ARTICLE: TEACHER VERSION

About this Article

Lexile: 1,090 **Wordcount:** 1,107

Text Complexity: The Lexile level for this text falls toward the end of the 6-8 CCSS grade complexity band. This text is suitable as a read aloud for students in grades 6 through 8. Teachers should use their professional judgement and knowledge of students' independent reading levels regarding assigning this text for independent reading.

Key for Teacher Notes

- Green text
  specific strategies
- Regular text
  instructions for teachers
- *Italicized text*
  teacher's instructions to students
- Underlined text
  important domain-specific words

Note: The teacher version of the text offers suggestions for facilitating interactive read-aloud. Students should be sitting with "elbow partners" for interactive read-aloud. When teacher notes suggest Think/Pair/Share, it is generally followed by instructions to "listen in" to student conversations. This enables you to select students to share out thinking that would benefit the whole group to hear. Additionally, it allows you to informally assess students' thinking about the text. You can follow up with a Think Aloud to help clarify parts of the text as needed. At times, you may want to facilitate whole class discussion after Think/Pair/Share. Alternatively, you may sometimes opt to substitute Think/Pair/Share with Stop and Jot. You can read over students' shoulders and select a student to share their thinking.

These teacher notes allow for frequent stopping for partner talk and sharing out. You should modify this interactive read-aloud in a way that suits the needs of your students. For instance, you may want to have students read parts of the text independently, depending on their reading levels. An additional strategy that you might consider using throughout this text is annotating in the margins. After stopping to talk with a partner and/or engage in whole group discussion, students can jot a phrase that expresses the main idea ("gist statement") in the margin. It is advisable to demonstrate this for the first few paragraphs and then ask students to jot gist statements in partners or independently as the read-aloud progresses.

As you guide students through this article, prompt students to use the images to help them understand what is being said in the text.

Cuba: An Example of Island Evolution, Biodiversity, and Conservation

Highlight the three topics the article will delve into based on the title.

Cuba is remarkably varied in its geography, with remote forests, deep caves, broad wetlands, and dazzling reefs. It has many well-protected ecosystems and is isolated from the mainland. This allows its species to evolve and adapt in unique ways.

Think/Pair/Share: *What factors make Cuba unique?*

(Sample response: It has varied geography, many well-protected ecosystems, and is isolated from the mainland.)

Over four thousand islands—an archipelago, with one main island—make up the nation of Cuba in the northern Caribbean Sea. It is located just 150 kilometers (94 miles) from the tip of Florida.

Think/Pair/Share: *What do you notice about Cuba's geography from the map and caption?*

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Over four thousand islands–an archipelago, with one main island–make up the nation of Cuba in the northern Caribbean Sea. It is located just 150 kilometers (94 miles) from the tip of Florida.

Island Geography and Endemism

Islands such as Cuba tend to be rich in endemic species. Endemic species are organisms that exist only in the particular area in which they evolved, and nowhere else in the world. "The island of Cuba is so large, it acts as a miniature continent," says Chris Raxworthy, curator-in-charge of the Department of Herpetology at the American Museum of Natural History. "Evolution there has produced a lot of species that can't be found anywhere else in the world." In fact, roughly half of all plants and a third of all vertebrate animals in Cuba are endemic. What could explain these high rates of endemism? "In many ways islands function as natural experiments," says Ana Luz Porzecanski, director of the Museum's Center for Biodiversity and Conservation. "They are isolated from the mainland and from one another, they have set boundaries, and they vary in size and geography. So evolution can take different paths in different islands, leading to very different plants and animals."

Think/Pair/Share: *What is endemism? Why does it tend to occur on islands?*

Coach students to paraphrase rather than read directly from the text. For additional scaffolding, prompt students to look closely at the scientist's quote and explain it in their own words. Coach as needed.

	Known Species in Cuba	Number of Species Endemic to Cuba	% Endemism
Mammals	38	12	31%
Birds	369	25	~7%
Reptiles	140	110	78%
Amphibians	59	56	95%
Fishes	57	21	36%
Spiders	1,300	761	58%
Insects	8,312	~3,000	30-40%
Mollusks	1,405	1,350	96%

Cuba has high rates of endemism. For example, out of the 59 known species of amphibians that live in Cuba, 56 species (95%) are endemic.

Think/Pair/Share: *Explain how the data represented on this chart relates to the quote from scientist Ana Luz Porzecanski in the previous paragraph.*

Evolution of organisms takes place on islands just as it does on large continents. But on islands it can have particularly unusual effects. Organisms can arrive on islands in various ways. They can cross a temporary land bridge or wash up on floating vegetation. Sometimes they hitch a ride with another species. What happens next depends on the availability of food, living space, and the presence or absence of predators. Depending on these conditions some species can develop unusual features, such as very large size (gigantism), small size (dwarfism), or the loss of the ability to fly (flightlessness).

