

AMASOWA



**AN EXPERIMENT IN THE RECLAMATION OF
ERODED BEACH AREAS ON ATOLL ISLANDS**

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By

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THE PROBLEM

My first trip to Unanu was in 1987. This was to be the first of many trips to come and would ultimately lead to my marriage to one of the fine women who live there and a permanent move to the island which is expected to take place in 1998. As the years have gone by, I have become very familiar with the customs and living conditions on Unanu and the nearby islands.

Unanu is located in Namonweito Atoll, one of the northernmost atolls in Chuuk State of the Federated States of Micronesia (FSM). Because of its northern location, Namonweito frequently experiences typhoons. One result of typhoons on atoll islands is beach erosion. Specifically, on Unanu, severe erosion occurred following typhoon Yuri in late 1991. This erosion was especially severe on the narrow northern end of the island. At least 10 feet of land was eroded from the east (ocean) and west (lagoon) sides of this end of the island as well as a larger amount from the end of the island itself.

In the years following this typhoon, vegetation gradually reappeared on the eroded areas roughly to the original extent of the island. It almost seemed that the island "remembered" its original size and shape. However, the elevation of the island in these eroded areas was approximately two feet below the original level. Because of this, the northern end of island would be more vulnerable to further erosion when another typhoon occurs. A severe typhoon could potentially destroy this part of the island.

PRESENT SOLUTIONS

A common approach to the problem of beach erosion in Micronesia is the construction of seawalls. I have seen the results of seawall projects on many of the islands of Micronesia. Some are still in place; many are not. While this approach has met with some success, at times it appears that seawalls have added to the problem they intended to solve. This can occur in two ways. First, storm waves that hit a seawall cause great turbulence leading to additional erosion at the base of the seawall. It then becomes increasingly difficult for sand to reestablish itself in this newly eroded area as it is now affected by even mild wave action. Second, extensive construction of seawalls can alter the natural currents around an island and cause erosion in unexpected areas. It is also worth noting that seawalls are often quite unattractive.

A pristine beach lined with shrubs and trees is one of the most beautiful sights in Micronesia. Certainly, this is one of the attractions of the atoll islands to "outsiders" such as myself. The vegetation on such beaches is also an excellent means of holding the soil in place during storm conditions. It would therefore appear to be worth pursuing a "natural" approach to reclaiming eroded beach areas that would result in the original elevation and shape of an island along with normal vegetation. Beach replenishment and revegetation are a logical alternative to the construction of seawalls.

OBJECTIVES

The primary object of this project was to reclaim a portion of eroded beach area on the northern end of Unanu Island by restoring it to its original elevation and by replanting it with trees and shrubs. Secondary objectives were to assess the short term stability of the reclaimed area and to survey attitudes toward the project. Based on the project findings, recommendations were to be made concerning possible similar future projects on Unanu or elsewhere.

INITIAL ACTIVITIES

I arrived on Unanu Island to implement the project a few days before Christmas, 1996. Immediately, I noticed, much to my amazement, that people were referring to the project as a seawall project! Apparently, because of the popularity of seawall projects in the past, this term was used rather than something more appropriate. Although there was great interest in the project, there was also a great deal of confusion concerning exactly what it would entail. Previously, the scope of the project and compensation to be paid for workers had been relayed to Unanu via various members of the community that I had the opportunity to discuss the project with at my office on Weno, the main island of Chuuk State. As a result of this oral transmission of information, a number of misunderstandings had arisen.

Shortly after my arrival, a meeting was held to discuss the project. The first item of business was to give the project an appropriate name. I half jestingly and half seriously indicated that anyone who used the term "seawall" would not be permitted to participate in the project. I then proceeded to explain the differences between seawalls and the approach to be used in the project as well as the many problems that have arisen as a result of seawall projects. We adopted the Chuukese name *amasowa* (which literally means to fill something up) for the project instead of seawall. Thus, we had an *amasowa* project rather than a seawall project. By the time the reclamation work was complete, the name *amasowa* had universally been adopted by all project participants. In the end, I only heard the term "seawall" used by a few small children (even they had been misinformed!) and visitors from neighboring islands.

