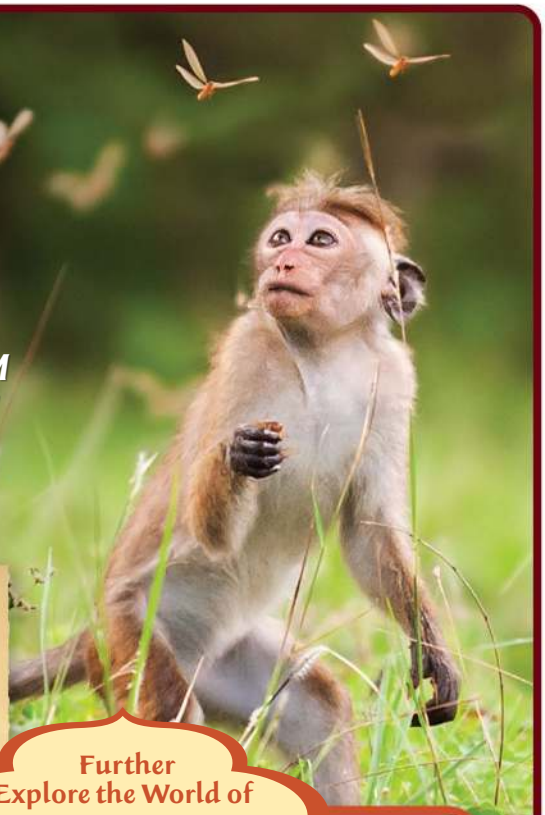
Educator's Guide

GRADES 2–6

Disneynature

Monkey Kingdom



Set in the storied jungles of South Asia, MONKEY KINGDOM showcases the adventures of new mom Maya, a clever and resourceful blonde-bobbed monkey who's determined to give her son a leg up in the world.

This Earth Day You're Invited into the World of MONKEY KINGDOM!

Life is an adventure for Maya, the clever and resourceful blonde-bobbed monkey in **MONKEY KINGDOM**, Disneynature's new feature film set among ancient ruins in the storied jungles of South Asia. Maya's world is forever changed when she welcomes her son, Kip, into her complicated extended family. Like all families, Maya's has more than its share of colorful personalities—and she's determined to give her son a leg up in the world. When their longtime home at Castle Rock is taken over by powerful neighboring monkeys, Maya's whole family is forced to relocate, and she uses her street smarts and ingenuity to lead them to untapped resources amidst strange new creatures and unsettling surroundings. Ultimately, they will all have to work together to reclaim Castle Rock, where Maya can hopefully realize her dreams for her son's future.

Featuring a rich variety of characters, including a mischievous mongoose, simple-minded langur monkeys, predatory leopards and monitor lizards, **MONKEY KINGDOM** is directed by Mark Linfield (CHIMPANZEE, EARTH) and co-directed by Alastair Fothergill (CHIMPANZEE, BEARS). With music from award-winning composer Harry Gregson-Williams (THE CHRONICLES OF NARNIA: THE LION, THE WITCH AND THE WARDROBE, SHREK movies), Disneynature's eighth True Life Adventure swings into theaters April 17, 2015.

For every ticket sold opening week (April 17-23, 2015), Disneynature will make a donation in your honor to Conservation International to help protect monkeys and other endangered species in their natural habitats.

Learn more at Disney.com/monkeykingdom

CONSERVATION INTERNATIONAL

Further Explore the World of MONKEY KINGDOM

The **MONKEY KINGDOM** Educator's Guide includes nearly 100 pages of lessons and activities targeted to grades 2 through 6. The complete Educator's Guide and additional educational resources are now available at disney.com/monkeykingdom.

The guide introduces students to a variety of topics, including:

- *Habitat and Ecosystems*
- *Biodiversity*
- *Learned Behaviors*
- *Communication*
- *Animal Relationships*
- *Life Cycle*
- *Earth's Systems*
- *Culture and the Arts*
- *Making a Positive Difference for Wildlife Worldwide*

EDUCATOR'S GUIDE OBJECTIVES

- ✓ *Increase students' knowledge of Toque Macaques Monkeys and their habitat through interactive, interdisciplinary and inquiry-based lessons.*
- ✓ *Enhance students' viewing of the Disneynature film **MONKEY KINGDOM** and inspire an appreciation for the wildlife and wild places featured in the film.*
- ✓ *Promote life-long conservation values and STEAM-based skills through outdoor natural exploration and discovery.*
- ✓ *Empower you and your students to create positive changes for wildlife in your school, community and world.*

Lessons are aligned to the Next Generation Science Standards, Common Core Language Arts and Common Core Mathematics Standards.

