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## Treading Water: Challenges and Solutions to Rising Sea Levels in the Philippines

A warming planet threatens the Earth's climate and presents geopolitical risks among allied nations and adversaries. As countries face the challenges of adapting to rising sea levels and stronger and more frequent extreme weather events, US international relations can become more strained, opening doors for US adversaries to expand their influence. Since WWII, the Philippines has been a long and pivotal regional partner for the US in the eastern Pacific. Recent changes in Filipino leadership have caused some friction in US-Philippine relations, and climate change hitting the Philippines especially hard creates an opportunity for the US or China to expand their influence over the country. As the Philippines navigates ways to deal with rising sea levels, it could be open to any assistance to improve its ability to manage associated challenges. The projected challenges the Philippines face in the near and far future will be very strenuous and stretch the government's ability to manage the future crisis alone.

**Increased US foreign assistance to the Philippines that targets adaptation efforts addressing sea level rise can help improve recent US-Philippines relations challenges and prevent increased Chinese influence over the region.** First, understanding the geo-political importance of the Philippines will help justify any future efforts the US may pursue. Second, acknowledging the recent relations challenges the US and the Philippines are experiencing helps understand the room for engagement. Third, examining the climate change challenges the Philippines face will help focus future efforts the US can make to maintain stability and positive relations with the Philippines. Finally, examining how the Philippines are managing rising sea levels will help the US focus its efforts to assist in these endeavors. These efforts can go a long way toward improving US-Philippine relations.

## What is the Big Deal?

Understanding the geo-political relevance of the Philippines helps understand why repairing relations is in the US's best interests as it continues to support the region in countering Chinese aggression. The Philippines is an island chain nation comprising over 7,500 islands within its archipelago, making any efforts in coastal defense increasingly difficult to manage as the coastlines are non-continuous and fragmented. The island's landmass collectively covers over 115,000 square miles, which is

about 3% compared to the US, see **Figure 1**. The two largest islands are the islands of Luzon in the north and Mindanao in the south. These two islands are about eight times larger than any other island within the chain. The island chain is strategically located along the eastern flank of the South China Sea, making it geographically important to sea and air access to these contested waters. As a US ally, the strategic position

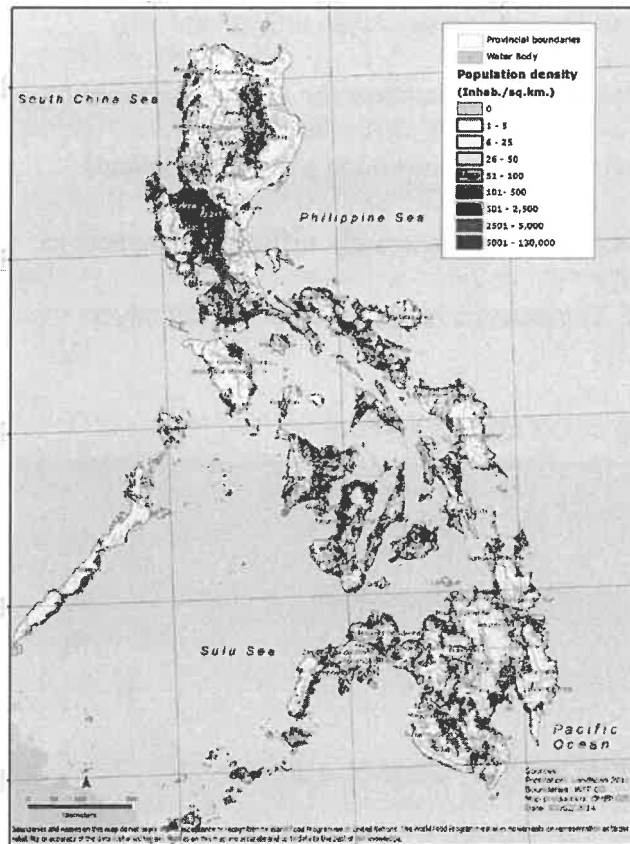
**Figure 1:** Map of US and Philippines



Source: <http://alenaamore.blogspot.com/2013/05/does-size-matter-canada-usa-vs.html>

of the Philippines can help counter the Chinese 9-Dash Line territorial claims that plague South China Sea nations and commerce that travel through the area.

