

## Small Island Sustainability Risks in Chuuk Atoll — Climate Change and Globalization —

NAGASHIMA Shunsuke

*Research Center for the Pacific Islands, Kagoshima University  
1-21-24 Korimoto, Kagoshima 890-8580 Japan*

### Abstract

Pacific Atolls are under the threat of environmental changes -globalization and climate change. After Micronesia concluded the Compact of Free Association with the United States in the 1970s, cash transactions accelerated and the consumption economic society, which is separated from the production structure, expanded. This consumption economic society gradually came to stay, laying out a critical situation for maintaining the community life economy. Rice, wheat, imported processed meat and canned fish, which spread into people's lives a long time ago, still rock the foundations of their economic structures for life. In addition, they are in the crucible of competition in the globalizing economy. In this area, where cheaper goods are imported and high value-added products are not made, the separated structure between production and consumption is accelerating. The local economy is inclined toward a MIRAB (Migration, Remittance income, foreign Aid, Bureaucracy) economic structure, but it is becoming even more critical as the Compact Fund is reduced.

Even if their future vision should be on the conquering Insularity Economic Problem under Island Complex, global economic competitions present them super hard challenges. (1) 'Conquering the problem of Distances': hardships caused by the big ocean which occupies one third of the earth, and by high fuel cost, Information links by satellite or line should be revolution. However digital divide and high cost requirement problem occur to the islanders from now on. Someone may insist bioengineered products are the best methods for bridging the gap! However they can produce in other competitive place near market. (2) 'Conquering the problem of Smallness': their competitive commercial products are limited. 'Small is beautiful' and 'Slow Life' strategy need well trained high touch services and promotion of original culture. However these not always lead to high value adding economy, directly. (3) 'Conquering the problem of Marine': their hardness to prevent natural hazard is increasing. Endogenous marine industry is not strong enough to the world market. Charges for fishing in other piscatorial for EEZ are exogenous developmental method. Marine tourism needs harmony with local fishing and nature reservation, and they have to pay respect for vernacular culture. They have to establish local and global (GLOCAL in Japanese English) rule. However these paths are on the way of Industrial and Post-Industrial Civilization.

They and we have to prepare and add alternative path to the next civilization: Life-nomic Civilization. The development path to promote 'Life economy (by Hazel Henderson)' is the royal road based on traditional and subsistence economy for the Pacific Islander and us. Subsistence economy for everyday life and sustainability is substance for their future. This is the crisis for their future and society; recognition and awareness of these issues have to be revealed and be discussed each other beyond generation. However dominant structures of cash economy prevent their Turn Pike Path. We have to establish Fair Trade Structure with Pacific Islanders beyond low cost competition in the World Market.

Climate change is advancing more and more the collapse of subsistence/production foundations. The rise in ocean levels caused by global warming, understood only as an average sea level, is only one of these problems. As real problems, the killing of creatures on the shore and at the surface of the sea by El Nino which causes coral destruction damage, 'sea burning' by both continuous drought damage caused by high temperatures and temporary drops in the sea levels. Land damage from salt water by La Nina which causes temporary sea level rises, powerful typhoon increases with serious damage by rainstorms and flood-tides, ocean sand movement and lost in deep sea by seaside infrastructure by urbanization. The thinning of fresh water lens by rising sea levels cause not only vegetation decline, but also cause the catastrophic risk of human living sustainability through trotting step destruction of ecology. These problems of huge risks give them social unrest, and anthropological spoil from other Advanced Industrial and Civilized Society. Anthropological climate change require us new Global Wisdom.

To check the situation, we investigated the actual situation of small islands in the Chuuk Atoll area. The outline of the results shows individual and concrete examples of these issues mentioned above. Life changes towards a United States lifestyle strongly influence not only a filtering into the culture base but also a consumption economy structure. The need for cash transaction and the lack of business chances advances immigration to

Hawaii, Guam, and the continental United States. They have to get over the collapse of production foundations and have to establish new paradigm and method toward sustainability.

International economic change is realized as the sensitive adjustment reaction to a lifestyle of importation. For example, in the case of a jump in oil prices, we can consider control of fishing and some drifting with high-risk without enough fuel. Extremely low-cost imported rice is sold as Guam-rice, and it cause change in family budget aspects, and production structure aspects, and health keeping aspects. They want to buy rice if money. Their nutrition had been well kept under the control of life culture of potato stomach and full body consumption, however now their imported food with high calories and partial body consumption lead them health keeping problem. Can we see any future plan under such changes? The only prospect is that a sense of impending crises exists in this generation. We have to show alternative methods and future passes which are appropriate to meet Pacific islanders' benefits to the next generations, and to avoid such big risk matters.

Our scholarly interests are as follows:

1) Can we propose, define, establish standards and take measures regarding the crisis critical point of sustainability for each scholarly area? And can we put these in a general order? For reference, Professor Lino Briguglio in Malta has ever proposed Vulnerability, but we can not know the measures by only extrinsic guidelines. We have to establish integrated intra island sustainability model of small island base and islander's life level, cooperated with integrated observation challenges by GEO (Group on Earth Observations) SS (System of Systems). It must be suitable to realize sound development and future plan for inhabitants of islands themselves. The problem is examining '5 Ware-5 Hierarchy, 3 Life Mode and Social Risk Management Procedure' and 'whether it can be countermeasure against Globalization + Climate Change or not'.

2) Keeping the balance of 'not traditional recurrent but future-oriented Life Economy', which is 'the first layer Ecology Economy, the second layer Inter-personal Activity Economy, the third layer Market/Government Economy', we can establish the global model through Pacific small islands, especially isolated islands? Of course, we check the proposal of the model and its concrete contents.

3) On consumer education and environmental education, for man-made factor regarding 'Sea level rise crisis' and 'Global abnormal weather', we have to introduce anthropological climate change and spoil risk. Then how does our understanding 'Island Area in Tropical Pacific/Polar Region' bring its force into play? We need to consider whether and how it can be the third pillar for the problem; the first pillar should be scientific technique — monitoring, prediction and simulation —, the second pillar is international regulation method by United Nations/International cooperation.

4) In addition to that, as national policy vision for Islands Area, can 'Re-consideration of post-MIRAB strategy' is sufficient condition of 'Traditional + Modernization + Globalization + Sustainability + Collaboration + Empowerment'? It must include concrete contents.

5) Especially, 'the scenario for sea level +88 cm rise at the end of 21 century' leaves problems unsettling those measures. We need to discuss study problem and forecast regarding those anxiety/measure social model. The key is social decision-making. We consider wisdom/concept/ method to add traditional Pacific Way.

