

## Monkey Species Forest Preference in the Osa Peninsula of Costa Rica

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### ABSTRACT

Conservation is important for managing and protecting species and their environment. Costa Rica has played a vital role in regenerating forests to protect the many species that live there. Identifying which forest types species prefer is important to re-introducing species into the regenerating forests. There are four monkey species which live in these forest. They include *Saimiri oerstedii*, *Cebus capucinus*, *Alouatta palliate*, and *Ateles geoffroyi*. This study examines three different monkey species in Costa Rica and whether they prefer interior or riparian forest. Transect walks are used to determine the areas which species may inhabit. Quadrat data and information is used to determine which qualities are essential in the riparian and interior forests. Transect data and quadrat data are used to determine which habitat each monkey species prefers. Understanding which types of forests each species prefers will help researchers and conservationists to determine where to introduce species into the regenerating forests. We found the *Cebus capucinus* and *Alouatta palliate* prefer the riparian forest environment with higher humidity, trees with a larger DBH and a greater variety of trees. The *Ateles geoffroyi* prefer the interior forest qualities which include taller trees, more canopy coverage and more lianas present.

Keywords: *conservation, interior forest, riparian forest, monkey, Saimiri oerstedii, Cebus capucinus, Alouatta palliate, and Ateles geoffroyi.*

### INTRODUCTION

Costa Rica provides habitat for over 505,000 different species of plants and wildlife (Henderson 2002). Costa Rica is known for its conservation based on researchers' efforts to study and protect the forests and animals. It is a great place to observe interactions in a healthy environment, but it also familiarizes the hazardous consequences of deforestation and other threats to the environment. However, about twenty-six percent of its territory is protected, Costa Rica has lost about a third of its rainforest during the 20<sup>th</sup> century. The rainforest protection is still currently an important political issue there. Understanding how an animal uses its habitat is essential for researchers. Some animals have been able to adapt to the development of human population in Costa Rica (Van Hulle 2001). Even though these animals have been able to live in harmony with humans, some of have not been able to adapt as easily as others (Fedigan 2001). Costa Rica has tried to put in efforts to regenerate forests in order to reintroduce animal populations which have dwindled over time. Monkeys specifically have not been able to adapt to the regenerating forests as well as other animals. (Fedigan 2001) Monkeys may prefer different types of forest which have been destroyed, making it difficult to survive. By understanding the types of forests monkeys prefer can help researchers and conservation efforts to reintroduce species into the appropriate habitat.

The four species of monkey in Costa Rica all live in the Neotropical dry forest (Henderson 2002). The four species which inhabit Costa Rica are *Saimiri oerstedii*, *Cebus capucinus*, *Alouatta palliate*, and *Ateles geoffroyi*.

The dry forests have many different areas. These

areas include the interior and edge forest. Studies have shown that some animal species actually prefer edge forest near human development. (Gillies 2010) Some monkeys in Costa Rica, such as the white faced capuchin (*Cebus capucinus*) and mantled howler monkeys (*Alouatta palliate*), can be seen near edge forest (Van Hulle 2001.) However, there is not enough research supporting which monkeys prefer edge riparian forest. Also, not enough data has been collected in order to prove which type of forest each monkey species prefers in Costa Rica. There are many different forest types in Costa Rica but the two analyzed in this study were interior and riparian forest. The interior forest can be determined as the forest not along the edge such as a road or a river. The riparian forest is located along the water's edge such as a river or a stream.

Understanding which elements are in the forest can also help conservationists and researchers determine why the species has habituated to a certain area of forest. This study was able to determine the different elements of the interior and riparian forest. The overall purpose of this study was to determine which elements the monkeys prefer and if the monkeys of Costa Rica would prefer interior forest over edge riparian forest.

### MATERIALS AND METHODS

#### Quadrat Data:

Researchers or group of students participating in DANTA conservation class, divided into two groups. One group measured and recorded data in the interior forest while the other group measured and recorded

data in the riparian forest. In order to measure the differences in forest, four quadrats were randomly placed in each forest area. The area was randomly selected by placing a 6X6 grid over a map of the selected area. Two dice were rolled and the first dice would indicate the number on top of the grid while second dice would indicate the number on the side of the grid. The quadrat would be placed in the area which the dice indicated on the map. This was repeated four times in order to place four quadrats. The quadrat squares were measured 10mX10m. Within the quadrat each group measured the diameter at breast height (DBH) of each tree using the foresters measuring tape. Each group measured and recorded the height of each tree using a clinometer. The densitometer and thermometer were used in the same location and same time of day in each quadrat, to record the canopy coverage, temperature, and humidity of the area. The average canopy coverage, temperature and humidity, were calculated and recorded with one standard deviation. Each group averaged the number of young leaves and mature leaves based on a 0-2 scale. The students also noted whether lianas were present in each tree were. The number of young leaves, mature leave and lianas present was averaged and recorded. Each group calculated the dispersion of each forest area using Morista's Index.  $Id=n ((Ex)^2-Ex) / ((Ex)^2 - Ex)$ . (Setchell 2003)

