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Tuvalu, Climate Volatility

## **Tuvalu: Saving a Country From Drowning**

Located in the Pacific Ocean halfway between Australia and Hawaii, Tuvalu (formerly the Ellice Islands) is a coral atoll collection of 9 islands spreading 420 miles across the tropical climate of Oceania. Through the eyes of a tourist, the limitless sea that *is* Tuvalu's landscape comes nothing short of intrinsically beautiful. The native who was raised by the sea neither lacks a spiritual connection to it; yet their gaze is a discomforted one, as they remember flooded homes, destroyed croplands, and empty fish-harvests following the most recent storm surge--all the precursor to a reflection on the seemingly inevitable future where that beautiful ocean takes the livelihood they've built around it.

Tuvalu is a sinking country. With an average height less than 2 meters above sea level, and an expected sea level rise between 2.4 and 4.4 times the previous century (at 19 centimeters), the atoll collection will likely become uninhabitable by 2050 (Dean, Australian Academy, Amakrane). Meanwhile, storm surges, the by-product of sea level rise, are responsible for eroding the islands' water table and surrounding coral reefs, which severely diminish agricultural production and fish-harvests, and physically tear apart Tuvaluan structures.

The land encroachment on these islands stems from a plethora of interconnected variables. Among them: an increase in ocean acidification in Tuvaluan waters (carbon dioxide from human activities being absorbed by ocean water, which stunts coral reef growth to diminish a barrier for offshore storms). Tropical cyclones also increase beachhead erosion, as up to three are annually possible during El Niño years especially. Additionally, the melting of glaciers worldwide due to heightened global temperatures has increased sea level rise in the past few decades, which may not noticeably affect the countries where they are located, but has severe repercussions on Tuvalu's shoreline and land area. Coastal engineering (such as agricultural mining) has stripped land from near-shore areas and induced higher volatility to seawater encroachment. Moreover, population growth in the small island has been a major reason for Tuvalu's environmental mismanagement, as more people require more food to be grown, and more agricultural practice means more land stripped for crop yields. Deforestation to build shelters for the increasing population has weakened Tuvalu's natural tree barrier and limited protection from cyclones; therefore, increasing coastal erosion evermore.

Before considering the effects of the issues at hand, it is vital to understand the Tuvaluan state. The population of the nation is approximately 11,646 people, with 36.78% of them living in rural areas. This group is especially challenged when their connection to urban resources is cut by surge floods and debris (World Bank). As of 2016, 18 square kilometers of land in Tuvalu is cultivated for agricultural purposes: 60% of the country's total 30 square kilometer area. Major crops grown by Tuvaluans are primarily for personal consumption and include copra (coconut kernel), taro (a root vegetable), bananas, and sugarcane (Tuvalu - Agriculture). According to the Observatory of Economic Complexity, in 2018, 95.1% of Tuvalu's total exports were non-fillet frozen fish. Supported by this statistic, climate change-related events that have harmed Tuvalu's fish harvest simultaneously weakened its economy and foreign trade participation.

This concept will be elaborated on later, but take note of the nation's reliance on this industry. Another foundational factor of the country; crops are typically grown in deep, 6-12 foot trenches in order to reach the water table and accommodate Tuvalu's poor soil. This design lends itself to be easily flooded along the coasts, and losses are noticeable and shared by neighbors in the communal farms occupying less than an acre.

A typical household in Tuvalu consists of extended families living together in a small village in the outer islands, where most citizens reside. On the other hand, 33% of the population lives in the capital, Funafuti. Only in Funafuti is electricity reliable and abundant. One radio station exists for the whole country, and people can only watch television through subscription channels (Tuvalu, Britannica). A lack of technology leaves many outer-island Tuvaluans feeling isolated and self-reliant when storm surges threaten communications--a contributor to poor mental states and lack of pride in leadership among residents. The average dwelling for a Tuvaluan is a small timber-framed (from coconut trees), one-story home with a thatch or tin roof with removable shutters acting as walls. Homes rest on a coral foundation and floors are mats woven from the pandanus fruit (*Tuvalu*, FIU). The weak nature of these constructions contributes to the impact of climate change-related invasion on the islands, as storm surges--exacerbated by higher sea levels--routinely infiltrate and destroy homes. This common tragedy is especially challenging for the already space-compromised average household size of 6 individuals.

