

ADAPTATION ASSESSMENT IN THE SOUTH PACIFIC

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1. Collaborative studies between Japan and the South Pacific

The South Pacific is one of those most vulnerable to global warming, due to high geographical and regional vulnerability. Along with the advance of global warming, there are concerns about not only sea-level rise, but also an increase in natural disasters caused by meteorological events, and negative impacts on water resources such as ground water. For these reasons, international assistance is essential to help implement appropriate responses.

Against this background, Pacific Island countries (PICs) and Japan have already been cooperating to implement various initiatives in order to address global warming issues. For example, with the support of the then Environment Agency of Japan (EAJ) and coordination by the Overseas Environmental Cooperation Centre of Japan (OECC) and SPREP, several investigations have been undertaken in Tonga, Western Samoa, Fiji and Tuvalu. Amongst other studies the joint South Pacific/Japan study team estimated the changes in return period of storm surge, wave height and run-up, and wave action on wharves, seawalls and concrete blocks, using techniques of coastal engineering. In addition, Geographic Information System (GIS) and economic evaluation were introduced to understand vulnerability to climate change and sea level rise in a comprehensive and quantitative manner.

Japan recognizes the importance of global warming responses in vulnerable PICs. Based on the spirit of the UNFCCC and Kyoto Protocol, it is of utmost importance to promote more effective cooperation toward the promotion of desirable responses to global warming.

Based on this awareness, the then EAJ implemented the *Assessment of Possible Climate Change and Sea-level Rise Activities to be Undertaken in Pacific Island Countries in Cooperation with Japan*. The project's objectives were to identify the needs of PICs, and to identify the most desirable framework for Japan's contributions to PICs, in order to achieve sustainable development through appropriate responses to climate change, including sea-level rise. The main foci were global warming mitigation, adaptation, technological and policy measures, research, awareness raising, training, technology transfer and policy development.

As a result of the study the needs of PICs for cooperation relating to responses to global warming were broadly identified. The logical first step is vulnerability assessment. In order to successfully adapt to the impacts, we have to know the answers to such questions as what impacts will occur where and when?, how serious are they?, and what are very vulnerable sectors and places? During the past studies, the basic impacts of sea level rise have been identified as inundation, flooding, coastal erosion, and salt water intrusion to rivers and aquifers. However we lack vulnerability information quantitative enough to consider adaptation in a realistic manner. Therefore, the needs for more accurate vulnerability was pointed out in the needs assessment, focusing on the coastal zone, disaster management, water resources, agriculture and aquaculture, and infrastructure.

Another major needs are to fulfill the gaps on information, scientific and technical data, capacity building, resources to carry out vulnerability and adaptation assessment, and institutional arrangement. The concrete needs are listed in the Table1 attached below.

2. Adaptation to Sea Level Rise and Climate Change in the Coastal Zone

In order to find the way to adapt to the impacts of sea level rise and climate change, it is important to recognize that natural systems and human society have the ability to respond to the environmental changes. Real impacts appear when such changes overwhelm their responsive ability. It has been recognized that vulnerability has two factors; one is the susceptibility of natural and human systems to environmental changes, and the other is their resilience. Vulnerability is determined by the balance of these two factors. Therefore, successful adaptation will take place by enhancing the resilience of the systems, and reducing their vulnerability.

The islands in the South Pacific have important resilience to the hazardous forces of the sea in the natural barriers, i.e. coral reefs, mangroves, and sandy beaches. They effectively protect and support the safety of lands, coastal ecosystems, and society by reducing the energy of incident forces. Therefore, it is important to preserve them from the viewpoint of adaptation to future climate change and sea-level rise.

Another resilience is in the social system. The rural villages consist of large families forming a mutually supporting system. Their settlement and culture have also been tied with the land strongly. In face of the loss of land by inundation and erosion, the supporting system may be activated to respond to the crisis. However, since these countries are experiencing a transition away from the traditional system to new one, it is unclear what a new flexible social community will form.

3. Adaptation Options

It is widely recognized that the adaptation strategy consists of various options which fall under three basic categories planned retreat, accommodation, and protection. However, the adaptation strategy involves more than just the technical options. Technical options can only be implemented effectively in an appropriate economic, legal, institutional, and social context. Any plan to construct engineering structure or to change the land use needs people's understanding and support, which in turn will be formed through increased awareness of the potential impacts and the need to take action. Moreover, the adaptation strategy will be successful when it is integrated other policies. Therefore, we can classify the adaptation options in a broad context as shown below.