#### Transect Methods:

Transect were selected in areas along the quadrat area. The transect walk of the riparian forest was located along the river and the transect walk for the interior forest was located along the Ajo trail of the Osa Research Station. The transect walks were measured 1Km long. Each group walked the transect once in the morning and once in the afternoon. The walks were taken at 5:00am and at 3:00pm on each trail. The groups stopped every 20 meters for 10 seconds to increase the chance of see the monkeys. The groups recorded the number of monkeys spotted, the types of monkeys, and the type of activity they monkeys were performing. The methods for this section were used from the Ross and Reeve Survey and Census Methods. (Setchell 2003)

## RESULTS

Table 1 shows the different elements in each forest. According to the calculations of mean and standard error we can determine which element varies between the two forest types. Humidity is much higher along the edge riparian forest than the interior forest. There is no significant difference in temperature between the forests. Tree height is much larger in the interior forest than the riparian forest. The diameter at breast height (DBH) was much larger in the riparian forest. The amount of lianas present was larger in the interior

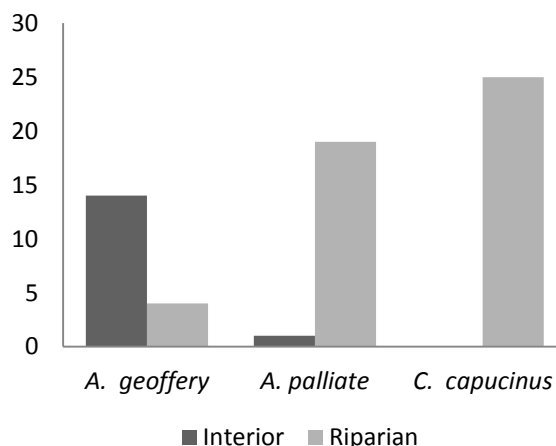
forest meaning there is older growth. The canopy coverage was also significantly larger within the interior forest. Morista's index shows the interior forest has a more diverse variety of trees within the interior forest. There was no fruit or young leave present in either forest type.

**Table 1.** Means and standard error of elements recorded within forest types

	Riparian	Interior
Humidity	92.3 ± 0.9	74 ± 0.6
Temperature (°C)	29.3 ± 0.2	29.4 ± 3.3
Height (m)	16.9 ± 1.2	19.8 ± 1.6
Lianas Present	65%	69%
DBH (cm)	35.5 ± 7.7	20.0 ± 2.2
Canopy Coverage	88% ± 1%	97% ± 2%
Fruit	0	0
Young Leaves	0	0
Morista Index	0.989	0.949

**Table 2.** Individuals present within forest types. Numbers differ significantly ( $P < 0.001$ ) Chi Square value = 1.51695E-09 DF= 62

	Interior	Riparian
<i>A. geoffroyi</i>	14	4
<i>A. palliate</i>	1	19
<i>C. capucinus</i>	0	25
Total	15	48



**Figure 1.** Individuals present within each forest type

**Table 3.** Groups performing activity. Numbers do not differ significantly ( $P < 0.001$ ) Chi Square value = 0.217085396 DF=16

	locomotion	feeding	resting
<i>A. Geoffroyi</i>	7	2	0
<i>A. Palliate</i>	2	1	2
<i>C. Capucinus</i>	1	1	0

Table 2 shows the individual monkey species

present within each forest type. With a chi square value of  $P < 0.001$  we can be certain there is a significant difference in forest preference between the monkey species. Figure 1 shows the dispersal of monkeys in the two forest types. *Ateles geoffery* is more abundant in the interior forest, while *Alouatta palliate* and *Cebus capucinus* is more abundant in the riparian forest.

Table 3 shows the activity performed by the groups of monkey species. With a chi square value  $P < 0.001$  we can be certain the activity is random and has nothing to do with forest preference.

## DISCUSSION

Based on the results we can be certain that individual species has a forest preference.

Since *Alouatta palliate* and *Cebus capucinus* prefer the riparian forest they must prefer an environment which is more humid, provides trees with a larger DBH and greater diversity. Since the *Ateles geoffroyi* prefers the interior forest they may favor elements such as tall trees, larger canopy coverage, and more present lianas.

*Cebus capucinus* may prefer the riparian forest based on their diet. The riparian forest is more humid and located near the water's edge which provides larger amount of insect population. Since the *Cebus capucinus* diet consists of insects and fruit, and there was no fruit present at the time, the *Cebus capucinus* may have been drawn to the large insect population located near the water's edge.

The *Alouatta palliate* are a slow moving, leaf eating species. The Riparian forest provides thicker trees for the slow moving species and a larger variety of leaf for their diet.

*Ateles geoffroyi* are a small quick moving species. They move quickly over vast amount of space. The large amount of canopy coverage and lianas may allow the *Ateles geoffroyi* to travel from tree to tree. The height of the trees allows the species to move quickly over a vast area.

When considering conservation efforts and re-introducing species into new habitat we should be aware what each species prefers. In this species the *Alouatta palliate* and *Cebus capucinus* prefer the riparian forest while the *Ateles geoffroyi* prefers the interior forest.

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