Entering the World of Los Caobos

Self-Guided Booklet

PARQUE NATURAL METROPOLITANO
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**BEFORE STARTING YOUR VISIT**

**How to use the guide**
There are 14 numbered stations along the trail and explanations for each one are found within this guide (pages 3 to 17). In addition, you will find an Animal Identification and Description Guide at the end to facilitate the naming of species you might encounter (pages 18 to 27) with illustrations (pages 28 to 31). Finally, you will find an asterisk (*) following some of the words. It means that a definition is provided in the Glossary at the end of the guide (page 32). Note that the common names of the species are given in English and in Spanish (in italics) and are followed by the scientific names in parentheses.

**Why are tropical forests important?**
As you will soon discover, the beautiful tropical forests provide a home for millions of species of plants and animals. In fact, tropical forests host the majority of the world biodiversity*. In addition, tropical forests and forests in general play multiple important functions. They influence the local and probably global climates. They moderate temperatures and maintain humidity levels. Furthermore, they absorb carbon and replenish the oxygen in the air we breathe. This is why the PNM is considered as “the lungs of Panama”. The forest also helps the conservation of watersheds* in preventing erosion* and regulating water inputs, thus preventing flooding. Consequently, conservation of forests along the Panama Canal is an essential component the strategies to guarantee the functioning of the Canal, irrigation, sanitation, and human consumption. The tropical forest can be a source of food, medicinal plants, wood and represents a great of potential for education, tourism and other economic opportunities.

**Parque Natural Metropolitano**
*El Parque Natural Metropolitano* (PNM) is the only natural park in Central America within the limits of a metropolitan area. It covers approximately 265 hectares. The park is part of the National System of Protected Areas of Panama (SINAP) and was established
in 1985 by executive law. Besides the impressive view of Panama City and its surroundings, the interest of visiting the park is primarily to see its great diversity. It contains 284 plant species and 322 animal species. The PNM vegetation is part of a transition zone from a humid tropical forest to a dry premontane forest (in which a great proportion of the trees lose their leaves). It is part of the Curundú river watershed*. The dry tropical forests of the Pacific coast have been nearly completely destroyed and consequently the PNM is one of the last refuges for the species such forests host.

There are only two seasons in the Tropics. The average temperature is 28°C and varies less around the year than the daily day/night difference. The main difference between seasons is the amount of rainfall. The lowest precipitation occurs in the summer which is the dry season that lasts from January to April inclusively (rainfall ranges from 0 mm in January and February to 87 mm in March). The rest of the year is the rainy season or winter with precipitations ranging from 155.6 mm in December to 553.7 mm in June.

**Los Caobos trail**

This trail, established in 1995, has a total length of approximately 0.9 km and is graded as a moderate level of difficulty. It received its name from the renowned Mahogany or *Caoba* tree (*Swietenia macrophylla*) found principally in this trail in the PNM. The trail was improved in 2004 by the PNM with the assistance of its sister park, Cleveland Metroparks, in Ohio, United States. This was part of the “Canal to Canal” project that is based on migratory bird species that are found in both parks, especially in the *Los Caobos* trail (they are the four migratory species found in the *Animal Identification and Description Guide*). The PNM also received funding from the National Fish and Wildlife Foundation and USAID to improve the infrastructures of the trail.

**Recommendations to Visitors**

- Wear appropriate clothing and footwear.
- Walk carefully in the trail; it can be slippery in some parts.
• Bring water with you because it is important to drink while exercising to avoid dehydration.
• Keep quiet to increase your chances of seeing wildlife. The best times are early in the morning or later in the afternoon. Pay attention to sounds and look carefully.
  • Binoculars can help you see animals.
• Avoid disturbing the wildlife and their habitat. Everything surrounding the trail plays an important role in this fragile ecosystem*.
• Minimize your impact. Take picture, leave footprints.
  • Stay on the trail not only to minimize your impact, but also to avoid some irritating plants or other hazardous species. For example, in the dry season insects are not a problem if you stay on the trail. However, in the rainy season, you might want to use bug repellent because of the mosquitoes.
  • Dispose of any garbage in appropriate location.
• Enjoy the trail!

**STATIONS**

1. **A young tropical forest**
The forest of the PNM is a young secondary forest* even if some of the trees are big. It is important to keep in mind that the trees and other plants can grow much faster in the Tropics because the temperature is constant throughout the year and because precipitations are more abundant than in temperate zones. In fact, the dense understory* seen here is an indicator of a young forest.

There are interesting tree species that can be seen here: a *Guálcimo colorado* to your left and an *Amarillo* to your right bearing the station number.

*Amarillo* (*Terminalia amazonica*) is one of the tallest trees of the forest (up to 30m) and it is part of the canopy*. The *Amarillo* is one of the most common species in the trail. The
branches tend to form flattened levels. The bark is flaking and shows shallow vertical fissures. It loses its leaves in the dry season. From January to May, at the same time as small white-greenish flowers, it produces many small winged fruits that are dispersed by wind. It is a strong wood even resistant to termites and thus is good for carpentry. In fact, plants are not as passive as we tend to think and they have developed ways to defend themselves against herbivory. For example, defense can be physical with spines or chemical with toxic substances in the leaves.

Have you noticed the roots of this tree? They are called buttress roots. **Buttress or tabular roots** are vertically flattened projecting out of the base of the trunk or of the ground. They provide additional support to large trees by widening their base and therefore helping them to resist uprooting due to strong winds and storms. Other species such as *Guácimo colorado* will also have such roots in poor soils or on sloped ground.