Partnership for 21st Century Skills

Disneynature.com

Content provided by education experts at Disney's Animals, Science and Environment

THIS FILM IS NOT YET RATED

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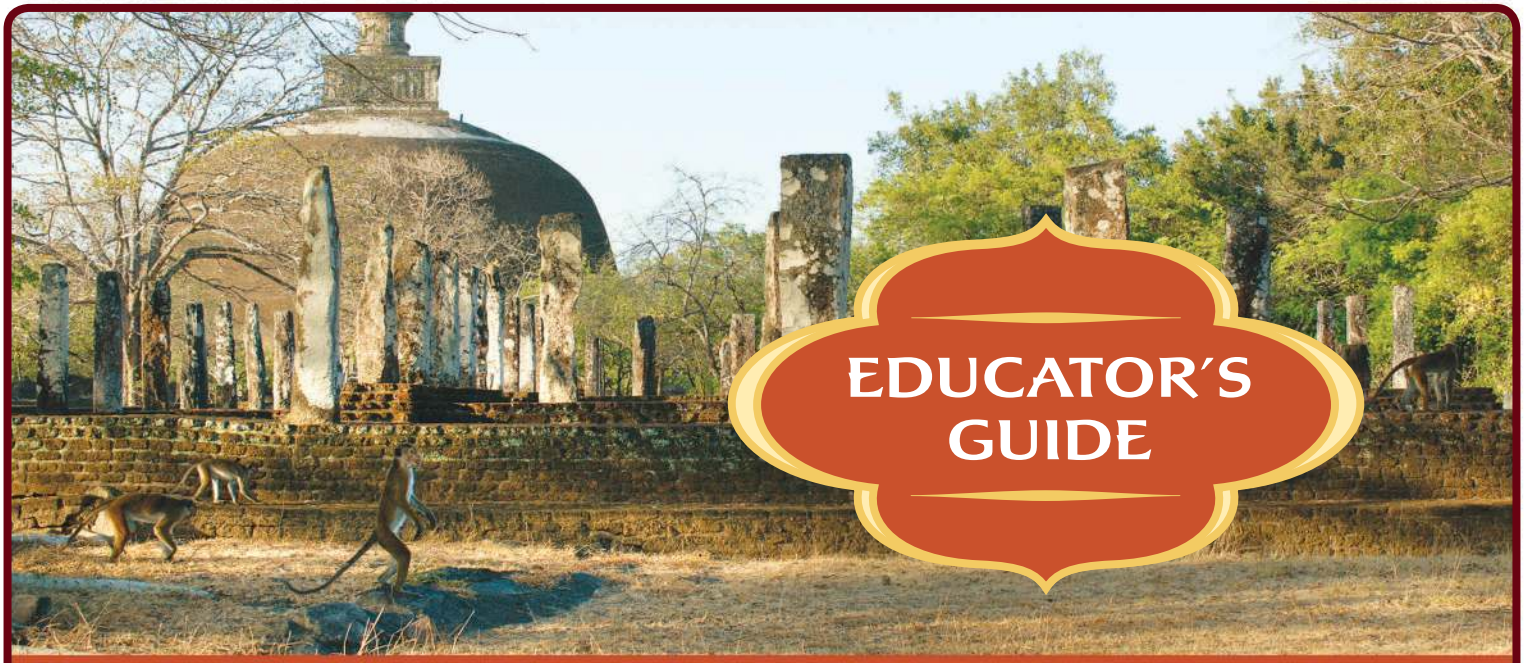
CALL 1-888-DISNEY6 TO RESERVE GROUP TICKETS FOR YOUR CLASS!

Schedule your class trip early to see MONKEY KINGDOM so you and your class can further explore the world of toque macaques. Starts in Theatres April 17!



EDUCATOR'S GUIDE

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A special thank you to Dr. Jackie Ogden and her team at Disney's Animal Kingdom: Animals, Science & Environment. These materials would not have happened without the diligence and dedication of Allyson Atkins and Kyle Huetter who worked side-by-side with the scientists and educators to help create these compelling lessons and activities. A special thanks to our primate experts, Dr. Anne Savage, Rebecca Phillips and Rachel Daneault for sharing all of their knowledge and insuring the accuracy of the information. A big thank you to Clary Powell Pickering for writing the background information, Erika Novak for her great work on the activity sheets, and Dr. Jill Mellen, Kim Carlson, Lisa Mitchell and Laurie Warfield for advising and reviewing all the materials. Thank you also to Dr. Beth Stevens, Kim Sams and Claire Martin for their leadership. The interdisciplinary and holistic approach to this guide could not have happened without the special talents of the following subject matter experts: Drs. Linda Labbo, Deborah Tippins, John Olive, John Hoge, NaJuana Lee, from the University of Georgia and Dr. Wayne Nelson from Southern Illinois University. Additionally, thank you to the amazing work of our director Mark Linfield ("Chimpanzee," "Earth") and co-director Alastair Fothergill ("Chimpanzee," "Bears") for this beautiful film. Lastly, thank you to Disneynature's Paul Baribault and Peggie Birkenhagen for their support and commitment to the development of these educational materials.

