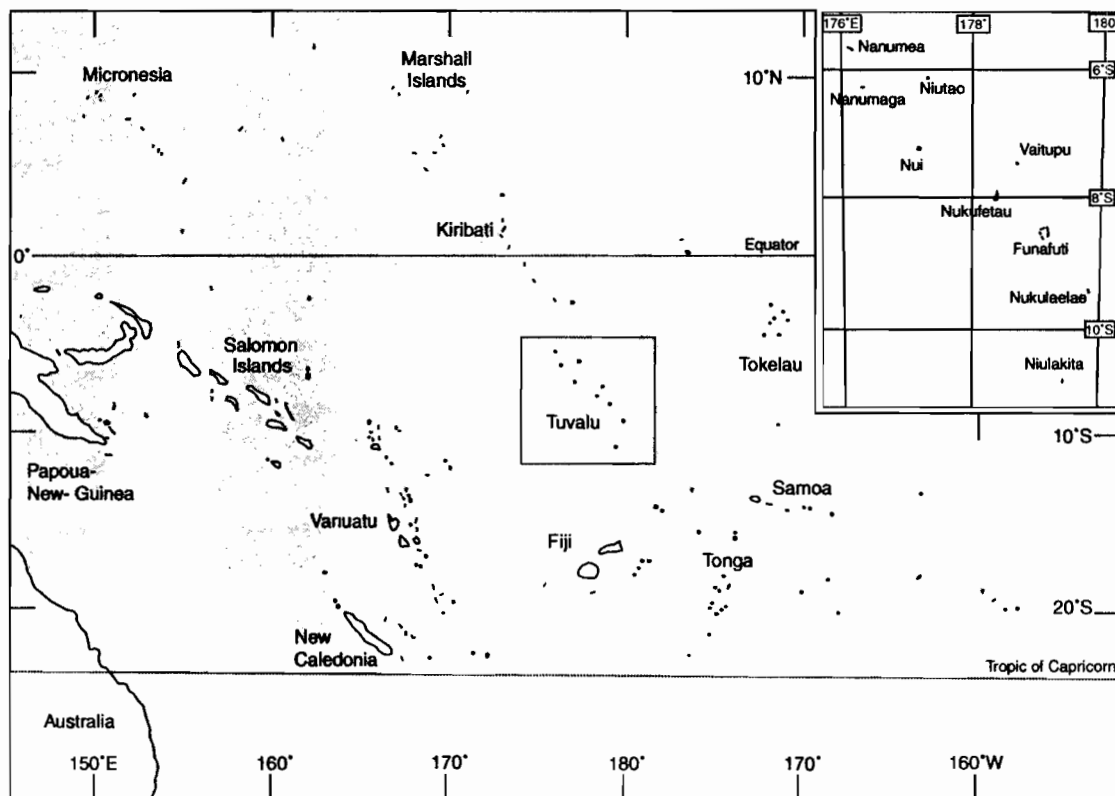


Shoreline of human-impacted coralline atolls: need for a concerted management. The case-study of Fongafale, atoll of Funafuti, Tuvalu

Caroline Rufin

The atoll of Funafuti (Tuvalu archipelago) is located in the South Pacific Ocean at latitude 8.31° South and longitude 179.13° East (Figure 1). According to its morphology, Fongafale island (atoll of Funafuti) can be split into three distinct geographical areas, *i.e.* the northern, central and southern parts. The present study deals with the central part, which results from the deposition of sediments from the two other areas following North and South longshore drifts.



Source : from McLean et Hosking, 1991

Figure 1
Localisation of Tuvalu within the Pacific Basin.

Through the example of Fongafale island, the present study is aimed at thinking about the management of low coralline islands confronted with erosion problems most often in relation with excessive coastal planning. This thought will be developed in terms of global geography while taking into account all the environmental conditions.

Our purpose will be not to demonstrate which of the two factors, Man or Nature, is the more disturbing. However, from the analysis of our data set it is clear that the contribution of the former is greater than that of the latter.

