

**Aspects of the Ecology and  
Social Organization of  
Free-ranging Cotton-Top  
Tamarins (*Saguinus oedipus*) and  
the Conservation Status  
of the Species**

**ABSTRACT**

Fifty-three *Saguinus oedipus* were live-trapped, marked, and released in one section of a relatively mature secondary forest located in the Western Caribbean coastal lowlands of Colombia. In a total of over 2,500 active field hours, approximately 750 hours of contact were made with marked and unmarked groups of tamarins.

Captures were made with decoy-type live traps and several types of collars were used for marking. Trapping and marking methods are discussed in detail since they may be applicable to future callitrichid field studies.

Certain groups containing between three and thirteen members restricted their movements to a well-defined home range. Although some groups changed considerably in size and composition during the study, they continued to occupy the same areas. Contact with neighboring groups or intruding individuals could usually be characterized as agonistic, including frequent "Rasp" vocalizations, vocalizations associated with separation of members from the group ("Dips" and "Long Calls"), frequent short chases, and occasional body contact. Encounters occurred most often in the overlap areas entered frequently by both groups, and terminated with the two groups gradually drifting apart.

<sup>1</sup>Author's name previously Warner.

Groups of from one to five were present occasionally within the home ranges of "established" groups. Some "transient" groups contained individuals which previously had been observed with "established" groups. Usually "transients" were chased vigorously by the resident group on contact, but two strange individuals joined resident groups with no sign of antagonism. Individuals examined from "transient" groups were adults whose age (based on weight and tooth wear) ranged from young to rather old. Both sexes were included.

Home-range sizes for three groups were 7.8, 7.8, and 10.0 hectares, with the corresponding group size (maximum and minimum numbers) ranging from 13 to 5; 5 to 3; and 6 to 3 individuals. Adjoining group home-range overlap was 20 to 30 percent. Density based on these three groups ranged from 0.3 to 1.8 tamarins per hectare.

Movement patterns, daily routine, group cohesion, and relations with other species are briefly described. Most of the 25 observed sleeping sites were broad tree forks, but a few were dense branch masses. Sites were frequently reused. In all but two cases, all individuals of a group slept together.

Food items included fruits of trees, vines and epiphytes, insects, newly sprouting leaves

or buds, leaves, leaf stems, and in one case a frog. Unidentified material was gathered from flowers, surfaces of certain fruits and tree branches or trunks, and the decayed parts of certain trees.

Variation in tooth wear indicated a probable spectrum of ages among the adults of the larger groups examined (eight members). Only one or a pair of infants or juveniles were observed in any group. Present data are not sufficient to support or reject the "extended family" social organization advanced by various workers (Epple, 1972b; Eisenberg, Muckenhirn, and Rudran, 1972); However, the changes in group size and composition observed in this and other studies on *Saguinus* (Dawson, 1976, 1977; Thorington, 1968; Durham and Durham, in press; Castro and Soini, 1977; Izawa, 1976) argue against the suggestion.

It is suggested that the availability of *Saguinus oedipus* to exporters is a misleading index of their abundance. The habitat destruction now occurring is the major threat to this species' future in the wild. The immediate establishment of adequately protected reserves can assure its long-term survival. The need for broad long-term policies on fauna preservation and financing of basic research, especially on callitrichids, is emphasized.

## SUMARIO

Cincuenta y tres *Saguinus oedipus* fueron atrapados vivos, marcados y posteriormente liberados en un área de un bosque secundario relativamente maduro, ubicado en la costa Oeste del Caribe, en Colombia. De un total de 2,500 horas de trabajo activo en el terreno, 750 hrs fueron de contacto con grupos marcados y no marcados de dicha especie.

Las capturas fueron hechas con trampas de señuelo vivo fabricadas con alambre por la gente del lugar. Collares de cuero, envueltos en cinta plástica en colores, medallas numeradas hechas de "Formica", y pequeñas campanitas fueron utilizadas en el marcaje. El método de captura, marcaje y determinación de la edad relativa de los individuos se discute en detalle puesto que pueden ser utilizados en futuros trabajos similares con otros Callitrichidae.

Algunos grupos restringieron sus movimientos a 'home ranges' (área de actividad) bien definidos, conteniendo entre 3 a 13 miembros. A pesar de que algunos de estos grupos cambiaron considerablemente en tamaño y composición durante el estudio, permanecieron sin cambios en los límites de los 'home ranges'. Los contactos con grupos vecinos o individuos que pretendieron entrar al área pudieron ser, en general, caracterizados como agonísticos, que incluyeron pequeños en-

frentamientos, aumento considerable en la cantidad de vocalizaciones emitidas, persecuciones, y ocasionales contactos cuerpo a cuerpo. Los encuentros ocurrieron en las zonas de sobreposición de las áreas de actividad de los grupos, terminando con una gradual separación de estas.