Dr. Lizabeth Fogel
Director of Education, The Walt Disney Studios

Disneynature Monkey Kingdom

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Standards Alignment Chart

	1 Where Do Toque Macaques Live?	2 Who Shares a Banyan Tree with the Toque Macaques?	3 How is a Toque Macaque Troop Organized?	4 How Do Toque Macaques Communicate?	5 What Life Events Do Toque Macaques Experience?	6 How Does Biodiversity Impact the Toque Macaques?	7 What Types of Relationships Do Toque Macaques Develop?	8 How Dangerous is the Journey to Water?
NEXT GENERATION SCIENCE STANDARDS								
Earth's Place in the Universe					2-ESS1-1		5-ES1-2	
Ecosystems: Interactions, Energy, Dynamics	2-LS2-2 2-LS2A MS-LS2-1 MS-LS2.A &C	2-LS4-1 2-LS4.D 3-LS2.1 3-LS2.D	5-LS2-1 5-LS2.A		3-SL2-1 3-SL2.D	5-LS2-1 5-LS2.A MS-LS2-1 MS-LS2-2 MS-LS2-3 MS-LS2-5 MS-LS4.D	5-LS2-1 5-LS2.A MS-LS2-1 MS-LS2.A	2-ETS1.B 3-LS2-1 3-LS2.D
Biological Evolution: Unity & Diversity	3-LS4-2,3,4 3-LS4.C & D MS-LS4-4		MS-LS4-6 MS-LS4.C				MS-LS4-5	2-LS4-1 2-LS4.D 3-LS4-2 & 3
Earth & Human Activity	5-ESS3.C							
From Molecules to Organisms: Structure & Processes			5-LS1-1 5-SL1.C	3-LS1-1 3-LS1.B	3-SL1-1 3-SL1.B		4-LS1-1 4-LS4-2 4-LS1.D	
Heredity: Inheritance & Variation of Traits				3-LS3-1 & 2				
Earth's Systems						4-ESS2-2 4-ESS2.E 5-ESS2-1		
COMMON CORE LANGUAGE ARTS STANDARDS								
Reading Foundational Skills							Fluency: RF.4.4b & RF.5.4b	
Reading Informational Text					Key Ideas & Details: RI.2.3 & RI.3.3			Key Ideas & Details: RI.2.1, RI.2.6, RI.3.1 & RI.3.2
Writing	Text Type & Purpose: W.4.1.A, B & D; W.5.1.A, B &D; W.6.1. A, B, D &E Research to Build & Present Knowledge: W.4.7, W.5.7, W.6.7, W.6.8 & W.6.9	Research to Build & Present Knowledge: W.2.8 & W.3.8	Research to Build & Present Knowledge: W.2.8, W. 3.8, W.4.9, W.5.9, W.6.9		Text Type & Purpose: W.2.3 & W.3.3	Text Type & Purpose: W.4.3, W.5.3 & W.6.3 Research to Build & Present Knowledge: W.4.9, W.5.9 & W. 6.9	Text Types & Purpose: W.4.3, W.5.3 & W.6.3	
Speaking & Listening		Comprehension & Collaboration: SL.2.1 & SL. 3.1	Present Knowledge & Ideas: SL.2.1, SL.2.2, SL.3.1, SL.3.2, SL.4.1, SL.4.2, SL.5.1, SL.5.2, SL.6.1, SL.6.2	Presentation of Knowledge & Ideas: SL.2.5 & SL.3.5				
Language				Vocabulary Acquisition & Use: L.2.5a & L.3.5a				
COMMON CORE MATH STANDARDS								
Measurement & Data		3.MD.C. 3.MD.C.5a 3.MD.C.6 3.MD.C.7,a,b,c,d 4.MD.A1 5.MD.A1			2.MD.7 3.MD.1 & 3	2.MD.9 3.MD.3 4.MD.4 5.MD.2	5.MD.1	
Geometry	5.G1 6.G1 & 3			2.G.1,2 & 3 3.G.1 & 2			4.G.1 & 2	5.G.1 6.G.3
Statistics & Probability						6.SP.1,2,3,4, 5a,b,c,d		
Ratio & Proportional Relationships							6.RPR.1 & 3a	
Standards for Mathematical Practice			1 & 3					

