

**National Science  
Education Standards**

✿ Standard C: *Life Sciences* — Structure and function in living systems.

✿ Standard C: *Life Sciences*— Populations and ecosystems.

✿ Standard C: *Life Sciences*— Diversity and adaptation of organisms.

✿ Standard F: *Science in Personal and Social Perspectives* — Populations, resources, and environments.



# Tropical Forest Food Chain

## OVERVIEW

In this activity we will explore one way that interdependency is seen in tropical forests. We will use as an example some of the food chains present in the Caribbean National Forest.

## OBJECTIVES

Students will:

1. Explore the importance of conserving biodiversity.
2. Learn the concept of food chain.
3. Identify some of the species that live in the Caribbean National Forest.
4. Develop understanding towards different species.

## SUBJECTS

Social Studies, Science

## VOCABULARY

Food chain, food web, producers, consumers, species, ecosystem, genetic

## TIME

Preparation Time—10 minutes; Activity—50 minutes

## MATERIALS

- Annex #1\* - Species illustration cards.
- Annex #2\* - Species information cards.
- Annex #3\* - Narrative on the “Food Web of the Caribbean National Forest”.
- Annex #4\* - Illustration/Poster “Food Web of the Caribbean National Forest”.

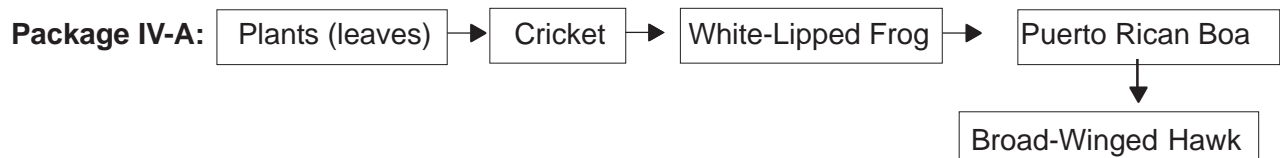
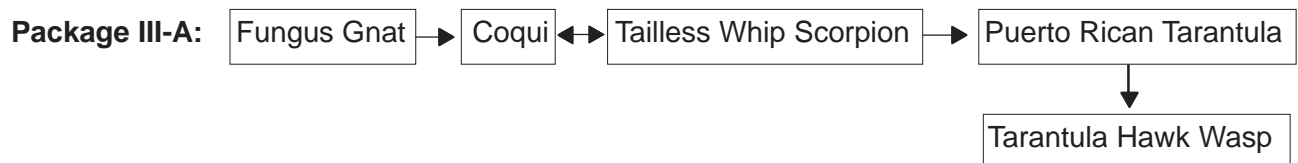
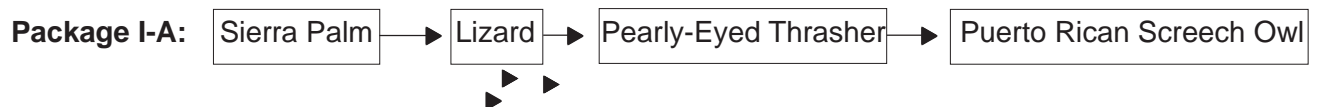
## BACKGROUND

A **food chain** is a mechanism that transfers energy within ecosystems. In this chain each species satisfies its own needs and aids in the survival of other organisms. In ecosystems there are two large groups – the **producers** and the **consumers**. Though we present the food chain as linear, this is not really so. In most cases a species of plant or animal is usually consumed by various species. When all these interrelationships combine together we call it a **food web**. Since there is a narrow interdependency between all species, it is imperative that we conserve all **biodiversity** (**genetic**, **species** and **ecosystem**). Also, each living organism deserves respect due to the simple fact that it exists. Each living thing provides beauty to our planet and offers multiple services, some yet unknown to humankind.

Due to the fact that energy flows through the food chain in an ecosystem, each species, no matter how insignificant it might seem, is important in maintaining the integrity of the system. As we will see, from the seeds of the sierra Palm to the Broad-Winged Hawk, all have an important role to play and, therefore; we must protect them. (Please see the poster “Food web of the Caribbean National Forest”).

## BEFORE THE ACTIVITY

Prepare packets of cards for your students. These packets should be organized in the following groups (please note - the arrows go from prey to consumer). Package III-A is repeated.



