Living Climate Change Impacts in Pacific SIDS: Articulating the Pacific Way in an Unresponsive World

Joeli Veitayaki, Peter Nuttall and Prerna Chand
University of the South Pacific, Apia, Samoa and Suva, Fiji

Introduction

Pacific Small Island Developing States (SIDS) are among the world's smallest nations living the severe impacts of climate change and development that are consuming them while the world remains largely divided about how to adapt to and mitigate against these changes. This is an onerous concern because while the life-threatening impacts of climate change are becoming better understood across the world, humanity has not agreed on concrete plans and appropriate activities to effectively address the single most callous threat of our time.[1] In spite of decades of the Conference of the Parties and associated meetings, assortments of agreements, treaties and conventions formulated at global, regional seas and continental levels and through various organizations, and innumerable partnerships that produced policy frameworks, guidelines, strategies, plans, action plans and pathways to direct countries, there has been little unified effective action taken by the global community. The deeply entrenched and polarized positions between the different countries and the variations in their activities have frustrated Pacific SIDS, which are fighting a losing battle against climate change unless all the major countries of the world commit to these initiatives.

1 M.C. Simpson, et al., *An Overview of Modeling Climate Change Impacts in the Caribbean Region with contribution from the Pacific Islands* (Barbados: United Nations Development Programme, 2009); J.D. Bell, J.E. Johnson and A.J. Hobday, eds., *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change* (Noumea: SPC, 2011); J. Connell, "Vulnerable islands: Climate change, tectonic change, and changing livelihoods in the Western Pacific," *The Contemporary Pacific* 27, no. 1 (2015): 1–36; T. Weir, E. Dovey and D. Orcherton, "Social and cultural issues raised by climate change in Pacific Island countries: An overview," *Regional Environmental Change* 17 (2017): 1017–1028. doi: 10.1007/s10113-016-1012-5; J.E. Johnson et al., "Impacts of climate change on oceanic fisheries relevant to the Pacific Islands," Pacific Marine Climate Change Report Card, *Science Review 2018* (2018): 177–188; L. Kumar, ed., *Climate Change and Impacts in the Pacific* (Springer, 2020). doi: 10.1007/978-3-030-32878-8; L.X.C. Dutra et al., "Synergies between local and climate-driven impacts on Pacific coral reefs: A review of issues and opportunities" (in press).

Ocean Yearbook 35: 239–270
 | DOI:10.1163/9789004450219_009

Climate change affects the interactions between the ocean, land and the atmosphere, and influences the health and productivity of the biosphere, society and its economic activities.[2] Increasing ocean acidity and extreme climatic events, for instance, are damaging marine ecosystems, including coral reefs, seagrass beds and mangroves, whose interaction helps sustain healthy marine environments.[3] The land is subjected to climatic variability that is worsening because the global effort to reduce carbon dioxide (CO_2) emissions has been slow.[4] Although the importance and benefits of reducing atmospheric CO_2 is recognized globally, the associated costs of reducing atmospheric CO_2 levels are borne individually by governments, which are not responding fast enough to offset CO_2 emissions.[5]

Pacific SIDS are scattered across the part of the Pacific Ocean characterized by natural hazards, which have become more damaging as a consequence of climate change.[6] While Pacific SIDS are doing their utmost to protect their people and territories from the devastating and economically draining tropical cyclones, storms, floods and droughts that are getting more destructive and arguably more regular in their attack on the environment, food systems and on the people's ability to recover from extreme events,[7] they are facing problems in convincing the international community to do their part. Between 1960 and

2 Bell et al. (2011), id.; Johnson et al. (2018), id; Kumar (2020), id.

3 I. Nagelkerken et al., "How important are mangroves and seagrass beds for coral-reef fish? The nursery hypothesis tested on an island scale," *Marine Ecology Progress Series* 244 (2002): 299–305; Bell et al., n. 1 above; K. Kandasamy and N.M. Alikunhi, "Tropical coastal ecosystems: Rarely explored for their interaction!," *Ecologia* 1, no. 1 (2011): 1–22; Johnson et al., n. 1 above; Dutra et al., n. 1 above.

4 R.J. Andres et al., "A synthesis of carbon dioxide emissions from fossil-fuel combustion," *Biogeosciences* 9 (2012): 1845–1871; C. Azar, D.J. Johansson and N. Mattsson, "Meeting global temperature targets: The role of bioenergy with carbon capture and storage," *Environmental Research Letters* 8, no. 3 (2013): 034004; D.Y. Leung, G. Caramanna and M.M. Maroto-Valer, "An overview of current status of carbon dioxide capture and storage technologies," *Renewable and Sustainable Energy Reviews* 39 (2014): 426–443; M. Fridahl and M. Lehtveer, "Bioenergy with carbon capture and storage (BECCS): Global potential, investment preferences, and deployment barriers," *Energy Research & Social Science* 42 (2018): 155–165; M. Fasihi, O. Efimova and C. Breyer, "Techno-economic assessment of CO_2 direct air capture plants," *Journal of Cleaner Production* 224 (2019): 957–980; G. Realmonte et al., "An inter-model assessment of the role of direct air capture in deep mitigation pathways," *Nature Communications* 10, no. 1 (2019): 1–12.

5 J.S. Wallack and V. Ramanthan, "The other climate changers: Why black carbon and ozone also matter," *Foreign Affairs* 88, no. 5 (2009): 105–113.

6 A. Jentsch, J. Kreyling and C. Beierkuhnlein, "A new generation of climate-change experiments: Events, not trends," *Frontiers in Ecology and the Environment* 5, no. 6 (2007): 315–324. doi: 10.1890/1540-9295(2007)5[365:ANGOCE]2.0.CO;2; Weir et al., n. 1 above.

7 Simpson et al., n. 1 above.

2010, for instance, ten of the fifteen most extreme events in the Pacific SIDS took place between 1995 and 2010.[8] This trend continues as the Pacific was thrashed by three category five tropical cyclones (TC) in the last five years. The Solomon Islands, Vanuatu, Fiji, the Kingdom of Tonga and surrounding countries are still recovering from the crippling impacts of TC Pam in 2015, TC Winston in 2016 and TC Harold in 2020.

Extreme natural hazards accounted for 65 percent of the total economic impact from disasters on the region's economies between 1950 and 2004.[9] TC Ofa in 1990 changed Niue from a food exporting country into one dependent on imports for the next two years, while TC Heta in 2004 had an even greater impact on agricultural production in the country.[10] In Vanuatu, the total estimated economic cost of losses and damages associated with TC Pam was US$449.4 million.[11] In Fiji, TC Winston in 2016 killed 44 people and displaced 45,000 and affected 350,000 people. The total cost of damages was FJ$650 million.[12] Ironically, TC Winston struck Fiji five days after the country became the first of the 195 nations to ratify the United Nations Climate Change deal, the Paris Agreement, signed in December 2015. In the aftermath, Fiji's Prime Minister Frank Bainimarama, lamented that "unless the world acts decisively … to begin addressing the greatest challenge of our age, then the Pacific, as we know it, is doomed."[13]

With increasing sea surface temperatures, there is a corresponding heightening number and intensity of tropical cyclones in recent years.[14] For example, in 2020, TC Harold was one of eight cyclones expected annually in the Pacific

8 UNESCAP, *Sustainable Development in the Pacific: Progress and Challenges* (Pacific Regional Report for the 5-Year Review of the Mauritius Strategy for Further Implementation of the Barbados Programme of Action for Sustainable Development of SIDS (MSI+5), ESCAP Sub-regional Office for the Pacific, Suva, 2010).

9 Weir et al., n. 1 above.

10 N. Mimura et al., "Small islands," in *Climate Change 2007: Impacts, adaptation and vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, eds., M.L. Parry et al. (Cambridge: Cambridge University Press, 2007), pp. 687–716.

11 M. Dornan and T. Newton Cain, "Vanuatu and Cyclone Pam: An update on economic, fiscal and development impacts," *Pacific Economic Monitor Mid-year Review* (July 2015).

12 Climate Council, "Was Cyclone Winston influenced by climate change?" (2016), available online: <https://www.climatecouncil.org.au/cyclone-winston-and-climate-change/>.

13 A.R. Gard and J. Veitayaki, "In the wake of Winston: Climate change, mobility and resiliency in Fiji," *International Journal of Safety and Security Engineering* 7, no. 2 (2017): 157–168.

14 P.J. Webster et al., "Changes in tropical cyclone number, duration, and intensity in a warming environment," *Science* 309, no. 5742 (Sept 2005): 1844–1846. doi: 10.1126/science.1116448.

region. The others were TC Rita, TC Sarai, TC Tino, TC Uesi, TC Vicky, TC Wasi, and TC Gretel.[15]

Climate variability and extremes disrupt food production, water supply, and economic development in Pacific SIDS, which spend billions of dollars earmarked for national development on recovery and rehabilitation after environmental disasters. Droughts, for instance,[16] affect agricultural productivity, hydroelectricity production, public health and freshwater resources leading to drinking water shortages on atolls.[17] In 2011, the Tuvalu government declared a national state of emergency due to the severe impacts of a drought on their water resources caused by seriously reduced precipitation as a result of a strong La Niña event in the region. On this occasion, the daily freshwater ration was only 40 liters per household.[18]

In Fiji, the Nadi area, valued for tourism, agriculture and service industries, has experienced severe flooding events.[19] The area was still recovering from the January 2009 floods, which left up to 10,000 people homeless and caused economic losses costing about FJ$244 million,[20] when it was hit by the January 2012 flooding event that lasted approximately twelve days.[21] A further round of flooding in the whole of the Western Division of Fiji took place two months later caused by the heavy rain brought by a tropical depression that compounded the impacts of the January floods. The flooding killed 10 people

15 Secretariat of the Pacific Regional Environment Programme (SPREP), "Government of Ireland Provides Support to Assist Recovery Efforts for Countries Affected by Tropical Cyclone Harold" (24 July 2020), available online: <https://www.sprep.org/news/government-of-ireland-provides-support-to-assist-recovery-efforts-for-countries-affected-by-tropical-cyclone-harold>.

