THE KINGDOM OF TONGA

KINGDOM OF TONGA'S
FIFTH NATIONAL REPORT TO THE
CONVENTION ON BIOLOGICAL DIVERSITY

gef UNEP SPREP PROE Convention on Biological Diversity

Review of Tonga's National Biodiversity Strategy and Action Plan – Fifth Report

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Executing Summary

Review Tonga National Biodiversity Strategy and Action Plan (NBSAP) and develop a Tonga's Fifth National Report.

Tonga is one of the many islands that are endowed with unique resources and derives much of its economic, environmental and social well-being directly or indirectly from its environment. Tonga harbours numerous special ecosystems: from the peak of Mt, Talau in Vava'u, to the serenity of Vai Lahi in Niuafo'ou; the vulnerability of the Ha'apai Group to 'Eua's National Forest and to the Fanga'uta Lagoon in Tongatapu. Beyond the aesthetic beauty of the ecosystems to tourists and visitors; they provide immense support to the communities whose livelihoods are centred. They provide food, shelter, fresh water, wood, fibre, medicine, fuel, tools and raw materials. They also provide spiritual, recreational values, educational references as well as contributing to the economies, livelihoods and culture of Tonga. Our ecosystems maintain and provide protection against diseases, climate, natural disasters, support nutrients cycling, and aid sand and soil formation.

Ecosystems and their biodiversity underpin sustainable development and human wellbeing. The loss of biodiversity results in serious reductions in ecosystem goods and services, negatively impacting economic prosperity and social and environmental sustainability. Therefore, there is a need to invest and re-invest in the productivity, health and sustainability of our ecosystems.

The well-being of the world population in the coming decades will at large depend on conservation and restoration of ecosystems to maintain and enhance biodiversity and ecosystem services, thereby contributing to sustainable development while reducing economic, social and environment related risks.

Objectives:

The objectives of this report are to:

1. **Update on biodiversity status, trends, and threats and implications for human well-being**
2. **Identify the current status of national biodiversity strategy and action plan, its implementation, and the mainstreaming of biodiversity**
3. **Discuss the Progress towards the 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goal.**

An ecological, socio-economic survey was conducted to review the National Biodiversity Strategic Action Plan (NBSAP) and to develop the 5th National report.

A series of community consultations in Tongatapu, 'Eua, Vava'u, Ha'apai, Niuatoputapu and Niuafo'ou islands groups were conducted. There were also literature and desk review, field observations and in depth interviews with various stakeholders.

Chapter 1 based its discussions on the updating of the biodiversity status, trends, threats and implications on human wellbeing. This includes forest, agro-biodiversity, marine ecosystems and species conservation.

Forest ecosystem

The current status of biodiversity has raised some questions with regards to the validity of the five species included in the IUCN Red List of 2009. Of the five species submitted, only *Aglaia heterotricha* (langakali vao) is supported and therefore should be maintained in the list. The other species recommended for inclusion include *Casearia bluelowii* and *Sesbania coccinea*. Target species identified for conservation should have regulatory protection and should be enforced by the law. Annual ban should be imposed on harvesting and trading of specific species that are either endemic or near extinction. Land use policy, plans and strategies are thoroughly considered for the protection and conservation of forest ecosystems and to address its multipurpose potentials.

The lack of and/or absence of management plans for the conservation and protection of endemic species continue to pose major threat. Moreover the uncontrolled and illegal harvesting, as well as, encroachment was identified as common threats to biodiversity conservation in Tonga. People's attitudes and behaviour may also attribute to biodiversity conservation threats. Commercial farming has also been identified as a major threat to forest ecosystem conservation. Increased number of invasive species continues to threaten our traditional genetic resources.

Agrobiodiversity

There is a reduction in variety of traditional crop species as you move further north from Tongatapu. This is due to the islands smallness and remoteness from Tongatapu. The variety of fruit trees are also decreased due to increase competition for land use, especially for commercial farming and population increase.

Other threats identified include heavy dependency on machinery for cultivation, fertilisers and pesticides, and climate change and natural disasters. Urban Spatial Management Act of 2012 and the National Land Use Policy could both attribute to a more comprehensive land use management.

Tonga's limited genetic pool may lead to loss of traditional genetic materials that may have been endemic to Tonga. This could explain the poor diversity in our root crop species (tuber-base cultivars) in comparison to fruit trees (seed based cultivars).

Marine ecosystems

The demand for marine resources has increased due to Tonga's growing population and change in dietary demands.

Overexploitation and destructive fishing practices are still the major threats to the marine ecosystem although natural disasters (i.e. hurricanes & tsunamis, water temperatures variations, natural predators, etc.) may contribute.

The destructive fishing methods such as dynamite fishing, fish poisoning and using hookah and SCUBA diving are still ongoing activities even though regulatory wise, these fishing methods has been declared illegal practices under Fisheries Management Act 2002. The SCUBA and hookah under water using air apparatus boasted as other major threats for the reef fishes and sea cucumbers resources included giant clams' species (i.e. Tridacnidae). Pollution and eutrophication also affect Tonga's coastal waters and reefs (Anon, 2010). The trend of the marine biodiversity is still unknown. The only baseline information might assist in determining the change in the marine ecosystem (refer to tables & figures indicated on chapter 1 of marines thematic area) is the landing catch and export production recorded by Fisheries Division database for the major commercial marine resources at Tongan coastal waters during this period (2010 – 2013).

Species Conservation

The fourth National report articulated the success of species conservation could be contributed to the involvement of private sector and civil society. This fifth national report has seen another stunning success, more donors are funding projects related to species conservation. For example, Tonga is a participant in two significant multi-country projects, supported by the Global Environment Facility (GEF), that are focused on the conservation of biodiversity and the management of major threats that cause biodiversity loss. The two projects are both under the

auspices of the Pacific Alliance for Sustainability housed under the South Pacific Regional Environmental Programme (PAS-SPREP)

The GEF-PAS (GEF –Pacific Alliance for Sustainability) Island Biodiversity Project titled 'Implementing the Island Biodiversity Programme of Work by integrating the conservation management of island biodiversity' and the GEF-PAS Pacific Invasive Project. There are more regulatory framework are drafted and passed, more flexible working environment are provided for government ministry to operate in- to ease implementation and execution of duties in relation to species conservation. To date, 13 more Special Management Areas were added to 13 protected areas of 2010, 12 organically certified sites and in situ and ex situ based projects have been funded for terrestrial and marine based organisms. There is also a major boost in the amount of donor funded projects that are involved in species and resource conservation thus giving Tonga a lot of prospect for becoming a major conservation hub in the region. There is also a collective effort to put into place regulatory framework that could govern conservation effort. Collaboration and partnerships between donors, government ministries and those of the civil societies has also been instrumental in this success.

Chapter 2 deals with National biodiversity strategy and action plan, its implementation and the mainstreaming of biodiversity.

The reviewing of the implementation of NBSAP to develop a Fifth National Report focused on 8 thematic areas that adopted in the Fourth National Report including, Forestry Ecosystem, Marine & Coastal Ecosystem, Species Conservation, Agro biodiversity, Local Community and Civil Society, Access and Benefit Sharing from the genetic resources, Mainstreaming biodiversity conservation and Financial mechanisms.

The overall 37 objectives of NBSAP is indicated that 2(5%) are considered unsatisfactory (Red Status), 27 (73%) objectives fall in the work in progress category (Yellow status) and 8 (22%) objectives are satisfactory (Green Status). The unsatisfactory category is from two of the objectives of Access & benefit sharing. These two objectives are needed to progress or to achieve in the future. The thematic areas discussed above are dominated with Yellow Status which reflected that their works are in progress category. As compared to 4th National Report, most of the objectives of those thematic areas were in the category of unsatisfactory (Red status) such as forest ecosystem, access benefit sharing, species conservation, mainstreaming and financial resources. In the satisfactory category (Green status) the local community and civil society is still the leading objectives achieved followed by two of the Marine objectives, two from financial resources and one objective from mainstreaming.

The mainstreaming activities to biodiversity conservation and sustainable development discussed in the report were from Non government, government organisations, other international conventions which Tonga involved, Act, Legislation and policies that had been approved (refer Annex 1 table 1, 2 and 3). It has been realised that these relevant sectors are progressive in priorities NBSAP objectives into their plan, policy and programme as compared to 4th National report. MLECCNR have integrated biodiversity conservation and sustainable development into Tonga Strategic Development Framework (TSDF). The Environment and Climate Change Division are working very closely in prioritising biodiversity conservation and sustainable development into Joint National Action Plan (JNAP) and NBSAP. They have implemented varieties of biodiversity conservation and sustainable development activities (refer chapter 3) into their programme of work. It is obvious, that community involved in working with Civil Society and other NGOs in their programme of biodiversity conservation and sustainable development.

Consequently, there are constraints with the implementation of the national NBSAP including: enforcement of legal and policy framework, lack of community awareness which were limited by vast geographical scatterings of the islands and high human and transportation costs. The geographical challenges are coupled with lack of government commitments in terms of funding for the management of biodiversity.

Chapter 3 relates to progress towards the 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goals

Tonga's progress towards meeting the Aichi Biodiversity Targets has shown a positive trend in majority of the national objectives with 80% in working progress. It is visioned that 50% of this working in progress category (yellow status) will be achieved (green status) by the year 2020. Of the total global objectives, about 15% of Tonga's overall progresses are considered achieved. The achievements were in the following global areas, in order of rank:

1. Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building;
2. Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity; and
3. Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use.

The contribution of the NBSAP national targets towards the MDG targets is 70%, namely towards targets 7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; and 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss.

Ongoing awareness programmes will strengthen conservation efforts with enforcement efforts from all relevant stakeholders, and this still requires financial assistance from external donors. It is critical that further commitment to sustainable resource use should include alternative livelihoods options. Communities are obliged to both resource conservation and income generating activities. There are some successful stories in Tonga which contributes to achieving the 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goals. This includes the increasing number of community-based marine managed areas (Special Management Areas). Thirty four communities have shown interest in the program. Several communities are in the pipeline for funding.

The MLECCNR have several ongoing programmes which include plans and policies to enhance biodiversity conservation and climate resilience. These include, and to name a few: The PoWPA programme which looked at effective management of existing protected areas and identifying new conservation and protected areas; Joint National Action Plan (JNAP) on Climate Adaptation and Disaster Risk Management; National Invasive Strategic Action Plan (NISAP) for management of invasive species from destroying biodiversity; Integrated Island Biodiversity Project; Land-use policy; Mangrove Ecosystems Climate Change Adaptation and Livelihoods Project (MESCAL); Deutshe Gesellshaft fur Internationale Zusammenarbeit Project (GIZ); Pacific Adaptation for Climate Change(PACC) projects and so forth .

Effective collaboration between government and civil society agencies are imperative for conservation efforts. For instance, Civil Society Forum of Tonga, Tonga Community Development Trust and Caritas and VEPA have all streamlined biodiversity and conservation of species into their implementation plan. These collective efforts have boosted Tonga's general performance giving us a comfortable zone to achieving the Aichi Targets by 2020 and 2015 Millennium Development goals.

ACRONYMS

CBD	Convention on Biodiversity
COP	Conference of the Parties
CSTF	Civil Society Forum of Tonga
ECC	Environment & Climate Change
EBAs	Endemic Bird Areas
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
FFA	Forum Fisheries Agency
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GEF	Global Environment Facility
GEF-PAS	Pacific Alliance for Sustainability
GBO	Global Biodiversity Outlook
GIZ	Deutshe Gesellshaft fur Internationale Zusammenarbeit
IAS	Invasive Alien Species
IBA	Important Bird Area
IIB	Integrated Island Biodiversity
IUCN	International Union for the Conservation of Nature and Natural Resources
MAFFF	Ministry of Agriculture and Food, Forests and Fisheries
MLECCNR	Ministry of Lands, Environment, Climate Change & Natural Resources
MESCAL	Mangrove Ecosystems Climate Change Adaptation and Livelihoods Project
MET	Ministry of Education and Training
NBSAP	National Biodiversity Strategic Action Plan
NISAP	National Invasive Strategic Action Plan
NFP	National Focal Point
NGO	Non Government Organization
NHI	National Host Institution
PACC	Pacifc Adaptation for Climate Change
POWPA	Programmes of Works on Protected Areas
SOPAC	South Pacific Applied Geoscience Commission
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme

TCDT	Tonga Community Development Trust
TEK	Traditional Ecological Knowledge
TFP	Tonga Forest Product
TPTRP	Tonga Post-Tsunami Relocation Project
TSDF	Tonga Strategic Development Framework
TTL	Tonga Timber Limited
TWB	Tonga Water Board
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

ACKNOWLEDGEMENT

The Government of Tonga extends its sincere gratitude to the UNEP and GEF for providing financial support to pursue the development of Tonga's Fifth National Report. In addition, thank you goes out to SPREP for their continuous support and excellent guidance from the beginning of this report to the final stage.

Special thanks are extended to the Minister and Chief Executive Officer for Lands, Environment, Climate Change and Natural Resources for their direction and continued support with the implementation of the National Biodiversity Strategy and Action Plan.

To the NBSAP Technical Working Group (TWG), from relevant sectors, for their valuable contributions and support during the development and completion of Tonga's 5th National Report.

Finally, a thank you is also extended to the communities for their valued input and participation during the consultation process; and to the staff of the Environment & Climate Change Division, and to the NBSAP Project Management Unit, for their continued assistance and coordination in completing this very important task.

FORWARD

It is with great pleasure that Tonga submits its Fifth National Report to the Convention of Biological Diversity. Although Tonga has limited biodiversity due to its small size and remoteness from other countries in the world, Tonga takes its commitment to preserving biodiversity and promotes sustainable use of natural resources seriously. This is not only because of our obligation under the Convention but the implications of the ecological, social and economic value of biodiversity on the livelihoods of the people.

The Fifth National Report focuses on the status, trends and threats of biodiversity, the status of its implementation and mainstreaming of the NBSAP, its progress towards meeting the 2020 Aichi Biodiversity Targets, and contributions to the 2015 Targets of the Millennium Development Goal. Due to the threats that are contributing to the degradation of biodiversity in Tonga, such as climate change, overharvesting, overfishing, overpopulation, introduction of invasive species and so forth, relevant sectors are now effectively mainstreaming biodiversity conservation and sustainable development into their work plans, policies and programmes in order to address those threats.

Considering the multidisciplinary nature of biodiversity, it was vital that a collaborative approach was undertaken through the involvement of various stakeholders, experts and concerned organisations, Ministries and Departments when developing this national report

May I congratulate all those who were involved with the preparation of this report. I am confident that the sharing of experiences with other Parties through this National Report would enormously help in addressing the challenges we face today and tomorrow and to reiterate the commitment of Tonga to the Convention on Biological Diversity.

Malo 'aupito

Lord Ma'afu Tukui'aulahi
Honourable Minister for Lands, Environment, Climate Change and Natural Resources

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CHAPTER I: An update on biodiversity status, trends, and threats and implications for human well-being

Introduction

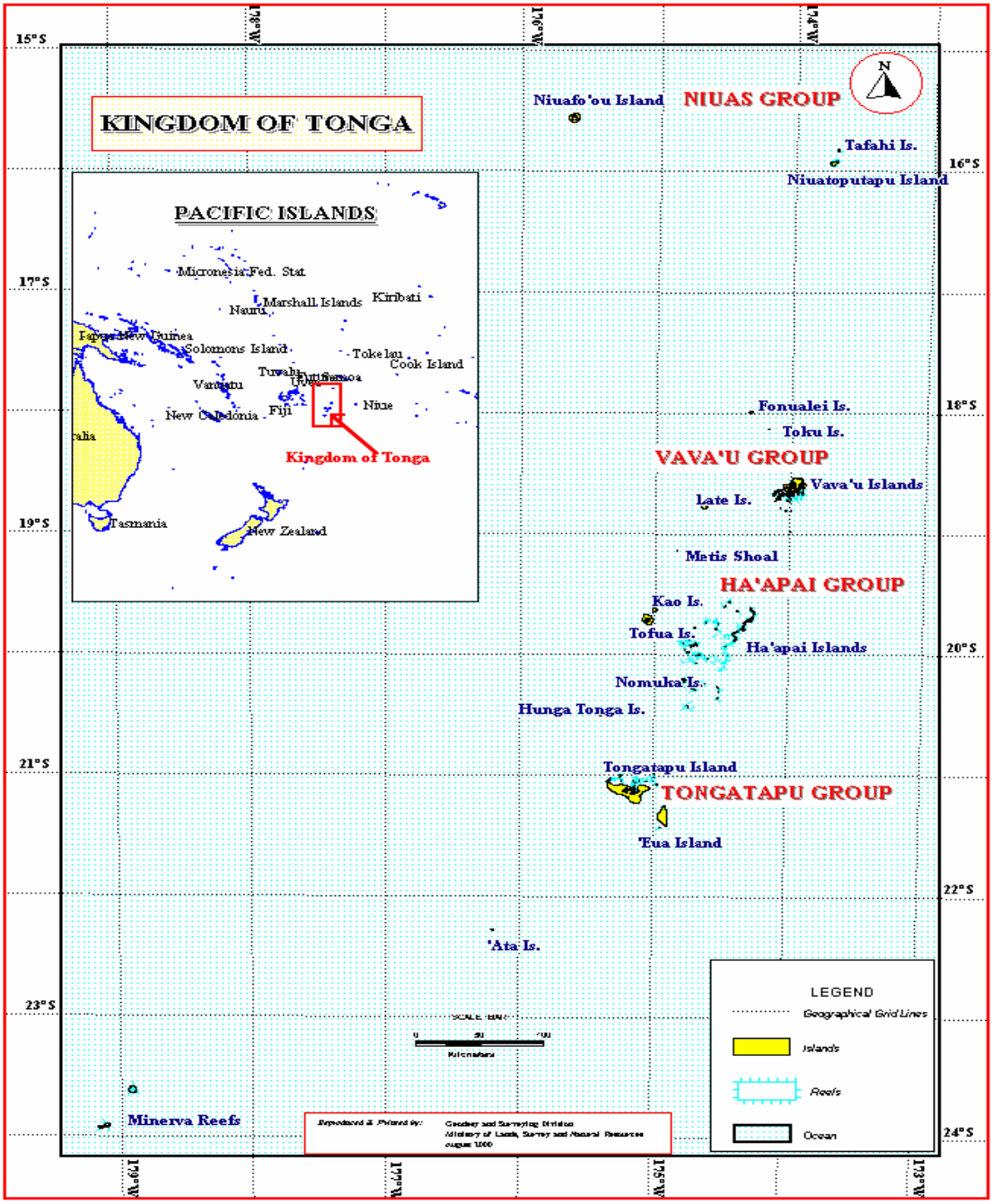
The Kingdom of Tonga is a small South Pacific nation comprising of 171 islands, of which about 37 are inhabited. There are four main groups of islands; Tongatapu, Ha'apai, Vava'u and Niuas. The Tonga Group of islands consisted of both volcanic and coral islands**.** The islands spread out between latitude 16: S to 24:S, and longitude 176:W to174.5:W (Fig 1). The total land area is only about 700 square kilometers but the territorial waters cover about 700, 000 square kilometers.

Concern about global biodiversity loss has emerged as a prominent and widespread public issue. Current critical environmental concerns in Tonga have arisen due to both natural and anthropogenic pressures such as deforestation; damage to coral reefs and the introduction, spread of invasive alien species, climate change and natural disasters.

Tonga supports a wide diversity of flora and fauna. Flora includes 419 fern and angiosperm species.Tonga is also home to 20 species of terrestrial and sea birds with two of which are endemic to Tonga and Near Threatened (NT), such as Tongan whistler (*Pachycephala jacquinoti*) and Polynesian Megapode. More than 100 000 sooty terns (*Sterna fuscata*) and according for the latest survey conducted in Late and Fonualei Islands in September 2013, Polynesian megapode continues to survive in good numbers on Fonualei but was not located on Late. About forty Polynesian megapode birds were seen each of two sites the forested slopes above camp and the forested gully in the north of the island. Several chicks were seen at the first site and one active nesting burrow located. The volcanic islands of Late and Tofua have some of the best remaining high diversity native forest and still support large populations of birds and reptiles.

The Convention on Biological Diversity (CBD) entered into force in 1992. The three main objectives of the CBD are: 1) The conservation of biological diversity; 2) The sustainable use of the components of biological diversity; and 3) The fair and equitable sharing of the benefits arising out of the utilization of genetic resources. 193 countries including Tonga are parties to the Convention. The Government of Tonga acceded to the CBD on 19 May, 1998, and ratified the Cartagena Protocol on Bio-safety to the CBD on 18 May 2003.

Figure 1: Location Map of the Kingdom of Tonga



Source: Geodesy & Surveying Section [Ministry of Lands, Environment, Climate Change and Natural Resources, TONGA

One of the principle instruments for implementing the CBD at the national level is the National Biodiversity Strategy and Action Plan (NBSAP). Tonga developed a NBSAP in 2006 formulating a strategy and planned actions for the conservation of biodiversity and its sustainable use.

Measures taken for the implementation of the Convention and their effectiveness have to be reported to the Convention. Tonga has submitted its First and Fourth National report in 2006 and 2009 respectively.

In 2010 at its tenth Conference of the Parties to the CBD adopted a revised and updated Strategic Plan for Biodiversity 2011-2020 that included twenty targets called the Aichi targets to serve as a framework for the establishment of regional and national targets. Countries are encouraged to establish national targets under the framework of the Aichi Biodiversity Targets when revising national biodiversity strategies and action plans.

National reports are essential tools in allowing the Conference of the Parties to keep track of the implementation of the Convention by providing information for the preparation of the Global Biodiversity Outlook (GBO*)*. The fifth national report provides a key source of information for a mid-term review of the implementation of the Strategic Plan for Biodiversity 2011-2020.

There are several programmes and initiatives that are currently being implemented in Tonga which are in line with the NBSAP. For instance, the GEF-PAS (GEF –Pacific Alliance for Sustainability) Island Biodiversity Project titled 'Implementing the Island Biodiversity Programme of Work by integrating the conservation management of island biodiversity' and the GEF-PAS Pacific Invasive Species Project.

Baseline information on the status and distribution of biodiversity and natural resources serves as a benchmark for monitoring and the development of biodiversity indicators and trends. These data and information are necessary for reporting and planning future actions.

This report has reviewed the 4th National report in 2010 under eight themes as outlined below:

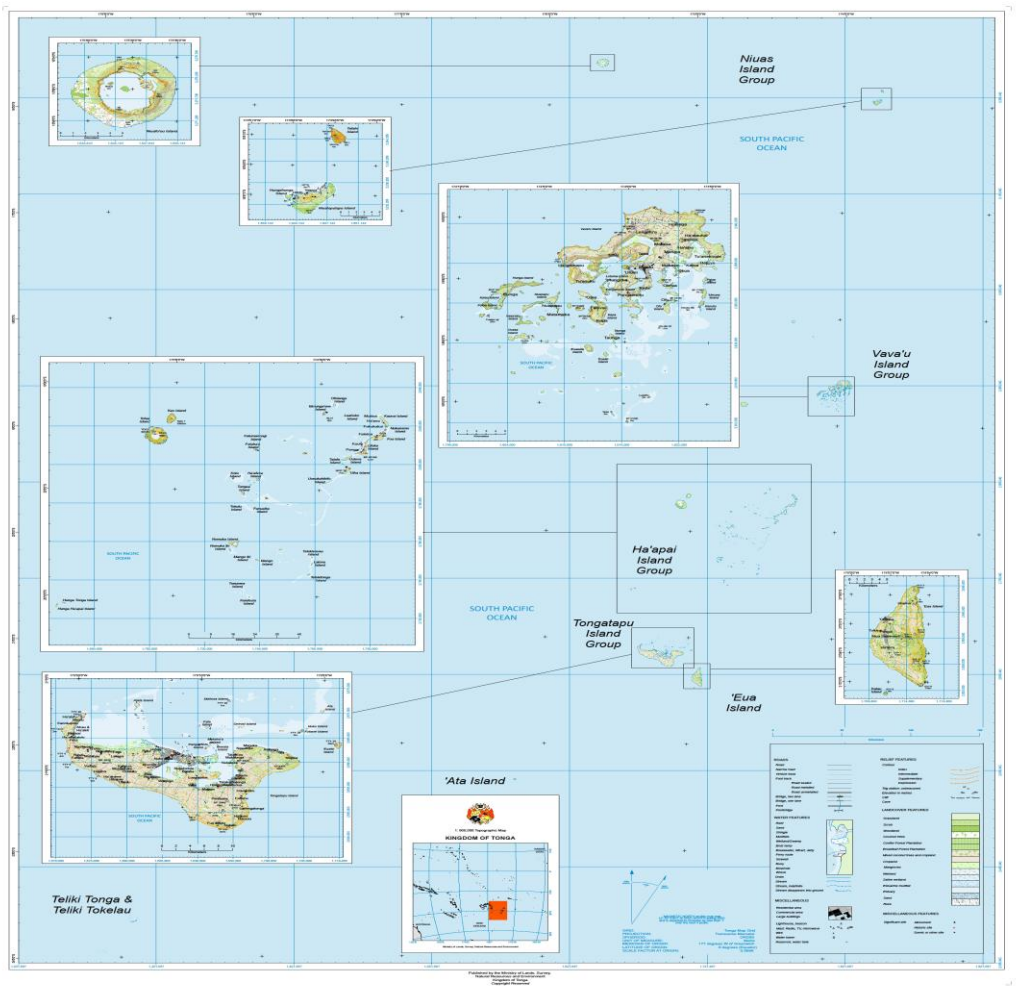
1. Forestry Ecosystem
2. Marine & Coastal Ecosystem
3. Agro Biodiversity

4. Species Conservation
5. Local Community and Civil Society
6. Access and Benefit Sharing from the genetic resources
7. Mainstreaming biodiversity Conservation
8. Financial Resources Mechanism

1.1 METHODOLOGY

Methodologies used included household surveys, in-depth interviews, literature review, public consultations and field observation.

Figure 2: The Extent of the Kingdom of Tonga - showing island groups where status, threats and trends of Biodiversity are clearly identified and illustrated in this Report



Methodologies used were undertaken throughout the main islands of Tonga includes Tongatapu, 'Eua, Ha'apai, Vava'u, Niuatoputapu and Niuafo'ou (Figure 2).

Household Survey

Household surveys were conducted on two islands of Tongatapu and' Eua. Villages surveyed on Tongatapu are shown with yellow mark on the map below and brown coloured spots in the island of 'Eua.

Figure 3: Map of Tongatapu

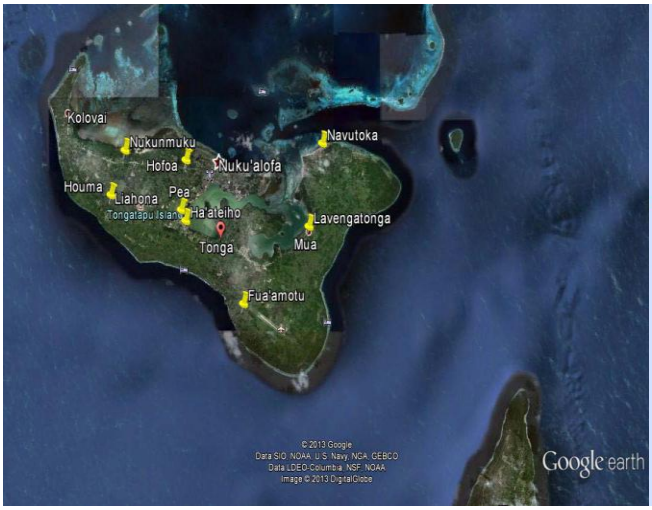


Figure 4: Map of 'Eua

Figure 5: Household survey at Ha'ateiho 2013

Source: Eileen Fonua

The Household survey was carried out on selected villages on the island of Tongatapu and 'Eua Islands. The survey was deemed important due to lack of field studies carried out on

biodiversity in the Kingdom. Secondly, the last review focused mainly on implementation status. The people's experiences and perceptions on the status, threats and future trends of their biodiversity in these two islands, were considered critical and relevant.

The household survey was conducted with the assistants of local consultant agency (Geocare & Petroleum Consult Ltd). The total households enumerated by this survey were 2,359 in Tongatapu (which is about 57% of total household census, 2011 and 192 in 'Eua 28% of number for households recorded in 2011 census) (refer table 1 & 2 Annex 1). Different methodologies were used for the rest of the island groups of Tonga.

1.1.1 Literature Review

This study focused on detailed analysis through literature review of all the existing data and information on Tonga Biodiversity including the 2006 and 2010 NBSAP reports. This includes other Pacific islands NBSAP, articles, regional and international Biodiversity training, workshop and conferences publications, journals and newspapers. Internet also offers many different sources of information for this research.

In-depth Interviews

Interviews were conducted with expertise from relevant sectors and stakeholders which Biodiversity conservation and sustainable development is one of the key priority areas in their programmes. This includes the Ministry of Agriculture, Fisheries, Forest and Food (MAFFF), the Ministry of Lands, Environment, Climate Change and Natural Resources (MLECCNR), Ministry of Education and Training (MET) and Civil Society.

Public Consultations

Public consultation meetings and workshops were conducted in communities in Tonga including Tongatapu, Ha'apai, Vava'u and the two islands of the Niua's. This is the first time for NBSAP public consultations to reach out to both Niuatoputapu and Niuafo'ou.
Schedule for public consultations held in Tonga are in Annex 1.

Figure 6: Ha'alaufuli district public consultations

Source: Eileen Fonua, 2013

Figure 7: Pangaimotu district public consultations

Source: Eileen Fonua, 2013

Field Observation: Field surveys and observations were conducted to gather information on the status, threats and trends as far as biodiversity is concern in Tonga. Sectors include Forestry, Agriculture landuse, Marine, Coastal area and Species Conservation were among those that have been thoroughly considered.

1.2 FACTORS AFFECTING THE STATUS OF TONGA'S BIODIVERSITY

Climate

The climate is tropical with a distinct warm period (December-April), during which the temperatures rise above 32 °C (89.6 °F), and a cooler period (May-November), with temperatures rarely rising above 27 °C (80.6 °F). The temperature increases from 23 to 27 °C (73.4 to 80.6 °F), and the annual rainfall is from 1,700 to 2,970 millimetres (66.9 to 116.9 inches) as one moves from Tongatapu in the south to the more northerly islands closer to the Equator. The average wettest period is around March with an average 263 mm (10.4 in). The average daily humidity is 80%. Thus, rainfall and temperature are factors that influence the varieties of biodiversity in Tonga.

Geology

Tonga archipelago is actually made of two geologically different parallel chains of islands which influence the range of biodiversity, both marines and terrestrial species.

The western islands, such as 'Ata, Fonuafo'ou, Tofua, Kao, Late, Fonualei, Toku, Niuatoputapu, and Tafahi, make up the Tongan Volcanic Arch and are all of volcanic origin. They were created from the subduction of the western-moving Pacific plate under the Australia-India plate at the Tonga Trench. The Tongan Islands sit on the Australia-India plate just west of the Tonga Trench. These volcanoes are formed when materials in the descending Pacific plate heat and rise to the surface. There is only limited coral reef development on these islands, except for Niuatoputapu. The eastern islands are non volcanic and sit above the mostly submerged Tonga ridge that runs parallel to the Tongan Volcanic Arch and the Tongan Trench. Of these islands, only 'Eua has risen high enough to expose its underlying Eocene volcanic bedrock, the rest are either low coral limestone islands or sand cay islands. These islands are surrounded by "a protective and resource-rich of fringing, apron and off-shore barrier reefs" that have supported most of the human settlement in Tonga.

The Tongan Volcanic Arc has been important in supplying the islands on the Tonga ridge with an andesite tephra soil that has resulted in "an extremely rich soil capable of supporting a high-yield, short-fallow agricultural system." and forestry.

This chapter basically emulates structure of the other NBSAP reports in order to provide consistency for comparison purposes. It will also maintain the four thematic areas as parameters to assess the status, trend and threats of Tonga's biodiversity. The Chapter will be putting the microscope specifically at our forest ecosystem (including coastal forest and mangroves), agro-biodiversity, marines' ecosystem and species conservation. It is envisaged that this holistically approach will provide the ideal based for the recommendations that will be proposed at the end of the report.

Overview:

Chapter one highlights the socio-economic, cultural and ecological importance of Forest, Marines, Agrobiodiversity ecosystems and species conservation to Tonga and the people's livelihood. It is also emphasised the threats that contributed to the depletion of biodiversity and trends. We all aware that biodiversity conservation and sustainable development are cross cutting issues among the relevant sectors. We cannot isolate one sector from another in the implementation of NBSAP objectives. Hence, coordination among the relevant stakeholders is very important to protect and conserve biodiversity from overexploitation and loss.

1.2.1 Forest Ecosystems

The importance of the forest ecosystems highlighted in three categories namely; economic, social and ecological aspects.

Economic

Forest ecosystems continue to provide the local communities with relatively small but increasing economic benefits. Since the fourth national report, the contribution of Forestry towards national Gross Domestic Product (GDP) increases almost twofold (Table 1). Much of the increase resulted from export of sandalwoods (*Sandalum yasi*). The most prominent forest-product development agency is the operation of the Tonga Forest Product Limited (TFP). Although small scales portable sawmill commenced operation in 2012, the trend in timber production is steady in the past 10 years including the time when Tonga Timber Limited was operational (1995-2010). The timber annual throughput averages at 300 square meters. This equates to 2-3 ha of plantation forest harvested annually or approximately 3 percent of annual timber import volume.

Table 1: Forestry contribution to GDP

Table 2: Agriculture sector GDP Contribution (TOP$ millions)					
Industry	**2007-08r**	**2008-09r**	**2009-10r**	**2010-11r**	**2011-12p**
1. Agriculture	80.6	85.2	95.1	107.6	109.1
2. Forestry	2.6	2.7	2.7	5.0	4.0
3. Fishing	14.7	13.9	19.1	19.4	20.8
Total	**98.0**	**101.8**	**116.9**	**132.0**	**133.8**
GDP at market prices	**659.3**	**664.3**	**712.2**	**775.0**	**799.3**
% Sector Contribution	**14.9%**	**15.3%**	**16.4%**	**17.0%**	**16.7%**

Source: MAFFF report, 2012

Such low percentage of local plantation forest harvesting has positive and negative implications especially on the ecosystem. On the positive side, the ecosystem kept relatively intact for longer period of years hence contributing to improving the status of other living organisms living in harmony inside the forest. Further, it contributes to improving the quality of water particularly in the 230 ha water catchment area, (refer to figure 26). TFP have developed better forest roads network and situate signs on appropriate locations to guide visitors (refer to figure 27, 28 & 29).

On the other hand, evidences from the author's site visit of May 2013, there are increasing risk of pest and diseases infestation of partially logged sites in which numerous merchantable logs

left to rot in the field (refer to figure 9 & 10). A return of the logging unit to complete the clear felling would disturb the naturally regenerated vegetation. Selective logging inside the declared watershed areas poses threat to the conservation of the main source of water for the island. Despite allowing of timber trees to mature, necessary silvicultural practices such as thinning, pruning and sanitation measures not carried out as desired.

The export of dried sandalwood, primarily to Chinese markets between 2007 and 2011 amounted to approx. 326,447 kilograms. Given an average local buying rate of T$30 per kilogram, this injected some 9-10 million pa'anga directly to the local communities.

Despite this positive economic benefit, there are critical risks associated with lack of management of sandalwood harvesting. Most of the matured (and juvenile) trees removed, thus limiting the number of mother trees to act as local seed sources. This resulted in local seedling production ventures, including Ministry of Agriculture and Food, Forests and Fisheries (MAFFF) Forest nurseries, to order new sandalwood varieties which could sabotage the high quality and the authenticity nature of the local *Sandalwood yasi* variety. Having several cultivars enhances cross pollination that may result in new offspring with inferior wood and oil qualities. Based on the result of the recent MAFFF community consultation, the average age of existing sandalwood trees range between 1 to 6 year old. It will take another 5-8 more years before these trees produces seeds.

The rate of replanting of sandalwood is considerably slow with annual number averaging at 50,000 seedlings produced and planted each year. Since sandalwood is epithetical, it requires companion plants and preferred heavy inter planting with higher crops. Given the low rate of replanting and long-term (15-25 years) nature of sandalwood plants, MAFFF is seeking cabinet degree to ban export of dried woods for at least 10 years.

Social

Wood carving export

Forests and trees have long been associated with the social well being of the Tongan communities. They serves production functions by supplying of; food mainly in the form of fruits and nuts, firewood mainly for cooking, timbers for both formal and informal constructions, sources of local medicine, tools mainly for domestic uses as in farming and fishing tools, etc.

Both the 2006 inventory and 2006 assessment did not disclose figures on fruit trees, whether ecosystem coverage, species diversity and endemism. The NBSAP 2006 sector on agro-biodiversity gave a short list of fruits considering as a source of food.

Export of local woodcarvings comes in the expense of harvesting the remaining hardwoods, especially local coastal trees namely; *Hibiscus tiliaceus, Casuarina equisetifolia, Thespesia populnea, Tournefortia argentea, Callophyllum inophyllum, Myristica hypargyraea, Terminalia catappa, Mertya macrophylla,* and *Ficus scabra.* These results in coastal regions exposing to soil erosion, loss of vital medicinal plant sources and increase in events of wind and salt spray damages.

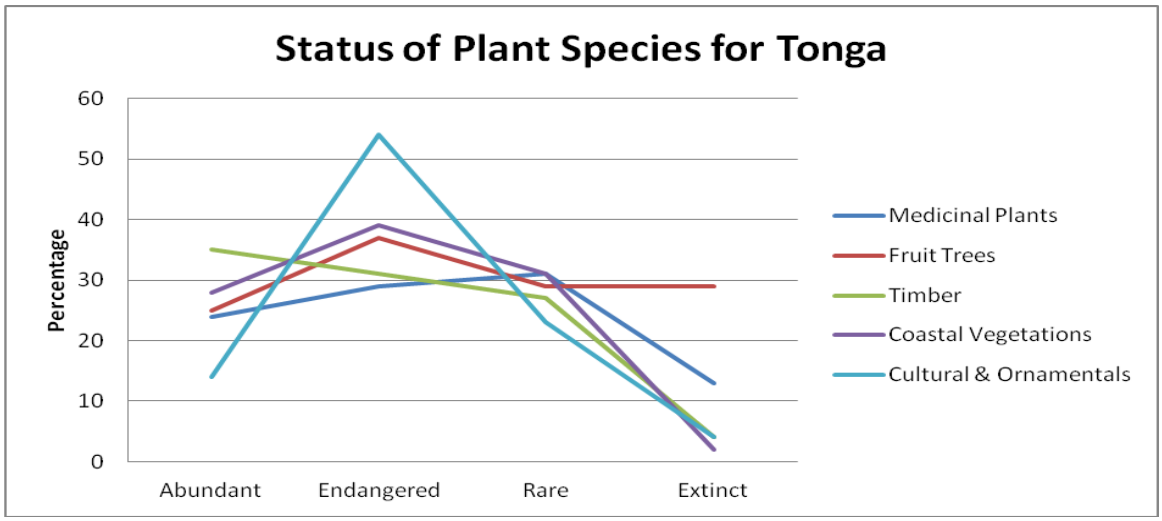
Ecological

Forests have ecological values which help conserve and enrich the environment in several ways. For example, forest soil soaks up large amounts of rainfall. It thus prevents the rapid runoff of water that can cause erosion and flooding. 'Eua Island is a high island, therefore forest grow in the upland area helps to prevent the rapid runoff of water that cause erosion and flooding. In addition, forest provides a clean and fresh source of water for 'Eua.

Forest plants, like all green plants, help renew the atmosphere. As the trees and other green plants make food, they give off oxygen. They also remove carbon dioxide from the air. People and nearly all other living things require oxygen. If green plants did not continuously renew the oxygen supply, almost all life would soon stop. If carbon dioxide increases in the atmosphere, it could severely alter the earth's climate. Forests also provide habitats for many plants and animals that can live nowhere else. Without the forest, many kinds of wildlife could not exist.

Figure 8 below indicates the status of plant species for Tonga as a result from public consultations took place in the main islands of Tonga including Tongatapu, Ha'apai, Vava'u, Niuatoputapu and Niuafo'ou.

Figure 8: Status of plant species for Tonga



Source: Kautoke, A. & Hoponoa, T, 2013

According to our public consultations in Tonga, it is identified that Fruit trees recorded the highest extinction rate of 30% followed by medicinal plants on 13%, timber on equal 4% and cultural is least on 2%. The range of rarity in all forest species compressed between 22% for cultural species to 32% for medicinal and coastal species. The endangered status is highest on cultural species with 54% and lowest in medicinal plants with 38%. Timber species in most abundant with 35% whereas cultural species recorded lowest of 14%. The overall status is therefore not critical because of low rate of species loss or extinct and that remedial action is progress.

Major Changes

A total of 502 ha of plantation forests were recorded in the 2009 assessment. The 2013 update concluded a total of **920ha** of exotic forests comprising of 719 ha (78%), 150 ha (16%) and 50 ha (6%) of Tonga Forest Product Limited ('Eua), Queen's plantation ('Eua) and collective agroforestry boundary planting timbers (nationwide) respectively. This represent a 418 ha increase in exotic forest cover. These are not new planting, but rather a miscalculation of the existing exotic forest ecosystem coverage during the 2009 assessment. Nonetheless, it marks a 4 % increase since the 2009 assessment. It appeared that the records on the acreage of privately planted exotic timber trees (potentially a responsibility of MAFFF) are not in order.

On island group assessment, the uninhabited volcanic island of Kao and Tofua have indigenous forest with unique ecological value for conservation. At the same, these islands are the only source of agricultural land available for nearby small islands to cultivate for food production.

Both of these requirements are essential and important, but, from conservation perspective, are incompatible. Such an extreme would need immediate intervention by appropriate authority to introduce proper management procedure and conduct public consultation to promote awareness on the important ecological values that need protection. This approach should be pursued for the protection and conservation of remaining forest ecosystem and biodiversity on other uninhabited islands in the Kingdom.

In Vava'u, the conversion of lands on very steep slope for settlement and development is becoming a common practice. These areas have forests that provide supporting services for the protection of lagoon and marine resource from pollution. Since the natural system do not correspond to political boundaries, all relevant government sectors, national economies, and communities are ultimately dependent on a common heritage of natural resources.

With climate change, some of the pilot project implemented to address and encounter impacts on climate change has, so far, shown very encouraging result. The GIZ funded project on mitigation and adaptation of climate change impacts for reforestation of cleared forest area for agriculture within the Eua National Park boundary and the Eua watershed estate. To date, over 20 hectares of cleared forest area is gradually restored to natural growth through enrichment planting and natural regeneration. Enrichment planting is used for re-vegetating areas that used mechanization for land preparation, whereas natural regeneration is used for area that had been cultivated using the traditional farming system. This rehabilitation model is also suitable for the conservation and development of the remaining forest under similar category in the Royal Estate. Legal securing of land ownership, by gazetting, would be necessary to justify long term security of any future investment and development in the area.

