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**"Symbiosis" of Human being and Nature  
in South Pacific Islands**

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## PREFACE

Traditional societies keep “symbiosis of nature and the human being”. Natural products are consumed but remain in a sustainable state and the environment stays relatively unaffected. However, modern societies have broken the balance between nature and mankind, which has induced environmental pollution and decreased biodiversity in the natural environment.

The South Pacific Islands are surrounded by sea; therefore, marine tourism is a very important industry for each country. For example, the Republic of Fiji Islands is one of the most famous sightseeing places. To make the marine tourism more attractive, many coastal sites were developed. This development may have decreased the biodiversity in the coastal area. However, despite the increased development, many villages on the coast retain a self-sufficient society and a common land sharing system in Fiji Islands. This means that they keep their traditional social systems. Therefore, the “symbiosis of nature and the human being” is retained. On the other hand, the South Pacific Island countries are characterized by their small size, close proximity, and remoteness. These characteristics have kept industrial capitals from investing in the region. Furthermore, frequent natural disasters such as cyclones lead to a relatively high transaction cost for the capitals. Hence, the region was not able to attract foreign capital fully which is opposite to the Southeast Asian countries whose economic structures were greatly influenced by direct foreign investment. The situation has left the local people the opportunity to control their own economic and environmental structure. We believe that one can study the coexistence of man and nature by examining the way of life in the region from an interdisciplinary approach.

To better understand how to achieve sustainable development, we should look at traditional society in the South Pacific Islands and its affects on the environment. In order to do so we held a symposium: “Symbiosis” of Human being and Nature in the South Pacific Islands, which was held on July 10th 2004. This is a report developed by the members of the symposium and also includes the papers by both editors. We acknowledged Professors SHIGA Y., NAGASHIMA S. and HIDAKA T. for their comments on the symposium. We are also grateful to the staff in the Exchange and Planning Committee of RCPI for their help in this symposium.

by Editors KAWAI K. & NISHIMURA S.

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# **Agriculture and the Economies of Pacific Islands: Trends, Issues and Challenges**

**REDDY Mahendra**

## **Abstract**

This paper will provide an overview of the role played by the agriculture sector in the growth and development of Pacific Island economies. It will examine the key agricultural areas which could provide sources of growth for the Pacific Island economies. While examining these sources of growth, the challenges these islands countries will face with respect to harnessing these sources of growth will also be examined. The eminent threat of globalization and the rapidly changing global economy is also placing lot of pressure on these island nations to respond with changes in domestic policies. Results from the research reveal that PICs have a very narrow resource base and thus could be vulnerable to external shocks. There are a number of problems that are faced by the PICs which are similar in nature and could have major impact on the performance of PICs agriculture sector. These problems are highlighted and policy measures are suggested to turn these challenges into opportunities.

## **Introduction**

The South Pacific islands are found in an area roughly bounded by the tropics and lying between 130°E and 125°W. The islands within the Pacific are group into three cultural grouping, namely Melanesia, Micronesia and Polynesia. The Melanesian islands are all relatively large archipelagos and include Papua New Guinea, the Solomon Islands, Vanuatu, Fiji and New Caledonia. Polynesia includes American Samoa, the Cook Islands, French Polynesia, Niue, Pitcairn, Tokelau, Tonga, Tuvalu, Wallis and Futuna and Western Samoa while Micronesian islands lie mainly north of the equator and include the Federated States of Micronesia includes Yap, Chuuk, Pohnpei, Kosrae, Guam, the Northern Mariana Islands, Marshall Islands, Nauru, Palau, and Kiribati. A common bonding between these groupings is the reliance of a large proportion of their populations livelihood on the agricultural sector.

While the stylised facts of growth for developing country states that they should grow at a rate 7 to 8% in real terms, PICs growth rate has been far too low. The economies have been characterized by low to negative GDP growth, low levels of investment, in particular private sector investment, low levels of savings, low foreign reserve, widening budget deficit and escalating public debt levels.

The poor growth performance and pressure from external forces led to PICs re-examining their growth strategies. However, this still did not lead to a major growth surge in the island economies. While at the global level, the era of state dominance in the areas of employment, investment, provision of goods and services is gradually declining, in the PICs, the state continues to play an important and dominant role.

The primary reason for state to continue its dominant role is the peculiar problems these island nations face arising out of their size in particular. The smallness of the island nation exposes them to a number of problems including:

- Terms of Trade;
- Economies of Scale; and,
- Domestic Market limitations.

The small size of the Pacific island countries renders the countries unable to influence their own terms of trade. Therefore, they are virtually a price taker in the export and import market.

The size also has an effect on the ability of the industries in these countries to achieve scale economies, indivisibilities, efficiency and competitiveness (Scitovsky, 1960) and scope economies (Streeten, 1996). Inability to achieve the minimum critical mass of economic activities has a direct bearing on the competitiveness of these countries. The small size of domestic market also results in domestic demand below the minimum required for efficient production (Armstrong, *et. al*, 1993).

Small island nations also generally tend to have narrow and limited resource base. These limited opportunities from resources which most of the developed nations have an edge on is quite serious and thus the most likely source of growth is investment in human capital (Table 1).

The lack of investment opportunities arising out of lack of non-labor resources is what Milner and Westaway (1993) refer to as capital shallowing. The narrow resource base and the other limitations outlined above makes these small countries specialize in a limited number of export goods. This makes them more vulnerable to natural disasters and price shocks. The case of small states vulnerability has been discussed widely by Brigiglio (1995) who developed a vulnerability index.

The narrow resource base and low levels of export have a significant effect on the country's ability to mobilise savings for investment and growth. The process of globalisation and resulting economic intergration could provide a means to bring in Foreign Direct Investment (FDI) to bridge the savings and investment gap. However, the move towards a more market-oriented growth is embedded in the notion of competition. Competition is the key pillar of surplus creation, investment and rapid growth. Even if the Pacific island countries move towards a more market oriented economy based on open market policies, they still cannot afford to ignore the agriculture sector. The agriculture sector has played a very important role in the growth and development of the Pacific island nations and it will continue to do so in the near future due its apparent lack of diseconomies of scale in the non-agr sector which makes it difficult to compete in the open market. Therefore, in this paper, we will examine in detail the agriculture sector of the Pacific Island economies and identify the areas in which sources of growth for PICs could be extracted.

Table 1 Basic Economic Indicators for Selected Pacific Island Countries

Country	Year	Variable GDP	Inflation	Growth rate of Exports	Growth rate of Imports	Budget Deficit as % of GDP	CA balance as % of GDP
Fiji	1999	9.5	2.0	19.4	25.3	-5.4	-4.5
	2000	-3.2	1.1	-6.8	-11.2	-6.6	-6.3
	2001	4.3	4.2	-6.8	-2.6	-6.9	-3.6
	2002	4.4	2.5	2.0	7.1	-6.9	-3.1
Papua New Guinea	1999	7.6	14.9	9.1	-0.1	-2.7	2.7
	2000	-1.2	15.6	7.3	-7.0	-2.0	9.9
	2001	-3.4	9.3	-13.7	-6.4	-3.6	9.4
	2002	-0.5	12.0	-23.7	2.1	-3.5	1.1
Samoa	1999	2.6	0.2	-2.3	20.8	0.3	-8.1
	2000	6.9	1.0	-25.6	-8.5	-0.7	-5.0
	2001	6.5	4.0	3.3	12.7	-2.3	-11.2
	2002	1.1	6.0	-10.3	9.2	-2.0	-12.3
Solomons	1999	-1.4	8.3	3.8	-15.5	-3.7	..
	2000	-16.0	4.8	-53.2	-14.8	2.9	-18.1
	2001	-13.0	1.8	-31.9	-11.5	-8.0	-13.3
	2002	3.0	11.0	6.5	-15.3	-3.0	-6.8
Tonga	1999	3.1	3.9	1.6	-28.9	-0.3	-12.8
	2000	6.7	4.9	-9.5	12.8	-0.4	-10.8
	2001	3.0	6.3	9.5	-1.6	-2.6	-10.7
	2002	3.0	4.0	76.9	18.6	-4.0	-9.7
Vanuatu	1999	-2.5	2.2	-24.3	9.3	-3.1	-5.4
	2000	3.7	2.7	6.0	-7.3	-7.4	2.1
	2001	-0.5	3.2	-27.0	0.5	-4.0	0.8
	2002	-0.4	2.5	5.6	-0.7	-3.0	1.7

Source: As cited in ESCAP 2003 report based on ADB, Key Indicators of Developing Asian and Pacific Countries 2002, vol. XXXIII (ADB, 2002), Asian Development Outlook 2002 (Oxford University Press, 2002) and Asian Development Outlook 2002.

## Agriculture and the Pacific Island Economies

The growth trend of PICs could be explained by using the contemporary “modernization” theory introduced by Walter Rostow in 1960. Rostow, based upon his observations of the European nations, postulated that countries proceed sequentially through five stages of development (Fig. 1).

The first stage is characterized by a traditional society, an economy oriented around subsistence activities. Family labour is used to produce for household consumption and any excess produced is exchanged with others in the community. This has been typical description of the traditional Pacific island societies. The second stage, “preconditioning”, comes about when a society favours to move into the commercial arena. There are efforts made to make investment. The third stage, “take-off”, is marked by increased investment and a move towards a increased production and commercial activity. There is a shift in emphasis on activities which are labour intensive. The fourth stage involves diversification of the countries production and export base. There is emphasis on capital intensive industries and surplus extracted by

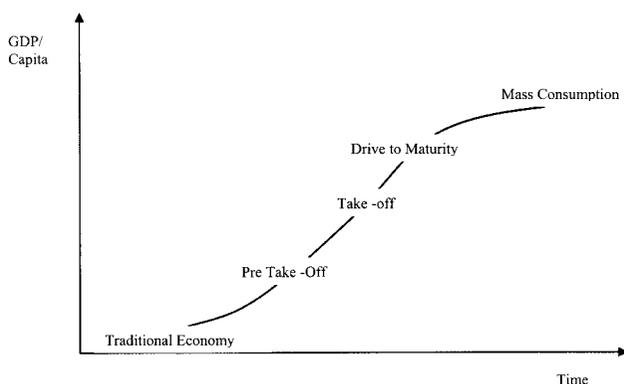


Fig. 1 Rostows Economic Stages of Growth

government is used raise welfare of the poor in the society. The benefits of economic growth starts to spread to the entire economy. The last stage involves move away from manufacturing towards service industries. High technology is used by consumer and producers and spending in public and privates sector escalates.

The PICs have small masses of land but are endowed with a large area of sea which provides them with a range of marine products. The land area size ranges from 26 km<sup>2</sup> for Tuvalu to 462,243 km<sup>2</sup> for PNG. PNG is the largest country with respect to land area. It has vast potential for agricultural production. PNG also has a good source of mineral sources, in particular gold and copper. However, the country has been torn apart due to two decades of civil war. The smaller countries are severely limited not only because of a smaller land mass, but also due to nature of these islands. Countries like Tuvalu, Tokelau, Kiribati, Niue are all atoll countries and therefore has very limited potential for agriculture. Instead, these countries have been heavily relying on the sea for sources of growth. They also are recipients of large amounts of aid and remittances which tends to raise their consumption much beyond their capacity to produce. Given the importance of the agriculture sector to Pacific Islands economy, the agricultural component in most of the PICs are very high, the highest is for FSM, 73% (Table 2).

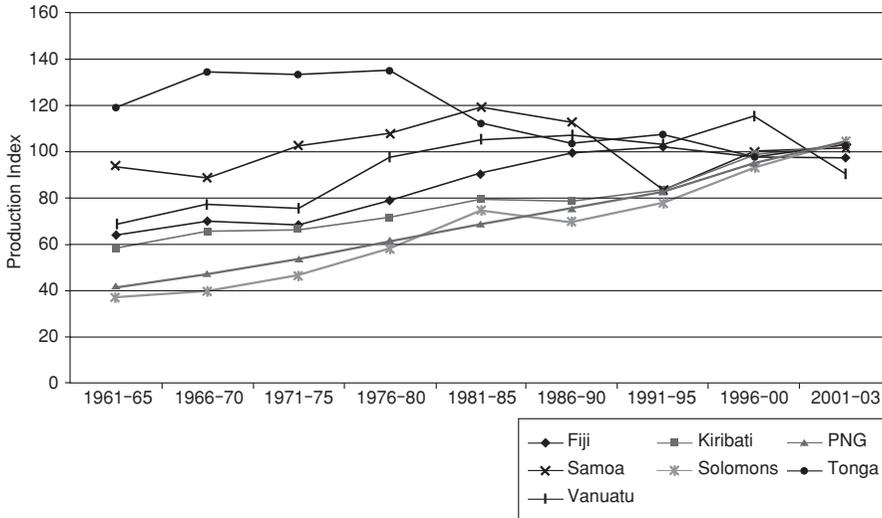
Table 2 Key Socio-Economic Profile of Pacific Island Countries.

Country	Population	Sea Area (km <sup>2</sup> )	Agriculture as % of GDP	Land Area(km <sup>2</sup> )
Fiji	819,000	1290	16	18,272
Cook Islands	18,000	1830	14	237
FSM	107,000	2978	73.2	701
Kiribati	87,000	3550	14.2	810
Marshalls	56,000	2131	13.8	181
PNG	5,500,000	3120	26.9	462,243
Samoa	177,700	120	14.3	2,935
Solomons	490,000	1340	43.5	27,556
Tonga	101,000	700	28.6	747
Tuvalu	10,880	900	16.8	26
Vanuatu	202,200	680	16.3	12,190

Source: ADB Statistics, 2004.

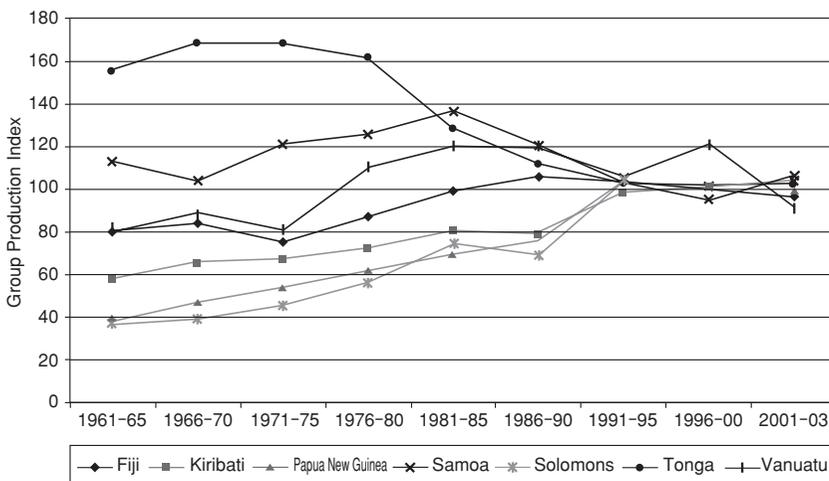
### 1)Trend in Agricultural Production

The FAO data base reveals that apart for Tonga, all the other agricultural production has increased (Fig. 2). Samoa’s agricultural sector was declining in the 1980’s but started to increase again from 1990. Fiji and PNGs agriculture sector output has been increasing steadily since 1960’s. Vanuatu also had a increasing trend but output started to decline since mid 1980’s.



