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Land Degradation Neutrality Strategy of Tuvalu









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LIST of ACCRONYMS

FAO	Food and Agriculture Organization
GEF	Global Environmental Facility
GM	Global Mechanism of the UNCCD
IPCC	Intergovernmental Panel on Climate Change
ISP	Island Strategic Plans
LDN	Land Degradation Neutrality
NAP	Tuvalu's National Action Programme to combat Land Degradation
NLUP	National Land Use Policy
SDG	Sustainable Development Goal
SIDS	Small Island Developing States
TSP	Target Setting Programme
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

Tuvalu is the fourth smallest independent state in the world one of the most vulnerable countries in the world to climate change and rising sea levels[1]. Climate change vulnerability is intensified by land degradation. Addressing these challenges that Tuvalu is facing requires urgent and collaborative action to attain a "**A peaceful, resilient and prosperous Tuvalu**"[2].

As signatory of the United Nations Convention to Combat Desertification (UNCCD), Tuvalu developed a National Action Plan (NAP) to combat land degradation and drought in 2006[3], prior to the introduction of the Land Degradation Neutrality (LDN) concept in 2015. UNCCD Parties were then invited to set voluntary targets to achieve LDN, based on their national circumstances and development priorities. To date, the LDN concept had not been introduced in Tuvalu, and the LDN strategy aims at filling this gap.

The objective of the LDN Strategy presented here is to provide a guiding policy framework for addressing land degradation and achieving LDN in Tuvalu. Recognizing the link between land degradation and climate change vulnerability, Tuvalu's LDN strategy highlights the urgent need for the nation to act in an integrated and proactive way to combat land degradation, thereby reducing its vulnerability to climate change.

The LDN strategy was developed in consultation with key national stakeholders and informed by a national workshop on Land Degradation and Land Degradation Neutrality Strategy, held in Funafuti from January 7–9, 2025. During the workshop, stakeholders identified preliminarily key drivers of land degradation and formulated LDN targets and measures. LDN targets reflect the country's ambitions to combat land degradation and achieve LDN and associated measures are the means to fulfil them. Local consultations on main land degradation issues were conducted in two Northern and Central islands: Nanumanga and Nui. The strategy was subsequently reviewed and refined through further stakeholder consultations.

This document is a combination and contains elements pertinent to a National Action Programme and a country report of the Land Degradation Neutrality Target Setting Programme. The LDN Strategy in Tuvalu has been formulated following the guidelines of the UNCCD LDN Target Setting Process (TSP) and drawing on the experiences and lessons learned from other countries, particularly Small Island Developing States (SIDS). The LDN strategy provides these elements recommended from the global UNCCD guidelines for setting voluntary LDN targets which include establishing national baselines, setting voluntary LDN targets, and defining measures to achieve them. The strategy also includes an analysis of current policies related to LDN, a summary of findings from the FAO Collect Earth (2024)[4] assessment, a deep analysis of land tenure, a participatory mapping of land degradation in all islands, and a participatory analysis of climate change disasters risks.

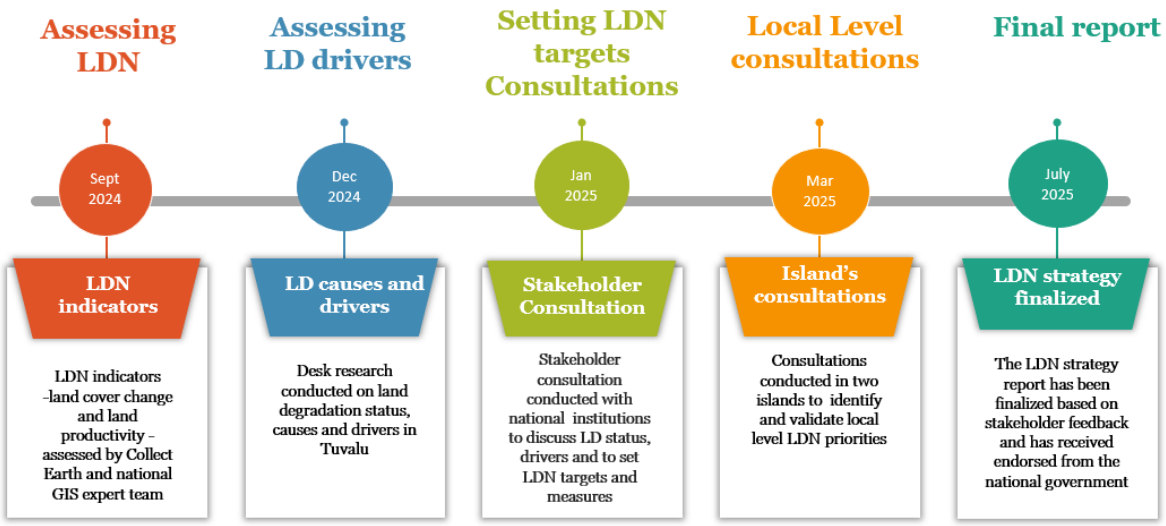
The LDN strategy has been formulated with the support of the GEF-funded project *Integrated Agro-ecosystem Approach for Enhancing Livelihoods and Climate Resilience in Tuvalu* implemented by FAO. The

[1] Tuvalu National Strategic Action Plan for Climate Change and Disaster Risk Management 2012–2016
[2] Tuvalu's National Strategy for Sustainable Development for 2021-2030 overarching theme.
[3] Tuvalu NAP : https://www.unccd.int/sites/default/files/naps/tuvalu-eng2006.pdf
[4] FAO Collect Earth Estimation of two LDN indicators in Tuvalu. FAO GEF Project: Integrated Agro-ecosystem Approach for Enhancing Livelihoods and Climate Resilience in Tuvalu.

project aims to reverse land degradation, enhance local livelihoods and increase climate resilience through an Integrated Agro-Ecosystem Approach (IAE) in all the islands of Tuvalu. The strategy has also received technical collaboration from the Global Mechanism of the UNCCD.

The process for developing the LDN strategy was participatory and was conducted following and adapting the LDN target setting process (See **Figure 1**.)

Figure 1. LDN setting process in Tuvalu



The development of the LDN strategy commenced in September 2024, with a workshop facilitated by Collect Earth to assess the national land use change and land productivity indicators in Tuvalu. This was followed by a comprehensive analysis of land degradation causes and drivers, conducted prior to and during a national stakeholder workshop held in January 2025. The national stakeholder consultation gathered main institutions related to environment, agriculture, fisheries, as well as the private sector, NGOs and women representatives Subsequently, validation consultations were carried out on two islands to refine and confirm the LDN targets and measures. As a result, the current LDN strategy encompasses a detailed analysis of the national context, along with the formulated LDN targets and measures in agreement with relevant national institutions.

2. National environmental, socio-economic and institutional context

2.1 Tuvalu's country profile

2.1.1 Geography

Tuvalu is a Small Island Developing State country (SIDS) in the Pacific classified by the United Nations as one of the Least Developed Countries (LDC). It is one of the most environmentally fragile states due to its low-lying characteristics, geographical isolation and remoteness, limited land-based natural resources and climate change vulnerability. Tuvalu is one of the smallest nations on the planet consisting of nine small inhabited low-lying limestone islands and atolls with a total land area of approximately 26 km²[5].

Tuvalu is one of the five nations in the world composed entirely of coral atolls: low-lying, sandy islands typically only a few meters above sea level. Tuvalu comprises five classic "true atolls" with reef islets encircling a shallow lagoon (Nanumea, Nui, Nukufetau, Funafuti and Nukulaelae); three small-raised limestone islands with no central lagoon but with small remnant landlocked "fossil" lagoons (Nanumanga, Niutao, Vaitupu, and Niulakita; and one composite island (coralline atoll/table reef) (Vaitupu)[6].

The nine islands extend over a distance of about 570 km from Nanumea in the northwest to Niulakita in the southeast. These islands are scattered over an ocean area of about 1.3 million km². Atoll nations have been framed by global media as "sinking islands," the first nations to disappear entirely as a result of rising seas [22].

The capital island, Fongafale Islet is located on Funafuti Atoll, a typical atoll with a lagoon of approximately 18 km in diameter. While Funafuti faces development pressures, Tuvalu's remaining islands are more pristine and isolated, they are the classic South Pacific landscape of coconut palms and turquoise waters.

2.1.2 Population

Tuvalu has been settled for over 2000 years by Polynesians, who, based on linguistic affinity and oral history, were most likely from Samoa and Tonga. The Tuvaluans are 96% ethnic Polynesian. Tuvalu's islands are characterized by rich cultural traditions, beautiful and friendly people and a rich cultural heritage across the islands.

European traders settled in the late 1800s, and in 1892, Tuvalu became part of the British protectorate of the Ellice Islands. During pre-European-contact times there was frequent canoe voyaging between the nearer islands and eight of the nine islands of Tuvalu were already inhabited. The Ellice Islands were administered by Britain as part of a protectorate (1892-1916) and as part of the Gilbert and Ellice Islands Colony (1916-74). During World War II, the United States built airbases on the islands of Funafuti,

[5] https://pacific.un.org/en/about/tuvalu

[6] Islets (motu in Polynesian and Tuvaluan) are smaller islands that encircle, border (on reefs) or are found within a lagoon of the main atoll island. The Tuvalu group therefore encompasses true atolls, islets (motu), and individual, separate low-lying limestone reef islands that have no lagoon or may have "secondary" or remnant "fossil" lagoons on the actual limestone island or islets (Thaman 2008 in The Flora of Tuvalu [18]).

Nanumea, and Nukufetau and several thousand American troops were in the islands. Tuvalu gained its independence from the British in 1978.

The country has a population of 10 875 inhabitants, 61.7% is urban and 38.3% is rural population[7]. Most population is concentrated in Funafuti, (61.7% percent of the nation's population) which is a typical atoll characterized by a discontinuous string of islets surrounding a lagoon. Funafuti has 6,320 inhabitants (2017 Census)[8] living in Fongafale Islet[9], which is a long narrow strip of land, 12 km long and between 10 and 400 m wide. While the entire country has a population density of 409.9 persons/km² (2017), Funafuti has a population density of 4300 persons/km².

The amount and proportion of Tuvalu's population in Funafuti and outer islands is shown in **Table 1**:

Table 1. Population in Tuvalu (HIES 2022-2023)

	Population	Proportion
Tuvalu	**10 875**	**100.0%**
Main island	6 710	61.7%
Outer islands	4 165	38.3%
Outer islands	**4 165**	**38.3%**
Nanumea	546	5.0%
Nanumaga	261	2.4%
Niutao	669	6.1%
Nui	481	4.4%
Vaitupu	1 062	9.8%
Nukufetau	740	6.8%
Nukulaelae	407	3.7%

Although population between 2012 and 2017 has increased in Funafuti, in all other islands it has decreased. The expansion of settlement in Funafuti is a driver of land degradation and will be further discussed.

The area and population of each atoll in Tuvalu are shown in *Table 2*. Tuvaluans are migrating, there is a net migration of -323 (2023) and a negative annual population growth (-1.8%) [10]. According to the Central Statistics Division (CSD, 2021), the 2017 Census estimated a total population of 10.645 people and 1.626 households across Tuvalu. This represented a decrease of 1.3 percent in the population count and a 7.7 percent reduction in the number of households compared with results from the 2012 Population and Housing Census. This responds to several factors, including the existing challenges posed by climate change, limited land-based resources, land degradation, and constraints for agriculture development.

Table 2. Area and population of Tuvalu's islands.

[7] Monetary-based hardship in Tuvalu: https://www.spc.int/digitallibrary/get/f4biw
[8] City Population data https://www.citypopulation.de/en/tuvalu/
[9] "Funafuti" is also used to refer to Fongafale Islet.
[10] World Bank data https://data.worldbank.org/country/tuvalu

Atolls

The population of the atolls of Tuvalu by census years.

For 1979 and 1985, the enumerated population (including visitors) is tabulated; later figures refer to the enumerated resident population.

Name	Abbr.	Area A (hect)	Population Census (C) 1979-05-27	Population Census (C) 1985-06-01	Population Census (C) 1991-11-17	Population Census (C) 2002-11-01	Population Census (C) 2012-11-04	Population Census (C) 2017-11-12
Funafuti	FUN	279	2,120	2,810	3,576	3,962	5,436	6,320
Nanumanga (Nanumaga)	NMG	278	605	672	644	710	551	491
Nanumea	NMA	387	844	879	817	855	612	512
Niulakita	NLK	42	65	74	75	2	46	34
Niutao	NIT	253	866	904	748	817	694	582
Nui	NUI	283	603	604	605	610	729	610
Nukufetau	NKF	299	626	694	740	701	666	597
Nukulaelae	NKL	182	347	315	349	392	364	300
Vaitupu	VAI	560	1,273	1,231	1,196	1,310	1,542	1,061
Tuvalu	**TUV**	**2,563**	**7,349**	**8,229**	**8,750**	**9,359**	**10,640**	**10,507**

(1979) A Report on the Results of the Census of the Population of Tuvalu 1979.
(1985) Britannica Book of the Year 1988.
(1991) (2002) (2012) (2017) Tuvalu Central Statistics Division / SPC Statistics for Development Division.

Source : https ://www.citypopulation.de/en/tuvalu/

In addition, a summary of population, households and the agriculture sector of the 2017 Census is found in *Annex1*. The Census shows, for instance, that 90% of households (totalling 1.464) are engaged in agriculture.

2.1.3 Ecosystems and vegetation

The most widespread vegetation type in Tuvalu is coconut-dominated agroforest or woodland. Abundant coconut trees (*Cocos nucifera*) are present in all islands, in extensive plantations, and trees such as breadfruit trees (*Artocarpus altilis*) provide shade in home gardens. Due to increasing population and urbanization, houseyard gardens are one of the most widespread vegetation types, especially on Fongafale Islet and island's villages. These trees provide shade, maintain humidity, contribute organic matter and enrich the soil with essential nutrients, creating a cooler micro-climate that is important to Pacific subsistence.

According to research of the flora of Tuvalu [18], the total number of vascular plant species that have been recorded at some time on Tuvalu, including all indigenous and introduced species, is about 362 species or distinct varieties, of which only about 59 (16%) are possibly indigenous. The remaining 303 species (83% of the flora) are non-indigenous species that have been introduced by humans, some of which may have been at one time or another early aboriginal introductions. There are no endemic species that are unique to Tuvalu, with almost all of the indigenous plants being widespread, easily dispersed coastal species that have the ability to cope successfully in the harsh atoll environment.

Tuvalu has also a variety of ecosystems, summarized in Table 3.

Table 3. Ecosystems and vegetation of Tuvalu

Ecosystem	Main characteristics	Species
Coastal littoral forest and scrub	Vegetation growing on the outer coastline directly facing the sea. Found mainly on uninhabited islets along both exposed ocean and more	▪ The dominant tree is tausunu (*Tournefortia argentea*), shrubs gasu (*Scaevola taccada*) and gie (Pemphis acidula).

	protected lagoon coasts and on coastlines bordering passes between the ocean and lagoon.	▪ Other important trees include kanava (*Cordia subcordata*), pua (*Guettarda speciosa*) and talie (*Terminalia samoensis*). ▪ Common understory herbaceous include the fern maile (Microsorum grossum), the sedge mouku milimili taliga (*Fimbristylis cymosa*), and the grasses Lepturus repens and Thuarea involute. ▪ Common vines include fue (*Ipomoea pes-caprae*), fue or fue kena (Ipomoea macrantha), legumes *Vigna marina* and *Canavalia cathartica*, both known as saketa, and fetai (*Cassytha filiformis*)
Inland Broad-leaved woodland	Broad-leaved woodland mainly in the central portions of atolls islets. Found mainly in small stands or as scattered trees on uninhabited reef islets (motu) (rare on Funafuti)	▪ Dominant species are puka vai (*Pisonia grandis*) and puka vaka (*Hernandia nymphaeifolia*) ▪ Other common to uncommon species: fala (*Pandanus tectorius*), pua (*Guettarda speciosa*), kanava (*Cordia subcordata*), tausunu (*Tournefortia argentea*), fao (*Ochrosia oppositifolia*), fetau (*Calophyllum inophyllum*), milo (*Thespesia populnea*) and futu (*Barringtonia asiatica*). ▪ Smaller trees or shrubs include fou tangata (Pipturus argenteusi), ogoogo (Acalypha grandis), valovalo (Premna serratifolia), nonu (Morinda citrifolia) and gasu (Scevola taccada). ▪ Important understory species include the ferns laukatafa (Asplenium nidus), sulufe (Nephrolepis acutifolia) and maile (Microsorum grossum); the sedge mouku milimili taliga (Fimbristylis cymosa); and the grasses Lepturus repens, Stenotaphrum micranthum and Thuarea involuta, all known generally as mouku (Woodroofe 1991; Thaman et al. 2013).
Mangroves and wetlands	Mangroves are found along lagoon flats or in back-beach basins. Mangroves occur on all Tuvalu's atolls, except Nukulaelae.	▪ Common mangrove: *Rhizophora stylosa* ▪ Red-flowered mangrove, sagale or hagale (Lumnitzera littorea) (only on Nanumaga, Niutao, Nui and Vaitupu).
Coconut woodland and agroforest	Agricultural lands dominated by the coconut palm, niu (*Cocos nucifera*). The most widespread vegetation type in Tuvalu is coconut-dominated agroforest or woodland.	▪ The most common woody species are pua (*Guettarda speciosa*), gasu (*Scaevola taccada*) along with ogoogo (*Acalypha grandis*), fou tagata (*Pipturus argenteus*) and nonu (*Morinda citrifolia*). ▪ Important understory species include the ferns laukatafa (*Asplenium nidus*), sulufe (*Nephrolepis acutifolia*) and maile (*Microsorum grossum*), the sedge mouku milimili taliga (*Fimbristylis cymosa*), and grasses.
Village Houseyard and Urban gardens	These include houseyard gardens around family dwellings and workplaces; landscaping at hotels, schools,	▪ Houseyard and urban gardens are a mixture of a wide range of planted indigenous and non-indigenous trees, shrubs, vines and other perennials and some short-term annual plants, plus many non-planted wild

	government and non-government developments; and lawns, hedges and living fencing and street trees and other roadside plantings.	or weedy species. They include coconut, bananas , breadfruit, pawpaw, pandanus, figs, etc.
Taro and pulaka gardens	Excavated Taro Pits (pela) are unique, specialized and highly modified communal garden areas found in the central parts of the larger atoll islets, normally near the main settlements.	▪ The main crop planted in the pela are the giant swamp taro, pulaka (*Cyrtosperma chamissonis*), and common taro (*Colocasia esculenta*). ▪ Bananas and plantains (*Musa cultivars*) are planted in contiguous stands bordering the pits. ▪ Sugarcane and tolo (Saccharum officiarum), are also planted along the margins of these gardens.
Summarized by Bastidas S., from: THE FLORA OF TUVALU: LAKAU MO MOUKU O TUVALU R. R. Thaman. Smithsonian Institution Scholarly Press. Atoll Research Bulletin No. 611 - 17 October 2016		

According to the NAP (2006) [1] and to the Rapid Biodiversity Assessment of the Conservation Status of Biodiversity and Ecosystem Services in Tuvalu conducted in 2016 [9] indigenous terrestrial flora of Tuvalu is very poor, highly disturbed and now numerically dominated by introduced exotic species. Terrestrial vascular plants account for about 362 species, of which only about 59 (16%) are possibly indigenous.

The marine environment of Tuvalu is comprised of six major ecosystem types (oceanic, outer reef, lagoonal backreef, lagoon floor, patch reefs and natural channels between the ocean and lagoon). These ecosystems are composed by a great diversity of fish, finfishes, rays, eels, dolphins, whales, lobsters, shrimps, jellyfishes, corals and other invertebrates, algae, plankton, and reptiles. Approximately 30 common species of corals and over 350 species of fish characterize the marine ecosystems of the country. Marine ecosystems are used as sediment for island building and for land reclamation.

2.1.4 Land use systems and agriculture in Tuvalu

According to the assessment done by Collect Earth (2024), land use in Tuvalu shows a prevalence of cropland (58%) and forest (22%), followed by settlement (13%). Under forests, there are mangroves, coastal vegetation and broad-leaved woodland (Table 4.).

Table 4. Land use distribution (2000-2015)

LU – Land Use	Area (HA)	Proportion (%)
Forest	596.1	22.6
Cropland	1,551.4	58.6
Grassland	30.6	1.2
Settlement	355.4	13.4
Otherland	30.6	1.2
Wetland	84.1	3.2

Source: FAO, 2024. Collect Earth Estimation of two LDN indicators in Tuvalu. [25]

Subsistence agriculture is prevalent in Tuvalu, as most people cultivate plants primarily to meet their own needs. Approximately 75% of the population of Tuvalu is involved in subsistence farming. Main cultivated crops are banana coconut, pawpaw, breadfruit, toddy, pandanus, swamp taro, taro, pumpkin and cabbage (See Annex 1.). While domesticated animals such as pigs, chickens, and ducks are raised, marine resources provide the primary source of protein, with an estimated 60% of the population engaged in fishing [5].

Regarding agricultural production, the Tuvalu Agriculture and Fisheries Report based on the 2017 Census (Central Statistics Division of the Government of Tuvalu (2021)[11], found that:

- Of the 1.626 households nationally, 1.464 (90 percent) reported some type of agricultural activity, including livestock raising (reported by 84 percent of all households), crop growing (69 percent), buying or selling fish (60 percent) and handicraft production (35 percent).
- In outer Islands, over 95 percent of households engage in agricultural activities of some kind. Raising livestock and crop production are the main agricultural activities in Tuvalu, and many households are engaged in mixed farming activities, i.e. in at least two or more of the sub-sectors of livestock raising, crop production, fishing or handicraft production.
- The vast majority of households engaged in agriculture were subsistence producers, that is, the produce grown by the household was primarily for the household's own consumption.
- The number of households raising livestock or poultry, growing crops and producing handicrafts all decreased significantly between 2012 and 2017. In the livestock sub-sector, the proportion of households raising pigs reduced from 81 percent of all households in 2012 to 76 percent in 2017, households raising chickens decreased from 54 percent (2012) to 42 percent (2017) and households raising ducks fell from 15 percent of all households in 2012 to 9 percent (2017).

2.1.5 Macroeconomy, Socio-economic conditions and livelihoods

Tuvalu is an upper middle-income country with a GNI per capita of AUD 10,144 in 2022 (HIES, 2024). The socio-economic conditions of Tuvalu are shaped by its geographic isolation, small population, limited arable land and natural resources, and vulnerability to climate change.

Tuvalu's economy is largely concentrated in its capital, Funafuti. With minimal local industry, Tuvalu's economy is sustained by aid, remittances, public sector, and fishing license fees from international vessels [22]. The nation's Gross Domestic Product (GDP) was estimated at USD 45 million in 2021 (IMF, 2022), with a per capita GDP of USD 3,800 (WB, 2022).

The primary industries include fishing, which significantly contributes to government revenue through licensing fees, and copra (dried coconut meat) production. Despite these sectors, Tuvalu faces challenges

[11] The Tuvalu Agriculture and Fisheries Report (done by the Central Statistics Division of the Government of Tuvalu)[11] provides a comprehensive analysis of the agricultural data derived from the 2017 Population and Housing Census. The Census provides an assessment of the current state of the agriculture sector in Tuvalu, including information on the characteristics of the households engaged in the agriculture sectors and its subsectors.
https://www.fao.org/fileadmin/templates/ess/ess_test_folder/World_Census_Agriculture/WCA_2020/WCA_2020_new_doc/TUV_REP_ENG_2017.pdf

like high unemployment rates, which are generally estimated at around 40% (Asian Development Bank, 2020). The economy is highly susceptible to external shocks, such as fluctuations in global fish prices and climate-related impacts. Employment is almost exclusively within the public (government) sector, on projects financed by international aid, and through private sector activities such as small businesses.