A political item discussed at the meeting was that ownership of reclaimed beach areas would not change as a result of the project; a family could under no circumstances acquire ownership of a parcel of land by virtue of the fact that it reclaimed it. Similarly, when bushes, etc. would be used to revegetate the area, it was stipulated that coconut trees not be used. The underlying logic was the same although it was not explicitly stated. Often, if someone plants a coconut tree, it remains the property of the planter even though it is not on his land. Sometimes ownership of a tree is used as a lever to acquire land. This issue was purposely avoided, again in order to minimize the chance of future problems arising concerning land ownership.

Prior to beginning the actual reclamation work, I toured the project area with representatives of the island Municipal Council and chiefly clan. The intent of this effort was to insure that there would be no disputes concerning the selection of the beach area that would be reclaimed. This was very important to me as, since my wife is a resident of this island, I did not want there to be any implications that the project in any way favored her extended family. We agreed that the logical areas to be filled were the northern end of the island and the adjoining beach on the east. These areas were the most severely affected by erosion as a result of Typhoon Yuri in 1991.

On the Saturday after Christmas, December 28, a picnic was held to kick off the project. Families cooked at the site and literally the entire island participated. I sat back and watched the event unfold wondering how it all could possibly work out (it is always best for the outsider not to meddle with these affairs and try to inject his western wisdom into them). Sure enough it did. Certain families cooked rice, bread, or local starch foods. One cooked a number of pots of soup. Still others cooked fish that the men and boys had caught the day before. There was a huge "cannibal" pot of boiling water available for making tea and coffee. Of course, as usual, there was a never-ending supply of drinking coconuts. The picnic meshed very nicely with festivities for the holidays. The residents of the island were very grateful that the project provided for this type of affair.

After a great deal of discussion, which actually extended over a number of days, we agreed on a procedure for compensating families who participated in the project. The project site was divided into squares 6 feet by 6 feet with a depth varying such that the filled area would have a smooth pleasing contour. The corners of each square were marked with sticks with ribbon tied to them at the height to which the square should be filled. The volume of each square was calculated by multiplying the area (36 square feet) by the average depth to which the square would be filled (the average of the heights of the 4 ribbons marking the corners of the square). This volume was then multiplied by the rate of \$.50 per cubic foot to determine the amount that would be paid for filling the square. A total of 159 squares (plus a few triangles and one trapezoid!) were filled. The monetary value allocated to the squares varied from a low of \$3 to a high of \$35. The total value of all the squares was \$3,618. At \$.50 per cubic foot, this amounted to 7,236 cubic feet of fill material, or 268 cubic yards.

As an incentive to keep the project moving, payment would be made to a family as soon as it filled a square. However, only one square was assigned at a time unless, as in the case of a few very large families, it was certain that work on a square could be completed in one day. This insured that a family would not "stake a claim" on a large area and then delay doing the work. Thus, the amount of area that would be allocated to each family would be determined by how fast a family worked. Consequently, a large family or a family that worked very hard would receive a greater area to work on. This assured that there would be no disgruntled families who would be barred from participating in the project. It also would reward harder working families. Finally, the procedure had a side benefit of favoring families that permanently reside on Unanu as it would be most

convenient for them to work. Anyone who could make a legitimate claim that Unanu was his home was permitted to participate in the project.