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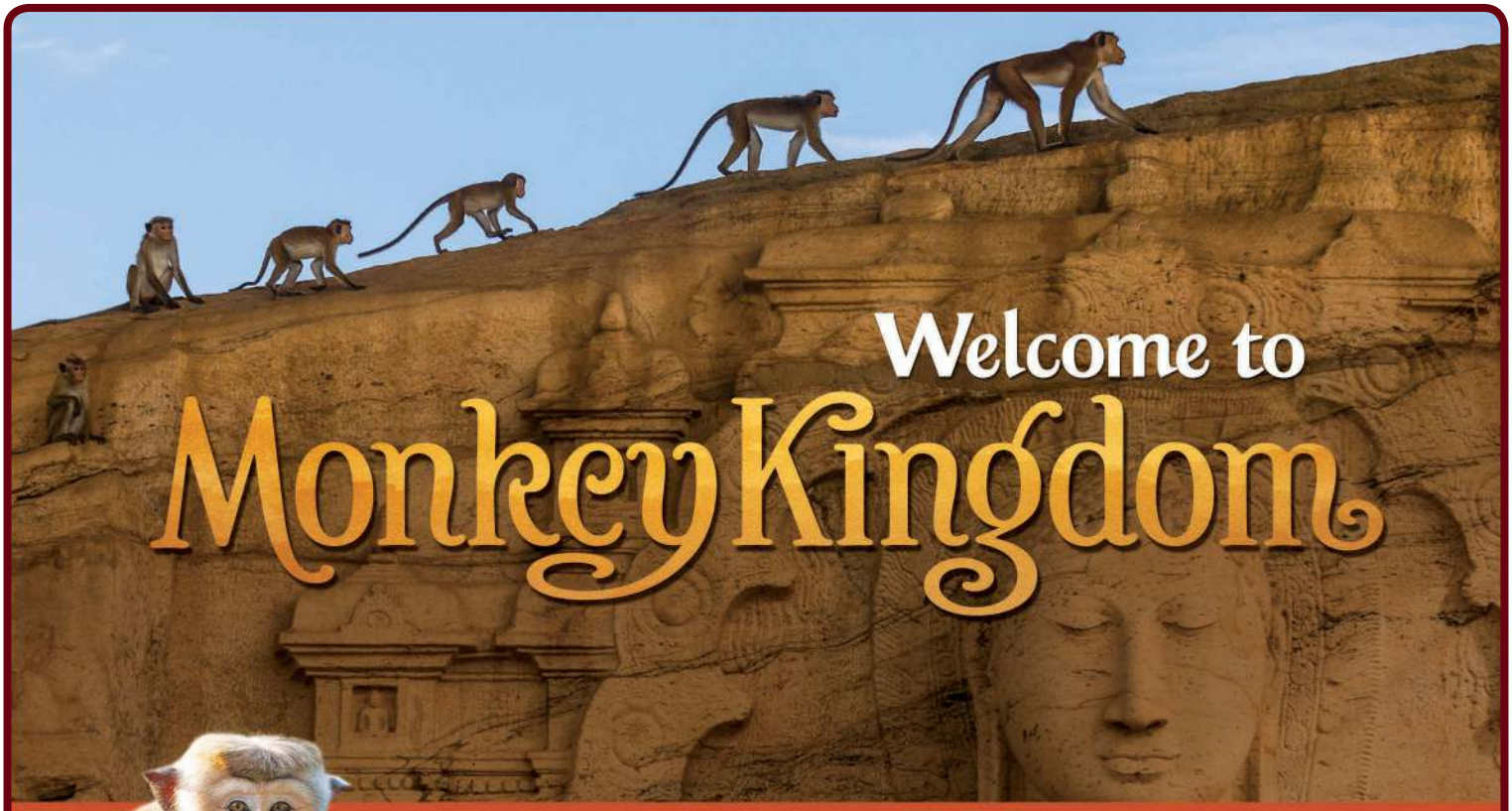

Why Are Toque Macaques Important?

Toque macaques are culturally significant: Macaques and humans have been coexisting in South Asia for centuries. In many cultures of this region, macaques are highly regarded and praised for their intelligence and curiosity. In the island country of Sri Lanka, the revered ancient capital of Polonnaruwa now serves as a home to toque macaques who explore the ruined shrines and temples.