We will first draw a schedule of Fongafale lagoon shoreline from aerial pictures and topographical readings; it will be essential to understand the environmental problems which this atoll is submitted to. We will next attempt to provide solutions to the management problems such small human-impacted islands are faced with.

The archipelago of Tuvalu, and especially the atoll of Funafuti, were privileged locations during World War II. This is the reason why Fongafale development was very early and fast. But, the amenities developed at that time have had and still have direct consequences on the behaviour and evolution of sediment deposit.

When the US Air Force facilities were set up at Fongafale, numerous channels were dug out in front of the lagoon coast. They were supposed to not only facilitate shipping, but also provide one with the materials required for the building of a runway and for the coastal replenishment. In addition to this first source of disturbance, one should mention the tens of quays and groynes that prevent sediment from depositing on the coast, the partial filling-up of the lake and mangrove, stone-packing along the lagoon shoreline as well as embankment works on more than 2 km.

Faced with such man-made alteration of the coastline, the people in charge of planning at that time had to find the materials needed for carrying out these works. In this purpose, they used dynamite to partly blow up the coral reef flat and dug out the structure of the atoll on more than 2 m.

These extraction processes have affected not only the island morphology, but also the life of inhabitants since, with more than ten quarries inventoried, the living space on the atoll has been significantly reduced. This imposed to find solutions in relation with the fast increase of the population on the capital island. These open cavities became, then, a gathering place for garbage (Figure 2). The policy instituted by the inhabitants themselves was, thus, to fill in these cavities to further build there new houses. But, it was done without taking into account the porous structure of atolls. At every spring tide the seawater percolates through it and scatters garbage over a large area around houses.

At the moment, the human-impacted activities on the shoreline endure. One cannot keep count of the removals of sediments for building purpose, *e.g.* roads, houses... For example, in the South of Fongafale, pebbles are frequently removed: in only one-day field trip we observed the removal of 525 kg of small pebbles packed in 25-kg bags, which was considered by the natives as a normal and regular extraction (Figure 3).

Even though such quarry areas are legal on the oceanic side of accretion, most of the time the sediments are taken from the lagoon side: natives, indeed, consider them of a better quality for building.

In fact, there is neither state control nor fine against those who break the law.

It is obvious that these removals have a direct impact on the evolution of Fongafale shoreline, but one must be conscious that these materials are the only ones available for building. So, in the long run, it seems difficult to forbid any extraction. Only a closer and regular watch would be desirable, especially because the lagoon side is the one that undergoes the greatest retreat.



Figure 2
Garbage and waste deposits in a quarry.



Figure 3
25 Kg bags of pebbles gathered on a beach.

Erosion is thus quite evident on Fongafale. Its government has tried to check it by anarchically setting up protections at some places. This has been followed by numerous private initiatives: each inhabitant has built up vertical walls, placed rocks or man-made devices like coconut-trees whose perverse consequences on the system do no longer need to be demonstrated.

We can thus wonder why this state is poorly interested in the future of its shoreline. In fact, contrary to other island states, the shoreline of Tuvalu is not a state-property, but a family one derived from customs.

Despite the lack of old enough data, can we date this erosion phenomenon? It can be asserted, however, that if erosion had been noticed before 1942 when the American premises were set up, it must have been natural and seasonal. Indeed, photo-analysis together with the talks we have had with inhabitant who lived there at that time showed that, in 1941, the shoreline consisted of sand (Figure 4). The analysis of photos taken in 1943 highlighted significant man-made actions on the environment such as embankment, quays and groynes. Sand was, however, the sedimentary element found in accretion. The next set of photos taken in 1984 exhibits a totally-worked coast. From surveys performed between 1984 and 1999 by the SOPAC, erosion was assessed to be dominant over accretion; sediment deposits mainly consisted of pebbles and beachrocks, whereas sand accounted for only a minor part (Figure 5).

If we intend to rethink about coast management, what actions can be envisioned in the future: let each landlord pursue his individual and punctual actions or evolve toward a global, long-term and well-argued thought on the system?