Beyond dwellings, mealtime is also a communal practice, where after a traditional coconut sap drink called "toddy" for breakfast, neighbors join for lunch and dinner around platters of cooked or raw fish, chicken, pork, papaya, bananas, spinach, plantains, pulaka (a root vegetable), crayfish, and breadfruit. Neighbors share in their farmland and go on fishing trips together, so a large sense of community is felt between families and their food; though, as agricultural productivity is increasingly compromised by flooding, Tuvaluans have relied more heavily on high sugar and fat-containing non-expirable imported products, consequently the primary reason for the population's record obesity rate of 56.2% in women and 47% in men. Tuvaluan crop production has suffered from poor, high salinity soils from its existence (due to the young geological age of the atolls), now, saltwater intrusion from surge encroachment exacerbates the issue by killing pre-harvest plants like the pit of pulaka, an ingredient of high cultural significance (Hedley, Thelwell). Additionally, Tuvalu's fishing industry, which provides recreational opportunity and food supply, has become increasingly deteriorated by tropical cyclones: another violent product of sea level rise which erodes coral reefs and induces die-offs of their inhabitants. These environmental and lifestyle shifts have adversely harmed the economic sustainability of subsistence farmers and fishermen (27% of the labor force), who must now rely more heavily on remittances from overseas relatives to provide for their large families on mean \$1,000 monthly incomes (CIA, Tuvalu - Agriculture). Provided that 90% of households were involved in agricultural activities including growing crops, buying/selling fish, or raising livestock in a 2017 study by the Central Statistics Division, the widespread impact of climate change on this industry and the Tuvaluan economy as a whole cannot be overstated.

Due to a disheartening 40% fail rate of secondary education entrance exams in Tuvalu combined with scarce opportunities for unspecialized workers in its small economy, fiscal resources are lacking for the future of this country where money and educated leaders are necessary for environmental protection measures and innovations that could prolong the life of the islands (Thelwell). Furthermore, the expense of college degrees amounting to 254,000 of the roughly 490,000 USD spent on education in the country annually is a major burden and turnoff for a population where 23% are below the poverty line (Tuvalu Government Central Statistics Division). These statistics suggest that Tuvalu will become more gradually reliant on foreign council and relief programs as large portions of their population remain limited in their knowledge and salary potential, especially in the environmental management sector.

As storm surge encroachment continues to challenge the routines of native islanders, a lack of infrastructure has made managing these obstacles very difficult. Only 5 miles of paved road exist across the 18 square mile land area, allowing for cyclone and storm surge damage to disrupt vehicular traffic flow on rural, unpaved roads. Additionally, mobile phone services are limited to three of the nine islands, while subscriptions to fixed line telephones are available elsewhere, but a costly expense for poverty-stricken citizens (Fakaofu). These factors are an unnecessary obstacle for emergency response operations in the frequently dangerous environment of Tuvalu coastal weather.

In urban in-land areas, flooding is occurring where it never has before. Several years ago, floods were expected only a few times a year, now they're expected once a month across the entire island. Tuvalu's one airport located in its urban capital, Funafuti, experiences difficulty allowing planes to land due to the runways flooding. As the country continues to have a greater dependence on imports and foreign aid, the loss of such access points are critically detrimental. New rural homes are being built on stilts at least 10 feet high, and urban hotels and restaurants are having to do renovations to raise their elevation as well. With significant financial limitations, construction expenses raise the question as to what is a worthwhile investment for a country whose life expectancy is less than its citizens?

