



ABSTRACT AND FINDINGS SYNTHESIS

12 au 16 décembre 2011
Tahiti
Hôtel Sofitel Maeva Beach



Regional Symposium on coastal area development policies in a perspective of adaptation to climatic change
Tahiti – French Polynesia December 12th to 16th, 2011

SYMPOSIUM PROCEEDINGS

From 12th to 15th December, 2011, the government of French Polynesia hosted a symposium about coastal land use planning policies as climate change adaptation strategy. The objective of this week long event was to create a forum of exchange of experience and expertise for technicians, decision makers and scientists from regional institutions, research entities, institutional organizations, administrations and governments (national and local), and non governmental organizations. Some hundred of participants from countries and territories in the Pacific and other regions participated.

Participants countries and territories of origin (10)

- Nauru
- Niue
- New Caledonia
- Marshall Islands
- French Polynesia
- Hawaii
- France
- Solomon Islands
- Western Samoa
- The Kingdom of Tonga
- Vanuatu
- Wallis and Futuna
- Cook Islands

Represented regional cooperation institutions, research bodies, institutional organizations (18)

- Académie des sciences (The Academy of Science – France)
- Agence des Aires Marines Protégées (Marine Protected Areas Agency _ France)
- Agence française de développement (French development agency)
- Agence de l'environnement et de la maîtrise de l'énergie - ADEME (antenne Polynésie française)
- Bureau de recherche géologique et minière (BRGM) – (Geological and Mining researches _France)
- Centre de la recherche interinsulaire et observatoire de la biodiversité et de l'environnement (CRIOBE) (Centre for inter-island research and observation of biodiversity and environment _ French Polynesia)
- European Commission
- Conservatoire du Littoral (Coastal Conservancy _ France)
- Indian ocean commission
- Institut du développement durable et des relations internationales (Institute for sustainable development and international relations (IDDRI) _ France)
- MétéoFrance (Weather Agency _ French Polynesia)
- Observatoire National des effets du réchauffement climatique (ONERC) (National research centre on global warming effects _ France)
- South Pacific Regional Environmental Programme (SPREP)
- Secretariat of Pacific Community - Applied Geoscience and Technology Division (SOPAC Division of SPC)
- School on ocean and earth sciences and technology (University of Hawaii – Ala Moana)
- University of the South Pacific (Cook Islands)
- University of French Polynesia (UPF)
- University of la Rochelle (France)

The discussions, led in French and in English, were carried out in plenary and group sessions in order to help:

- improve coastal planning policies,
- develop a multidisciplinary regional common reflection aimed at implementing one or more Oceania coastal development models,
- spread sound practices in the field of coastal land use planning and protection,
- establish a regional cross-collaboration between political decision-makers, technical experts and research organizations.



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EXECUTIVE SUMMARY

In past decades, Islands have witnessed significant population growth and rapid economic development leading to an increase in infrastructure and buildings concentration in coastal areas. In most cases, land use planning techniques (construction or protection) have prioritized infrastructures and equipment safety over sustaining and ensuring coastal public space usage. As a result, beach disappearance or erosion, as well as high coastal degradation, have multiplied.

Climate change impacts, such as sea level rise or increase intensity of extreme weather events, and environmental degradation effects on coral reef ecosystems exacerbate these difficulties in coastal management. Sea level rise in particular remains a major concern of Pacific island countries. Indeed, the latest data show an average increase of 1.2cm per year in the past 20 years in Eastern Pacific. Projections indicate that by 2100, sea level could rise by 50 cm to 1m¹.

Therefore, it is imperative to rethink land use planning policies in order to better protect the coast and ensure adequate adaptation to climate change.

Sustaining a healthy, functioning and resilient coastal zone requires, among other solutions, the protecting the coastline from development projects. This zone can host numbers of human activities and maintain the natural coastal dynamics.

Protective sea walls are one of the main examples of inadequate measures. Despite their short term protective relevance, such option tends to exacerbate eroding processes by impeding various natural dynamics.

Restricting the attention to addressing people and goods safety does not suffice. One has to consider the sustainability of natural equilibriums and their resiliency to atmospheric and marine modifications.

