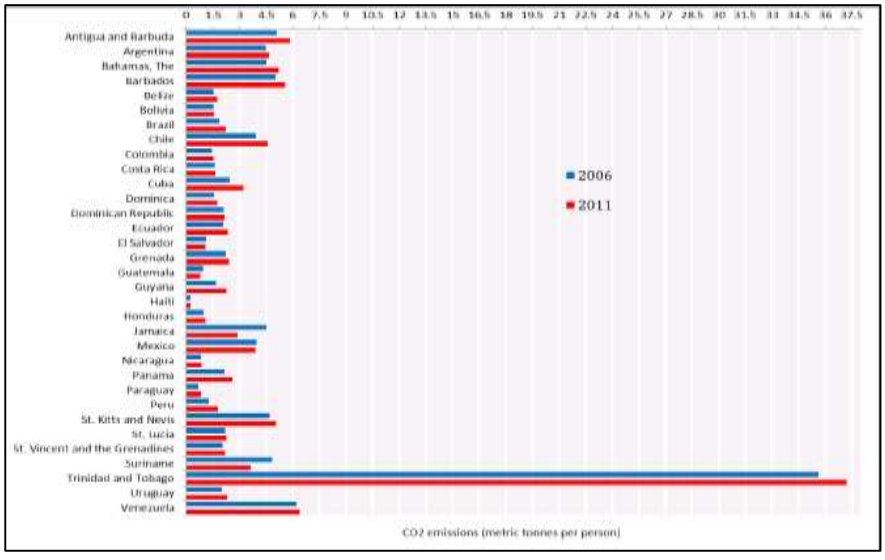
Figure 45: Total Carbon Dioxide Emissions for Countries of Latin America and the Caribbean (2006 and 2011)



Source: World Bank 2015

When T&T's CO_2 emissions are considered in a per capita context however, the overall picture becomes quite alarming (Figure 46), and T&T stands out from every other country in the LAC region.

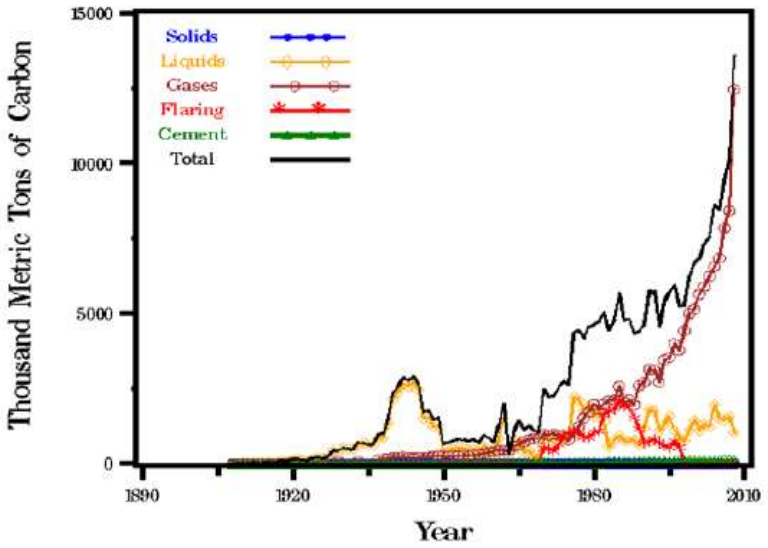
Figure 46: Carbon Dioxide Emissions Per Capita for Countries of LAC (2006 and 2011)



Source: World Bank 2015

The World Bank (2015) reports that CO_2 emissions in T&T, on account of fossil fuel burning and cement manufacturing, rose by 6.77% (measured in kilo tonnes of CO_2) over the period 2006 to 2011. Further, the Government of Trinidad and Tobago (2015) reported that total anthropogenic GHG emissions increased more rapidly over the 10-year period 2000 to 2010, than it had done in the three (3) previous decades (Figure 47).

Figure 47: T&T's Carbon Dioxide Emissions Based on Global Monitoring Data (1900 – 2010)

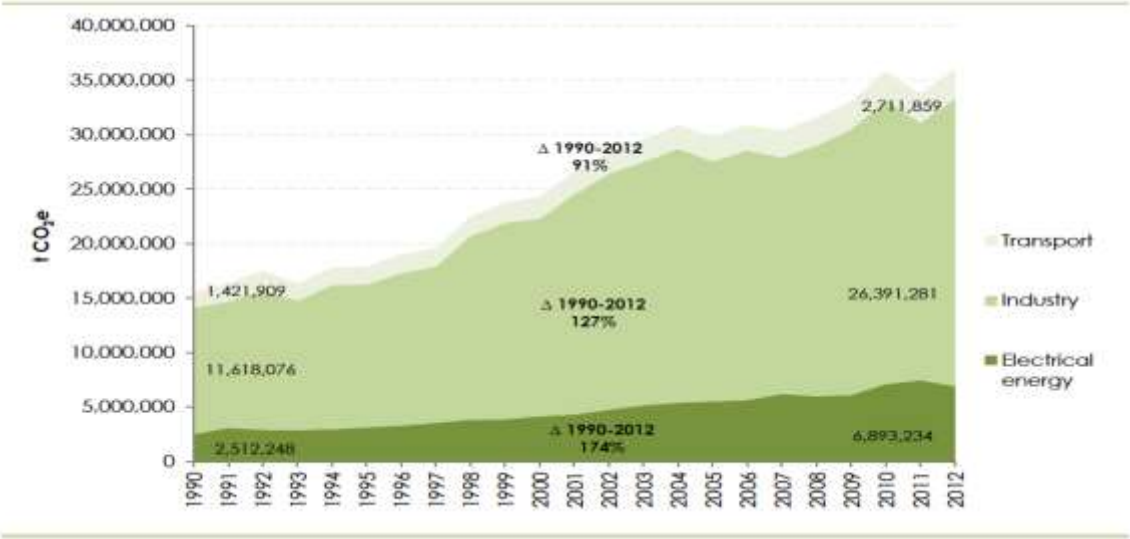


Source: Carbon Dioxide Information Analysis Centre – CDIAC (2011)

GHG emissions in T&T have, and continue to be largely on account of industrial activity (Figures 48 and 49), but there are also significant contributions from electrical power generation and from the transportation sector. There was a small, observed decrease in the overall share of emissions from the industry sector between 1990 and 2012 (from 75% to 73%), which means that there was a concurrent increase in the combined share from electricity generation and transportation. It is worth noting that in 2013, it is estimated that the number of land vehicles per 1,000 persons in T&T was 561[10].

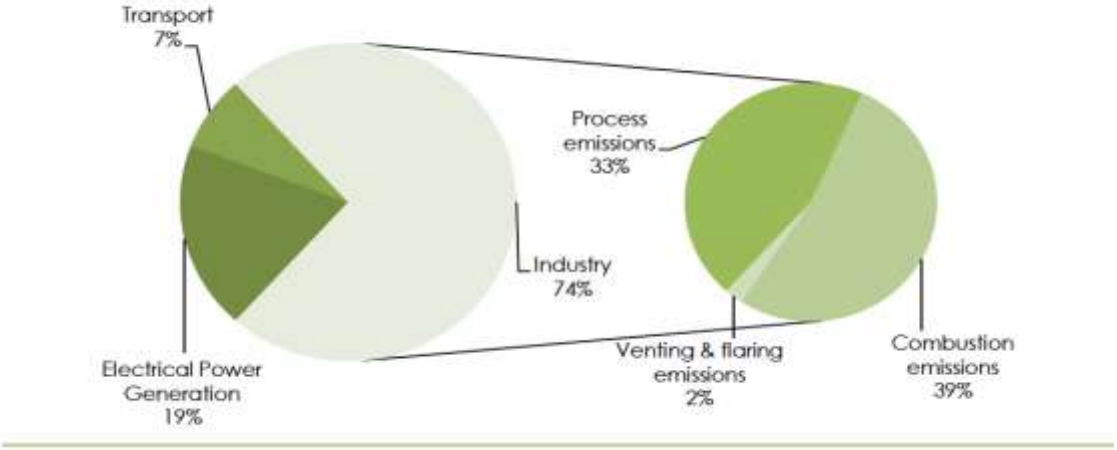
[10] This figure is calculated using data from GoRTT (2015), and population data from the Central Statistical Office.

Figure 48: Historical Reconstruction of GHG Emissions in T&T (1990 – 2012)



Source: GoRTT 2015

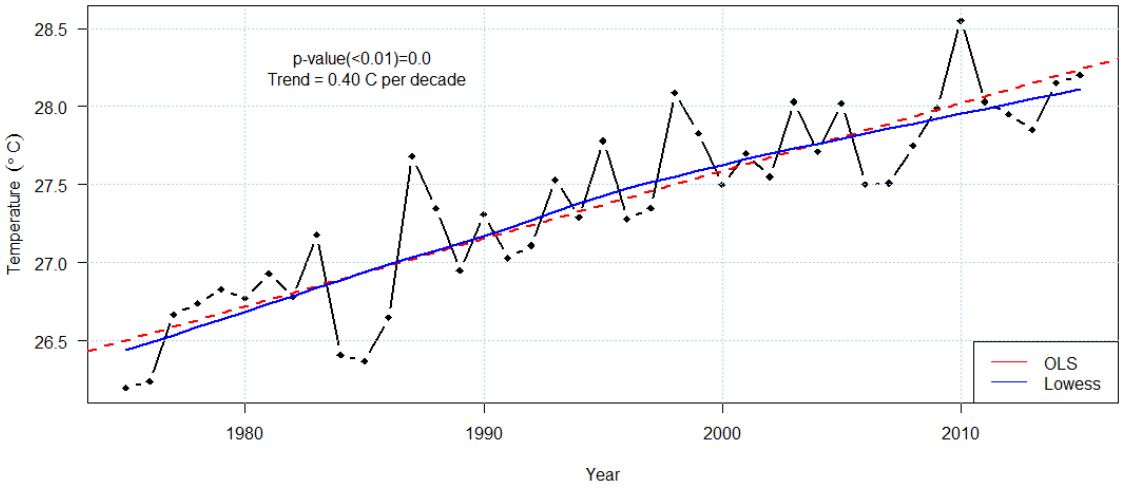
Figure 49: Sectoral GHG Emissions in T&T (2012)



Source: GoRTT 2015

There is evidence to suggest that there have been changes in T&T's climate, with an overall upward trend in temperatures over the last four (4) decades. Between 1975 and 2015, the mean annual temperature increased by 1.64 ^{0}C, at a rate of 0.4 ^{0}C per decade, which is statistically significant at the 1% level (Figure 50). Additionally, there was an increase in 30-year averages: 26.6 ^{0}C for the 1961-1990 baseline period, compared to an average of 27.4 ^{0}C for the 1981-2010 period.

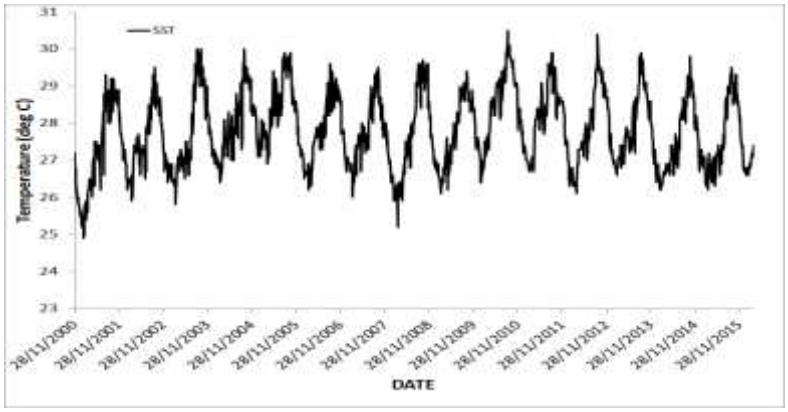
Figure 50: Mean Long-term Annual Temperature at Piarco, Trinidad (1975 – 2015)



Source: T&T Meteorological Services 2016
Note: The black line indicates the time series of mean annual temperatures. Red and blue lines indicate ordinary least squares linear regression and non-parametric lowess trends, respectively.

Increasing ambient temperatures have been driving changes in sea-surface temperatures. Although there is significant seasonal variation, there has been an increase in the maximum temperatures observed at monitoring stations in T&T (Aleumu and Clement, 2014) – Figure 51.

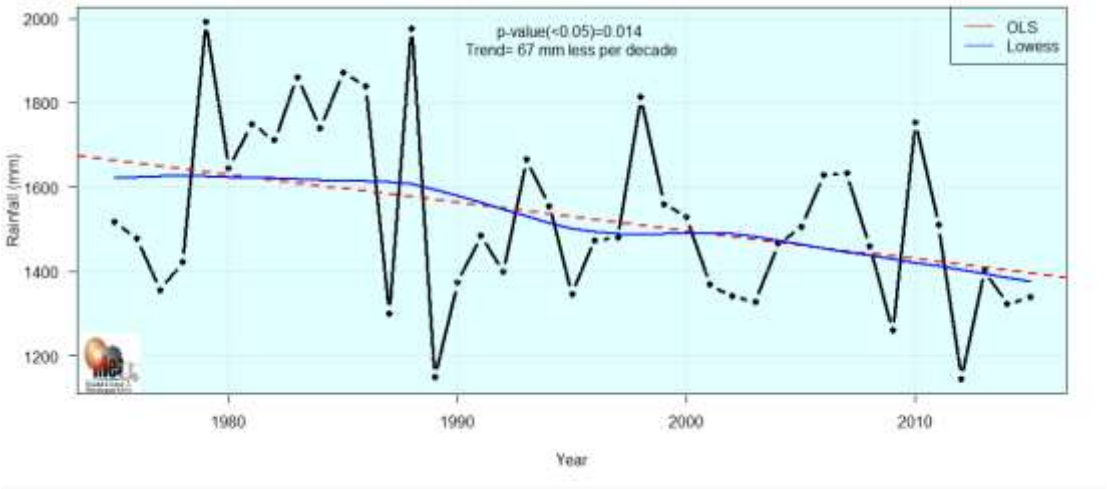
Figure 51: Sea Surface Temperatures in T&T (2000 – 2015)



Data Source: National Oceanic and Atmospheric Administration (NOAA) Coral Reef Watch. 2000, updated twice-weekly. NOAA Coral Reef Watch 50-km Satellite Virtual Station Time Series Data for Buccoo Reef, Tobago

Rainfall patterns in T&T are also showing worrying signs especially in the wet season, where rainfall appears to be in decline at a measured rate of 67.0 mm per decade, which is statistically significant at the 5% level (Figure 52). This trend has been steady since 2003; and if it continues can lead to droughts and severe water shortages in T&T.

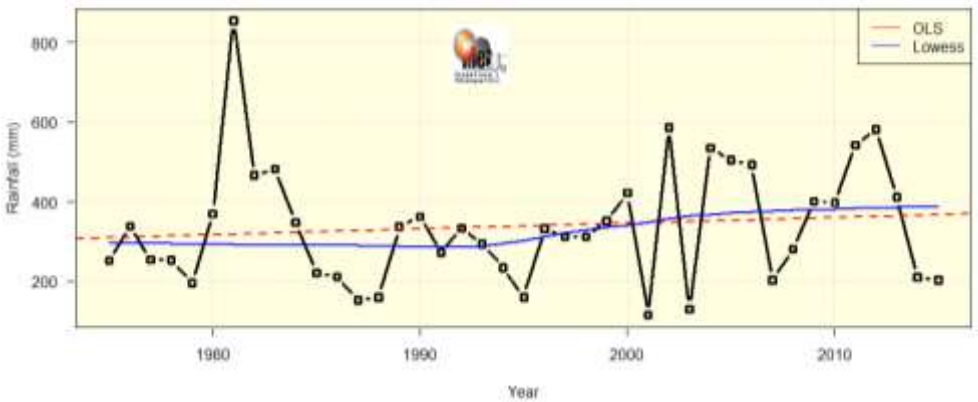
Figure 52: Annual Wet Season Rainfall Totals in Piarco, Trinidad (1975 – 2015)



Source: T&T Meteorological Services (2016)
Note: Trends in Wet Season (June to December) rainfall totals (Piarco) 1975-2015. Black line indicates time series of wet season rainfall totals. The red and blue lines indicate ordinary least squares linear regression and non-parametric lowess trends, respectively.

In the dry season, there has been an increasing linear trend of 15.0 mm per decade, but this is not statistically significant at the 5% level. This trend has been steady since 1992 (Figure 53).

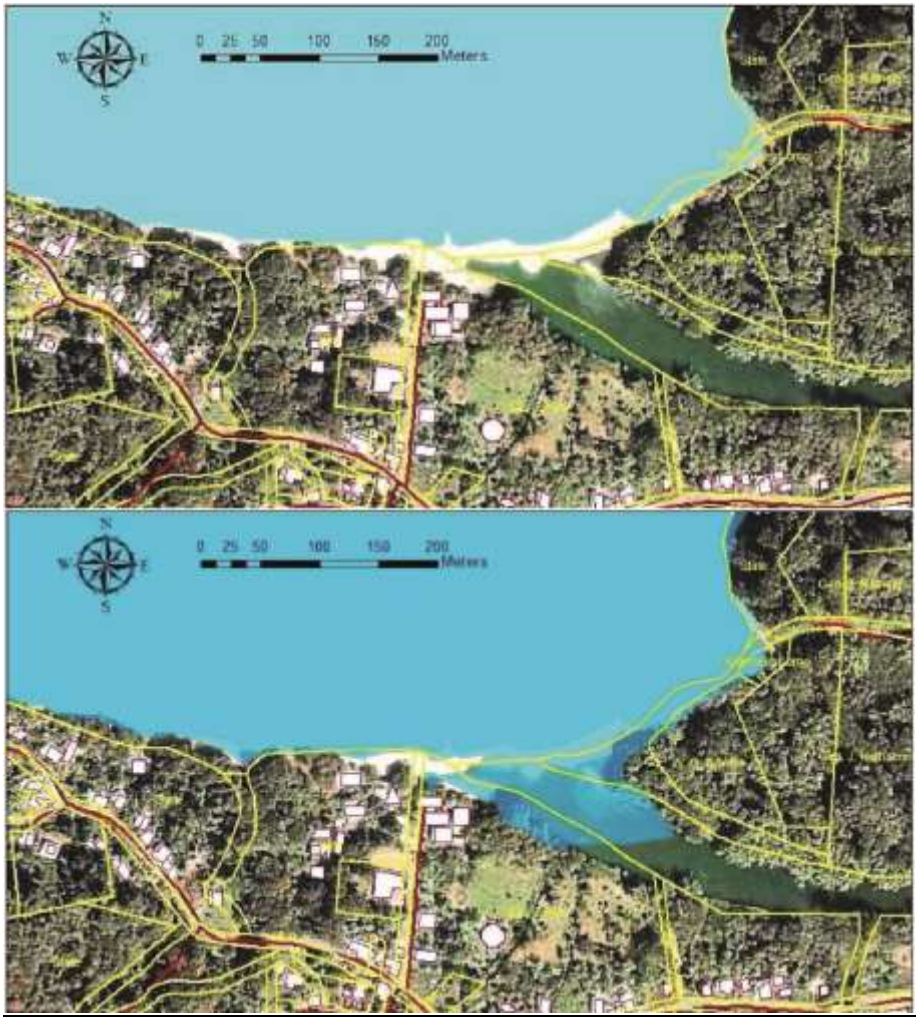
Figure 53: Annual Dry Season Rainfall Totals in Piarco, Trinidad (1975 – 2015)



Source: T&T Meteorological Services (2016)
Note: The black line indicates time series of dry season rainfall totals. Red and blue lines indicate ordinary least squares linear regression and non-parametric lowess trends, respectively.

Sea level rise continues to be an important consideration for T&T as a small island state. There are several anticipated impacts of sea level rise on the islands' biodiversity, especially in the coastal zones (Jeppesen et al, 2015; GoRTT, 2013). A case study on the effects of sea level rise on the Grande Riviere beach in northeastern Trinidad, which serves as a popular nesting site for leatherback turtles, indicates that almost the entire beach can be lost in the future (Figure 54; Griffith-Charles and Sutherland, 2011). This will likely result in a number of socio-economic impacts on the local community, which depends heavily on turtle watching to provide a source of livelihoods (Sookram and Sutherland, 2011).

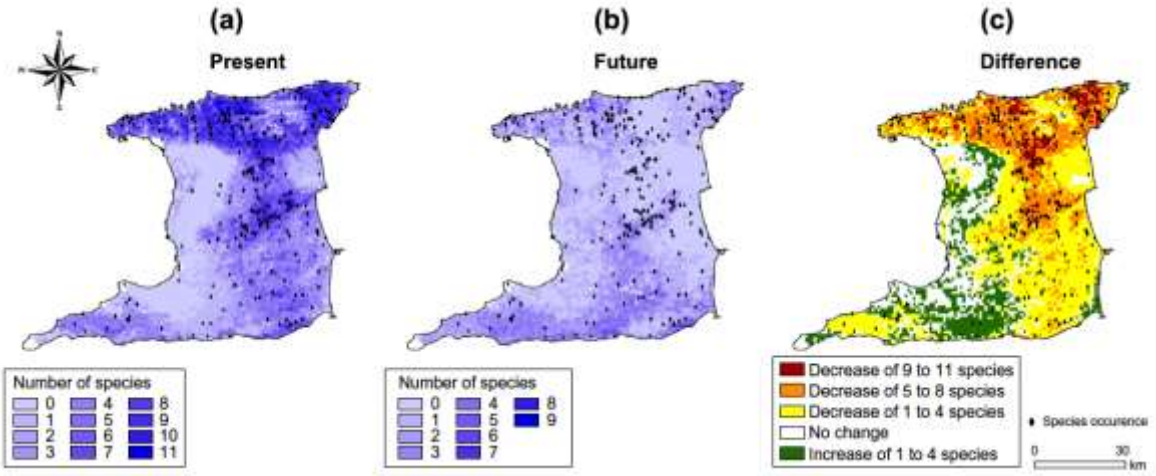
Figure 54: Anticipated Sea Level Rise on Grande Riviere Beach in Northeastern Trinidad



Simluated MSL (above) and Simulated 0.8m above MSL (below)
Source: Griffith-Charles and Sutherland (2011)

Research so far indicates that changes in climate will affect T&T's biodiversity in a number of ways. Modelling of the effects of climate change on vascular plants in Trinidad (Maharaj and New, 2013) indicates that significant decreases in species diversity and range can occur especially in the northern and central areas of the island of Trinidad (Figure 55). Trinidad's Northern Range, a very important ecosystem and watershed area, is expected to be the most heavily impacted area, with losses and shifts expected in a number of floral species, especially endemic species at the higher altitudes.

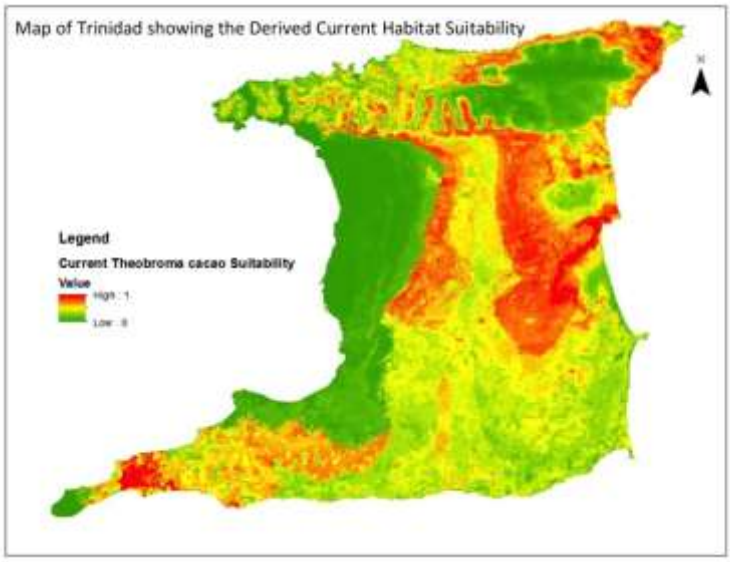
Figure 55: Potential Changes in Distribution and Diversity of Vascular Plants in Trinidad Based on Climate Change Modelling



Source: Maharaj and New (2013)
Note: These maps use timescales: Present (2000 – 2010) and Future (2035 – 2065) and are based on 11 species of vascular plants.

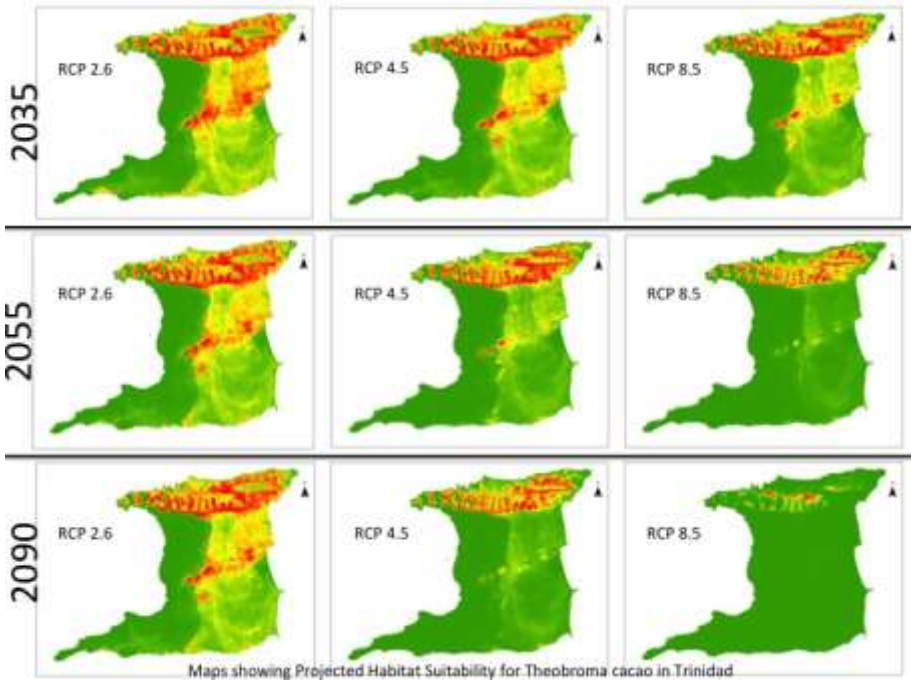
Data from a recent study, using the results from the Intergovernmental Panel on Climate Change (IPCC) AR5 indicate that a commercially important crop in T&T, cocoa (Theobroma cacao), will likely be affected by climate change as shown in Figures 56 and 57. The areas suitable for growing cocoa are projected to be most affected under the highest Representative Concentration Pathway (RCP) used in IPCC AR5 – RCP 8.5; but even under the lowest RCP scenario (RCP 2.6), the areas suitable for growing cocoa will be reduced in the next 20 years.

Figure 56: Map Showing the Current Climatic Suitability for *Theobroma cacao* Growth in Trinidad



Source: Department of Life Sciences, The University of the West Indies (UWI), St. Augustine (2016) from the EU ACP-funded project: Global-Local Caribbean Climate Change Adaptation and Mitigation Scenarios (GoLoCarSce)

Figure 57: Projected Climate Suitability for Growing Cocoa in Trinidad Under Different Scenarios



Source: Department of Life Sciences, The UWI, St. Augustine (2016) from the EU ACP-funded project: Global-Local Caribbean Climate Change Adaptation and Mitigation Scenarios (GoLoCarSce)

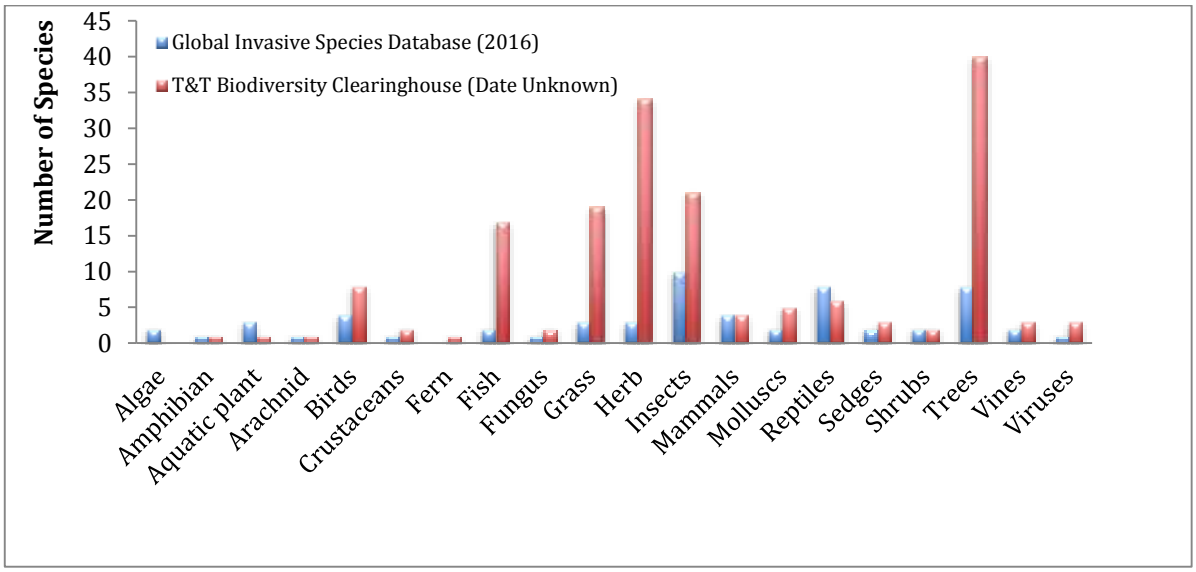
5.1.5 Invasive Alien Species

Indicator 9i: Number of IAS identified that are immediate threats

According to the Global Invasive Species Database (2016) there are 57 recorded invasive alien species (IAS) in T&T. This figure is significantly higher than the 36 invasive species that were reported in both the 4th National Report (2010) and the NBATT (2012). Another account from the T&T Biodiversity Clearinghouse produced as a part of the GEF funded Caribbean IAS project (http://www.ciasnet.org/) indicates that the number of IAS in T&T may be as high as 173 species (Figure 58). The Invasive Species Compendium developed by the Centre for Agriculture and Bioscience International (CABI) lists 431 Invasive Species for T&T. This latter list contains species that are present but whose invasive status is not known for Trinidad but are reported as invasive in other regions; including some native species and some that are commercial species in agriculture, forestry and livestock production.

