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Impact of Climate Change on Island

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ABSTRACT

Climate change is one of the most pressing political, economic and environmental issues of our time. It demands honest and timely collective global actions. Despite the ever-rising environmental catastrophes that are occurring around the world from destructive hurricanes, cyclones and flooding to sea level rise, coastal erosion, drought, fire, and sea acidification, there are climate change deniers who argue that climate change is not posing the kind of danger that is being put forward. Yet, if the global community does not take drastic measures now, climate change could result in many of the **Pacific island nations** being wiped from the map of the world in the not so distant future. The small island nations of the Pacific region are more vulnerable to the acute effects of climate change than any other region in the world. Most of these volcanic islands are barely a few metres above sea level. Ocean level rise amongst other climatic changes is threatening the very existence of these geographically isolated and small land masses. 'The rising scale and the intensity of storm surges, saltwater intrusion and coastal destruction of the past decades have decimated coping capacities, leaving island populations with failing crops, crippling water shortages and an uncertain future'. The existential threat of environmental change is irrefutably claiming land and human lives year-in and year-out.

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It is now widely accepted by the scientific community that the Earth is undergoing drastic climate change due to increased **greenhouse gas** emissions1. Changes in global climate have occurred several times throughout the Earth's history but have stretched over very long periods of time whereas currently these changes are taking place over the space of a century or less1,2,3. This rapid change, associated with other threats resulting from human activity related to production and consumption4, are having a strong impact on biodiversity. Considered as one of the five main causes of species and populations losses, climate change may lead to direct alterations of natural habitats, forcing species to move from their historical range, adapt to new environmental conditions, find refuge in unaltered microhabitats or may lead to species extinction. Importantly, climate change acts in synergy with other human-induced threats, such as land use intensification or biological invasion, increasing their effects.

Most small islands already have high burdens of **climate-sensitive diseases** such as vector-, food- and water-borne diseases like malaria, dengue and diarrhoeal disease.

The effects of climate change (including increased average temperatures, more frequent and severe extreme weather events and rising sea levels) will exacerbate this disease burden with an expected increase in illnesses and deaths, as well as threatening access to safe food supplies, clean water and sanitation

INTRODUCTION

Because heat-trapping warming emissions from the small island states are a very small percentage of overall emissions, this region's responses to global warming include calls to other countries to limit global temperature increases and aggressive efforts to adapt to the changes that are coming. This region, which more than 40 million people call home, consists of more than forty small island developing states spread across the Indian and Pacific oceans, the Mediterranean, and the Caribbean.[1] These low-lying coastal nations face similar challenges in that they have small populations, limited resources, remoteness, susceptibility to natural disasters, and excessive dependence on the international community for trade. Sea-level rise poses perhaps the greatest threat to these nations. Storm surges, flooding, erosion, and even possible inundation threaten the

future occupancy of some islands. They also face significant threats to their vital infrastructure, water resources, fisheries, coral reefs, tourism income, and agricultural resources. Small island nations have banded together in the international arena to call on other countries to limit their emissions in order to curtail the devastating impacts of climate change on their vulnerable nations. Some—including the **Maldives, Tuvalu, and several Caribbean island states**—are also working to go carbon neutral (zero net greenhouse gas emissions).

Evidence of human migration as a response to climate change is scarce for small islands. Although there is general agreement that migration is usually driven by multiple factors ,several authors highlight the lack of empirical studies of the effect of climate-related factors, such as SLR, on island migration .Furthermore, there is no evidence of any government policy that allows for climate "refugees" from islands to be accepted into another country. This finding contrasts with the early desk-based estimates of migration under climate change [2] .These early studies have been criticized as they fail to acknowledge the reality of climate impacts on islands, the capacity of islands and islanders to adapt, or the actual drivers of migration. Studies of island migration commonly reveal the complexity of a decision to migrate and rarely identify a single cause. For example, when looking at historical process of migration within the Mediterranean, it appears that rising levels of income, coupled with a decreased dependence on subsistence agriculture, has left the Mediterranean less vulnerable to all environmental stressors, resulting in a reduced need for mobility to cope with environmental or climatic change. Studies from the Pacific have also shown that culture, lifestyle, and a connection to place are more significant drivers of migration than climate .For example, a Pacific Access Category of migration has been agreed between New Zealand and Tuvalu that permits 75 Tuvaluans to migrate to New Zealand every year. Instead of enabling climate-driven migration, this agreement is designed to facilitate economic and social migration as part of the Pacific Island.[3]