In Tongatapu, conversion or subdividing of agricultural land for residence and development has resulted in the clearance of small fragmented forest and important tree species and plant varieties. Protection of agricultural land from further allocation to other form of landuse is required. Similarly, land under long term lease for agriculture, including mortgage land that is subleased for loan repayment, very little consideration is given to conservation of biodiversity; extensive and continuous farming of short term crops is preferred for profit maximization. Indiscriminate clearing of coconut and trees to increase production is normally the case.

The coconut population is declining and, with lack of economic incentive, there is no interest in replanting of this very important resource. At the local level, however, it appears that there is a surplus supply of coconuts due to lack of overseas market for export of coconut products. However, in considering the extent and density of coconut resource it shows a big decline in

population with up to 36% reduction especially on the main islands of Tongatapu and Vava'u. The local indigenous varieties are considered to be rare and only found on isolated small islands in the Ha'apai group. These native populations should be protected for conservation of local varieties.

Adopting of boundary planting and agroforestry as a prefer form of agriculture will contribute to the protection of the forest ecosystem and its biodiversity. However, the using of agricultural land as mortgage or on long term lease arrangement has resulted in the abuse of farming system to maximize profit. This has often resulted in the promoting of continuous short term mono cropping in favour of long term mixed cropping. With this type of farming system, it involves heavy mechanization of land preparation which results in the removal of fragmented woodland and trees for convenience and to increase productivity.

The current status of biodiversity has raised some questions with regard to the validity of the five species included in the International Union for Conservation of Nature (IUCN) Red List of 2009. Of the five species submitted, only *Aglaia heterotricha* (langakali vao) is supported and therefore should be maintained in the list. The other species recommended for inclusion include *Casearia bluelowii* and *Sesbania coccinea* found only on Vavau islets. Because of lack or absence of management and development in the conservation and protected areas, uncontrolled and illegal harvesting and encroachment are usually occurred which cause degradation in biodiversity.

The usual public expression indicating keen interest in planting of traditional and cultural species is still a common remark heard in consultation meetings and workshops with lack of commitment shown in the field. Apart from common excuses such as lack of funds and planting materials for seedling production, the people's attitude and mentality toward forest and trees as natural gift and are ultimately at the disposal of humans to be use and abused, should be change. Moreover, he detrimental notion of non-conservational that the environmental services we received should be obtain free of charge, need to be addressed with appropriate education and awareness program. It is strongly recommended that species conservation should be practiced using ex-situ approach and identification of wild population with unique conservation values for protection and conservation should strongly advocate. The hunting of birds and fruit disperser in the wild, with shotgun, should be banned and strictly enforced.

In view of limited forest resources and the increasing competition for other land use, future strategy for conservation and protection of forest ecosystem and biodiversity should be base

on multipurpose objectives or ecological potentials of the forest. As the current Deputy for Forestry once said "…now we must shift our thinking of the forest as a mono-use objective to a multi-purpose, as now we are not moving from a predictable and sure era to a time of uncertainty and unpredictability…" (Land Use Policy Workshop, Moulton Hall, 12th March 2014)

Main threats to 'Eua forestry: Survey conducted at 'Eua Forestry (9-14 of May, 2013)

Figure 9: Heavy Machineries used for deforestation

Source: Kautoke, R.A. 2013

Figure 10: Leaving cut trees for long periods of time on the ground leads to introduction of Invasive species

Source: Kautoke, R. A. 2013

Figure 11: Termites (Invasive species) observed on wood cuttings

Source: Kautoke, R. A. 2013

Natural disaster, such as cyclones, tsunami, climate change and heavy mechanisation (Figure 9) are still the main cause of destruction for forest ecosystem and biodiversity. With increase in climate change impacts, there is a correspondent increase in the frequency of occurrence and the intensity of natural disaster. The destruction and degradation of forest will affect people livelihood with decreasing supply of forest products and the low standard of services provided.

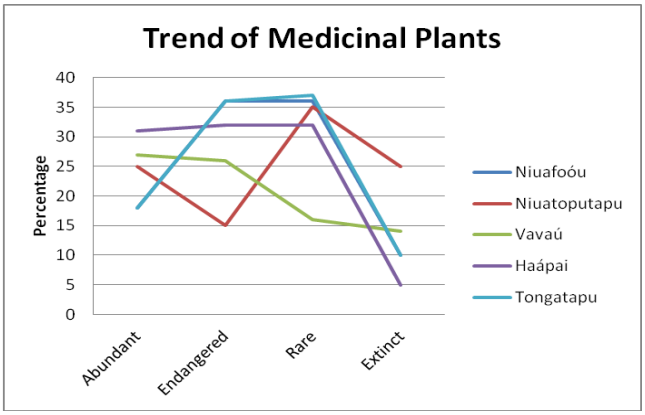
Since forest rehabilitation is a very long term process, it would be impossible to restore the forest to original state once it is polluted and depleted.

Some exotic species introduced with good intention is becoming a concern in the conservation of forest ecosystem and biodiversity. *Codia sp* (kotia) was introduced as timber species for plantation establishment on 'Eua posed a major threat to the conservation of biodiversity at the national park and in the adjacent remaining forest on the royal estate. The species regenerates profoundly and is spreading along the eastern boundary of the plantation with the national park. It has been reported that *Cordia* has started to intrude the national park area. Usually, with an opening in the canopy, the species will establish and eventually, over time, colonize the area.

On the other hand, the introduction of *Santalum album* for species trial has threatened the genetic conservation of the local species of *Santalum yasi* through hybridization and the overharvesting. The new hybrid has shown very good growth and performance. With the current rate of harvesting for export and the mass production of hybrid seedlings for planting, there is concern of local species becoming extinct if selected natural population is not protected. S*antalum yasi* is found only in Tonga and Fiji.

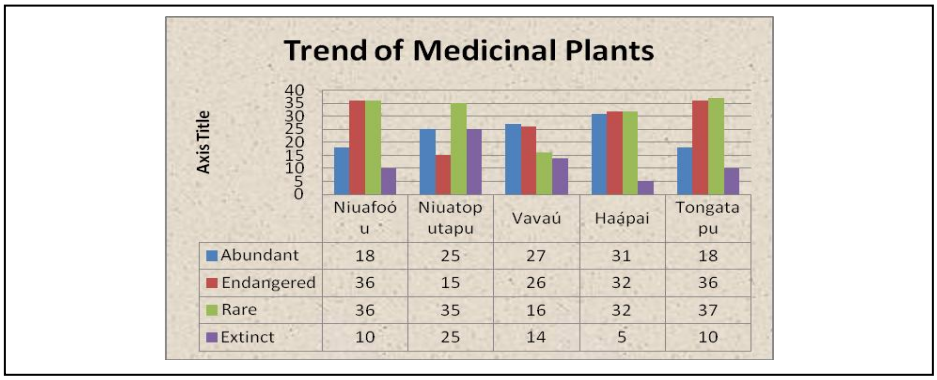
The trends of each plant species for all islands that our public consultations were held are discussed below:

Figure 12: Trend of Medicinal Plants



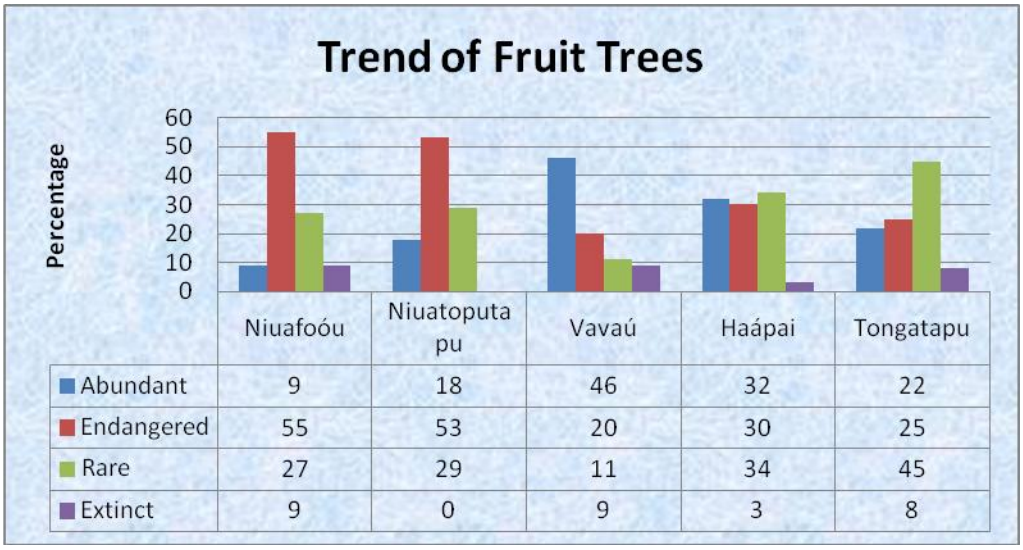
Medicinal plants lost most in Niuatoputapu (25%) and least in Haápai (3%). Species rarity notable in Tongatapu, Niuatoputapu and Haápai with 37%, 34% and 32% respectively

There are positive signs for medicinal plants availability in Tongatapu, Haápai and Vavaú due to availability of the MAFFF forestry nursery which can supply seedlings for these communities



	Niuafoóu	Niuatoputapu	Vavaú	Haápai	Tongatapu
Abundant	18	25	27	31	18
Endangered	36	15	26	32	36
Rare	36	35	16	32	37
Extinct	10	25	14	5	10

Figure 13: Trend of fruit trees

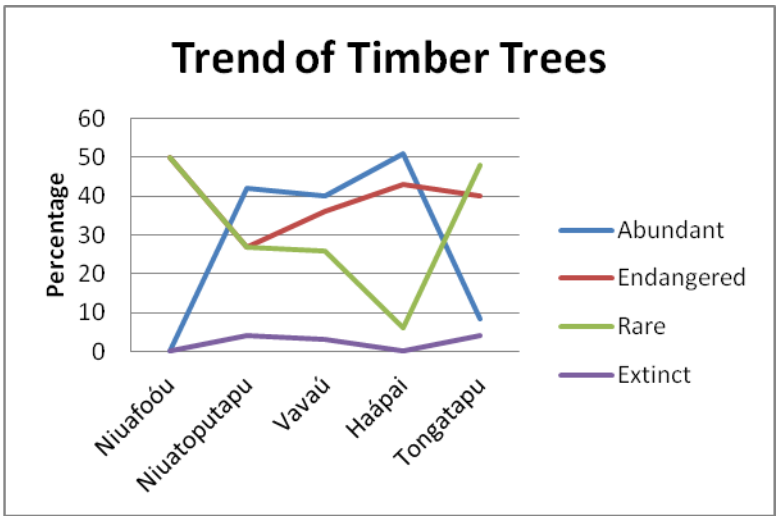


	Niuafoóu	Niuatoputapu	Vavaú	Haápai	Tongatapu
Abundant	9	18	46	32	22
Endangered	55	53	20	30	25
Rare	27	29	11	34	45
Extinct	9	0	9	3	8

Hoponoa T. and Kautoke, R A., 2013

The percentage of fruit trees species loss is kept at minimum of less that 10% in all island districts with Niuatoputapu recorded least at 1% and Niuafoóu on 10% Rarity of fruit trees is most critical in all island districts except Vavaú. There is a notable concern over endangered species in Niuafoóu and Niuatoputapu at 54%.

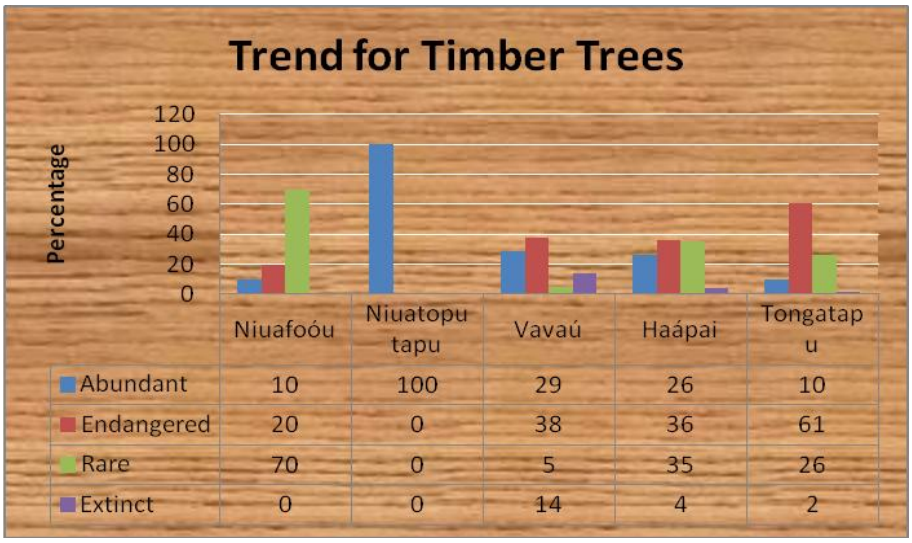
Figure 14: Trend of Timber Trees



Source: Hoponoa T. and Kautoke, R. A., 2013

Niuatoputapu, Vavaú and Tongatapu recorded high 4% average extinct timber species. Rarity in timber species is highest in Niuafoóu on 50% followed by Tongatapu on 48% but lowest in Haápai. On the other hand, Timber species is endangered mostly in Haápai with 43% and lowest in Niuatoputapu with 27%.

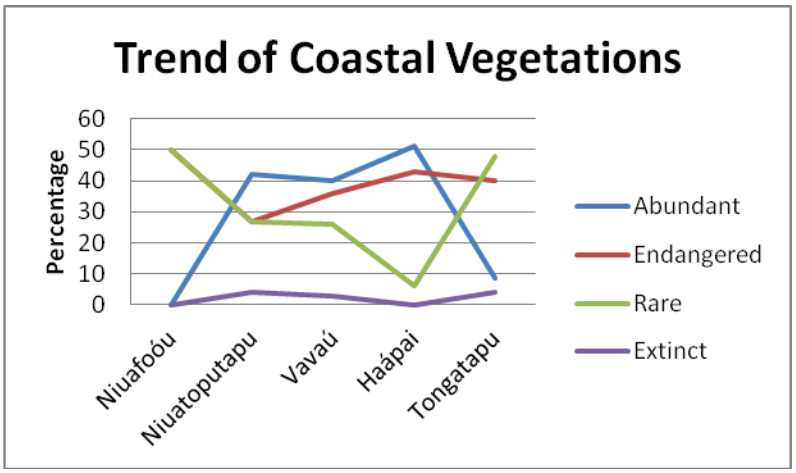
Figure 15: Graph depicting Trend of Timber Trees



Source: Hoponoa, T. and Kautoke, A., 2013

Haápai recorded highest species abundance (51%) followed by Niuatoputaou (42% and Vavaú 40%). Most of the recorded timber species are introduced species of Pinus, mahogany and red cedar. Tamanu is the main locally known timber species

Figure 16: Trend of Coastal Vegetation

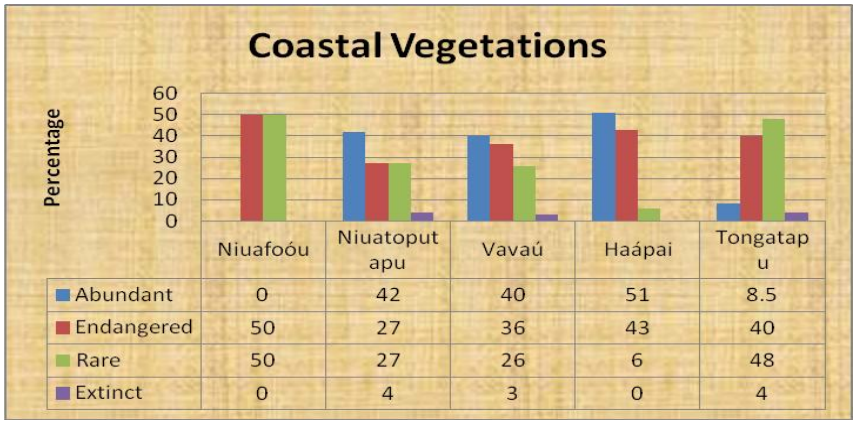


Source: Hoponoa T. and Kautoke R. A., 2013

The overall loss of coastal species is relatively low on 3% average with least recorded in Niuatoputapu and Haápai. The most concern over rare species is in Niuafoóu on 50% and Tongatapu on 48%. The endangered species is kept on 30 to 42% range thus requiring active

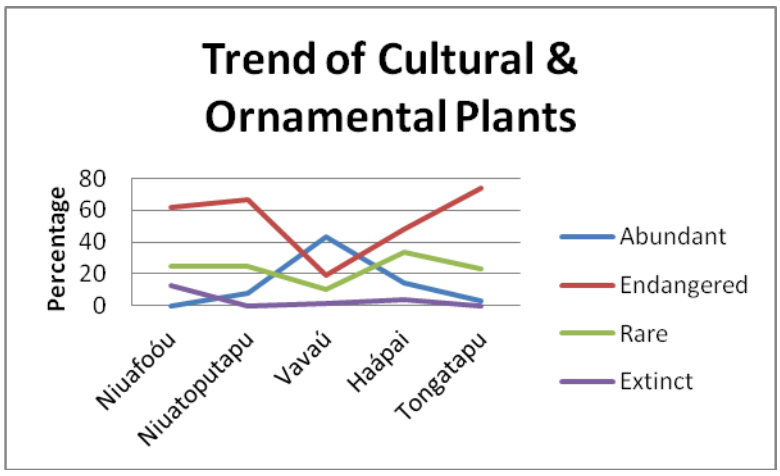
replanting programs in all island districts. The main causes of species loss is soil erosion, harvesting of timber for wood carving, lack of replanting programs and unmanaged encroachment by the local communities.

Figure 17: Bar graph depicting trend of Coastal Vegetation



Source: Hoponoa, T. and Kautoke, R. A., 2013

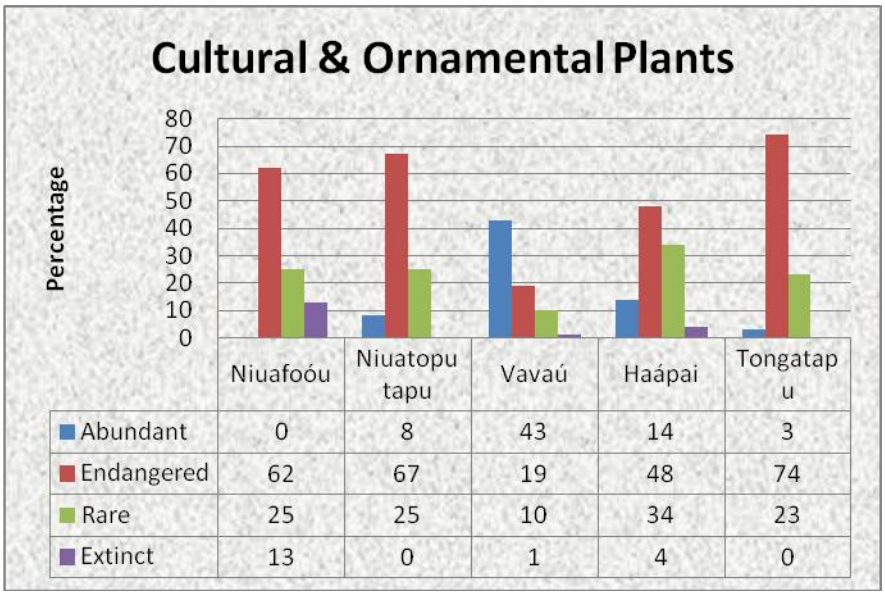
Figure 18: Trend of Cultural & Ornamental Plants



Source: Hoponoa, T. and Kautoke, R. A., 2013

Apart from Niuafoóu on 20%, all island districts recorded low species loss of cultural species with an average of 3%. The status of endangered cultural species is a concern with Tongatapu recorded highest of 73% followed by Niuatoputapu and Niuafoóu on 64% and 62% respectively. Valuable cultural species namely Heilala, Hea and Moónia are in high demand by women all over Tonga although propagation of such species is a challenge.

Figure 19: Trend of Cultural & Ornamental Plants



	Niuafoóu	Niuatopu tapu	Vavaú	Haápai	Tongatapu
Abundant	0	8	43	14	3
Endangered	62	67	19	48	74
Rare	25	25	10	34	23
Extinct	13	0	1	4	0

Source: Hoponoa, T. and Kautoke, R. A., 2013

Impacts of declining biodiversity on human well-being and livelihood

With the continuing degradation of ecosystem and biodiversity, it will affect the quality and the sustainability of the forest products and polluted the ecological service provided. The nature and quality of the services provided by the ecosystem is subject to the richness of biodiversity composition and species interaction.

Naturally, the species in the ecosystem is dependent on each other for their existence. If one species becomes extinct it will affect the other species and eventually cause degradation to the ecosystem. This will cause major negative impact to forest ecological services.

The international trade in forest products is increasing and non-market value of fuel wood remains invaluable. In addition, the values of ecological services are immeasurable. Forests stabilize water supplies and soil especially on island with rugged terrain such as Eua. As repositories of diversity, it is estimated that, with one hectare of tropical forest, it has as many as over 200 tree species. With climate change, forests regulate climate by removing carbon from the atmosphere. Its provide homes for many wonderful life forms. Forests are key sources of local jobs and community stability; with interaction with forest - not just the material aspects of lives, but spiritual and cultural aspects as well.

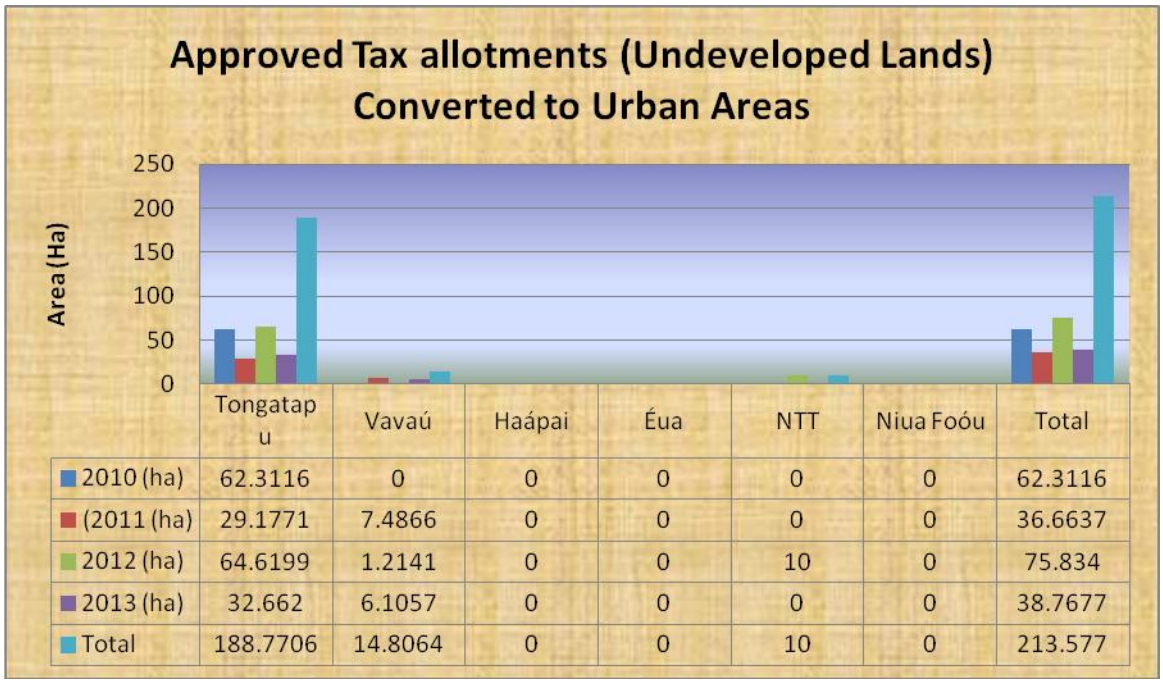
In addition, habitat destruction due to land use change (for agriculture) and establishment of plantations; habitat alteration due to the spread of invasive alien plants that compete with and displace native species are the main causes. Introduced *Casuarina equisetifolia* (introduced most probably when the Polynesians arrived) and several other alien and invasive plants both shrubs and lianas introduced by the European settlers are dominating some ecosystems. *Clidemia hirta*, *Lantana camara*, *Psidium guajava* and *Epiprenum* vine are examples. Introduced *Paspalum vaginatum* is the dominant grass cover in the inland margins of the swamp (Pagad, 2013).

Urban Sprawl – Encroachment of Residential areas into Forested and Agricultural Areas

The data for this part of the report was taken from recorded tax allotments (lands allocated for cultivation) approved by the Ministry for the Scheme Planners to be subdivided into town allotments within the timeframe 2010 – 2012.

It has been documented in the National Biodiversity Strategy and Action Plan "that the main threat for Biodiversity is from the indiscriminate expansion of Agriculture". However, other unstated but increasing threat related to Land has been identified as another major threat to the Biodiversity – the encroachment of residential areas into forested and agricultural lands, as shown in (figure 20) below. The total areas approved to be subdivided into town allotments – urban zones; between 2010 -2012 was approximately 213.577 hectares. Approximately 88 per cent of this approval for urban crawl was allowed at the main island of Tongatapu. The main reason for this high concentration of approval for subdivisions of land at the main island was due to the desperate needs for residential lands from mass migration of the population from the outer islands to the main island.

Figure 20: Area of Agricultural Lands/Forested Areas (tax allotments). Approved to be Sub-divided into Urban Zones (Townn allotments) between 2010 and July 2013



	Tongatapu	Vavaú	Haápai	Éua	NTT	Niua Foóu	Total
2010 (ha)	62.3116	0	0	0	0	0	62.3116
(2011 (ha)	29.1771	7.4866	0	0	0	0	36.6637
2012 (ha)	64.6199	1.2141	0	0	10	0	75.834
2013 (ha)	32.662	6.1057	0	0	0	0	38.7677
Total	188.7706	14.8064	0	0	10	0	213.577

Lands Data Source: Approved Scheme Plans - MLECCNR records office of Minister

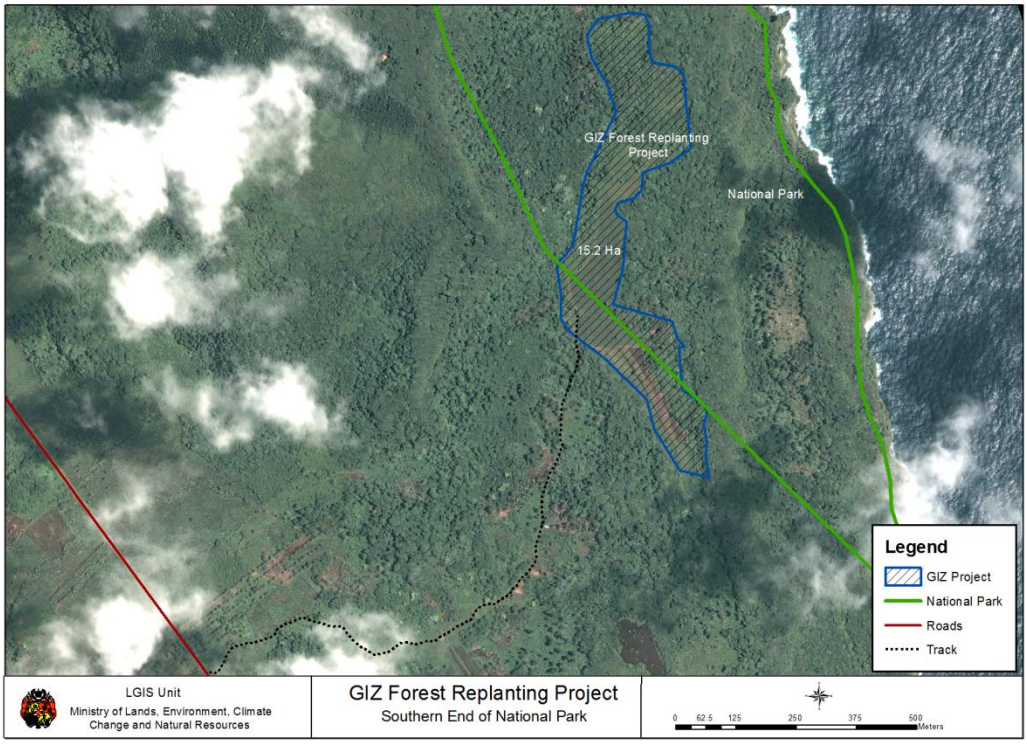
Related Regulations, Policies and Plans for this topic include the followings: National Spatial Planning and Management Act 2012, Environment Impact Assessment Management Act 2010, National Strategic Planning Framework - 2010, Nukuálofa Integrated Urban Development Plan, Urban Infrastructure Development Plan, National Strategic Spatial Framework, National Planning and Management Systems – Final Report – 2010 (refer table 3 Annex 1).

Case Study: Eua Island

The reason for selecting the island of Éua as a second island for survey and assessment of the Biodiversity status was not only due to its proximity to the main island of Tongatapu but new developments and changes to Biodiversity have been identified in this island.

'Eua National Park Agricultural Encroachment and Replanting Scheme

Figure 21: Deutshe Gesellshaft fur Internationale Zesammenarbeit (GIZ) Replanting Scheme



Unauthorised and illegal clearings of land for cultivation at protected areas have been recognised for many years but with the joint collaboration of the *Ministry of Lands, Environment, Climate Change and Natural Resources (MLECCNR)*, Forestry Division of the *Ministry of Agriculture, Food, Forests and Fisheries (MAFFF)*, and the locals, these have been finally controlled.

Huge successful replanting schemes have been established at prohibited areas previously cleared by locals for farming as shown in Fig 21 above – a GIZ replanting scheme of 15.2 hectares has been established at the southern end of the Éua National Park (also shown in Figure 22 & 23 below).

Figure 22: GIZ new replanting scheme at the southern end of the National Park

Figure 23: The National Park looking northward from the GIZ Replanting Scheme Project

1. GIZ Food Security Project

Figure 24: The Proposed GIZ Food Security Project at Petani Village - Plots 1, 2 and 3

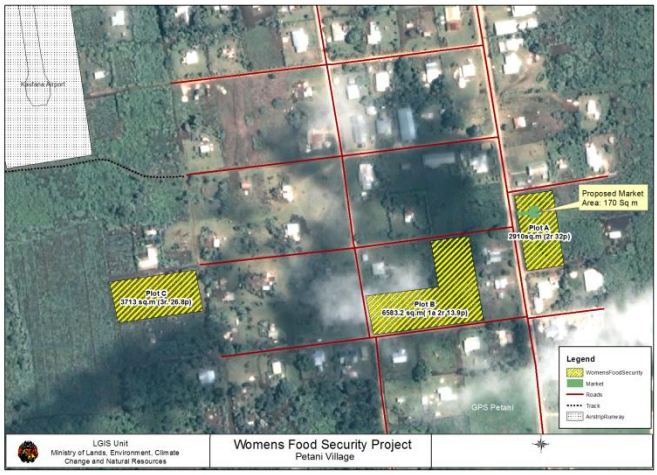
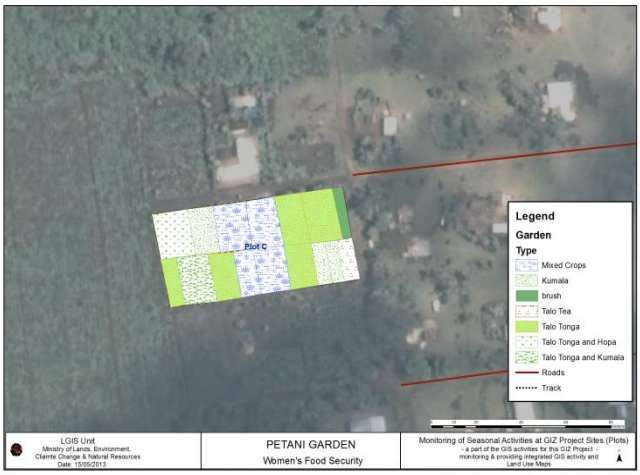


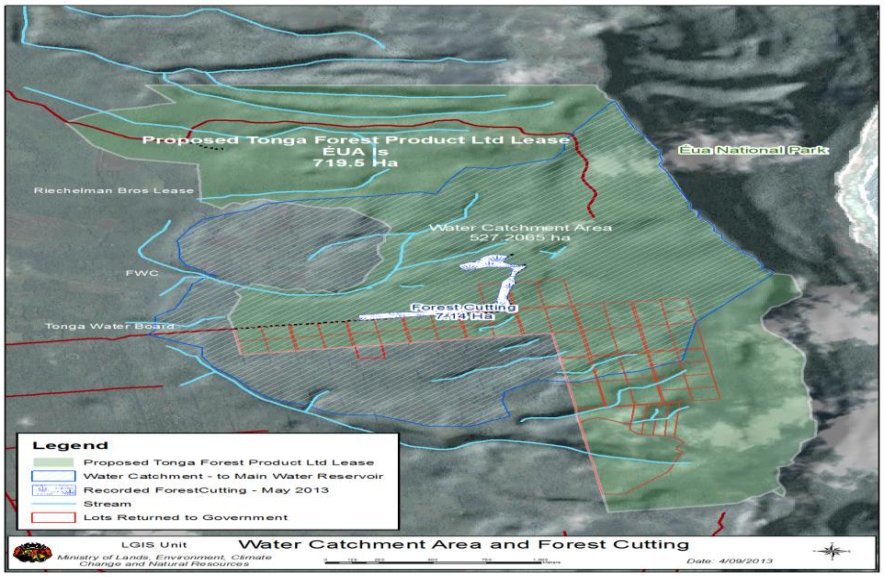
Figure 25: The Existing Food Security Project also at Plot 3 - Petani village



These new developments were also identified, during the Éua survey, at lands left unattended (open space – absentee landowners) for long period of time – Petani villag

'Eua Watershed and Forest Reserve

Figure 26: 'Eua Watershed, relocated lands from Forestry Reserve, and Forest Cutting at Proposed Tonga Forest Product Lease



Eua Forestry Lease and Tax Allotments relocation

The people of Éua had been practising slash and burn cultivations, for a long time, at prohibited areas within the watershed and at the National Park but with the intensely contributions from stakeholders and the people of Éua, they have been finally in control these changes have been clearly observed during the watershed survey of Éua:

There was obvious evidence that unauthorised and illegal clearing of lands for agriculture at prohibited areas reserved for Watershed and National Park as shown in Fig 26, have finally been in control as some of the protected areas are fenced in and signs are located at various entrances to the protected areas (Figure 27).

Figure 27: Signs and Warnings to locals to keep out

The encroachment of Agriculture to National Forest Reserves, National Parks and watershed had been in control with relocation of tax allotments out from the watershed to the new allocated area immediately south of the water catchment boundary as shown in Fig 26 above.

The 719.5 Hectares lease for Tonga Forest Product was just granted at the end of 2013 subject to the MOU in line with the TFP Environment Management Plan 2014 -2018, MLECCNR Environment Management Act 2010, and MAFFF EIA of the Éua Forest 2010.

Deforestation – There was no evidence of replanting of young forest plants to replace the timber harvesting of approximately more than 7.4 hectares as shown in Figure 26 above. Although there is no clear evidence of forest replanting to replace the wood cuttings but after interviewing of the manger of the TFP Ltd, Vaitaki Branch, it was declared that a huge replanting scheme has been proposed, however, no evidence of any action yet put into practice.

Case Study: A threat to Niuatoputapu Island by tsunami

A tsunami that happened in September 2009 destroyed approximately 46 percent of the island of Niuatoputapu's vegetations and infrastructures. The damage was estimated at about US$10 million. Most of the public utilities and government buildings were completely destroyed, along with the water and sanitation system.

The island was heavily devastated by the huge tsunami waves and the result of the surveys done by the team from the Ministry was as follows:

Total forest and heavily vegetation by the huge tsunami waves as shown in red on the map- Fig 10 below:

i. Coastal strip at Liku – east of the main island: 174.2362 Ha
ii. Islands of Hunganga and Hakautuútuú: 22.006 Ha

Figure 28: 2009 Tsunami map showing areas inundated by seawater and vegetations and young forests heavily damaged by tsunami waves

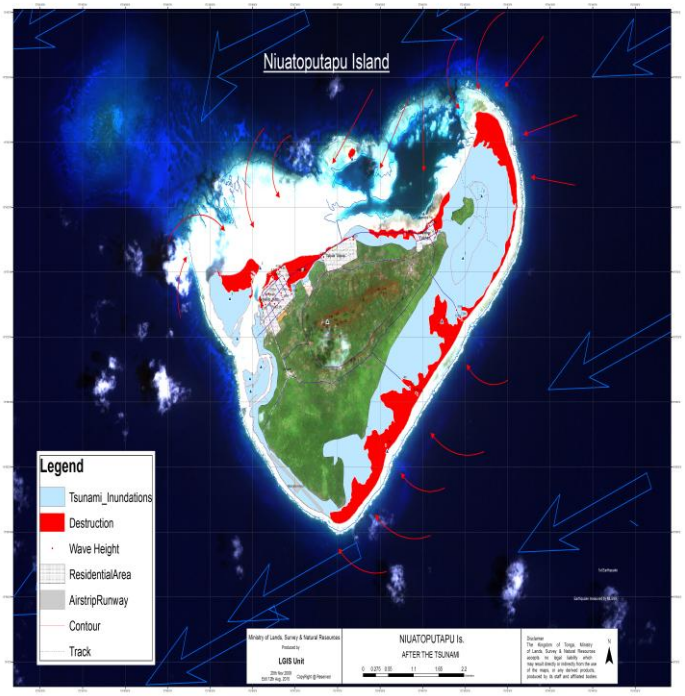


Figure 29: Tsunammi of 2009 wiped out the heavily forested and thick vegetation at the north easter coastal strips of the island

The damaged areas are now heavily populated by young plants and dense vegetations as shown in Figure 31 below.

Figure 30: Plants died from huge tsunami waves

Figure 31: Heavily populated by young plants and dense vegetation in 2011

Source: LGIS Unit, 2011

Government of Tonga Post-tsunami Relocation Project (TPTRP)

Tonga Post Tsunami Reconstruction Project (TPTRP) commenced in October 2010 with the objective to assist the Government of Tonga to implement its medium to long-term Priority Tsunami Recovery Program for Niuatoputapu aimed at recovering the living standard of the population living on the island affected by the tsunami through the reconstruction and retrofitting of residential houses with auxiliary water and sanitation facilities, and strengthening Tonga's capacity to address future natural disasters.

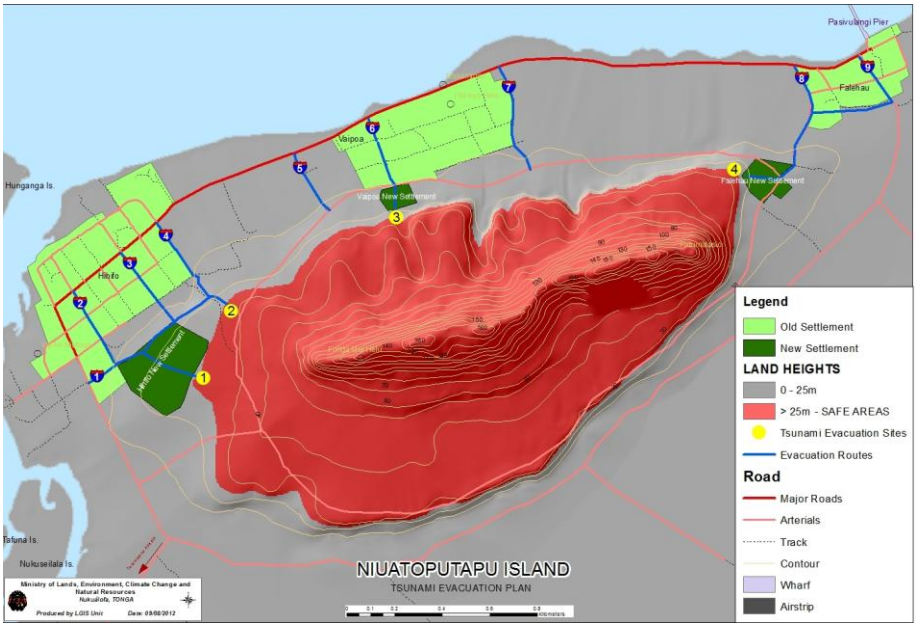
The relocation from the tsunami affected areas near the coast to lands above and behind the current residential areas for safety from future tsunamis.
The outcome for this predetermined relocation of residential areas from coastal tsunami affected lands to further inland clearly affected the agricultural land as well as loss of forest cover in predetermined locations.'

The University of Hawaii (UH) as well as Pacific Disaster Centre (PDC) in Hawaii under the MLECCNR component of the TPTRP project funded by World Bank, hosted a workshop to identify and prioritize the appropriate planning tools and processes of integrating land use planning and disaster risks in NTT and to be applied elsewhere in Tonga.

In endeavour to recover the loss of ecosystems as well as the biodiversity at the island, this workshop also identified the coastal areas vacated by the tsunami land relocation scheme as suitable for Open Space.

Figure 32: Residential houses from Land Relocation Scheme located at formerly forested areas. Trees had been cleared and burned

Figure 33: Niuatoputapu Island map showing the existing villages (light green) and new residential areas (green colour)



Total area of forested lands at Niuatoputapu Island cleared for residential purposes is show in Table 2.

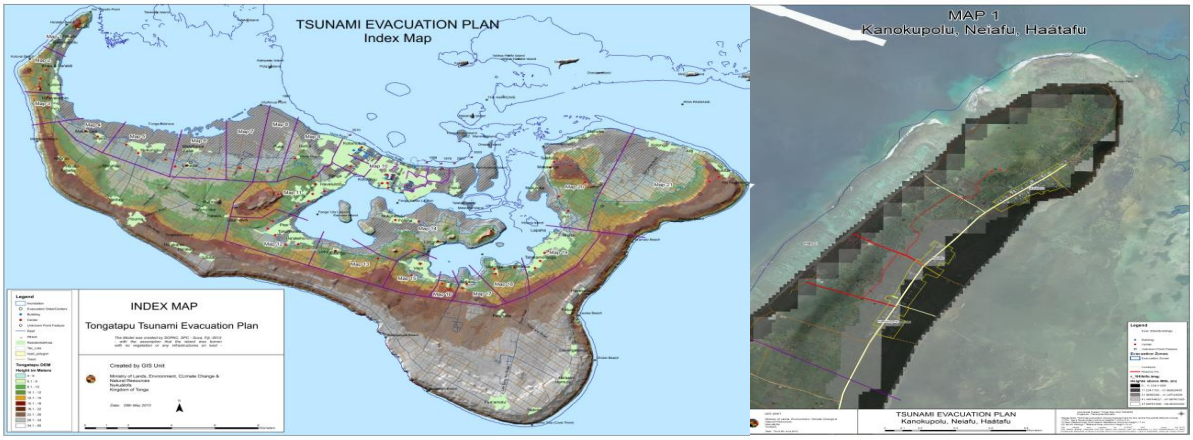
Table 2: Total area of forested lands at Niuatoputapu Island cleared for residential purposes.