The private sector growth is limited and mostly hindered by a lack of infrastructure and investment. The important sources of household income include the selling of fish, seafaring (under international shipping agreements) as well as property income and remittances [2]. A large portion of the households relies on subsistence agriculture for food, growing crops like coconut, babai (swamp taro), taro, breadfruit, and a few other tropical fruits and vegetables. Small-scale, backyard gardening is also common, with people cultivating bananas, papayas, pumpkins, and other vegetables. Limited production, unavailability of arable lands, climate stress, declining interest in farming triggering the dependency on food import.

There is only limited tourism, with most visitors being consultants, officials of international and regional organizations and business (Carter 1984; Thaman et al. 2013) [9]. Despite the potential the tourism sector is not flourishing due to remoteness and lack of infrastructure.

Tuvalu Trust Fund (TTF), Falekaupule Trust Fund (FTF), fish licenses and remittances from migrant labour as well as international aid are the key sources of income for Tuvalu's government [5]. Tuvalu reliance on imports, leading to high inflation (peaking at ~10% in 2023 due to global supply shocks).

Tuvalu's socio-economic landscape is marked by a young population, with a median age of about 27 years. The education system, while progressive, faces limitations due to resource constraints. The literacy rate is approximately 98% (UNESCO, 2020)[12], but higher educational facilities and access to higher education remain inadequate. Health care services are limited and primarily provided by the national hospital in Funafuti, the capital. The country's health indicators, such as infant mortality rates—around 25 deaths per 1,000 live births (WHO, 2021)—reflect significant challenges in healthcare provision.

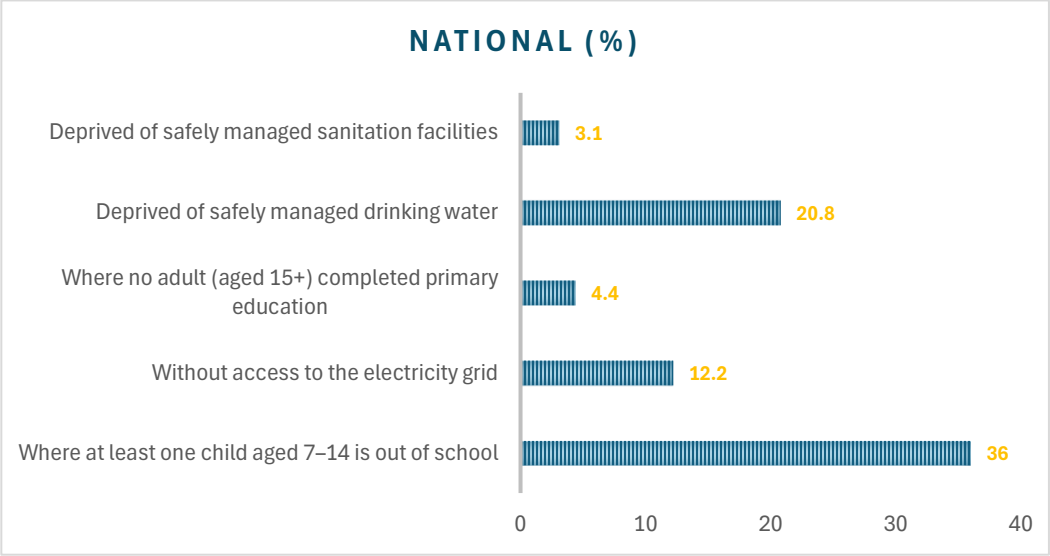
In 2022, Tuvalu's unemployment rate was 7%, while employment to population ratio was 40.7%[13]. According to the Household Income and Expenditure Surveys-HIES (2022) country's basic needs poverty line was AUD 2,715 in 2022, with 2,339 individuals living in poverty. The national poverty rate is 21.5% (20% urban and 245 rural) indicating one in five people in Tuvalu lives in hardship. Despite these challenges, Tuvalu has relatively low inequality when compared to similar countries. The poverty gap in rural areas is slightly higher, at 5.8%, compared to 4.9% in urban areas. The Gini Index (a measure of inequality) is 0.294 (urban 0.31 and rural 0.25), indicating a more balanced income distribution than in several East Asian and Pacific countries such as Tonga, Kiribati, Vietnam, Salomon Islands, Indonesia, Samoa. Federated States of Micronesia, and Papua New Guinea. According to ILO, agriculture accounted for 29% of overall employment, followed by industry and services with 10% and 61%, respectively[14].

Figure 2 illustrates the national percentages of various types of household deprivation in Tuvalu. A considerable 36% of households have at least one child aged 7–14 who is out of school, indicating a

[12] UNESCO Institute for Statistics: Data for Tuvalu.https://uis.unesco.org/en/country/tv
[13] ILO Statistics on employment: https://ilostat.ilo.org/topics/employment/
[14] ILO Statistics on employment: https://ilostat.ilo.org/topics/employment/

significant concern regarding education access. Additionally, 20.8% of households are deprived of safely managed drinking water, highlighting a critical public health issue. In contrast, 12.2% lack access to the electricity grid, which can limit economic opportunities and quality of life. The percentage of households with no adults (aged 15+) who completed primary education stands at 4.4%, pointing to educational disparities. Whereas, only 3.1% of the population is deprived of safely managed sanitation facilities, suggesting relatively better conditions in this area. Overall, the data reveals remarkable challenges in education and water access that affect the well-being of Tuvalu's population.

Figure 2. Non-monetary deprivations, by household consumption distribution (Source: HIES, 2022-23)



The high expense of living, unemployment, inadequate health-care facilities, and reliance on imports for essential food and non-food products all put a strain on households in different ways. Tuvalu's socio-economic conditions are influenced by its isolation, limited transport facilities among the outer islands, and vulnerability to climate and environmental changes. While the nation exhibits strengths in education and community cohesiveness, considerable challenges remain, particularly regarding economic diversification, conservation of resources and climate change adaptation. External assistance, reorient planning and sustainable livelihoods will be critical for Tuvalu's future socio-economic resilience and development.

2.2 Agricultural, climate change and food security challenges

In Tuvalu, the connection between environment, agriculture, climate change, and food security very evident. As mentioned by Tui and Fakhruddin (2022) [5], low agricultural productivity and limited fishing in Tuvalu are mainly caused by characteristics of the physical environment (poor soil, small and limited arable lands, poor vegetation types, and degraded biodiversity) and climate change impacts (flooding, soil salinization, erosion, increasing seawater temperature, and acidification), resulting in the exacerbation of an existing situation of food insecurity.

2.2.1 Agricultural challenges

Subsistence agriculture is predominant in Tuvalu, people grow food crops mainly to meet their needs. Agriculture, in the form of the production of copra, is the nation's only true export. Total agricultural exports in 1998 amounted to US$400,000, and agriculture accounted for 25% of the nation's total GDP[15]. Besides this macroeconomic figure, additional data on agricultural productivity is not easy to find.

Coconut tree plantations and pulaka, babai (swamp taro), taro pits, and most crops are cultivated in small gardens and agroforestry. These crops include banana, breadfruit, pandanus, pumpkin, sweet potatoes and pawpaw. Livestock and poultry farming include pigs, ducks and chickens and provides the only local and stable supply of meat. The limited number of plants are also the main local sources of medicines, fuel, construction and boatbuilding materials, handicrafts, garlands and perfumes and a wide range of other products.

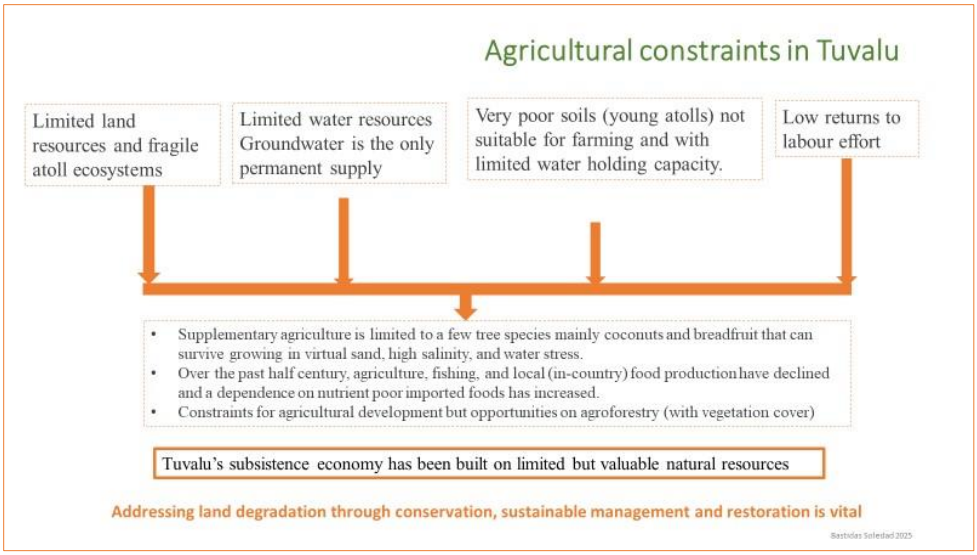
The main basis of subsistence is marine products, Tuvaluans rely on marine sources for nutrients, particularly for protein, with supplementary agriculture limited to a few tree species, mainly coconuts and breadfruit that can survive growing in virtual sand, high salinity, and water stress [2]. The fisheries sector contributes up to 60% of government revenue and 60% of population are engaged in fishing, with reef and lagoon fishing being most common [10].

As described below, there are several environmental challenges agricultural development in Tuvalu. Most of them are related with the amount and quality of natural resources available in Tuvalu. Most islands are covered by coconut tree plantations, maintaining high amounts of tree and vegetation cover.
Agriculture in Tuvalu is limited by the lack of arable land and the challenges of soil fertility. Tuvalu's limited terrestrial natural resources base, including poor soils and scarcity of water resources, is one of the most challenging environments for crop and livestock production, with limited options for increasing production and for expansion.

Tuvalu presents a combination of limited land and water resources, fragile ecosystems, very poor soils and low returns to labour which puts binding constraints to agricultural development (Figure 3.).

Figure 3. Agricultural constraints in Tuvalu

[15] https://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Tuvalu-AGRICULTURE.html



Soils of Tuvalu are among the poorest in the world and their water holding capacity is very low. As in all atolls, the young geological age of sand deposits being established on reef platforms means very minimal soil development. Soils in Tuvalu are shallow, alkaline, coarse-textured, and lacks most nutrients required for plant growth, such as organic carbon, nitrogen, potassium, iron, and magnesium. The water holding capacity of these soils is very low, with plant nutrition dependent on the humus cycle and the retention of vegetation cover [7][21].

Cultivated lands are being heavily affected by salinization. As mentioned by Tui and Fakhruddin (2022):

> *Coastal flooding and soil salination due to rising sea levels have adversely affected cultivated lands and non-resistant food plants such as bananas and breadfruits, and vegetable gardens along coastal areas in all islands of Tuvalu. King tides caused inland saltwater flooding in arable lands majority of the country. Storm surges during cyclones were identified as the threats for the less salt-water resistant food plants (bananas and breadfruit trees) and destroy pit plantations of pulaka. This insecurity lowers people's interest in engaging in farming activities, thus threatening local food security. In addition, the limited diversity of cultivated crops has hindered efforts to boost agricultural production* [5]

In despite of this situation, Tuvalu has a significant vegetation cover, mainly composed by coconut palm plantations and many trees such as breadfruit cover urban areas such as Funafuti. On one hand, agriculture have not been developed diminishing income opportunities, on the other hand, if land degradation occurs, in any form of land use change to areas with less tree cover, the environmental and social impact could be extremely negative. Soil is not fertile and freshwater resources are scarce, in this sense and therefore existing vegetation cover should be maintained.

In addition, the introduction of more modern agricultural crops and techniques have affected traditional agricultural systems. For instance, traditional farming methods such as shifting cultivation (in small levels), the raising of crop beds and the use of natural fertilizers prevented land degradation. A balance between

preserving environmentally sound traditional farming technologies and income-generating activities is needed in order to prevent further land degradation.

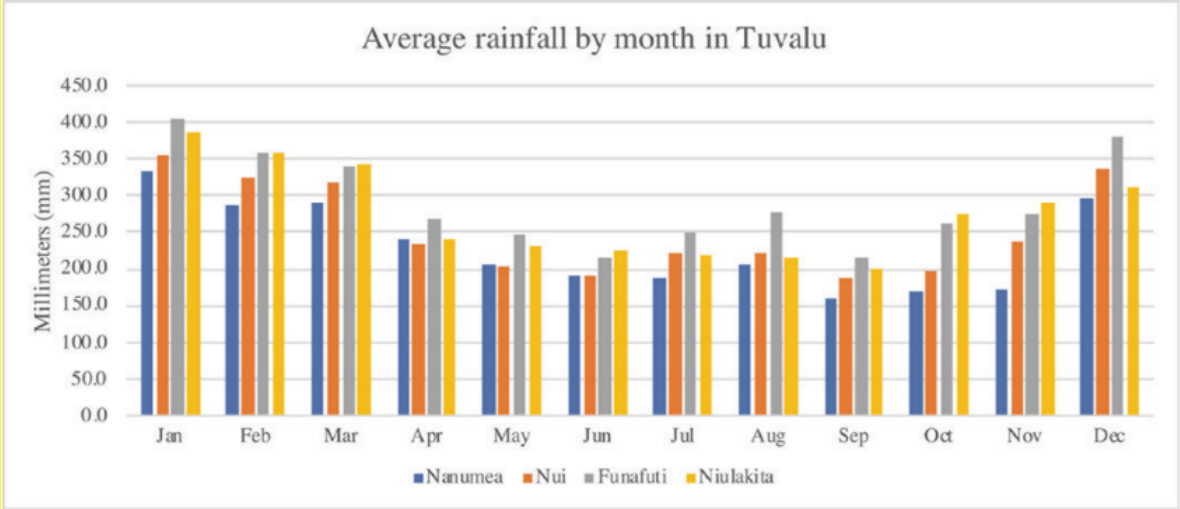
2.2.2 Water resources challenges

Tuvalu's primary water resources are rainwater and groundwater, with rainwater being the main source, especially for household use. There are no freshwater rivers or lakes in Tuvalu. The primary sources of freshwater are rainwater collected in external tanks catching rainfall from iron roofs and groundwater found in underground lenses. However, water quality can be compromised by poor tank maintenance and inadequate filters. During heavy rainfall, the limited number of water tanks can become full, making it difficult to collect excess rainwater.

Given the low-lying nature of the islands, managing freshwater resources is critical, especially in the face of rising sea levels and increased salinity in the soil. However, water availability in Tuvalu is impacted by overuse of groundwater and droughts which leads to water scarcity. Limited availability of freshwater directly affects Tuvalu's livelihoods for both human consumption, and imported water for drinking is extremely expensive. Direct impact on agriculture from water unavailability also limits all opportunities for Tuvalu to diversify and increase crop productivity.

Tuvalu experiences a hot, humid tropical maritime climate, between the inter-tropical and South Pacific convergence zones, with near constant temperatures throughout the year. The mean annual rainfall ranges from 2,300 to 3,700 mm per annum. There is moderate seasonal variability in precipitation, November to April are the wet months while May to October are the drier months [14]. The yearly patter of rainfall analysed by the Taiwan cooperation for Funafuti, Nanumea, Nui, and Niulakita is shown in Figure 4.

Figure 4. Average rainfall by month in four Islands of Tuvalu between 1953 and 2022.



Source : Lin P-J et al., 2022 [19]

The annual rainfall is subject to considerable seasonal and annual variability and there are frequent water shortages. The only permanent supplies being groundwater lenses that are often brackish. Replenishment or recharge of the lens is also dependent on rainfall. However, the islands are low-lying, most being at most 4 to 5 metres above above and saltwater intrusion due to rising sea levels has degraded groundwater.

Land degradation in the form of coastal erosion and flooding is affecting groundwater, as freshwater is salinized. In addition, groundwater which is found in underground lenses, has been significantly contaminated by animal, salt-water intrusion, human and waste leachate. Reports from the Health Department have also confirmed that ground water on Funafuti in 2006 was unfit for human consumption[16] [1] [26]. Climate change exacerbates the risks of saltwater intrusion and over-abstraction of groundwater, threatening the sustainability of the water supply. Rapid population growth specially in Funafuti puts additional strain on already limited water resources. On Funafuti, groundwater is mostly utilized to feed pigs, clean pig pens, and flush toilets. During droughts, it is also used to wash cloth, bathe, and cleaning purposes.

Most wells in Tuvalu's villages are protected by coral stone walls and equipped with diaphragm hand pumps, but they share proximity with latrines, leading to poor water quality. As a result, well water is rarely used for drinking, and during low rainfall periods, its quality can deteriorate and become more saline[17]. Limited access to wells and reliance on groundwater as an emergency supply in the outer islands highlight its importance, especially in times of drought. A period of two to three weeks of no rainfall on this island can cause serious water shortages, halving water levels in its water tanks by 50% and adversely affecting village livelihoods and agricultural production[18].

While periodic flooding is a major concern in Tuvalu, drought has also been a problem; severe droughts have occurred sporadically. Drought in Tuvalu is attributed to the phenomenon of El Niño. Northern islands in Tuvalu have more frequent drought events. The 1999 El Niño event severely affected the entire nation especially in the northern islands. A desalination plant was imported from Japan. The drought of 2011 was particularly serious, and Tuvalu declared a State of Emergency due to the prolonged drought through the islands. However, the formal concept of “drought” in the country is uncertain as few days without rain are considered drought[19].

Like many other Pacific Island countries, Tuvalu depends heavily on freshwater for daily living, agriculture, and economic activities. The well-being and resilience of Tuvalu’s communities are closely linked to the availability and condition of its freshwater resources. Yet, Tuvalu's small land area, geographic isolation, delicate ecosystems, and limited human, financial, and natural capacities present major obstacles to managing water resources effectively. These challenges set Tuvalu apart from larger nations and

[16] The Waste Management Project (WMP) together with the International Water Programme (IWP) carried out two water quality testings on Funafuti as part of the AusAID thru TAFE GLOBAL in-country training programme and confirmed that all ground water sources on Funafuti are highly contaminated with biological contaminants (NAP, 2006) [1]

[17] Status of Water Resources: https://www.pacificwater.org/pages.cfm/country-information/tuvalu.html

[18] PACC Country Brief: https://www.sprep.org/attachments/Climate_Change/PACC/15.pdf

[19] Personal conversations.

underscore the particular vulnerabilities of small island developing states in achieving sustainable water management. The scarcity of freshwater makes Tuvalu's ecosystem especially fragile and highly susceptible to drought and water shortages. Communities—particularly in Funafuti—rely on freshwater sources that are increasingly affected by salinization and pollution. If freshwater supplies continue to decline, public health will be at risk, and prospects for expanding home gardens or diversifying crops will be further constrained.

2.2.3 Climate change challenges

Observed climate risks

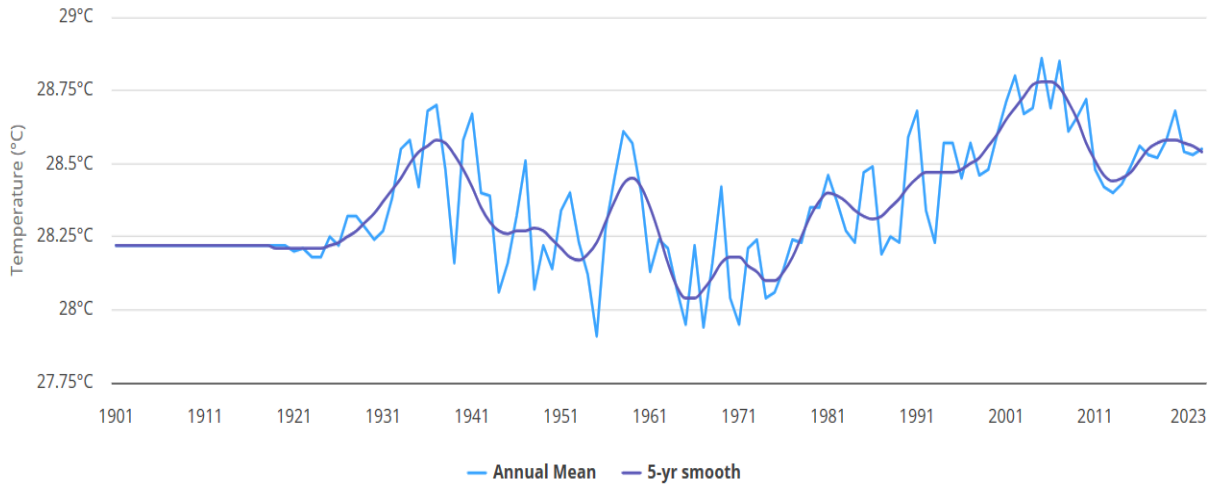
The adverse impacts of climate change are considered the foremost challenge of Tuvalu, particularly rising sea levels. The nation's average elevation is only about 2 meters above sea level, threatening habitability and economic stability.

Climate change has been assessed in Tuvalu and data on seasonal mean temperature and seasonal precipitation from 1931 to 2020 (Tables in **Annex 2**.) reflects the following:

- A gradual warming trend is evident across all seasons over time. For example, in December–February, the average temperature rose from 28.27°C (1961–1990) to 28.59°C (1991–2020). Similar increases are observed in other seasons, with March–May and June–August showing clear rises.
- Overall, temperatures have steadily increased by approximately 0.2°C–0.4°C across seasons over the past 90 years, reflecting the broader pattern of climate warming in Tuvalu. Whereas, the average seasonal minimum temperature in Tuvalu has increased gradually around 25.2°C to 25.58°C. The data also directs a clear increase in maximum temperatures over time, with the average peaking at around 31.92°C in the 1991–2020 period.
- The temperature rises from about 30.96°C in 1931–1960 to over 31.7°C in the most recent period, indicating a warming trend in the maximum seasonal temperatures. This suggests that Tuvalu is experiencing progressively higher peak temperatures over the decades, which could have implications for climate resilience and environmental stability.
- Overall, precipitation is highest during December–February across all periods, with values slightly declining from 969.32 mm (1931–1960) to 907.62 mm (1991–2020). In other seasons precipitation shows smaller fluctuations, with March–May around 725 mm and from June to November showing slightly lower values. Whereas, a slight decrease in rainfall is observed over time, particularly in December-February and June-August, suggesting changes in seasonal rainfall patterns possibly linked to climate variability and climate change impacts.

Figure 5. shows the observed annual mean surface air temperature in Tuvalu from 1901 to 2023. Fluctuations are visible year-to-year, but the long-term trend highlights a rise of approximately 0.5°C over the 20th and early 21st centuries, reflecting the highly visible impact of global climate change on Tuvalu's climate.

Figure 5. Observed Annual Mean Surface Air Temperature in Tuvalu, 1901-2023 (Source: WB, 2022)



The light blue line represents the annual mean temperature, while the dark blue line shows the 5-year smoothed trend. Overall, the data indicate a gradual warming trend, particularly from the 1970s onward, with more pronounced temperature increases after 1990.