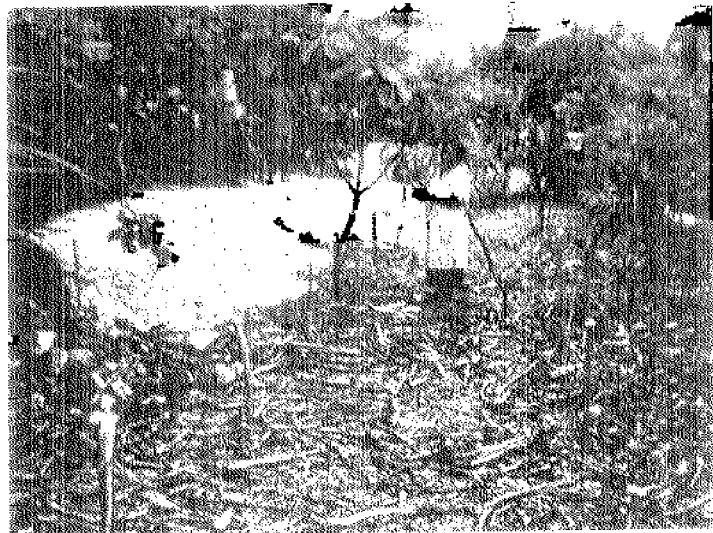
BEACH RECLAMATION



The project area on the northern end of the island has been cleared and sticks have been driven into the ground to mark 6 foot by 6 foot squares. Men are now laying out the final contour for the filled land. This will be marked on the sticks with ribbons.

As indicated earlier, since typhoon Yuri in 1991, the island had begun to revegetate in the eroded areas. This vegetation consisted of shrubs, vines, and trees, notably coconut and pandanus. Some of the shrubs --- which can actually become trees --- already had trunks around four inches in diameter. Prior to beginning the actual beach reclamation work, it was necessary to clear some of this growth in order to have convenient access to the area that was to be filled. Since the vines made it most difficult to access the work area, they were removed first. This was not regarded as too great a loss as they recover very quickly. In only a few areas was it necessary to trim shrubs; none were removed.

The reclamation work began on December 30. Families that wished to participate in the project were assigned a "square" to fill with rocks, gravel, sand, etc. If rocks were used as fill material, it was stipulated that they be covered with gravel, and finally with at least 3 or 4 inches of sand. The purpose of this stipulation was that the finished area would have a pleasing landscaped



Filling work on the northern end of the island has begun. Note that the first layer of fill in the square in the foreground consists of fairly large rocks.

appearance. My work at the project site was to insure that squares were filled to these specifications. When rocks were used as fill material, I informed families when they should cover them with gravel. As gravel was applied, I raked it smooth until it was around 3 or 4 inches below the



Filling on the north end of the island progresses. Note the sticks marking the squares. The ribbons on them indicate the level to which the squares will be filled.

ribbons on the sticks marking the square. Finally, the family filled the square to the prescribed depth with sand, while I again raked it smooth. The result was that the finished area was very attractive. As the project progressed, residents appreciated that they had indeed created a beautiful area and they began to call it their "beach" or, for the more well-traveled, their Waikiki.

The project had a spin-off benefit. Rocks that were regarded as litter and were scattered all over the island were used as fill material. One type of "rock" that was used for fill were sacks of cement that had cured in the sack. On an island, it is very difficult to store cement for any length of time. Consequently, cured sacks of cement frequently litter the islands. This project was an ideal disposal ground for this litter. Another type of "rock" that was used was dead coral from on the reef. Care was taken to insure that no live coral was used. In order to insure consistency among the filled areas and to insure that the

reclaimed area would be stable in the long term, the use of vegetable matter (logs, palm fronds, etc.) for fill was not permitted.



The northern tip of Unanu is extremely dynamic. It consists of a sand spit that extends beyond the normally vegetated part of the island. The length of this sand spit can be almost nil following severe storm conditions such as Typhoon Yuri that caused the erosion that this project hoped to remedy. At the other extreme, it can extend all the way to the

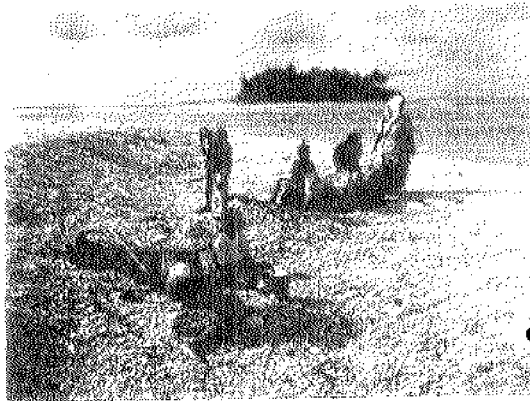
My job at the project site was to rake the filled material level with the ribbons on the top of the sticks. This insured that the reclaimed area would have a pleasing contour. In this photo, I am spreading the final layer of sand over the coarser gravel below.