*Guácimo colorado* (*Luehea seemannii*) is a pioneer species of 15 to 30 m in height that is found in secondary forests. It is typical of humid and dry tropical forests of Panama. Because it is a pioneer species, it needs enough light coming from a gap in the canopy, to get established (see Station 2 for additional information on forest regeneration). The branches of this tree stand more vertically than laterally. The bark has black and white prominent blister-like protuberances (these are vertical in young trees). The bark also peals easily. The buttress roots can be up to 4 m wide at the base and appear continuous with the ribs on the trunk. Leaves fall slowly in the dry season and grow back in May. The flowers are seen in December and January. The fruits are found from March to May. When the seeds are released from the fruit they are dispersed by wind because they are equipped with wings.
Finally, you can see on both trees that the bark is lifted. Insects put their eggs under this type of bark and birds can feed on the larvae. Furthermore, this type of bark allows epiphytes* to put their roots easily in the bark (to know more about epiphytes, consult Station 2).

2. Forest regeneration
The story of forest regeneration starts when a tree falls on the ground for some reason (e.g. because it was struck by lightning, uprooted by strong winds or died of old age or disease). This gap in the canopy* will let more light reach the ground and consequently will increase the temperature and will decrease the humidity. You can observe these phenomena yourself by comparing how you felt before entering the forest and now under the canopy. Because of those changing conditions, the plants that were well adapted to the old conditions may die. At the same time, plants like the ones we see on the side of the road or the trail prefer lighter, warmer and drier conditions and take advantage of the new state of the environment to colonize these areas. These fast growing species are called pioneer species*.

However, as the gap closes because the trees next to the gap expand their branches laterally or because new sun-loving trees grow, then the conditions will change again and the situation will be reversed as the pioneer species will not be the most adapted to the new conditions. The pioneer trees that are now mature will be able to survive because they have enough light. Nevertheless, new individuals of pioneer species cannot grow under the newly closed canopy. Therefore, because the environmental conditions are continually changing with disturbances, the forest is a mosaic of patches of different ages and stages of regeneration.

At Station 2 we can see that new palms are colonizing. Birds and mammals transport the seeds in new locations and allow the forest to regenerate itself. We can also see pioneer species like the Guácimo colorado (the tree with the station number)
to the left and Carricillo across from it to the right. There is also a Cuipo to the left side of the trail a few meters before the sign.

**Carricillo** (*Chusquea simpliciflora*) is one such plant that creates a dense understory* characteristic of secondary or young forests. It is a vine-like plant that is slender, arching or clambering. It can measure up to 25 m long. It flowers from December to May but only at intervals of several years. The timing of the flowering corresponds with the presence of migratory birds in the PNM that will then feed on the seeds of the Carricillo. This bamboo will die after flowering and the new individuals will be able to grow where the parent has died. You will see this plant very often along the trail especially when the canopy is not completely closed and it is found in dense groups of many individuals. People in the countryside sometimes use the stems to make beds that are fresh and comfortable since the wood is straight and smooth.

**Cuipo** (*Cavanillesia platanifolia*) is one of the highest trees of the forest measuring up to 40 m. The trunk bulges at about two meters from its base and it is ringed at regular intervals making its identification easy. It loses its leaves in the dry season. Its red flowers appear from March to May and the fruits are mature in April and May. The big (15 cm long) red and green fruits are dispersed by wind since they have large wings. While this particular individual is still young, it is interesting to note that the base of the trunk of a mature tree looks like an elephant foot. If you hit the trunk with the hand it produces a hollow sound because it has high water content. This wood can be used to build canoes for example. You will see at Station 12 a tree, the Barrigón, that has similar characteristics since it belongs to the same tree family.

Finally, if you look closely at the Guácimo colorado (the tree bearing the station number), you can see that
many plants grow on it. These are epiphytes* or plants that grow on other plants. They are the longest plants that exist. However, they depend on the host* only as a place to grow. For epiphytes, light is usually not a problem since they can live close to the canopy. The major challenges are associated with the fact that their roots do not reach the ground and therefore they can face limitations of water and nutrients. Several adaptations help them to cope with this: they have leaves that retain water like those of desert plants, and special roots and leaves configurations that can maximize the capture of water and organic debris carried by wind and rainwater. A very well known example of epiphytes is the orchids. Of all flowering plants, the orchid family has the most species and Panama has 25% of all the species, half of this percentage is found only in Panama and Costa Rica.

3. A favorite of humming-birds

**Platanillo** (Heliconia platistachi) is a medicinal plant that can measure 3 to 7 meters. It is another pioneer species* that grows rapidly. It is less common than other species of Heliconias found in the PNM. Heliconias are relatives of plantains and bananas. This particular species can be recognized by its pendent and spiral inflorescence*. The flowers are red and yellow at the tip and are present from July to December. The flowers are pollinated by hummingbirds that drink the nectar of the flowers. You can see by the holes in the leaves that it is also appreciated by insects. Kunas prepare an infusion with the fruits to ease birth.

4. Palms

You will probably notice that the temperature is cooler than at the beginning of the trail. This is due to the fact that the canopy* is higher and closed thus letting less light penetrate to the ground. As you read earlier, this is a sign of an older,
more mature forest. Notice the contrast between the right and left sides of the trail. To the left are many *Maquenque* palms. In contrast, on the right the understory* is dense and there are many pioneer species* such as *Carricillo*, an indication that the forest is at a younger stage of regeneration. Look inside the forest close to the palms and you will see enormous lianas (for more information on lianas, see the next station).