16 T.W. Giambelluca et al., *Drought in Hawai'i* (Hawai'i Commission on Water Resources Management, Rep. R88, 1991); A.M. d'Aubert and P.D. Nunn, *Furious Winds and Parched Islands: Tropical Cyclones (1558–1970) and Droughts (1722–1987) in the Pacific* (Google Books, 2012); S. McGree, S. Schreider and Y. Kuleshov, "Trends and variability in droughts in the Pacific Islands and Northeast Australia," *Journal of Climate* 29, no. 23 (2016): 8377–8397. doi: 10.1175/JCLI-D-16-0332.1.

17 J. Barnett and J. Campbell, *Climate Change and Small Island States: Power, Knowledge and the South Pacific* (London: Earthscan, 2010); McGree et al., n. 6 above.

18 Y. Kuleshov et al., "Extreme weather and climate events and their impacts on island countries in the Western Pacific: Cyclones, floods and droughts," *Atmospheric and Climate Sciences* 4, no. 5 (2014): 803.

19 A. Chandra and P. Gaganis, "Deconstructing vulnerability and adaptation in a coastal river basin ecosystem: A participatory analysis of flood risk in Nadi, Fiji Islands," *Climate and Development* 8, no. 3 (2016): 256–269.

20 P. Holland, "Nadi floods, economic costs: January 2009," SOPAC Technical Reports 426 (Suva: Pacific Islands Applied Geoscience Commission (SOPAC), 2009); Chandra and Gaganis, n. 19 above.

21 Weir et al., n. 1 above.

and forced 15,000 into evacuation centers. The damages cost at least US$40 million, which excluded the catastrophic loss to private property.[22]

Pacific SIDS are striving to create more resilient societies at all levels, including the local community. According to Barnett and Campbell, successful adaptation "needs to operate at a scale at which most of the important decisions about the social organization are made."[23] In Pacific SIDS, this is often at the community level where there are binding roles, responsibilities and social norms that offer the most effective adaptation approaches that reflect local concerns and avoid the pitfalls of externally imposed "top-down projects, which underestimate local capacities and ignore local particularities." It is critical that adaptation "programmes must be consistent with the values, needs, and rights of the affected communities" who need to be asked for the support they need, "rather than being told what they should receive."[24] Community-based climate change initiatives across the Pacific emphasize the participatory approach and the involvement of local people to build on their priorities, knowledge and capacities to find solutions for local challenges.[25]

This article discusses some views from the Pacific SIDS on climate change and development impacts on environmental sustainability, food security and resilience in their region. It will not cover the climate change debate. It will highlight the Pacific SIDS' position on climate change and development impacts and what they have done to adapt to the debilitating changes they are dealing with as a result of climate change and their disappointments at the lackluster response from the international community. The article concludes with some reflections on the way ahead for Pacific SIDS living in a climate change-ravaged world.

---

22 United Nations Office for the Coordination of Humanitarian Affairs (OCHA), "Revised humanitarian action plan for the Fiji floods (TD17F)," Revision 28 May 2012 (Suva: OCHA, 2012); E. Nolet, "A tsunami from the mountains: Interpreting the Nadi flood," in *Pacific Climate Cultures: Living Climate Change in Oceania*, eds., T. Crook and P. Rudiak-Gould (Warsaw: De Gruyter, 2018), pp. 60–72.

23 Barnett and Campbell, n. 17 above, p. 178.

24 M. Elliott and D. Fagan, "From community to Copenhagen: Civil society action on climate change in the Pacific," in *Climate Change and Migration South Pacific Perspectives*, ed. B. Burson (Wellington: Institute of Policy Studies, Victoria University, 2010), pp. 61–88.

25 P. Dumaru, "Community-based adaptation: Enhancing community adaptive capacity in Druadrua Island, Fiji," *WIREs Climate Change* 1, no. 5 (2010): 751763. doi: 10.1002/wcc.65; J. Veitayaki and E. Holland, "Lessons from Lomani Gau Project: A local community's response to climate change," in Crook and Rudiak-Gould, n. 22 above, pp. 121–136; R. Westoby et al., "From community-based to locally led adaptation: Evidence from Vanuatu," *Ambio: A Journal of the Human Environment* 49, no. 4 (2019). doi: 10.1007/s13280-019-01294-8; K.E. McNamara et al., "An assessment of community-based adaptation initiatives in the Pacific Islands," *Nature Climate Change* 10, no. 7 (2020): 628–639.

Climate Change Impacts in Pacific SIDS

Although life in Pacific SIDS is continuously transformed by a variety of factors that include tectonic forces, erosion and deposition, climatic variability and human impacts,[26] the impacts of climate change are currently the topic of discussion because of the way they affect people's lives in the region and throughout the world. Higher temperatures and changing sea levels are causing coral bleaching and severe tropical storms that generate the destructive cycles of loss and damages that affect economies and ecosystems. Rising sea levels are consuming coastal areas, damaging coastal properties and infrastructure, and causing saltwater intrusions that affect freshwater supplies. Floods and droughts impact agricultural activities, economies and human health, while increasing atmospheric CO_2 levels cause ocean acidification that harms coral reef ecosystems and fisheries resources.[27]

The impacts of climate change on Pacific SIDS include direct impacts of anticipated changes in climate and sea level, such as reduced productivity of subsistence and commercial crops, loss of potable and other water sources, heightened risk of diseases like dengue fever, malaria, cholera and anxiety over Western-style houses.[28] Tropical cyclones, storm surges, floods and droughts have short- and long-term effects on human health, including increased disease transmission and decreased agricultural production. Outbreaks of climate-related diseases, such as the 1997–1998 dengue fever outbreak in Fiji, were costly in terms of lives and economic impacts.[29] The intensified, combined effects of seasonal storms, high tides and storm surges caused chronic erosion and inundation, for example, in parts of Honiara, Solomon Islands that are exposed to a combination of coastal hazards, increasing human settlements and degraded lands. Storm surges along the waterfront are common during the wet, cyclone season from November to April, which cause regular inundation in the Mamana Water settlement, around the Mataniko Bridge and National Referral Hospital.[30]

---

26 Connell, n. 1 above.

27 Veitayaki and Holland, n. 25 above.

28 J. Hay, "Climate change and small island states," *Tiempo* 36–37 (September 2000): 1–4; Simpson et al., n. 1 above.

29 J.P. Terry and R. Raj, "The 1997–98 El Niño and drought in the Fiji Islands," in *Hydrology and Water Management in the Humid Tropics* (Proceedings of the Second International Colloquium, Panama, Republic of Panama, 1999), pp. 22–26; J. Feresi et al., "Climate change vulnerability and adaptation assessment for Fiji" (The International Global Change Institute (IGCI), University of Waikato, 2000).

30 Simpson et al., n. 1 above.

Inundation and saltwater intrusion in lowlands and small atolls contaminate groundwater sources.[31] Sea level rise exacerbates saltwater intrusion, inundation, storm surges, erosion, and, salinization of soils and groundwater, which threaten the economies of local communities.[32] In Papua New Guinea (PNG), the islands of Manus, Duke of York, Siassi Islands, Mortlock, Tasman and Nurguira, and Carteret recorded rising sea levels that have caused loss of land for decades. Furthermore, coastal flooding in PNG affected thousands of people and forced migration to less affected areas.[33] In urban areas, a 0.5 meter rise in sea level combined with waves associated with a one in 50-year cyclone would induce overtopping, damage to wharves and flooding of the hinterland of the port facilities in Suva, Fiji, and in Apia, Samoa.[34]

Disruption to water catchments due to the changing frequency of extreme events is another climate-related problem that affected fresh water during drought periods in smaller and low-lying islands.[35] A 10 percent reduction in average rainfall by 2050 is likely to correspond to a 20 percent reduction in the size of the freshwater lenses on Tarawa atoll in Kiribati.[36] Due to its small size, geology and land topography, the reduced rainfall, together with land loss from sea level rise, are likely to reduce the thickness of the water lens on atolls by about 29 percent.[37] With the increased water demand from the increasing population and economic activities, climate change is expected to reduce water resources in many Pacific SIDS and seriously threaten water supply during dry spells.[38] Limited water storage capacity and groundwater reserves in Pacific SIDS further increases their vulnerability to extreme droughts such as the prolonged droughts of 1998–2000 in Fiji, when borehole yields decreased by 40 percent during the dry period.[39] Pacific SIDS must examine appropriate

31 Hay, n. 28 above; Simpson et al., n. 1 above.

32 Mimura et al., n. 10 above; Simpson et al., n. 1 above.

33 M. Struck-Garbe, "Reflections on climate change by contemporary artists in Papua New Guinea," in Crook and Rudiak-Gould, eds., n. 22 above, pp. 106–120.

34 J.E. Hay et al., *Climate Variability and Change and Sea-Level Rise in the Pacific islands Region: A Resource Book for Policy and Decision Makers, Educators and Other Stakeholders* (Apia: South Pacific Regional Environment Programme, 2003); Simpson et al., n. 1 above.

35 Hay, n. 28 above; Simpson et al., n. 1 above.

36 Simpson et al., n. 1 above.

37 Mimura et al., n. 10 above.

38 M.L. Parry, eds., "Summary for Policymakers," in *Climate Change 2007: Impacts, Adaptation and Vulnerability Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge, UK: Cambridge University Press, 2007), pp. 23–78; Simpson et al., n. 1 above.