Toque macaques are like us: They live in families called troops and are exceptionally social animals. Toque macaques communicate using a wide variety of facial expressions, body postures and vocalizations. Troop members strengthen bonds with one another by grooming and sitting next to each other. Macaques have excellent color vision that helps them to find food and they sometimes swim or walk on their hind legs to reach a good meal!

Toque macaques are part of a diverse community: Toque macaques share the forest with an incredible diversity of species. Asian elephants, leopards, langur monkeys and more all share the tropical forest habitat with the toque macaque. Although neighbors, the macaques must keep an eye out for predators such as snakes and water monitors that could be lurking nearby.

Toque macaques help replant the forest: Toque macaques play an important role in their ecosystem. As part of their diet, macaques consume a large quantity of fruit. These monkeys disperse seeds through their feces, further "planting" trees all over the tropical forest floor. Over time, these trees grow tall and provide food and cover for animals of the tropical forest.

Toque macaques face challenges: Toque macaques are an endangered species and in need of help for their continued survival. They face many challenges such as habitat loss, diminishing resources and drastic changes to regional weather seasons. People can make a positive difference by sharing what they learn about these monkeys or joining conservation efforts to help protect them.

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TEACHER'S BACKGROUND INFORMATION

MONKEY KINGDOM

What is a Macaque?

Macaques belong to the primate order and are classified as an Old World monkey. Scientists have distinguished different types of primate species into either New World or Old World classifications based on physical features and geographic location. There are twenty-two different species of macaques, with all but one, the Barbary macaque, living in Asia. All twenty-two macaque species are unique with different adaptations and behaviors. Some, like the Japanese macaque, can live in high altitudes and have thick fur adapted to cold temperatures and snow. Others, like the long-tailed macaque, have a unique diet that includes crabs, frogs and even octopus. The smallest species of macaque is called the toque macaque. Toque macaques are named after the whorl of hair on top of their heads, which resembles a brimless hat. These amazing monkeys can be found in the forest trees amidst the ruins of Polonnaruwa, an ancient city that was once home to inhabitants over 1,000 years ago.

Who is the Toque Macaque?

The toque macaque is a playful, agile and adaptive monkey weighing between 7.9 and 12.6 pounds (3.6 and 5.7 kilograms) and standing 15.7 to 18.7 inches (40 to 47.5 centimeters) tall. Their short coat is golden brown with a snowy white chest that reaches up to their cheeks and around their ears. Their faces, although hairless, range in color. Males have tan faces while females have pink to red faces, almost as if they forgot to put on sunscreen! The toque macaque's tail is slightly longer than both its head and body combined, and is used for balance or a brake to control movement through the trees. Another unique adaptation of the toque macaque is its color vision. Even more than smell, the toque macaque relies on sight to find food. Whether swimming, escaping a predator, walking on their hind legs to carry food, or settling on alternative sources of food to ensure they have a good meal, these impressive monkeys have learned to adapt as best they can to their changing environment.

Toque macaques are an endangered species, which means they need help in order to continue to survive! Endangered refers to the conservation status of a particular species of plant or animal, telling us how close that species is to possible extinction. The purpose of identifying a species as endangered is to help inspire conservation awareness and action. It is unknown exactly how many of these monkeys exist in the wild, but their population has decreased by half over the last 40 years, a trend that hopefully will not continue as these animals play an important role in their ecosystem.

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A Mysterious Setting

The stunning location seen in Disneynature **MONKEY KINGDOM** is the island country of Sri Lanka. This small country located in the Indian Ocean, just off the southern tip of India in South Asia measures 25,332 square miles (65,610 square kilometers), making it similar in size to the state of West Virginia and slightly smaller than the country of Ireland. Starting along the coast with beautiful beaches, the terrain is mostly lowland plains with mountains in the south central part of the island. Sri Lanka is known for its expansive coastline, 2,000-year-old temples, beautiful forests, 15 national parks and 500,000 acres of tea plantations.

Today, the ruins of Polonnaruwa have been designated a World Heritage Site. Many ruins date back as far as the 12th century and have now been meticulously excavated and preserved.

Moonstone carvings are some of the unique ornamentations found in the ruins. Moonstones are chiseled semi-circled slabs of rock that were often placed at the base of a staircase leading to a shrine.

The Cultural Triangle

Deep in the heart of Sri Lanka is the Cultural Triangle. This culturally rich area is located in the central part of the country and encompasses numerous United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Sites. These sites include the ancient cities of Anuradhapura and Polonnaruwa, the rock fortress of Sigiriya and the Dambulla temple cave.