*Maquenque* (*Oenocarpus mapora*) are palms that can measure up to 20m tall and are found in small groups of 3-10 individuals of different ages. They have a smooth trunk. The leaves can be up to 6 m long. Flowers and fruits can be found all year long. Indigenous people use this plant to build houses. The Emberas also make baskets with the leaves. A beverage (*chicha*) can be prepared from the fruits. Monkeys also consume its fruits.

*Palms* are definitely the symbol of the tropical regions. They are among the largest plant families both because of the great number of species and their relative abundance. Palms like other trees have a woody stem. However, palms are different from other trees and shrubs in the way they grow. Most trees grow from the inside out, laying down a layer of new wood each year, just inside the bark of the tree. On the contrary, palms have been described as “grasses that grow as tall as trees” because they only grow from the end of their trunks and will not get much thicker with age. It is mainly the woody stem which grows in length but not in width like other trees. All palms have also large, conspicuous leaves. Palms are found almost exclusively in the Tropics and are ubiquitous in this part of the World. They play important ecological roles for example by being part of the diet of mammals, birds, fish and insects. They are a major component of the canopy and understory of tropical forests. Nonetheless, some also thrive in very arid areas. They are also of great usefulness to humans, for example, indigenous groups use palms to build houses, hammocks, baskets, weapons, body ornaments and as food and beverages.

5. Vines and lianas
If you look up the tree with the station number, you will see a dark mass on the tree trunk. It is an Aztec ant nest. These ants do not attack the tree as the termites do but instead protect it from other insects. For more information on these very interesting organisms you can look at the Animal Identification and Description Guide on page 26.

Once more, you can appreciate the importance of vines and lianas in tropical forests. **Vines and lianas** are climbing plants that need support to grow in height. The difference between the two is that lianas are woody plants while vines are not. To attach themselves on other plants, they use specialized parts on their leaves and branches. Lianas are rare in other types of forest and they are often associated in our minds with jungles. As the forest matures the lianas increase in size.

**6. Symbiosis***

Many of the trees around you have lichen on their trunk. A lichen is an unusual creature because it is not a single organism but rather it is a combination of two organisms: a fungus and an alga. They form a symbiotic association in that both the fungus and the alga benefit from their relationship. In fact, the alga, like other plants, uses sunlight to produce sugars, which will feed both the fungus and the alga. On the other hand, the fungus will create a body that will house both organisms and protect them from adverse environmental conditions. Another interesting characteristic of some lichens is that they can glow in the dark.

To your left is **Chirimoya (Annona spraguei)**, a small tree that can reach 15 m. It loses its leaves in the dry season. It produces scented yellow flowers in April and May and a delicious green thorny fruit in July and August appreciated by the animals of the tropical forest. This tree is also planted in gardens as an ornamental plant.
Do you recognize the tree that bears the Station number? It is another *Amarillo*.

### 7. The famous mahogany tree
The tree bearing the station number and the one just in front to the right side of the trail are Mahogany trees (*Caoba*). If you look up to the one on your left you will be able to see a termite nest (for more information on termites, you can consult the Animal Identification and Description Guide on page 27).

The **Mahogany tree** or *Caoba* (*Swietenia macrophylla*) is a tall tree that can measure up to 45m in height and up to 2m in diameter. The individual on the left is thought to be more than 300 years old. It has a deeply fissured grey bark. The *Caoba* is another example of a tree having buttress roots. It loses its leaves briefly in the dry season. The tiny, fragrant flowers are of a white-yellow color and appear with the formation of new leaves (in January or February). Bees and moths pollinate the flowers. The very characteristic fruits are in ovoid capsules 12-15 cm long and are found throughout the year. The capsule breaks open at maturity and the many seeds inside are dispersed by wind. The reddish wood of this tree is synonymous of luxury and solidity and is therefore greatly appreciated in carpentry. It is found on well-drained soils of low elevations in dry and wet climates. The bark is used as a dye for leathers and the bark and seeds have medicinal properties to cure fever and diarrhea. It is planted as an ornamental tree around Panama City. This tree is considered an endangered species and logging for this species is one of the leading catalysts of tropical deforestation.

### 8. From the soil to the canopy*
You are now at the shelter. At this station you can take time to rest and listen to the sounds of the forest. If you are quiet you have more chance of seeing and hearing animals. You can also enjoy a nice view of Panama City and the Pacific Ocean.
The forest canopy*

Look in front of you at the forest. It is an excellent location to observe the forest canopy. A forest canopy, which is the uppermost layer of the forest, contains an extraordinary diversity of species. More than 70% of the species living in a tropical forest live within the canopy. It is very important because it serves as the boundary between the biosphere (the living world) and the atmosphere, and is physically and biologically the most active part of the forest. Because it is increasingly recognized as a very important part of the forest, there is more research being done on canopies. The PNM was a pioneer of canopy research by having the first canopy crane in the World. The canopy crane is used facilitate the access to the canopy and therefore study the organisms that inhabit it.

Soils and erosion*

If you are visiting the Park during the dry season you will probably see fissures in the ground and a lot of dead leaves covering the forest floor. The reason why some trees lose their leaves in the dry season is because they do not have enough water to keep them. In fact, when leaves respire, they transpire water that is then evaporated. Therefore, by losing their leaves, trees prevent this phenomenon and lose less water. These leaves, like fallen trees, will be decomposed principally during the wet season when water is abundant, allowing biological activity by bacteria, fungi and insects that will release, through their excretion, nutrients that will enrich the soil and will be absorbed by plants. These nutrients will be transferred to the animals that eat the plants. This is the cycle of life.