	Village	**Area in Hectares**
i	Falehau	3.0329
Ii	Vaipoa	2.2638
iii	Hihfo	12.0144
	Total	**17.3111**

National Tsunami Evacuation Plan

The tsunami evacuation plan for Tongatapu – evacuation routes and sites - was created with the purpose to avoid destroying of the ecosystems such as trees, plants and even plantations. In times of tsunami warnings, the planners attempted to keep evacuation routes limited to existing roads and tracks. Similarly, proposing evacuation sites at community halls, school buildings and high rise infrastructures limiting selection evacuation sites at open space.

Figure 34: Tsunami evacuation plan index map



Source: LGIS Unit, 2013

Mangrove/coastal forests

Mangroves are unique trees that grow in intertidal areas of subtropical and tropical regions. They are highly specialized in adapting to distinctive environmental conditions they occupy. For instance, some mangroves are able to absorb seawater from the ocean and expel the excess salt through glands on the leaves, while others are able to exclude salt through their roots.

As latitude increases diversity of mangrove species decreases. Tonga has a total land area of 720 square kilometers (sq km), whereby only 3.36 sq km are mangroves. So far, only 10 major species of mangroves have been discovered in Tonga. Two of the most common species in Tonga are *Rhizophora samoensis* and *Rhizophora stylosa.*

Figure 35*: Rhizophora stylosa* propagule

Source: 'Aholahi, H. 2013

Most of the information collected is based on studies completed on the main island of Tongatapu. A more recent baseline study on 'Eua Island near Tongatapu recorded only two main species of mangroves, the *Pemphis acidula* and *Excoecaria agallocha.*

Figure 36: *Pemphis acidula* in Eua

Source: 'Aholahi, H. 2013

Other islands require identification and distribution studies including Nomuka Island (Ha'apai Group), Vava'u Group, and Niuatoputapu.

Ecological value

Mangrove ecosystems provide nursery ground for many fish and crustaceans. They also protect shorelines thus reducing erosion, especially in low lying areas with strong wind and storm surges. Additionally, mangroves trap sediment runoff while maintaining water quality and promoting a healthy environment for coral reefs. It is important to recognize that there are no boundaries between mangrove, seagrass, and coral reef ecosystems. All of these ecosystems, work together to keep everything in balance between these productive natural systems.

Economic value: The people of Tonga who settle along the coastal area of Fanga'uta lagoon are mostly the people who generated more income from mangroves such as cutting of mangrove for firewood at the market, making tie for tapa cloth and sell at the market, selling crabs and fishes at the market. Economic valuation on mangroves ecosystem was one of a component for Mangrove Ecosystem Climate Change Adaptation and Livelihoods (MESCAL) Project but it was not completed. In fact, this gap should be a challenge for NBSAP Project to update in the future.

Status of Mangrove at Fangaúta Lagoon

The GIS Unit of MLECCNR managed to expose the change detection of mangrove status between year 2004 and 2012 (8 years) at three selected sectors at the Lagoon.

Figure 37: Mangrove in 2004

Figure 38: Mangrove loss of 48.7 per cent in 2012

Figure 39: Mangrove in 2004

Figure 40: Mangrove loss of approximately 30.7 per cent in 2012

Figure 41: Mangrove in 2004

Figure 42: Mangrove loss of 12 percent in 2012

Within a short timeframe of 8 years, there is an alarming loss rate of mangroves at these selected 3 sectors at the Lagoon - 30.5 per cent (30%). The mangrove species that belong to the **Major components group** are*: Bruguiera gymnorhiza (W), Lumnitzera littorea, and Rhizophora species.* However, the total mangrove loss at the lagoon between year 2004 and the end of year 2012 was barely above seven percent (7.4%) (MLECCNR 2013 - assessment using satellite imageries 2004 and Lidar data Dec 2012). Although there is a sign of mangrove loss at the Lagoon but elsewhere in the Kingdom, (at Tongatapu and Vavaú), the mangroves increased in a healthy percentage (Mr. Yarita and Mr. 'Aholahi, 2012).

Related Regulations, Policies and Plans established to control the Lagoon includes the following: (i) Environment Management Plan – Fangaúta Lagoon 2001 (ii) Environment Management Act 2010, (iii) National Spatial and Management Act 2012, (iv) Environment Impact Assessment Act 2003 (refer to table 3 at Annex 1).

Threats to Mangroves ecosystems

<u>Fangaúta Lagoon Developments - Marine and Coastal Ecosystems</u>

The main threats to the Biodiversity at the lagoon, identified from previous studies and reports, were nutrients drifted down to the Lagoon from agricultural lands, chemicals from household usages, expansion of developments and urban areas to lagoon perimeters resulting in degradation of mangrove strips from clearing, overharvesting, waste dumping,land reclamation and storm-water drainage. Unsustainable stripping of the mangroves for tannins (a pigment

that is used to make dyes) for the tapa making and medicine, and cutting the mangroves for firewood and building materials pose additional threats to the remaining mangroves in Tonga.

Figure 43: Unsustainble stripping of *Bruguiera gymnorhiza*

Source: 'Aholahi, H. 2013

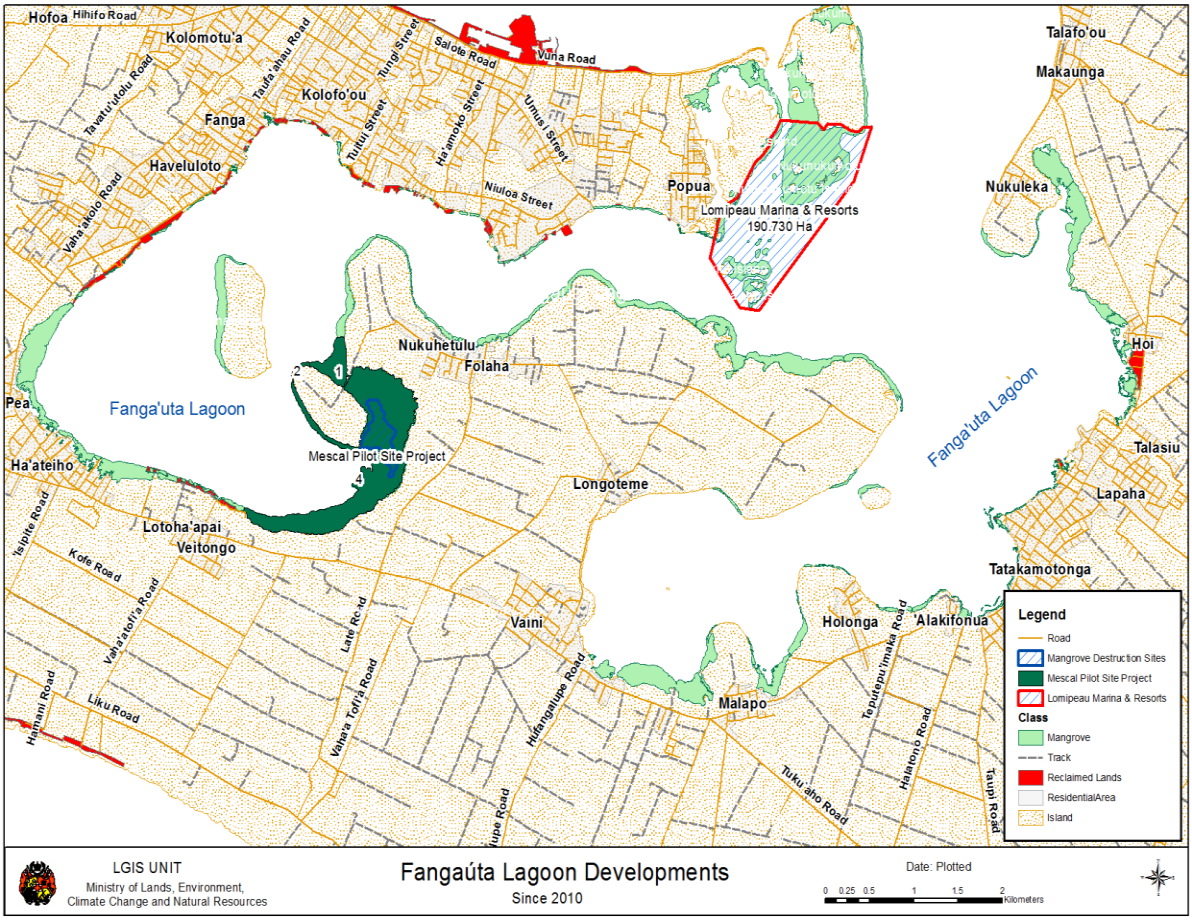
Figure 44: Mangrove destruction at Uatoloa, Vava'u

Source: Eileen Fonua, 2013

The resulting impacts are the loss of habitats for native marine species and the declining of essential ecosystems functions and services including normal marine hydrological cycle such as high and low tide flows. The degraded and disturbed lagoon ecosystems also provide conditions conductive to the spread of invasive marine and coastal species.

As shown in this part of the report, developments in and around the Lagoon are identified as reclamation of lands for residential and new development purposes, remaining mangrove strips, Lomipeau Marina and Resorts, and Mescal Pilot site project with the proposal to establish Nukuhetulu mangrove forest as a conservation area.

Figure 45: Developments at Fanga'uta Lagoon showing: (i) *Remaining mangrove strips* (ii) *Reclaimed Lands* (iii) *Lomipeau Marina and Resorts Project* (iv) *MESCAL Pilot Project Site*



Case study: Lomipeau Marina development Project

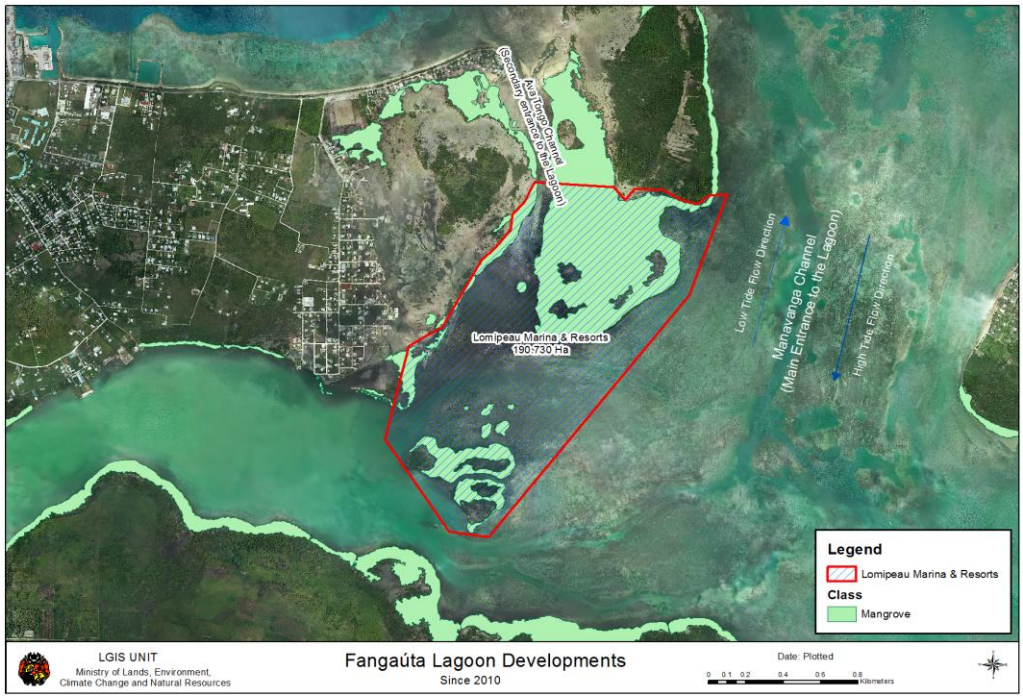
A lease for marina and resort development was awarded to **Lomipeau Marina Resort Holdings Ltd** in 2010 and that created huge chorus of disapproval and protests not only from villages surrounding the Fangaúta Lagoon but also from some of stakeholders who had been closely involved in Environment and Biodiversity projects. This was a contest between developments - for economic profit and value to the country, and reservations for human consumptions.

The huge uproar caused by this proposed development was due to the degraded marine water quality of the Lagoon. The proposed location of the project (as shown on the map–Fig 46

below) might create further problem to the water quality of the Lagoon thus generating more trapped pollutions – a major threat to the marine ecosystems.

His Majesty's Cabinet eventually terminated this lease in June 2012 due to no development or constructions at project site after three years from approval of the lease – **A huge bonus to the Biodiversity**.

Figure 46: Part of the Fanga'uta Lagoon showing the Lomipeau Marina & Resorts Proposed Project



If the project was approved for execution, there may have been major impacts due to:

- Approximately thirty two percent (32%) of the total area of the Lomipeau Marina & Resorts Project are mangrove forests.
- Approximately 61.7877 hectares of Mangrove forest would be cleared to give way for this project
- The infrastructures would block most of the in-out flows of the marine hydrological current, therefore, trapping more pollution at the inner zones of the lagoon.
- However, it would be a major threat to biodiversity but the constraint was the capacity to really measure the full adverse impact of this huge project on the Fangaúta Lagoon ecosystems if it was implemented.

Land Reclamation - Fangaúta Lagoon Land Allocation Scheme

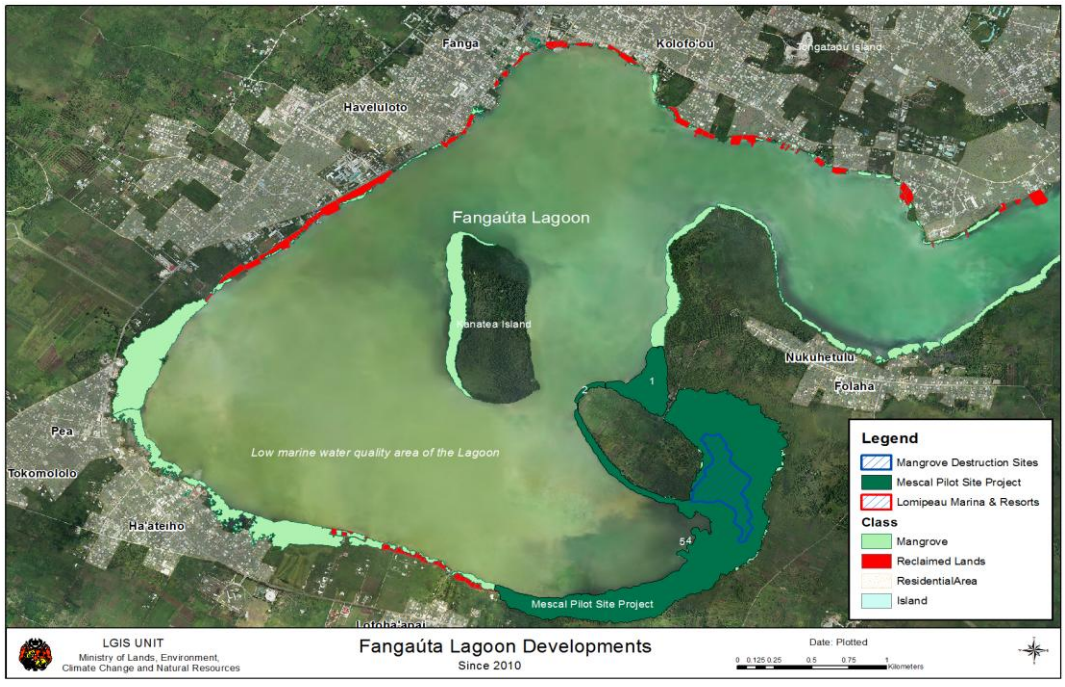
Lands at the fringe of the lagoon were allocated to public but were decisively terminated by Privy Council.

A survey by Land Commissions in 2011 (mapping was done by LGIS Unit of MLECCNR) illustrated that 78.09 hectares of land were reclaimed at the beach fronts or at the lagoon rims of Tongatapu Island for development and residential purposes. Approximately 35% of these reclaimed lands were found within the areas surrounding the lagoon – Fig 45 and 46 above.

The decision to cancel the allocation and reclamation of lands at the fringes or areas surrounding the lagoon made a huge change to the biodiversity and specifically mangrove ecosystems.

Establishment of Nukuhetulu Mangrove Forest as a Conservation Area – A MESCAL Pilot Site Mangrove Rehabilitation Schemes

Figure 47: Part of the Lagoon showing the Reclaimed Lands (in red) and the MESCAL Pilot Project site (in dark green)



The pilot site was initially selected at southwest of the Fangaúta Lagoon, not only due to its sheltered position but also Nukuhetulu is the largest mangrove forest area in Tongatapu. The objective was to increase community livelihood, protection of mangroves ecosystem, biodiversity conservation and increase resilience to climate change.

The 115.3485 hectares of mangroves forest is the richest diversity of mangroves in Tonga and is well established. However, 13.9272 hectares these mangrove forests are dead from non-identified causes.

It was proposed to establish Nukuhetulu forest as the conservation area. This would allow traditional use of mangroves in a sustainable manner by community. This project is important for future maintenance of water quality of the western arm of the Fangauta lagoon and is clearly revealed in the LIDAR imagery of Dec 2012 –Fig 47 above, the polluted yellowish-green colour of the water at this area is not equal to the clear, water quality towards the entrance to the Lagoon at Manavanga Channel. The growing city of Nukualofa has increased pressure on the lagoon from disturbance and run off. However the mangroves area acts as a buffer zone for nutrient run-off from these settlements maintaining the clarity of the lagoon. The Nukuhetulu mangroves swamp has also an excellent potential for development as an education resources and ecotourism.

1.2.2 Marine resources

Status of Marine resources

The status of the marine ecosystem has yet to be fully explored eventhough there are informations available on fisheries and coral reefs. Lack of resource assessment is the key issue for the marine ecosystem, however only few selected fisheries are known i.e. sea cucumbers, seaweed, and etc. The overharvest and overexploitation of the marine resources remain the major causes of the changed to the marine ecosystem. The main fisheries in Tonga are offshore tuna, snapper, groupers and inshore fisheries (refer to table 3 below). Both shallow and deep water fisheries are vital to subsistence and source of income.

The demand for marine resources has increased due to; Tonga growing population; change in diet towards a more marine protein-based products; and increase demand for marine products from overseas, particularly from Asian countries (i.e. sea cucumbers fisheries resources, seaweeds, etc.). The PROCFish socioeconomic surveys in 2009 found high rates of

seafood consumption in coastal communities in Tonga up to 92kg/person/year for finfish and 21kg/person/year for invertebrates.

The 2011 ***Reefs at Risk Revisited*** analysis suggests that over a third of Tonga's coral reefs is threatened by overfishing (moderate risk or higher), and the 2005 UNEP/SOPAC (South Pacific Applied Geoscience Commission) Environmental Vulnerability and 2009 Pacific Ocean Synthesis report also suggest that fishing poses a threat (Chin et al, 2011). The level of marine organisms listed at UN-red list, apart from existing list, one of the popular cockle shellfish, has increased.

The overall status of harvesting resources has almost reached its maximum sustainable yield for certain marine species; unfortunately we are still unable to determine the population trend for the whole marine ecosystem. Additionally, dramatic overexploitation of the inshore fisheries compared to the last decade was recorded (Table 3).This may be due to the change of habitat, destructive fishing activites, climate change, sedimentation runoff, pollution, and so forth.

Table 3: Marine and Fisheries Sector Consultation outcomes and comments during NBSAP community consultations throughout selected villages for Tonga in 2013

	Vulnerable species	**Rare Species**	**Threatened/Critical**	**Change of the habitat and comments.**
Tongatapu groups	Sea cucumbers (Holothuridae)	To'o teka (*Gafrarium tumidum*)	Total loss from certain areas i.e. shift or relocated due to habitat change; and overexploitation	Change in water quality and increase in sedimentation loadat Fanga'uta lagoon has caused a shift in abundance of reef fishes.
Vava'u groups	Sea cucumber	To'o teka (*Gafrarium tumidum*)	Total loss from certain areas i.e. shift or relocated due to environmental effects; and overexploitation	Causeway located at Eastern areas at Vava'u caused major shift of edible marine organisms (i.e. shellyfish, cockle shellfish, seaweed, etc.) due to the mangrove plant colonize the areas.
Niuas groups	Sea cucumbers	None	None	The two Niuas are still at a sustainable level due to low commercial activities except for sea cucumbers fisheries resources.
Ha'apai groups	Sea cucumbers	None	Unknown. Mussels	Based on the feedback

			and red fiddler crab totally disappeared from the lake in Nomuka island.	from the communities, fishing efforts escalated with low catches compared to the last decade.

Threats

Fishing activities is one of the major threats to the marine ecosystem apart from natural disaster (i.e. hurricanes & tsunamis, water temperatures variations, natural predators, etc.). The destructive fishing activites such as dynamite fishing, fish poisoning and using hookah and scuba diving are still ongoing even though they are illegal practices under the Fisheries Management Act 2002.

Pollution and eutrophication also affect Tonga's coastal waters and reefs (Anon, 2010). Tonga does not have adequate sewerage systems in place and eutrophication has been reported, particularly around Nuku'alofa areas. In Fanga'uta lagoon on Tongatapu, urban runoff and eutrophication are the suspected causes for loss of hard corals, and the algal bloom reported in the year 2000. Runoff of agriculture fertilizers from plantations and sewage effluent are the major contributors to eutrophication. There are also concerns over wastes from boats and ships, with regular arrivals and departures of containerships and inter-island ferries. Pollution from soilid waste is also an issue, especially in urban areas.

Figure 48: Sedimentation runoff to 'Eua coastal waters during heavy rain led to marine species degradation

Source: Fonua, E. 2013

Pagad, S. 2013 explicated that biological resource use, followed by climate change & severe weather, habitat loss, invasive alien species, human intrusion and disturbance are the major threats. The key threat mechanisms are harvesting and fishing, followed by habitat alteration

and degradation, and predation by IAS. These impacts were contributed to decline in species population numbers and habitat loss.

The inner Neiafu harbour in Vava'u has shown high sedimentation, crown-of-thorns starfish, eutrophication, and coral mortality; and Pangai harbour on Lifuka Island in Ha'apai, eutrophication, and high coral mortality. This may be due to the lack of compliance and enforcement with current legislation and policies for coastal development, yachties, agricultural activities and so forth.

A warming climate where temperature extremes can lead to bleaching and increased susceptibility to disease, increased severity of ENSO events and storms, ocean acidification and the spread of coral diseases have been identified as a threat to coral species globally. During a rapid biodiversity survey in Vava'u 2014, bleaching of corals was observed at 30m depth with waters of 30 degrees celsius.

Coral harvesting for the aquarium trade is another potential threat. Both hard and soft corals that can be used in aquariums are traded. Live hard coral species exported from Tonga are from the following genera *Acropora, Stylophora. Millepora, Pocillopora, Turbinaria, Tubastrea, Favia, Fungia, Pavona, Porites, Hydnophora, Montipora, Tubipora, Galaxea* etc. Offshore bottom-fish fishery, commercial fishery of tuna species is prevalent. Traditional shark noosing in Tonga is carried out on the outlying reefs. (Pagad, S. 2013).

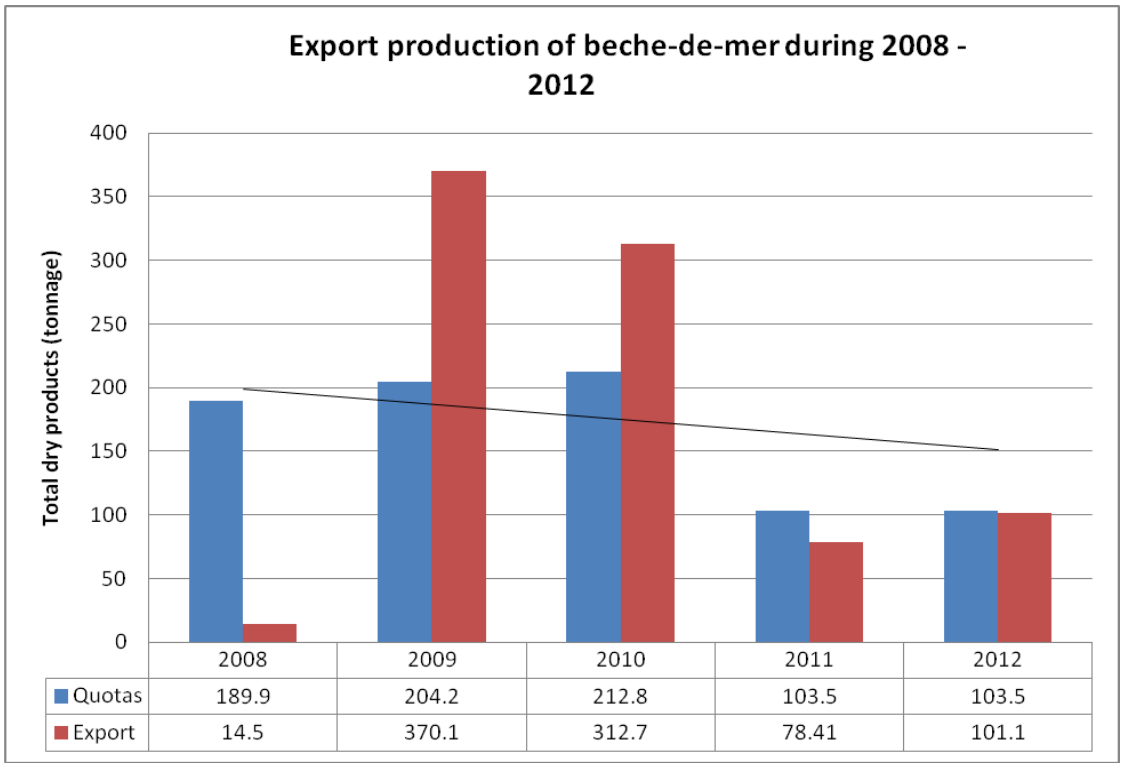
Trends

The information on marine biodiversity trends is not clearly defined due to lack of resources assessment during 2010-2013. However, the only baseline information available is from landing catch and export production by the Fisheries Division database (commercial coastal marine resource.

Sea cucumbers Fisheries resources (Inshore Fisheries Resources)

The sea cucumber fishery in Tonga was started in the 80's with small amounts being harvested. In 1990's production increased to hundred tonnes before dropping significantly in 1996. A stock assessment was conducted after the fishery was banned for commercial harvesting. It has been realised that sea cucumbers were unsustainably harvested which led to the heavily depletion of the wild stocks.

Figure 49: Export production of beche-de-er during 2008-2012



(Sources: Fisheries Division Database, 2013)

Beche-der-mer Stock depletion was caused mainly by overfishing. Factors attributed to overfishing are as follows:

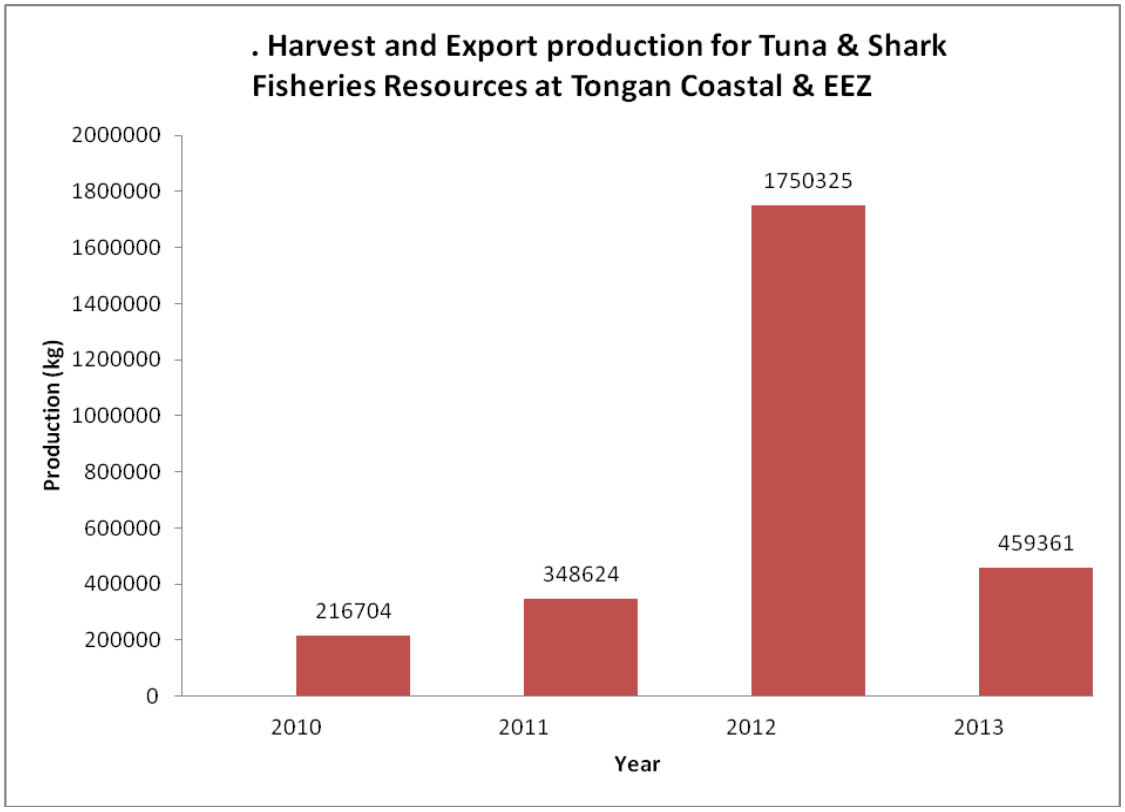
1. Limited number of income opportunities in the island communities.
2. High prices.
3. Easy to harvest.
4. Increase need for cash in rural island and coastal communities.

A clear indication of beche-der-mer fishery overfished is that fishermen have to go further and deeper. That could lead to fishermen using illegal fishing practices such as hookar and scuba. Of

Offshore Fisheries Resources

Tuna & Shark Fisheries Resources

Figure 50: Harvest and Export production for Tuna & Shark Fisheries Resources in Tongan coastal & EEZ



(Source: Fisheries Division Database, 2013

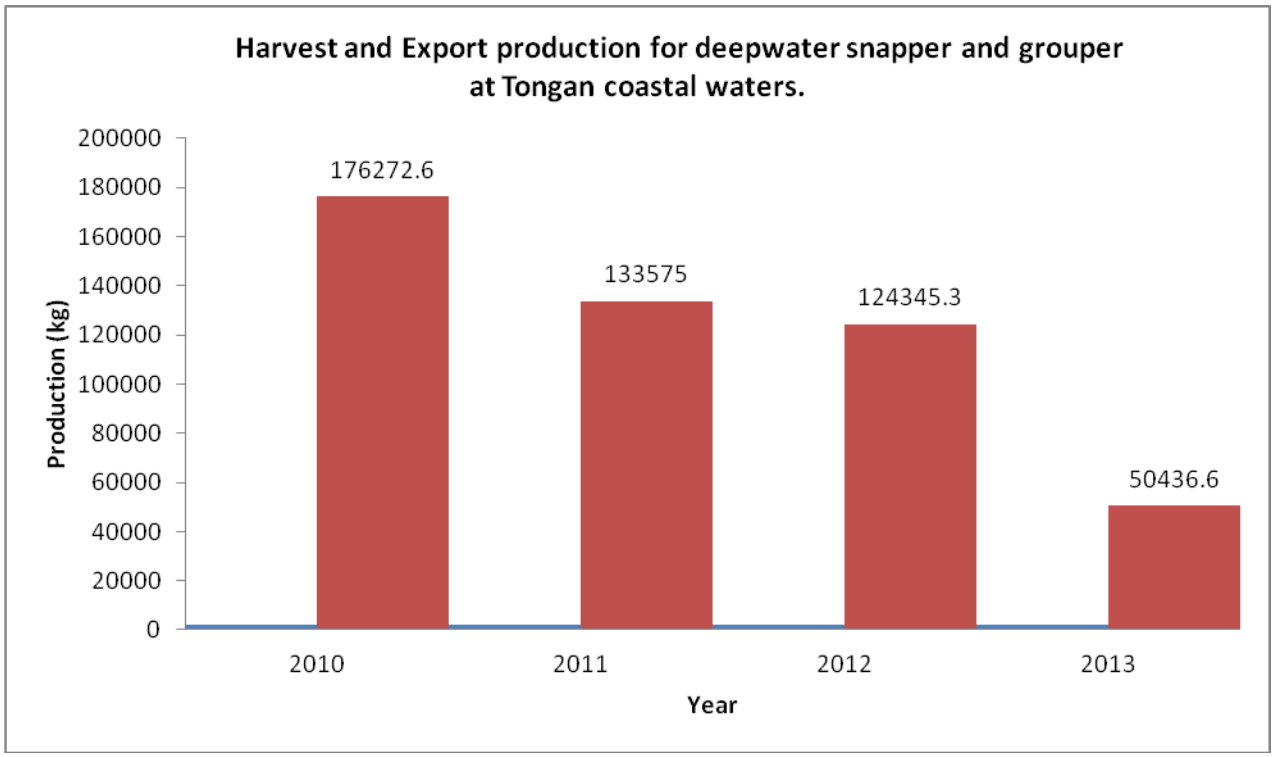
- Albacore tuna species dominated landing catch and export with more than 300% increase and the highest on the record in 2012 follow Skipjack, Yellowfin and Bigeye tuna.
- Does not include tuna species fished by local fishers using trolling fishing methodology.
- Increase catch could be associated with more fishing vessels were participated on exploitation of Tuna fisheries resources in 2012 (i.e. <10 new fishing vessel issued licenses from Fisheries Division to exploit tuna at Tonga EEZ). Licenses were issued for both foreign fishing vessels & foreign locally based license.
- Year 2013 represent January to June landing and export production.
- Still unknown what the status of the pelagic ecosystem in term of abundance and species richness.

- It was estimated in 2011-2013 from landing catch, approximately 10% of the total production was shark species.

Deepwater Snapper and Grouper Fisheries Resources

- Still unpredictable the trend of the resources except CPUE that the landing catches drop dramatically and a shift from the target species to low value species.
- Catch and export dominant by high value species (i.e. Flame and Crimson jobfish snapper).
- Dramatically decrease in harvest and export could be also associated with few fishing vessels still participated on deepwater snapper fisheries resources exploitation activities in 2011 to 2013 (4 - 7 licensed fishing vessels) with comparison to more than 10 licenses in 2010 participated on exploitation activities.

Figure 51: Harvest and export production for deepwater snapper and grouper in Tongan coastal waters



Sources: Fisheries Division Database, 2013

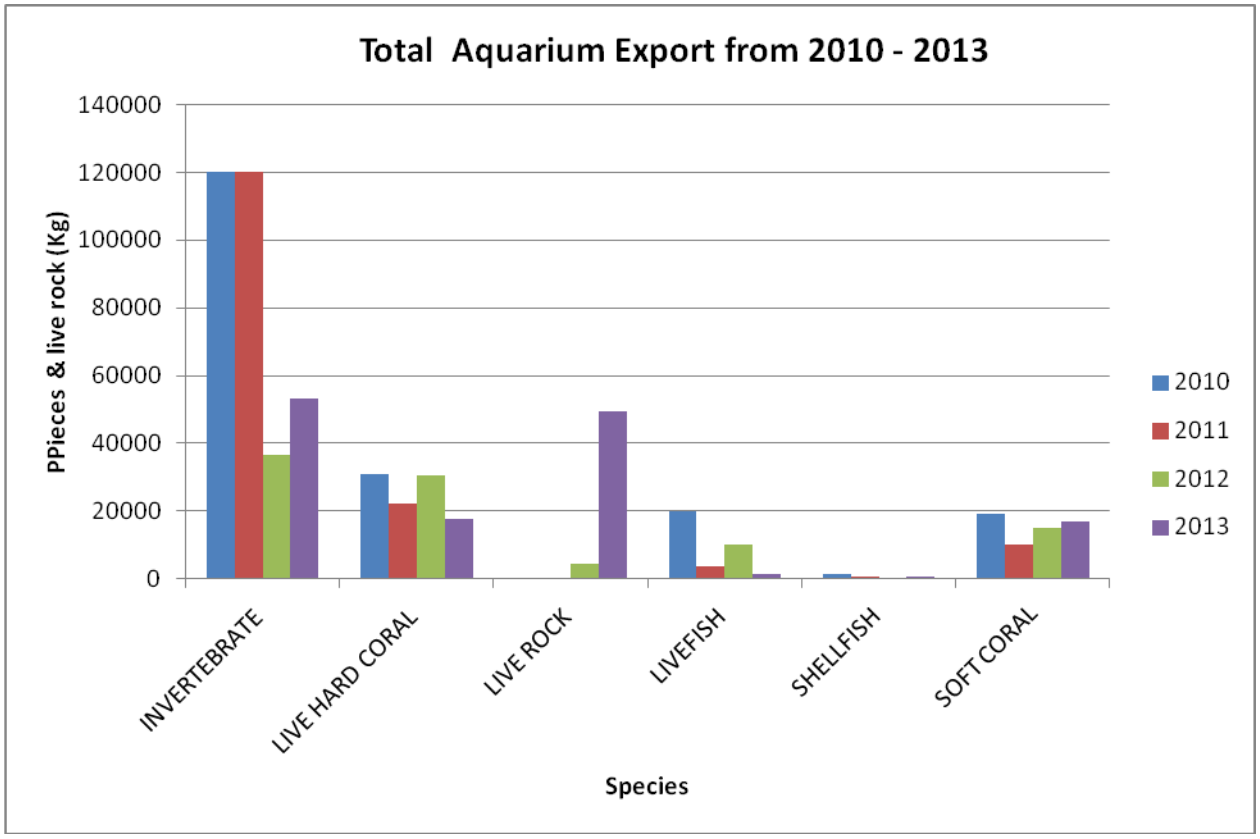
Coral reef ecosystem and subsistence Fisheries resources.

- Decreasing in harvest and export for aquarium market could be also associated with banning of harvest and export of wild live rocks in 2008/9 included few operators still

active (i.e. 4 operators had been issued Licenses in 2010/11 whereas only two in 2012/13).

- Harvest and export production mostly concentrated on hard corals with more than 20 species of coral exported in yearly basis by the aquarium operators with exclusive of the souvenir taken by the tourists.
- Live rock was the major target export aquarium commodity in the last decade but banning in late 2000s due to community concern.
- Invertebrate's production included shellfish (triton shellfish species, green-snail species), sea anemones species, and echinoderm species (sea star species, etc).

Figure 52: Total Aquarium export from 2010-2013



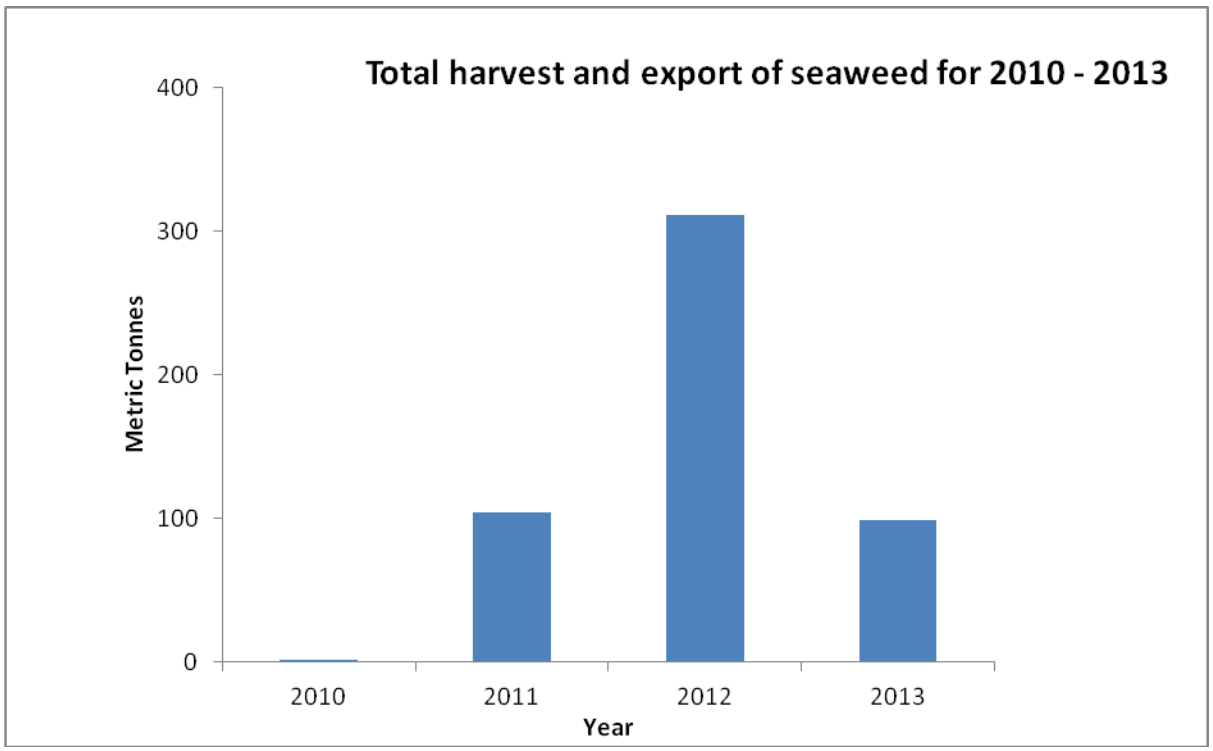
(Sources: Fisheries Division Database, 2013

- Landing catch for inshore fisheries still unknown due to lack of statistical data or failure to record data at Fisheries Division Database. So far, only marine edible organisms send overseas indicated a high level of reef fishes and invertebrates are taken by Tongan abroad with majority of the traveller designated to Australia, New Zealand and United Stated.

Seaweed Fishery Cladosiphon sp.

- Seaweed harvest and export production was developed in late 1990s until late 2000s. In year 2007 - 10, seaweed was not harvested commercially due to market issues but in the same time the resources still at sustainable level.
- Re-exported of seaweed was started in 2010 with peak in 2012 with only 3 Licenses issued by Fisheries Division but in 2013, only one license had been issued whereas other two operators did not renew their License.
- The seaweed production indicated was only focused on the resources harvested in Tongatapu areas whereas the seaweed resources found at Ha'apai areas were not commercially harvested.
- This seaweed resources only found here in Tongan coastal waters throughout the Pacific regions included Japan (Okinawa Island region).