## 要 旨

太平洋環礁域は環境変動の嵐にさらされている。グローバリゼーションと気候変動である。ミクロネシア地域は1970年代の米国との自由連合協定以降、現金経済化が加速化して、生産構造と分離した消費先行経済社会が展開して、その定着化が地域生活経済の持続可能性に危機的な影響を及ぼしている。米食・小麦食・輸入肉食・同加工品・缶詰魚食の浸透は、それより長い歴史性を持ちつつ、生存経済構造を根底から揺るがし続けている。これにグローバリゼーションの「競争」化が厳しい試練を突きつけている。より廉価に輸入され、高付加価値産品を持たないこの地域の、生産・消費分離構造はますます加速化されていく。地域経済はMIRAB（移民・送金収入・援助・官僚経済）構造に走りつつ久しいが、その中で人の移動は加速化し、現金経済・消費先行型経済は益々進んでおり、その資金源であった連合協定資金の減額化の中で、展望を持ちがたい危機を迎えている。

展望を得るとしたら、隔絶・環海・狭小性の是正である。時代は変わりつつある。地球の1/3をしめる大海原の「距離の暴虐」克服には情報化と高速移動手段の発達、「Small is beautiful」「Slow Life」の見直し、個性ある文化振興、海洋性の発揚・再生、

情報化リンク・EEZ入漁料・観光振興・バイオ産品開発等が、彼らの希望であり、未来である。しかし、それへの橋渡しは「持続可能性」の尺度での十分条件的基盤充実を前提にしなければならない。「生存経済ベースの生命系経済」振興以外にあり得ない。それへの危機意識・問題意識も「対策」として結実していない。

その生存・生産基盤崩壊はさらに気候変動で促進化されつつある。地球温暖化の海面上昇問題（その平均値認識的無理解）だけではない。現実問題としての、エルニーニョ（高温干害の持続・海水面の著しい一時的低下の重なった珊瑚壊滅被害・海焼け）による陸上・海面生物破壊、ラニーニャ（海水面の著しい一時的上昇）による塩害被害、強力台風の増大、その暴風雨・高潮の重なりによる被害の甚大化、都市化・構造部・高潮による海砂移動と減少（外洋深海構造）、高潮頻度の増大と水位上昇による淡水レンズ希薄化、による植生衰退の趨勢展望がもたらす社会不安・生存条件不安である。

これらの実態について、チューク環礁縁辺部小島嶼と中央部小島嶼の実態調査を行った。その概要は、まさに上記内容の個別的な具体事例群であった。米国型ライフスタイルの変化は、文化基盤に浸透するのみではなく消費先行型の経済構造にも強い影響を及ぼしている。ビジネス機会の欠如での、現金経済獲得機会は、ハワイ・グアム・米国本土への移民を促進している。生産基盤崩壊は、人口圧を下げる対応で乗り切れるしかない。また国際経済の変動は、移入価格への敏感な「生活行動調整反応」としても具現化する。例えば石油価格高騰は、出漁範囲調整・リスク高い移動での漂流頻発などである。極端にやすい輸入米はグアム米（再梱包）として売られ、「芋腹の生活文化」での健全性保持を、健康面（部分食・肥満）・家計面・生産構造（基盤）面で崩壊に導き続けている。この変化の持続の上にもどのような未来設計があり得るのか。現世代に危機感が存在していることが唯一の展望であった。

学問的に関心が在るのは、①持続可能性の危機の臨海点（critical point）を、学問的に（それぞれの分野で）提示（定義・基準・対策）できるかどうか、またその総合的整理は可能かどうか（以前マルタのリノ教授 Lino BriguglioがEconomic Vulnerabilityを示したが、外形的な指標だけでは対策が見えてこない。GEO（Group on Earth Observations）による統合観察を巡る試みに呼応しつつ、ミクロ次元・生活次元からの島嶼内統合的研究が必要である。諸島民自身の健全な発展とその未来構想に耐えられるものでなければならない。5 Ware - 5 Hierarchy, 3 Life ModelとSocial Risk Management Procedureでの検討がそのGlobalization + Climate Changeへの対抗力たり得るかの検討が課題である→②がさらにそのDevelopment Passの検証）、②伝統回帰ではなく、未来志向的に「生命系の経済（第1層エコ経済、第2層対人的活動経済、第3層市場・政府経済）」の間のバランスで、太平洋小島嶼、特に離島が世界モデルを構築できるか。（モデルとその具体内容の提示可能性チェックをしてみる。）③消費者教育・環境教育的に「海進危機」「地球異常気象」の人為原因に対して、どう熱帯太平洋・極地海岸島嶼域「理解」が、力を発揮できるかに関して、国際政治的（国連・国際連携等）・科学技術的（モニタリングと予測・シミュレーション）に加えた第3の柱であり得る可能性についても、考えてみる必要がある。%ルールの移転と対策、原因物質削減、観測とエビデンス報道などの具体策に対して、教育の果たしうる役割の対比論である。④それらの上での島嶼域の国策的ビジョンとしての、脱MIRAB戦略の練り直しは、Traditional + Modernization + Globalization + Sustainability + Collaboration + Empowermentで十分条件であり得るかどうか。その内容に盛り込むべきもの具体的内容である。⑤特に、21世紀末の+88cm海進シナリオは、これら対応・対策に耐えられない問題を残している。それら不安と対策の社会モデルに関する研究上の課題と見通しまで、論じておく必要がある。その鍵は、社会的意志決定である。従来のパシフィックウエーに加えるべき知・理念・手法を考える。

## 1. Environmental Change in the Pacific Islands

### (1) Globalization and new Paradigm of the Pacific Way

When we consider **Environmental Change** in the Pacific Islands, now and in the future, two huge impacts to the Life-Style Changes of Islanders are indispensable: one is **Globalization** and other is **Climate Change**. Globalization is not only the problem of urbanization and modernization trends, but also the conflicts between urbanization vs. country or village life, modernization vs. traditional, monetary vs. subsistence, exogenous vs. endogenous, Papalagi (Euro/American) vs. Tuiavii (Pacific), Continental vs. Oceanic Island, and competitive vs. co-existence way of life for the Pacific Islanders. Pacific islanders' Life-Style Changes are confronted too much matters, so they need big challenges; digital divide strategy for informational revolution, monetary and consumer education for too much dependence on consumption, job opportunity and empowerment for income generation, local and vernacular culture promotion to meet with global cultural flux, local and traditional wisdom reservation like food knowledge and custom to meet with imported food flux, reproduction skill renaissance against exploitation by overuse by commercial activities, establishment of u-turn circumstances for after higher education by immigration, community promotion against de-population and urbanization problems.

A New Paradigm of the Pacific Way is needed by Pacific Islanders to meet the storm of globalization. This way is not to go back to the old days but towards a system that is the best for the next and future generation. The system should be based on their essential way of life and spirits more than exchange, competitiveness and overuse; that is share with, reciprocity, redistribution, consensus (long discussion), peace and order under authority, reproductive-ness, sustainability, new identity, and endogenous decision making procedure.

### (2) Climate Changes in the Pacific Island and Islanders' Life

Climate Changes in the Pacific Island are not only global warming, but also abnormal weather, El Nino, La Nina and so on. Climate change is advancing more and this is enhancing the collapse of subsistence/production foundations. The rise in ocean levels caused by global warming, understood only as an average sea level, is only one of these problems. Real problems are more severe.

If IPCC prediction of sea level rising by 88cm rise at the end of 21st Century is true, how will the islanders on atolls survive! Adding one century after, they shall lose almost all of their mother land into the sea. Like Fig. 1 shows, even a 20cm rise of sea level will destroy the ecological base of freshwater.

The changes include the killing of creatures on the shore and at the surface of the sea by El Nino, which causes coral destruction damage, "sea burning" by both continuous drought damage caused by high temperatures and temporary drops in the sea levels.