Thus, soils play a key role in the ecosystem*: as the foundation of all terrestrial communities, as a habitat for numerous organisms and as a source of nutrients for the plants which ultimately feed all the other organisms. Due to their great importance, it is necessary to protect soils against degradation, especially from erosion. Erosion is a natural process by which soil particles
are carried away mainly by water and wind. During the rainy season, the heavy rain falling on the steep slope in front of you can erode a lot of soil. This natural loss of soil is aggravated by human activities, for example by people constantly walking on a trail. Rooted plants that retain the soil together prevent erosion naturally. In order to prevent erosion caused by visitors, the park staff works very hard at installing different infrastructures like wood steps, stairs, cement walls in the ground, wooden walkways, etc. In addition, tropical soils unlike temperate soils retain less nutrients and organic matter. These are found instead in the vegetation because the cycling of those components is faster in the tropic and dead organic matter is rapidly degraded and reincorporated into new plants. But when the soils lose their vegetative cover, they will be eroded rapidly because they are so thin. We can therefore see how tropical soils are easily degraded by deforestation.

9. Majestic and deadly trees
At this station you can appreciate two very well known species: bearing the station number is a Royal palm and across from it, to your left, is a Strangler fig.

**Royal palm** or *Palma real* (*Attalea butyracea*) can measure 30m or more (which is tall for a palm) with leaves that can be as long as 10 m. The upper trunk of this tree is broad with dead leaves persisting for many seasons. Flowers and fruits mature at the same time in massive inflorescences* and can be seen all year long. The heavy fruit crop (brownish to orange when mature or green the rest of the year) provides food for many animals (from agoutis to vultures). This tree spreads rapidly in man-made, disturbed habitats. Major predators of the seeds are the bruchid beetles and the red-tailed squirrel. The leaves can be used to build roofs. In addition, the oil from the fruit can be used in cooking and the coco inside the fruit can be eaten. The sap can be used to make a type of wine (*chicha*). The young leaves are used to wrap the *bollos*, a typical Panamanian dish made of corn. As their name indicates these trees are majestic and are often seen planted in rows within gardens or along
avenues.

**Strangler fig, Matapalo or Higo estrangulador** (*Ficus obtusifolia*). The development of this tree is very different from that of other trees because instead of starting its life in the understory*, it starts it in the canopy*. Many birds, bats and monkeys eat the figs and in this way disperse the seeds in the trees. After germination, the small tree will live as an epiphyte* until the roots touch the ground. Then the roots can gather more nutrients and water and the growth will be accelerated. Ultimately, the roots will fuse with one another and kill the host* tree by strangulating it or by blocking its access to light with its leaves. Even if it kills its host, it is still an epiphyte because it doesn’t need the nutrients from the host but only uses it as a place to grow.

**10. Zorro**
The tree bearing the station number is a **Zorro** tree (*Astronium graveolens*). It can measure up to 35m tall. It is common in both tropical humid and dry forests. It loses its leaves in the dry season and can subsequently be seen flowering. It can be recognized by its bark that peels off in small round patches that leave shallow depressions showing the inner yellowish bark.

**11. The commonest tree in the PNM**
At this station you can see the **Espavé** to your right bearing the station number with an enormous liana and another big
Strangler fig a bit farther to your left.

The **Wild cashew** or *Espavé (Anacardium excelsum)* is a tree of old growth forests. It is thought that the name could mean *Es para ver* (i.e., it is to see) because people would climb this high tree to see the horizon. It is the most common tree in the PNM. It can reach a height of 40 m. It has very small buttress roots for a tree of this size. The coarse and deeply fissured outer bark peels in large patches showing an inner pink to orange bark. It loses its leaves in November. The flowers, found from December to May, are cream colored or green and have a strong and sweet cloverlike aroma. The fruit, a green nut, is found from March to June and provides food for many mammals and birds. However, eating the fruit raw is poisonous. The wood of the *Espavé* provides a good construction material and thus has a commercial value. It is used for canoes and *pilón*. Indigenous people also use the bark to make a violet dye and the latex as a medicine to cure some skin infections caused by a fungus.

12. **The seasons**

Try to imagine what this station could look like in the other season. During the dry season, from January to April, the stream *Quebrada Tigrio* is completely dry. There are other major changes in the forest between the two seasons. For example, as mentioned earlier, many tree species lose their leaves that will pile on the forest floor during the dry season. Leaves that fall allow for more light to penetrate to the forest floor. In consequence, plants in the understory* that were lacking light can grow in size. There might be fewer leaves during the dry season but many trees are flowering during this period in order to reproduce. Finally, the trees that use wind to disperse their seeds may produce fruits at that time to take advantage of the
strong winds. In April, the first rains will allow new leaves to grow. At the beginning and middle of the rainy season, a lot of fruits are present. As mentioned earlier, the decomposers will take advantage of the water availability to eat the litter on the forest floor leaving patches of bare earth at the end of this season. The rainy season creates a green and luxuriant forest with many flowers.

The most massive tree on the riverside opposite to the benches is a *Barrigón*. There are also many Wild cashews. With the description you had at the last station, can you identify them?