Tuvaluans are among the first in the world to be labeled as environmental refugees. Parents have chosen to move their families to countries like New Zealand, in hopes of escaping before it's too late. Safety plays a key role in these decisions, but particularly mothers are concerned about the psychological effects of being exposed to large waves and destruction on their children, and have been compelled to relocate. Indigenous elderly residents of the country can recall times when they would look out over the ocean and see nearby islands, but since then sea levels have covered them. The average man has taken on significant responsibility with the repairment and upkeep of property. Resident Teautu Teuria recalls having roughly a 30 foot stretch of his land wiped out by floods and having to relocate his late brother's grave to higher elevations (Moya). Although it's easy to acknowledge hardship in Tuvalu, it's difficult to pinpoint minority groups here, particularly because it is collectively the 4th most impoverished country in the world. Everyone being of lower-class experiences similar devastation from rising sea levels, the only difference is between people who have just enough to afford settlement elsewhere, versus those who can barely afford to keep their crop alive to avoid starvation.

A solution to make Tuvalu a more climate change resilient country exists in the currently underway Tuvalu Coastal Adaptation Project. Mainly because of the Green Climate Fund's grant of \$36 million, the government of Tuvalu will be able to provide scholarships for local students to study coastal engineering, oceanography, environmental science, and other coursework that could assist in the evolution and implementation of efficient environmental protection programs. Schoolchildren will also experience climate-change updated curriculums, ensuring the future of Tuvalu will be equipped with knowledgeable activists. In addition, government officials are being added and trained to combat and develop protection programs of Tuvalu's own. In terms of actual coastline development, the project also finances the construction of sea walls and revitalization of the beaches. Weaknesses of this project include the fact that it only applies to three of the nine islands, meaning approximately 3,300 of the 11,646 people living in the country will benefit, with no plans to expand. The project is estimated to only be effective until 2060 (due to the lifespan of the protective materials used to construct barriers and strengthen buildings). The Tuvaluan government was only able to finance roughly 5% of the project, and therefore, their control over where the money is implemented is minimal (Coalition of Atoll Nations on Climate Change Leaders). While steps are being taken to protect homes, the Tuvalu Coastal Adaptation Project exists at a

community education level more so than physically changing the island, and consequently weakens the scope and impact it has now versus the future.

In comparison, a feasible solution in which the Tuvaluan people could secure and preserve their culture while also bettering their quality of life through greater food access and agricultural opportunity, would be to relocate their relatively small population to the Fijian Islands. Among the same geographic location in Oceania, the neighboring Republic of Kiribati is facing the same “island-sinking” future that Tuvalu is up against, and therefore, is a phenomenal model for the Tuvaluan government to consider when in decision about the future of its people. The president of Kiribati, Anote Tong, argues that “it is too late to save the island” under the current circumstances, and rather than invest in moderate-risk technological developments, he implied that the better option was to ensure a bright future for his people while the country's budget could afford it. In 2014, Kiribati purchased 5,500 acres of land from Fiji in the Navatu region for \$8.77 million, and the Fijian prime minister has since been quoted saying “he would welcome climate refugees from Tuvalu and Kiribati” (Tuvalu Country Profile). Although these words are applicable now, it would be important for the Tuvalu government to realize that a land purchase for future migration would not secure the future Fijian leadership’s cooperation with immigration, thus initiating a real weakness to this plan. While no Kiribati people have immigrated to their new land thus far, the acquisition remains a significant fall-back when conditions become unsuitable in their homeland. As previously stated, post-cyclone affected land contains less nutrients for foods in Tuvalu. Luckily, the Fijian land provides enhanced agricultural environments and food availability. Kava, taro, and rice are abundantly grown by natives of the region, as well as fish being nationally consumed and sold. Promises of greater terrestrial dominance in Navatu--averaging 49 feet above sea level--would hasten excitement in any Tuvaluan farmer, as they’d experience a much more protected environment for themselves and their crops during storm surge encroachment. Despite these benefits, several complications exist: the journey to the new land from Oceania is treacherous, as mangrove swamps and inclined forest hills layer the topography, yet a transition of this scale remains easier for Tuvalu’s 11,000 when compared to Kiribati’s 105,000 citizens. Another devastating reality for Tuvalu’s working class is that some cultural traditions may need to be altered to accommodate the Fijian regulations, such as fishing rights being exclusive to the natives in the region, meaning the Tuvaluan people would need to travel to fish in public waters. A strength of the purchase; however, would be a greater global awareness of the problems Tuvalu is facing, as Kiribati’s acquisition ensued vast media coverage. Yet without proper utilization of the media to plead for donations, this move would remain a costly publicity stunt, as the 5,500 acre purchase made by Kiribati (less than Tuvalu’s current 6,400 acre land) would equal roughly 20% of Tuvalu’s annual GDP if made by Tuvalu. Yet again, with a relatively low population, Tuvalu may be able to fit its country into smaller acreage, and therefore, make the move more affordable.