The large discrepancies in the various IAS lists for T&T, as well as the absence of relatively new and important IAS such as the Lion fish in the databases, indicate that further work is required in order to establish a single baseline figure for IAS of immediate threat, and to track and report on changes in the numbers and status of IAS over time.

Figure 58: Numbers of Invasive Alien Species in T&T



Data sources: Global Invasive Species Database (Accessed 2016)
Trinidad and Tobago Biodiversity Clearinghouse - http://www.biodiversity.gov.tt/home/trinidad-a-tobago-biodiversity/invasive-alien-species.html (Accessed 2016)

One of the newest IAS threats in T&T is the lionfish, and it has caused disruptions on the reefs, especially in Tobago (See Box 6).

Box 6: The Lionfish: A Threat to T&T's Coral Reefs

The lionfish, *Pterois spp.*, is the newest threat to coral reef health in T&T. The first lionfish in Tobago was officially recorded in July 2012 (unofficially February 2012) and the first sighting in Trinidad was in August 2013. This IAS has successfully and prolifically spread through most marine habitats on both islands, and has become a major feature on most reefs and rocky bottom habitats. Densities of this fish increased from as low as 10 individuals/ha to over 300 individuals/ha in the first two (2) years of its invasion. The highest densities of individuals have been recorded in northeast Tobago (up to 326 individuals per hectare), and the lowest densities in Trinidad at 11 individuals per hectare.

With its voracious appetite, this fish is known to prey on a long list of native coral reef species. Some of species targeted by the lionfish are ecologically important, and include the parrotfish (Family Scaridae), wrasse (Family Labridae) and cleaner shrimp (Family Stenopodidea), which keep algae and fish parasite loads low on the islands' reefs. The lionfish is also a nuisance to fishermen because they are caught in nets and pots, and often take the place of target fish. Further, the lionfish is treated with some trepidation, as a sting from the lionfish can be quite painful with effects lasting several days in some cases.

Local management of the lionfish has been primarily through regular removal exercises by divers and fisher folk, as well as through capture derbies. To date, these actions have led to thousands of individuals being removed from the waters surrounding T&T, and has resulted in a reduction in lionfish biomass by as much as 30% as well as a 27% decline in fish abundance on target reefs. However, the prolific reproduction rate of the lionfish makes it difficult to manage. One of the successes of the management programme has been the recognition of the lionfish as a potential fishery in some communities, with the result that the lionfish has also become a regular item on the menu of a number of local restaurants in T&T.

Information and photo courtesy Mr. Jahson Alemu I (March, 2016)
See: Alemu (2016) for further information.

The control of IAS can be very costly, as was evident in the case of the eradication programme for the Giant African Snail (GAS) in Trinidad between 2009 and 2012 (Box 7). However, cost benefit analyses for IAS management plans in T&T highlighted that investment into the design of effective management plans can help to improve the control of the negative impacts of IAS (Box 8).

Box 7: Eradication Programme for the Giant African Snail – a Costly Venture

The Giant African Snail (GAS) (*Achatina fulica*) was first noticed Trinidad in October in 2008. This highly invasive pest had a potential to cause serious damage in the agricultural, health and environmental sectors and also threatened international trade. The pest was confined to the Diego Martin Valley in northwestern Trinidad; and a very intensive eradication programme led by the Research Division of the Ministry of Agriculture in association other divisions and external agencies were initiated in 2009. The programme was multifaceted and comprised of weekly baiting and monitoring operations, a public awareness programme, field sanitation, surveillance and the development of legislation.

By the end of 2012 a total number of 34,747 snails were collected and an average annual cost of TT$1,520,000.00 incurred. The total expenditure of the GAS Eradication Programme from 2009 to 2012 amounted to TT$6,080,000. After successful containment of the GAS for five (5) years within the Diego Martin Valley (the Eradication Zone), the pest was discovered in two (2) towns east of the containment in the Diego Martin/Maraval area and eradication continued at a significant cost.

Source: Balfour and Ali (2014)

Box 8: The Importance of Cost Benefit Analyses in Designing Effective IAS Management Plans

As part of a regional project: Mitigating the Threats of Invasive Alien Species in the Insular Caribbean (MTIASIC), funded by the GEF/UNEP, teams of invasive species specialist and economists were trained to conduct cost benefit analyses as a best practice in managing IAS. As part of this initiative, 12 case studies were conducted to determine the cost and benefits of management options for managing Invasive Species. Several studies were conducted for Trinidad as follows:

White Top (*Parthenium hysterophorus*) is a noxious and invasive weed that reduces crop yield and quality, and has shown to be harmful to humans and animals. The weed is characterized by its vigorous growth, high fecundity and allelopathic properties. A cost-benefit analysis of four (4) management options was conducted by Kimberly Singh at the Waterloo Research Centre of The UTT over a one-year period beginning March 2013. The study evaluated several variables including benefit and cost values of agricultural crops, human health, labour, herbicides and research amongst others, using the logistic curve toolkit developed by Landcare Research, New Zealand. The ranking function within the toolkit suggested that an 'Integrated Management Approach' attributed the highest Net Present Value whereas the 'Current Management' option ranked highest as the option with the greatest Benefit-Cost Ratio, displaying the most benefits expected for each dollar of costs. The 'Current Management' option also ranked first in terms of cost-effectiveness with a return of close to six dollars in benefit for each dollar invested in control.

Giant African Snail (GAS): An Economic Analysis of three (3) management options of the GAS (*Achatina fulica*) in T&T was conducted by Allan Balfour and Nazia Ali in 2014. The study considered various management options to address the dynamics of the pest outbreak outside of the containment area in Diego Martin, Trinidad, and their respective costs and benefits. This cost benefit analysis of the GAS management included the collation of data from several agricultural agencies and a survey of residents. Most results reflected that the public was in favour of some control over the GAS and that it was damaging to aspects of the local environment. The data for the cost benefit analysis of the management option was 40% less than that of the eradication option. The results from the analysis highlighted the eradication programme as favourable using the Net Present Value, whereas the

management option was preferred using the Cost Benefit Ratio. Both options were preferred over no management.

Varroa Mite: A socioeconomic assessment of the Impact of an IAS on the Beekeeping Industry in T&T: the Case of *Varroa jacobsoni* or the Varroa Mite was conducted by E. Evans and others from the Department of Agriculture Economics and Extension, UWI, St. Augustine in 2014. Varroa Mite was first sighted in July 1996 in Maraval on the island of Trinidad. The IAS is believed to have reached Trinidad on swarms that migrated from the Venezuelan mainland into the country. The mite attacks all bee stages of the life cycle from pupa to adult. Early reporting indicated that hives were completely destroyed within three (3) months after invasion. Soon after the sightings, beekeepers began to use Apistan strip to treat their hives and this continues to this date.

The study assessed: (i) Producers' perception of the IAS (Varroa Jacobsoni) as an indicator of "level of threat" on their business. The IAS was rated against other threat factors such as the Africanized honey bee, vandalism and colony migration. This was done through producer surveys in Trinidad using the five (5) point Likert scale and point score analysis. (ii) The cost of the IAS to beekeepers in T&T. The results of the study showed that producers ranked the Varroa mite as having the greatest impact on their operations while the Africanized bee on the other hand was considered to have little to no impact on the industry. The findings suggest that the use of the Apistan strip might have been effective in control of the mite and prevented the decline of the industry. The direct cost to manage the IAS through the application of the Apistan Strips bi-annually before the honey flow periods was estimated at US$29,759.84. Indirectly, the Varroa mite will place other costs on the beekeeping and honey industry. These include increasing the probability of losing the hives, the negative impact on pollination services, losing the "organically-produced" and possibly "Geographic Indications" labels and possibilities of pesticide contamination. In 1996, the production of honey in T&T was recorded at 40 tons. However, by 2012, honey production increased to about 100 tons, which represents a 150% increase over 1996 levels.

Perna viridis: The invasion of the *Perna viridis*, a marine species, in T&T was studied by Rosemarie Kishore and others of the Institute of Marine Affairs (IMA) and reported at the closeout workshop of the MTIASIC project in 2014. This marine invasive was introduced in 1990 either via ballast water or through fouling of hulls of commercial ships. The population of the green mussel is still largely restricted to the west coast of Trinidad with a very recent introduction on the north coast. The main habitat of the green mussel is now pier pilings with mussel beds no longer existing and populations on the decline.

This study examined the invasion of *Perna viridis* through a determination of its current distribution and community structure in selected habitats as well as from a study on the economic costs of *Perna viridis* in industrial cooling systems. Comparisons were made amongst habitats surveyed, using the condition factor and morphometric measurements of the green mussel collected, multidimensional scaling (MDS) plots and the use of biological indices.

For the economic assessment, data was collected through a census directed at nine (9) firms and was used for a descriptive analysis. The results indicated that six (6) of the nine (9) firms had their operations significantly affected specifically by the marine invasive *Perna viridis* and the fouling of the species in its peak years of invasion (1990 – 2003) has been responsible for as much as 60-90% of their maintenance costs. Although the ecological assessment revealed that the species has naturalised and the population declined within recent times, firms have used *Perna viridis* as a catalyst to put control mechanisms in place to help avoid heavy infestation of fouling organisms including any potential marine IAS. Their sustained presence at port facilities however, facilitates the continued spread of the green mussel to other countries via trade.

Source: Daigneault *et. al.* (2014)

It is worth noting that the classical biological control fo the Pink Hibiscus Mealy bug (*Maconellicoccus hirsutus*) implemented prior to 2010 is still providing control; the Green Mussel is now naturalised with declining popultions and is no longer threatening biodivesity or commerical water cooling plants; the national control plan for the GAS has contained this IAS to two (2) areas in the country to date; and a National Emergency Action Plan was developed in 2014 to prevent the introduction of Frost Pod Rot in cocoa.

Although not described as an IAS, the large influxes of Sargassum on T&T's beaches have had a number of effects locally, not the least of which have been economic. Box 9 outlines the impacts of Sargassum on the coastlines of T&T (TEMA, 2015).

Box 9: Sargassum Affecting T&T's Coastlines

In 2015 it was observed that Sargassum beaching and subsequent decomposition may hinder the normal day to day activities of affected communities and ecosystems in many ways[11]:

"Residents cannot use the beaches for recreational purposes or fishing; also aesthetic beauty and the intellectual stimulation provided to residents and other users are severely compromised; tourists are not allowed to maximize their expected vacation package on the beaches that are adjacent or in close proximity to their chosen area of accommodation; fishermen, tour and dive operators, are restricted from going out to sea since maneuvering through the Sargassum may damage boat engines; gases produced by the decaying Sargassum may exacerbate respiratory problems and cause nausea and vomiting; gases also cause discoloration of metal objects such as water faucets and corrosion of the wiring system of electrical appliances, also it impedes the access of turtles intending to nest as well as the migration of hatchlings to the open sea."

The tourism industry was significantly impacted by the excessive beaching of Sargassum in 2015. Facilities experienced significant losses due to the increase maintenance cost, cancellations, out bookings and refunds, the economic impact was calculated in U$1,200.000 for the given period and based on a report from the Tobago Emergency Management Agency (TEMA).

11 Sargassum Vulnerability Evaluation. 2015, TEMA. Mr. Allan Stewart

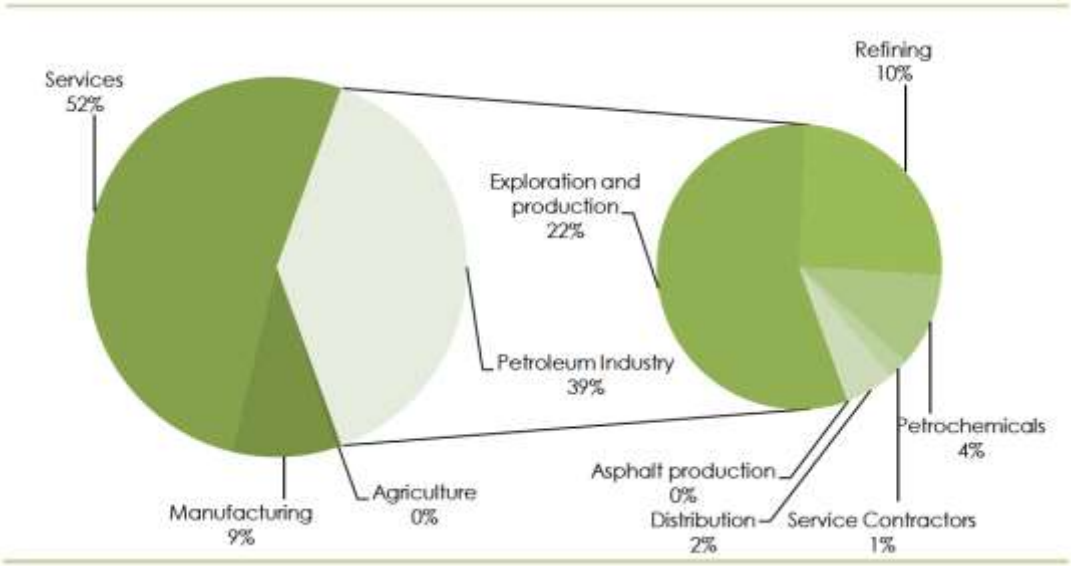
5.2 Indirect Drivers of Change

5.2.1 Economic factors (no T&T Aichi Target indicator)

Platform in T&T's Offshore Environment
Source: GoRTT (2012b)

The economy of T&T continues to be heavily dependent on the energy sector (Figure 59); and this renders T&T as one of the most buoyant economies in the Caribbean (Central Intelligence Agency, 2016[12]) (see Figures 60 and 61 for GDP statistics). What is of particular interest is that approximately 70% of the population and 80% of the economic activities in T&T are concentrated on the coastline (Juman and Hassanali, 2013), indicating the importance of coastal areas to the economy and livelihood base of the country. From a biodiversity management perspective, this consideration is of critical importance.

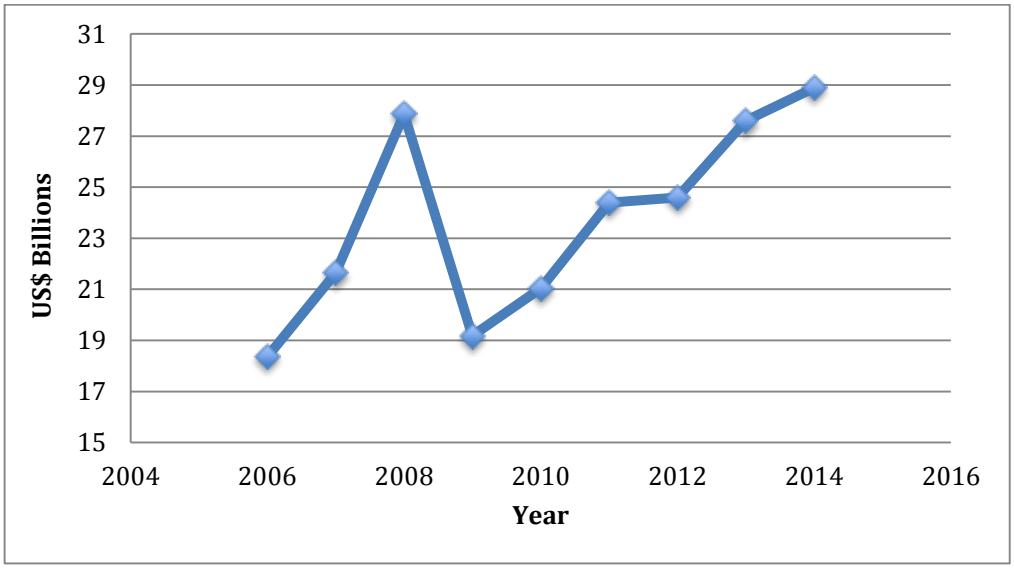
Figure 59: Sectoral Distribution of GDP in T&T (2013)



Source: GoRTT (2015)

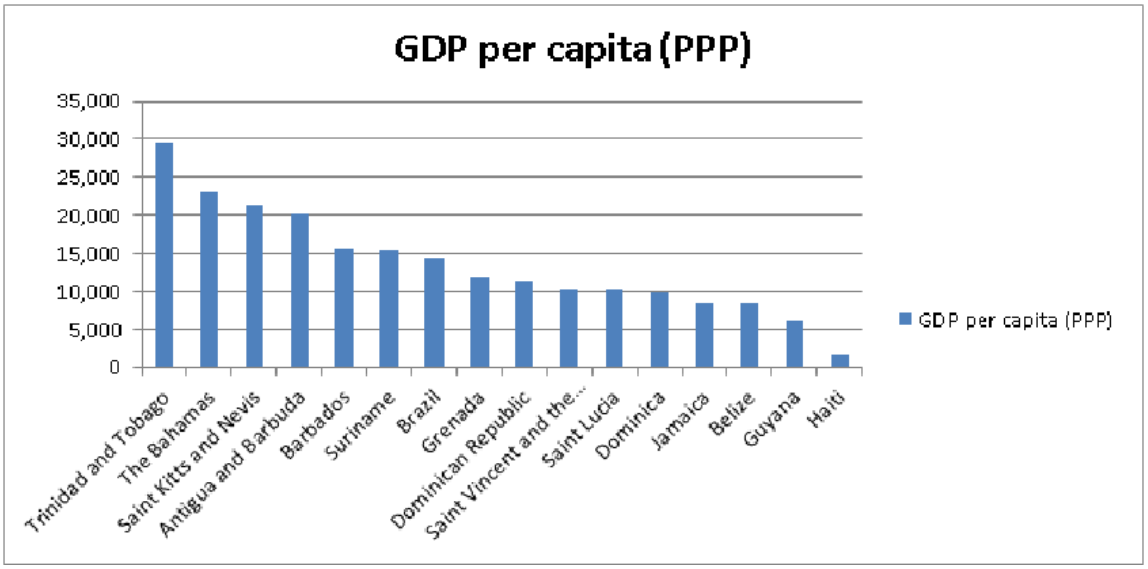
12 https://www.cia.gov/library/publications/the-world-factbook/geos/td.html

Figure 60: T&T's Gross Domestic Product (2006 – 2014)



Data Source: World Bank (2016)
http://data.worldbank.org/indicator/NY.GDP.MKTP.CD/countries/TT?display=defaul

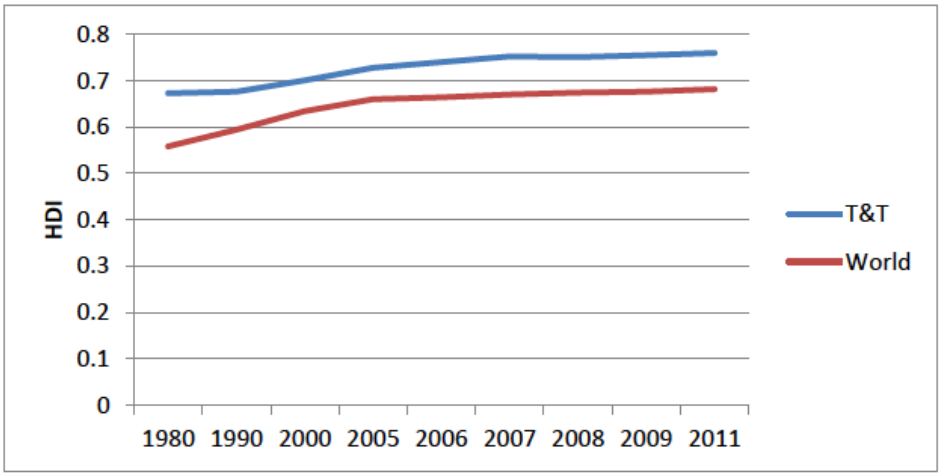
Figure 61: GDP per Capita of Caribbean Countries



Source: Key factors around ocean-based power in the Caribbean Region, via Trinidad and Tobago. - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/275464354_fig4_Figure-4-This-plot-of-Caribbean-countries'-GDP-per-capita-places-Trinidad-and-Tobago-at [accessed 1 Apr, 2016]

Although a strong economy has allowed T&T to maintain a high human development index (Figure 62), the patterns of production and consumption that are associated with this sustained economic growth continue to have a range of implications for biodiversity and ecosystem services; and consequently human well-being, as reported in previous sections of this report.

Figure 62: T&T's Human Development Index Compared to the Rest of the World (1980 – 2011)

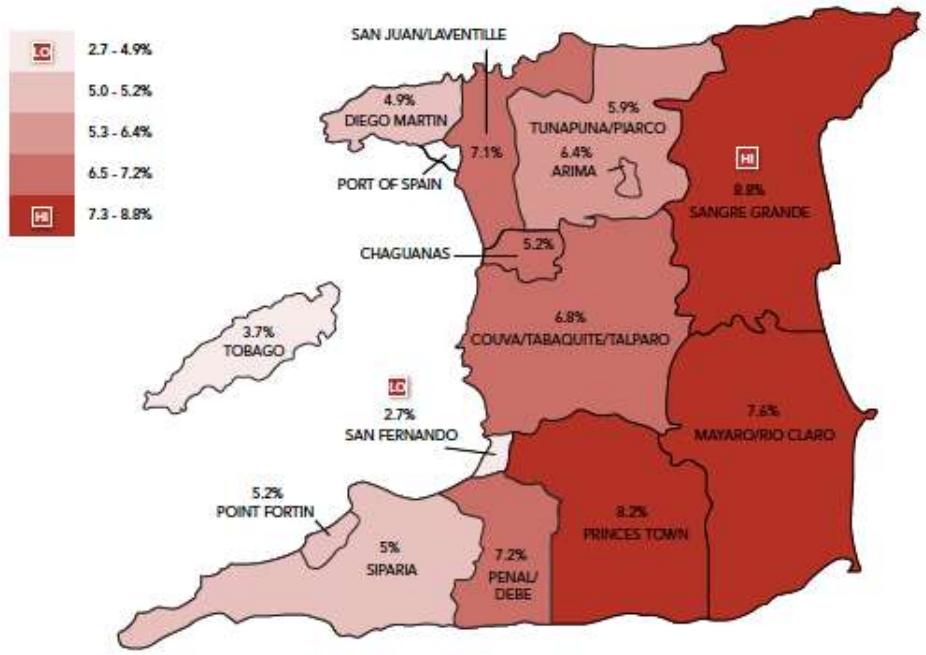


Source: United Nations Development Fund- Human Development Index Report, 2011

Extracted from NBATT (2012)

Economic wealth is not evenly distributed around the country however. As shown in Figure 63, higher levels of poverty are seen along the east and southeast portion of Trinidad, most of which is considered rural. In many of these areas, there is a higher dependence on ecosystem services to support livelihoods. One area in eastern Trinidad where the link between an ecosystem and human well-being is well established is the Nariva Swamp. Over 50 small-scale farmers operate in the swamp (Dempewolf, 2015), and many inhabitants derive income from subsistence fishing and tourism-related activities (Carbonell *et al*, 2007; Bynoe 2014 – Figure 12). Along the northeastern coast of Trinidad, many local communities are also involved in providing turtle-watching tours and associated services; and these activities provide livelihoods for many inhabitants of the rural areas.

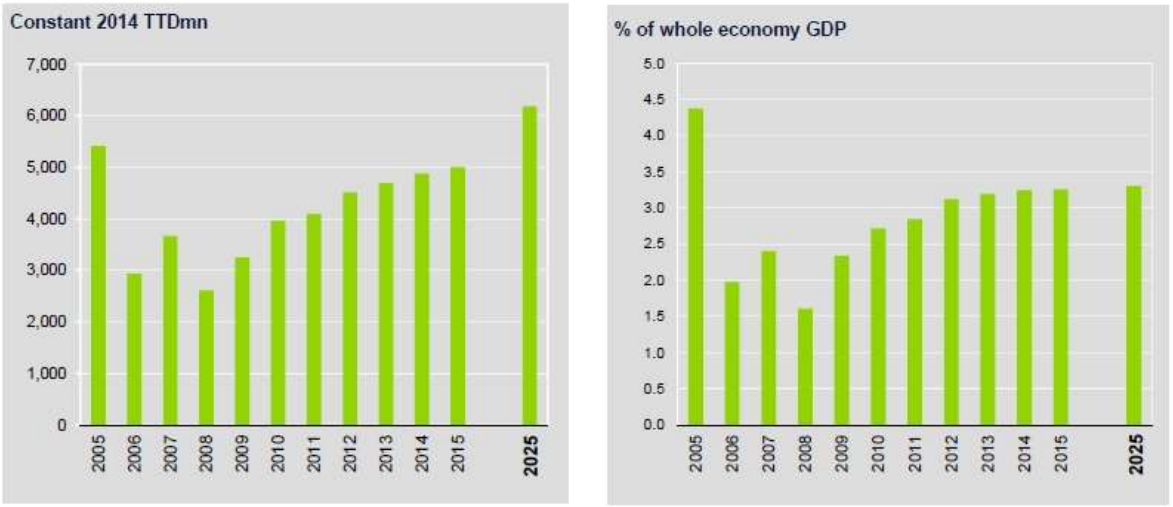
Figure 63: Multidimensional Poverty in T&T by Administrative Area (2006)



Source: GoRTT (2012a)

Tourism is especially important to the economy of Tobago. In 2014, the direct contribution of Travel & Tourism to GDP in 2014 was TT$4,882.0 million (3.2% of GDP). This is expected to grow by 2.1% per annum to TT$ 6,183.1million (3.3% of GDP) by 2025 (Figure 64). The importance of considering tourism is underpinned by the fact that its growth locally requires special considerations for managing various drivers impacting biodiversity – for example, tourism increases freshwater demand - and this ecosystem service is already under notable stress in this small island state (Figures 41, 42, 43 and 44). Additionally, tourism increases activities and impacts in popular ecosystems – especially coastal areas, as shown in Figure 9; and coastal ecosystems are showing signs of decline because of a range of driving forces impacting on them (Section 4.1.2). Increasing tourism load in T&T will thus, from a BES standpoint, require careful planning and proper monitoring – a system which is still largely lacking in the country.

Figure 64: Travel & Tourism Contribution to T&T's Annual GDP.

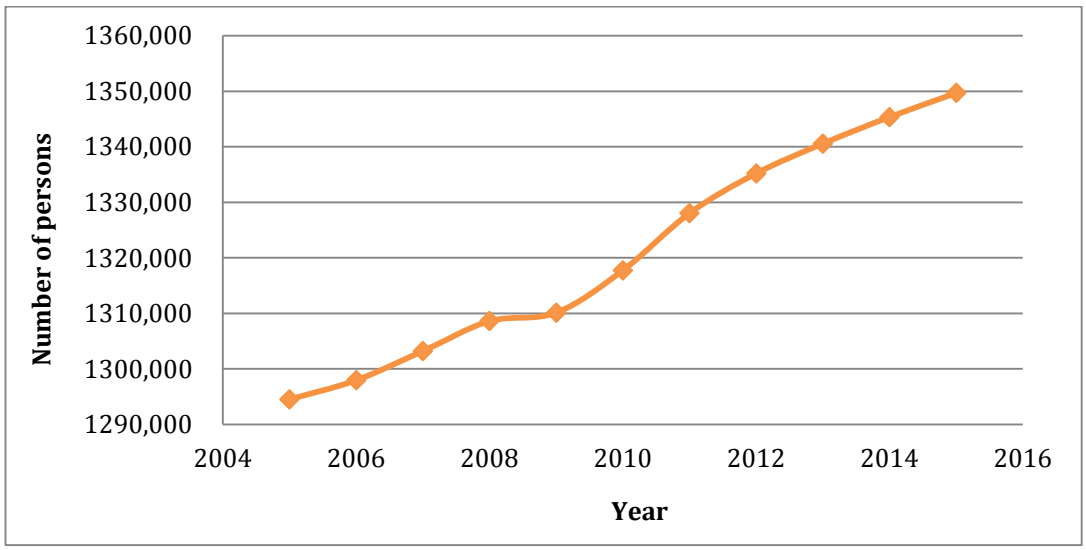


Source: WTTC Report for T&T 2015

5.2.2 Demographics (no T&T Aichi Target indicator)

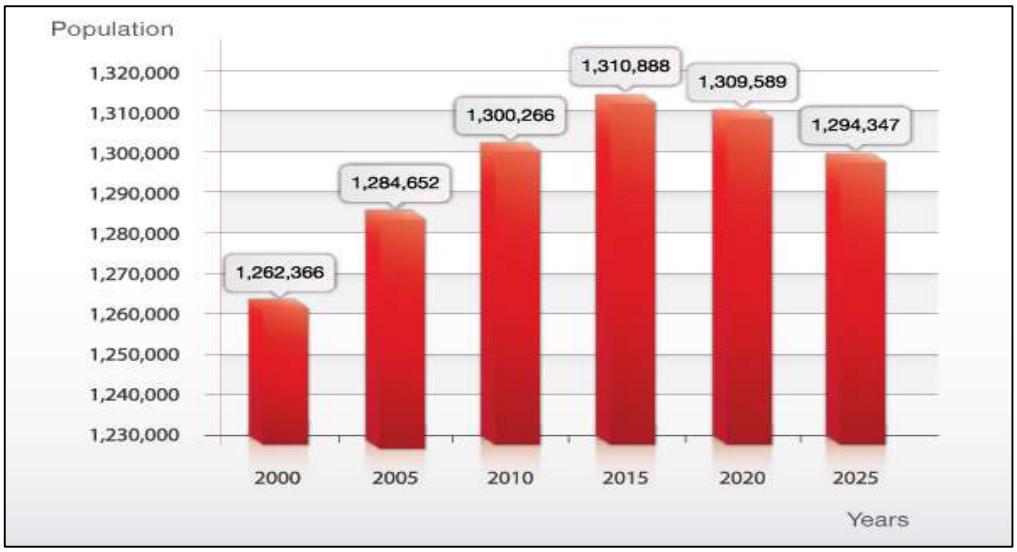
The population of T&T has been growing (Figure 65), although this growth is expected to reverse after 2015 (Figure 66).