Figure 53: Total harvest and export of seaweed for 2010-2013



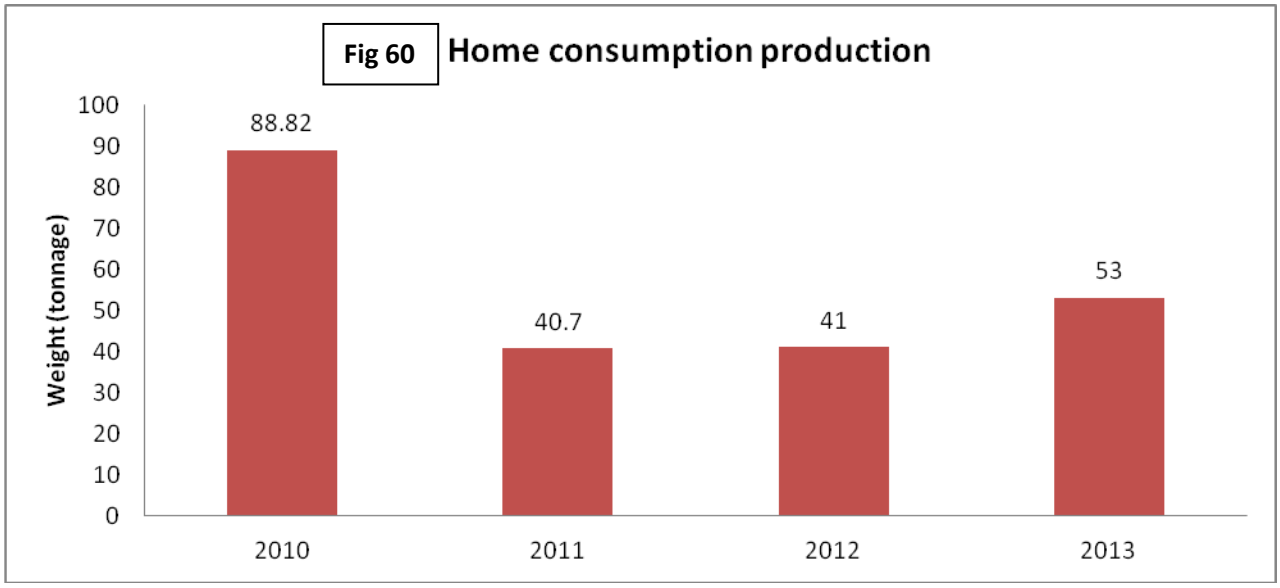
Sources: Fisheries Division Database, 2013

Home consumptions Production

- People travel out of the country had been allowed only 20 kg per person as objected for home consumptions purpose under Fisheries Management Act 2002.

- The marine products were categorized in general form not in detail i.e. frozen, dry or slated fish rather than species name (refer to appendix list of home consumption production).
- Based on the recorded of marine production kept at Fisheries Division Database travel with individual passengers or send through air cargo services, the fin fishes as the major home consumption production in different form (i.e. frozen, dry, salted, fresh).
- Australian government authority restricted for CITES species in term of trades and transits into the country i.e. giant clams, black corals, turtles & whale souvenir production. Not only has that but only allowed 15 kg of finfishes for one person travel to Australia.

Figure 54: Total home consumption for 2010-2013



(Sources: Fisheries Division Database, 2013)

Overall Trend and Production for Marine Biodiversity

The overall trend of the marine biodiversity still unknown due to lack of baseline study but based on the export production for commercial marine species recorded at Fisheries Division database, it was clearly indicated of resources decline especially inshore fisheries resources (i.e. sea cucumber, aquarium production, etc.).

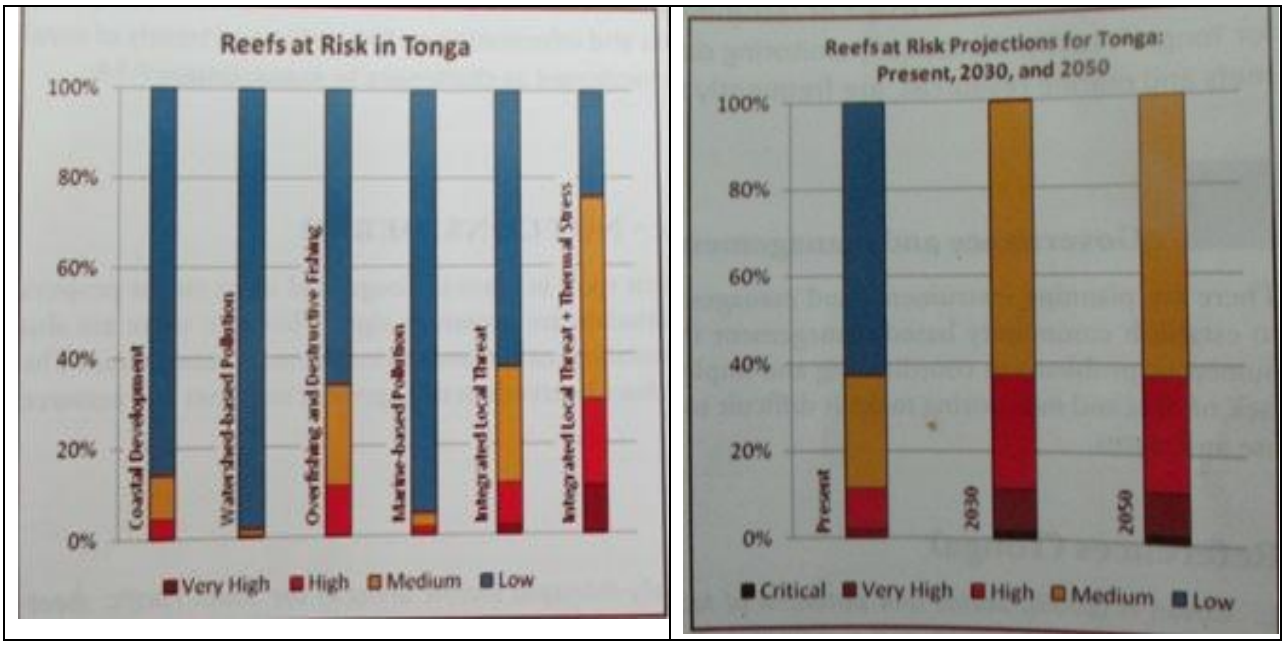
Based on the communities consultation results took place throughout Tongan Groups, sea cucumber fisheries resources as the major vulnerable resources seem had been overfished, which could be associated with commercial harvested during 2008 - 2013 after closed for early 10 years. The rare species found during consultation was only shellfish species known locally '

To'o teka' (*Gafrarium tumidum*) for only Tongatapu and Vava'u areas. Other target inshore fisheries resources such as giant clams (Tridacnidae), rock lobster, finishes and other invertebrates had been indicated that had low in abundance and decreases in size in comparison to the last decades based on the landing catches. On the other hand, similar results found and recorded under the biological survey conducted by PROCFish in 2002 & 2009 and CRIOPE 2009 & 2011. These surveys also highlight significant concerns over the status of reef fish and invertebrates, with severe drops in abundance identified for several species (i.e. parrotfish - Scaridae and surgeonfish - Acanthuridae). Not only that but fish communities dominated by small fish with mean sizes of several fish families below 50 % (Friedman et al., 2009, Chin et al., 2011. Anon, 2010).

Reefs *at Risk Revisited* for Tongan Coastal areas

The analysis below (**Figure 55)** estimates that nearly 40% of Tonga's coral reefs are currently threatened (medium risk or high), mainly from the effects of overfishing and pollution. When combine with observations of thermal stress over the past 10 years, the number of threatened reefs increases to 75%. As indicated, the reefs around Tongatapu and Vava'u, the main populated island in Tonga, were the most at risk. By 2030 for example, projections for the thermal stress and ocean acidification suggest that the number of reefs assessed as being highest risk will increase from 10% to nearly 40%.

Figure 55: Reefs at risk and projections for Tonga



(Sources: Chin et al., 2011: Status of the coral reefs of the Pacific and outlooks)

1.2.3 Agrobiodiversity

Status of Agro biodiversity and it's important.

The economy of Tonga consists of a large public sector with huge dependency on aid and remittances from the migrant Tongan population residing in overseas countries. The economy has a large trade deficit of which export of largely agricultural products to Japan and New Zealand is worth about 20% of the total food imports. The trade deficit is balanced by the remittance account for at least 50% of the import trades. Foreign Aids from development partners of Tonga also assist in balancing the trade deficit.

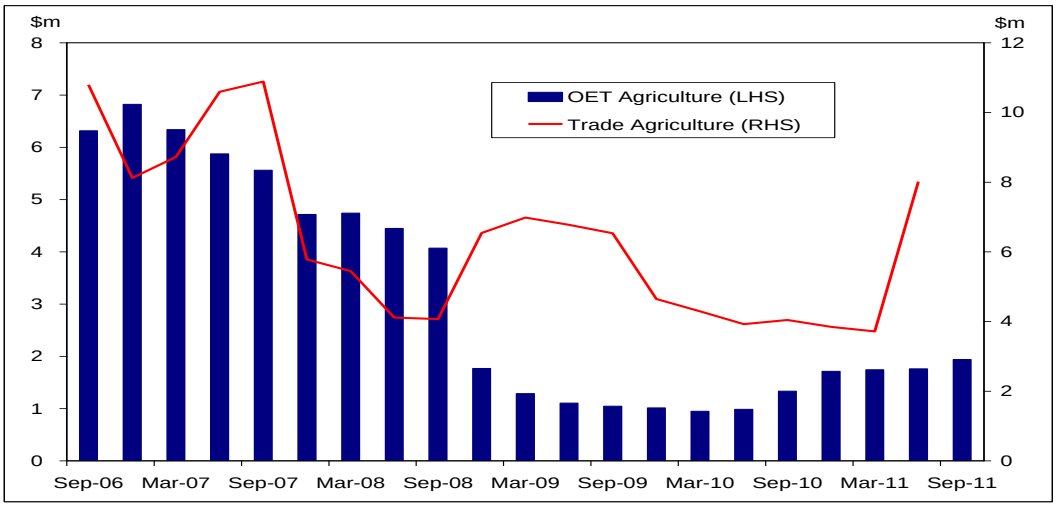
Agriculture biodiversity is critically important to the stability and security of the supply of adequate, nutritious and safe food for the people of Tonga, in the past, present and in the future. Numerous verifiable scientific evidences have proven the importance of the ecosystem's provision of regulating services and the suite of benefits that are enhance by greater biodiversity to agriculture and to food supply, that is:

- greater diversity of species *increases* the ***overall biomass yield***
- greater genetic diversity and also within species *increases* the overall ***food yield***
- greater species diversity of natural pest enemies *decreases* the ***plant's herbivorous population***
- greater species diversity of plants *decreases* the ***prevalence of disease on plants***
- greater species diversity *increases* the ***resistance to weeds invasions***, *increases* ***carbon sequestration***, *increases* ***soil nutrients mineralization***, and also *increases* the **organic matter in soil**
- greater species diversity *increases* resilience to various ***impacts of climate change***

With the above mentioned benefits, thereby rest the key importance of agriculture, to the national food security and for balancing of trade deficit.

The contribution of agricultural product trading to the economy has been reduced since 2008 and only marginally increases in 2010, as in figure below.

Figure 56: The total annual national earning of trade of agricultural products relative to the overall trade since, MAFFF annual report, Agricultural Division 1986



Hence, the overall key imp*ortance o*f species diversity in ***agriculture for the purpose of enhancing*** security of food in Tonga. The purpose of this report is an assessment of the survey of the agriculture species diversity status in Tonga, that is the:

1. ***Inter-specific species diversity*** which is the number and types of different species
2. ***Intra-specific species diversity*** refer to the genetic variety within one single species

Agricultural systems in Tonga

Traditional Agriculture System

The traditional cropping system involves partial clearance of secondary fallow vegetation, followed by mixed and relay cropping for about 3 to 5 years before it is allowed to revert back to bush fallow. The clearing involves cutting of undergrowth, shrubs and small tree vegetation, while the bigger trees are ring-barked and burned at the base to die slowly during the cropping phase. The cropping phase is initiated by planting of yam as the main crop and intercropped with giant taro, plantain and taro. This is followed by sequential rotation of harvesting and planting of taro tannia as the second crop, followed by sweet potatoes and then lastly by cassava.

The order of the crops in the cropping sequence, matches their respective minimum nutritional demand from soil as the soil fertility declines from the yam crop to the cassava crop, thereby maximizing the utilization of the soil. The mixture and rotation of different crop species minimizes build up of pest and disease infestation on these crops. The system also maximize the use of the forces of nature by timing the planting, the management and the harvest to the lunar cycles, the rainfall water cycles, short to long day length and the cool to warm temperature. The increasing economic value of indigenous plants such as paper mulberry (*Broussonetia papyrifera* (L.)Ventenot), vanilla (*Vanilla fragrans* Andrews), kava (*Piper methysticum* Forster f.) and pandanus (*Pandanus* spp.) or pineapple has taken the place of yam as the main crop in the traditional cropping system. Currently, in many outer islands, forests are being cut down and cropped with these cash crops in traditional farming systems.

The Modern Cropping System

The modern cropping system is mainly the production of one particular species mainly for commercial purposes. This involves the use of mechanical tillage, the application of fertilizer and pesticides, and also the application of irrigations. Modern cropping system is very much dependent on the contemporary national target crop for export. In the 1960's, copra from coconut and fresh bananas were the main export. The main features are production of few varieties of a single species crop (mono-crop), subsidized or acquire or loan capital, the use of mechanical tillage, the import of exotic crop species/varieties, application mineral fertilizer and pesticides, post harvest process for export, price takers of export markets. Squash is currently the main export crop and also the main user of mineral fertilizer and pesticides.

From the table below, the gradual specialization of agriculture from the traditional mixture of species to one species with a few varieties necessitates the use of mechanical tillage, agri-chemicals of fertilizer and pesticides and irrigation to support the continuity of the system.

Table 4: The key export crop from Tonga and its respective period and modern mono-cropping system used by farmers

Period	Key Export Crop	Modern Mono-Cropping System Introduced
<1978	Coconut & Banana	Subsidized Mono-crop Production from Seedling Production, Planting, Fertilizer inputs, Pest Control, Management, Processing of copra, price takers of export markets
1970 - 1985	Watermelon & Capsicum	Mechanized Cultivation, Pesticide & Fertilizer application, Mono-crop Production of few Varieties & Post harvest process, Subsidized management, price takers of export markets
1980 -1987	Banana	Subsidized Mono-crop Production of few varieties from Mechanized Cultivation, planting material, Pesticide & Fertilizer application,

		Management & Post harvest process for export, price takers of export markets
1987 - 2013	Squash & Root crops	Farmer's Loan from Banks, Mono-crop Production of few varieties, Mechanized Cultivation, Pesticide & Fertilizer application, Organized Production & Post harvest process, price takers of export markets

NBSAP Assessment Crops & Livestock Genetics Diversity

The assessment of the species diversity in agriculture was conducted in four districts in each of Tongatapu ('Ahau, Popua, Vaini, Lapaha) and Vava'u (Tefisi, Neiafu, Ha'alaufuli and Pangaimotu) one each in Niuatoputapu and Niuafo'ou and one collectively in Ha'apai. In each consultation meeting, a representative group was engaged in collectively dialoguing about all varieties of each food crop species currently cultivated in its respective district.

Additionally, the group was asked to rank the varieties from the most cultivated varieties to the least cultivated. The group was asked to agree collectively on reasons for: the most popular variety; discarded variety; adoption of new varieties; the value of lost varieties. Lastly, the group was guided to forge a way forward on how best to preserve and enhance the genetic pool of each species. The main weakness of crops in Tonga is their very small genetic pool that exists. This is the consequence of propagations from the vegetative parts of the crop, such as cassava from stems, vines for sweet potato, corms for tannia and tubers for yam. Therefore the new generation has exactly the same genetic material as the parents. In contrast to propagation from seeds which is a fusion of two parental genes that provides opportunities for genetic variation of the new generation in relations to the parents.

Threats to Agrobiodiversity.

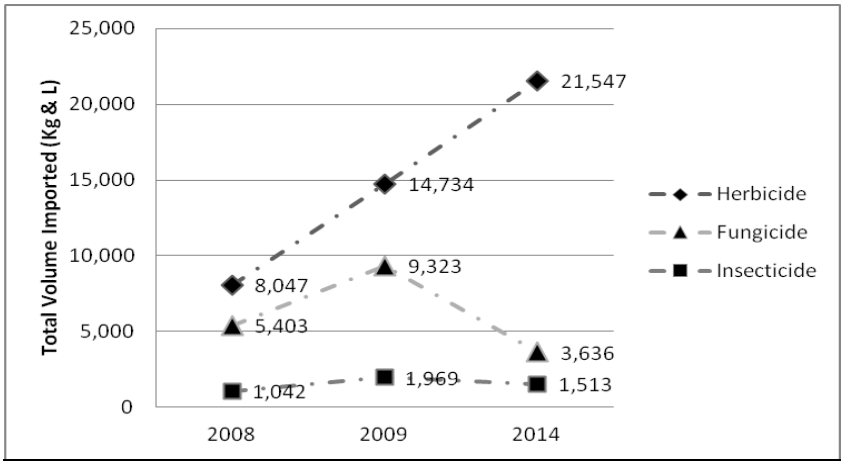
<u>Pollution</u>

The use of pesticide and fertilizer in agriculture has increased dramatically since the production of squash for export in 1987. Since then, the amount of pesticides imported is dictated by the trend of squash produced for export. In 2008, the export of squash dramatically was reduced from the annual quota of about 15,000 since 1990 to less than 4,000 metric tons per season. This is reflected in the reduction of fungicides imported which is mainly targeting the control of the squash's main pest of "*Powdery mildew"* fungal disease.

The total volume of pesticide imported increases from 14,492 in 2008, to 26.203 in 2009 and further to 26,696 in 2014. From fig 64 below, shows that herbicides is responsible for this dramatic increase. Pesticide has been used traditionally for the production of vegetables for the

local market and crops such squash, watermelon, etc. to be exported to market overseas. However, herbicides is now used for production of food crops such yams, taro, sweet potatoes and cassava.

Figure 57: The total volume of kilogram and litres of pesticide imported into Tonga since 2008



Traces of pesticides used in agriculture for production of crops for export, have been detected in soils, lagoon sediments as well as underground water supply of villages and community in Tongatapu (Van der Velde, 2005). Traces of the insecticide, *DDT (Di-chloro diphenyl trichlro ethane)* used for control of insect pest in banana production in 1960s, to *Dieldrin* used for control of insect pests in coconut production, to *Myclobutanil* used for control of leaf's fungal diseases in the production of squash.

This has indicate the increasing extend and the potential of pesticides to pollute the ecosystems, hence affecting the biodiversity of terrestrial ecosystems including human beings. Also as pesticides is drained and transported by rainfall above and leached into underground water system and flow laterally into the coastal marine ecosystems.

Cyclone Ian: Case study of Ha'apai Island

Pre-cyclone drought

Agriculture in Tonga as in other Pacific islands is vulnerable to the adverse effects of climate change. Climate change is predicted to bring more frequent and extreme rainfall events, longer dry spells and drought events, rising sea levels and extreme high tide events, extreme winds and increased air and sea water temperature.

Prior to Cyclone Ian, Ha'apai had been experiencing a drought since August 2013. The drought had already had adverse effects on food crop production particularly on yams, the main

planting of which normally starts in August/September with subsequent harvest in April/May. The yield from the season's yams was thus expected to be low due to the impact of the drought. The crops have been struggling due to the drought and were at the critical growth stage of tuber production when the cyclone occurred.

The supply of drinking water was also at a low level by the time of the cyclone. Cyclone Ian with its 160 knots (296 kph) devastating wind compounded with associated salt spray thus hit Ha'apai at a time when the food crops and drinking water situation were highly compromised by the ongoing drought. There has been some rain since the cyclone, however more is needed to flush out the salt from the land and to restore the supply of drinking water. Current rainfall projections from the Tonga Meteorological Office indicate continued below-average rainfall at least until May 2014.

In the event of a cyclone, coconuts, breadfruit, fruit trees, Musa species will be damage severely, but in an event of a drought, root crops will be severely damage. For example, Tropical Cyclone Ian with strong wind of 160 knots (296 KPH) winds ripped through the Ha'apai Hahake Districts on January 11, 2014 flattening homes, uprooting ancient and valuable trees, destroying food crops and displacing thousands of families. The damage and loss to the agriculture and fisheries sectors of Ha'apai caused by Tropical Cyclone Ian is estimated at T$38.5 million Pa'anga, and T$4.1 million Pa'anga are needed to restore food security and livelihoods in the affected districts of Lifuka, Foa, Ha'ano and 'Uiha .

Figure 58: Devastation to coconuts, pandanus and fruit trees with members of the survey team carrying out the assessment at Ha'ano Island

Picture by Manaia Halafihi.

Damages Food Crops and fruit trees at Ha'apai Island during Ian cyclone

Based on field inspections and the household survey undertaken by MAFFF and other stakeholders, the damage level to crops is assessed as being severe, with the overall consolidated damage level to this sector calculated at 95 percent. The balance of 5 percent reflects an expectation that the plants will reshoot, grow and in due course produce fruit. However, as indicated below, the time-line for such recovery depends on the type of crop, and varies from 1 month for leafy vegetables, 4 months for food crops and about 2 years for fruit trees.

Damages to food crops including yam, cassava, sweet-potato, colocasia, bananas and other root and vegetable crops were severe (Table 5). The average percentage damage to food crops ranged from 75 percent for yams to 99 percent for the banana family. In terms of volume consumed, cassava is the most important food crop in the affected area. The survey recorded 98 percent of all households having cassava crops. Cassava, however, is one of the crops most prone to wind damage, recording an average damage level of 96 percent, second only to bananas. About 50 percent of tuberous roots of all half mature to fully mature plants were expected to rot in the ground within one to two weeks of the cyclone event. Cassava roots do not store well even in the soil, and especially damaged root

Table 5: Estimated value of food crop damage due to TC Ian at the four Haapai Hahake Disticts

Crop	Average area per HH (acre)	Average damage (%)**	Percentage reporting damage	Estimated number HH* having each crop	Base value production/acre/yr. (T$)	Total damage due TC Ian (million T$)
cassava	0.98	96	97.8	929	2,761	2.41
yam	0.37	75	50.0	475	22,730	4.00
plantain	0.68	99	71.5	679	4,764	2.19
alocasia	0.66	79	53.7	510	6,503	1.72
Sweet potato	0.68	79	53.7	510	4,978	1.37
xanthosoma	0.58	84	47.9	432	8,724	1.84
banana	0.49	99	25.8	245	3,362	0.40
bluggoe	0.48	99	25.3	240	1,902	0.22
colocasia	0.73	86	12.6	120	9,816	0.74
sweet yam	0.42	80	5.3	50	5,819	0.10
					Total	**14.99**

Average damage (%) ** The farmers' estimation of the level of damage to his crops as a deviation from what is normal. HH* Total number of household in affected area is 950

The banana crops, across three types, (banana, plantain, bluggoe) have sustained the highest level of damage at 99 percent. All banana plants in the four affected districts were either felled, cut or had all leaves stripped, thus any future harvest of banana will require young suckers to fruit which will take about 12 months. The value of the damage and loss therefore is equivalent to a whole year's harvest of bananas.

Damages to food crops were insignificant at the Lulunga and Motu Districts. Root crops were practically untouched except for cassava having an average 41 percent and 18 percent damage in the two districts respectively. This level of damage is low compared to the four affected districts of Lifuka, Foa, Ha'ano and 'Uiha with an average damage level of 96 percent. However the damage to cassava at Lulunga (41%) is important as this is their major crop for food security. Alocasia (kape) was damaged at 12 and 22 percent at Lulunga and Motu respectively. The only other crop reported with a relatively medium damage level is for banana (banana, plantain and bluggoe) with 74 percent at Lulunga district. Average damages level for coconut (20%) and breadfruit (35%) were medium at the Motu district and no data was available for Lulunga district.

Figure 59: Left - Damages to remaining root crops, like cassava and sweet potatoes by pigs at Lotofoa; Right – Devastations to bananas, coconuts and pandanus at Ha'ano Island

Picture by Manaia Halafihi

With the reported level of damage on food crops at Lulunga and Motu districts, it is concluded that Cyclone Ian has had a medium to low impact on food security of the Lulunga and Motu districts.

Table 6: Food crops and coconut and breadfruit average damage (percentage)

Average Damage (%)

Village	bananas	alocasia	yam	cassava	xanthosoma	Coconut*	Breadfruit*
Fotuha'a	94	13	5	50	0	-	-
Ha'afeva	69	0	0	44	0	-	-
Kotu	50	10	0	50	0	-	-
Matuku	50	0	0	50	0	-	-
O'ua	80	50	0	50	0	-	-
Tungua	100	0	0	0	0	-	-
Lulunga	**74**	**12**	**1**	**41**	**0**	0	-
Falevai	5	2	0	0	0	0	10
Hunga	1	74	11	63	0	60	87
Kapa	0	10	0	3	0	30	50
Matamaka	0	17	6	8	0	0	21
Noapapu	1	53	22	25	13	10	50
Otea	0	8	0	11	0	20	13
Ovaka	0	16	0	31	0	35	50
Taunga	0	0	0	0	0	0	0
Motu	**0**	**22**	**5**	**18**	**2**	**20**	**35**

At Lifuka, Foa, Ha'ano and 'Uiha districts, damages were extensive to tree crops including coconuts (90%), breadfruit (93%), mangoes (93%), citrus (89%) and other fruit trees (Table 2). Forest, timber trees and medicinal and culturally important trees were either flattened or have had most branches stripped. All fruit trees will take at least 12 months for any harvest of fruits; however, to get back to any reasonable level of harvest, it will take at least 24 months especially with the seasonal tropical fruit trees such as mangoes, polynesian lychee and breadfruit. Some fruit trees such as mangoes, breadfruit and avocado were in peak season and due for imminent harvest when the cyclone struck and the whole harvest has been lost. Value of the damage is equal to the damaged harvest and the value of the loss is the missing harvest in the second season assumed to be of the same value as the cyclone damaged harvest.

The three culturally important damaged crops/plants namely paper mulberry, pandanus and sandalwood sustained high level of damage at 91, 95 and 92 percent respectively and although only a low percentage (11%, 26% and 10% respectively) of households had these crops, these are extremely high value crops and account for more than half (62%) of the total loss value of tree crops (Table 7).

Table 7: Estimated value of fruit, cultural and forest tree damage due to TC Ian at Ha'apai and Hahake Districts

Fruit Trees and culturally important plants	**Average number of trees per HH**	**Average damage (%)**	**Percentage reporting damage**	**Estimated HH* having each crop**	**Base value production /tree/yr. (T$)**	**Estimated loss due to TC damage/tree/2yrs (T$)**	**Total damage due to TC Ian (million T$)**
coconut	111	90	78	741	16.5	30	1.22
mango	7	93	100	950	158.3	294	0.98
breadfruit	7.2	93	82	779	222.8	414	1.42
polynesian lycee (Tava	6.4	94	39	370	62.4	117	0.14
citrus	6.7	89	29	275	56.6	101	0.10
tahitian chestnut)	3.4	91	16	152	64.3	117	0.03
mountain apple (fekika)	3.5	92	14	133	13.2	24	0.001
paper mulberry	2.02 (acre)	91	11	100	$32,285/ac	29,379 (1yr)	5.93
pandanus	78	95	26	247	233.4	222 (1yr)	4.28
sandlewood (ahi)	28	92	10	95	1,000	920	1.23
						Total	15.15

HH* Total number of households in the affected areas is 950

Table 8: Total number of livestock deaths due to cyclone with total loss figures

Livestock Type	Total No.	Total No. died	Total No. of Casualties	% died	Ave. price/head	Estimated total Damage
chickens	10,850	2,250	25	21	$10	$22,500
Pigs	1,220	220	10	18	$800	$176,000
sheep	45	5	0	11	$200	$1,000
goats	420	15	0	4	$200	$3,000
horses	645	15	0	2	$1,500	$22,500
cattle	2,395	10	0	0	$2,000	$20,000
Total						$237,500

Livestock

Local livestock is important in the local diet, estimated to contribute about 15 to 20 percent of the protein component of the affected population's diet. The rest consists of a combination of marine foods and store frozen meat. The people of Uiha and Ha'ano districts eat more marine foods while those of Foa and Lifuka would eat more frozen meat due to its availability. There is no electricity and thus no freezers for meat storage in Uiha and Ha'ano. Livestock is sometimes sold for cash; however no figures are available on these ad hoc sales.

Cattle are normally reserved for cultural obligations and are rarely sold in the affected areas.

Damage in the livestock sector includes the death of cattle, pigs, horses and poultry, the damages to housing, pig pens, cattle fences and tethering ropes for larger animals. Damage due to the death of livestock is estimated at $237,500 (Table 8). Damage to fencing and livestock equipment is estimated at T$176,700. The primary damage to fences resulted from fallen trees and branches.

Following the cyclone, with severe destruction to fencing and enclosures, herds of roaming escaped pigs and cattle caused further damage to the remnants of what might have been viable food crops, as pigs have been digging and feeding on roots and tubers while cattle have grazed on any remaining and sprouting shoots.

Reports were received that animals, mainly pigs that disappeared during the cyclone, were located days or even weeks later a few hundred meters away from their original home. It is assumed these animals were startled during the cyclone and with the changed landscape

afterwards, could not find their way back. Thus, numbers reported for loss reflect the household loss, but some number of these animals may still be alive in an alternate geographic area and thus not constitute a total loss.

Food Crops Genetics Diversity

The assessment of the species diversity in agriculture was conducted in four districts in each of Tongatapu ('Ahau, Popua, Vaini, Lapaha) and Vava'u (Tefisi, Neiafu, Ha'alaufuli and Pangaimotu) one each in Niuatoputapu and Niuafo'ou and one collectively in Ha'apai. In each consultation meeting, a representative group was engaged in collectively dialogue about all varieties of each food crop species currently cultivated in its respective district.

Additionally, the group was asked to rank the varieties from the most cultivated varieties to the least cultivated. The group was asked to agree collectively on reasons for: the most popular variety; discarded variety; adoption of new varieties; the value of lost varieties. Lastly, the group was guided to forge a way forward on how best to preserve and enhance the genetic pool of each species. The main weakness of crops in Tonga is their very small genetic pool that exists. This is the consequence of propagations from the vegetative parts of the crop, such as cassava from stems, vines for sweet potato, corms for tannia and tubers for yam. Therefore the new generation has exactly the same genetic material as the parents. In contrast to propagation from seeds which is a fusion of two parental genes that provides opportunities for genetic variation of the new generation in relations to the parents.

<u>Root & Tree Crops</u>

The full list of plant species for used significantly for food in Tonga is listed in Annex I. The table below provides the results of the consultative assessment of varieties cultivated in each district. The total number of local and imported varieties for each species for all of Tonga from Annex I, correspond to the data on the second column of Table 9. The number on top is the total varieties of that species and the number below in brackets is the number of imported new varieties cultivated in that district

Table 9: The total number of crop species and varieties in Tonga

Food Crops Species	[a] Local & Imported Varieties	Tongatapu Islands				Vava'u Islands				Ha'apai Islands	Niuas Islands
		West	*Suburb*	*Central*	*East*	*West*	*Town*	*East*	*Islands*		
	---------- Total Number of Varieties (Number of New Imported Varieties) ----------										
Yam	41 (6)	14 (4)	4 (2)	13 (6)	15 (4)	9 (0)	14 (0)	15 (4)	11 (2)	8 (2)	3 (0)
Sweet Yam	11 (0)	3 (0)	0 (0)	4 (0)	2 (0)	1 (0)	1 (0)	1 (0)	2 (0)	4 (0)	7 (0)
Giant Taro	10 (1)	2 (0)	2 (0)	4 (0)	3 (0)	4 (0)	5 (0)	2 (0)	3 (0)	3 (0)	4 (1)
Taro	11 (4,>40acc[b])	8 (4)	3 (2)	7 (4)	3 (2)	3 (0)	4 (1)	1 (0)	1 (0)	1 (0)	5 (0)
Taro Tannia	6 (0)	4 (0)	1 (0)	4 (0)	3 (0)	3 (0)	4 (0)	1 (0)	5 (0)	3 (0)	4 (0)
Sweet Potato	19, (7, >40 acc)	5 (5)	3 (3)	6 (5)	5 (4)	4 (3)	3 (3)	4 (3)	5 (4)	2 (2)	2
Cassava	11 (2)	5 (2)	3 (1)	6 (2)	4 (2)	6 (1)	7 (1)	4 (1)	5 (1)	3 (1)	2
Plantain	10 (>7 acc)	4 (0)	1 (0)	3 (0)	3 (0)	3 (0)	4 (0)	1 (0)	3 (0)	7 (0)	2 (0)
Banana	5 (3, >15 acc)	2 (1)	0 (0)	2 (1)	3 (1)	2 (1)	2 (1)	3 (1)	3 (1)	3 (1)	1
Musa spp	7 (1)	4 (1)	3 (1)	4 (1)	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)
Breadfruit	8 (1)	4 (1)	2 (1)	4 (1)	3 (1)	4 (1)	6 (1)	4 (0)	6 (1)	5 (1)	4 (1)
Potato	3 (3)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

NB: (1) a Total Number of varieties accounted by farmers, old records and references (Wijmeersch,1986)

(2) [b] Exotic and Hybrid Accessions from MAFFF's Breeding & Regional & International Plant Genetic Improvement Programs

Yam ('Ufi) Varieties

From Annex I, there are 41 varieties of yams and 70 sub-varieties that existed in Tonga and 6 imported new varieties. Further, huge reduction was found in all the yam sub-varieties in all districts. From history, the traditional varieties of Tonga are the Kahokaho, Kaumeile plus the Tua and Palai variety. From table 9, there is a huge reduction of 63 to 93 per cent in the

varieties in Tongatapu to the Niuas in the north, with highest in the Niuas due to its smallness and remoteness. The highest cultivation rate of new varieties in Tongatapu reflects that fact that the international seaport and airport as the entry point of imported new varieties is in Tongatapu. The low rate for Tongatapu suburbs is due to the poor reclaim soils of the area, and most of the inhabitants are migrants from the northern islands with no readily lands owned to be farming. The lower number in the Vava'u western district, reflect their cultivation of kava as the main crop in the traditional farming system because of the current high economic value of kava. Usually, kava is first planted from February to April, followed by giant taro and taro, and last by yams of the variety Paholo and Mahoa'a in the July August period. The higher yam varieties in Vava'u east and the islands are due to the poor growth of kava in these areas, so the traditional cultivation of yam as the main crop still prevails.

The Kahokaho and Kaumeile variety is traditionally the two main cultivated varieties of Tonga for reasons of culture, security in yield, etc. In Tongatapu, Kaumeile is mainly confined to the lesser productive soils of the east and part of the west and the Kahokaho is the main variety of the central and the western district. However, in Vava'u both varieties including Heketala is cultivated in discriminately throughout the group. The increasing vulnerability of Kahokaho to the Anthracnose *Glomerella cingulata* fungal leaf disease has move farmers to adopt the new varieties Lose, Pita, Kina, etc. who are all resistant to this disease. However, Kahokaho still have a high market demand locally ranging from T$5 to T$10 per kilogram, it's ability to thrive in the off- season period from May to December with it's heist prices, drive farmers maintain production with control of the leaf fungal disease with fungicide.

The proliferation of cultivation of the "Lose" variety in Tongatapu is due to it's high demand from overseas market (fresh or frozen peeled Lose), it's lacks of any serious pest, and it's durability to different cultivation methods and high yield in different soil type and high yield. The latest imported varieties, Kina and Pita, is rapidly being adopted Tongatapu, Ha'apai and Vava'u due it's yield and free of pest, but is yet to have a market demand as for Lose. The traditional famine relief varieties of Sikau, Sikovai, Misimisi still exist in Vava'u west, while the traditional famine crop "Teve" is nowhere to be found.

Sweet Yam ('Ufilei) Varieties

The sweet yam varieties has been reduced by 36 to 100 per cent for most of Tonga but still highest for the Niuas because it is its main food crop due to its tradition, soil and the warmer and higher rainfall climate. For the rest, it is traditionally a famine relief crop which are planted

and left to re-grow for years without harvest. However, an export market has been found and expansion of production by mechanized cultivation in Tongatapu and 'Eua has started last year.

Giant Taro (Kape) and Tannia (Talofutuna) Varieties

The cultivation of the Giant taro variety has been reduced by 50 to 80 per cent throughout Tonga. Traditional the production increases to the north with its warmer and higher rainfall climate. Vava'u is the hub of giant taro production with its Fohenga varieties. The Fulai variety is one of the famine relief crop in the Niuas. The demand for giant taro in the export market but especially the Fohenga varieties is reflected by the high variety numbers in Tongatapu.

The existing tannia varieties in production have dropped by 17 to 57 per cent. The local demand for its leaves as the green vegetables and the taro cormel remains high for both local and overseas market. The main variety in production is Mahele'uli. The leaves can be harvested continually for about 6 to 10 months before the actual harvest. In addition, is it's mechanized tillage and weeding at the early growth stages plus it's lack of serious pest. It is vulnerable to drought, so its production is favourable for the western to central districts of Tonga with its soil with higher available water for plants. Two rare varieties of Panefu and Lahelahe still exist in Vava'u islands and the Niuas. Tonga has the highest varieties stock and production in all the Pacific countries, making it an unique product from Tonga to competitive markets in New Zealand and Australia.

Taro (Talotonga) and Sweet Potato (Kumala) Varieties

From the survey, the taro varieties existed in production has dropped by 27 to 91 per cent. The main variety in production is the local Lau'ila variety. The ministry of Agriculture has imported greater than 40 taro accessions since 1980's in collaboration with universities and ministries of the region. These accessions has leaked out to farmers field as far as the Niuafo'ou which has a variety call Taro 20, probably from its accession number that came with it. Huge demand from overseas market but especially the Niue variety for the New Zealand market maintains its production to be high. Its enemies are drought and an insect pest in Tongatapu where it is mass produced as a mono-crop. Therefore, higher productions in the western districts and the pest are controlled with an insecticide. The higher rate of new varieties cultivated in Tongatapu is due to proximity to MAFFF which imported these new varieties.

Similarly for sweet potato the varieties have dropped by 68 to 89 per cent throughout Tonga. The proliferation of sweet potato's leaf fungal disease called Scab (*Elsinoe batatas)* in late 1970's devastated and eradicated almost all the traditional varieties except an imported new

variety Hawaii. The ministry of Agriculture immediately responded with advising application of fungicides for control plus the import of resistant varieties from overseas of more than 40 accessions (Table 2), while long-term breeding programs of all varieties with the Hawaii variety was conducted. The resultant varieties of today are the original Hawaii variety plus the Hawaii progeny from those breeding programs. The higher adoption of the new varieties in Tongatapu is due to close proximity to the ministry. The two sweet potato weevil *Euscepe postfaciatus* and *Cylas formicarus* pests prevents the export of sweet potatoes as fresh products, however, frozen products has been accepted by both New Zealand and Australia's quarantine.

Cassava (Manioke) Varieties

The cassava varieties that are currently used by farmers have dropped by 36 to 82 per cent. From Table 2, the diversity is relatively uniform throughout Tonga which implies the relative larger production of this species for food and or export. In terms of volume, cassava is the highest production export frozen mainly to New Zealand. The most preferred variety by farmers differs by districts. Traditionally, Mataki'eua is the most grown variety for consumption. However, Engeenga variety is popular due to its shorter durations 8-10 months hence a lower production cost. However, the long duration of the quality of the new Fisi variety has gained popularity very quickly. The harvest period can start from 10 months to as far as 24 month and the roots are still edible with good quality.

The traditional methods of storing all the root crops other than yams is done as live plants at the field coupled with sequential harvest. Hence, the longevity of the quality of the Fisi variety is slowly dominating the cassava variety with the exception of the Niuas.

Potato (pateta) Varieties

The potato varieties seedling has always been traditionally imported every season from New Zealand and Australia. The ministry has recommended two varieties, Red Pontiac and Sequoia, the single supplier imported only the Desiree variety from New Zealand as the cheapest choice. Potato is also produced in significant amount but because of its cool temperature requirement, it is mainly cultivated in Tongatapu during the cool months of June to August. In Table 2, potato production is found in Tongatapu central district.

Vegetables

The majority of vegetables seeds are imported and most of its production is confine to Tongatapu due to the high market demands and access to supply of seeds, fertilizer and

chemicals and also the mechanical tillage services. Watermelon is produced significantly for local and export market with production from Tongatapu, 'Eua and Vava'u. All the varieties are imported annually with the production season started from May to November.

Squash is the main export crop with production confine to mainly to Tongatapu. The varieties vary with different years and different exporters also, but usually, Delica and Kurijimann is one of them.

Fruit Trees

Overall there is a huge decline in population of fruit trees in the wild, as there is huge reduction in the area of undisturbed forest vegetations. Extension of cropping cleared trees by ring-barking followed by burning of the base result in losses of fruit trees. Yam cultivation also requires trellising support from pruning of fruit trees. Lastly, there is very little planting on new fruit trees, for various reasons, but mostly the benefits took years to result. In 2008, the Ministry of Agriculture in collaboration with the Australian Center of International Agricultural Research and the Secretariat for Pacific Community conducted a project 2008 to 2011 on improving fruit trees genetics and diversity. The list of promoted species is at Annex III.

Table 10: The total fruit tree species and varieties in Tonga

Fruit Tree Species	[a] Local & Imported Varieties	Tongatapu Islands				Vava'u Islands				Ha'apai Islands	Niuas Islands
		West	*Suburb*	*Central*	*East*	*West*	*Town*	*East*	*Islands*		
	Total Number of Varieties (Number of New Varieties)										
Orange	9 (4)	4 (2)	2 (1)	5 (2)	3 (1)	3 (0)	4 (0)	4 (1)	3 (1)	3 (1)	3 (0)
Lemon Lime	4 (1)	3 (1)	1 (0)	4 (1)	2 (0)	3 (0)	3 (0)	3 (1)	3 (0)	2 (1)	3 (0)
Mango	10 (3)	4 (0)	2 (0)	5 (1)	3 (0)	8 (0)	9 (1)	10 (3)	7 (1)	3 (0)	3 (0)
Pacific Lychee	6 (3)	3 (0)	1 (0)	3 (1)	3 (0)	2 (0)	2 (1)	2 (0)	2 (0)	3 (0)	2 (0)
Tahitian Chestnut	4 (0)	3 (0)	0 (0)	2 (0)	3 (0)	4 (0)	3 (0)	4 (0)	3 (0)	2 (0)	2 (0)
Soursop	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
Malay Apple	1 (0)	1 (0)	0 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)	1 (0)
Polynesian	2	2	0 (0)	1	2	1	1	1	2	1	1

Plum	(0)	(0)		(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Guava	3 (0)	3 (0)	3 (0)	2 (0)	2 (0)	2 (0)	1 (0)	3 (0)	2 (0)	1 (0)	0 (0)
Coconut	6 (1)	5 (0)	2 (0)	3 (0)	3 (0)	5 (0)	3 (0)	3 (0)	3 (0)	4 (0)	5 (0)
Papaya	4 (2)	2 (1)	1 (0)	3 (1)	3 (1)	2 (0)	2 (0)	2 (0)	2 (0)	2 (0)	1 (0)
Pineapple	2 (0)	2 (0)	0 (0)	2 (0)	2 (0)	1 (0)	2 (0)	2 (0)	1 (0)	1 (0)	1 (0)

Orange (moli) and Lemon (lemani) Species & Varieties

The citrus species and variety diversity has dropped for orange by 36 to 82 per cent and for lemon by 25 to 75 per cent. The population of citrus species and varieties sweet orange (molikai) in the wild and in farms has dropped dramatically due mainly to very little new planting. The 'Eua Islands is famous for its supply of mandarin (molipeli) and tangelo (molivaikeli) when it is on season and to a much lesser supply from other islands. The pummel (molitonga) is found in Ha'apai islands group, and sour orange (kola), lemon and lime are mostly found in residential homes throughout Tonga. The new citrus species from the fruit project were mostly planted in residential homes with very little plantation planting.