39 World Bank, *Cities, Seas and Storms: Managing Change in Pacific Islands Economies*, Vol. IV, Adapting to Climate Change (Washington DC: World Bank, 2000).

adaptation options such as water use management, integrated water management, increased water storage and desalination plants, which all require substantial financial and technological investments.[40]

Climate in the tropics and subtropics is affected by El Niño-Southern Oscillation (ENSO) events which are characterized by irregular periodic variations in the equatorial trade winds and sea surface temperatures of the tropical Pacific Ocean that cause changes in atmospheric and oceanic circulations globally. These changes cause extreme droughts, flooding, and affect marine and terrestrial productivity.[41] Recent studies predict future global warming-related changes associated with ENSO events in both surface temperatures and precipitation,[42] while ENSO events are predicted to be increasingly frequent as a result of global warming.[43] La Niña events are likely to nearly double from the present occurrence.[44]

Extreme weather conditions are evident during ENSO cycles: sea levels are unusually high, storm surges more frequent and overwash more regular.[45] The tropical cyclone region will extend eastward during this period, while sea level falls by about 20 cm in the Western Pacific, potentially exposing coral reefs to extreme conditions. In addition, ENSO is associated with floods, droughts

40 Parry et al., n. 38 above.

41 Terry and Raj, n. 29 above; J.S. Field, "Interannual rainfall, ENSO and agricultural productivity in the Western Pacific," in *The Renaca Papers* (VI International Conference on Rapa Nui and the Pacific, 2005), pp. 75–80; L. Masotti et al., "Large-scale shifts in phytoplankton groups in the Equatorial Pacific during ENSO cycles," *Biogeosciences* 8 (2011): 539–550; K.M. Keller et al., "Detecting changes in marine responses to ENSO from 850 to 2100 CE: Insights from the ocean carbon cycle," *Geophysical Research Letters* 42, no. 2 (2015): 518–525; A. Timmermann et al., "El Niño-southern oscillation complexity," *Nature* 559, no. 7715 (2018): 535–545; W. Anderson et al., "Trans-Pacific ENSO teleconnections pose a correlated risk to agriculture," *Agricultural and Forest Meteorology* 262 (2018): 298–309.

42 G. Wang, W. Cai and A. Santoso, "Stronger increase in the frequency of extreme convective than extreme warm El Niño events under greenhouse warming," *Journal of Climate* 33, no. 2 (2020): 675–690; M.B. Freund et al., "Higher frequency of Central Pacific El Niño events in recent decades relative to past centuries," *Nature Geoscience* 12, no. 6 (2019): 450–455; W. Cai et al., "Increasing frequency of extreme El Niño events due to greenhouse warming," *Nature Climate Change* 4, no. 2 (2014): 111–116; W. Cai et al., "Increased frequency of extreme La Niña events under greenhouse warming," *Nature Climate Change* 5, no. 2 (2015): 132–137; S. Power et al., "Robust twenty-first-century projections of El Niño and related precipitation variability," *Nature* 502, no. 7472 (2013): 541–545; A. Santoso et al., "Late-twentieth-century emergence of the El Niño propagation asymmetry and future projections," *Nature* 504, no. 7478 (2013): 126–130.

43 Wang et al., n. 42 above.

44 Cai et al., (2015), n. 42 above.

45 J. Connell, "Nothing there atoll? 'Farewell to the Carteret Islands'," in Crook and Rudiak-Gould, eds., n. 22 above, pp. 73–87, p. 79.

and other weather disturbances that devastate island environments, land use systems and threaten people's livelihood.[46] The 1997–1998 El Niño in Fiji "affected 24,000 people out of an approximate population of 856,000, caused 13 deaths and cost US$3–6 million."[47] It ushered in droughts resulting in bush fires, fresh water and food shortages, agricultural losses and frost that caused serious health problems. Food shortages were severe in PNG, which had to rely on foreign aid to feed people in isolated highlands and low-lying islands.[48] The impacts on agriculture were severe with two-thirds of Fiji's new sugarcane plants wiped out, Tonga's squash exports reduced by more than half, and more than 30 atolls in the Federated States of Micronesia faced drinking water shortages. Fresh water shortages in the Republic of the Marshall Islands forced its people to scramble for desalination plants, while large areas of natural forests were destroyed by fire sparked by extremely dry conditions in Samoa.[49]

During the La Niña periods, the tropical cyclone region moves further westward, with increases in average rainfall causing flooding and landslides with adverse effects on people's lives. The 1998–1999 La Niña distorted rainfall patterns and brought flash floods to Fiji, while Kiribati, Nauru and Tahiti, which previously enjoyed high rainfalls during the El Niño period, suffered droughts. Kiribati used desalination plants to supply drinking water to their people.[50] In the spring of 2010, the Sepik River communities in PNG experienced their worst flood in 40 years, which destroyed the food supply for an estimated 20,000 people in the East Sepik Province.[51] The overwash contaminated freshwater lenses that were unsuitable for drinking for more than six months.[52] The residents used their inter-community supply chains and traditional coping mechanisms to sustain themselves.[53]

46 Simpson et al., n. 1 above; I. Kelman, *Pacific Island Regional Preparedness for El Niño* (Springer Link, 2017); S.Z. Yang et al., "El Niño-Southern Oscillation and its impact in the changing climate," *National Science Review* 5, no. 6 (2018): 840–857. doi: 10.1093/nsr/nwy046.

47 Simpson et al., n. 1 above, p. 188.

48 Struck-Garbe, n. 33 above.

49 Simpson et al., n. 1 above.

50 Australian Bureau of Meteorology, "El Niño and La Niña: Important Ocean Phenomena," (2007), available online: <http://www.bom.gov.au/pacificsealevel/pdf/Elnino_and_La_Nina.pdf>; Simpson et al., n. 1 above.

51 Struck-Garbe, n. 33 above.

52 Connell, n. 45 above.

53 Struck-Garbe, n. 33 above.

Development Challenges in Pacific SIDS

Pacific SIDS consistently face environmental and resource management challenges that exacerbate their situation, making them less resilient to the impacts of climate change. Barnett and Waters attribute Pacific SIDS' development challenges to their location, landmass, population, geomorphological characteristics, resource profile, economic characteristics and susceptibility to extreme events.[54] Pacific SIDS have a high ratio of coastlines to land area, with a majority of their population situated along coastlines, thereby increasing the exposure of their infrastructure and people to natural hazards.[55]

Pacific SIDS' susceptibility to climate change impacts is linked to their economic vulnerabilities. Agriculture, fisheries and tourism, which are highly sensitive to environmental changes, are among the key sectors of Pacific SIDS' economies.[56] Agricultural land use changes, settlement and use of marginal lands for agriculture diminish the natural resilience of environmental systems and affect their ability to adapt to the stresses caused by climate and sea level changes.[57] The quality of agricultural land varies on the basis of coastal erosion, groundwater contamination through saltwater intrusion and soil erosion associated with flooding of river catchments. Land clearing and tree cutting for agriculture, timber and fuel that has led to deforestation-associated collapses in the Pacific Islands pre-dates European contact.[58] Deforestation, improper agricultural practices, overgrazing, mining and population pressure are now conspicuous poor land practices in the Pacific SIDS.[59]

Coastal and offshore fisheries extensively support food security, livelihood, revenue generation, employment, and development in Pacific SIDS.[60]

---

54 J. Barnett and E. Waters, "Rethinking the vulnerability of small island states: Climate change and development in the Pacific Islands," in *The Palgrave Handbook of International Development* (London: Palgrave Macmillan, 2016).

55 Id., pp. 731–748.

56 Barnett and Campbell, n. 17 above; Barnett and Waters, n. 54 above.

57 Hay, n. 28 above; Simpson et al., n. 1 above.

58 B. Rolett and J. Diamond, "Environmental predictors of pre-European deforestation on Pacific islands," *Nature* 431, no. 7007 (2004): 443–446.

59 P. Dauvergne, "Globalisation and deforestation in the Asia-Pacific," *Environmental Politics* 7, no. 4 (1998): 114–135; T.T. Kabutaulaka, "Deforestation and politics in Solomon Islands: Governance and reform in the South Pacific" (Canberra: National Centre for Development Studies, Australian National University, 1998), pp. 121–153; M. Wairiu, "Land degradation and sustainable land management practices in Pacific Island Countries," *Regional Environmental Change* 17, no. 4 (2017): 1053–1064.

60 Barnett and Campbell, n. 17 above; J.D. Bell et al., "Planning the use of fish for food security in the Pacific," *Marine Policy* 33 (2009): 64–76; S. Albert et al., "Keeping food on the table: Human responses and changing coastal fisheries in Solomon Islands," *PLoS One* 10 (2015);

Coastal fisheries resources are heavily utilized and overexploited because of weak resource management systems.[61] Offshore fisheries such as tuna contribute significantly to Pacific SIDS' revenue and economic activities, but these resources must be used under strict conservation and management arrangements that need to be enforced across the region. The management of offshore fisheries resources requires effective regional policies and regulations because of the shared and highly migratory nature of tuna. Managing these resources is difficult to conceptualize, negotiate and implement.[62]

Tourism is a key driver of the economy of several Pacific SIDS and contributes to their gross domestic product (GDP), creating employment and boosting foreign exchange,[63] but is also associated with environmental change and degradation.[64] Given the Pacific SIDS' small land area to sea ratio, most of their tourist activities are sea-based. Activities such as diving, water skiing, snorkeling and game fishing are detrimental to natural ecosystems unless they are managed in a sustainable manner. Many tourist operators in Pacific SIDS are

Q. Hanich et al., "Small-scale fisheries under climate change in the Pacific Islands region," *Marine Policy* 88 (2018): 279–284.

61 T. Aqorau, "Illegal fishing and fisheries law enforcement in small island developing states: The Pacific Islands experience," *International Journal of Marine and Coastal Law* 15, no. 1 (2000): 37–63. S. Jupiter, S. Mangubhai, and R.T. Kingsford, "Conservation of biodiversity in the Pacific Islands of Oceania: Challenges and opportunities," *Pacific Conservation Biology* 20, no. 2 (2014): 206–220; Hanich, n. 60 above.

62 V. Ram-Bidesi and M. Tsamenyi, "Implications of the tuna management regime for domestic industry development in the Pacific Island States," *Marine Policy* 28, no. 5 (2004): 383–392; Q. Hanich, F. Teo and M. Tsamenyi, "A collective approach to Pacific islands fisheries management: Moving beyond regional agreements," *Marine Policy* 34, no. 1 (2010): 85–91; S. Tarte, "Regionalism and changing regional order in the Pacific Islands," *Asia & the Pacific Policy Studies* 1, no. 2 (2014): 312–324.