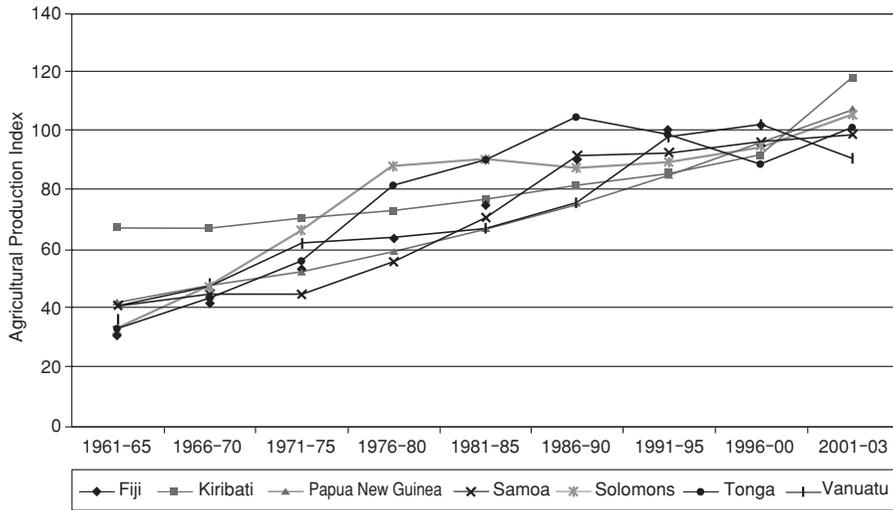
Source: FAO Statistics, 2004.

Fig. 2 Trend in Agricultural Production Index of PICs (1999-01 base year)



Source: FAO Statistics, 2004.

Fig. 3 Trend in Crop Production Index (1999-01 as the Base year)



Source: FAO Statistics, 2004.

Fig. 4 Trend in Livestock Production Index for PICs (199-01 as base year)

The trend in crop production is similar to the trend in overall agricultural production (Fig. 3). Samoa's crop production has declined along with that of Tonga. However, for the other countries, crop production has increased over the years.

An examination of the livestock production index reveals that it has increased for all the countries (Fig. 4). So what this implies is that the fall in agricultural output for Tonga and Samoa is primarily due to a fall in crop production and not in livestock production. Therefore, if policy makers want to raise agricultural production in these two countries, then they must examine the crop sector as the decline in agricultural output is due to a fall in crop production and not livestock production.

## 2) Production of Agricultural Commodities by Country

Most of the crops produced across the Pacific island countries are similar. The main agricultural products that Fiji produces are sugarcane, rice, copra and fish. However, due to opening up of the economies, rice production has declined over the years. Fiji is nearly self sufficient in poultry products, even in a competitive market. However, Fiji's agricultural sector is affected by the issue of Land Tenure system. Over 90% of the land is leased out and leases have began to expire since 1997. A large number of leases, which have expired, have been pulled out of agriculture thus leading to a decline in total agricultural produce. Fiji has also produced two mineral, Gold and Silver. Both of these have provided a steady source of revenue for Fiji and have created employment.

The other large agricultural producer in the Pacific is PNG. PNG has a potential to produce much more than what is being produced currently. However, due to civil war in the country for the last two decades, PNG has lost a great deal of its resources. The major crops produced by

PNG is Coconut, Copra, Sweet Potatoes and coffee. PNG also is the second country to have large deposits of Copper and Gold. Solomons, apart from producing copra and other agricultural crops listed in Table 3, produces a large volume of timber products. Tonga produces copra, coconuts and bananas in large volumes. However, there are two commodities that cuts across all island agricultural production and that is Copra and Fish. Copra is a commodity that is common to all Pacific island countries. It is produced and exported thus serving as a source of foreign exchange. Fish is a commodity that Pacific island countries have a natural advantage given such large EEZ's that they have.

Table 3 Production of Major Agricultural and Mineral Commodities by Pacific Island Countries (Metric Tons '000).

Commodities	1986-90	1991-95	1996-00	2-01
<b><i>Fiji</i></b>				
1. Sugarcane <sup>d</sup>	3674	3758	3454	3188
2. Paddy rice	29	22	14	15
3. Fish	12	15	17	15
4. Copra	16	12	13	17
5. Chicken	4	7	9	8
1. Gold, <i>kg.</i>	3666	3452	4214	3274
2. Silver, <i>kg.</i>	887	1286	1962	1635
3. Sugar <sup>d</sup>	427	446	355	305
7. Coconut oil	10	7	7	7
<b><i>Vanuatu</i></b>				
1. Bananas	10	12	13	13
2. Cocoa	2	2	1	1
3. Coconut	317	263	313	190
4. Copra	35	29	34	27
5. Maize	1	1	1	1
<b><i>Solomons</i></b>				
1. Cocoa	3	4	3	3
2. Coconut oil	3	4	7	0
3. Copra	31	26	24	2
4. Fish	36	44	40	18
5. Palm oil and kernels	20	35	31	0
6. Timber, '000 cu. m.	370	448	641	542
<b><i>Samoa</i></b>				
1. Coconut	164	118	130	140
2. Copra	20	9	6	0
<b><i>Tonga</i></b>				
1. Coconut	40	35	52	58
2. Copra	4	2	3	4
3. Bananas	3	1	1	1

Source: ADB Statistics, 2004.

Table 3 Table: Production of Major Agricultural and Mineral Commodities by Pacific Island Countries (Metric Tons '000)(Cont...)

Commodity	1986-90	1991-95	1996-00	2001-02
<b>Tuvalu</b>				
1. Copra	7	10	10	0
<b>FSM</b>				
1. Copra	1	1	1	1
<b>Kiribati</b>				
1. Copra	8374	10390	8693	6322
<b>Marshalls</b>				
Copra	5732	5375	4564	
<b>PNG</b>				
1. Coconuts	864	731	955	637
2. Sweet potatoes	474	467	466	490
3. Copra	139	110	148	172
4. Coffee	59	58	75	63
5. Cocoa	37	33	38	42
6. Rubber	4	5	7	7
7. Peanuts	1	1	1	1
8. Sorghum	1	2	3	4
9. Rice	1	1	1	1
1. Copper metal	204	199	117	154
2. Gold, m.t. <sup>e</sup>	34	59	57	64

Source: ADB Statistics, 2004.

### 3) Exports of Agricultural Commodities by Country

#### 3.1) Value and Composition of Exports

The Pacific island countries export potential is very narrow and limited. Most of the countries export primary agricultural products and some do transform these primary products into secondary product. Fiji's main primary agricultural products are sugar, gold, fish and coconut oil. Fiji sugar industry has been receiving price which were three times higher than the world free market price and thus, this higher price than the market price, has led to a major expansion of the sugar industry. However, as world economies are changing and along with it the trading rules, Fiji's sugar producers will have to adjust their cost and productivity to remain competitive in a falling output price scenario. Cook islands has been exporting fresh fruits, copra and pearls. Fiji has also ventured into pearl production, but to a limited extent. The FSM has been exporting 4 major commodities, Fish and Shell meat and Banana and Copra. All these products show a declining trend in exports.

Smaller atoll countries have very few export commodities and these include, copra and fish

products for Marshalls, Copra and Handicrafts for Tuvalu. These narrow export based makes the country vulnerable to shocks. The relatively larger countries like Vanuatau, has slightly diverse export base and these include Beef, Cocoa, Copra and Timber. However, the export value of all these has been fluctuating over the last two decades. PNG probably has the largest range of products for export and these include Copper, Gold, Coffee, Cocoa, petroleum and palm oil. All these provides a very strong economic base for PNG. Samoa and Solomon's has a limited range of products for exports, mostly agricultural products. However, Solomon's has timber exports which Samoa and most other PICs do not have at their disposal.

So in summary, apart from PNG, the other countries have a very narrow range of products that are exported. The smaller countries like Tuvalu, Marshalls, Kiribati all these have great potential to harvest and export marine products in their EEZ. However, lack of technology, capital and skills have prevented them from exploiting these resource.

### *3.2) Direction of Trade for Pacific Island Countries*

Direction of Exports: Table 4 & 5 provides the five major trading partner countries where PICs export their products. The five most important countries include Australia, USA, Japan, and Germany for most of the country in PIs. Japan was the only country which appeared the most number of times in the top five lists. Japan is a major destination of export products from Fiji, Cooks, FSM, Kiribati, PNG, Solomon's, Tonga, and Vanuatu. USA and Australia follows Japan in order of importance.

Table 4 Five Top Export Destination Countries for PICs (%).

Country	Fiji	Cooks	FSM	Kiribati	Marshalls	PNG	Samoa	Solomons	Tonga	Tuvalu	Vanuatu
Australia	19.7	26.3				24.3	60.3		1.5		
USA	27.2	11.6	18.3	3.2			10.1		37.9		
UK	10.7									43.8	
Japan	5.4	40.2	78.9	52.4		10.2		21.1	47.4		6.59
Samoa	5.2										
New Zealand		10.8							4.0		
Hong Kong		7.9									
Marshalls			0.2								
Thailand				21.5				8.9			
Bangladesh				4.31							
Korea				12.2		3.1		20.2			
China						3.9		7.5			
Germany						3.4	2.1			17.6	22.8
Indonesia							11.0				1.9
Philippines								9.96			
Italy										11.4	
Fiji									1.5	10.9	
Belgium											31.0
Chile											15.0

Source : ADB Statistics, 2004.

Table 5 Five Top Export Destination Countries for PICs (US\$m).

Country	Fiji	Cooks (NZ)	FSM	Kiribati	Marshalls	PNG	Samoa	Solomons	Tonga	Tuvalu	Vanuatu
Australia	121.9	2.3				645.9	47.4		0.4		
USA	167.9	0.9	1.9	1.1			7.9		9.2		
UK	66.3									0.5	
Japan	33.4	3.6	8.2	18.4		270.9		17.1	11.5		5.3
Samoa	32.3										
New Zealand		0.9							0.9		
Hong Kong		0.6									
Marshalls			0.02								
Thailand				7.6				7.1			
Bangladesh				1.5							
Korea				4.3		81.7		16.1			
Taiwan											
China						105.3		5.9			
Germany						90.7	1.6			0.2	18.2
Indonesia							8.7				1.6
Philippines								7.7			
Italy										0.1	
Fiji									0.4	0.1	
Belgium											24.7
Chile											12.0

Source: ADB Statistics, 2004.

Direction of Imports: In terms of imports for PICs, Australia appears in all countries top five import countries list (Table 6 & 7). Japan is second with USA followed by New Zealand. The close proximity of Australia and New Zealand gives them an edge over the other countries in terms of transportation. Its quite interesting to see that Fiji is also a preferred import destination for quite a large number of PICs. With the promulgation of free trade areas into the region, there will be a rise in the flow of goods and services within the region.

Table 6 Five Top Import Source Countries for PICs (%).

Country	Fiji	Cooks (NZ)	FSM	Kiribati	Marshalls	PNG	Samoa	Solomons	Tonga	Tuvalu	Vanuatu
Australia	40.6	6.5	3.5	30.4	2.8	50.3	14.2	30.4	12.5	5.1	19.1
USA		1.8	72.1	7.8	82.2	2.2	18.8	4.7	11.2	2.2	
Japan	4.0	1.2	12.0	7.6	6.9	4.4	11.1			10.9	23.3
New Zealand	15.9	76.9				4.2	19.9	5.0	32.2		8.3
Hong Kong					2.6						
France				18.6							
Thailand									4.4		
China	4.4				1.8						
Germany										0.9	6.2
Indonesia						3.0					
Singapore	12.5							19.2			11.8
Fiji		8.8		15.6			15.7	4.2	21.8	20.8	

Source: FAO Statistics, 2004.

Table 7 Five Top Import Source Countries for PICs (\$).

Country	Fiji	Cooks (NZ)	FSM	Kiribati	Marshalls	PNG	Samoa	Solomons	Tonga	Tuvalu	Vanuatu
Australia	322.9	6.9	2.9	20.7	1.4	581.6	31.9	32.3	9.9	2.4	28.3
USA		1.9	60.6	5.3	41.8	25.1	42.4	5.1	8.8	1.0	
Japan	31.6	1.3	10.1	5.1	3.5	50.5	24.9			5.1	34.6
New Zealand	126.7	82.1				48.8	44.8	5.4	25.4		12.3
Hong Kong					1.3						
France				12.6							
Thailand									3.5		
China	35.1				0.9						
Germany										0.4	9.2
Indonesia						34.9					
Singapore	99.0							20.5			17.6
Fiji		9.4		10.6			35.4	4.4	17.2	9.7	

Source: FAO Statistics, 2004.

## Problems facing Pacific Islands Agriculture

The Pacific island countries are facing a number of challenges that affect its performance. These challenges include:

- 1) Dependence on a narrow range of exports;
- 2) Smallness and remoteness;
- 3) Susceptibility to Natural disasters.
- 4) Lack of Technology

### 1) Dependence on a Narrow Range of Exports

Small island nations tend to depend on a narrow range of exports. This high dependence on a narrow range of exports, coupled with a high degree of openness, renders the economies of small islands very vulnerable to changes in external demand for these products. Interestingly, while the theory of trade suggests that countries should specialize in goods and services in which they have a comparative advantage, in the case of small states such specialization exacerbates their vulnerability to conditions outside its control.

### 2) Insularity and Remoteness

Cost of doing business are also affected by the high cost transportation arising from the remoteness feature of small island states. Furthermore, not only importation costs contributes to high production costs and thus its impact on the competitive edge of exports, the Pacific island producers also face lack of available transport to freight produce to external markets. These problems could remain for sometime as the feature of remoteness is one which cannot be overcome by easily.

### 3) Susceptibility to Natural Disasters

The Pacific island economies, has been subjected to a range of natural disasters on a periodic

basis. Natural disasters affects the economy in two ways, one by destroying a significant proportion of the capital stock and secondly by its direct effect on output (Reddy, 2000). The capital stock loss affects has an effect on the economy over a longer run period.

Between the periods 1961 to 1999, Fiji was subjected to 35 natural disasters (see Reddy, 2000, for detail description of these disasters). The three major types of natural disasters are cyclones or hurricanes, flooding and droughts. The immediate cost of these natural disasters run into millions of dollars with the highest one in 1993 incurring a loss of F\$154m, approximately 18.8% of the total government expenditure (Reddy, 2000). The narrow resources based coupled with a limited number of primary export base could be crippled by natural disasters and thus lead to a collapse of the economy.

## **Self Inflicted Vulnerabilities**

### **1) Political Instability and Role of Armed Forces**

Some of the Pacific island countries have faced internal political unrest which has result in loss of property and life. It has also led to a fall in investor confidence and withdrawal of investment. Some of these countries which has faced such problems are Fiji, PNG and Solomons. Fiji has been experiencing political instability since 1987. One of the main causes of such instability could be the relatively large size of its armed force, which total just over 5000. The military has mixed allegiance, to the chiefs and to the Head of State.

In 1987, the military took over the government and abrogated the constitution. This led to massive economic and social problems in the country. Economic growth was negative in the same year and low in the following years. The country witnessed massive financial and human capital loss during these years. In 2000, just when the economy rebounded with high growth rate, a unit within the forces took over the government again pushing the economy and the nation into another crisis.

### **2) Loss of Human Capital**

Political unrest and instability followed by discrimination and marginalization has led to loss of significant human capital from the island nations. Fiji has been losing a significant proportion of its human capital from the early days of independence. However, the number has increased since 1987 following the military coups (Fig. 1). The two key human capital sectors i.e. education and health have both been greatly affected due to the continued loss of professionals. During 1987-1999, teachers were the single most dominant professional group that Fiji has been losing. Of the total professionals, teachers accounted for about 31% and architects, engineers and related technicians nearly 21%. An average of about 164 teachers left Fiji every year during the same period. In addition, there has been a loss on an average of nearly 69 medical, dental, veterinary and related workers annually. More than 500 professionals left Fiji annually during this time (see Table 5).