From the conclusion of data, I would recommend Tuvalu relocate to combat climate change from destroying their citizen’s livelihoods amidst the seemingly inevitable and upcoming time when conditions are unsuitable for life on its islands. The Tuvaluan government should begin seeking out enough real estate in Fiji (that would comply with its current 1.2% growth rate as soon as 2070), as well as grants from world organizations that could help finance the cause of “environmental refugement”, in order to keep the cost of immigration as minimal as possible for an already fiscally challenged country. Once territory is acquired, alliances and befriending should be pursued among the natives whom the Tuvaluan government could recruit to help develop the land as financial resources are slowly and gradually diverted into constructing homes and buildings. While the Tuvalu Coastal Adaptation Program is already underway, government officials and the community should continue to become more educated on how to preserve their homeland, allowing for citizens to reside there as long as possible and providing more time for future-homeland development before mass habitation.

This project should be facilitated by a joint committee in the United Nations. Tuvalu, Great Britain, and Fiji should be in frequent contact with each other in the initial stages, and contracts should be proposed in order to ensure the welfare and preservation of leadership and economic sustainability. The European Union in support of the Coalition of Atoll Nations on Climate Change (CANCC) could play a critical role in funding the project. In 2016, EU Ambassador Andrew Jacobs stated “The EU has provided substantial climate financial support... the actual figure in the Pacific region could eventually go beyond 50% of the total EU support” (Coalition of Atoll Nations on Climate Change Leaders). This shows that the European Union is striving to make efforts to change the script of devastated Pacific island countries, and with more than half of the budget being transferred to countries like Tuvalu, significant aid could be provided for this project. Organizations like the previously mentioned CANCC have and will continue to play a vital role in uniting atoll nations like Tuvalu, the Marshall Islands, Kiribati, and the Maldives under the joint effort of publicizing the disasters they’re all facing. This organization will be responsible for holding summits that keep each nation in consistent communication, even pooling funding to finance each other’s initiatives, and in this case Tuvalu’s land in Fiji. Other nations not directly impacted by Pacific beach head erosion will also be necessary to complete tasks more swiftly, like providing aid to finance conference logistics as New Zealand did for a 2019 climate-change education meeting in Fiji, held by The Pacific Community (a leading scientific agency in the region).

An example of a policy that could be implemented by Tuvalu’s government might be moving farmland further inland at the sacrifice of empty lands between and behind village houses. This would ensure a better-fed population by preventing the destruction of crops from beach head erosion at higher elevations and behind the barrier of dwelling walls. I believe such an effort would pair astoundingly with agroforestry techniques already being utilized on the islands, where the Food and Agriculture Organization of the United Nations and The Secretariat of the Pacific Community’s Centre for Pacific Crops and Plants has bred salinity and heat withstanding crops collected from the outer islands, and then taught locals how to plant these crops adjacent to fruit bearing trees in order to maximize climate resilience (Thelwell). The larger trees will anchor smaller crop roots in the soil, protecting the harvest from high intensity weather events. Another benefit of utilizing residential spaces is that community morale may increase as a result of the combined efforts to achieve greater food security in Tuvalu between neighbors. Larger harvests through this scenario will lead to economic opportunities for Tuvaluans of any education-level, as neighbors gain firsthand knowledge of profitable agricultural production by learning from each other. Secondly, stricter fishing regulations may be deemed necessary for the preservation of surrounding coral reefs, as fish feed off of algae which compete with coral for space. Furthermore, the coral reefs provide a natural barrier for the island against cyclones. Minimal regulations are in place to limit catches; however, after substantial fishing practice offshore of densely populated Funafuti, in 1996, the United Nations Development Programme in partnership with the South Pacific Regional Environmental Programme established a marine reserve covering 40 square kilometers in the Funafuti lagoon. This area has since protected biodiversity of marine life in the region (FAO). I suggest that a coalition of these organizations might again prohibit fishing along the coasts of Tuvalu’s most populated areas, in order to encourage offshore fishing where resources are abundant, and in an attempt to revitalize the inshore reefs that are becoming weakened.