63 S. Foale and M. Macintyre, "Green fantasies: Photographic representations of biodiversity and ecotourism in the Western Pacific," *Journal of Political Ecology* 12, no. 1 (2005): 1–22; S. Gössling, C.M. Hall and D. Scott, "The challenges of tourism as a development strategy in an era of global climate change: Rethinking development in a carbon-constrained world," *Development Cooperation and Climate Change* (2009): 100–119; D. Harrison and S. Pratt, eds., *Tourism in Pacific Islands: Current Issues and Future Challenges* (London: Routledge, 2015), pp. 3–21.

64 D.B. Weaver, "Tourism and the elusive paradigm of sustainable development," in *A Companion to Tourism*, eds., A.A. Lew, C.M. Hall and A.M. Williams (Oxford: Blackwell, 2004), p. 510; S. Gössling and C.M. Hall, "Uncertainties in predicting tourist flows under scenarios of climate change," *Climatic Change* 79, no. 3–4 (2006): 163–173; Harrison and Pratt, n. 63 above.

embracing eco-tourism and marine conservation to promote the sustainability of natural environments.[65]

Pacific SIDS economies are more exposed to extreme events and climate change because of their reliance on one or a few economic activities, which makes the cost of adaptation relative to GDP relatively high. Without adaptation, it is estimated that by 2050, high islands such as in Fiji could experience damages of up to US$52 million (equivalent to 2–3 percent of the country's GDP in 1998), while low islands such as in Kiribati could face average annual damages of US$8–16 million (or 17–18 percent of GDP in 1998).[66] The region's limited resources, concentration of population and infrastructure in coastal areas, susceptibility to natural hazards, sensitivity of freshwater supplies, isolation, small size and limited financial, technical and institutional capacities put them at the mercy of what the global community does in relation to climate change adaptation and mitigation.[67]

Agriculture and Fisheries in Pacific SIDS

Pacific SIDS' agriculture and fisheries sectors are threatened by a combination of climate change and development issues. Current and future climate change threats to terrestrial biodiversity are dependent on the pace and degree of warming and the extent to which natural landscapes have been or will be modified or degraded by human activities.[68] Increased human pressure will reduce species and ecosystem resilience to environmental changes and enhance the decline in ecosystem services (e.g., food resources, provision of rainfall and water supplies, pollination, and storm protection) that people depend on. The transition from semi-subsistence to commercial-oriented activities has been accompanied by the increased and unregulated use of pesticides and chemical fertilizers, large-scale land clearing, changes in land use, introduced trees, and infrastructure development, which have altered the natural conditions and

65 H.C. de Haas, "Sustainability of small-scale ecotourism: The case of Niue, South Pacific," *Current Issues in Tourism* 5, no. 3–4 (2002): 319–337; D. Harrison, *Pacific Island Tourism* (Cammeray: Cognizant Communication Corporation, 2003); Foale and Macintyre, n. 63 above; H. Zeppel, *Indigenous Ecotourism: Sustainable Development and Management*, Vol. 3 (Wallingford, UK: Cabi, 2006); C.C. Wabnitz et al., "Ecotourism, climate change and reef fish consumption in Palau: Benefits, trade-offs and adaptation strategies," *Marine Policy* 88 (2018): 323–332.

66 Simpson et al., n. 1 above.

67 Weir et al., n. 1 above.

68 Simpson et al., n. 1 above.

biodiversity. These changes increase sediment and nutrient runoff into coastal waters, causing coral reef degradation.[69] According to Hasan,[70] the sediment load from Rewa River floods in Fiji was estimated at approximately an average of 107 tonnes per year. Consequently, the Fiji government, since 1983, has been spending about US$6 million annually on dredging to minimize flooding.[71] Conversion of forests, logging, mining and fire threaten biodiversity and worsen climate change impacts, affecting unique habitats and associated taxa, montane systems and dry land vegetation, species in higher areas, isolated or outlying mountain ranges, smaller islands, and/or those targeted by people.[72]

The effects of erosion, increased contamination of groundwater by saltwater intrusion, cyclones and storm surges, heat stress and drought associated with climate change hinder agricultural production in coastal communities.[73] The most prominent impacts of climate change on agriculture are felt during and after tropical cyclones and flooding, which have caused devastating agricultural losses over the years. Over the period 1950–2004, the cost of climate-related disasters on agriculture in the Pacific region was US$13.8 to US$14.2 million.[74] More recently, Tropical Cyclone Harold that stuck the Solomon Islands, Fiji and Vanuatu destroyed and caused extensive damage to staple crops. In Vanuatu, an estimated 17,500 hectares of cropland were exposed to hurricane force winds,[75] while the impacts of saltwater intrusion and inundation on taro plantations were witnessed in atolls.[76]

69 P. Nuttall and J. Veitayaki, "Oceania is vast, Canoe is centre, Village is anchor, Continent is margin," in *Routledge Handbook of Ocean Resources and Management*, eds., H.D. Smith, J.L.S. De Vivero and T.S. Agardy, (London: Routledge, 2015), pp. 560–575.

70 R.R. Hasan, *Hydrology of Rewa and Ba Watersheds* (Unpublished report, UNDP/FAO for Fiji Ministry of Primary Industries, 1986).

71 C. Togamana, "Nutrient Transport via Sedimentary Processes in the Rewa Catchment" (Thesis, University of the South Pacific, Suva, 1995).

72 Simpson et al., n. 1 above.

73 Simpson et al., n. 1 above; M. Wairiu, M. Lal and V. Iese, "Climate change implications for crop production in Pacific Islands region," in *Food Production: Approaches, Challenges and Tasks*, ed., A. Aladjadjiyan (Rijeka: Intech, 2011), p. 67.

74 Wairiu et al., id.

75 Food and Agriculture Organization of the United Nations (FAO), "The Pacific Islands: Tropical Cyclone Harold—situation report May 2020," available online: <http://www.fao.org/resilience/resources/resources-detail/en/c/1274007>.

76 C. Woodruffe, "Reef-island topography and the vulnerability of atolls to sea-level rise," *Global and Planetary Change* 62, no. 1–2 (2008): 77–96; J.P. Terry and A.C. Falkland, "Responses of atoll freshwater lenses to storm-surge overwash in the Northern Cook Islands," *Hydrogeology Journal* 18, no. 3 (2010): 749–759; Wairiu et al., n. 73 above; L. Berthe, D.C. Seng and L. Asora, "Multiple stresses, veiled threat: Saltwater intrusion in Samoa," in Samoa Conference III: Opportunities and challenges for a sustainable cultural and natural environment (August 2014), pp. 25–29; S. Rao, M. Taylor and A, Jokhan, "A descriptor

Approximately 70–80 percent of food for people in the larger islands of Melanesia, 40–60 percent in Polynesian countries and between 30–40 percent in rural atolls of Kiribati and Tuvalu come from agriculture.[77] About 70 percent of these agricultural systems are rain fed, highlighting the dependence on variations in rainfall. Most farmlands are in river plains and coastal lowlands that are vulnerable to floods, saltwater intrusions and inundation.[78] Variations in agricultural production thus have serious consequences on local economies, food security, trade and foreign exchange. Cyclone Heta, a category 5 cyclone that hit Niue in 2004 and brought huge waves smashing over the island's 30-meter high cliffs, destroyed almost all of the country's agriculture, and caused economic damages equivalent to 200 years of Niue's exports.[79]

Fiji was hit by one of its worst flooding events in more than 50 years in January 2009.[80] In the same year, king tides struck the Federated States of Micronesia, Republic of the Marshall Islands, Kiribati, Papua New Guinea, Solomon Islands and Tuvalu, simultaneously.[81] In addition to damaging crops and discouraging farmers, these extreme events contributed to the spread of new pests and diseases, including "rot" problems, Pythium, taro leaf blight and Anthracnose in yams. Pests and diseases further hindered crops and livestock production.[82]

Coastal fisheries that contribute significantly to Pacific SIDS' economies[83] are heavily dependent on coral reef ecosystems.[84] Coral reefs are sensitive and continuously exposed to stresses such as increasing sea surface temperatures, unstable ocean conditions during storms, changing ocean chemistry, and

---

list for Giant Swamp Taro (*Cyrtosperma merkusii*) and its cultivars in the Federated States of Micronesia," *Telopea* 16 (2014): 95–117.

77 V. Iese et al., "Agriculture under a changing climate," in Kumar, ed., n. 1 above, pp. 323–357.

78 Id.

79 Simpson et al., n. 1 above.

80 Fiji Government, "Consolidated Reports on Floods 8–16 January 2009, Damage sustained and necessary responses, rehabilitation and reconstruction," Office of the Prime Minister, Suva, 2009, pp. 79.

81 Simpson et al., n. 1 above.

82 Id.

83 Hanich, n. 60 above.

84 S. Džeroski and D. Drumm, "Using regression trees to identify the habitat preference of the sea cucumber (*Holothuria leucospilota*) on Rarotonga, Cook Islands," *Ecological Modelling* 170, no. 2–3 (2003): 219–226; E. Lovell et al., "Status of coral reefs in the South West Pacific: Fiji, Nauru, New Caledonia, Samoa, Solomon Islands, Tuvalu and Vanuatu," *Status of Coral Reefs of the World* 2 (2004), pp. 337–362. D. Zeller et al., "Reconstruction of coral reef fisheries catches in American Samoa, 1950–2002," *Coral Reefs* 25, no. 1 (2006): 144–152; K. Newton et al., "Current and future sustainability of island coral reef fisheries," *Current Biology* 17, no. 7 (2007): 655–658.

run-off from land-based activities.[85] While corals have persisted and evolved with changing environments, temperatures and seawater chemistry over millions of years,[86] large-scale coral mortality together with accelerated human-induced climate change over the past 50 years seriously threaten the corals reefs' ability to cope with higher prevalence of coral disease, bleaching and predation outbreaks.[87] With global warming, increasing sea temperatures and associated frequent bleaching and severe storm events, further demise of coral reefs is expected. Urgent action is needed to understand these synergistic pressures and address them at local and regional scales to build reef resilience against climate change and human impacts.[88] More intense cyclones, ocean acidity and sea level rise threaten coral reefs and associated ecosystems, and are expected to drive coral reef declines if the global efforts to curb CO_2 emissions fail.[89]

Physical impacts, pollution and overfishing have degraded coral reefs in Pacific SIDS for centuries.[90] Nutrient pollution from sewage contamination has been a serious issue in Pohnpei (Federated States of Micronesia), Fanga'uta Lagoon (Tonga),[91] and the Coral Coast and Suva Lagoons (Fiji)[92] for decades. Sustained stresses on coral reefs have led to simplification of reef community structure and reductions in live coral cover,[93] species and coral trait diversity,[94]

85 Dutra et al., n. 1 above.

86 J.M. Pandolfi et al., "Projecting coral reef futures under global warming and ocean acidification," *Science* 333, (2011): 418–422.

