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CHAPTER 2

HISTORY OF LAND USE

Christopher Kitalong, David Mason

Initial Immigrants

Coastal settlements in Babeldaob date back more than 4000 years (Clark et al., 2006; Fitzpatrick, 2003), however due to acidity, sedimentation and intertidal changes, archaeological remains on the large island of Babeldaob are limited (Fitzpatrick, 2003; United States Department of Agriculture, 2009). Most archeological evidence is drawn from the Southern Lagoon from scattered limestone rock islands settlements, seen in Fig.2. These archeological features and the ecological significance of these limestone

rock islands were the deciding factors in the Rock Islands Southern Lagoon’s nomination as a UNESCO World Heritage site in 2012 (Reepmeyer et al., 2011, Fig. 2). Archeological studies provide evidence supporting early settlement in Palau dating back more than 3000 years (Liston, 2008). The origin of these settlers is not clear and Palauan settlement may have been through several waves of different immigration events (Clark, 2005).

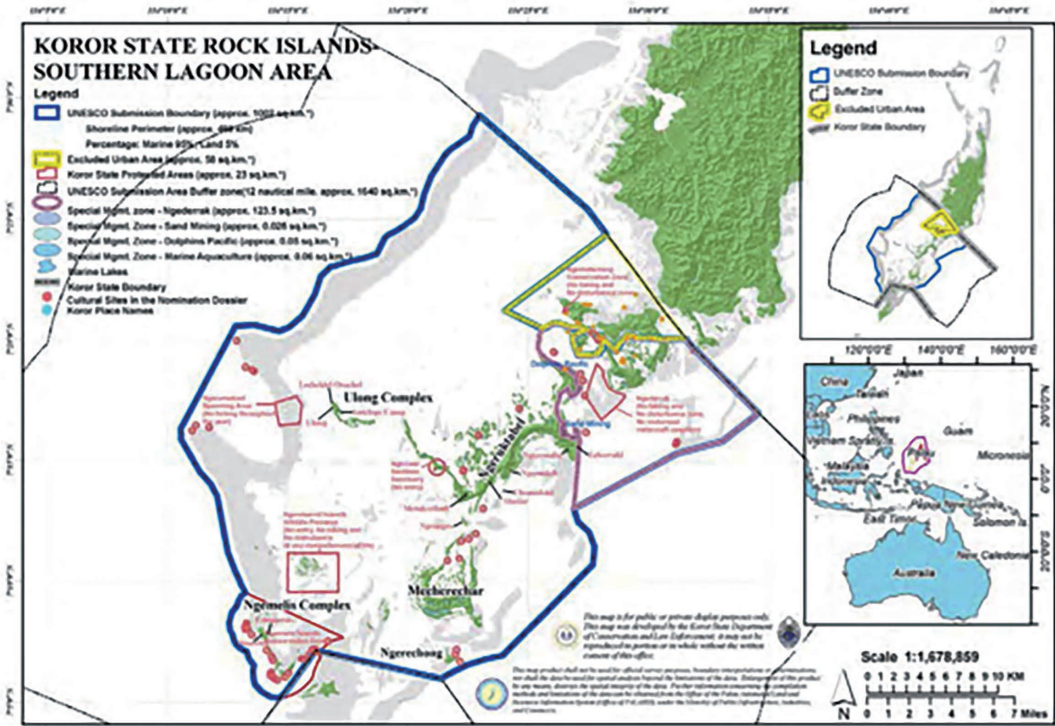


Fig. 2. UNESCO World Heritage Site delineation (blue line) (Reepmeyer et al. 2011).

Archaeological and paleoenvironmental evidence suggests early settlers in Palau, as with other Pacific islands, survived on a diet consisting largely of seafood and cultivated carbohydrates such as the human swamp taro, *Cyrtosperma merkusii* (Hassk.) Schott. (Athens and Ward, 2002; Fitzpatrick et al., 2011; Fitzpatrick and Kataoka, 2005). Pollen cores provide chronological evidence of the introduction of the aforementioned swamp taro and *Areca catechu* L., then increased charcoal from clearing/burning activities and then a subsequent increase in savanna ecosystems (Clark, 2005). More than three thousand years ago early settlers in Palau altered the landscape of Babeldaob from that of forest to terraced fields, taro patches and vast savanna (Welch, 2008). Fig.3 shows the

layout of a traditional Palauan village, where stone paths connected the village from the tops of hills down through the mangrove channels to the ocean. Palauan villages were designed to fit the natural landscape in order to guarantee sustainable harvest of food and drinking water. The main sources of protein for early Palauans came from the sea, therefore the majority of villages were connected to the ocean, as seen in Fig. 3. The villages were connected either directly by docks or by channels created through the mangroves. From these docks and mangrove channels, stone paths were laid to the village. Stone paths were the main terrestrial routes within the villages, passing in front of most major structures and taro patches.



