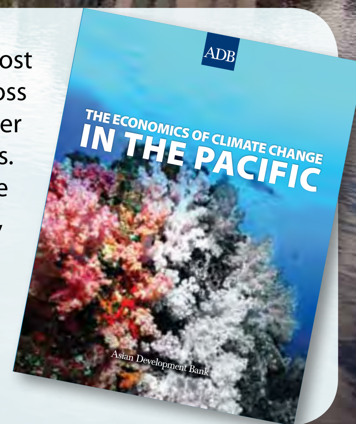
THE ECONOMICS OF CLIMATE CHANGE IN THE PACIFIC



If the world does not deviate from the present trend in greenhouse gas emissions, the total cost of climate change in the Pacific region could range from 2.9% to as high as 12.7% of annual gross domestic product (GDP) equivalent by 2100. The cost could be significantly lower under lower emissions scenarios, but may still offset nearly all gains of economic growth from 2100 onwards. 'The Economics of Climate Change in the Pacific' includes modeling of future climate over the Pacific region, assessments of the potential impacts on agriculture, fisheries, tourism, coral reefs, and human health, and predictions of the potential economic impact of climate change for specific sectors and economies under various emissions scenarios. The study demonstrates the need to integrate climate change and its potential consequences in current and future plans for economic advancement if Pacific island countries are to improve their living standards and achieve sustainable development.

Background

The Pacific region is a diverse array of 7,500 islands scattered across an area of 30 million square kilometers (km^2). As of 2013, 10.7 million people inhabited its 14 countries. The region has varying topographies, cultures, and economies. Many islands are small and geographically remote, with fragile biodiversity and a limited natural resource base. These features make the region particularly vulnerable to global warming, with increasing and more intense cyclones, floods, and drought. Climate change affects food production and uses of land, coastal, and marine resources; damages infrastructure and water resources; and adds risk to human health. All in all, economic costs of climate change have been large and are expected only to increase. In the 1990s, extreme weather cost the Pacific region more than $1 billion. In 1990 and 1991, cyclones Ofa and Val alone cost Samoa $440 million—more than the country's gross domestic product (GDP). Cyclone Heta in Niue wrought $27 million in damages (25% of its GDP). And in early 2005, the Cook Islands faced five cyclones within 5 weeks—four of which were Category 5. In February 2008, Fiji lost $32 million to Cyclone Gene, forcing the government to provide $1.2 million in food rations. Clearly, the prosperity, stability, and security of the Pacific will depend on how the development challenges associated with climate change are tackled.

Scope and Methodology

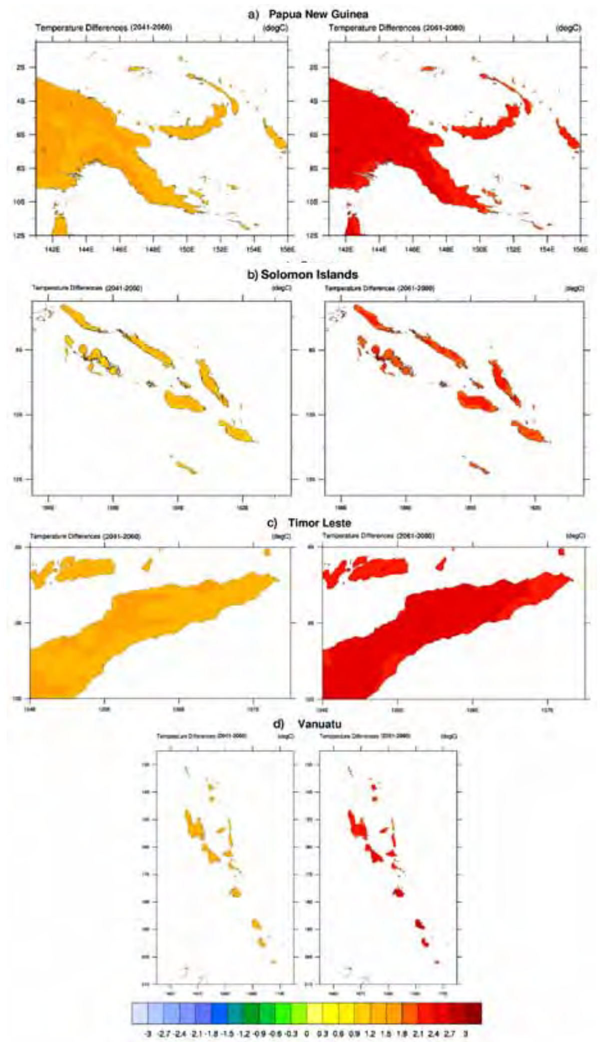
The study focused on Fiji, Papua New Guinea (PNG), Samoa, Solomon Islands, Timor-Leste, and Vanuatu. It followed a three-step strategy, using state-of-the-art models. First, a regional climate model downscaled to a 20 x 20 km resolution was set up. Second, sector impact was assessed to quantify potential impacts of climate change on selected key sectors in the Pacific—agriculture, fisheries, coral reefs, tourism, and human health. Third, an economic assessment of climate change impacts in the Pacific was conducted. Following are the results.