(1) Information options

The knowledge of the amount and speed of sea-level rise and climate change and its effects are important basis for establishing adaptation strategies. In addition, proper understanding of people on the future threats and planned countermeasures is needed to implement adaptive options. These are necessary precursors to the planning and implementation stages of adaptation. Such measures include monitoring and research to reduce uncertainty around the estimate, and enhancement of people's awareness. Vulnerability assessment itself is also a measure of this kind.

(2) Technical options

This category includes a range of concrete measures of planning and engineering for adaptation. Through the studies, suggestions relevant for the islands in the South Pacific were formed focusing on the protection of land and prevention of coastal erosion.

There are many cases where coastal settlements need to construct seawalls for protection or landfill to meet the requirement for land due to population growth, as mentioned above. So far, people have constructed line structures along the coastlines by putting stones or vertical walls as shown in Photo 1 and 2. The largest problem associated with seawalls is inappropriate design. It is necessary to change the concept of the design from the line to two-dimensional protection utilizing natural protection. If there are reefs, mangroves, and sandy beaches from offshore to the shoreline, it is easy to protect against the waves by rather simple structure in front of the village, because the waves will

have already lost a large portion of their energy. Such two-dimensional arrangement consisting of natural systems and artificial structures are much efficient to protect the land. It is already mentioned that the coastal erosion was exacerbated when mangroves and other coastal vegetation were once cleared. Therefore, preservation of natural barriers, such as mangroves, coral reefs and sandy beaches, is important from many viewpoints.

For the preparation of the future sea-level rise and climate change, it is important to increase the height of the ground where people live, or to move to higher land in advance. This is also an effective way to ensure people's safety during storm surges and tsunamis, for seawalls alone cannot sufficiently protect against storm surges and tsunamis with extraordinary high water levels.

(3) Policy options

This category is for the adaptation policies which include disaster prevention, changes in land use planning, improvement and reinforcement of infrastructures etc. It is important to integrate the adaptation policies for climate change with other policies, such as environmental conservation, coastal management, and national plans for sustainable development. The adaptation strategy is most effective, when it is incorporated in and coordinated with the other existing sectoral policies. However, the discussion for the adaptation is still in the beginning stage, we need more studies and practices to start actual adaptation processes.

Table1: Needs and problems related to adaptation and other priority areas

a) Vulnerability Assessment

An important problem/need	The type of assistance that would help address the problem/need
<ul style="list-style-type: none"> Inadequate information about the numbers of people and the economic value of the areas likely to be affected directly by sea-level rise. There is a need for more precise maps of coastal areas in the Pacific Islands, and more precise quantification of the economic value of activities within those areas. 	<ul style="list-style-type: none"> Collection and analysis of in-country population and economic data using GIS to produce vulnerability maps, for (i) whole countries and (ii) specific areas in more detail. This would include contour mapping with 1 m intervals.
<ul style="list-style-type: none"> Inadequate understanding of how the coastal zone in the Pacific Islands functions (also see the following problem/need). Fundamental research is needed to support management decision-making. Priority research areas are (i) coastal processes along tropical (reef-fringed) island coasts, (ii) assessment of various solutions to shoreline erosion and/or inundation associated (even in part) with sea-level rise (could include short-term monitoring of seawalls and mangrove replanting), and (iii) coral-reef health with particular regard to their ability (or inability) to respond to an acceleration of sea-level rise in future. 	<ul style="list-style-type: none"> Organize and conduct research, including coordination of research driven from <u>outside</u> the region. Facilitate research by in-region organizations and personnel. This could involve establishing short-contract positions and awarding postgraduate studentships at USP (and elsewhere) to specifically address the priority research issues at representative sites. Enhance the use of existing mechanisms within regional organisations e.g. SOPAC for conducting data collecting, storage, retrieval and assessment, and to advise on solutions to specific problems. Explore indigenous coastal protection means, apart from vegetation and re-vegetation projects and bio-engineering measures, including use of geotextiles in coastal protection. Explore new/appropriate building technologies for the region, including those that are more hazard resistant
<ul style="list-style-type: none"> Insufficient capacity to develop and implement policies relating to integrated coastal-zone management, specifically (I) 	<ul style="list-style-type: none"> Capacity building through training, such as (I) the Vulnerability and Adaptation (V&A) Assessment training at the University of the