**Figure 2: Population Density**



Source: <https://geonode.wfp.org/wfpdocs/ica-philippines-2014-population-density-2011/>

The Philippine population is also something the US should consider when approaching this strategic relationship. As previously stated, the landmass of the Philippines is only about 3% of that of the US, but its population is almost 1/3 of that of the US at nearly 110 million people.<sup>1</sup> The island of Luzon is the most densely populated region of the country, with over 10 million residents living in the national capital region alone (Manila).<sup>2</sup>

Figure 2 gives a visual representation of the population distribution of the Philippines.

The country's population density creates grave dangers for the country's ability to

withstand extreme environmental impacts. Additionally, most of the population living along or close to the coast creates additional challenges. Extreme weather events (EWE) and rising sea levels can potentially impact many people on these islands.

The US and the Philippines have a long history of partnership which has impacted demographics in both countries. According to the US State Department, over four million Filipino Americans live in the US, and over 300 thousand US citizens live in the Philippines.

Former US military represents a large portion of that population, demonstrating this

<sup>1</sup> Worldometer, The Philippines, accessed on January 14, 2023. <https://www.worldometers.info/world-population/philippines-population/>.

<sup>2</sup> Statistical Tables, Philippines Statistical Authority, accessed on January 14, 2023. <https://psa.gov.ph/population-and-housing/statistical-tables/2020>.

relationship's importance in both a political and military sense.<sup>3</sup> This data shows the potential the US has to impact future decisions made by the Philippine Government. With a long, contentious relationship with China, the US should be able to gain future support from the Philippines, especially over fishing rights and access to the South China Sea. However, if the US does not foster this relationship, it could open doors for nations like China to exert their influence over the Filipino leadership.

### **Troubled Relationship?**

Relations between the US and the Philippines have hit a friction point since the election of Rodrigo Duterte in 2016. In a 2016 speech to Chinese leadership, Duterte claimed that it was time for the Philippines to separate itself from the US economically and militarily.<sup>4</sup> In 2020, Duterte announced that the Philippines would terminate the visiting forces agreement (VFA) with the US.<sup>5</sup> However, in 2021 the US and the Philippines signed a new VFA when the Secretary of Defense Lloyd Austin visited the Philippines.<sup>6</sup> Although the overall outcome of the VFA worked out in the US's favor, the situation itself was troublesome. The fact that Duterte would quickly acquiesce to the Chinese pressures shows that the US-Philippines relationship is far from rock solid.

In 2021, Filipinos elected President Ferdinand Marcos Jr and vice president Sara Duterte (daughter of Rodrigo Duterte). Both Marcos and Sara Duterte are related to former leaders of the Philippines. Compared to the other candidates in the race, Marcos and Duterte are considered

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<sup>3</sup> U.S. Relations With the Philippines, The US State Department, accessed on January 14, 2023, <https://www.state.gov/u-s-relations-with-the-philippines/>.

<sup>4</sup> Alfred W. McCoy, "A Rupture in Philippine-U.S. Relations: Geopolitical Implications," *The Journal of Asian Studies* 75, 4, (2016): 1049.

<sup>5</sup> Joshua Kurlantzick, Duterte Terminates the Visiting Forces Agreement ... or Does He?, Council on Foreign Relations, February 21, 2020, <https://www.cfr.org/blog/duterte-terminates-visiting-forces-agreement-or-does-he>.

<sup>6</sup> US Embassy Manila, U.S. Secretary of Defense Welcomes Recall of VFA Abrogation, July 31, 2021, <https://ph.usembassy.gov/us-secretary-of-defense-welcomes-recall-of-vfa-abrogation-reinforces-strong-us-philippine-alliance-during-manila-visit/>.