Fig. 3. Rendition of a Traditional Palau Village (courtesy of Bureau of Cultural Affairs, Palau).

Stone platforms were used as the foundation for traditional structures. Stone paths interconnected the village, beginning at water access and ended up in hills where the dead were laid to rest. The main means of carbohydrate subsistence was through the cultivation of taro in muddy rectangular patches located near homes (*mesei* vegetation). Villages were usually situated along streams or rivers in order to provide freshwater sources for these wet muddy patches (Olsudong, 2002; Soaladaob, 2010; Wickler, 2002), as shown in Fig. 4.

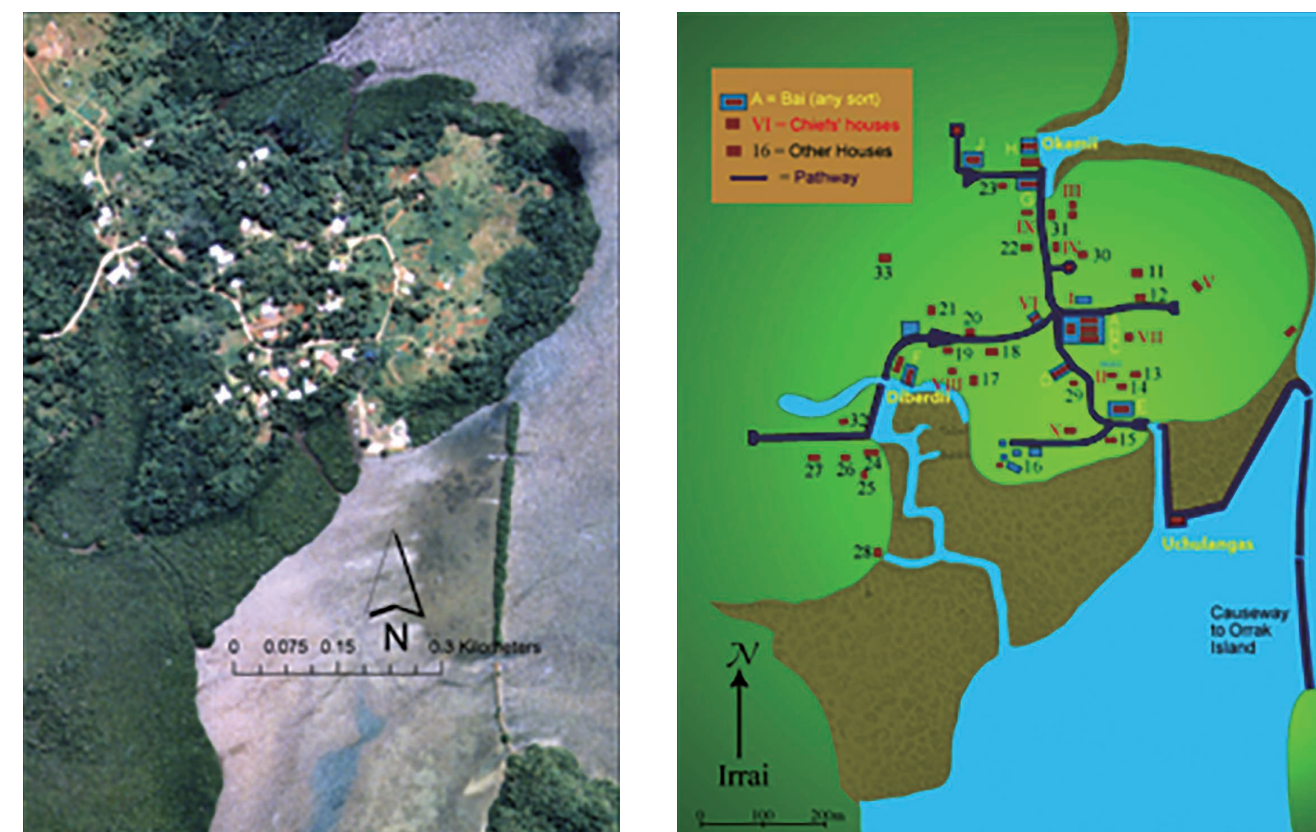


Fig. 4. Sketch of Traditional Village in Irrai, Airai State (top left), Aerial View of Irrai (top right) and overlay of aerial view on sketch (Kramer, 1926).