The use of green methods should be promoted especially in sparsely built or pristine areas. These methods are based on conserving coastal and marine ecosystems, such as coastal forests acting as green buffer zones, mangroves, or coral reefs.

Some coastal states, such as those in the USA, have developed land use planning regulations promoting the preservation of near-coastline areas. Such regulations include banning protection infrastructures (except for exceptional cases), applying no built coastal zones, or imposing building techniques such as the use of stilts.

Decision making processes in land use planning policies can affect the efficiency of measures adopted both in the short and long terms. Participative approach and the effort to ensure shared understanding of regulations and their objectives are essential for the sustained success of a proposed project.

In the Pacific, research programmes should be lead in three areas in particular.

First, a pluri-disciplinary programme should focus on the environmental, social and economical future of atolls. Indeed, the physical future of atolls cannot be restricted to a creeping submersion scenario, but is subject to more complex phenomena.

Second, research programmes should be planned to deepen the knowledge of the impact of climate change and ocean acidification on coral reef ecosystems health.

Last, the Pacific region lacks targeted climate projections scenarios. These should tend to focus on sub-regions in the Pacific. Results from these research programmes, which ought to be conducted by a small number of scientific teams in the world, shall be used for subsequent research as well as adaptation programmes in various fields and sectors.

Coastal land use planning and adaptation to climate change necessitate observation tools in terms of land use and other environmental parameters. Examples of such tools include coastal mapping, coastline monitoring,

¹ Anny Cazenave (2011)



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infrastructures description, sea and tide gauges, weather measurements, and climate data.

A more organized and subtle coastal management that takes into account local characteristics should promote participative approach. This necessitates that stakeholders are sufficiently informed on coastal environmental and legal realities. Restricting information to administrative and scientific terms does not suffice. Information should be accessible to the greater mass, translated, explained, illustrated and taught as an education, training and communication effort targeting the youth and adults alike.

Public financial development aid mechanisms already exist and are likely to benefit from new climate funds. However, due to human resources limits in island countries and territories, as well as the high number of programmes available, aid efficiency is not optimum. This is the reason why budget support should be promoted in order to ensure national programmes coherence.

Some overseas territories are granted little access to funding despite sharing numbers of characteristics or vulnerabilities with other countries from the region. The role of regional organisations is thus highly important for these territories' interests and to promote wide regional cooperation.

Debates held at this symposium have focused on coastline as an area necessitating a particular attention. However, land use planning concerns wider areas beyond the coast. Policies should focus on categorizing usages and users, analyse coastal value in order to improve its long term management and planning.

Lastly, climate change adaptation is an opportunity as it contributes to promoting discussions and exchanges of experience in the Pacific region. It also encourages a new approach to the integration of human activities in relation to the environment. It also calls for a more moderate use of natural resources. Regardless of climate change, it is high time coastal land use planning methods and policies be rethought.

The symposium draws the conclusion of the urgency to call upon the political class and key island societies stakeholders for action. New ways and practices in coastal land use planning ought to be implemented to restore the equilibrium between environmental, economical and social sectors.



I - CONTEXT / CURRENT STATUS INVENTORY

1.1. Island coastal planning

Due to geographic and geological singularities, Pacific Islands are regarded as one of the most exposed the regions to climate impacts.

Coastal areas host the majority of economical and social activities of island societies right from their origin. The ocean, the lagoons and their shores, which so intensely mark the Pacific islands spaces, have always supplied key resources for these societies livelihoods. They are also used privileged leisure areas. For that reason they have a central place in the Pacific peoples' cultures and traditions.

This extremely strong cultural link explains the intrinsic sensibility and demand of quality and sustainable use of these areas .

Pacific islands are characterized by a great institutional, socio-economic and cultural diversity. Yet, they all share a common relation to the sea which is to consider it (including shorelines) as public or community space. As a result, privatization of near shoreline areas remains exceptional or restricted by law.

Past decades have been characterized by rapid population growth and a consistent trend towards socio-economical activities and infrastructures, such as housing, public facilities, and tourism activities, in coastal areas. Land use planning techniques implemented have been focused on the safety of constructions and amenities with little consideration for the quality and access to coastal public areas as well as their sustainable use. As a result, loss of beaches and coastal damages has grown at the expense of local people.