Grupos de uno a cinco individuos estuvieron temporalmente presentes en varias oportunidades dentro las áreas de los grupos 'establecidos' descritos más arriba. En varios casos, contenían individuos marcados previamente observados con algún grupo establecido. En general, los visitantes fueron perseguidos vigorosamente por el grupo residente; sin embargo en dos ocasiones un individuo ajeno al grupo pasó a formar parte del grupo residente sin ningún signo de rechazo. Los individuos en estos grupos transeúntes cuya edad se pudo estimar basada en peso y desgaste de dientes, fueron en su mayoría adultos maduros, y de ambos sexos.

El tamaño del 'home range' en tres grupos fue de 7.8, 7.8 y 10.0 hectáreas, respectivamente, con un amplitud de variabilidad correspondiente en el tamaño del grupo. Los mínimos y máximos dados a continuación fueron determinados durante el estudio: 13 a 5; 5 a 3; y 6 a 3 individuos. La sobreposición entre grupos contiguos fue de 20 a 30 por

ciento. La densidad basada en estos tres grupos tuvo una variabilidad de 0.3 a 1.8 tamarinos por hectárea.

Los patrones de movimiento, actividad diaria, cohesión de grupo y sus relaciones con otras especies se describen brevemente. Las características de 25 sitios para dormir se resumen. Estos sitios fueron a menudo reutilizados. La mayoría de ellos eran esencialmente árboles con gruesas ramas laterales, unos pocos fueron densas masas de ramas. La cantidad de cobertura presente fue altamente variable. Con la excepción de dos casos, todos los miembros de un grupo dormían juntos.

La alimentación consistió básicamente en frutos e insectos. Los frutos provenían de árboles, enredaderas y algunas epífitas. Con menor frecuencia fueron ingeridas hojas nuevas o yemas, hojas, tallos, y en un caso, una rana. Material no identificado fue recogido de algunas flores, valvas de ciertas frutas, ramas o troncos y de algunas porciones aéreas de ramas en descomposición.

La variación en el desgaste de las dientes, probablemente indica un espectro de edades entre los adultos de los grupos más grandes examinados (8 miembros). Sólo uno o un par de infantes o juveniles fue observado en algún grupo. De tal modo, los datos aquí presenta-

dos no son suficientes para decidir si los grupos pertenecen al tipo de familia extendida, hipotetizada por varios autores basados en trabajo de laboratorio (Epple, 1972b; Eisenberg, Muckenhirn and Rudran, 1972). No obstante, la hipótesis no predeciría los substanciales cambios en el tamaño y la composición del grupo observados en este estudio y algunos recientes tratando de otras especies de *Saguinus* (Dawson, 1976, 1977; Thorington, 1968; Durham and Durham, en imprenta; Castro and Soini, 1977; Izawa, 1976). Estudios a largo plazo en poblaciones marcadas son necesarias para completar el esquema parcial que tenemos ahora de la estructura social de estas especies.

El presente estado del hábitat de *Saguinus oedipus* es discutido en extensión con énfasis en el hecho de que las cifras otorgadas por los exportadores llevan fácilmente a errores con respecto a la abundancia de esta especie. El substancial agotamiento del hábitat que está ocurriendo actualmente es la mayor amenaza para la especie. Sólo a través del establecimiento inmediato de reservas protegidas puede asegurarse su supervivencia. A pesar de los problemas la singular riqueza de la fauna colombiana hace que esta medida sea valiosa de tomar.