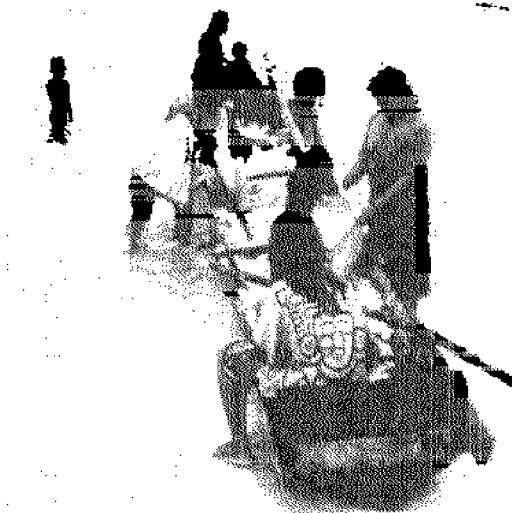
The photo on the left is the northern end of the island after the filling had been completed. The photo on the right is the filled area on the east side of the island (looking to the north).

next island located an estimated 1,500 feet away. During the course of this project the sand spit was around 600 feet long, although dramatic changes in its width and angularity as well as significant changes in its length could be noticed even on a daily basis. As far as this project was concerned, there was an enormous amount of sand and gravel available for fill material at the northern tip of the island. This material could be safely used without endangering the stability of the island. Normal daily fluctuations in the volume of sand and gravel on the sand spit were probably greater than what the project required on a daily basis. This situation made it unnecessary to obtain fill material from sand islands located at some distance from Unanu. This greatly hastened the filling operation.

Material from the sand spit was transported to the project site either by manually carrying it in rice sacks or cement sacks or by loading it in a boat and then bringing the boat to the project site. Since the project site was so near to the borrow site, the boats could be poled. Use of an outboard motor simply hastened the process. Every able bodied person participated in the project. Men, boys, women, and girls. Each worked to the limits of his or her ability and had a good time doing it. The mayor of Unanu remarked to me a



Sand was taken from the sand spit on the northern tip of the island. The photo on the left is looking north toward the small nearby island of Pihaf. The photo on the right is looking south toward Unami. It can be seen that the borrow site was at a considerable distance from the main portion of the island.



number of times that he would like to repeat this type of project, not only because of the technical and monetary benefits, but also because of the fellowship that it stimulated among the families.

As the project progressed, it quickly became evident to the participants that there were only a limited number of squares and that families who worked the fastest would be given more squares to fill. Money is a very scarce commodity on the outer islands and, for better or worse, it is a great motivational factor. In order to earn more money, a number of families even worked at night. It happened to be moonless at the time of the project and, in order

Fill material was primarily transported to the project site by means of boat.

to provide enough light, people tied 12 volt fluorescent lights (from solar systems in their homes) high in the coconut trees. They were powered with a battery on the ground (also borrowed from their solar systems). This industriousness, coupled with the fact that fill material was available near by, enabled the filling operation to be completed in a mere seven days. I had originally estimated that it would take around a month!

Whereas there were a handful of skeptics at the beginning of the project, by the time it was underway a few days, all were converted (with one possible exception). Initially, the traditional chief was opposed to the project and even tried to stop it. However, when he visited Unanu (he lives on another island in the atoll) and actually observed the project in progress, he became a firm supporter of it. He is a frail old man and asked the younger people in his clan if they would kindly fill some "squares" for him, which they very willingly did.



Almost everyone physically participated in the project!

People were grateful for the cash that the project brought to the island. A total of 19 families participated in the project with incomes from it ranging from a low of \$49 (for the traditional chief) to a high of \$655. Actually, the high is a misleading figure as that family was made up of an extended family that included five couples. One other family included 2 couples. Other than that, all families included only one couple. The average income per family from the project was around \$190.

After the filling operation was complete and the area raked smooth, seedlings were planted. Initially, we had planned to pull up the stakes that were used to mark the squares. However, the mayor said to leave them in place because many of them would take root!

FINAL ACTIVITIES



A picnic was held at the conclusion of the project.