The observed loss of damage of the ongoing climate impact are tremendously high. For instance, total damages of the tropical cyclone Pam in 2015 are estimated at approximately US$ 10.34 million, equivalent to 26.9% of Tuvalu's GDP [5]. A participatory analysis of climate change risks, disasters, and adaptative measures was conducted during the LDN stakeholder consultation (Funafuti, 7-9 January 2025). The results of this analysis are found in **Annex 3.**

Projected climate risks

Tuvalu is projected to experience more frequent and more destructive flooding events and the loss of the entire atoll [13]. The Intergovernmental Panel on Climate Change (IPCC) in its sixth Assessment Report AR6 (2021) projected that sea level rise under different Shared Socioeconomic Pathways (SSPs)[20] for Tuvalu will be in the range from 0.5 m to 1 m by 2100. Under all scenarios, the frequency, intensity, and impacts of extreme weather events such as flooding are projected to increase significantly.

Table 5. summarizes projected future climate changes for Pacific across various climate indicators, along with their confidence levels and trend attributions. The HEAT AND COLD indicates with high confidence that mean surface temperature and extreme heat will increase, with upward trends. WET AND DRY, COASTAL, and OTHERS suggests with medium to high-confidence projections of increased heavy rainfall, flooding, aridity, coastal erosion, sea levels, marine heatwaves, ocean acidity, and atmospheric CO_2, mostly with upward trends without specific attributions. Overall, these projections suggest significant warming, increased climate variability, and coastal impacts in the Pacific including Tuvalu.

[20] Shared Socioeconomic Pathways (SSPs) are scenarios of projected socioeconomic global changes up to 2100

Climate change projections prepared by the Pacific Climate Change Science Program[21] from different scenarios for Tuvalu include the following results:

- Sea level is expected to continue to rise in Tuvalu. By 2030 under a high (A2) emissions scenario the rise in sea level is projected to be in the range 4-14cm; by 2090 under a high (A2) emissions scenario the rise is expected to be in the range 19-58cm.
- The average annual air temperature and sea surface temperature will increase in the future. By 2030 under a high (A2) emissions scenario this increase in temperature is projected to be in the range 0.4-1.0°C.
- There will also be a rise in the number of hot days and warm nights, and a decline in cooler weather.
- An increase in average annual and seasonal rainfall around Tuvalu over the course of the 21st century, due to the expected intensification of the South Pacific Convergence Zone.
- Extreme rainfall days are likely to occur more often.
- A decrease in the frequency of tropical cyclones by the late 21st century and an increase in the proportion of the more intense storms.
- Under all three emissions scenarios (low, medium and high) the acidity level of sea waters in the Tuvalu region will continue to increase impacting the health of coral ecosystems.

Nevertheless, it is evident that the country is highly vulnerable to climate change, and fast and slow onset extremes events including tropical cyclones, storm surges and high seas waves [17], due to its geographical or physical characteristics and location close to the cyclone belt. The aforementioned risks pose a serious threat to Tuvalu, its people, socio-economic systems, natural resources, and vital ecosystems including land, forests, water, and coastlines.

Table 5. Future climate risks in the Pacific (Adapted from IPCC WGI Interactive Atlas, 2021)

[21] Discussed in the *Climate Change in the Pacific: Scientific Assessment and New Research.* Predictions based on extensive analysis of the 24 global climate models from the Coupled Model Intercomparison Project Phase 3 (CMIP3) together with dynamic and statistical downscaling.

CID	FUTURE CHANGES	TREND / ATTRIBUTION
HEAT AND COLD		
Mean surface temperature	^ High confidence of increase	^ Upward trend without attribution
Extreme heat	^ High confidence of increase	^ Upward trend with medium confidence of attribution
WET AND DRY		
Heavy precipitation and pluvial flood	^ High confidence of increase	—
Aridity	^ Medium confidence of increase	—
WIND		
Tropical cyclone	^ Medium confidence of increase	—
COASTAL		
Relative sea level	^ High confidence of increase	^ Upward trend without attribution
Coastal flood	^ High confidence of increase	—
Coastal erosion	^ High confidence of increase	—
Marine heatwave	^ High confidence of increase	^ Upward trend without attribution
Ocean acidity	^ High confidence of increase	^ Upward trend without attribution
OTHERS		
Atmospheric CO_2 at surface	^ High confidence of increase	^ Upward trend without attribution

2.2.4 Food security

As land degradation and climate change increase, land productivity and the food production capacity of the islands' ecosystems decreases, with severe impacts on food and nutrition security and loss of food sovereignty. The direct impact on the ability of the population to access more nutritious traditional food sources has had severe consequences on livelihoods and health of the population (GEF project CEO doc)

The precolonial Tuvaluan diet was based primarily on nearshore marine foods and coconut and was supplemented by the cultivation of local root crops, pulaka and taro (David 1913, Koch 1961 in [2]). Starting in the late 19th century, through sustained contact with European and American traders, the food system in Funafuti shifted to a dual mode based on local and imported foods, with an increasing dependence on the latter. Over the past half century, agriculture, fishing, and local (in country) food production (per capita for domestic consumption) have declined as a dependence on nutrient-poor imported foods has increased. The reliance on imported food has caused the economic vulnerability of people in the food sector [2].

Tuvalu's food system in Funafuti is currently a dual system composed of both local and imported foods. Food imports to Tuvalu include some fresh, but mostly processed, foods – including rice, flour, sugar, breakfast crackers, chicken, and tinned fish – that are shipped from Fiji to Tuvalu in cargo ships. For instance, the country imports 100 tonnes of rice every 3 weeks [2]. Tuvalu's reliance on food imports is so heavy that even eggs are imported, although they could be grown in every household. In 2022, the country imported eggs worth $182,000. The primary supplier was Fiji, exporting eggs valued at approximately $181,640 (77,499 kg) to Tuvalu in the same year.

Climate change is reducing coastal land productivity due to sea level rise, soil salinization, erosion, and flooding. Freshwater shortages and salinity intrusion threaten food security, while habitat loss weakens natural coastal defences. Reduced freshwater availability, combined with increased salinity intrusion into groundwater, challenges food security. Tuvalu is also losing coastal buffers that absorb wave energy. Rising ocean temperatures and acidification degrade coral reefs, as well as the use of coral reefs and sediments for land degradation are limiting marine food sources. For instance, this phenomenon has already degraded the turtle coastal habitat and affected local food source as turtle meat which is traditionally a very important food in Tuvalu [5].

If unsustainable agriculture and coastal management persist, the situation will worsen, especially as solutions like land reclamation continue to disrupt marine ecosystems. This not only increases vulnerability to climate disasters but also threatens the primary source of food security.

3. Assessing Land Degradation Neutrality in Tuvalu

3.1. Land Degradation Neutrality

3.1.1 LDN Definitions

"Land"is defined by the UNCCD as:

> *Land is the terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system."* UNCCD (2017)

"Land degradation" under Article 1 of the UNCCD is defined as:

> *Land degradation is the reduction or loss, in arid, semi-arid and dry sub-arid areas, of the biological or economic productivity and complexity of rain fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land use or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as: (i) soil erosion caused by wind and/or water; (ii) deterioration of the physical, chemical and biological or economic properties of soil; and (iii) long-term loss of natural vegetation.*

The GEF Operational Programme 15 (GEF OP-15) definition of land degradation is:

> *Land degradation is any form of deterioration of the natural potential of land that affects ecosystem integrity either in terms of reducing its sustainable ecological productivity or in terms of its native biological richness and maintenance of resilience.*

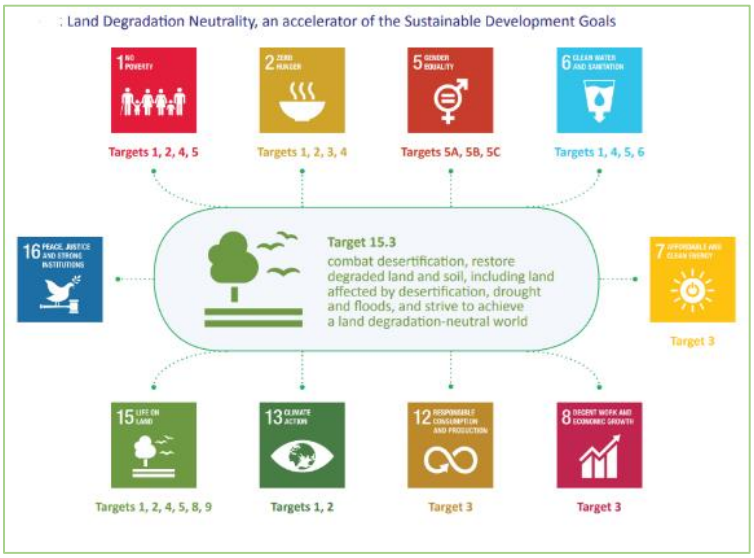
Land Degradation Neutrality (LDN) is defined by the UNCCD as:

> *"State whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems. The goal of LDN is to protect, maintain, restore and enhance the land resource base and the ecosystem services that flow from them" (UNCCD, 2015).*

3.1.2 The LDN approach

LDN is part of the Sustainable Development Goal 15 (SDG 15– Life on Land), which emphasizes the importance of managing forests, combating desertification, halting and reversing land degradation, and stopping biodiversity loss. Within this goal, target 15.3 aims at ending desertification and restoring degraded land by 2030: *By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.* (Figure 7.)

Figure 7. Sustainable Development Goals SDG - TARGET 15.3



Source: The Global Mechanism of the UNCCD. 2019. [31]

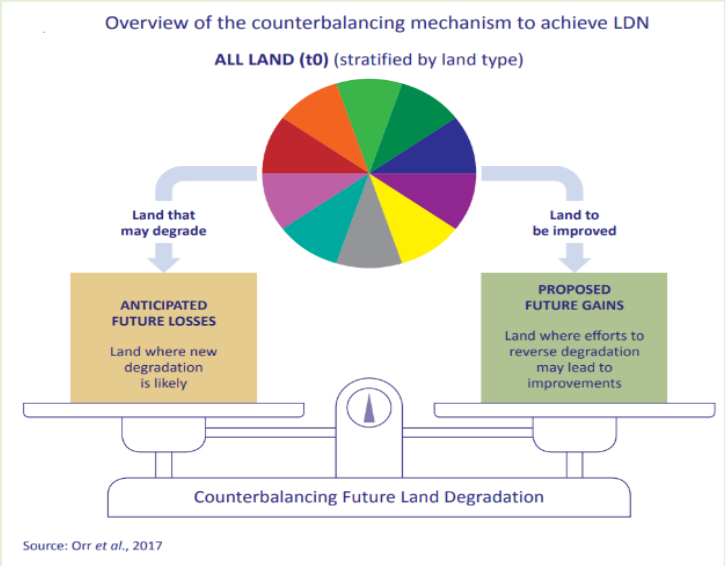
The extent of land degradation for reporting on SDG Indicator 15.3.1 is calculated using three sub-indicators:

Collect Earth described these indicators as follows:

1. **Land cover** (trends in vegetative land cover) is indicative of land use, land conversion and habitat fragmentation.
2. **Trends in land productivity,** delivers an indication of ecosystem functioning and health and sharpens the focus on ecosystem services.
3. **Soil organic carbon (SOC) stock** denotes overall soil quality.

These indicators (and associative metrics) are recommended for tracking progress towards LDN and reporting to the UNCCD. However, countries may include additional indicators from landscape and local levels that are relevant to their specific context.

Figure 8. The LDN approach



The LDN approach ensures that any degradation of land is counterbalanced by an equivalent area of land being restored or improved. Given Tuvalu's extremely limited land area, the approach for introducing and achieving LDN in Tuvalu focus on avoiding, reducing, and reversing land degradation, as specified in the LDN intervention hierarchy. LDN targets are defined by the UNCCD as the voluntarily adopted objective of a country to achieve LDN at a national level. Countries may elect to set a more ambitious LDN target if they envision the possibility that gains will exceed losses.

The LDN approach includes a response hierarchy: avoid, reduce and restore. This means that in LDN, the focus is on avoiding land degradation in the first place as the most cost-effective way to maximize the conservation of natural capital. Restoring degraded land is an important part of the solution but will not be enough if we continue degrading land (See Figure 8.).

In 2015, the UNCCD Parties were invited to formulate voluntary targets to achieve LDN in accordance with their specific national circumstances and development priorities. The Global Mechanism and the Secretariat of the UNCCD established the Land Degradation Neutrality Target Setting Programme (LDN TSP) to guide and assist countries in the formulation of LDN targets and to achieve LDN by 2030. Up to date, 131 countries committed to set LDN targets and 112 countries have successfully completed this voluntary process[22].

The project *Integrated Agro-ecosystem Approach for Enhancing Livelihoods and Climate Resilience in Tuvalu* funded by GEF and executed by the Government of Tuvalu and implemented adopted the LDN approach for strengthening the enabling framework for implementing the integrated agro-ecosystem approach.

3.2. Land Degradation Neutrality Baseline indicators in Tuvalu

[22] Country LDN reports on the UNCCD website https://www.unccd.int/our-work/country-profiles

3.2.1 Land use and land cover change indicator

The assessment of land cover and land cover change done by Collect Earth[23] [25] established the land cover distribution shown in Table 8. according to the IPCC land use categories. There is an extensive plating of coconuts (56%), a limited presence of coastal vegetation (12%) and the overall confined extension of the villages (10%).

Table 8. Land cover distribution (2000-2015) – Collect Earth assessment 2024.

IPCC Land Use framework	Tuvalu Land Cover classification	Area (HA)	Proportion (%)
Forest	Mangrove forest	72.6	2.7
	Coastal vegetation	340.1	12.8
	Broad-leaved woodland	183.4	6.9
Cropland	Coconut	1,505.5	56.9
	Pulaka	42.0	1.6
	Taro	3.8	0.1
Grassland	Grassland	3.8	0.1
	Grassland with shrubs	3.8	0.1
	Grassland with trees and shrubs	7.6	0.3
	Shrubland	11.5	0.4
	Shrubland with trees	3.8	0.1
Settlement	Village	271.3	10.2
	Infrastructure	68.8	2.6
	Urban Park	15.3	0.6
Otherland	Sand	30.6	1.2
Wetland	Lagoon	30.6	1.2
	Swamp	19.1	0.7
	Lake/Pond	34.4	1.3

Source: FAO. Collect Earth report: Estimation of two LDN indicators in Tuvalu, 2024.

Regarding land use change, the results of the analysis of the land use change indicator done by Collect Earth shows that “settlement” changed the most from the baseline, as it has increased by 84 ha, at the expenses of forest (3.8 ha), cropland (68.8 ha) and wetland (11.4 ha).

The “cropland” is second category that has seen a major change in absolute terms, since its extension was reduced by 74,6 ha, due to conversion to settlement (68.8), grassland (11.4 ha), forest (3.8 ha) and wetland (3.8 ha).

The latter land conversion process can be interpreted as inundation from the sea. There was also a significant contraction of “wetlands” from the baseline period of 22.9 ha, due to conversion to cropland (11.4 ha), settlement (11.4) and other land (3.82 ha). In relative terms, the categories that have lost and gained the higher proportion of land are respectively wetlands (27%) and grassland (38%) (Tables 5 and 6).

Table 9. Land use change by category (2000- 2023) – Collect Earth Assessment 2024.

[23] Collect Earth is an augmented visual interpretation tool for land monitoring through Google Earth, Google Earth Engine, Bing Maps and other freely available images. Users can analyze high- and very high-resolution satellite images for a variety of purposes, including multi-phase national forest inventories, Land Use, Land Use Change and Forestry (LULUCF) assessments, monitoring agricultural land and urban areas, quantifying deforestation, reforestation and desertification (https://www.collect.earth/)

Sub-indicator 1 Land Cover SDG 15.3.1

LU Matrix	Forest Area (HA)	Cropland Area (HA)	Grassland Area (HA)	Settlement Area (HA)	Otherland Area (HA)	Wetland Area (HA)	Total in 2000 (ha)
Forest	592.27			3.82			596.1
Cropland	3.82	1,539.89	11.46	68.78		3.82	1,627.8
Grassland			19.11				19.1
Settlement				271.30			271.3
Otherland					26.75		26.7
Wetland		11.46		11.46	3.82	80.24	107.0
Total in 2023 (ha)	596.1	1,551.4	30.6	355.4	30.6	84.1	2,648

Source: FAO. Collect Earth report: Estimation of two LDN indicators in Tuvalu, 2024.

Of the total land area, 95.5% is land area with stable land cover, meaning that there is no land use change. Only 4.3% has a degraded land cover.

Collect Earth concludes that the results of the analysis of the land cover change indicator shows that the land under "coconut cultivation" changed the most from the baseline, as it has lost 68.8 ha, while pulaka has lost 7.6 ha. The country is also facing different processes of coastal erosion as the "coastal vegetation" was reduced by 3.8 ha.

Table 10. Summary of land use change – Collect Earth Assessment 2024.

	Area (ha)	Percent of total land area
Total land area:	2,648.0	100%
Land area with improved land cover:	3.8	0.1%
Land area with stable land cover:	2,529.5	95.5%
Land area with degraded land cover:	114.6	4.3%
Land area with no data for land cover:	0	0%

Source: FAO. Collect Earth report: Estimation of two LDN indicators in Tuvalu, 2024.

There was also a significant expansion of "infrastructure" from the baseline period, with an increase of 34 ha; as well as the expansion of the "village" of 42 ha. In relative terms, the categories that have lost the higher proportion respectively the "lagoon" (60%) and "swamp (38%) (table 10).

Table 11. Land cover change by category (2000- 2023)

Land cover change by category	LCC	Total in 2000 (ha)	Total in 2023 (ha)
Mangrove forest	3.8	68.8	72.6
Broad-leaved woodland	0.0	183.4	183.4
Coastal vegetation	-3.8	343.9	340.1
Coconut	-68.8	1,574.3	1505.5
Pulaka	-7.6	49.7	42.0
Taro	0.0	3.8	3.8
Grassland	3.8	.0	3.8
Grassland with shrubs	3.8	.0	3.8
Grassland with trees and shrubs	3.8	3.8	7.6
Shrubland	0.0	11.5	11.5
Shrubland with trees	0.0	3.8	3.8
Village	42.0	229.3	271.3
Infrastructure	34.4	34.4	68.8
Urban park	7.6	7.6	15.3
Sand	3.8	26.7	30.6
Lagoon	-11.5	42.0	30.6
Swamp	-11.5	30.6	19.1
Lake/Pond	0.0	34.4	34.4
Total		2,648	2,648

Source: FAO. Collect Earth report: Estimation of two LDN indicators in Tuvalu, 2024.

3.2.2 Land productivity indicator

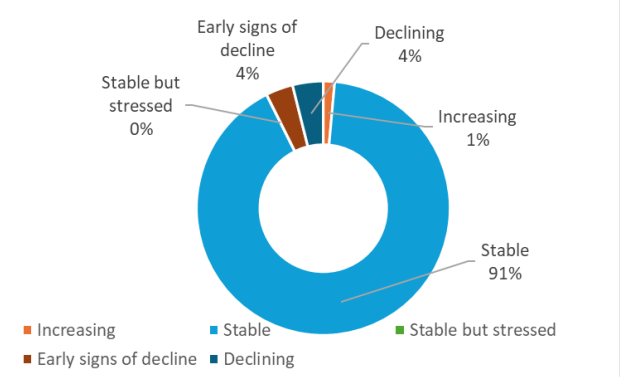
Collect Earth's results of the land productivity dynamics indicator show that most of the land remains stable (91%) or with no sign of decline, while 7% of the total land area of the country is presented with degraded productivity (i.e., locations classified as 'Early sign of decline' or 'Declining', of the LPD default data classes are considered as degradation). See Table 8 and Figure 9.

Table 12. Land productivity status (2000-2015)

Source: FAO. Collect Earth:
Estimation of two LDN indicators in Tuvalu, 2024.

Land Productivity Status	Area (ha)	Percentage
Increasing	38.2	1%
Stable	2414.9	91%
Stable but stressed		0%
Early signs of decline	91.7	3%
Declining	103.2	4%
Total	2,648	100%

Figure 9. Changes in Land Productivity (2000-2015)



According to Collect Earth's assessment, land productivity in Tuvalu es mostly stable. Land degradation, in terms of productivity, does not appear to be significant.

SUMMARY OF FINDINGS ON SOIL ORGANIC CARBON – CSRIRO

Existing soil organic carbon (SOC) data for Tuvalu are derived from two legacy surveys: the University of Auckland survey (1982–1985) covering all islands except Funafuti, and the CSIRO survey (2021) in Funafuti. Both surveys applied two analytical methods, generating duplicate SOC measurements per sample. Harmonisation of these datasets will be undertaken following completion of laboratory analyses from the recent nationwide soil survey.

Figures 10 and 11 present SOC concentrations for Funafuti (CSIRO) and the outer islands (University of Auckland), respectively. The Funafuti dataset reports the lowest mean SOC concentration (2.48%) and is adopted as the interim national baseline pending integration of new survey data and harmonisation of legacy datasets. Subsequent analyses will support digital SOC mapping, assessment of spatial patterns, trends and drivers, and stratification of SOC estimates by land-use and land-cover categories.

Figure 10. Distribution of SOC content from soils in Funafuti sampled by CSIRO in 2021. Each sample was analysed for SOC using the Dumas (SOC_Dum) and Walkley and Black (SOC_WB) analytical methods

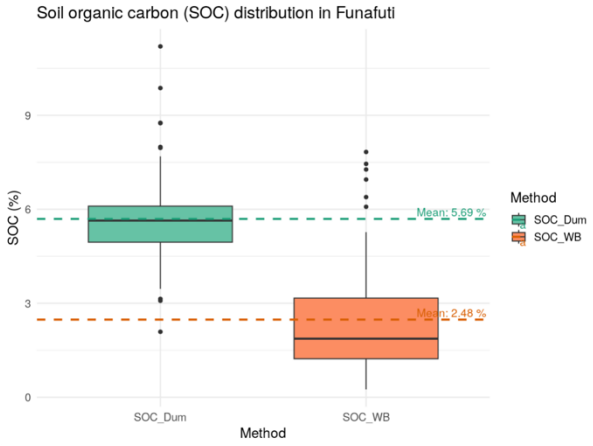
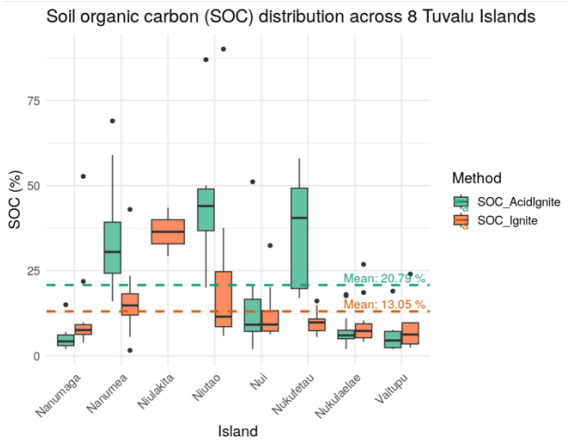


Figure 11. Distribution of SOC content in soils for 8 islands in Tuvalu sampled by University of Auckland Between 1982 and 1985. Each sample was analysed for SOC content using Ignition in a furnace with acid (SOC_AcidIgnite) and without acid (SOC_Ignite) pretreatment.



3.3 Policy framework for LDN

3.3.1 National institutional framework

Tuvalu has two spheres of government: national (or central) and local (islands).

Tuvalu was a British Colony before separately gaining its independence in 1978, as a member of the British Commonwealth. Tuvalu's form of Government is a constitutional monarchy, with the British monarch as the head of state. The British monarch is represented locally by a Governor General. The head of state is the Prime Minister24 who is elected by a 16-member unicameral Parliament elected every four years. The Cabinet consists of the Prime Minister, and several ministers.