To date there is no unequivocal evidence that reveals migration from islands is being driven by anthropogenic climate change. There is, however, some evidence that environmental change has played a role in Pacific Island migration in the past. In the Pacific, environmental change has been shown to affect land use and land rights, which in turn have become drivers of migration. In a survey of 86 case studies of community relocations in Pacific Islands, found that environmental variability and natural hazards accounted for 37 communities relocating. In the Pacific, where land rights are a source of conflict, climate change could increase levels of stress associated with land rights and impact on migration [4]. Although there is not yet a climate fingerprint on migration and resettlement patterns in all small islands, it is clear that there is the potential for human movement as a response to climate change. To understand better the impact of climate change on migration there is an urgent need for robust methods to identify and measure the effects of the drivers of migration on migration and resettlement.

Island countries (a term used to include both independent nations and various territories) have been responsible for emitting less than 1% of human-produced greenhouse gases. They have, however, been acutely conscious of the effects of sea level rise, which has occurred at a rate of about 0.08 in (2 mm) per year throughout the twentieth century. According to the United Nations Intergovernmental Panel on Climate Change**'s 2007 report,** world sea level could rise as much as 23 in (58 cm) by 2100. Moreover, this calculation does not take into account the possibility of accelerated melting of the Greenland and portions of the Antarctic ice sheets: actual melting could be more, or less, than 23 in (58 cm).

The report noted the following points, among others, about the impacts of climate change on small islands:

- Small islands are especially vulnerable to the effects of climate change, including sea-level rise and extreme weather events. In most cases, small islands have fragile economies and the costs of adapting to climate change—where adaptation is possible at all—are high compared to the size of the local economy. In other words, most small islands cannot afford to do much about climate change.[5]
- Rising sea levels will submerge territory and worsen storm surge (high water during storms) and erosion, threatening settlements and infrastructure that support livelihood. In Caribbean and Pacific islands, over half the population lives within a mile (about 1.6 km) of the shoreline, and most roads, airports, capital cities, and the like are located along the coast or on very small coral islands that are essentially all coast. Because most small islands do not rise steeply from the sea and may only be a few feet, or meters, above sea level at their highest point, all these facilities can be threatened by even apparently small increases in sea level.