## ACTIVITY

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1. Divide the class into five groups.
2. Assign each group a package containing a segment of the food web (See Annex 1).  
**Note:** the arrows from prey to consumer.  
Hand out a package of cards to each group.
3. Ask the group to establish the order in which they believe the species interrelate in the package they have. Provide 3 minutes for this part of the exercise.
4. Hand out packages I-B, II-B, III-B, IV-B accordingly (III-B is repeated). These contain the information of the species on the illustrations (see Annex #2). Provide the groups the necessary time to read the information on the cards, evaluate the order in which they placed the illustrations and make any necessary changes.
5. Each group, working together, will answer the following questions (see Annex #3):
  - ☆ How do you think these species interrelate? After the group presents the established order, confirm or correct the same explaining the answer.
  - ☆ Eliminate a species of your food chain. How do you think this will affect the others?
  - ☆ With which of these species do you identify? Why?

6. Explain the concept of a food chain (See Background” as one of the reasons why we must conserve biodiversity.
7. Show the poster “Food Web of the Caribbean National Forest”. Ask that they observe the uncommon phenomenon called “reciprocal depredation”, which is when a species is both the prey and the consumer of another species. Some examples are the Coqui, the Tailless Whip-Scorpion, and the Tarantula. These species prey among themselves; size is basically the determining factor for this phenomenon.

## EXTENSIONS

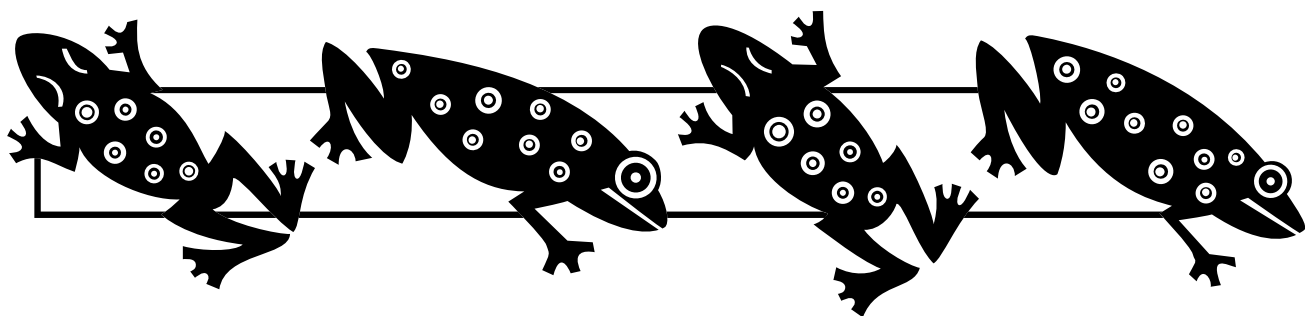
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Ask each group and/or student to look for more information on the species with which they previously said they identified with.

## ASSESSMENT

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Ask the students to write an essay or short paragraph on the importance of conserving biodiversity.