The thinning of fresh water lens by rising sea levels causes vegetation decline against ecological and sustainable development. Land damage from salt water by La Nina, which causes temporary sea level raises, with low pressure, shall occur at most level of sea level rise. Increase of powerful typhoons, which may be lowest level of pressure, with serious damages by rainstorms and flood-tides, are much risky than before the sea level rise. Sea level rise is risky on coastal management and with tsunami, shall cause destructive damages. We can see recent upgrading risky phenomena by El Nino and La Nina which occur at most levels of both directions in Fig. 2. by M. Lander.

## Sea Level Rise Crisis

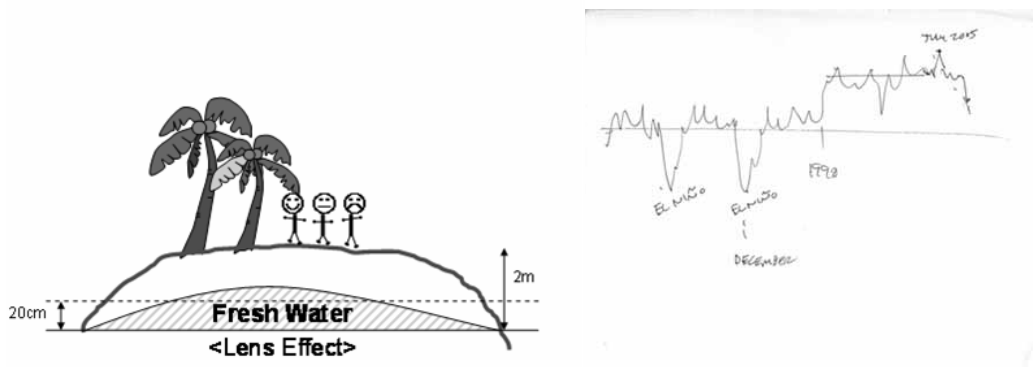


Fig. 1. (left). Sea level rise crisis by 20cm even  
 Fig. 2. (right). El Niño and La Niña Effect of the at most level of the sea. Hand writing by M. Lander Sep.2006 in UOG. Vertical=At most see levels, Horizon=years

In some places, like Majuro (see, the last our occasional paper), the damage is not only by climate change but also artificial seaside infrastructure constructions and dirty water by urbanization, ocean sand productivity and movement and lost occurred. This is also risky situation to protect beaches. These problems of many huge risks give the people social unrest, and anthropological spoil feeling from other Advanced Industrial and Civilized Society. Anthropological climate change requires us to have new **Global Wisdom**.

How can they and we prepare against these risks? We need comprehensive methods for every risk management. The islanders can also contribute to the global activities, after all they are the first victims. They have to prevent their multiple risks, first!! Risk management methods are effective, however here we have cut to mention in detail by the limit of papers for print.

The author can use comprehensive human – environmental 5 ware model. For example for endurance system against salty water sacrifice, fresh water reservation and disaster prevention; we can consider in detail, hard-ware: ex. civil engineering, soft-ware; ex. safety net, ecological-ware; ex. salt endurance species, human-ware; ex. empowerment and spiritual-ware; ex. culture promotion on risk management by community. Each specialist can do support in detail and in concrete on this 5 wares or comprehensive managerial unit. These combinations are required on every small island in every atoll in the world.

## 2. Background and restriction of sustainability risks in FSM

Pacific Atolls are under the threat of environmental changes – globalization and climate change. After Micronesia concluded the Compact of Free Association with the United States in the 1970s, cash transactions were accelerated and the consumption economic society, which is separated from the production structure, was expanded. This consumption economic society gradually became established, laying out a critical situation for maintaining the community life economy. Rice, wheat, imported processed meat and canned fish, which spread into people's lives a long time ago, still are rocking the foundations of their economic structures for life. In addition, they are in crucible because of the competition, surplus production, mono-culture

products, and cash economic circulation/cash valued standard on globalization. In this area where cheaper goods are imported and high value-added products are not made, the separation in structures between production and consumption is accelerating. The local economy is inclined towards a MIRAB economic structure (Migration, Remittance income, foreign Aid, Bureaucracy). Besides population movement is accelerated and also cash economy/consumption driven economy structure is accelerated more and more. In addition, reducing fund from the Compact of Free Association which is main fund source makes hopeless crisis.

### 3. Toward post MIRAB economy and new civilization

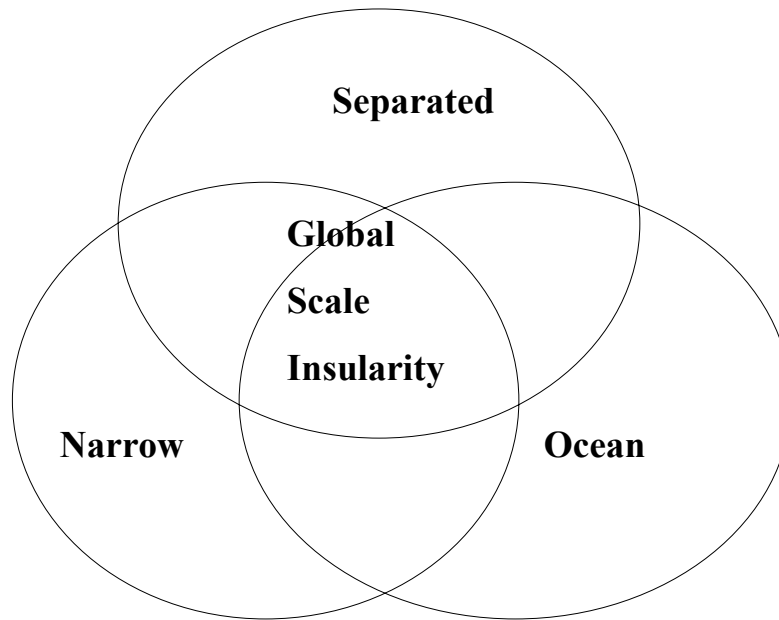


Fig. 3. Insularity Structure in Central Position of the Pacific Ocean

If their future vision should be on conquering Insularity Economic Problem under Island Complex, global economic competitions will undergo immensely hard challenges. “Conquering the problem of Distances”: hardships caused by the vast ocean surface, which occupies one third of the earth, and by high fuel cost, Information links by satellite or line should be evolutionary. However, digital divide and high cost requirement problems are faced by the islanders from now on. Someone may insist that bioengineered products are the best methods for bridging the gap!! Bioengineered products should be left to other competitive markets in their best competitive circumstances. “Conquering the problem of Smallness”: their competitive commercial products are limited, and scale merit shall be grate handicap for them. Alternatives are required. “Small is beautiful” and “Slow Life” strategies need well trained quality touch services and promotion of the original culture. However these do not always lead to direct high value additive economy. “Conquering the problem of Marine”: it is becoming ever so difficult to prevent natural hazards. Endogenous marine industry is not competitive enough to the world market. Charges for fishing in other piscatorial for EEZ are exogenous developmental method. Marine tourism needs

harmony with local fishing and nature reservation, and they have to pay respect for vernacular culture. They have to establish local and global rule (GLOCAL in Japanese English). However, these paths are still on the way to Industrial and Post-Industrial Civilization.