This specimen of *Barrigón* (*Pseudobombax septenatum*) is thought to be more than 300 years old. *Barrigón* means beer belly in Spanish! It can be recognized from its bulbous base and green stripes on its bark. It can measure up to 25m. Its leaves fall in January or February and will grow back in May. It is most often found in second growth or disturbed forests or along the roads. Its flowers look like shaving brushes and are found from January to March and its fruits are present from March to May. The flowers are pollinated at night by bats. The three-toed sloth eats the flower in the tree while the agouti eats the flower when it has fallen on the ground.

13. Panama hats
The tree bearing the station number is a Hog plum and in front of it, to the right side of the trail, is the famous Panama hat plant. Look past the Hog plum and you will see a beautiful valley. Remember the description of the forest regeneration. Here is a very good spot to observe those gaps and the many layers of the forest or the forest profile. Look how the forest contains many stages of regeneration.

**Hog plum** or **Jobo** (*Spondias monbin*) is a tree about 10-30 m tall of tropical dry forests. Its grey bark is deeply and coarsely fissured. Flow-
ers bloom from March to June and fruits mature from July to October. The fruits are long, yellow to orange, sweet and tasty inside their coarse, fibrous envelope. They are very appreciated by many animals of the forest but also by humans. Furthermore, the roots are used as a disinfectant and to alleviate colds and fevers.

**Panama hat plant** or *Sombrero de Panamá* (*Carludovica palmata*). Looking at the scientific name of this plant one would expect it to be a palm. However it is not. Neither is the Panama hat from Panama. It originated in Ecuador. This tree grows very well under intense sunlight and this way can colonize new areas excluding other plants that need intense sunlight too.

14. **Hasta luego**

We are near the end of the *Los Caobos* trail. We hope that you have enjoyed your visit and that you now know more about the characteristics of tropical forests and its inhabitants. However, these ecosystems* are very complex and still misunderstood. The complexity is derived in part from the fact that each species of the forest, through its interactions with the physical environment and with other living organisms, has its role to play to keep the system running. Conversely, the survival of the species depends on the good functioning of the whole ecosystem.

You probably notice that the sounds of the city are more present near this station. This makes us realize that the PNM is really an island of forest within the city. At the beginning of the guide we discussed the importance of tropical forests. However, those extremely important regions and the organisms they protect are also subjected to many significant threats. Destruction, fragmentation and contamination result in habitat loss and degradation for the species that live in the tropical forests. This is the first cause of species extinction and thus of loss of biodiversity*. Other threats to forest organisms include their
exploitation such as hunting, fishing, logging, harvesting, and competition from exotic species. Nowadays, biodiversity* loss is one of the greatest global catastrophes. It has been estimated that the current species extinction rate is between 1,000 and 10,000 times higher than it would naturally be.

The PNM too faces these threats. For example, the Curundú River is at the Eastern boundary of the PNM. However, the Corredor Norte that was built within the PNM in 1995 now restricts the access of the animals of the western portion of the park to their only permanent source of water. Thus we can see that even if the park is a protected area it is still threatened by developmental pressures.

On the bright side, remember that the PNM was created following pressures from Panamanian environmentalists who saw the importance of this patch of forest within the city. Protection of our last natural areas needs to be accomplished in part by citizens like us because humans do not only have the capacity to modify or even destroy the environment but also to protect it.

**ANIMAL IDENTIFICATION AND DESCRIPTION GUIDE**

The list of species described in this guide is not exhaustive. It is a selection of those of particular interest and of the ones most likely to be seen along the trail. If you do not see animals, look for signs: tracks in the mud, bits of food that they have left, etc. These signs give you information about an animal like where it was, if it was running or resting, what and when it was eating and where it slept!
**BIRDS**

Most birds share many characteristics: they have horny beaks; two wings and two legs; no teeth; feathers; and hard-shelled eggs that develop within the female’s body but hatch outside of it. Nonetheless, there are differences among species. Some birds, even though they have wings, cannot fly; others can swim in the water. Also some spend their whole lives in one location while others migrate to warmer areas when the weather gets cold. These birds can travel thousands of kilometers and come back to the exact same location every year. There are about 929 bird species in Panama. Of those, 273 are found in PNM, including 46 migratory species. According to evolutionary theory, birds evolved from reptiles and thus share a common ancestor with dinosaurs!

1. **Black vulture / Gallinazo negro** (*Coragyps atratus*)
24 in/62 cm. This large bird is black with a white patch near each wing tip and a short tail. As a scavenger, it feeds on carrion but will also occasionally capture young birds and other vertebrates. It relies on eyesight to find food. It is found almost everywhere and has been observed to live up to almost 20 years.

2. **Crimson-crested woodpecker / Carpinteros crestirrojo** (*Campephilus melanoleucos*) 15 in/37 cm. This bird is identified by the white stripe running down the side of its neck and forming a V on its black back and its red head. It can be seen in pairs or groups, feeding on insects or excavating its nest on large trees. Its drum sounds like a double tap.

3. **Keel-bill toucan / Tucan picoiris** (*Ramphastos sulfuratus*)
19 in/48 cm. One of the largest species of toucan, it is recognizable by its huge yellow, orange, red, green and black bill. The toucan’s bill (up to 1/3 of its body in size) is amazingly dexterous and allows it to feed on a variety of fruits. Its tail is long and square-shaped, and its wings are wide and short to enable flight through trees. It travels in flocks staying high in the canopy. It is hard to see but you can easily hear its “creek
creek” sound, similar to that of a frog.