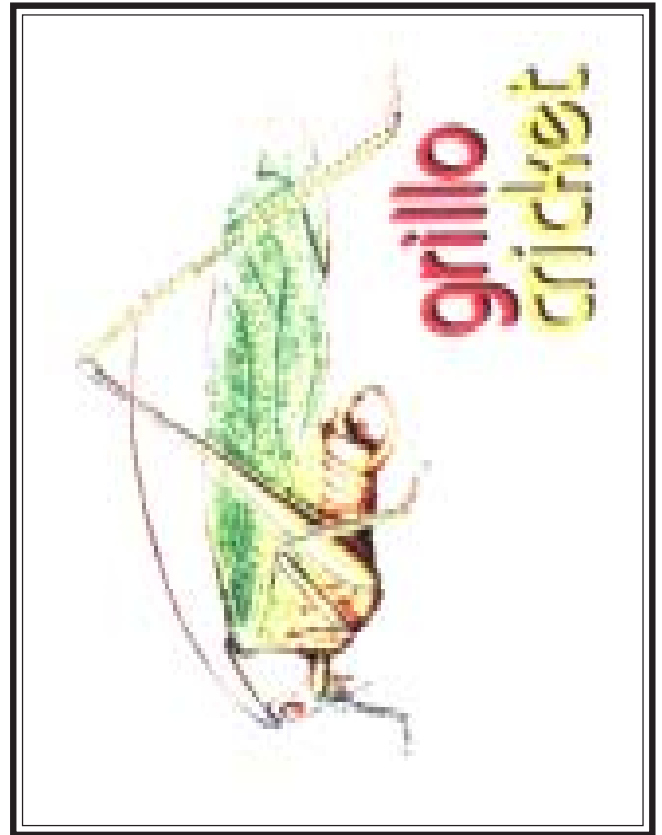
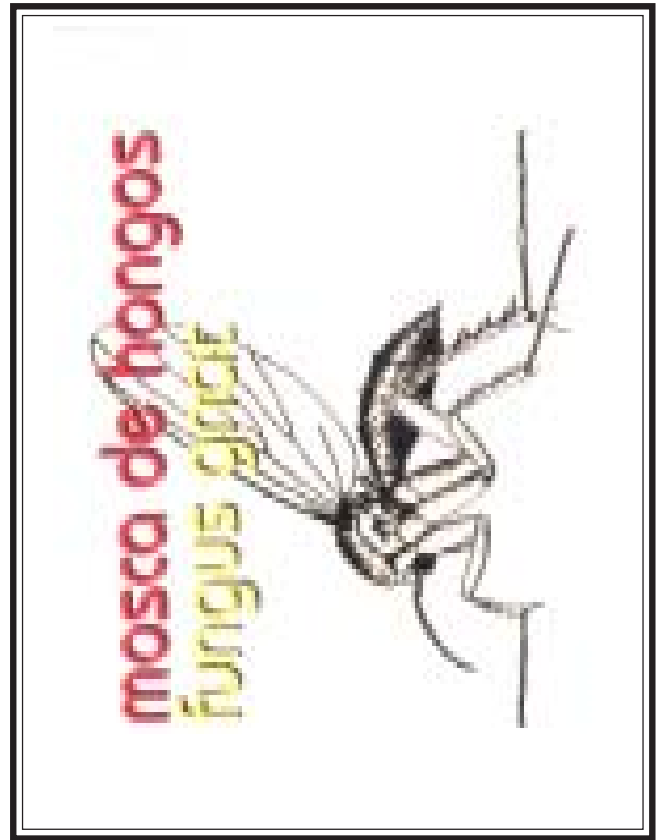
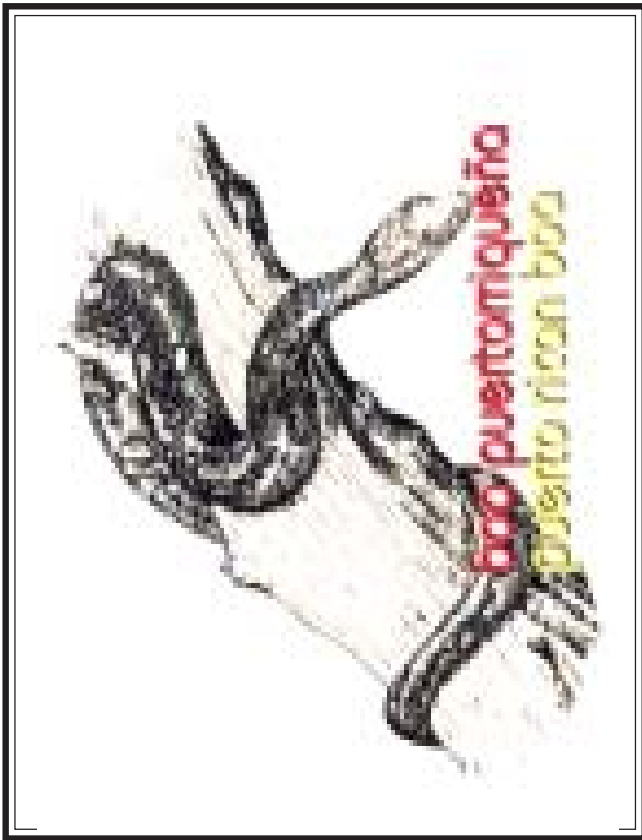