## Introduction

*Saguinus oedipus*<sup>2</sup>, the cotton-top tamarin, was one of the first callitrichids to become well known in the United States. The proximity of its range to Barranquilla, Colombia's second major animal export center, ensured that this species early became one of the cheapest and most easily available New World primates for the North American pet and biomedical market. However, despite the large numbers that have been held in captivity, there have been relatively few studies of its basic biology. Some information is available on the following: reproductive behavior and physiology (J. K. Hampton et al., 1966, 1971; Epple, 1967, 1970); general behavior (J. K. Hampton et al., 1966; Wendt, 1964); vocal repertoire (Epple, 1968; Muckenhirn, 1967); scent marking behavior (Epple, 1972a); skin and scent gland morphology (Wislocki, 1930; Perkins, 1969) and cytotaxonomy (DeBoer, 1974). Some of these topics have been treated for three other species of *Saguinus* in captivity: *S. geoffroyi* (Moynihan, 1970; Muckenhirn, 1967); *S. fuscicollis* (Epple, 1970, 1971, 1972a, 1972b, 1977); and *S. midas* (Mallinson, 1971). Substantial information has accumulated on the maintenance and propagation of these species in captivity (Epple, 1970; Lorenz, 1972; J. K. Hampton et al., 1966; S. H. Hampton and J. K. Hampton, 1967; S. H. Hampton et al., 1972).

Field observations of callitrichid species have been short-term or lacking, except for a one-year study of *Saguinus geoffroyi* (Dawson, 1976, 1977). Reports based on one to several weeks of field observation are available for the following species: *S. geoffroyi* (Moynihan, 1970; Muckenhirn, 1967); *S. midas* (Thorington, 1968; Durham and Durham, in press); *S. nigricollis* (Mazur and Baldwin, 1968—semi-natural conditions); *S. fuscicollis* (Izawa, 1975, 1976; Castro and Soini, 1977); *S. mystax* (Castro and Soini, 1977); *Cebuella pygmaea* (Ramirez et al., 1977; Izawa, 1975, 1976) and *Leontopithecus rosalia* (Coimbra-Filho, 1977; Coimbra-Filho and Mittermeier, 1973). Studies of free-ranging populations are completely lacking for the remaining 23 callitrichid species (cf., Napier and Napier, 1967), and for *Saguinus oedipus*.

This paper restricts itself to group characteristics, general aspects of the use of space and resources,

<sup>2</sup>Although Hershkovitz, 1966, suggested that the rufous-naped tamarin (*S. geoffroyi*) and cotton-top tamarin (*S. oedipus*) be considered subspecies of *Saguinus oedipus*, they will be considered as separate species in this paper in accordance with Hernandez and Cooper (1976).

and relations with other species by cotton-top tamarins in a single study area, plus a review of problems concerning conservation of the species. Methods have been described in some detail because of their possible applicability to future field studies of callitrichids. Other results and conclusions from the study will be presented in subsequent publications.

## Study Area

The study area was located about 15 km to the east-northeast of Tolú, Sucre, on the Caribbean coast of Colombia, at about 9°34'N, 75°27'W (Figure 1). It forms part of an alluvial plain at about 100 m elevation at that point, formed from the San Jacinto hills lying just to the east (560 m maximum altitude). The area appears level, but after a heavy rain the standing water can be seen flowing along the surface of the ground and the area drains rapidly into a network of gullies (*arroyos*), 3 m to 7 m deep and 5 m to 15 m wide which carry the water seaward.

Using the Holdridge classification, Espinal and Montenegro (1963) described the region as one capable of supporting "very dry tropical forests," with relatively low rainfall (500 mm to 1000 mm annually) distributed in a highly seasonal pattern. Between December and April when there is practically no precipitation, an estimated 60 percent of trees lose their leaves. During the heavy rainfall months of August through November, large areas of the forest become flooded. About 30 percent of the study area was flooded to three feet or less at the worst of a very rainy year (1974). In the preceding very dry year, the forest floor remained nearly dry during the same period. Even during the wet season three to four days without rain—a not uncommon happening—has a marked effect in drying out the forest floor. During the dry season, the water found in *arroyos* is the sole water supply for the entire area.

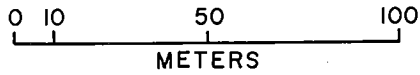
The study area is in one of the larger remnant forests still existing in that part of Colombia (Figure 1), totaling about 600 hectares, and surrounded by pasture. It contains an essentially isolated population of *S. oedipus*, although some dispersal is possible via fence lines which connect to *arroyos* since both often are lined with trees. The study groups frequented the southeastern corner of the forest block (about 45 hectares) plus an adjoining strip of forest along a fence line and *arroyo* (about 7 hectares) (Figure 2).

Human exploitation of the forest probably dates

# HABITAT FOREST PRESENT IN *Saguinus o. oedipus* RANGE

## LEGEND

- Primary forest limits in 1966<sup>1</sup>
- ◐ Secondary forest (1966)<sup>1</sup>
- ◑ Verified remaining forest (1974)<sup>2</sup>
- ⊙ Department capitals
- Other important cities
- + Present supply center *Saguinus o. oedipus*
- - - Limits of former *S. o. oedipus* range<sup>3</sup>
- ? Uninvestigated area



1- After "Mapa General de Bosques", Instituto Geografico Agustin Codazzi, Dept. Agrológico, Vol. III No.2, 1967 Republic of Colombia. (1966)

2- Struhsaker et al., 1975

3- Southern limit of Andes foothills probably less than 1000 m.