Prior to the military coups in 1987, the only pull factor was the wage differential between Fiji and metropolitan countries. However, the military coups provided the push factors which resulted in an exodus of migrants from Fiji. The expiry of land leases and the resulting eviction of farmers has further added to this push factor.

Loss of human capital affects agricultural growth in a number of ways. One is its direct impact from lack of skilled personal which has arisen due to emigration. The second is the loss of personnel from other sections will lead to a rise of wage rates in this sector and will pull labor from agricultural sector into these sector. This will lead to a rise in wage rates in the agricultural sector and thus make its product less competitive in the export market.

### 3) Land Tenure Issues

The Pacific island countries have at least one issue in common which could turn out to be the only obstacle for a purely market based economy. This is with relations to land, which, in almost all PICs, are communally owned (Table 8). Those land that is used by the communal group, could end up in poor condition given the nature of commons, where all wants to maximize its benefit, without any concern for the rest or the next generation. Those land which are not required by the communal groups, it is leased out. However, the leasing conditions has often been not very conducive for major productivity enhancing investments. A current example is the land tenure system in Fiji where most of the land in Fiji is communally owned and is leased to tenants for agricultural or non agricultural use. The Land tenure system has become more complex since a large number tenants are of Indo-Fijians which are embroiled in a political struggle with the ruling indigenous Fijian government. As the leases began to expire, the Fijian leaders were reluctant to renew the leases and for those that they were willing to renew, they wanted to renew it under a new legislation which would further safeguard their interest and raise the returns to land. However, the Indo-Fijian leaders has rejected the new

Table 8 Communal Land in the Pacific.

Country	% Land in Communal Ownership
Solomons	83
Niue	100
Fiji	89
Tokelau	100
Tonga	74
Vanuatu	92
Tuvalu	100
Kiribati	89
Nauru	--
Marshalls	--
Western Samoa	80
Papua New Guinea	97
Cooks	15

Source: As cited in ESCAP 2003 report based on ADB, Key Indicators of Developing Asian and Pacific Countries 2002, vol. XXXIII (ADB, 2002), Asian Development Outlook 2002 (Oxford University Press, 2002) and Asian Development Outlook 2002.

proposed legislation on grounds that it does not protect the interest of the tenants adequately and may in fact exploit them. This battle has led to a large proportion of land, which was leased to the Indo-Fijian farmers, reverting to the Native Land Trust Board (NLTB), the trustee of the landowners, thus moving out of production. The fall in agricultural output, in particular, sugarcane, has led rise to major social and economic problem in Fiji. Land will continue to play a central role in the growth and development of Fiji as it has done in the past and unless an appropriate legislation is adopted with the consensus of the stakeholders, it will continue to weaken the economy.

#### **4) Bad Governance and Its Impact on Public Expenditure**

The small island states of the Pacific are relying a lot on the state to provide back up support, particularly in terms of marketing, infrastructural development and finance. However, bad governance has led to loss of a significant proportion of the public sector resources which has affected the ability of government to undertake such activities. As such, agricultural development are affected.

### **Policy Measures to Address the Challenges**

Given the inherent problems and challenges faced by the PICs needs to be turned into opportunities. This could be done by:

- Improving competitiveness;
- Building sound macroeconomic environment;
- Strengthening the transport and communications infrastructure;
- Diversification of the economy;
- Improving the capacity of SIDS to manage their ocean resources; and,
- Improving governance.

#### **1) Improving competitiveness**

The conduct of business in the global market has changed markedly and developing countries are gradually responding to these changes by adopting appropriate policies. The PICs has begun the reform process, but much remains to be done to have a competitive market. The labor market is heavily protected, most of the land is communally owned with property rights governing its use under dispute. In addition, the financial market is very small and behaves oligopolistically (in most countries) in terms of interest rates and lending. Unless these anomalies are corrected, PICs will have difficulty in fostering a competitive environment to promote stable growth.

#### **2) Building sound macroeconomic environment**

A sound macroeconomic environment should deliver low inflation rates, low levels of budget deficit, low levels of debt, improvements in trade and current account balances and stable exchange rate regime. If PICs can achieve and maintain this, then it will be in a strong position to recover from any shock. While this objective is on PICs agenda, progress in this regard in

PICs has been slow.

### **3) Strengthening the transport and communications infrastructure**

Transport and communications infrastructures are very important for PICs due to the fact that the countries are remotely located. Infrastructure development in PICs are lagging behind and is a major impediment to business development. PICs have to re-examine its budgetary expenditure allocation to ensure that resource allocation for infrastructural development takes priority. The PICs currently spend a large proportion of their annual resources on administrative expenditure. The long-term strategy should be to cut operating budget, raise capital component of the infrastructure budget and aim for 7-8% real growth of the economy on an annual basis. Such growth should deliver increased revenues to government coffers and thus reduce the debt burden over the longer run period, releasing funds for infrastructural development.

### **4) Diversification Possibilities**

PICs have relied to a large extent on a narrow range of products for its export, which renders it quite vulnerable to shocks to these industries. Furthermore, under the current growth strategy, there is excessive reliance on tourism earnings, which are highly volatile. On the other hand, the agriculture sector has not received as much attention. In Fiji, this sector plays a very crucial role in distribution of income to the rural dwellers and has a very strong multiplier effect.

Given the narrow resource base and small size, Fiji tends to import most of its industrial supplies. While the theory of comparative advantage suggests that a country should produce only that commodity in which it has a comparative advantage, there are other areas products that could be developed with equally good efficiency to hedge against potential shocks that specific to products or product types. Fiji has potential in cash crop agriculture, which has market both locally and externally (particularly New Zealand, Australia and Hawaii). There is also lot of potential for export of marine resources from Fiji to Australia, New Zealand, Japan and USA. More work needs to be done to explore the timber industries for export purposes. If Fiji strengthens these areas, then it could be better placed to withstand shocks in any particular industry.

### **5) Improving the capacity of SIDS to manage their ocean resources**

PICs enjoys jurisdiction over a 200 mile Exclusive Economic Zone. Ocean resources are therefore major potential source of wealth for the country. Unfortunately, ocean resource management is a serious problem in Fiji and the other Pacific Islands. This problem is found at both commercial and subsistence levels. At the commercial level, there are concerns raised that licenses given to fishing vessels which has exceeded the maximum number allowable, thus raising issue of unsustainability. At the semi-subsistence levels, there are also concerns that the open access system of property rights can lead to depletion of Fish stock. Under this system, fisherman pays a fixed amount fee to harvest unlimited amount of stock. There has to be some means of levying fee on stock, which would discourage fishing beyond a certain amount. Also based on an estimate of the stock the number licenses should be limited unlike the current

practices. At the commercial level, the maximum number of allowable vessels should be strictly adhered to.

The University of the South Pacific's Marine studies program should re-examine its courses and training in technologies that would lead to the sustainable use of the resources of the ocean. The marine resources should be further explored for potential energy sources.

## **6) Improving governance**

Bad governance is leading to the unproductive use of a large proportion of public sector resources. Most importantly it is leading to bad management of the islands resources. Cases of bad governance are more evident during periods of political instability and lawlessness. Fiji, Solomons and PNG has witnessed massive loss of state resources during periods of political crisis and also years following the coups and political crisis. In order to curb such cases of abuse of public sector resources, the Auditor Generals report must be taken seriously and those implicated must be charged and punished according to law. This would send positive signals to others as well. Furthermore, proper accounting procedures must be put in place and strictly adhered to all times.

## **7) Improving the Land Tenure System**

While land may continue to be under communal ownership, an appropriate legislation which provide long term, secure leases to the tenant community while providing a market based rent to the land owners may provide the required incentive for competitive growth.

## **Summary and Conclusion**

This paper has examined challenges and opportunities for Pacific Island countries have to pursue a agricultural sector led growth. These countries are at the cross roads, struggling to achieve rapid growth amid challenges from both the domestic and the external fronts. The challenges need to be transformed into opportunities and to do so, major reforms needs to be implemented. For these reforms to deliver the ultimate objective, certain fundamental prerequisites needs to be in place.

These fundamentals include well-defined property rights, political stability, good governance of public sector resources, macroeconomic stability and confidence in the country. At the moment, all these requirements are lacking. Some governments have launched reforms to change the economy into a more market oriented one. Unless the countries are adequately prepared to meet the challenges of a free market, growth will not be promoted, and unemployment and poverty could increase. In addition, the economy will become more vulnerable financially to external shocks. Therefore, the long-term strategy to make an economy more resilient is to ensure that the fundamentals required for a market-based ideology are in place first before allowing market to allocate resources.

PICs also have to examine ways in which it could partner with larger countries both within the region and outside the region to gain access to capital and technology to assist them in harvesting their resources. The Pacific Island Forum could assist them in accessing the funds and also provide a framework for forming partnership in resource extraction, production and export. In this day and age, working in partnership with countries of similar interest will allow for the pooling of resources, ideas and skills which could alleviate some of the major constraints. Such pooling which would create supply will also create demand, much larger than what would have been for a single country. So the longer term strategy for PICs would be to forge not only agreements in trading, but also in production and resource extraction.

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## Appendix 1 Value of Primary Commodity Exports from Pacific Island Countries.

Country	1986-90	1991-95	1996-00	2001-02
<b><i>Cook Island (NZ\$,000)</i></b>				
2. Fruit - fresh and canned	1213.5	851.0	368.8	133.4
3. Copra	87.4	1.3	0.0	0.0
4. Pearls	1607.2	2789.7	4310.9	6799.5
<b><i>Fiji (F\$m)</i></b>				
1. Sugar	109726.9	135795.1	142522.8	129214.7
2. Gold	36501.5	33396.8	42770.2	46231.8
3. Molasses	5209.8	6730.0	7625.3	6189.4
4. Coconut oil	2352.0	2194.5	3812.3	2345.4
6. Fish	20987.5	28147.7	34676.1	53229.1
<b><i>FSM (US\$'000)</i></b>				
1. Trochus shells/meat	420.0	294.4	115.0	
2. Copra	393.2	239.25	58.0	
3. Fish	595.8	32170.2	4815.0	
4. Banana	68.6	404.4	55.0	
<b><i>Kiribati (AUS\$,000)</i></b>				
1. Copra	1292.1	2732.7	3362.1	
2. Fish	1107.4	239.7	268.7	
3. Seaweed	159.3	235.3	596.3	
4. Shark fins	18.1	156.6	146.9	
<b><i>Marshalls (US\$,000)</i></b>				
1. Crude coconut oil	1439.6	1954.8	1947.0	
2. Chilled and frozen fish	226.8	9712	13169.0	
3. Pet fish	78.75	444.2	294.0	
4. Copra cake	73.0	131.8	789.0	
5. Handicraft	15.0	10.4	4.0	
6. Trochus shells	235.0	70.4	188.0	
<b><i>PNG (US\$,m)</i></b>				
1. Copper	315.8	403.0	442.0	929.0
2. Gold	387.4	727.4	1243.0	2281.0
3. Coffee beans	140.2	131.3	341.0	220.0
4. Forest products	92	318.3	332.0	316.0
5. Cocoa	46.6	35.3	78.0	159.0
6. Crude petroleum		662.4	1209.0	1660.0
7. Palm oil	31.22	83.12	261.0	352.0

Appendix 1 Value of Primary Commodity Exports from Pacific Island Countries (cont..).

Country	1986-90	1991-95	1996-00	2001-02
<b><i>Samoa (WST,000)</i></b>				
1. Banana	14	99.7	218.9	81.75
3. Cocoa	971.2	3.0	0	0
4. Coconut cream	2047	2294.0	2137.0	1735.0
5. Copra	742.2	562.75	2484.7	390.0
6. Fresh fish	0	125.0	9743.0	16257.5
8. Taro	2396.4	2140.3	145.8	453.5
9. Timber	222.8	43.4	100.6	6.0
<b><i>Solomons (US\$m)</i></b>				
1. Cocoa	8546.6	14174.6	25234.0	16132.0
2. Copra	12754.6	20563.6	31718.0	1325.0
3. Fish (fresh, frozen, smoked and canned)	62333.2	104366.6	146793	54044
4. Palm oil and kernels	12203.8	38901.6	58745	119
5. Timber	40215.8	182377.2	269446	222303
<b><i>Tonga (US\$m)</i></b>				
1. Squash	3410.5	10251.5	6274.0	3000.0
2. Fish	1087.0	2494.0	3468.0	250.0
3. Banana	736.6	265.0		
4. Coconut oil	1195.4	325.0		
5. Desiccated coconut	419.5			
6. Vanilla beans	1825.4	2628.6	632.0	150.0
<b><i>Tuvalu (US\$m)</i></b>				
2. Copra	34.2	15.0	4.0	
3. Handicrafts	4.8			
<b><i>Vanuatu (V\$m)</i></b>				
1. Beef	254.8	402.4	391.0	217.0
2. Cocoa	188.4	185.8	175.0	104.0
3. Copra	682.2	811.4	1486.0	249.0
4. Timber	134.4	210.8	434.0	266.0

Source: ADB Statistics, 2004.

## Deep-sea Mineral Potential in the South Pacific Region

### — Review of the Japan/SOPAC Deep-sea Mineral Resources Study Programme—

OKAMOTO Nobuyuki

#### Abstract

The Government of Japan and South Pacific Applied Geoscience Commission (SOPAC) have been conducting joint surveys of deep-sea mineral resources in the Exclusive Economy Zones (EEZs) of SOPAC member countries, since 1985. The various research and government institutions that have been closely involved in this long-standing programme include: the Japan International Co-operation Agency (JICA) and Japan Oil, Gas and Metals National Corporation (JOGMEC) which is the former Metal Mining Agency of Japan (MMAJ) and relevant ministries of the participating Pacific Island government.

The survey programme is on-going using research vessel Hakurei-Marun No.2 which belongs to JOGMEC.

This twenty year long, joint project initiative has been extremely successful in confirming the resource potential of the Pacific region through discovering valuable deep-sea mineral deposits such as manganese nodules in the Cook Islands waters, cobalt-rich manganese crusts in the Marshall Islands, Kiribati and Federated States of Micronesia, and polymetallic massive sulfides in the Fiji waters.

**Key words:** cobalt-rich manganese crust, deep-sea mineral resources, manganese nodule, hydrothermal deposit

#### Introduction

Pacific Island countries consist of many small islands scattered over vast areas of ocean space (Fig.1). Therefore the ocean resources that occur within their exclusive economic zones (EEZs) are and will continue to be critical importance for the sustainable development of these countries' economies, due to the paucity of available land and related resources.

Aside from the richness of the living resources base, such as the oceanic and coastal fisheries, of the Pacific Islands Ocean Region, it is believed that non-living resources, such as the deep-sea mineral resources of manganese nodules, cobalt-rich manganese crusts and hydrothermal

deposits (polymetallic massive sulfides), will become importance to the economies of these large ocean islands countries when deep-sea mining of sites for possible marine mining among the so-called “Seven Seas”. The results of current investigation on deep-sea mineral resources indicate that a significant proportion of the world’s known deep-sea mineral resources occurring in the Pacific Ocean.

Although the numerous marine scientific researches were/are conducted by the Japan, France, Germany, Korea and Australia in the South Pacific Region, continuous survey programme to assess the marine mineral potential in the South Pacific Region is only the Japan/SOPAC Co-operative Deep-sea Mineral Resources Study Programme.

The mineral potential in the South Pacific Region will be summarized through the results of the survey cruises as well as the outline of the Programme.