Mango (mango) Pacific Lychee (tava) & Tahitian Chestnut (ifi)

The species diversity of these fruit trees are being reduced by 0 to 83 per cent for mango, 50 to 83 per cent for Lychee and 0 to 50 per cent for chestnut. The main threat to fruit trees is the change from traditional to modern mono-cropping system. The mechanized tillage demand trees to be removed. This reflected by the lower diversity for Tongatapu with higher modern farming compared to farming with the majority still with the traditional farming. Vava'u is famous for its supplies of the Kaimata varieties when it is on season. The Mango lesi varieties are quite common from Tongatapu to Niuas in the north. The new varieties in Annex III are yet to materialize.

The lychee species diversity are also similar to that of mango, however, the 3 new species from the project (Annex I) is yet to be seen in farmer's field. The chestnut is very much threatened.

Soursop ('apele 'initia), Malay Apple (fekika), Polynesian Plum (vi) & Guava (kuava)

These 3 species follows the same trend as the previous species but with much lesser population and hence diversity. However, there are lesser varieties but seemed to be present in every district with no new species introduced. There is huge wild area of soursop in the eastern

side of Vava'u. Most of the malay apple and the Polynesian plum species are found in small numbers in various farms and homes. The Guava species is normally found in the wild vegetation mostly in the marshy waterlogged areas northern coastline of Tongatapu, or in some abandoned farms, etc.

Coconut

The diversity of coconut is very much threatened in areas where mechanized tillage is intensive. Hence the higher reduced diversity for Tongatapu relatively. It has been estimated that about 50% of the farms in Tongatapu has its coconut cut down. The 5 local varieties is also varied thoughout. The new Red Malayan Dwarf variety introduced by MAFFF in late 1990's was devasted by the cyclone in 2005 and has never recovered. Replanting programs has been auctioned on and off depending on the resources. The Tokomololo Forestry nursery keeps producing seedlings for farmers.

Papaya (lesi) & Pineapple (faina)

The papaya species diversity has found to be maintaining throughout Tonga, but especially the local varieties. The new species is only seen at Tongatapu districts reflecting the availability of seedlings. Similarly, planting are small number of trees informal manner. However, exporters are trying to engage farmers to produce for export to New Zealand.
Pineapple diversity is very stable with only two varieties targeting the local market. However, move has been proposed to seek the New Zealand market for fresh pineapple fruits.

<u>Livestock</u>

The livestock species diversity has been found to be very narrow, as a result of Tonga's remoteness. Most of the new breeds were imported for pig, cattle and goat though various genetic improvement program of MAFFF. From Annex I the 3 exotic Pig breeds of Large White, Landrace and Duroc were imported and cross-bred with Tonga breeds and then distribute the hybrid off-springs continuously. From the survey at least one of the breeds or a hybrid is actually presence in all the districts but higher occurrence for Tongatapu and the least for the Niuas.

Similar for cattle, the exotic breed Brahman and Santa Gertrudus were cross bred and distributed with supplement programs from Mormon Church cattle ranch in introducing new breeds. The horse species is very stable and the population is very much reduced at the arrival

of vehicles. The ducks is similar to the horses with a single breed Muscovy. The poultry breed is different where the exotic breeds are mainly for the commercial poultry businesses.

Sheep was introduced Tonga in the 1990's by his late majesty Tupou IV. The sheep introduced was a temperate breed from New Zealand which was not faring very well in Tonga's hot and humid climate. Its main enemy were stray dogs which attack and kill the sheep during their birthing season. In 2002, all the sheep flocks were wiped out. However, in 2005, the Ministry of Agriculture in collaboration with Food and Agriculture Organisation (FAO) imported a cross bred sheep (New Zealand breed and a Caribbean tropical breed) called "Fiji Fantastic breed" from Fiji which seasonally shed off its wool naturally. The 40 ewes and 4 rams reproduced and were distributed to about 84 farmers and 5 livestock stations including the outer islands. To date, the number has expanded in total to about 900 plus in stations and farmers.

Table 11: The total number of breeds in Tonga and the number present in each district

Livestock Species	Local & Exotic Breeds	Tongatapu	'Eua	Haapai	Vava'u	Niua
	---------- *Total number of breeds (Number of New Imported Breeds)* ----------					
Pig	4 (3)	4 (3)	3 (2)	2 (1)	3 (2)	2 (1)
Poultry	3 (2)	3 (2)	2 (1)	2 (1)	2 (1)	1
Cattle	4 (4)	4 (4)	3 (3)	2 (2)	3 (3)	1 (1)
Horses	1 (0)	1	1	1	1	1
Goat	2 (1)	2 (1)	2 (1)	1	1	1
Duck	1 (0)	1	1	1	1	1
Sheep	1 (1)	1 (1)	1 (1)	1 (1)	1 (1)	0

1.2.4 Species conservation

Overview:

In order to maintain Tonga's biodiversity, efforts to conserve species that are endangered have to be urgently addressed. Tonga's vision for biological diversity and natural resources are to protect, conserve and enrich; and to be enjoyed by present and future generations. This can be

achieved by ensuring that the national targets are aligned with the global Aichi Target 11 in thematic areas of forest and marine ecosystems, species conservation, and agro-biodiversity. Species conservation activities are currently being implemented in Tonga and executed by various stakeholders through external funding. There are two projects aiming at species conservation, currently being executed by MLECCNR, which are the conservation of the Polynesian megapodes, and addressing of invasive species.

The Polynesian Megapode

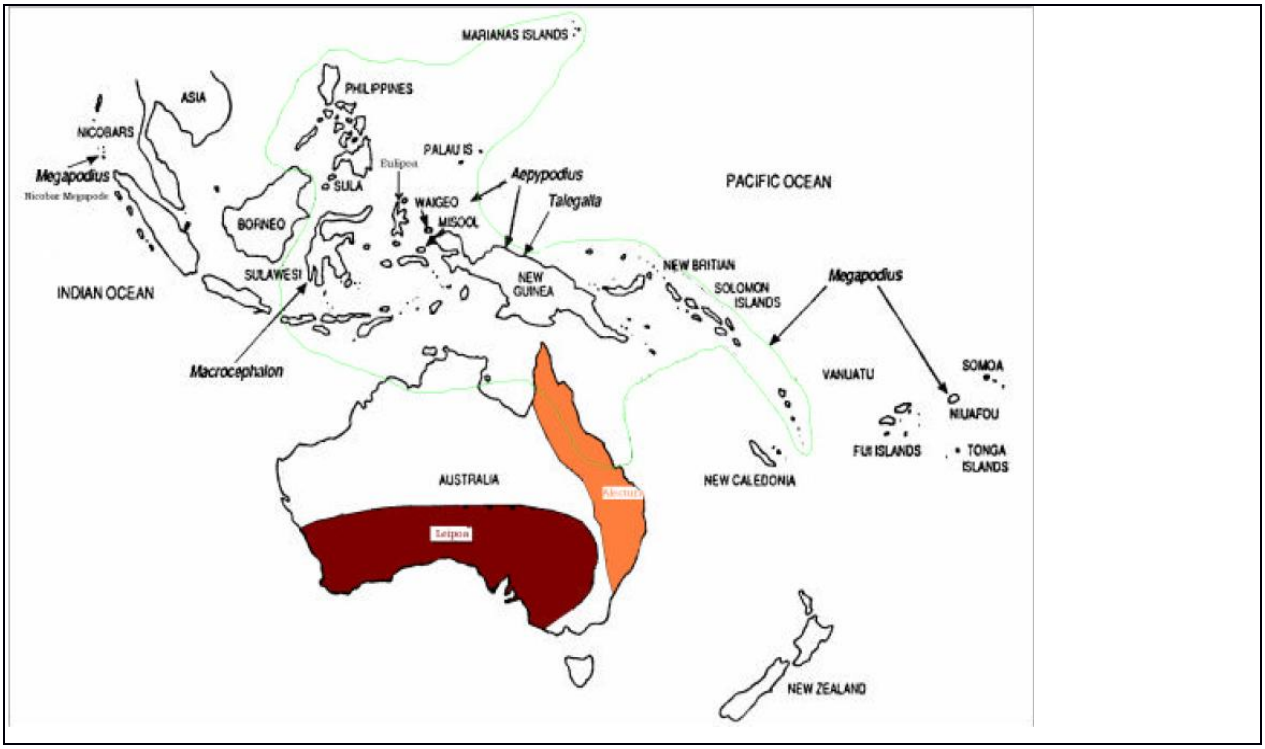
***Megapodius pritchardii, monitoring and conservation* of Malau**

Two Endemic Bird Areas (EBAs) have been found in the Niuafo'ou and Vava'u islands for the Polynesian megapode and theTongan Whistler respectively. Seven Important Bird Areas (IBAs) have been proposed, these are areas where significant seabird colonies and Pacific restricted species are known to occur. The islands of Late and Fonualei, the sites of translocation of the Polynesian megapode, are also considered. Birdlife International Data Zone provides datasheets on each of its site that outline a description of the site, the species that occur on it, its biodiversity significance as well as threats and conservation action.

The Polynesian Megapode *Megapodius pritchardii* or the Malau bird, is found only in Tonga, and is listed under the IUCN criteria as Critically Endangered (CR) before the translocation took place on 1991-1993 to two volcanic islands in the Vava'u Group known to be Late and Fonualei. Sixty eggs were buried on Late whereas thirty five eggs and chicks were introduced to Fonualei (Watling, 2003).

In 2003 the Van Tienhoven Foundation provided a grant of US$2000 for Dick Watling, an Ornithologist to conduct survey in the islands of Late and Fonualei in determined the success of translocation efforts of the Polynesian Megapode *Megapodius pritchardii* in the early 1990s. The results of his five days survey were concluded that no megapodes were seen, heard or present in the island of Late whereas megapodes population is doubled on Fonualei Island approximately to 300-500 megapodes that are present on Fonualei Island.

Figure 60: Distribution of 22 Megapode species in the world



Source: Jones, 1989

Nature

Polynesian Megapodes *Megapodius pritchardii* is known to be restricted to the Island of Niuafo'ou. Adult birds are dark slate grey, with a dark ash-grey forehead and crown with slight brownish tinge. The feathers of the nape and back of head are lighter slate-grey and slightly elongated, forming an indistinct short but broad crest. Area around the lores, eyes and ears are virtually bare with some light grey feathers boarding the bare patch. Those on the neck are much reduced in length leaving a variable amount of skin of the head and neck bare. The feathers above the eye extending back to the nape contrast sharply with the darker crown, forming a pale grey streak (only really visible when the birds are in the hand). The feathers on the upper throat and chin are pale white. The lower back, rump and wings are washed reddish brown, with a white patch at the base of the primary feathers and white upper-tail coverts. Both these field characteristics are individually variable and usually concealed. Overall the underparts are grey becoming paler on the belly (Lloyd, Sovero and Faka'osi, 2010). The bird has very limited abilities, being able to sustain flight for no more than a few metres. However, they sue their small wings to assist in rapid maneuvering and short runs on the ground and in

leaping from shrub to shrub. They are also agile climbers moving quickly from shrubs and sedges to the low canopy. Megapodes are easily found in secondary forests, in dark areas where no predators or humans can see them.

Vocalizations

The song of the male easily distinguishes the Polynesian Megapode bird from other birds within its range, but the colour and behaviour combine the dense habitat to make them difficult to observe. However, they are not as secretive as casual observations would suggest, but are inquisitive birds, moving quickly to investigate the cause of any disturbance in their territory. Male megapodes are most frequently heard by whistles whereas female megapodes are recognized with a chirp voice (personal observation) during survey on all nest sites. A single whistle follow each other in a bout have about the same but get softer towards the end. Both male and female Polynesian megapodes always sing a duet. Neighboring pairs respond to each other help to go to roost at the same time and in close approximation.

Figure 61: Singing male Malau at Kele'efuefu

Photo taken by Phillip Parton, 2012

Habitat

Lloyd, Sovero and Faka'osi studied the habitat of Polynesian Megapode in the island of Niuafo'ou during two weeks survey in 2010. Based on this survey, they considerd that, historically, Polynesian Megapodes in the island may have been confined to the areas and sites near the lakes (Vai Lahi and Vai Mu'a) and they inhabit different types of broad-leaved forest in

all succession stages, ranging from secondary forest dominated by Fekika Vao and Fanakio *Sterculia fanaiho.*

According to the most experienced egg collector on the Niuafo'ou Island, Mr. Lafaele Pe'ei, the Polynesian Megapodes *Megapodius pritchardii* always love to stay and breed at dense forests and dark places which are hardly visited by feral predators.

Within all the nest sites, it is evident that habitats are likely to be an important determinant of the distribution and number of birds. For thirteen sites on Niuafo'ou that were surveyed, habitats are changing all the time as it is not protected.. Effective management depends on understanding the relationship between the Malau birds and their habitats, revising the Birds Act and other relevant legislation, and compliance

Field Survey

IIB Project had first conducted their survey at Niuafo'ou in September, 2012 and they had found 13 nest sites for megapodes. The 13 nest sites on Niuafo'ou consisting of *'Utupalapu, 'Utumea, Lolo, Kele'efu'efu, Hikutemotu, 'Akofa, Koko, Teleka, Laloola, Vai Kona, Vai 'Ahau, Motu Molemole and Motu Lah*i were surveyed by the team for a short period of time. Desktop review, showed that reports were mainly focused on status and conservation strategy of Polynesian Megapodes and the acoustic communication of the Polynesian Megapode on Niuafo'ou. All data were stored and recorded in a field notebook and photographed of nest sites and nesting burrows were taken using a digital and video cameras. (see photo 62-72).

Figure 62: View of Motu Molemole and Motu Lahi from Hikutemotu lookout

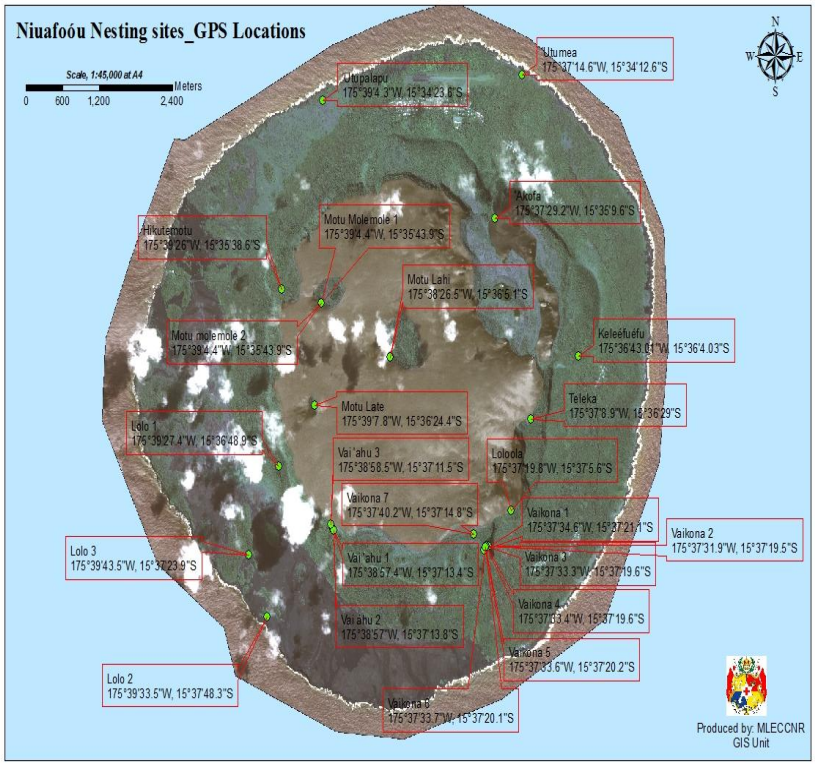
Figure 63: Inactive nesting grounds in Lolo nest site, Niuafo'ou

Figure 64: Dirt track on the way to 'Utupalapu site, dominated by Fekika Vao

Mapping nesting grounds

The GIS unit from the Ministry of Lands, Environment, Climate Change and Natural Resources produced and designed the map for all the nest sites and nesting grounds. All 14 nest sites on Niuafo'ou were mapped out together with the new nest site using their coordinates compared to the past survey in 2010 and previous year's research. Lolo, 'Utupalapu and 'Utumea are situated outside near the coastal area whereas 'Akofa, Koko, Kele'efu'efu, Teleka, Laloola, Vai Kona, Vai 'Ahau, Motu Lahi , Hikutemotu, Motu Molemole and Motu Late (new nest site) are located around the crater near the Big Lakes (Vai Lahi) and within the Big Lake. The green dots show the location of the new active nesting grounds found during the four weeks survey in the island of Niuafo'ou. Some of the nest sites contain more than one nesting grounds such as Vai 'Ahau, Vai Kona, Lolo and Motu Molemole. Figure 65 shows the map of the 14 nest sites with all the active nesting grounds located with their coordinates.

Figure 65: Counting number of nesting burrows, birds & eggs



During short period of survey on Niuafo'ou, the surveyors were able to count and recorded the number of active and inactive nesting grounds on each thirteen sites. Adult birds, chicks and eggs were also noted on the survey data sheet.

Figure 66: Adult Malau found in Laloola nesting ground, Niuafo'ou

Source: 'Ana Fekau, 2012

Threats to Malaubirds

Many Malau birds are found on undisturbed sites with few predators present. . Nesting burrows are prone to predators on the island (past researcher personal observation). However, during the survey in September, 2012 to all the 14 nest sites, the nest sites within the Lake (Vai Lahi) are the sites that require protection by government. The Megapode species have declined on each nest site since the 2010 survey. Human beings, dogs, cats and pigs are the major threat to the Malau birds' population due to the destruction of their habitats and local practices.

Invasive Alien Species

The International Union for Conservation of Nature, (IUCN) describes invasive species as "*animals, plants or other organisms introduced by man into places out of their natural range of distribution, where they become established and disperse, generating a negative impact on the local ecosystem and species*." Invasive species can negatively impact native ecosystems and the species they contain. These impacts may disrupt the ecosystem processes, degrade habitats, reduce biodiversity and introduce diseases to flora and fauna

Small Island ecosystems are extremely vulnerable to invasions. Island ecosystems tend to have fewer species present and are less complex with distance from the continent; simpler systems are less resilient to new arrivals. Introduced mammal predators (rats, feral cats, mongooses, stoats and pigs) and herbivores (rabbits, deer, goats and sheep), alien invasive plants and introduced diseases have had devastating effects on native and endemic island species and their habitats (Birdlife International Data Zone).

The indigenous and endemic fauna and flora of Tonga underwent alteration with the arrival of Polynesian settlers more than 3000 years ago. The settlers brought with them herbaceous food crops, trees and animals like the Polynesian rat and the pig. The second wave of introductions of alien species occurred with the arrival of European settlers- more plants and trees for food resource, and ornamentals and weeds and animals like domestic goats, the black rat, Norway rat and birds like the European starling, jungle myna and rock pigeon. Ecosystem alteration, predation and other impacts led to native species extinctions, further leading to ecological disruptions such as alteration of dispersal guilds leading to more decline in native species populations and the integrity of ecosystems (Fall, P. L. and T. D. Drezner, 2011).

A household survey was conducted on Tongatapu and 'Eua with regards to components of status, threats and trends of Biodiversity in Tonga. ., About 22% of people interviewed in

Tongatapu believed that there were new plant species in their homes and tax allotments. There was a strong belief that this type of invasive plant has caused harm to human being and the surrounding environment. *Tisaipale* plant was considered by most as the fastest spreading plant and has caused harm to human beings with its spiky stem and branches. This type of characterisation could also be observed species of vine (fue). Other invasive species also mentioned are shown below in Table 12.

Figure 67: *Solanum torvum* (Tisaipale)

Table 12: List of invasive species mentioned in the survey in Tongatapu

Tongan Name	Common Name	Scientific Name
Tisaipale	Devils fig	*Solanum torvum*
Fuemea	Merremia	*Merremia peltata*
Musie (generic)	Grass (generic)	Family: Poaceai
Kava Hawaii	Kavakavaˇulie	*Macropiper puberulum*
Te'eho'osi	False mallow	*Malvastrum coromandelianum*
Kotia	Ecuador laurel	*Cordia alliodora*
Talatala	Lantana	*Lantana camara*
Kihikihi	Creeping wood sorrel	*Oxalis corniculata*
Mo'osipo,	Chinese burr	*Triumfetta rhomboidea*
Mateloi	Sensitive plant	*Mimosa pudica*
Ovava Palangi	Weeping banyan	*Ficus benjamina*

In chronological order of species causing the most damages, the community identified the following species; he'e, (grass hopper) rats (Kuma), ants (lo), pigs (puaka), dove (lupe), kutu, snails (elili vao), chicken (moa), cow (pulu) and cockroaches (mongomonga). The other species consist of termites (ane) and kalae.

Figure 68: *Bidens alba* in Neiafu, Vava'u

Source: Dr. Viliami Kami, 2013

Plants

Most of the people interviewed on the island of 'Eua agreed that there were very few invasive species they were aware of. There were four species mentioned by few during the survey. They are; (vines) fuemea, piti, Tisaipale and Talatala. Merremia peltata (Figure 69) continues to endanger natural forests in Eua and Vava'u by smothering existing vegetation. There is a need to look at possible means of sustainable management.

Figure 69: *Merremia peltata* (Fuemea) is covering lower and higher canopy plants in 'Eua

Source: Fukakitekei'aho, 2013

The psyllid *Heteropsylla spinulosa* was released at the Fangatongo site for the integrated pest management of *Mimosa diplotricha.* The psyllid has established as seen in Figure70.

Figure 70: Adult psyllid *Heteropsylla spinulosa* feeding on leaves of *Mimosa diplotricha* at Fangatongo site, Neiafu, Vava'u

Source: Dr. Viliami Kami, 2013

Figure 71: A looper feeding on *M. diplotrichae* flower at Fangatongo, Neiafu, Vava'u

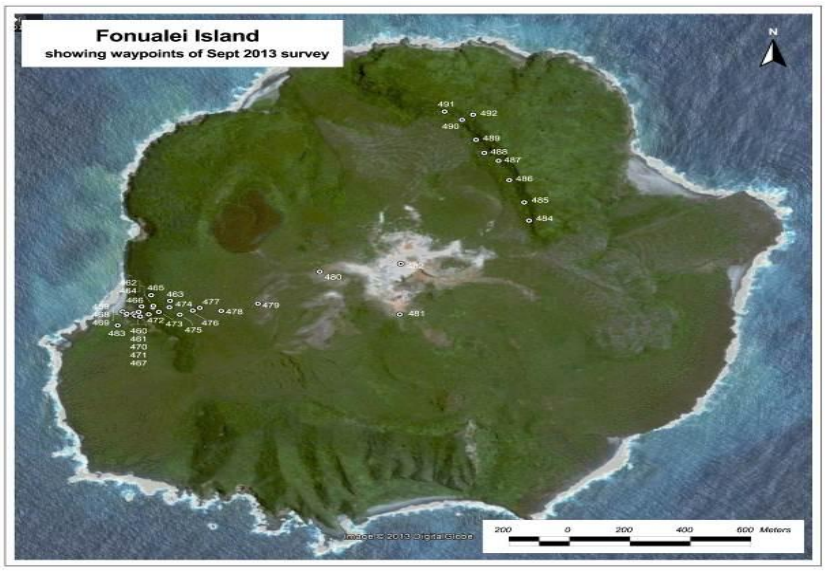
Dr. Viliami Kami, 2013

BIRD AND RATS SURVEYS OF LATE AND FONUALEI ISLANDS, VAVA'U, KINGDOM OF TONGA, SEPTEMBER 2013

Figure 72: Late Island, Vava'u

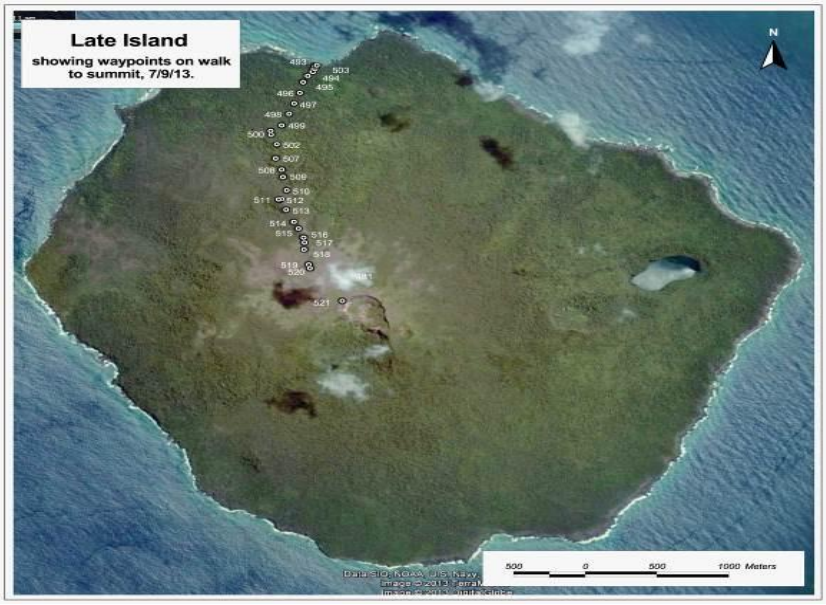
Source: Dr. David Butler, 2013

Figure 73: Fonualei Island, Vava'u



Source: Dr. David Butler, 2013

Figure 74: Late Island showing waypoints on walk to summit



Source: Dr. David Butler, 2013

The second survey for megabode was conducted in Late and Fonualei Islands (photos above).This survey was co-finance by the IIP and IAS Projects. The objective of the IIP project was improved conservation status of priority threatened species, consistent with selected outcomes set out in the Island Biodiversity Programme of Work (IBPOW). IAS Project has to find

out whether rats are found in these two islands. Surveys were initially aimed at establishing the status of species at different sites in the Vava'u Group, Niuafo'ou, Late and Fonualei to assess fate of introduced populations of Tongan Megapode.

Late Island is an isolated 6-km wide circular island about 55 km WSW of the island of Vava'u which rises to 565m. The island is an uninhabited 15sq km island which rises to 565m. It is volcanically active but has been dormant since 1854. Late has some of the finest forest to be found in Tonga and is a global stronghold of the threatened friendly ground-dove *Gallicolumba stairi* and the endemic Tongan whistler *Pachycephala jacquinoti*. A translocation attempt of the Tongan Megapode *Megapodius pritchardii* to Late was made in 1992. An initial positive report (1997) was not confirmed by searchers at the translocation site in 2003 and 2004. Late is also home to seven central Polynesian Restricted Range Species, as well as eleven species of seabird which are currently believed to breed on the island.

Fonualei is an isolated island about 65km North West of Vava'u. It is a round volcanic cone with a fumarolicaly active crater, approximately 1.5km across, which rises to about 195m. There are steep cliffs on all but the eastern side. Fonualei IBA comprises the whole island of Fonualei which supports a recently established population of the Tongan Megapode and another globally threatened species, the friendly ground-dove *Gallicolumba stairi*. The island is an isolated active volcano, approximately 200 ha in areas and the megapodes lay their eggs in soil heated by volcanic ducts. The introducing of Polynesian Megapodes to Fonualei in the 1990s was successful as the result in 2003 shows a doubling in the population of Polynesian Megapode in the island.

Key findings:

- The Tongan megapode (malau) continues to survive in good numbers on Fonualei but was not located on Late
- Both islands are important refuges for Tongan bird species with Fonualei of greater significance for seabirds (and malau) and Late having a greater variety of landbirds including the endemic Samoan whistler
- No reptiles were found on Fonualei and four widespread species (2 geckos and 2 skinks) were found on Late.
- No rats were found on Fonualei but the invasive Pacific rat (*Rattus exulans*) is present on Late.
- Eradicating rats from Late appears both feasible and worthwhile.

- There needs to be a strong emphasis on biosecurity to keep these islands free of any further invasive species.

Results:

Bird Observations – Fonualei

Tongan Megapode (Malau)
About forty birds were seen at each of two sites – the forested slopes above camp and the forested gully in the north of the island. At the first site birds were present from the coast up to waypoint 475 at 156m altitude when the understorey was becoming increasingly dominated by thick fern. At the second site birds there was a dense sequence of territories along the floor of the gully and apparently further territories up the slope. Several chicks were seen at the first site and one active nesting burrow located. No active burrows were found at the second site and there was no evidence of heat (or steam) at the surface here but very deep easily dug soils.

Shy Ground-Dove – common in forest and in open grassland near summit
Pacific Pigeon – surprisingly numerous in most habitats.
Spotless Crake – 1 seen and 1 caught on glue trap
Purple Swamphen – c6 pairs; one with two large chicks.
Brown Booby – 100+ birds with chicks at various stages from fluffy white to fledging
Red-footed Booby – less abundant than brown booby – nesting not noted
Great & Lesser Frigatebird – fewer than 100 with chicks in various stages; some males with red throats – generally not identified to species
Sooty Tern – 3 colonies along ridge west of crater with chicks flighted or close to flying – total population 5000-10,000.
White Tern – several hundred seen most in the gully forest
Red-tailed tropic bird – 1 seen
Brown Noddy – sizeable colonies with some sitting on nests in tall trees in gully forest (waypoints 487, 490)
Black Noddy – most noddies seen were identified as brown with small numbers of black present
Golden Plover – 5 flying near summit
Bristle-thighed curlew – 1 seen flying and calling near summit
Turnstone – 3 flying near summit
Long-tailed cuckoo – 1 seen.
Wattled honeyeater – common throughout.
Polynesian starling – common throughout.

Native Mammals

Tongan flying fox – 1 seen flying over coastal forest on Fonualei in evening. (None seen Late)
Humpback Whale – seen occasionally near the islands with several close to boat off Fonualei during night.

Bird Observations – Late

- Shy Ground-Dove – common in lower forest areas
- Pacific Pigeon – heard throughout.
- Spotless Crake – 1 caught on glue trap
- Brown Booby – few seen
- Red-footed Booby – few seen
- Frigatebird - few seen – nesting in mature forest
- White Tern – good numbers seen in coastal areas and summit crater
- White-tailed tropic bird - a few flying in crater.
- Brown Noddy, Black Noddy – hundreds seen on rocks/cliffs around coast from boat – not identified to species but according to Watling (2003) most would have been black
- Tongan whistler – several seen/heard in more mature forest
- Long-tailed cuckoo – 1 seen
- Wattled honeyeater - common throughout.

Polynesian starling - common throughout.
Crimson-crowned fruit dove – heard regularly in more mature forest
Many-coloured fruit dove - small number heard
Kingfisher – several seen and heard at various altitudes.
White-rumped Swiftlet – few hawking around summit and coast in evening.
Barn Owl – 1 flew along coast in evening
Reed heron (white phase) – 1 seen on coast
Shining parrot – one squawk heard may have been from this species.
No megapodes were detected on Late.

Figure 75: Shy ground-dove (Tuu) – male

Source: David Butler, 2013

Figure 76: Nestling frigatebird (Lofa, Helekosi)

Source: David Butler, 2013

Figure 77: Nestling brown booby (Ngutulei)

Source: Dr. David Butler, 2013

Figure 78: Spotless crake (Moho) released

Source: Dr. David Butler, 2013

Figure 79: Purple swamphen & chick (kalae)

Source: Dr. David Buler, 2013

Figure 80: Sooty Tern fledgling ('Ekiaki)

Source: Dr. David Butler, 2013

Reptiles

No reptiles were seen or caught in glue traps on Fonualei.
The following were recorded on Late:
Oceanic gecko *Gehyra oceanica* – 3 found in timber and at night
Slender toed gecko – *Nactus pelagicus* – 1 found during day and 1 seen at night
Moth skink – *Lipinia noctua* - 1 found in day
Blue tail skink – *Emoia impar* - one caught in glue trap and 1 seen on coastal rocks during day
One unidentified skink was seen in rock and low scrub near the summit
Banded sea snake (*Laticauda colubrina*) – one seen ashore on rocks.

Malau are present in good numbers in the two areas of suitable forest habitat visited during the survey and are breeding successfully. Watling (2003) recorded 38-56 malau at the first site they visited and based on the proportion of island visited and the areas of suitable habitat he 'guesstimated' the population at 300-500. They have added a second site which alone would seem likely to hold over 100 birds. Based on their observations including the presence of malau up to almost 160m in altitude where the forest transitions to fern and scrub, it seems likely that the two areas defined in red on the map below offer suitable habitat for the species. Based on encountering c.40 malau in the two areas surveyed (in blue) the population in the northern area could be more than 600 birds. The southern area has not been visited but if birds were found there at similar densities it could hold 400. So the surveyors would conclude that there may be 600-1000 malau on Fonualei, significantly more than on Niuafo'ou.

Rat trapping

No rats were detected on Fonualei following 34 trap nights of glue trapping from the coast to the summit ridge and 30 trap nights of snap-trapping near the coast. No feeding sign was observed or animals seen during night-time searches. It is concluded that rats are probably absent from the island.

The first rat was seen on Late during the day walking from the boat to set up camp. Seven *Rattus exulans* were caught in glue and snap trapping sessions, 7 males, 1 female and 1 juvenile. Rat densities were not considered high as bait (roasted coconut and smears of peanut butter) remained intact on the majority of snap traps after being left out for two nights. All but two rats were caught in glue traps and two others also escaped from these leaving furs behind.

Samples for DNA analysis

Tail samples were taken from each rat using the usual precautions to ensure no cross-contamination and stored in 95% ethanol. Examination identified that none of the males had prominent testes and the female was carrying no young and not lactating.

Samples obtained on the 8th were 2 labelled 'C' at the camp (waypoint 493 18°47'08.1" 174°39'05.0"), 1 labelled '3' 200m inland (waypoint 496 18°47'14.7" 174°39'07.7") and 1 '7' 600m inland (waypoint 500 18o47'27.4" 174°39'14.2"). Samples on the 9th came from sites along the coast from the camp (no waypoints).

Figure 81: Invasive coordinator setting glue trap Pandanus

Source: Dr. David Butler, 2013

Figure 82: Rat on glue trap baited with roasted on coconut

Figure 83: Rat caught in snap trap

Source: Dr. David Butler, 2013

Figure 84: Juvenile rat on glue trap

Source: Dr.David Butler, 2013

Late Island

No malau were detected on Late. This survey covered an area on the northern side of the island. This side has been the one traditionally visited by Tongans with areas used periodically for kava plantations and it has significant areas of coconuts. Judging by a circuit of much of the island by boat the habitats we surveyed from shore to summit were typical of the island as a whole.

Watling (2003 & pers. comm.) surveyed the eastern part of the island in 2003 (c. 1 day) and 2004 (c. 1 week) focussing on the area around the Crater Lake where malau eggs were initially buried in 1991-93. He also found no birds and no indications of their presence.

Combining their findings, they would conclude that malau are very unlikely to survive on Late. The 'release' area has been surveyed in detail and they have now added a transect through typical forest from another part of the island. There does not appear to be any different habitats that have not been surveyed with the possible exception of the floor of the summit crater (as photo below) where there was forest and some open, sandy-looking areas.

Figure 85: Late Island - looking down into main crater

Figure 85 identifies that a volcanologist did detect some activity and steam on Late in the 1970s and it would be worth finding out whether this was in this area. It could theoretically be accessed from the south as the crater 'breaks open' in this direction, or more readily by helicopter if one is used for a rat eradication.

An obvious question is whether a further attempt to establish malau on Late is worthwhile, perhaps this time transferring adults and chicks as worked on Fonualei. It is suggested that this is not considered until rats are eradicated, and that a range of experts are consulted. Clearly Late has been volcanically less active than Fonualei over the last 200 years and appears to provide less opportunity for eggs to be incubated through heat derived from such activity. However megapodes as a group have other incubation strategies including using the heat of the sun on exposed beaches or cinder fields, and using decompositional heat from plant matter in burrows between tree roots. I am uncertain whether the malau can use such strategies.

From a malau viewpoint, Late Island does not appear to currently offer the same opportunities for incubation of eggs through volcanic heat that Fonualei does. However it is noted that in 2006 a large raft of pumice rock was found on the sea surface near Late and a new volcanic island appeared to its south, so Late could go through another period of activity at any time.

Biosecurity

Any visit to islands significant for the conservation of native biodiversity need to address the biosecurity risk of introducing invasive species. Biosecurity precautions need to be taken prior to departure from home base and upon arrival on the islands. Ideally all food, equipment and personal effects would be packed in sealed containers before departure. In practice this was not possible with food and cooking pots bought loose on the last morning and root crops delivered to the boat just prior to departure. Figure 86 shows stems of kape (giant taro) with roots covered in soil, and tops with spaces between leaf stems that could provide refuges for invertebrates or even reptiles. These were completely peeled before being taken on to the islands.

Figure 86: Giant taro with soil - a high biosecurity risk

Source: Dr. David Butler, 2013

Other root vegetables were delivered in sacks covered with soil and washed in the sea before being allowed onto Late.

Figure 87: Washing taro in the sea at Late

Source: Dr. David Butler, 2013

Upon arrival on Fonualei, all bags and boxes were opened on to a spread-out tarpaulin to check for any unwanted species. Ideally a can of fly spray should have been available to kill any insects that were found.

It was more difficult to ensure that insects were not taken from Fonualei to Late after tents had been erected and equipment set out on the first island. Given this it was important to visit Fonualei, the more remote and unmodified island, first. Any pest animals found on Fonualei would be likely to be present on Late, whereas the reverse was not true. As it happened sea water entered a number of the containers when leaving Fonualei and they were re-packed and checked for pests on the boat.

Information for planned rat eradication, Late

An eradication of rats from Late had been identified as a priority before this survey, following a review of invasive species issues in Tonga. The following conclusions are offered in relation to this:

- There is no evidence of rats on Fonualei – if rats had been detected their eradication could be a higher priority than Late given the presence of the Tongan megapode
- The Pacific rat (*Rattus exulans*) is present on Late though not in particularly high density.
- Rats were not in breeding condition though a juvenile was trapped
- There are very few competitors for poison baits on Late – no land crabs were seen except a few Coconut crab (*Birgus latro*), there are few ants and there was no evidence of the presence of pigs (reported in the past)
- There are no significant non-target species at risk. Coconut crabs may be affected. Shy ground-doves
- Fallen fruit was relatively abundant.

CHAPTER II: Identify the national biodiversity strategy and action plan, its implementation, and the mainstreaming of biodiversity.

Overview: Tonga's NBSAP is designed to be a stand-alone document with clearly defined objective, strategies and actions. It seeks to achieve the Aichi Biodiversity Targets of the Strategic Plan for Biodiversity 2011-2020 by targeting these issues and constraints. As a result, the NBSAP should be in line with the Aichi Biodiversity Targets.

This chapter is to review the current status of NBSAP implementation. This will be followed by the mainstreaming activities from relevant sectors, the obstacles and challenges to the implementation of the NBSAP.

The NBSAP identified eight thematic areas that are essential to conservation of biodiversity in Tonga including:

1. Forest Ecosystem	5. Local Community and Civil Society
2. Marine Ecosystem	6. Access and Benefit Sharing from the Genetic Resources
3. Species Conservation	7. Mainstreaming Biodiversity Conservation
4. Agro-Biodiversity	8. Financial Resources and Mechanisms.

2.1 Current Status of Implementing the NBSAP

Table 13 is an attempt to discuss the current status in the implementation of the strategies and action plan in Tonga.