Figure 65: Population of T&T (2005 – 2015)



Source: CSO (2016)

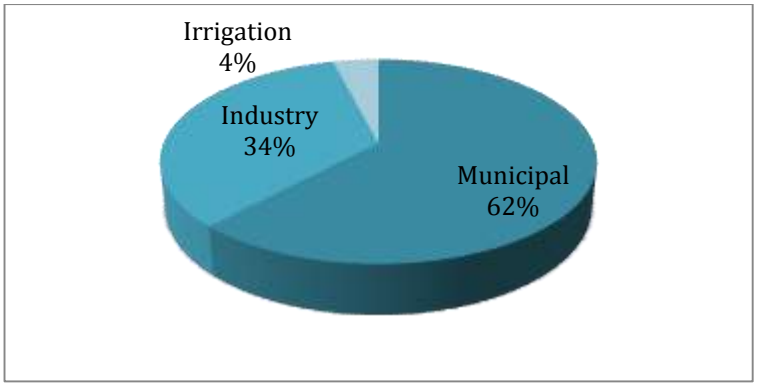
Figure 66: T&T Population Projections (2000 – 2025)



Source: Central Statistical Office (2016) Available at: http://cso.planning.gov.tt/tt-today/Trinidad-Tobago-Population-Projections-2000-2025.html. Accessed March 2016.

Population growth can likely be correlated with increased consumption of goods such as freshwater (Figures 40, 41, 42 and 43), given that the majority of T&T's water is used by the municipal sector (Figure 67).

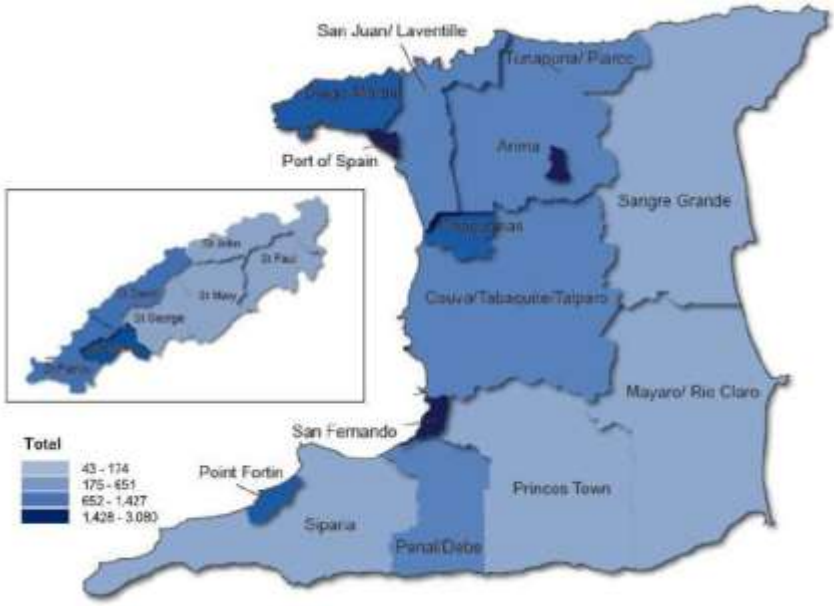
Figure 67: Water Use by Main Sectors in T&T as a Percentage of Total Water Used (2011)



Source: FAO AQUASTAT http://www.fao.org/nr/water/aquastat/countries_regions/tto/index.stm Accessed March 2016.

The distribution of the population across T&T (Figure 68) can also be correlated with changes in important ecosystems such as watersheds and coastal ecosystems. High concentrations of T&T's populations coincide with the areas where coastal ecosystems have been shown to be important (such as the Buccoo Reef in Tobago, and the Caroni Swamp in Trinidad); and the watersheds of northwestern Trinidad. Issues such as these have already been recognised as crucial considerations for spatial/development planning and are reflected in the draft NSDS for T&T (GoRTT, 2012 a&b).

Figure 68: Population Distribution in Trinidad (2011)



Source: T&T Population and Housing Census (2011) in NBATT (2012)

5.2.3 The Policy and Legislative Framework

An assessment of the policy and legal framework for the management of biodiversity in T&T, undertaken as a part of the current report preparation, has highlighted the following issues:

- **Several gaps exist in the legal framework that undermine the government's capacity to effectively manage biodiversity.** Much of the legislation in place to address natural resource extraction, the management of biodiversity and habitats, and pollution is outdated and therefore fails to integrate a modern approach to sustainable development and sustainable management of biodiversity. The existing legislative structure in many cases

approaches the management of natural systems from a purely economic or anthropocentric perspective. While these considerations are important, such provisions meanwhile sideline environmental considerations once overarching economic priorities have been addressed. This not only undermines efforts for biodiversity protection, but also fails to capitalise on synergies between sustainable management and community livelihood opportunities which are today considered necessary and effective to balance both needs and achieve sustainable development. Further, despite being one of the greatest threats to SIDS, climate change considerations are rarely integrated into management strategies;

- **Yet, the existing legislative foundation provides a sound basis upon which several critical gaps can be filled.** While new legislation can comprehensively address many of the threats to biodiversity and integrate models of sustainable management (such as in the case of the relatively new Planning and Facilitation of Development Act (PFDA) No. 10/2014 – See Box 10), existing legislation already establishes several mechanisms for the enactment and revision of relevant laws. Most legislation governing biodiversity-related issues provides for the development of subsidiary legislation, or Rules and Regulations, to deal with related concerns under the Acts. The scope of issues for which such subsidiary legislation can be made is usually quite broad, and can be enacted by the Minster by negative resolution. This means that they are not required to go through as rigorous a process as an Act of Parliament, and therefore can be used to enact provisions to address concerns that require urgent attention;

- **Mechanisms to guarantee public participation in environmental decision-making or rule-making could be made much stronger**. Though an established process is provided for under the law in respect of major development activities, legislation is not specific in some cases on the manner and timing of consultation, leaving some of these determinations up to the discretion of the authorities. The strength and extensiveness of provisions which include the public on environmental decision-making and provide access to information varies vastly by sector. Very limited provisions are established under the energy and minerals sectors, and other sectors governed by older laws do not contain any provisions at all for information access or public involvement. This places significant limits on transparency as well as stakeholder involvement in activities which directly impact biodiversity;

- **There is hitherto little provision for the integration of research and scientific knowledge into decision-making.** There is a general lack of provision for a research function in existing laws, which in turn also lack mechanisms to integrate recent knowledge into management. This has posed challenges to effective regulation and the utilisation of adaptive management techniques that are essential to biodiversity protection. The sharing of data among relevant or related sectors is also not contemplated under the laws, overlooking a vital function that could significantly improve efficiency and accuracy in existing work;

- **There is very little use of economic instruments in promoting compliance or deterring "bad behaviour."** The law does not take advantage of innovative economic instruments that could promote voluntary compliance and thereby ease the burden on enforcement and administrative systems. Payment for ecosystem services, which could create livelihood opportunities and incentivise community involvement in enforcement, has not been given effect by the law. The payment of bonds or other sureties before undertaking potentially harmful activities has been explored in only limited examples. Existing measures to promote compliance take the form of fines, which are themselves ineffective due to very low caps for maximum payments, as well as a general lack of enforcement;

- **There is no formal recognition given to the implementation of access and benefit sharing over genetic resources.** Though the need for this is raised in recent policies, there is no legislative framework currently in place to enable the necessary mechanisms for implementation;

Fire degraded forests in Trinidad's Northern Range
Photo courtesy: Robyn Cross

- **Recent policies propose necessary measures to fill gaps in legislation and adopt modern approaches to biodiversity management.** The implementation of such policies could modernise and enhance the regulation of biodiversity, address conflicts and establish more comprehensive and coherent management approaches, thereby addressing several problems created by existing outdated legislation.

Box 10: The Planning and Facilitation of Development Act No. 10/2014

The PFDA was partially proclaimed in 2015, bringing into effect some, though not all of its sections.[13] The PFDA is intended to eventually repeal and replace the Town and Country Planning (TCP) Act, thereby updating the legal and institutional landscape governing development in T&T. Importantly the PFDA seeks to streamline environmental considerations into the process for land development through several means. This is reflected in one of its main objectives under the Act to "assist in the orderly, efficient and equitable planning, allocation and development of the resources of Trinidad and Tobago, taking account of all relevant social, economic, ecological and cultural factors so as to ensure that the most efficient, equitable and environmentally sustainable use is made of land…".[14]

The PFDA establishes the National Physical Planning Authority (NPA) and endows it with relevant powers to achieve the overall objectives of the Act, though to date, these functions have yet to be proclaimed. One of its principal functions is to facilitate "good and sustainable development" in T&T, as well as to undertake monitoring, reviewing and ensuring compliance with the NSDS and coordinating the land development approval process.[15] The NPA is constituted by a broad, multi-sectoral scope of stakeholders, including from the agriculture, energy, tourism, and environment sectors, as well as the Tobago House of Assembly (THA) and civil society.[16]

Development Plans

The PFDA expands the focus of land management beyond purely physical planning to the inclusion of other factors that aim to integrate environmental concerns. It specifies that development plans must contain a review of the environmental characteristics of an area.[17] Development plans must also contain a land use plan highlighting, *inter alia*:

- Areas of land for agricultural, forestry, or recreational (including national parks);
- Conservation areas, environmentally sensitive areas, areas subject to development hazards, and areas of special interest[18];
- Buffer zones where development shall be restricted due to vulnerability of the zone to development hazards, whether natural or man-made.

The term "development hazards" is defined under the PFDA as areas where the following conditions are likely to occur on or in the vicinity of land subject to development: erosion; flooding; landslides or unstable soil; any breach of a written law relating to the environment; or abandoned, discarded or unlawfully deposited waste. The requirement to include "development hazards" therefore requires that development plans integrate the consideration of important issues that currently threaten or undermine biodiversity conservation at the development plan stage. Development plans must also attach an environmental impact statement which incorporates a systematic environmental appraisal of policies and proposals having environmental implications. As development plans are intended to guide development in a specific area by requiring all development approvals to align with its provisions, they are therefore very important tools in planning for sustainable development.

Decentralisation of planning responsibility

Once fully enacted, the PFDA will require that responsibilities associated with planning are decentralised to local and municipal governments, as well as to the THA. The PFDA requires the development of regional or local development plans to implement the NSDS to ensure the efficient planning and

management of land.[19] Development plans are expected to address matters or conditions unique to the area in a greater level of detail.

Development Approvals

Persons seeking to develop land require permission to do so in the form of a Development Order. Though "development" takes on a broad definition under the Act to include "other operations in, on, over or under any land," as under the TCP Act it specifically excludes the use of land for agriculture, forestry or aquaculture, "subject to such exceptions or limitations as the Minister may, by Order, specify."[20]

Applications for development approval will specifically be required to take into account any disaster mitigation information relevant to the area to which the application relates, as well as the likely effect of the development on the environment.[21] This could bring disaster risk management and related climate change adaptation concerns into development considerations thereby supporting the existing Certificate of Environmental Clearance (CEC) process (under the Environmental Management Act, 2000). This is an important function since the CEC Rules, Legal Notice No. 104 of 2001, which outline the process related to the grant of a CEC, do not specifically require disaster management or climate change adaptation considerations to be considered in the grant of a CEC or in determining its terms and conditions. The integration of disaster risk management considerations is also important in circumstances where a development activity does not trigger the CEC process at all because it is not within the category of "designated activities."

In the consideration and granting of development approvals, the PFDA specifically contemplates close collaboration with the Environmental Management Authority (EMA), one of the key institutions entrusted with the responsibility for ensuring good environmental regulation. While the EMA and Town and Country Planning (TCPD) coordinate in practice, it is positive that the PFDA explicitly affirms this relationship. Coordination of the development approval process and the granting of final approval will be governed by the Development Control Committee on behalf of the NPA. It specifically lists the EMA as an appropriate representative on this Committee, though it leaves scope for the designation of other agencies and officers. The NPA may only proceed with a development proposal once, together with the EMA, it is satisfied that significant environmental impacts are adequately avoided or mitigated by the development plan for the area or land development regulations.[22]

Interventions by the Minister

[13] Per Legal Notice No. 151 of 2015, the following sections came into operation on the 3rd August, 2015: 1, 2, 3, 4, 5(1), 6, 13, 31(1), 31(3), 31(4)(a), 31(4)(b), 33(1) and 107 and clauses 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19 and 20 of the First Schedule.
[14] The Planning and Facilitation of Development Act No. 10/2014, s. 4(c)
[15] The Planning and Facilitation of Development Act No. 10/2014, s. 7(1)
[16] The Planning and Facilitation of Development Act No. 10/2014, First Schedule, s.1
[17] The Planning and Facilitation of Development Act No. 10/2014, s. 20(2)(a)
[18] "Area of special interest" means any part of Trinidad and Tobago determined by a competent authority under any law to be an area of natural, scientific, heritage, historic, architectural or aesthetic interest or significance and includes a building listed under the National Trust of Trinidad and Tobago Act (The Planning and Facilitation of Development Act No. 10/2014, s. 3(1)).
[19] The Planning and Facilitation of Development Act No. 10/2014, s. 19
[20] The Planning and Facilitation of Development Act No. 10/2014, s. 29
[21] The Planning and Facilitation of Development Act No. 10/2014, ss. 35(1)(d),(2)(c)
[22] The Planning and Facilitation of Development Act No. 10/2014, s. 36

Applications for permission to develop land which conflict with national policy or affect the obligations of T&T under any treaty or international convention must be referred to the relevant Minister for determination.[23] Apart from the National Environmental Policy (NEP) to which the Environmental Management Act specifically requires all government agencies to adhere, without concrete legal requirements, national policies rarely result in tangible efforts towards implementation and compliance. Similarly, although T&T is party to several major international treaties, a consistent drawback is that enabling legislation remains lacking – once the terms of the treaties have not been integrated into national law, they remain largely unenforceable. To some extent, the PFDA bridges this gap created by the non-enactment of legislation by giving the NPA the authority to refer development proposals which conflict with any existing national policies or international laws to the Minister for his/her review.

This provision would therefore require all developers to have regard to the policies and international law (provided that T&T is a party) in undertaking their activities, likely increasing the stringency to which development applications are subject during review by the NPA. Though the Act does not expressly *require* that developments comply with international law or national policy, at the very least it, establishes additional criteria for consideration by the NPA and provides a basis for Ministerial review where such conflicts occur.

The PFDA also specifically grants the Minister power to make regulations for a coastal zone policy, and more generally, for activities that may be carried out in areas of special interest.[24] Given the broad definition of "areas of special interest,"[25] this power could potentially extend to the regulation of areas important to biological diversity or environmental sensitivity.

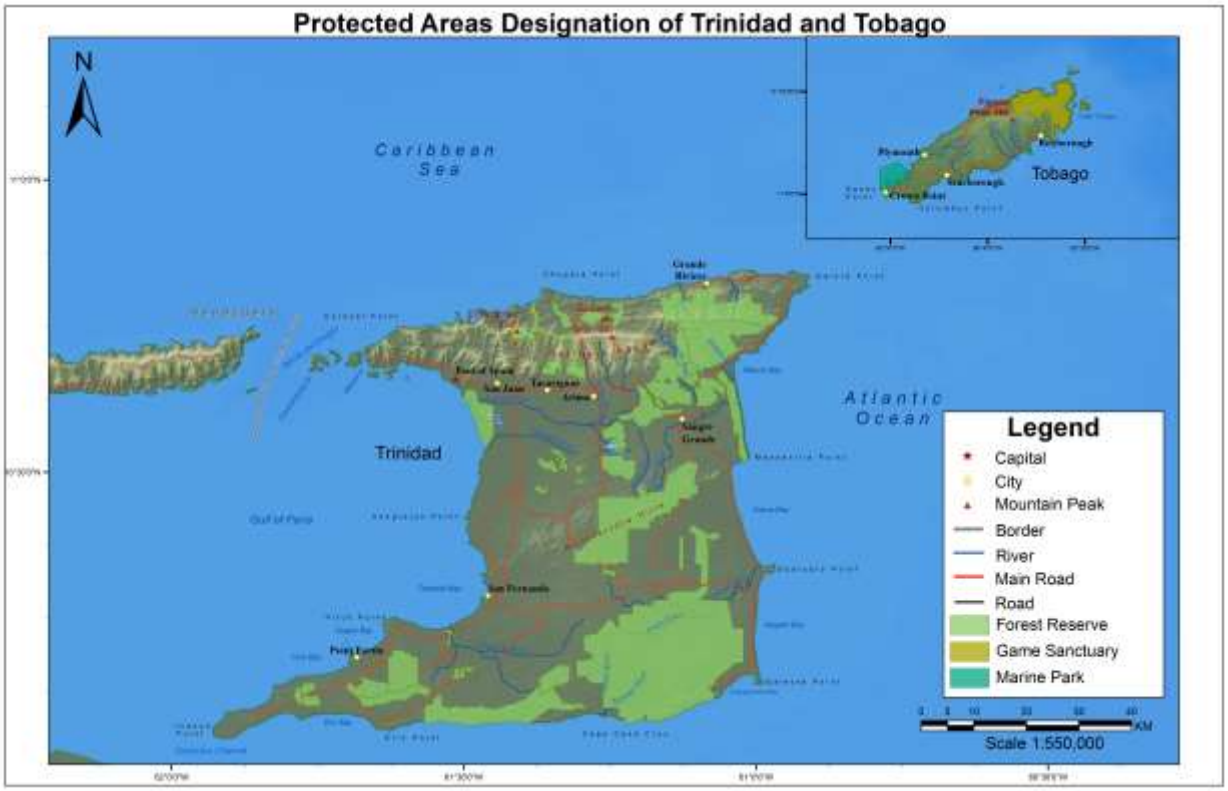
Overall, the PFDA shifts the focus on planning and development to include sustainable development concerns. Through integrating biodiversity-related considerations into the creation of a development plan, it ensures that such factors are included at an early stage. As mentioned, the PFDA has not yet come into force in its entirety. However, given the emphasis on the environment and the role of the EMA, it can be an important tool in supporting sustainable development through more equitably balancing the risk of environmental harm in making development decisions.

A significant issue overshadowing many of the concerns related to the management framework is the general lack of enforcement of existing laws governing biodiversity and the environment in T&T. This is due in large part to the lack of human, technical and financial resources to ensure that sufficient capacity exists to undertake enforcement. Limited public awareness for environmental issues, and well as the lack of appreciation for the value of biodiversity and ecosystem services through all levels of society generally exacerbate these concerns. The subject of enforcement needs to be addressed with priority, since revised laws will effect little change if enforcement is not

[23] The Planning and Facilitation of Development Act No. 10/2014, s. 48
[24] The Planning and Facilitation of Development Act No. 10/2014, ss. 107(1)(d), (n)
[25] "Area of special interest" means any part of Trinidad and Tobago determined by a competent authority under any law to be an area of natural, scientific, heritage, historic, architectural or aesthetic interest or significance and includes a building listed under the National Trust of Trinidad and Tobago Act (The Planning and Facilitation of Development Act No. 10/2014, s. 3(1).

adequately addressed. One area where these concerns are prevalent is in the enforecemnt of laws related to protected areas. Although Protected Areas have been designated across T&T (Figure 69), the effectiveness of the management of these areas requires further attention. It has been suggested that the establishment of the Forest and Protected Areas Management Authority, as well as greater attention to managing land use and unsustainable harvesting activities will lead to better protection of T&T's PAs (USAID, 2013).

Figure 69: Protected Areas in T&T (2012)

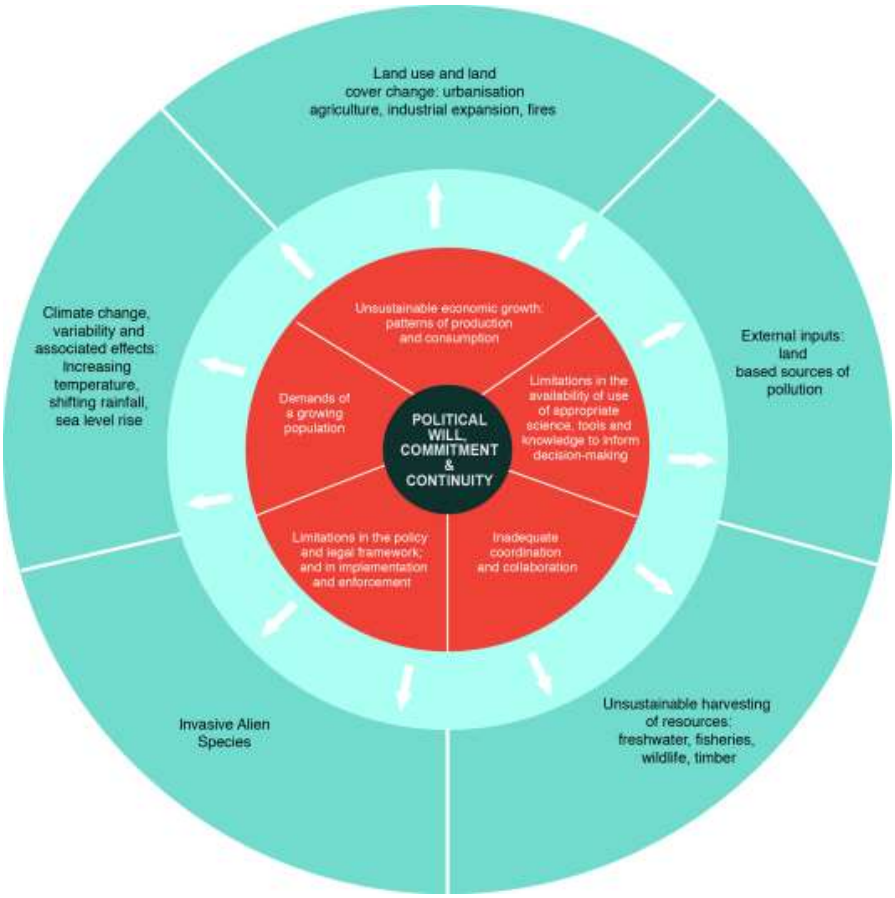


Source: Based on maps published by UNEP-WCMC (2015)

5.2.4 Summary: The Multitude and Complexity of T&T's Driving Forces

The foregoing presentation of the main driving forces affecting T&T's biodiversity and associated ecosystem services has highlighted that the landscape of human activities affecting biodiversity (as reported in T&T's 4th National Report to the CBD) has generally not changed. The relationships between and amongst drivers (Figure 70), and the general manner in which indirect drivers continue to provide momentum to direct drivers of change, appear to persist.

Figure 70: The BES Driving Forces of Highest Priority in T&T



While there have been several important advancements in policy and science (including some attention placed on the science/policy interface); as well as greater effort to design and implement programmes and projects with tangible outcomes for biodiversity and human well-being in T&T, the overall picture is that most aspects of biodiversity continue to be threatened because of increasing anthropogenic pressures on them (Table 14). For T&T, as a SIDS, this is not good news, as is evident for example, in the current and potential losses which can be incurred due to persistent impairment of T&T coastal ecosystems (Box 11).

Box 11: The Importance of and Complexity Associated with Managing Human Activities in T&T's Coastal Zone

The complexity of driving forces affecting T&T's ecosystems is perhaps nowhere better exemplified than in the country's coastal areas. As reported in the Draft ICZM Policy Framework (2014), there are several important and challenging considerations related to managing the coastal zone:

- 'More than 70% of the population resides within the coastal zone, particularly along the west coast of Trinidad and in Southwest Tobago; and 80% of urbanized land is located within or adjacent to coastal areas;
- 80% of industrial activities of strategic national importance are located in the coastal zone;
- 60% of small scale economic activities significant for the support of human lives are located in the coastal zone;
- Approximately 50% of the country's national transportation arteries; coastal roads, bridges and ports are in the coastal zone;
- Approximately 90% of tourist facilities and hotel room budget in the country are located within the coastal zone areas;
- Coastal areas account for about 90% of annual fish production.

At the same time, the coastal zone houses the most biologically diverse ecosystems on the islands such as coral reefs, seagrass beds, rocky shores, beaches, mudflats, mangrove swamps and littoral woodlands and scrubs. These ecosystems provide a range of provisioning, regulating, cultural and supporting services that include erosion control, storm protection, floodwater retention, water quality maintenance and climate regulation. Despite, their importance, these ecosystems are under severe pressure as a result of population growth, increasing urbanization, industrialization and tourism in coastal areas, and the associated catchments.'

Source: Extract from: Ministry of the Environment and Water Resources (2014)

Drivers and the interactions amongst them are, by nature, complex; and identifying the most expedient entry points for action has, for T&T, been challenging. The approach to biodiversity management in T&T continues to be largely characterised by a patchwork of well-meaning activities, but these efforts have not been systematic or continuous, either over time or geographical space. As such, they have not attained a critical mass. Moreover, the need for political will, commitment and continuity in the management of BES continues to sit at the centre of biodiversity management discourse; as does the need for a more coordinated and collaborative approach at all levels. While championship for BES management has emerged within the non-governmental sector (such as within research institutions, non-governmental organisations and local communities), and there are persons within the public sector who work assiduously to promote and try to address BES issues, biodiversity management has not yet found a dedicated champion at the higher political levels.

The spectrum of measures that will be required to address the multiple driving forces which are causing negative trends in T&T's biodiversity and ecosystem services presents T&T with several challenges. Many of the specific measures required to halt and/or reverse these trends are not

currently in place;with the 2020 target timeline presenting a further challenge. The situation is compounded by a recent change in T&T's national government in September 2015, as well as the recent (2014 – present) drop in global oil prices - both of which have led to shifts in national priorities and policy focus.

As highlighted by the assessment of driving forces presented in this report, the outlook for BES management may need to focus on a few, very high priority pressures (or direct drivers) over the next five (5) to 10 years in order to have any chance of success. These include land use planning, climate change adaptation, and sustainable use of biological resources (sustainable patterns of production and consumption) – Figure 71. While actions in other areas are undeniably necessary, the very high correlation of these three focal areas with the negative trends occurring in T&T's biodiversity and ecosystem services provides the required evidence base for prioritisation, mainstreaming and action. These issues will be elaborated in the revised NBSAP for T&T.