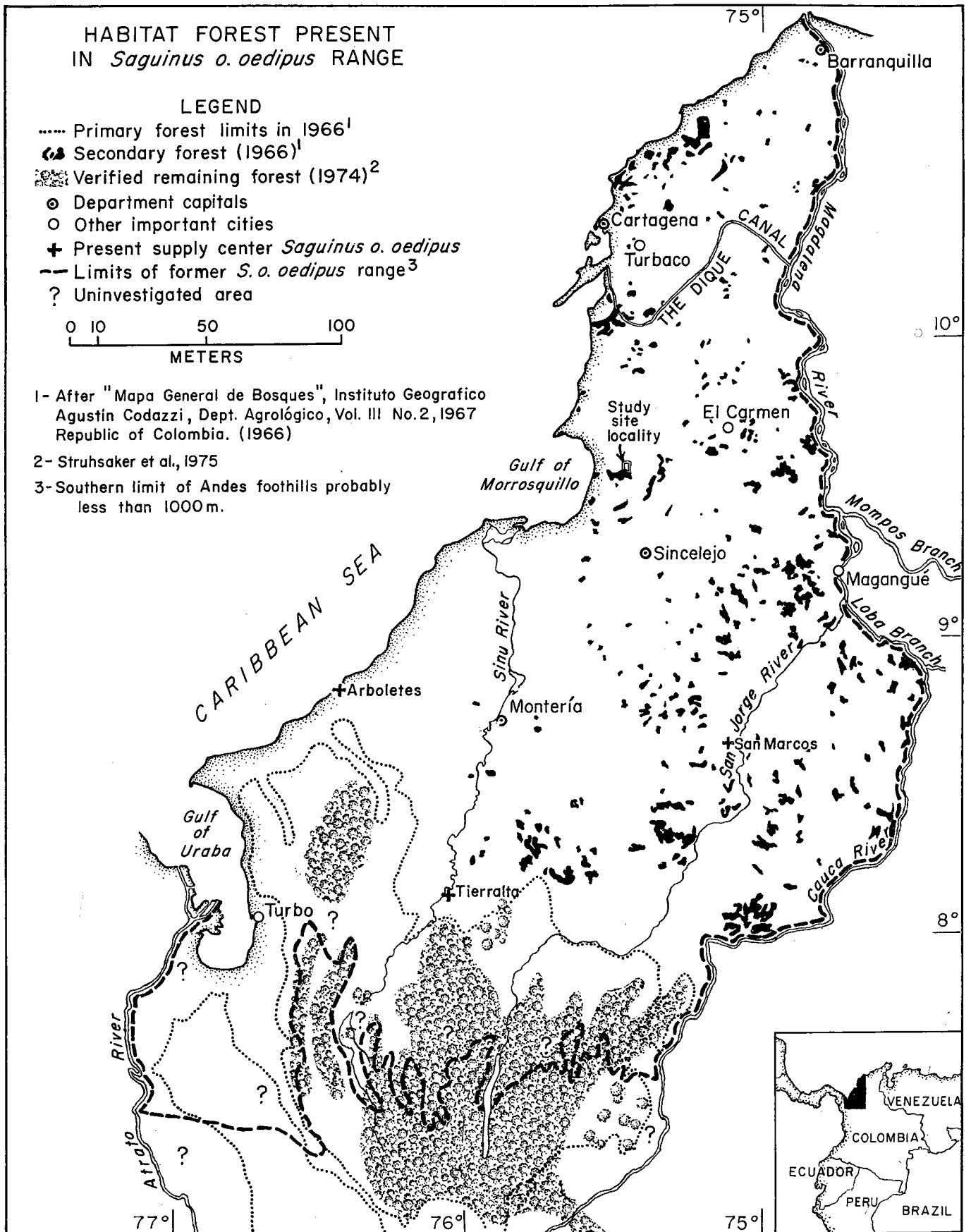


Figure 1. Location of study site and distribution of forest remaining in the original range of *Saguinus oedipus* (as given by Hernandez and Cooper, 1976). This is a composite showing 1966 forest limits together with 1974 aerial reconnaissance estimates of remaining forest in the southernmost section (Struhsaker et al., 1975). Part of the latter may be primary forest, but extensive clearcutting was already occurring there in 1966. Forest designated in 1966 as secondary is shown as black patches. Many of these may no longer exist.