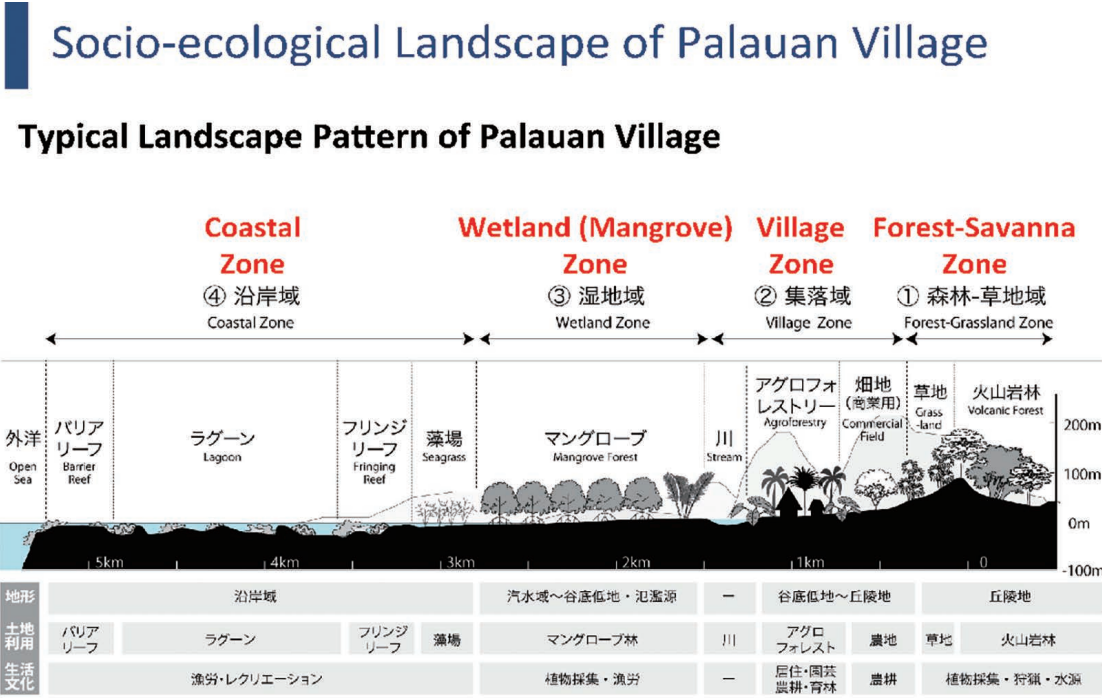


Fig. 5. Sketch of agro-ecological zones (Iida et al., 2011).

Fig. 5 shows a sketch interpretation of a Palauan village from coastal zone to forested area and the current representation of a modern day homestead and its surrounding areas. The older “agroforestry” would consist of *homestead* and *farm* vegetative types that would be more useful to daily life. The modern “agroforestry” has been immensely affected by western lifestyle. The importation of goods has devalued the importance of agroforestry management and has led to either the abandoning of subsistence farming techniques or increased production of social money crops such as betelnut, Areca catechu L. Cash crop plantations do not follow the traditional design and many agricultural products are now farmed by non-Palauans. Land use management was under strict regulation by a hierarchy of chiefs, to ensure the success of its inhabitants. Most villages were located near the ocean and utilized communal marine organism aggregation and collection techniques.

Distribution of food and resources was also communal, assuring the survival of contributing members of the community. Furthermore, Palau is a matriarchal society, where most important decisions required, and today still require, the input of both sexes ensuring a non-biased utilization of land for agriculture, agroforestry, homes and communal structures. In addition, as a society with a rich history of oral tradition, knowledge was passed down from generation to generation, bestowing respect and importance on the knowledgeable elders within the community. The transfer of knowledge from generation to generation was, and still is, a prerequisite to title and prestige. Fig. 6 shows a project sketch of a reconstruction of an old “*diangel*”, canoe house and is a modern-day example of elders teaching of traditional building, food planting and marine collection techniques. This project is the first steps in a traditional revival program for sustainable development and food security

in Ngetkib, Airai. The community-based project was initiated by a local chief and political representative, *Obak er a Debkar*, Clarence Kitalong Sr., for the local men’s and women’s groups of the village. Each of these projects incorporated teaching of traditional hunting,

gathering, farming and construction techniques by the elder members of the community to the younger village members. As seen in the past and with the revival project, in Palau, traditional knowledge was and still is power.



Fig. 6. Stone path and diangel rehabilitation project in Ngetkib, Airai.