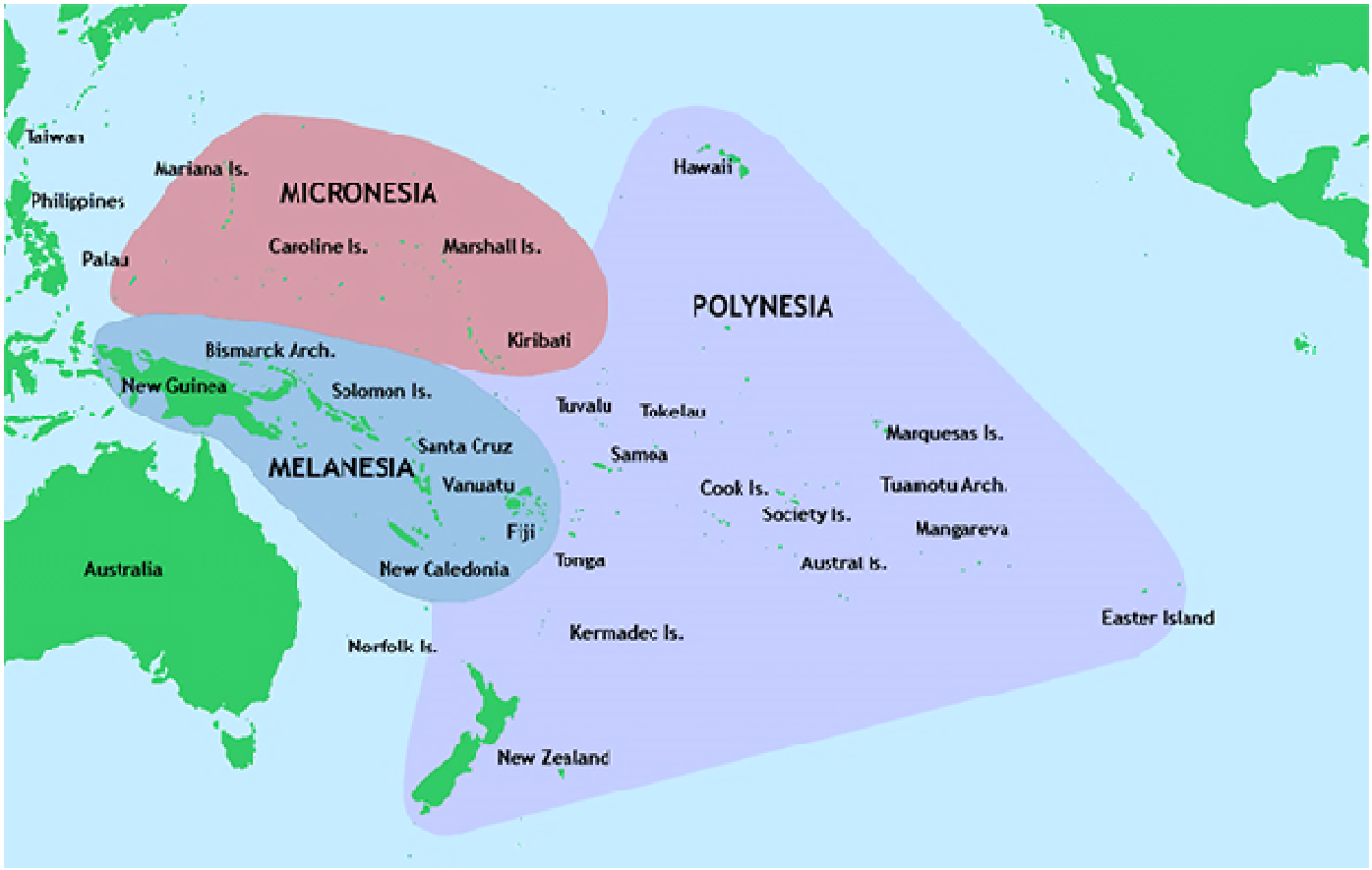
- Freshwater resources on most small islands will be seriously reduced in most future climate-change scenarios. On a small island, fresh groundwater exists in a lens-shaped volume of ground surrounded by undrinkable saltwater. Two effects of climate change can contribute to reducing the size of this lens—rising sea level and reduced rainfall. Rising seas shrink the freshwater lens by mixing seawater with it at its boundaries and base. Reduced summer rainfall is predicted for the Caribbean. On the Pacific atoll of Tarawa, a predicted 10% reduction in rainfall by 2050, if it occurs, will cause a 20% shrinkage of the freshwater lens.[6]
- Tourism, fisheries, agriculture, and human health will be adversely affected by climate change. For example, **coral reefs are already being destroyed** by warmer temperatures in tropical waters around the world. Fish populations and thus fish catches by island populations decline sharply when coral reefs shrink.[7]

DISCUSSION

Pacific island nations are considered to be islands located in the Pacific Ocean that are east of both Australia and the Philippines. These islands span as far west as Papua New Guinea and as far east as Easter Island. Sometimes this region is referred to as Oceania – which also includes island continent Australia.