Figure 71: Proposed Policy Focal Areas for Addressing Driving Forces Affecting BES in T&T

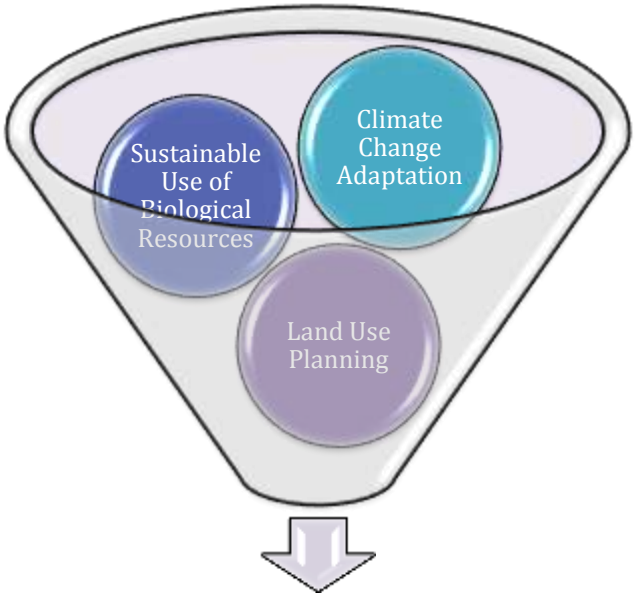


Table 14: Qualitative Assessment of the Change in Intensity of Drivers Since 2010

Components of Biodiversity and Ecosystem Services		Land Use/Land Cover Change				Chemical Pollution from LBS	Overharvesting	Climate change, Variability and Associated Effects		Invasive Alien Species
		Urban Growth	Agricultural expansion	Industrial Expansion	Fires			Temp and/or rainfall	Sea Level Rise	
Ecosystems										
Terrestrial Forests	Natural	↗	↗	↗	↗		↗	↗		
	Plantation				↗		↗			
Coastal	Mangroves	↗	↗	↗					↗	
	Coral Reefs					↗		↗	↗	↗
	Freshwater Marshes									
	Seagrasses					↗	↗	↗		
Freshwater	Rivers	↗	↗	↗		↗	↗			
Species										
Terrestrial	Fauna	↗	↗				↗			↗
	Flora	↗	↗	↗	↗			↗		
Freshwater	Fauna					↗				
	Flora					↗				
Marine	Fish (commercial)						↗			
Ecosystem Services										
Ecosystem Services	Freshwater provision	↗	↗	↗		↗	↗	↗	↗	
	Sediment retention	↗	↗	↗	↗		↗	↗		
	Coastal protection	↗	↗	↗					↗	
	Carbon sequestration	↗	↗	↗	↗		↗	↗		
	Coastal tourism/ recreation	↗	↗	↗		↗			↗	↗
	Pollination	↗	↗	↗	↗	↗		↗		↗

Key: ↗ Increasing intensity

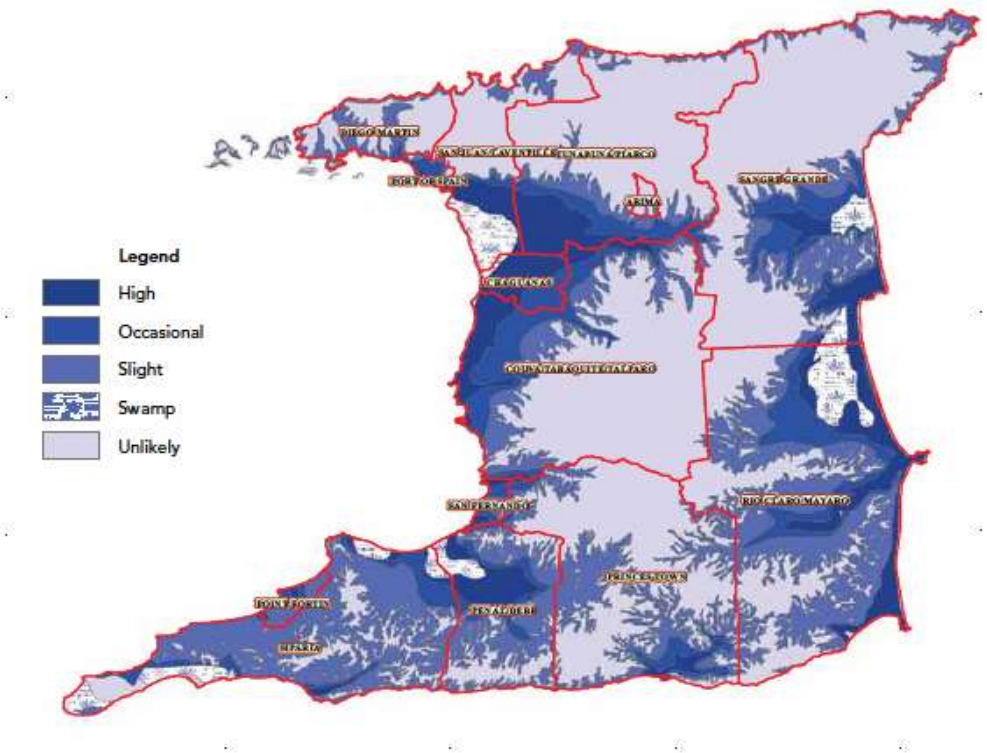
6.0 Implications of Changes in Biodiversity for Human Well-being

Q4. What are the impacts of the changes in biodiversity for ecosystem services and the socio-economic and cultural implications of these impacts?

Section 3 provided an overview of the ecosystem services of importance in T&T, especially by highlighting the economic value of these services at a national level. In cases where services can account for noteworthy contributions to T&T's GDP (for example in the case of carbon sequestration, soil retention services and water purification), losses in biodiversity will have economic consequences at a national scale.

The increase in flooding incidence and costs around T&T was highlighted both in T&T's 4th National Report (2010) and NBATT (2012). This trend in flooding continues, especially in the areas of high flooding risk in Trinidad (Figure 72), with significant losses in some cases.

Figure 72: Flood Risk Areas in Trinidad

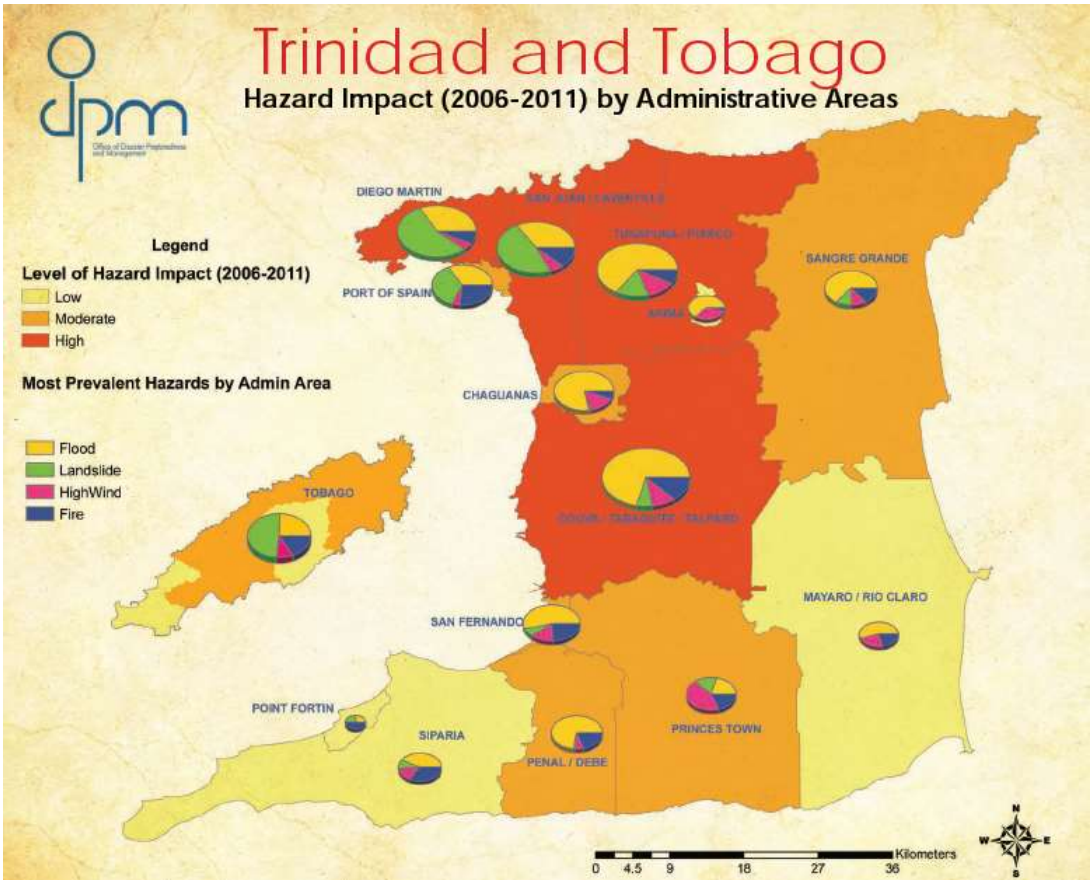


Source: GoRTT (2012a)

In the 20-year period prior to 2008, it is estimated that agricultural losses on account of flooding in low-lying areas amounted to over US$20 million (Ramlal and Baban, 2008). More recently, the cost of a single flood event in August of 2012 in the Diego Martin Valley in the northwestern section of Trinidad's Northern Range was estimated to be over TT$100 million (The Guardian, 2012 in NBATT, 2012). Although flooding occurs on account of a combination of factors, many of the severe flooding incidents in T&T coincide with areas where watersheds and other natural ecosystems have been degraded (Chadee and Sutherland, 2014).

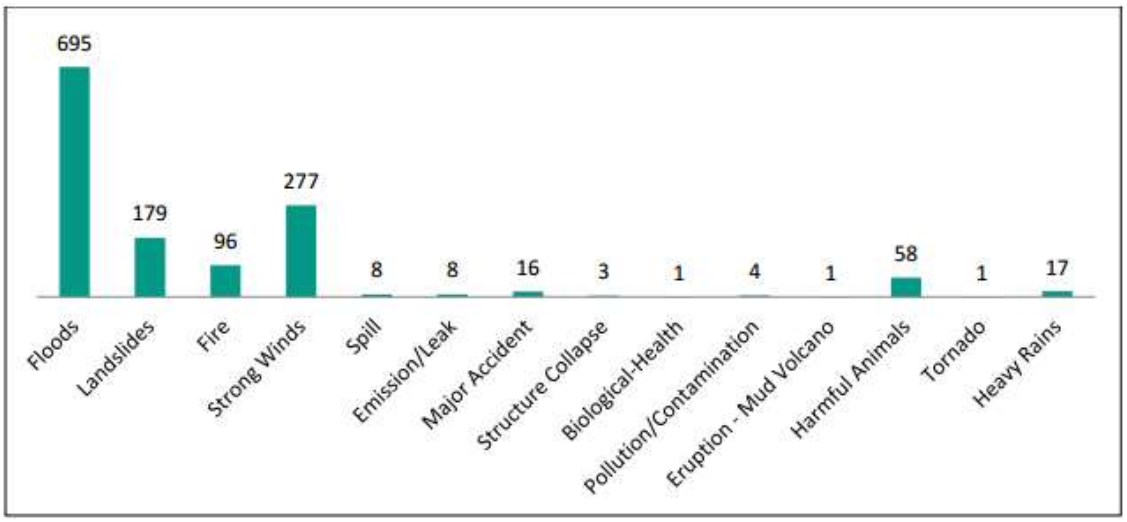
Taken together with floods, other natural hazards such as landslides and fires are also impacting areas where ecosystems are known to be under greatest threat – especially in northwestern and western Trinidad (Figures 73 and 74). Areas at highest risk from natural hazards also coincide with some of the most densely populated areas, especially in Trinidad (Figure 73).

Figure 73: Hazard Impact in T&T by Administrative District (2006 – 2011)



Source: GoRTT (2012c)

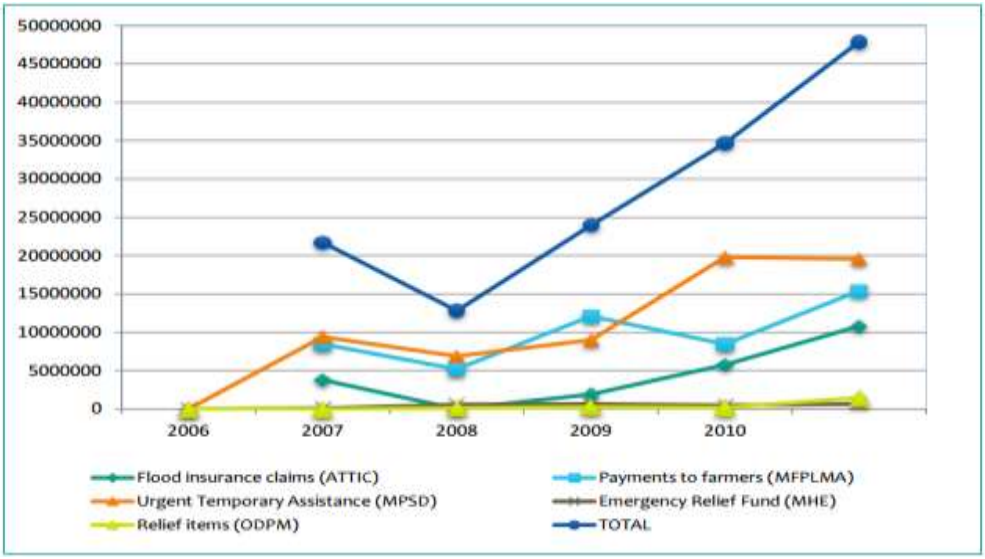
Figure 74: Number of Occurrences by Hazard Type Over the Period 2011-2014



Source: Source MNS/ODPM Archives, 2014

There was an overall increase in the economic costs associated with hazard between 2006 and 2011 (Figure 75).

Figure 75: Costs of Disasters (by Hazard Type) in T&T Dollars (2006 – 2011)

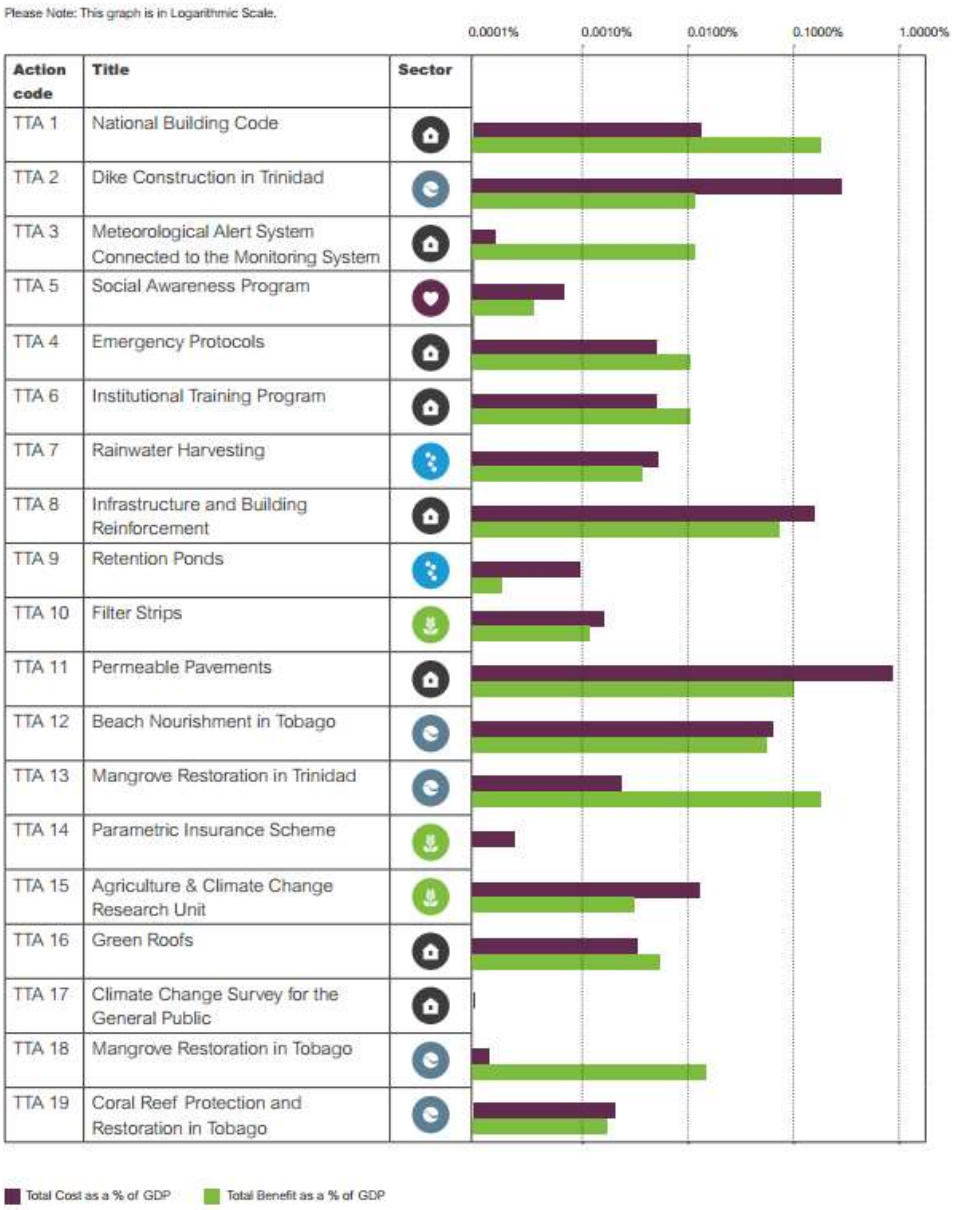


Source: MNS/ODPM, 2014

From available studies, there is strong evidence to suggest that from an economic perspective, ecosystem/ecological based adaptation is typically more cost effective in developing sustainable approaches when compared with anthropogenic initiatives – for example ethrough mangrove

restortaion (Figure 76). Additionally, ecological disaster risk reduction (Eco-DRR) strategies offer several opportunities for T&T to accelerate its actions towards meeting the Aichi Targets (as shown in Table 15). There are only a small number of examples of Eco-DRR in T&T, and the loss of important ecosystems in T&T, presented in earlier sections of this report, is potentially reducing the country's capacity to apply Eco-DRR strategies, thereby increasing the vulnerability of local populations.

Figure 76: A Cost-Benefit Analysis of Various Measures to Adapt to Claimte Change in T&T



Note: Measured as a % of Trinidad and Tobago's GDP
Source: IDB (2014)

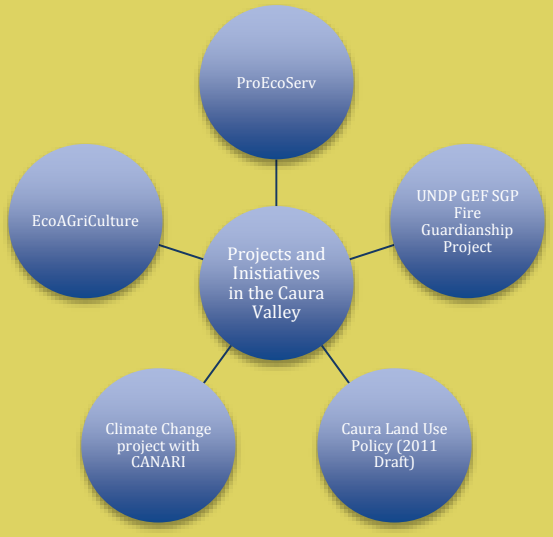
Table 15: The Aichi Targets Supported by the Eco-DRR Activities that Potentially Could be Adapted According to the Type of Disaster/Risk

Disaster/Risk	Eco-DRR Activity	Aichi Target supported
Flooding	Forest restoration, mangrove forest restoration, wetland restoration, sustainable agriculture practices and estuary recovery	1, 5, 7, 10, 14 and 15
Hurricanes	Mangrove forest restoration, coral reef restoration and coastal restoration	1, 5, 10, 14 and 15
Tsunamis	Coral reef restoration, mangrove forest restoration and coastal restoration.	1, 5, 10, 14 and 15
Landslides	Forest restoration and sustainable agriculture practices	1, 5, 7, 8, 14 and 15
Drought	Forest restoration, wetland restoration and sustainable agriculture practices	1, 5, 7, 8, 14 and 15
Fires	Sustainable agriculture practices	1, 7, 8 and 14
Storm Surges	Coral reef restoration, mangrove forest restoration and coastal restoration	1, 5, 10, 14 and 15

Box 12 provides an example of an initiative in T&T which reflects Eco-DRR thinking.

Box 12: Protecting Ecosystems as a Means of Improving the Resilience of the Caura Valley Residents

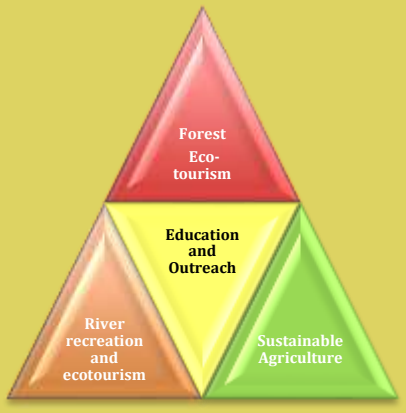
The Caura Valley watershed is affected by a range of driving forces (Box 5), which are leading to declines in the capacity of the ecosystems in the area (especially the forested lands and the river). Having noticed the changes that are taking place, and being the persons who are most directly affected by these changes, residents of the Caura Valley have mobilized themselves to become advocates, and lobbyists for the protection of the Valley. Over the last five (5) to 10 years, the Caura residents, led by the Caura Valley Village Council (CVVC), have become involved in many different projects and initiatives that are aimed at conserving and restoring the biological diversity of the Caura Valley; providing opportunities for livelihoods; and reducing the vulnerability of the Valley to natural disasters. Some of these projects are shown in the diagram below.



In 2015, the Caura Valley Village Council (CVVC) finalized their Strategic Plan (2015 – 2017). Five goals were established as a part of the plan:

1. A well-managed watershed within environmental limits;
2. Strategic infrastructural development serving the valley;
3. Sustainable levels of wealth generated by the residents;
4. A vibrant, world-renowned heritage and nature centre;
5. A well-governed village council and equipped Activity Centre.

An important area of focus within the Strategic Plan that ties all of the goals together and builds on the projects that have been undertaken is the development of an eco-finance (or Payment for Ecosystem Services) scheme – the components of which are shown in the diagram below. The members of the CVVC consider that this type of scheme, which could be piloted and potentially funded under T&T's Green Fund, would provide an opportunity to address many of their concerns related to the declining state of the ecosystems within the Valley, and the associated risks that this poses not only to the residents, but the wider community in Trinidad, especially in the context of climate change.



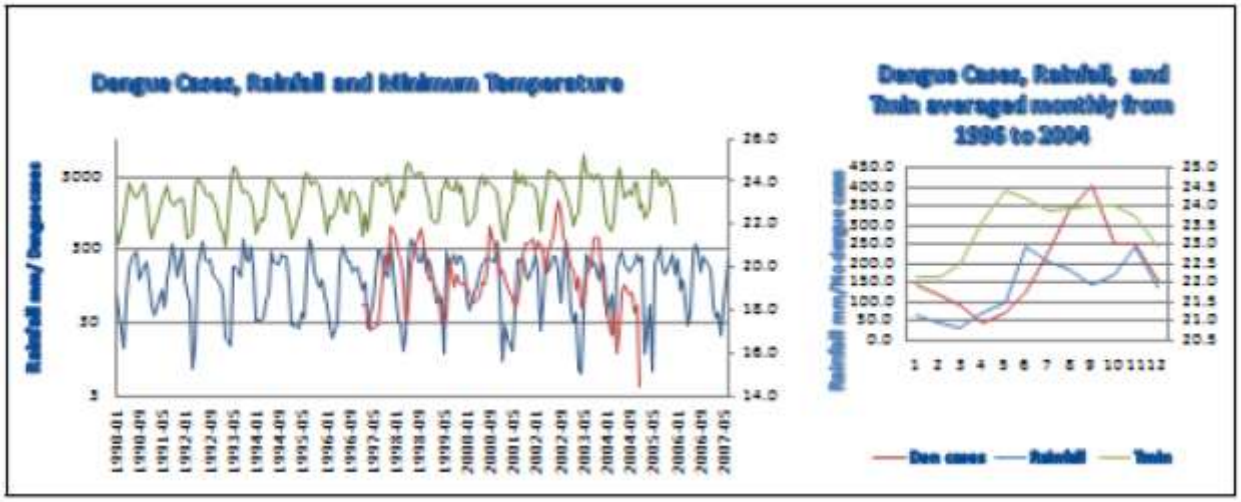
The work that has been done by the CVVC and the Caura Valley residents to date exemplifies the commitment of communities in T&T in helping to address the biodiversity-climate change nexus at a local scale. This type of initiative, related to the development of an eco-finance model for the Valley, is one that could likely be adapted in due course across T&T as an Eco-DRR model to help the country to reduce its vulnerability to climate change.

Source: Information drawn from the Project for Ecosystem Services (2015)

There is also a growing body of evidence regarding the link between climate change and the spread of communicable diseases such as dengue fever (mosquito vector *Aedes aegypti*) in T&T. According to data published in the Second National Communication of T&T to the UN Framework Convention on Climate Change (UNFCCC) (GoRTT, 2013), outbreaks of dengue fever are linked to rainfall and temperature (Figure 77). With the anticipated changes in rainfall and temperature due to climate change, there is the likelihood of increasing incidence of vector borne diseases such as dengue across the country. However, it should be noted that research on mosquito resistance to organophosphate

insecticides indicates that as temperature increases with climate change, there is expected to be a concomitant increase in the susceptibility of the *Aedes aegypti* mosquito to these pesticides (Polson *et. al.*, 2012).

Figure 77: Dengue Cases in Relation to Rainfall and Temperature in T&T



Source: GoRTT (2013)

It is now well established in the literature that poor and vulnerable communities will likely be hardest hit on account of biodiversity losses (Diaz *et. al.* 2006). In T&T, the rural and local communities that depend on biodiversity as a source of livelihoods are at risk. For example, it has been calculated that if pollinators were to be completely eliminated from the Nariva Swamp (e.g. through the unsustainable use of pesticides or through the removal of the surrounding forested areas that provide pollinator habitats), farmers growing hot peppers would potentially incur weekly losses between US$ 398 and US$ 861; while cucumber farmers will potentially lose between US$ 2,348 and US$ 12,692 per crop cycle (Dempewolf, 2015). For the subsistence farmers in the Nariva Swamp who depend on agriculture as a main source of income, these losses will be staggering.

PART II

The National Biodiversity Strategy and Action Plan, its Implementation, and the Mainstreaming of Biodiversity

Forests on the southern flanks of the Northern Range, Trinidad
Photo courtesy Maurice Rawlins

7.0 Trinidad and Tobago's Aichi Targets and Indicators

Q5: What are the biodiversity targets set by your country?

7.1 Background to the Development of National Biodiversity Targets and Indicators

In 2014 and under the overall framework of the 2020 Aichi Biodiversity Targets, the GoRTT began a process to develop National Biodiversity Targets and Indicators that are most relevant and useful to the local context and circumstances in T&T. Led by the Multilateral Environmental Agreement Unit (MEAU) of the Environmental Policy and Planning Division (EPPD), and undertaken in consultation with a range of relevant stakeholders, a series of workshops were held over the period April to September 2014 to identify indicators, and to determine the agencies/organisation best suited to tracking these.

On completion of the full round of consultations in 2014, a comprehensive list of 97 draft indicators was forwarded for Cabinet approval (Table 16). The decision regarding their approval is still pending; and as such, T&T does not have an official Government-endorsed list of Biodiversity Indicators. Additionally, no formal process has yet been established to coordinate the generation and assessment of data relevant to the various indicators. The draft list of Targets and Indicators is presented in Table 16.

7.2 T&T's Aichi Biodiversity Targets - Opportunities and Challenges

T&T has made some progress in managing various aspects of its biodiversity, but the finding that most of the negative trends in both biodiversity status and driver intensity continue to persist or have intensified since 2010, indicates that efforts to date have not been sufficient to ensure greater sustainability in the use of the country's biodiversity. Progress and success stories are being recorded around the country however, they are not occurring at the scale necessary to reduce the pressures on biodiversity.

The Targets and associated indicators developed by T&T in 2014 under the Aichi framework provide an opportunity to concentrate efforts, cultivate partnerships and pool resources in order to design a streamlined approach to BES management. This is an important development in attaining the necessary approach to biodiversity management. However, based on work conducted as a part of the 5th National Report and the process to revise the NBSAP (on going), it has become apparent that there are a number of challenges associated with the use of the list of targets and indicators for T&T that have been drafted (as in Table 16):

- As has been described, T&T's list of Aichi Target indicators is still in draft form, and has not yet been approved by Cabinet. With 2020 less than four (4) years away, the ability of T&T to make the proper investments in order to be able to meet its intended targets by 2020 is limited. The T&T targets are meant to correct many of the negative trends in BES, but there may be insufficient time to do so by 2020. As such, these Targets will likely have to be incorporated into Plans that have a longer-term outlook;

Fire in Trinidad's Northern Range
Photo courtesy Robyn Cross

- The list of indicators is very long (97 indicators in total), and for the majority of indicators, there are insufficient data in forms that can be used to systematically and accurately track national progress:
    - Some indicators are very broad and are difficult to measure and track in a meaningful way, for example: Change in access to and use of biodiversity (19iii) and Number of different information documents produced (1ii);
    - In the majority of cases, baseline data do not exist for the indicators. Even if baseline data are collected in the next few years, it would be difficult to report on changes by 2020;
    - National aggregate data only exist for a few indicators - such as Forest Cover (5i and 5ii); Area under agriculture (7i); Protected Area coverage (11i); Threatened Species (12i) and Contribution of forests to carbon stocks (15i and ii). For other indicators, there is available data that do not provide a true national level aggregate (such as the change in coastal ecosystems – 5iii, iv and v), but still allow for some appreciation of

overall trends. For other parameters, such as pollution (8), there is a patchwork of spatial and temporal data that may not necessarily be providing a true indication of trends;

- The robustness / appropriateness of scientific techniques used to collect data to inform indicators needs to be examined. Comparison of trends has also been made difficult or impossible because of the variations in field and lab techniques used (such as historic accounts of mangrove cover). Additionally, it has been established that some aspects of the ecosystem services valuation is based on the application of a value transfer method (and therefore not based on locally collected data). In tracking indicators, significant attention will be required to ensure that proper scientific methods are applied; and that these methods are largely consistent across space and time. Otherwise, there is a chance that reported changes may not be accurate.