In terms of cultural practices that should be considered with the transition to new land, fishing rights should be strongly fought for in Fiji in exchange for a service or good that the Tuvaluans can provide. Fishing is the major source of income and way for people to spend time and form kinship in Tuvalu, so whether or not the Fijian government grants access to local bodies of water, access to nearby estuaries should be considered when evaluating potential candidates of real estate. Coconut trees being the vital

resource in concocting the widely consumed breakfast drink “toddy”, should also be made abundantly available in the new land, whether by means of purchasing land with sustainable groves or investing in the planting of enough palm trees to be harvested upon the year of arrival. Another critical aspect of this transition is the sympathetic consideration of how the Tuvaluans may be feeling about such a drastic change in their lives. Although many adults who’ve grown up on the island will be deceased by the time the government begins orchestrating immigration, the realization of thousands that their children and grandchildren will eventually have to leave their culturally-historical homeland will undoubtedly be an emotional one. This sentiment should prompt slow and sympathetic policy implementation and community outreach programs to assess and rehabilitate the mental health aspects associated with an initiative of such vast societal impact. As far as recruiting native Fijians to help develop land in the new real estate, respect for what these people have already built will be key to sustaining a positive relationship with the locals. The Tuvaluan government’s approach should be to only add and not take away in terms of construction, unless agreed upon by both parties.

This overall process is difficult to be titled sustainable because of the fact that an entire island is being lost to the sea; however, through strategies like slowly diverting the national budget to the new land over the course of the next 50-100 years, Tuvaluans will experience little degradation of their current lifestyles year-to-year, but enough long term change to provide a suitable environment for future generations in Fiji. The fact is, though, that Tuvalu is an impoverished country, so every monetary loss or gain has an impact. This is why grants and aid from the previously mentioned sources and organizations that are able to help will heavily contribute to the effort of sustainable development in Fiji, while still keeping Tuvalu afloat for as long as possible through investment and education in climate change combatant technologies, and the shared information and resources from other countries with Tuvalu. The fact that natives already dwell in the proposed future land is beneficial to everyone because their recruitment to help develop the land will improve quality of life for them now (as they could inhabit buildings as they’re constructed), and Tuvaluans later (allowing the Tuvaluans to enjoy and live on their home island as long as possible, while remaining confident in the sentiment that a safer future home is being prepared overseas).

Overall, the climate change induced devastation facing Tuvalu is a severe issue, not only for the country itself, but as an example for other atolls globally. Luckily, the country is aware of the harm being done, and can make genuine efforts to preserve the lifespan of its islands. At the rate the current ocean levels are rising, saving Tuvalu’s current land from being washed away is hard to imagine. This is why plans need to be developed for the future population who will inhabit the island when it becomes unsuitable for life. Through the securing of geographically similar land in Fiji, the Tuvaluan people will be able to remain confident in the preservation of their society and practices, and conclude that their grandchildren will experience sustainable food supply through the agricultural and fishing possibilities in the new land.

