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- M. A. B. LEE Department of Geography and Program in Evolutionary Ecology and Behavior, University of Iowa, Iowa City, Iowa 52242

**THE VEGETATION AND ANTHROPOGENIC DISTURBANCE OF
TOLOA FOREST, TONGATAPU ISLAND, SOUTH PACIFIC**

Tropical forests in general are being threatened by the activities of humans (Myers 1980). Tropical insular forests are no exceptions (Wodzicki 1981). There is a need to describe such forests threatened with destruction as well as a need to describe the nature and extent of the anthropogenic disturbance regime. Here I briefly discuss the vegetation and anthropogenic disturbance of Toloa Forest, Tongatapu Island, the Kingdom of Tonga, South Pacific.

Tongatapu is approximately 3500 km NE of Sydney, Australia, has an area of 250 km, and a maximum elevation of around 90 m. The average annual temperature is 23.3 °C and the annual rainfall is 172.8 cm (Crane 1979). Toloa forest has negligible slope, an elevation of around 50 m, and an area of approximately 20ha, and is located near the end of a runway at Fua'amoto Airport. The forest is managed by Tupou

College. There is only one other inland forest which is comparable in size, but it is dominated almost exclusively by *Aleurites moluccana*, an aboriginally introduced species.

In December 1981, a total of 50 circular 100 m² quadrats were randomly located along seven NW-SE transect lines. Within each quadrat, trees (defined as woody nonvine plants with a diameter at breast height greater than 10 cm), large saplings (individuals of tree species with a diameter between 2.5 and 10 cm), small saplings (individuals of tree species with a diameter less than 2.5 cm), seedlings (individuals of tree species shorter than breast height), and lianas (woody vines) were sampled. Dominance for trees is here calculated from basal area, and dominance for seedlings is calculated from Braun-Blanquet cover estimates converted into percentages (Mueller-Dombois and Ellenberg 1974). Density was determined for trees and saplings, and frequency (percent of plots occupied) was determined for all categories of woody plants. For each category, importance values were calculated by averaging relative dominance, relative density, and relative frequency, or whichever of these were available.

The importance values for trees, large and small saplings, seedlings, and lianas are shown in Table 1. *Rhus taitensis* and *Elattostachys falcata* are the most important trees. The understory trees *Vavaea amicorum* and *Syzygium clusiifolium* are the most important species in the seedling and sapling categories. *Dioscorea bulbifera* and *Jasminum simplicifolium* are the most frequent lianas. Toloa Forest is similar to the *Alphitonia-Rhus* association described by Straatmans (1964) and the *Rhus* secondary forest described by Whistler (1980) in that all three have *Rhus taitensis* and *Alphitonia zizyphoides* as important canopy species. Straatmans (1964) describes how the *Elattostachys falcata-Callophyllum vitiense* association gradually replaces the *Alphitonia-Rhus* association on 'Eua Island. In Toloa Forest, *Elattostachys falcata* and *Elaeocarpus tonganus* are likely to increase in importance because of their high representation in the smaller size classes (Table 1). *Rhus taitensis*, with almost no representation in small size classes, will eventually disappear, or perhaps become established only in large canopy gaps (Whistler 1980).

Because Toloa Forest is the last non-coastal natural wooded area on Tongatapu, it serves as a refuge for many of the island's native species. The red shining parrot, *Prosopeia tabuensis tabuensis*, actually named for the island of Tongatapu, is considered extinct on the island by Watling (1982). However, there is a small population in Toloa Forest. Plant species which

Table 1. The importance values (IV) for the most important woody plants in several categories (trees, large saplings, small saplings, seedlings, and lianas) in Toloa Forest. Plants of canopy tree species (species which commonly attain diameters greater than 50 cm) are marked with an asterisk (*).