These islands are often grouped into three ethno-geographic regions: Micronesia, Polynesia, and Melanesia. You've probably heard of New Zealand, Samoa, and Hawai'i, but

(as you can see in the map below), there are many more countries in the region.[8]



RISING TEMPERATURES

Here's the climate reality: As humans burn more and more fossil fuels, we're releasing heat-trapping gases like carbon dioxide into our atmosphere. That means we're experiencing warmer temperatures both above water and below it.[9]

On Land: In 2018, the Oceania region endured it's third warmest-year on record, with temperatures 2.1 degrees Fahrenheit (or 1.2 degrees Celsius) above average. It might not seem like much, but a small change in temperature can really disrupt systems we depend on to survive. *After all, think of the difference between 33 and 32 degrees Fahrenheit (1 and 0 Celsius).*

As our world becomes warmer, climate impacts can be seen everywhere you look. Scientists observe (and everyday people experience) things like sea-level rise, longer and more intense wildfire seasons, and devastating droughts.

In the Ocean: Things aren't just getting warmer above ground as humans continue to burn fossil fuels. Ocean temperatures are also rising, with "temperatures from the surface to a depth of 660 feet rising by as much as 3.6°F" in the Pacific region, according to the US National Climate Assessment.[10]

That's because our oceans are absorbing much of the extra heat in our atmosphere – with new ocean heat records set again and again. Many kinds of marine life – from coral to fish – struggle to adapt to the warmer water and often die. This has devastating impacts on coral reefs, fisheries, and resources that Pacific Islanders depend on to survive.

According to the Secretariat of the Pacific Regional Environment Programme (SPREP), "Pacific Ocean-based fishing and tourism provide USD $3.3 billion to the national economics of Pacific countries and territories." Just like on land, ecosystems depend on a stable climate to survive – and our economies with them.

Island nations are on the front lines of global climate change. Heavy rainfall and rising sea levels are eroding shorelines and causing flooding. Warming and increasingly acidic oceans are damaging coral reefs that support fisheries and attract tourists. Some island communities are already moving or making plans to relocate.[11]

Fiji, a chain of 300 islands in the South Pacific, currently is chairing the meeting of the Conference of Parties of the U.N. Climate Change Convention in Bonn, Germany. Frank Bainimarama, the prime minister of Fiji and president of COP-23, has called on all nations to take climate action because "we are all vulnerable to climate change and we all need to act."

Fiji's leading role in Bonn presents an opportunity for island nations to raise their voices. Islanders know that sea level rise could completely eliminate their homelands. Their concerns, symbolized by the Fijian canoe on display at the Bonn conference center, have been a legitimate and powerful force in international climate change negotiations.[12]

RESULTS

Because the health impacts of climate variability and change can be direct, indirect, multiple, simultaneous, and significant, governments, policy makers, decision makers, and resource managers in small island states are faced with major challenges. The capacity to undertake vulnerability assessments and develop adaptation policies and measures requires information on the health impacts of climate variability and change at the local and regional level; this information must include a comprehensive perspective from multiple sectors.[13]