- The list of Targets and Indicators for T&T was developed in 2014 - before the revision of T&T's revised NBSAP (2016). During the process to revise the NBSAP, it was necessary to consider the targets and how they might be prioritised. Table 17 provides an assessment of T&T's national targets – their linkages and the likelihood of achieving them by 2020.

Table 16: Proposed National Biodiversity Targets and Indicators for T&T, and Organisations/Institutions to Collect the Relevant Data

NATIONAL TARGETS	INDICATORS	PROPOSED LEAD AGENCY
1a. By 2020, at the latest, at least 50% of people are aware of the values and understanding of biodiversity. 1b. By 2020, at the latest, at least 30% of people are aware of the steps they can take to conserve and use biodiversity sustainably.	i. Access to local biodiversity information ii. Number of different information documents produced iii. Number of activities to promote awareness on values of biodiversity. iv. Number of activities to promote steps to conserve and sustainably use biodiversity. v. Number of people aware of biodiversity and its importance vi. Change in the level of awareness on the values of biodiversity (%)	i. EPPD, EMA, IMA, FD, Trade, Industry and Communications ii. As (i) iii. As (i) iv. As (i) v. As (i), CSO vi. As (i), CSO

NATIONAL TARGETS	INDICATORS	PROPOSED LEAD AGENCY
2a. By 2020, at the latest, biodiversity valuation has been integrated into at least 50% of national and local development and poverty reduction strategies, and planning processes and reporting systems. 2b. By 2020 at the latest, biodiversity values are integrated into national and local plans.	i. Number of national initiatives that incorporate biodiversity valuation. ii. Number of local (regional corporation, THA) development plans that incorporate biodiversity valuation. iii. Number of national reports that incorporate biodiversity values and valuation. iv. Level of financial support for biological collecting, monitoring and evaluation. v. Number of policy and legislative documents that target biodiversity valuation and management.	i. Min. of Planning/TCPD ii. ? iii. ? iv. EPPD, research institutions v. EPPD
3a. By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are reformed in order to minimize or avoid negative impacts. 3b. Positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations.	i. Change in the number of incentives harmful to biodiversity. ii. Change in the number of incentives reformed to minimize or avoid negative impacts on biodiversity. iii. Number of positive incentives for conservation or sustainable use of biodiversity. iv. Change in the value of incentives for conservation or sustainable use of biodiversity. v. Change in the value of harmful incentives vi. Value of incentives reformed to minimize or avoid negative impacts on biodiversity.	i. Finance, Food Production, Energy, Tourism, Housing, Local Gov't, DNRE/DAMME ii. As (i) iii. As (i) iv. As (i) v. As (i) vi. As (i)
4. By 2020, at the latest, the Government, business and stakeholders has taken steps to achieve or have implemented plans to keep the impacts of use of natural resources within safe ecological limits.	i. Number of plans prepared to reduce negative impacts of use of natural resources. ii. Number of plans implemented to reduce negative impacts of use of natural resources. iii. New technologies implemented to reduce negative impacts of use of natural resources.	i. WASA, Energy, Food Prod'n, Local Gov't, EMA, TCPD ii. As (i) iii. Energy, WASA,

NATIONAL TARGETS	INDICATORS	PROPOSED LEAD AGENCY
5. By 2020, the rate of loss of all natural habitats, including marine habitats, is at least halved and degradation and fragmentation is significantly reduced.	i. Change in area of natural forest, by types of forest. ii. Change in area of plantation forest. iii. Change in area of wetlands by type of wetlands iv. Change in area, rugosity and diversity of coral reefs v. Change in area of seagrass beds vi. Change in area of fire degraded habitats vii. Change in area of natural habitats degraded or lost through conversion.	i. FD, State Lands, Housing, Land and Marine Affairs, THA ii. FD iii. FD, IMA iv. IMA v. IMA vi. FD vii. FD, State Lands
6. By 2020 at least 30% of the major commercially important fish, invertebrate stocks and aquatic plants are managed and harvested sustainably.	i. Number of site, species or fishery specific management plans prepared. ii. Number of site, species or fishery management plans implemented. iii. Number of commercial fish species and invertebrates harvested in accordance with management plans. iv. Number of aquatic plants and depleted species under threat from harvesting. v. Number of illegal fishing activities reported. vi. Number of illegal fishing activities leading to conviction. vii. Change in status of key species of commercial fish and invertebrate stocks. viii. Change in no of fisher folk who use or adopt sustainable fishing techniques. ix. Change in awareness and knowledge of sustainable fishing techniques.	i. Fisheries, EMA (For aquaculture CEC applications), IMA ii. Fisheries, IMA iii. Fisheries, EMA, IMA iv. IMA v. Fisheries, Forestry, National Security vi. Fisheries, Forestry, National Security vii. Fisheries viii. Fisheries ix. Fisheries
7a. By 2020 at least 30% of areas under agriculture are managed sustainably,	i. Area under agriculture. ii. Area under agriculture sustainably managed.	i. and ii. Food Prod'n iii. and iv. Fisheries, EMA v. to viii FD ix. Fisheries

NATIONAL TARGETS	INDICATORS	PROPOSED LEAD AGENCY
ensuring conservation of biodiversity. 7b. By 2020 aquaculture activities are managed sustainably, ensuring conservation of biodiversity. 7c. By 2020 at least 50% of areas under forestry are managed sustainably, ensuring conservation of biodiversity.	iii. Number of aquaculture projects . iv. Number of aquaculture projects that contribute to conserving local biodiversity. v. Number of native species cultivated. vi. Number of non- native species cultivated vii. Acreage of non native species. viii. Acreage of native species. ix. Number of aquaculture projects managed in accordance with global standards and best practices. x. Area under forest management. xi. Area under sustainably managed forests.	x and xi. FD
8. By 2020, pollution, including from excess nutrients, at key sites has been brought to levels that are not detrimental to ecosystem function and biodiversity.	i. Change in the Level of all types of pollution at key sites. ii. Number of measures in place to control pollution. iii. Change in biodiversity at key sites affected by pollution. iv. Number of occurrences in non-compliance with pollution rules.	i. EMA, WRA, IMA, UWI ii. EMA iii. IMA, DNRE, FD iv. EMA
9a. By 2020, invasive alien species and pathways are identified and prioritized for action. 9b. By 2020, at least 40% of priority terrestrial IAS species present are controlled or eradicated at priority sites. 9c. By 2020, at least 50% of priority marine IAS species present are controlled or eradicated at priority sites.	i. Number of IAS identified that are immediate threats. ii. Number of pathways identified as immediate threats . iii. Number of IAS controlled or eradicated. iv. Number of measures in place to prevent introduction of IAS. v. Number of new IAS identified in T&T annually.	i. FD, Food Prod'n, IMA, EMA ii. Food Prod'n, EMA, IMA iii. FD, Food Prod'n, IMA, EMA iv. FD, Food Prod'n (plant and animal quarantine), IMA, EMA v. FD, Food Prod'n , IMA,

NATIONAL TARGETS	INDICATORS	PROPOSED LEAD AGENCY
9b. By 2020, measures are in place to manage pathways to prevent their introduction and establishment.		
10. By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable coastal ecosystems impacted by climate change are minimized, so as to maintain their integrity and functioning.	i. Number of management plans approved ii. Number of management plans implemented to reduce anthropogenic impacts on coral reefs and other vulnerable ecosystems. iii. Change in anthropogenic impacts on coral reefs and other vulnerable coastal ecosystems.	i – iii. IMA, Fisheries , THA, Buccoo Reef Trust, EMA
11. By 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are managed consistent with approved plans.	i. Percentage of terrestrial area including inland waters protected. ii. Percentage of coastal and marine areas protected. iii. Number of management plans implemented for these areas.	i. FD, State Lands, THA ii. IMA, THA, Fisheries, CDA, EMA iii. CDA, IMA, THA, Fisheries, EMA
12. By 2020 the extinction of at least 60% of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	i. Number of threatened species. ii. Number of management plans for threatened species and habitats implemented. iii. Change in population/status of threatened species.	i. FD, IMA, EMA, THA ii. FD, Fisheries iii. FD, Fisheries, IMA, THA
13. By 2020, the genetic diversity of priority, native socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for safeguarding their genetic diversity.	i. Number of native socio-economically and culturally valuable species utilized. ii. Number of strategies developed for safeguarding native socio-economically and culturally valuable species. iii. Number of strategies implemented for safeguarding native socio-economically and culturally valuable species. iv. Measures in place to protect erosion of genetic resources	i. – iii. FD, Fisheries, CARDI, CABI iv. Research institutions, orchid society, CARDI, CABI

NATIONAL TARGETS	INDICATORS	PROPOSED LEAD AGENCY
14. By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are rehabilitated and managed, taking into account the needs of local communities, and the poor and vulnerable.	i. Number and acreage of degraded ecosystems ii. Number and acreage of degraded ecosystems rehabilitated and managed. iii. Number of people employed or gaining a livelihood from rehabilitated ecosystems	i. EMA, FD, Energy, WRA, Food Production, UWI (Geoinfomatics) ii. EMA, FD, Energy, WRA, Food Production iii. CSO*, ENGOs*, Green Fund, EMA, GEF SGP
15. By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced, through conservation and rehabilitation, including rehabilitation of at least 15 per cent of degraded ecosystems.	i. Percentage of degraded ecosystems rehabilitated. ii. Contribution of natural forest to carbon stocks. iii. Contribution of plantation forests to carbon stocks. iv. Number of carbon sinks created annually.	i. FD, NRWRP, EMA, Energy ii. FD, NRWRP, THA iii. FD, NRWRP, THA iv. FD, NRWRP, eNGOs, THA
16. By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is ratified by the Government.	i. Number of work programmes that incorporate some of the provisions of the Nagoya Protocol. ii. Number of legal instruments supporting implementation of the Nagoya Protocol. iii. Number of PA and education events to promote info on ABS	i. EPPD, Food Prod'n, Legal Affairs, Trade ii. Legal Affairs, AG Office iii. EPPD, Food Prod'n, Legal Affairs, Trade
17. By 2015 the Government has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	i. Number of consultations held in preparing the updated NBSAP. ii. Level of participation in consultations held in preparing the updated NBSAP. iii. Approval of the revised NBSAP by the Government. iv. Number of work programmes that incorporate elements of the updated NBSAP.	i. – iii. EMA, EPPD iv. All applicable agencies
18. By 2020, the traditional knowledge, innovations and practices of indigenous	i. Number of documented traditional knowledge, innovations and practices of indigenous and local communities.	i. Research institutions e.g. UWI, FD, Food Prod'n, NGOs ii. FD, Food Prod'n, NGOs

NATIONAL TARGETS	INDICATORS	PROPOSED LEAD AGENCY
and local communities relevant for the conservation and sustainable use of biodiversity, are integrated and reflected in the implementation of the Convention in a participatory manner.	ii. Number of biodiversity related activities implemented that incorporates traditional knowledge, innovations and practices of indigenous and local communities. iii. Level of participation by local communities in management of biodiversity. iv. Number of research projects utilizing indigenous and local knowledge.	iii. FD, NGOs iv. Research institutions
19. By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied at key sites.	i. Number of scientific studies on local biodiversity published annually. ii. Number of skilled persons by disciplines, managing biodiversity. iii. Change in access and use of biodiversity information. iv. Number of biodiversity research projects undertaken. v. Number of records per year to citizen science websites.	i. Research institutions e.g. UWI, CABI, UTT; FD, IMA, ii. EPPD iii. EMA, EPPD, IMA, FD, iv. Research institutions e.g. UWI, CABI, UTT; FD, IMA, v. NGOs, Research institutions
20. By 2020, at the latest, the mobilization of and access to financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 including the updated NBSAP, from all sources, increased substantially from the current levels.	i. Total funds allocated annually by government for management of biodiversity. ii. Total funds derived from donors (e.g. GEF) for management of biodiversity. iii. Total funds from other sources e.g. Green Fund, for management of biodiversity. iv. Total funds from the private sector for management of biodiversity v. Total dollar value of projects implemented annually for management of biodiversity.	i. EPPD ii. EMA, EPPD iii. EPPD iv. Commerce Chambers v. EPPD

Table 17: Assessment of T&T's Draft National Targets in the Context of the Process to Revise T&T's NBSAP

Target #	Measure(s) of....			Strong linkages between/ among Targets	Are the Target's Indicators measurable?	Is the national Target already been monitored through existing programmes etc.?	Is the Target Achievable by 2020 based on BAU?	Can some appreciable progress be made by 2020 based on BAU?
	Biodiversity Status	Direct Drivers of Change	Indirect Drivers					
1			☐	19	Partially	Partially	Yes	-
2			☐	19	Yes	No	No	2b (only) Likely
3			☐	4	Yes	No	No	Unlikely
4			☐	3	Partially	No	No	Likely
5		☐		10, 11, 14, 15	Partially	Partially	No	Likely
6		☐		12	Yes	Yes	No	Likely
7		☐		8	Yes	Partially	No	7c (only) Likely
8		☐		7	Partially	No	No	Unlikely
9		☐		10, 12	Yes	Partially	No	Likely
10		☐		8, 14	Partially	No	No	Unlikely
11		☐		5, 10, 12,14, 15	Yes	Yes	Yes	-
12	☐			6, 9, 11, 13	Partially	Partially	Yes	-
13		☐		12	Yes	No	No	Likely
14	☐			5, 7, 8, 10, 11, 15	Yes	No	No	Likely
15		☐		11, 14	Yes	Partially	No	Likely
16			☐	18	Yes	No	Yes	-
17			☐	Overarching	Yes	Yes	Yes	-
18			☐	16	Partially	No	No	Unlikely
19			☐	Underpinning	Partially	No	No	Likely
20			☐	Underpinning	Yes	No	No	Unlikely

8.0 Trinidad and Tobago's National Biodiversity Strategy and Action Plan

8.1 Implementation Status of the Existing (2001) NBSAP

Q9: How fully has your national biodiversity strategy and action plan been implemented?

T&T began the process to update its NBSAP in February 2016. It is anticipated that the process will be completed in the last quarter of 2016. As such, the original version of the NBSAP (2001) is the version of the NBSAP currently under implementation. The 2001 NBSAP identified 23 strategies and their associated actions to be implemented. These strategies sought to address five (5) priority areas of interest i.e. Education and Awareness, Legislation and Enforcement, Capacity, Research and Information, and Policy and Commitment. The actions defined for each area were significant for supporting the establishment of a comprehensive framework for long-term biodiversity conservation within T&T. However, by their sheer number they were ambitious and the resulting assessment of their implementation revealed varying levels of completion were achieved in each area. Table 18 provides a summary assessment of the implementation of the 2001 NBSAP to date. Box 13 provides an example of work being undertaken in the Matura National Park Environmentally Sensitive Area (ESA) which seeks to incorporate many of the NBSAP (2001) strategies.

Erosion on Trinidad's south coast
Photo courtesy: Robyn Cross

Notable contributions towards the execution of the strategies and actions came via the implementation of small and medium sized projects ably supported by various funding agencies including: GEF Small Grants Programme, which funded over 30 biodiversity related projects between 1995 and 2010;the Green Fund, which funded approximately 16 projects (as at 2013); development of an ICZM Policy Framework for T&T; and participation in regional programmes such as, the Caribbean Regional Fisheries Mechanism. While these are achievements are notable, much more could have been accomplished if there was an overarching national framework for biodiversity conservation, effective coordination to guide the implementation of the NBSAP process, and ready access to adequate financial resources to support implementation of the actions. The revision of the NBSAP is an opportunity to address these gaps and build on the collective work that has been and continues to be done by the relevant agencies, organisations and their partners.

Table 18: Update on Progress Made in Implementing T&T's (2001) NBSAP

STRATEGY	ACHIEVEMENTS	CHALLENGES	OPPORTUNITIES
Education and Awareness: Strategies 1-9	All agencies (government and civil society) involved in biodiversity conservation have actively carried out education and awareness initiatives, or have established regular awareness activities. Environmental and biodiversity conservation concepts are entrenched in the formal education system at primary, secondary and tertiary levels. Corporate entities and religious organisations have also been involved in biodiversity conservation activities	Weak coordination and collaboration amongst agencies in delivering a unified education and awareness programme. Limited, finite financial resources usually associated with a project.	Improve coordination and collaboration to maximise human and financial resources; presentation of a coordinated effort will likely increase impact on public
Legislation and Enforcement: Strategies 10 & 11	The following laws have been drafted and enacted: Water Pollution Rules No. 12/2007; Planning and Facilitation of Development Act No. 10/2014; Air Pollution Rules, No. 12/2015; Litter Act 30:52, 1973 (rev. 2014) (revised to increase fines for violations); Waste Management (Hazardous Waste) Rules (Draft), 2014. The following policies have come into force: the Climate Change Policy (2011), Protected Areas Policy (2011), Wildlife Policy (2013), and Forest Policy (2011). The Environmental Commission has been established since 2001	Legislative gaps still exist with respect to the control of alien invasive species, marine pollution, sustainable extraction of natural resources and the mainstreaming of climate change among others. Lack of integration of modern biodiversity management methods e.g. science-based decision-making, co-management mechanisms, ecosystem-based approaches into existing laws. Ineffective law enforcement due to lack of human, technical and financial capacity to monitor and respond to environmental violations. Jurisdiction of Environmental Commission is limited to violations of the Environmental Management Act 2000.	Build capacity with non-specialised court system to effectively address environmental violations. Integratemodern biodiversity management methods in existing laws.

STRATEGY	ACHIEVEMENTS	CHALLENGES	OPPORTUNITIES
Capacity: Strategies 12 – 14	Agencies involved in biodiversity conservation are known to each other and interact at coordinated events. They all have tools (e.g. website, Facebook page, periodic newsletter) they use to disseminate information on their activities. The civil society within T&T has grown and some are actively engaging in regional and international initiatives to build their capacity for more effective national engagement. NGOs and CBOs have also been actively building their internal capacity to support management of biodiversity.	Limited, coordinated interaction amongst agencies. No formal environment for networking and sharing of information and experiences. Lack of enabling environment to facilitate development of and utilisation of advocacy tools. Absence of formal framework to facilitate NGO and CBO involvement in biodiversity management.	Increase networking opportunities and interactions amongst biodiversity conservation agencies and organisations. Integrate modern methods of co-management into existing legislation and policies.
Information and Research: Strategies 15 - 19	A biodiversity clearinghouse was established by the EPPD. Academic and research institutions, e.g. National Herbarium, the UWI, actively engage in projects with the Forestry Division, EMA and IMA and NGOs to improve the flora and fauna inventories of Trinidad and Tobago.	Absence of a national agenda to guide and coordinate biodiversity research and data gathering. No defined procedure for the government sectors to include biodiversity related activities in their work programmes. No financial resources allocated to research and information management. Limited willingness by some entities to share data	Establish a national framework to guide research, and build on and expand collaborations amongst agencies
Policy and Commitment: Strategies 20 - 23	Ministries with responsibility for Environment, Agriculture, Tourism, Transport, Planning, Public Utilities, Energy and Local Government have been incorporating biodiversity considerations into their policies and programmes. There has also been increased public participation in the development of government policies for conservation and management of biodiversity	Absence of an overarching national framework for integration of biodiversity conservation across sectors. Limited collaboration and coordination within and amongst public (government) agencies related to biodiversity conservation actions. Poor articulation of public views and opinions in national planning and policy development	Utilise the revised NBSAP and the national framework for implementation of the 2030 Sustainable Development Agenda

Box 13: Participatory Three-Dimensional Modeling for Protected Area Management in Trinidad: a Case Study from the Matura ESA Education and Outreach Programme (MEEOP)

The Matura National Park (MNP) located in northeast Trinidad, is comprised of approximately 9,000 hectares of protected tropical forest and is surrounded by several communities which collectively are referred to as the Matura to Matelot network (M2M network). Declared as an ESA under Legal Notice No. 323 of 2004 by the EMA, it is an important habitat for a wide array of wildlife including two (2) ESS – the endemic Pawi (*Pipile pipile*) and the Ocelot (*Leopardus paradalis*). The MNP is important for sustaining watersheds and is an ecotourism attraction in Northern Trinidad, with an abundance of nature trails, hiking opportunities and scenic waterfalls. Many educational, recreational and economic opportunities exist through the ecotourism industry at MNP.

Participatory 3-dimensional modelling (P3DM) is a participatory mapping approach integrating community-based spatial knowledge with data on land and sea elevation and depth to produce accurately scaled and georeferenced models. The EMA conducted a P3DM exercise of the MNP encompassing the communities within the M2M network. Stakeholder engagement kicked off the activities with community (comprising of CBO's, NGO's village councils, residents, etc.) and government meetings held to introduce the concept of P3DM (including the process, its benefits, and potential applications in the MNP for its sustainable management and conservation). The legend development process also commenced at the mobilization meetings, where various stakeholders suggested features and their associated symbols that should be placed on or 'populate' the map (e.g. housing settlements, landslides, hunting camps, historical sites, rivers, roads and waterfalls).

Construction of the blank model engaged teams of students from schools within the M2M network who worked alongside the MEEOP facilitators in building the model using a topographic map, carbon paper, cardboard, glue, cutting tools and other equipment as required. Using a topographic base map, individual contours were superimposed (traced) on cardboard sheets which were then cut into the shape of the contour line and pasted on top of each other with glue. Upon completion of the tracing, cutting and gluing process of all the contours, the entire model was covered with crepe paper (smoothened).

Both government officials from various institutions, as well as communities, were involved in model population to depict various features, land use or land cover from a combination of maps, recollections, storytelling and memory. These aspects are represented using assorted colours of yarn and push pins which could be easily shifted around on the model depending on discussions among participants of identified features (e.g. roads, rivers, etc.). After this process was completed, the yarn, pins and labels were carefully removed and replaced with paint representative of the features identified.

The placement of co-ordinate lines of latitude and longitude onto the model was conducted and high resolution digital photography was systematically executed in order to capture all the populated information. The information will be transferred into a digital database via on-screen digitization.

The communities that surround the MNP would benefit from a greater understanding of the MNP, its threats and features. As Moore and Davis 1997 states 'Tell me, I forget. Show me, I remember. Involve me, I understand'. So too, the greatest benefit to communities is an increased awareness of MNP and its importance as an ESA within the wider area that encompasses the MNP and the M2M Network. The P3DM model can facilitate communication between communities and government or institutional agencies responsible for further development, and maintain stakeholder relationships that have been formed. The model can serve as a tourist attraction, education tool and conversation piece.

Prior to the P3DM component of the MEEOP, a Knowledge, Attitude and Practices (KAP) Survey was done under the MEEOP throughout the M2M network to gather responses related to the communities' perception of MNP, its features and threats, as well as suggestions on its management efforts. Information from these surveys assisted in legend development during the P3DM process. The data gathered from both the KAP Survey and the P3DM process will inform a Communication Plan with Management Strategies for the MNPESA.

Source: Provided by The Environmental Management Authority (2016).

8.2 Incorporation of Aichi Targets into the Revision of T&T's NBSAP

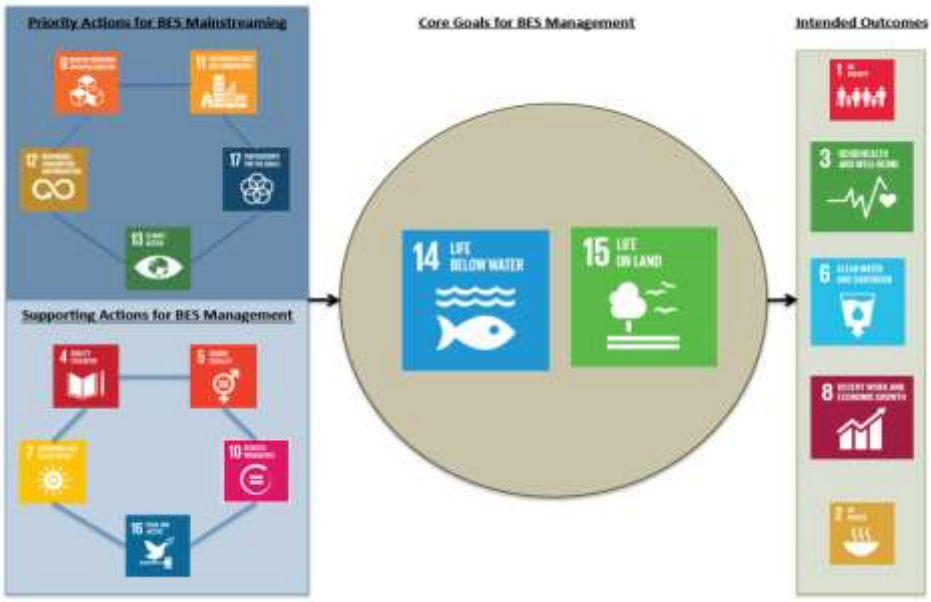
Q6: How has your national biodiversity strategy and action plan been updated to incorporate these (T&T Aichi) targets and to serve as an effective instrument to mainstream biodiversity?

8.2.1 Conceptual Basis for Incorporation of Targets

The ongoing process to revise T&T's NBSAP (February to October 2016), including the development of the strategies and actions for moving forward, is built upon three (3) main inputs, with the Aichi Targets at the core:

- **Core:** The draft list of Aichi Targets and Indicators for T&T developed in 2014 (Table 16). The national Targets for T&T were developed in 2014 and thus preceded the revision of T&T's NBSAP (2016 ongoing). The process to revise the NBSAP is therefore not required to develop national Targets, but rather the existing list of draft national Targets will be used to inform the NBSAP;
- The findings of the assessment of driving forces affecting BES in T&T, including the identification of priority drivers in T&T (Section 5.0). This serves as a basis for considering mainstreaming options and opportunities;
- An examination of the BES Management for T&T in the context of the SDGs that are the 2030 Sustainability Agenda – Figure 78.

Figure 78: BES Management in T&T in the Context of the 2030 Sustainability Agenda



A comparative review of the targets established for achieving the individual SDGs and the national biodiversity targets shows that achievement of all the national targets contributes directly and indirectly to achieving all the SDGs (Table 19).

Table 19: Relationship Between SDGs and National Biodiversity Targets

SDGs	National Biodiversity Target	How National Targets support SDG
1 - No Poverty	1, 5, 7	Addresses SDG target that seeks to reduce vulnerability and exposure to climate-related extreme events and environmental shocks and disasters
2 - Zero Hunger	7, 13, 16, 19, 20	Addresses SDG targets that *inter alia* seek to implement resilient agricultural practices that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality; maintain genetic diversity, promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge; increase investment in agricultural research, technology development, etc.
3 - Good Health and Well-Being	8	Supports SDG target that seeks to reduce number of deaths and illnesses from

SDGs	National Biodiversity Target	How National Targets support SDG
		hazardous chemicals and air, water and soil pollution and contamination
4 - Quality Education	1, 17, 18,	Supports SDG target that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles
5 - Gender Equality	16, 17, 18	Indirectly supports SDG targets that promote women's full and effective participation and equal opportunities for leadership at all levels of decisionmaking in political, economic and public life; require reformation to give women *inter alia* control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws
6 - Clean Water and Sanitation	7, 8, 14, 15, 17, 18, 19	Supports SDG targets that seek to improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials; protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
7 - Affordable and Clean Energy	3, 4, 19	Indirectly supports achievement of all targets for this SDG
8 - Decent Work and Economic Growth	2, 3	Indirectly supports achievement of target that seeks to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production
9 - Industry, Innovation and Infrastructure	2, 3, 19	Indirectly supports SDG target that promotes domestic technology development, research and innovation
10 - Reduced Inequalities	18	Indirectly supports SDG target to empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status
11 - Sustainable Cities and Communities	8, 14	Supports SDG targets that aim to strengthen efforts to protect and safeguard the world's cultural and natural heritage and reduce the adverse per capita environmental impact of cities
12 - Responsible Consumption and Production	1, 3, 4, 5, 6, 7, 8, 19	Supports SDG targets that seek to achieve the environmentally sound management of chemicals and all wastes throughout their life cycle; substantially reduce

SDGs	National Biodiversity Target	How National Targets support SDG
		waste generation; ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature
13-Climate Action	1, 5, 7, 10, 15	Supports SDG targets that aim to strengthen resilience and adaptive capacity to climate-related hazards and natural disasters; improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation,
14 - Life Below Water	6, 7, 8, 10, 11, 19	Directly supports SDG targets that aim to sustainably manage and protect marine and coastal ecosystems; effectively regulate harvesting and end unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks; conserve at least 10 per cent of coastal and marine areas
15 - Life on Land	2, 3, 4, 5, 7, 9, 16, 20	Directly supports all SDG targets
16 - Peace, Justice and Strong Institutions	18	Indirectly supports this SDG
17 - Partnerships for the Goals	19, 20	Indirectly supports targets related to finance, technology and capacity

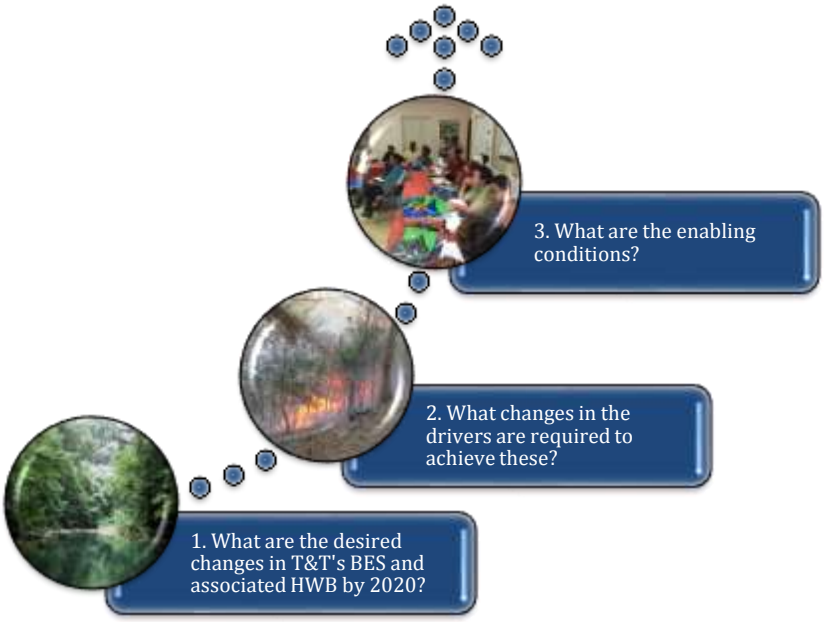
The resulting interconnections that link the National Targets, the direct drivers and the SDGs, provide the basis for the most effective means by which to advance T&T's efforts to manage its biodiversity both within the context of the Strategic Plan for Biodiversity (2011 – 2020) and beyond (Figure 79).