## Annex 1—Illustrations



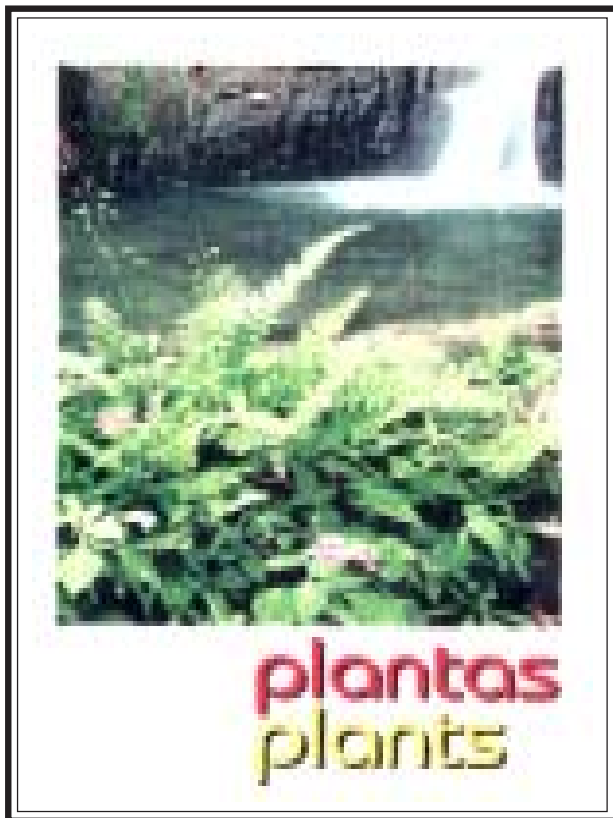
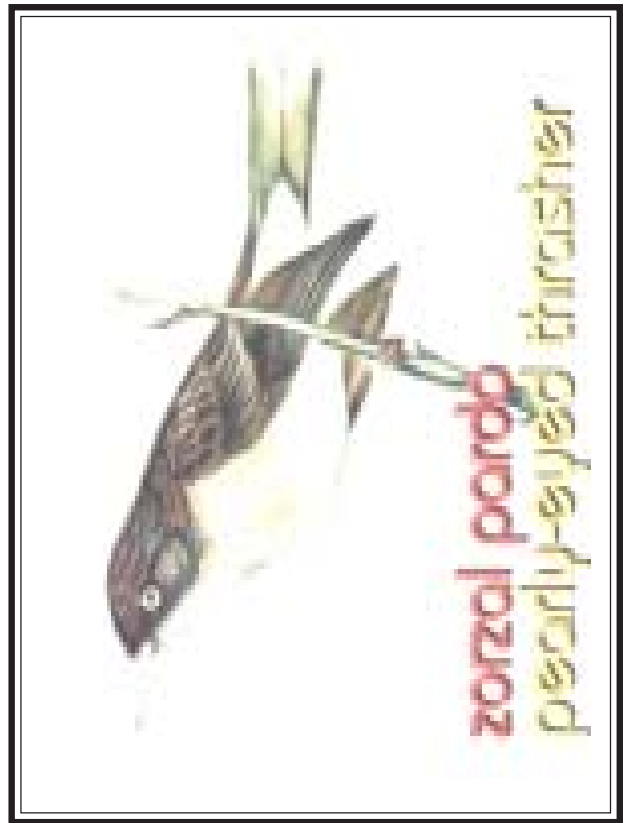
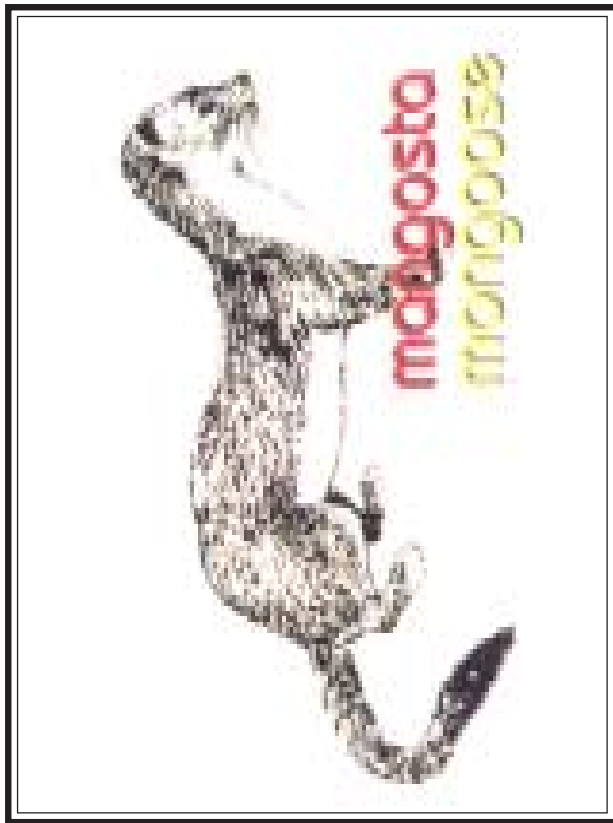
## Tropical Rain Forest Food Chain