In this context, climate change impacts are likely to exacerbate these phenomena.

So, rethinking land and shoreline planning has become a necessity to preserve the costal public space in order to ensure islands climate change adaptation is efficient.

1.2. Climate change

Understanding climate change impacts and related risks caused to coastal areas and coral reefs is an essential first step. This is why newest available data on climate change impacts are assessed, such as sea level rise, sea surface temperatures, ocean acidification, or extreme weather events, focusing when possible on the Pacific zone.

Sea level rise draws wide attention since it has significant impact on coastal geomorphology

This rise has accelerated since the early 1990s. It is globally increasing at about 3.3 mm per year, the increase rate, differing from one region to another. Over the last two decades, the rate of sea level rise has reached more than 12 mm per year in the western tropical Pacific. In the long run (end of this century), sea level rise in the tropical Pacific zone should approximate global average rise. There are still uncertainties about it despite improvements in climate projection models . Part of such uncertainty results from the the plethora of emissions scenarii (level of greenhouse gas release? Response of climatic system?). Pole icecaps (Greenland and Western Antarctica region) responses to GES emissions remain the biggest unknown. What is certain is that loss of ice mass shall have impacts on sea level rise.

In its fourth assessment report, the intergovernmental panel on climate change (IPCC) predicted a sea level rise of 40 +/- 20 cm above the present level by 2100. A scaling up of these figures seems now to prevail, following a number of recent research findings: a 50 cm to 100 cm bracket is anticipated for 2100. For the aforementioned reasons, it is quite difficult today to give more accurate figures.

Coral reef ecosystems play a crucial role in coastal stability and protection. Reef barriers absorb up to 90% of wave force, thus protecting coastal land and associated urban infrastrucutre from erosion.

According to the United Nations Environmental Programme (UNEP), 1sq km of this ecosystem preserves up to



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2,000 m³ of coastal land against erosion every year. Therefore, acting as an obstacle to waves strength, barrier reefs enable calm water lagoon or post-reef areas suitable for activities, such as navigation, fishing and or leisure.

Climate change impacts are a dangerous reality for these ecosystems.

Sea **surface temperature** is another major concern. According to current scenarios , it could reach around 30°C by 2050 and up to 31°C by 2100.

Salinity grade modifications combined with temperature or the sunlight conditions may lead to coral bleaching events. Coral bleaching consist of a massive release of the symbiotic photosynthetic zooxanthellae from the coral polyp after a particular temperature threshold. In French Polynesia, this threshold is 29.2°C. Such phenomenon can be lethal to corals.

This phenomenon is the most controversial issue among experts. There are varying assumptions among marine biologists about the adaptability of corals from changes in sea water parameters. Genetic diversity may improve adaptation capacity. Organisms, especially those with an ectoderm like corals, have been observed to adapt to temperature changes. The differences in genetic tolerance of hosts and zooxanthellae is observed in habitats that develop in warmer and warmer thermal patterns. Otherwise, global coral population genetic structure changes are likely to take several hundreds of years.

A second reflection focuses on the possibility for zooxanthellae to turn into types that would better tolerate warmth: it is the bleach adaptation hypothesis.

Ocean **pH** ranges from 8 et 8,2. The ocean is an alkaline environment by nature. The increasing CO₂ concentration in oceans leads to a reduction in pH levels. This phenomenon is commonly referred to as ocean acidification.

In our current state of knowledge, the calcification of coral skeletons would become a difficult process beyond a pH of 7.6-7.9. Since the beginning of the industrial era, pH level has decreased by 0.1, which means a 30% increase in ocean acidity. By the end of the century, ocean pH could reach levels of 7.8 and 8, increasing coral reefs and other organisms vulnerability.

Extreme weather events, such as cyclones are difficult to model. Although it is generally accepted that cyclones may increase in intensity, the increase in frequency is uncertain.

Nevertheless, we perfectly know the devastating effects of cyclones on coral reefs. In addition, in synergy with a cyclone-induced sea level rise, flooding on the coastal area is to be anticipated in an attempt to reduce the damage to homes and road and power supply networks.

By contrast it should be noted that cyclones generate increased deposits of coarse sedimentary rocks on the atolls levees.