China-Friendly, making Chinese influence a potential future problem for the US.<sup>7</sup> However, after Rodrigo Duterte canceled many initiatives with the US to appease the Chinese, the Philippines received little in return from China, which may have caused Marcos to run on the support of the defense relationship with the US.<sup>8</sup> It can be expected that Marcos will hedge his bets between the US and China in the future.<sup>9</sup> Filipino leadership is still determining the best partner for the Philippines, which is why the two latest administrations have been hedging bets between the close aggressive neighbor in China and the distant ally in the US. The fact that Marcos still supports defense relationships with the US opens the door for the US to strengthen its ties with the Philippines through initiatives aimed at combating the effects of climate change that will impact the Philippines significantly.

### **Climate Change Vulnerabilities**

The Philippines faces severe challenges regarding climate change in the near and distant future. According to the Climate Change Risk Index, the Philippines ranks 4<sup>th</sup> in the world regarding the negative impacts of our warming planet.<sup>10</sup> The two biggest challenges the Philippines face are EWEs and rising sea levels. These two challenges are multipliers of each other, making the dangers they pose more threatening.

The Philippines is one of the highest-risk nations that experience EWE, such as tropical cyclones (TC) and typhoons. From 1945-2011 over 70% of Western North Pacific TCs entered the Philippines Region.<sup>11</sup> The island nation averages about 6.5 TCs landfalls per year, and **Figure**

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<sup>7</sup> Ya-wen Yu, The 2022 Philippines Presidential Election and its Influence on Asia-Pacific Geopolitics, The Prospect Foundation, accessed January 10, 2023, 22-23.

<sup>8</sup> Yu, The 2022 Philippines Presidential Election, 23-24.

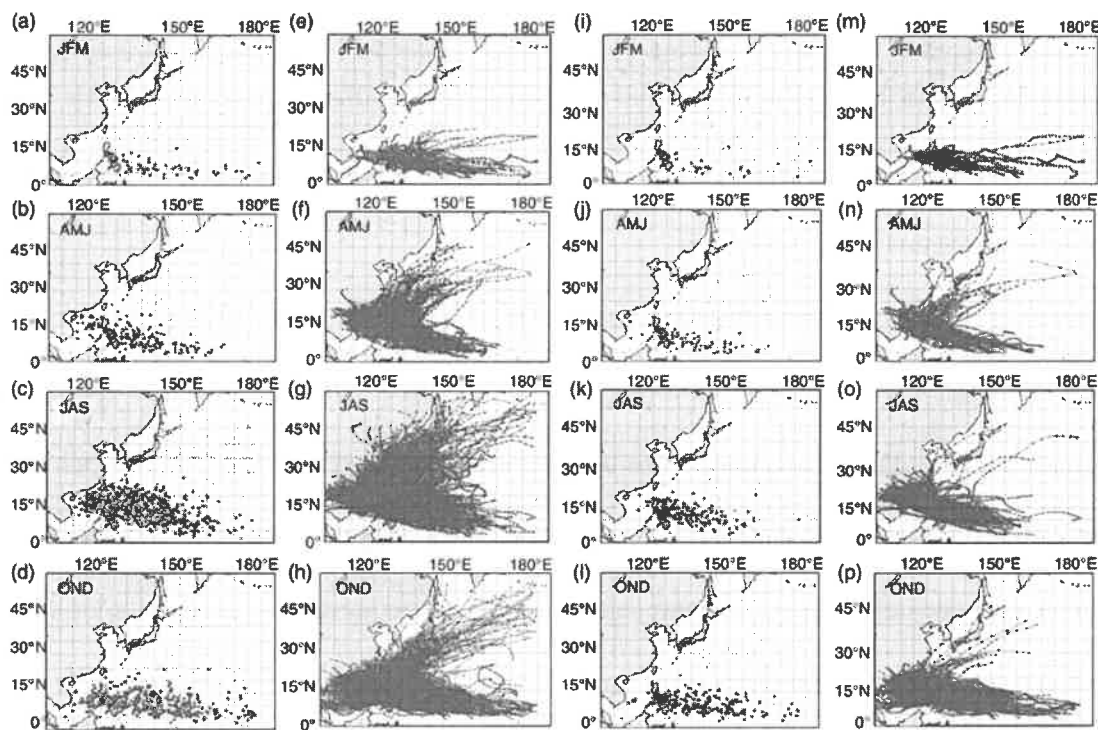
<sup>9</sup> Yu, The 2022 Philippines Presidential Election, 39.