The Ancient City of Polonnaruwa

Over 1,000 years ago, the city of Polonnaruwa was a fabulous garden capital for the people of Sri Lanka. After building a lake to ensure people had a bountiful water source, the expansive grounds were constructed to include palaces, temples and Buddhist shrines. The city of Polonnaruwa would thrive for 150 years before falling due to political strife and conflict.

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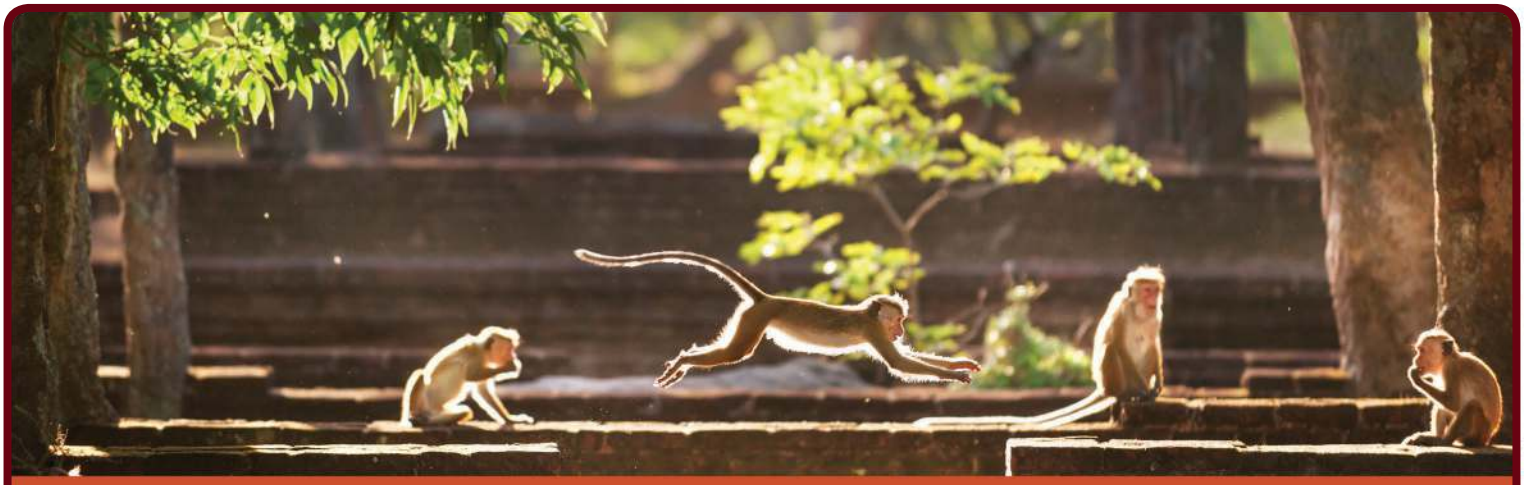

A Mysterious Setting cont'd

These moonstones were decorated with designs of animals, often a horse or an elephant, surrounded by a row of floral patterns. These intricately crafted moonstones are considered by many scholars to be one of the highest achievements in Sri Lankan artistry. Having been abandoned for centuries, the site of this former great city is now a historical testament to the early rulers of the kingdom and a forest playground for toque macaques. Polonnaruwa's beautiful temples and palaces are an interesting place for the monkeys to explore with many hiding places and observation decks giving the monkeys a new perspective of their forest home.

The Fig Tree

Within the ruins, toque macaques must find a safe place to rest and serve as their home. The fig tree or Indian banyan tree seen in Disneynature **MONKEY KINGDOM** is an excellent choice for these agile monkeys. Growing up to 100 feet (30 meters) tall, these trees are strong and secure. Their strong root systems extend several feet/meters from the base of the tree making them one of the most resistant trees in the forest. Even the changing wet and dry seasons don't bother the banyan tree because it is drought tolerant. Strong limbs make great beds or chairs, perfect for resting or engaging in social grooming. Sweet bulbs of cherry-sized figs make the best lunch and the evergreen leaves protect the monkeys from the rain and sun. With the banyan tree being a great home for many birds and mammals, the toque macaques end up sharing space with their forest neighbors.

Tropical Weather

This tropical island's climate has distinctive wet and dry seasons, but as warming temperatures continue to increase around the globe, seasons have become more severe. The wet, rainy season takes place from December through March in the northeast region of the island and June through October in the southwest region. This wet season is important as it provides water, vital not only for the toque macaques, but for all plants and animals in the tropical forest. Dry seasons alternate with wet seasons in each region, and during these times water becomes more challenging to find.