Table 13: Current status of implementation of the NBSAP

NBSAP VISION	**Tonga's biodiversity and genetic resources are protected, conserved and sustainably managed**		
Theme 1 Objective	FOREST ECOSYSTEM		
Objective 1.1	To minimize the loss and degradation of forest ecosystems and habitats as a result of agricultural expansion		
Intended Outcomes	Indicators	Means of Measurement	Assumptions
The expansion of agriculture is minimized and contained	Total area of primary and established secondary forests sustained and increased	Aerial photos; satellite images; MAFFF reports	National Forest Policy is compiled; Logging of native forests is limited due to decrease large-scale commercial farming. No severe natural disaster (cyclones, fire) occurring.
Implementers	MAFFF, MLECCNR, TWB		
Status of Implementation	▪ Clearing of forests, especially in arable lands, for commercial agriculture remained as the major cause of deforestation. Such practice favors complete clearance of trees, repeated cultivation with short-term fallow periods allowed and high inputs of chemicals and fertilizer to enhance crop yield ▪ The tendency to remove forests, most often by means of heavy machineries, in farmlands acquired through short-term leasing arrangements is most vulnerable to habitat loss. On the other hand, farmers who cultivate own lands conserve and replant tree crops for food (fruits), social (medicinal and flower) and commercial (sandalwoods and timber) ▪ No further loss of natural primary and secondary forests resulting from substantial decline in large scale commercial farming, especially squash pumpkin cultivation from some 4,000ha to 2,000ha to 1,000ha in 1994, 2004 and 2014 respectively ▪ The rate of coconut palm sawmilling declined from 2,000 palms (@ 2 logs per palm) in 2009 to 500 palms per annum in 2014. This resulted from stoppage of coconut sawmilling operations in Vava'u and Ha'apai and shift to milling of conventional wood by TFP in Tongatapu. The TFP operation in 'Eua focused milling of *Pinus caribaea* logs from the forest plantation		

	▪ Although the rate of large scale commercial farming decreased, the MAFFF efforts in promoting mass replanting of appropriate tree crops for economic, social and ecological purposes is minute. Some 2,000 timber seedlings recorded at the MAFFF forest nurseries in Tongatapu, Vava'u and 'Eua of which only 10% were sold and transplanted ▪ The traditional practice of "unmanaged fallow" systems continue thus keeping rate of the natural forest regeneration at a considerable low rate. Unmanaged fallow implies that a cultivated area, vacated by a farmer, is left to regenerate by nature's cause. Hence, there is no extra intervention by either the grower or landowners in terms of encouraging soil improvement and management practices. ▪ Although restricted to a few landowners/farmers who have access to seed sources, Mucuna plants (a nitrogen fixation vine) is a promising soil conditions and structure improvement species. Despite its promising contribution, there is a need to promote replanting of perennial soil improvement trees such as *Leucaena* and *Sesbania* species. ▪ *Leucaena*, despite its invasive nature in colonization of abandoned lands, rapidly overtake panicum grass fields. There is evidence of rapid colonisation of around 20 percent at the Eastern district.		
Objective 1.2	To ensure the optimal and sustainable allocation and use of Tonga's land and natural resources		
Intended Outcomes	Indicators	Means of Measurement	Assumptions
Forest ecosystems and ecosystems services are protected	An integrated land use plan adopted & implemented. Legislation and polices adopted & enforced	MLECCNR reports & maps; MAFFF reports	Political and public support exists. Funding and capacity not constrained
Implementers	MLECCNR, MAFFF		
Status of Implementation	▪ Tonga's national Forest Policy formulated and endorsed by Cabinet in 2010. Despite this significant milestone, not much is achieved from the several recommendations for actions ▪ Forest ecosystems continued to suffer from uncontrolled agricultural expansion. The proposed National Integrated Land Use System (NILUS) is yet to be formulated and the adverse effect of its absence has resulted in the relocation of 45 registered tax allotments (75 ha of farmed land) from the water catchment area to another part of the forest reserve on 'Eua. The vacated land replanted with trees but the trees on the new reallocated tax allotments now cleared for farming. (2009 statement remained unchanged)		

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- Tonga's National Land Use Policy first draft made available for further stakeholder/community consultation in 2013. The Policy sets out land use objectives and principles to direct the present and future land use decisions in the Kingdom. The purpose of the policy is to –
  - *facilitate and advocate for sustainable land use;*
  - *provide a framework upon which consensus can be reached amongst Tongan stakeholders on a national vision, fundamental principles and strategies of land use in Tonga;*
  - *set out principles upon which the interests of all stakeholders can be balanced out;*
  - *provide a framework for dispute and conflict resolution;*
  - *prepare land users to adapt to changing circumstances; and*
  - *support the progressive move towards integrated land use*
- MAFFF continue to rely on its strategic corporate plan to provide guiding principles to lead its operation on three yearly basis. Despite the unavailability of a formal agriculture policy, MAFFF's corporate plan 2014-2017 highlight biodiversity conservation as one major organizational outputs that it endeavours to attain

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<tr><td>Intended Outcome</td><td>Indicators</td><td>Means of Measurement</td><td>ASSUMPTIONS</td></tr>
<tr><td>Agricultural expansion is managed within predetermined
Areas</td><td>1. Reducing of loss forest cover
2. More replanting programs implemented</td><td>MAFFF reports</td><td>MAFFF is proactive in its forestry nursery and field activities;
Community participation in reforestation activities</td></tr>
<tr><td>Status of Implementation</td><td colspan="3">

- MAFFF noted that no new secondary forested areas cleared for commercial farming. Old cleared farm-fields re-cultivated by same lease or sub-lease holders. This is a result of constant decrease in export volume and number of squash-pumpkin growers in recent years. The gap here is the absence of actual inventory data on forest cover and cleared arable lands
- MAFFF (Forestry Division) does not have established inventory mechanisms nor structural framework to facilitate such vital component of agricultural and forestry development strategies. As in the 2009 report, the 2014 fifth report recorded the comprehensive inventory of the natural forests of Tongatapu and nearby islands as the only proper inventory carried out to date

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Objective 1.3 Community participation	To ensure the sustainable management of Tonga's natural resources		
Intended Outcomes	Indicators	Means of Management	Assumptions
Community participation improved	No. of stakeholders participating in managing of the natural resources; No. of community projects	MAFFF & MLECCNR corporate reports Project reports	NGO plays active role in mobilizing of the communities
Implementers	MAFFF, MLECCNR		
Status of Implementation	▪ The 2009 review estimated a reduction of forest cover by 26% from the 2006 figure. This is due to reduction in woodland (13%), plantation forest (10%) and mangrove forest (3%). This gives an average annual loss of about 9%. This loss is likely to continue unless existing laws in relation to protected areas and mangroves are enforced. Mangroves for Tongatapu and Vava'u, where majority of mangroves are found, have been mapped digitally using ArcGIS from LiDAR data and ground truthing. Information will be useful for the planning of decision makers. The Spatial Planning Act 2012, Forest Policy and the draft Land-use Policy will certainly help in reducing the loss of forest areas if it is enforced. ▪ SPC/GIZ Climate Change project empowers local communities, primarily in Eua, through urban replanting programs through mobilizing of women groups to cultivate crops and multipurpose trees on vacant town allotments. Furthermore, GIZ assist in reforestation of the encroached parts of the Eua National Park (Loupata region) ▪ Interview of stakeholders reveals the view that the size of the National Park on 'Eua remains the same but individual trees are either removed, cut or damaged for the purpose of obtaining medicine, firewood, carving wood or decoration. It is also reported by stakeholders that the uncontrolled removal of trees from the coastal forest for firewood, medicine and carving is at an alarming rate and contributes to the overall decline in the forest cover.		
Objective 1.4 Conservation Areas	To improve the management of existing parks and reserves and, consistent with the integrated land use plan, to expand the conservation area network to recover representative samples of all major terrestrial ecosystems		
Intended Outcomes	**Indicators**	**Means of Measurement**	**Assumption**

Improved management of parks and reserves	No. of management plans developed and implemented; Increasing in trend in funding Increasing in visitations	Existence of management plans. Visitors book from parks etc.	Increasing funding correlates to increasing no. of PA staff and investment in PA developed.
Implementers	MAFFF, MLECCNR		
Status of Implementation	▪ The MLECCNR has the mandate for the management of the 'Eua National Park. In the absence of an office in 'Eua, there has been verbal agreement between Forestry and MLECCNR for Forestry to act on behalf of the Ministry in managing the Park. Under funding of the Programme of Work on Protected Areas, Forestry was able to fence off areas to minimise agricultural encroachment into the park. A draft revised Management Plan 2011 exists for 'Eua National Park which was developed by Forestry and Environment. ▪ GEF funding through UNEP and UNDP, funding from ADB and others, have been received for the whole purpose of establishing new protected areas for various reasons. Implementation of protected areas is through the collaborative work of MLECCNR, MAFFF, NGOs and Communities. Plans are in place with funding secured to expand the conservation area network and to carry out rapid biodiversity surveys in each of the island groups. Forestry Division of MAFFF contributes through marking and clearing of tracks and look out points. ▪ Tongan needs to be aware of the concept of national park.therefore, a considerable increase in the promotion and reinforcement of the concept is required, for the community to see the benefits that may flow from such a system before it is regarded as socially and politically acceptable. Community based marine managed areas (SMAs) have been established, with its own management plan, but it is too early to see whether it is serving its purpose. The 'Eua Ecotourism Association, in collaboration with the MLTC, has made a significant step towards raising public awareness and the promotion of the national park and reserves through their website. This will attract tourists and funds to revive this concept. ▪ IIP Project has completed their vegetation plot at 'Eua National Park in July, 2013		
More ecosystems under conservation management	No. of new conservation areas; No. of previous unrepresented ecosystems under conservation management	GIS maps; No. of CA management plans. Aerial photos & satellite pictures.	No drastic natural disaster or environmental event happening.

Status of Implementation	▪ The forth report noted no growth in this area due to the absence of a National Land Use System and unavailability of funds for establishing, control and policing such conservation areas. NB: No significant development from this stage in 2014 hence no growth in conservation area ▪ The existing National Forest Park in 'Eua has suffered from lack of proper management. There is evidence of abuse as local people are harvesting priority species like sandalwoods and other medicinal plants. NB: Increase in public awareness and fencing off areas to minimise encroachment of communities into the Park has minimised the harvesting of forests and agricultural use of the land. At the national level, the one and only significant establishment of new conservation area was the relocation of 45 registered tax allotments within the catchment areas (75 ha of farmed land) to be rehabilitated with forest. However there is no plan in place to expand forest ecosystems in the vacated lands. A small replanting covered approximately 8 acres on the vacated lands since 2009. Majority of the vacated lands are protected as they are with the watershed areas ▪ This (2009) review also revealed abuse of forest reserves in isolated volcanic islands through agricultural practices. NB: No substantiated documents to support further development in this regard due mainly to lack of formal inventories and resource assessments ▪ The National Forest Policy for Tonga (2009) envisaged the formulation of a National Land Use Plan and a National Agricultural Policy as a way forward for Tonga. This could be a starting point for Tonga provided they can find finance to monitor and manage additional forest ecosystem effectively. NB: Agriculture policy initiated although repeated proposed by MAFFF due to lack of funding. However, a National Agricultural Sector Plan will be formulated in 2014 and it should pave ways for better policy formulation and planning		
Objective 1.5 Information, research and monitoring	To promote the effective and systematic collective and management of relevant information through scientifically designed research and surveys.		
Intended Outcomes	Indicators	Means of Measurements	Assumptions
Knowledge of the status of forest biodiversity is up to date and verifiable.	Regular and up-to-date information available; Ecosystem survey completed Data available on databases.	No. of technical survey reports Amount of data stored on databases.	Technical capacity exists.
Implementers	MAFFF; MLECCNR		

Status of Implementation	• The status of Tonga's forest resources as cited in the NBSAP 2006, based predominantly on Wiser et.al, inventory report on the status of natural forests of Tongatapu and nearby islands ('Atata and 'Eueiki). As stated, the natural forest coverage for Tongatapu and nearby islands accounted to 4.43% of total land area. FAO (2004) estimated 6 percent national coverage. • The forth report 2009 reported a total forest area (native plus other woodlots such as coastal and swamp forest ecosystems) of 9.7 percent (a decline from 11.5 percent in 2006) • Mangrove forests and wetland area declined from 4.3% in 2005 to 2.6% in 2009. The 2013 observation disagree with this decline as the Fanga'uta mangrove forest covers 62ha. The Western region (Toafa) has over 150ha of mangrove forests. Evidences from Vava'u (Tuánekivale- Koloa causeways) indicate rapid colonization of mangrove forests despite discouraging signs of illegal clearing of some of the coastal forests near Uatoloa. *NB: Again, lack of proper inventory does not help in disclosing the exact figures* • The 2009 report noted that the knowledge of the status of forest biodiversity in the TTL's Forest Estate is now up to date and verifiable. *Similar situation noted in 2013 although no replanting, other than production of seedlings in the nursery* • The need for proper stocktaking to be undertaken to accurately define the true status of this important ecosystem throughout the island groups remains a top national priority • The next Agricultural census is due to commence in mid-2014. This, with proper planning, will provide valuable data on forest and trees resources • During the project review, several community consultation were conducted, whereby forestry ecosystems essential features and contribution to the environment were discussed		
Objective 1.6 – Public awareness and education	To increase public understanding and support for the conservation and sustainable use of forest biodiversity		
Intended Outcomes	Indicators	Means of Measurements	Assumptions
Supportive public of forest conservation actions	No. of people participating in forest activities e.g. tree planting No. of people surveyed with supportive responses.	Polls and attitude surveys	Positive attitude translates to positive actions.

Implementers	MAFFF, MLECCNR, NGOs		
Status of Implementation	• The existing public awareness programs on forest activities are on ad hoc basis and therefore not planned to address national interest. Emphasis on replanting of forests and trees focused in 'Eua • Television and radio programs, particularly on Forestry issues, still not regular • The formation of an Agro forestry Society for farmers of the Eastern District had proven to be the best available and practical means of getting the conservation message across and above all applying those messages. To ensure efficiency and continuity exists in the administration and operations of the Society, MAFFF and MECC has not improved necessary advisory and supportive role. • The Tongan culture continues to thrive on group/village activities. Strategies are of necessity when directed towards group efforts such as youth, clubs, NGOs, schools, churches, etc. • A case study of positive conservation efforts, the initiative taken by a private business, 'Ene'io Enterprise Ltd, to establish a botanical garden for the purpose of providing eco-tour services to the community and visitors to Vava'u continue to standout as model to be followed nationwide • The introduction of biodiversity and environment in Primary, Secondary and Tertiary Schools' curriculum is one giant step towards achievement of the knowledge and attitudinal quality that will ensure the long-term sustainable usage of biodiversity. This initiative remain in infantry stage		
Theme Area 2	Marine Ecosystem		
Objective 2.1 - Minimize the impact Land based activities.	To minimize the adverse impact of land based activities on coastal and marine species and ecosystems.		
Indented Outcomes	Indicators	Means of Measurement	Assumptions
Healthy coastal ecosystems and habitats for priority species.	Reducing no. of algae bloom outbreaks. Reducing trends of eutrophication. Evidence of good coral growth.	Coastal, coral reefs & marine surveys; Environmental impact assessments on major developments; Building codes	No significant El Nino event
Implementers	MAFFF, MLECCNR		

Status of Implementation	There has not been any biological study on the phytoplankton content of the Tonga coastal waters, especially to the formation of algal blooms. Assumptions on the high nutrient and phosphate levels in our lagoon system on Tongatapu may have contributed from agricultural runoff (use of fertilisers), inputs from wastewater (washing detergents), and so forth. Sediment input from stormwater drainage has also contributed to the change of ecosystem type, causing a shift in marine species migration. The Tonga's National Programme of Action (NPA) for Protection of Marine Environment from Land Based Activities 2007 was to address this Objective, but it needs to be revised. Activities are currently being implemented, such as the IWRM project in Vava'u, composting toilets, piggery projects, and so forth, to address the strategies under this NPA. About 70% of the strategies have been implemented to date. The Environment Impact Assessment Act 2003 continues its assessments on major projects, including those at coastal (wharfs, reclamation, etc.), however, it has not been fully enforced. An EIA Regulations 2010 and the Environmental Management Act 2010, now exists, however, we still lack the resources to enforce compliance to these legislations. The MLECCNR is working collaboratively with MOI to review its Building Code to be relevant to different areas of characterisation (e.g. different code for coastal areas versus that for inland development).		
Objective 2.2 - Marine conservation areas	To expand the existing network of protected areas to effectively conserve ma coastal and marine habitats of biological and socio-economic value.		
Indented Outcomes	Indicators	Means of measurement	Assumptions
A 50% increase in the total area of marine ecosystem under conservation management in 10 years.	No. of new marine areas under conservation management.	MMAs are proposed and gazetted; Management plans approved and under implementation	Supportive local communities
Implementers	MAFFF; MLECCNR; NGOs; Communities		

Status of Implementation	Community-based marine managed areas (Special Management Areas or SMAs) have increased from 6 to 9 areas by 2013, with another confirmed 6 new areas in the Ha'apai group and 4 in the Vava'u group, already secured with funding support by UNDP and GEF. The potential aquaculture areas already approved by the Cabinet in December 2013 which will legalize local communities to conduct aquaculture activities in a way to reduce pressures on fishing (i.e. farming fish, seaweed, giant clams, etc.). A rapid biodiversity survey was conducted in February 2014 and coordinated by Environment, MLECCNR and SPREP. It had found that there were extremely low numbers of commercially valuable species such as sea cucumbers and clams; low fish biomass on important fish groups such as grouper, snapper, emperors and jacks; reef fish consists of many small and juvenile fish groups, bleaching of reefs from increased water temperatures causing long term impacts on coral health and reef community. It was proposed that there is a need to continue with community consultations on establishing MMAs; protect and manage areas covering a range of habitats including forests, coastlines, coral reefs and offshore habitats.		
Objective 2.3 - Sustainable management of marine biodiversity.	To promote the use of environmentally sound practices in the management o marine resources.		
Indented Outcomes	Indicators	Means of Measurement	Assumptions
Marine resources are managed sustainably.	No. of management plans developed & implemented. No. of fishing practices & technologies banned by legislation. Legislation banning under sized catches enacted and encforced. Declining no. of adverse reports of negative impacts of whale activities. Declining no. of incidences of algae boom and COT. PacPOL implemented successfully.	Physical existence of management plans and its compliance; Survey reports on marine and coastal biodiversity.	Legislation will be enforced. Cooperation of whale watching operations
Implementers	MAFFF, MLECCNR, NGOs, Communities		

Status of Implementation	Tuna Management Plan (2013) was reviewed and endorsed by the Cabinet in 2013 included Deepwater Snapper Management Plan (2013). Whale Watching and Swimming Regulations 2013 was also endorsed by Cabinet. National Plan of Action (2013) for shark fisheries also approve with included CITES species of shark had been adopted under COP 16 conference in Bangkok, Thailand. Global Reef Expedition conducted in September to October 2013 in Tongan coastal areas Findings: • Most reefs are overfished – Few sharks, large groupers, large schools – herbivores (parrotfish and surgeonfish) small in size • Reefs dominated by small-bodied adults and juveniles (damselfish, butterflyfish, wrasses) • Noticeably lower fish biomass near villages • Slightly higher diversity of fish inside reserves, but biomass still low • More snapper, parrotfish and surgeonfish at Vava'u • Highest diversity at Niau; 11 species of snappers, goatfish, parrotfish, butterflyfish, and surgeonfish not seen elsewhere • 1 site off the west coast of Niau had many more predatory fishes than anywhere else The Reefs at Risk Revised analysis (2011) estimates that nearly 40% of Tonga's coral reefs are currently threatened (medium risk or higher), mainly from the effects of overfishing and pollution. When combined with observations of thermal stress over the past 10 years the number of threatened reefs increased to 75%. By 2030, projections for the thermal stress and ocean acidification suggest that the number of reefs assessed as being at the highest risk will increase from 10% to nearly 40% especially reefs around Tongatapu and Vava'u due to high populated islands. Coral health and species diversity, reef fish biodiversity, commercial fish species biomass, invertebrate biodiversity, commercially valuable invertebrate species and marine mammals were looked at during the rapid biodiversity survey in the Vava'u archipelago. Findings included: extremely low numbers of commercially valuable species such as sea cucumbers and clams; low fish biomass on important fish groups such as grouper, snapper, emperors and jacks; reef fish consists of many small and juvenile fish groups, bleaching of reefs from increased water temperatures causing long term impacts on coral health and reef community. This means that our food security will be affected; it will impact on economic development of export markets and ease of earning for local fishermen; as well as impact on the tourism market. There is a need to improve sustainability of commercially valuable species through effective management plan (seasonal closures, limit night diving, etc.) and enforcing compliance.
Objective 2.4 - Information research and monitoring	To promote scientific research and regular monitoring of critical marine ecosystems, and the proper management of scientific data to support the conservation and sustainable management of marine ecosystems.

Indented Outcomes	Indicators	Means of Measurement	Assumption
Knowledge of the state health of critical marine ecosystems is current and regularly updated.	No. of marine survey reports of critical ecosystems and species: Amount of data on database.	Reports on marine surveys; Database and amount of data stored	Technical expertise is not a constraint.
Implementers	MAFFF; MLECCNR; NGOs		
Status of Implementation	Polynesian Mana coral monitoring programme which included Tonga still in progresses but only focused at Ha'atafu reefs in 2009, 2011 and will be finalized in 2015. For invertebrates (i.e. sea cucumbers resources, shellfishes, etc,) latest survey was conducted in 2009-10 and report published in 2013 with collaboration with Fisheries Division and Secretariat of the Pacific Community (SPC). New database for Tuna and inshore fisheries included aquarium trades already established at Fisheries Division with technical support provide by Forum Fisheries Agency (FFA) and SPC. Tonga is one of the countries involved in an NZ ODA project that looks to establishing networks of community based turtle monitoring with an eventual view to explore ecotourism around turtle watching. One of the project activities is conducting nesting beach/turtle population monitoring. The rapid biodiversity survey report for Vava'u will be available in September 2014. Under the MESCAL project, knowledge of the state health of mangrove ecosystems were looked at. Reports are available with MLECCNR.		
Objective 2.5 - Public awareness and education.	To enhance public knowledge and understanding of Tonga's marine ecosyster and of issues related to their conservation as a mean of fostering public suppo for marine conservation objectives.		
Indented Outcomes	Indicators	Mean Measurements	Assumptions
A general public that is well informed of marine conservation issues and supportive of marine conservation objectives.	No. of local initiatives supporting marine conservation; No. of local communities schools, organizations etc interested and are involved in community conservation work	Coastal, coral reefs & marine surveys engaging local communities and schools. Public access to information; mode c information dissemination to stakeholders	No significant El Nino event. No nutrients input to the marine ecosystems
Implementers	MLECCNR, MAFFF, NGOs		

Status of Implementation	Ongoing TV and radio programs co-sponsored by the Ministry of Environment, Fisheries Division, Ministry of Agriculture & Foods are on-going and proving successful in promoting awareness and reasons for conservation and sustainable consumption of resources. Marine Biology and basic Fisheries Management courses are taught at one of the Vocational Institutions in Tonga. Joint community consultations with various stakeholders, namely Fisheries, Environment & Civil Society with the communities; the establishment of the Tonga Environment & Climate Change Portal will strengthen our outreach programmes to the public; increase public access to environmental information; Environment Awareness Week is an ongoing annual programme during the first week of June and these activities just strengthens the public engagement with all environmental work. Ongoing presentations with primary and secondary schools and field trips have been organised for mangrove rehabilitation.		
Theme 3	AGRO-BIODIVERSITY		
Objective 3.1	To preserve the genetic variability of Tonga's agro-biodiversity and promote the conservation and sustainable use of threatened species of economic and socio-cultural importance.		
Intended Outcomes	Indicators	Means of Measurements	Assumptions
Populations of all targeted species are increasing in the wild and ex-situ Promotion of the traditional/modified production of mixed species is key to conservation of biodiversity	Current introduced Genetic Resources crossed, evaluate, bulk &distribute to farmers and public: 1. 8 x banana new accession 2. 7 x cassava new accession 3. 1 x new maize hybrid 4. 10 x new taro accession 5. > 40 x new taro lines as cross with local varieties 6. 9 x local sweet potato varieties 7. 13 x new fruit tree species propagated for	MAFF reports	No drought or severe cyclone or severe pest infestation.

	sources of planting material 1 x sheep cross breed.		
Implementers	MAFFF; NGOs		
Status of Implementation	All new genetic materials are propagated at the MAFFF Research Division to bulk up the planting materials. Local varieties of sweet potatoes were collected and propagated to boost the volume of planting materials during the whole year. The source of fruit trees stem cuttings/seeds are partially from the Research Division but the production of seedlings are at the Forestry Division to be sold to farmers and general public.		
Objective 3.2 Research and development	To promote and support research initiatives that contributes to the conservation of threatened species and the sustainable use of commercial and traditional agro-biodiversity.		
Intended Outcomes	Indicators	Means of Measurement	Assumptions
Increased diversity of existing crops and of the conservation existing crops	Number of new crops species & varieties introduced. Number of local crops species and varieties preserved	Number of MAFF's new collaboration projects with regional or national institutions	All research projects are relevant and targeting approved NBSAP priorities.
Implementers	MLECCNR; MAFFF		
Status of Implementation	The injection of new species/varieties/breeds from external sources depends mostly on collaborated projects with external research partners such as SPC, ACIAR, universities, etc.		
Objective 3.3 Public awareness and education	To foster public support for the conservation of threatened agro-biodiversity by enhancing awareness and understanding of their importance		
Intended Outcomes	Indicators	Means of Measurement	Assumptions
The farmers and general public are informed and trained for in-situ conservation of crops, trees and livestock species/ varieties/ breeds. Conservation are taught at all levels of school's	Rate of awareness of the importance of new/local species/varieties /breeds at farmers /residential homes, schools, parks, etc. Conservation are included in the school's syllabus	MAFFF report Ministry of Education report	Harmonious integration/ collaborations at all levels
Implementers	MLECCNR; MAFFF; MOET		
Status of Implementation	The status of conservation awareness of the addition of the new as well preserving the existing species/varieties/breeds is very low as a results of specialization of the few with lower production cost and higher market		

	demands. Therefore, the long-term importance of wider genetic resources has to be instilled into the current farmers as well as the farmers of the future.		
Objective 3.4	To strengthen the capacity of local farmers, agriculturalists and scientists to effectively implement programmes for the protection, conservation and sustainable management of Tonga's agro-biodiversity.		
Intended Outcomes	Indicators	Means of Measurements	Assumptions
Improved skills of farmers and residents in propagation and production of new/local species/varieties /breeds target for conservation	Rate of successful adoption by farmers and general public	MAFF extension reports site assessment of innovation, MAFF training reports	MAFF extension reports cover privately managed farms.
Implementers	MAFFF/NGOs		
Status of Implementation	The availability and accessibility of the new/local species/varieties /breeds target for conservation from points of supply to farmers and general public is to be improved. The need for more collaboration and integration is critical to ensure timely and harmonious exchange of these genetic material and associated knowledge and skills. The ultimate target is an even distribution throughout the whole of Tonga		
Theme Area 4	Species Conservation		
Objective 4.1- Protection of priority species	To ensure the protection of viable populations of all priority conservation species of Tonga.		
Intended Outcomes	Indicators	Means of Measurements	Assumptions
Priority species are well protected & their population increasing	Populations of priority species increasing. Associated habitats are healthy	Species survey reports Aerial photos and satellite pictures	No drastic or environmental event happening
Implementers	MAFFF/MLECCNR		

Status of Implementation	The surveys on the endangered species of Polynesian Megapode (Malau) were planned and organized not only in Niuafo'ou but also on two other islands (Late and Fonualei, in Vava'u group) where the birds was experimentally translocated (ex-situ) during the early 1990s. These surveys were associated in-service training of Government staff, awareness raising and education of local communities. It is in line with the conservation strategy's goal A (objectives 1 and 2). The surveys carried out in Late and Fonualei in September 2013 determined that the megapode continues to survive in good numbers on the latter island. Out of the appr. Total population of 300-500 Megapodes in 2003. An estimate of ca. 1000 birds was attempted to collect from both islands of Fonualei on September 2013. The bird was not located on Late. The planned survey to Niuafo'ou could not be undertaken due to last minute cancellation of the only monthly flight. In order to be able to monitor the status of this bird population over time, it is critical to collect data that enable to make sound statistical comparison with data collected during surveys done in early 1990s, 2003 and 2010. A thorough survey, including an assessment of current egg harvesting levels and methods, will be conducted in Niuafo'ou during August-September 2014.		
Objective 4.2 - Sustainable use and management of species	To ensure the sustainable use and management of species of economic and cultural significance		
Intended Outcomes	**Indicators**	**Means of Measurements**	**Assumptions**
Targeted species are managed sustainably	Population of targeted species are increasing ex situ and or in-situ	Regular population count. MLECCNR & MAFFF and reports	No drastic natural disaster or environmental event happening.
Implementers	MAFFF; MLECCNR		
Status of Implementation	Niuafo'ou has established a committee which is a very challenging task for local egg collectors, town district, town officers and government representative in selecting the best people from egg collector experts to become the core members of this committee. This committee were trained to assist the Ministry of Lands, Environment, Climate Change & Natural Resources on their target goal to protect the fourteen nest sites of Malau on the island of Niuafo'ou and to minimise the local people from getting access to nesting burrows. To sustain the use of Malau on Niuafo'ou, a couple of community education programmed on sustainable harvesting of eggs and presentations made to		

	primary and secondary schools, villagers, community leaders and government representatives were highly motivated the people and young generation of Niuafo'ou which believed that it is important to increase and speed up the work on the island as the only way to reach to people about the global importance of Malau. There has been a concern that the management and sustainable use of Malau habitat at fourteen nesting sites should be considered by the government. Declaring protected areas will protect the Malau from extinction or decline in the future.		
Objective 4.3 Invasive Species	Prevent the accidental introduction of known invasive species into ecosystems and agricultural biodiversity		
Intended Outcomes	Indicators	Means of Measurement	Assumptions
No alien invasive detected in Tonga	No. of interceptions at border e.g. Giant African Snail	MAFF (Quarantine) reports. SPREP reports on PIER.	Data on seizes on border control operations are made and reported.
Implementers	MLECCNR, MAFFF		
Status of Implementation	*Mimosa diplotricha* is new invasive weed and is currently localised to the main island in the Vava'u group. The herbivore, psyllid *Heteropsylla spinulosa* (Homoptera: Psyllidae) was introduced from Fiji as part of an integrated management strategy for controlling the invasive weed. A recent terrestrial fauna survey of Vava'u coordinated by MECC will provide updated information on the current status of invasive terrestrial species. *Bidens alba* continues to spread in very dense swaths across the main island in Vava'u. Giant African Snail *Achatina fulica* was intercepted in the Ma'ufanga area on two separate occasions in 2013 by Quarantine officers. The potential for invasion through ships' water ballast is real in Tonga, due to lack of a proper facility and lack of a control process in place. Marine and Ports need to collaborate with Division of Fisheries in designing policies to alleviate this problem. Also attention should be drawn to marine organisms on ship's hulls which could be another source of invasive species. A proper facility would be very expensive but other temporary measures like sampling of water ballast for laboratory testing could be ideal for the time being.		
Objective 4.4 Research and monitoring	To encourage basic scientific research monitoring surveys to identify, document and monitor progress in the conservation of priority species and to support on-going planning and conservation efforts.		
Intended Outcome	Indicators	Means of measurement	Assumptions

Better understanding of what is known and not known about Tonga's priority species ecological requirements for conservation management	Completed review of existing information about priority species. Monitoring programs initiated and maintained	Reports of MLECCNR & MAFFF	Technical capacity is not a constraint
Implementers	MLECCNR; MAFFF		
Status of implementation	Monitoring surveys to identify priority species is weak due to lack of financial support from government. Therefore, project funding from international funds for research/monitoring activities and for ongoing planning is very much needed in the future. However, UNEP-GEF-SPREP executed Integrated Island Biodiversity Project (IIB) is currently underway in Tonga is helping to update the status of an endemic bird in Tonga known as Megapode(Malau) since 2010, their threats and trends. IAS Project is also currently operating in Tonga under MLECCNR. It helps to update status of invasive species, threats and trends. A local scientific expertise is acquired under this review in order to monitor the priority species and invasive species regularly.		
Objective 4.5 Public Awareness and Education	To enhance public knowledge and understanding of priority species and their importance for conservation as part of Tonga's natural heritage, as a way of fostering public support for species conservation objectives.		
Intended Outcome	Indicators	Means of Measurement	Assumptions
A general public that is well informed of Tonga's natural heritage and priority species and supportive of species conservation work	No. of local initiatives supporting species conservation. No. of local communities, schools organisations etc interested and are involved in species conservation work.	Polls and questionnaire surveys. Count of supportive communities or local initiatives	Local are willing to express support and participate in polling and questionnaire survey
Implementers	MLECCNR; MAFFF; NGOs		
Status of Implementation	There is urgent need to engage NGOs, Churches, community, and government to work together using media outlets, workshops and also the internet. The current public awareness programs which include introduction of environment topics into schools' curriculum is an advantage but does not address much in the area of conservation regarding our priority species. Priority species need to be emphasized at this level. The priority species and possible ways to conserve them in Tonga should be documented and provide copies to schools' curriculum unit so that school children have better understand on those priority species and ways to conserve them. This would be an effective programme for the school children to learn about the priority species in Tonga and how to conserve them for future generation. Our school children will be the foundation to build up		

	these important skills and knowledge that they may be able to pass on that knowledge for future generations.		
Objective 4.6 Capacity Building	To strengthen the technical, management and research knowledge and skills of local scientists and researchers, and the capacity of responsible agencies and organisations to effectively implement research programs supporting the protection, conservation and sustainable management of Tonga's priority species.		
Intended Outcomes	Indicators	Means of Measurement	Assumption
Adequate expertise and capacity exists locally independently address Tonga's priority research needs	No. of graduates returning. No of staff attending specialised training; National herbarium is established. Specialised equipment procured; Increasing trend in research funding. No of research papers published	Reports of MAFFF, MLECCNR	Appropriate overseas education and research institutions and supportive and appropriated training courses are on offer
Implementers	MLECCNR; MAFFF; MOET		
Status of Implementation	Many graduated students returned back to the country with relevant skills to conservation and sustainable management of Tonga's priority species. Most of the staff workers and project officers from different sectors have attended capacity building workshop locally and overseas countries, therefore applying those skills to conservation and sustainable management of Tonga's priority species is lack of enforcement among the relevant sectors.		
Theme Area 5	Local Community and Civil Society		
Objective 5.1- Local communities and resource owners.	To empower local communities and resource owners to effectively participate in the conservation and the sustainable management of biodiversity resources in areas under their control.		
Intended Outcomes	Indicators	Means of Measurements	Assumption
Local communities and resource owners are active and effective contributors to biodiversity conservation and resource management	No. of national level planning processes involving local communities and resource owners. Amount and quality of conservation and resource related information accessed by locals. No. of community based conservation area projects initiated. No. of multi-sectoral project takes teams with local	Polling of planning processes & multi-sectoral task teams; No. & type of requests received for technical information from local people MAFFF & MLECCNR reports	National level planning processes are participatory and accessible to local people. Local people are interested and available to participate.

	NGO, civil society representation.		
Implementers	MLECCNR/ALL GOVT/MAFFF		
Status of Implementation	This objective has been achieved through civil society programs. Currently there are about four youth programs on conservation of the lagoon and other coastal areas around Tongatapu and the Ha'apai group. This objective has been achieved through integrated civil society programs. Currently there are about 7 on-going Marine Conservation projects that cover 3 SMAs, coral breeding, Turtle Watch, clams breeding/adaptation and general marine watch. These programmes are back up by on-going workshops, awareness and training provided by National Hosting Institutions such as the GEF SGP and VEPA (Vava'u Environmental Protection Association). On the terrestrial front we have 12 Organic Certified sites canvassing the whole Kingdom which is managed by the Tonga National Youth Congress, these include 7 projects funded by GEF that canvass Coastal Protection, Climate Mitigations and youth stewardship programs on conservation of the lagoon and other coastal areas . Caritas Tonga and Tonga Community Development Trust also hosted over 50 projects of food security and alternative livelihood which heavy emphasis on conserving plants and animals for subsistence livelihood. These collective community based programs covers rehabilitation and conservation. A lot of these projects prompt community empowerment and their success can be contributed to the close partnership between CSOs, CBOs, FBOs, local governments and also government ministries. These are community based programs targeting rehabilitation and conservation, conducted by youth groups. The other project is on forest conservation, targeting National Youth Groups on Vava'u, Ha'apai and Tongatapu. Target areas with existing forest have to be legally transferred to this group to conserve and replant.		
Objective 5.2- Civil Society	To empower civil society and groups to be effective advocates of biodiversity & sustainable resource management.		
Intended Outcomes	Indicators	Means of Measurements	Assumptions
Civil Society organisations and groups are active advocated or biodiversity conversant	No. of civil society advocating initiatives. No. of new environment multi sectoral committees with civil society reps.	Polling	No political restriction on formation of and activities of civil society groups.
Implementers	MLECCNR; MCTL;NGO's; ALL GOVT		
Status of Implementation	This objective has been achieved. Civil society initiated its programs in 2008, and there about seven programs already operating on biodiversity at the moment. These relate to mangrove rehabilitation, coastal protection and replanting in the coastal zone, a coastal erosion program in Ha'apai and forest conservation around Vava'u, Ha'apai and Tongatapu, establishment and certification of over 12 organic sites; Objectives 5.1 and 5.2 are considered successful however there has been a concern in the Fourth		

	National report on the lack of reporting to capture and reflect NBSAP activities that are on-going on the ground. It is anticipated that with the launching of the Climate Change Portal by the Ministry of Lands, Environment, Climate Change and Natural Resource, all stakeholders especially those of the CSO, NGO, FBOs will be able to access and input their information directly to a centralised database. This would make NBSAP work easier to capture ongoing projects related to biodiversity.		
Objectives 5.3 Schools	To ensure the full integration of biodiversity conservation concepts into school curricula at levels.		
Intended Outcomes	Indicators	Means of Measurements	Assumptions
School Children are understand and are supportive of conservation objectives early in life	No. of schools and environmental conservation projects supportive of conservation initiatives	Polling and questionnaire surveys.	Increase in understanding will result in positive changes in behaviour.
Implementers	MOET/Relevant GOVT M/MLECCNR		
Status of Implementation	This objective has been achieved. The concept of biodiversity conservation has been integrated into primary and secondary schools curriculum. The relationship of the environment and its biodiversity is addressed. Functions of ecosystems are also addressed in various components of subjects that are related to biodiversity such as Science, Geography, Home Economics, Animal Husbandry, Agriculture and so forth. There is also a close collaboration between CSO and the Curriculum Unit in developing resources, manuals and tool kits that could be use to aid teachers in teaching various topics that are related to conservation.		
Theme Area 6	Access & Benefit Sharing from the Use of Genetic Resources and TEK		
Objective 6.1- Access to Genetic resources	To prevent illegal access to and lawful exploitation of Tonga's genetic access.		
Intended Outcomes	Indicators	Means of measurement	Assumptions
Tonga's genetic resources are fully protected from unlawful exploitation	No. of illegal access cases prosecuted. No. of application received, and legally approved	Polling MoJustice reports.	Legal framework is in place and enforced
Implementers	CL/MLECCNR; MCTL; MAFFF; MFAT		
Status of Implementation	There is no legislation in place that is specific to this area. Tonga hasn't signed for The Nagoya Protocol, and although the protocol helps us to have benefits from the utilization of genetic resources, and to protect our traditional knowledge (TK) associated with genetic resources, there is still a need for consultation to see whether Tonga would benefit from signing the Protocol.		

	Tonga is in the process of applying to the Nagoya Protocol		
Objective 6.2- Fair and equitable Sharing of Benefits	To ensure the fair and equitable sharing of benefits generated from the use of genetic resources		
Intended Outcomes	Indicators	Means of measurement	Assumptions
Local owners of resources and Traditional Ecological (TEK) are receiving equitable share of benefits	No. legally binding agreement signed benefiting local owners of resources and TEK	Polling	Information on benefits sharing is accessible
Implementers	MLECCNR; MCTL; MAFFF; MIA		
Status of Implementation	Tonga needs to register its endemic species with the appropriate authority and pass legislation that is needed to address this objective. There is no specific legislation on this area.		
Objective 6.3 Traditional practices & ecological knowledge	To prevent the loss of traditional ecological knowledge (TEK)		
Intended Outcomes	Indicators	Means of measurement	Assumptions
Traditional ecological knowledge (TEK) is documented, protected from unlawful use and where appropriated promoted	Reports, database etc capturing TEK. Legislation enacted and enforced. Appropriate TEK applied in conservation management	MLECCNR reports and database. Crown Law Office reports. MCTL reports	Holders and custodians of traditional knowledge willing and able to share TEK
Implementers	MLECCNR, NGOs, CL, MCTL		
Status of Implemenation	*Traditional ecological knowledge should be documented with all the relevant stakeholders and protected. Training should be enforced among the relevant sectors and communities so that people are aware on how important it is to document TEK in Tonga.*		
Objective 6.4 Public Awareness and Education	To raise public awareness and understanding of the importance of Tonga's genetic biodiversity resources and Traditional Ecological Knowledge (TEK)		
Intended Outcomes	Indicators	Means of measurement	Assumptions

Tongans have pride in their natural heritage, are well informed about their TEK and supportive of efforts to protect them	Increasing use of traditional healing methods, and other TEK	Polling and questionnaire surveys.	Pride and improved awareness of natural heritage will result in support for conversation efforts
Implementers	MLECCNR, MAFFF, MCTL		
Status of Implementation	There has not been any awareness with regards to TEK since the development of the NBSAP.		
Theme Area 7	Mainstreaming Biodiversity Conservation		
Objective 7.1 Legislation, policies and plans	To integrate concepts of conservation and sustainable use of biodiversity into all relevant sector policies, programme and plans.		
Intended outcomes	Indicators	Means of measurement	Assumptions
Concepts of conservations and sustainable use of biodiversity are integrated into sectoral policies, programmes and plans	No. of sector plans policies & legislation that specifically integrate conservation and sustainable use of biodiversity. No. of projects & programs implemented by Government Agencies integrating conservation and sustainable use of biodiversity. The NBSAP is recognised as authoritative reference for economic planning purposes. No. of projects redesigned to comply with EIA recommendations.	TSDF; NBSAP; JNAP; Multi-sector action plans and reports; sectoral legislations	Greater integration of conservation and sustainable use concepts will result if NBSAP in recognized in national planning as the source document for national environmental issues and priorities. EIA is consistently enforced.
Implementers	All government sectors; NGOs; communities		
Status of implementation	There is recognition on a national and community level for implementing biodiversity objectives. This is observed by the inclusion of biodiversity in the TSDF, as well as the NBSAP and JNAP, which are the overarching National Strategic and Action Plans for environment & climate change issues. These		

	two plans are recognised by all government sectors, but whether each sector actually uses these Plans to align their programmes is yet to be determined. All sectors, NGOs and communities are aware of the strategies, as they are involved in drafting the Plans, implementing projects and are members of the Technical Working Groups. Some communities have developed District Development Plans which are also in line with the overarching plans. The Environmental Management Act 2010 is a cross cutting legislation which can cover aspects that may be lacking in other sectoral legislations.		
Objective 7.2- Multi-sectoral collaboration	To improve and strengthen multi-sectoral collaboration amongst all relevant sectors and stakeholders in support of biodiversity conservation and sustainable development.		
Intended Outcomes	Indicators	Means of measurement	Assumptions
Agencies and organizations of varied interests and areas of specialization work collaborate regularly on conservation work	No. of conservation projects involving organisations from different sectors. No. of environmental initiatives initiated by non conservation organisations and companies	Consultation reports; National Strategic and Action Plans; Proactive Committees and Technical Working Groups.	Collaboration indicates shared concern and commitment to conservation objectives
Implementers	MLECCNR and relevant government agencies; NGOs; Communities; regional and international agencies		
Status of Implementation	*Cross sector collaboration is still strong. The relevant stakeholders managed to form a Technical Working Group to work very closely with the NBSAP project coordinators during this review. This enable to share the experiences from their own sectors in regards to biodiversity conservation and sustainable management. In fact, other projects operated under the MLECCNR have involved the relevant stakeholders in the work.*		
Objective 7.3- Environmental Impact Assessment	To ensure that environmental and social impacts of all proposed major projects and activities are thoroughly assessed using approved EIA guidelines and standards prior to implementation		
Intended Outcomes	Indicators	Means of measurement	Assumptions
EIA is an acceptable planning requirement for all development activities	No. of development projects redesigned to take into account EIA recommendations. No. of major projects with EIA reviewed and approved by DOE	No. Of major projects approved by the Minister; No of proposals submitted for processing by the EIA Unit.	There is political commitment to enforce EIA legislation without discrimination
Implementers	MLECCNR/ALL GOVT		
Status of Implantation	*The EIA Act 2003 is in place and all the projects for development activities have to comply with EIA especially project with climate change adaptation*		

	and mitigation. EIA is acquired to enforce under the MLECCNR due to more development activities takes place along the coastal ecosystem.		
Objective 7.4 Economic valuation	To encourage the quantification of benefits derived from the use of biodiversity and other ecosystem services to support the full integration of biodiversity conservation into sustainable development planning and decision-making		
Intended Outcomes	Indicators	Means of measurement	Assumptions
Biodiversity valuations results are accepted and incorporated into cost benefit analyses of development proposals		Economic evaluation report	Biodiversity valuation results are accepted by Central Planning officials when reviewing economic analyses of development proposals and projects
Implementers	MLECCNR; NGOs; Communities		
Status of Implementation	Tonga Timber has done valuation works on 'Eua Forest plantation. No work has been done on other forest ecosystems around Tonga. Work has been carried out to quantify mangrove (its value as firewood, habitats and offering coastal protection) and other marine habitats. Many projects currently operated under the MLECCNR conducted surveys on quantification of benefits derived from the use of biodiversity and other ecosystem services to support the full integration of biodiversity conservation into sustainable development planning and decision-making. For instance GIZ project replanted trees at the National Park because of their ecological services and value. The Marine & Coastal Biodiversity Project funded by IUCN/SPREP is conducting an economic evaluation in Vava'u in April/May 2014. A study that estimated the economic activity of snorkel-with-whales tourism in Vava'u. The research shows that these activities generate important economic and other benefits and that these benefits grew from a relatively modest USD500,000 per year in 1999 to USD5 million per year by 2009. Whales have become the predominant attraction for visitors, and provide benefits to the local people and to the country.		
Objective 8	Financial Resources and Mechanisms		
Objective 8.1- Assessment of biodiversity conservation capacities	To ensure the through and comprehensive assessment of technical, managerial and administrative capacity for implementing biodiversity conservation within Tonga's line ministries and all conservation organisations.		
Intended Outcomes	Indicators	Means of measurement	Assumptions
Gaps in Tonga's technical, scientific, technological	NCSA report is complied. No. of capacity building measures identified in	MLECCNR reports and database. MLECCNR workshop reports.	Accessibility to DOE database is feasible for most

managerial and administrative capacity are identified and a plan for filling them is implemented	NCSA and NBSAP implemented	Qualitative assessment of proposals	organizations.
Implementers	MLECCNR		
Status of Implementation	We have local expertise in technical, managerial and administrative capacity for implementing biodiversity conservation within Tonga's line ministries and all conservation organisations. The relevant stakeholders especially MAFFF members have attended in NBSAP workshops and training consistently, the other organisations are not attending due to not being informed. Other Ministries should be informed to participate in workshops and training because they would be able to share the importance of conservation in their organisation.		
Objective 8.2- Collation and dissemination of donor related information	To inform all interested organisations of potential funding sources for biodiversity conservation and of donors funding requirements		
Intended Outcomes	Indicators	Means of measurement	Assumptions
All interested organisations, groups and individuals are informed on possible sources of conservation funding and or funders requirements	No. of meetings, workshops held. No of organisations attending. Quality of funding proposals received	MLECCNR reports and database. MLECCNR workshop reports. Qualitative assessment of proposals	Accessibility to DOE database is feasible for most organisations.
Implementers	MLECCNR		
Status of Implementation	Workshops have been held with a number of organizations attending and had informed all the relevant organisation of potential funding sources for biodiversity conservation and donors funding. The focal point for donor funding is the MLECCNR, therefore individual projects under biodiversity conservation have worked in team with other relevant organisations such as Government and Non-Government organisations. Consequently, those funds help to implement NBSAP activities such as the Malau and Invasive Species Project and others. In the NGOs, it does not appear that they experience much difficulty with accessing funds for their biodiversity programs. The Civil Society has been operating their programme through GEF Small Grants Funding.		
Objective 8.3 Capacity building in conservation	To strengthen the capacity of key stakeholders in planning and implementing fund raising strategies and in managing conservation funds.		

fundraising and management			
Intended outcomes	**Indicators**	**Means of measurement**	**Assumptions**
Amount of projects funding received by conservation organisations register a significant increase over previous years	No. of successful fund raising initiatives including proposals	Reports of Conservation NGOs and donors	NGO and donor reports are accessible
Implementers	MLECCNR/NGOs		
Status of Implementation	Civil Society and Tonga Community Development Trust have secured about 13 projects on fundraising from international sponsors. Please refer to Annex 3A.2 for the detail of past and on-going projects worth almost 1 million pa'anga. Civil Society is the focal point for GEF Small Grants.		
Objective 8.4 Economic tools and instruments for conservations funding	To generate local funding sources for biodiversity conservation		
Intended Outcomes	Indicators	Means of measurement	Assumptions
The establishment of local funding mechanisms well endowed with locally generated funding	Funding mechanism idea supported and viable, No. of economic instruments introduced to generated income from biodiversity related services and others.	MLECCNR reports & database report of feasibility study on funding mechanism	There is political support for conservation funding mechanism
Implementers	MLECCNR		
Status of implementation	Government funding towards biodiversity conservation is not a priority to all government sectors. There is currently no local funding mechanism in place. The Climate Change Trust Funds and the Fisheries Development & Export Funds are currently received from external funding agencies. It has been identified that budget from government to ECC was only for staff with no operational budget. Government has invested in funding permanent positions to try and secure external funds for operation to fulfil its multilateral agreements and to address national environmental issues. There is minimal local funding mechanism in place for conservation, but initiatives coming from resort owners.		
Objective 8.5- Partnership	To build effective partnership with key local and international organization to support the implementation of NBSAP		
Intended outcomes	Indicators	Means of measurement	Assumptions

Increasing numbers of partnerships between local conservation organisations and outside organisations	Increasing no. of foreign organisation active in biodiversity conservation work in Tonga. Increasing no. of multi-donor funded projects implemented in Tonga	DOE reports Donor reports	There are no political barriers to the participation of any foreign organizations in biodiversity conservation in Tonga.
Implementers	MLECCNR; All government		
Status of Implementation	ECC have worked very closely with Government and Non-Government organisations include the MAFFF, Civil Society and Tonga Trust Community, Finance Department and international organisation such as UNEP, GEF, SPREP and UNDP in regards to implementation of NBSAP activities and the review of NBSAP for the development of 5th National Report. With their supports and assistance, this 5th National Report has been completed.		