4. Squirrel-cuckoo / *Cuclillo ardilla* (*Piaya cayana*) 18 in/ 45 cm. You could easily mistake this bird for a squirrel as it slips through branches. It has a very long, graduated tail. It has a red iris and yellowish bare skin around the eyes and its throat and chest are pinkish in color. It mainly feeds on insects.

**Migratory Species**

5. Cedar waxwing / *Ampelis americano* (*Bombycilla cedrorum*) 7 in/8 cm. It lives in open woodland areas that have with fruit bearing trees and shrubs. Its plumage is gray and brown with pale yellow on the breast and belly. The inner feathers of the wings are tipped with red wax-like droplets. A black mask runs across its eyes, edged with white. Very social, this bird travels in flocks and gathers in small groups around ponds containing insects or at fruit trees to feed.

6. Indigo bunting / *Azulillo indigo* (*Passerina cyanea*) 5 in/12.5 cm. Known for its brilliant blue plumage, the crown of the bird is a darker blue, with a purple tint. It has a short and conical beak. It likes open grasslands and leafy trees and eats seeds, buds, and some insects.

7. Scarlet tanager / *Tangara escarlata* (*Piranga otilacea*) 7 in/17 cm. Mature males are a bright red color with black wings and tails. Females, immature birds, and males in winter are a dull, olive green above and yellow below with dark wings and tail. They eat insects, nuts and berries and forage in treetops, in shrubs or on the ground.

8. Yellow warbler / *Reinata amarilla* (*Dendroica petechia*) 5 in/12 cm. This warbler has a golden yellow plumage and rusty streaks on the breast. Males and females are similar with golden yellow upper parts tinged with olive, yellow underparts, and thin pointed beaks. It mainly feeds on insects and occasion-
MAMMALS
All mammals, including Humans, share three characteristics: they have fur or hair, produce milk for their young, and maintain a constant body temperature. They have been present on Earth for hundreds of millions of years but their number greatly increased only after the extinction of the dinosaurs, 65 million years ago, which left empty habitats for mammals to take advantage of. There are 232 species of mammals in Panama and 45 of those are found in PNM.

1. Bats / Murciélagos (Chiroptera). There are over 120 species of bats in Panama that vary in size and behavior. They can feed on many things: fruits, insects, seeds, animals, etc. Bats are the only mammals capable of powered flight. Almost all bats are nocturnal, although some are seen at dawn or dusk. Bats use a highly developed sonar system in order to navigate. They emit sounds that bounce on objects in their path, sending echoes back to the bats. From these echoes, they can determine the size of objects, how far they are, how fast they are traveling, and even their texture, all in a split second!

2. Capybara / Poncho (Hydrochaeris hydrochaeris) 60lb/22kg. The largest rodent in the world, the capybara has no tail and its reddish fur is long and coarse. Its limbs are short, its ears are short and rounded, and its muzzle is heavy. Its webbed digits and the position of its eyes, nostrils and ears on the top of its head make this species an excellent swimmer. In fact it is found near water, living in small groups. A capybara can stay underwater for up to 5 minutes. It can be active during night and day, feeding on plants.

3. Central America agouti / Neque (Dasyprocta punctata) 8lb/4kg. This orange rodent has a rounded back and long, skinny legs. Diurnal* and terrestrial*, it sleeps in hollow logs, under buttress roots, or in tangles of vegetation. Its diet consists mainly of nuts and fruits. It feeds on seeds and consequently plays an important role in seed dispersion. Its population is
declining due to hunting and habitat destruction.

4. Geoffroy’s Tamarin / Monotiti (*Saguinus geoffroyi*) 1lb/375g. It is the smallest monkey in Panama. It has brown and black fur covering its body, a triangular section of white fur on its head and a narrow tail. Mainly arboreal, it can also be seen on forest ground. Its diet consists of fruits, insects and plants. It lives in small groups.

5. Nine-banded armadillo / Armadillo nueve bandas (*Dasypus novemcinctus*) 11lb/4kg. The armadillo has a rounded back, narrow head and a long armored tail, covered with rings. It has a dark gray leathery skin with 8-9 bands on its back that look like a carapace. Its sense of smell is good but its eyesight is poor. It feeds virtually on anything: insects, small vertebrates, fruits, carrion, etc. It is rarely seen because it is mainly nocturnal and digs burrows to move in the forest.

6. Northern raccoon/ Gato manglatero (*Procyon lotor*) 3-12lb/3-7kg. This species is recognizable with its black mask covering its eyes and its banded tail. It is nocturnal. Omnivorous, it eats whatever can be found. It is very agile with its hands and always washes its food before eating. It easily adapts to new conditions and can be found from Canada all the way to Panama.

7. Northern tamandua / Hormiguero bandera (*Tamandua mexicana*) 12lb/5kg. This type of anteater is brownish and has a distinct, black “V” on its back that looks like a vest. Its tail is naked and prehensile*, with irregular, black markings. It has four clawed digits on each fore leg and five clawed digits on each hind leg, used for defense and to slash termite and ant nests. Its ears are large but its eyes are very small. It is very agile in trees but looks clumsy when walking on land. The Northern Tamandua is threatened throughout most of its range because of habitat destruction.

8. Red-tailed squirrel / Ardilla colorado (*Sciurus granatensis*)
1 lb/375g. The red-tailed squirrel has a red-brown to yellow-brown fur and an orange tail with a black tip. It can be quite noisy. Diurnal, it spends lots of time feeding and traveling on the ground but can also be in all levels of the forest. It feeds on fruits, flowers, tree bark, leaves, fungi, insects, and frog eggs.