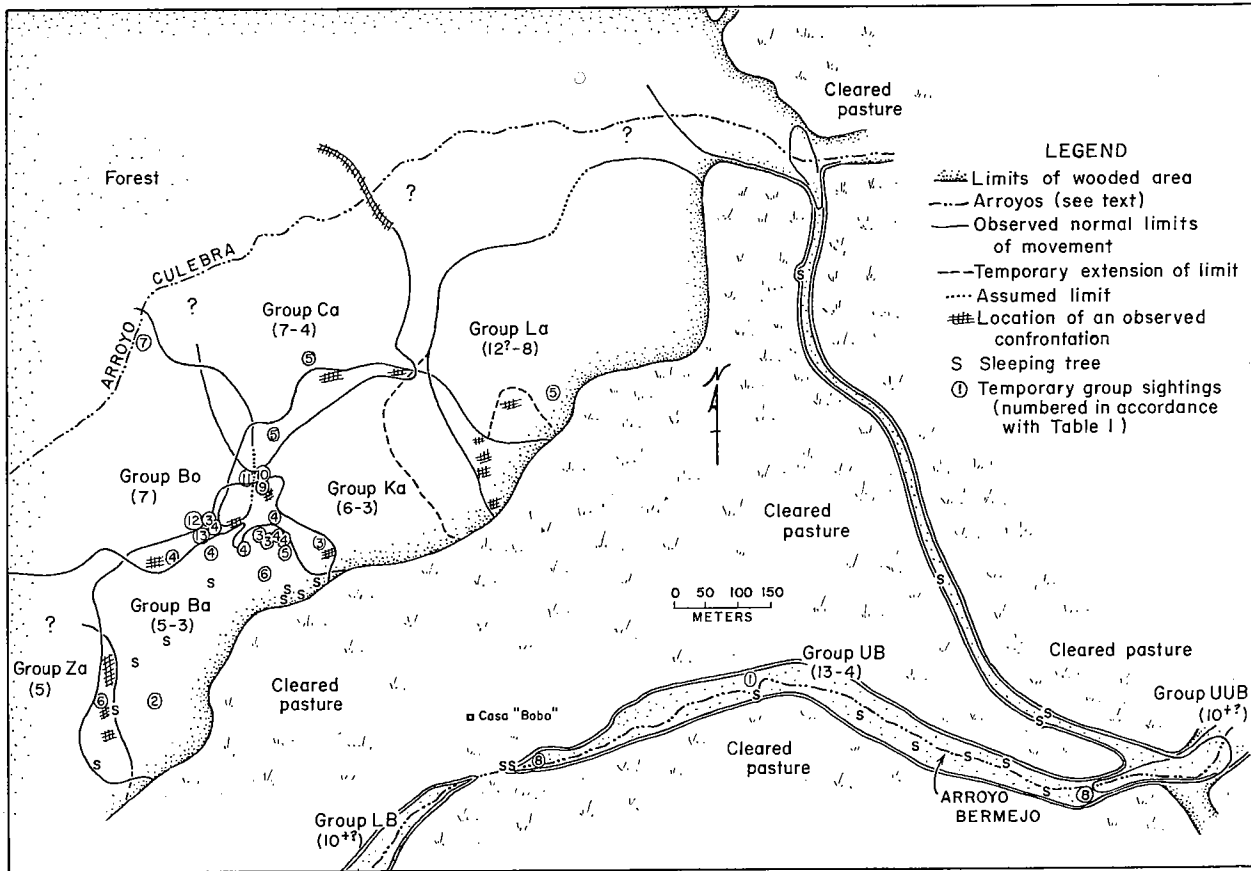


Figure 2. Map of main study area (see text). Surrounding areas are pasture, as indicated. Partial or complete limits of eight "established" groups in and adjacent to the study area are shown, together with observation locations of "transient" or temporary groups. The latter are numbered in accordance with Table 3. Sleeping trees for the Ba and UB groups are indicated. Maximum and minimum size of groups shown in parentheses. Hatched areas show points of inter-group encounters.