The current Cabinet of Tuvalu consists of the following ministries and representatives:

- Prime Minister
- Deputy Prime Minister & Minister of Finance and Development
- Ministry for Foreign Affairs, Labour, and Trade
- Ministry for Home Affairs, Climate Change, and Environment
- Ministry for Natural Resources Development
- Ministry for Transport, Energy, Communication, and Innovation
- Minister for Health and Social Welfare
- Minister for Education and Human Resources Development
- Minister of Public Works, Infrastructure, and Water

While the Department of Environment (UNCCD Focal Point) and the Department of Climate Change are both situated within the Ministry for Home Affairs, Climate Change, and Environment, the Department of Agriculture operates under the Ministry for Natural Resources Development. Tuvalu is very small, and all governmental ministries operate within the same building or close to each other, allowing for smooth coordination among ministries and departments.

The Land and Survey department is directly related to land management. Their role focus cadastral, monitoring and information development. They are responsible, for instance, of preparing land leases, but agreements need the Lands Court's approval.

Table 13. summarizes the main roles of national and local institutions and institutional fragmentation in 2009 [24].

Table 13. Institutional fragmentation related to land management

[24] History of Tuvalu: First People, British Rule and Independence. https://ioa.factsanddetails.com/article/entry-680.html

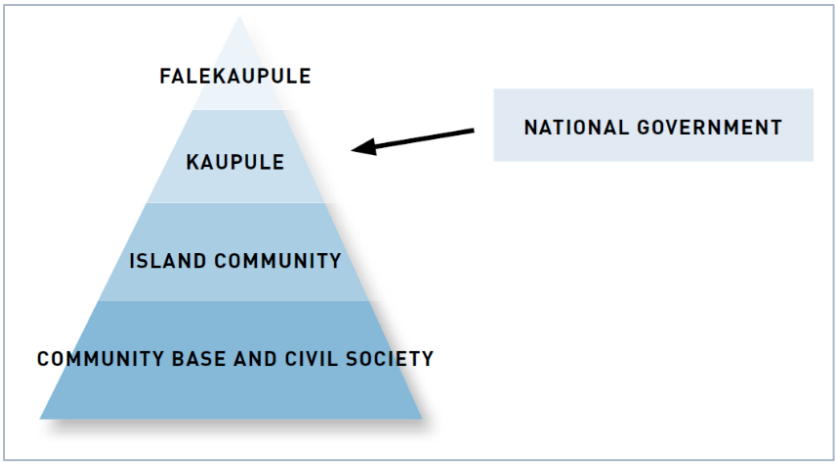
Institutions	Areas of concern & Issues
Office of the Prime Minister	International Conventions-UNCED,
Department of Foreign Affairs	International Conventions/regional agreements
Lands & Survey Department (MNRE)	Land leases/ cadastral maps/ Lands Development Planning Committee
Department of Environment (MNRE)	Implementing international/regional conventions and agreements- biodiversity, climate change, pops, EPA
Department of Agriculture (MNRE)	Plant Quarantine, livestock, home gardening, bio-security, mangrove replanting, coconut replanting, training sharing agriculture knowledge, composting , pesticides etc
Office of the Attorney General	Drafting laws, compensations
Judiciary Department	Lands Court, Lands Appeal Panel, Magistrate Court, High Court- compensation, land disputes,
Ministry of Home Affairs	Town Planning, Local Government (Kaupule), Falekaupule Act implementation, island development, Police Force, Waste management.
Ministry of Education, Education Department	Pre- School, Primary, Secondary, curriculum development
Ministry of Health,	Public Health Act, Public Health Committee, Water quality, Sanitation, Land Cleaning
Kaupule- 8 separate institutions (MOHA)	Implement Falekaupule Act- Foreshore & Reclamation Act, Water, earth moving, housing license, business premises, roads, Public Health Committee inspection, approve infrastructure on private land, fisheries, agriculture, island planning, waste management.. etc, enforcement of Acts
Fisheries Department of Ministry of Natural Resources	Marine pollution, EEZ, territorial waters, fishing license
Public Works Department	Major Infrastructure Design & Construction & maintenance, Water management, maintenance of Tuvalu road, Funafuti international runway,
Economic Research Planning Department	Planning and Research- Kakeega II, NSSD, Investment Programme, Donors
Ministry of Finance	Budget formulation- allocation of budget provisions

Source: Paeniu L. 2009. Mainstreaming Sustainable Land Management in Tuvalu Government's Plans and Policies. [24]

3.3.2 Local governance scheme

The Falekaupule is the product of the fusion of the traditional leadership and the introduced governing system. It functions as the decision-making body on the island. The Kaupule (Island Council) is the executive arm of the Falekaupule. The central Government links directly to the Kaupule [14] (Figure 9).

Figure 12. Local Governance structure



Source: NSAP National Strategic Action Plan (NSAP) for Climate Change and Disaster Risk Management 2012-2016

There is one kaupule (or Island Council) for each of the eight main inhabited islands. The ninth island, Niulakita, is under the administration of Niutao Kaupule[25].

Island councils in Tuvalu act as local government bodies planning and executing local development initiatives, managing public resources, and overseeing essential services such as education, healthcare, and infrastructure. They are supreme seat of authority and power in each island. The councils play a crucial role in implementing national policies at the local level, ensuring decisions align with the community's needs and priorities.

These councils have evolved from traditional customary councils, like the kaitasi system, with formal structures gradually introduced and continuously developed. Each kaupule has six members elected for a maximum of two four-year terms. The pule (council president) is indirectly elected by a simple majority from among the councillors and appoints a tokolua pule o kaupule (deputy council president) from among the council members.

The Department of Rural Development within the Ministry of Home Affairs (MHA) is responsible for local government. A quarterly assembly is held by each kaupule where the annual budget and development plans prepared by the island council are assessed by the people (CLGF, 2025 [20]). The MHA's roles are overseeing the activities of each department in its portfolio in order to achieve national goals and objectives set out in the National Strategy for Sustainable Development ('Te Kakeega III'); and reviewing any policy the Department of Rural Development wishes to implement before such policy is submitted to cabinet for legislation.

Island councils in Tuvalu are established and mandated by the Local Government Act (Cap. 26). This legislation formalizes the councils' operations, making them responsible for overseeing local affairs on each island, such as land use, resource management, and community development. The Act specifies the

[25] The local government system in Tuvalu - Country profile 2017–18. https://www.clgf.org.uk/default/assets/File/Country_profiles/Tuvalu.pdf

councils' structure, functions, and the roles of elected members, including island chiefs and community leaders.

The common services that all island councils provide include land transport, lagoon travelling services, roads and public facilities such as meeting halls, recreation facilities (playing fields, multi-purpose courts), beach ramps and land title records. Services provided by national government in partnership with the island councils include health, education, agriculture and fisheries. Therefore, agriculture, forests and fisheries as well as water and sanitation are of responsibility of both the central government and the island councils, while environmental protection is of responsibility of central government only.

Island councils work in close collaboration with national government agencies and other partners to coordinate activities like disaster management, environmental conservation, land management and sustainable development. Additionally, they promote community engagement, ensuring that local voices are heard in shaping policies that directly impact their lives.

Despite their significant role, the councils' capacity to make independent decisions is often constrained by limited resources, weak understanding of the formal policies, and the need to comply with national policies.

Furthermore, as mentioned by the Pulefenua who is the head of the Falekaupule and other Kaupule members plus the women's representative and youth groups representatives during the LDN Island consultation in Nanumanga, all projects that are to be implemented on the Island of Nanumaga, has to be brought up, discussed and agreed by the Falekaupule before it is approved and implemented.

3.3.3 Policy framework for Land Degradation Neutrality

The national policy framework addressing land degradation in Tuvalu consists mainly of different policy instruments related to development, climate change, environment and agriculture. Due to the cross-sectoral nature of land degradation, as in many other countries, LDN is embedded and anchored in a set of different sectoral policies, despite the necessity for integrated approaches. Table 14. summarizes national policy instruments and key elements that are relevant for LDN.

Table 14. Tuvalu's policies relevant for LDN

Policy, Strategy, Action plan	Key elements relevant to LDN
1. Tuvalu National Strategy for Sustainable Development (2021-2030) – Te Kete	The *Te Kete* or National Strategy for Sustainable Development enhances the national vision of a *Peaceful, Resilient and Prosperous Tuvalu*. The Te Kete addresses national priorities for the development of Tuvalu, including economic, social, cultural and infrastructure development. There are 5 Strategic Priority Areas: 20 National Outcomes and 89 Key Strategic Actions. Climate change, environment and land directly related issues are considered under: **Strategic Priority 1. Enabling environment:** **Outcome 4: Climate Change and Disaster Resilience Increased and National**

	Key Strategic Actions (KSA) seek an increased adaptive capacity and resilience for climate change and disaster through: 1.4.1: Develop long-term national adaptation strategy, including a staged land reclamation programme, that takes into account a worse-case scenario of sea level in Tuvalu rising by one meter by year 2100. 1.4.2: Secure increased funding from global climate financing facilities. 1.4.4: Develop effective frameworks for disaster risk and resilience management. 1.4.5: Implement a land rehabilitation and reclamation framework that is resilient to sea level rise and climate change impacts. **Outcome 5: Environment, Meteorology, Land and Waste Management Strengthened** Key Strategic actions seeking the strengthening of the environment, meteorology, land and waste management, for the islands to remain pristine and clean, include: 1.5.1: Enforce application and management of Environmental and Social Impact Assessments. 1.5.2: Improve Meteorology services capacity to respond to climate change, disaster resilience and adaptive capacity. 1.5.3: Develop the capacity to implement Multi-Hazard Early Warning Systems (MHEWS). 1.5.4: Develop and implement improved waste management strategies with local communities and the private sector. 1.5.5: Adopt and implement an Integrated Geospatial Information Framework (IGIF) to measure, monitor, quantify and manage Tuvalu's natural environment. 1.5.6: Improve land management and development. **Strategic Priority Area 2: Economic Development** **Outcome 8: Agricultural Productivity Increased** Outcomes for increasing agricultural productivity are: • Coconut replanting associated with a small-scale production of coconut by-products for income and healthier diets have reached all the islands. • Traditional food production increased including revival of traditional food preservation techniques (faka Tuvalu – go local). • Collection of agricultural quality data and analysis is up to date. Key strategic actions on agriculture: 2.8.1: Foster import substitution through effective fiscal and tax policy incentives. 2.8.2: Implement a national integrated coconut replanting scheme. 2.8.3: Develop agricultural commercial activities including agribusiness. 2.8.4: Develop greater level of local food production and use of traditional food preservation knowledge. https://tuvalu-data.sprep.org/system/files/GoT%202020%20Te%20Kete.pdf
Tuvalu National Action Plan to Combat Land Degradation and	The Tuvalu National Action Plan to Combat Land Degradation and Drought (UNCCD NAP) was formulated in 2006. The NAP addressed the underlying causes of land degradation and drought, and identified strategies as means of addressing land degradation under the UNCCD framework.

Drought (UNCCD NAP 2006)	Land degradation drivers identified in 2006 in the NAP included: - Lack of land use planning - Sea level rise causing coastal erosion, inundation and saltwater intrusion - Drought and bush fires - Unsustainable agricultural practices such as overuse of pesticides and fertilizers - Unsustainable development activities, such as seawalls and boat ramps. - Unsustainable use of watershed and water pollution. - Uncontrolled waste disposal, in particular in Funafuti. The strategies that were considered in the NAP as means of addressing land degradation under the UNCCD framework include a synergistic approach between UNCCD, CBD and UNFCCC activities, coordination and partnership building with local institutions, communities, non-governmental organisations, regional institutions, networks and international organisations, as well as the development of participatory decision-making and actions plans and awareness raising. NAP Priority Programme Activities included: 1. Providing enabling activities, focusing on legislation review, information on Tuvalu's ecosystems to enhance sustainable land management efforts, institutional capacities and public awareness. 2. Land Degradation Inventory and Monitoring of land degradation and soil erosion. 3. Prevention of Land Degradation through soil conservation, local participation in land degradation prevention projects, urban and community greenspace activities, proper solid waste management and a network of protected areas with SLM activities. 4. Rehabilitation of Degraded Land and solid waste disposal sites, coastal erosion mitigation action plans and local participation in reforestation and afforestation programs. 5. Establishment of Sustainable Land Management Plans 6. Monitoring and Mitigating the Impact of Drought through drought contingency plans, early warning systems; monitor of water availability and climate change impacts as well as research activities on drought-resistant (and salt resistant) crops. 7. Integrating of traditional knowledge into modern ways through collating traditional knowledge from island elders and leaders and incorporate it into sustainable land management practices. Although the NAP was formulated nearly twenty years ago, many of the drivers and strategies identified at the time remain relevant.
Island Strategic Plans (Palani Atiake) – ISP	The Island Strategic Plans *(ISP – Palani Atiake*) are four-year plans which map the key development priorities and outline proposed developments on each island. The ISPs are developed at the local level by Kaupules, with the input of local communities, focused on the aspirations of local people for improving their welfare and livelihoods. While the technical expertise to support implementation are offered from the national government and partners, communities determine their own requirements and needs. The first generation of Island Strategic Plans were developed in 2010. All of the current round of ISPs (the third generation) for 2020-2023 have identified adaptation to climate change as a priority area requiring the attention of Kaupules and Falekaupules. To

	streamline and systematize development planning at Kaupule level, the MLGA has recently introduced the 'Kaupule Integrated Planning and Reporting Framework'.
Tuvalu climate change policy – TE KANIVA (2012)	The TE KANIVA, Tuvalu Climate Change Policy was coordinated by the Ministry of Foreign Affairs, Trade, Tourism, Environment and Labour. Examples of key strategies of the climate change policy that are relevant for LDN include: 1.2 Assessment and analysis of salt and/or heat tolerant food crops (e.g., pulaka) and tree species for coastal protection. The outcome is coastal protection through re-planting programmes and other appropriate schemes. 1.3 Integrated and coordinated water resources (including desalination) planning and management including preparedness and response plans for each island 1.4 Coordinated planning and management of marine, coastal and land resources and systems (Whole Island Systems Management/ecosystem base management). The expected outcome is the recognition of inter-linkages of systems and adaptations and disaster risk reduction activities strengthened resilience and adaptability of these inter-linkages (ecosystem-based management). 3.2 Island governance and leadership (Kaupule) strengthened. An expected outcome is an effective and responsive island governance where climate change and disaster risks and impacts are integrated into Island Strategic Plans. https://faolex.fao.org/docs/pdf/tuv143764.pdf
Tuvalu National Agriculture Sector Plan (2016-2023)	The Tuvalu National Agriculture Sector Plan 2016-2023 provides detailed and longer-term strategic guidance for the agriculture sector, beyond what is provided in *Te Kete*. It aims to systematically improve the most important aspects of the supporting environment for agriculture in Tuvalu, including: • Updating and harmonizing the policy, legislative and regulatory framework. • Improving access to financing for agricultural production and projects. • Strengthening facilitating institutions including government agencies and production and marketing organizations, establishing within the DOA a research & development unit and a home economics unit (to support development of value adding to agriculture products and promotion of consumption of local foods). • Repairing and replacing ageing DOA infrastructure and machinery; and • Improving the capacity and effectiveness of the extension service.
Tuvalu Food Systems Pathway	In September 2021, Tuvalu submitted its National Food Systems Pathway as part of the United Nations Food Systems Summit. The pathway document emphasises the importance of Tuvalu's National Vision "*A Peaceful, Resilient and Prosperous Tuvalu"* and outlines the following national priorities in relation to food systems: 1. Increase local food production 2. Strengthened partnerships 3. Change and shifting of diets 4. Eat safe and nutritious food 5. Governance and finance strengthened 6. Coalition with other Atoll Nations The National Food Systems Pathway is well aligned with the FSS mentioned above, and like the FSS, it does not cover the importance of natural capital and health of ecosystems upon which the agri-food systems rely upon. This gap will be addressed at

	the policy level in the proposed National Food Systems and Nutrition Policy to be developed under Component 1 of this project.
Tuvalu Agriculture Strategic Marketing Plan (TASMP) 2016-2025	Developed with support by the EU funded Global Climate Change Alliance – Pacific Small Island States regional project, the TASMP 2016-2025 aims to revive domestic and international trade of locally produced agricultural products through domestic activities and trade arrangements. It advocates for a revival of trading of local agricultural products and acknowledges the importance of traditional skills for the production and preparation of local food and handicrafts in this regard. The TASMP encourages the people of Tuvalu to eat more local food in order to enable them to live longer and healthier lives and a means for many families to earn extra income from the sales of local produce. The TASMP support the increased sale and consumption of local food with emphasis on a "Go Local" campaign and production of local food through organic farming, including development of the pulaka pit system. https://ccprojects.gsd.spc.int/wp-content/uploads/2016/07/5.-Tuvalu-Agriculture-Strategic-Marketing-Plan-2016.pdf
Tuvalu National Biodiversity Strategy and Action Plan – 5th National Report to the Convention on Biological Diversity (NBSAP 2016)	The NBSAP 2016 summarises the nature, cultural importance, conservation status and threats to Tuvalu's Biodiversity and actions taken or that need to be taken to promote the conservation and sustainable use of biodiversity. The interventions outlined in the NBSAP 2016 that are relevant to integrated agro ecosystems include: 1) enforceable conservation legislation, including stronger local by-laws. 2) designation of selected uninhabited, preferably pest-free, reef islets or forest remnants as reserves for threatened plants and animals; 3) replanting of coastal protection species. 4) establishment of agricultural conservation and enrichment areas, including improved excavated taro pit gardens, coconut dominant agroforestry plots and village gardens. 5) development of revegetation soil enrichment programmes for reclaimed barrow pit and lagoon land. 6) nursery and propagation capacity development. 7) improved pig and chicken husbandry systems, including improved fodder resources. 8) strengthened international and national biosecurity and IAS eradication and management programmes; and 9) national awareness and education programmes, including the recording and teaching traditional knowledge. One of the actions under the theme of Climate Change and Disaster Risk Management is to identify options for ecosystem-based adaptation. Under Trade, Biosecurity and Food security, there is: establishment of organic home-gardening, establishment of nurseries, raising awareness and understanding on the value of organic farming as opposed to inorganic farming for example the use of chemical fertilizers and pesticides, increase cultivation and preservation of traditional food crops, and review of the national food policy to strengthen those elements fostering biodiversity.

The Native Lands Ordinance of 1957 and the Tuvalu Lands Code of 1962 (revised in 2008).	The formal legal framework related to land tenure includes the Native Lands Ordinance of 1957 and the Tuvalu Lands Code of 1962 (revised in 2008). These laws support traditional practices, emphasizing kaitasi-led, collective ownership and the crucial role of extended families in land stewardship. The Board works with government departments and is part of the Island council too. The Tuvalu Lands Code (1962 and recently updated in 2008) outlines the rules governing land ownership rights and the restrictions imposed by the Land Court. It also regulates the alienation of rights, ensuring that customary practices are respected within the legal framework. The Native Lands Ordinance (1957) restricted the transfer of native land to non-natives, allowing such transactions only under specific conditions, such as alienation to the Crown, Local Government Councils, or registered cooperative societies. Land titles are registered with the Native Lands Commission, and disputes are resolved by the Lands Court.

The policy framework that serves as a basis for LDN consists on several national policy instruments that tackle land degradation. However, Tuvalu has not developed a comprehensive and integrated land use policy. The Land and Survey Department (LSD) is leading the formulation of a new National Land Use Policy (NLUP), who is seeking to tackle land use challenges, with a particular emphasis on climate change and sustainable development.

The LDN strategy in Tuvalu is also committed to achieving international commitments and multilateral environmental agreements, including the three Rio Conventions namely the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Convention to combat land desertification (UNCCD), and the Convention on Biological Diversity (CBD), as well as the 2015-2030 Sendai Framework for Disaster Risk Reduction.

The LDN strategy will support the implementation of various international and national provisions within existing development and sectoral policies while also complementing them. Notably, it fills a critical gap by offering an integrated approach to addressing land degradation, which is essential for strengthening the country's efforts to face climate change and for conserving and restoring the country's biodiversity.

3.4 Customary Land Tenure regime

In Tuvalu, land tenure is primarily governed by complex customary practices and guidelines that support them, with formal legislation providing additional structure.

In Tuvalu, customary land tenure is based on three key concepts: **Keitais**, where land is collectively owned by extended families; **Kai Tokotasi**, which assigns land to individuals or small family units for exclusive use; and **Vaevae**, a system ensuring fair distribution of land rights among family members. The traditional leaders, known as Kaitasi, in Tuvalu oversee collective land ownership, mediate disputes, ensure fair resource distribution, uphold traditions, and promote sustainable land management.

These traditional practices emphasize sustainability, including ecosystem preservation for species reproduction. Compliance is enforced through regular monitoring, penalties, and monthly community meetings to resolve disputes and update conservation strategies.

Key elements of Tuvalu's customary tenure system include:

1. **Matai system** – Extended families own land, with a **matai** (family head) overseeing its use for the collective benefit.
2. **Clan-based tenure** – Land is collectively inherited within families or clans, with usage rights based on oral agreements and traditions.
3. **Inheritance through lineage** – Land inheritance is typically patrilineal but can be flexible based on circumstances, with disputes settled by elders.
4. **Communal rights** – Some lands are shared for agriculture, fishing, and cultural activities, governed by customary laws ensuring equitable access.
5. **Use rights vs. Ownership** – While land ownership is collective, individuals or families hold use rights, often tied to community participation and responsibilities. Once community consent is secured, an individual is permitted to lease the land held.
6. **Role of elders and chiefs** – Traditional leaders allocate rights, mediate disputes, and promote sustainable land management, ensuring decisions are based on consensus and respect for customs.

Despite the presence of statutory land laws from colonial times, customary tenure remains dominant, particularly in outer and remote islands. However, in the capital, this system is gradually loosening with the increasing use of land leases (a form of tenure) for specific activities. Balancing these traditional systems with modern governance continues to be a challenge in Tuvalu.

In Tuvalu there are several land tenure categories. The Tuvalu Lands Code (2008) outlines land tenure classifications and provides comprehensive guidelines for the use and management of land across all the islands, including:

Tuvalu's land tenure can be categorized as:

1. *Customary Tenure*: Based on family or clan ownership passed through generations.
2. *Statutory Tenure*: Formalized under legal frameworks, offering clear rights and responsibilities.
3. *Leasehold*: Land use rights granted for specific terms.
4. *Freehold*: Unrestricted ownership within legal boundaries.
5. *Reserved Land*: Allocated for public or conservation purposes, restricting private claims.

In summary, Tuvalu's land tenure system is deeply rooted in customary practices, with formal legislation reinforcing traditional systems. The interaction between customary and statutory laws ensures that land management aligns with cultural values while providing a framework for dispute resolution and governance.

While formal laws provide a structured approach, customary land tenure systems remain dominant, particularly in rural areas. The kaitasi system, where extended families manage land collectively, plays a central role in land management. In the capital Funafuti, the establishment of the Native Land Trust Board is a sign of the formal recognition of the customary leaders and governance of land and resources. However, balancing traditional practices with modern land governance remains an ongoing challenge in Tuvalu.