## Works Cited

- “Atoll Nations Unite against the Exceptional and Existential Threat Caused by Climate Change.” *The Pacific Community*, May 2019,  
[www.spc.int/updates/blog/2019/05/atoll-nations-unite-against-the-exceptional-and-existential-threat-caused-by](http://www.spc.int/updates/blog/2019/05/atoll-nations-unite-against-the-exceptional-and-existential-threat-caused-by).
- Central Intelligence Agency*, Central Intelligence Agency,  
[www.cia.gov/the-world-factbook/countries/tuvalu/#economy](http://www.cia.gov/the-world-factbook/countries/tuvalu/#economy).
- “Coalition of Atoll Nations on Climate Change Leaders.” *PCCP*, 11 Oct. 2016,  
[www.pacificclimatechange.net/news/coalition-atoll-nations-climate-change-leaders](http://www.pacificclimatechange.net/news/coalition-atoll-nations-climate-change-leaders).
- “Coastal Erosion and Polluted GroundWater on Tuvalu.” *Oxfam Australia*, March 2011,  
[www.oxfam.org.au/2011/03/coastal-erosion-and-polluted-ground-water-on-tuvalu/#:~:text=The%20small%20and%20utterly%20remote,the%20soil%20and%20the%20sea](http://www.oxfam.org.au/2011/03/coastal-erosion-and-polluted-ground-water-on-tuvalu/#:~:text=The%20small%20and%20utterly%20remote,the%20soil%20and%20the%20sea).
- Ellsmoor, James, and Zachary Rosen. “Kiribati's Land Purchase in Fiji: Does It Make Sense?” *Devpolicy Blog from the Development Policy Centre*, 12 Oct. 2018,  
[devpolicy.org/kitibatis-land-purchase-in-fiji-does-it-make-sense-20160111/](http://devpolicy.org/kitibatis-land-purchase-in-fiji-does-it-make-sense-20160111/).
- G.B.K.. Baines, R. F.. McLean, et al. “Causes of Land Loss in Tuvalu, a Small Island Nation in the Pacific.” *Journal of Ocean University of China*, Science Press, April 2005,  
[link.springer.com/article/10.1007/s11802-005-0004-8](http://link.springer.com/article/10.1007/s11802-005-0004-8).
- Mason, Moya, “Tuvalu: Flooding, Global Warming, and Media Coverage.” *Tuvalu: Flooding, Global Warming, and Media Coverage - Climate Change, Sea Levels, Coral Reefs, Sea Erosion, Ellice Islands*, [www.moyak.com/papers/tuvalu-climate-change.html](http://www.moyak.com/papers/tuvalu-climate-change.html).
- Dean, Mohseen Riaz Ud, “‘Climate Tragedy: If We Drown Tuvalu, We Drown the Entire World’: UNDP in the Pacific.” *UNDP*, UNDP, 11 Jan. 2021,  
[www.pacific.undp.org/content/pacific/en/home/blog/2020/climate-tragedy-if-we-drown-tuvalu-we-drown-the-entire-world.html](http://www.pacific.undp.org/content/pacific/en/home/blog/2020/climate-tragedy-if-we-drown-tuvalu-we-drown-the-entire-world.html).
- “Population - Census and Surveys.” *Business*, 2002, [tuvalu.prism.spc.int/index.php/census-and-surveys](http://tuvalu.prism.spc.int/index.php/census-and-surveys).
- “Population, Total - Tuvalu.” *Data*,  
[data.worldbank.org/indicator/SP.POP.TOTL?locations=TV&name\\_desc=true](http://data.worldbank.org/indicator/SP.POP.TOTL?locations=TV&name_desc=true).
- Rosane, Olivia. “Seas Could Rise 8 Feet by 2100 Without Urgent Action to Curb Climate Change.” *EcoWatch*, EcoWatch, 18 Dec. 2019,  
[www.ecowatch.com/sea-level-rise-climate-change-2611093046.html#:~:text=Projections%20for%20moderate%20emissions%20estimate,10%20inches%20by%20mid%2Dcentury](http://www.ecowatch.com/sea-level-rise-climate-change-2611093046.html#:~:text=Projections%20for%20moderate%20emissions%20estimate,10%20inches%20by%20mid%2Dcentury).