Climate Change and Extremes in the Pacific

Average temperatures in the Pacific are expected to rise between 2.0°C and 3.0°C relative to the 1990 level by 2070. Climate downscaling shows that annual mean temperatures would increase for all six selected Pacific countries under two different emissions scenarios (A1B and A2)[1]. By 2070, Fiji and Samoa are projected to experience

1 Greenhouse gas emission scenarios from the 4th Report of the Intergovernmental Panel on Climate Change. Since the finalization of this study, the IPCC has issued its Fifth Assessment Report (AR5). Working Group 1 projected climate change based on Representative Concentration Pathways (RCP) similar to AR4 in both patterns and magnitude after accounting for scenario differences.

Figure 1. Temperature Change under A1B Scenario: PNG, Solomon Islands, Timor-Leste, and Vanuatu



Source: ADB study team.

a temperature rise of approximately 2°C on average from the 1990 level (i.e., more than a 2.5°C rise from the pre-industrial level). PNG, Solomon Islands, Timor-Leste, and Vanuatu are expected to experience an increase of more than 2.5°C on average by 2070, with some areas in these countries experiencing an increase of nearly 3°C in the same period relative to the 1990 level (Figure 1). Under higher emissions scenarios, temperature increases would be even more pronounced.

The frequency of El Niño Southern Oscillation (ENSO) cycles is likely to increase, leading to potentially more extreme weather events in the Pacific. The frequency of El Niño and La Niña events could increase in the future. Many climate models point to an increase of over 40% in the Pacific under A1B and A2 scenarios. One effect would be unexpected heavy rains and dry episodes. The effects of ENSO on rainfall could be considerable, causing either too much or too little rain depending on the areas and the seasons. Extreme temperatures are expected to increase in all six countries. Bobonaro (Timor-Leste) would be the warmest; temperatures there could reach 44°C by 2070 under the A1B scenario. Extreme wind speeds and rainfall are also expected to increase. In Fiji, for example, maximum normal wind speeds would increase from current 60 km/hour to a high of 66 km/hour, and maximum rainfall would increase from 160 to 200 millimeters (mm) per day by 2070, bringing greater likelihood of high waves and strong gales.

Properties built in a flood prone area in Popua Village, on the outskirts of Nuku'alofa, the capital of Tonga
(Photographer: Luis Enrique Ascui)

Sea-level rise poses risk of inundation to economically important coastal areas in the Pacific. Sea-level rise would put large coastal areas at risk of inundation. Although better elevation data are needed, high-range estimates suggest that by 2100 under the A1B scenario all Pacific island countries but Kiribati could face sea-level rise, ranging from 1.2 meters (m) in the Cook Islands to 1.7 m in Solomon Islands; low-range estimates suggest sea-level rise of 0.5 m in the Cook Islands and 1.1 m in Solomon Islands. Airports and seaports, road infrastructure, and local communities, all of which are highly concentrated on coastal areas, could sustain significant damage from sea-level rise. Perhaps more importantly, there is risk that the already limited freshwater resources in the region may be severely affected by encroaching seawater.

The effects of climate change on key economic sectors will be primarily negative, leading to potentially large losses in agricultural production. Some key economic sectors could sustain potentially high losses. In agriculture, impacts on staple food and commercial crops are assessed to show significant long-term declines in yields, calling for effective adaptation measures.

A sugarcane farmer in Fiji
(Photographer: Ian Gill)

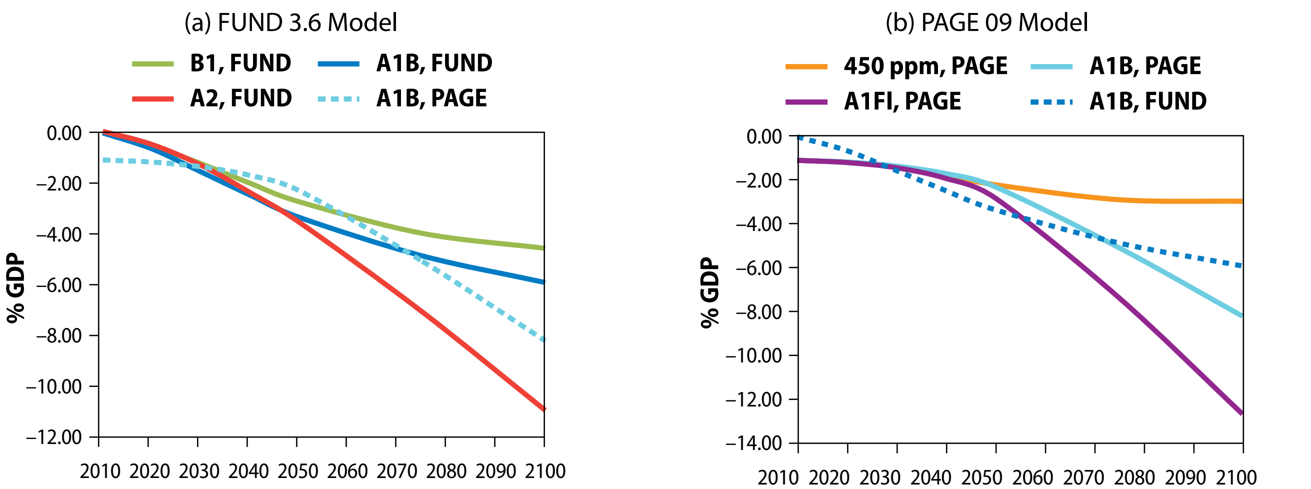
Children walking through a flooded road in Lepa, Samoa
(Photographer: Luis Enrique Ascui)