Decision making for leadership roles lays in the hands of women and the capability of a man to attend to the practical needs of his family/clan, through activities such as fishing, farming or building, was and still is highly valued in leaders (Parmentier, 1984, 1986); where individuals with knowledge and practical experience were

consulted on all matters and involved directly in all community decisions (Olsudong, 2002; Parmentier, 1984; Petersen, 1999; Soaladaob, 2010). Oral tradition and the value placed on practical experience; amongst other factors is key in the establishment of the traditional family and clan lineages that exist up until today. Most

of the cited works on lineage are based on interviews of elders whose lives were governed by these principles. The system of governance was based on family lineage and proper behavior; where rules were known and passed

on by oral tradition to the next generation. Respect and etiquette are paramount in Palau even today, but have been slowly degraded by the assimilation of foreign cultures and values.

Western Contact (1783)

The *Antelope*, an English ship captained by Henry Wilson, hit the reefs off of the Ulong Rock Island group in the Southwest of Palau in 1783, marking the first extensive social contact with foreign civilizations. Subsequent contact with the populations and cultures from the outside world has since been a huge factor in the changing face of Palau. Before, during and more prominently, after Captain Wilson's interaction, Pacific trade routes were important for collecting/trading "*trepang*", a name given to species of the Holothuroidea (sea cucumber) family, derived from Indonesian "*teripang*" (Clark and May, 2013), dried coconut endocarp or copra, sugarcane, and other such items that were traded. The extremely high value placed on porcelain and stone beads "*udoud*" or money derived from Southeast Asia indicates prior trade contact between Palau and other ancient cultures (Petersen, 2009). However, from the early 1500s, to the time of Captain Wilson's wreck in 1783, there were only 10 reported sightings of Palau and very little if any Western contact with natives (Hezel, 1979). Contact with European trade ships was irregular and had little impact socially in Palau until the running aground of the

Antelope. In exchange for supplies and assistance in repairing their ship, Captain Wilson and his crew introduced guns into warfare and forever shifted the traditional political power structure in the favor of the southern high chief of Palau, Ibedul. This political power shift resulted in the conglomeration of most commerce and trade in Koror, currently the most developed section of Palau (Soaladaob, 2010). Despite larger and more fertile land being located in the North, the contact and trade with Captain Wilson has shifted most major development to the smaller southern island of Koror. Furthermore, within the period from Captain Wilson's arrival to the annexation of Palau to Spain in 1875, there were over 100 documented visits to Palau by foreign vessels (Hezel, 1979). Many of these visits can be attributed to increased seafarers, but more specifically to the increased interest in the importance and value of coconut oil during the 1800s. Numerous permanent trading posts were set up throughout the islands, introducing commerce and trade to Palau. Vast areas of the landscape were disturbed and altered for coconut plantations and trading posts (Hezel and Berg, 1979).

Spanish Era (1885-1899)

As Spain's influence increased, during the Restoration, Pope Leo XIII asserted Spain's right to the Caroline Islands, including Palau, in 1885. Spain capitalized on the trade boom established earlier, but of more significance was the first introduction of Christianity in the region (Hezel, 1991). Christianity remains the dominant religion in Palau (Office of Planning and Statistics, 2005). The introduction of Christianity marked a dramatic decline in the traditional social environment in Palau, eliminating many "pagan" values, such as the observance of animal and plant spirits, which

work to promote respect and value for the environment. Spanish occupation of Palau was limited, unlike increased development and occupation of other Pacific islands, including but not limited to, the Philippines and the Mariana islands. During the Spanish occupation, authorities put an end to inter-village warfare reducing inter-village exchanges. After its loss in the Spanish-America War, Spain sold its remaining Pacific colonies to Germany in 1899, having left its religious mark on Palau (Hezel, 1989).

German Era (1899-1919)

The German development of the Pacific was much more marked. Germany increased copra farming and processing during the copra boom. The world demand for the use and promotion of coconut oil is represented by an early advertisement (Fig. 7) in Germany that proclaimed: "Just as the palm tree towers above all animals on earth, so coconut oil surpasses all animal fats in purity and quality" (Spennemann, 1999). Increased focus on agriculture of copra and mining activities drastically altered the Palauan landscape. In addition, the Germans began phosphate mining on Palau's southernmost volcanic island Angaur. Phosphate mining has left large areas of Angaur uninhabitable to this day (Arnaw, 1961; Peattie, 1988). Intense mining activities required the importation of foreign workers; other Pacific

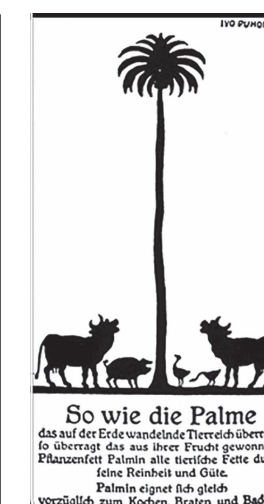


Fig. SEQ Figure 1*
ARBIC 7. Early campaign promoting coconut oil over animal products; note all animals looking up to the coconut.