back to at least precolonial times, as Indian remains are common in nearby areas. The pastures are fairly recent in origin; those immediately adjoining the study area were cleared less than fifteen years ago. Exploitation of the forest is continuing. Middle-stratum trees are utilized for fence posts, corals, houses, and bridges. Also some selective cutting is occurring, chiefly for *Cedrela*, *Ceiba*, *Bombacopsis*, and *Lecythis*. Few usable large specimens of the first three species remain. Hunters also frequent the study area. As far as is known, the resident primates (*Alouatta seniculus*, *Cebus capucinus*, and *Aotus trivirgatus* in addition to *S. oedipus*) are not presently subject to hunting pressure; however, they are commonly chased when encountered in vulnerable places, such as on fence lines, on the ground, or in low vegetation. The notable shyness of *A. seniculus* suggests that they may have been molested in the past. They react to an observer by hiding, often sitting without moving for long periods, and attempting to sneak away. This contrasts with the typical alarm patterns which this species shows in other forests in northern Colombia (branch shaking, grunting, urination, and defecation).

Common easily recognizable tree species are those typical of secondary forests in northern Colombia: *Luehea* sp., *Bursera simaruba*, *Anacardium excelsum*, *Cavanillesia platanifolia*, *Pseudobombax septenatum*, *Cecropia* sp., *Inga* sp., *Spondias mombin*, *Pithecellobium saman*, *Lecythis magdalenica*, *Gustavia* sp., *Triplaris* sp., *Calycophyllum* sp., *Guazuma ulmifolia*, *Brosimum* sp., *Muntingia calabura* sp., *Swartzia* spp., *Garcia nutans*, *Sapium* sp., *Ormosia* sp., *Cas-searia* spp., *Mayna* sp., *Nectandra* sp., *Trichilia* sp., *Urera* sp., *Hybanthus prunifolius*, *Claviya* sp., *Picramnia* sp., *Randia* sp., *Panopsis* sp., *Quararibea* sp., and others including various species of palms (e.g., *Bactris* spp., *Astrocaryum* spp., and *Sabal* sp.) Much less common, but also present are: *Ceiba* spp., *Bombacopsis septenatum*, *Cedrela* sp., *Enterolobium cyclocarpum*, *Prioria copaifera*, *Fagara* sp., *Sterculia apetala*, *Cochlospermum* sp., and *Cordia aliadora*. In many places the forest floor is dominated by a very spiny palm which branches from ground level (tentatively identified as *Astrocaryum* sp.). In other areas, a mixture of saplings and low palms (cf., *Cryosophila* and *Heliconia* spp.) predominates. In places more recently cleared and therefore receiving more sun, the *Heliconia* may form dense stands to over 3 m in height. All areas can be penetrated with the aid of a machete, though not always at the speed necessary to maintain contact with a *Saguinus* group.

The relative scarcity of densely vined areas and the openness of the floor in most places suggest forest of some maturity. Nevertheless, the brokenness of the canopy is marked—only infrequently is travel possible for more than 50 m in any one direction at a height of over 15 m. Breaks in the canopy are due to both selective logging and tree falls occurring during seasonal high winds (September–November). In 1973 a high wind blew over so many trees in one section of the study area that a continuous canopy did not remain at any level. Also, the fall of one large tree always causes extensive damage to adjacent trees.

### Methods

Between August 1973 and August 1975 about 750 contact hours were spent with free-ranging cotton-top tamarin groups. Total active field time was conservatively estimated at 2,500 hours.

Basic procedure consisted of searching for groups and following them until contact was lost. Success in following was greatest with one group (UB) which frequented the narrow forest strip of 7 hectares (Figure 2) and with those groups in which one member was marked with a bell (see below). Over half of the total contact time was spent with the UB group. The three most-studied groups (UB, Ka, Ba) became somewhat conditioned, but always showed nervousness if observed intently, especially if binoculars were used. Their disquiet could often be allayed by rapidly glancing away whenever they began to stare at me, but frequently attempts to observe them even from a distance of 20 m resulted in their moving to more hidden branches or leaving the area completely. Conditioning such small animals is complicated by the fact that the observer is constantly disappearing and reappearing in their visual field as they forage.

Minimal data were obtained on unmarked groups, as it was not possible to distinguish individuals (except in one case), or to be certain whether the same group was encountered on different days in a given location. Age and sex composition of groups, often used by field workers to identify troops, was not helpful here. Tamarins cannot be sexed at a distance, and the rapid growth of juveniles renders them indistinguishable from adults after the age of about ten months if seen from a distance (unless adjacent). Group size was not a useful criterion either, as difficulties in detecting all members of moving groups often rendered group counts questionable. Marked ani-