Figure 79: Main Inputs for Developing T&T's Revised NBSAP

The design and implementation of the existing NBSAP for T&T (2001) points to some important insights for updating the NBSAP, especially related to the incorporation of Targets and Indicators. One of the main challenges posed by the 2001 NBSAP is that it is a very ambitious plan for T&T – there were a total of 23 strategies with almost 70 associated activities. The lesson learned from this is that the revised NBSAP needs to focus on very high priority strategies and actions, and that there should be critical entry points for actions identified in order to create multiplier effects. As such, T&T's revised NBSAP is predicated on a selected group of priority national Targets, drawn from the draft list of 20 Targets and their accompanying 97 indicators.

A second important lesson learned from the existing NBSAP is that strategies and actions should be guided by measureable endpoints – i.e. while the NBSAP should focus on the driving forces that are affecting biodiversity and ecosystem services, T&T's success in measuring the impact of its NBSAP should not only be based on measuring changes in the indicators focused on drivers, but also on trying to track whether there are in fact positive changes in elements of BES and HWB. This therefore points to a need to work backwards from the desired outcomes to determine the strategies and actions required (Figure 80).

Figure 80: Concept Map Used to Guide the Determination of Strategies and Actions in the Revised NBSAP



9.0 Steps to Implement the CBD in T&T Since 2010

Q7: What actions has your country taken to implement the Convention since the fourth report and what have been the outcomes of these actions?

Since 2010, there have been a number of initiatives catalyzed, and measures put in place in T&T to implement the work of the CBD – please refer to Section 8.1 for the assessment of the progress made in implementing the 2001 NBSAP.

For the purpose of this Section, it is not prudent to try to list every activity undertaken/underway since 2010. As such, a few noteworthy activities are presented in Table 20 using the overall framework of the Strategic Plan for Biodiversity 2011 – 2020.

Table 20: Actions in T&T to Implement the Convention on Biological Diversity (2010 – 2016)

Strategic Goal	Activity description	Year started	Year Completed
Overarching	National Biodiversity Targets and Indicators: The EPPD of the Ministry with responsiblity for the environment, in its capacity as National Focal Point for the CBD facilitated the development of National Biodiversity Targets and Indicators. This was achieved through a consultative process involving the convening of stakeholder workshops, and soliciting of written comments. The list of Targets and Indicators was sent for Cabinet approval; and approval is still pending.	2014	2014 (Cabinet approval pending)
	Updating T&T's NBSAP: The process to update T&T's NBSAP began in February 2016 and is expected to be completed by October 2016. The revised NBSAP will consider the new 2030 Sustainable Agenda and the SDGs alongside the Aichi Targets.	2016	2016
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	In 2011, the Ministry of Planning and Sustainable Development partnered with the University of the West Indies to implement the ProEcoServ – see Appendix II (b). ProEcoServ's intention was to identify opportunities for mainstreaming BES into policies in T&T; to work with a wide range of stakeholders to build capacity in the use of	2010	2015

	mainstreaming tools; and to provide the GoRTT with preliminary data and information that could help to facilitate the mainstreaming process. In this regard, ProEcoServ focused on (1) fiscal planning (natural capital accounting); (2) developing a sustainable national incentive schemes (using T&T's Green Fund) to enhance the involvement of local communities and other civil society organizations in on-the-ground BES management; (3) developing capacity to use BES mainstreaming tools in land use planning. See Appendix II(b).		
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	There are a number of policies that were developed in T&T over the last several years that include BES protection as a principal or core component: • National Forest Policy (2011); • National Protected Areas Policy (2011); • National Climate Change Policy (2011); • National Wildlife Policy (2013); • Waste Management (Hazardous Waste) Rules (Draft 2014); • National Spatial Development Strategy Draft 2015) supported by the Planning and Facilitation of Development Act No 10/ 2014; • Comprehensive Economic Development Plan for Tobago (CEDP) 2.0 2013 – 2017: Redoubling the Effort; • Integrated Coastal Zone Management Policy Framework (Draft 2014); • Draft National Invasive Species Strategy and Action Plan (2013 – 2017); • Climate Change Adaptation and Mitigation Strategy (process ongoing).	Various	Various
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	Several measures were put in place to afford greater protection to BES, including: • National Protected Areas Policy (2011); • National Wildlife Policy (2013); • Designation of an additional seven (7) ESS under the ESS Rules (2001) - See Section 4.2.2;	Various	Various

	• A two-year moratorium was placed on the hunting of terrestrial wildlife species (2013 – 2015) & this was accompanied by the commissioning of a wildlife survey (2014 – 2017) to assess the status of wildlife populations; • A more integrated approach to overseeing and implementing activities related to the conservation and management of sea turtles was identified by the ministry with responsiblity for the environment. As such, the EPPD took the necessary steps to establish a Cabinet appointment National Sea Turtle Task Force, to oversee and coordinate such activities; • A project titled - A Biodiversity Monitoring System T&T, involving collaboration between Oxford University, The NH, UWI, Forestry Division and the Asa Wright Nature Centre (July 2005 to December 2008) was undertaken to build and maintain capacity in T&T to monitor habitats, detect changes in plant populations and measure the effects of management. The results of this study were published in 2015; • Improving Forest and Protected Area Management in T&T is a full-scale project funded by the GEF, the GoRTT, the European Union and the Food and Agriculture Organization (FAO). The project's overarching objective is to improve the sustainability of protected areas systems in T&T. The four (4) year project is intended to conserve biodiversity in the country by setting up a protected areas system and enhancing capacity and finance for conservation management. It will also assist in the implementation of the new National		

	Forest Policy and the National Protected Areas Policy[26]; • A baseline assessment of the Aripo Savannas was conducted (2013 – 2015); • An assessment of the Caroni Swamp was undertaken (2011 – 2015); • See policies under Goal B.		
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services	• T&T is not yet a Party to the Nagoya Protocol; and in order to support the countries of the Caribbean to capitalise on opportunities to make the Protocol operational in national jurisdictions, the United National Environment Programme (UNEP) in collaboration with the IUCN has developed a Caribbean Regional Project entitled "Advancing the Nagoya Protocol in Countries of the Caribbean Region". This Project is to be implemented over three (3) years beginning 2016 with grant funding from the GEF, and is being executed by IUCN Regional Office for Mexico, Central America and the Caribbean (ORMACC). The project is to be implemented in eight (8) CARICOM countries, including T&T. It has been designed to strengthen the capacity of participating countries on the modalities of implementation of the Protocol by providing training by regional and international specialists; • The National Restoration, Carbon Sequestration, Wildlife and Livelihoods Project (2010- 2017), is a pilot project in the Nariva Swamp funded by the Green Fund which seeks to enhance the livelihoods of local communities through reforestation and conservation programmes. One important intended outcome of the project is the enhancement of carbon sequestration services from the planting and maintenance of trees (Box 14).	Various	Various
Strategic Goal E: Enhance implementation through participatory	• A National Biodiversity Information System (NBIS) is in the process of being established by the EPPD on behalf of the GoRTT for the purpose of gathering and	Various	Various

[26] Source: http://eppd-tt.blogspot.com/2014/08/improving-forest-and-protected-area.html

planning, knowledge management and capacity building	managing biodiversity data and information in order to share it efficiently with all stakeholders, so as to ensure better decision making. The technical staff of the EPPD organised and undertook a training session for building capacity for a NBIS in support of the Biodiversity Clearing House of T&T from CONABIO during the period November 11th-15th, 2013 in St. Joseph, T&T. Key elements of the session included; sensitizing relevant stakeholders on the development of the NBIS, identification of data sources in T&T and training participants in the use and manipulation of the CONABIO'S NBIS (referred to as BIOTICA) for the collating and management of local biodiversity data and information; • In 2010, The EMA of T&Tcommissioned a NBATT to fill some critical gaps in knowledge related to biodiversity in T&T. Completed in 2012, this 476 page report provides a very detailed analysis of all aspects of T&T's biodiversity, it management, and steps needed to improve management; • A capacity building training programme conducted in the Department of Geomatics, Engineering and Land Management at the UWI was attended by eight (8) technical officers within the EPPD. In June/July 2014 technical staff of the EPPD were trained in Geographic Information Systems (GIS); as GIS was seen as being an essential a tool for managing and reporting on data related to hunting, forestry, protected areas and biodiversity. It has also been realised that GIS is necessary in the pursuit of the current upgrading of the Biodiversity Clearing House Mechanism of T&T; • In August 2013, a Sub-Regional Capacity Building Workshop on the National Action Plan/Integrated Financial Strategy (NAP/IFS) Alignment Process in the Caribbean Community Sub-Region		

	was organised and co-chaired by the EPPD in close collaboration with the UNCCD Secretariat, the GEF and the Caribbean Network for Integrated Rural Development (CNIRD) support staff. The objectives of the workshop were to provide technical support, training and guidance to CARICOM countries for the strengthening of national capacity to facilitate and give impetus to the alignment of their National Action Programmes. Several CARICOM parties to the Convention were in attendance. T&T was represented by two (2) members of the EPPD; • In May 2014 the Young Women's Christian Association of Trinidad and Tobago (YWCATT) partnered with the EPPD to give support in the implementation of its environmental programme. The programme was intended to expose young women to environmental education. The biodiversity portion of the programme consisted on conservation both at a global and at a national level.		

Box 14: The National Restoration, Carbon Sequestration, Wildlife and Livelihoods Project

The Nariva Swamp is the largest freshwater wetland in T&T and has a rich biodiversity due to the variety its vegetation communities: tropical rain forest, palm forest, mangroves and grass savanna/marshes. However, there were many hydrological changes which negatively impacted T&T's largest freshwater swamp. These included a water reservoir upstream being built in the 1960s and hundreds of acres cleared by illegal rice farmers from 1985 to 1996.

In April 2010, the EMA launched the Nariva Swamp Restoration, Carbon Sequestration and Livelihoods Project. The project was the first phase of the management plan for the Nariva Swamp and the product of over ten years of research from various researchers, educational institutions and government agencies. The initial focus was on the restoration of the marsh swamp forest (western area known as Sector B and the bowl) which was affected by the illegal rice farming. One of the core deliverables of the project in this regard is the anticipated replanting of 500 hectares of the Nariva Swamp by March 2017, through the collaborative effort of the EMA, the Forestry Division and the eleven CBO's attached to the project. Between 2010 and 2013, 192 hectares were planted; however, in March 2014, forest fires destroyed approximately 45 percent of the replanted area. In June 2014, another 22 hectares were planted.

The project was redesigned in February 2014 to include a wildlife component and is now called the National Restoration, Carbon Sequestration, Wildlife and Livelihoods Project (NRCSWLP). The project end date has not changed, but in addition to the original objectives, the project also seeks to undertake a National Wildlife Survey, a Species Research and Data Capture Program and the establishment of a Wildlife Rehabilitation Centre.

Sources: EMA (2014); EMA (2015)

Photo of fires in the Nariva Swamp (2010): Courtesy Robyn Cross

10.0 The Mainstreaming of Biodiversity in T&T

Q8: How effectively has biodiversity been mainstreamed into relevant sectoral and cross-sectoral strategies, plans and programmes?

Issues related to biodiversity are included in many different ways across sectoral policies, plans and strategies in T&T. However, the sustained decline in most aspects of BES, and the increase in intensity of pressures on BES seem to indicate that the manner in which mainstreaming has been occurring is hitherto not effective. Table 21 provides a summary of the inclusion of BES considerations (based on the Aichi Targets) across T&T's policy and legal framework.

During the course of the ProEcoServ (Appendix IIb), several deficiencies related to mainstreaming of BES in T&T were identified:

- *Lack of national priority on BES management:* T&T's development pathway to date has generally been characterised by economic growth at the expense of natural resources. The trends, for at least the last 30 years, in the country's biodiversity status and overall environmental condition speak clearly to this relationship. Although various government agencies manage portfolios whose purview include BES considerations, these considerations are not very often prioritized, especially where tradeoffs related to economic or social development are required;

- *Recent recognition of Ecosystem Services in the Policy Framework:* Biodiversity is a term that has long been included in various policy documents in T&T. However, it was not until the revision of the NEP in 2005 that the term 'ecosystem services' was incorporated into national level policy. The concept of ecosystem services and implications for management is still not well understood;

Fiscal planning in T&T does not take biodiversity and ecosystem services into account in any meaningful way (especially for the purpose of managing BES). At present, BES is not included in the national accounting framework in an explicit manner. Contributions to agriculture are captured in overall agricultural figures, but beyond this, other services have not been incorporated.

- *'Lack of implementation:* Several policy documents speak to the importance of biodiversity or give consideration to ecosystem services. However, accounting for and ensuring the

protection of biodiversity in land use planning or in climate change policy and action, and including BES into poverty reduction strategies have not been fully implemented;

- *Limited data and absence of mainstreaming tools:* Data and tools to support the mainstreaming of BES into T&T's planning and decision-making processes are generally lacking; and the science-policy interface remains weak. Prior to ProEcoServ, data on ecosystem services was not generated and made available in a manner that could effectively inform policy. The majority of data on other aspects of biodiversity has been (and continues to be) proxy-type data, which is usually not available in the correct form (collected systematically at the correct scales) to inform policy and decision-making. There has also been very limited use of mainstreaming tools. Even where mainstreaming tools have been/are used (e.g. economic valuation), their use has been very limited in scope. ProEcoServ (2011 – 2015) explored the use of biophysical modelling, economic valuation, natural capital accounting, strategic environmental assessments (SEAs), scenario development, and payments for ecosystem services (PES) to support aspects of T&T planning framework related to land use, fiscal planning and poverty reduction. The findings of ProEcoServ were that although there was significant interest in the use of these tools by the technical persons working within government agencies and local communities, the policy framework does not easily facilitate the application of tools. Capacity and funding to use tools also remain limited;

ProEcoServ Regional Capacity Building Workshop on Ecosystem Services Valuation, Trinidad (July, 2015)
Photo courtesy: ProEcoServ

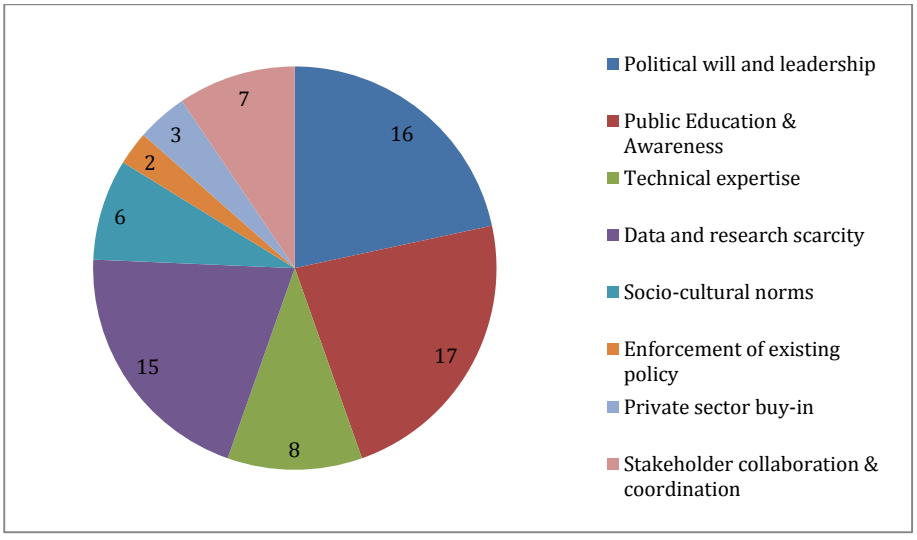
- *Interagency collaboration and coordination for BES mainstreaming remains weak:* The 4th National Report of T&T to the CBD and several other biodiversity-related assessments in T&T have highlighted the general lack of collaboration and coordination amongst government agencies and other stakeholders with respect to the management of BES. There are existing collaborations, such as the GEF/FAO's "Improving Forest and Protected Areas Management Project Steering Committee and other committees. However, the problem persists to today,

and there continues to be the absence of an effective coordinating mechanism for BES management in T&T;

- *Capacity for mainstreaming remains weak:* Although there have been many meetings, workshops and conference on various aspects of biodiversity and ecosystem services in T&T (and involving T&T citizens), capacity building for BES mainstreaming has not itself been mainstreamed.

A survey undertaken at the end of the ProEcoServ project (2015) to determine the perceptions of stakeholders regarding the challenges to mainstreaming of BES in T&T highlighted that public education; political will and leadership; and data and research scarcity are considered amongst the greatest hurdles to overcome in order to secure more effective management of BES across all sectors of society in T&T (Figure 81). The results of this survey highlighted that BES stakeholders in T&T are interested in participating in BES management, but that they feel constrained to do so because of capacity, information and government support.

Figure 81: Stakeholder Perceptions About the Challenges in Mainstreaming Biodiversity and Ecosystem Services in T&T



From a policy standpoint, the process to develop the NSDS for T&T (2012) served, *inter alia*, as an important pilot exercise to examine how BES could be mainstreamed into national development planning. This is an important sector for BES management because land use/land cover change is the greatest single threat to BES in T&T (see Section 5). The NSDS sought to consider how to address

some of the deficiencies in the mainstreaming approach (Figure 82). During the course of the process to develop the NSDS, a Multi-stakeholder Development Planning Steering Committee was installed to provide leadership; scenarios were used as a tool to consider possible outlooks for land use planning in T&T; data and information were collected to assess the impact of land use in T&T; and ProEcoServ was engaged to provide data on critical ecosystem services in T&T as well as to begin to build awareness and capacity in the use of tools such as Strategic Environmental Assessments, Economic Valuation and InVest.

Figure 82: Excerpt from the (Draft) NSDS Core Document (2012)

Integrated planning for Sustainable Development

1. Ecosystems provide a range of life-supporting services, such as water, air-sustaining vegetation, valued natural resources, food, and much more. Fragile, but vital features like the rainforests and swamps require special protection, but the synergy between human life and all elements of the ecosystem needs to be recognised in spatial planning decisions.
2. Hillside developments warrant particular care to avoid destabilising land, changing water flows and causing flooding. Strict and restrictive policies are needed to prevent harmful impacts.
3. Agriculture has been "neglected" for too long, but the rising costs of food imports and the associated lack of food security are causes for concern. Agriculture needs boosting through coordinated programmes of planning and action, whilst ensuring harm to ecosystems is avoided.
4. Tourism brings economic benefits but can cause environmental harm. Emphasis needs to be on Eco-tourism, working with the environment and supporting local economies, including the agricultural and fisheries sectors.
5. Urban development has been rapid, extensive and very land-consuming in recent decades, causing loss of productive land, inefficient patterns of settlement, travel, service delivery and infrastructure provision. A more sustainable approach is required, including more efficient urban forms and better urban design.
6. Climate change is expected to have significant impacts, including more volatile weather, increased intensity of storms and flooding, rising sea level with resultant coastal changes and changing conditions for food production both on land and at sea. Integrated responses are required.
7. Marine ecosystems are valuable, often fragile – particularly swamps and reefs - and provide essential life services. At the same time the marine environment plays a vital economic role, providing resources such as energy, food and the basis for much of the tourism industry. Ports, shipping and marine services play vital economic roles and water transport may have an increasingly important role within an integrated transport strategy. The environmental impacts of developing these sectors necessitate integrated planning and management so that the economy-supporting and health and service-providing capabilities of this complex environment can be maintained.
8. Oil and gas have literally fueled economic and social development for decades, but they have not been used as efficiently as they could be. The aim now must be to make the most of the economic value of these rich but finite resources – and the technological expertise they have generated - making more efficient use of them domestically and maximizing the value gained from international marketing.
9. Renewable energy has much potential to reduce reliance on finite resources of fossil fuels and to enable a shift to a more energy-efficient future. Solar, wind, biological and marine energy sources all have contributions to make.
10. Airports provide vital links with overseas markets, colleagues, cultures and families. Their roles and potential as national gateways need to be supported whilst environmental impacts need to be managed positively.
11. Transport is vital to the economic and social life of the nation but it needs to work much more efficiently. Congestion and associated, inefficiency, waste and pollution require that a fully integrated approach is adopted to move from car dependence to modal choice.
12. Regional development needs to be based on each region playing to its particular strengths, with diversity valued and regional contributions fully harmonised.

Source: GoRTT (2012b)

Despite the numerous benefits that this policy would offer to biodiversity management, the NSDS remains in a draft form, and its potential benefits are thus indefinitely on hold. The main factor affecting its adoption is political will, support and continuity.

Table 21: Summary of the Inclusion of Biodiversity Considerations in Selected Policies, Plans and Laws in T&T

List of Main National Policies/Plans/Laws with relevance to Biodiversity	Status	Strategic Goals																		
		A				B						C		D			E			
GENERAL ENVIRONMENTAL MANAGEMENT AND DEVELOPMENT		Aichi Biodiversity Targets																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Environmental Management Act 2000	1	X	X	X	X	X	X	X	X		X	X	X		X	X		X	X	X	
Certificate of Environmental Clearance Rules 2001	1	X	X		X	X	X	X	X		X	X	X		X				X	X	
National Environmental Policy 2005	2, 3, 4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
The Town and Country Planning Act 1960	2, 3, 4		X																		
The Planning and Facilitation of Development Act 2014	2		X			X		X			X	X			X				X		
State Lands Act Chap. 57:01	2, 4					X					X										
Standards Act Chap. 82:03	1	X							X		X										
People's National Movement Manifesto 2015	1	X		X		X		X				X			X					X	
National Climate Change Policy, 2011	1	X	X	X	X	X	X	X	X	X	X	X			X	X			X	X	X
National Physical Development Plan 1982	2, 3, 4					X															
National Spatial Development Strategy, 2015	5	X	X			X	X	X			X	X			X	X			X		
Comprehensive Economic Development Plan for Tobago 2.0 2013-2017	2	X	X		X		X	X	X		X										
National Tourism Policy	2	X	X	X		X					X	X			X	X			X	X	
Integrated Coastal Zone Management Policy Framework	5	X		X	X	X	X	X	X	X	X	X			X	X			X	X	
PROTECTED AREAS																					
Forests Act Chap. 66:01	1, 4					X						X									
Agricultural Fires Act Chap. 63:02	2					X															

List of Main National Policies/Plans/Laws with relevance to Biodiversity	Status	Strategic Goals																		
		A				B						C		D			E			
GENERAL ENVIRONMENTAL MANAGEMENT AND DEVELOPMENT		Aichi Biodiversity Targets																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Environmentally Sensitive Areas Rules No. 37/2001	1	X	X		X	X	X	X			X	X	X		X	X			X	X	
Marine Areas (Preservation and Enhancement) Act Chap. 37:02	2, 4				X	X	X				X	X									
Institute of Marine Affairs Act Chap. 37:07	1	X	X		X	X	X				X	X			X					X	
National Protected Areas Policy, 2011	2	X	X	X	X	X	X	X			X	X	X		X	X	X		X	X	X
TERRESTRIAL AND MARINE BIODIVERSITY																					
Conservation of Wild Life Act Chap. 67:01	1, 4										X										
Environmentally Sensitive Species Rules No. 78/2001	1	X	X		X	X					X	X	X	X					X	X	
Archipelagic Waters and Exclusive Economic Zone Act Chap. 51:06	2					X	X		X		X										
Fisheries Act 67:51	1, 4					X	X				X	X									
National Forest Policy, 2011	2	X	X	X	X	X		X	X	X	X	X	X		X	X			X	X	X
National Wildlife Policy, 2013	2	X	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X
National Policy and Programmes on Wetland Conservation for Trinidad and Tobago, 2002	2, 4	X	X			X	X	X	X		X	X			X	X			X	X	
Fisheries Management Policy 2013	5	X	X	X	X	X	X	X		X	X	X	X		X	X			X	X	X
ALIEN INVASIVE SPECIES																					
Animals (Diseases and Importation) Act Chap. 67:02	1, 4							X		X											
Plant Protection Act, Chap. 63:56	2, 4							X		X											
Control of Importation of Live Fish Act Chap. 67:52	2						X	X		X											

List of Main National Policies/Plans/Laws with relevance to Biodiversity	Status	Strategic Goals																			
		A				B						C			D			E			
GENERAL ENVIRONMENTAL MANAGEMENT AND DEVELOPMENT		Aichi Biodiversity Targets																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Mongoose Act (rev. 1980)	1							X		X											
Beekeeping and Bee Products Act Chap. 67:53	1							X		X											
POLLUTION																					
Oil Pollution of Territorial Waters Chap. 37:03	1								X	X	X										
Continental Shelf Act Chap. 1:52	1								X												
Water Pollution Rules No. 12/2007	1		X		X				X		X										
Water and Sewerage Act Chap. 54:40	1, 4								X		X										
Waterworks and Water Conservation Act Chap. 54:41	1, 4								X												
Shipping Act Chap. 50:10	1, 4								X		X										
Air Pollution Rules, No. 12/2015	1		X		X				X		X										
Motor Vehicles and Road Traffic Act Chap. 48:50	1								X		X										
Noise Pollution Control Rules No. 60/2001	1				X				X		X										
Pesticides and Toxic Chemicals Act Chap. 30:04	1								X		X										
Waste Management (Hazardous Waste) Rules (Draft), 2014	1		X		X				X		X										
Litter Act 30:52	1								X		X										
Highways Act Chap. 48:01	1								X		X										
Public Health Ordinance, Chap. 12:04	2, 4								X		X										
Malaria Abatement Act Chap. 28:50	2, 4								X		X										
Dry River Act Chap. 26:50	2, 4								X		X										
Municipal Corporations Act Ch. 25:04	1								X		X										
NATURAL RESOURCE EXTRACTION																					
Minerals Act Chap. 61:03	1								X		X										

List of Main National Policies/Plans/Laws with relevance to Biodiversity	Status	Strategic Goals																			
		A				B						C			D			E			
GENERAL ENVIRONMENTAL MANAGEMENT AND DEVELOPMENT		Aichi Biodiversity Targets																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Petroleum Act Chap. 62:01	1								X		X										
MISCELLANEOUS																					
Freedom of Information Act Chap. 22:02	1	X																			
Finance Tax Act, 13 of 2010	1			X	X																
Miscellaneous Taxes Act Ch. 75:01	1															X	X				X
Disaster Measures Act Chap. 16;50	1, 4																				

Key for Implementation Status:

1. Implemented; 2. Limited implementation; 3. Under review/revision; 4. Outdated; 5. Draft

PART III

Progress towards the 2020 Aichi Biodiversity Targets and Contributions to the Relevant 2015 Targets of the Millennium Development Goals

Photo courtesy Lena Dempewolf
Research to support decision-making: Pollinator exclusion experiments in the Nariva Swamp, Trinidad

11.0 Progress Towards the 2020 Aichi Biodiversity Targets and Contributions to the Relevant 2015 Targets of the Millennium Development Goals

11.1 Progress in Implementing the 2020 Strategic Plan

Q10: What progress has been made by your country towards implementation of the Strategic Plan for Biodiversity (2011 – 2020) and its Aichi Biodiversity Targets?

T&T's progress towards implementing the Strategic Plan for Biodiversity and its Aichi Targets has been met with several challenges. Two (2) core aspects associated with the Strategic Plan are hitherto not approved for national implementation:

1. The T&T national Targets were drafted in 2014, and have not yet received Cabinet approval;

2. Revision of the NBSAP, which ideally should have taken at the early stages of implementation of the Strategic Plan, only began in 2016, and this has likely delayed certain actions and progress.

As shown in Table 22, progress or movement away from the Targets in the majority of cases is limited. Reforestation efforts and initiatives geared at enhancing Protected Areas are the two (2) aspects of BES management in T&T that have received some attention. The likelihood of meeting the national Targets by 2020 is shown in Table 20.