With the desire of fixing up the shoreline and fighting erosion, through his actions, man seems to have been the main actor in the morphological changes observed on the lagoon coast of Fongafale. As frequently demonstrated in the Tuvalu archipelago and elsewhere, a shoreline anarchically protected is far much damaged because of these protections than a bare shoreline devoid of amenities.

Beaches being vulnerable and sedimentary cells constituted of small-sized accumulations, sensitive to changes and with a low natural-recharge capability, they must be protected and conserved.

At a time when anyone can notice that human activities have played a determining part in restructuring coastal area, new parameters must be taken into account (Figure 6). So, from now on, everyone will have to compromise with external factors that can be more harmful for shoreline. Within the context of a world-wide reduction in sedimentary deposits along the coasts and of increase in paroxysmal events, *i.e.* storms, hurricanes, rise of the sea level, it will be interesting to wonder about the future of this state and especially of its capital island.

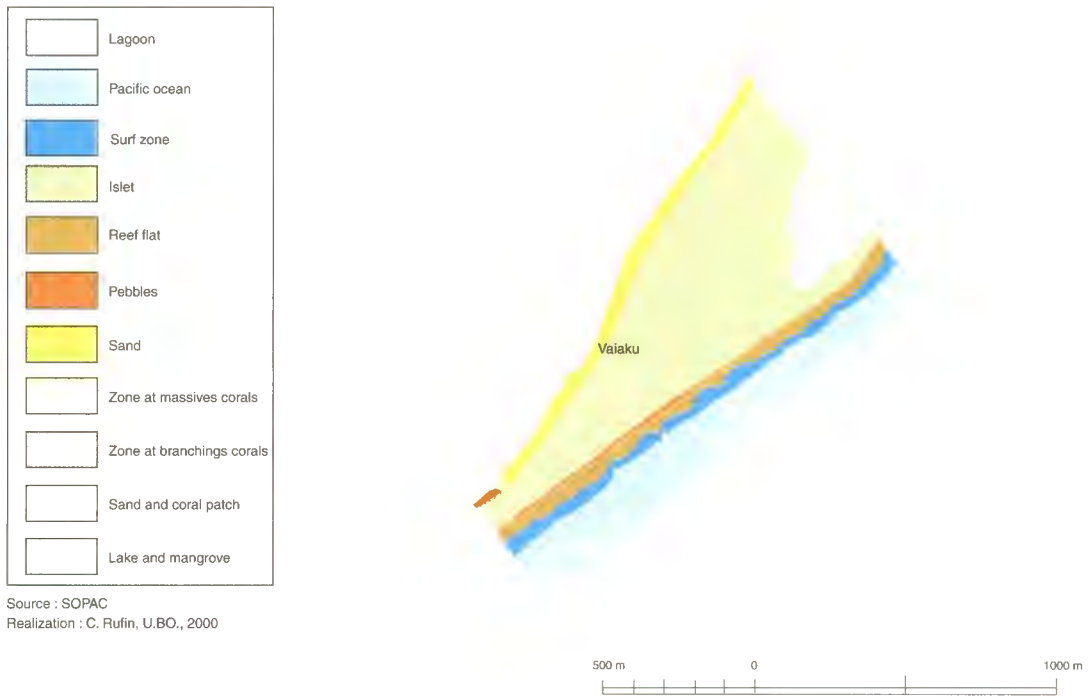


Figure 4
State of the lagoonal coast of Fongafale in 1941.