## New Civilization model from Islands

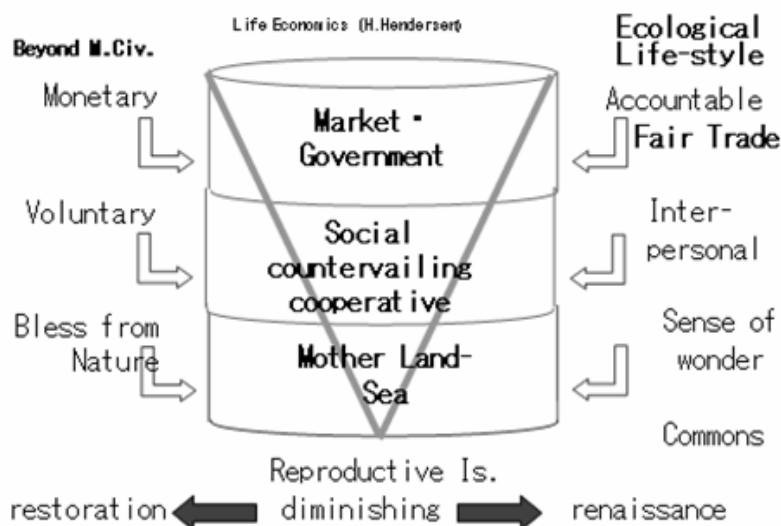


Fig. 4. Alternative Model for the Next Civilization: Life-nomic Civ.

The locals and us professionals have to prepare and add alternative paths to the next civilization: Life-nomic Civilization. Life Economy, which is the first class layer is Ecology Economy, the second class layer is Inter-personal Activity Economy, the third class Market/Government Economy, can we establish the global model through Pacific small islands, especially the isolated islands?

The developmental path to promote "Life-nomic" economy is the royal road based on a subsistence economy for the Pacific Islander and us. Subsistence economy for every day life and sustainability are key concepts for their future, not only from traditional path. However their recognition and initiative movement is not enough established, even their sustainability conditions are confronted to many risks by globalization and climate change. This is the crisis for their future; recognition and awareness of these issues are measurably noted. However dominant structures of cash economy prevent their Turn Pike Path. We have to establish Fair Trade Structure with Pacific Islanders beyond low cost competition in the World Market.

NPO establishments in the second class layer shall be co-governance revolution. Mutual help system in traditional rule shall more effectively work with inner-networking and inter-networking, sometimes with global link.

Volunteer guide and activities shall be changed to the professional work by valuably respect fee. Local knowledge and traditional training system shall be paid by eco-money or community-money (reciprocity cycle) with many thanks.

Re-evaluation and planning by ecological productivity measure beyond monetary and short

term measure is the best effective global sustainability path rather than local benefit. This may be the best policy for global warming by the Pacific Islanders. Kyoto protocol and carbon tax strategy shall be supportive of this way beyond and within global market. Figure 5 shows these productivity indexes. We need add more indexes and measures for assessments in concrete in each Pacific Island. Eco-tourism is not almighty, however if we can make better arrangement, mutual understanding shall be enforced.

**TABLE 9.2**

**Primary Productivity Rates in the Ocean**  
(after Sumich 1988 and Barnes and Hughes 1982)

Location	Average productivity (gC/m <sup>2</sup> /yr.)*
Open ocean (tropical)	40
Open ocean (temperate)	120
Continental shelf	200
Upwelling zones	300
Seagrasses (temperate)	600
Mangroves	800
Coral reefs	1000
Kelp beds	1000
Seagrasses (tropical)	1500

\*average figures from various studies; much higher maxima frequently occur.

Fig. 5. Primary Productivity in the Ocean source. (Moshe Rapaport ed. 'The Pacific Islands 1999, p.111')

Multiple use strategy and technology is another alternative for bio-zero emission. Not only utilized their resources, make less import and some case can make export with advanced technology (sometimes by university and academic contribution) or marketing; like one village one product movement.

#### 4. Small islands researches in Chuuk Atoll on Environmental Change

##### (1) Outline of the researches by RCPI

Researches were conducted on those devastating conditions in Chuuk atoll area by RCPI (Kagoshima University Research Center for the Pacific Islands) using scientific research expenses, some are subsidized by research foundation of JSPS (Japan Society for the Promotion of Science) by the title; on Environmental changes in atoll area: internationally cooperative research to create the stronghold of monitoring center and functions in Chuuk Atoll in FSM. We crossed to the atoll 4 times in 3 groups in almost last year. In the duration of the stay, we were able to make Academic Exchange Agreements with Guam University. The research was conducted by the following groups. First group: Nov.2005, Terada R. (Ueno= Korea Ocean Research Center), January 2006, Nagashima S., Hidaka T. (Ueno, Tonowas, Eten, Uman, Piis); Second group: September 2006, Tajima Y., Noda S., Tominaga S., Nagashima S., Kuwahara S. and Kawai K. (Ueno, Tonowas, Eten, Piis, Romonum, Tol, Fanapages), Third group: November 2006, Onjyo M., Tsuda K., Kawai K. and Nishimura A. (Ueno, Tonowas, Romonum, Fanapages). (Boldface was the focal research destination.) Their specialties are anthropology, geography, humanities, human life and environment (nissology), mosquitoes and medicine, fruit sciences, soil, potatoes, insects, marine animals, sea glass.

(This thesis is neither the official report nor the summary from the team, but the private opinion and responsibility in author's field and specialty on nissology.)