Following the completion of the project activities, another picnic was held, this time on and adjacent to the land that was reclaimed by means of the project. A meeting followed the picnic at which various elected and traditional leaders praised the project and, overwhelmingly, expressed a desire for more projects of this type. I awarded small prizes of packaged/canned food to three families that did exceptional work. These awards were for:

- Conscientious effort. A large amount of work accomplished by a small group of people.
- Surprising accomplishment. A large amount of work accomplished by an unlikely family.
- Good work. High quality work in all respects.



Some of the sticks marking the squares even took root!

At a meeting of the island council, a resolution was unanimously passed recognizing the importance of the project and prohibiting "sand mining" on the beaches in the narrow northern portion of the island with the exception that sand and gravel may be taken from the sand spit on the northernmost tip of the island at times when it extends farther than 200 feet north of the northernmost coconut tree on the island. This may be the first time that an outer island government formally passed environmentally conscious legislation. This resolution is reproduced in Appendix A.

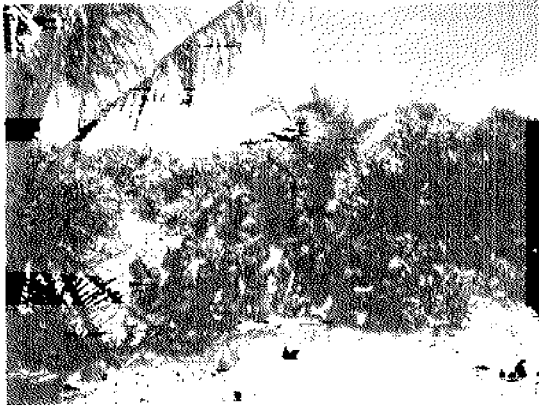
FOLLOW-UP TRIP

In June, 1997, I asked a resident of Unanu to take photos of the project site and to administer a brief questionnaire. I was interested in seeing how well the shrubs that were planted survived and if any the filled area had eroded due to wave action. I was also interested in knowing what the residents of the island thought of the project --- now that the initial excitement had worn off. Based on the photos and reports from persons who recently arrived from Unanu, it appears that around 50% of the shrubs that were planted have survived. Also, some native vines, grass, and other shrubs have naturally taken root. Finally, many of the stakes that were used to mark the squares to be filled have, indeed, taken root! The reclaimed areas have begun to look like a normal part of the island. Since the reclaimed area is above the normal high-water line, there has been no erosion. This can only be expected to occur during storm conditions.

The questionnaire consisted of three statements that that people were asked to indicate to what degree they agree or disagree with.

- I think that the *amasowa* project was beneficial to the island.
- I would participate in a repeat project even if no money were paid for labor.
- I would do this type of work on my own land even if no money were paid for labor.

Thirty seven adults responded to the questionnaire. There were no surprises. People liked the project. However, they would probably not do it again if no money was provided for their labor. People were more or less neutral concerning whether or not they would do this type of work on their own land. The results of the survey are tabulated in Appendix B.



These photos were taken approximately six months after the completion of the project. Native vines and grasses are evident. Some of the shrubs that were planted at the completion of the project are flourishing and others have taken root by themselves. The reclaimed area looks like a normal part of the island. The photo on the left is at the northern end of the island. The photo on the right is the eastern side of the island (looking to the south).

CONCLUSIONS AND RECOMMENDATIONS

Technically, the project was successful. A portion of an island was recognized that was eroded below the natural contour of the island but was above the normal high-water mark. This area was filled with rocks and sand and graded so that it has a pleasing contour. Shrubs were planted on the reclaimed area and are thriving well. Likewise, native vines and grasses are reestablishing themselves. After a six month period, none of the refilled land has eroded. The reclaimed land is attractive and is gradually blending in with the adjacent parts of the island. If another storm occurs, previously uneroded areas will be protected by the filled area; it will be that much harder for erosion to continue. There is a high probability that some of the refilled land will remain in place on a long term basis. These observations suggest that this procedure should be followed in similar situations. There is absolutely nothing to lose and everything to gain.