Islanders and Chinese were brought in for labor and this continued during the Japanese occupation (Engelberg, 2006; Gorenflo, 1996). Exploitation during the German occupation marked the beginning of foreign efforts to build administrative offices, schools, industrial plants, agriculture facilities and modern roads

that carved into Palau's landscape. The German occupation of the Pacific from their purchase of the islands from Spain in 1899 to the end of World War I, marked a significant deterioration

of the once, "uneducated" face of Palau, to one with a stricter German education, commercial work ethic and marked the beginning of the importation of foreign labor.

Japanese Era (1914-1944)

Facing economic hardship after World War I, the Germans relinquished their rights in the Pacific to the Japanese in 1919. Germans and Japanese had similar ideas for Palau, however, Japan's proximity, fastidious nature and extended occupation brought about some of the biggest changes in Palau. Agricultural, mining and fishing activity peaked during the Japanese period (Peattie, 1988). Land use maps, land use agreements between Palauans and Japanese production reports show intense, scaled up focus on agriculture for export to Japan (Fig. 8). In addition to mining of phosphate on

Angaur Japan began intense terraced bauxite mining in Babeldaob (Iida et al., 2011). Land use succession maps (Fig. 8) show the changes over time prior to Japanese occupation (1921), after World War II (1947), and current land use succession (2006). As seen, the amount of grassland after the war was substantially larger. The grasslands represent areas that were used for agriculture and abandoned after the war. The 2006 map of land use (Fig. 8) shows increased natural secondary reforestation (Endress and China, 2001; Iida et al., 2010; Iida et al., 2011).

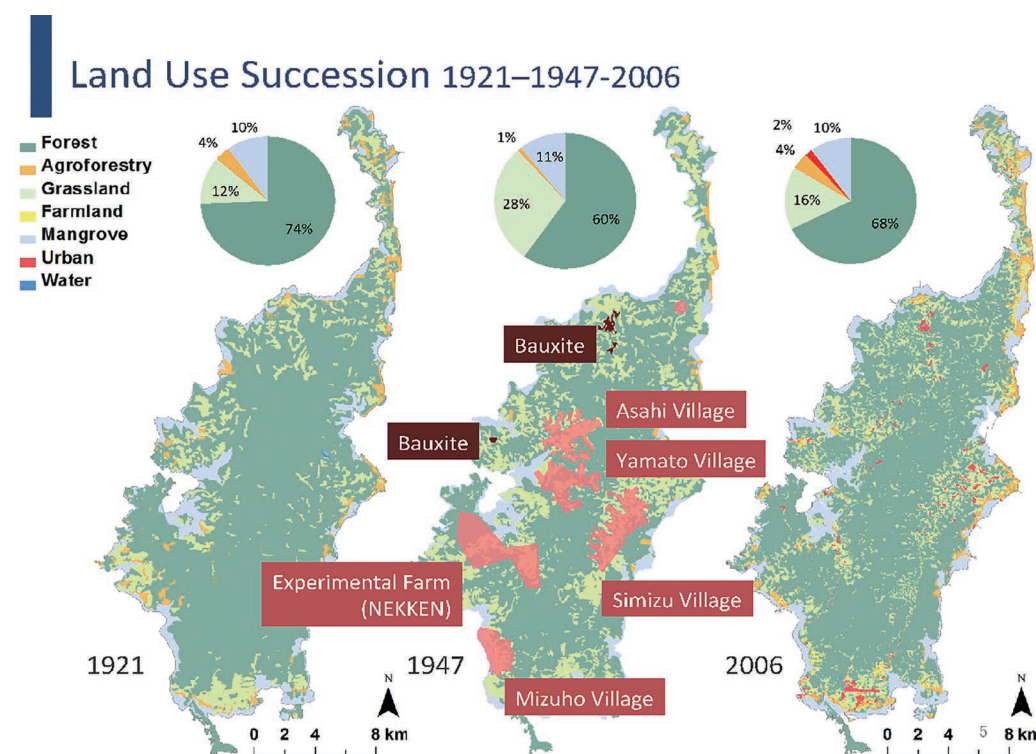


Fig. 8. Landscape succession in Palau (Iida et al., 2011).

With the increased economic interest in Palau, came a strict education and administration system. Formal education was offered for all children, however, Japanese and Palauan pupils were instructed separately and Palauan children

were limited to a certain number of years of education (Kai, 2011; Mita, 2009; Soaladaob, 2010). As recounted in interviews with Ngemelas Kitalong, in 2005 by Mita (Fig. 9)...