87 Dutra et al., n. 1 above.

88 J.M. Lough, "Small change, big difference: Sea surface temperature distributions for tropical coral reef ecosystems, 1950–2011," *Journal of Geophysical Research* 117 (2012): C09018. doi: 10.1029/2012JC008199; D. Obura and S. Mangubhai, "Coral mortality associated with thermal fluctuations in the Phoenix Islands, 2002–2005," *Coral Reefs* 30 (2011): 607–619; S. Mangubhai, "Impact of Tropical Cyclone Winston on coral reefs in the Vatu-i-Ra Seascape" (Report No. 01/16, Suva, Fiji, 2016), p. 27; L.J. Raymundo et al., "Successive bleaching events cause mass coral mortality in Guam, Micronesia," *Coral Reefs* 38 (2019): 677–700; Dutra et al., n. 1 above.

89 Dutra et al., n. 1 above.

90 Id.

91 R.J. Morrison, "The regional approach to management of marine pollution in the South Pacific," *Ocean and Coastal Management* 42 (1999): 503–521; L.P. Zann, "The status of coral reefs in South Western Pacific Islands," *Marine Pollution Bulletin* 29 (1994): 52–61.

92 Dutra et al., n. 1 above.

93 J.F. Bruno and E.R. Selig, "Regional decline of coral cover in the Indo-Pacific: Timing, extent, and subregional comparisons," *Plos One* 2 (2007).

94 E.S. Darling, T.R. McClanahan and I.M. Cote, "Life histories predict coral community disassembly under multiple stressors," *Global Change Biology* 19 (2013): 1930–1940.

which drive habitat losses.[95] Intensive land use practices also worsen sedimentation in coral reef areas.[96]

Coral cover is expected to decrease by 75 percent due to bleaching and increased ocean acidification.[97] Increasing acidity and sea surface temperatures are likely to overwhelm even the most resilient of reefs. This poses significant threats to Pacific SIDS' livelihoods and well-being. Healthy reefs are natural breakwaters that reduce wave impacts during extreme events and are a daily food source for people.[98] Increasing sea temperatures in the tropics stress reef-building corals, resulting in regular bleaching events that damage massive coral colonies. For Pacific SIDS, these mean reduced shoreline protection and food security.[99]

Coastal fisheries catch for commercial and subsistence fisheries added an estimated value of greater than US$300 million to the GDP of Pacific SIDS and territories in 2014.[100] Fisheries provides the main source of protein for Pacific Islanders of whom, 89 percent consume fish weekly, 59–100 percent of the time.[101] Fish per capita consumption rate is, on average, 37 kg per person per annum from the range of 20–110 kg.[102] This sector is thus critical to food security in the region, but is not expected to meet the demand of the rapidly

95 R.B. Aronson and W.F. Precht, "Physical and biological drivers of coral-reef dynamics," *Coral Reefs World* 6 (2016): 261–275; C.J. Brown et al., "Tracing the influence of land-use change on water quality and coral reefs using a Bayesian model," *Science Reports* 7, no. 4740 (2017).

96 B.S. Halpern et al., "Marine protected areas and resilience to sedimentation in the Solomon Islands," *Coral Reefs* 32, no. 1 (2013): 61–69; R.J. Hamilton et al., "Logging degrades nursery habitat for an iconic coral reef fish," *Biological Conservation* 210 (2017): 273–280; A.S. Wenger et al., "Predicting the impact of logging activities on soil erosion and water quality in steep, forested tropical islands," *Environmental Research Letters* 13, no. 4 (2018): p.044035; Dutra et al., n. 1 above.

97 O. Hoegh-Guldberg et al., "Coral reefs under rapid climate change and ocean acidification," *Science* 318 (2007): 1737–1742.

98 Simpson et al., n. 1 above.

99 O. Hoegh-Guldberg, "Climate change, coral bleaching and the future of the world's coral reefs," *Marine & Freshwater Research* 50, no. 8 (1999): 839–866. doi: 10.1071/MF99078; Simpson et al., n. 1 above.

100 R.D. Gillett, *Fisheries in the Economies of Pacific Island Countries and Territories* (Noumea: Pacific Community, 2016), available online: <https://www.spc.int/sites/default/files/wordpresscontent/wp-content/uploads/2016/11/Gillett_16_Benefish-fisheries-in-economies-of-pacific-countries.pdf>.

101 Household Income & Expenditure Survey data from 10 PICTS (2012–2016). See n. 103 below.

102 Household Income & Expenditure Survey data from 15 PICTS (mainly 2001–06). See n. 103 below.

increasing human populations in 16 of the 22 Pacific SIDS and territories in the near future.[103]

Future projections for Pacific SIDS are bleak as the primary sources of food, water and economic development will all be negatively impacted by climate change.[104] As the Solomon Islands, Vanuatu, Fiji, Tonga and many of the Pacific SIDS have witnessed, the annual cyclones, storms, floods and droughts demonstrate the threats that Pacific Islanders face and must prepare for.[105] Given the mammoth challenges faced by Pacific SIDS in living climate change, which they blame on the economic and industrial activities of developed countries, these small and economically vulnerable States have looked to the international community for leadership, support and assistance. Up to now, 28 years after the global United Nations Framework Convention on Climate Change (UNFCCC)[106] process started in 1992, the results have largely been disappointing.

The Global Community's Climate Change Response

Pacific SIDS used the United Nations, its agencies and activities to publicize their plight and solicit international support for a consolidated global stand to fight climate change. However, Pacific SIDS quickly realized that climate change is a complex issue, as it encompasses all aspects of life and demands confronting friends and allies.[107] Moreover, climate science is being used as a "weapon for the weak" or "an act of symbolic violence by the powerful."[108]

The UNFCCC was adopted at the United Nations Conference on Environment and Development in 1992 to "stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference

103 Pacific Community (SPC), *Fish and Food Security*, Policy Brief 1/2008 (Nouméa, New Caledonia: Secretariat of the Pacific Community, 2008); Bell et al., n. 60 above.

104 UNESCAP, n. 8 above, p. 10; SPC, Future of Fisheries: Coastal Fishery Report Card 2018 (SPC, 2018), available online: <https://fame1.spc.int/en/publications/roadmap-a-report-cards>.

105 Weir et al., n. 1 above; Dutra et al., n. 1 above.

106 UN General Assembly, Resolution 48/189: United Nations Framework Convention on Climate Change, adopted 21 December 1993.

107 N. Grey-Riley, Pacific Island Nations want partners that will help them fight climate change," *The Diplomat* (18 October 2019), available online: <https://thediplomat.com/2019/10/pacific-island-nations-want-partners-that-will-help-them-fight-climate-change/>.

108 T. Crook and P. Rudiak-Gould, "Introduction: Pacific Climate Cultures," in Crook and Rudiak-Gould, eds., n. 22 above, pp. 1–20.

with the climate system."[109] The UNFCCC outlines the principles, general obligations, basic institutional arrangements and an intergovernmental process for agreeing to specific actions. These include actions through collective decisions by the Conference of the Parties (COP) and other international legal instruments with more specific obligations such as the Kyoto Protocol that was agreed to at COP 3 in 1997 and the Paris Agreement reached at COP 21 in 2015. Under the Kyoto Protocol, the commitment is for each Annex I Party to ensure that its total emissions from greenhouse gases (GHG) sources listed in Annex A to the Kyoto Protocol, over the designated time, do not exceed its allowable level of emissions. Annex A covers GHG emissions from the energy, industrial processes, solvent and other products used, agriculture and waste sectors.[110]

The Paris Agreement to combat climate change, implement and mainstream the actions and investments necessary to keep the global temperature rise this century to well below 2 °C above pre-industrial levels, with the intentions to pursue this even further to 1.5 °C through a series of actions and commitments, was eventually agreed to 18 years after the Kyoto Protocol. This was the basis for the ambitious activities required to combat climate change and adapt to its effects, with enhanced funding support to assist developing countries to deal with the impacts of climate change.[111] The SIDS, including 14 from the Pacific, took the lead at COP 21 to demonstrate their conviction, which Samoa's Ambassador and Permanent Representative to the United Nations, Ali'ioaiga Feturi Alisaia explained "is an existential issue for us so there is no way we were going to wait for others to take the lead." The Director General of the Secretariat of the Pacific Regional Environment Programme (SPREP), Mr. Kosi Latu, assured that SPREP would continue to provide support for its members through the Pacific Climate Change Centre, the regional climate hub for inclusive collaboration to meet the adaptation and mitigation priorities of Pacific Island countries and territories.

The Paris Agreement also aims to improve the capacity of countries to deal with the impacts of climate change, and establishes finance mechanisms to

109 United Nations Framework Convention on Climate Change (UNFCCC), "Climate Get the Big Picture," available online: <https://unfccc.int/resource/bigpicture>.

110 Protocol to the United Nations Framework Convention on Climate Change (Kyoto Protocol), adopted 11 December 1997, entered into force 16 February 2005, (1998) 37 *International Legal Materials* 22. See also UNFCCC, *Kyoto Protocol Reference Manual on Accounting of Emissions and Assigned Amount* (2008), available online: <https://unfccc.int/resource/docs/publications/08_unfccc_kp_ref_manual.pdf>.

111 SPREP, "Pacific Islands Help Bring Paris Agreement into Force" (4 November 2016), available online: <https://www.sprep.org/news/pacific-islands-help-bring-paris-agreement-force>.

support low GHG emissions and climate-resilient pathways.[112] It was agreed that a new technology framework and an enhanced capacity-building campaign were required to support developing, and the most vulnerable, countries that need to undertake these transformative changes in accordance with their own national objectives. The Agreement also provided for an enhanced transparency framework for action and support.