America's Rain Forests



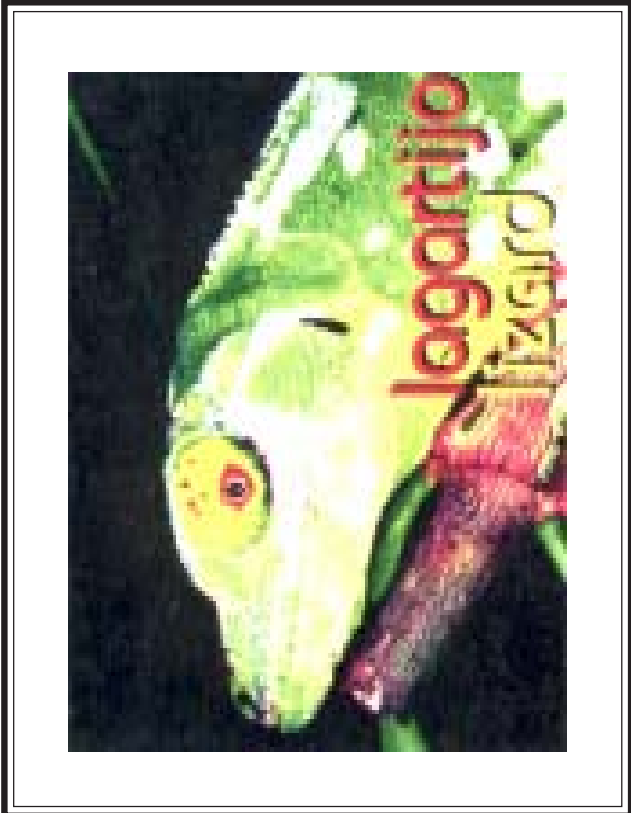
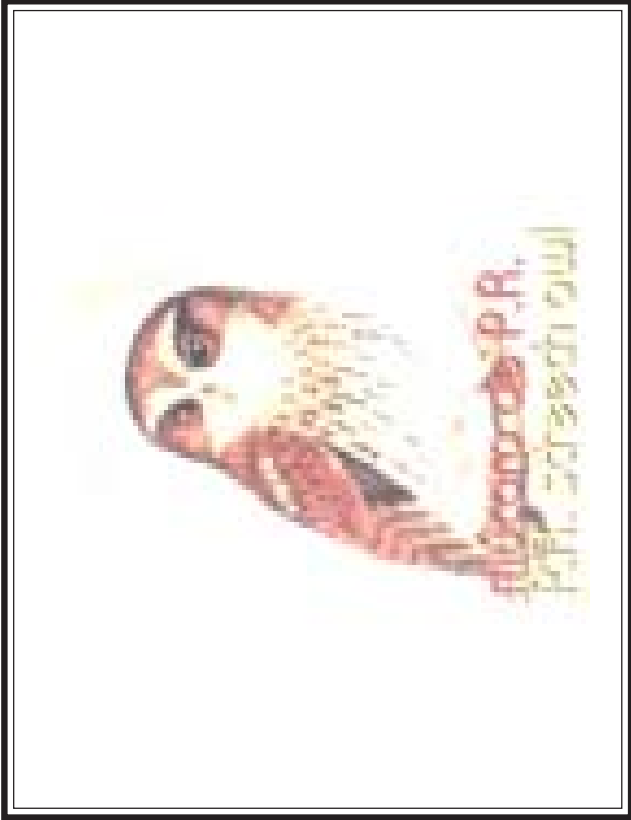
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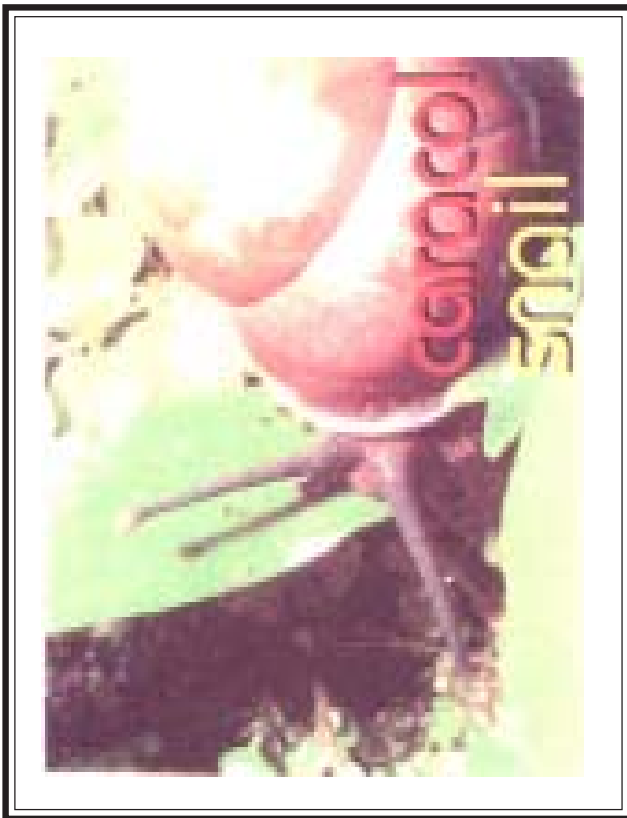
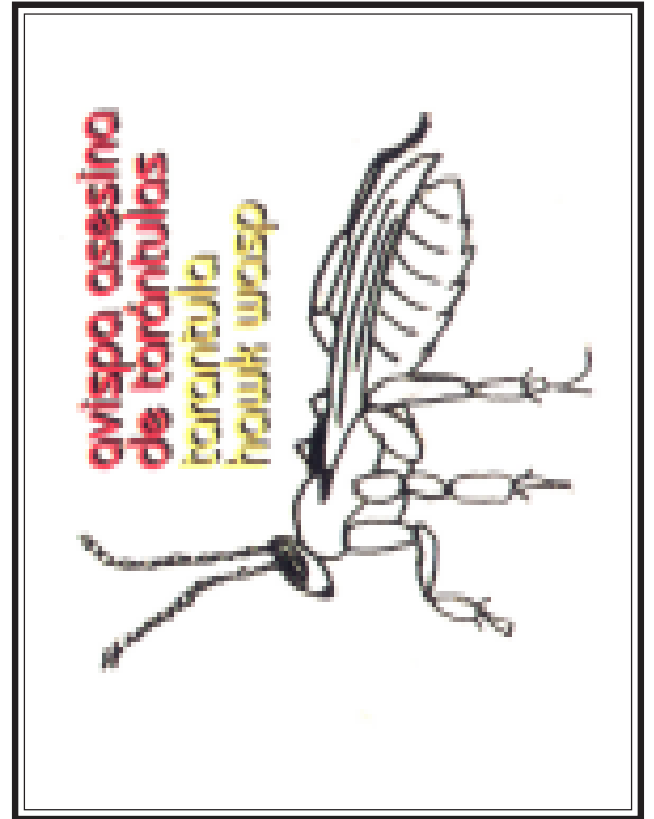