Table 22: Summary Assessment of T&T's Progress Towards the Strategic Plan for Biodiversity (2011 – 2020) and its Aichi Biodiversity Targets

Strategic Goals	Global Target	T&T National Targets	T&T Progress towards Goal and Targets (2016)
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	**Target 1** By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	1a. By 2020, at the latest, at least 50% of people are aware of the values and understanding of biodiversity. 1b. By 2020, at the latest, at least 30% of people are aware of the steps they can take to conserve and use biodiversity sustainably.	↗
	Target 2 By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	2a. By 2020, at the latest, biodiversity valuation has been integrated into at least 50% of national and local development and poverty reduction strategies, and planning processes and reporting systems. 2b. By 2020 at the latest, biodiversity values are integrated into national and local plans.	→
	Target 3 By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid	3a. By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are reformed in order to minimize or avoid negative impacts. 3b. Positive incentives for the conservation and sustainable use of biodiversity are developed and applied,	→

Strategic Goals	Global Target	T&T National Targets	T&T Progress towards Goal and Targets (2016)
	negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	consistent and in harmony with the Convention and other relevant international obligations.	
	Target 4 By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	4. By 2020, at the latest, the Government, business and stakeholders have taken steps to achieve or have implemented plans to keep the impacts of use of natural resources within safe ecological limits.	➔
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use	**Target 5** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	5. By 2020, the rate of loss of all natural habitats, including marine habitats, is at least halved and degradation and fragmentation is significantly reduced.	↗
	Target 6 By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and	6. By 2020 at least 30% of the major commercially important fish, invertebrate stocks and aquatic plants are managed and harvested sustainably.	↘

Strategic Goals	Global Target	T&T National Targets	T&T Progress towards Goal and Targets (2016)
	ecosystems are within safe ecological limits		
	Target 7 By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	7a. By 2020 at least 30% of areas under agriculture are managed sustainably, ensuring conservation of biodiversity. 7b. By 2020 aquaculture activities are managed sustainably, ensuring conservation of biodiversity. 7c. By 2020 at least 50% of areas under forestry are managed sustainably, ensuring conservation of biodiversity.	↘
	Target 8 By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	8. By 2020, pollution, including from excess nutrients, at key sites has been brought to levels that are not detrimental to ecosystem function and biodiversity.	↘
	Target 9 By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	9a. By 2020, invasive alien species and pathways are identified and prioritised for action. 9b. By 2020, at least 40% of priority terrestrial IAS species present are controlled or eradicated at priority sites. 9c. By 2020, at least 50% of priority marine IAS species present are controlled or eradicated at priority sites. 9b. By 2020, measures are in place to manage pathways to prevent their introduction and establishment.	↗
	Target 10 By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimised, so as to maintain their integrity and functioning.	10. By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable coastal ecosystems impacted by climate change are minimised, so as to maintain their integrity and functioning.	↘
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	**Target 11** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for	11. By 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are managed consistent with approved plans.	↗

Strategic Goals	Global Target	T&T National Targets	T&T Progress towards Goal and Targets (2016)
	biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes		
	Target 12 By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	12. By 2020 the extinction of at least 60% of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	↘
	Target 13 By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimising genetic erosion and safeguarding their genetic diversity.	13. By 2020, the genetic diversity of priority, native socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for safeguarding their genetic diversity.	→
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services	**Target 14** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	14. By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are rehabilitated and managed, taking into account the needs of local communities, and the poor and vulnerable.	↘
	Target 15 By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and	15. By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced, through conservation and rehabilitation, including rehabilitation of at least 15 per cent of degraded ecosystems.	↗

Strategic Goals	Global Target	T&T National Targets	T&T Progress towards Goal and Targets (2016)
	restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.		
	Target 16 By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation is in force and operational, consistent with national legislation.	16. By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is ratified by the Government.	↗
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building	**Target 17** By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	17. By 2015 the Government has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	➔
	Target 18 By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	18. By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, are integrated and reflected in the implementation of the Convention in a participatory manner.	➔
	Target 19 By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and	19. By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied at key sites.	↗

Strategic Goals	Global Target	T&T National Targets	T&T Progress towards Goal and Targets (2016)
	trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.		
	Target 20 By 2020, at the latest, the mobilisation of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	20. By 2020, at the latest, the mobilization of and access to financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 including the updated NBSAP, from all sources, increased substantially from the current levels.	➔

Table 23 summarizes the available data sources for each of the T&T Targets and indicators.

Table 23: Summary of Available Data for T&T's Draft Aichi Biodiversity Targets and Indicators

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
1a. By 2020, at the latest, at least 50% of people are aware of the values and understanding of biodiversity. 1b. By 2020, at the latest, at least 30% of people are aware of the steps they can take to conserve and use biodiversity sustainably.	i. Access to local biodiversity information	i. Not available	i. Not available	i. Not available
	ii. Number of different information documents produced	ii. Not available	ii. >700 (1991 – 2011)	ii. NBATT (2012)
	iii. Number of activities to promote awareness on values of biodiversity.	iii. Not available	iii. Not available	iii. Not available
	iv. Number of activities to promote steps to conserve and sustainably use biodiversity.	iv. Not available	iv. Not available	iv. Not available
	v. Number of people aware of biodiversity and its importance	v. Not available	v. Not available	v. Not available
	vi. Change in the level of awareness on the values of biodiversity (%)	vi. Not available	vi. Not available	vi. Not available
2a. By 2020, at the latest, biodiversity valuation has been integrated into at least 50% of national and local development and poverty reduction	i. Number of national initiatives that incorporate biodiversity valuation.	i. Not available	i. Not available	i. Not available
	ii. Number of local (regional corporation, THA) development plans that	ii. Not available	ii. Not available	ii. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
strategies, and planning processes and reporting systems. 2b. By 2020 at the latest, biodiversity values are integrated into national and local plans.	incorporate biodiversity valuation. iii. Number of national reports that incorporate biodiversity values and valuation. iv. Level of financial support for biological collecting, monitoring and evaluation. v. Number of policy and legislative documents that target biodiversity valuation and management.	 iii. Not available iv. Not available v. 57(?)	 iii. Not available iv. Not available v. Not available	 iii. Not available iv. Not available v. Table 19
3a. By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are reformed in order to minimize or avoid negative impacts. 3b. Positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant	i. Change in the number of incentives harmful to biodiversity. ii. Change in the number of incentives reformed to minimize or avoid negative impacts on biodiversity. iii. Number of positive incentives for conservation or sustainable use of biodiversity. iv. Change in the value of incentives for conservation or sustainable use of biodiversity.	i. Not available ii. Not available iii. Not available iv. Not available	i. Not available ii. Not available iii. Not available iv. Not available	i. Not available ii. Not available iii. Not available iv. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
international obligations.	v. Change in the value of harmful incentives vi. Value of incentives reformed to minimize or avoid negative impacts on biodiversity.	v. Not available vi. Not available	v. Not available vi. Not available	v. Not available vi. Not available
4. By 2020, at the latest, the Government, business and stakeholders have taken steps to achieve or have implemented plans to keep the impacts of use of natural resources within safe ecological limits.	i. Number of plans prepared to reduce negative impacts of use of natural resources. ii. Number of plans implemented to reduce negative impacts of use of natural resources. iii. New technologies implemented to reduce negative impacts of use of natural resources.	i. Not available ii. Not available iii. Not available	i. Not available ii. Not available iii. Not available	i. Not available ii. Not available iii. Not available
5. By 2020, the rate of loss of all natural habitats, including marine habitats, is at least halved and degradation and fragmentation is significantly reduced.	i. Change in area of natural forest, by types of forest. ii. Change in area of plantation forest. iii. Change in area of wetlands by type of wetlands iv. Change in area, rugosity and diversity of coral reefs	i. See Figure 16 (2015) ii. 20,306 Ha (2015) = -6% ii. Not available iv. 33% decrease hard coral	i. See Figure 16 (1970) ii. 21,614 Ha (1970) iii. Mangroves = 9,396.3 Ha (2007) iv. 1985 baseline	I & ii. FAO FRA T&T Country Report (2010); FRA 2015. iii. 2007 data (Juman and Ramsewak, 3013b)

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
	v. Change in area of seagrass beds	v. No aggregate	v. No aggregate	v. Not vailable
	vi. Change in area of fire degraded habitats	vi. >50,000 (2015)	vi. (1998)	vi. GORTT (2010); NBATT (2012); Forestry Division (2016)
	vii. Change in area of natural habitats degraded or lost through conversion.	vii. Not available	vii. Not available	vii. Not available
6. By 2020 at least 30% of the major commercially important fish, invertebrate stocks and aquatic plants are managed and harvested sustainably.	i. Number of site, species or fishery specific management plans prepared.	i. Not available	i. Not available	i. Not available
	ii. Number of site, species or fishery management plans implemented.	ii. Not available	ii. Not available	ii. Not available
	iii. Number of commercial fish species and invertebrates harvested in accordance with management plans.	iii. Not available	iii. Not available	iii. Not available
	iv. Number of aquatic plants and depleted species under threat from harvesting.	iv. Not available	iv. Not available	iv. Not available
	v. Number of illegal fishing activities reported.	v. Not available	v. Not available	v. Not available
	vi. Number of illegal fishing activities leading to conviction.	vi. Not available	vi. Not available	vi. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
	vii. Change in status of key species of commercial fish and invertebrate stocks. viii. Change in no of fisher folk who use or adopt sustainable fishing techniques. ix. Change in awareness and knowledge of sustainable fishing techniques.	vii. No aggregate viii. Not available ix. Not available	vii. No aggregate viii. Not available ix. Not available	vii. Table 12 viii. Not available ix. Not available
7a. By 2020 at least 30% of areas under agriculture are managed sustainably, ensuring conservation of biodiversity. 7b. By 2020 aquaculture activities are managed sustainably, ensuring conservation of biodiversity. 7c. By 2020 at least 50% of areas under	i. Area under agriculture. ii. Area under agriculture sustainably managed. iii. Number of aquaculture projects. iv. Number of aquaculture projects that contribute to conserving local biodiversity. v. Number of native species cultivated.	i. 830 km² - Trinidad (2010); 5km² – Tobago (2010) ii. Not available iii. Not available iv. Not available v. Not available vi. Not available	i. 770 km² (1990) i. 131,572 ha (1982) ii. Not available iii. Not available iv. Not available v. Not available vi. Not available	i. 2010 data – GoRTT (2012a); 1990 data – WB (2016)[27]; 1982 data – FAO[28] ii. Not available iii. Not available iv. Not available v. Not available

[27] http://data.worldbank.org/indicator/AG.LND.AGRI.ZS?locations=TT
[28] www.fao.org/fileadmin/ess/documents_and_meetings/iica_2013/linkages_TT_10_12June2013/presentations/Trinidad_and_Tobago_Agriculture_statistics.pdf

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
forestry are managed sustainably, ensuring conservation of biodiversity.	vi. Number of non- native species cultivated vii. Acreage of non-native species. viii. Acreage of native species. ix. Number of aquaculture projects managed in accordance with global standards and best practices. x. Area under forest management. xi. Area under sustainably managed forests.	vii. Not available viii. Not available ix. Not available x. 143,000 ha (2010) xi. 143,000 ha (2010)	vii. Not available viii. Not available ix. Not available x. 143,000 ha (1990) xi. 143,000 ha (1990)	vi. Not available vii. Not available viii. Not available ix. Not available x. FAO FRA (2010) xi. FAO FRA (2010)
8. By 2020, pollution, including from excess nutrients, at key sites has been brought to levels that are not detrimental to ecosystem function and biodiversity.	i. Change in the level of all types of pollution at key sites. ii. Number of measures in place to control pollution. iii. Change in biodiversity at key sites affected by pollution. iv. Number of occurrences in non-compliance with pollution rules.	i. Not available ii. Not available iii. Not available iv. Not available	i. Not available ii. Not available iii. Not available iv. Not available	i. Not available ii. Not available iii. Not available iv. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
9a. By 2020, invasive alien species and pathways are identified and prioritized for action. 9b. By 2020, at least 40% of priority terrestrial IAS species present are controlled or eradicated at priority sites. 9c. By 2020, at least 50% of priority marine IAS species present are controlled or eradicated at priority sites. 9b. By 2020, measures are in place to manage pathways to prevent their introduction and establishment.	i. Number of IAS identified that are immediate threats. ii. Number of pathways identified as immediate threats. iii. Number of IAS controlled or eradicated. iv. Number of measures in place to prevent introduction of IAS. v. Number of new IAS identified in T&T annually.	i. 36 (2010) ii. Not available iii. Not available iv. Not available v. Not available	i. 57 (2016) ii. Not available iii. Not available iv. Not available v. Not available	i. Global Invasive Species Database (2016) ii. Not available iii. Not available iv. Not available v. Not available
10. By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable coastal ecosystems impacted by climate change are	i. Number of management plans approved ii. Number of management plans implemented to reduce anthropogenic impacts on coral reefs and	i. Not available ii. Not available	i. Not available ii. Not available	i. Not available ii. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
minimized, so as to maintain their integrity and functioning.	other vulnerable ecosystems. iii. Change in anthropogenic impacts on coral reefs and other vulnerable coastal ecosystems.	iii. Not available	iii. Not available	iii. Not available
11. By 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are managed consistent with approved plans.	i. Percentage of terrestrial area including inland waters protected. ii. Percentage of coastal and marine areas protected. iii. Number of management plans implemented for these areas.	i. & ii. combined 31% (2016); 32% (2014) iii. Not available	i. & ii. Combined 7% (1990) iii. Not available	i. & ii. 2016 – UNEP-WCMC (2016); 2014 - GoRTT (2014) 1990 – IUCN (2010) iii. Not available
12. By 2020 the extinction of at least 60% of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	i. Number of threatened species. ii. Number of management plans for threatened species and habitats implemented. iii. Change in population/status of threatened species.	i. 66 animal species (2015) + 56 plant species (2016) ii. Not available iii. Not available	i. 59 species (2010) ii. Not available iii. Not available	i. IUCN Red List (2015) ;Baksh-Comeau et al (2016);GoRTT (2010) ii. Not available iii. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
13. By 2020, the genetic diversity of priority, native socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for safeguarding their genetic diversity.	i. Number of native socio-economically and culturally valuable species utilized.	i. Not available	i. Not available	i. Not available
	ii. Number of strategies developed for safeguarding native socio-economically and culturally valuable species.	ii. Not available	ii. Not available	ii. Not available
	iii. Number of strategies implemented for safeguarding native socio-economically and culturally valuable species.	iii. Not available	iii. Not available	iii. Not available
	iv. Measures in place to protect erosion of genetic resources	iv. Not available	iv. Not available	iv. Not available
14. By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are rehabilitated and managed, taking into account the needs of local communities, and the poor and vulnerable.	i. Number and acreage of degraded ecosystems	i. Not available	i. Not available	i. Not available
	ii. Number and acreage of degraded ecosystems rehabilitated and managed.	ii. Not available	ii. Not available	ii. Not available
	iii. Number of people employed or gaining a livelihood from rehabilitated ecosystems	iii. Not available	iii. Not available	iii. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
15. By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced, through conservation and rehabilitation, including rehabilitation of at least 15 per cent of degraded ecosystems.	i. Percentage of degraded ecosystems rehabilitated. ii. Contribution of natural forest to carbon stocks. iii. Contribution of plantation forests to carbon stocks. iv. Number of carbon sinks created annually.	i. Not available ii. Figure 19 iii. Figure 19 iv. Not available	i. Not available ii. Figure 19 iii. Figuer 19 iv. Not available	i. Not available ii. Figure 19 iii. Figure 19 iv. Not available
16. By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is ratified by the Government.	i. Number of work programmes that incorporate some of the provisions of the Nagoya Protocol. ii. Number of legal instruments supporting implementation of the Nagoya Protocol. iii. Number of PA and education events to promote info on ABS	i. 0 (2016) ii. 0 (2016) iii. 1 (2016)	i. 0 (2016) ii. 0 (2016) iii. 0 (2015)	i. EPPD pers. comm. (2016) ii. EPPD pers. comm. (2016) iii. EPPD pers. comm. (2016)
17. By 2015 the Government has developed, adopted as	i. Number of consultations held in preparing the updated NBSAP.	i. 4 (2016)	i. N/A	i. NBSAP process (IUCN, 2016)

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	ii. Level of participation in consultations held in preparing the updated NBSAP. iii. Approval of the revised NBSAP by the Government. iv. Number of work programmes that incorporate elements of the updated NBSAP.	ii. TBD iii. N/A iv. N/A	ii. N/A iii. N/A iv. N/A	ii. TBD iii. N/A iv. N/A
18. By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, are integrated and reflected in the implementation of the Convention in a participatory manner.	i. Number of documented traditional knowledge, innovations and practices of indigenous and local communities. ii. Number of biodiversity related activities implemented that incorporates traditional knowledge, innovations and practices of indigenous and local communities. iii. Level of participation by local communities in management of biodiversity.	i. Not available ii. Not available iii. Not available iv. Not available	i. Not available ii. Not available iii. Not available iv. Not available	i. Not available ii. Not available iii. Not available iv. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
	iv. Number of research projects utilizing indigenous and local knowledge.			
19. By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied at key sites.	i. Number of scientific studies on local biodiversity published annually. ii. Number of skilled persons by disciplines, managing biodiversity. iii. Change in access and use of biodiversity information. iv. Number of biodiversity research projects undertaken. v. Number of records per year to citizen science websites.	i. Not available ii. Not available iii. Not available iv. 42 (2011) v. Not available	i. Not available ii. Not available iii. Not available iv. 1 (1991) v. Not available	i. Not available ii. Not available iii. Not available iv. NBATT (2012) v. Not available
20. By 2020, at the latest, the mobilization of and access to financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 including the updated NBSAP, from all sources, increased	i. Total funds allocated annually by government for management of biodiversity. ii. Total funds derived from donors (e.g. GEF) for management of biodiversity. iii. Total funds from other sources e.g. Green Fund, for management of biodiversity.	i. Not available ii. Not available iii. Not available	i. Not available ii. Not available iii. Not available	i. Not available ii. Not available iii. Not available

NATIONAL TARGETS	INDICATORS	MOST UP-TO-DATE MEASURE	BASELINE MEASURE (where applicable)	DATA SOURCE(S)/ REFERENCE(S)
substantially from the current levels.	iv. Total funds from the private sector for management of biodiversity	iv. Not available	iv. Not available	iv. Not available
	v. Total dollar value of projects implemented annually for management of biodiversity.	v. Not available	v. Not available	v. Not available

11.2 Contributions to the Millennium Development Goals

Q11: What has been the contribution of actions to implement the Convention towards achievement of the relevant 2015 Targets?

Table 24 summarises T&T's progress in respect of the MDGs related to BES. This table utilises information from T&T's 2014 MDG Progress report as well from a number of other sources.

Table 24: Summary of T&T's Progress in Meeting the Millennium Development Goals, Focusing on Issues of Relevance to BES

Millennium Development Goal	Description of the Contribution of T&T's Actions to Implement the CBD Towards the MDGs
	T&T has been successful in its efforts to reduce poverty levels, but there is little evidence that success is based on any actions related to BES management. Rather poverty reduction is reportedly linked to improved social services such as education, health care and transportation.
	Progress is reported in this Goal, but there is no link with BES management. Rather, success is related to better infrastructure and access to education services.
	Women's roles in decision-making and in the non-agricultural sectors were improved, but there is little evidence to suggest any linkages with BES management.
	T&T has shown success in reducing child mortality, but this is directly linked to improved policies and practices in the health care sector. There are no direct or even indirect linkages to BES management efforts.
	T&T has shown success in improving maternal health, but this is directly linked to improved policies and practices in the health care sector. There are no direct or even indirect linkages to BES management efforts.
	Mosquito borne diseases are being more effectively managed. • Malaria has been eradicated through effective health care. • There is evidence to suggest that changes in rainfall and temperature linked to climate change have been increasing the incidence of diseases like Dengue (Figure 74), and the GoRTT has been implementing preventative measures to

Millennium Development Goal	Description of the Contribution of T&T's Actions to Implement the CBD Towards the MDGs
	reduce mosquito levels (such as regular spraying and visits to homes and offices to eliminate mosquito breeding grounds) in order to better manage this disease. • More recently, other mosquito borne diseases such as the Zika virus (genus Flavivirus) and the Chickungunya virus (genus Alphavirus) are also affecting T&T, and the same preventative measures for Dengue are in place for these diseases.
	Target 7.A Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources. • T&T has developed several policies and programmes in order to safeguard biodiversity. Target 7.B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss. • Indicator 7.1 Proportion of land area covered by forest (Target – more than 1996 baseline of 44.85%): The Target has reportedly been met. Based on the 2014 GoRTT MDG report, forest cover increased from 44.1% in 2005 to 48% in 2012. Data from the Forestry Division (2016) indicate that forest cover is currently estimated at 45.7%, (2015). This is higher than the 44.85% Target. • Indicator 7.2 Carbon Dioxide absolute emissions (Target less than 25,397.2Gg). This Target has not been met. CO_2 levels from activities in T&T continue to rise. • Indicator 7.3 Consumption of Ozone Depleting Substances (Target – less than 168.7 tonnes). Consumption of ozone depleting substance dropped from 168.7 tonnes in 1990 to 34.34 tonnes in 2011. This Target was surpassed, but the implications for BES in T&T are unclear. • Indicator 7.4 Proportion of fish stocks within safe biological limits (no specific Target). It has been recognized that the safe biological limits for many commercially important fish stocks has been surpassed, and this Target has therefore not been met. • Indicator 7.6 Proportion of terrestrial and marine Protected Areas (no Target). The most recent quantitiative data indicate that 32% of T&T's land and 0.1% of its marine space is protected (GoRTT, 2014). On the basis of the T&T's national Aichi Target #11, it would appear that T&T is doing well in the protection of land area (Aich Target: 17% land area protected); but that the country is well below its desired Target in terms of coastal and marine areas protected (Aich Target: 10% coastal and marine area protected). • Indicator 7.7 Proportion of species threatened with extinction (no Target). There has been an increase in the number of threatened species since 2010. Most recently (2015), it is estimated that there are 66 threatened animal species (in the IUCN categories - extinct, extinct in the wild, critically endangered, endangered and vulnerable); and 56 threatened plants (in the IUCN categories - extinct, extinct in the wild, critically endangered, endangered and vulnerable).

Millennium Development Goal	Description of the Contribution of T&T's Actions to Implement the CBD Towards the MDGs
	Target 7.C: Halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation. • Indicator 7.8 Proportion of population using an improved drinking water source (Target 82.5%). It is reported that between 1990 and 2011, this % of the population in T&T with improved access to water increased from 55 to 76. More recent (verifiable) estimates are not available. A large proportion of the potable drinking water in T&T is derived from natural sources (surface and groundwater) – Figure 3. Maintaining these sources is of critical importance to ensuring a sustainable supply of water.
	The GoRTT (2014) describes a range of partnerships developed regionally and globally for development – many of which are related to trade and financial services. There are no specific mentions of partnerships for BES management. However, through continued relationships with donors such as the InterAmerican Development Bank (IDB), the Global Environment Facility (GEF), the EU (e.g. through its ACP Fund) and the World Bank to name a few, there continues to be support for local efforts to protect BES. T&T has also become a member of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) and has nominated a number of its citizens to serve in various capacities within the IPBES work programme. T&T has also been working with CONABIO (Mexico) to improve it BES information management systems, and with international networks and organisations such as the United Nations, IUCN and other to advance BES management efforts.

11.3 Lessons Learned

Q12: What lessons have been learned from the implementation of the Convention in your country?

Although T&T has been putting various measures in place to manage biodiversity, available data indicate that biodiversity and associated ecosystem services continue to be lost. The following insights have been gained from the implementation of the CBD in T&T, and these have/can assist T&T's in its efforts towards managing its biological resources:

1. ***Developing targets in order to streamline and focus efforts:*** BES management in T&T continues to be faced with a range of challenges and complexities. Although there have been many efforts to manage BES, these have not been guided by a framework that has easily lent itself to coordination and streamlining of efforts towards common end goals for BES and HWB. The development of the national list of Aichi Target indicators to guide the NBSAP is

of utmost importance to ensure that all BES stakeholders understand respective roles and responsibilities; and that all efforts are moving towards common end points;

2. ***Developing indicators to measure and monitor progress:*** Biodiversity assessment reports for T&T have historically had to depend on many proxy datasets to assess the state of biodiversity. This has significantly limited the extent to which data has been able to inform policy and decision-making. The action of developing a comprehensive set of indicators against the Aichi (National) Targets, establishing baselines and systematically collecting data will play a very important role in focusing T&T's efforts towards measuring and monitoring its biodiversity as a basis for action and reducing biodiversity loss;

3. ***Strengthening the science-policy interface:*** The 4th National Report indicated that there was a need to strengthen the science-policy interface to improve decision-making in T&T related to biodiversity and ecosystem services (a pervasive problem that relates to environmental management as a whole in T&T). Over the last five (5) to six (6) years, there were clear signs that the GoRTT took various steps to explore models to help bridge the science-policy interface in order to be able to apply better science to guide development. One (1) very important example is where, in 2012, the ministry with responsibility for planning partnered with the UWI and other agencies to undertake the Project for Ecosystem Services (Figure 83);

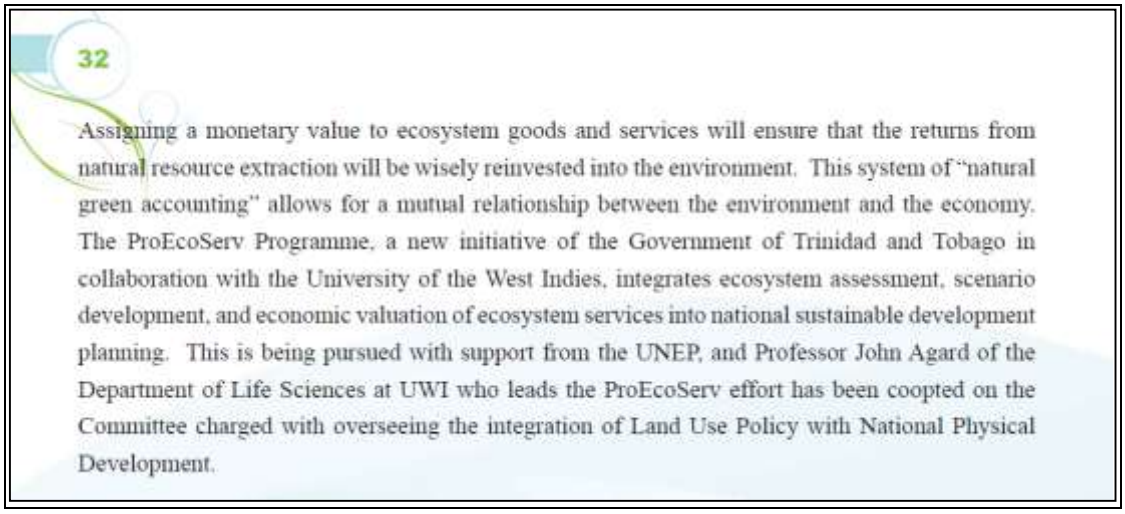
Development in southwest Tobago
Photo courtesy Oswin Brown

4. ***Improving Biodiversity Information Systems:*** Accessing data and information on BES remains a challenge in T&T for a number of reasons; and this issue needs to be addressed in order to boost BES management. Some of the considerations for improving access to information pertain to the following:

- Establishing and maintaining an effective NBIS for T&T (see Section 9.0);

- Identifying and implementing a mechanism or arrangements that will encourage and allow stakeholders to share data and information in a timely manner.

Figure 83: Excerpt from the Policy Document 'Working for Sustainable Development in Trinidad and Tobago' (2012)



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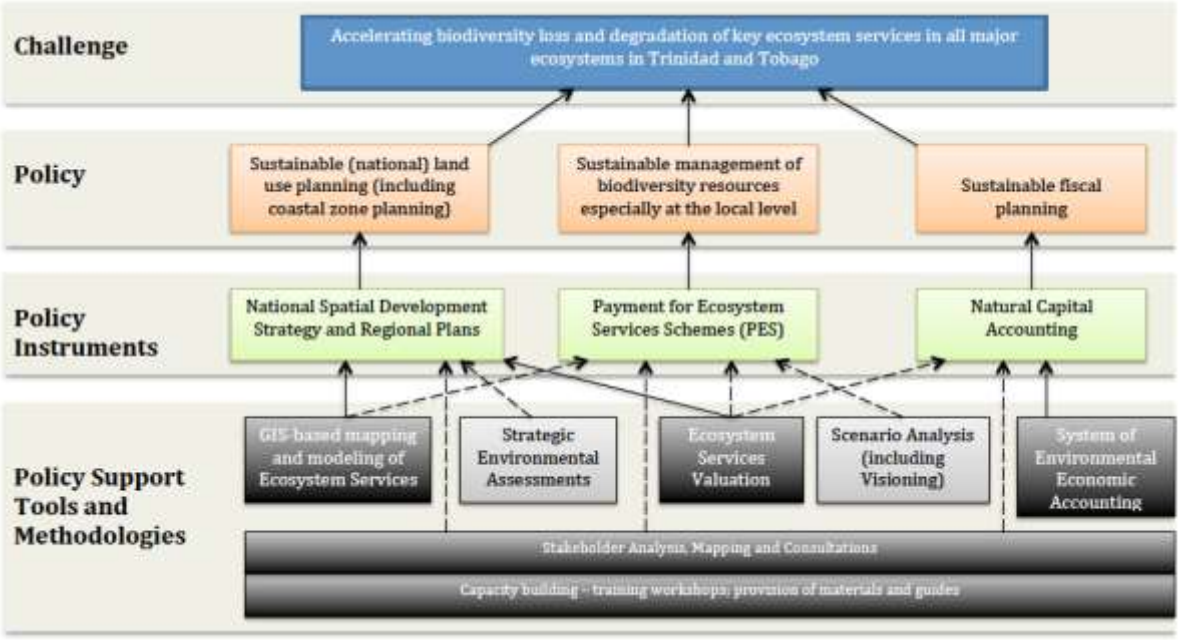
Assigning a monetary value to ecosystem goods and services will ensure that the returns from natural resource extraction will be wisely reinvested into the environment. This system of "natural green accounting" allows for a mutual relationship between the environment and the economy. The ProEcoServ Programme, a new initiative of the Government of Trinidad and Tobago in collaboration with the University of the West Indies, integrates ecosystem assessment, scenario development, and economic valuation of ecosystem services into national sustainable development planning. This is being pursued with support from the UNEP, and Professor John Agard of the Department of Life Sciences at UWI who leads the ProEcoServ effort has been coopted on the Committee charged with overseeing the integration of Land Use Policy with National Physical Development.