9. **Ocelot / Gato tigre** (*Leopardus pardalis*) 22 lb/8kg
Ocelots have a short pelage that is marked with both black spots and rosettes from tawny to reddish brown. This cat has a single, white spot on the back of each ear and some white markings around its eyes and mouth. Shy and not common, this expert climber will usually go up in trees during the day to rest and hunt a wide variety of preys at night. Habitat destruction is the primary threat to ocelots throughout most of its range.

10. **Paca / Conejo pintado** (*Agouti paca*) 18lb/7kg
It is a large and stocky herbivorous mammal with a pig-like body and reddish-brown upperparts marked with rows of white spots along each side. Commonly found near water it is a good swimmer. Strictly nocturnal it sleeps in burrows during the day.

11. **Silky anteater / Tapacara** (*Cyclopes didactylus*) 0.5lb/185g. This small anteater has a long and dense silky fur with a prehensile* tail and 2 large claws on its forefeet. This distinguishes it from other similar mammals, even though it is often confused with a squirrel. Having nocturnal habits, it rolls into a fur ball to sleep during the day. It is strictly arboreal and feeds only on ants that live in trees.

12. **Sloth: Hoffman’s two-toed** (*Choloepus hoffmanni*) 13lb/6kg & **Brown-throated three-toed** (*Bradypus variegatus*) 8lb; 4kg / **Perezoso 2 o 3 dedos**
Sloths are mainly arboreal* and their normal activities (eating, sleeping, mating and giving birth) occur hanging upside down. Their movements are very slow. Nocturnal, they sleep during the day in vines high in the canopy. Both species bear
digits with long, hook-like claws used for suspension. They eat a variety of leaves, twigs and fruits. In wet conditions, algae grow in their spongy fur helping to camouflage them in trees. Deforestation is threatening these species.

13. White-nosed coati / Gato solo (Nasua narica) 10lb/4.5kg
This species has a long muzzle with white markings around its eyes and nose. Its tail is long and its fur is grayish brown. Mainly diurnal, it can be seen resting in tree branches but is also terrestrial. Omnivore, it feeds on fruits, seeds, insects and occasionally on small vertebrates. Hunters and predators are major threats for this species.

14. White-tailed deer / Venado de cola blanca (Odocoileus virginianus) 150lb/55kg. This species has a short grey to orange-brown fur with its belly, chest, throat and inner thighs white. It is slim, with long legs, a flat back and a long narrow head. Males have curved branched antlers. It is a common species found in a wide variety of habitats and feeds on fruits, leaves and nuts. Being a nervous animal, it runs away at the slightest disturbance.

**REPTILES & AMPHIBIANS**
Most reptiles and amphibians have common characteristics: they have lungs to breathe, give birth to young hatched from eggs, and are cold-blooded. Being cold-blooded means that they do not produce their own heat like mammals do. They need to get heat from the sun to warm them.

**Amphibians**
Amphibians were the first animals to walk on land when they evolved from fish to species able to walk and breathe air 350 millions years ago. They are characterized by their moist, smooth skin without scales and by the “double life” that they live. Adults usually live on land but lay their eggs in water. Youngsters begin their life in water. They resemble fish more than they resemble their parents, for they have no legs, and swim by wriggling their tail. As they mature, their bodies
change to adapt to life on dry land. There are 170 species of amphibians in all of Panama. Fourteen are present in the PNM. Among those we found the cecilia (*Oscaecilia ocrocephala*), the common frog (*Bufo marinus*), the jungle frog (*Bufo typhonius*), the giant toad (*Leptodactylus pentadactylus*) and the tungara toad (*Physalemus pustulosus*). Interestingly, amphibians are thought to be good indicators of the health of the environment. For example, they are very sensitive to contamination and will rapidly decline in numbers as their environment is altered.

**Reptiles**

Reptiles evolved from amphibians 250 millions years ago. They have dry, rough scaly skin. They will lay their eggs on or under dry ground and will begin their life on land. Reptiles were dominant on Earth until the mammals took over 65 million years ago. You can find 228 of species of reptiles in Panama, 36 of those within the PNM.

1. **Boa constrictor** (*Boa constrictor*) 50cm – 4m/1.5-13ft
   One of the largest snakes in Panama, it is brownish in color, with dark cross bands. This snake is nocturnal. It feeds on lizards, birds, bats, rats and squirrels. Not poisonous, it uses constriction to suffocate its prey. The longest recorded boa in the world was 5.5m / 18ft long!

2. **Corral snake / Coral** (*Micrurus nigrocinctu*) 40-80cm/1.3-2.6ft
   This snake can be recognized with its brilliant large red bands with smaller yellow and black bands. It is terrestrial and generally nocturnal. Its diet consists mostly of snakes, including its own species. It also eats lizards, birds, frogs, fish, and insects. It uses venom to kill its victims.

3. **Fer-de-Lance / Equis** (*Botrops asper*) up to 2m/6.5ft
   The color of this snake can take on many shades for camouflage. It can be gray, brown, olive, or green. This snake has large, dark and pale margined triangles with points that meet on the dorsal line. The head is triangular (lance-shaped) and
pointed. The food habits of the adult snake consist mainly of small mammals. It is mainly terrestrial and venomous.