All the parties announced their best efforts through "Nationally Determined Contributions" (NDCS) and are to improve on these efforts in the years ahead.[113] The parties are to regularly report on their emissions and implementation efforts, while a global review is to be undertaken every five years to assess the collective progress and inform further individual actions by the parties. The Agreement opened for signature on 22 April 2016 and its popularity was evident when it entered into force on 4 November 2016, 30 days after the ratification by 55 countries that accounted for at least 55 percent of global emissions.[114] Today, 189 of 197 parties to the Convention have ratified the Agreement. However, the climate change problem is far from over and the Pacific SIDS are still to be appeased with their concern that the global community is committed to collaborate with them to combat their most imminent threat.[115] Even at COP 23 in 2017, the NDCS were still different in nature and coverage, and were barely comparable, indicating the lack of agreement on the actions to be undertaken.[116]

After more than 70 climate change meetings, over 28 years, to attain the aspirations of the UNFCCC, the world has agreed on how to fight climate change, but differed on the operationalization of the Agreement.[117] The aforementioned meetings include 26 COPS, 15 CMP (Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol), two CMA (Conference of the Parties serving as the meeting of the Parties to the Paris Agreement),

112 Paris Agreement on Climate Change, adopted 12 December 2015, entered into force 4 November 2016, [2016] *Australian Treaty Series* 24; United Nations Climate Change, "What is the Paris Agreement?," available online: <https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement>.

113 United Nations Climate Change, "Nationally Determined Contributions," available online: <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement/nationally-determined-contributions-ndcs>.

114 United Nations Climate Change, "Paris Agreement—Status of Ratification," available online: <https://unfccc.int/process/the-paris-agreement/status-of-ratification>.

115 Id.

116 W. Obergassel, et al., *The Calm Before the Storm: An Assessment of the 23rd Climate Change Conference COP23 in Bonn* (Wuppertal Institute, 2018), available online: <https://wupperinst.org/fa/redaktion/downloads/publications/COP23-Report.pdf>.

117 SPREP, 2016, n. 111 above; UNFCCC, 2020d, n. 113 above.

51 SBSTA (Subsidiary Body for Scientific and Technological Advice) and 52 SBI (Subsidiary Body for Implementation). During that time, the SIDS, which were advocating for the global transformation to adapt to and mitigate against climate change, managed only to transit from the Barbados Plan of Action of 1994, to the Mauritius Strategy for Implementation of 2005 and then the SAMOA (SIDS Accelerated Modalities of Action) Pathway of 2014. Over the last 26 years, SIDS were largely stuck on planning on how to do what they all knew they needed to do because of the lackluster support from the global community.

Since the ratification of the UNFCCC in 1992, Pacific SIDS have been persistent in their demand for leadership from the world's developed nations to save the planet and humankind from climate change. Papua New Guinea's Climate Change Ambassador facilitated the eventual endorsement of the Reducing Emissions from Deforestation and Forest Degradation (REDD) scheme at COP 13 in Bali, Indonesia, in 2006 after calling on the United States to lead or to get out of the way.[118] REDD was formulated by PNG and Costa Rica and presented at COP 11 in 2005.

Fiji's Minister for Foreign Affairs, Ratu Inoke Kubuabola, in his address to the 67th United Nations General Assembly in 2012, related how Fiji lived through its worst flooding on record from January to April of 2012 and moaned that the "ongoing failure of the international community to seriously address climate change means we will all see more frequent and more intense weather events."[119]

In addressing the UN General Assembly in 2015, Tuilepa Lupesoliai Neioti Aiono Sailele Malielegaoi, Prime Minister of Samoa, called on the member States in global leadership positions to "lead the charge in finding and implementing solutions to the causes of climate change."[120] He argued that as current "custodians of our world's environment, we owe it to our children and future generations to do what needs to be done quickly, and decisively, before we run out of time."[121] The Prime Minister, who at that time had served his country for

118 A.C. Revkin, "Issuing a bold challenge to the U.S. over climate," *The New York Times* (22 January 2008), available online: <http://www.nytimes.com/2008/01/22/science/earth/22conv.html?_r=0>; N. Bingeding, "Papua New Guinea's Response to Climate Change: Challenges and Ways Forward," in Crook and Rudiak-Gould, eds., n. 22 above, pp. 139–154.

119 Nolet, n. 22 above, p. 62.

120 Statement by Honourable Tuilaepa Lupesoliai Sailele Malielegaoi, Prime Minister of the Independent State of Samoa at the General Debate, United Nations General Assembly, Seventieth session, New York, 30 September 2015.

121 Id.

over 20 years, demanded that the Paris Agreement be ready in December of that year for the Conference of the Parties to adopt a plan that is "ambitious, universally applicable, effective, binding, capable of swift implementation and universally owned and respected by all member states."[122] He also urged "all the member states of the UN [to] uphold their part of the bargain in the work that needs to be done" because this was the only way of "reaching the objectives we all know should be achieved."[123] This prophetic advice still has not been accomplished five years later.

Pacific SIDS unanimously supported Sustainable Development Goal 13 to "[t]ake urgent action to combat climate change and its impacts" and enshrined it in the SAMOA Pathway, the outcome of the Third International Conference on Small Island Developing States that was undertaken in Samoa. The Pathway was linked to the 2030 Agenda for Sustainable Development, the Addis Ababa Action Agenda, the Sendai Framework for Disaster Risk Reduction, the New Urban Agenda and the Paris Agreement to ensure action. Unfortunately, Pacific SIDS' concerns were nearly always "unheard of at the global stage, drowned by a cacophony of larger states, superpowers, and alliances whose consumption-based development and security interests easily outweighed their voice."[124] The failure to gain international consensus on global emission reductions in Copenhagen, Mexico, Rio+20, Warsaw, and Bonn reinforced the futility of Pacific SIDS expecting any support in this matter from developed countries.

Pacific SIDS were also frustrated that climate change adaptation and mitigation processes directed by agencies and donors were poorly coordinated. In addition, the institutional rigidity of donor organizations in Pacific SIDS hindered cooperation and partnerships.[125] A 2012 AusAID-authored assessment of multilateral agencies revealed that there was a need to reduce duplication of climate change programs.[126] On the other hand, donors raised the lack of capacity in Pacific SIDS to absorb available funding, extend into new areas, expand programs, and be transparent and accountable. It is obvious that Pacific SIDS and the global community must work together because Pacific SIDS need to adapt to sustain their needs, rights and values, while the international community has to reduce emissions to an effective level and support communities in the Pacific to adapt in appropriate ways.[127]

122 Id.
123 Id.
124 Nuttall and Veitayaki, n. 69 above.
125 N. Maclellan et al., *Owning Adaptation in the Pacific: Strengthening Governance of Climate Adaptation Finance* (Auckland: Oxfam, 2012).
126 Weir et al., n. 1 above.
127 Barnett and Campbell, n. 17 above.

At the beginning of the millennium, it was estimated that between US$290 and 530 million was required to undertake the most urgent and immediate adaptation actions needed in Pacific SIDS.[128] This is a major problem for these nations that have to meet costs of long-term and transformational changes that address the underlying social, economic, and political drivers of vulnerability.[129] As a result, the AU$35 million Australia proposed to spend in 2008/2009 in the Pacific was insufficient to cover the adaptation needs of Kiribati, Tuvalu, and the Solomon Islands, the most vulnerable and least developed countries. Moreover, the donor community's priorities were not always aligned to the needs in the recipient countries as demonstrated at the NZAid/EU-sponsored Pacific Energy Summit in Auckland in April 2013, when US$535 million was pledged to reduce the region's dependence on imported diesel. All of these funds were used to reduce fuel use for electricity generation, the source of 17 percent of the region's imports, while transport, which accounted for over 70 percent of the region's fuel bill, was not addressed.[130] While the use of renewable energy for electricity was in all Pacific SIDS' NDCs, maritime transport continued to be a major source of emissions that remains unresolved. This case exemplified the complexity of determining adaptation and mitigation priorities because there are always sectors that will miss out.

Pacific SIDS Fighting Climate Change

Climate change impacts in Pacific SIDS have devastating economic, social and environmental costs that threaten local communities, water, food supplies, and the health of people and natural ecosystems.[131] For these reasons, Pacific peoples are taking action at all levels of governance to ensure their survival in their climate change-ravaged island homes. From political leaders such as President Anote Tong of Kiribati calling for all to take moral responsibility in the fight against climate change to ensure the well-being of all at international

128 W. McGoldrick, "Financing adaptation in Pacific Island countries: Prospects for the post-2012 climate change Regime," *Australian International Law Journal* 14 (2007): 45–70.

129 C. Klöck and M. Fink, "Dealing with climate change on small islands: Towards effective and sustainable adaptation?," in *Dealing with Climate Change on Small Islands: Towards Effective and Sustainable Adaptation?*, eds., C. Klöck and M. Fink (Göttingen: Göttingen University Press, 2019), pp. 1–15. doi: 10.17875/gup2019-1209.

130 E. Holland et al., "Connecting the dots: Policy connections between Pacific Islands shipping and global carbon dioxide and pollutant emission reduction," *Carbon Management* 5, no. 1 (2014): 93–105.

131 Simpson et al., n. 1 above.

meetings,[132] to the rural villagers of Gau Island in Fiji undertaking community adaptation,[133] Pacific Islanders are fighting climate change and are leading the world in many respects. The climate change initiatives undertaken in Pacific SIDS include the regional policy frameworks and guidelines such as the following:

- Pacific Islands Framework for Action on Climate Change (2006–2015)
- Niue Declaration on Climate Change (2008)
- Pacific Forum Leaders Majuro Declaration (2013)[134]
- Pacific Islands Development Forum's (PIDF) Suva Declaration on Climate Change (2015)
- Pacific Small Island States Moresby Declaration on Climate Change (2015)
- Pacific Leaders' Call to Action on Climate Change at the 73rd session of the United Nations General Assembly (2018)
- PIDF's Nadi Bay Declaration on the Climate Change Crisis in the Pacific (2019)[135]

These guidelines are reflected in the initiatives that the countries and communities are undertaking to address climate change threats in their region.