Fig.1 South Pacific Region Maritime Limits

### Japan/SOPAC Deep-sea Mineral Resources Study Programme

The Government of Japan and South Pacific Applied Geoscience Commission (SOPAC) have been conducting joint surveys of deep-sea mineral resources in the EEZs of SOPAC member countries since 1985 (Table 1). The various research and government institutions that have been closely involved in this long-standing programme include: the Japan International Co-operation Agency (JICA), the Japan Oil, Gas and Metals National Corporation (JOGMEC) which is the former Metal Mining Agency of Japan (MMAJ), and relevant ministries of the participating Pacific Island government.

The first stage of this programme comprised three five-year phases, with surveys conducted

within the EEZs of the following eleven SOPAC member countries; Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu. The primary objective of the first stage was to conduct a preliminary assessment of the deep-sea mineral potential of these eleven countries.

The second stage of the programme commenced in the year 2000 with the phase 1 completed in 2002 fiscal year. The focus of the second stage has been to conduct surveys within the EEZs of Cook Islands, Fiji and Marshall Islands to further evaluate the resource potential of marine mineral in the more prospective areas identified during the first stage. Also, since 2000, the programme has started to acquire environment baseline data for use in environmental assessments when marine mining activities commence. The phase 2 of the second stage of the programme started in 2003. The phase will concentrate its survey efforts in the EEZs of Kiribati, Niue, Fiji and FSM.

Table 1 Areas and mineral resources surveyed within the selected SOPAC Member Countries

Stage	Phase	Year	SOPAC Country	Area Surveyed	Mineral Resource
I	1	1985	Cook Islands	North Penrhyn Basin	Manganese Nodules
		1986	Cook Islands	South Penrhyn Basin	Manganese Nodules
		1987	Kiribati	Phoenix Islands Group	Nodules and Crusts
		1988	Tuvalu	Ellice Islands and Ellice Basin	Nodules and Crusts
		1989	Kiribati	Southern Line Islands	Nodules and Crusts
	2	1990	Cook Islands	Southern Cook Islands	Manganese Nodules
			Samoa	Samoa Islands	Nodules and Crusts
		1991	Kiribati	Gilbert Islands Group	Nodules and Crusts
		1992	Papua New Guinea	Manus Basin	Hydrothermal Deposits
		1993	Solomon Islands	Woodlark Basin	Hydrothermal Deposits
		1994	Vanuatu	Coriolis Trough	Hydrothermal Deposits
	3	1995	Tonga	Tonga Rides East Lau Basin	Hydrothermal Deposits
		1996	Marshall Islands	Northern part	Cobalt-rich Crusts
		1997	FSM	Whole area	Cobalt-rich Crusts
		1998	Marshall Islands	Southern part	Cobalt-rich Crusts
		FSM	Whole area		
	1999	Fiji	North Fiji Basin	Hydrothermal Deposits	
II	1	2000	Cook Islands	South Penrhyn Basin	Manganese Nodules
		2001	Fiji	North Fiji Basin	Hydrothermal Deposits
		2002	Marshall Islands	Northern and southern part	Cobalt-rich Crusts
	2	2003	Kiribati	Gilbert Islands Group	Cobalt-rich Crusts
			Niue	Whole area	Manganese Nodules
		2004	Fiji	North Fiji Basin	Hydrothermal Deposits
	2005	FSM	Whole area	Cobalt-rich Crusts	

### Survey and Sampling Platform Tools

The programme has been conducting using research vessel *Hakurei-Maru No.2* (Fig.2). It is owned and operated by JOGMEC and is designed specifically for deep-sea mineral resources prospecting. The vessel is equipped with a full range of specialized survey devices (Fig.3) and uses the Benthic Multi-coring System (BMS), a state-of-the-art drilling machine, to recover up to 20m long cores (Fig.4).



Fig.2 Research Vessel *Hakurei-Maru No.2*

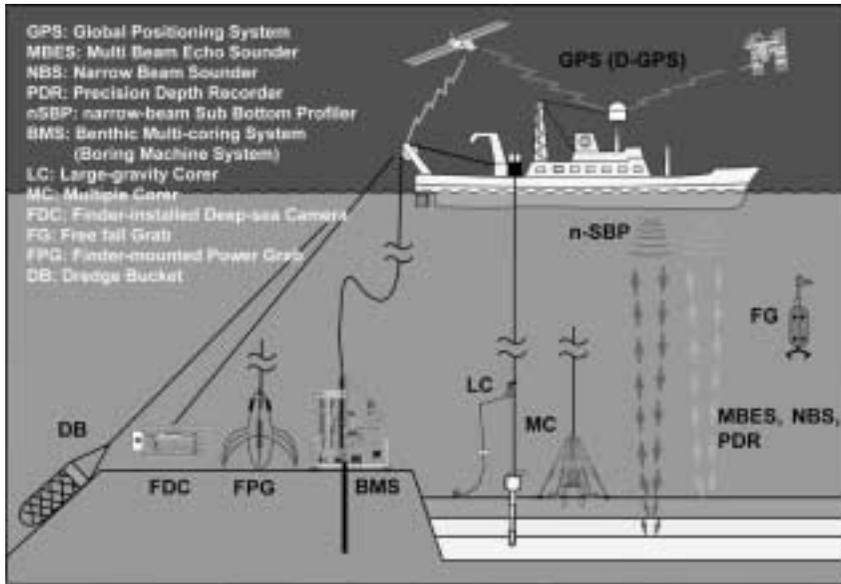


Fig.3 Survey and Sampling Platform Tools of the *Hakurei-Maru No.2*



Fig.4 Benthic Multi-coring System

## Deep-sea Mineral Potential in the SOPAC Region confirmed by the Programme

### *Manganese Nodules*

Nodules are small, very dark, “potato-like” balls of metals (Nickel, Copper, Cobalt, Manganese and Iron) and other minerals that have accreted around a central core, over millions of years. They vary in size and generally have a diameter of between 2 and 15cm. Nodules are most abundant on area of the seafloor with low sedimentation rate. Therefore they tend to occur far from major continental landmasses such as in the mid-Pacific Ocean. The nodule fields that have been discovered areas of the seafloor, in water depths of between 4,000 and 6,000m.

During the programme, the survey to assess the potential of manganese nodules of the programme were conducted in the EEZs of the four SOPAC member countries; Cook Islands, Kiribati, Tuvalu and Samoa.

Sampling using free-fall grab, spade corer and/or the large diameter gravity corer were conducted to confirm the distribution of manganese nodules in the EEZs of the selected four SOPAC member countries.

Based on these survey results, promising area was selected at the central area within the EEZ of the Cook Islands (Fig.5).

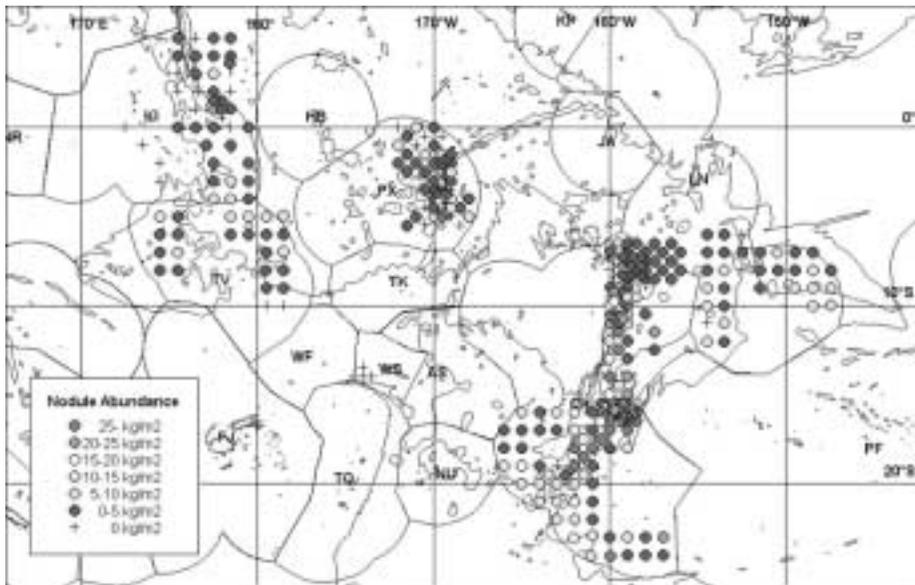


Fig.5 Manganese nodule abundance in the four SOPAC member countries

The survey revealed that the central area of the EEZ of the Cook Islands has the highest concentration of manganese nodules, with an abundance of over 25kg/m<sup>2</sup> covering approximately 7,000km<sup>2</sup> of the area (Fig.6). Seafloor photo is shown in Fig7.

Using the method of polygons developed by Kohpina and Usui (1996), the resource in the selected area is estimated to be about 55,000 metric tones of manganese nodules and 288,000 metric tones of cobalt (Table2).

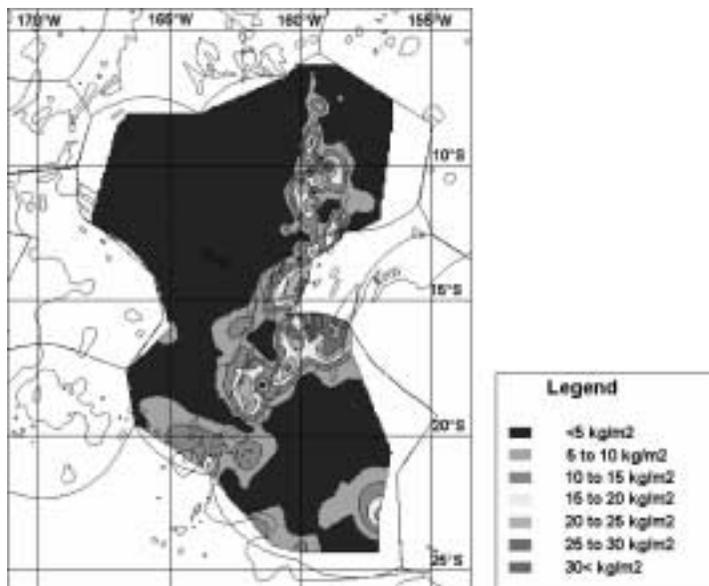


Fig.6 Distribution of Manganese Nodules in the Cook Waters

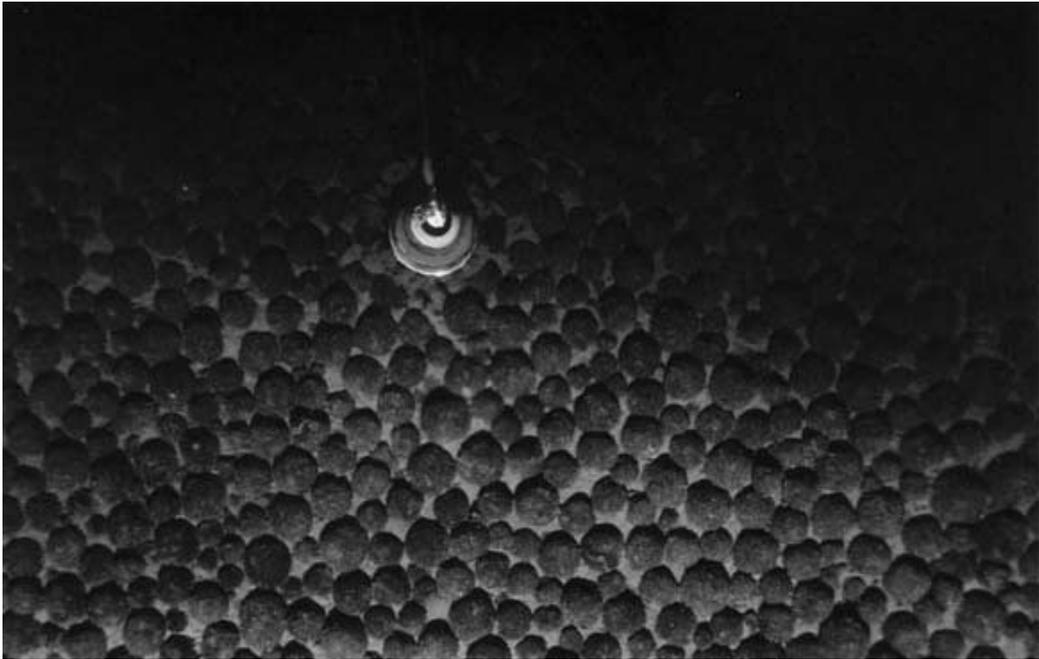


Fig.7 Seafloor Photo taken at around Central Area of the EEZ of the Cook Islands

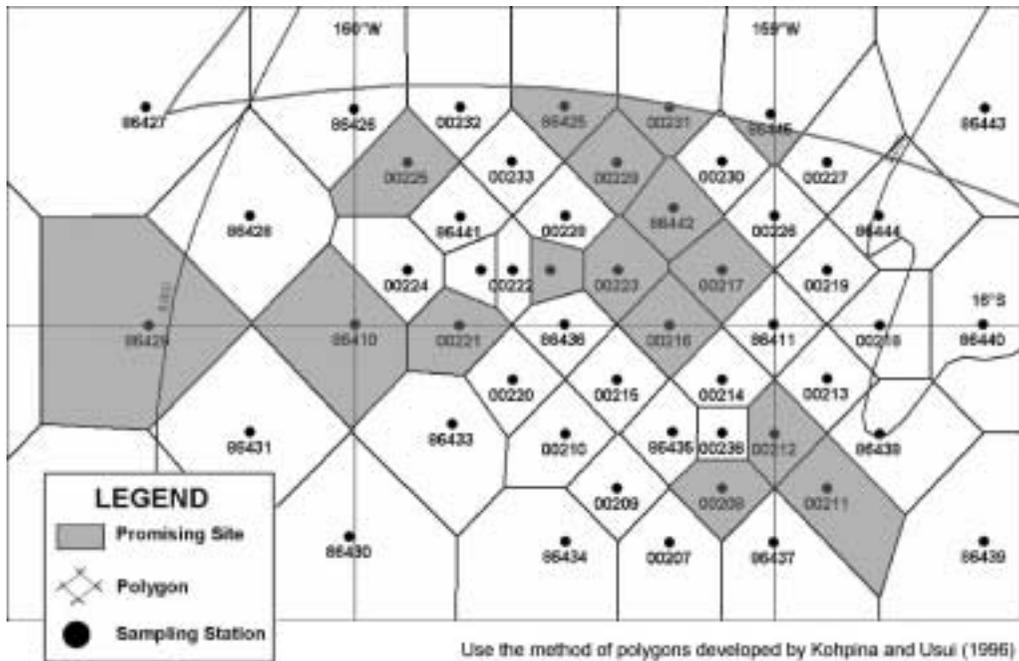


Fig.8 Resource Estimates of Manganese Nodules within the Central Area of the EEZ of the Cook Islands, using the Method of Polygons Developed by Kohpina and Usui in 1996.

Table 2 Nodule and cobalt resources in Area 1 located within the EEZ of the Cook Islands.

Station No.	Abundance (kg/m <sup>2</sup> )	Water Content (%)	Co Grade (%)	Area (km <sup>2</sup> )	Nodule Resources (thousand metric ton)	Cobalt Resources (metric ton)
86410	33.09	31.10	0.49	1,031	23,506	115,178
86425	34.57	28.60	0.48	304	7,504	36,017
86429	31.00	31.50	0.56	2,177	46,229	258,880
86442	31.54	30.50	0.55	369	8,089	44,487
86445	32.93	26.40	0.51	99	2,399	12,237
00208	31.18	22.20	0.50	325	7,884	39,419
00211	32.39	27.93	0.54	651	15,197	82,062
00212	31.14	23.73	0.55	325	7,719	42,454
00216	34.81	29.96	0.53	373	9,094	48,199
00217	32.16	25.99	0.46	378	8,997	41,386
00221	36.66	23.37	0.46	403	11,321	52,078
00223	33.08	30.33	0.58	368	8,481	49,191
00225	30.44	22.94	0.46	522	12,245	56,325
00229	32.96	27.52	0.52	369	8,815	45,839
00231	32.93	24.91	0.51	205	5,069	25,852
00234	30.63	33.63	0.44	185	3,761	16,548
Total				8,084	186,309	966,153

**Cobalt-rich Manganese Crusts**

Cobalt-rich manganese crusts occur largely on the flanks of volcanic islands, on submerged seamounts and on ridges and are recognized as a potential mineral resource reservoir for cobalt, in the future. The richest cobalt deposits of up to one percent cobalt generally lie in water depths of between 800 and 2,500m. Assessments suggest that crusts range from 2 to 15cm in thickness, however, crusts as thick as 20cm have also been found.