"Island Rule"

Some of Cuba's species exhibit the effects of the "island rule." The island rule proposes that, over time, island animals tend to evolve smaller body sizes (dwarfism) when food sources are limited. Or, they tend to evolve larger body sizes (gigantism) when there is less pressure from predators. For example, the extinct flightless owl, *Ornimegalonyx*, weighed 38 pounds and is the largest owl that ever lived. Scientists think it evolved from a smaller ancestor. It may have grown so large due to the absence of natural predators and the lack of competition

This is a model of *Ornimegalonyx*, the largest owl that ever lived. This extinct giant owl may not have been able to fly.

Think/Pair/Share: *The article states that gigantism and dwarfism are attributed to "the island rule." Explain gigantism and dwarfism to your partner. Tell how the "island rule" explains why these unusual features are seen in animals on islands.*

(Sample response: high availability of food due to less pressure from predators can lead to gigantism; limited food sources can lead to dwarfism)

Prompt students to look at the photos that show examples of the unusual features explained in the text.

for food. At the other end of the spectrum, Cuba also harbors one of the world's smallest frog species, Monte Iberia eleuth (*Eleutherodactylus iberia*).

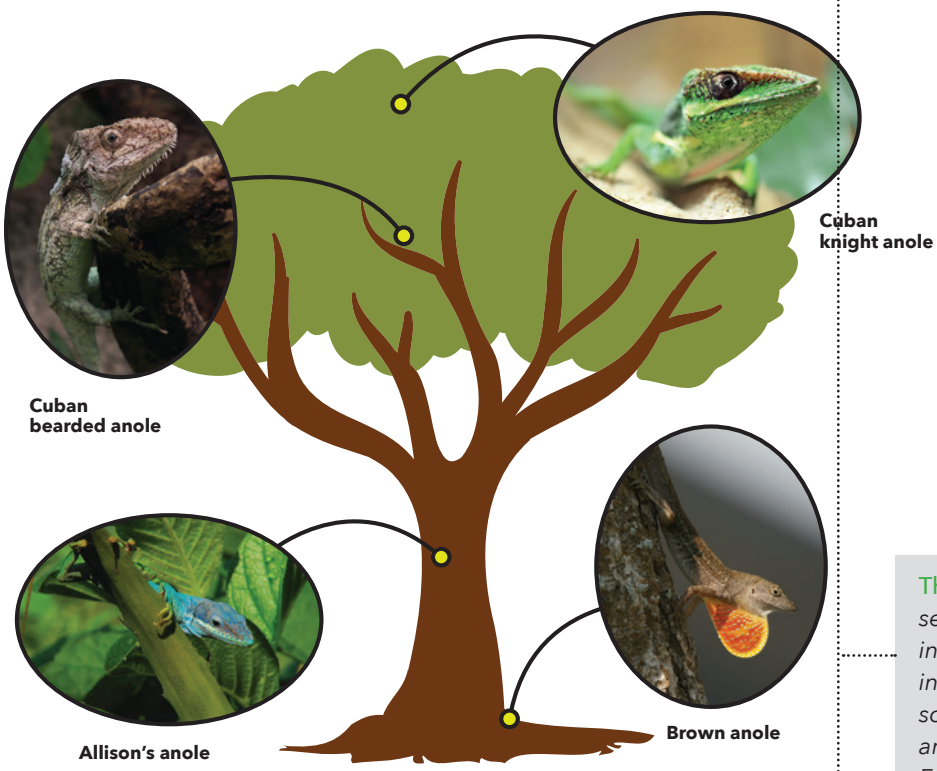
An adult Monte Iberia eleuth can fit on a human fingernail with room to spare.

Formation of New Species

When Charles Darwin arrived in the Galápagos Islands almost 200 years ago he observed small birds called finches. The finches he saw were all different species. He noted that each species had adapted to eating different kinds of food. Darwin later concluded that the finches were able to coexist on the small island because they had adapted in ways that allowed them to divide up the limited resources, and in the process, became different species. This phenomenon of organisms diversifying when there is competition among members of the same species is also well documented in a group of lizards called anoles. Many species of these lizards, some endemic to Cuba, reside in the lush forests of Cuba's Humboldt National Park.