<sup>10</sup> David Eckstein, Vera Kunzel, Laura Schafer, Global Climate Change Risk Index 2021, Germanwatch, January 2021, [https://germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021\\_2.pdf](https://germanwatch.org/sites/default/files/Global%20Climate%20Risk%20Index%202021_2.pdf).

<sup>11</sup> Irene L. Corporal-Lodangco, Lance M. Leslie, "Climatology of Philippine Tropical Cyclone Activity: 1945–2011," *International Journal of Climatology* 37, (2017): 3526.

3 shows quarterly tracks of TCs that enter the region from the Western North Pacific.<sup>12</sup> This is over three times the US's average of 2 Hurricane landfalls per year.<sup>13</sup> TCs and Typhoons are no strangers to the Philippines. Historical data suggests that the Philippines will continue to face this challenge. However, how climate change affects these events is something to consider when developing plans to protect the Philippines from these storms.

**Figure 3: TC Quarterly Tracks**



Source: Corporal-Lodangco, Irena L., Leslie, Lance M. "Climatology of Philippine Tropical Cyclon Activity: 1945–2011." *International Journal of Climatology* 37, (2017): 3537.

Recent studies have shown that although the planet is warming, data suggest that the frequency and intensity of storms that enter the Philippines region remain unchanged. A study

<sup>12</sup> Corporal-Lodangco, Leslie, "Climatology of Philippine," 3531-3537.

<sup>13</sup> Climate Change Indicators: Tropical Cyclone Activity, United States Environmental Protection Agency, accessed January 15, 2023, <https://www.epa.gov/climate-indicators/climate-change-indicators-tropical-cyclone-activity#:~:text=Key%20Points%201%20Since%201878%2C%20about%20six%20to,the%20mid-1990s%20%28see%20Figure%202%29.%20...%20More%20items.>

published in the International Journal of Climatology stated, “Both all TCs and landfalling TCs annual average LMIs imply a slight decreasing trend during the satellite era. The results suggest a weakening trend in the maximum sustained winds of Philippine TCs. This observation is not consistent with most climate change predictions of an increase in the frequency of intense TCs in a warming world scenario.”<sup>14</sup> Another article for the Terrestrial Atmospheric and Ocean Science Journal claimed, “WNP-born TC frequency dropped sharply in late-1990s, and the SCS-born TC frequency slightly increased in mid- 1990s.”<sup>15</sup> These studies seem like good news for the Philippines at face value, but maintaining an average of 20 TC landfalls a year is still very taxing. Other climate change effects can exacerbate the effects of TCs, making them more dangerous and economically burdensome.

Rising sea levels and inland flooding pose the most significant risk to the security of the Philippines. Although EWEs trends remain unchanged, rising sea levels will increase the damage storm surges can inflict. Rising sea levels also pose several risks to places like the Philippines. These risks include the permanent submergence of land, more frequent or intense coastal flooding, enhanced coastal erosion, loss and change of coastal ecosystems, salinization of soils, ground and surface water, and impeded drainage.<sup>16</sup> Places like Metro Manila are especially vulnerable to rising sea levels because their relative height above sea level and urbanization has caused land subsidence equal to .4m of sea level rise.<sup>17</sup> Global sea level rise is expected to have

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<sup>14</sup> Corporal-Lodangco, Leslie, “Climatology of Philippine,” 3532.