"Children in Airai went to kogakko [school for Palauan children] in Koror. I went to school from my house by canoe every week, and stayed in the dormitory until the weekend. The Japanese government was very strict, and made every child go to school. One child ran away from school again and again, but if the child was not returned to school, the father could be jailed.

I performed very well at school, so I went on to the hoshuka [advanced course] and got further education. If a student got poor grades, he or she had to do the same class again. After studying in kogakko for five years, I worked as an assistant teacher in Koror kogakko. At this time many Japanese soldiers started to come to Palau. Some of them were just disembarked here before going to outer parts of the Nanyo [South Seas]. The Airai bai [meeting house] was occupied by soldiers. The military taught us Kyujyoyohai [a greeting to the palace], and we taught this to the older Palauans who had not been to Japanese school. We said, "We



Fig. SEQ Figure * ARBIC 9. Picture of the late Ngemelas Tomiko Kitalong, in her home, beta change, Ngetkib, Airai

are the children of the emperor! We will be splendid Japanese!", and so on. And then we bowed to the north. I had not learned this as a student, but I learned it after I started to work as an assistant teacher. In those days, we used Japanese often in Koror and Airai. But the older people had not been to Japanese school, so they did not understand. My mother could say, "Thank you" and "Congratulations" in Japanese." (Mita, 2009)

For three decades the lands were harvested and Palauans were taught to be productive members of a small agriculture and mining-based Japanese society.

World War II (1940-1945)

World War II brought with it a destructive element to Palau, where the land and people suffered dearly, as recounted in interviews with Ngemelas Kitalong in 2005 by Mita:

*“Americans came to Koror in big boats. Three M-boats were there in front of Airai. The Americans attacked the Japanese ships, and killed Japanese soldiers. Their bodies were scattered in the sea. On the Airai road, many Japanese soldiers died. We were very scared. They dropped bombs ... a Palauan was also killed on this road. We were in a panic. I was terrified by all this killing. During the war, we planted taro, tapioca and sweet potato at night. In the daytime, we stayed in our dugout. Sometimes, those who worked for the Japanese military, from Korea, the Marshalls, Yap, Truk and other islands, stole our plants. I don’t think they knew which were good to eat and which were weeds. Like other people, we ate belloi [*Dioscorea bulbifera* L.] [a bitter fruit which looks like potato] and denges [*Brugeria gymnorhiza*(L.) Lam.]. Denges are the fruit of*

the mangrove, and its shape is long. We boiled denges and after soaking it for three days, we ate it. It tasted terrible! But if we did not eat it, we could die. Because my brother caught fish for the Japanese military, they gave us some rice. He caught fish using poison. During the war, we could do almost nothing but look for food. At night, we cultivated the garden, and in the daytime, we hid ourselves and slept. Because we could gather coconuts at my sister’s place, we could survive. The coconuts where I lived were all taken by the military. At night, when we lit a fire, we carefully hid it. We could endure the situation because it lasted for only a year. If it had continued for another year.... If we heard the airplanes, we hid the small children. But fortunately, I did not lose any of my family during the war.” (Mita, 2009)

World War II in Palau was devastating, not only to the people, but to the land as well. The Japanese in Palau were preparing for battle and during this preparation more than 30,000 Japanese were brought in resource production and farm land was expanded to supply not only resident troops but to supply the entirety of Japan (Hezel and Berg, 1979; Peattie, 1988).

During World War II, the land was bombed heavily leaving the island of Peleliu barren (Fig. 10) and all the rest of the Palauan islands were in a constant state of turmoil. Bomb holes and old Japanese buildings are all that remain today of the battle for Palau, one of the bloodiest battles in the Pacific (Hough, 1950).



Fig. 10. Peleliu war-ravaged lands.

The suffering endured during this time by the local Palauans is beyond the imagination of younger generations. Despite the tragedy, when speaking of the soldiers and battles there is very little, if any animosity. As seen through interviews with Palauans alive during the war,

traditional knowledge and survival skills such as the consumption of specific plants and reverting to old fishing methods are what kept them alive through the war. World War II left the face of Palau bloodied and barren.

United States of America Era (1945-1994)

In 1947, after World War II, the islands of Palau, along with the rest of the islands of Micronesia, were placed under the control of the United States Trust Territory government. Rebuilding of infrastructure was under the control of the Civic Action Team and Army Corp of Engineers. The presence of secondary forest is a strong indication of land clearing for agricultural and/or human habitation, evident through the review of

forest succession after the Japanese occupation of Palau (Iida et al., 2010). The succession maps in Fig. 11, indicate that development and cultivation in Palau retracted quite dramatically (Endress and China, 2001). These results are consistent with the decrease in population—through Japanese and Palauan casualties and the return of most Japanese survivors to Japan.