II. MEASURES

2.1. Coastal planning measures

2.1.1 An overall philosophy: « start improving what was done poorly »

Uncertainties about the impacts of climate change at a regional level lead to many questions regarding intensity, frequency and geographical distribution of extreme weather events. But the nature of such hazards is not likely to change drastically. This means that seaside island territories already face the threats of tomorrow. They, thus, should develop natural risk management to deal with and anticipate climate change related risks. Climatic uncertainty may not be held as a reason not to act or as an inescapable obstacle to the definition of a risk reduction



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strategy and adequate coastal planning policies and decisions.

One of the strong conclusions to be considered is therefore that beginning to do correctly what we have always done badly is a necessary first step to adapt to climate change. Numerous examples show that the issue with climate change is also a problem of unsustainability of the land use planning and development methods implemented over past decades.

One of the most outstanding examples relates to the potential harmful effects of sea walls. For several decades, these works have been built with no study and on erroneous technical database. They have greatly demonstrated their counter-productive effects as they tend to accelerate the coastal areas erosion. They are also likely to cause loss of coastal public areas overtime.

It is essential that political action and territory development practices seek to avoid « maladaptation », i.e. measures that bring short-term benefits while worsening the problem in the long term.

2.1.2 Key challenges

Atoll preservation

Atolls are among the most vulnerable environments from climate change impacts. Atoll islanders cultivate a strong attachment to their land. They want to manage their island development so as to sustain livelihoods and adapt to changing environments.

Depending upon the demographic status, chosen options for urban development related issues may vary.

Sparsely populated atoll communities in the Pacific want to protect their environment and ecosystem services which are important assets they rely upon. Forced departures are not contemplated, even in the long-term. With regard to energy, waste management, materials extraction, agriculture and fishing options, mild solutions are favored because they are least destructive for the environment and natural resources.

Civil / marine engineering works may allow populations to remain on these small pieces of land. However, issues such as waste management remain. « Trash islands » or « hotel islands » concepts found in some densely populated atolls-countries is fully rejected.

Sea level rise is another source of problem with regard to ground water rising and fresh water stocks decrease, requiring the implementation of actions to adapt, among other things, agricultural practices..

Using green methods to sustain the ecosystem services

Uncontrolled coastal population growth and urban development may have negative consequences on coastal ecosystems. Should they be unable to fulfill their ecological function (ecosystem services), local populations might be directly exposed to security, sanitary, or food risks. Therefore, it is advisable to implement « green methods » which are especially favorable to scarcely developed or natural areas

Green methods are aimed at protecting coastal and lagoons ecosystems, such as coastal forests (green buffer zones), mangroves, and/or coral reefs.

The first of these soft protection methods is to keep the existing native vegetation on a sufficient land expanse to prevent erosion. It serves as a buffer zone able to face exceptional weather events, and maintains biodiversity-rich ecosystems.

The second options involves planting « effective » species:

- an array of diversified indigeneous species (herbaceous plants, shrubs, arborescence): they are potentially rich in term of biodiversity and resistant to disturbances. However, little is known about their shore protective efficiency as well as their introduction and growing conditions;
- imported forest species, often grown on monoculture basis; the introduction techniques are well-mastered



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and such species are fast-growing, but this is not the optimal solutions from an ecological point of view.

Keeping or restoring a coastal green buffer zone is interesting for many reasons:

- if well-done, it serves as a physical protection for the coast against erosion;
- its implementation or its maintenance is often less expensive than “grey” methods;
- it may sometimes include rare species;
- carbon balance is positive if compared with the development of permanent structures.

A green buffer zone is particularly effective when sufficiently wide. It is difficult and even inappropriate to implement that option in a coastal urbanized zone. A green buffer zone may take some time with regard to the optimal growth of the plants.

In many Pacific islands, replanting mangrove to reconstitute damaged mangrove swamps and as a result restoring buffer zones, is an option with many advantages (low cost, low technical support, etc.). However, mangrove swamps is not always a « green solution », like in French Polynesia where mangroves are not endemic. However, other plants might play a similar role. Thus, when choosing a replanting options, it is important to choose the species adequately.