**Tropical Rain Forest Food Chain**

America's Rain Forests



Tropical Rain Forest Food Chain



Tropical Rain Forest Food Chain



## Annex 2—Species Information

### SIERRA PALM

**Food source:** As do all plants, the Sierra Palm produces its own food via photosynthesis.

**Physical description:** Its trunk is slender and cylindrical with bright orange prop roots at its base. It can reach a height of 50 feet. Its numerous small white flowers are clustered in a hanging stalk. The fruit of the palm is round which turns black when ripe.

**Importance:** Each of its parts (leaves, flowers, fruit) are food source for different species, including the Puerto Rican Parrot.

**Habitat:** It is found on steep slopes, mountain ridges, and along water courses in moist forests.

**Condition:** It is native and common in humid or waterlogged areas of the mountains.

**Curious fact:** Its roots are above ground to deal with the excess water and for O<sub>2</sub> exchange.

### BROAD-WINGED HAWK

**Food source:** It feeds on boas and lizards, among other species.

**Physical description:** A bird of prey about 15 inches tall. A broadly banded black and white tail and rufous breast characterizes the adults. The juveniles do not have the tail banding.

**Importance:** Biological control.

**Habitat:** It is found in El Yunque region and in the vicinity of the Río Abajo Forest.

**Condition:** Endangered species.

**Curious fact:** Its ability to fly, plane and go through the dense forest canopy to catch its prey is magnificent.

### WHITE-LIPPED FROG

**Food source:** It feeds primarily on insects.

**Physical description:** Does not have pads on its fingers or toes. Adults are dark in color with darker streaks or spots on their backs, while their chests are whitish. It has a white upper lip.

**Importance:** Biological control for insects. Food source for the Puerto Rican Boa.

**Habitat:** Prefers areas where water and sediments have accumulated.

**Condition:** Common.

**Curious fact:** Its song is so loud that, according to studies done in 1928, the songs of the frogs in the San Felipe del Morro castle are said to be heard by the people on the ships that were entering San Juan Bay.

## Annex 2—Species Information

### PUERTO RICAN BOA

**Food source:** It feeds on amphibians, bats, mice, bats, and mongoose.

**Physical description:** Its color varies from beige to dark brown. It can grow to 7 feet in length. It is a constrictor.

**Importance:** Biological control of rats and mice.

**Habitat:** It lives in all the different forests types of El Yunque except in the Cloud forest.

**Condition:** Endangered species.

**Curious fact:** Instead of laying eggs, as do other snake species, the young are born alive (viviparous). Also, it produces a foul smelling substance which it uses to repulse its enemies.

### CRICKET

**Food source:** Though primarily vegetarians, they sometimes food on other insects.

**Physical description:** Yellowish-brown in color. Its two back legs are longer than the front ones. Males are approximately  $\frac{5}{8}$  to  $\frac{3}{4}$  in long and the females are  $\frac{5}{8}$  to  $\frac{7}{8}$  inch long.

**Importance:** Biological control for insects. Food source for birds and amphibians.

**Habitat:** Lives primarily in the understory of humid forests.

**Condition:** Abundant.

**Curious fact:** Its peculiar sound is made by the movement of its wings.

### FUNGUS GNAT

**Food source:** It feeds on the Oyster Mushroom.

**Physical description:** This brown fly grows t 1 millimeter in length.

**Importance:** Very important food source for coquis and spiders.

**Habitat:** Humid forests

**Condition:** Abundant.

**Curious fact:** They are a problem in the production of common mushrooms.

## Annex 2—Species Information

### PEARLY-EYED THRASHER

**Food source:** Omnivorous. Its diet includes lizards, insects, and fruit.

**Physical description:** It can grow to 12 inches in height. Distinguished by its white iris. It is brown in the upper parts, and white in the under parts with white patches on the tail.