<sup>15</sup> Fang-Ching Chien, Wan-Ru Huang, and Ben Jong-Dao Jou, “Introduction to the Special Issue on Taiwan-Philippine VOTE-Meteorology: Typhoon Study and Related Natural Hazard,” *Terrestrial Atmospheric and Ocean Science* 32, No 5 (2021): 616.

<sup>16</sup> Lindy Williams, Marie Joy B. Arguillas, Florio Arguillas, “Major Storms, Rising Tides, and Wet Feet: Adapting To Flood Risk in the Philippines,” *International Journal of Disaster Risk Reduction* 50, (2020): 1.

<sup>17</sup> Anh Cao, Miguel Esteban, Ven Paolo Bruno Valenzuela, Motoharu Onuki, Hiroshi Takagi, Nguyen Danh Thao, and Nobuyuki Tsuchiya, “Future of Asian Deltaic Megacities Under Sea Level Rise and Land Subsidence: Current Adaptation Pathways for Tokyo, Jakarta, Manila, and Ho Chi Minh City,” *Current Opinion in Environmental Sustainability* 50, (2021): 92.

an average increase of .3m by 2100.<sup>18</sup> This means that if land subsidence is accounted for regarding rising sea levels, Manila is likely to see over double the global average sea rise affect its coast by 2100. Not only does the Philippines need to meet the challenges of today, but it will have to consider the challenges of the future as it defends its coast against rising oceans.

Manila is not the only place affected by the sea level rise. In Tubigon, Bohol, Philippines, in 2013, the islands experienced an earthquake that changed the landscape of the islands and made them more susceptible to flooding from tidal waters.<sup>19</sup> The communities went from nearly zero tidal flooding to flooding most of the year (see **Figure 4**).<sup>20</sup> Although the land subsidence resulted from an earthquake and climate change, the future flooding of these communities will be more challenging as the sea level rises. Policymakers can expect that sunny day flooding events will increase in frequency and duration as the world gets closer to 2100. This does not consider the increased risk these regions are to EWE.

**Figure 4:** Flooding in Tubigon, Bohol, Philippines

Island	Flood height (median)	Flooded area	Flooded days in 2016	Flood duration
Pangapasan	20.5 cm	100%	44 days	2.6 h
Bilangbilangan	24.5 cm	91%	44 days	2.6 h
Batasan	36 cm	100%	135 days	3.9 h
Ubay	43 cm	100%	135 days	3.9 h

Flood height, area and duration in the four island communities during high tides. Number of flooded days and average flood duration are based on flood threshold and 2016 tide calendar. The base level for the flood height measurement is the ground level in each of the surveyed areas, not the average sea level.

Source: Jameró, “Small-Island Communities,” 582.

Monsoon season is another risk the Philippines face as it addresses the country’s “flooding resilience.” Annually, the monsoon contributes to about 43% of rainfall in the Philippines.<sup>21</sup> Some projection models indicate that rainfall could increase as

<sup>18</sup> Rebecca Lindsey, Climate Change: Global Sea Level, Climate.gov, April 19, 2022, <https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level>.

<sup>19</sup> Ma. Laurice Jameró, Motoharu Onuki, Miguel Esteban, Kristina Billones-Sensano, Nicholson Tan, Angelie Nellas, Hiroshi Takagi, Nguyen Danh Thao, Ven Paolo Valenzuela, “Small-Island Communities in the Philippines Prefer Local Measures to Relocation in Response to Sea-Level Rise,” *Nature Climate Change* 7, (2017): 582.

<sup>20</sup> Jameró, “Small-Island Communities.”