New coastal planning principles

Most coastal property land management regulations duplicate those used for construction and land development in other areas without any attempt to adapt them. One exception is a specific definition of the coastal/maritime public domain boundaries that allows for a modification of the cadastral limits of concerned estates. Specific regulations may ensure the protection of goods and persons faced with marine submersion related-risks, such as disaster risks prevention plans implemented in the French territories (especially in French Polynesia). These regulations are mainly based on the definition of building-free areas and on building recommendations.

However, land management regulations can elude specific guidelines regarding the construction of protective walls and their negative impact. It is plainly established that the density of construction works next to the shore is likely to damage the quality of the public coastal domain and in the end contribute to the disappearance of many beaches.

The State of Hawaii is the only example in the region where general land planning regulations have been implemented on wide stretches of territories. The main objective is to secure the protection of a natural public coastal area, especially beaches. These rules rest on the ban of protective construction works (with some duly controlled exceptions), a drastically declining number of constructions, and building principles favoring stilts constructions with a view to ensuring protection against extreme events such as swells and tsunamis linked submersion risks.

Therefore, it seems appropriate for the relevant authorities to think about the definition of at least two main categories of zones. It should be done in consultation with the concerned communities, following a wide public information and consultation process. In each zone, land management principles would be adjusted according to the development priority choices implemented.

In the first category, a urbanized coast, defense works, modification of natural land, and construction works would be allowed at a relatively close distance from the shoreline. Urbanization would come first in terms of priority.

In the second category, the priority would be given to the preservation of the natural coast and to protecting its quality. This typically consists of a vegetation buffer separating the shore to inland. Construction work would be allowed at a reasonable distance from the shoreline, such distance varying according to the specificities of the concerned area. Protection works or whatever modification of the natural land, especially backfill, would be forbidden, with possible exceptions strictly controlled and subject to the opinion of the concerned populations.

Land planning experience in many Pacific islands and in the world shows that designing long lasting protective



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works to preserve the safety of estates and persons require a good knowledge of the sedimentary dynamics at the level of the entire sedimentary cell. Such considerations shall extend beyond the limits of a land-registry mapped plot of land. Only an approach at this scale may provide a good analysis of the repercussions of construction works and help keep control of their impacts on the environment.

Undertaking this kind of analysis on a scale larger than the considered plot of land necessitates early on dialogues between residents and land developers with respect to the concerned stretch of coast.

All these regulations and principles should be presented in a « book of sound practices » made publicly available (<http://seagrant.soest.hawaii.edu/hawaii-coastal-hazard-mitigation-guidebook>).

In the end...

Although climate change is a newcomer in the fields of public policies and land use planning, it is a matter of implementing options which are already parts of the day-to-day coastal management. In the end, it may lead to a positive assessment: Pacific societies are able to set concrete goals, and by already having the experience they also detain the means to achieve them.

2.2. Decision making process

Land management and urban planning is a matter of local actions with the concerned populations and their representatives in political institutions (city councils, customary council, etc...).

Thus, the efficiency of the management measures to be implemented is dependent upon the choice of the decision making process. The participative approach remains the most appropriate in the Pacific region where oral tradition is a key element of the regional culture.

Discussing is essential to follow up and enforce the application of local regulations. In the state of Hawaii for instance, they seek local population involvement in the decision making process: an illustration is the special committees dedicated to examining the exemption requests with regard to the banning of coastal construction works, such as specified in the local regulation. This democratic process allows the community to adopt appropriate regulations.

The participative approach also means the search for some exchange of views before making a decision. It is advisable to build up on the wealth of knowledge and traditional experience held by the Pacific communities. Thus, the objective consisting in reconciling traditional and modern solutions is useful and makes it possible to adapt the regulations and the development options to the local context.

Furthermore, the exchange of views also means that the discussions will include some explanations on the so-called « sound » methods, and even on the stakes to be considered. Indeed, when a population understands the nature and logic of certain rules to be complied with, they are more prone to apply the relevant regulations. For instance, the efficient management of the Nandi drainage basin in Fiji, is essentially the result of informative discussions and meetings undertaken by the community management committee.