<p>insufficient in-country understanding of the coastal system (terrestrial and offshore inputs, coastal processes, and outputs) and (ii) how future changes, both natural and human-induced, could affect it.</p>	<p>South Pacific, and (ii) shorter courses by sub-region (for example, atoll coastline course for representatives from Tokelau, Tuvalu, Kiribati and the Marshall Islands).</p> <ul style="list-style-type: none"> • Also specialised courses on CZM/ICZM and technical data collection, assessment, monitoring and evaluation.
<ul style="list-style-type: none"> • Agriculture/aquaculture. There is insufficient information about present agriculture/aquaculture outputs (both subsistence and commercial) to allow effective planning for sustainable development, particularly in view of future climate change and sea-level rise. 	<ul style="list-style-type: none"> • Extend current initiatives which are attempting to inventorize agriculture and aquaculture, to quantify the amounts harvested and to recommend (maybe develop) conservation areas, both terrestrial and marine. • Also attempt to ensure agriculture regimes are appropriate to country circumstances, through planning.
<ul style="list-style-type: none"> • There is need for vulnerability assessment to be carried out on coastal communities and towns presently affected by coastal erosion and flooding and at the risk of sea level rise. 	<ul style="list-style-type: none"> • Financial and technical assistance to assess the vulnerability of coastal communities and towns to the effects of climate change and sea level rise, flooding and coastal erosion.
<ul style="list-style-type: none"> • There is need for vulnerability assessment on smaller islands whose water sources have been affected and/or are at the risk of salt-water intrusion, and other communities and Provincial Centers that are prone to drought, and exacerbated by climate change. 	<ul style="list-style-type: none"> • Financial and technical assistance to assess the vulnerability of smaller islands and atolls' water sources from rising sea levels; and other communities and towns whose water sources and resources are affected by droughts caused by extreme events (eg El Nino).
<ul style="list-style-type: none"> • Research and studies need to be done on various local food crops to ascertain the possible risks that could be due to the effects of climate change and sea level rise. As well as on human health, assessment of vulnerability is necessary to determine the potentials and risks of diseases' outbreak especially of the epidemics such as malaria. 	<ul style="list-style-type: none"> • Financial and technical assistance for research and studies on local food crops and pests; as well as the potential risks of malaria increase in a climate change regime
<ul style="list-style-type: none"> • Lack of traditional and scientific data. 	<ul style="list-style-type: none"> • Comprehensive vulnerability surveys of sites in Samoa. • Compilation of traditional practices pertinent to vulnerability issues.

<ul style="list-style-type: none"> • Unavailability of appropriate resources (financial/human) to carry out vulnerability assessment. 	<ul style="list-style-type: none"> • Make available needed resources to undertake these studies. • Multi/bilateral arrangements to access these required resources.
<ul style="list-style-type: none"> • Capacity Building (human/institutions) 	<ul style="list-style-type: none"> • Overseas/in-country training for nationals. • Make available training in appropriate national institutions to address cc/V&A etc.. SLR

b) Adaptation Options (Identification, evaluation and assessment of adaptation options)

An important problem/need	The type of assistance that would help address the problem/need
<ul style="list-style-type: none"> • An inventory and evaluation of community level adaptations found in the region. 	<ul style="list-style-type: none"> • Assistance, in the form of research projects, to identify such adaptations, and human resource capacity building including support of graduate students interested in research in this area.
<ul style="list-style-type: none"> • Sustainable coastal zone management in PIC communities. 	<ul style="list-style-type: none"> • Development of public awareness materials on sustainable settlements, environmental management, and coastal management (including protection works) appropriate for use in the region. • Also for biodiversity programmes, especially reef-mangal-seagrass systems, including plans, and programmes that aim toward a greater understanding.
<ul style="list-style-type: none"> • Enhancing existing natural disaster management in PICs. 	<ul style="list-style-type: none"> • Help programmes to build national disaster management capabilities and community disaster vulnerability assessment and preparedness activities.
<ul style="list-style-type: none"> • Identify, evaluate and assess adaptation options for coastal communities and towns affected by coastal erosion and at the risk of sea level rise. 	<ul style="list-style-type: none"> • Financial and technical assistance to undertake an assessment of adaptation options for communities and towns affected by coastal erosion and at the risk of sea level rise.
<ul style="list-style-type: none"> • Identify, evaluate and assess adaptation options for smaller islands whose water sources have been affected and/or are at the risk of salt-water intrusion, and other 	<ul style="list-style-type: none"> • Financial and technical assistance to undertake an assessment of adaptation options for communities and towns whose water resources are affected by droughts, and those

communities and Provincial Centers that are prone to drought.	at the risk of salt-water intrusion.
<ul style="list-style-type: none"> Determine and evaluate options for adapting in the agriculture sector particularly for food crops, as well as the options for counteracting health risk problems. 	<ul style="list-style-type: none"> Financial and technical assistance to undertake an assessment of adaptation options in the agriculture and health sectors.
<ul style="list-style-type: none"> Devise a suitable integrated coastal zone management plan. 	<ul style="list-style-type: none"> Experts to train/work with national people in ICZM techniques/methodologies. Case studies/monitoring activities in-country.
<ul style="list-style-type: none"> Specialist training of staff in all sectors, government provinces and non-government organizations in understanding vulnerability of their respective sectors and how to adapt. 	<ul style="list-style-type: none"> Finance for staff (perhaps one consultant to do training needs assessment), workshops and travel. There is a need to raise awareness on climate and sea level change issues in all these sectors.
<ul style="list-style-type: none"> Real adaptation options should be identified for vulnerable sites that have cultural, biological, economical and ecological significance. These may well require awareness raising to change people's attitude to using their resources or could well require technology transfer. 	<ul style="list-style-type: none"> This outcome will depend very much on an improved vulnerability study. Based on findings, technical experts should work closely with local officers and rural people to determine the most appropriate adaptation option for these areas.