Impacts on important marine resources, such as coral reefs, would be highly negative, but those on commercial fish catches would be mixed. Also, as a result of a less attractive climate, tourist arrivals are expected to fall along with their contribution to local and national economies. These losses could be further compounded by the adverse impacts of climate change on health and labor productivity.

Economic impact could be alarmingly high. Assuming the world does not deviate from its business-as-usual scenario, the total cost of climate change in the Pacific will continue to grow prohibitively high over the long term, reaching 12.7% of annual GDP equivalent by 2100 (Figure 2a). Even under a low emissions scenario in which the global economy is assumed to restructure itself to be service-oriented, the economic loss would still reach 4.6% of the region's annual GDP equivalent by 2100.

If the atmospheric concentration of greenhouse gases were to reach 450 parts per million (ppm) of carbon dioxide equivalent, which would maintain global warming at approximately 2°C, the economic cost would be smaller but still would reach 2%–3% of GDP by 2100 (Figure 2b).

Figure 2. Climate Change Cost in the Pacific, based on Different Models and Scenarios



FUND = Climate Framework for Uncertainty, Negotiation and Distribution, GDP = gross domestic product, PAGE = Policy Analysis of Greenhouse Effect
Notes on scenarios used: A1B refers to high population and economic growth leading to medium emissions scenario. A1FI refers to high population and economic growth, fossil-intensive, and high emissions scenario. A2 refers to high population and slow economic growth, heterogeneous world, and high emissions scenario. B1 refers to high population and economic growth, structural transformation toward a service and information economy, and low emissions scenario. 450ppm depicts a low emissions scenario.
Source: ADB study team.

Substantial investment is needed to prepare the Pacific for climate change. The estimated cost for achieving climate-resilient development reflects the additional investment for offsetting the impacts of climate change and includes measures for building climate change adaptive capacity as well as climate proofing for key sectors. To prepare for the worst of the high emissions scenario A1FI, the funding requirement every year until 2050 could average $447 million or 1.5% of GDP and could go as high as $775 million or 2.5% of GDP. If greenhouse gas concentration stabilizes at 450 ppm of carbon dioxide equivalent, adaptation cost would be significantly lower, reaching an average cost of $158 million per year (See Table below).

Policy Implications

The Pacific island countries will benefit from early climate action, as climate risks and costs due to impacts of climate change are expected to accelerate over time. Mainstreaming climate change actions in development planning is crucial for reducing vulnerability to extreme climate and promoting sustainable development. Climate mainstreaming requires integration of climate change objectives and agendas into existing national or multisector agency programs and policies. Adaptation planning needs to consider feasible cost-effective adaptation in the form of low-regret options, early climate action and disaster-risk preparedness and management plans, and strengthening capacities of Pacific developing member countries (DMCs) to develop practical information and decision support tools. Increased financial and technical support for measures that will ensure continued economic growth in the face of climate change is needed for the Pacific region. Initiatives and activities that facilitate Pacific DMCs' access to financing facilities that build climate resilience and promote clean energy development are essential tools to bridge the region with its financing and capacity needs.

Table. Annual Average Adaptation Cost over the Period 2010–2050 with 2100 Adaptation Targets

Scenario	Adaptation target	Annual average cost ($ million)	Range ($ million)	Annual average cost (% GDP)	Range (% GDP)
A1FI	2100 worst case (95th percentile)	446.7	214.6–775.4	1.52	0.78–2.54
A1FI	2100 (4.5 C, 0.70 m SLR)	284.3	131.1–483.7	0.97	0.48–1.59
A1B	2100 (4.0 C, 0.65 m SLR)	253.1	118.9–438.4	0.86	0.44–1.43
450 ppm	2100 (2.5 C, 0.55 m SLR)	158.3	75.2–273.2	0.54	0.27–0.89

GDP = gross domestic product, m = meter, ppm = parts per million, SLR = sea-level rise.
Note: The 95th percentile represents the critical point. Moving beyond, there is a low probability (at 5% chance) that would lead to a catastrophic outcome.
Source: ADB study team.

Woman fetching water from a stream in PNG (Photographer: Eric Sales)

FOR INFORMATION, CONTACT

Robert Guild
Director, Transport, Energy and Natural Resources Division
Pacific Department,
Asian Development Bank
rguild@adb.org

Cyn-Young Park
Assistant Chief Economist
Economics and Research Department, ADB
cypark@adb.org

OR VISIT www.adb.org/Pacific

Printed on recycled paper
Publication Stock No. ARM 136138-2