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Discovering the Toque Macaque

Troops

Toque macaques have rich social lives and very distinct personalities. They live in social groups called troops that include 20 to 25 members. Each troop has a home range or neighborhood that typically overlaps with other troops of toque macaques. This can lead to competition and conflict among rival troops for resources such as food, water and sleeping sites. Home ranges with fruiting trees are the most popular as they provide an abundance of food. Having a stocked pantry is never a bad idea!

Toque macaques strengthen bonds in their troop by hugging, grooming and sitting next to each other. Hugging often occurs after threats have passed, serving to comfort and calm each other. Grooming is a regular social activity, one that further solidifies the bond between individuals in a troop. Toque macaques work together to clean each other's hair using their fingers, lips and sometimes teeth. When a toque macaque is injured, grooming serves an important role, as other macaques help clean the wound from dirt and bugs. More attention is paid to the injured individual in order to help speed recovery.

Toque macaque mothers play a huge role in how troops are formed. Female infants typically stay in the social group they were born into and only leave on rare occasions. However, with males it is different. When males reach maturity they leave to join a new group. It is not uncommon for males to move to a new group more than once in their lifetime. The most dominant male in the troop is called the alpha male. This individual is responsible for leading the troop and protecting it from predators and rival troops. This individual must continually maintain his dominance as other males are always nearby, waiting to take over. The alpha male is easily recognized as being better groomed, more muscular and overall the most fit. Or in other words, he has great hair and looks like he spends a lot of time at the 'jungle' gym.

Relationships In the Troop

Within the toque macaque troops and community there is a hierarchy, or pecking order of members. This means that the highest-ranking individual has the most power and is essentially the leader. When a toque macaque is born it inherits the ranking status of its mother. The hierarchy chain thus begins with the mother ranking above the offspring, members of one family ranking above or below another family, and certain troops ranking above or below other troops in a community. The rank of an individual, family or troop is important because it determines access to resources like food and water. For example, higher-ranking individuals in a troop take food from lower ranking individuals in a troop. In general, the higher the rank, the longer you live because of better access to the best food and best cover for safety.

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Discovering the Toque Macaque cont'd

Learning through Mimicry

Though mothers take on the majority of the responsibility when raising the young, everyone in the troop is a teacher. Mothers give birth to one offspring a year and take care of infants until they are old enough to play on their own in juvenile groups. They learn a lot from their playmates, like how to communicate, the rules of play and how to get along well with others. They also start to exhibit their dominance patterns during play as well. Similar to other primates, toque macaques learn by watching older monkeys in their troop. By mimicking behaviors such as facial expressions, young macaques begin to learn important non-verbal communication cues that will help them interact with other toque macaques.

Fission and Fusion

Group fission and fusion are also possibilities within toque macaque troops and involve more than one monkey making a move. Group fission means that part of a group breaks off to start their own group. Group fusion is when two groups join to form a larger group. There are many reasons this can occur, but most are due to hierarchy and are considered a survival tactic. If a family is low in rank and having a hard time getting access to resources, they may break off from a group and become the leaders of their own troop, making their own rules. Sometimes, there is also power in numbers. Two groups joining together can mean larger territories and better protection from other groups or from predators.

A Treetop Villa

During the day when the monkeys are most active, they spend a lot of time on the ground looking for food. However, a favorite spot for the toque macaques can be found high above the temples in the treetops of the forest canopy. These leafy houses provide safety from predators, as well as shelter from nature's elements. Fruit trees, such as the banyan tree, are not only a safe haven but also provide a sweet and delicious food source. Safety is the number one priority in the lives of these monkeys. Before nightfall, toque macaques pick a tree to rest in and sleep. Although the troop may return to a favorite tree in their home range, they rarely sleep in the same tree two nights

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Discovering the Toque Macaque cont'd

in a row in order to keep predators from guessing their exact location. Once a tree is selected, the troop members will then find positions on branches away from the trunk. When it's time to sleep, families will huddle together, like one big blanket, for warmth and protection.

Foraging – Finding Food and Water in the Forest

Though fruit makes up a large part of their diet, toque macaques are omnivores. They eat plants, insects, and sometimes reptiles and birds when they are easy to catch. Toque macaques maintain a cautious approach as they forage in the forest, nervously looking around and eyeing their surroundings for predators or rival neighboring groups of monkeys. A unique adaptation of the toque macaque that helps with foraging is their cheek pouches. Much like a grocery bag, these pouches can hold food items that macaques find as they shop around the forest. This allows them to easily carry their food with them if they need to make a quick escape from a predator or even a more dominant monkey. Watering holes are visited daily during the dry season for a nice refreshing drink. These watering holes can be near ponds, lakes or rivers. Toque macaques are excellent swimmers. Swimming provides an expanded foraging territory for toque macaques looking for resources.