Humboldt National Park

The first anoles in Cuba lived in the trees. At first they competed for resources with members of their same species. Over time the anoles were able to coexist by evolving strategies to divide the tree habitat vertically. By adapting, groups of anoles became specialized to live exclusively in different micro-habitats of the trees. Some lived at the ground level. Some lived in the crown of trees. While others lived in between, on trunks and twigs. Over many generations, these populations of anoles became distinct enough, morphologically and genetically, to be considered different species.



The brown anole (*Anolis sagrei*) lives near the base of a tree trunk. This small lizard has long back legs for jumping, sprinting, and moving fast. It is camouflaged—it blends in with the tree's trunk and branches.

The Allison's anole (*Anolis allisoni*) lives on tree trunks, especially on palm trees. Its big toe pads help it cling to the trunk and it can climb straight up (or straight down!) trunks in search of insects.

The Cuban bearded anole (*Anolis barbatus*) lives between the branches that form the leafy roof of the rainforest. It moves slowly, using its short legs to grasp fragile twigs.

The Cuban knight anole (*Anolis equestris*) lives near the top of the canopy. It is the largest anole, and devours tree frogs, tarantulas, and even birds.

Environmental Threats to Islands

The qualities that make islands so rich in biodiversity also make them very vulnerable to environmental threats. This makes conservation efforts challenging. Cuba is relatively isolated from the mainland and other islands. This results in many endemic organisms having limited population sizes, and

Think/Pair/Share: *The first paragraph in this section explains how species diversify, or evolve, into different species. The example of finches in the Galapagos islands is given to explain this scientific phenomena. The next paragraph gives an example of this same phenomena in Cuba. Explain what happened to anoles in Cuba over many generations.*

You may consider having students reread this second paragraph with a partner and paraphrase the more complex parts before answering the question. It is essential that students understand that these different species evolved over many generations.

being confined to small areas. For example, the Cuban parakeet (*Psittacara euops*), a bright green endemic bird, resides only in the Zapata Biosphere Reserve. Because of its small population, this bird can be severely affected by environmental threats, such as habitat loss or pet trade exploitation. Only 5,000 of the parakeets remain.

The Cuban parakeet lives only in Cuba's Zapata Biosphere Reserve.

Think/Pair/Share: *How does having a small population put a species at risk?*

Environmental threats can affect multiple species at once. Limited space often leads island animals to co-evolve. These animals come to depend on one another—they play critical roles in one another's life cycles. For example, in one study, Cuba's endemic bee hummingbird (*Mellisuga helenae*) sought the nectar of just ten flower species. Nine of those flower species are endemic to the island. With such a narrow choice of food options, a decline in plant species could spell disaster for the bee hummingbird population.

The bee hummingbird, the smallest bird in the world, is endemic to Cuba.

Think/Pair/Share: *How does having coevolved with another species put an animal at risk?*

Invasive species also pose a threat to island species. When invasive animals arrive on an island they often face no predators and can quickly establish themselves. Dr. Gilberto Silva Taboada of the Cuban National Museum of Natural History, points to the North African catfish (*Clarias gariepinus*), a particularly destructive example of an invasive species. "This large fish can survive outside of water for days, it regularly climbs onto dry land wandering and feeding on all kinds of endemic animals, even those inside caves."

The North African catfish is a threat to some of Cuba's endemic species.

Think/Pair/Share: *How do invasive species put native species at risk?*

Like in other Caribbean countries, Cuba's environments are changing. Habitat loss and fragmentation pose growing risks. Climate change also adds to environmental decline by contributing to rising sea levels; changes to disease patterns; and an increase in droughts, heat waves, and heavy rains. Island species are especially susceptible to changes in their environments and, as a result, are at high risk of extinction.

Cuban and American scientists doing fieldwork in Cuba's Humboldt National Park.

Well aware of these challenges, Cubans continue to take strong measures to protect their natural heritage. Cuba's scientists are working with colleagues around the world to study, monitor, and protect the country's flora and fauna. The government has also created protected areas, including Humboldt National Park, the Gardens of the Queen marine reserve, and the Zapata Biosphere Reserve, where human activities have to follow strict rules. Ongoing efforts to protect these areas are important to conserve Cuba's biodiversity.

Think/Pair/Share: *Based on these last two paragraphs, what environmental threats does Cuba face?*

(Sample response: habitat loss; fragmentation; climate change is causing rising sea levels, heat waves and heavy rains; changes to disease patterns)

What are some of the steps the Cuban people are taking to "protect their natural heritage"?