<sup>21</sup> Marcelino Q. Villafuerte II, Ian Macadam, Joseph Daron, Jack Katzfey, Thelma A. Cinco, Emma D. Ares, Richard G. Jones, “Projected Changes in Rainfall and Temperature Over The Philippines From Multiple Dynamical Downscaling Models,” *International Journal of Climatology* 40, (2020): 1793.

much as 40% across the island chain, further increasing community risk of coastal and inland flooding.<sup>22</sup> In 2021, monsoon rains forced thousands of residents out of their homes in Manila to evacuate from the rain-induced flooding.<sup>23</sup> The Philippines is a wet place to live, and flooding can be considered one of the country's most significant risks as it deals with the effects of climate change. This flooding comes from multiple sources (Tidal flooding from rising sea levels, TCs, and monsoons) that will continue to challenge the Philippines as it tries to adapt to these hazards.

### **Philippines' Fight Against Rising Sea Levels**

The first set of adaptation efforts Filipinos apply is at the local level. As mentioned earlier, the Bohol region residents are experiencing sunny day flooding from tidal waters regularly. This has caused Bohol residents to adapt to the changes in lifestyle from this regular flooding. Efforts have focused on raising floors and houses above the tidal flood lines. Some areas use coral and solid waste to raise houses above the water—the simple effort of elevating valuable items above the water line to protect them.<sup>24</sup> Residents are doing anything and everything they can to get by. Some of these efforts are viable in the short term, but these residents need better long-term adaptation efforts to help them endure these challenges. US assistance can help fund construction projects that provide reliable and resilient improvements to residents' efforts to escape flooding.

Another local effort Filipinos are doing is to raise main access roads above the flood line. The local government has elevated main roads so vehicles can operate during heavy rains,

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<sup>22</sup> Villafuerte, "Projected Changes in Rainfall," 1801.

<sup>23</sup> Philippines Evacuates Thousands As Monsoon Rains Flood Manila, Al Jazeera, July 24, 2021, <https://www.aljazeera.com/news/2021/7/24/philippines-evacuates-thousands-as-monsoon-rains-flood-cities-pr>.

<sup>24</sup> Jamer, "Small-Island Communities," 584.

especially in Manila. However, a lot of residential areas remain below the flood line.<sup>25</sup> According to a study conducted on the Philippines flooding, “Some parents carry their young children to the main road so that their school shoes will not get ruined.”<sup>26</sup> Raising main roads is essential regarding emergency response and evacuation efforts in the event of EWEs, but most residents still face flooding challenges within their neighborhoods. Exploring quality of life improvements for these residents can help prevent or limit regular flooding of their homes. Main roads have been the overall focus of the Philippines. Still, additional targeted assistance to elevate secondary and residential roads will allow authorities to respond better to emergencies during weather events.

Coastal defense measures are another way to deal with rising sea levels. Protecting and integrating natural barriers such as coral reefs can help defend coastlines against damage and erosion.<sup>27</sup> Reefs can reduce wave energy by up to 97% and help protect shores during storms.<sup>28</sup> However, as mentioned earlier, some residents are mining local coral to help raise their homes. Philippine authorities should attempt to discourage coral mining as short-term mitigation efforts could lead to long-term challenges during future EWEs. Aid that provides alternative materials for similar purposes the residents are using coral for will have a two-fold return by protecting the existing coral and helping raise homes above the flood line.

Along with protecting the coral reefs that already exist along Filipino coasts, it is worth exploring efforts to grow and reinforce more coral. The Great Barrier Reef Foundation website explains how helping grow coral reefs by planting baby reefs or whole coral fragments in the

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<sup>25</sup> Williams, “Major Storms,” 5.

<sup>26</sup> Williams, “Major Storms,” 13.

<sup>27</sup> Henry Hausmann, Soft vs Hard Engineering for Coastal Defense Adaptation, Climate Institute, August 18, 2019, <http://climate.org/soft-vs-hard-engineering-for-coastal-defense-adaptation/>.

<sup>28</sup> Coastal Protection, Coral Reef Alliance, accessed January 16, 2023, <https://coral.org/en/coral-reefs-101/why-care-about-reefs/coastal-protection/>.

damaged reef helps restore the coral.<sup>29</sup> This means saving already damaged coral from mining is still an option. Examining whether new coral locations in critical areas may benefit certain coastlines to defend against EWEs also needs to happen. Funding for organizations that assist in these matters can help the Philippine government explore this option and help improve coastal defense against strong storms.