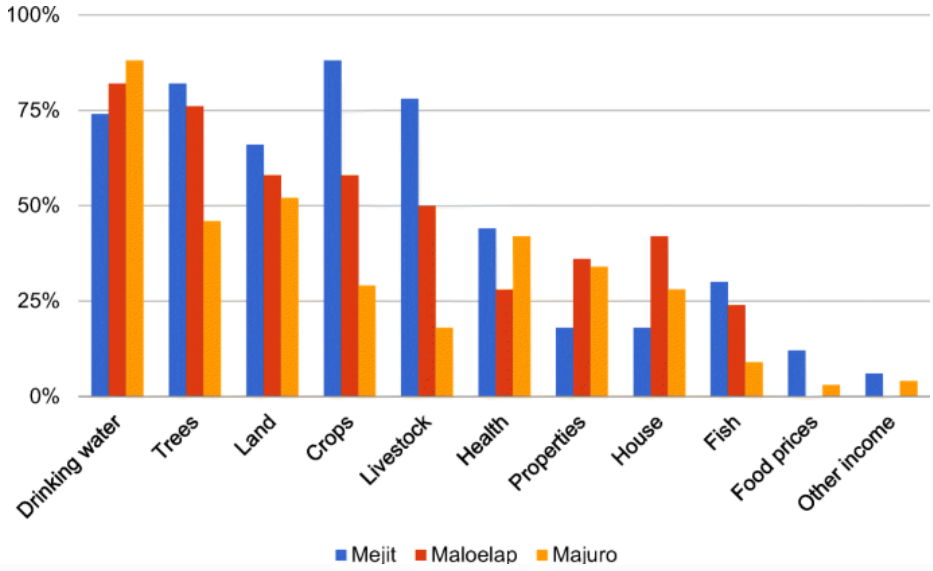


FIG.1. Impacts of climate-related stressors in the past 5 years (percentage of households affected)

The workshops identified the following recommendations for improving the capacity of the health sector to anticipate and prepare for climate variability and change in small island states.

High-priority research

- Expand knowledge of climate-sensitive diseases of importance in small island states through national and regional research. Research is particularly needed for diseases where information is limited, such as for skin, respiratory, and waterborne diseases. Identify and map locations, hazards, and communities especially vulnerable to climate variability and change, including sea-level rise, taking a holistic, cross-sectoral view. Establish verifiable links between ENSO, extreme weather events, climate

variability, and health consequences in small island states.[14]

- Conduct basic entomologic research, including the distribution of vector species, habitats, and biting habits, and their responses to climate variability.
- Improve understanding of the complex relationship between the risks posed by climate variability and change, and by other factors that influence population health. Expand knowledge of the social, cultural, and economic factors that modify vulnerability.
- Develop and evaluate indicators of the potential health impacts of climate variability and change at the national and regional level, incorporating environmental, social, and human dimensions.
- Understand the links between climate and other sectors, such as agriculture and water supply, and how these could affect health.[15]

Capacity building (including institutional needs)

- Develop institutional arrangements for knowledge sharing at national, regional, and international levels, including identification of regional centers of excellence; promote national and regional interdisciplinary working groups to study the impact of climate variability and change on health; and develop effective mechanisms for information sharing
- Improve education and training through workshops, follow-on networking, and structured training at local, national, and regional levels.
- Encourage programs of action and partnerships between public and private sectors, including business and nongovernmental organizations.[16]
- Transfer knowledge of adaptation options to countries with similar climate/health concerns.

Advocacy and community awareness of the potential impact of climate variability and change on human health

- Build awareness of the potential impact of climate variability and change in small island states across the full range of stakeholders, including local communities and the media; educate young people and medical/health professionals about climate/health links through school and university curricula; and work with policy makers to enhance awareness of climate variability and change and to catalyze discussions at national and regional levels.
- Incorporate a consideration of climate/health interactions in planned and ongoing development programs and include health aspects in global, regional, and local environmental and disaster-management planning. Advocate for integrated policy development across sectors to take account of the effects of climate variability and change on health.
- Develop advocacy messages in brief, nontechnical language for decision makers and policy audiences; ensure that advocacy messages reach key decision makers and policy audiences through appropriate channels and formats.[17]

Adaptation strategies, policies, and measures to reduce projected impacts

- Develop, improve, implement, and monitor early-warning systems.
- Monitor and evaluate the effectiveness of other public health interventions implemented to address the health impact of climate variability and change, including integrated pest management.
- Develop long-term adaptive strategies for sea-level rise on the basis of an understanding of current coping efforts and national development priorities.
- Assess the costs and benefits of intervention options.

Data needs

- Collect more valid and comprehensive health, meteorologic, environmental, and socioeconomic data at appropriate local, regional, and temporal scales for research, program planning, and advocacy. Conduct inventories of existing data, identify current data gaps, and develop strategies to fill these gaps. Improve health surveillance systems to allow assessment of the impact of climate variability and change on health.[18]
- Establish better data-management systems, programs, and practices, including the establishment of data-quality standards and best practices.
- Identify, engage, and enhance appropriate national and regional institutions for handling and analyzing data.
- Encourage fuller use of available data through regional and national capacity building (human resources, information technology, etc.). Improve sharing and timely access to relevant data sets.

Climate forecasts

- Develop and improve national and regional forecasting capacity.