1. January 2006



2. September 2006



3. November 2006



Research teams of Research Center for the Pacific Islands

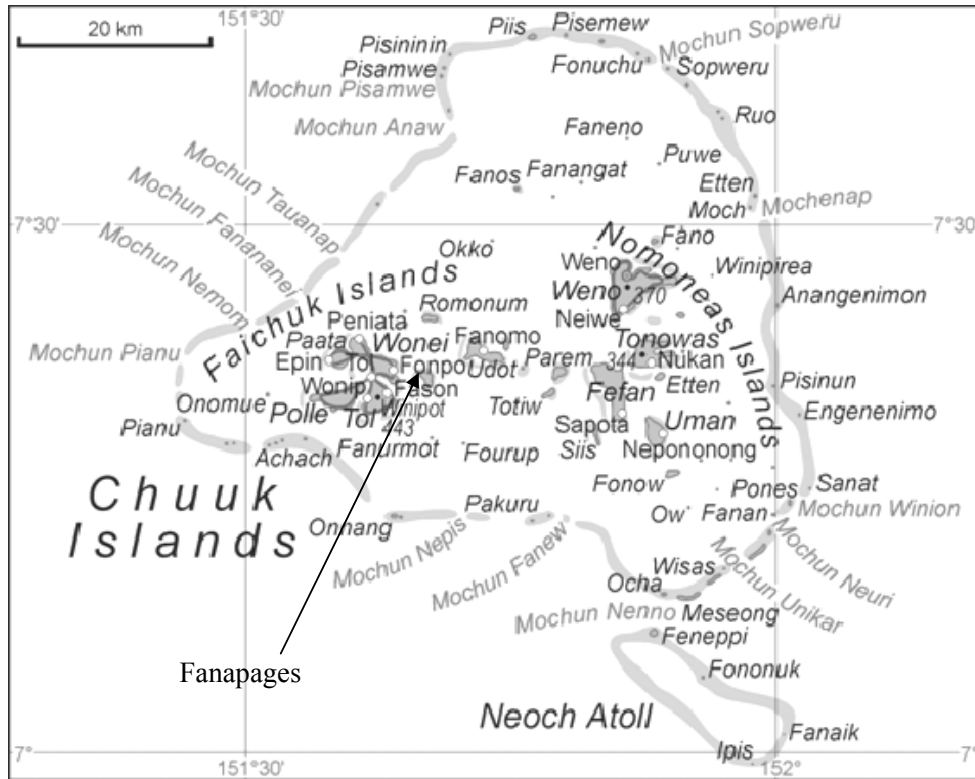
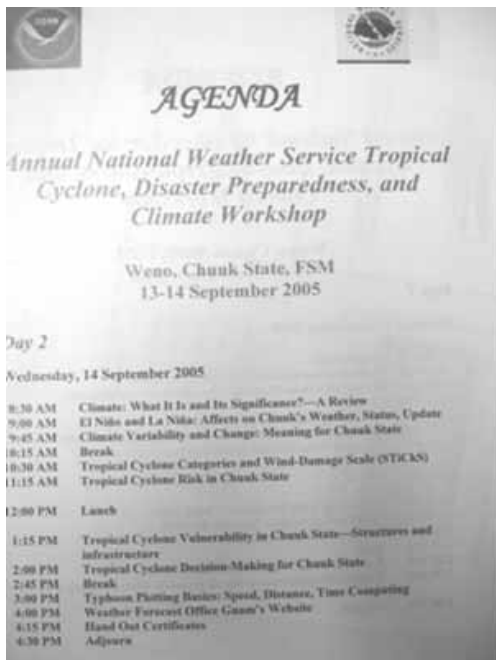


Fig. 6. Map of our research area.



(2) Method and procedure

Our research of the first was preliminary one to see the outlook of the environmental changes and feasibility check of research; however we could check many evidences on our main theme. We were happy to know that important workshops have done with the staff from University of Guam (Fig. 7). At the Mortlock Development Commission, they have kept a copy of power point as if precious treasure; because they have heavy disasters attack zone and islands. During the second time, we prepared interview sheet on our main theme.

Fig. 7. Workshop by UOG.

What kind of food do you eat for everyday meal? Weight of Local food vs Imported food.	
Anxiety level to Socio-Economic Change and Climate Change	
I What is the Main (no need single answer) and Second Anxiety on Socio-Economic Change? To each Main(Strong), Second(Some), No problem	
1 Exofuss of younger generation	
2 Income Structure or Stability	
3 Cultural Restoration	
4 Local Identity	
5 Sustainable Life	
6 Other (in detail or HOPE)	
II Anxiety level to Climate Change and How and When you feel anxiety To each M(Strong), S(Some), No problem If possible in detail, please	
1 High Tide	
2 Hurricanes or Strong Wind	
3 El Nino and/or La Niña! Too Hot and Cold	
4 Droughts and/or Heavy Rain especially what	
5 Sustainable Agriculture and Fishery	
6 Health and Care	
7 Other (in detail or HOPE)	

CPI Interview Format		No.
Village Location		Electricity/ Cooking Fuel
Name		Age/ Gender Last Education
Duration in Moon		Duration in Other Chuuk Where,
Duration out Chuuk	Where	-- Aim And Activities
Occupation (Family Income activities%)	Farming % Fishery % Remittance % from who Others % in Detail	
Community Role or Status	Member of Household(Family)(Gender, Age, Relationship) live here	
Member of Household(Family)(Gender, Age, Relationship) living in other places		
What kind of crops do you grow?		

Fig. 8. Interview sheet.

(3) Briefing the impression and comments on the circumstances.

Investigations took place to study the actual situation of small islands in the Chuuk atoll area on environmental dynamic changes. The outline of the results shows individual and concrete examples of the issues mentioned above. Life changes towards United States lifestyle strongly influence not only a filtering into the culture base but also a consumption economy structure. The need for cash transaction and the lack of business chances advances immigration to Hawaii, Guam, and the United States mainland. They have to get over the collapse of production foundations and have to start establishing new paradigm and method toward sustainability.

International economic change is known as the sensitive adjustment reaction to a lifestyle of importation. For example, in the case of a jump in oil prices, they cannot go fishing faraway and some drifting occurs with high-risk. Extremely low-cost imported rice is sold as Guam-rice, and it causes the health keeping based on the life culture of potato stomach consumption to lead to a collapse in health aspects, family budget aspects, and production structure aspects. Can we see any future plan under such changes? The only prospect is that a sense of impending crises exists in this generation. We have to show alternative methods and future passes to the next generations, which are appropriate to meet pacific islanders' benefits and to avoid such big risks.

Reports and concerns about the abnormal sea level seem a bit exaggerated, but it seems adequate if we were to think about the seriousness of the problem. The problematic impact of the climate change to the societies affects not only Tuvalu, which was of concern at the Pacific Islands Forum in February 2005 by RCPI, but also the islands in the Pacific region, especially the low island and the overall atoll area. Our researches confirm our concerns. In addition to that, globalization which is one of the factors of climate change brings serious problems.

Sonsorol Atoll in Mortlock located outside Chuuk Atoll is known to be low islands and be hit by typhoons frequently and has had major damages by tsunami in the past. We scheduled to conduct preparatory research of the area, but due to restricted time and troubles with oil supplies, the trip could not be confirmed. We waited for information the resumption for half a year, however there was only disappointment. This region remains to be a crucial area for research.



Investigation at Chuuk Atoll by members of Research Center for the Pacific Islands, Kagoshima University.



Salty water anxiety by big typhoon and sea level rise (Piis).

We have to make briefing to know well circumstances beyond research sheet on current conditions and outlines of the researched area. Low island, Piis, (originally North Island in Japanese) located on the periphery of the atoll was a farming island during the war and there were no soldiers. There are 30 soldiers at Pisemuu Island (originally New Island) across from North Pass. There are 939 official residents (in fact 500 without emigrants). Population comparison between two villages is 6:4, but continual cooperation in region integrates two villages into one village and now there is only one head mayor in the island. From junior high school, they have to go to Ueno (originally, Spring Island, which is the Main Island), but in the outskirts of the city centre, there are residential areas for Piis. In the central a little hilly island, Romonum (previously known as Sunday Island), with 711 official residents, had anti-aircraft gun and the land caved in by bombing. In the island of Fanapages (previously known as Tuesday Island), with 606 official residents, immediately after the election our research group went to investigate this island. An island called Tor (previously known as Wednesday Island) has no roadway or cars and where the army opened the canal, but was full of life economy. As former Japanese professional baseball pitcher and the head chief, Aizawa Susumu (eternal title) had died; our purpose was to visit his grave. He was in a good shape at the beginning of the year and we had spoken for an hour. On the main island, Moen, he was doing business with Susumamaru and other liners. Being quite an intellect, in 1984 he had spoken about the frequent eruptions of cholera epidemics. As a measure of forbidding aquatic toilets, they had to form a system where chiefs from other islands took turns to be the watch, because the chief treated the locals with a kindness like a father. Due to this new system, they were able to at once thoroughly solve the problem. His nephew is the vice ambassador to Japan and the director of tourism bureau. Currently with \$300,000 his youngest nephew is constructing communication tower for education and preservation of health. He is the technician for the 20 different sites under construction in centre of the outer islands. Like those examples, some Japanese related people are in the core of the society in Chuuk, and international cooperation with Japan is becoming more important.