2.2 Results and Interpretation

There were 37 objectives required to be achieved by the NBSAP in order to allow for full conservation and sustainable utilization of biodiversity. The status of the current implementation of each objective is analysed according to following criteria shown in Table 14.

Table 14: Summary results achieved by the NBSAP

	NUMBER OF OBJECTIVES				**Percentage**			
Thematic Area	Red indicator	Yellow Indicator	Green Indicator	Total	Red	Yellow	Green	**Total %**
Forest Ecosystem		6		6		100		**100**
Marine Ecosystem		3	2	5		60	40	**100**
Agro Ecosystem		4		4		100		**100**
Species Conservation		6		6		100		**100**
Local Community &Civil Society			3	3			100	**100**
Access & benefit sharing	4			4	100			**100**
Mainstreaming		2	2	4		50	50	**100**
Financial Resources	1	3	1	5	20	30	20	**100**
Total	5	24	8	37				
Percentage	**14**	**65**	**21**	**100**				**100**

Status

	Green:	(SATISFACTORY) It is estimated that more than 50% of the Indicators have been achieved and impact on objective is Obvious and have reached sustainable position
	Yellow:	(WORK IN PROGRESS) It is estimated that up to 50% of the Indicators have been achieved and impact on objective is below 50%. Not sustainable yet.
	Red:	(UNSATISFACTORY) Less than 25% of the indicators have been achieved and its overall impact on the objective is not so obvious. No obvious programs in place.

Future outlook: The future outlook for each sector is based on combined SCORE after adding values in GREEN and YELOW columns.

2.2.1 Overall Performance

Table above highlights the levels of achievements on the NBSAP objectives. Of the 37 total objectives, 5(14%) are considered unsatisfactory (Red Status), 24 (65%) objectives fall in the work in progress category (Yellow status) and 8 (21%) objectives are satisfactory (Green Status). The unsatisfactory category is from four of the objectives under Access & benefit sharing; and one objective under the Financial Resources. These objectives are needed to progress or to achieve in the future. The thematic areas discussed above are dominated with Yellow Status which reflected that their works are in progress category. As compared to 4th National Report, most of the objectives of those thematic areas were in the category of unsatisfactory (Red status) such as forest ecosystem, access benefit sharing, species conservation, mainstreaming and financial resources. In the satisfactory category (Green status) the local community and civil society is still the leading objectives achieved followed by two of the Mainstreaming objectives, two from the Marine and one from financial resources.

2.2.2 Sector Performances

1. Forest Ecosystem: A Forest Ecosystem has total of six objectives. About 100% of those objectives are considered in progress (Yellow status) as compared to 4th National report was in Red (unsatisfactory). It has been identified under this review that Forest ecosystem is in progress of being protected. For instance no further removal of remain natural primary and secondary forests resulting from substantial decline in large scale commercial farming especially squash pumpkin. Furthermore, GIZ assist in reforestation of the encroached parts of the 'Eua National Park (Loupata region). The rate of coconut palm sawmilling declines from 2,000 palms (@ 2 logs per palm) in 2009 to 500 palms per annum in 2014. This resulted from stoppage of coconut sawmilling operations in Vava'u and Ha'apai and shift to milling of conventional woods by TFP in Tongatapu. The TFP operation in 'Eua focused in milling of *Pinus caribaea* logs from the forest plantation.

2. Marine Ecosystem: Marine Ecosystem has total of 5 objectives. About 40% of those objectives are considered satisfactory (Green status) and 60% are in progress (Yellow status). The green status indentified that SMAs programme operated under the Fisheries Department is now extended from 6 to 9 with expect 6 new in Ha'apai groups and 4 in Vava'u groups already secured fund supported by UNDP and GEF in regard to Climate Changes. The potential aquaculture areas already approve by the Cabinet in December 2013 which will legalize local community to conduct aquaculture activities in a way to reduce pressure on fishing (i.e. farming fish, seaweed, giant clams, etc.). Awareness program conducted in TV and radio programs co-sponsored by the Ministry of Environment, Fisheries Division, Ministry of Agriculture & Foods are ongoing and providing successful in promoting awareness and reasons for conservation and sustainable consumption of resources. Marine Biology and basic Fisheries Management course teach at one of the Vocational Institution in Tonga.

3. Agrobiodiversity: Agrobiodiversity has a total of 4 objectives. About 100% of those objectives are considered progress (Yellow status). The overall performance of biodiversity is an erosion of local traditional genetic resources as a result of combination of many factors, they are: first, impact of the modern farming technologies; low economic or cultural value; the local practice of asexual vegetative reproduction of crops; devastating pest. The only balancing development is the import of new exotic genetic resources in collaboration bilaterally with neighbouring countries or with regional institutions such the Centre of Plant Genetic Resources of the Secretariat of the Pacific Community. The current crop improvement program with the centre is on breeding and introducing new exotic varieties on talotonga, bananas and cassava. These new genetic resources have the advantage of higher yield and superior quality, resistant to pest and shorter production time.

4. Species Conservation: Conservation of Polynesian Megapode (Malau) is important in Tonga because Polynesian Megapode is an endemic bird to our island Kingdom. The revised NBSAP will include other animals and plants that were not included in the NBSAP 2006. About 100% of those objectives are considered progress (Yellow status) as compared to 4th National report. IIP Project is currently implemented in Tonga under the MLECCNR and it has conducted survey on the updated status of Polynesian Megapode, threats and trends. This project is also helps to address problems faced with the protection of Polynesia Megapode (Malau). The surveys carried out in Late and Fonualei in September 2013 determined that the megapode continues to survive in good numbers. Out of the appr. Total population of 300-500 Megapodes in 2003. An estimate of ca. 1000 birds was attempted to collect from both islands of Fonualei on September 2013. The bird was not located on Late.

IAS Project is also implemented in Tonga under the MLECCNR. Therefore, this project is also help to address problems that invasive species impact on our environment and human being. *Mimosa diplotricha* is new invasive weed and is currently localised to the main island in the Vava'u group. The herbivore, psyllid *Heteropsylla spinulosa* (Homoptera: Psyllidae) was introduced from Fiji as part of an integrated management strategy to controlling the invasive. A recent terrestrial fauna survey of Vava'u coordinated by MECC will provide updated information on the current status of invasive terrestrial species. *Bidens alba* continues to spread in very dense swaths across the main island in Vava'u. Giant African Snail *Achatina fulica* was intercepted in the Ma'ufanga area on two separate occasions in 2013 by Quarantine officers.

5. Local Community and Civil Society: As comparing to 4th National Report, Local Community and Civil Society is still recording the highest performance in achieving its objectives in Green status of 100%. Civil society initiated its programs in 2008, and there about seven programs already operating on biodiversity at the moment. These relate to mangrove rehabilitation, coastal protection and replanting in the coastal zone, a coastal erosion program in Ha'apai and forest conservation around Vava'u, Ha'apai and Tongatapu, establishment and certification of over 12 organic sites.

6. Access and Benefit Sharing:

Access and Benefit Sharing has 75% of its objectives in the Red. It has 25% of its objectives in Yellow. This sector lacks support in term of legislation and policies in place. MECC needs to coordinate this sector and can take up this responsibility then there is hope of improving the performance in future. Documentation of TEK is very important to Tonga so MECC should feel responsible to take part in this very important issue. Users need clear access and providers also need to know his/her share. It is anticipated to know that there will be a project coming soon in

the future for Access Benefit Sharing then this project might help to follow up all the issue mentioned above.

7. Sectoral and Cross Sectoral or Mainstreaming

Mainstreaming has 50% of its objectives in Yellow and 50% in Green status. This sector is scoring well as compared to 4th National Report. Many biodiversity conservation activities implemented with the assistance of international funding. In addition, some plan and policy have reviewed from relevant sectors especially MECCNR and MAFFF. Civil society has increasing their number of community programs in biodiversity financed by GEF Small Grant and other international sponsors.

8. Financial Resources and Mechanisms

Financial Resources and Mechanism has 30% in Yellow and 20% in Green status. Financial Resources achieved in Green status because more contributed from overseas organisations towards biodiversity conservation programme in Government and non-Government. For instance, more contributions from Civil Society and NGOs, with their overseas funds led to increasing their memberships and setting up biodiversity conservation programs for community participation around Tonga. Nevertheless, there is lack of Government funding towards biodiversity conservation. In fact, there is hope that Government contribution to biodiversity conservation programme will be improved in the future.

2.3 Mainstreaming of Biodiversity at policy levels and across other Multilateral Environment Agreements.

Mainstreaming biodiversity conservation into national plans and programs of the government of Tonga is essential. In this revised report, MLECCNR have integrated biodiversity conservation and sustainable development into Tonga Strategic Development Framework (TSDF). Nevertheless, relevant sectors have now in progress in prioritised biodiversity conservation into their corporate plan and annual management plan so that Government will provide financial support to NBSAP objectives. Eventually, few activities discussed below as for examples of how the Non-government and Government sectors mainstreamed NBSAP objectives into their relevant strategies. They are not in ranking because it has been realised that all these relevant sectors are improved in performance in their mainstreaming activities as comparing to the last report. The update Plan and Act are at Annex 1.

2.3.1 Case Study: CIVIL SOCIETY FORUM OF TONGA (NGO)

The Civil Society Forum of Tonga is mandated with task "*To provide strong Leadership to developing an effective Civil Society Sector in Tonga".* In serving this mandate, CSFT is endeavoured to assist its members through the provision of various platforms, capacity building, and leadership development on thematic areas such as socio-economic, political, human rights and environment.

CSFT is the NHI (National Host Institution) for the GEF/SGP programme. Since its commencement in 2009, 11 projects were funded under the GEF/SGP and three of which have been completed with 8 still under implementation and anticipated to end at the end of this calendar year.

One of the successful projects implemented under the GEF/SGP were the Special Management Areas (SMAs). In collaboration with the Ministry of Agriculture, Food, Forestry and Fisheries, CSFT provided continuous support to each of the three SMAs communities namely: 'Atata Community in Tongatapu, Felemea in Ha'apai and Ovaka in Vava'u. Amongst the stories and best lessons learnt, four factors stood out as instrumental to their success:

1. **Community Ownership.** When communities feel they have ownership over the project than the level of commitment and engagement is heightened. On the island of Felemea the yield benefits from their SMAs is equally shared amongst its members.

Figure 88: Felemea's SMA 2012

Source: Emeli Tofu,

All three communities have indicated there is an increase in the fish species variation and species concentration in all three sites. There are also species that were known to have disappeared, and now in abundance, which is a very positive indication. No data was available to us but there is a rough estimate that there may be an increase of up to 40% of fish species recovery in these SMAs. However, it is still too early to determine during this short period of time. A survey on the biodiversity and ecosystem health has not been conducted.

Community participation is monitored when a new project commences. In 2011, community participation was as low as 48% from all families within the community. As the people witnessed the positive results emerging during project implementation, there was full commitment from the community. Community support is the key to the success of any project to be completed on time, but it is also the success of managing resources for the long term.

2. The second factor that contributes to GEF/SGP successful stories is the **Governance structure** that is in place to govern and support the communities. All the positions, under the governance structure, were selected by the community themselves. The National Focal Person (NFP), in collaboration with MAFFF, provides training and capacity building for all the projects. Financial training, project management and community awareness were part of the project components, thus ensuring sustainability in all project stages of the implementation.

Figure 89: Awareness programme with schools and communities

3. The third factor that contributes to the effectiveness of the conservation effort under GEF/SGP is the provision of **alternative livelihood**. SMAs provide alternatives rather than the strict no take policy. It provides an alternative source which may relieve the pressure on coastal and marine areas and ensure the sustainable use of natural resources. For instance, income can be generated from ecotourism, handicrafts, aquaculture and so forth).

Another success story is the effort from the Coastal Conservation and community preservation initiatives, the Lagoon for Generation project, Kolokakala mitigation and adaptation project, and Kolovai Climate Change Adaptation project. The Lagoon for Generation selected the surrounding coastal rim of the Fanga'uta Lagoon as their target site. With the massive coastal cleanup, the results showed increased mangrove population, improved coastal cleanliness and raised community awareness.

Figure 90: " Lagoon for Generation" Halaleva 2013

Source: Pelenatita Kara

Although there are ongoing efforts for restoring natural resources, socio-economic development tends to pose a threat to these works.

The photo below depicts coastal reclamation at Fanga'uta Lagoon.

Figure 91: Land reclamation - Fanga'uta Lagoon 2013; and Destruction of Kalevalio Coastal Trees at Lifuka, Ha'apai 2013

Source: Pelenatita Kara

Figure 92 shows sand mining in the backyard of Tu'anekivale in Vava'u where Mangroves were cut and the sand mined. The community reported a sharp dropped in the amount of marine life they are able to fish because of these two activities.

Figure 92: Sand mining and mangrove cutting in the backyard of Tu'anekivale, Vava'u

Photo: 'Anitelu Toe'api, 2013

Tonga Community Development Trust

The Tonga Community Development Trust (TCDT) is an indigenous, non-governmental development organization operating in the Kingdom of Tonga. TCDT's focus is on capacity building with special attention on the less developed and more disadvantaged communities of

Tonga.. TCDT projects cover the following focal areas: Family and Community Health; Rural Water Supply and Sanitation; Sustainable Development; Environmental Conservation; Disaster Preparedness; Women's in Development; Human Rights; Good Governance, Civic Education and Voter Education. TCDT projects status are at (Annex 1, table 14)

Relevance to the National Strategic Development Framework

Tonga Trust strategic goals are in line with the following goals from the government TSDF:

1. Create a better governance environment
2. Ensure equitable distribution of the benefits of growth
3. Improve health standards
4. Ensure environmental sustainability and disaster risk reduction
5. Maintain law and order, social cohesion and cultural

2.3.2 Mainstreaming Activities from Government sectors.

1. Éua National Park Agricultural Encroachment and Replanting Scheme, supported by CCCPIR with the assistance of MAFFF and MLECCNR, have been discussed in chapter 1. The table below advocates the Watershed and National Park list of plants replanted.

Watershed & National Park list of plants replanted

Reforestation (Forest Plantation) May - June, 2012

2012	Blanking	Forest Plantation	*Bischovia javanica*	Koka	200
			Calophyllum neo-ebudicum	Tamanu	100
			Rhus taitensis	Tavahi	32
			Ellatostachus falcate	Ngatata	80
			Macaranga harveyana	Loupata	50
				Total	**462**
	New Plant	Forest Plantation	*Bischovia javanica*	Koka	280
			Rhus taitensis	Tavahi	30
			Ellatostachus falcate	Ngatata	110
				Total	420

Reforestation (Forest Plantation) July-August 2012

2012	Blanking	Forest Plantation	*Ellatostachus falcate*	Ngatata	52
			Rhus taitensis	Tavahi	18
			Calophullum neo-ebudicum	Tamanu	26
				Total	96
	New Plant	Forest Plantation	*Bischovia javanica*	Koka	527
			Rhus taitensis	Tavahi	29
			Terminalia Cattappa	Telie	1
			Neisosperma oppositifolium	Fao	2
			Heritiera littoralis	Ifi	1
				Total	**560**

Reforestation (National Park) June-July 2013

2013	Blanking	Forest Plantation	*Bischovia javanica*	Koka	270
			Rhus taitenis	Tavahi	41
			Macaranga harveyana	Loupata	469
				Total	**780**

Source: Forestry, 'Eua

2. Mixed cropping and Agro forestry practises for species conservation at Nakolo site.

The adaptation measures trialled at Nakolo by SPC/GIZ Coping with Climate Change in the Pacific Island Region Programme project promotes sustainable farming practices and conservation for some of the endangered species in crops, food trees and other cultural plants as discussed in the table below. The sustainable farming includes mixed cropping, agro forestry and promoting natural solutions. For instance, use of chemical fertilisers is discouraged and other methods like mulching and organic compost is promoted. Agro forestry systems have been established and harvesting of produce is already taking place. A belt of salt water tolerant trees shield the crops salt water sprays. Locally available climate ready crop varieties are also trialled on this site. List of plants and crops at Nakolo (refer annex1).

Figure 93: Map of mixed cropping and Agro forestry practices for species conservation at Nakolo Site

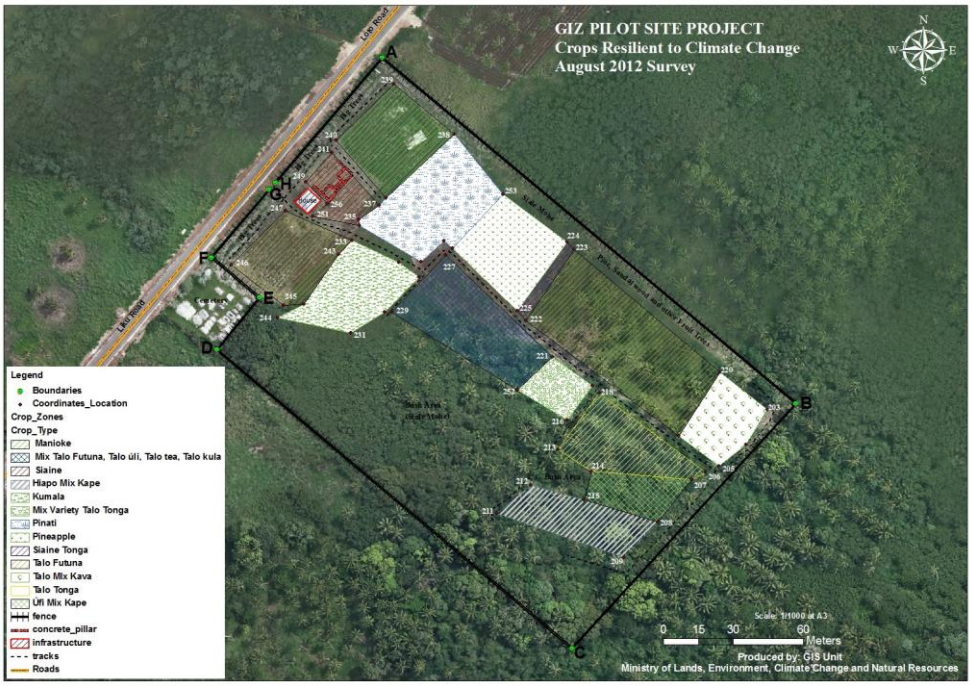

Figure 94: Pine trees, sandalwood and other fruit trees at Nakolo Site

Pine trees, sandalwood and other fruit trees are planted surrounding the site. Agroforestry is a system where trees and plants are grown together for mutual benefit (e.g. trees provide shade to food crops and shelters small plants against rains and wind.) Communities are provided income generating opportunities from timber trees.

3. **GEF PAS Integrated Island Biodiversity Project** is ongoing under the MLECCNR- This project focuses on the Implementation on the Island Biodiversity Programme of Work by integrating the conservation management of island biodiversity (Refer chapter 1). This project is implemented across the forestry, marine and environment sectors with active involvement of key stakeholders including government agencies, NGOs, and private sector.
4. **GEF PAS Prevention, control and management of invasive alien species in the Kingdom of Tonga** is ongoing under the MLECCNR. (Refer chapter 1). This project helps to reduce the environmental, economic, and human health impacts of invasive species in both terrestrial and marine habitats in the Pacific region.
5. **Programme of Work on Protected Area**: The POWPA and Priority Setting Exercise undertaken in August 2008 represents the people of Tonga's aspirations for a national Programme of Work for Protected Areas that conserves and protects Tonga's unique terrestrial and marine ecosystems and sustainability upholds the integrity of the environment and Tongan cultural way of life in the midst of Small Island Developing States Socio-economic realities. Although historically, Tonga was a regional trendsetter in establishing its first national reserve in the 1940s and later in 1976 established five national marine parks, the development of an effective management regime for these protected areas and consequently the identification to the UNCBD in 1998, marked a new era in which the conservation and effective management of scarce and threatened biodiversity resources have re-emerged as a national priority. Since the completion of Tonga's commitments to POWPA. The financial assistance provided by these international conventions are enabling the implementation of relevant sections in the NBSAP for Protected Areas, that otherwise lacked the financial resources.
6. **Community Turtle Monitoring and Eco-tourism Development Project in Tonga:** The Pacific Community Turtle Monitoring and Eco-tourism Development Project was developed based on a successful model being implemented in Vanuatu and Fiji with links to the Regional Marine Species Action Plan 2008-2012, as well as the SPREP Strategic Plan 2011-2015. Tonga is among the four countries (with Fiji, Kiribati and Solomon Islands) in the Pacific to implement community based turtle monitoring and development of sustainable ecotourism business to assist livelihoods, while promoting sustainable management of turtle adopting the lesson learned from the model project in Vanuatu. As part of our commitment to the project, it is the duty of the national government leading agencies (Environment Division of MLECCNR, and the Fisheries Division of (MAFFF) to coordinate consultations with local stakeholders and communities.

7. **Mangrove Ecosystems Climate Change Adaptation and Livelihoods Project (MESCAL):** The MESCAL project is promoting joint management and conservation of mangrove ecosystems in selected areas of Tongatapu. The geographical focus of this project is limited to certain areas of Tongatapu Villages surrounding the Fanga'uta Lagoon.

8. **Mangrove replanting at Siesia, remote and lowlying Island.**

MLECCNR (Environment and Climate Change Divisions) had replanted mangrove at Siesia Island early this year 2014. Siesia is a remote and low-lying island with a population of 80 people. This remote island is vulnerable to climate change and natural disasters, therefore ECC had replanted mangroves at the coastal area of Siesia with the involvement of its community in order to protect their lowlying island from climate change and natural disasters and for mangroves conservation.

9. **Agro biodiversity (Agricultural Department)**

Mainstreaming of biodiversity is agriculture are mainly: first, the crop and livestock improvement programs in collaboration with regional and international institutions; promotion of the traditional and it's modified evolve commercial version. The link is the importance of biodiversity to the food security and the economical development of Tonga.

Continuous Re-structuring of MAFFF

The key to securing focus and significant program on biodiversity is a national sector plan on agriculture. The plan will formally bind both the private sector and the public sector on agreed

and concerted national efforts and activities directly on agriculture biodiversity. This will direct the resources of the Ministry of Agriculture to biodiversity as a whole.

10. **Marine Ecosystem:**

- Development of Aquaculture activities with Management Plan (2014) to be endorsed this year. This could be a milestone can assist to reduce fishing pressure of the coastal reefs. Milkfish farming trail for Nomuka (milkfish) and Tongatapu (milkfish and tilapia) under fund provided by FAO. Seaweed farming trail for all Island groups (i.e. Tongatapu, Vava'u and Ha'apai) under Government fund to support livelihood of the coastal communities.
- Estimated that towards the end of this year, SMAs will be extended from 9 to 14 Island communities under Fisheries Division co-based management activities.
- Ongoing B surveys for invertebrates (i.e. sea cucumbers, giant clams, and others (shellfishes).
- Cultured aquarium species (i.e. giant clams, trochus, etc) still ongoing at the Tonga Mariculture Center located at Sopu. .
- Protection of shark fisheries by reducing by-catch from tuna long-lines fisheries (Sharks National Action Plan 2013)..
- Strengthening research activities and resource assessment programme. .
- Marine and Coastal Biodiversity Programme and integration of Marine Spatial Planning.

2.4 Barriers for effective implementation

Barrier 1: Legal and Policy framework

Enforcement of legislations is weak. . Although legislation is the main instrument used in Tonga to protect the environment, some of the existing legislation is old and no longer applicable to the current physical and socio-economic environment of Tonga. Enforcement is also a major problem due to lack of staffing and finances for operations.

Barrier 2: Lack of awareness program to the outer islands in Tonga due to lack of financial support and transportation

The process for preparing the 5th national report reached out to the furthermost islands of Tonga known as Niuatoputapu and Niuafo'ou for the first time. Only two days were spent on public consultation to both of these two islands due to flight schedule deferred. We managed to conduct our public consultation when the passengers' ship went to these two islands for

Agricultural Show. However, we had identified that there is lack of awareness programme to other scattered islands in Tonga due to financial supports and transportation.

Barrier 3: Monitoring

The monitoring programme for protected areas and biodiversity conservation activities in Tonga are very weak due to lack of financial support from government. MLECCNR can do the monitoring activities while projects operate in the Ministry, but when the project ends, the monitoring programme stops. Financial support for monitoring programme from government and donor agencies are needed for this programme.

Barrier 4: Human capacity

There is a need for an NBSAP Secretariat to be established under the Environment Division of the MLECCNR to mobilise resources and monitor the implementation of NBSAP activities. It would be beneficial for Tonga to invest in recruiting permanent posts for the NBSAP Secretariat to ensure the ongoing work to achieving Tonga's obligations to the CBDs Strategic objectives and the Aichi Targets for 2020 is met, and to keep the momentum of engaging all stakeholders in the process.

Barrier 5: Available funding

It has been identified from all the relevant sectors perceptions that there is lack of government contribution to support biodiversity conservation activities. Most of the biodiversity conservation activities are implemented through donor funded projects. In fact, government funding is an issue to all the government sectors for biodiversity conservation activities. To address this problem, more funding from external sources have been requested to assist with the implementation of the NBSAP activities in the future.

CHAPTER III: Progress towards the 2015 and 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goals.

This chapter will look at Tonga's progress towards meeting National targets, the implementation of the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets, its contribution to the relevant 2015 Targets of the Millennium Development Goals (MDGs), and what lessons have been learned from the implementation of the Convention.

3.1 Progress towards 2020 Targets

Progress towards achieving the Aichi 2020 targets is measured using the Indicators for the Strategic Plan for Biodiversity 2011 – 2020 under the CBD framework. By mapping Tonga's relevant national target against each Aichi Target, we can measure the progress through the achievement of the appropriate indicators listed for each national target. Achieving these objectives at a national level would be considered as Tonga's contribution to the world, in conservation and sustainable utilisation of its biodiversity. Contributions to the relevant 2015 Targets of the Millennium was also included to see where national targets had made contributions it.

Details of Tonga's national objectives and Targets are listed in Table 13.

Table 15 lists the Aichi Targets in the first column, Tonga's relevant Targets are in the second column and its associated indicators in the fourth column. The ranking for each Target is carried forward from analyses of the status of implementation in Table 16 and depicted under the 2014 Indicator Assessment.

Table 15: Progress towards achieving the Aichi Biodiversity Targets by 2020

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society				**RED – not achieved** **YELLOW – in progress** **GREEN - achieved**
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.	1.6 Supportive public of forest conservation actions;	7B. By 2010, achieve a significant reduction in biodiversity loss;	• Public access to information; • Mode of information dissemination to stakeholders	
	2.5 A general public that is well informed of marine conservation issues and supportive of marine conservation objectives;		• No. of people participating in forest activities e.g. tree planting; • No. of people surveyed with supportive responses	
	4.5 A general public that is well informed of Tonga's natural heritage and priority species and supportive of species conservation work;		• No. of local initiatives supporting species conservation; • No. of local communities, schools, organisations etc interested and are involved in species conservation work	
	5.1 Local communities and resource owners are active and effective contributors to biodiversity conservation and resource management;		• No. of requests for technical support • Community-based plans developed • No. of community based conservation	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
			projects initiated; • Reports of non-compliance • No. of multi-secotral projects with NGO/community representation	
	5.3 School children understand and are supportive of conservation objectives early in life;		• No. of schools ad environmental conservation projects supportive of conservation initiatives; • Mainstreaming of biodiversity concepts into school curriculum	
	6.4 Tongans have pride in their natural heritage, are well informed about their TEK and supportive of efforts to protect them		• Increasing use of traditional healing methods, and other TEK	
REMARKS:	The general trend in awareness, attitudes and public engagement in support of biological diversity and ecosystem services show a positive change since 2010. Awareness, however, has been very weak with regards to ABS and TEK, and the MCTL and MLECCNR are working collaboratively to progress this thematic area. Traditional healing methods are still being practiced and have been documented, but have not yet resulted in conservation efforts.			
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	7.4 Biodiversity valuation results are accepted and incorporated into cost benefit analyses of development proposals	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources	No. of conservation with biodiversity benefits fully quantified and built into cost-benefit analyses.	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
reporting systems.				
REMARKS	Integration of biodiversity, ecosystem services and benefits sharing into planning, policy formulation and implementation and incentives has been developed for forest plantation, mangroves and other marine resources. An economic evaluation of biodiversity is to be conducted in the Vava'u archipelago in April/May 2014 with financial assistance through IUCN and SPREP. Guidelines and applications of economic appraisal tools have not been developed yet. Biodiversity and ecosystem service is considered when assessing environmental impacts under Tonga's Environmental Impact Assessment Act 2003. The number of development projects submitted to the MLECCNR for processing is increasing due to awareness.			
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.	3.3 The farmers and general public are informed and trained for in-situ conservation of crops, trees and livestock species/varieties/breeds.	7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss;	Rate of awareness of the importance of new/local species/varieties/breeds at farmers/residential homes, schools, parks, etc.	
	5.1 Local communities and resource owners are active and effective contributors to biodiversity conservation and resource management		No. of national level planning processes involving local communities and resource owners; Amount and quality of conservation and resource related information accessed by locals; No. of SMAs established.	
	7.4 Biodiversity valuations results are accepted and incorporated into cost benefit analyses of development proposals		No. of conservation with biodiversity benefits fully quantified and built into cost-benefit analyses	
REMARKS	Trends in the integration of biodiversity, ecosystem services and benefits sharing into planning, policy formulation and implementation and incentives has shown a positive change. *Positive incentives*:			

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
	• With the establishment of Special Management Areas (SMAs), it has given communities the incentive to monitor and manage marine resources within their jurisdiction, as they can foresee the benefits they may receive. • In designating Tonga as a whale sanctuary, it had increased the no. of whale watchers to Tonga. Whales migrate to Tonga to give birth to their calves. By conserving our marine areas, to be suited for whale migration, and have a marine spatial plan in place, Tonga can still benefit economically from the whale watching industry, as well as have food security, protection, and their livelihoods. • Organic farming certification in an attempt to value add to produce and access niche markets; • Implementation of Integrated Pest Management (IPM) farming practices in order to reduce economic costs of production. Implementation is driven by economic viability and involves selection of appropriate crops and while maintaining yield levels, secondary benefits include increases to environmental sustainability and long-term economic benefits; • Pacific Horticultural and Agricultural Marketing Access (PHAMA) is working regionally, and in Tonga with the Market Access Working Group (MAWG) to reduce technical trade barriers and increase export market access for Tongan agricultural produce.			
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.	1.2 Forest ecosystems and ecosystems services are protected;	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss; 7C: Halve, by 2015, the proportion of people without	An integrated land use plan adopted & implemented; Legislation and policies adopted & enforced;	
	2.3 Marine resources are managed sustainably.		No. of management plans developed & implemented; No. of fishing practices & technologies banned by legislation;	
	7.4 Biodiversity valuations results are accepted and incorporated into cost benefit analyses of development proposals		No. of conservation with biodiversity benefits fully quantified and built into cost-benefit analyses	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
		sustainable access to safe drinking water and basic sanitation;		
REMARKS	• Trends in pressures from unsustainable agriculture, forestry, fisheries and aquaculture have decreased, and has led to a positive change. This has been achieved by the development of many relevant management plans e.g. National Plan of Action (2013) for shark fisheries which included CITES species of shark; the Forestry Management Plan; Community based Management Plans for SMAs, etc. But its success is contributed to public awareness and enforcing compliance to the legislations and policies, as well as funding. • The uncertainty of availability of resources due to climate change issues. Climate change affects species migration patterns. They also affect current and create upwelling changes that alter traditional situations; • Although there are a number of initiatives in place, the trends in pressures from habitat conversion, pollution, invasive species, climate change, overexploitation and underlying drivers are still increasing. Challenges identified include financial constraints, coordination between public/private administrative bodies, political issues, lack of accountability of government departments/civil servants, incentives motivated by better standard of living, and so forth.			
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.	1.1 The expansion of agriculture is minimised and contained;	7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss;	No. of new marine areas under conservation management.	
	1.2 Forest ecosystems and ecosystems services are protected;		An integrated land use plan adopted & implemented; Legislation and policies adopted & enforced.	
	1.3 Community participation improved		No. of stakeholders participating in managing of the natural resources;	
REMARKS	• Trends in pressures from unsustainable agriculture, forestry, fisheries and aquaculture are decreasing through awareness and enforcing compliance with the			

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
	legislations. • Although there is evidence of abuse in forest reserves, there have been tax allotments used for conservation areas to be rehabilitated with forests. • Extinction risk trends of habitat dependent species, for avifauna is currently low. After a rapid biodiversity survey, habitats for dependent species have been located and will be nominated for protection. This includes habitats for the polynesian megapode. Population trends for dependent species show a positive change. • The Vava'u archipelago retains high terrestrial biodiversity values including species found no where else in the world. Several sites are particularly important to conserve these values. There are a range of threats present of which invasive species such as rats and yellow crazy ants are particularly important. • We recognize the key role that local communities play in looking after their natural resources and we hope that the information will assist them to be strong guardians of the plants and animals that make Vava'u such a special place.			
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.	2.3 Marine resources are managed sustainably.	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss; 8C: Address the special needs of small island developin states	No. of management plans developed & implemented; No. of fishing practices & technologies banned by legislation;	
	2.4 Knowledge of the state health of critical marine ecosystems is current and regularly updated		No. of marine survey reports of critical ecosystems and species;	
	2.5 A general public that is well informed of marine conservation issues and supportive of marine conservation objectives;		No. of people participating in forest activities e.g. tree planting; No. of people surveyed with supportive responses	
REMARKS	The trend of marine biodiversity is still unknown. Trends in catch per unit effort and fishing effort capacity defer for each fishery. Albacore tuna species dominated landing catch and			

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
	export with more than 300% increase and the highest on the record in 2012. This depicts a positive change fish catch from foreign fishing vessels and foreign locally based licenses. Shark species was estimated at 10% of the total production from 2011 – 2013. The trend for deepwater snapper fisheries have declined, some landing catches have dropped dramatically and a shift from the target species to low value species. This is due to few fishing vessels participating in this fishery. Sea cucumber fisheries have declined since 2012, caused by overfishing of stocks in terms of the overall population and density reduction. Illegal means of fishing, including hookah and SCUBA has been resorted to, including untrained fishermen in diving, resulting to death.			
Target 7 - By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	1.2 Forest ecosystems and ecosystem services are protected	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; 8C: Address the special needs of small island developing States	An integrated land use plan adopted & implemented	
	1.3 Community participation improved		No. of stakeholders participating in managing of the natural resources	
	7.4 Biodiversity valuations results are accepted and incorporated into cost-benefit analyses of development proposals		No. of conservation with biodiversity benefits fully quantified and built into cost-benefit analyses	
REMARKS	As mentioned above, the trend towards conservation of biodiversity has increased over the years due to the policies and legislation in place to sustainably manage aquaculture, agriculture and forestry activities. However, compliance is still an issue, and therefore enforcement is needed to be strengthened.			
Target 8 - By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	2.1 Healthy coastal ecosystems and habitats for priority species	7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss	Reducing no. of algal bloom outbreaks; Reducing trends of eutrophication; Evidence of good coral growth.	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
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.	4.3 No alien invasive detected in Tonga		No. of interceptions at border; No. of species recorded from surveys	
	4.4 Better understanding of what is known and not known about Tonga's priority species ecological requirements for conservation management		Completed review of existing information about priority species; Monitoring programs initiated and maintained	
	4.5 A general public that is well informed of Tonga's natural heritage and priority species and supportive of species conservation work		No. of local initiatives supporting species conservation	
REMARKS				
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.	7.1 Concepts of conservations and sustainable use of biodiversity are integrated into sectoral policies, programmes and plans	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss	No. of sector plans, policies and legislation that specifically integrate conservation and sustainable use of biodiversity; The NBSAP and JNAP are recognized as the authoritative reference for economic, social and environmental planning purposes.	
	7.2 Agencies and organisations of varied interests and areas of specialization work collaborate regularly on conservation work		No. of National Strategic and Action Plans implemented; Proactive Committees and Technical Working Groups; Technical reports	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
	7.3 EIA is an acceptable planning requirement for all development activities		No. of development projects redesigned to take into account assessment recommendations.	
REMARKS	**Trends in pressures from habitat conversion, pollution, invasive species, climate change, overexploitation and underlying drivers** • Minimal impacts on diversity of corals with 75 species found, during a rapid biodiversity survey conducted in February 2014, at Vava'u that has not been reported from Tonga. There were three species of coral may be new to science, and 201 coral species now reported for Tonga. • A negative change in the trends for valuable commercial species of sea cucumbers. After a rapid biodiversity survey in the Vava'u islands in February 2014, only 4-5 valuable commercial individuals per dive site was observed over 54hours of diving. For the giant clams, only 2 clams per dive site was observed, low numbers of octopus, lobsters. • Trends in climate change impacts on extinction risk for coral reefs have been observed on *Galaxea* corals at 30m depth with 30 degrees celsius water temperatures during the rapid biodiversity survey in Vava'u. If temperature increases, it will lead to long term impacts on coral health and reef community. Few COTS and Drupella observed. Low incidence of disease, widespread of bleaching, likely to increase in next few months; little damage from recent cyclone Ian, most sites showed little physical damage. Abundant sheltered sites accumulated with rubbish. • Reef biodiversity in Tonga has healthy balanced reef communities. Need coral abundance. A range of topography brings in a higher range of fish species. Coral reef health is impacted from imbalance from herbivorous species if there is a lack of predators. • There is a change in boundaries of vulnerable ecosystems of which has affected species migration or a shift in ecosystem. For instance, the main lagoon on Tongatapu has increased sedimentation load due to higher rainfall and recent development. This has caused a shift of jellyfish populations, seagrass beds, shrimps, just to name a few, to areas best fit for them.			