From the perspective of land tenure, the following are key challenges, additional to those already mentioned:

a) **Balancing customary and formal systems**: The integration of traditional land management practices, such as the kaitasi system, with formal legal frameworks like the Native Lands Ordinance and Tuvalu Lands Code remains complex. The challenge lies in maintaining respect for customary practices while ensuring legal recognition and enforcement of land rights.

b) **Limited land availability**: Tuvalu, being a small island nation, faces significant limitations in land availability, exacerbating pressure on land use, especially for housing, agriculture, and infrastructure development. This scarcity can lead to conflicts over land rights and uses. Weak physical planning adds to the challenges.

c) **Land disputes**: Disputes over land ownership, inheritance, and use often arise, particularly in a context where both customary and statutory land laws are in play. The resolution of such conflicts can be complicated, as traditional dispute resolution mechanisms sometimes conflict with formal judicial processes.

d) **Impact of climate change**: Rising sea levels and environmental degradation pose an existential threat to Tuvalu's land, leading to concerns about land loss, displacement, and the future of land tenure. These changes add complexity to land management and legal systems.

e) **Lack of updated land records and outdated surveying methods**: The absence of updated land records, combined with outdated surveying methods, creates challenges for accurately determining land boundaries and ownership. These gaps in data can complicate land administration and increase the potential for disputes.

f) **Weak progress in modernisation/digitalisation of records**: The slow pace of digitizing land records hampers efficient land management and access to information. This delay in transitioning to digital systems further complicates the resolution of land disputes and the efficient management of land resources.

g) **Lack of defined socio-environmental safeguards**: There is a near absence of well-defined socio-environmental safeguards that could support sustainable land management, leaving land use vulnerable to environmental degradation and conflicting economic pressures.

h) **Recent changes in government department mandates**: Since 2019, the mandate for managing land registry and records was transferred from Land and Survey Department to the Magistrate Courts, which has caused disruptions and some confusion in the continuity and coordination of land administration and management activities.

i) **Foreign investment and land ownership**: Tuvalu's cautious approach to foreign investment in land, for valid reasons, results in policies that restrict land transfers to non-natives, which can limit economic development opportunities while helping protect land from external

exploitation. Finding a balance between protecting land rights and fostering economic growth remains a continual challenge.

j) **Lack of awareness and education on land and resources**: Limited awareness of formal land tenure laws (both formal and customary), particularly among rural communities, makes it difficult for people to navigate the legal system and assert their land rights effectively. Education and capacity building are needed to address this gap. Customary practices are often taken for granted by the younger generation, leading to a poor transfer of knowledge between generations.

k) **Impact of missing national land policy (or guiding framework) on resource governance**: The absence of a comprehensive land policy in Tuvalu hampers efforts to establish clear, consistent guidelines for land tenure administration and land use management. Without a unified framework, decision-making becomes fragmented, and traditional and modern systems may conflict. This lack of policy makes it challenging to address land disputes effectively, plan for sustainable development, and protect land rights for future generations.

3.4 Drivers of land degradation in Tuvalu

3.4.1 Drivers of land degradation

Monocultural coconut plantations for the export production of coconut oil and copra were established during a long post–European contact and during the British colony (Thaman, 2016 [18]). Extensive habitat destruction and conversion of much of the best cultivable land on Funafuti and large areas on Nanumea and Nukulaelae occurred during this period, including the excavation of materials from "borrow pits" to build airstrips during World War II. Since independence in 1979, rapid population growth, including the migration from outer atolls to, and the expansion of, the main settlement and government center on Fogafale Islet, Funafuti. In terms of biodiversity, throughout all of these periods of development, there has been a selective removal of indigenous species and vegetation for growth of settlements, construction, boatbuilding, firewood, medicine, tools, handicrafts and other purposes, and the introduction of a wide range of nonindigenous plants, some of which have become important cultural plants and some of which are now invasive weeds (Thaman et al. 2013) [18].

Key drivers and processes of land degradation were identified through a comprehensive desk review and during the national stakeholder consultations (January 2025), desk reviews, field observations, and supplementary consultations. Table 15. summarizes these findings.

Table 15. Land degradation drivers and processes in Tuvalu

Land degradation drivers and processes		**Land degradation types**
1. Climate change: Sea level rise	• Sea level rise due to climate change is causing coastal erosion and saltwater intrusion. • Salt-water intrusion in groundwater increased soil salinity, limiting the range of plants that can be grown on the islands and decreasing crop productivity. • King tides flooding impact is increasing as the water reaches further inland than it did in the past. • Coastal management including reclamation to expand land in coastal areas are changing marine environment and increasing wave impact.	➔ Coastal erosion ➔ Groundwater salinization. ➔ Soil salinization. ➔ Crop damage due to salinity. ➔ Coral reefs and fisheries degraded.
2. Settlement expansion	• Land-use change for infrastructure development • Settlement expansion generates impact on scarce land and fragile natural resources. • Urban expansion occurs mainly in Funafuti Island. • Settlement has increased over cropland. • Infrastructure and development projects are done on natural areas.	➔ Land cover change ➔ Croplands reduced. ➔ Wetlands reduced.

3. Unsustainable agricultural practices.	• Coconut trees are old and not replaced. • Coconut plantations easily suffer from pests (1984) • Agroforest systems are not maintained, diversified and improved, and useful trees are getting lost. • Burning of bush and shrub vegetation. • Home gardens have limited species diversity, which is both a cause and a consequence of the heavy reliance on food import. • Pulaka pit cultivation is declining due to saltwater intrusion and abandonment (young people migrating). Therefore, there are Increased areas of abandoned croplands. • Loss of coastal forests and vegetation, mangroves, and beaches.	➔ Decrease in productivity of coconut palm trees. ➔ Coconut plantations are being reduced ➔ Decrease in natural soil fertility and loss of soil life. ➔ Decreased biodiversity
4. Unsustainable water management practices	• Wetlands have been contracted. Some of them have been replaced by infrastructure such as waste disposal sites. • Wetlands have been polluted by piggeries discharging waste in mangrove areas. • Groundwater is affected by salt-water intrusion. • Overdrawing of groundwater due to dry periods: (e.g., in Nanumea Island), causes changes in water balance: coconut trees, breadfruit and bananas are affected. • Groundwater has been pumped and overused • Coral reefs, beaches, near-shore lagoon and oceanside marine ecosystems have been transformed. • Increased water temperatures and ocean acidification have affected coral ecosystems that serve as fish nurseries, making it harder for Tuvaluans to catch and eat fish.	➔ Wetlands contraction ➔ Wetlands pollution ➔ Marine environment altered ➔ Groundwater quality decreased salinization. ➔ Groundwater availability decreased. ➔ Soil salinization.

Indirect drivers of land degradation include:

1. Population growth.
2. Land tenure challenges.
3. Lack of integrated land use planning.
4. Loss of traditional knowledge (linked to the loss of land resources).
5. Limited education and awareness raising.

3.4.2 Analysis of land degradation drivers

Direct drivers of land degradation are analysed in the following paragraphs, emphasizing on their interlinkages and the critical two-way relationship between land degradation and climate change, underscoring the importance of addressing land degradation as a crucial strategy for diminishing climate change vulnerability.

DRIVER 1. Climate change: Sea level rise

Sea level rise and land degradation are closely connected, not only through coastal erosion but also through the decrease in water availability and low productivity of agricultural crops.

With a coastline of 24 km, Tuvalu is classified as highly vulnerable to sea level rising[26]. The mean sea level rising in Funafuti is currently 5.1 mm/year, which is three times higher than the global average [5]. Sea level rise exacerbates the impacts of storm waves on atolls which causes severe coastal erosion and inundation of coastal areas. As a result, from sea-level rise, coastal erosion, soil salinisation, and seawater intrusion into freshwater ecosystems lead to land degradation and food insecurity.

Tuvalu has the second-lowest maximum elevation of any country (after the Maldives). The nine islands of Tuvalu are less than five meters above sea level and average 1.83 m above mean sea level. The highest elevation is 4.5 metres above sea level, which gives Tuvalu is one of the most vulnerable countries in the world with regards to rising sea-levels, king tides and other climate change impacts and extremes[27].

Coastal erosion has reduced the landmass of Tuvalu and already caused the disappearance of Funafuti's small islets Pukavilivili and Vasafua and two small islets in the outer islands of Nukulaelae and Nukufetau.

Tuvalu, and particularly Funafuti, is also increasingly affected by the "king tide", which are extra high tides caused by the gravitational pull of the full moon. The king tide is a flooding event that normally occurs once or twice a year. Flooding from king tides and waves could be 3–5 m. A king tide with 3.2-m height could inundate half of Fongafale land (Lin et al., 2014) [11]. King tides are now causing inundation across Funafuti, especially in the area surrounding the airstrip. King tides cause flooding that has washed the coastline, destroyed cultivated lands, contaminated freshwater, and decreased the productivity of agricultural crops [12] [5].



Now, according to some authors, the flooding occurred by King tides may not respond only to climate change but also to unsustainable management of land and groundwater. Research suggest that this flooding may be caused or amplified by increasing construction in low-lying swamps [23]. Similarly, the salinization of fresh groundwater is linked to over-extraction from delicate freshwater lenses as well as from rising sea levels and inundation.

26 Climate risk and food security assessment (Saami and Bapon, 2022, in [5])
27 UNDRR, 2022, Disaster Risk Reduction in Tuvalu – Status Report (in [17])

Photo: King Tide in Funafuti. Source: Yarina and Takemoto, 2017

Other "solutions" that are affecting climate change vulnerability and that should be at the center of the policy dialogue in Tuvalu are land reclamation and sea walls. Land reclamation, which consists of dredging up sediment from the ocean floor to extend coastlines in coastal areas is a response to sea level rise, population growth and to the shortage of land area[28].

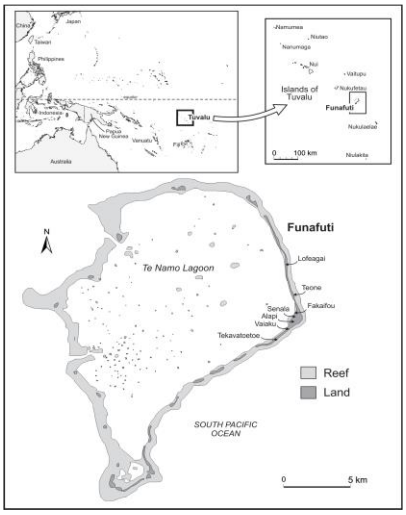
DRIVER 2. Settlement expansion

The results of the analysis of the land use change indicator conducted by Collect Earth in Tuvalu shows that "settlement" is the land use that changed the most from the baseline, as it has increased by 84 ha, at the expenses of forest (3.8 ha), cropland (68.8 ha) and wetland (11.4 ha).

Human settlement patterns have changed in Tuvalu, in particular in Funafuti, the capital. Internal migration from outer islands to Funafuti has led to increased urbanization. The 2012 census reported that 57% of Tuvalu's population resided on Funafuti. Of a total population of 11,204 people in Tuvalu, 65% live in urban areas, with the majority living in Funafuti, where the population density is at least 2,500 people/km^2 [29] .

The density rises to 4,225 people/km2 in Fongafale islet, a heavily populated area of the capital. Figure 14. shows how Funafuti has changed from 1896 to 2004. Swamps have also diminished, and this might be one of the factors why king tides are now flooding more easily Funafuti [22].

Figure 13. Funafuti atoll



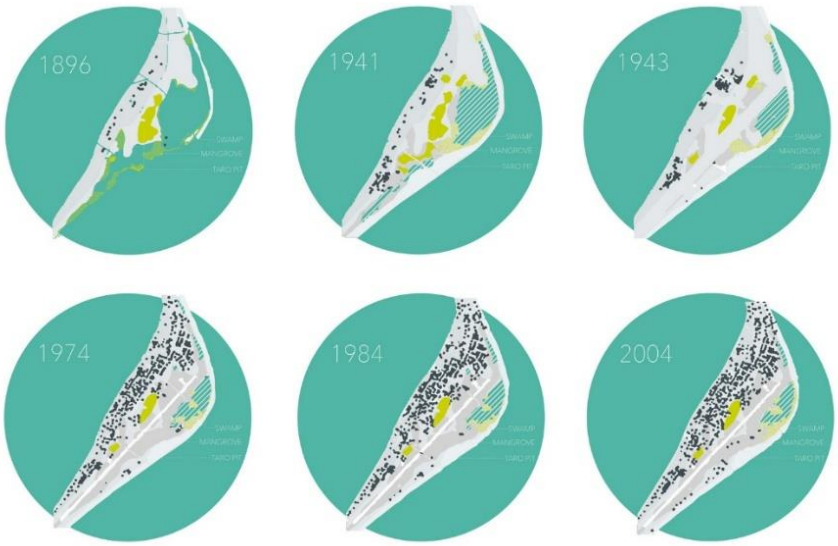
Source: McCubbin et al.,

Previously, the population centered on two villages, with surrounding land dedicated to food cultivation. Urbanization has fundamentally changed land use and vegetation cover in Funafuti (Yamano et al. 2007), it has consumed much of that land, making it unavailable for cultivation and harvesting.

Figure 14. Transformation of Funafuti atoll over time (from 1896 to 2004)

28 Land reclamation is a common practice in the Pacific, it has been implemented in In Majuro, Marshall Islands (Ford, 2012), Tarawa, Kiribati (Biribo and Woodroffe, 2013; Duvat, 2013), and the Maldives Islands (Kench, 2012; Naylor, 2015; Duvat and Magnan, 2019b).

[29] Government of Tuvalu. 2018. Tuvalu Population & Housing Mini-Census 2017 – Final Report. Funafuti.



Source: Yarina Elizabeth, Takemoto Shoko, 2017 [22] (adapted from Yamano, Hiroya, et al.)

Along with infrastructure development in Funafuti, there is also a problem of mining of coastal areas. As mentioned in the NAP (2006), the uncontrolled extraction of earth material (rock, gravel and sand) from foreshore areas has left some areas of the islands more vulnerable to the forces of the ocean and less able to combat the threats caused by climate change, including severe weather events. Increased infrastructure development is leading to a growing demand for earth material. The removal of this material is leading to accelerated coastal erosion and considerable loss of land. This is a crucial matter that warrants urgent attention, especially on the island of Funafuti. Funafuti is experiencing a rapid population growth and increasing need from government and public infrastructure developments. Consequently, the Kaupule (Island Council) of Funafuti has put in place several bylaws that prohibit the mining of earth materials. However, the government needs to establish a policy that helps prevent our foreshore environment from erosion and other threats associated with climate change [1].

DRIVER 3. Unsustainable agricultural practices

Unsustainable farming practices, including overuse of land for infrastructure & development, under-utilized land and growing crops without proper rotation or fallow periods that can lead to land degradation.

While climate change impacts is a major drivers of land degradation (e.g causing such as saltwater intrusion in pulaka pits) there are unsustainable environmental and agricultural practices occurring. Specifically, unsustainable agricultural practices include:

a) Unsustainable practices in coconut tree plantations and agroforestry systems

Most agroforestry systems in Tuvalu are coconut dominant. Coconut trees (*Cocos nucifera*) are vital for Tuvalu's economy, environment and food security. Coconut crops occur in all islands and account for 56.9% of land cover in Tuvalu. However, coconut trees are aging and therefore becoming less productive.

An estimation done in 2019 for IFAD [26], calculated 2,100 ha, or some 70% of the cultivable land planted with coconut. A major problem facing coconut industries is the ever-increasing percentage of senile palms. A high percentage of coconut plants are senile (> 60 years) [26] but are not replaced. There is also lack of diversification in coconut tree plantations, as being a monoculture, they have low resilience to pests and diseases.

b) Unsustainable practices in home gardens

Home gardens and backyards of Tuvalu provide a diverse and effective multi-layered and micro-climate vegetation cover. Home gardens originally grew mainly non-traditional short-term seed crops, but recently perennial shrub and tree food plants have also been introduced. Home gardens are increasingly important on Funafuti on some other atolls, such as Vaitupu.

Land degradation in home gardens is related to saltwater intrusion, mainly during king tide floodings, and to the opportunity of introducing sustainable land management practices in order to increase their diversity and productivity.

c) ***Unsustainable practices in Pulaka crops***

Pulaka (*Cytosperma chamissonis*) is a Tuvaluan traditional stable food crop. Unfortunately, 50–80% of the pulaka pits in Funafuti are abandoned due to the changing dietary preferences, declining interest in pulaka cultivation, periodic drought, and saltwater intrusion [2]. Saltwater intrusion and waterlogging due to climate change cause the deterioration of chemical and biological properties of soils, and that has rapidly decreased productivity of agricultural lands and pulaka pits.

In 2006, the NAP noted that Pulaka pits, covering a total land area of approximately 0.34 sq. km of the entire land area of the country, are being adversely affected by sea water intrusion. This is due to the upwelling of saline water through blowholes and saltwater intrusion into the pulaka plantation pits.

d) Other unsustainable agricultural practices

Other unsustainable land-use practices include burning shrubs to clear the land mainly during droughts as it leaves soil bare vulnerable to erosion and nutrient decrease. The fires remove ground cover and leave soil prone to erosion when rain eventually fall and king tides in coastline areas. Fires also reduce soil organic matter which reduce the water-holding capacity of soil. Though each fire is small in size, they are nonetheless significant compared to the total land mass of the country.

An additional land degradation driver is the introduction of invasive species, such as Sphagneticola trilobata (creeping oxeye or trailing daisy), Commelina diffusa (climbing dayflower or spreading

dayflower), spreading aggressively. The crazy ant (Anoplolepis gracilipes) as sap-sucking insects is also damaging agro-ecosystem.

Finally, unsustainable agricultural practices include the overuse of pesticides and inorganic fertilizers, which degrade the soil by damaging the community of organisms living in the soil and further reduce quality of groundwater. The infertile nature of Tuvalu soils has led to an increase in the use of agricultural chemicals.

e) Land degradation in other ecosystems providing ecosystem services.

In addition to the loss of agricultural biodiversity, land degradation occurs in ecosystems providing important ecosystem services, such as coastal forests, mangroves, coral reefs, beaches, and marine ecosystems. These ecosystems are vital for maintaining vegetation cover, water balance, soil fertility but also for facing climate change. For instance, trees such as Hibiscus tiliaceus (Chatenoux and Peduzzi 2007) and shrubs of *Scaevola taccada* and *Pemphis acidula* helped dissipate the 2004 Indian Ocean tsunami force (UNEP 2005). [21]. If land degradation is not correctly addressed, climate change vulnerability will increase.

Moreover, within all of these ecosystems there is a wide range of threatened plants and animals, with over half of over 1000 named species in need of conservation by local communities. Almost all coastal trees and palms in Tuvalu have local uses as food, medicines, cultural products and wood[30]. Among the most threatened species are marine and land crabs, a wide range of native coastal, mangrove and inland trees, shrubs, vines, ferns and other herbaceous species, almost all of which are culturally important multipurpose plants, cultivated food, ornamental and multipurpose plants [21] (FAO GEF project PRODOC).

DRIVER 4. Unsustainable water management

Groundwater resources are compromised by saltwater intrusion and unsustainable extraction rates. Seawater infiltration has already increased soil salinity, limiting the range of plants that can be grown on the islands. Over-pumping, particularly during prolonged dry periods, has disrupted the water balance, resulting in observable impacts on agricultural productivity, including reduced yields of coconut, breadfruit, and banana crops.

Freshwater and ocean ecosystems are affected in Tuvalu. Tuvalu's wetlands are diminishing due to land use change conversion for infrastructure and pollution from agricultural sources and waste disposal. For instance, while mangroves are important to protect the islands from tidal and storm surge, piggery waste discharge into mangroves and ponds.

[30] Examples of useful plants include Cocos nucifera (myriad uses including food, edible oil and drinking nuts), Cordia subcordata and Thespesia populnea (premier carving woods, medicine), Terminalia catappa and T. littoralis (nuts, bark for medicine, timber), Calophyllum inophyllum (tamanu oil, timber, carving) and Pandanus tectorius (food, thatch and building timber on atolls).

Marine ecosystems are also degrading. Climate change impacts such as rising sea surface temperatures (already about 29 ◦C) and ocean acidification are the main reasons for coral bleaching and degradation, which – as main habitats of fish, particularly tuna – decrease marine productivity [5]. In Funafuti, the ecological health of the lagoon has declined in recent years, and many fishers now travel outside the lagoon to access fish (McCubbin et al. 2015).[8]

In sum, unsustainable practices are degrading freshwater and marine ecosystems, thereby reducing the country's natural resilience and increasing its vulnerability to climate change impacts.

3.4.3 Land degradation in Tuvalu's islands – consultations in Nui and Nanumanga

In order to formulate a ground-based LDN strategy, a participatory mapping of all islands was conducted and two Island consultations were held in March-April 2025.

The information provided serves as a basis for the LDN strategy. Specific Island LDN Strategies will be formulated during the development of Island plans, with the support of FAO GEF project. This document will serve as guidance and framework for Island LDN strategies.

During the LDN stakeholder consultation conducted in Tuvalu in January 2025, a participatory mapping of examples of land degradation problems was conducted for all Islands. The mapping was done with the support of Land Survey Department, through GIS mapping (QGIS) for the 9 islands of Tuvalu (See **Annex 4**). Table 16. summarizes the findings of this participatory mapping.

Table 16. Tuvalu area, population, NDVI and examples of land degradation.

ISLANDS	Location	Area (ha)	Population (Census 2017)	Population density (hab/46ros)	NDVI changes (Collect Earth image)	Examples of Land Degradation Processes – identified through participatory mapping during the national LDN stakeholder consultation
1. Nanumea	North	**387**	512	1.32	Yes	• Important LD issue: over-extraction of ground water during the drought in 2022 affected trees (the image shows the area brown, while in 2019 it was all green). • In northern islands, they pumped the freshwater to desalinate (instead of sea water), • Low productivity (coconuts, bananas, breadfruit) • A coastal sea wall broke down, vegetation was gone.
2. Nanumanga	North	278	491	1.77	weak	• Pulaka pit washed away by the sea • Saltwater erosion in pulaka pits • Coastal soil erosion.
3. Niutao	North	253	582	2.02	Yes	• Saltwater intrusion • Overgrowing of mangrove.

4. Nui	North	283	**610**	**2.16**	weak	• Pulaka pits abandoned after PAM cyclone in 2015. • Graveyard Cemetery cleaned by a wave. • Inundation by cyclone PAM affected breadfruit trees
5.Vaitupu	North (close)	**560**	**1,061**	1.89	Yes	• Flooding around the lagoon during spring times (inundation)
6. Nukufetau	North (close)	299	597	2.00		• Bags of sand as coastal walls have been placed all around to avoid coastal erosion
7. Funafuti		279	6,320	22.65		• Erosion of settlements • Coastal erosion • Waste disposal on land that was previously a wetland.
8. Nukulaelae	South	**182**	**300**	1.65		• Yellow crazy ant devastated pulaka pits, coconuts • During last drought in 2012, most trees collapsed
9. Niulakita	South	42	34	0.81		• Southern island: only 40 inhabitants • New Zealand company mined phosphate then they left holes in the island • Senile trees very tall and pests (fly fruit) • Tilapia and tuna ponds, also eel.

This mapping shows that islands in Tuvalu are relatively similar in terms of ecosystems and land cover and, as analysed by Collect Earth, most islands have a vegetation cover primarily of coconut tree plantations. Land degradation problems, such as coastal erosion and damage to pulaka pits, are found in all islands, however there are specific processes in each of them. There is also a history of interventions, such as mining and waste disposal in some islands, that have had long lasting impacts.

Two local level consultations were conducted with the objective of validating and complementing the analysis of causes and drivers of land degradation and the overall LDN targets formulated during the process of development of the LDN strategy.

LDN Consultation in Nui

The consultation in Nui Island was held on the 11th of March. It was conducted by Mr. Falefou Papua, FAO national specialist. The consultation was held with 10 participants from the local council or Falekaupule, the women's community, and youth, a representative from the magistrate, and FAO representatives (in person and online). The consultation was facilitated by Falefou Papua, FAO national consultant.

The analysis of land degradation processes, causes and impacts in Nui Island is summarized below, in Table 17. The information presented aims to preserve the information from the consultation as it was held and provided during the consultation.