c) Implementation of Adaptation Projects

An important problem/need	The type of assistance that would help address the problem/need
<ul style="list-style-type: none"> Lack of, or inadequate, technical capacity/technology for project execution/implementation, quality assurance, quality control, monitoring and/or maintenance, including post implement stages (post-project evaluation). 	<ul style="list-style-type: none"> Technology transfer and training (awareness, secondary and tertiary) on various adaptation mixes for successful management and execution of projects. Training should be in country and/or within the region, on island systems and resources (assessment, monitoring, evaluation and management). Technology transfer in itself is insufficient; it should be complemented by development of appropriate solutions i.e., low-cost, using locally available materials, not solutions that are highly technical to implement, or

	expensive to maintain.
<ul style="list-style-type: none"> Resources (non-living) and data/information. This includes equipment (specialised and/or general) and instrumentation. Data and information in this case is separate and discrete from pre-implementation stage/s (for redefining adaptation options during the implementation and post-implementation/project review stages). 	<ul style="list-style-type: none"> Monitoring (short-term) projects to assess parameters and data collection/assessment studies. Fundamental research and capacity building.
<ul style="list-style-type: none"> Building capacity for community implementation of adaptation projects. 	<ul style="list-style-type: none"> Improve understanding of community decision-making processes, provision of information/awareness building regarding impacts and adaptive options; identification of Government role in facilitating community level implementation.
<ul style="list-style-type: none"> The need for a national policy framework that considers climate change and sea level rise related issues and which is designed to ensure the implementation of adaptation projects. 	<ul style="list-style-type: none"> Financial and technical assistance to formulate and put in place, a national policy framework for implementing adaptation projects.
<ul style="list-style-type: none"> Lack of human and financial resources. 	<ul style="list-style-type: none"> Make available financial resources through regional/national arrangements to implement identified adaptation projects.

d) Technology Transfer

An important problem/need	The type of assistance that would help address the problem/need
<ul style="list-style-type: none"> Conservation of coastal zones - clarify appropriate technology to suit specific conditions in the South Pacific (e.g. for representative island system types, such as reef/atoll, terraced and high volcanic islands). 	<ul style="list-style-type: none"> hard structures (e.g. sea walls and geomaterials) based on experimental field designs soft structures (e.g. vegetation) CZM planning application and capacity building of local expertise public awareness access to information institutional mechanisms for implementation
<ul style="list-style-type: none"> Establishment and maintenance of disaster warning systems 	<ul style="list-style-type: none"> clarify current vulnerable areas, through mapping and other means, including case study areas and data gap filling – e.g. lowland, river mouth, land slide

	<ul style="list-style-type: none"> • establish early warning system for cyclone and tsunami • impact assessment of climate change, including changed of frequency and scale of disasters • public awareness
<ul style="list-style-type: none"> • Adequate supply and quality of water resources. 	<ul style="list-style-type: none"> • water resource management technologies • water quality control <ul style="list-style-type: none"> - waste water treatment and CH4 capture - desalinization plant, including maintenance • encouragement of community activities access to information
<ul style="list-style-type: none"> • Capacity building and training in identified suitable technologies, relevant to its transfer, application and sustenance, for appropriate national experts and institutions. 	<ul style="list-style-type: none"> • Financial and technical assistance for capacity building and training of national experts and awareness creation
<ul style="list-style-type: none"> • Little information available on technology suited to island situation. 	<ul style="list-style-type: none"> • More simplified information should be made available to PICs on alternative technologies.
<ul style="list-style-type: none"> • Criteria for technology transfer are too tight for SIDS to meet their requirements. 	<ul style="list-style-type: none"> • Criteria for TT shall be simplified to enable SIDS to qualify for their transfer and implementation.
<ul style="list-style-type: none"> • Free exchange of technologies rather than selling technologies. 	<ul style="list-style-type: none"> • Opportunity for PICCAP Country Team to consult relevant organizations willing to freely exchange technologies. Such an opportunity often presents itself at regional and international conventions, etc. This would require invitations and sponsorship to attend such events.