#### (4) Small Islands Environmental Change and Social Unrest

As the team, we are conducting interdisciplinary and comprehensive researches. The key purpose of research, 'Environment changes of small islands in Atoll' will be outlined. The biggest concept of each climate changes is narrowed down to increase in intense typhoons and damages caused by El Nino. Especially the high temperature, coral reef extinction, and shortage of rain during the 8 months beginning from September 1998 were detrimental. Social changes are also rapid and are serious matters.

##### 1) El Nino

Overlaps of coral destruction, high temperature, damages of evaporated plans are caused by continual high temperature and dropping of sea level. There are strong anxieties towards this. The high temperature climate during the 8 months since September 1998 had made even the natives, who are used to heat, dull. Coral reefs of outer island Piis, surrounded by shallow sea of Inou (coral reef forming the outer wall), and received destructive damages. Coral reefs are kept at high temperature, and dramatic decrease in the water level has caused coral reefs inside the shallow lagoon area a devastating damage, and it has still not recovered from these damages. The ones currently growing are fractions after damage. For a full recovery, it is estimated to take

a few years, and it may be likely to have another outburst of devastations. Seriousness of the evaporation and destruction of plants and water scarcity were narrowly secured by drinking water supplied by ship from main island Ueno where there are highlands. Measures against damages in areas where problems mentioned above cannot be solved like Sonsorol and other atolls lead to problems with international human rights (BHN=Basic Human Needs). Maintaining records of the devastations of the outer islands will be part of their safety net. It is necessary to find procedures to carry out investigations with the cooperation of the locals.



Taro patch destruction: Seven household units = 15 x 800 feet (Romonum).



Sea level rise anxiety and evidence of beach sacrifice.

## 2) Tidal wave and La Nina

Flood tide damages leave behind a very unpleasant aftermath in the coastal area. For example, the occurrence of flood tide and low atmospheric pressure such as SetoUchi islands (inland see in Japan) at BisanSeto area in 2003, were independent from typhoons. There are new records of the damages by abnormal water level in Kumamoto (neighbor prefecture of Kagoshima). Of course the typhoons are results of incredibly low atmospheric pressure, so the water level rises at once. Even to the present day since the mid-July 1996, their lives are affected. The occurrences of high flood tides are seen when La Nina was affecting the Micronesia and equatorial regions (Mark Lander, Guan University). The 15x800 feet taro farm used by 7 families in Romonum in the islands inside the lagoon was lost 10 years ago, and it still has not recovered.

Recoveries were seen in places where the water falls down directly from the spring water of the hills and the rain. There are many abandoned land in the outer island, Piis.

We have done present land surveys, but we have to conduct comparison investigations regarding diagrams of current and past land usage and do research on the soil quality of abandoned land. Of course, on this land, it is strongly relevant that originally bread-fruit was the staple diet but recently there have been shifts to rice and other products. Piis relies heavily on living substantial economy more than Romonum, so possibility of continuation of farming is becoming anxiety factors.

## 3) Increase in frequency of severe rain

Frequent occurrence of landslides and silt layer being washed away in higher island type are causing environmental damage. The topsoil of coral reef area is thinning, and washing away of this valuable topsoil (equivalent to damages cause by red soil washed away in Okinawa) is bound to cause environmental pollution.

## 4) Escalation of frequent eruptions of large scale typhoons

Increase in extreme damages and anxieties are severely affected in low islands around atoll region. There are times of frequent attacks, and they say that there are the most intense problems. The strength of the typhoons are higher than average. Highest speed can be over 200km/h (many occurrences of similar typhoons are also found in the Caribbean; in the Commonwealth of Dominica and Grenada, I have heard stories of the damages at churches; they are as serious as Katrina). Especially in the outer atoll Sonsorol, the effects of tsunami, which was enormous enough to engulf the islands, caused anxieties to the point of trauma. Being a site for tsunami damages, it is necessary to gather information of their instructions, measures, and traditions, and to check for room for improvements in their forecast system (system support after wireless maintenance). Piis is acknowledged as a site to have immense direct image. A medium-sized boat, which seemed like a Japanese aid, lay shipwrecked on the port.

## 5) Sustainability fishing, agriculture and total life

These damages and anxieties are linked to the collapse of existing base for agriculture and fishery. Sustainable living economics or village economics are already under threat of collapse due to shifts in socioeconomics. In Romonum there was a tradition of making the broiled and mush bread-fruit to a sticky paste and preserving that in soil (bread-fruit are seasonal). The domestic food supply in the small island is nearing 90%. However potential need for rice, wheat,

noodles, canned goods, and other imported food stuff is strong enough. If they can keep electricity and use refrigerator well, frozen meat and meal should be flood, if money. It seems like cash can resolve some problems, and to the road of destructing of sustainability and health.



Typhoon attack



Severe rain attack



Hygiene Sanitation Health Emergency





Throughout Micronesia, especially in the Pacific, lies a common problem: the cash flow and consumption driven lifestyle after concluding the Compact of Free Association. The remarkable gap between the production structure and this problem has been indicated since 1982 after requests for research, but disappointingly not only are the problems not resolved but it is causing the sustainable living economics itself as the social base to be abandoned and collapse. The problem can affect even on the island of Piis, 'if we have money, primal usage should be on rice and tinned fish'. Changes in people's taste in likes and dislikes of food and changes in socioeconomic circumstances facilitate the worsening of the situation. Crisis of decreasing taro potato farms and growing "sea burning" and breach of coral are spurring on for a malignant cycle.

#### 6) Population problems

Issue of population outflow is not a matter here, but problem of overpopulation is serious because of its effects on the future production base. Especially on small islands there is a limit to the expansion of resources found on land. On Romonum where the cash economics is in its primary progressive stage, there was a strong awareness of the worrying consciousness. There are times when commercial activities overtake the regional resource recycling cycle. Depending on the management of the situation, this may be destructive (for example from over-deforestation and mono-culturalization like seen in a part of islands in South East Asia). It is vital for the small scale island model to maintain the compound multiple production structure. Along with resolving issues of primary industrial production technology, there are callings for cooperating with the main island on reorganization of diversification of production system within the region and developments of skill-oriented education like technical college.

#### 7) Island identity and globalization

Transfiguration of lifestyle is becoming a problem. It is certain that they have solid island identity; love and pride. However, over-penetration of consumption driven society and individualistic United States culture and lifestyle is a worrying matter when it comes to the future of the islands. Prevalence of videos is accelerating, and storm of information from televisions and internet is approaching the islands. As part of United States' aid, there are now new 50 Personal Computers mounted with Windows XP in Micronesia College.