Sea dikes are some of the best defenses the Philippines can develop against the effects of rising sea levels. Sea dikes are essential to raising the coasts above the flood or storm surge line to prevent flooding. Sea dikes provide a high degree of protection against coastal flooding and erosion, and as sea levels rise, so can the dikes.<sup>30</sup> The Philippines have already built dikes in places like Manila to help reduce the risk of flooding. The government should consider investing in additional dikes in communities facing the present-day challenges of sunny day flooding and EWEs. Protecting as many communities as possible help reduce the cost of disaster relief efforts. Targeting assistance to build up the dike infrastructure can help the Philippines manage rising seas and its resilience against future TCs.

Addressing the resiliency of the infrastructure can determine how well these interventions stand up. It is important to build dikes to an acceptable standard. Wealthy and tourist area dikes are in much better shape than dikes that protect impoverished areas (See **Figure 5**).<sup>31</sup> Strong waves destroyed a dike in Batan, ultimately destroying over 28 houses along the coast.<sup>32</sup> Quality is essential when building coastal defenses like sea dikes. Poor quality infrastructure can lead to

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<sup>29</sup> How Do You Plant Corals?, Great Barrier Reef Foundation, June 7, 2022, <https://www.barrierreef.org/news/explainers/how-do-you-plant-corals>.

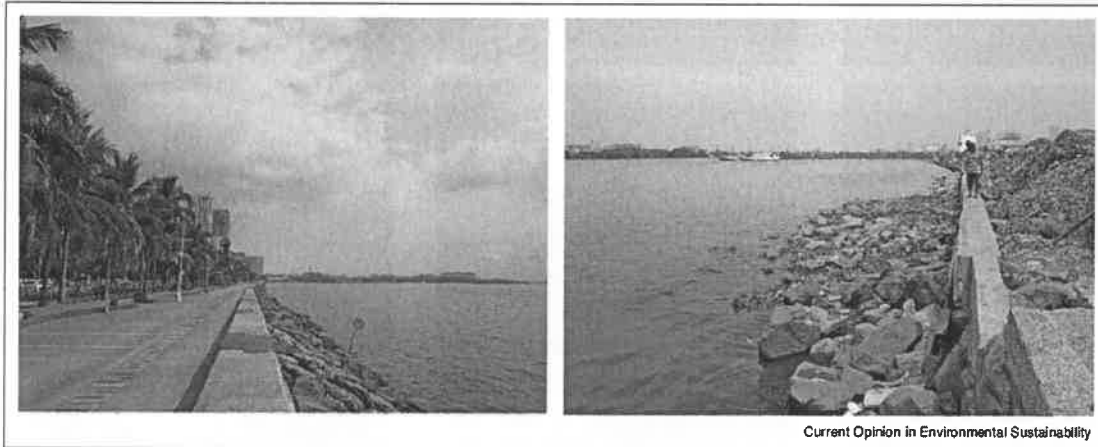
<sup>30</sup> Seawalls and Jetties, Climate ADAPT, September 10, 2022, <https://climate-adapt.eea.europa.eu/en/metadata/adaptation-options/seawalls-and-jetties>.

<sup>31</sup> Cao, "Future of Asian Deltaic Megacities," 92.

<sup>32</sup> Ernie Esconde, Strong waves destroy dike, 28 houses in Bataan, Republic of the Philippines News Agency, October 12, 2021, <https://www.pna.gov.ph/articles/1156411>.

preventable damages that cause the government to expend additional disaster resources. Future projects should protect all citizens with quality coastal defenses. Requiring regular maintenance of dikes will help prevent catastrophic failures in the future.

**Figure 5:** Dikes in Metro Manila



Source: Cao, "Future of Asian Deltaic Megacities," 92.