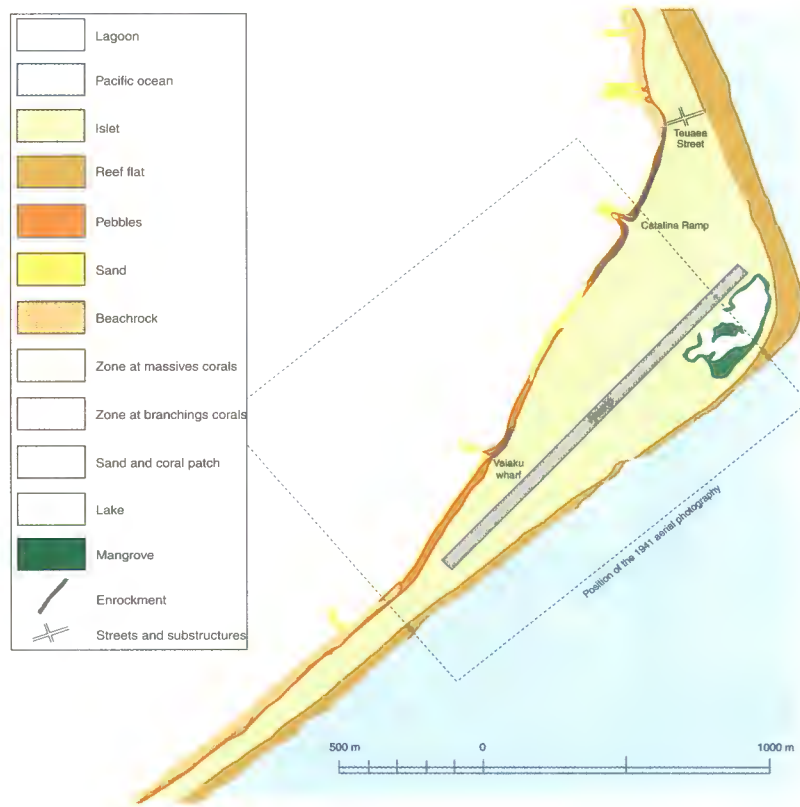


Figure 5
State of the lagoonal coast of Fongafale, Funafuti, Tuvalu, in 1995.

Climatic change phenomenon has sized up a risk only because of an increased use of coastal areas. In the event of a continuous rise of the sea level, the future of coralline atolls would be all the more worrying that archipelagos, which constitute independent states and lack of less-vulnerable places convenient for moving back populations, will be threatened.

It seems, indeed, essential to learn from the past in order to better adapt to the problems these low coralline islands are facing. It is only from this inventory of facts that the management of these small island states often protected or developed hastily could be rethought.

These islands populations exposed to the natural and anthropic ups and downs would take profit of the implementation of applied geography. In this prospect it is fundamental to lay down a land management policy for these limited territories and to make their politicians compromise with natural dynamics through adaptation instead of fighting against them. In order to think about the coastal cell in its whole, and no longer on an *ad hoc* basis, envisioning a management concerted between the different actors involved would be of high interest. However, this should be done without going to the opposite extreme of site restoration to come back to the Natural conditions from which Man is often excluded.