The support of the community or traditional leaders (clan or tribe leaders, village leaders or clergymen) is particularly important in the participative approach. These opinion leaders relay the views between the community and the Central government because they have a good knowledge of the local context, of the expectations, and of the specific needs of their community. So they are able to identify suitable solutions and rule out inappropriate regulations.

The appropriate participative method to be implemented depends on the local social system and also on the goal to be reached. A good knowledge of the community will allow to wisely choose the appropriate method. In any event, that method must reflect a good representativeness of the people who have been consulted. Following are some examples of what is found in a participative approach:



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- « neighbourhood committees » meetings intervening in the city councils,
- involvement of an active network of associations,
- door to door visits,
- television and other media
- discussions
- conferences/debates

III TOOLS

3.1. Scientific research : three priority programmes

The future of the atolls facing sea level rise

Atolls concentrate specific problems in terms of exposure to natural circumstances, and many questions remain without reasoned answers.

First, cyclones surges of about 5 to 6 m that might submerge atolls are not very well explained; these destructive events cause a bio-detrital charging process of the atoll, via the transportation of dead, broken coral transported by the strength of the waves; however there is no real assessment about their constructive role.

There is big uncertainty about the reactions of atolls reef structures facing a 1 m increase in sea level by the end of the century, with an increasing rise in the next centuries. To what extent then might the whole atoll be made fragile? What might be the real impact of extreme cyclone swells on such coasts? Would the building up of sedimentary materials related to these extreme events be sufficient to maintain in a natural way and in the long term range the rise of the atoll level as the sea level is rising ?

During the previous millennia, as sea level was rising, did the coral reef growth occur with the continued existence of land surface (atolls), or exclusively with fringing reefs?

Up to this day, there is no specific data, and the existing assumptions require further study as part of a comprehensive, multidisciplinary program which is still to be outlined.

The health of coral ecosystems associated with climate change

There are some vital issues associated with the future of the coast in the Pacific region, such as coral ecosystem behavior issue in a warmer climate and a more acid ocean. These common issues should encourage the strengthening of regional works and cooperation, given that the complementarities of Polynesian, regional, metropolitan research in different areas (especially biology, geodesy, geo-sciences, social and climate sciences) are a real asset on which it is important to rely.

Research progress includes the strengthening of interactions between the different research areas and laboratories, in order to stimulate multidisciplinary research. As an example: coral studied as a biological system, and as a sediment producer, and thus as an actor of the coastal dynamic.

Communities involvement in research work

Some atoll communities in French Polynesia are interested in making research work easier on their island. Also, some NGOs are willing to volunteer in order to assist and facilitate research work, thanks to their on-field knowledge and expertise, and their capacity to put scientists in touch with the local know-how or the community leaders.

3.2 Observations

The observation requirements relate to the occupation of space and to some environmental factors.



Sea level monitoring

Variation in sea level is the result of marine, atmospheric and land phenomena. It is not uniform throughout the Pacific. In order to anticipate future change at local levels, where coastal development choices are made, it is important to have accurate data. Tidal gauges and co-located GPS instrumentation needs to be pursued in the region in order to secure reliable and permanent sea level measurements. Those measurements are essential complements to altimetry measurement done by satellite. Developing knowledge about variability in the Pacific area requires a certain number of measurements, spread in a well distributed manner in the area of interest, in order to better model the risk and optimize public spending for littoral.

Monitoring of the coastal line dynamic at the Local level

This monitoring is necessary to anticipate operation choices on coastal zones and in the end allow a better return on experience and coastal risk prevention.

The surveys of a geo-referenced database about the geomorphology and coastal protection systems set up in Moorea (French Polynesia) and other examples of coastal fine studies were presented by representatives of partner countries and territories. Thus, university studies were conducted in Hawaii, at the request and with the support of local authorities, to list areas around the island where coastal erosion is observed, and to help develop regulations aiming at restoring threatened beaches or preserving existing beaches.

Public geo-referenced databases on the model implemented in Hawaii, and supported with aerial photos, would allow to determine and view areas currently sustaining erosion, or stable or in accretion, and their geomorphology.

Such a database should be set up first and foremost on the islands where persons and stakes are most exposed to natural risks; It would make it possible to monitor the coastal line moves, the morpho-dynamic aspects of the coastal zone and its development and to carry out a special inventory of damages, erosion patterns and submersions limits.