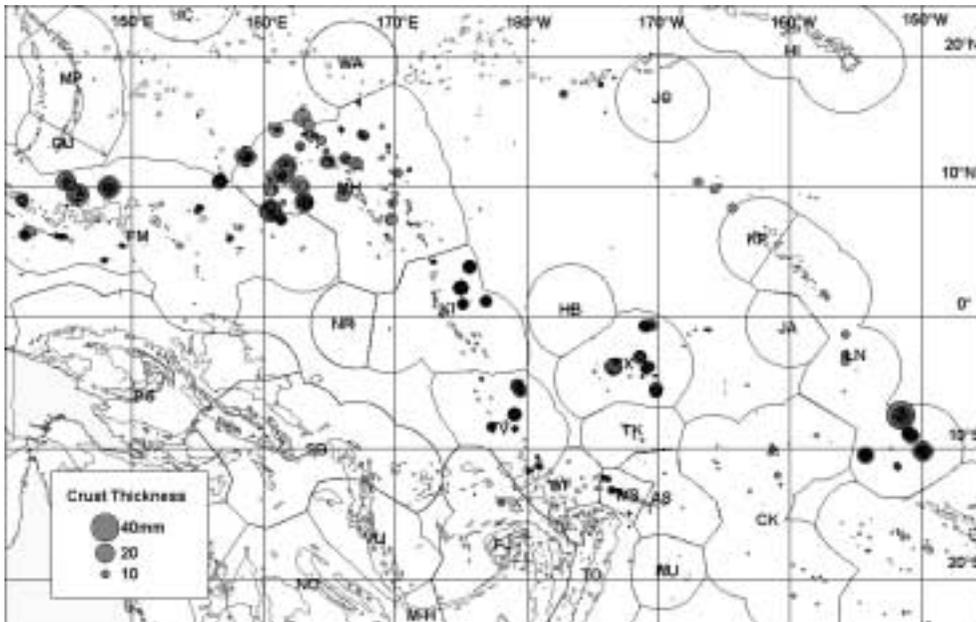


Fig.8 Cobalt-rich crust thickness in SOPAC region studied by the present Programme

The surveys to assess the potential of cobalt-rich manganese crusts were conducted in the EEZs of the five SOPAC member countries; Kiribati, Tuvalu, Samoa, Marshall Islands and Federated States of Micronesia (Fig.8)

The surveys found thick crusts that were well developed in the western part of the EEZ of the Marshall Islands and at some seamounts within the EEZs of the Federated States of Micronesia and the Line Islands of Kiribati. Several seamounts in the Marshall Islands warrant further investigation, based on their metal contents and the areas of manganese crust coverage.

### *Hydrothermal Deposits (Polymetallic massive sulfides)*

The surveys to assess the potential of hydrothermal deposits were conducted in the EEZs of the five SOPAC member countries; Fiji, Papua New Guinea, Solomon Islands, Tonga and Vanuatu.

The 2001 cruise of the programme was conducted around the triple junction in the North Fiji Basin. The area had showed significant hydrothermal activities such as chimneys and mounds during the 1999 cruise of the programme.

Of the twenty-two sampling stations drilled using the Benthic Multi-coring System (BMS), polymetallic massive sulfides were recovered from eight of the twenty-two cores. This is the first time that the third dimension of a polymetallic massive sulfide deposits have been established in the North Fiji Basin, as well as in the Pacific region.

Polymetallic massive sulfides of up to 7m thick were confirmed from one of the cores drilled (Fig.9). Assay results of fragments of chimney and sulfides ore formed on the surface of the mound showed samples to be Zn-Au-Ag rich, with Cu4.04%, Zn3.17%, Au1.83g/t and Ag71.20g/t. Cu-rich massive sulfides formed in the core of the mound showed Cu6.93%,

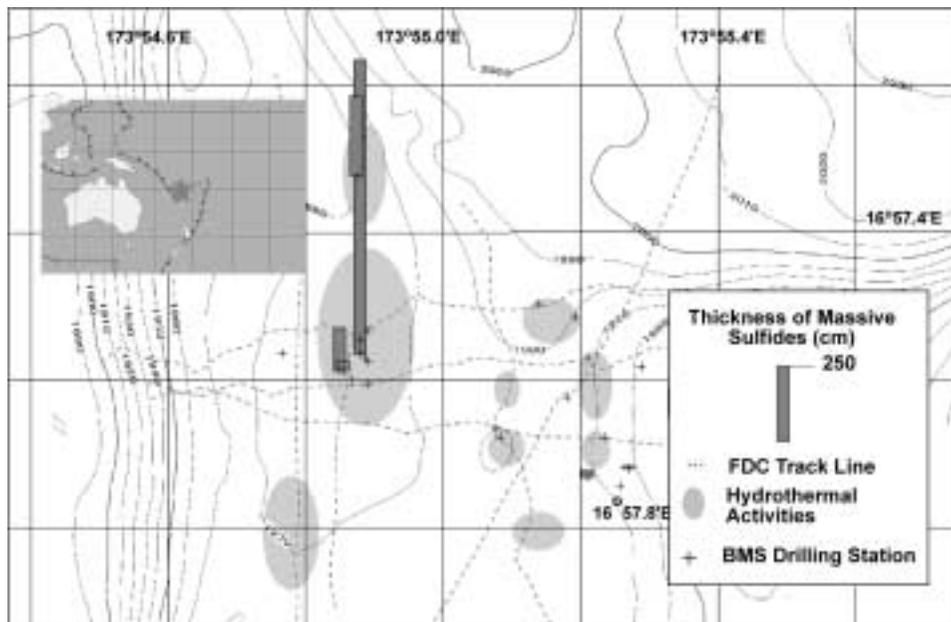


Fig.9 Distribution of the vertical dimension of massive sulfides around the Triple Junction in the Fiji EEZ

Zn0.61%, Au0.85% and Ag24.39%. Consequently, the inferred resource of a mound with lateral dimensions of 100m by 30m and vertical thickness of 7m was estimated to be 73,500t at the grade of Cu6.93%, Zn0.61%, Au0.85% and Ag24.39%. Although the scale of the mound (ore body) may be small in comparison to its on-land analogues, the Cu grade is considerably higher. The observation using deep-sea towed TV camera suggests that there are at least seven mounds within the vicinity of the mound that was sampled. It is proffered that through more detailed surveying within the area, further massive sulfide occurrences may be elucidated.

In addition to sampling using the BMS, an environmental baseline survey was also conducted within the survey site area. It is envisaged that this will be used in future environmental assessments in the event of marine mining. The environmental baseline surveys collected samples of water and sediments.

## Conclusion

The survey cruises during the programme have identified numerous sites with potential marine mineral resources such as manganese nodules in the Cook waters, cobalt-rich manganese nodules in the Marshall Islands, FSM and Kiribati waters, and hydrothermal deposits in the Fiji waters. South Pacific countries consist of many small islands. These countries have limited land resources but have huge and rich EEZ (Exclusive Economic Zone) waters. Their EEZ are rich in not only living resources but also deep-sea mineral resources. The deep-sea mineral resources have a large economic potential. It is very important for the South Pacific nations to study their offshore mineral resources.

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## Palau: Reflections of a Volunteer Entomologist

TAKAHASHI Keichi

### Abstract

This report examines the issues related to agricultural production in Palau and attempts to provide a realistic assessment of the many problems which are limiting production and how these problems can be overcome.

All agricultural production in Palau is for the local market and almost none of the farm production is exported except minor ones. The staple food in Palau is taro. The soil of Babeldaob Island, on which there are many farms, is very acid and lacking in nutrients. Soil improvement is necessary to sustain agricultural production. Many insect pests, diseases and weeds have been introduced into Palau and these have a negative impact on agriculture. This invasion is accelerating with the increased importation of products and the movement of people to and from the islands. Measures to prevent the arrival of insects, diseases and weeds are ineffectual and the control of them once established is very difficult. The diet is rapidly Americanizing and in the supermarket of Koror there are many farm products and canned foods imported from the USA and other countries. The change in diet along with a change from rural to urban lifestyle is resulting in serious health problems including obesity and diabetes.

Many of the projects aimed at enhancing agriculture as well as other aspects of the economy and lifestyle of Palau have been poorly conceived and have been of limited success or have failed to achieve their aims. The predicted value of projects and the investment required to fund them has frequently been poorly estimated. This major shortcoming needs to be addressed to ensure that future projects will contribute to enhancing agricultural production in Palau.

**Key words:** Palau, agriculture

## Geography

### 1. Location

The Republic of Palau is located in the North Pacific Ocean, south west of Philippines, north latitude 2° to 8° and east longitude 131° to 135°. The total area is 488 km<sup>2</sup>. Palau belongs to the tropical maritime climate. The average temperature and humidity is 27.9°C and 82 %, while the average total rain fall is 3,784 mm. Palau has more than 350 islands of which Babeldaob Island is the biggest.

The Palau Islands arose on the circum-Pacific volcanic belt, where the Pacific plate slips

under the Philippines plate. Although many of the islands are of volcanic origin there are no active volcanoes in Palau. The soil of Babeldaob Island, which has many field crops, is very acid. There are also many rocky coral islands. The islands of Palau are oceanic and have never been connected to continents or big islands, a feature they have in common with the Galapagos and Bonin Islands.

## 2. Fauna and flora of Palau

The fauna and flora of Oceanic islands have several features in common: adaptive radiation (the evolution of an ancestral species into many diverse species, each adapted to a different habitat), founder effects (many species have a narrow gene pool having arisen from just a few ancestral members) as well as a bottle neck effect (the population has experienced a nearly extinction in the past). There are many closely related species, each of which is confined to just one or a small number of the Palau Islands. The ecosystems of the islands are very fragile and many of the endemic species are endangered.

The fauna and flora of Palau has arisen following migration to the islands. This migration followed by reproductive isolation and adaptation has resulted in a very high number of endemic species.

Sea currents have played an important role in this migration. There are two currents that have an impact on Palau; the North Equatorial Current from east to west in the north of Palau, and the Equatorial Countercurrent from west to east in the south of Palau. Most of the ancestral species came from the Philippines and PNG with the Equatorial Countercurrent. An important plant species that arrived by being carried with ocean currents was the coconut palm.

Another method of migration has been by flying. Some of the plant species will have arrived by this method, being carried by birds. In recent times however, the arrival of humans has played a huge role in the development of the fauna and flora. All the many species of mammals present on Palau, with the exception of some bats, were brought by humans. Most of the many insect pests, diseases and weeds have arrived through the movement of people. The number of pests, diseases and weeds is rapidly increasing with the increase of transportation arriving in the country.

## 3. Terrestrial fauna

The biggest group of the terrestrial fauna is insects. Some 700-900 species of insects are present in Palau, a low number compared with that present on continental islands. The main order of the insects of Palau is Coleoptera with around 350 species being recognized. The Palau Islands are rich with members of the Curculionidae which spread to these islands in logs carried by currents. There are 3 species of snakes and 10 species of lizards in Palau. Only one of these reptiles is endemic, the lizard *Gehyra brevipalmata*. The presence of an endemic frog, *Platymantis pelewensis*, in Palau is of particular interest as endemic frogs are rare on oceanic islands. Many mammals are established in Palau, including rats, cats and dogs where once mammals were represented only by bats.

#### 4. Oceanic life

Although there are many species in the ocean, especially in coral reefs, the number of endemic species is low as is the concentration of marine life.

### A short history of Palau

The Mongolian ancestors of the indigenous Palauan people came from Indonesia around 1000 BC. They arrived in outrigger canoes along with taro, dogs, pigs, chickens and earthenware utensils. The natural environment suffered severe damage following the arrival of man. Bird populations were severely reduced. Slash-and-burn farming along with tree felling reduced the forest cover resulting in the inland regions of large islands becoming barren. The soil that had covered the surface of the cleared areas moved down to the lowlands, which then became productive for taro cultivation. Over time, many plant and animal species were introduced into Palau. Contact with the western world began with the arrival of Captain Draig in 1579, and trade between western countries and Palau started in the late 18th century.

In the late 19th Century Palau became ruled by a succession of foreign powers. From 1885 to 1899 Palau was under Spanish rule. Missionaries during this time converted much of the population to Christianity. In 1899 Palau passed in the control of Germany following being sold by Spain. Mining of phosphate ore began on Angaur Island in 1909. The phosphate ore was the main export from Palau until the end of the First World War. In 1914 to the end of the Second World War Palau was under Japan rule. The central government office of the Japanese south pacific territory was in Koror. Many industries were encouraged and the Palauan people received a Japanese style education. Many Japanese moved to Palau during this period and comprised three times the population of the indigenous Palauan people. The Japanese were employed in the mining of phosphate and bauxite ore, agriculture and fishery.

The end of the Second World War saw Palau move under the rule of the USA. The USA government strengthened the education and medical systems. However, during this period little was done to strengthen the local economy, develop self sufficiency and move the economy away from a hand-out dependency. On October 1, 1994, Palau became a constitutional government in free association with the USA. The development of Babeldaob Island, funded by USA aid, commenced followed the arrival of self government.

### Politics

Palau has a presidential constitutional government in free association with the USA. There are no political parties. The president and the deputy president are elected by direct election. The Parliament consists of the Senate (nine members) and the House of Delegates (sixteen seats). There are eight ministries. The tribal chiefs still have big powers. There are sixteen states in Palau and they have their own governors, state constitutions and state legislatures. There are no regular military forces, the defense of Palau being the responsibility of the USA.

There is a large Government administration. This has been possible by the size of the grants from the USA, but with the size of the grants now reducing, there is a problem with the funding

of this large infrastructure. As many government agencies are involved with policy development and administration, this can result in problems relating to decision making.

## Society

The population of Palau is around 20,000 of which approximately one third are foreigners. Many of these are Filipino, Chinese and Bangladeshi. Eighty percent of the population lives in the Koror State and the surrounding district. The average life expectancy of men is 64 years old and 67 years for women. Eighty percent of the total population is Christian. Palau has a matriarchal society and the mutual aid system provided within families is strong. The chieftain system is still strong and has much authority.

Education, based on the US 8-4 system, is compulsory for twelve years. There is a community college but the students who wish to attend university have to go abroad. The health system is established around health clinics in rural districts, with a national and a private hospital in Koror. There are three newspaper publishing companies, a radio station and a TV station. The official languages are Palauan and English, except in the south west islands where the languages are Sonsoralese, Tobi and English.

The proportion of the population engaged in farming is decreasing. People are leaving the rural areas and the traditional way of life and have moved into an urban life style. This change in life style is contributing to many social problems present in Palau. There is an increasing gap in the income of people, with the gap between people in Koror and in the rural areas being large. Many homes have Filipino room maids. The use of drugs is a problem and there are many people with an addiction problem. There is a custom to chew beetle nuts and also tobacco. Marijuana use is widespread.

Due to a move away from traditional to American type food much of the population is overweight and many are obese. Lifestyle related diseases such as diabetes have become a serious problem.