The consultation in Nui included a mapping and more detailed analysis of land degradation problems, which is found in **Annex 4**.

Table 17. LDN Strategy - Results of the FAO consultation in NUI ISLAND – 11 March 2025

ENVIRONMENTAL and LAND DEGRADATION main processes	CAUSES of land degradation	IMPACT to livelihoods	SOLUTIONS Proposed by the local community
1. Pulaka Pits are unproductive.	• Sea level rise. • Tropical Cyclone PAM (2015) and Tropical Cyclone TINO (2019-2020). • Inundation of Pulaka Pits. • Salted groundwater.	Shortage of food availability.	Technical assistance on Pulaka Pits. Expert to come over to the island to survey the fertility of the pits. Block the areas where the seawater enters with cement or a seawall on the shore to prevent the seawater from entering the pits. Technical assistance and supply material (cement) for concrete pits provided were inadequate as it gives the pulaka a hard time to grow, and there were no specialists who came over to the island and elaborated more on how to plant and how to make these concrete pits.
2. Coconut trees are dying.	• Lack of groundwater. • Trees are old and not replaced.	Lack of food available for people. Lack of food for pigs, as people on the island feed the pigs with the coconuts. Women use the coconut tree's leaves for handicrafts for financial support. Lack of income (handicraft for selling, like weaving fans).	Replanting of coconut trees. The Coconut Rehabilitation project is starting. This is a government project under Agriculture. Public shall provide plain lands for the replanting of coconut trees and receive the money in return.
3. Government Gardens are dying, business gardens are dying.	• Too much heat and lack of superficial and ground water	Shortage of food availability: No other option besides the private gardens to get their fresh fruits/vegetables from. Those who don't have their	Providing materials for people to make their own home gardens (Home Gardening).

	to water the garden.	own gardens will not get any fruits or vegetables from the business gardens or government gardens.	However, due to poor supervision, wrong materials were provided for each plant, so they did not grow well. The project is a failure; locals suggest doing this again but with the right supervision.
4. Degradation occurs in the whole land, but it mostly affects the plants that are near the sea.	Strong wind, sea level rise, and heat. (Climate change).	Lack of food availability nearby home, the village is located near the sea. The people are relying on the coconut trees and any other trees that are close to them within the village. The degradation affects the trees in the village, making people travel far from the village to get what they need for food, like coconut trees, breadfruit, pandanus, bananas, and any other trees. E.g., goes to the bush to harvest the breadfruits.	A concrete Slide seawall, not the stand-up seawall.

LDN Island Consultation in Nanumanga

The consultation in Nanumanga Island was held on March 31st, 2025. Mrs. Lanuola Keleta Fasiai, FAO Island Field Project Assistant conducted this consultation.

Participants of the local council and representatives participated in this consultation (see Figure 15. photo):

Figure 15. Photo of consultation in Nanumanga Island – Falekaupule, women and youth representatives.



First Row (Left to Right): Mrs Saimila Petaia-Women's Rep, Mr Paani Munatu-Agriculture Extension Officer, Mr. Talepa Tehoa-Pulefenua, Mrs Vasati Malua- Court Regiatra, Mrs Lita. Uoka-Kaupule Assistant Secretary reps. Second Row(left to right) Mrs Lanuola K Fasiai, Mr Peni. Atoni (youth) Mr. Iosefa. Tulafono (Church youth rep), Mrs Laloi Kapua (Kaupule & Secretary rep), Mr Isopo Tehoa- Kaupule, Luka Teiaputi- Kaupule Vice.

The consultation in Nanumanga consisted in working groups which discussed the main land degradation problems as well as provided Suggestion for Strengthening Land Tenure for Sustainable Land Management & LDN in Tuvalu.

Among the causes of land degradation in Nanumanga, the following were prioritized:

Land degradation problem	Causes	Impact
1. Soil erosion	Climate change	Land becomes smaller or scarce
2. Sea water intrusion	Rising sea level	Trees are not growing well especially edible local trees
3. Pest that harm trees	Too many development projects coming to the island	Harm our local edible plants such as coconuts, bananas, breadfruits etc

Recommendations proposed for the LDN strategy in Nanumanga include:

1. All development projects that are to be implemented on the island of Nanumaga should be notify to the Falekaupule prior to approval and implementation.
2. Every landowner should be aware or have some understanding of the island map to avoid problems or disputes between families or by the Law.
3. At present any disputes over land matters is solve by the Island Court.
4. The Falekaupule or the customary law has to work in collaboration with the Government in order to solve or come to an agreement on such matters regarding short term and long-term actions.

4. Setting Land Degradation Neutrality targets and associated measures

4.1 National land degradation priorities

Based on the national context, the drivers of land degradation, and, in addition to the policy framework analyzed in previous chapters, a summary of national land degradation priorities, climate change adaptation and land/forest-based mitigation measures in Tuvalu presented by the Agriculture Department during the National Stakeholder Consultation National-level consultation workshop on Land Degradation and Land Degradation Neutrality Strategy (Funafuti – 07-09 January 2025). These priorities are shown in Table 18.

Table 18. Summary of land degradation priorities - problems and actions to be taken

National Land degradation priorities, Climate Change adaptation and land/forest-based mitigation measures in Tuvalu	
1. Coastal Erosion and Sea-Level Rise	Problem: Tuvalu's islands are low-lying and extremely vulnerable to sea-level rise. Coastal erosion, exacerbated by rising sea levels, is a significant concern, as it threatens both the physical land and the agricultural systems that depend on it. Saltwater intrusion into freshwater supplies and agricultural lands also contributes to land degradation.
	Priority/Action: Protecting the coastal areas from further erosion through sustainable coastal management practices, including the restoration of coral reefs, mangroves, and seagrass beds that can act as natural buffers against wave action and storm surges.
2. Soil erosion and Degradation	Problem: In Tuvalu, soil erosion is a concern, particularly in areas where human settlements, infrastructure, and agricultural activities put pressure on the land. Deforestation, poor agricultural practices, and the limited amount of arable land contribute to soil degradation.
	Priority: Implementing sustainable land management practices, such as agroforestry, contour farming, and reforestation programs to reduce soil erosion and improve soil fertility. Additionally, enhancing organic farming and better waste management practices could help preserve soil health.
3. Saltwater Intrusion	Problem: Due to the country's low elevation and vulnerability to climate change, saltwater intrusion into both freshwater aquifers and agricultural lands is a major concern. This makes it difficult to grow crops and access clean water for both human consumption and agriculture.
	Priority: Protecting freshwater resources and improving rainwater harvesting infrastructure, alongside research into salt-tolerant crop varieties, to enhance food security and reduce dependency on vulnerable freshwater sources.
4. Climate Change Adaptation and Resilience Building	Problem: As one of the countries most at risk from climate change, Tuvalu faces extreme weather events such as cyclones, floods, and droughts, all of which contribute to land degradation. Rising temperatures, along with changes in rainfall patterns, also impact agriculture and biodiversity.
	Priority: Integrating climate change adaptation into land-use planning, including strengthening the resilience of communities and ecosystems. This includes enhancing disaster risk management systems and promoting climate-resilient infrastructure.

5. Sustainable Agriculture	Problem: Agriculture in Tuvalu is limited by the lack of arable land and the challenges of soil fertility. Unsustainable farming practices, including overuse of land for infrastructure & development, under-utilized land and growing crops without proper rotation or fallow periods, can lead to land degradation.
	Priority: Promoting sustainable agricultural techniques such as crop diversification, organic farming, and soil conservation measures to ensure long-term productivity and reduce pressure on the land.
6. Biodiversity Conservation	Problem: Tuvalu's unique biodiversity is under threat from habitat loss, particularly as coastal ecosystems like mangroves and coral reefs are degraded. Loss of biodiversity can further destabilize the land and the ecosystems that support human life.
	Priority: Strengthening conservation efforts for critical ecosystems such as coral reefs, mangroves, and coastal forests. Protecting biodiversity through community-led conservation programs and partnerships with international environmental organizations is vital.
7. Community Education and Involvement	Problem: There is a need for greater awareness and education about the impacts of land degradation and climate change, especially at the community level where traditional knowledge and practices can be integrated with modern conservation efforts.
	Priority: Engaging communities in land management and conservation efforts through education, capacity building, and participatory planning. This includes fostering local ownership and involvement in sustainable land management practices and resilience building.
8. International Cooperation and Funding	Problem: Given Tuvalu's limited resources, international cooperation and external funding are crucial for addressing land degradation and climate change impacts.
	Priority: Strengthening partnerships with regional and international organizations, such as the Pacific Islands Forum, the United Nations, and international donor agencies, to secure financial and technical support for sustainable land management and climate adaptation programs.
Mr. Matio Lonalona, Director of the Agriculture Department. Presentation done during the LDN National Consultation in Tuvalu. 08.01.2025	

These priorities are the foundation of the following LDN targets and measures.

4.2 Land Degradation Neutrality targets and associated measures

LDN targets at national level have been set to achieve a neutral (no net loss) or improved (net gain), considering current national policy priorities, actions undertaken by various projects and initiatives, as well as identified gaps. National LDN targets in Tuvalu were formulated by key national institutions during the National-level consultation workshop on Land Degradation and Land Degradation Neutrality Strategy held in Funafuti in January 2025.

Based on an analysis of national governmental priorities for addressing land degradation and climate change and following the identification of land degradation drivers, 8 LDN targets and 28 measures for achieving these targets were formulated and agreed with participating institutions. These targets were further adjusted following consultations.

There are two types of LDN targets, those focusing on sustainable land management and restoration practices needed (e.g., coastal management, coconut rehabilitation, climate-smart agriculture, etc.) and

targets for improving the enabling environment (land use planning and resource mobilization) (See Table 19).

TABLE 19. LDN TARGETS AND MEASURES

LDN STRATEGY OF TUVALU		
LDN OBJECTIVES	**LDN TARGETS**	**Measures**
Sustainable land management practices		
Objective 1. To mitigate coastal erosion and sea -level rise through Integrated coastline management and restoration in all islands	**Target 1** Enhance sustainable coastal management and restoration of **coastline vegetation** by planting adapted trees and shrubs in a total of at least 16 km of coastline in all islands by 2040.	1. Avoid further erosion from coastal areas through sustainable coastal management practices, including restoring coral reefs, and seagrass beds that can act as natural buffers against wave action and storm surges. 2. Restore coastline vegetation by planting coastal trees, mangroves, shrubs, and other plant species (e.g., Casuarina, Fetau). 3. Strengthen conservation efforts for critical ecosystems such as coral reefs, mangroves, and coastal forests to protect biodiversity through community-led conservation programs.
Objective 2. To enhance sustainable agriculture and agroforestry to increase productivity, restore biodiversity and degraded ecosystems.	**Target 2.** Rehabilitate **Coconut palm tree systems** to increase productivity by 30% in at least 450 ha by 2040.	1. Restore coconut tree plantations by replacing senile coconut trees by new ones. 2. Introduce in coconut systems other agroforestry trees and shrubs. 3. Diversify and develop value chains and market for coconut oil products.
	Target 3. Diversify and implement Sustainable Land Management practices in **village house yards and house gardens** in at least 30% of households by 2040.	1. Promote crop diversification and incorporate climate-tolerant species of household vegetables, cassava, sweet potatoes, etc. 2. Improve composting practices for soil conservation and for increasing soil fertility in house yards and house gardens. 3. Improve smart-agriculture, water conservation practices and drip irrigation (e.g., raise garden beds). 4. Promote sustainable minor livestock raising (chicken, ducks) 5. Improve waste management practices to preserve soil health.
	Target 4. Avoid the loss, improve the management (250 ha) and establish at least 250 ha of new **agroforestry systems** (breadfruits, coconut, figs, pandanus, fruit trees) in all islands.	1. Improve crop management practices, through shifting cultivation, crop rotations, mixed cropping, contour farming, composting, etc. 2. Diversify existing agroforestry systems by enhancing the conservation, planting and management of useful plants for traditional medicine, building, fibres, etc. 3. Establish new agroforestry systems. 4. Conduct research and implement biological control of coconut and other trees from invasive species.

	Target 5. **Increase soil organic carbon (SOC)** on all islands by 2 to 5%, reduce non-biodegradable waste disposal, and improve vegetation by 10-15% by 2040.	1. Reduce the use of polyethylene, polypropylene, polystyrene, polyvinyl chloride, polyurethane, and polyethylene terephthalate in the soil. 2. Plastic mulching films should be properly disposed of after use. 3. Avoid dumping macro- or meso-plastic trash into soil. 4. Minimized land and vegetation clearing. 5. Reduce the amount of vacant land.
Objective 3. To mitigate saltwater intrusion in soils and crops.	**Target 6.** Restore 30 abandoned **pulaka pits** in each island and other low-lying crops from saltwater intrusion by 2040.	1. Research for salt-tolerant crop varieties and soil salinity mitigation technologies. 2. Establish demonstration plots of restored and improved pulaka pits. 3. Planting of pulaka and other root crops (e.g. Colocassia – Taro) 4. Capacity building activities on pulaka restoration and consumption, in particular with youth. Develop value added activities for pulaka.
Enabling environment		
Objective 4. To strengthen integrated and participatory land use planning in all islands.	**Target 7.** Strengthen **integrated land use planning** processes and formulate participatory LDN land use plans in all islands by 2040.	1. Coordinate, provide inputs and incorporate LDN targets and approaches into the National Land Use Policy under development by the Land and Survey Department (e.g., developing guidelines) (ongoing process January 2025) 2. Ensure coordination with the Island Strategic plan ISP (4-year plan) (the planning is ongoing until June 2025) and the KETE National Strategic Plan. 3. Develop participatory integrated land use plans (IAEPs) focusing on combating land degradation and climate change (SLM/LDN) in all islands.
Objective 5. To increase coordination and synergies and strengthen integrated management with climate change	**Target 8.** **Strengthen coordination, integrated management and mainstreaming** of LDN into climate change adaptation policies, strategies and projects and other sectors.	1. Encourage and strengthen coordination and synergies with climate change adaptation plans and projects to ensure that LDN complement adaptation measures (e.g., coastal erosion, mangrove planting, etc). 2. Awareness raising and education on the importance and linkages between land degradation and climate change. 3. Establish a LDN Forum to ensure coordination with different sectors and monitoring and follow up of LDN targets and measures
Objective 6. To increase resource mobilization for LDN	**Target 9.** **Mobilize financial resources** for LDN through climate finance and innovative financing mechanisms.	1. Identify finance opportunities and innovative financing mechanisms for implementing Tuvalu's LDN targets. 2. Mobilize national, regional and global resources for implementing LDN projects and measures.

5. Achieving land degradation neutrality

Land degradation neutrality in Tuvalu will be achieved through the following objectives:

1. Mitigating coastal erosion and sea -level rise through Integrated coastline management and restoration in all islands
2. Restoring and enhancing sustainable agriculture and agroforestry to increase productivity, biodiversity
3. Mitigating saltwater intrusion.
4. Strengthening integrated and participatory land use planning in all islands.
5. Increasing coordination and synergies between LDN and climate change adaptation to enhance an integrated management.
6. Mobilizing resources for LDN.

The following paragraphs highlight key elements to take into consideration when implementing LDN targets and measures for achieving LDN.

5.1 Promoting integrated coastline management and restoration

Target 1. Enhance sustainable coastal management and restoration of coastline vegetation by planting adapted trees and shrubs in a total of at least 16 km of coastline in all islands by 2040.

Enhancing sustainable and integrated coastal management is crucial to effectively address the impacts of climate change, in particular sea-level rise. Associated measures suggested include:

- Avoiding further erosion from coastal areas through sustainable coastal management practices, including restoring coral reefs, and seagrass beds that can act as natural buffers against wave action and storm surges.
- Restoring coastline vegetation such as coastal trees, mangroves, shrubs, and other plant species is crucial to diminish the impact of sea level rise.
- Strengthening conservation efforts for critical ecosystems such as coral reefs, mangroves, and coastal forests to protect biodiversity through community-led conservation programs.

As the South Pacific Applied Geoscience Commission (SOPAC31) suggests, “while Tuvalu is vulnerable to climate change there are additional environmental problems such as population growth and poor coastal management that are affecting sustainable development on the island”. In fact, poor coastal management increasing the impact and decreasing the vulnerability to climate change.

Unavoidable climate change is not an isolated problem, as land degradation adds to this situation. Therefore, avoiding activities that cause land degradation in coastal areas is needed as well as further national attention and discussion about the pertinence of some solutions for sea-level rise.

[31] SOPAC ranks the country as extremely vulnerable using the Environmental Vulnerability Index. https://www.psp-ltd.com/tuvalu_stat_eng.html

Many Pacific Island communities may seek to emulate solutions that have been successful elsewhere including seawalls and land reclamation. However, according to the Sixth Assessment Report of the IPCC, a typical reactive adaptation along small island coasts involves the construction of hard impermeable structures such as seawalls to stop the encroachment of the sea. Yet such structures, especially along rural island coasts, often fail to prevent flooding during extreme sea levels or extreme wave impacts and can inadvertently damage nearshore ecosystems such as mangroves and beaches.

Seawalls are often presented as a straightforward 'solution' to rising sea levels, however, seawalls not only fail to provide long-term protection but also generate unforeseen problems and frequently collapse within a short period. Land reclamation is another solution that should be analyzed. The extensive area along the lagoon in central Fongafale, which have been reclaimed and infilled with lagoon sediments, will probably be less fertile than existing soils and will require considerable rehabilitation and enrichment if vegetation is to be re-established [18]. Therefore, coastal rehabilitation nowadays can only be done in areas without land reclamation works.

Integrated coastal management is needed, where land and marine ecosystems are managed in an integrated and inter-linked manner, considering all trade-offs. Potential more sustainable and effective strategies should be discussed and foreseen in Tuvalu.

5.2 Enhancing Sustainable Land Management and restoration

Sustainable land management and restoration, including restoration of saltwater intrusion, will be achieved through:

- Rehabilitating coconut palm tree systems (LDN target 2).
- Diversifying and implementing sustainable land management practices in village house yards and house gardens (LDN target 3.)
- Avoiding the loss of agroforestry trees, improving the management and establishing new agroforestry systems (LDN target 4.)
- Restoring abandoned pulaka pits and other low-lying crops from saltwater intrusion (LDN target 5.)

Target 2. Rehabilitate Coconut palm tree systems to increase productivity by 30% in at least 450 ha by 2040.

Maintenance and rehabilitation of coconut palm tree systems is extremely important for Tuvalu, since this is the largest crop. Measures foreseen under target 2. focus on agroforestry-based coconut replanting activities as well as on diversifying and developing value chains and market for coconut oil products.

Coconut palm trees are very tolerant to cyclones and climate disasters as well as to drought and to short periods of saltwater inundation. Now, although South Pacific tall coconut varieties evolved in

cyclone-prone environments and therefore have adapted to survive in the strongest of winds, a high number of old trees have been lost due to the increased frequency of intense cyclones[32] [26]. However, prolonged drought significantly delays nut production. They will tolerate short periods of intensive rainfall and longer periods on well-drained soils. Coconuts will also tolerate [26].

Tuvalu is implementing the Tuvalu Coconut Sector Rehabilitation Programme, financed by the European Union. Coconut rehabilitation is done through a combination of agricultural replanting including an agroforestry-based coconut replanting activities. According to this programme document[33], the low yield in coconut production has limited private sector development and hindered the domestic trade market for local coconut products reducing the possibility to earn a living. The coconut rehabilitation plan focuses on coconut rehabilitation and the development of coconut products with a high added value.

Target 3. Diversify and implement Sustainable Land Management practices in village house yards and house gardens in at least 30% of households by 2040.

The objective is to diversify and strengthen existing home gardens and houseyards which are an important source of food, shade and biodiversity.

Associated measures related to SLM in village houseyards include crop diversification, incorporating climate-tolerant species, improving composting practices for soil conservation and soil fertility, improve smart-agriculture, water conservation practices and drip irrigation, promote sustainable minor livestock raising (chicken, ducks) and improving waste management practices.

The Tuvalu Department of Agriculture has advocated for the concept of a “home garden” (“fatoaga ite fale” in Tuvaluan), encouraging Tuvaluans to grow vegetables near their houses.

Village and house yards and house gardens provide an important source of food, mainly coconuts, breadfruit, papaw and vegetables, promote agricultural diversification and maximize self-sufficiency contributing to the overall food security of the country. Improving soil fertility and introducing climate-smart agriculture, including small irrigation, in village and houseyards is an opportunity to address land degradation, while diversifying nutrition and diminishing Tuvalu’s dependency on highly processed imported foods and drinks.

There are a number of initiatives to diversify houseyard food gardens for improving nutrition and increasing production and consumption of vitamin-rich vegetables and fruits. These initiatives

[32] such as the Tuvalu Category 5 Cyclone Pam in 2016
[33] Revised Programme document.
https://www.gtai.de/resource/blob/905098/1d1cf8c2ef284b3767c588e90b41241c/PRO20221005905088%20-%20Annex%202.PDF

include the UNICEF Home Garden Development Program and the Technical Mission of Taiwan's International Cooperation and Development Fund's (ICDF) vegetable production project[34].

Live and Learn Environmental Education Tuvalu carried out a Compost Feasibility Study in 2020[35], in partnership with the Ekalesia Kelisiano Tuvalu (EKT) Women's Centre Senala, Funafuti, on the recognition that compost production is an important climate adaptation and food security strategy for both increasing soil fertility of more traditional land-based agriculture and for improving home gardening systems to be less vulnerable to saltwater intrusion from sea level rise.

Target 4. Avoid the loss, improve the management (250 ha) and establish at least 250 ha of new agroforestry systems (breadfruits, figs, pandanus, fruit trees) in all islands.

Although coconut tree systems and houseyard gardens are in fact agroforestry systems, Tuvalu needs to consolidate the existing agroforestry systems and there is the opportunity to establish new ones. To this end, conserving, improve the management, diversifying and establishing new agroforestry systems is seen as an opportunity. This entails also conserving traditional ecological knowledge to support sustainable food sources for local communities.

The Tuvalu National Biodiversity Strategy and Action Plan highlights ongoing programs aimed at restoring and enriching traditional taro pit gardens and coconut-dominant agroforestry systems. These efforts include introducing climate-resilient crops and increasing the diversity of home vegetable gardens, which contribute to soil fertility and moisture retention.

Target 5. Increase soil organic carbon (SOC) on all islands by 2 to 5%, reduce non-biodegradable waste disposal, and improve vegetation by 10-15% by 2040.

Increasing soil organic carbon (SOC) in Tuvalu is critical because the country's soils face multiple pressures that reduce their natural fertility, resilience, and long-term productivity. SOC decline in Tuvalu is driven by factors such as indiscriminate dumping of plastics, wastes, inadequate land-use planning that leads to encroachment into productive areas, soil salinity that suppresses plant growth, and extensive land and vegetation clearing that leaves soil exposed to erosion. Low SOC makes soils less able to retain moisture, support healthy root systems, and buffer against climate-related stresses—an urgent concern for a low-lying atoll nation already vulnerable to sea-level rise and extreme weather events. Increasing SOC therefore strengthens soil structure, boosts agricultural productivity, improves food security, and enhances climate resilience, making it

[34] Previously, the Pacific Regional Agricultural Project (PRAP) Atoll Farming Systems Program was implemented in the late 1990s and early 2000s

[35] https://livelearn.org/assets/media/docs/resources/Tuvalu-compost-feasability-study.pdf

a foundational requirement for sustainable land management and long-term environmental stability in Tuvalu.

Target 6. Restore at least 30 abandoned pulaka pits in each island and other low-lying crops from saltwater intrusion by 2040.