	IV = (% Density + % Dominance + % Frequency)/3
Trees	$\text{IV} = (\% \text{ Density} + \% \text{ Dominance} + \% \text{ Frequency})/3$
<i>Rhus taitensis</i> (Anacardiaceae)*	23.6
<i>Elattostachys falcata</i> (Sapindaceae)*	19.9
<i>Syzygium clusiifolium</i> (Myrtaceae)	8.0
<i>Cryptocarya hornei</i> (Lauraceae)	4.9
<i>Ficus scabra</i> (Moraceae)	4.9
<i>Morinda citrifolia</i> (Rubiaceae)	4.4
<i>Alphonisia zizyphoides</i> (Rhamnaceae)*	4.2
<i>Elaeocarpus tonganus</i> (Elaeocarpaceae)*	3.7
18 other species	26.4
Large saplings	$\text{IV} = (\% \text{ Density} + \% \text{ Frequency})/2$
<i>Syzygium clusiifolium</i> (Myrtaceae)	25.9
<i>Vavaea amicorum</i> (Meliaceae)	25.3
<i>Micromelum minutum</i> (Rutaceae)	9.3
<i>Xylosma simulans</i> (Flacourtiaceae)	5.2
<i>Cryptocarya hornei</i> (Lauraceae)	5.1
<i>Elaeocarpus tonganus</i> (Elaeocarpaceae)*	4.7
21 other species	24.5
Small saplings	$\text{IV} = (\% \text{ Density} + \% \text{ Frequency})/2$
<i>Vavaea amicorum</i> (Meliaceae)	32.9
<i>Syzygium clusiifolium</i> (Myrtaceae)	23.4
<i>Elaeocarpus tonganus</i> (Elaeocarpaceae)*	6.0
<i>Cryptocarya hornei</i> (Lauraceae)	5.8
<i>Elattostachys falcata</i> (Sapindaceae)*	4.6
<i>Xylosma simulans</i> (Flacourtiaceae)	4.4
<i>Micromelum minutum</i> (Rutaceae)	4.2
23 other species	18.7
Seedlings	$\text{IV} = (\% \text{ Dominance} + \% \text{ Frequency})/2$
<i>Vavaea amicorum</i> (Meliaceae)	19.2
<i>Syzygium clusiifolium</i> (Myrtaceae)	18.4
<i>Elattostachys falcata</i> (Sapindaceae)*	14.9
<i>Micromelum minutum</i> (Rutaceae)	12.3
<i>Elaeocarpus tonganus</i> (Elaeocarpaceae)	5.8
<i>Cryptocarya hornei</i> (Lauraceae)	3.8
31 other species	25.6
Lianas	$\text{IV} = (\% \text{ Frequency})$
<i>Dioscorea bulbifera</i> (Dioscoreaceae)	19.3
<i>Jasminum simplicifolium</i> (Oleaceae)	19.3
<i>Jasminum didymum</i> (Oleaceae)	16.8
<i>Melodinus vitiense</i> (Apocynaceae)	14.9
<i>Gynochthodes ovalifolia</i> (Rubiaceae)	5.9
<i>Entada phaseoloides</i> (Leguminosae)	5.9
9 other species	17.9

are extremely rare or absent elsewhere on the island include *Randia conchinchinensis*, *Cordia aspera*, *Psychotria insularum*, *Memecylon vitiense*, *Sphaeropteris lunulata*, *Corymborchis veratrifolia*, *Tarrena sambucina*, *Niervilia aragoana*, *Gynocephalus ovalifolia*, *Cryptocarya hornei*, *Alyxia bracteolosa*, *Melodinus vitiense*, *Ervatamia orientalis*, and *Pteris tripartita*.

Plant communities are not only characterized by a natural disturbance regime (e.g. White 1979, Denslow 1980), but, in populated areas, they also have an anthropogenic disturbance regime. Physical disturbance of Toloa Forest by students of Tupou College and others is quite substantial. Large trees are harvested for firewood and construction. *Rhus taitensis* is often burned in quest of bee honey, occasionally resulting in tree death. I have met several students in the forest searching for rare plants for medicine. Young trees and saplings are often cut down or slashed with machetes without any intent for use of the plants. The presence of cow manure suggests some level of grazing.

In many tropical forests, canopy gaps allow for the colonization and establishment of a large number of native species (Denslow 1980). In Toloa Forest, however, fast-growing nonnative species such as *Lantana camara*, *Solanum mauritianum*, *Psidium guajava*, and *Ipomoea* spp. form dense thickets under natural as well as man-made canopy openings. They undoubtedly reduce the establishment and growth of native species in gaps.

Another anthropogenic factor disturbing the forest is its proximity to the airport runway. Aside from possible damages inflicted to the plant and animal populations caused by noise and air pollution, the proposed expansion of the airport runway would partially or entirely destroy the forest.

I thank Tom Hubbard for suggesting the study, Drs. Dotty Douglas and Brent Smith for helpful suggestions, Gary Buelow for introducing me to the flora of Tonga and for plant identification, Solomone Fifita and Paula Taufa for help with Tongan plant names, and Dr. Tevita Puloka for permission to study Toloa Forest.

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- MICHAEL W. PALMER, Department of Botany, Duke University, Durham, NC 27706, U.S.A.
- FIRST DESCRIBED NEST AND NEST SITE ACTIVITY OF THE TRUK GREATER WHITE-EYE (*Rukia ruki*)**
- The genus *Rukia* (Zosteropidae) contains four species of “greater” white-eyes endemic to island groups of Micronesia (Mayr 1945, Baker 1951, Morony *et al.* 1975). Little is known about the status and life histories of these species, and the taxonomic affinity of at least one (*R. palauensis*) has been strongly questioned (Pratt *et al.* 1980). Nests or nesting behavior have not been previously described for any member of this genus.
- The Truk Greater White-eye (*R. ruki*), confined to the Faichuk (Tol) Islands of Truk (6°22'N, 151°36'E) is perhaps the least known species of the genus. There have been virtually no published accounts of this white-eye since it was first described by Hartert (1897). Until recently, it was thought to inhabit only a small patch of forest on the top of Mount Tumuital, South Tol Island (R. Owen, pers. comm.). From 18 March to 29 April 1984 the U.S. Fish and Wildlife Service (USFWS) conducted bird surveys in Truk as part of the Micronesian Forest Bird Survey and located restricted populations of Truk Greater White-eye on nearby Polle, Pata, and Onei Islands (Engbring and Ramsey, in press). The species’ total known range, however, remains only about 1 sq. km. It is presently listed as a candidate endangered species by the USFWS.