**Importance:** Food source for owls and other birds.

**Habitat:** Forests throughout Puerto Rico.

**Condition:** Common.

**Curious fact:** A very aggressive species that eats the eggs and kills the juveniles of other birds, including the Puerto Rican Parrot.

### LIZARD

**Food source:** Its diet consists mainly on insects, spiders, worms, and frogs.

**Physical description:** The green lizard is the largest, up to 5 inches long without including the tail, and brightest of the lizards of Puerto Rico.

**Importance:** Insect control. It is a prey item for various species of birds.

**Habitat:** It can be found in trees, shrubs, and grassy areas.

**Condition:** Globally, reptiles and amphibians are in decline. At present, the status of native species to El Yunque is unknown. Two species, *Anolis cuieri* and *Anolis occultus* are rarely encountered.

**Curious fact:** There are 12 species of lizards in Puerto Rico; 8 of these can be found in El Yunque.

### PUERTO RICAN SCREECH OWL

**Food source:** Feeds on birds and insects.

**Physical description:** It reaches to 10 inches in height. Its coloring is grayish-brown on the upper part, and white with dark brown stripping on the inferior part.

**Importance:** Biological control.

**Habitat:** Lives on trees from the coast to the mountains. Its distribution is limited by the availability of trees with appropriate cavities.

**Condition:** Common.

**Curious fact:** Nocturnal bird with distinct call.

## Annex 2—Species Information

### COQUI

**Food source:** Feeds mainly upon insects.

**Physical description:** Grows to between 0.6 and 3.5 inches long. Its color varies from gray to brown and olive to yellow.

**Importance:** Biological control for insects. Also an important food source for many organisms.

**Habitat:** It can be found from the coast to the mountains, mainly in humid areas.

**Condition:** Of the 13 species found in El Yunque, two species are considered endangered.

**Curious fact:** In contrast to other frogs, coquis do not go through a tadpole stage. Fully formed coquis come out of the eggs laid by the female. In at least five species, the male is the nest caretaker.

### PUERTO RICAN TARANTULA

**Food source:** It feeds on crickets, juvenile lizards and coquis.

**Physical description:** It is blue as a juvenile and later turns brown.

**Importance:** Food for the Tarantula Hawk Wasp and for the Pearly-Eyed Thrasher.

**Habitat:** Forest canopy and upper parts of tree trunks.

**Condition:** Abundant.

**Curious fact:** One of the main predators of the coqui.

### SNAIL

**Food source:** It feeds upon lichens, leaves and Oyster Mushrooms.

**Physical description:** Light gray in color; grows to 1 ½ inches.

**Importance:** Principal prey of the Fresh Water Crab.

**Habitat:** Humid forests.

**Condition:** Common.

**Curious fact:** It is the largest species of mollusk, and the one with the widest distribution, found in the mountain forest of El Yunque. There is evidence to show that the Taino used them for food.

## Annex 2—Species Information

### TAILLESS WHIP SCORPION

**Food source:** Its diet consists mainly on insects and coquis.

**Physical description:** Its color varies from brown to black. Its body, without accounting for the appendages, can measure up to 2 inches.

**Importance:** Prey and predator of various species.

**Habitat:** It is found in caves and in rocky aggregations.

**Condition:** Common at nighttime.

**Curious fact:** Contrary to popular belief, this is not a venomous species. Its juveniles are prey for the coquis.

### FRESH WATER CRAB

**Food source:** Voracious predator. It feeds on snails and other species, including decaying organisms.

**Physical description:** Brownish, with a pair of small, short chela, or claw. Its carapace is approximately 3 inches wide.

**Importance:** food source for the mongoose.

**Habitat:** Can be found on the upper parts of fast moving streams and in natural pools that are surrounded by rocks.

**Condition:** Moderately abundant.

**Curious fact:** This species can live both in and out of the water.

### TARANTULA HAWK WASP

**Food source:** Its larvae feed upon the Puerto Rican Tarantula.

**Physical description:** This insect grows to 1 cm in length. Its coloration is metallic blue, black, and reddish-orange.

**Importance:** Biological control of tarantulas.

**Habitat:** Rain forests.

**Condition:** Common.

**Curious fact:** The female paralyzes a tarantula by injecting it with a venom, and then lays her larvae on it so the larvae have a ready food source.