Pulaka was the main source of food in Tuvalu. All the islands of Tuvalu have land that has been dug and used as pulaka pits which are rich in compost and usually store brackish water throughout the year. It is only during droughts that the pits dry up and the pulaka crops start dying. Seawater had infiltrated a sizeable amount of pulaka pits resulting in a decline in production and abandonment of a number of pits.

Pulaka consumption has significantly declined. Restoring pulaka pits and exploring their restoration and diversification with other species, such as bananas, could help revitalize its production while providing additional food. In this regard, there are suitable banana cultivation systems the narrow pit system – a traditional planting technique developed in the Cook Islands for atoll soil; and the large bed system – developed to address saltwater intrusion[36].

6.3 Strengthening an enabling environment for LDN

Target 7. Strengthen integrated land use planning processes and formulate participatory SLM/LDN land use plans in all islands by 2040.

Measures for strengthening integrated land use planning include:

I. Incorporating LDN targets into the National Land Use Policy under development.
II. Ensuring coordination with the 4-year Island Strategic plan ISP and the KETE National Strategic Plan.
III. Develop participatory integrated land use plans (IAEPs) focusing on land degradation and climate change in all islands.

Integrated Land Use planning (ILUP) is an integral part of the LDN approach. ILUP is land use planning that seeks to balance the economic, social, and cultural opportunities provided by land with the need to maintain and enhance ecosystem services provided by land-based natural capital. ILUP requires the coordination of planning and management across sectors concerned with land resources. [28]. ILUP requires also the participation and coordination of all stakeholders, community leaders play a crucial role in decision-making, particularly in land allocation and land resource management.

[36] See lessons learned from FAO TCP https://openknowledge.fao.org/server/api/core/bitstreams/553b2318-83d7-426a-9d4f-c29e7e3fd3c6/content

At present, Tuvalu lacks a formal, comprehensive national land use plan, as well as a land use policy. As part of the National Sustainable Development Plan (2020-2030), efforts are being made to strengthen coordination between traditional and formal systems for better land management, as well as for developing a land use mapping system to support future planning and ensure more effective land management practices in Tuvalu. Ongoing efforts aim to establish a policy that combines traditional land management practices with contemporary requirements, prioritizing environmental sustainability and climate resilience.

In 2021, the government assigned the Land & Survey Department to lead the formulation of the National Land Use Policy (NLUP), who is seeking to tackle land use challenges, with a particular emphasis on climate change and sustainable development. Other planning instruments under development or being updated are the Island Strategic Plan ISP and the KETE National Strategic Plan. Ensuring the integration of the LDN targets and measures and integrating approaches of SLM, integrated land use planning, agro-ecosystem management into these instruments will be fundamental. To this end, ensuring coordination and developing of guidelines and criteria for this integration will be needed.

The Land&Survey Department initiated consultations with relevant government agencies, including the Environment Department, Climate Change Unit, Magistrate Courts, and Island Councils. In collaboration with researchers from the South Pacific University. However, the policy has not yet been developed. The National Land Use policy shall include the LDN targets and contents of the LDN strategy in order to strengthen coordination among different efforts undertaken to address land degradation.

In recent years, Island Sustainability Plans (ISP) and local development plans help guide land use for housing, agriculture, and infrastructure. However, several challenges hinder the process, including a limited understanding among leaders of integrated land use planning, lacking guidelines for preparing comprehensive land use plans, following a cohesive land policy with clear criteria and indicators in line with the LDN approach and strategy and the KETE National Strategic Plan and other relevant policies and strategies.

Integrated Agro-Ecosystem Plans (IAEPs) focusing on combating land degradation and climate change (SLM/LDN) will be developed in all islands, with the support of the FAO-GEF project *Integrated Agro-ecosystem Approach for Enhancing Livelihoods and Climate Resilience in Tuvalu* under implementation.

The development of integrated land use plans led by the Kaupule is crucial and capacity building and facilitation support are needed. In Tuvalu, community participation in land management is deeply embedded in customary practices, particularly through the kaitasi system, where extended families collectively oversee land stewardship. This traditional practice ensures that decisions related to land are made collaboratively within family units, with each family playing a vital role in the management and care of the land. Kaitasi leaders represent these families in key decision-

making processes, including the preparation of Island Sustainability Plans and local development plans, which are updated periodically.

Formal mechanisms complement traditional practices, including the Native Lands Board/Commission and Magistrate Courts, which engage communities and kaitasi leaders in land title registration and resolving any land disputes. These formal bodies provide a structured approach to land governance while respecting traditional land management systems. Local government councils also participate in land management activities, though the extent of community involvement in decision-making processes can vary.

Efforts are being made to bridge the gap between customary and formal land management systems, aiming to create a more inclusive and effective governance framework. By integrating these two systems, Tuvalu seeks to ensure that land management not only upholds traditional practices but also aligns with modern governance needs, fostering sustainable development and community participation.

Within these land use planning instruments, LDN targets and measures as well as SLM, LDN and ILUUP approaches for achieving LDN should be mainstreamed and incorporated in the island planning.

Target 8. Strengthen coordination, integrated management and mainstreaming of SLM/LDN into climate change adaptation policies, strategies and projects and other sectors.

Measures for achieving this target include strengthening coordination and synergies with climate change adaptation plans and projects, enhancing awareness raising and education on the linkages between land degradation and climate change, and establishing a multi-sectoral LDN Forum.

A key target for strengthening Tuvalu's enabling environment for achieving LDN is ensuring coordination and synergies with climate change adaptation plans and interventions.

Being such a small country, intersectoral and inter-institutional coordination is a relatively easy task in Tuvalu. However, in practice, attaining an integrated management for combating land degradation and climate change is a challenge. In line with the need of an integrated coastal management, coordination with climate change adaptation plans should include a continuous process of dialogue and planning in order to find the best integrated and long-term solutions.

Regarding land reclamation, the NAP (2006) mentions: "Environmental impact assessment should be required as an integral part of the decision-making process relating to application under the Foreshore and Land Reclamation Act for approval to remove sand, coral and rocks from designated foreshore.".

Land reclamation is recommended in different national policies and implemented by different projects as it is one of the only solutions seen for increasing land area. However, as analysed by the

IPCC and other research institutions, it may increase the vulnerability to climate change instead of diminishing it. Land Reclamation consists of dredging up sediment from the ocean floor to extend coastlines in coastal areas is a response to sea level rise, population growth and to the shortage of land area[37]. Land reclamation is also made with dredged lagoon sediments, using materials from coral reefs [38][18].

Land reclamation has been implemented in Funafuti and in many different locations, such as Port of Spain, the Maldives and other Pacific atoll countries such as South Tarawa, Kiribati, Rangiroa Atoll, Takapoto and Mataiva in French Polynesia. However, as analysed by the IPCC[39], land reclamation and some coastal protection structures may contribute to coastal erosion, instead of solving it, as they increase flood risks and undermines long-term adaptive planning. This creates a vicious cycle where continued land reclamation is needed to face climate change, population growth and settlement expansion but these interventions exacerbate land degradation, ultimately increasing the exposure and climate change vulnerability of island communities. There is no possibility to restore coastal plants in land reclamation areas. Marine habitats are permanently lost where land is reclaimed from the sea. It is estimated that nearly 51% of coastal wetlands in China have been lost due to land reclamation (An et al., 2007). Coral reefs and marine ecosystems act as natural barriers and reduce the ability of coral ecosystems to protect coastlines from erosion and storms and to support local fisheries.

Therefore, climate change interventions like land reclamation must be rigorously analysed, as they can trigger land degradation, paradoxically exacerbating climate change vulnerability. Integrated approaches are fostered highlighting the linkages between land degradation and climate change, calling for deeper dialogue and positively complementary solutions.

Target 9. Mobilize financial resources for LDN through climate finance and innovative financing mechanisms.

Measures associated to this target include identifying finance opportunities and innovative financing mechanisms for implementing Tuvalu's LDN targets and mobilizing national, regional and global resources for implementing LDN targets and measures.

Implementing the LDN strategy requires the mobilization of resources for (i) establishing and monitoring the overall strategy implementation, and (ii) implementing the measures envisaged within each target.

[38] The dredged material used in Funafuti's land reclamation contains mainly biogenic sand consisting of shallow-water benthic foraminifera along with varying proportions of calcareous algae, coral, mollusk and other marine invertebrate remains [18].
[39] IPCC sixth assessment Report, Chapter 15 on Small Islands [15].

Many projects are already being implemented in Tuvalu, covering several targets and measures (see Section 7.1 on ongoing projects. Complementarily, new projects contributing to achieve LDN can also be planned, and financial resources mobilized. To this end, the LDN Strategy serves as a framework for the development of LDN Transformative Projects and Programmes. The Global Mechanism of the UNCCD provides support for the target setting process as well as for the development of transformative projects[40].

LDN Transformative Projects and Programmes aim to contribute to the implementation of voluntary LDN targets by delivering multiple benefits, building on high-impact good practices, enhancing national capacities, and leveraging innovative finance from the public and private sectors. Guidance for LDN Transformative Projects and Programmes has been developed by the Global Mechanism in collaboration with the UNCCD secretariat and reviewed by the UNCCD's Science Policy Interface (SPI).

In line with LDN targets and measures of the LDN strategy, some preliminary ideas of **transformative projects**, include:

1. Enhancing integrated coastal management.
2. Strengthening integrated and participatory land use planning, with emphasis on customary governance systems, land tenure and land practices.
3. Diversifying agroforestry systems and recovering traditional knowledge.
4. Designing of a financing strategy for LDN in Tuvalu.

There are several potential financing mechanisms and funds for LDN in SIDS, including multilateral, bilateral facilities and funds, such as:

- The Global Environmental Facility, GEF - through its priority areas for land degradation and climate change.
- The Least Developed Countries Fund (LDCF) of the UNFCCC – is the only facility exclusively dedicated to helping Least Developed Countries adapt to climate change.
- The Green Climate Fund.
- Climate Investment Funds (CIF) – in particular, the USD1.2 billion Pilot Program for Climate Resilience (PPCR) supporting developing countries to integrate climate resilience into development planning.
- The Adaptation Fund – for adaptation projects related to forestry, climate-smart agriculture, ecosystem services, Coastal zone management and water resources management.
- Multilateral Development Banks including the Asian Development Bank (ADB)[41].

[40] The Global Mechanism - Guidelines for the development of transformative projects: https://catalogue.unccd.int/1224_UNCCD_LDN_TPP_technical_guide_GM.pdf

[41] Asian Development Bank portal – Tuvalu - https://www.adb.org/publications/tuvalu-fact-sheet

- Innovative financing mechanisms such as carbon credits and payment for ecosystem services.

Of particular interest for Tuvalu could be for instance, the Adaptation Fund for financing LDN activities such as coastal zone management as it includes: Coastal zone protection, management and rehabilitation of salinized areas, prevention of sea water intrusion and protection of coastal zones from storm surges through mangrove reforestation or revegetation.

Developing innovative financing mechanisms related to Payment for Ecosystem services could be also a good opportunity to be explored for Tuvalu, in coordination with regional trading enterprises.

Another potential source of finance to explore is the Tuvalu Trust Fund (TTF) and the Falekaupule Trust Fund (FTF), created in 1987 as a publicly owned investment funds whose earnings help bridge the gap between its annual budgeted revenue and expenditure.

6. Implementing the Land Degradation Neutrality Strategy

6.1 Institutions involved

In order for the LDN strategy to be effectively implemented, key partners, national decision-makers and relevant stakeholders, are involved.

Specific roles and responsibilities have been agreed among the different institutions involved during a final consultation (See Annex 6)

The implementation of many LDN targets and measures is underway through diverse projects, including:

- Tuvalu Coastal Adaptation Project (TCAP) supported by GCF
- Ecosystem based adaptation for improved livelihood in Tuvalu supported by GEF
- Funafuti Water and Sanitation Project supported by GEF
- Integrated Agro-ecosystem Approach for enhancing Livelihoods and Climate Resilience in Tuvalu supported by GEF
- Capacity Building for Sustainable Land Management in Tuvalu supported by GEF
- Managing Water Scarcity through Strengthened Water Resources Management Project supported by New Zealand
- Pacific Adaptation to Climate Change and Resilience Building supported by EU

The LDN Forum

The LDN Strategy needs the support of a multi-sectoral LDN Forum or LDN working group to provide oversight and strategic guidance in the development and implementation of the LDN Strategy developed.

The LDN Forum consists of officers in key government departments whose mandates cover land, agriculture, climate change, fisheries, environment and economic development. It is composed of relevant government institutions and non-governmental organizations, including the private sector, NGOs and the international cooperation, including:

- Department of Agriculture, Ministry for Natural Resources Development of Tuvalu.
- Department of Environment Ministry for Home Affairs, Climate Change, and Environment (UNCCD Focal Point).
- Climate Change Department
- Land & Survey Department
- Fisheries Department
- Tuvalu National Private Sector Organization (TNPSO).
- Tuvalu National Council of Women (TNCW).
- Technical Assistance to Coconut Rehabilitation
- Live & Learn NGO
- Tokialofa NGO

- Other institutions conforming the GEF project Steering Committee.

The Land and Survey Department is working on establishing an inter-agency working group and organizing online discussions on the importance of the NLUP. This inter-agency working group could be the departing point for the LDN forum.

Concrete actions and responsibilities of different institutions and stakeholders for LDN implementation should be further agreed in the aegis of the LDN Forum.

6.2 Finance needs to achieve LDN targets

In the Pacific Island countries, finance plays a crucial role in implementing land degradation strategies due to the region's high vulnerability to climate change and environmental challenges. Land degradation threatens the sustainability of agriculture, freshwater resources, and local livelihoods, which are fundamental to the socio-economic stability of these nations. The successful implementation of Tuvalu's LDN strategy will require the convergence of domestic, international, and innovative financial resources, ensuring a diversified and sustainable funding base throughout its execution and to ensure sustained support over time. Nevertheless, effective financial mobilization and investment will support sustainable land management practices, restore degraded ecosystems, and build climate resilience in Tuvalu. Without targeted financial mechanisms and commitments, efforts to combat land degradation may fall short, exacerbating poverty, food insecurity, and environmental decline in these already vulnerable island communities.

It is estimated that USD 19.2 will be needed in total, based on the input of different stakeholders, to achieve the LDN targets and advance sustainable development in Tuvalu. Annex 6 summarizes the financing needs and budget calculations and commitments from different institutions for implementing the LDN strategy (See Annex 6).

6.3 LDN Monitoring and Reporting

Recognizing that under the LDN framework, land degradation goes beyond soils only (as it includes all land uses, vegetation, water and biodiversity), the monitoring and reporting of LDN focus on the three indicators: land use change, productivity trends and Soil Organic Carbon (SOC).

There are two dimensions of monitoring and reporting:

a. Monitoring progress towards the achievement of LDN targets, where the monitoring and reporting of progress toward the LDN target involve both quantifying the baseline (the initial values of the indicators) and gains and losses relative to the baseline in the future, and

b. Monitoring the implementation of the overall LDN strategy, including commitments achieved with different institutions during joint implementation to ensure all actions agreed for implementing LDN measures are executed.

A series of tools and applications for LDN monitoring and reporting have been developed under the UNCCD framework, including for instance:

- Trends Earth for monitoring land change.
- The LandPKS: a free LandPKS mobile app to discover the potential of your land and monitor change over time. This app for mobile devices is used for soil identification, land cover and soil health monitoring, land management, farm record keeping.
- The Tools4LDN developed by WOCAT.

The FAO-GEF and Agriculture Department project *Integrated Agro-ecosystem Approach for Enhancing Livelihoods and Climate Resilience in Tuvalu* will support the establishment of a National Technical Support Programme for LDN and agroecosystem health, considering LDN indicators (land cover, land productivity and soil organic carbon).

6.4. Conclusions and recommendations

- The LDN strategy in Tuvalu has been acknowledged as a guiding framework for addressing land degradation in Tuvalu. The strategy prioritizes the adoption of integrated approaches in two spheres of intervention: (i) enhancing sustainable land management (SLM) and restoration of degraded agro-ecosystems (e.g. coconut and houseyard agroforestry); and (ii) strengthening enabling environment for LDN through improved decision-making processes regarding policies, land use planning and finance.
- While the LDN strategy sets targets and measures for avoiding, reducing, and reversing land degradation, implementation is challenging due to Tuvalu's limited land area, few land uses, and dispersed islands. The focus remains on addressing all forms of land degradation losses.
- Tuvalu faces significant environmental constraints for agricultural development, including limited freshwater availability, absence of arable land and poor soils, and small land area. While these factors limit extensive agriculture, they contribute to a comparative advantage in vegetation cover and soil conservation through biomass. Customary land management practices and laws associated with their natural resource management, as well as their traditional knowledge on how to survive in isolated conditions is also a key comparative advantage, and their conservation is a priority within the LDN strategy
- LDN strategy recommends primarily the adoption of integrated approaches for the management and restoration of degraded areas. This entails the integration of programmes which must be enhanced between the sectors responsible for the implementation of land-based resources so that outcomes of projects are consistent with LDN.
- The strong link between land degradation and climate change requires integrated approaches and strengthening dialogue seeking for synergistic solutions. Policy and technical discussions should further assess the potential of climate change solutions, such as seawalls and land reclamation. In particular, land reclamation although envisaged in many policies as a solution, exacerbate land

degradation and reduce climate resilience. Land reclamation requires further discussion in Tuvalu to inform sound decision-making. For instance, some climate change solutions such as land reclamation, along with seawalls need deeper analysis, high-level policy, inter-sectoral and technical dialogue.

- The LDN strategy requires strong leadership and coordinated support from different institutions.
- A multi-sectoral LDN Forum will provide oversight and strategic guidance for the implementation and monitoring of the LDN Strategy. The LDN Forum will strengthen inter-sectoral and policy-technical dialogue.
- Integrated land use planning is crucial for LDN. Enhancing integrated agro-ecosystem land use plans done by the Kaupule or local councils is crucial. Local governance schemes favour decision-making to be done at island level. However, balancing traditional systems with modern governance continues to be a challenge in Tuvalu.
- A key next step for implementing the LDN strategy is the planning of Transformative Projects for achieving LDN targets and measures, complementing the ones that are already ongoing in Tuvalu.
- Finally, the LDN strategy is designed as a 'living document' to ensure its long-term relevance and effectiveness. The formulated LDN targets and measures will provide guidance for policies and interventions in coming years, with the flexibility to incorporate additional measures as circumstances evolve.

ANNEX 1. Agriculture sector – Census 2017

Tuvalu and agriculture sector at a glance, 2017

Total number of households	1 626 households	
Total population	10 645	
Male population	5 486	
Female population	5 159	
Median age of population	25.1 years	
	Number	Percentage
Households engaged in agriculture	1 464	90.0
Male-headed households engaged in agriculture	1 076	73.5
Female-headed households engaged in agriculture	388	26.5
Heads of households engaged in agriculture – level of education attained		
No qualification	337	23.0
Still in school	7	0.5
Primary school	377	25.8
Secondary school	315	21.5
Form 7/AFP	41	2.8
Vocational	222	15.2
Tertiary	154	10.5
Crop production		
Households engaged in crop production	1 121	69.0
Male-headed households engaged in crop production	829	74.0
Female-headed households engaged in crop production	292	26.0
Number of household members whose main activity was growing crops	96	
Livestock raising		
Households engaged in livestock raising	1 362	83.8
Male-headed households engaged in livestock raising	1 014	74.4
Female-headed households engaged in livestock raising	348	25.6
Number of household Members whose main activity was raising livestock	60	

SOURCE: 2017 Census

Source: [6] Tuvalu agriculture and fisheries report (2022): based on the analysis of the 2017 population and housing census. Tuvalu, Funafuti: Central Statistics Division (CSD) of the Government of Tuvalu. 102 p. https://pacificdata.org/data/is/dataset/oai.

Tuvalu and agriculture sector at a glance, 2017 *(continued)*

	Number	Percentage
Households engaged in crop production by crop type		
Banana/pata/fuamaulalo	776	47.7
Coconut/niu	694	42.7
Pawpaw/olesi	624	38.4
Breadfruit/mei	540	33.2
Toddy	437	26.9
Pandanus/fala	395	24.3
Swamp taro/pulaka	394	24.2
Taro/talo	300	18.5
Pumpkin/squash/panikeni	231	14.2
Cabbage/kapisi saina	201	12.4
Households engaged in cutting toddy		
Number of households engaged in cutting toddy	437	26.9
Average litres of toddy collected	4.7 litres	
Households raising livestock and number of livestock	**Number**	**Number of livestock**
Pigs	1 242	10 894
Chickens	682	15 443
Ducks	150	1 209
Dogs	294	391
Cats	540	1 206

	Number	Percentage
Households engaged in buying or selling fish		
Number of households buying or selling fish	976	60.0
Number of households buying reef fish	246	15.1
Number of households buying pelagic fish	852	52.4
Number of households buying deep sea fish	83	5.1
Number of households selling reef fish	44	2.7
Number of households selling pelagic fish	85	5.2
Number of households selling deep sea fish	20	1.2
Households engaged in handicrafts		
Number of households engaged in handicrafts	571	35.1
Number of handicraft items produced	60 014	

SOURCE: 2017 Census

Source: [6] Tuvalu agriculture and fisheries report (2022): based on the analysis of the 2017 population and housing census. Tuvalu, Funafuti: Central Statistics Division (CSD) of the Government of Tuvalu. 102 p. https://pacificdata.org/data/is/dataset/oai.

ANNEX 2. CLIMATE DATA

Table 1: Observed Average Seasonal Average, Minimum and Maximum Temperature in Tuvalu (Source: WB, 2022)

Observed Average Seasonal Mean Temperature Tuvalu

	1991-2020				1961-1990				1931-1960			
Units:°C	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Tuvalu	28.59	28.72	28.48	28.51	28.27	28.41	28.1	28.13	28.49	28.53	28.06	28.4

Observed Average Seasonal Minimum Temperature

	1991-2020				1961-1990				1931-1960			
Units:°C	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Tuvalu	25.49	25.58	25.55	25.41	25.2	25.32	25.21	25.05	25.38	25.39	25.21	25.23

Observed Average Seasonal Maximum Temperature

	1991-2020				1961-1990				1931-1960			
Units:°C	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Tuvalu	31.75	31.92	31.46	31.67	31.38	31.55	31.04	31.25	31.65	31.71	30.96	31.62

This table shows the observed average seasonal mean temperature in Tuvalu across three periods: 1931–1960, 1961–1990, and 1991–2020, measured in degrees Celsius (°C).

A gradual warming trend is evident across all seasons (DJF, MAM, JJA, SON) over time. For example, in DJF (December–February), the average temperature rose from 28.27°C (1961–1990) to 28.59°C (1991–2020). Similar increases are observed in other seasons, with MAM (March–May) and JJA (June–August) showing clear rises. Overall, temperatures have steadily increased by approximately 0.2°C–0.4°C across seasons over the past 90 years, reflecting the broader pattern of climate warming in Tuvalu. Whereas, the average seasonal minimum temperature in Tuvalu has increased gradually around 25.2°C to 25.58°C. The data also directs a clear increase in maximum temperatures over time, with the average peaking at around 31.92°C in the 1991–2020 period. The temperature rises from about 30.96°C in 1931–1960 to over 31.7°C

in the most recent period, indicating a warming trend in the maximum seasonal temperatures. This suggests that Tuvalu is experiencing progressively higher peak temperatures over the decades, which could have implications for climate resilience and environmental stability.