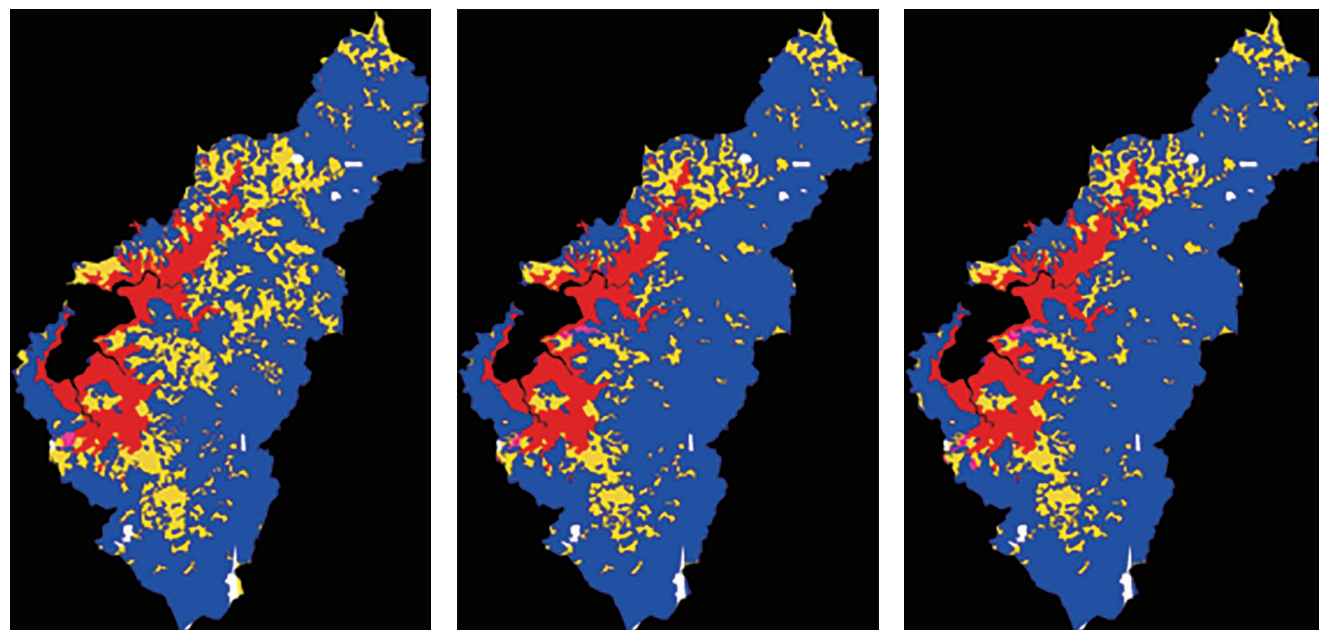


Fig. 11. Vegetation composition succession maps: 1947, 1976, 1991 from left to right (blue=forest, yellow=non-forest, red=watershed) showing reforestation after World War II (Endress and Chinea, 2001).

The Palauan landscape was altered severely by commercial agriculture, mining and war during foreign occupation. The land exploited during colonization and cultivation and internal agriculture productivity has been highly reduced due to globalization/importation and infusion of money into Palau (Government Accountability Office, 1989). Foreign contact in Palau resulted in drastic population and demographic changes. Furthermore, for about a century after initial contact with the foreign ship the Antelope, the population of Palauans

declined drastically, due to disease (Gorenflo, 1996). There was limited documentation by scattered European traders, however, the original pre-contact population is estimated to be near one-hundred thousand and dropped to as low as three thousand Palauans (Gorenflo, 1996; McKnight, 1978). The indigenous population fluctuated and Palauans became a minority in their own land. Furthermore, interracial and foreign inhabitants of Palau brought upon demographic, cultural and language changes.

Palau Independence (1994-Present)

In 1994, after centuries of colonial powers Palau became an “independent nation”, in free association with the United States of America. However, it would be fair to say that due to the large amount of financial assistance from the United States of America (Government Accountability Office, 1989), Palau can be considered a semi-independent country. As with most newly “freed” countries that were under United States trusteeship, Palau was obliged to form a democratic system of government. The burden of land management, which was highly organized and effective under traditional rule (Parmentier, 1984), was placed in the hands of a newly independent democratic government’s rule to do as it saw fit. The governmental policy development has been a slow process for a young nation trying to find its place in the contemporary capitalist world. Sustainability has taken on a whole new meaning; as a catchphrase in the international arena, where many people of many nations come together to decide and fund development plans that meet “international” criteria. Palau, although exposed to minor degrees of trade and commerce during the booming copra years of the 1800s and the heavy agricultural years while under the rule of Japan, has been thrust into a cash economy that lacked the communal approach in which Palauan people had thrived. Palauan values and power shifted from the respected knowledgeable and able hands, to a Western nuclear thought process which has led to reduced community-based action and more western law and regulation-based modalities (Government Accountability

Office, 1989). The once important communal mentality was turned on its head, as individuals focused on personal gain and forgot their heritage and traditional obligations.