## Economy

The economy of Palau is based around tourism, subsistence agriculture and fishing. At present production of primary products plays a small part in the economy and although copra was exported during the period of Japanese rule, there are now almost no exports of farm or horticultural products from Palau except minor ones. Mining and other land based industries largely ceased following the end of the Second World War. Forestry plays little part in the economy, although it does supply some wood for housing. Fishing is an earner of foreign currency mainly from the sale of concessions to foreign countries to fish, mainly for tuna, in territorial waters. The manufacture of goods is of small scale and consumer goods including most foods are imported.

The country receives much aid, a large part from the USA and Taiwan. A contributing factor for the supplying of aid money to Palau appears to be the bargaining power it has by having a vote in the United Nations. The aid money that Palau receives is an important source of

revenue. However, the financial aid that Palau receives from the USA is due to end in 2009. Japan has also contributed much aid and outcomes of this are a major bridge, an airport and the electricity network. Palau has resisted the temptation to raise money by selling off assets and foreign companies and people are prevented from buying land and property.

The principal energy source in Palau is imported petroleum fuel. This is a big cost to the economy as now most families in Koror have cars and there are also families that have boats.

In recent years the economy has become increasingly dependant on experienced Filipino workers including in the professions. However, policies in place give indigenous Palauans economic advantages and a high proportion of the officials are Palauan.

In rural areas the lifestyle is still traditional but increasingly in Palau people are moving to the capital Koror and the gap in the lifestyle and living standards of people is rapidly widening. In the statistics of 2000, the average annual earnings per family is 12,845 US dollars. The annual income per resident is 3,726 dollars. The unemployment rate is 2.3 %. Many people, 27.7 %, are employed as officials in government positions.

## Agriculture

### 1. Overview

Taro has been the staple food and is grown in all regions of Palau. The cultivation of cassava (tapioca) and cooking bananas is also common. Mango, star fruit and mountain apple are planted around houses for the occupants' own consumption. Around Koror are farms producing crops for small local markets. Almost none of the products grown in Palau are exported. The soil of Babeldaob Island, the location of many farms, is very acid and is lacking in nutrients. The application of lime and fertilizer is essential to overcome the soil acidity and nutrient deficiencies.

### 2. Insect pests, diseases and weeds

There are few endemic insect pests on Oceanic islands. With the frequent arrival of ships and planes now occurring many insect pests including the fruit fly *Bactrocera philippinensis*, have become established in Palau. With few exceptions, such as a scale insect that has effective natural enemies, control of the introduced insects is difficult. Once a new pest reaches Palau it is very difficult to control. The spread of pest insects, diseases and weeds usually starts on Koror State, the site of an international port. Quarantine measures are poorly funded and have not been effective in stopping the arrival and spread of these threats to agricultural production and which also can harm native fauna and flora.

### 3. Change of diet

Many farm products and canned foods imported from the USA and other countries are now widely consumed, resulting in a rapidly Americanizing diet. Much of the population is overweight and many are obese. Lifestyle related diseases such as diabetes have become a serious problem.

Much of the food consumed in Palau is now imported with the supermarket in Koror selling

farm products including canned food obtained from the USA and other countries. The diet is Americanizing and adult diet-related diseases are becoming a big problem.

#### **4. Structure of the agricultural bureaucracy**

The Bureau of Agriculture of Palau consists of four sections: forestry, quarantine, horticulture and livestock. Around twenty officers work in this Bureau. The budget is largely spent on staff salaries and money is frequently not available for the purchase of essentials such as fuel or the delivery of mail.

### **The future outlook**

#### **1. Environment**

In their efforts to survive on the islands of Palau, people cleared the original forests and so now, with the exception of some small rocky islands, all of the forest is secondary modified growth. The term natural habitat now refers to what has regenerated after the destruction caused by the early settlers. Thus, any sense of belonging of the people with the native flora and fauna of the Islands has been lost. There is now almost no consideration given to the preservation of the endemic land fauna and flora of Palau, unlike what happens in the Galapagos and Bonin Islands. Environmental concerns have received a low priority in the budgets. An example of this is the big problem now being caused by the disposal of waste including sewerage.

With rapid development set to continue there is an urgent need for scientific surveys to monitor the effects that the developments will have on the environment. It is certain that extinction of some of the endemic fauna and flora will continue in Palau. However, measures to preserve the environment will be hard to develop and enforce as the measures will be viewed as stopping progress and which will be perceived as resulting in hardship for people.

#### **2. Problems facing Palau**

The way of life and the way of thinking is very different in Palau from developed countries. There is a sense that the tide of globalization will soon go away. The people fail to understand the severity of the problems faced by the Islands and the urgent need for action. At times fine words are spoken about the need for action but these fail to result in appropriate meaningful action. When plans that may be of benefit in overcoming environmental problems are made they invariably fail. The economic aid provided from other countries is too poorly directed to undertake effective action. Corruption is common and aid money is frequently diverted. Measures to improve the economy are not seriously considered apart from the issue of obtaining additional aid money from donor countries.

The sense of “problem” does not seem to exist in Palau. An example of this is the prevailing attitude on self-sufficiency. Rather than being seen as being dependant on aid the local people think of themselves as being self sufficient, and benefiting from aid obtained by targeted use of the UN voting right is seen as evidence of this self sufficiency. Efforts to make the administration strive to become truly self-sufficient are unlikely to succeed. Many reports and declarations are prepared, but these typically do not lead to effective action to overcome

problems.

One can get the feeling that the only problem that is perceived is how to get aid money from other countries.

A serious problem being faced relates to the projects being funded by aid schemes. Many projects including ones involving agriculture have been carried out in Palau. Most of these projects have been poorly conceived, and although perhaps well intentioned they have failed to show an understanding of the situation that prevails in this island country. For projects to succeed they need to be better planned and take a realistic view of the likelihood of a successful outcome. Unless this is done further large amounts of money will be wasted and the situation of the people will not improve. An additional outcome will be the loss of morale of those competent people sent in to work on projects that are doomed to fail and an increase of cynicism in local people and a reinforcement of the attitude of some local people that the projects are just a source of income.

The justification for aid projects being carried out in Palau can be placed into three categories. The first is those with political aims. The main aim of these projects is purely political, to show that a country is providing aid. The outcome of these projects is not important and typically there is no follow-up once a project is finished. The second aim is to enhance the economy of Palau. Due to the lack of natural resources it is difficult to plan and successfully carry out such projects. The third aim is the benevolent aim of making a difference. This includes projects run by often highly motivated and idealistic individuals or groups of people, often volunteers. Those doing these types of projects often gain much satisfaction but the real outcome is typically very poor.

## Conclusion

The problems involved in enhancing agricultural/primary production in Palau are considerable. Soil fertility is one serious issue as is the continuing establishment of many insect pests, diseases and weeds. The fragile nature of the ecosystems needs to be considered and there will be difficulties achieving a balance between maintaining the already degraded flora and fauna and enhancing economic and agricultural development. Poor planning of aid projects to overcome problems facing Palau has frequently lead to poor outcomes. Unless future aid projects are realistically reviewed and there is a change in attitude of officials as to the purpose of aid, it is unlikely that agricultural productivity can be enhanced.

## Acknowledgement

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## Biodiversity in Replanted Mangrove Forests: A Study in the Southern Viti Levu Island Mangrove Ecosystem in Fiji

KAWAI Kei

### Abstract

The biodiversity level of mollusks and environmental conditions in replanted as well as natural mangrove forests were investigated to determine the restoration level in replanted mangroves. This study was performed in 2 replanted and 2 natural mangrove forests in 2003 and 2004 in Viti Levu Island, Fiji. The ages of the trees in each replanted mangrove were 1-3 and 7 years old. The main mangrove tree species replanted in both areas was *Rhizophora stylosa*. The mangrove trees in the natural forest were between 5 m and 20 m in height. However, those in the forests replanted 1-3- and 7 years previously were from 1 m to 1.5 m and from 3 m to 4 m in height, respectively. Trees near the landside were taller than those on the seaside in all of the mangrove forests examined. Salinity in the regions of the replanted mangroves was about 3‰ but that in natural mangrove forests was from 0.2 to 3‰. The older mangrove forests had neutral pH but younger forests were alkaline. About 10 mollusks were counted in natural forests but the replanted mangrove forests contained only 2 to 3 mollusks. Each quadrat showed a different frequency of observed mollusks. *Littorina scabra* was the dominant species in the 1-3-year-old mangrove forest. *Nerita planospira* and *Littorina scabra* were the dominant species near the landside but only *Littorina scabra* were dominant near sea side in the 7-year-old replanted mangrove. Environmental conditions and biodiversity levels in replanted mangrove forests were different from those in natural mangrove forests. However, the 7-year-old mangrove forest showed a slightly higher biodiversity level than 1-3-year-old forest and environmental conditions similar to those of the natural forest.

**Key words:** biodiversity, Fiji, mollusks, replanted mangrove, Viti Levu Island

### Introduction

Biodiversity is very high in mangrove forests and coastal reefs. Mangrove forests provide protection from predators and habitat for juveniles. Accumulation of detritus and leaf material in mangroves might also provide an enhanced food source for macrofauna, e.g., detritus feeders and filter feeders. Although the mangroves provide a complex habitat that provides spaces for juveniles to escape from predators, these forests are also good environments for predators because of the presence of many small and juvenile animals. Moreover, there are many

industrially important species in these forests.

Mangroves formerly occupied about 75% of tropical coasts and inlets (Farnsworth & Ellison, 1997). However, more than 50% of the world's mangroves have been lost (World Resources Institute, 1996) due to population pressure, wood extraction, conversion to agriculture and salt production, tin mining, coastal industrialization and urbanization, and conversion to coastal aquaculture (Ong, 1995; Macintosh, 1996). These mangrove losses have resulted in a reduction in biodiversity and a decrease in the number of industrially important macrofauna.

Habitat rehabilitation has increased in importance over the last two decades and mangroves have been replanted around the world (Field, 1998). Field (1999) suggested that there are 4 main reasons for rehabilitating mangroves: conservation, landscaping, sustainable production, and coastal protection.

The dominant macrofauna in terms of number and species are the crustaceans and mollusks (Sasekumar, 1974; Jones, 1984). Although there have been several studies of mangrove fauna, little information is available regarding the effects of replanted mangroves on the faunal community.

The present study was performed to monitor the biodiversity and environmental conditions in replanted mangroves in comparison with those of natural mangrove forests.

## Materials and Methods

This study was carried out in 1 natural (Naikawaqa) and 2 replanted (Korotogo and Namboutini) mangrove forests from August to September 2003 and in 1 natural mangrove forest (Laucala Island) in February 2004 in Viti Levu Island, Republic of Fiji Islands (Fig. 1).

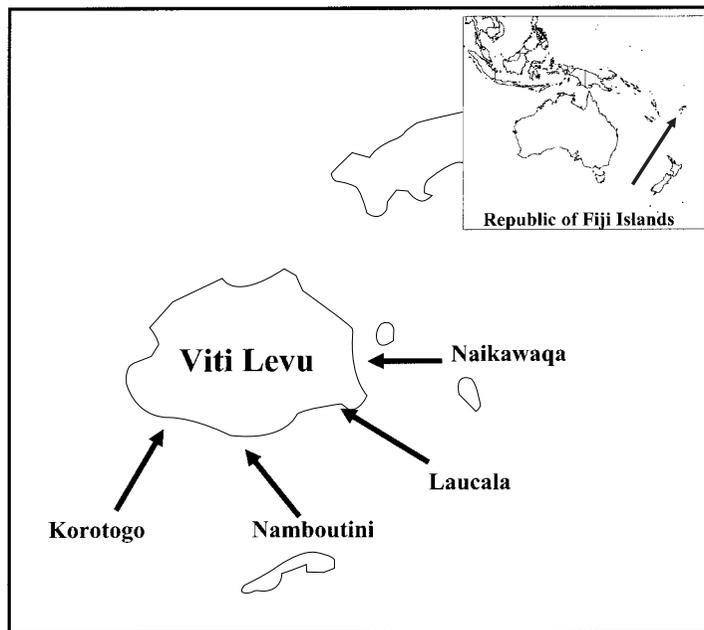


Fig. 1 Map of research area in Viti Levu Island, Fiji.

Mangrove forests in Korotogo and Namboutini were replanted in 2000-2002 and 1997, and therefore the ages of the trees were 1-3 and 7 years old, respectively. The sizes of the replanted areas from landside to seaside were about 40 x 100 m<sup>2</sup> and 100 x 50 m<sup>2</sup>, respectively. The replanted mangrove trees in both areas were mainly *Rhizophora stylosa*. Naikawanqa and Laucala Island were rural and city natural forest and the lengths from landside and seaside were 150 m and 250 m, respectively.

One line transect were placed from seaside to landside in each mangrove forest. The line transect was divided equally into 5 intervals and two 2×2 m quadrates were placed at random in each divided area. We monitored the total numbers of snails and bivalves on the trees and on the ground surface in each quadrate. Each species was recorded and the total numbers of each species were counted.

The ground was dug to a depth of 50 cm in each quadrate and the salinity and pH of the seawater exuded from the ground were measured. The heights of the mangrove trees in each quadrate were also measured.

## Results and Discussion

The heights of the highest mangrove tree in each quadrate in each mangrove forest are shown in Fig. 2. In the natural forest, the mangrove trees ranged in height from 5 m to 20 m. However,

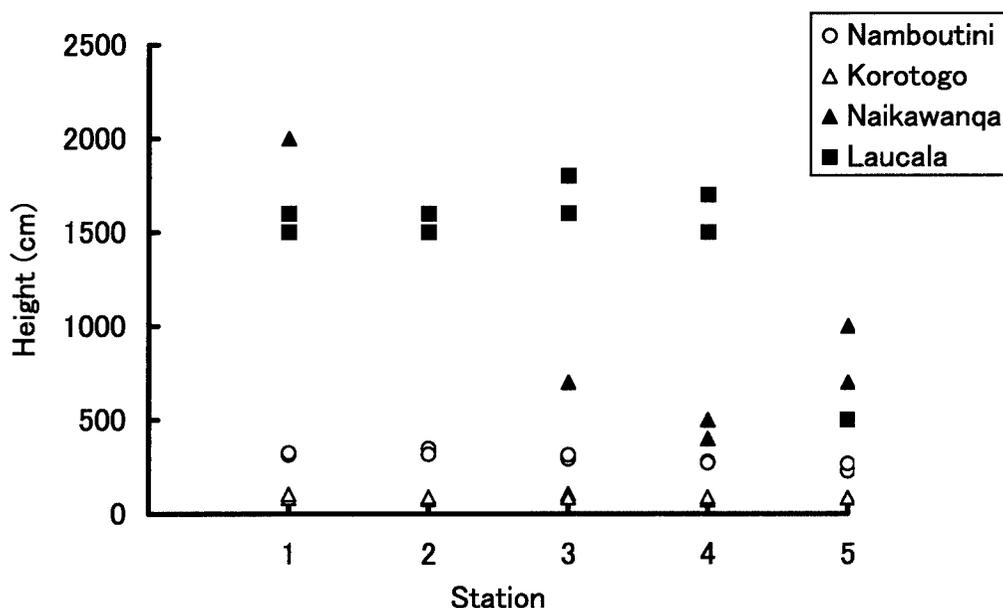


Fig. 2 Height of highest mangrove tree in each quadrate in each mangrove forest.

in the 1-3- and 7-year-old replanted mangroves the trees ranged in height from 1 m to 1.5 m and from 3 m to 4 m, respectively. Trees near the landside were taller than those on the seaside in all mangrove forests.