- Create partnerships between climate/meteorology and public health/medical specialists to improve awareness of the use and uses of climate forecast information. Provide user-friendly forecasts and applications information at national and regional levels.
- Facilitate communication between the public health/medical communities and national meteorologic and hydrologic services, as well as other relevant agencies and organizations.

Resources needs

- Improve international, national, and regional facilities and funding for capacity building, interdisciplinary research, and regional/ national assessments. Establish programs with WHO, World Meteorological Organization, and United Nations Environment Programme in collaboration with other relevant agencies to provide country assistance in conducting vulnerability and adaptation assessments. Ensure that adequate funding is made available for priority research on climate and health from both the public and private sectors.
- Mobilize funding through all available mechanisms, including the Programme of Action for the Sustainable Development of Small Island Developing States (Barbados Programme of Action), the United Nations Framework Convention on Climate Change, the Global Environment Facility, the United Nations Convention on Biological Diversity, and the United Nations Convention to Combat Desertification.[19]

CONCLUSION

With the potential to impact weather patterns, agriculture, and habitability of certain regions, global warming is a topic of interest to environmentalists, scientists, as well as farmers around the world. The threat of food shortages and famine especially becomes a major concern as a result of recent climate shifts.

Impacts of Climate Change on Food Security in Small Island Developing States discusses the repercussions of a shifting climate on food production and availability in small island nations. Comprised of research-based chapters on topics relevant to crop management, sustainable development, and livestock management on island territories, this advanced reference work is appropriate for environmental researchers, food scientists, academicians, and upper-level students seeking the latest information on agricultural concerns amidst a changing climate.

There is **no single approach** to climate change adaptation and resilience planning for ports, but an important message for policymakers, industry, international organizations and development partners is that there is no time to lose **and "all hands on deck"** are needed. An interconnected world depends on well-functioning transportation links. In the absence of timely planning and implementation of requisite adaptation measures, the projected impacts on seaports may have broad economic and trade-related repercussions and may severely compromise the sustainable development prospects of the most vulnerable groups of countries, such as SIDS. Given what is at stake and the potential costs of inaction, prevention and mitigation of climate change impacts on ports – and other key transport infrastructure, should become a major priority as part of sustainable development and climate strategies.

Enhancing the **climate-resilience** of seaports and other critical transport infrastructure will be central to advancing the 2030 Agenda for Sustainable Development (e.g. goals 9, 13, 14 and target 1.5) and to achieving progress on the objectives of other international agreements, including the Paris Agreement, the Sendai Framework for Disaster Risk Reduction, the SIDS Accelerated Modalities of Action (SAMOA) Pathway, **the Istanbul Programme of Action for the Least Developed Countries**, and the New Urban Agenda.

Effective adaptation requires 'fit-for-purpose' risk assessment procedures (at local and facility levels), bridging of potential data and knowledge gaps, and the development of appropriate technical and management solutions that reduce vulnerability and allow for decision-making under uncertainty. It also requires finance, technology and capacity-building, as well as coordinated policy responses and supportive legal and regulatory approaches **(UNCTAD 2020a; UNCTAD 2020b).** Standards, guidance, and methodological tools also have an important role to play. Investment in energy efficiency, decarbonization and renewable may also provide major co-benefits, in terms of climate change mitigation and adaptation, as well as reduced dependency on energy imports and related expenditure.

Aiming for synergy and policy coherence in efforts at post-pandemic recovery and adopting more systemic, integrated approaches to climate change adaptation and resilience-building across sectors and networks could yield major benefits, especially for the most vulnerable communities. And investing in climate-resilience makes good economic sense: according to the World Bank, the overall net benefits of investing

in resilient infrastructure in developing countries could amount to $4.2 trillion over the lifetime of new infrastructure – a $4 benefit for each dollar invested in resilience.

While the need for action on climate-change adaptation and resilience-building for ports is increasingly being recognized, including as part of the **Global Climate Action Pathways** for Transport and Resilience, much remains to be done. And time is of the essence.

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