Source: GoRTT (2012d)

5. ***Use of Policy Support Tools to bolster mainstreaming efforts:*** T&T has recognised that the mainstreaming of biodiversity and ecosystem services will benefit from the use of appropriate policy support tools and instruments. The application of tools and instruments such as Strategic Environmental Assessments in land use planning; Payments for Ecosystem Services; biophysical modeling and valuation of ecosystem services; scenario development and natural capital accounting all have the potential to improve the approach to biodiversity management in T&T. The ProEcoServ introduced many of these tools and instruments at a national level over the period 2011 – 2015. This specific project engaged over a hundred stakeholders from all sectors, and it applied the framework shown in Figure 84;

6. ***Reporting timeframes:*** Undertaking an in-depth, national-level assessment of biodiversity and ecosystem services every 4 – 5 years is ideal, especially for a SIDS like T&T. Trying to perform an assessment more often is likely to lead to a lot of repetition and will likely not be a good use of the country's resources. Performing an assessment in time intervals greater than five (5) years will likely result in opportunities for highlighting important change being lost; and this can affect decision-making;

Figure 84: A Framework for Applying Policy Support Tools to Support Biodiversity Mainstreaming in T&T



Source: ProEcoServ (2015)

7. ***Strategic use of resources:*** It has become clear that trying to deal with all of the gaps/deficiencies in biodiversity management at once would be very challenging. There are many different issues that need to be dealt with in order to curb and reverse the loss of biodiversity in T&T by 2020. Given the human and financial resources available in this small island state, it has been realised that careful selection of priorities in BES management will be crucial in attending to the most urgent issues. These priorities would need to be guided by research and would require stakeholder buy-in. These are therefore being clearly articulated in the (revised) NBSAP, and will be systematically kept under review. Additionally, the identification of key policy entry points for action could prove to have multiplier effects, and could help to streamline efforts to manage the multiple driving forces affecting biodiversity. The manner in which BES considerations have been incorporated into T&T's (draft) NSDS (2012) is one such example;

8. ***The role of champions:*** Champions for biodiversity and ecosystem services can significantly improve the success of efforts to manage biodiversity – as has been demonstrated by several initiatives in T&T. Within local communities, a champion can play an important role in helping to catalyse community members, serving as a liaison between the local community and other stakeholders and helping to ensure the success of initiatives on the ground. At the policy level, persons with senior ministerial posts, such as Ministers or Permanent Secretaries (and even senior technocrats) can help to ensure that policies and other legal instruments are developed and enacted in a timely manner. Other champions such as civil society groups and research institutions can provide very effective hubs for organizing biodiversity management initiatives and bringing stakeholders together to advance biodiversity research and management initiatives - see for example http://www.canari.org;

9. ***Capacity building:*** The importance of investing in the development of local capacity to attend to the biodiversity challenges has become very clear. Capacity to manage BES is required in almost every aspect of the management cycle – from research, to analysis, to reporting, to on-the-ground implementation of activities, to the advocacy capacity of civil socity in order to influence decision-making. It has been realised that different strategies need to be employed to build capacity (depending on the intended outcome). Effective communication and outreach, workshops, peer-to-peer learning, fellowships and in-situ training (such as in Protected Areas management) are all tools that are considered important. The government has also recognised the importance of being involved in international initiatives that foster professional and technical growth – one such being the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). At present, T&T is represented on the Multidisciplinary Expert Panel of IPBES, and has authors involved in the regional assessment for the Americas, as well as the Global Assessment. Further avenues for involvement in IPBES and other related initiatives will continue to be sought;

10. ***Developing strategic partnerships:*** The GoRTT has recognized the importance of forming strategic alliances between and amongst stakeholders for the management of biodiversity. Such partnerships firstly involve better collaboration and coordination amongst government ministries whose portfolios affect or are affected by biodiversity (public sector mainstreaming). Secondly, the formation of strategic public-private partnerships involving local communities, non-governmental entities, research institutions and private sector

companies that can provide very specific support in meeting certain objectives or goals, will help to share the burden of the BES management portfolio, and can therefore help in meeting the 2020 Targets;

11. ***Implementation of policies/plans/programmes:*** The establishment of the Aichi Biodiversity Targets brings the timeframe for attending to biodiversity loss clearly into focus; and it places a certain urgency on taking appropriate action. Many people (including decision-makers) are aware of the challenges facing biodiversity, yet so much of the 'action' that has been put in place to date (not just in T&T, but in many other parts of the world) has either been in writing (legislation, reports etc.) or in the form of 'talk shops' amongst stakeholder groups. Keeping the 2020 Targets in sight will mean that all of the information and exchange that is brought to bear on the BES management process in T&T has to be put into action, lest efforts will be destined to fail;

12. ***Continuous action:*** The production of this report, the 5th National Report, is a stark reminder that many of the trends in biodiversity that were raising concern in T&T over 20 years ago still persist (in many cases, have gotten worse). Such findings could be very discouraging. However, the CBD provides a stable, progressive platform and network for T&T to continue to attend to biodiversity-related challenges. This, taken together with the Government's own commitment to preserve T&T's natural heritage, and move T&T on to more sustainable development pathways, provide the continued impetus in T&T to invest in BES management efforts.

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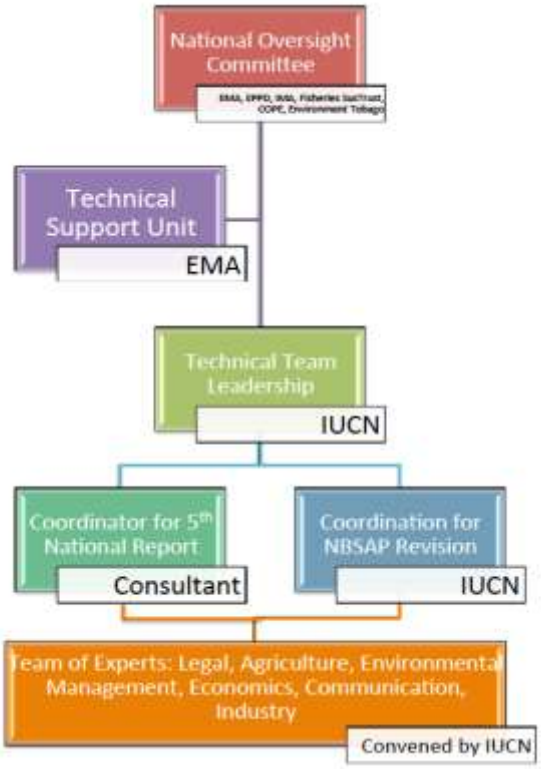
Appendix I: Process to Prepare the 5th National Report

The process to prepare the 5th National Report to the Convention on Biological Diversity officially began in February 2016 alongside the revision of T&T's National Biodiversity Strategy and Action Plan. The joint package of work was commission by the Environmental Management Authority of Trinidad and Tobago on behalf of the Government of the Republic of Trinidad and Tobago; and funding was provided by the World Bank. The International Union for the Conservation of Nature - Regional Office for Mexico, Central America and the Caribbean (IUCN ORMACC) was selected through a competitive process to undertake the projects; and the IUCN convened a team of experts from T&T and Costa Rica to help deliver the work.

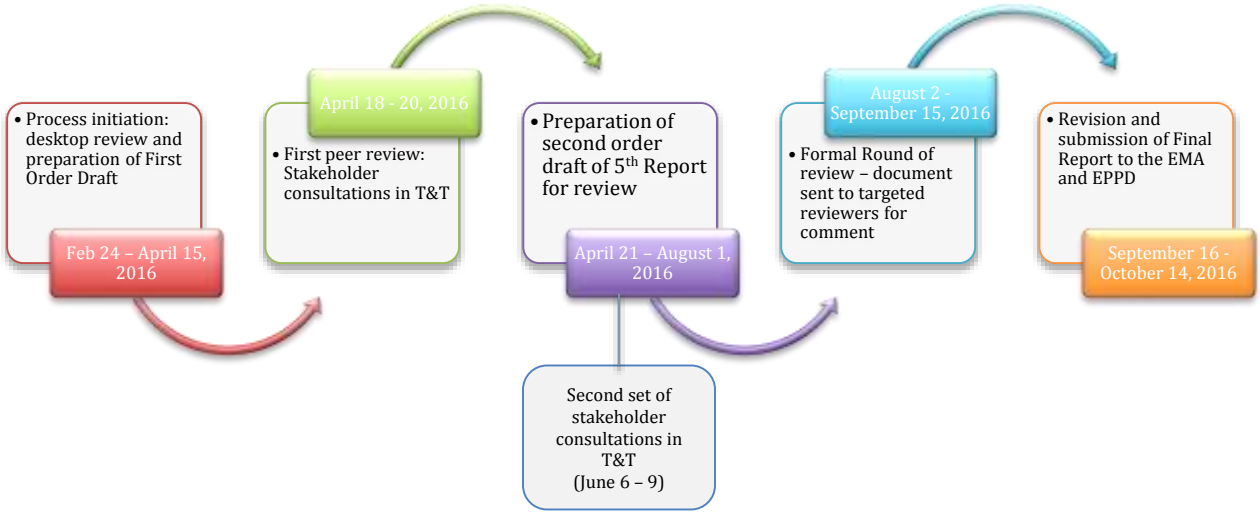
Project governance was provided through the constitution of a National Oversight Committee (NOC) which was chaired by the EMA and which comprised of representatives from major stakeholder groups (Figure 85). The EMA provided technical support for both projects.

Figure 85: Organisation Structure for the Joint Project to Prepare T&T's 5th National Report to the CBD and to Update T&T's NBSAP



The preparation of the 5th National Report to the CBD and the NBSAP update were run as two parallel, but closely linked projects. A coordinator was hired as a part of the IUCN team to ensure that the 5th National Report was prepared in keeping with both the guidelines provided by the CBD and also with the expectations of the GoRTT. As highlighted in Figure 86, the preparation of the 5th report followed standard guidelines for the preparation of biodiversity and ecosystem services assessment, and it included desktop review, stakeholder consultations and a formal review process.

Figure 86: Main Steps in the Preparation of T&T's 5th National Report



Data and information for the 5th National Report were drawn from published studies, official national and global reports, from websites, from a range of grey literature sources, and from interviews and focus group discussions held with various stakeholders. For Part II of the 5th Report, inputs from the NBSAP process were solicited for inclusion.

Over 50 stakeholders from all sectors were invited to attend the stakeholder consultations held in Trinidad and Tobago. The following persons, including NOC members, attended the meetings: Ms. Sabriyah Abdullah-Muhammad (Environment Tobago); Ms. Candace Amoroso (EPPD, Ministry of Planning and Development); Ms. Rachael Amoroso (IMA); Dr. Yasmin Baksh-Comeau (National Herbarium); Ms. Albada Beekham (Ministry of Agriculture, Land and Fisheries); Mr. Marc Benjai (Fisheries Division); Ms. Sarah Bharath (UWI); Mr. Bertrand Bhikarry (Environment Tobago); Ms. Neila Bobb-Prescott (FAO); Ms. Casey-Marie Boucher (THA Plant Protection); Ms. Nikki Braithwaite

(Ministry of Trade and Industry); Ms. Xiomara Chin (EMA); Mr. Louis W. Farrell (Agriculture Division); Ms. Lara Ferreira (Fisheries Division); Ms. Anastasia Gordon (EPPD); Mr. Carlos Hazel (THA Finance); Dr. Rahanna Juman (IMA); Mr. Attish Kanhai (IMA); Mr. Kenneth Kerr (Met Services); Mr. Giancarlo Lalsingh (SOS); Ms. Danielle Lewis-Clarke (EMA); Ms. Shanesse Lovelace (THA); Ms. Pat McGaw (COPE); Ms. Kamlyn Melville-Pantin (THA DNRE); Mr. Dayreon Mitchell (THA); Ms. Siddiqua Mondol (Ministry of Tourism); Dr. Michael Oatham (UWI); Mr. Kerry Pariag (TCPD); Ms. Ruth Redman (THA Fisheries Division); Mr. Hayden Romano (EMA); Mr. David Shim (SusTrust); Ms. Gillian Stanislaus (EMA); Ms. Vernessa Teesdale (Ministry of Finance); Mr. Stephen Thomas (Ministry of Energy and Energy Industries); Mr. William Trim (THA DNRE); Ms. Patricia Turpin (Environment Tobago); Mr. Hollis Walker (Tobago Chamber of Commerce); Mr. David Wong (Tobago Chamber of Commerce).

As a part of the peer review process, feedback and inputs were first gathered during the stakeholder consultations, and these were included in the Second Order Draft (SOD) of the report. A more structured, formal review process was then conducted after preparation of the Second Order Draft – the SOD was circulated to NOC members and selected organisations involved in BES management in T&T (with multi-sectoral perspectives) along with review templates. Feedback received from this process was included in the report as relevant, and all comments were responded to.

Appendix II (a): The Current State of Knowledge on Biodiversity and Ecosystem Services in Trinidad and Tobago

Since the preparation of the 4th National report in 2010, there has been an overall improvement in the information base upon which decisions in T&T related to biodiversity management are made. In addition to the aspects of biodiversity which continue to be regularly monitored (e.g. fisheries; wildlife; freshwater abstraction…), there been some important improvements in efforts to track changes in biodiversity and ecosystem services in Trinidad and Tobago:

- The first noteworthy change is the development of a draft list of national biodiversity targets and indicators for T&T, as mentioned in Section 2.2.
- There is a vastly improved knowledge base about important ecosystem services (ES) in T&T. The 4th National Report utilized proxy data sets in many instances to track changes in the status of ES. The Project for Ecosystem Services (ProEcoServ), undertaken between 2011 an 2015, identified, measured and valued a range of services across the country, using a mix of policy support tools. These data and associated tools have provided important insights into the management of biodiversity in T&T, and these results are presented in the current report.

Pollination research in the Nariva Swamp
Photo courtesy Lena Dempewolf

- The Environmental Management Authority of T&T (EMA) commissioned a National Biodiversity Assessment of Trinidad and Tobago in 2010 in order to take stock of changes in biodiversity in T&T. Led by the University of the West Indies (UWI), this report was completed in 2012, and some of its contents have been used in the current report.
- A comprehensive inventory of the plant diversity of Trinidad and Tobago has been completed as part of a project known as the Darwin Initiative. This study resulted in the production of an annotated checklist of T&T's vascular plants as well as an analysis of vegetation types and hotspots.
- The process to prepare an updated Land Use Plan (the Draft National Spatial Development Strategy 2012) for T&T resulted in the production of a significant amount of data and information on land use in T&T and its impacts on BES. These findings are reflected in the current report.

- There has been greater investment into (scenario) modeling exercises to examine the effects of climate change on various aspects of biodiversity in T&T. Although these results are not available for use in the current report, they are expected to be available in the coming months (John Agard pers. comm. 2016).

Appendix II (b): The Project for Ecosystem Services (2010 – 2015)

The Project for Ecosystem Services (ProEcoServ) was a five-year initiative (2010 – 2015), which was funded by the Global Environment Facility (GEF), and led by the United Nations Environment Pogramme (UNEP). This project aimed to build on the sub-global assessments (SGAs), or site-specific assessments that were undertaken in the following four countries as a part of the Millennium Ecosystem Assessment (MA: 2001 - 2005) - Trinidad and Tobago (Northern Range and Caribbean Sea), Chile (San Pedro de Atacama), South Africa (Southern Africa) and Vietnam (Downstream Mekong Wetlands).

The intention of ProEcoServ was to develop/ apply a set of tools and approaches that would aid in mainstreaming biodiversity and ecosystem services into national development planning processes in each of the selected countries, with the overall goal of reducing threats to biodiversity at a range of scales. To achieve this, ProEcoServ had three focal areas: policy support tools; support for implementation of policies; and bridging the science-policy interface.

In Trinidad and Tobago (T&T), ProEcoServ was led by the University of the West Indies (UWI) and the Ministry of Planning and Sustainable Development, and it was undertaken in collaboration with a consortium of partners. The project in T&T had three major objectives, as follows:

1. To introduce GIS-based ecosystem services maps and an associated Decision Support System into spatial development planning in Trinidad and Tobago, by focusing on the draft National Spatial Development Strategy for T&T

2. To introduce exploratory Ecosystem Services Accounting into the T&T System of National Accounts

3. To develop a pilot Eco-finance scheme (e.g. Payment for Ecosystem Services - PES) in collaboration with the Green Fund (T&T's Environmental Fund) for replication throughout Trinidad and Tobago

Concluded in August 2015, the project in T&T produced new data and insights on a range of ecosystem services that were considered to be of national importance – pollination; water purification and soil erosion in Trinidad's Northern Range; coastal protection; water provision; coastal recreation and carbon sequestration. The project also afforded for several opportunities to

build capacity in the use of biodiversity-related policy support tools; and to enhance and encourage more effective discussions at the science-policy interface. Figure 87 below shows the mainstreaming process used in ProEcoServ – this process has now been adapted and used in a range of other similar projects in T&T. Table 25 shows the ecosystem services and the specific policy support tools used. See www.proecoservtt.org for more information.

Figure 87: Mainstreaming Approach Used in the Project for Ecosystem Services, T&T

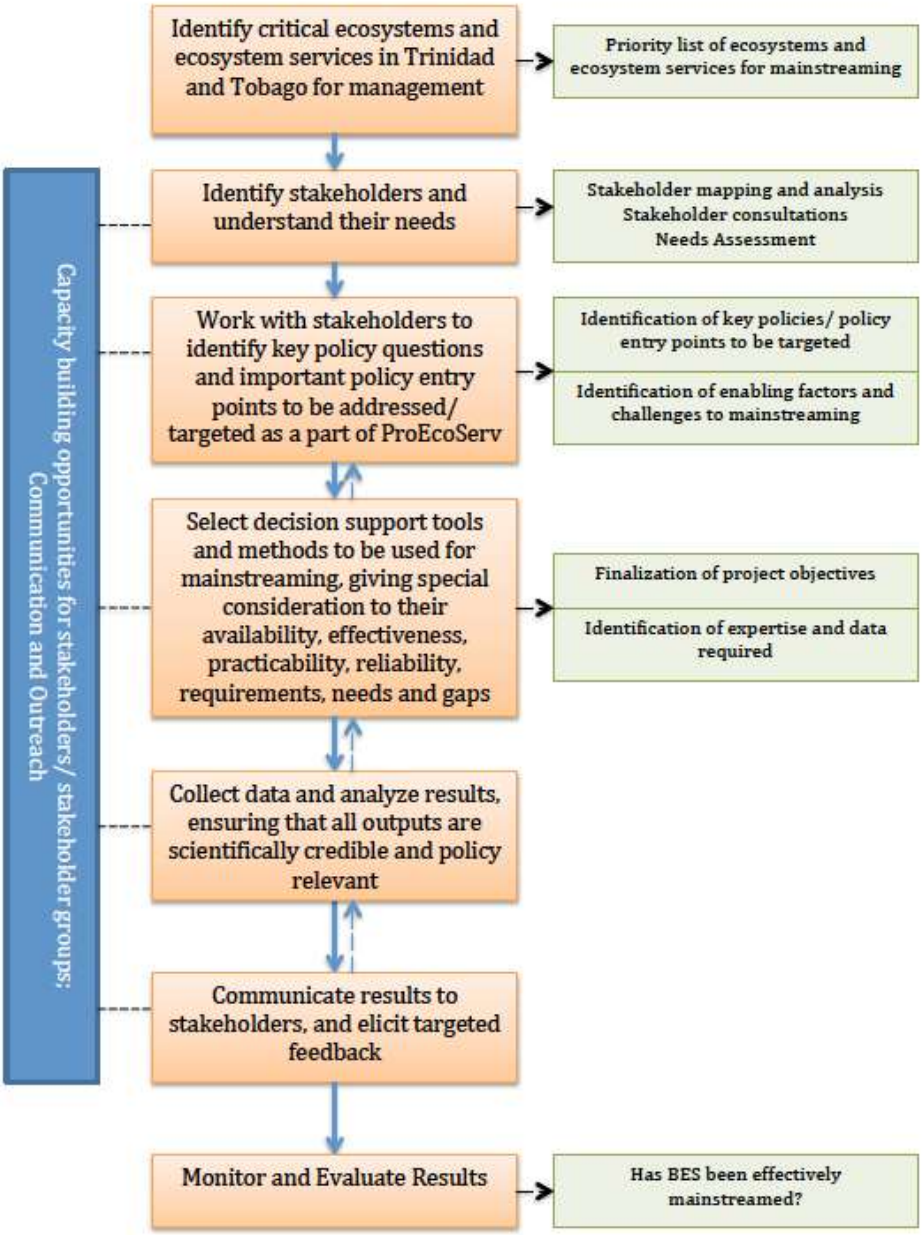


Table 25: Ecosystem Services Studied as a Part of the Project for Ecosystem Services

Ecosystem Service	Ecosystem	Policy Instrument Targeted	Biophysical Modeling and Mapping Tools and Methods	Valuation Methods
Pollination	Nariva Swamp Northern Range (Tucker Valley)	Draft National Spatial Development Strategy	InVest (Pollination model) Fragstat	Market value (proportion of yield attributable to pollination)
Soil erosion	Northern Range (Caura and Maracas Valleys)	Draft National Spatial Development Strategy	RUSLE InVest (Sediment Retention model)	Clean up cost and Replacement cost
Water purification	Northern Range (Caura Valley)	Draft National Spatial Development Strategy	InVest (Water purification model)	Valuation was not performed as a part of ProEcoServ
Coastal protection	Trinidad and Tobago	Draft National Spatial Development Strategy	N/A	GIS-based valuation using the meta-analytical value transfer method
	Southwest Tobago		MIKE by DHI	N/A
Water provision	Main Ridge of Tobago	Draft National Spatial Development Strategy; Natural Capital Accounting	Biophysical modeling not undertaken as a part of ProEcoServ	Replacement cost
Coastal recreation	Trinidad and Tobago	Draft National Spatial Development Strategy	Biophysical modeling not undertaken as a part of ProEcoServ	State-of-the-art meta-analytical value transfer methodology, integrated with GIS tools
Carbon Sequestration	(1) mangroves; (2) salt marshes and swamps; (3) seagrasses; and (4) tropical forests	Draft National Spatial Development Strategy	Biophysical modeling not undertaken as a part of ProEcoServ	Market value

On the basis of ProEcoServ, the University of the West Indies, in 2011, began to develop a research work programme to fill some of the important gaps in knowledge about ecosystem services in Trinidad and Tobago. Figure 88 shows the various projects that have been implemented (some completed; others still underway) to gather data and information on key ecosystem services.

Figure 88: Package of Projects at the UWI Focused on Collecting Data on Ecosystem Services

Source: ProEcoServ (2015)

Appendix II (c): Carbon Stored in T&T's Forests, by Forest Type (1990 – 2010)

Carbon in above ground biomass

	Carbon fraction	1990	2000	2005	2010
Evergreen Seasonal Forest	0.47	7264818	6947578	6788998	6630419
Semi-evergreen seasonal forest	0.47	891635.6	852726.6	833237.3	813748
Deciduous Seasonal Forests	0.47	195164.9	186656.5	182373	181551.5
Dry evergreen forests	0.47	31670.12	30278.02	29581.98	28885.93
Seasonal montane forests	0.47	74134.66	70915.2	69261.96	67695.73
Montane forests	0.47	1729983	1654456	1616692	1578929
Swamp forests	0.47	867650.2	829777.2	810784.6	791848.1
Secondary forests	0.47	1210849	1157953	1131505	1105115
teak plantations	0.47				
pine plantations	0.47	1472502	1521337	1535415	1413502
Other plantations	0.47	306739.9	306739.9	306739.9	306739.9
Bamboo	0.47	19852.8	19852.8	19852.8	19852.8
Water					
Other areas within forests (OWL)	0.47	2453679	2706940	2798154	2960095
Private lands					
Total forest land owned by state					
Private forests	0.47	2697800	2697800	2697800	2697800
total carbon in above-ground biomass		19216478	18983010	18820396	18596182

Carbon in below ground biomass

	carbon fraction	1990	2000	2005	1010
Evergreen Seasonal Forest	0.47	1743556	1667419	1629360	1591300
Semi-evergreen seasonal forest	0.47	178327.1	170545.3	166647.5	179024.6
Deciduous Seasonal Forests	0.47	39032.98	37331.3	36474.59	36310.29
Dry evergreen forests	0.47	6334.023	6055.605	5916.395	5777.186
Seasonal montane forests	0.47	17792.32	17019.65	16622.87	16246.98
Montane forests	0.47	415195.9	397069.4	388006.2	378943
Swamp forests	0.47	173530	165955.4	162156.9	158369.6
Secondary forests	0.47	242169.7	231590.6	226301	221023.1
teak plantations					
pine plantations	0.47	353400.4	365120.8	368499.6	339240.5
Other plantations	0.47	61347.97	61347.97	61347.97	61347.97
Bamboo	0.47	3970.56	3970.56	3970.56	3970.56
Water	0.47				
Other areas within forests (OWL)	0.47	490735.7	541388	559630.8	592019.1
Private lands	0.47				
Total forest land owned by state	0.47				
Private forests	0.47	539560	539560	539560	539560
total carbon in below-ground biomass	0.47	4264953	4204373	4164494	4123133

Carbon in dead wood

	Carbon fraction	1990	2000	2005	2010
Evergreen Seasonal Forest	0.47	161691.3	154630.5	151101.1	147571.6
Semi-evergreen seasonal forest	0.47	22938.87	21937.87	21436.47	20935.07
Deciduous Seasonal Forests	0.47	5955.868	5696.217	5565.496	5540.426
Dry evergreen forests	0.47	814.7685	778.9545	761.0475	743.1405
Seasonal montane forests	0.47	1525.676	1459.421	1425.397	1393.165
Montane forests	0.47	35602.7	34048.37	33271.21	32494.04
Swamp forests	0.47	27650.2	26443.27	25838.01	25234.54
Secondary forests	0.47	37302.07	35672.53	34857.77	34044.79
teak plantations	0.47	17011.65	17011.65	17011.65	17011.65
pine plantations	0.47	9848.85	9848.85	9848.85	9848.85
Other plantations	0.47	9501.454	9501.454	9501.454	9501.454
Bamboo	0.47	945.4896	945.4896	945.4896	945.4896
Water					
Other areas within forests (OWL)	0.47	124183.3	137001.1	141617.5	149813.5
Private lands					
Total forest land owned by state					
Private forests	0.47	100279.2	100279.2	100279.2	100279.2
total carbon in deadwood	0.47	555251.3	555254.9	553460.6	555357

Carbon in litter

	Default values	1990	2000	2005	2010
Evergreen Seasonal Forest	2.1	189619.5	181339.2	177200.1	173061
Semi-evergreen seasonal forest	2.1	26901	25727.1	25139.1	24551.1
Deciduous Seasonal Forests	2.1	6984.6	6680.1	6526.8	6497.4
Dry evergreen forests	2.1	955.5	913.5	892.5	871.5
Seasonal montane forests	2.1	1789.2	1711.5	1671.6	1633.8
Montane forests	2.1	41752.2	39929.4	39018	38106.6
Swamp forests	2.1	32426.1	31010.7	30300.9	29593.2
Secondary forests	2.1	43745.1	41834.1	40878.6	39925.2
teak plantations	2.1	19950	19950	19950	19950
pine plantations	5.2	28600	28600	28600	28600
Other plantations	2.1	11142.6	11142.6	11142.6	11142.6
Bamboo	2.1	1108.8	1108.8	1108.8	1108.8
Water					
Other areas within forests (OWL)	2.1	145632.9	160664.7	166078.5	175690.2
Private lands					
Total forest land owned by state					
Private forests	2.1	117600	117600	117600	117600
total carbon in litter		668207.5	668211.7	666107.5	668331.4

Source: FAO (2010)

Appendix III: National Implementation of Thematic Programmes of Work and Plans Under the CBD or Decisions of the Conference of the Parties Related to Cross-cutiing Issues

Please note that the information related to national implementation of thematic programmes of work and plans under the CBD or decisions of the Conference of the Parties (COP) related to cross-cutting issues is included throughout this report as relevant.