(Sample response: scientists are collaborating to study problems; there are protected areas with strict rules)

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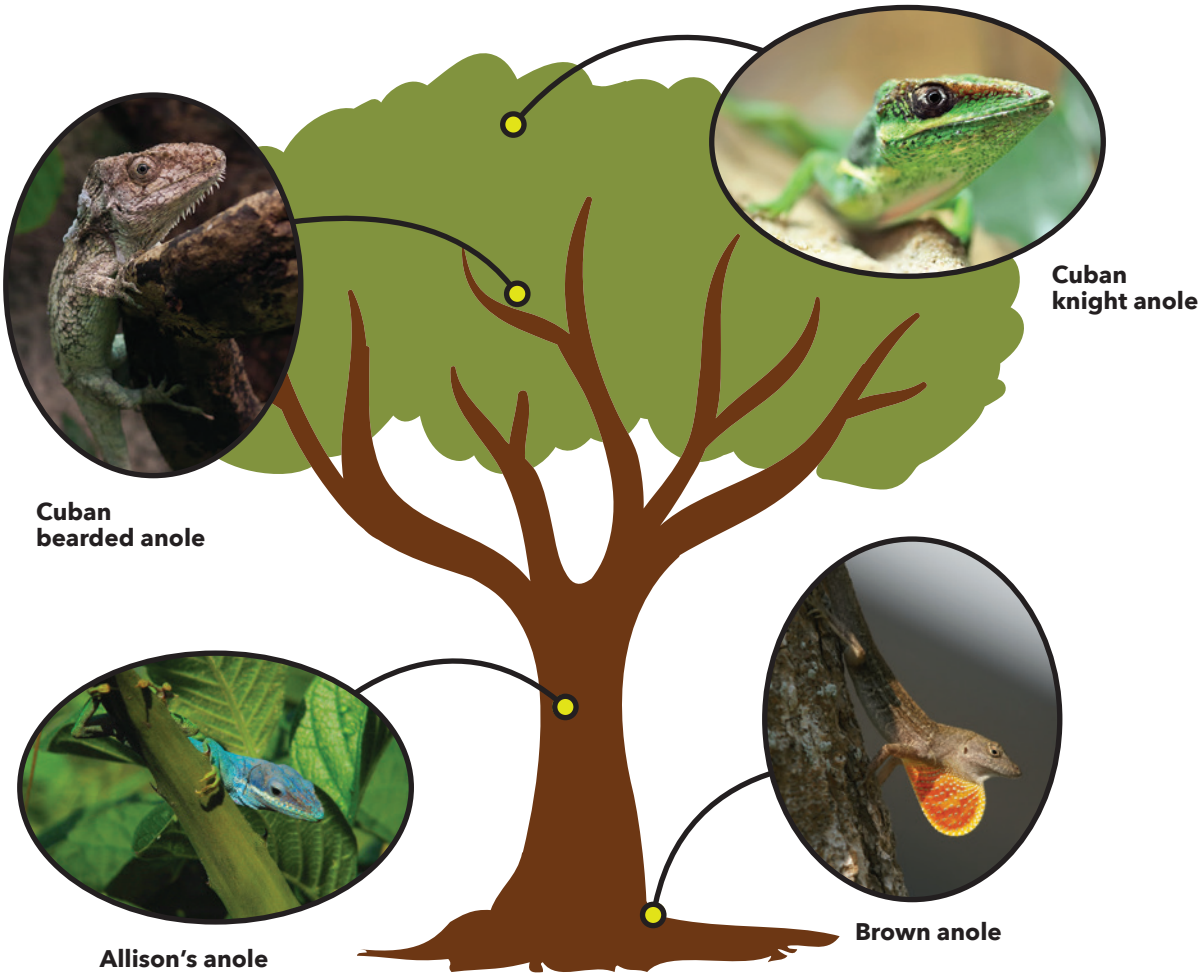

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PHOTOS: map of Cuba, ©AMNH; *Ornimegalonyx*, ©D.Finnin/AMNH; Monte Iberia eleuth and Humboldt National Park, ©C.Raxworthy/AMNH; tree, dumbmichael/Vecteezy.com; Brown anole, ©H.Hillewaert/CC-BY-SA-3.0; Allison's anole, ©Lezumbalaberenjena/CC-BY-SA-3.0; Cuban bearded anole, ©L.Leszczynski/CC-BY-SA-3.0; Cuban knight anole, ©O.Shvadchak/CC-BY-SA-3.0; Cuban parakeets and bee hummingbird, ©E.Chernetsova/CC-BY-SA-3.0; North African catfish, ©P.Asman&J.Lenoble/CC-BY-SA-3.0; scientists, ©B.T. Smith/AMNH.