- “Rising Waters and a Smaller Island: What Should Physicians Do for Tuvaluans?” *AMA Journal of Ethics*, vol. 19, no. 12, 2017, pp. 1211–1221.,  
doi:10.1001/journalofethics.2017.19.12.imhl1-1712.
- “Thelwell, Kim. “5 Facts about Hunger in Tuvalu.” *The Borgen Project*, Kim Thelwell  
[https://Borgenproject.org/Wp-Content/Uploads/The\\_Borgen\\_Project\\_Logo\\_small.Jpg](https://Borgenproject.org/Wp-Content/Uploads/The_Borgen_Project_Logo_small.Jpg), 7 Oct. 2020, [borgenproject.org/5-facts-about-hunger-in-tuvalu/](https://Borgenproject.org/5-facts-about-hunger-in-tuvalu/).
- “Tag: Tuvalu.” *Domain Islands Tour*, 11 Mar. 2020,  
[islanddomains.earth/en/tag/%E3%83%84%E3%83%90%E3%83%AB/](https://islanddomains.earth/en/tag/%E3%83%84%E3%83%90%E3%83%AB/).
- “Tuvalu (TUV) Exports, Imports, and Trade Partners.” *Observatory of Economic Complexity*,  
[oec.world/en/profile/country/tuv](https://oec.world/en/profile/country/tuv).
- “Tuvalu - Agriculture.” *Encyclopedia of the Nations*,  
[www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Tuvalu-AGRICULTURE.html](http://www.nationsencyclopedia.com/economies/Asia-and-the-Pacific/Tuvalu-AGRICULTURE.html).
- “Tuvalu Agricultural Land Area, 1960-2019.” *Knoema*, [knoema.com/atlas/Tuvalu/Agricultural-land-area](https://knoema.com/atlas/Tuvalu/Agricultural-land-area).
- “Tuvalu Country Profile.” *BBC News*, BBC, 26 Feb. 2018,  
[www.bbc.com/news/world-asia-pacific-16340072](http://www.bbc.com/news/world-asia-pacific-16340072).
- “Tuvalu.” *Encyclopædia Britannica*, Encyclopædia Britannica, Inc., [www.britannica.com/place/Tuvalu](http://www.britannica.com/place/Tuvalu).
- Tuvalu Government Central Statistics Division. *Household Income and Expenditure Survey*.  
[http://prdrse4all.spc.int/system/files/tuvalu\\_hies\\_report\\_2010.pdf](http://prdrse4all.spc.int/system/files/tuvalu_hies_report_2010.pdf)
- “Tuvalu Nutrition Profile.” *Tuvalu Nutrition Profile - Global Nutrition Report*,  
[globalnutritionreport.org/resources/nutrition-profiles/oceania/polynesia/tuvalu/](https://globalnutritionreport.org/resources/nutrition-profiles/oceania/polynesia/tuvalu/).
- “Tuvalu Population (LIVE).” *Worldometer*, [www.worldometers.info/world-population/tuvalu-population/](http://www.worldometers.info/world-population/tuvalu-population/).  
*Tuvalu*, <https://elearn.fiu.edu/e-dev/WorldExplorer/Customs/Oceania/Tuvalu.htm>.
- “Tuvalu: TV: People Using At Least Basic Sanitation Services: Rural: % of Rural Population: Economic Indicators: CEIC.” *Tuvalu | TV: People Using At Least Basic Sanitation Services: Rural: % of Rural Population | Economic Indicators*, 2001-2015,  
[www.ceicdata.com/en/tuvalu/health-statistics/tv-people-using-at-least-basic-sanitation-services-rural--of-rural-population](http://www.ceicdata.com/en/tuvalu/health-statistics/tv-people-using-at-least-basic-sanitation-services-rural--of-rural-population).
- “Warming Oceans and Human Waste Hit Tuvalu's Sustainable Way of Life | Florent Baarsch and Lan Marie Berg.” *The Guardian*, Guardian News and Media, 4 Mar. 2011,  
[www.theguardian.com/global-development/poverty-matters/2011/mar/04/tuvalu-sustainable-way-of-life-disappears](http://www.theguardian.com/global-development/poverty-matters/2011/mar/04/tuvalu-sustainable-way-of-life-disappears).



Weatheronline.co.uk. "Tuvalu." *WeatherOnline*, [www.weatheronline.co.uk/reports/climate/Tuvalu.htm](http://www.weatheronline.co.uk/reports/climate/Tuvalu.htm).

"Worldwide Elevation Finder." *Topographic Map - Altitude Map*,  
[elevation.maplogs.com/poi/suva\\_fiji.198478.html](http://elevation.maplogs.com/poi/suva_fiji.198478.html).