#### 8) Water circulation

Water circulation is related to the decisive difference between life structure/ production structure of the small-hill islands and the small-low islands. The richness of the power of collecting rain on the hill islands can be seen on laundries even when they use running water. The dirtiness of the well used for laundries and shower in the low islands is abysmal. Severely prodigious contamination was shown when bacterial examination was carried out; to the point the whole test paper changed its color! To note, waterworks in Japan has the standards of zero expectancy.

Spread of those basic health information, on the other hand, thinization of fresh water lens with drought and sea-level rising, increase of fresh water demand according to lifestyle, reservation of city water that is indispensable to existence/ crops/ economic activity, this adjustment of quality and quantity of tri-lemma is a big urgent problem.



Sustainability



Human Life and Environment



Ecology



Sustainability



Income Structure



Urbanization



Modernization

Tourism ⇔ Culture ⇔ Identity



1980's skull diving vs. remembering tour by survivors



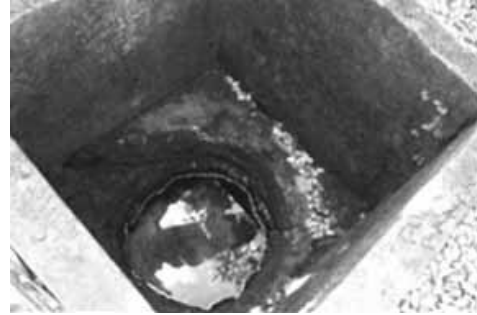
Best interest for the next generation and islanders



Overpopulation anxiety than depopulation



Quality of fresh water



Basic human needs



Globalization



Electricity

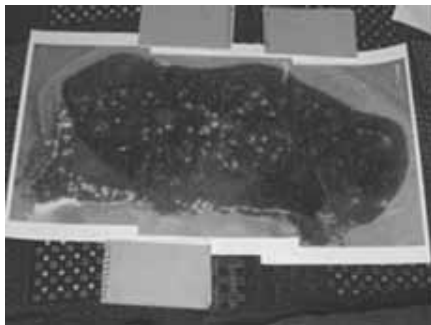


How to meet industrial society





Informative society in the main island



Informative society in the small island





Non refrigerator  
Cf. Imported meal



Food and nutrition

Health and subsistence affluence



High potential of desire

Traditional lunch



Commercial  
Use ↔  
Goods ↔  
Activities  
Sustainable  
life, technology  
system



Sustainable  
fishing and  
agriculture





Power generation; Cost vs. usage



Fuel cost attacks from global market price.



Fishery and transportation

Transportation not only cost but safety



#### 9) Problems with medical care and health

In both these islands there are no medical doctors, and quick to note this is a very troubling matter. Although there is a native nurse in her 30s, there is a limit of what she can do during emergencies (in terms of technology, prescription, information, and transferring). Especially dealing with situations in the remote islands and outer islands, there will be predicaments due to traveling time, expenses, high waves, storms, and the like. We should consider “multi-usage of information technology through communication towers that are currently being built in the outer islands” to put to practical use in the inner atoll, so that this can culminate to function as a whole island system. We can expect an outstanding result from optimum experiments. We should consider the public health nurse system and medical care assistance system that has been successfully installed in Okinawa to aid expansion in the atoll area. At Kagoshima University International Island Medicine’s seminars, with the cooperation of Research Centre for the Pacific Islands, we receive medical doctors from islands in the South East Asia and the Pacific Islands, and with JICA and prefecture government, they undergo medical training in remote islands.

#### 10) International value fluctuations

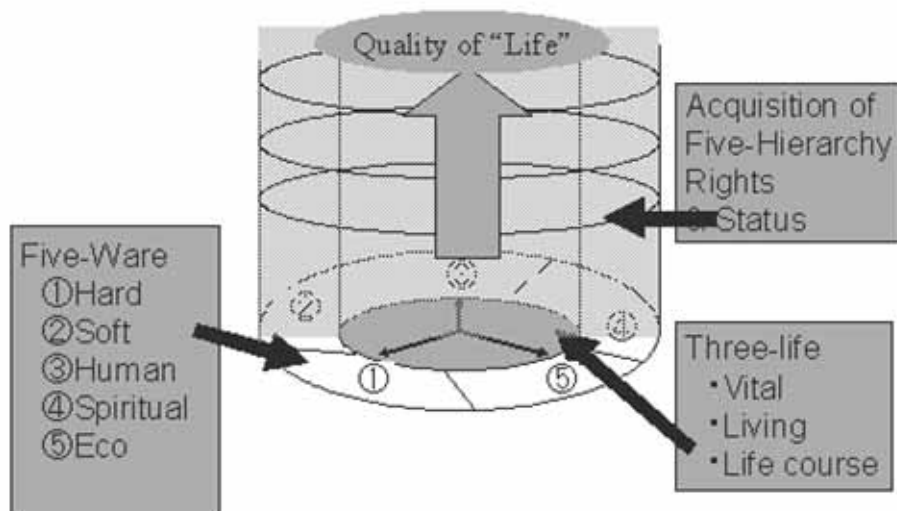
The rising price of oil is especially problematic in both the areas. Remotely situated Piiis not only can be sustained existence cash economy foundation but also gas price for transportation to and from the island costs \$50. In our second visit, we encountered boat that was out of gas and were waiting for aid for two hours. The seven passengers probably expected gas shortage when they boarded the ship. Danger seems to be inescapable. Piscatorial radius and opportunities are under constraint. Also, ice making facilities provided as a Japanese aid is not under operation due to fuel problems. Popularization of household electronics was at one point seen constantly (about 30%), but fuel problems decreased the usage of these goods to 10%. It is hard to say that it is consistent. A fraction of solar battery was seen on the Romonum Island. One of the places is International Net Religious Facility. Another for a long term use is the one gained from piscatorial resource project by an ex-civil servant. He said that it is vital for radios and the like. Accepting core figure in Romonum, a protestant pastor, owns a power plant, and with wireless ham he was communicating and was regulating connections with central cities.

#### 5. Problems and prospects on environment change in the Pacific

The development of globalization/information network at capital cities of Pacific islands is remarkable. The author have often visited since the trusteeship Government was retained 26 years ago, and its change are remarkable speedy in the world. Universally, detail researches of individual circumstances are indispensable for concern of local identity and useful method of local measures. In Pacific islands, especially isolated islands, there were many problems on social change and consumption economy, when author start to study in the field in Micronesia. Each level of trade frequency, information network, cash economy, electrification was different. But now the double-punch of climate change and globalization, or the storm of comprehensive and dynamic environmental change, may increase all at once and steadily. To follow these phenomena, those comprehensive and multi-disciplinary methods are needed by professional researches on the islands. Especially in the isolated islands, these environmental dynamic changes may work destructive to keep the community base. Then we have to respect *raison d’être* of vernacular system, and endogenous process which may be different from our modernization, even if outlook and technology might be the same.