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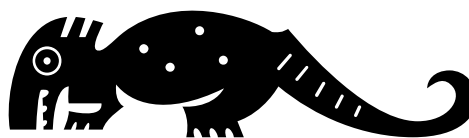
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## Annex 3—Food Web Information

### Food Web of the Caribbean National Forest



The destruction of tropical forests with the resulting loss in biodiversity brings to our attention the need to know the importance of conserving these valuable resources. To begin with, we still do not know many of the tropical species. As to the ones we do know, it is necessary to study them in order to determine their importance within the ecosystem (Smith, 1992). The study of the food chains will help throw some light on this question. These chains are considered a “map of the food interactions that occurs within a community” (Reagan & Waide, 1996).

Within the ecosystems, energy flow is a basic function for sustaining life. The levels through which this energy flows are known as **trophic levels**. The first level is made up of **primary producers**. In terrestrial ecosystems, the process begins when plants, utilizing solar energy, synthesize sugars and other components which are used for food for them and for other organisms which cannot produce their own food. In the food web all organisms, directly or indirectly, depend on plants. Those that directly feed on plants are known as **primary consumers** or **herbivores**. These herbivores provide food for the **carnivores** or **secondary consumers** and for some parasites. The secondary consumers feed the **tertiary consumers** and so forth. The **decomposers** complete the cycle. These organisms have the role of recycling the decomposing material. In this way they obtain their own food while at the same time returning to the soil the nutrients plants need. These decomposing organisms include bacteria, fungi, and other small animals.

There are also some organisms that feed on both plants and animals. These are known as **omnivores**, and are usually found in the

highest levels of the food chain. As you go up in trophic level, an increasing number of food producers of an inferior level are needed. The reason for this is that as you go up in trophic level, energy and efficiency in the caloric yield of usable edible food is lost. Therefore, while an insect may obtain all it needs from a single tree, a lion needs hundreds of acres in order to survive.

Due to the fact that existing resources in ecosystems are shared, the feeding relationships in these are very complex and occur in a branching fashion. One organism may be the food source of various species. In this way, food chains interweave forming food webs. The complexity of the web will vary with the ecosystem. Let us take as an example a part of the food web of the Caribbean National Forest. To understand this web, we must start by discussing some of its food chains. In the diagram of the “Food Chain in the Caribbean National Forest” the arrows go in the direction from the prey to the consumer (prey → consumer).

Chain I begins with the **Sierra Palm**. While the tree is alive, it provides food for many species. In this case, the lizard consumes the fruit. The lizard in turn is food for the **Pearly-Eyed Thrasher**, which in turn is food for the **Puerto Rican Screech Owl**.

Chain II also begins with the **Sierra Palm**, this time the palm is decomposing. After the palm dies, various decomposing organisms, such as the **Oyster Mushroom**, facilitate the decomposition. During this process, the Oyster Mushroom obtains its food while at the same time it returns nutrients to the soil. The Oyster Mushroom is consumed by the **Snail**, who is eaten by the **Fresh Water Crab**, which in turn is eaten by the **Mongoose**. The mongoose is food for the Puerto Rican Boa and for the Broad-Winged Hawk. On the other hand, the snail not only eats the Oyster Mushroom, but also the Fungus Gnat, the species that starts Chain III.

## Tropical Rain Forest Food Chain

Chain III begins with the **Fungus Gnat**, which is eaten by the **Coqui**. The juvenile coquis are food for the **Tailless Whip Scorpion**, and simultaneously the coquis can eat juvenile scorpions. This is known as reciprocal depredation, in other words, an organism can be prey and predator at the same time. This relationship is not common in nature. The Coqui and the Tailless Whip Scorpion are food for the **Puerto Rican Tarantula**, while the tarantula is food for the **Tarantula Hawk Wasp**. We usually think that predators are larger than the prey. In reality, this is not always the case; some organisms have developed various mechanisms that permit them to prey upon larger creatures. This is the case with the Tarantula Hawk Wasp; it paralyzes its prey with venom and then lays its eggs on the tarantula in order for its larvae to have a ready food source.

Chain IV begins with **plants** that make their own food, and which are eaten by **Crickets**. The cricket is eaten by the **White-Lipped Frog**, who in turn is eaten by the **Puerto Rican Boa**, who is a food source for the **Broad-Winged Hawk**.

Other than the above mentioned food chains, we can see other chains in the diagram. For example, lizards feed on insects, butterflies, and even on other lizards, while they are food for various species such as the Pearly-Eyed Thrasher and the Puerto Rican Boa.

It is important to note that no values can be assigned in food webs; there is no such thing as good guys and bad guys. Each species fights for its food and in these interactions the fittest ones survive. Also, all predation is necessary in order to maintain the population levels of each species, an indispensable guideline in maintaining ecosystem equilibrium.



## Tropical Rain Forest Food Chain