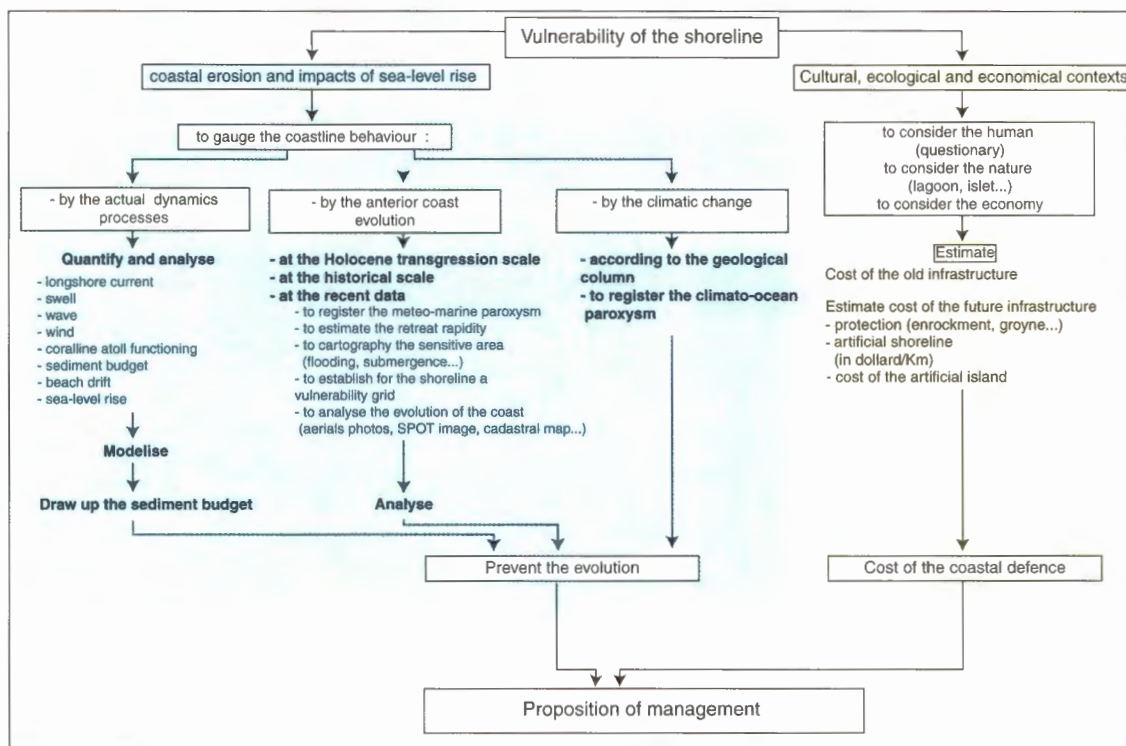


Figure 6
Steps taken in the analysis of the shoreline evolution in Fongafale.

With the desire of developing tourism-related activities all over this country in order it turns into the myth of New Cythera like many other islands in the Pacific Ocean, endeavour should be made in shoreline management. Why not envision the rehabilitation of some coastal areas by, for example, developing a policy aimed at reducing empoldering ?

Bibliography

- CAZES-DUVAT V., 1999 —
Les littoraux des îles Seychelles. Université de la Réunion, L'Harmattan, 365 p.
- MCLEAN R. F., HOSKING P. L., 1991 —
Geomorphology of reef islands and atoll motu in Tuvalu: *in* Rogers K.A. South Pacific Journal of Natural Science, v.11, 190-202.
- MCQUARRIE P., 1994 —
Strategic atolls. Tuvalu and the second World War. University of Canterbury and University of the South Pacific.
- XUE C., MALOLOGA F., 1995 —
Coastal sedimentation and coastal management of Fongafale, Funafuti atoll, Tuvalu. Technical Report 221, SOPAC, 54 p.
- XUE C., 1996 —
Coastal erosion and management of Amatuku island, Funafuti atoll, Tuvalu. Technical Report 234, SOPAC, 34 p.

DOCUMENTS
SCIENTIFIQUES
et TECHNIQUES

II5

Volume spécial

*Coral reefs in the Pacific:
Status and monitoring,
Resources and management*

**Les récifs coralliens du Pacifique :
état et suivi,
ressources et gestion**



Institut de recherche
pour le développement

CENTRE DE NOUMÉA

**DOCUMENTS
SCIENTIFIQUES
et TECHNIQUES**



Publication éditée par :
Centre IRD de Nouméa
BP A5, 98848 Nouméa CEDEX
Nouvelle-Calédonie
Téléphone : (687) 26 10 00
Fax : (687) 26 43 26

L'IRD propose des programmes regroupés en 5 départements pluridisciplinaires :

- I DME Département milieux et environnement
- II DRV Département ressources vivantes
- III DSS Département sociétés et santé
- IV DEV Département expertise et valorisation
- V DSF Département du soutien et de la formation des communautés scientifiques du Sud

Modèle de référence bibliographique à cette revue :

Adjeroud M. *et al.*, 2000. Premiers résultats concernant le benthos et les poissons au cours des missions TYPATOLL.
Nouméa : IRD. *Doc. Sci. Tech.* II 3, 125 p.

ISSN 1297-9635

Numéro **II 5** - **Septembre 2002**

© IRD 2002

Distribué pour le Pacifique par le Centre de Nouméa

*A regional symposium
International Coral Reef Initiative (ICRI)
Symposium régional*

International Coral Reef Initiative (ICRI)
22-24 Mai 2000
Noumea IRD Centre - New Caledonia

*Coral reefs in the Pacific:
Status and monitoring,
Resources and management*

Les récifs coralliens du Pacifique :
état et suivi, ressources et gestion