4. **Green iguana / *Iguana* verde (*Iguana iguana*)**
This iguana is green to grayish, with a crest running from behind the head to the middle of its muscular tail. It is arboreal, being an agile climber but also a very good underwater swimmer and can jump in the water to escape predation or move to nesting sites. It can stay under water for up to 30 minutes. It feeds mainly on fruits, flowers and leaves.

5. **Green vine snake / *Bejuquilla* (*Oxybelis fulgidus*) up to 1.8m / 6 ft.**
This species has a pointy head with leafy green coloration on its back and lighter green on its belly. Its iris is golden colored with a round pupil. It is an arboreal snake that specializes in “sit and wait” predation. It waits in a tree without moving, looking like a vine, waiting to catch a prey (primarily lizards).

**INSECTS & ARACHNIDS**
With around one million named species and perhaps several times that number unnamed, this group accounts for the majority of animal species on Earth. They are the more diverse group of organisms and can be found in almost all terrestrial and freshwater habitats, from deserts to freshwater ponds, from a tropical rainforest canopy to the arctic land. They also show huge variety in shape and form. Some features are shared by most types of living insects: their body is composed of a head, thorax, and abdomen; a pair of antennae; often with wings and three pairs of walking legs. Arachnids have 4 pairs of legs; a head and abdomen, but never have wings. In addition some spiders feed on insects and even small mammals.

**Ants / *Hormigas* (Hymenoptera)**
Social insects such as ants and termites are ecologically dominant on land in terms of their relative abundance and their impact on the rest of the biota. Ants have existed for the last 100 million years and are found around the globe from the
tropics to the Polar Regions. Social insects have a very complex organization system and have common characteristics. There is a system of specialization in the division of labor in which some individuals are sterile (workers and soldiers) and help the reproducing ones (queens). In an ant colony all the workers are the queen’s daughters and the males only have reproductive functions.

1. **Azteca ants / Hormiga Azteca** (*Azteca* sp)

Aztec ants build their nest on tree trunks or branches in a long conical shape. This nest is made of a mixture of ant saliva and vegetal material. There is a symbiotic* relationship between the Aztec ants and the tree where they live. On one side, these aggressive and territorial ants they “clean” the tree by attacking other insects present on it, protecting it from herbivorous insects that feed on its leaves. On the other side this provides a shelter for the ants.
2. Leaf cutter/ *Arrieras* (*Atta sexdens*)
Colonies are found throughout the rainforest floor and can include 5-8 million ants. The type of function an ant perform will depend on its size. The largest are the soldiers, who protect the colony and the underground nest from invaders. Three hundred times lighter than the soldiers are the gardeners. These keep a fungus garden in the colony that the ants will eat. There are intermediate-sized ants, foragers and leaf-cutters. These are very strong and carry leaves up to 18 times their own weight back to the nest. They can walk for long distances and “pave” a path for themselves along the forest floor. As you can see these ants have a highly developed organization!

*Butterflies & Moths / Mariposas y Polillas* (Lepidoptera)
Butterflies and moths are part of the same family. There are more species of moths than there are of butterflies. The main difference between the two is that moths are active during the nighttime while butterflies are active during the day. The fascinating life cycle of Lepidoptera is a good example of metamorphosis. It starts as an egg which turns into a caterpillar. The function of this larval stage is to feed. It will then spin itself into a cocoon and eventually emerge as an adult. The adult will not feed its main function being to reproduce. Several species are found in the trail, the most common being the blue morpho (*Morpho granadensis*), easily recognizable with its blue wings. You will see them where there are flowers since they feed mainly on nectar.

*Termites / Termitas* (Isoptera)
Termites exist since 200 million years. They feed on dead plants and decomposed matter. They are pale-colored, usually soft-bodied social insects. Many species feed on wood, often marking trees and wooden structures. They are known for their destructive habits, their remarkable social instincts, and their division of labor. Their large nest is easily identifiable as a rounded and black cluster on tree trunks or branches. Look
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GLOSSARY

Arboreal: Living in trees.
Biodiversity: The variety of living organisms.
Canopy: Upper layer of a growth form generally applied to forests.
Diurnal: Active during the daytime rather than at night.
Ecology: The study of the relationship between organisms and their environment.
Ecosystem: A system formed by the interaction of a community of organisms with their physical environment
Inflorescence: General arrangement and disposition of flowers.
Epiphytes: Plants that grow on other plants.
Erosion: The movement of soil particles, carried away by wind, water and human activity.
Herbivorous: Feeds on plants or other vegetation.
Host: The organism that provides a substrate, energy, or some benefit to another organism of a different species.
Nocturnal: Active at night rather than during the daytime.
Omnivorous: Feeds both on animal and vegetation foods.
Pioneer species: Plant that colonizes a recently disturbed area.
Prehensile: Adapted for seizing, grasping, or holding, especially by wrapping around an object
Primary forest: It is sometimes described as a particular community of organisms of a forest type in a given region and environment, which is thought to be relatively stable and capable of perpetuating itself. At times it is synonymous to old growth forest, which is a forest that has not been cut or disturbed by humans for hundreds of years.
Secondary forest: Early stage of forest development (succession) characterized by rapidly growing plant species that do not survive as the forest matures. Secondary succession* is complete when they develop again into climax communities or primary forests.
Succession: The sequence of changes in the population of organisms in the forest.
Symbiosis: A close, prolonged association between two or more different organisms of different species that may, but does not necessarily, benefit each member.
Terrestrial: Living or growing on land.
Understory: Forest vegetation growing beneath the tree canopy layer.
Watershed: The whole region or extent of land which contributes to the supply of a river or lake.