Table 2: Observed Seasonal Precipitation in Tuvalu (Source: WB, 2022)

Observed Seasonal Precipitation

	1991-2020				1961-1990				1931-1960			
Units:mm	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Tuvalu	907.62	725.18	594.12	585.98	935.72	724.43	597.98	589.28	969.32	673.91	626.22	598.48

Seasonal precipitation in Tuvalu across three periods: 1931–1960, 1961–1990, and 1991–2020, measured in millimeters (mm).

Overall, precipitation is highest during DJF (December–February) across all periods, with values slightly declining from 969.32 mm (1931–1960) to 907.62 mm (1991–2020). In other seasons (MAM, JJA, SON), precipitation shows smaller fluctuations, with MAM (March–May) around 725 mm and JJA (June–August) and SON (September–November) showing slightly lower values. Wheareas, a slight decrease in rainfall is observed over time, particularly in DJF and JJA, suggesting changes in seasonal rainfall patterns possibly linked to climate variability and climate change impacts.

ANNEX 3. CLIMATE CHANGE RISK PARTICIPATORY ANALYSIS

National LDN Stakeholder Consultation. Funafuti, 7-9 January 2025

CLIMATE CHANGE DISATERS RISKS IN TUVALU

Disaster mapping exercise

Key disasters in Tuvalu	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Drought due to less rainfall						**	**		***	***	*	
Cyclone	***	***	***									
High (King) tide		*** (3m+)	*** (3m+)	** (1-2 mm)	**							
Strom surge	***	***	***	**								**
Land/coastal erosion	**	***	***	**							*	*
High rainfall	***	***	***	**								

Severity scale: *Low, **Medium, ***Significant

More drought prone islands (Northern Islands): Nanumea, Nanumaga, Niutao

High rainfall, cyclone, and storm surge prone islands (Southern Islands): Funafuti, Nukulaelae, Niulakita

Severe drought was recorded in 2011 and 2022 and severe cyclone recorded was in 2015 and 2020.

Climate risks and adaptation mapping exercise

Key climate risks on land, soils and agriculture	Existing adaptation practices	Gaps in the existing adaptation	Adaptation needs under higher warming/climate change condition
Drying of soil and lands	Mulching and shedding	Availability of raw materials	Drip irrigation and wicking bed farming
Vegetation damage	Improved compost, improved agricultural practices, open pollinated seeds	Coconut leaves can be used as compost	Promotion of conservation agriculture practice
Soil moisture reduction	Irrigation and mulching	Lack of awareness	Smart irrigation
Low water availability due to drought and salinity	Improved agricultural practices, open pollinated seeds used	open pollinated seeds and stress tolerant varieties used for shrimp Taro did not work well	Smart irrigation, wicking bed, more water storage to capture rainwater
Pulaka pits flooded due to heavy rainfall and high tide	Increase the height of Pulaka pits	Flood water management is weak	Pumping the water from Pulaka pits and improve the drainage condition
Salt content increased in soil and land during drought	Composting and watering	Unavailability of saline tolerant crops and varieties	Introduce saline tolerant crops and varieties
Storm and cyclone brings heavy sand in the land	Clearing the sand and use the sand for construction work	Limited technology to clear the sand from land	Adopt low-cost technology to clear the sand from land
King tide affect coastal and inland coconut and other trees	No adaptation technology is available		Increase the height of coastal areas and plant trees
Sea level rise (SLR) and erosion reducing coastal land	Building sea walls	No technology to prevent SLR and mitigate the associated impact	Increase coastal plantation and rise the height of coastal land

Impact of cyclone, storm surge, drought on Forest and trees

Key climate risks on forest resources	Existing adaptation practices	Gaps in the existing adaptation	Adaptation needs under higher warming/climate change condition
Damaging of big trees	Replantation	Replantation is limited	Coastline plantation, agro-forestry
Pest and disease infestation on coconut, bread fruits and other tree crops due to drought	Biological control for coconut and bread fruits, slash and burning, application of home mad pesticide, integrated pest management	Lack of awareness	Community training on IPM and improved practices, better management and biological control of coconut and other trees. Need solution for coconut leaf blight
Damaging Forest biodiversity	Mangrove plantation	Plantation is limited and build up is increasing specially in Funafuti	Reclaim land and promote mangrove plantation and agroforestry with deep rooted trees
Affecting the growth of trees and forest in the coastal areas	Pruning the trees and replacing with good species		Promote mangrove plantation and agroforestry

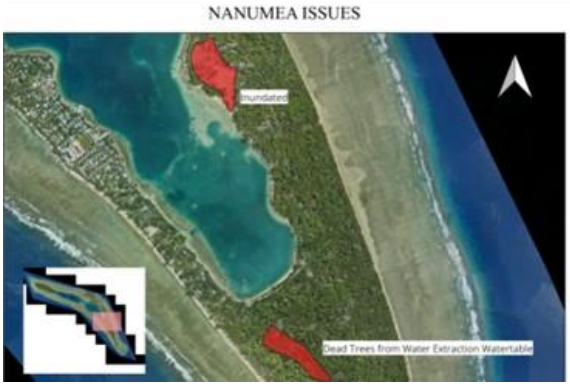
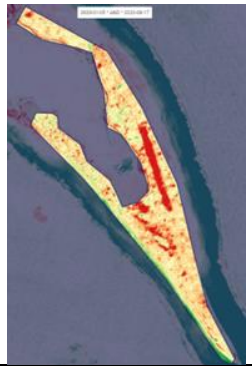
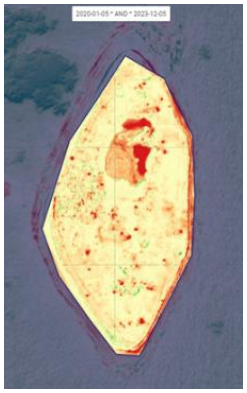
Impact of cyclone, storm surge, drought on water

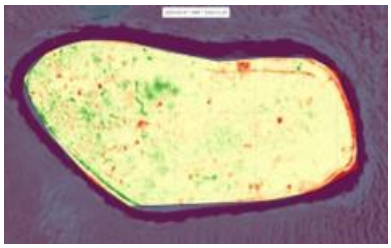
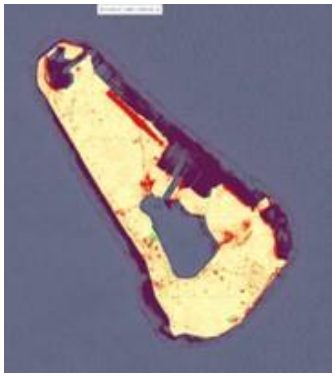
Key climate risks on water resources	Existing adaptation practices	Gaps in the existing adaptation	Adaptation needs under 1.5^{0}C warming
Salinity contamination in groundwater	No technology is available		Agroforestry and plantation, redesigning of wells
Breakish water brings mosquitos	Destroy the breeding sites	There is limited awareness and measures	Destroy the breeding sites regularly
Lack of water in drought	Desalination plant established and water supplied at HH levels in all islands and Community based water storage	Desalination plant is not available everywhere	Continue the current practice. Assess water supply and demand of Tuvalu and take long term action
Drought affects the productivity of Pulaka pits	Mulching and shedding over the Pulaka	Farmers are not aware about this technology	Building water storage near to Pulaka pits for irrigation

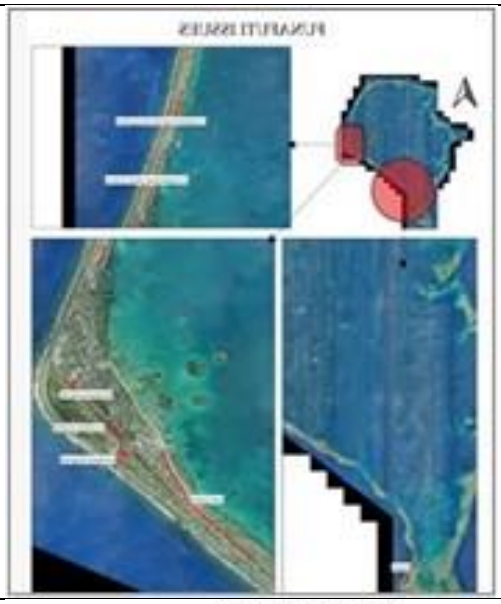
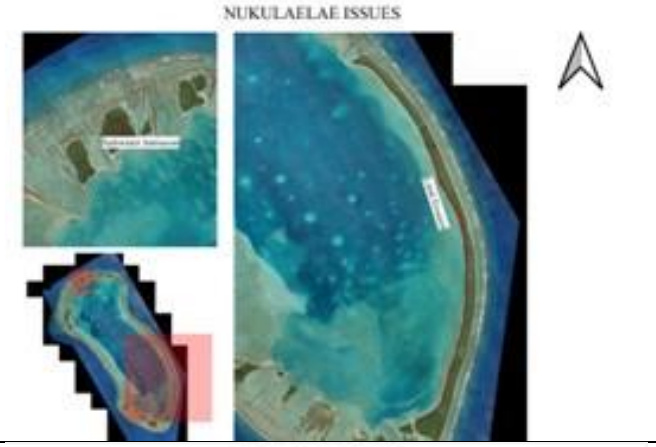
Drought affects the yield of fruit crops and vegetable	Wicking bed, concrete Pulaka pits for home garden	Limited irrigation infrastructure, materials for wicked beds are imported	Install smart irrigation system and overhead water tanks to irrigate the fruit trees

ANNEX 4. MAPPING OF LAND DEGRADATION IN ALL ISLANDS OF TUVALU – Examples of LD issues.

Participatory mapping conducted with the support of Mr. Ielemia Maheu from the Land Survey Department, through GIS mapping (QGIS) for the 9 islands of Tuvalu and NDVI changes assessed by Collect Earth.

<table>
<tr><th colspan="3">TUVALU - MAPS</th></tr>
<tr><th colspan="2">Mapping of LD issues - Examples</th><th>NDVI changes
(Collect Earth)</th></tr>
<tr><td>1. Nanumea</td><td>
</td><td></td></tr>
<tr><td>2. Nanumanga</td><td>
</td><td></td></tr>
<tr><td>3. Nui</td><td>
</td><td></td></tr>
</table>

4. Niutao		
5.Vaitupu		
6. Nukufetau		Not available

7. Funafuti		
8. Nukulaelae		Not available
9. Niulakita		Not available

ANNEX 5. ISLAND CONSULTATION IN NUI: MAPPING OF LAND DEGRADATION

This map shows Nui's degradation, with almost the entire island affected. The following maps will show which areas have been affected by land degradation and which factors have contributed to it.
Land degradation is a widespread problem throughout the island.



Pulaka Pits.

One of the most significant food sources is pulaka pits. The majority of the residents keep their taro and pulaka in the area located in the map below. The indigenous people depend on these regional delicacies. The location of the Pulaka Pits is displayed on the map.

Locals noticed that the pits had changed, and they are struggling to expand and to grow theirs, though it is more difficult than it was in the past. All of the pulaka pits were filled with salted water following Tropical Cyclone PAM (TCPAM 2015), which killed the taro and pulaka. After the Tropical Cyclone TINO (TCTINO 2020), the pulaka pits are still recovering from the TCPAM strikes in 2015, which caused more damage to the pits. The locals struggled to fertilize their pits so they would grow, but the salted water still remained trapped inside the pits, and some pits are still unable to grow anything because they are overflowing with salted water.





Pulaka Pits are located in the village. The area in brown is the pulaka pits area; the area is covered with pulaka pits, and it is where all the locals plant their pulaka and taro and do any other farming, like sugarcane and banana plantations.

Tropical Cyclone Impacts (TCPAM 2015, TCTINO 2019-2020).

The whole village is lately impacted by sea level rise, which causes land degradation on the coastline and the trees nearby. In the tables of Land Degradation Problems and Solutions, locals mentioned that the coconut trees are dying and sea level rise is the main driver of it. Most of the trees nearby the shore are all.

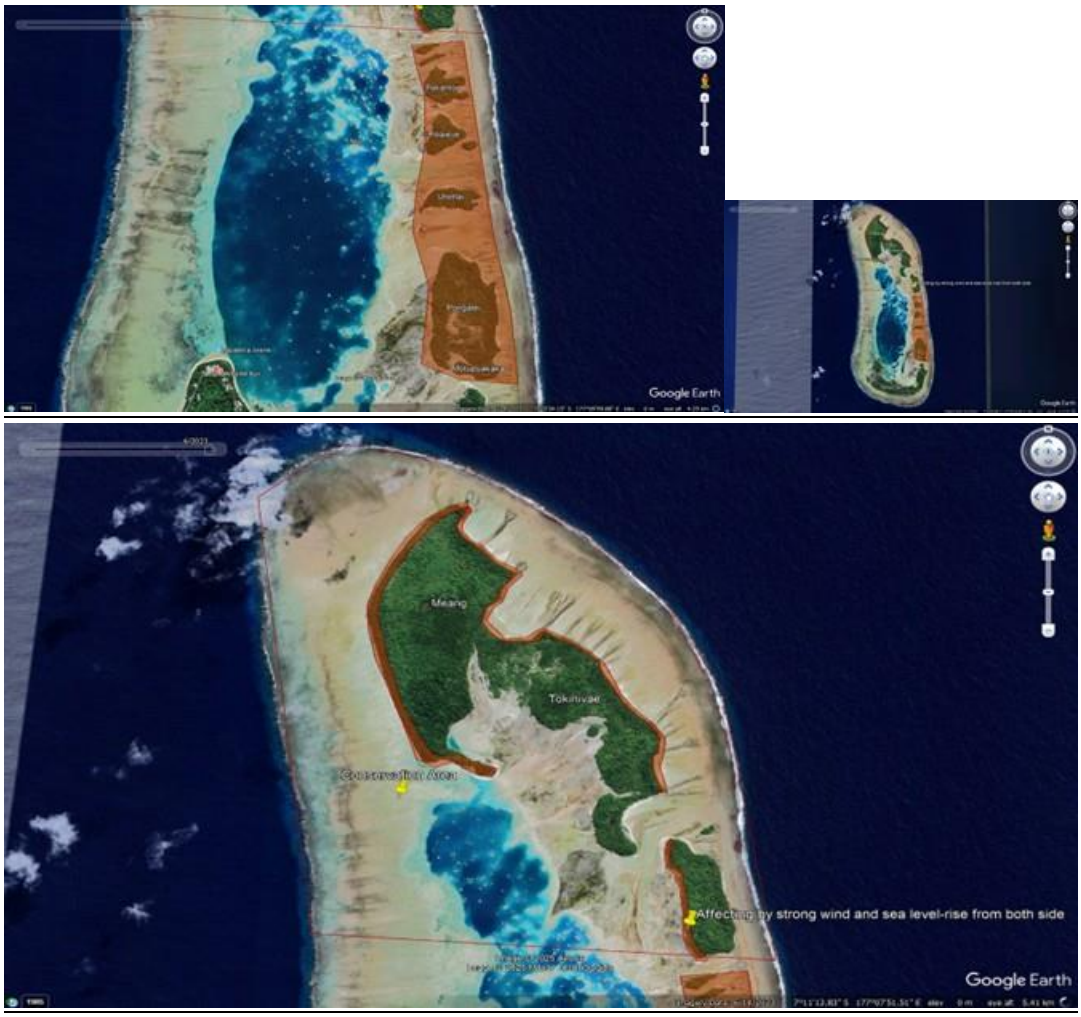


In the map above, the areas that are affected by strong winds are located. These are the impacts of Tropical Cyclone Pam 2015 and Tropical Cyclone Tino 2020. Fenua Tapu is the name of the atoll that the

village is located on, and it is affected by sea level rise. The brown color in the map is to locate the degradation area caused by these strong winds. The brown color in the middle of the island is from the flooded areas during the two tropical cyclones; it is now always flooded during high tides. The brown color on the coastal area is all the areas affected by the two tropical cyclones. During these strong winds, the sea rose and big waves struck the island, causing damage to the coastal area. These caused land degradation in the coastal area and soil erosion.

Strong wind impacts on the small atolls.

Climate change is cited as the primary cause of land degradation in conversations with the local population. Tuvalu frequently experiences high winds. According to the locals, the main issue with the land-based plants and trees has been tropical cyclones. In recent years, plants and humans have been impacted by tropical cyclones PAM and TCTINO. Food, as well as other financial commodities and activities, was derived from natural resources on the island. The entire island, and primarily the island's periphery, experienced land degradation as a result of these powerful winds. Strong winds caused flooding throughout the island, and as of right now, the island floods during every high tide, killing the trees. The ground is flooded in many places.



In the above map, the green color represents the trees on land, and the brown color represents the located areas of land degradation. The red line polygon is to locate the conservation area of the Island Nui. The island has a conservation area where they preserve all kinds of natural resources in the area. This conservation area can only open to the public when the elders decide to open it, mostly during bad weather times when people cannot go out to the open sea fishing, and mostly opens when the community has important feasts.

ANNEX 6. LDN TARGETS AND BUDGET

LDN STRATEGY OF TUVALU LDN TARGETS, MEASURES and POTENTIAL INSTITUTIONS INVOLVED				
LDN objectives	**LDN TARGETS**	**LDN measures**	**Institutions involved in implementing LDN measures**	**Estimated budget (USD)**
Sustainable land management practices			Preliminary list	
Objective 1. To mitigate coastal erosion and sea - level rise through Integrated coastline management and restoration in all islands	**Target 1.** Restore **coastline vegetation** by planting adapted trees and shrubs in a total of at least 16 km of coastline in all islands by 2040.	1. Avoid further erosion from coastal areas through sustainable coastal management practices, including restoring coral reefs, and seagrass beds that can act as natural buffers against wave action and storm surges. 2. Restore coastline vegetation by planting coastal trees, mangroves, shrubs, and other plant species (e.g., Casuarina, Fetau). 3. Strengthen conservation efforts for critical ecosystems such as coral reefs, mangroves, and coastal forests to protect biodiversity through community-led conservation programs.	Department of Agriculture Department of Environment Land & Survey Department Falekaupule Live & Learn Tokialofa Tuvalu National Council of Women (TNCW) Home Affairs Department TuCAN Fuligafou Tuvalu Fisheries Authority Climate Change Department Public Works Department	4 million
Objective 2. To enhance sustainable agriculture and agroforestry to improve water management and restore biodiversity	**Target 2.** Rehabilitate **Coconut palm tree systems** to increase productivity by 30% in at least 450 ha by 2040.	1. Restore coconut tree plantations by replacing senile coconut trees by new ones. 2. Introduce in coconut systems other agroforestry trees and shrubs. 3. Diversify and develop value chains and market for coconut oil products.	Department of Agriculture Department of Environment Tuvalu National Private Sector Organization Tuvalu National Council of Women Falekaupule	3.5 million

and degraded ecosystems.			Live & Learn Tokialofa	
	Target 3. Diversify and implement Sustainable Land Management practices in **village house yards and house gardens** in at least 30% of households by 2040.	1. Promote crop diversification and incorporate climate-tolerant species of household vegetables, cassava, sweet potatoes, etc. 2. Improve composting practices for soil conservation and for increasing soil fertility in house yards and house gardens. 3. Improve smart-agriculture, water conservation practices and drip irrigation (e.g., raise garden beds). 4. Promote sustainable minor livestock raising (chicken, ducks) 5. Improve waste management practices to preserve soil health.	Department of Agriculture, Department of Environment Tuvalu National Council of Women, Taiwan Technical Mission, Falekaupule Live & Learn Tokialofa Lands and Survey Department Home Affairs Department Public Works Department Home Affairs Department	2.7 million
	Target 4. Avoid the loss, improve the management (250 ha) and establish at least 144 ha of new **agroforestry systems** (breadfruits, coconut, figs, pandanus, fruit trees) in all islands.	1. Improve crop management practices, through shifting cultivation, crop rotations, mixed cropping, contour farming, composting, etc. 2. Diversify existing agroforestry systems by enhancing the conservation, planting and management of useful plants for traditional medicine, building, fibres, etc. 3. Establish new agroforestry systems. 4. Conduct research and implement biological control of coconut and other trees from invasive species.	Department of Agriculture Department of Environment Tuvalu National Private Sector Organization, Tuvalu National Council of Women, Tuvalu National Private Sector Organization, Kaupule & Falekaupule Live & Learn Tokialofa Home Affairs Department Tuvalu National Youth Council (TNYC)	2.2 million

			Fuligafou Youth Organization Public Works Department	
	Target 5. **Increase soil organic carbon (SOC)** on all islands by 2 to 5%, reduce non-biodegradable waste disposal, and improve vegetation by 10-15% by 2040.	1. Reduce the use of polyethylene, polypropylene, polystyrene, polyvinyl chloride, polyurethane, and polyethylene terephthalate in the soil. 2. Plastic mulching films should be properly disposed of after use. 3. Avoid dumping macro- or meso-plastic trash into soil. 4. Minimized land and vegetation clearing. 5. Reduce the amount of vacant land.	Department of Agriculture Department of Environment Tuvalu National Private Sector Organization, Tuvalu National Council of Women, Kaupule & Falekaupule Live&Learn Waste Management Department	4 million
Objective 3. To mitigate saltwater intrusion in soils and crops.	**Target 6.** Restore 50 abandoned pulaka pits and other low-lying crops from saltwater intrusion by 2040.	1. Research for salt-tolerant crop varieties and soil salinity mitigation technologies. 2. Establish demonstration plots of restored and improved pulaka pits. 3. Planting of pulaka and other root crops (e.g. Colocassia – Taro) 4. Capacity building activities on pulaka restoration and consumption, in particular with youth. 5. Develop value added activities for pulaka.	Department of Agriculture Department of Environment Tuvalu National Private Sector Organization, Tuvalu National Council of Women, Falekaupule Live&Learn, Home Affairs Department Kaupule and Falekaupule Tuvalu National Youth Council Fuligafou Youth Council Climate Change Department	2.8 million
Enabling environment				

Objective 4. To strengthen integrated and participatory land use planning in all islands.	**Target 7.** Strengthen SLM/LDN into existing island land use planning processes and formulate participatory land use plans in all islands by 2040.	1. Coordinate, provide inputs and incorporate SLM/LDN targets and approaches into the National Land Use Policy under development by the Land and Survey Department. (e.g., developing guidelines) (ongoing process January 2025) 2. Ensure coordination with the Island Strategic plan ISP (4-year plan) (the planning is ongoing until June 2025) and the KETE National Strategic Plan. 3. Develop participatory integrated land use plans (IAEPs) focusing on combating land degradation and climate change (SLM/LDN) in all islands.	Land & Survey Department Climate Change Department Department of Agriculture Department of Environment Tuvalu National Private Sector Organization Tuvalu National Council of Women, Falekaupule Live & Learn	
Objective 5. To increase coordination and synergies and strengthen integrated management with climate change	**Target 8.** Strengthen coordination, integrated management and mainstreaming of LDN into climate change adaptation policies, strategies and projects and other sectors.	1. Encourage and strengthen coordination and synergies with climate change adaptation plans and projects to ensure that LDN complement adaptation measures (e.g., coastal erosion, mangrove planting, etc). 2. Awareness raising and education on the importance and linkages between land degradation and climate change. 3. Establish a LDN Forum to ensure coordination with different sectors and monitoring and follow up of LDN targets and measures	Land & Survey Department Climate Change Department Department of Agriculture Department of Environment Tuvalu National Council of Women, Falekaupule Live & Learn Tokialofa	
Objective 6. To increase resource mobilization for LDN	**Target 9.** Mobilize financial resources for SLM/LDN through climate finance and innovative financing mechanisms.	1. Identify finance opportunities and innovative financing mechanisms for implementing Tuvalu's LDN targets. 2. Mobilize national, regional and global resources for implementing SLM/LDN projects and measures with national agencies.	Ministry of Finance, Climate Change Department Department of Environment Land & Survey Department, Department of Agriculture, Tuvalu National Private Sector Organization	

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