Both replanted mangrove forests showed salinity of about 3% continuously from seaside to

landside. However, in both natural mangrove forests the salinity decline from seaside to landside, and this trend was more marked in Naikawanqa than in Laucala Island (Fig. 3). The older mangrove forests had neutral pH, while the younger forests were alkaline (Fig. 4).

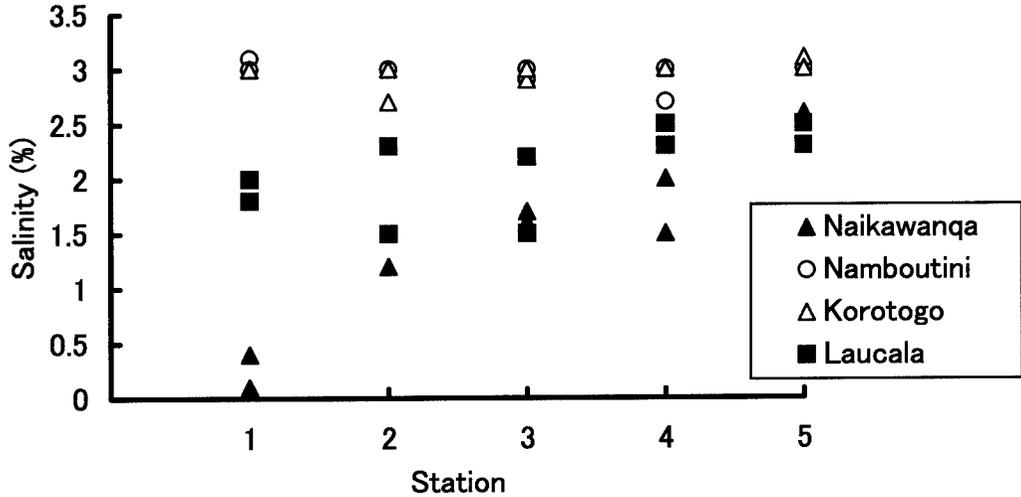


Fig. 3 Salinity level in each quadrat in each mangrove forest.

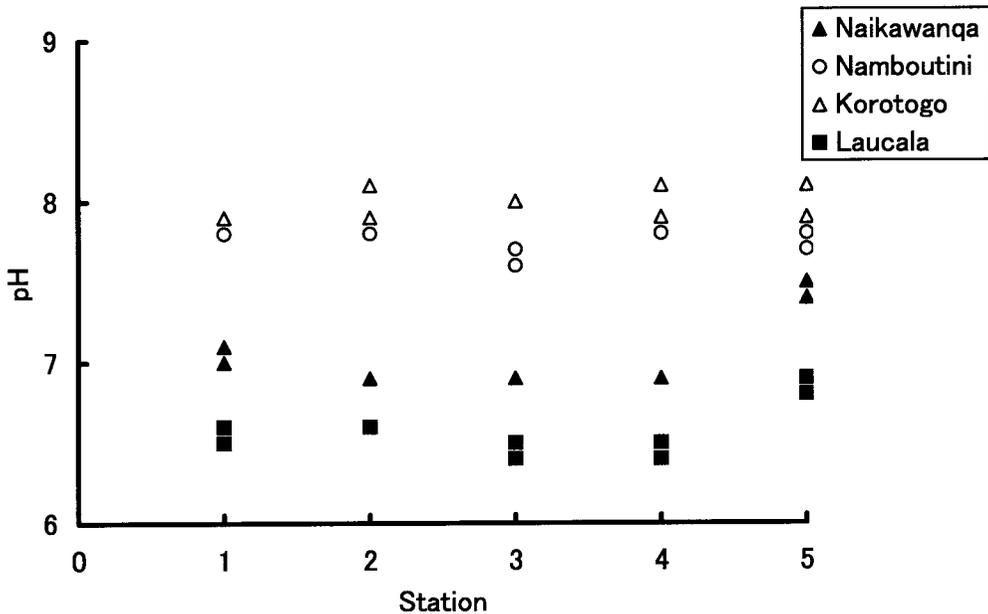


Fig. 4 pH in each quadrat in each mangrove forest.

The salinity in the 1-3-year-old replanted forest was similar to that of the 7-year-old forest. However, the latter had taller trees and lower pH than the former. These observations indicated that by 7 years after replanting the conditions had begun to return to those in the natural forest.

Ten mollusks were observed in the natural forest but only 2 to 3 were observed in the

replanted mangrove forests (Table 1).

Table 1 Observed mollusks species in each mangrove forest.

	Korotogo 1-3 year old	Namboutini 7 year old	Naikawaqa Natural	Laucala Natural
<i>Patelloida</i> sp.				○
<i>Nerita planospira</i>	○	○	○	○
<i>Nerita turrata</i>			○	
<i>Littorina scabra</i>	○	○	○	○
<i>Morulaanaxeres</i>				○
<i>Melampus</i> sp.			○	○
<i>Cassidula</i> sp.			○	○
<i>Pythia</i> sp.			○	
<i>Crassostrea mordax</i>		○	○	○
<i>Septifer virgata</i>			○	○

Each quadrat showed a different frequency of observed mollusks. *Littorina scabra* was the dominant species in the 1-3-year-old mangrove forest (Fig. 5). *Nerita planospira* and *Littorina*

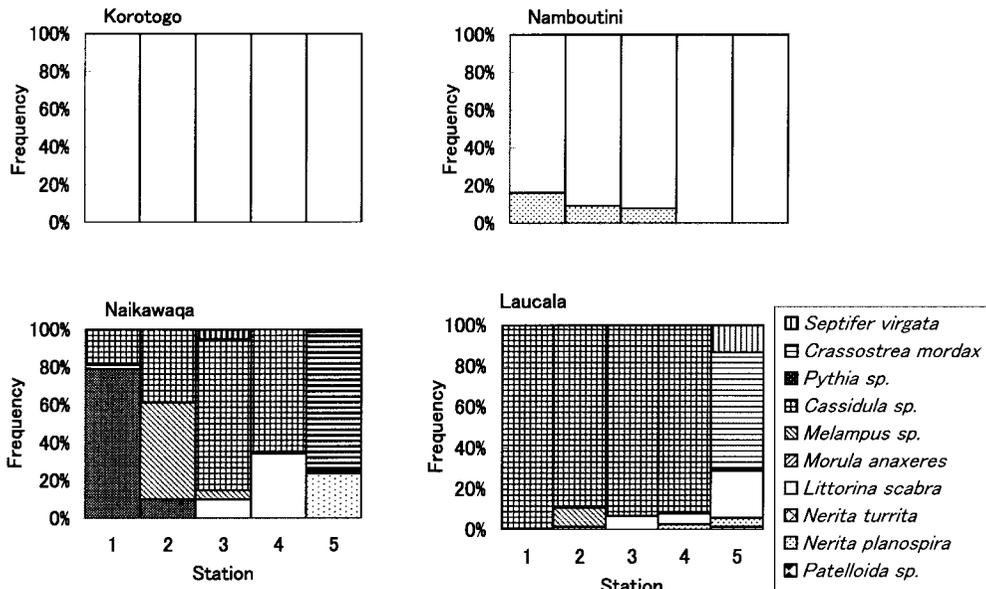


Fig. 5 Frequency of observed mollusk species in each quadrat in each mangrove forest.

*scabra* were dominant near the landside but only *Littorina scabra* was dominant near sea side in the 7-year-old replanted mangrove. *Littorina scabra* was dominant in both replanted mangroves indicating that *Littorina scabra* was the first species recruited to the newly made habitats in mangrove forests.

The animals beneath the ground were not monitored. The 7-year-old replanted mangrove showed a cline of pH beneath the ground from landside to seaside, although it was not sufficient to recover to the natural conditions. The values of dissolved oxygen, temperature, and pH were closely related to the distributions of the gastropods (Blanco and Cantera, 1999), suggesting that the incline in pH contributed to the complexity of the habitat. Biodiversity in replanted

mangrove increased with complexity of habitat conditions, such as pH. The results of the present study revealed both the number and species of mollusks in these forests. However, the dominant animals in mangrove forests are usually crustaceans and mollusks. Local people reported that the numbers of both individuals and species of crustaceans increased in replanted mangroves after 7 years.

This study suggested that both biodiversity and habitat complexity were increased in mangrove forests 7 years after replanting, although they did not show recovery to the natural conditions. Further studies are required to continuously monitor the dynamics of community structure and environmental changes in these forests over time. Moreover, it is also necessary to monitor biodiversity at the DNA level in replanted mangrove forests as well as other environmental factors, such as dissolved oxygen level, temperature, *etc.*

### Acknowledgments

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## Toward Genuine South Pacific Islands Study: Trend and Challenge in Japan

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### Abstract

First, this paper overlooks the trend of South Pacific Island Studies in Japan briefly by introducing the associations or institutions which specialize in the area. It shows that the anthropology is more popular, and the interests in the area are less than those in other areas such as Southeast Asian Countries. It concludes that it is necessary to study the area from the view points of sustainable development, which is characterized by environmental preservation and coexistence of different identities.

**Key Words:** South Pacific Island Courtiers, sustainability, trend in Japan

### Introduction

The purpose of this paper is to take a glance at the trend of South Pacific Island Countries (SPICs) study in Japan in order to clarify what is the center of the interests of the Japanese scholars especially in social science. South Pacific Island Countries cover the islands countries in Polynesia, Melanesia, and Micronesia<sup>2</sup>. First, we show the outline of the South Pacific Study in Japan. Then we examine the characteristics of academic areas of Japanese scholars, whose fields are South Pacific Countries. We use the data of an academic association of Ocean courtiers, or “*The Japan Society of Oceanic Studies*”<sup>3</sup> and the *Grand-in-Aid for Scientific Research*<sup>4</sup> by *Japan Society for Promotion of Science*, an independent administrative institution. Then we take the series of studies initiated by the *Japan Center for Area Studies, National Museum of Ethnology*, or JCAS<sup>5</sup>, as an example of the contemporary South Pacific Studies from the view points of social science. Finally we seek for the approaches that the Japanese social scientists can contribute in the discussion of the cotemporary issues confronting the areas.

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2 About the definition and the problems of grouping the countries, refer the web page (in Japanese):  
[http://www.yashinomi.to/semi/yashidail\\_11.html](http://www.yashinomi.to/semi/yashidail_11.html).

3 The web page of the association is <http://wwwsoc.nii.ac.jp/jsos>.

4 See details at <http://www.jsps.go.jp/j-grantsinaid/index.html>.

5 See details at <http://www.minpaku.ac.jp/jcas/english/index.html>.

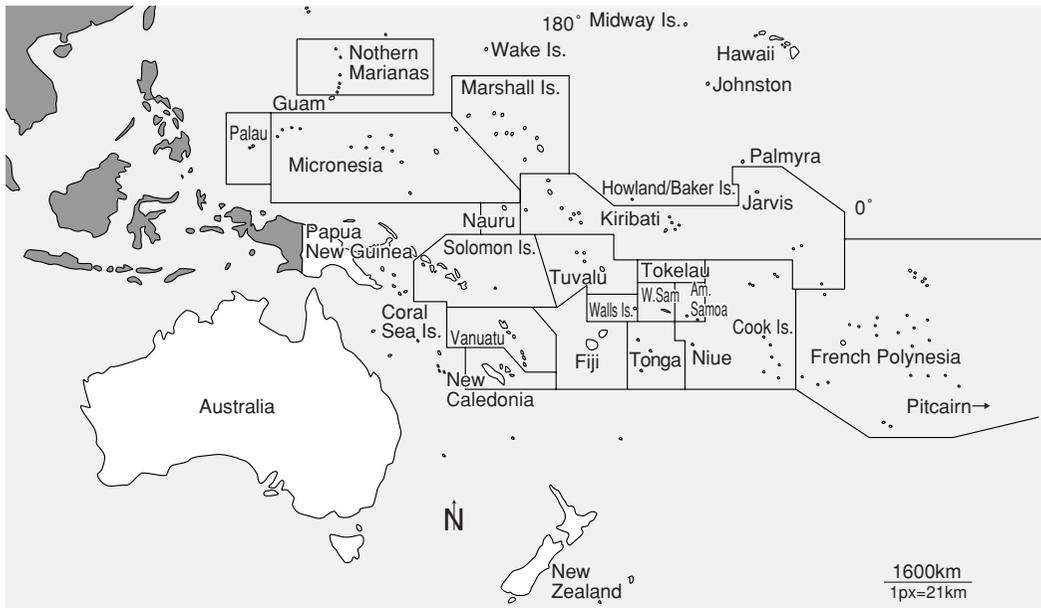


Fig. 1 Map of South Pacific Island Countries

## The South Pacific Study in Japan

### *Outlook of Study*

Here we introduce some academic associations or institutions in Japan, which lead and contribute to the development of the SPICs studies. We take a short survey of them relating to the aims and publications.

*The Japan Society of Oceanic Studies* is one of the few academic communities, which specializes in the area. It aims to understand the people, society, and culture of Oceanic countries in order for Japan to establish deeper and more appropriate relationship with Oceanic countries in the 21<sup>st</sup> century. It publishes *People and Culture in Oceania* annually.

*The Pacific Society* publishes *Journal of the Pacific Society* twice a year. It was founded in 1978, aiming to make efforts in research and preservation of the culture in the Pacific region in order to contribute to establish deeper friendships and develop the region by exchanging the knowledge and information<sup>6</sup>.

*Japan Institute for Pacific Studies (JAIPAS)* publishes *Pacific Way* twice a year<sup>7</sup>. The articles are not necessarily for the experts but for the ordinary readers. However, the articles discuss the political and economic problems of the region in rather simple terms and contribute to the

6 <http://www.osaka-gu.ac.jp/society/taihei/index.html> (in Japanese)

7 <http://www.jaipas.or.jp/> (in Japanese)

deeper understanding of the region. The institute was established as a corporate juridical person, named *Japan Micronesia Association* in 1974 under the Ministry Foreign Affairs of Japan. The business community and those who used to live there initiated to establish the institute for deeper friendship with Micronesia, which was used to be mandated by Japan. After the areas of interest and activity related to it expanded to the South Pacific Islands, it changed the name to *Japan Institute for Pacific Studies*.

An non profit foundation, *The Sasakawa Peace Foundation* (SPF) is also making an effort to develop the region<sup>8</sup>. It established *Sasakawa Pacific Nations Fund* (SPINF) recognizing the need for development in the region in 1988. It bases the programs on a respect for the native cultures and traditional social systems of the island nations. It publishes a news letter, or *SPINF Report* annually. SPF also has a project of *Coconuts University*, which aims to promote the understanding of the region by way of internet and public lectures<sup>9</sup>.

*Kagoshima university, Research Center for Pacific* is one of the few university research institutes which specializes the South Pacific Islands. It is an interdisciplinary research center, which set five major topics or Interrelationship between Man and Nature, Natural Geography, Transfiguration of Society/Culture/Nature, Socio-medical Environment, and the Role of Islands Nations in International Community. It issues *South Pacific Study* twice a year<sup>10</sup>. The purely academic journal has contributions of both social science and natural science from Japan and abroad.

There are not so much books, which deal with the socio-economical topics of the region as a whole. Among the few, Kobayashi (1994) elaborated a book discussing those issues as international relations, economic structure and aid<sup>11</sup>. Hata (1993) edited a book, which focused on the topic and law and society<sup>12</sup>. *University of Tokyo Press* published *Series Oceania*, namely *Adapting to an Ocean Environment* (1993)<sup>13</sup>, *Surviving in Intact Cultures* (1993)<sup>14</sup> and *Struggling with Modernity* (1993)<sup>15</sup>.

