

Finding Endangered Tropical Dry Forest in the Pacific: A Case Study from Fiji *by Thomas W. Gillespie, Ph.D., Associate Professor of Geography, UCLA*

Tropical dry forest can be defined as forest in frost-free regions with annual precipitation between 500-2000 mm and a pronounced dry season of four to seven months with less than 50 mm of precipitation. Tropical dry forests in the Pacific may currently be the world's most endangered forest type and could be ideal for testing a number of remote sensing, biogeographic, and conservation theories associated with extremely fragmented systems.

My research focuses on woody plants (trees, shrubs, lianas) in five regions that contain tropical dry forest (Marquesas, Marianas, New Caledonia, Fiji, and Hawaii). The primary objectives of this research are to undertake biogeographic comparisons of floristic composition, natural history characteristics, and forest structure, to enable us to determine the conservation status of woody plants in remaining fragments of tropical dry forest in Biodiversity Hotspots of the Pacific. Field data on woody plants were collected at the stand level using Gentry's transect method at 45 sites in the Pacific. To do this I brought undergraduates, graduates, and local scientists into the field to survey what remains.

Another aspect of this research has been to identify remaining fragments of native forest in the Pacific. The tropical dry forests in Fiji have a long history of anthropogenic disturbance beginning with the arrival of the first native Polynesians and Melanesians over 3,500 years ago. Dry forests of Fiji have been identified as critically endangered because native forests on the dry side of Fiji have been reduced to less than 1% of their historic extent. Although dry forests of Fiji have been identified as critically endangered by The World Conservation Union (IUCN), there have been no quantitative data on the number of remaining fragments, size of fragments, or quality of native vegetation in fragments. This data would be very useful for natural resource managers in Fiji.

I traveled to Fiji to begin this research in the summer of 2005, accompanied by UCLA graduate student Travis Terpkosh. During the three months that we carried out our fieldwork, we were assisted by University of the South Pacific professor and researcher, Gunnar Keppel. We took small motorboats to different islands, remaining anywhere from one day to two weeks, and either camped or stayed in local hotels. I returned to Fiji for three months in the summer of 2006, along with undergraduate researcher Carolina Sanchez, to continue work on the project.

The first problem we faced was to identify the remaining fragments on the dry side of Fiji. This was done by identifying the areas where dry forests historically occurred in Fiji using data on precipitation and seasonality (Figure 1). Once the region was identified, the next step was to examine a satellite imagery to identify remaining forest fragments (Figure 2). There are over 300 islands in Fiji, 75 of which occur on the dry side of Fiji. It was important to identify the largest and best fragments that remain in Fiji because it is difficult to visit all 75 islands. To do this we needed to undertake a high-resolution assessment of each fragment before investing the time and money needed to take a boat and field researchers to each site.

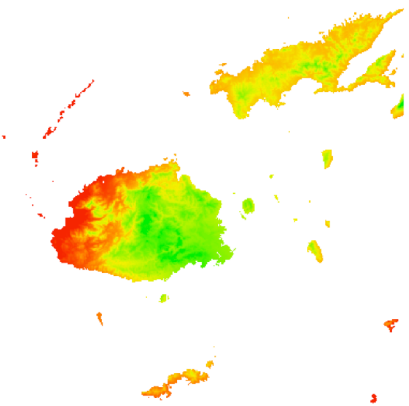


Figure 1. Red areas are the life zone of dry forests in Fiji based on annual precipitation and seasonality.

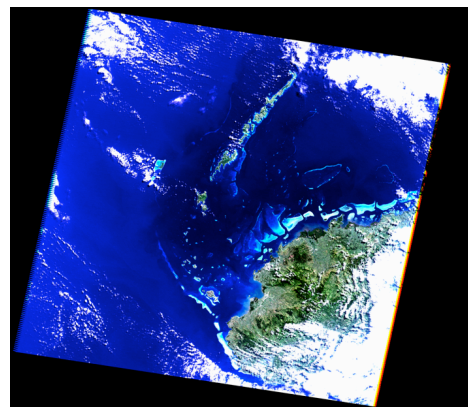


Figure 2. Landsat ETM+ image of the dry side of Fiji in the visible wavelengths.

We combined data on elevation (Figure 3) to model each potential site in the visible wavelength. Then we applied an algorithm that identified native vegetation based on the spectral signature of native and exotic vegetation and greenness values. The result was a map of potential dry forest sites that could be visited and accurately assessed in the field (Figure 4).

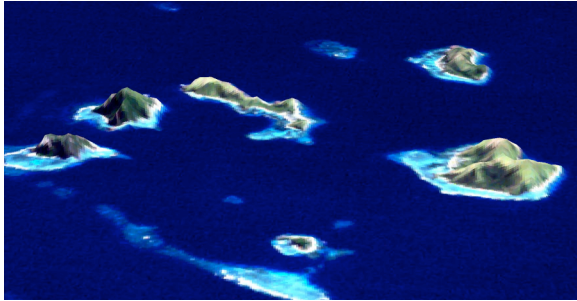


Figure 3. Three dimensional view of islands in the Mamanuca Group, Fiji.

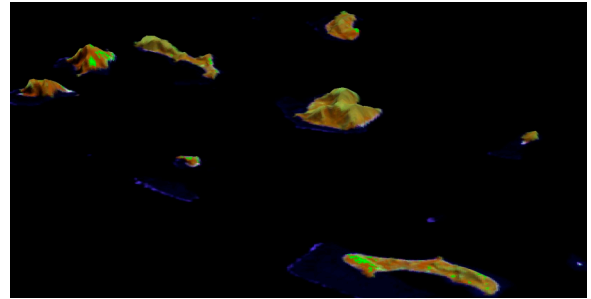


Figure 4. Infrared image of the Mamanuca Group and remaining native dry forests in green polygons.

Once in the field, it was possible to compare islands modeled from remote sensing imagery with ground truth data (Figure 5).

We have concluded that dry forests in Fiji contain about 100 tree, shrub, and liana species, 30% of which are endemic, or restricted, to Fiji. There is only one dry forest site that is currently protected. All other fragments are still threatened by fire, grazing, and invasion of exotic species. Tropical dry forests of Fiji are also home to the Critically Endangered Fijian Crested Iguana (*Brachylophus vitiensis*) (Figure 6), which is now restricted to three populations on the islands of Macuata, Yadua, and Tabu, and a small population on Monuriki.

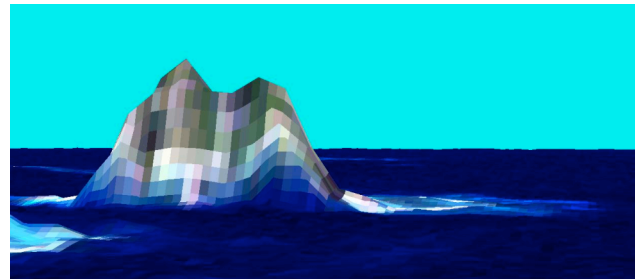


Figure 5. Island of Monuriki modeled from Landsat and Shuttle Radar Topography Mission (SRTM) data, and a photograph of Monuriki taken in the field to assess accuracy.

Dry forests are restricted to approximately 16 fragments greater than 10 hectares (100,000 square meters) in the Yasawa Group of islands and islets. There is high potential for conservation of these forest fragments in the Yasawas due to a recent increase in ecotourism on the islands over the last five years. We have surveyed five of the forest fragments, but further floristic inventories in the remaining dry forest fragments are needed.



Figure 6. Crested Iguana, endemic to the dry forests of Fiji and now restricted to three small islands (Photo by Gunnar Keppel).