Unfortunately, this type of project is time-consuming, requires a lot of hard work, and, as the questionnaire indicated, it may be unrealistic to expect the residents of an island to undertake such projects on a gratis basis. Because of the success of this pilot project, it would appear to be worth considering the allocation of funds for similar projects. This could be on the national, state, or municipal level. These funds should be readily accessible in order that a project could be implemented quickly. It may be feasible to utilize a lower rate of compensation for labor than that used for this project, especially if the source of fill material is close to the project site.

The clue to recognizing a "similar" project is that native vegetation will naturally reestablish itself in an eroded area. It would appear to be ideal to refill such eroded areas

as soon as they are recognized in an effort to immediately achieve the benefits of this type of project. This would be a wonderful procedure to incorporate into an island resource management plan.

There are a number of cautions that should be kept in mind:

- Land should only be filled that is above the high water line. It would be a futile waste of time and money to dump sand on an active beach.
- The borrow site should not create a different erosion problem. A site must be chosen such that, when material is removed from it, it is certain to be replenished by natural means.
- There is the political danger that this type of project might only be undertaken for the money that it brings into an island. This might result in careless work and an unattractive result. The Unanu project could simply have resulted in piles of sand and rocks along the beach. Considerable effort was devoted to landscaping. Some training in basic landscaping techniques might be necessary in future projects.

For the specific case of Unanu, funds should be sought to enable all eroded lands on the narrow northern end of the island to be replenished as soon as possible. Since it will usually be possible to use the sand spit on the tip of the island as a borrow site, it will be relatively easy to bring fill material to the site and the rate of compensation can probably be decreased, possibly to half the amount used in this project. At this rate, the estimated budget to complete the beach reclamation on the east side of the island is approximately than \$4,500. The cost of beach reclamation on the west side would be less than \$10,000.

APPENDIX A

UNANU MUNICIPALITY

UNANU MUNICIPAL COUNCIL

RESOLUTION

Whereas, significant erosion of the beach on Unanu took place during typhoon Yuri in 1991, and;

Whereas, this erosion was particularly severe on the narrow northern end of the island, and;

Whereas, significant erosion of the beach on the northern end of Unanu again took place during recent tropical storm Dale in November, 1996, and;

Whereas, it can be expected that such erosion will continue to take place during future storms and typhoons, and;

Whereas, the residents of Unanu recognize the importance of a stable coastal land area, especially at the vulnerable northern end of the island, and;

Whereas, the residents of Unanu are aware of the possible adverse effects of attempting to protect coastal areas by means of engineered structures such as sea walls, and;

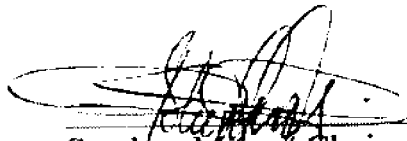
Whereas, the residents of Unanu recognize that simple methods of coastal protection, particularly, preservation of reefs, replenishing eroded beach areas, and revegetation can result in no adverse effects, and;

Whereas, funding has been received from the University of Hawaii Sea Grant Extension Service in support of an experiment that will involve the reclamation of certain eroded beach areas on the northern end of Unanu by means of beach replenishment and revegetation, and;

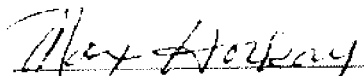
Whereas, the residents of Unanu recognize that the practice of "sand mining" of beach areas is in direct contradiction to the objectives of this project,

Be It Resolved That: "sand mining" is prohibited at all beach areas of Unanu north of the land areas known as *Leangeruh* and *Lefanifarh* except that sand and rocks may be taken from the northern tip of the island at such times when that beach area extends more than 100 feet north of the northernmost coconut tree on the island.

Adopted this 15TH day of JANUARY, 1996⁷


Stephen Maras, Chairman

Approved,


Max Hockay, Mayor

APPENDIX B

QUESTIONNAIRE RESULTS

I think that the *amasowa* project was beneficial to the island.

strongly disagree	5
disagree	2
neutral	5
agree	6
strongly agree	19
Total	37

I would participate in a repeat project even if no money were paid for labor.

strongly disagree	8
disagree	7
neutral	14
agree	4
strongly agree	4
Total	37

I would do this type of work on my own land even if no money were paid for labor.

strongly disagree	7
disagree	4
neutral	13
agree	7
strongly agree	6
Total	37