SPREP leads and coordinates the integrated climate change adaptation and mitigation activities of the Pacific SIDS. It promotes the Framework on Resilient Development in the Pacific, an Integrated Approach to Climate Change and Disaster Risk Management, and guides the collaboration of regional organizations, donors, and the United Nations to enhance climate change resilience in the Pacific. It stresses integration, capacity-building and ecosystem-based approaches,[136] and assists member States in accessing

132 USP, "Kiribati Head of State Visits USP," News @USP (23 July 2012), available online: <https://www.usp.ac.fj/news/story.php?id=1094>.

133 E. Remling and J. Veitayaki, "Community-based action in Fiji's Gau Island: A model for the Pacific?," *International Journal of Climate Change Strategies and Management* 8, no. 3 (2016): 375–398. doi: 10.1108/IJCCSM-07-2015-0101; Veitayaki and Holland, n. 25 above.

134 Pacific Islands Forum Secretariat, "Majuro Declaration for Climate Leadership" (5 September 2013), available online: <https://www.forumsec.org/wp-content/uploads/2017/11/2013-Majuro-Declaration-for-Climate-Leadership.pdf>.

135 Pacific Islands Forum Secretariat, "The Niue Declaration on Climate Change" (2008), available online: <https://www.forumsec.org/2008/02/21/the-niue-declaration-on-climate-change/>; Pacific Islands Forum Secretariat, "Pacific Leaders Emphasise Action on Climate Change" (2018), available online: <https://www.forumsec.org/2018/10/29/pacific-leaders-emphasise-action-on-climate-change/>; COP 23 Fiji, "Nadi Bay Declaration on the Climate Change Crisis in the Pacific" (31 July 2019), available online: <https://cop23.com.fj/nadi-bay-declaration-on-the-climate-change-crisis-in-the-pacific/#:~:text=Recall%20the%20Suva%20Declaration%20on,3>.

136 SPREP, "Climate Change Resilience," available online: <https://www.sprep.org/programme/climate-change-resilience>.

climate change finance, which is a necessity for these nations that do not have the resources and capacity to do what they know they need to do. SPREP is also a Regional Implementing Entity for the Adaptation Fund, Green Climate Fund and other financing mechanisms. It accesses and leverages climate finance for members and assists them to allocate and administer or receive funding, matches regional needs and priorities with externally dictated objectives, and distinguishes between climate change-prompted funding and conventional assistance. SPREP also offers meteorological support through its Pacific Climate Change Centre.[137]

The Pacific SIDS Leaders' submission of the Pacific Islands Regional Ocean Policy (PIROP) at the World Summit on Sustainable Development in 2002, illustrated the countries' commitment to promote sustainable ocean development. PIROP and its Strategic Action Framework were to safeguard a "healthy ocean that sustains the livelihood and aspirations of Pacific Island communities" and "provide responsible ocean governance in the region." The successes of the Parties to the Nauru Agreement,[138] the Micronesia Challenge,[139] the designations of large marine protected areas (MPAS) in the exclusive economic zones (EEZS) of countries, the effective management of special marine areas in Tonga, the marine protected areas in Samoa, and the locally managed marine areas in Fiji, Solomon Islands and Vanuatu all illustrate the hard decisions taken by Pacific SIDS and their citizens to maintain a healthy and vibrant marine environment that supports ecosystem services and livelihoods.

At the local level, 16 rural villages on Gau Island, Fiji, like many others across the Pacific, have been implementing an integrated and co-management arrangement over the last two decades to address the effects of climate change in their lives. Working with their external partners that include development agencies, research institutions and non-governmental organizations, these local communities, who have customary ownership rights over their natural resources, are undertaking resource management activities that are relevant to them and address climate change adaptation and mitigation requirements. They are dedicating portions of their customary fishing areas as marine reserves, are rehabilitating coastal and riverine vegetation, protecting their

137 Id.

138 See Parties to the Nauru Agreement (PNA) website, available online: <https://pnatuna.com/>.

139 See Micronesia Challenge, "A Shared Commitment to Conserve," website, available online: <http://www.micronesiachallenge.org>.

water sources, managing their waste, securing their food sources and are using renewable energy.[140]

The Pacific Oceanscape was adopted by the Pacific SIDS after PIROP and advocated integrated marine resource management and conservation based on the collaboration between the Kiribati government and Conservation International to declare the Phoenix Islands Protected Area (PIPA), the world's largest at that time.[141] Pacific Oceanscape and its Strategic Action Framework spurred the declaration of large MPAs within the Pacific SIDS EEZs (Figure 1). The Cook Islands, Niue and Palau have declared large ocean MPAs and prompted the Cook Island's Prime Minister, Henry Puna to call on Pacific leaders to "break the hold that defines us too narrowly and limits us in any way"[142] and to recast the regional identity from SIDS to 'Large Ocean Island States'.

Pacific SIDS are also active members of the Association of Small Island States (AOSIS) that has promoted the ambitious aims of reducing GHG emissions by lowering the long-term temperature to below the 1.5 °C warming target and the establishment of the principle of loss and damage.[143] AOSIS has also been influential in the successful conclusion of international climate change negotiations.[144]

The Kiribati government's "Migration with Dignity" policy was a reaction to the pressing need to prepare many citizens who are expected to emigrate given the lack of progress on limiting global GHG emissions and the catastrophic consequences of territory loss. The Kiribati government at that time

140 J. Veitayaki and T. Murai, "Pursuing sustainable development on Gau Island, Fiji," in *Sharing Innovative Experiences. Examples of Successful Experiences in Coastal Community Development* (New York: UNDP, 2010), pp. 85–97; J. Veitayaki, "Vakarau ni se Siga Toka (prepare while there is time): Lomani Gau's response to Climate Change," in *Pacific Voices Local Government and Climate Change*, ed., R. Qalo (Suva: USP, PACE-SD and Commonwealth Local Government Pacific Forum, 2014), pp. 85–101, available online: <https://www.academia.edu/30544113/Vakarau_ni_se_Siga_Toka_Prepare_while_there_is_time_Lomani_Gaus_response_to_climate_change>; Remling and Veitayaki, n. 133 above; Veitayaki and Holland, n. 25 above.

141 T. Tito, "Perspective: The Phoenix Islands Protected Area: The Greatest Ocean Conservation Story Ever Told," *MPA News* (31 July 2020), available online: <https://pipap.sprep.org/index.php/news/perspective-phoenix-islands-protected-area-greatest-ocean-conservation-story-ever-told>.

142 M. Komai, "Cook Islands PM suggests a new regional identity," PACNEWS (27–31 August 2012), available online: <http://www.pina.com.fj/downloads/pifs_1.pdf>.

143 UN Climate Change, see notes 109, 110 and 112 above.

144 SPREP, "heme of 2013 Pacific Island Forum Leaders Meeting Shared at the PCCR" (7 July 2013), available online: <https://www.sprep.org/news/theme-2013-pacific-island-forum-leaders-meeting-shared-pccr>.

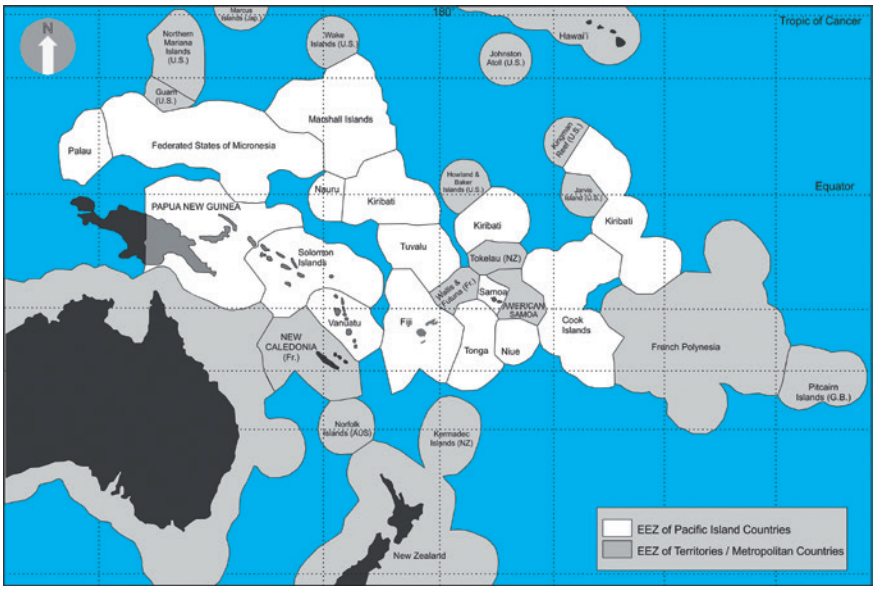

FIGURE 1 Map of Pacific SIDS illustrating the exclusive economic zones of Pacific Island countries and territories/metropolitan countries
SOURCE: DR. EBERHARD WEBER, ASSOCIATE PROFESSOR, UNIVERSITY OF THE SOUTH PACIFIC

saw migration as a long-term strategy "that requires long-term forward planning" and action to make it less stressful and painful for all concerned.[145] Implementing this long-term merit-based relocation strategy for the people was the leaders "duty to the people we serve to prepare them for the worst-case scenario."[146]

In 2014, the Kiribati government purchased a 5,500 acre property in Fiji worth US$8.77 million to relocate its nationals in response to climate change.[147] At that time, President Tong asserted that while "it is already too late" for Kiribati, world leaders must reduce their countries' CO_2 emissions to prevent further climate change-associated displacement of people in the future. He also complained,

145 N. Maclellan, "Kiribati's policy for 'migration with dignity'," DEVPOLICY BLOG (12 January 2012), available online: <https://devpolicy.org/kiribati_migration_climate_change20120112/>.

146 Id.

147 J. Ellsmoor and Z. Rosen, "Kiribati's land purchase in Fiji: Does it make sense?," DEVPOLICY BLOG (11 January 2016), available online: <https://devpolicy.org/kitibatis-land-purchase-in-fiji-does-it-make-sense-20160111/>.