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
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.	2.2 A 50% increase in the total area of marine ecosystem under conservation management in 10 years	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss	No. of new marine areas under conservation management.	
	4.1 Priority species are well protected & their population increasing		Populations of priority species increasing; Associated habitats are healthy	
	7.1 Concepts of conservations and sustainable use of biodiversity are integrated into sectoral policies, programmes and plans		No. of sector plans, policies and legislation that integrate conservation and sustainable use of biodiversity; Implement NBSAP and JNAP relevant activities.	
	7.4 Biodiversity valuation results are accepted and incorporated into cost benefit analyses of development proposals		No. of conservation with biodiversity benefits fully quantified and built into cost-benefit analyses.	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
REMARKS	• Trends in coverage of protected areas show a positive change, mainly with the marine managed areas (SMAs and MPAs). With regards to effectiveness, consultation with communities, they have responded that they are getting an increase in diversity of fishes, and an increase in fish catch. No surveys have been conducted to verify this. After a rapid biodiversity assessment in the Vava'u group, protected areas will be nominated for consideration. • There has not been any change in the trend for terrestrial protected areas. However, tax allotments have been converted for forest conservation. • Tonga designating its EEZ as a whale sanctuary has provided benefits for whale migration, as well as tourism and revenue for the country. • Conservation of turtle nesting sites are considered as a future for eco-tourism.			
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.	4.1 Priority species are well protected & their population increasing	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss	Populations of priority species increasing; Associated habitats are healthy	
	4.2 Targeted species are managed sustainably		Population of targeted species are increasing ex-situ and/or in-situ	
	4.3 No alien invasive detected in Tonga		No. of interceptions at borders; No. of IAS located during surveys	
	4.4 Better understanding of what is known and not known about Tonga's priority species ecological requirements for conservation management		Completed review of existing information about priority species; Monitoring programmes initiated and maintained.	
	4.5 A general public that is well informed of Tonga's natural heritage and priority species and supportive of species conservation work		No. of local initiatives supporting species conservation;	
	4.6 Adequate expertise		No. of graduates	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
	and capacity exists locally independently address Tonga's priority research needs		returning; No. of staff attending specialized training; National herbarium is established.	
REMARKS	• Ad hoc surveys have been conducted on biodiversity to assist in identifying threatened species. There has been loss of inshore biodiversity due to easy and open access by coastal populations. The main threat would be human activity. This has obvious consequences on the quality of the environment as evidenced by air pollution and the increased use of fossil fuel, inadequate disposal of solid waste, pesticide and fertilizer runoff in the groundwater and sea. Water pollution in Tonga is becoming an increasing problem due to salinisation, sewage and toxic chemicals from farming. • There has been success in the translocation of threatened species, e.g. polynesian megapode. It is in the hope that more suitable environments can be located in order to duplicate the effort. • The Tongan whistler was thought to be endangered, but it has been found in good numbers in Vava'u.			
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.	3.1 Populations of all targeted species are increasing in the wild and ex-situ; Promotion of the traditional/modified production of mixed species is key to conservation of biodiversity		Current introduced genetic resources crossed, evaluated, bulk and distribute to farmers and public	
	3.2 Increased diversity of existing crops and of the conservation existing crops		Number of new crops species & varieties introduced; No. of local crops species and varieties preserved.	
	6.1 Tonga's genetic resources are fully protected from unlawful exploitation		No. of illegal access cases prosecuted;	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
REMARKS				
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.	1.2 Forest ecosystems and ecosystems services are protected	1A: Halve the proportion of people whose income is less than one dollar a day (between 1990 and 2015); 1C: Halve the proportion of people who suffer from hunger; 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss; 7C: Halve by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.	An integrated land use plan adopted & implemented; Legislation and policies adopted & enforced	
	2.1 Healthy coastal ecosystems and habitats for priority species		Reducing no. of algal bloom outbreaks; Reducing trends of eutrophication; Evidence of coral growth.	
	2.3 Marine resources are managed sustainably.		No. of management plans development and implemented; No. of mal-practices and technologies banned by legislation;	
	5.1 Local communities and resource owners are active and effective contributors to biodiversity conservation and resource management		No. of national level planning processes involving local communities and resource owners;	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
REMARKS	• There is negligible incidence of hunger in Tonga and death from starvation does not exist. The prevalence of underweight children was very low in 1986 at 1.6% and has increased marginally to 2% in 1999. Since more recent data are not available, it is difficult to assess the direction of the trends for this particular indicator. • The data available to assess progress on this particular target are limited and therefore an in-depth analysis cannot be carried out. • The 2006 census data records 81% of all households obtaining drinking water from a rainwater tank. The second most important source was piped water (15%.). Reasonable access is defined as the availability of at least 20 liters a person a day from a source within 1km of the dwelling. • 70% of all households have flush toilets. Although most households were located in Tongatapu, percentages were much lower in the outer islands.			
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.	1.4 Improved management of parks and reserves	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss;	No. of management plans developed and implemented;	
	1.5 Knowledge of the status of forest biodiversity is up to date and verifiable		Regular and up-to-date information available; Ecosystem surveys conducted.	
	7.1 Concepts of conservations and sustainable use of biodiversity are integrated into sectoral policies, programmes and plans		No. of sector plans, policies and legislation that specifically integrate conservation and sustainable use of biodiversity; The NBSAP and JNAP are recognized as the authoritative reference for economic, social and environmental planning purposes.	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
REMARKS	**Trends in distribution, condition and sustainability of ecosystem services for equitable human well-being** • Under the Second National Communications report to the UNFCCC Secretariat, evidence has shown that Tonga is currently a sink for greenhouse gases, therefore, the status and trend is positive. • Mangrove biomass data were collected from 25 plots for 4 dominant vegetation assemblages, *Bruguiera gymnorhiza, Rhizophora species, Excoecaria agallocha* and *Lumnitzera littorea*. Stand heights ranged from 3-9m with derived estimates of carbon in living mangrove biomass of 94 – 326 t.ha^{-1} (Duke, 2013).			
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.	6.1 Tonga's genetic resources are fully protected from unlawful exploitation		No. of illegal access cases prosecuted; No. of application received and legally approved.	
	6.2 Local owners of resources and Traditional Ecological Knowledge (TEK) are receiving equitable share of benefits		No. of legally binding agreement signed benefiting local owners of resources and TEK	
	6.3 TEK is documented, protected from unlawful use and where appropriate, promoted		Reports, database, etc. capturing TEK; Legislation enacted and enforced; Appropriate TEK applied in conservation management	
	6.4 Tongans have pride in their natural heritage, are well informed about their TEK and supportive of efforts to protect them		Increasing use of traditional healing methods, and other TEK	
REMARKS	• An area of which little attention has given. MLECCNR and MCTL are currently working on it and funds are made available for assistance, leading to the signing of the Protocol.			

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
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.	7.1 Concepts of conservation and sustainable use of biodiversity are integrated into sectoral policies, programmes and plans	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources;	No. of sector plans, policies & legislation that specifically integrate conservation and sustainable use of biodiversity; The NBSAP is recognized as authoritative reference for economic planning purposes; No. of projects and programmes implemented;	
	7.2 Agencies and organisations of varied interests and areas of specialization work collaborate regularly on conservation work		No. of conservation projects involving organisations from different sectors; No. of environmental initiatives initiated by non conservation organisations and companies	
	7.3 EIA is an acceptable planning requirement for all development activities;		No. of development projects redesigned to take into account EIA recommendations; No. of major projects reviewed by EAC and approved by the Minister.	
REMARKS	• Trends in implementation of national biodiversity strategies and action plans (NBSAP), the national action plan for climate change adaptation and disaster risk management (JNAP) indicate a positive change in all sectors.			

<table>
<tr><th>Aichi Biodiversity Target</th><th>RELEVANT National Targets</th><th>Tonga Contribution to MDG Target</th><th>RELEVANT Tongan Indicators</th><th>2014 Indicator ASSESSMENT</th></tr>
<tr><td rowspan="2">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.</td><td>5.1 Local communities and resource owners are active and effective contributors to biodiversity conservation and resource management</td><td rowspan="2">7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources;</td><td>No. of national level planning processes involving local communities and resource owners;
No. of community-based conservation areas established.</td><td></td></tr>
<tr><td>6.2 Local owners of resources and Traditional Ecological Knowledge (TEK) are receiving equitable share of benefits</td><td>No. of legally binding agreement signed benefiting local owners of resources and TEK</td><td></td></tr>
<tr><td>REMARKS</td><td colspan="4">Trends in integration of biodiversity, ecosystem services and benefit-sharing into planning, policy formulation and implementation and incentives
Trends in land-use change and land tenure is changing. Many of the tax allotments are now being subdivided into town allotments or residential areas. There is a need for the PUMA to start identifying land areas that are fit for certain developments. There is a need for government to give incentives for people not to subdivide their land allotments, but use it the benefit of conservation and their livelihoods.
There is an increased number of community programmes on food security and alternative livelihoods which are heavily emphasised on conserving terrestrial and marine plants and animals for subsistence livelihoods, as well as rehabilitation and conservation.
Trends in accessibility of scientific/technical/traditional knowledge and its application
Trends in which traditional knowledge and practices are respected through their full integration and effective participation of local communities in the national</td></tr>
</table>

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
	implementation of the Strategic Plan is positive. • Trends of the number of speakers in the Tongan language is declining. However, the Competent Authority for Education has made this a compulsory subject in primary and secondary schools. The official language for Tonga is English and Tongan.			
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.	4.1 Priority species are well protected & their population increasing;	7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources;	Increased populations of priority species;	
	4.2 Targeted species are managed sustainably		Population of targeted species are increasing ex- situ and or in-situ	
	4.4 Better understanding of what is known and not known about Tonga's priority species ecological requirements for conservation management.		Completed review of existing information about priority species. Monitoring programmes initiated and maintained.	
REMARKS	• There is a positive trend in coverage of comprehensive policy-relevant to sub-global assessments including related capacity-building and knowledge transfer. This includes sectoral legislations, corporate plans, management plans, inhouse trainings, community workshop, etc. • The number of maintained species inventories are being used to implement the Convention.			
Target 20 - By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for	8.2 All interested organisations, groups and individuals are informed on possible sources of conservation funding and/ or funders requirements		No. of meetings, workshops held; No. of organisations attending; Quality of funding proposals received.	

Aichi Biodiversity Target	RELEVANT National Targets	Tonga Contribution to MDG Target	RELEVANT Tongan Indicators	2014 Indicator ASSESSMENT
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.	8.3 Amount of project funding received by conservation organisations, register a significant increase over the years		No. of successful fundraising initiatives including proposals	
	8.5 Increasing numbers of partnerships between local conservation organisations and outside organisations		Increasing no. of foreign organisation active in biodiversity conservation work in Tonga; Increasing no. of multi-donor funded projects implemented in Tonga.	
REMARKS	• A Fisheries Development and Export Fund (FDEF) was established in 2014 with starting capital of TOP300,000. The objective of this fund is to improve the cooperation between fishermen, vessel owner and exporters (Fisheries Business) so that all parties can work more effectively together to generate increased exports, income and employment in the fisheries sector; • Climate Change Trust Fund • All stakeholders are informed on possible funds available for conservation work through government organisations websites, coordinating committees (comprising of CEOs and representatives of NGOs and private sector), NGOs, Civil Society (focal point for small grants), Chamber of Commerce, and so forth. • Project funding for conservation work have increased over the years, through GEF Small Grants to communities to local and bi-lateral funding.			

3.2 Results and Discussion

There are five (5) major areas identified as critical to the conservation and sustainable utilization of biodiversity globally. Twenty (20) targets were developed within these five major areas, to guide members in their contributions (Table 15). Summary status of national targets contributing to meeting the Aichi Biodiversity Targets are shown in Table 16 and 17:

Table 16: Summary status of national targets contributing to meeting the Aichi Targets

Global Strategic Goals	Aichi Targets Number	National Target Number 2006	Status (Rank)
Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society	1	1.6, 2.5, 4.5, 5.1, 5.3, 6.4	
	2	7.4	
	3	3.3, 5.1, 7.4	
	4	1.2, 2.3, 7.4	
Reduce the direct pressures on biodiversity and promote sustainable use	5	1.1, 1.2, 1.3	
	6	2.3, 2.4, 2.5	
	7	1.2, 1.3, 7.4	
	8	2.1	
	9	4.3, 4.4, 4.5	
	10	7.1, 7.2, 7.3	
To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity	11	2.2, 4.1, 7.1, 7.4	
	12	4.1, 4.2, 4.3, 4.4, 4.5, 4.6	
	13	3.1, 3.2, 6.1	
Enhance the benefits to all from biodiversity and ecosystem services	14	1.2, 2.1, 2.3, 5.1	
	15	1.4, 1.5, 7.1	
	16	6.1, 6.2, 6.3, 6.4	
Enhance implementation through participatory planning, knowledge management and capacity-building	17	7.1, 7.2, 7.3	
	18	5.1, 6.2	
	19	4.1, 4.2, 4.4	
	20	8.2, 8.3, 8.5	

Table 17: Summary of Tonga's progress in implementing the Strategic Plan for Biodiversity 2011 - 2020

SUMMARY						
STRATEGIC GOALS	RED	YELLOW	GREEN	PERCENTAGE		
				RED	YELLOW	GREEN
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society		4			100	
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use		5	1		83	17
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity		2	1		67	23
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services	1	2		23	67	
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity-building		3	1		75	25
	1	16	3			
Overall performance (%)	**5**	**80**	**15**			

Tonga's progress is further discussed in detail below under the three ranking categories assigned to the objectives. The ranking criteria are similar to those used in Chapter 2.

ACHIEVED (GREEN)

Of the total global objectives, about 15% of the national objectives are considered achieved. The achievements were in the following global areas, in order of rank:

4. Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building;
5. Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity; and
6. Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use.

IN WORKING PROGRESS (YELLOW)

Of the total global objectives, about 80% of the national objectives are considered in progress. These achievements were in the following global areas, in order of rank:

1. Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society;
2. Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use;
3. Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity-building; and
4. Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity and Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services.

Tonga had managed to contribute to all the global objectives of up to 50% of the Aichi Biodiversity Targets. Indicators have been achieved and impact on objective is below 50%. Not sustainable yet.

IN SLOW WORKING PROGRESS (RED)

Only 5% of Tonga's overall progress has not been achieved towards the Strategic Plan for Biodiversity 2011 – 2020. This is a considerable positive working progress for Tonga since the Fourth Review of the NBSAP. The achievements were in the following global area: Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services, which will require more attention in the future. Only one (1) national objective, 6.1: Tonga's genetic resources are fully protected from unlawful exploitation, contributes to Strategic Goal D that will require considerable attention.

It is visioned that approximately 50% of the working in progress category (yellow status) will be achieved by the year 2020.

3.2.1 Contribution to MDG Targets

The contribution of the NBSAP national targets towards the MDG targets is 70%, namely towards targets 7A: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources; and 7B: Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss. The MDG targets does not include topics on genetic resources, traditional ecological knowledge, invasive species, genetic diversity and resource mobilization for conservation, as dealt with under the Aichi Targets. 10% of the NBSAP national targets also contributed towards Targets 1A: Halve the proportion of people whose income is less than one dollar a day (between 1990 and 2015); and 1C: Halve the proportion of people who suffer from hunger.

4.0 Recommendation and Conclusion

The implementation of the Convention on Biological Diversity through the NBSAP is a mechanism to the conservation of biodiversity in Tonga. The NBSAP provides the framework for national implementation of biodiversity programme, addressing current and future challenges to reflect broader national development and environmental objectives, and a mechanism for resource mobilization.

In this report, it has been realised that NBSAP has facilitated several institutional and legislative improvements, including the use of environmental impact assessment, integration of biodiversity conservation and sustainable development into their programme, workplan and policy, and the implementation of various project to conserve and use biodiversity more sustainably. Importantly, the NBSAP has also provided the identification of several challenges and constraints, such as limited technical resources, lack of awareness programme, lack of human capacity and lack of financial resources.

Tonga recognises that in order to protect biological diversity we must first understand what biological diversity is present. In the three main areas of the CBD, - conservation of biodiversity, sustainable use of resources, and access to and benefit sharing – the most progress was observed in the former two – conservation and sustainable use. To an extent, this is because both directly relates to livelihoods. Communities were already feeling the impact of past unsustainable practices with the depletion of livelihood resources such as near shore fisheries. Community supports to initiatives aimed at replenishing resources, and reduce unsustainable practices because people could relate to them. The other contributing factor is the availability of project funding including those from GEF, UNEP, UNDP, IUCN, GIZ, SPREP, and of technical support through various Government agencies, principally MAFFF, MLECC&NR, and NGOs.

The lack of progress on access and benefit sharing arising from the use of genetic resources is still an issue under the 5th National report. Many people are unfamiliar with it and there were not any concrete examples of access benefit sharing that people can relate to. Tonga has participated in a regional GIZ-SPREP project on capacity building on Access and Benefit Sharing and it will also participate in a regional UNEP-GEF SPREP Project to support with the ratification and implementation of the Nagoya Protocol. As a result, Access and Benefit Sharing of genetic resources will be improved in the future. Cross-sectoral issues such as waste management and climate change adaptation that have strong biodiversity conservation links were similarly facilitated.

In addition, as to achieve the status of NBSAP implementation and the Aichi Biodiversity Targets for 2020 and contributions to the relevant 2015 targets of the Millennium Development Goal,

there is an identified need for better coordination of activities and a strengthened approach to engage relevant stakeholders in biodiversity conservation and sustainable development activities of NBSAP, improving awareness programme and actively enforces existing laws promoting sustainable management of biodiversity to other scattered islands in Tonga as a way of strengthening support for biodiversity conservation and use, improved monitoring programme, human capacity and external funding.

Nevertheless, the strategy is seen not just as a scientific or technical document but as a tool for management, with the ecosystem approach which bringing together ecological, social and economic perspective as unifying concepts. For example, Marine protected areas, conservation of agrobiodiversity and forestry, integrated management and coastal marines' areas and so forth.

The conservation of marine ecosystem, forestry ecosystems, and agrobiodiversity is not the responsibility of governments and environmental NGO's but the responsibility of every community, every family and every individual. This land was given to us by our ancestors and it is our obligation to pass it on to our children in at least the same state in which we received it.

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Annex 1

Tonga is a party to several international environment agreements of which the EEC is the National Focal Point or the Implementing Agency.

Table 1 : International Agreements signed by Tonga

International Agreement	Date Signed	Date Ratified/Acceded	Role of Ministry
Waigani Convention	16 September 1995	22 May 2002	Focal Point
Agreement establishing SPREP	15 September, 1995		Focal Point
Marine Pollution Convention		1 May 1996	Co-implementing Agency with Marine and Ports
United Nations Convention on Biological Diversity		19 May 1998	IA
United Nations Framework on Climate Change		20 July 1998	IA
Kyoto Protocol		January 2008	IA
United Nations Convention to Combat Desertification		20 July 1998	IA
Vienna Convention for Protection on Ozone Layer		29 July 1998	IA
Montreal Protocol		29 July 1998	IA
London Amendment		26 November 2003	IA
Copenhagen Amendment		26 November 2003	IA
Montreal Amendment		26 November 2003	IA
Stockholm Convention on Persistent Organic	22 May 2002	9 September 2009	National Focal Point

Pollutant			
Protocol to the Convention on the Prevention of Marine Pollution by Dumping wastes		18 September 2003	IA
Cartagena Protocol on Biosafety		18 September 2003	IA, Competent Authority, Clearing House Mechanism
Basel Convention		26 March 2010	IA
Rotterdam Convention		31 March 2010	IA
MOU on Migratory Species			

Table 2: Current legislation affecting the conservation of biodiversity in the Kingdom of Tonga.
(From: GEF-PAS Biodiversity. 2011. Implementing the Island Biodiversity Programme of Work by integrating the conservation management of island biodiversity. United Nations Environment Programme)

Date	**Legislation**
1912	Rhinoceros Beetle Act
1927	The Land Act
1949	Mineral Acts
1970	Quarantine Act
1970	The Continental Shelf Act of 1970
(amended in 1974)	Birds and Fish Preservation Act
1976	Parks & Reserve Act
1978	The Territorial Sea and Exclusive Economic Zone Act
1988	The Plant Quarantine Act, Vol. 4.
(amended in 1988)	Noxious Weeds Act

1989	Fisheries Act
1994	Terrestrial and Fisheries (Conservation and Management) Regulation
2002	Marine Pollution Act
2002	Fisheries Management Act
2002	The Pesticide Act and Regulations, Vol. 4.
2003	Environmental Impact Assessment Act
2005	Waste Management Act
2009	Forest Act Draft
2013	DRAFT Biosecurity Act

Table 3: Information used to prepare this report plus Regulations, Policies and Plans passed since from 2010

I UH – PDC Review of Plans and Policies of Tonga **National land Use Policy – Kingdom of Tonga**
Legislations **National Spatial Planning and Management Act 2012** – Provides for a framework for planning the use, development, management and protection of land in the Kingdom in the public interest and for related purposes
Environment Management Act 2010 – Provides for the establishment of the Environment and Climate Change to ensure the protection and proper management of the environment and the promotion of sustainable development.
Environment Impact Assessment Management Act 2010 – Regulates the procedures relating to an Environment Impact Assessment
Maritime Zones Act 2009 – Makes provision for the establishment of the Maritime Zones of the Kingdom and in the exercise of the sovereign rights of the Kingdom and, the exploration, exploitation, protection, preservation, conservation and management of those zones and for matters concerned with those purposes.
Water Resources Management Bill 2011 – Provides for the management, protection and conservation and conservation of the water resources of the Kingdom of Tonga.

- **Deep Sea Mining Bill ?** – An act to provide for the management of the kIngdom of Tonga's seabed minerals, and the regulation of exploration and exploitation activities within the Kingdom's jurisdiction or under the Kingdom's control outside of the national jurisdiction, in line with the Kingdom's responsibilities under international law.

Policies and Plans

- National Strategic Planning Framework - 2010
- NBSAP
- JNAP
- Nukuálofa Integrated Urban Development Plan
- Urban Infrastructure Development Plan
- National Strategic Spatial Framework
- National Planning and Management Systems – Final Report – 2010
- Agriculture andTourism Linkages in Pacific Island Countries – 2012
- National Water Policy – 2011
- National Water, Sanitation and Climate Outlook – 2011
- Fourth Report: Review of the National Biodiversity Strategy and Action Plan - 2010
- Tonga Energy Roadmap - 2010

National Tsunami Plan 2012 – Disasater Risk Management

Table 4: Total number of household enumerated by the survey from selected villages on Tongatapu.

Name of selected villages	Number of households from biodiversity survey	Number of households from 2011 census	% of HHLDs (enumerated)
Fua'amotu	178	312	57
Ha'ateiho	255	412	62
Hofoa	97	165	59
Houma	185	349	53
Navutoka	116	129	90
Nukunuku	181	343	53
Pea	102	348	29
Tatakamotonga	222	301	74
Total	1336	2359	57

Table 5: Villages and number of household surveyed in 'Eua Island

Name of selected villages	**Number of households from biodiversity survey**	**Number of households from census 2011 census**	**% of HHLD enumerated**
Mu'a village	**1**	**29**	**3**
'Esia	**9**	**32**	**28**
Angaha	**34**	**72**	**47**
Houma	**43**	**58**	**74**
Pangai	**5**	**59**	**8**
Sapa'ata	**12**	**23**	**52**
'Ohonua	**41**	**265**	**15**

Mata'aho	**18**	**48**	**38**
Ha'atu'a	**29**	**89**	**33**
Total	**192**	**675**	**28**

Public consultation schedule

Places	Dates
'Atata Island	24-25/5/2013
Kolovai, Kanokupolu, 'Ahau, Ha'atafu	12/5/2013
Lapaha village	13/5/2013
Vaini village	14/5/2013
Popua village	15/5/2013
Neiafu (Vv)	15/7/2013
Tefisi (Vv)	16/7/2013 (10:00am-11:00am)
Ha'alaufuli (Vv)	16/7/2013 (7:00pm-8:00pm)
Pangaimotu (Vv)	17/7/2013
Niuatoputapu	7/7/2013
Niuafo'ou	8/8/2013
Ha'apai	12-14/8/2013

Table 6. Target harvest species for sea cucumbers resources in Tongan coastal waters

Common Names (Local)	**Local Names**	**Scientific names**
Amberfish	Saieniti	*Thelenota anax*
Black teatfish	Huhuvalu 'uli'uli	*Holothuria nobilis*
Brown sandfish	Mula	*Bohadschia vitienis*
Curryfish	Lomu	*Stichopus hermanni*
Brown spotted sandfish	Finrmotu'a	*B.similis*
Deep water redfish	Telehea loloto	*Actinopyga echinites*
Elephant trunkfish	'Elifanite	*H.fuscopunctata*
Flowerfish	Lomu matala	
Greenfish	Holomumum	*S.chloronatus*
Golden sandfish	Nga'ito	*H.lessoni*

Hairy blackfish	Loli fulufulu	*A.miliaris*
Lollyfish	Loli	*H.atra*
Pinkfish	Loli pingiki	*H.edulis*
Prickly redfish	Pulukalia	*T.ananas*
Snake fish	te'epupulu maka/tu-ngongo	*H.coluber*
Stone fish	Telehea maka	*A.lecanora*
Surf redfish	Telehea kula	*A.mauritiana*
Tigerfish	Matamata	*B.argus*
White teatfish	Huhuvalu hinehina	*H.fuscogilva*
Total		**18 harvesting species**

Table 7. Target harvest and export species for Tuna & Shark Fisheries Resources in Tongan coastal waters

Common Name	**Local name**	**Scientific name**
Albacore tuna	Alapakoa	Thunnus alalunga
Yellowfin tuna	Takuo	Thunnus albacares
Bigeye tuna	Valupuku	Thunnnus obesus
Skipjack tuna	'Atu	Katsuwonus pelamis
Blue marlin	Hakula pulu (blue)	
Black marlin	Hakula 'uli'uli	
Stripe marlin	Hakula matohitohi	
Swordfish	Hakula puaka	
Mako shark	Neiufi	Isurus sp
Blue shark	Aho	Prionace glauca
Oceanic whitetip	La'ila	Carcharhinus longimanus
Sailfish	Hakula la	
Shortbill spearfish		
Dolphin	Mahimahi	Coryphaena hippurus
Opah	Sifisifi	Lampris guttatus
Oilfish	Valu maka	
Wahoo	Valu louniu	
Others		

Table 8. Target harvest and export product for deepwater snapper and grouper fisheries resources (Bottom-line Fisheries) in Tongan coastal waters.

Common Name	**Local name**	**Scientific name**
Flame snapper	Palu tavake	*Etelis coruscans*
Crimson jobfish	Palu hina	*Pristipomoides filamentosus*
Golden eye jobfish	Palu sio'ata	*P.flavipinnis*
Ruby snapper	Palu malau	*E.carbunculus*
Comet groupers	Ngatala pusi	*Epinephelus morrhua*
Eightbar groupers	Mohuafi	*E.octofaciatus*
Trumpet emperor	Manga	*Lethrinus miniatus*
Spotcheek emperor	Ngungutoa	*L.rubrioperculatus*
Bluenose	Bluenose	
Saddle-back snapper	Palu mutumutu	*Paracaesio kusakarii*
Rusty jobfish	Palu polosi	*Aphareus rutilans*
Others (i.e. groupers, snappers, emperors, etc.)	Others (i.e. ngatala, palu, etc.)	*Epinephelua sp, Lethrinus sp*, etc.

Table 9. Target harvest and export for Aquarium trades.

	HYDNOPHORA	TANG FISH	PLEROGYRA
CANTHASTREA	INVERT	TRACHYPHYLLIA	PLEROGYRA SPP
ACROPORA SP	LEPTASTREA	TUBASTREA SPP.	POCILLPORA SP.
ACROPPORA SP	LEPTORIA	TUBIPORA SP.	POLYPHYLLIA
ACTINARIA	LEPTOSERIES	TURPINARIA PELTATA	PORITES
AGGANCIA	LION FISH	WRASSES FISH	PREMIUM
ALVEOPORA SP.	Live Rock	Zooanthus Erythrocloros	PUFFER FISH
ANGLE FISH	LOPOPHYLLIA		SCOLLYMIA
ANTIPATHARIANS (B/CORAL)	MADRACIS SPP	DIPLOSTREA	SERIATOPORA
ASTREOPORA	MARICULTURED CORALS	DISCOSOMA	SINULARIA
BARBATTOIA	MERULINA	ECHINOPHYLLIA	SLAP
BLASTOMUSSA	MICROMUSSE	ECHINOPORA	SOFT CORAL
BRANCH	MILLEPORA SP.	EUPHYLLIA SP.	SOLID
BUTTERFLIES	MISCELLINIOUS	FAVIA SP.	STYLASTER
CAULASTREA FURCATA	MONASTREA	FAVITES ABDITA.	STYLOPHORA
CLADELLA	MONITIPORA SP.	FOLIOSA	STYLOPHORA SPP
CLAMS	MONTASTREA	FUNGIA	SYMPHYLLIA

CLOWN FISH	MYCEDIUM	GALAXEA SP.	
CONIAPORA	OTHER LIVEFISH	GONIASTREA SP.	
CYNARINA	OXYPORA	GONIOPORA SP.	
CYPHASTREA	PACHYSERIES	HAWK FISH	
DAMSEL FISH	PAVON	HELIOPORA	
DENDROPHYLLIA SP.	PECTINIA	HEMEROMENTRA	
DEPLOSTREA	PLATYGYRA DEODALEA.	HUMUHUMU FISH	

Table 10: List of target marine product recorded at Fisheries Database for home consumption purpose

Common Name	Form of the production	Comments
Fin fishes	Reef fishes (Frozen, dry, smoked, fresh, salted and cooked), Tuna species (fresh, frozen, cooked).	Fin fishes production included reef fishes (inshore fisheries resources) and tuna and deepwater snapper and groupers species (offshore fisheries resources).
Crustaceans	Lobster species (cooked and frozen), mud crabs (cooked and frozen), coconut crabs (cooked).	
Holothuria	Snakefish, dragonfish, lollyfish and chalkfish	All these sea cucumbers species harvested for home consumption locally whereas snakefish and dragonfish only collected internal organ but lollyfish and chalkfish cut the body wall in pieces which consume raw.
Molluscs	Octopus species (cooked and frozen), shellyfish (fresh).	
Shellfish	Giant clam species (frozen, fresh and cooked, anadara shellfish (frozen and fresh), trochus species (cooked and frozen), greensnail species (cooked and frozen), slender chiton shellfish (cooked), mussels (frozen)	CITES listedspecies were very restricted to send to Australia and only 15 kg of any marine species allowed for each person or passengers travel to Auastralia.

Agrobiodiversity

Table 11: Food Crops Species

Food Crops Species	Variety (sub-Variety)	Recent Introduction
Yam *(Dioscorea alata)*	Kahokaho (kulufau,hako,vai,tavake,siamane,tefau,muihina,'ulumaka)	Hawaii (mangamanga, 'ululoa),Panama,Lose, Lavelio,Kina,Pita
	Kaumeile (hina,'uli,kulo,punuluo,hako,puku,pekavalu,laukoka,toua,va'ekuli, 'Eua)	
	Kivi (kula,hina,hako)	
	Kulo (hina,kula,hako,kau,matapoko)	
	Kafiu (kula, punailave)	
	Kapakau'ikava (kapakau'ikava,muihina)	
	Koukau (hina,kula)	
	Heketala (hina,kula,fisi,palau,puku,loloa,vai)	
	Laumahi (hina,kula)	
	Lausi (hina,kula)	
	Lokoloka (kula,hina,mangavalu)	
	Mahoa'a (puku, leleva,lotuma,tausi)	
	Mamange (kula,hina)	
	Malau (tu'a,melie)	
	Palai (palai,tu'akuku)	
	Ngu (vaikula,pakata,tupakata,kafakafa,kia'imoa,puku)	
	Sikau (felefele,tulao)	
	Sivoli (hina,kula)	
	Sikovata (hoi,fulufulu)	
	Poa (hina,kula)	
	Solomone (hina,kula)	
	Tamuni (hina,kula,kau)	
	Tua (hina,kula,vai,maka,'ata,'atavai,'atakafiu)	
	Ufi-fisi (hina,kula,langakali,matanikali)	
	Vesivesi (hina,kula,hako,puku,felei,puhipuhi)	
	Voli (hina,kula,hako,leka)	
	Palai,Lena,Levei,Nise,Nuku,Paholo,Palangi,Palatea,Punailave	
Sweet Yam *(Dioscorea esculenta)*	Puku,Vai,Kula,Mo'ata,Lavilavi (hina,kula),Fie'ufi,Kauhola,Heke,'Ulu'ikuma, Lotuma	
Giant Taro (*Alocasia macrorrhiza)*	Talo, Kula, Hina, Laukoka, 'Uli, Fuotavahi, Fohenga (fohenga,'uli,enga), Tu'u, Fulai	Ha'amoa
Taro *(Colocasia esculenta)*	Lau'ila (hina,'uli), Manu'a (hina,'uli), Manga (siva,koka), Mumu, Futuna, Sikavi (hina,'uli), Vahe mangamanga,tu'utaha),	Niue, Fisi, Haamoa, Hulimama'o >40 accessions
Tannia *(Xanthosoma sagittifolium)*	Mahele'uli,Kula,Tea,Panefu,Tofua,Lahelahe	
Sweet Potatoes (*Ipomoea batatas)*	Teiko, Tongamai, Vai, Kula, Lesi, 'Eua,Palu (hina,kula),Siale (hina,lau'ila), Silika,Hawaii, Tolumahina,Halasika,Kaloti	Papua,Hawaii kolosi, Setaita, Melefakahau, Xadu,Lafalafa, Forget >40 accessions

Cassava (*Manihot escelenta)*	Mataki'eua, Tano'a, Lepa (kula, hina), Silika, 'Akau, Koka'anga, Leka (hina,kula),Fala'oa,Engenga	Fisi (puku,hako),Papua
Potato *(Solanum tuberosum)*		Sequoia,Red Pontiac,Desiree
Plantain (Musa paradisiaca)	Feta'u (kula,'ulu'ikuma), Tu'utu'u-kau-tala,Lehia,Potalinga (hina,kula),Manu'a,Uhotaha,Tateau,Vaivai (puku,hako),Tokoni vai, Misipeka	>7 acessions
Banana (Musa sapentium)	Tonga, Haamoa,	>15 accessions, Ducasse Cavendish,Sucrier
Musa spp	Tea, Kula, Mamae,Tonga,Lahelahe,Pikipiki hina	Pata Kolosi
Breadfuit (*Artocarpus altilis)*	Kea (tala,molemole), 'Aveloloa, Kulufau, Puou, Loutoko, Maopo, Ma'ofala	Fisi
Orange *(Citrus spp (grandis, reticulate, hybrid,sinensis))*	Molitonga, Molipeli, Molipeli fuoiiki, Moli Vaikeli, Molikai,	Pommelo,grapefruit, Kumquat,Tangelo
Lemon *(Citrus spp limon, aurantifolia,aurantium)*	Lemani (petepete,molemole), Laimi,Kola,	Tahiti Lime
Mango *(Mangifera indica)*	'Akau,Kaimata,Lesi,Kalasini,'Apele,Hopa	Bowen,Hawaii,Tahiti
Pacific Lychee *(Pometia pinnata)*	Hina,Kula,Moli	
Pineapple *(Ananus comosus)*	Tonga,Haamoa	
Pacific chestnut *(Inocarpus edulis/fangifer)*	4 x "Ifi" Varieties	
Papaya *(Carica papaya)*	Tonga,Meleni	Sunrise,Waimanalo
Soursop *(Annona muricata)*	'Apele 'Initia	Star apple,
Coconut *(Cocos nucifera)*	NiuVai,Kafa,Ta'okave,Mata Kula,'Utongau	Red Malayan Dwarf
Malay Apple *(Syzygium malaccense)*	Fekika	
Polynesian Plum *(Spondias dulcis)*	Vi Fua fuopotopoto, Fua fuololoa	
Guava *(Psidium guajava)*	3 x "Kuava" Varieties	
Island Cabbage *(Ablemoschus manihoy*	Laufuopotopoto, Laumahaehae,Kula	
Water melon *(Citrullus lanatus)*		Imported Exotic varieties
Vegetables		Imported Exotic Varieties
Squash *Cucurbit spp)*		Imported Exotic Varieties

Table 12: Livestock

Livestock	Local Breed	Imported New Breed
Pig (*Sus scrofa domesticus)*	Tonga	Large White,Landrace,Duroc
Poultry (*Gallus domesticus)*	Tonga	Rhode Island Red (meat),White Leghorn (broilers)
Cattle (*Bos primigenius)*		Brahman,Santa Gertrudis,Hereford, Friesian (milk)
Horses (*Equus ferus caballus)*	Tonga	
Goat (*Capra hircus)*	Tonga	Anglo Nubian
Ducks (Anas platyrhynchos domesticus*)*	Muscovy	
Sheep (*Ovis aries)*		Fantastic hybrid

Table 13: The MAFFF/SPC/ACIAR: HORT-2006-173 Fruit Tree Genetic Improvement project target on producing seedlings from local species, exotic species at Vaini Research Station and from imported exotic species from Australia.

Fruit Tree Seedling Species 2008 (Tokomololo Forestry Nursery)	Fruit Tree Seedling Species 2011 (Tokomololo Forestry Nursery)	Fruit Tree Species (Vaini Research Station)
Avocado	'Ai	Ambarella *Spondias edulis*
Beetle nut	'Apele initia	Avcoado (alligator skin) *Persea americana*
Beach cherry (AUS)	'Apele Tonga	Black sapote *Diospyros digyna*
Black sapote	'Avoka kula	Brazilian cherry *Eugenia brasilensis*
Bread fruit (local)	Apele fetu'u	Cherimoya *Annona cherimola*
Cactus pitaya (AUS))	Apiu	Cola *Citrus spp*
Canarium (PNG)	Avoka lanumata	Cucumber tree (bilimbi) *Averrhoa bilimbii*
Citrus cola (Philippine)	Fekika	Galip nut *Canarium indicum*
Citrus orange (Tonga)	Kulamasama	Guava pear *Psidium guajava*
Citrus lime (Mexican)	Kakatisi (pot)	Guava *Psidium guajava*
Citrus lime (Tahitian)	Kalepi	Hybrid lemon/grapefruit *Citrus spp*
Citrus grapefruit (local)	Kamquat	Hybrid Manderin *Citrus spp*
Coffee	Kofi	Hybrid Orange *Citrus spp*
Granadilla (AUS)	Koko	Jack fruit *Artocarpus heterophyllus*
Granadilla (local)	Kola *Kolosi*	Lime *Citrus aurantifolia*
Grumachama (AUS)	Kuava	Longans *Dimocarpus longana*
Guava	Laimi	Lychee *Litchi chinensis*
Jackfruit	Laisii	Macademia nut *Macademia integrifolia*
Logans	Lemani petepete	Mamey sapote *Pouteria sapota*
Lychee	Longani	Mango *Mangifera minor*
Macademia nut	Laimi fakaaka	Mulberry
Malayan apple (fefika)	Laimi tahiti	Peaches
Mamey Sapote	Mango	Peanut tree
Mango (Australia)	Mei fisi	Pomelo *Citrus maxima*
Mango (kai mata)	Mei puou	Rambai *Baccaurea motleyana*
Mangosteen AUS	Meimafala	Rollinia *Rollinia deliciosa*

Mangosteen (yellow)	Mei 'Initia	Santol *Sandoricum koetjape*
Pacific lychee (tava)	Moli Fisi	Sour cumquat *Citrus spp*
Papaya (waimanaro)	Moli inu	Soursop *Annona muricata*
Passion fruit (local)	Moli mango	Star apple *Chrysophyllum caimito*
Passion fruit (purple)	Moli peli	Star fruit sour *Averrhoa carambola*
Passion fruit (yellow)	Moli Vaikeli	Star fruit sweet *Averrhoa carambola*
Peanut tree	Nati	Tahitian Lime *Citrus spp*
Soursop (Aus)	Pasiole	White sapote *Casimora edulis*
Spondias import (Vi)	Pasione	
Starfruit (sour)	Pinati akau	
Star fruit (sweet)	Pomikanite	
Star apple	Sapote hinehina	
White sapote	Sapote Uliuli	
	Tapa nima mahi	
	Tapa nima melie	
	Tava Kula	
	Telie	
	Vaine	
	Vi	

Table 14: Tonga Community Development Trust Project Status

Project Status	**Project Title**	**Proponents' Name**
Completed May 2012	Lifuka and Foa Coastal Management Project	Tonga Community Development Trust
On-going	Tatakamotonga Coastal Protection and Muinahafu Community Based Conservation Area Project	Kalapu Kolokakala Incorporated
On-Going	Protecting 'Eua's Biodiversity	Eua Youth Congress
On-going	Lagoon For Generations	Halaleva Youth Group
Completed May 2012	Fonuatanu Tree Planting	Lapaha Women in Development
On-going	Youth Conservation and Environmental Stewardship	Tonga National Youth Council
On-going	E-Waste Tonga: A project to Keep POPs and Other Hazardous Materials Contained in Electronic Waste Out of Soil, Air and Waters of Tonga	Tupou Tertiary Insitute
On-going	Community Based Resource Management in Atata's Coastal Special Management Area	Atata Community

On-Going	Community Based Resource Management in Ovaka's Coastal Special Management Area	Komiti Fakakolo 'A Ovaka
On –going	Community based resource management in Felemea's Coastal Special Management Area	Komiti Toutai a Felemea
Funding ends Dec 2012	Kolovai's Climate Change Nature Calling Project	Kalapu Toa Ko Pouvalu (MCGA)

Table 15: GIZ: Food trees and tree replanting at Nakolo

2012		2013	
Pine	171	Pine	163
Sandalwood	41	Sandalwood	66
Coconut	37	Coconut	65
Breadfruit	21	Breadfruit	29
Polynesian plum	5	Polynesian plum	4
Plantain banana	33	Plantain banana	387
Canarium harveyi	13	Canarium harveyi	11
Avocado	5	Avocado	5
Orange	12	Orange	20
Peanut trees	14	Peanut trees	14
Star apple	11	Star apple	11
Tropical almond	3	Tropical almond	3
Sour soap	4	Sour soap	4

Table 16: Crops replanting at Nakolo

Crops	**Total**	**Block numbers**	**Proposed harvest dates**
Cassava (3 varieties)	1679	3,4,5	June - ongoing
Plantain (crossed variety) – Hopa	74	14	September - ongoing
Plantain Banana	387	2	ongoing
Giant taro	259	11	August
Paper Mulberry	185	9	December
Kava	156	16	December 2014
Taro (3 varieties)	5605	7,8,15,16	August
Tongan Taro	340	12	May
Pele	30	Beside track	ongoing
Kumala (sweet potato)	428	1	September
Yam	To be planted	6	