

# Soil Degradation and Sustainability on Humid Tropical Islands – Palau

Robert Gavenda, USDA-NRCS Pacific Islands Area

Republic of Palau  
7° 35' N latitude  
134° E longitude  
3,700 mm rainfall  
27° C air temp.



## 1. Introduction

- ✓ Highly weathered soils have high sensitivity to disturbance and have low resilience
- ✓ Soil degradation is caused by forest clearing and repeated burning of grasslands
- ✓ Soil conditions under different vegetation cover are examined
- ✓ Can degraded soils be recovered?
- ✓ Soil with bauxite surface mining was partially restored to forest conditions



Figure 1. The volcanic island of Babeldaob is mostly forested with cleared areas of grasslands and ferns.

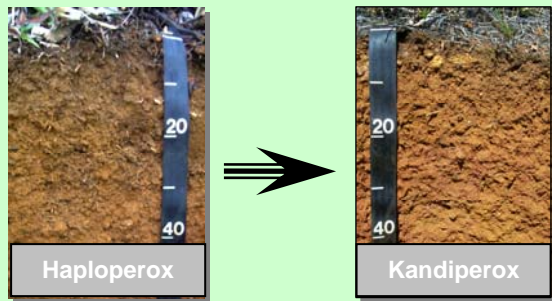


Figure 2. Forested and grassland soils (left) are transformed to degraded soils under ferns (right) through clearing, burning and erosion.

## 2. Methodology

- ✓ Data from two Haploperox (forest and grassland) and one Kandiperox (fern) are compared
- ✓ Soil at bauxite strip-mined site had lime added at 2000 lbs/acre, 10-30-10 fertilizer and chipped wood mulch applied about 6 cm thick
- ✓ Standard USDA soil analyses conducted to determine values for various soil quality parameters

## 3. Forest – Grassland – Fern Soil Properties

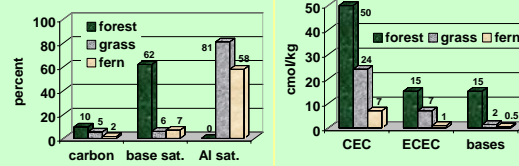


Figure 3. Soil properties in the 0-10 cm horizon under different vegetation. Topsoil carbon under forest is twice that as under grass and five times as much as under ferns. Because of the predominately halloysitic mineralogy nearly all the cation exchange capacity comes from soil organic matter (SOM) SOM also appears to complex with soluble aluminum

## 4. Bauxite Strip-mine Revegetation



Figure 4. Condition outside of bauxite revegetation plot (left), the revegetation plot (center) and 2 cm of topsoil that formed in five years inside of the plot (right).

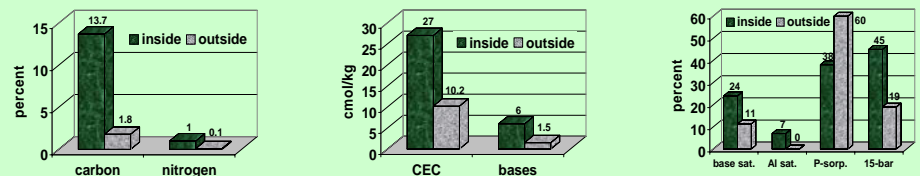


Figure 5. Carbon, nitrogen, CEC, extractable bases, base saturation, aluminum saturation, phosphorus sorption and 15-bar water holding capacity of the 0-2 cm layer for samples (average of 3) inside and outside of the bauxite revegetation plot.

## 5. Summary

- ✓ A number of soil quality parameters have unfavorable trends when forest is cleared on Palau's volcanic upland soils
- ✓ Soil with bauxite surface mining was partially restored to forest conditions