These observations must be led in a recurrent way with specific campaigns after storm or outstanding cyclone events.

More accurate knowledge of swell with measurement devices on site

Swell modeling and forecasting achieved great progress in the course of the last decade, allowing improvement of people and assets security. However the signaling, forecasting and climatology of this parameter in the Pacific would require the use of more tidal gauges.

Data from the worldwide meteorological observation network

Pacific is rich in meteorological observation data produced as part of the Worldwide Meteorological Organization (OMM-WMO) and of the worldwide System of Observation of Climate (SMOC-GCOS). The importance of these observations, of their continuity and permanence must always be reminded considering the various areas of research and application to which they contribute and which they are the necessary basis of:

- Assistance to day-to-day observation, assistance to the warning of dangerous phenomena
- Data entry of meteorological forecasting, eg forecasting model
- Climatology: knowledge of present and past climate but also implementation of forecast models and projection of future climate
- disasters risks reduction (DRR)
- adaptation to climate change.

A part of the ancient meteorological data is not digitized. Some operations of « data rescue » are already



undertaken and others could possibly follow.

Information collection on environment by population itself

Public and associations can contribute to the observation of the effects of climate change and to the improvement of scientific knowledge. Their knowledge of the environment and their on-field distribution are complementary assets for professional scientific networks. By way of examples, amateur astronomer networks and some networks called « weather watchers » are presented; in both cases amateurs implement codified observation methods resulting in perfect usable data by professional in the field.

Thus in the Pacific, former toponymy often gives information about the characteristics of the site.

Clubs and societies are particularly adequate for the collection – or the assistance of scientists in the collection – of empirical data and tradition or custom deriving knowledge.

Information on data itself, « point zero », « history » and monitoring

The archiving of measures relating to environment does not generally limit itself to the archiving of the values of a parameter, but also requires the archiving of meta-data, that is to say of information relating to the detailed conditions under which measurement was performed and its nature. This aspect is sometimes forgotten.

Development studies besides would improve if supported with a planning history, which allows an understanding of past decisions before sketching a future evolution. If we consider the example the coastal line description and its defenses, implementing “baseline” must take place as early as possible.

This step also corresponds to the awareness of the coastal planning current situation, that is to say the existence of an “inheritance” which must collectively be assumed, while developing possible restoration of damaged environment and a return to the previous situation when it is still possible and necessary.

3.3 Communication and education

On the long term perspective that fits territories planning questions, environment protection or adaptation to climate change, education plays a key role, to foster efficiency, development, extension, permanence of investments and actions, and to avoid falling again into some errors of the past.

It is well known that the very young generations are today sensitive to environmental issues and contribute to spread, in the home environment, “virtuous” behaviors regarding environment.

On the other hand, the problems complexity, the rapid evolution of scientific knowledge, the evolution of law, the necessity to share knowledge to make cooperation possible, etc... make it necessary to foster sustained communication activities.

Beyond these general points, the littoral planning problematic is raising specific and new questions. Indeed, it straightforwardly emphasizes legal and social issues and stakes such as individual property, public property, public coastal domain. Yet, the basic legal knowledge on littoral proves often little known outside directly concerned profession.

Among the individuals who own part of a coastal band, many people are unaware of their rights and obligations. Some have only a very vague notion of the border limit between their private land and the public coastal domain. Others pretend not to know or not to understand. Public power has sometimes, by its passivity in front of de facto situations or legal hiatus, contributed to keep vagueness going about rights and values, therefore maintaining a cognitive confusion.

There are consequently civic education and communication stakes towards both the young generations and the adults.

In the future, a more controlled management of the littoral, but also a more refined and balanced management,



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taking into account local specificities, will require a more frequent resort to cooperation processes.

Debate and cooperation, in democratic conditions, requires sufficiently informed citizens about the littoral realities, in particular from a scientific and legal stand point. The means of this communication and of this training could be:

- Audiovisual programs
- cartoons.

Besides, some NGOs suggest the regulation relating to littoral be translated in the local languages, and be accompanied with educational or explicative supplements.