Finally, authorities should require temporary or permanent relocation efforts if other measures do not work. When dangerous storms come through, the government encourages residents to flee their homes to more safe areas on the mainland. Bohol residents hardly ever cancel school or flee their homes from tidal flooding and have learned to treat this situation as a new normal (See **Figure 6**). The only time they flee is when strong storms threaten the area.<sup>33</sup> Manila residents wait until the last minute to flee their homes during major cyclones due to their fears of looting.<sup>34</sup> These examples show that it is tough to get people to relocate from flooding or EWEs. Better security measures during EWEs can help ease residents' minds and allow more proactive evacuation efforts.

<sup>33</sup> Jamero, "Small-Island Communities." 584.

<sup>34</sup> Williams, "Major Storms," 13.

**Figure 6: Sunny Day Flooding in Bohol**



Source: Jamero, "Small-Island Communities," 583.

Getting people to relocate permanently away from their homes can be challenging. The Philippine Government has tried to implement programs that include housing for communities such as the Bohol Island communities on the mainland. The government planned to build new homes as permanent relocation efforts for these residents, but only some want to leave their original homes even as the water continues to rise. Residents have reservations because their livelihoods are tied to their homes.<sup>35</sup> In Manila, only a few residents relocated to other parts of the island because of financial constraints and economic opportunities away from the capital.<sup>36</sup> Asking people to leave their homes because of rising sea levels and storms is very easy to say,

<sup>35</sup> Jamero, "Small-Island Communities." 583.

<sup>36</sup> Williams, "Major Storms," 13.

but in reality, it is hard to do. Familial ties to their homes can be tough to overcome, and it is not uncommon to see people fight until the last minute. The government can try to develop economic opportunities elsewhere on the island to incentivize the residents' relocation. However, this will be difficult as many economic opportunities are along the coast. US assistance should still encourage economic opportunities for Filipinos, making relocation decisions easier for residents.

### **Current US Engagement**

The Philippines has historically been one of the region's top recipients of US foreign aid. However, the US allocates only about \$5 million of the over \$190 million in total US assistance to disaster readiness in the Philippines, specifically targeting the energy and communication sectors. Only about \$3 million is specifically addressing the effects of climate change.<sup>37</sup> The US needs to consider including the adaptation efforts offered earlier to take a more proactive role in addressing sea level rise and its impact on the Philippine archipelago. Infrastructure programs to assist Filipinos in combating rising waters will be an easy sell to the communities as they could see quick improvements to their quality of life.

These recommendations for targeted assistance to improve Filipino defenses against rising sea levels can come from a reallocation of already obligated funds. The US designates almost \$30 million to emergency response efforts.<sup>38</sup> The US can approach the reallocation of funds using two options. One is to directly transfer funds from emergency response to disaster prevention that targets infrastructure to combat EWEs and rising sea levels. In theory, this reallocation could reduce the long-term cost of emergency response as the country becomes more resilient against disasters. Two, use any unused funds from the emergency response fund in

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<sup>37</sup> U.S. Foreign Assistance By Country, [foreignassistance.gov](https://www.foreignassistance.gov), accessed January 19, 2023, <https://www.foreignassistance.gov/cd/philippines/2022/obligations/0>.

<sup>38</sup> U.S. Foreign Assistance.

disaster prevention. This would be less predictable and dependent on current events. Either way, the US should consider addressing these funding options to help the Philippines combat the effects of rising sea levels.

## **Conclusion**

The Philippines will have to face many challenges as it deals with rising sea levels for many years. Locals will continue to have to adapt at the local level as flooding becomes more common and severe. Expanding and improving coastal defenses will support more communities as EWEs continue to threaten the area. Finally, relocation efforts will have to get more and more traction as communities fail to cope with the challenges of a rising ocean. The US has an opportunity to strengthen its relationship with the Philippines, which has waned in recent years. Increasing assistance targeted at helping the country manage these specific challenges will provide security to the region and ensure that other nations like China will not gain more influence within the region. The Philippines is looking for a prosperous future, and it is too important an ally for the US to allow their relations to continue to sour.

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