### ***The Areas of Interests***

Here we see the details of the academic areas of interests of the Japanese scholars. *The Japan Society of Oceanic Studies* is taken up here in order to understand the trend of interest of the scholars who specialize in the area study.

8 <http://www.spf.org/spinf/index.html>

9 <http://www.yashinomi.to/aisatsu/aisatsu.html>

10 <http://cpi.kagoshima-u.ac.jp/index.html>

11 Kobayashi, I, 1994. *Studies for Pacific Island Countries* (in Japanese).Toshindo, Tokyo.

12 Hata, H. (ed.) 1992. *Law and Society of South Pacific Island States* (in Japanese). Yushindo-Kobunsha, Tokyo.

13 Ishikawa, E. (ed.) 1993. *Adapting to an Ocean Environmet* (Series Oceania) (in Japanese). University of Tokyo Press, Tokyo.

14 Ishikawa, E. (ed.) 1993. *Surviving in Intact Cultures* (Series Oceania) (in Japanese). University of Tokyo Press, Tokyo.

15 Ishikawa, E. (ed.) 1993. *Struggling with Modernity* (Series Oceania) (in Japanese). University of Tokyo Press, Tokyo.

16 A separate volume of Newsletter, no. 76, 2003, tThe Japan Society of Oceanic Studies.

According to the list of the membership as of July, 2003, there are 245 members<sup>16</sup>. Each member specifies the academic fields and the geographic area of his study. The geographic areas in the list are eleven, or Melanesia, Polynesia, Micronesia, Australia, New Zealand, Indonesia, Malaysia, Philippines, Taiwan, Oceania in General, and Others. The academic fields are categorized into 13 groups, or anthropology, ecology, medicine, music, geography, sociology, archeology, history, linguistics, international relations, economics and others.

Table 1 Geographic Areas of Study for the Members of the Japanese Society for Oceanic Study

Geographic Areas of Study	No. of Members	Geographic Areas of Study	No. of Members
Oceanic Countries in general	63	General	55
		Gen/Mic	4
		Gen/Pol	2
		Gen/Oth	2
Melanesia	67	Melanesia	36
		Mel/Pol	7
		Mel/Ind	5
		Mel/Aus	2
		Mel/Mic/Ind	2
		Mel/Pol/Mal	2
		Mel/Twn	1
		Mel/Ind/Mal	1
		Mel/Ind/Phi	1
		Mel/Mal/Aus	1
		Mel/Mal/Pol	1
		Mel/Mic	1
		Mel/Mic/Aus	1
		Mel/Oth	1
		Mel/Pol/Aus	1
		Mel/Pol/Ind	1
Mel/Pol/Mal/Ind	1		
Mel/Pol/NZD	1		
Mel/Pol/Mic	1		
Polynesia	38	Polynesia	26
		Pol/NZD	3
		Pol/Mic	2
		Pol/Aus/Mic	1
		Pol/Twn	1
		Pol/Gen	1
		Pol/Ind	1
		Pol/Mel/twn	1
		Pol/Mic/Mel/NZD	1
		Pol/Oth	1
Micronesia	18	Micronesia	16
		Mic/Ind/Mal	1
		Mic/Phil	1
Indonesia	27	Indonesia	16
		Ind/Mal	4
		Ind/Mal/Phi	3
		Ind/Gen/Oth	1
		Ind/Phi	1
		Ind/Mic	1
		Ind/Oth	1
Philippines	11	Philippines	8
		Phi/Twn/Gen	2
		Phi/Mal	1
Australia	9	Australia	6
		Aus/Ind	2
		Aus/Oth	1
Taiwan	4	Taiwan	1
		Taiwan/Oth	2
		Taiwan/Gen	1
New Zealand	3	New Zealand	3
Malaysia	1	Malaysia	1
Others	4	Oth	4
Total	245		245

Source: The Japan Society of Oceanic Studies, 2003 July.

As table 1 shows, about one fourth of the members study on Oceanic courtiers in general. By deducting the number of the members specializing in advanced countries such as Australia (9) and New Zealand (3), and the Southeast Asian Countries such as Indonesia (27) and the Philippines (11), the number of the scholars of the developing SPICs, or Melanesia (67), Polynesia (38), and Micronesia remain. Among the developing areas of SPIC, Melanesia is more paid attention, and Micronesia the least.

Table 2 shows the academic field of the 191 members, who listed developing SPICs as their first, second or third specialty. Among them, ethnology ranks the top as 95 members,

Table 2 Academic Fields of the Members of the Japan Society of Oceanic Studies

Academic Fields	No. of Members	Academic Fields	No. of Members
Ethnology	95	Ethnology	81
		Ethnology/Archiology	5
		Ethnology/Geography	3
		Others	6
Archology	16	Archology	16
Ecology	12	Ecology	12
Linguistics	12	Linguistics	11
		Linguistics/Others	1
International Relatic	6	Int'l Relations	2
		Int'l Relations/Economics	2
Sociology	5	Sociology	2
		Sociology/History/Others	1
Music	4	Music	4
Medicine	3	Medicine	3
Economics	2	Economics	2
History	2	History	2
Others	12	Other	11
		Other/Music	1
Total	191		191

Source: The Japan Society of Oceanic Studies, 2003 July.

Table 3 No. of Final Reports of *Grand-in-Aid for Scientific Research*, 1994-2003

Country	No. of Reports
<b>Papua New Guinea</b>	<b>5</b>
<b>Vanuatu</b>	<b>2</b>
<b>Micronesia</b>	<b>1</b>
Indonesia	45
Vietnam	27
Philippines	26
Australia	21
New Zealand	8

Source: Internet Search Result of National Diet Library.

archeology, ecology, and linguistics come next. Interestingly, economics is not so popular among the members. International Relations is also less popular area of study. One can conclude that this academic society is dominated by ethnologist, not by encomiast or political scientists. SPICs seem to be are still the object of cultural study.

Table 3 shows the numbers of the final reports of the studies, which were funded the *Grand-in Aid for Scientific Research by Japan Society for Promotion of Science (JSPS)* from 1994 to 2003. Because JSPS, established by way of a national law for the purpose of contributing to the advancement of science in all fields of the natural and social sciences and the humanities support the scholars in nation wide more than any other institutions. By examining the grant distributed to the scholars, one can understand the academic trend somehow. The data was acquired through the internet search engine of *National Diet Library Online Public Access Catalog* or *NDL-OPAC*<sup>17</sup>. When searched by the key words by courtiers in the SPICs, the results show that only very few reports were presented. The reports, which include Papua New Guinea in the titles, are only five, which is the biggest number in the region. Two for Vanuatu and one for Micronesia. The numbers are far fewer than those of Southeast Asian courtiers such as Indonesia (45), Vietnam (27) and the Philippines (26). The other oceanic countries such as Australia (21) and New Zealand (8) are even more.

### ***The Research Trend in Social Science: An Inter-institutional Research Project of JCAS***

JCAS has series of inter-institutional research projects about area studies by establishing networks with other academic institutions of area studies. The projects enable the scholars specializing in the areas which are less popular in Japan to exchange information and broaden their perspectives. The results of their research are published by JCAS as *JCAS Area Studies Research Reports*. The publications of JCAS help us to understand the themes of the Japanese scholars in the specific areas of study.

About the researches on SPICs, there are such projects as *National Integration and National Culture in Micro States of Oceania*<sup>18</sup>, and *National Integration and Localism in Oceania*<sup>19</sup>. We introduce some of the studies from the two reports. By examining their topics and approaches, one can comprehend some aspects of the interests of the Japanese scholars specializing in the area.

*JCAS Area Studies Research Report 2* is divided into four parts; Democratic Policy and Traditional Policy for Part 1, Sustainable Management of the Resources and Economic Development for Part 2, Creating Their Own Culture and Representation of Tradition for Part 3, and Modernization of Disease Pattern for Part 4. By just viewing the titles of each part, one can refer that some key words seem to be tradition, modernization and sustainability. One can guess

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17 The web site is [http://opac.ndl.go.jp/index\\_e.html](http://opac.ndl.go.jp/index_e.html).

18 *JCAS Area Studies Research Report 2*, JCAS, National Museum of Ethnicity, 2000 (in Japanese).

19 *JCAS Area Studies Research Report 6*, JCAS, National Museum of Ethnicity, 2003 (in Japanese).

that the writers have the image that the people in the areas as those who are in the transient process from tradition to modernity, and they are facing the problems of sustainability. Relating democracy, the main theme is the conflict of political system between tribal chief dominant one and democracy integrated into national wide. Eedo emphasizes that the so-called traditional power is linked with modern systems<sup>20</sup>. Hashimoto describes the political situation in Fiji, where there are two major ethnic groups or Fijians and Indo-Fijian<sup>21</sup>. He points out the trend of the participation of Fijians in the political party shows the degree of national unity. As for sustainable development, Sekine takes up the concept of eco-tourism in the Solomon Islands, which he says is opposite to developing forests products such as timbers and logs<sup>22</sup>. He concludes that eco-tourism can foster participation of the local people in the process of development and lead to environmental sustainability. Takahashi compares the SPICs with Caribbean Island Countries. He stresses that the SPICc can not rely on tourism industry too much, for their neighbor courtiers such as Australia and New Zealand are relatively small in population unlike U.S.A. and Canada, where the majority of tourists to Caribbean Island Countries come from<sup>23</sup>.

*JCAS Area Studies Research Reports 6* is divided into five parts; Ethnicity and National Integration for Part 1, Indigenous Peoples and National Integration for Part 2, National Integration after the Coup for Part 3, Conflict/Disaster and National Integration for Part 4, and Nationalism, Localism and Regionalism for Part 5. The main theme of this report is how the SPICs with diversity in ethnicity and culture are challenging in order to realize national unity. The key words are identity, localism and regionalism, which are the important factors for national integration. As for identity, Edo points out that the notion of identity emerged after the people encountered with modern concepts of ethnicity and nation<sup>24</sup>. Regarding regionalism, Ogashiwa explains that the Pacific Islands Forum (PIF), a kind of regionalism has good grounds for existence<sup>25</sup>. She disputes that the nature of the forum remains the defensive system against the 'external' pressure, or global trade liberalization more precisely, despite the frequent 'internal' conflicts among the nations such as Fiji and Solomon Islands.

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20 Endo, Hisashi, 2000, "The End of the Politics of Negotiation and Consensus: From the Diachronical Study of Power in Palau From 1947 to 1994" IN *JCAS Area Studies Research Report 2*, JCAS, National Museum of Ethnicity (in Japanese).

21 Hashimoto, Kazuya, 2000, "Constitution of Republic of the Fiji Islands and Way to the National Unity" IN *JCAS Area Studies Research Report 2*, JCAS, National Museum of Ethnicity (in Japanese).

22 Sekine, Hisao, 2000, "Pacific Islands and the Participatory Development: Case of Eco-tourism in the Solomon Islands" IN *JCAS Area Studies Research Report 2*, JCAS, National Museum of Ethnicity (in Japanese).

23 Takahashi, Yasuaki, 2000, "Comparative Studies for Self-reliance of Small Island Countries: the Pacific Island Countries and Caribbean Island Countries" IN *JCAS Area Studies Research Report 2*, JCAS, National Museum of Ethnicity (in Japanese).

24 Edo, Junko, 2003, "New Caledonia: Kanak Identity Seen through the Narrative of Community" IN *JCAS Area Studies Research Report 2*, JCAS, National Museum of Ethnicity (in Japanese).

25 Ogashiwa, 2003, "Yoko Region, State and Ethnicity: Responses of the Pacific Islands Forum to Regional Conflicts Community" IN *JCAS Area Studies Research Report 2*, JCAS, National Museum of Ethnicity (in Japanese).

### Toward Genuine South Pacific Islands Study

Here we discuss the way to understand the SPICs and make some suggestions for genuine development, which is characterized by sustainability of environment and coexistence of different identical/ethnic groups. The points can be summarized to the following:

1. The study has to focus more on local people, for the people in the area are various in identities such as ethnicity, which leads to difficulty in national unity. Without national unity, the government can not provide services and chances so that the people can enjoy more welfare.
2. The factors which determine the welfare of the people have to be specified in both socio-economic and scientific terms.

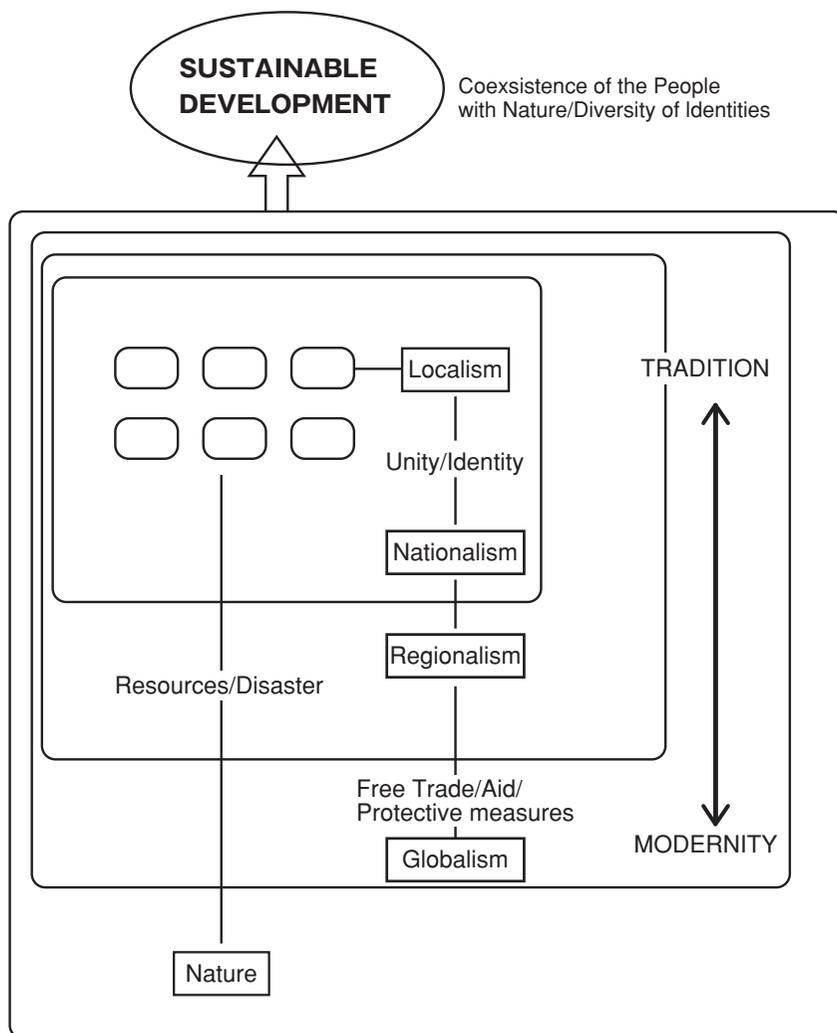


Fig. 2 Sustainable Development in SPICs

3. Series of interdisciplinary fields researches have been conducted on various groups of people and in different ecological places. Only accumulations of the data gathered from the viewpoints of social and natural science can outline the characteristics of the multi-ethnic courtiers.
4. National and global level factors need to be put in consideration in order to understand the socio-economic and environmental structure of the locality. The government law and democratic system could both benefit and harm the people in general or specific identical groups. Regionalism, represented by South Pacific Forum in the area is an important factor to facilitate the member courtiers to enjoy the benefit from the global factors. It also plays a role as a buffer for the courtiers to protect the courtiers from some negative impacts of global factors such as environmental destruction and too much dependence on external economy, which makes the domestic economy more unstable.
5. If some indicators are created so that the socio-economic and environmental factors could be measured and analyzed in the same context, they could help greatly the area study. The figure 2 shows the concept illustrating the discussion above.

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