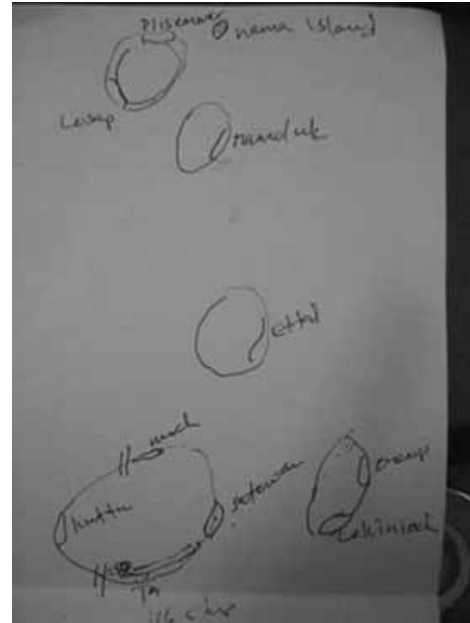
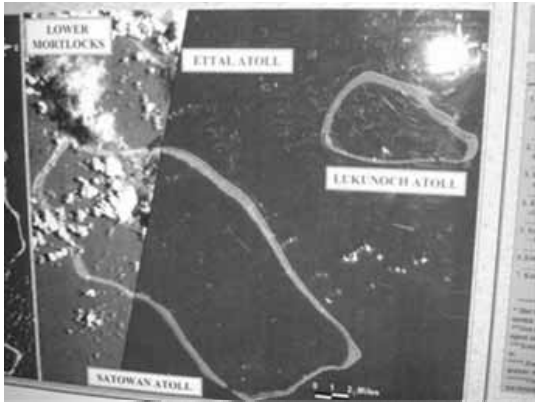
## Up Grade of Life-Governance



Outer remote island disaster society  
(Culture/ ecology/ life style/ globalization)



Jet fuel problem for supply



Climate change

Typhoon and tsunami

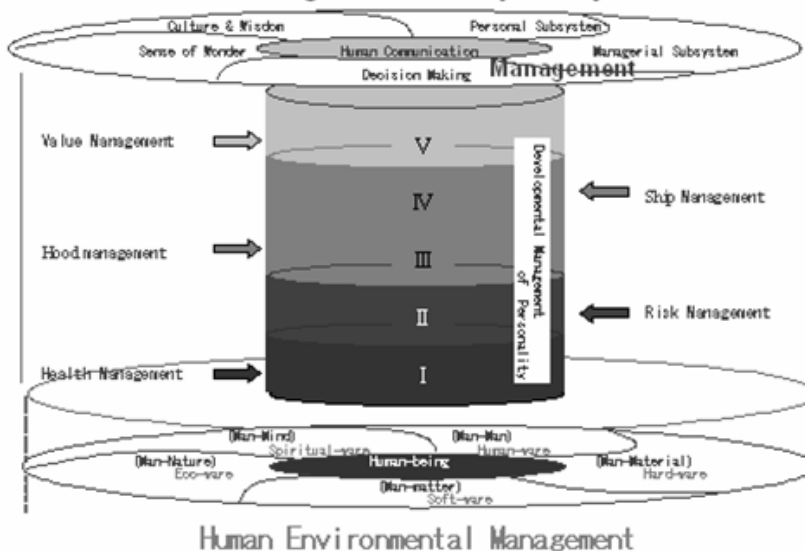


International collaboration

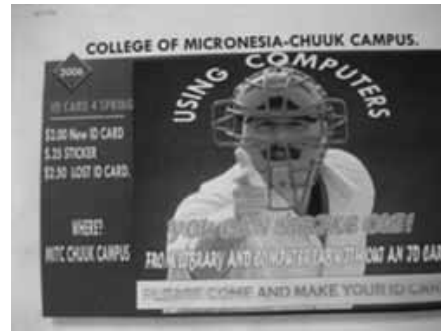




### Island Comprehensive Developmental Formational Management of Subjectivity for C.Gov.



Endogenous process with counter part



Historical burden and mutual respects





With best friendship



Small is beautiful.



Our academic interests on environmental dynamic changes are as follows:

(1) Can we propose, define, establish standards and take measures regarding the crisis critical point of sustainability for each scholarly area? Can we put these in the order of importance? For reference, Professor Lino Briguglio in Malta has proposed Vulnerability, but we can not know the measures by only extrinsic guidelines. It must stand up healthy development and future plan for islanders themselves. The data of Pacific islands is restricted originally and is large-scale except statistic relatives of time lag. Therefore we need to consider the phenomenon understanding depended on data can be highly outdated and limited partly. The problem is examining ‘5 Ware-5 Hierarchy, 3 Life Mode and Social Risk Management Procedure’ and “whether it can countermeasure against Globalization + Climate Change or not’.

(2) Keeping the balance of “not traditionally recurrent but future-oriented Life Economy, which is the first class Ecology Economy, the second class Inter-personal Activity Economy, the third class Market/Government Economy,” can we establish the global model through Pacific small islands, especially the isolated islands? Of course, we may check the proposal of the model and its concrete contents.

(3) On consumer education and environmental education, for human-derived factors regarding “Sea level rise crisis” and “Global abnormal weather,” how does our understanding of ‘Island Area in Tropical Pacific/Polar Region’ bring its force into play? We need to consider whether or not educational method can be the third pillar; first is the political and second is the academic method.

(4) GEOS; Global Earth Observation System of Systems is now active working to get global data from satellite and combine with the local data. Japan is working as the leader in Asian Pacific regions. We need to combine our community base study in the small islands in the Pacific with these global units.

How we can make approach with appropriate method? Not only get information, but we may make combine micro and local phenomena as the concrete and representative data in fact, which is not as a case study. We may act for the checking function to the scientific techniques - monitoring, prediction and simulation by comprehensive method, social unrest and ecological restorations.

(5) In addition to that, as national policy vision for Islands Area, can “Re-consideration of post-MIRAB strategy” are sufficient conditions of ‘Traditional + Modernization + Globalization + Sustainability + Collaboration + Empowerment’? It must include concrete contents.

(6) Especially, ‘the scenario for sea level +88cm rise at the end of 21 century’ leaves problems unsettling these measures. We need to discuss study problem and forecast regarding those current anxiety-provoking social model. The key is social decision-making. We have to consider wisdom/concept/ method to add to the traditional Pacific Way. Regarding those problems now is the time to have cooperative research with the next generation of native islanders. On and How, we need discussion together, like let’s start with what’s close at hand, zero emission, enhancing biological productivity, biomass energy and soft energy, resource management, environmental management and sustainability.

This time, we did out research only the small and little isolated islands, with pre-research measure and research measure, because of budget limitation. But we got the fixed interdisciplinary result. We expect more details to be gathered special knowledge and result from each field. For more detail researches of human and social phenomenon, especially, for researches of whole life, we need repeat visit, diversified observation, hearing and collecting data. Detail researches and diversified observation with enough time at local are most important. Particularly, at Pacific islands (especially, isolated islands), statistics and literature materials are limited. It is indispensable for high quality of result that the past researches, some materials and human network in Guam University, South Pacific University and Hawaii University are combined. It is a significant international contribution that we establish the maintaining research base in close cooperation with local collage, local government, local research organization (Korea Ocean Research Center located at Chuuk, KORDI). But we see, at library in Chuuk branch school, Micronesia collage, even science books were not put in order enough. This time, we could have a simple discussion with collage staff, but, regarding outer atoll and isolated research, with consideration of interdisciplinary and time-limitation, establishing the sustainable research system with locals and the repeatable collaboration are requested especially.