> While we require adaptation measures, our adaptation options are extremely limited, given the nature of our islands … We are a country of low-lying coral atolls with most islands rising no more than two metres above sea level. Adaptation measures of moving inland and to higher ground are impractical for us. We cannot move inland due to the narrowness of our islands, nor are there higher grounds to which we could escape from the rising seas.[148]

Palau is leading the international fight to have vibrant and healthy coral reefs as the centerpiece for sustainable development that supports strong and robust economies. Working under the Micronesia Challenge with the Commonwealth of Northern Mariana Islands, the Federated States of Micronesia, Guam and the Marshall Islands, Palau pledged to protect 30 percent of its coral reefs and 20 percent of its forest resources by 2020, as well as contribute to the global coral reef conservation targets.[149] These countries have heightened marine resource management within the region, solicited much needed funds and technological assistance to support local initiatives and advocated the importance of taking appropriate action at all levels of governance.

On 28 October 2015, President Tommy E. Remengesau Jr. signed the Palau *National Marine Sanctuary Act* into law setting up 475,077 km^2, about 80 percent of the nation's maritime territory, into the world's sixth largest protected area.[150] The reserve, to be fully protected, bans extractive activities such as fishing or mining. It was phased in over a five-year period and now has a zone reserved for local fishers and small-scale commercial fisheries with limited exports covering the remainder of Palau's waters. The territorial sea (12 nautical miles) is managed under current regulations and the Sanctuary provides fish for the local and growing tourism markets. The arrangement is good for the people, the environment and the economy, redirecting business incomes from importers to local fishers and boosting tourism, as a healthy marine environment will lure high-value tourists such as divers and game fishers. In addition,

148 Maclellan, n. 145 above.

149 Leannem, "A Pacific Success Story: The Micronesia Challenge Reaches 2020 Milestone Year," (29 September 2020), available online: <https://www.sprep.org/news/a-pacific-success-story-the-micronesia-challenge-reaches-2020-milestone-year>.

150 Pew Trust, "Palau National Marine Sanctuary: Building Palau's future and honoring its past" (June 2017), available online: <https://www.pewtrusts.org/en/research-and-analysis/fact-sheets/2015/09/palau-national-marine-sanctuary>; A. Cirilla, "Palau National Marine Sanctuary Goes into Effect," Pew Trust (1 January 2020), available online: <https://www.pewtrusts.org/en/research-and-analysis/articles/2020/01/01/palau-national-marine-sanctuary-goes-into-effect>.

the Sanctuary will enhance surrounding ecosystems through the migration of healthy species into nearby waters and the protection from illegal fishing as the restricted commercial activity will make surveillance and control easier.[151] The Palau National Marine Sanctuary came into effect on 1 January 2020, fulfilling the promise made in 2015 when the law was signed.[152] Palau is now realizing the benefits of taking such a bold step for environmental management that required meticulous planning. At the first World Ocean Initiative webinar on Ensuring a Robust 'Blue" Recovery in Asia and the Pacific in 2020, President Remengesau Jr. announced that Japan's Nippon Foundation is providing a coast guard vessel to help patrol their EEZ.[153]

The Republic of the Marshall Islands' 2050 Climate Strategy is a multi-phased approach to address climate change.[154] The Strategy has quantified economy-wide targets to reduce its emissions of GHGs to at least 32 percent below 2010 levels by 2025, and to be at least 45 percent below 2010 levels by 2030; set an indicative target to reduce emissions of GHGs by at least 58 percent below 2010 levels by 2035; aspirations to achieve net zero GHG emissions by 2050 at the latest; produce a National Adaptation Plan (NAP) by the end of 2019 to set out short-, medium- and long-term milestones to adapt to the impacts of climate change and transition to climate resilience, suggest implementation measures and include a plan to generate the necessary financing; an Adaptation Communication to the UNFCCC by 2020; adopt a gender-responsive and human rights-based approach in all NDC-related planning, programming and implementation; and use the latest Intergovernmental Panel on Climate Change (IPCC) guidelines in the future.[155]

The world's first 'Oceanic' COP, COP23 in 2017 was chaired by Fiji.[156] Special attention was offered in support of developing countries' activities "to reduce emissions, adapt to climate change and deal with the unavoidable impacts of climate change to which adaptation is no longer possible."[157] Ironically, 2017

151 Id.

152 Id.

153 World Ocean Initiative, "Ensuring a robust 'blue' recovery in Asia and the Pacific," (27 July 2020), available online: <https://www.woi.economist.com/ensuring-a-robust-blue-recovery-in-asia-and-the-pacific/>.

154 The Republic of the Marshall Islands, *Tile Til Eo, 2050 Climate Strategy, "Lighting the way,"* (September 2018), available online: <https://unfccc.int/sites/default/files/resource/180924%20rmi%202050%20climate%20strategy%20final_0.pdf>.

155 Id., p. 8; see also, United Nations Climate Change, "Nationally Determined Contributions," n. 113 above.

156 See COP23 Fiji, UN Climate Change Conference, Bonn 2017–18 website, available online: <https://cop23.com.fj>.

157 Obergassel et al., n. 116 above, p. 4.

was when leadership in the United States changed to President Trump and the country gave up its global leadership role and withdrew from the Paris Agreement. It was also the year of unprecedented extreme weather-related disasters, such as a series of devastating hurricanes in the Caribbean and the Gulf of Mexico, severe flooding in South Asia and catastrophic drought and extensive forest fires in Portugal. These extreme threats have continued in all the years since,[158] demonstrating the imminent nature of the climate change threat.

In the build-up to the Madrid Climate Summit in 2019, Pacific SIDS announced new high ambition targets for their domestic shipping sector. The commitment to have it 100 percent carbon-free by 2050 with a milestone of 40 percent reduction by 2030[159] is ambitious, challenging, even daunting, but achievable and illustrates the desire to make the hard decisions to address a major threat. Wind power has to be a major source of propulsion for ships to be economically justifiable in the Pacific Islands. With the people's sailing culture and the various trials in Fiji during the oil crisis of the 1980s, this is the best option, which is now boosted by the increasing interest globally in the use of wind energy in shipping. Successful large-scale trials of Flettner Rotors and fixed-wing sails on ships up to 50,000 tonnes have been undertaken, while soft sails are entering the market in Europe and are now targeting commercial ships smaller than 5,000 tonnes. German researchers are working on similar technologies for ships of 500 tonnes in the Marshall Islands, while Swire and the University of the South Pacific (USP) are working on a 200-tonne design.[160]

Climate change adaptation and mitigation must address inequities to improve the well-being of people and societies.[161] This calling cannot be addressed if all nations continue to look at climate change adaptation and mitigation from their own preferred position. Humanity needs to be united in addressing the cross-cutting problem for the benefit of everyone.

The Way Ahead

Pacific SIDS are living the combined impact of higher temperatures, damaging extreme natural hazards, ocean acidification, altered natural habitats,

158 Id.

159 P. Nuttall, "Back to the Future: Lessons from the Past," *Fiji Sun* (19 February 2020), available online: <https://fijisun.com.fj/2020/02/19/back-to-the-future-lessons-from-the-past/>.

160 Id.

161 Klöck and Fink, n. 129 above.

pollution and increased nutrient loading.[162] They must continue with their climate change adaptation and mitigation activities to minimize the devastating impacts of climate change because these are worsening. Pacific SIDS must continue to work together and share their experiences and useful lessons. They must engage at the international level while looking for appropriate local solutions that integrate traditional adaptation practices, as well as appropriate contemporary measures to address their needs.[163] They have to persevere with all of the activities they are undertaking because inaction is not an option for them.

They must devise short-, medium- and long-term integrated adaptation and mitigation programs capable of instigating positive transformations at all levels. The programs must be appropriate for the special needs of Pacific SIDS and be suitable to the cultural and environmental contexts.[164] They must focus on addressing the economic, social and cultural challenges of reducing poverty, improving governance systems, using innovative resource management approaches that merge traditional knowledge and practices with contemporary ones,[165] and in aligning these with people's development aspirations. Pacific SIDS need to persist with the strategy that only a healthy environment can support their long-term needs and security, and must maintain this focus.[166]

Capacity-building at national and local levels is needed to strengthen institutions, human resource knowledge and practices. Good practices should be widely shared to maximize their use and stimulate transformational change. Baseline data must be gathered through long-term monitoring programs and resource management to allow wider data access. Research initiatives need to address gaps, such as understanding the complexities of Pacific people, culture, knowledge, and perceptions, stakeholder inclusiveness, governance, innovations, migration and (im)mobility.[167]

The wise counsel of His Highness Tui Atua Tupua Tamasese Ta'isi Efi, former Head of State of the Republic of Samoa, must guide the activities of Pacific SIDS because climate change is fundamentally "a problem of arrogance and

162 Dutra et al., n. 1 above.

163 Klöck and Fink, n. 129 above.

164 P.D. Nunn, "Bridging the gulf between science and society," in *Adaptation and Mitigation Strategies for Climate Change*, eds., A. Sumi et al. (Tokyo: Springer, 2010), pp. 233–248; Weir et al., n. 1 above.

165 Veitayaki (2014), n. 139 above; Veitayaki and Holland, n. 25 above; Dutra et al., n. 1 above.

166 Remling and Veitayaki, n. 133 above; J. Veitayaki, "Ocean in Us: Security of Life in the World's Largest Ocean," *Pacific Studies* 41, no. 1/2 (2018): 55–81.

167 Klöck and Fink, n. 129 above; Iese et al., n. 77 above.

greed."[168] Pacific Islanders have to come up with solutions bold enough to allow us to say the unsayable, if we want to effectively address the critical issues that face our world today. These issues, according to His Highness, are more to do with the soul-searching questions that force us to confront the truth about ourselves and our pursuit of wealth than the technicalities of understanding atmospheric changes and rising sea level.[169] He emphasized that "the relationship between man and his environment, between man and his co-inhibitors is based on a spiritual culture that finds affinity and equivalence, balance and harmony, between them. In taking from the environment we are accountable to the environment."[170]

168 His Highness T.A.T.T.T. Efi, "Prelude: Climate change and the perspective of the fish," in Crook and Rudiak-Gould, eds., n. 22 above, pp. ix–xiii.

169 Id.

170 Id., p. xii.