3.4 Funding and regional cooperation

The implementation of government-decided planning and development policies to better adapt to climate change in our Pacific islands comes up against the difficulty to mobilize sufficient resources either technical, human or financial.

Conscious of their own limits, Pacific countries and territories are therefore led to seek financing resources overseas and to appeal to regional and international institutions. The regional cooperation is a tool that allows to better adapt the Pacific region to the major challenge of climate change.

The Pacific countries and territories have taken commitments and have federated within regional institutions such as the SPC and SPREP for the Pacific Region. These bodies operate by supporting the region acting forces, assisting them in the training of their agents, in establishing and strengthening local expertise, the technical assistance and the development of skills as well as facilitating access to information and existing programs – in particular those aimed at supporting the public policies of adaptation to the climate change in the Pacific. These regional entities may also be used as fora for experience and practice exchanges between the countries and territories of the region. These exchanges thus allow to identify the sound practices to be implemented accordingly.

A great many financing programs are proposed. The European Union, for instance, is one of the active partners in the region. It operates through the European Development Fund (EDF, for the Overseas Countries and Territories, OCTs, as well as for the ACPs), with budget supports, loans of the European Investment Bank, or through community programs (instruments for financing and development cooperation, or the Research and Technological Development Framework Program).

However, because of the restricted human resources in these countries and territories, but also because of the diversity of programs, the efficiency of the financial aid is not secured. The lack of consistency in the organization of the money lenders often results in a duplication of the projects implemented. An approach of financing based on budget support is recommended to ensure some consistency in the national programs.

For territories and local communities, the financing sources and programs are limited despite a number of common characteristics shared with the region countries. The support of regional institutions is accordingly essential to allow the development of adequate programs in these territories, and to ensure an optimal regional cooperation.

In this context, the regional Pacific organizations have a capital interface role to play between complex international financing programs and the local concrete needs of their member states. They may contribute to scale economics in the mobilization of expertise at the regional level, while permitting the setting of coordinated programs.

III. A new approach to coastal planning

If the island economical life closely depends upon coastal biological life –the survival of mankind keeps



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depending as well on the good condition of this ecosystem called littoral.

To plan means to organize space and often transform our environment, but it also means treating nature and diverse forms of life on which we depend with care, therefore preserving the future of the generations to come.

Coastal planning in the island of the Pacific is often synonymous of island development as a whole. These questions are therefore among the most complex and the most essential ones, at the very heart of the political issue.

Today, we are in a transitional period, a key moment. Although our development was very successful in many ways, we may witness, in many places in the Pacific and our islands, so many examples of errors not to be repeated.

On the other hand, crises we have sustained, whether economical or environmental, have created a burst of reflection, a wish to re think activities and development in a long term vision where values such as life protection, quality of public spaces, social links, and the protection of certain identities are more clearly explained, more often chosen to enlighten choices, thus overshadowing short term criteria and values.

In many coastal places, a threshold has been overstepped, where the addition of private decisions to build without coherence and respect for public space, becomes progressively inconsistent with an access of all to the common public property – the sea, the shores, their fruits, their ecosystems and their diversity – and opposes even to the collective building of a long-lasting, viable environment, by jeopardizing too widely the natural and vital exchanges between marine and land environments and by disturbing the social link which expresses itself daily around the coastal area.

As for climate change, it is now and for the centuries to come a context element and problem which adds to many others. Generally speaking, it increases some difficulties since it generates disturbances in the environment of our human activities and imposes important stresses on the natural settings themselves. Sea level rise in the course of the century to come – 50 centimeters to 1 meter – will probably be the strongest consequence for most of the Pacific islands. Adaptation to climate change requires to return toward less rigid, more flexible, more mobile, leaving natural areas and unoccupied and possibilities of evolution for transition areas, buffer zones represented by reefs, mangrove swamps, or shores.

This necessary adaptation is an opportunity that contributes to opening such thinking and at the same time promote exchanges of experience in the Pacific region, to plan differently the integration of our activities into our environment, and to curb our consumption of natural resources.

But even without climate change, our time would have needed to ask again the questions of coastal planning.

At the end of this symposium, we call upon all the politicians and the life blood of our island communities to open new ways and practices as an obvious fact and an urgent matter.

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