As Palau was flooded with loans and foreign money, traditional knowledge and values were cast aside in order to “develop” the land. Concrete buildings and roads were cut through the natural landscape without regard for the environment. With a small population and foreign money pouring in, luxury items, once hard to obtain, became commonplace. Foreign food, like rice, made popular during Japanese times and frozen/canned meats flooded the island and rare, fatty foods that once were important to survival over long fishing trips became easily obtainable. Communal labor and work were transformed into sedentary desk jobs. The population of Palau has changed from the lean, strong and sharp communal Palauan of old, into an overweight, business-oriented individual experiencing stress over western work-related matters and money (Kermode and Tellei, 2005). All these factors have led to the deterioration of culture, language and traditional practices. In response, work on increasing local production of plant products hopes to refocus Palau’s economy and lifestyle. If successful, this work will help to establish a document that will promote local food production and a increase health model infor the Pacific and Palauans may once again become a people that are so far from disgracing, live an ornament to human nature (Keate, 1789).

Glossary

Agroforestry: A multistory cropping system consisting of food-producing plants, such as bananas, breadfruit etc., mixed with trees that do not produce food	Bauxite: A residual rock-weathering product consisting of hydrated aluminum oxides; the principal commercial source of aluminum
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Index of Genera and Species

Scientific	Common	Palauan
<i>Areca catechu</i> L.	betel nut Palm	buuch
<i>Bruguiera gymnorrhiza</i> (L.) Lam.	black mangrove	denges
<i>Cyrtosperma merkusii</i> (Hassk.) Schott.	giant taro	brak
<i>Dioscorea bulbifera</i> L.		belloi

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CHAPTER 3

SOIL

CHARACTERISTICS

IN PALAU

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What is soil?

Soil, pedosphere, is a mixture of solids and pores filled with air and water (Fig.12). The solid components include mineral (stone fragments, sand, silt, and clay), and organic fractions (Fig. 13). It serves four important functions:

- as a medium for plant growth
- as a means of water storage, supply, and purification
- as a modifier of Earth's atmosphere
- as a habitat for organisms

(Moebius-Clune et al., 2017)

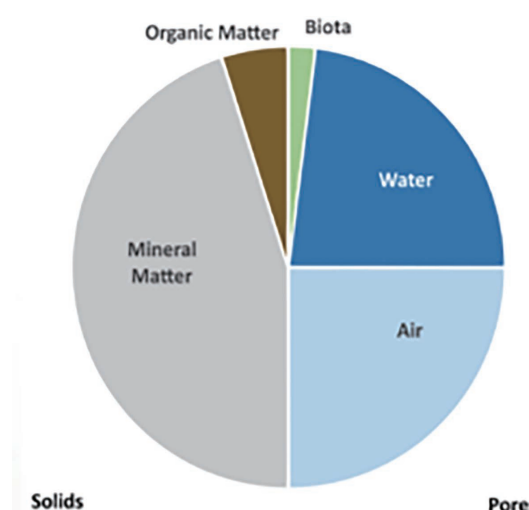


Fig. 12. Distribution of solids and pores in soil. Solids are minerals, organic matter and living organisms, or biota. Pores are filled with water, air, and biota. (Moebius-Clune et al., 2017)

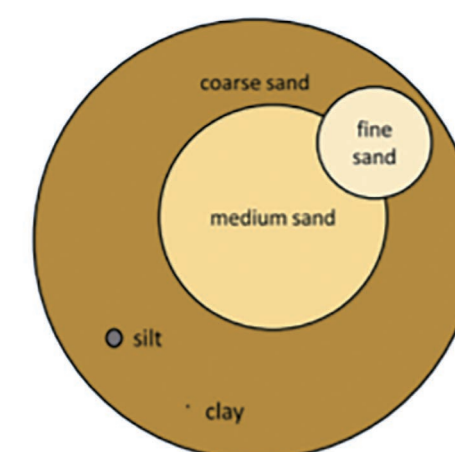


Fig. 13. Relative size of soil particles. (Moebius-Clune et al., 2017)