When food is available a toque macaque has no trouble collecting a bountiful feast in the forest – they just stuff their mouths and cheek pouches full and then grab what they can, walking on their hind legs if they have to! If their only option is a protein-rich bug sitting on a limb in the middle of a waterhole, they'll just swim right to it and bring it back to shore. They aren't picky eaters, and they will eat what they can get to survive. If their habitat is on the edge of a nearby town, they won't hesitate to raid a garbage bin or pick up fallen fruit from a truck or backpacker traveling near their forest. Toque macaques are brave and curious and most of the time they do not appear to be afraid of people due to their close interactions with tourists at popular sites in Sri Lanka's cultural triangle.

Communication

Communicating in social groups is an important part of the toque macaque's survival. Being able to communicate with their troop or other animals in the forest can mean life or death. Communication is a key way in which these monkeys warn others of "danger" or reconcile after a fight. Toque macaques use a variety of communication methods including vocalizations, body postures and facial expressions.

Vocalizations

There are different calls used to communicate a variety of things to the group such as alerting them to danger, the presence of food, or even an awareness of dominance. Thirty different calls have been recorded. Scream calls alarm the group to nearby predators. Loud calls from males will establish distance between other approaching groups.

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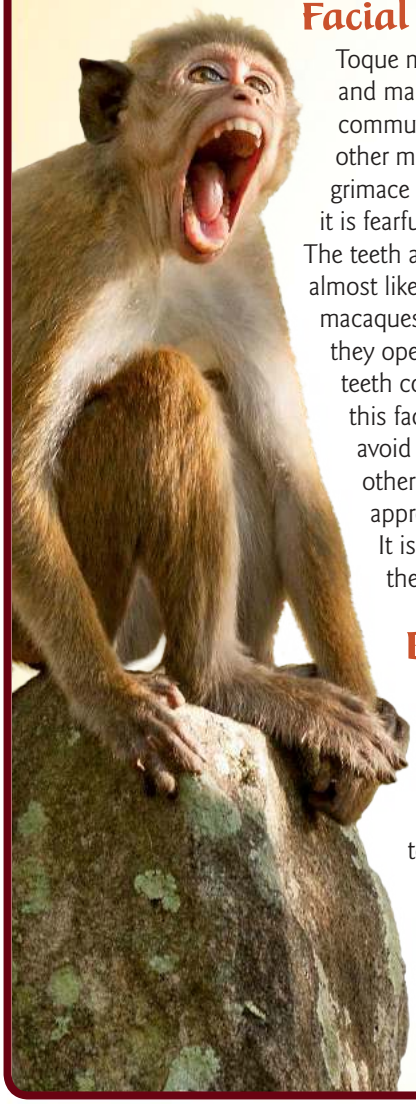
Discovering the Toque Macaque cont'd

Food calls alert others in the troop that an abundant food source has been located and they should come quick to enjoy the buffet! Troop members often respond by running in the direction of the call. Contact calls are quieter hums or grunts used while communicating within the troop. This soft chatter is the most common vocalization.



Facial Expressions

Toque macaques are very expressive and make certain faces to communicate their intentions to other monkeys and animals. A fear grimace communicates to others that it is fearful and does not want to fight. The teeth are exposed and clenched, almost like a smile. When toque macaques wish to threaten others, they open their mouth, keeping their teeth covered. Toque macaques make this face to assert dominance and avoid physical altercations. If the other macaque does not respond appropriately, a fight will ensue. It is the macaque's way of using their words before their fists!

Behavior

Adaptive and flexible, the toque macaque is a clever animal who makes the most of what it has. Toque macaques are considered to be arboreal which means they spend most of their time in trees. Because of this, the toque macaque must be well adapted for climbing, with excellent control over their hands and feet. While moving through the trees, they walk on all fours. This is called quadrupedal locomotion, and it allows them to balance safely and move about among the branches of the trees.

In macaque troops, the roles of males and females are very different. The males are responsible for leading the group and settling fights, while the females care for the young. Mothers have not only themselves to care for, but their offspring as well. If they are lucky enough to be at the top of the social hierarchy, food, water and shelter should be rather easy to find. However, if they are the lowest ranking monkey in a group, times will be harder and their options will be fewer – the ripest, most succulent fruits are off limits and they are not allowed to forage for food in the best places. However, females can improve their social status through alliances formed with other females. Females often cooperate with one another, and a low ranking female may even form an alliance with a higher ranking female. Choosing the right mate, especially the alpha male in the troop, is a smart move for climbing the social ladder.

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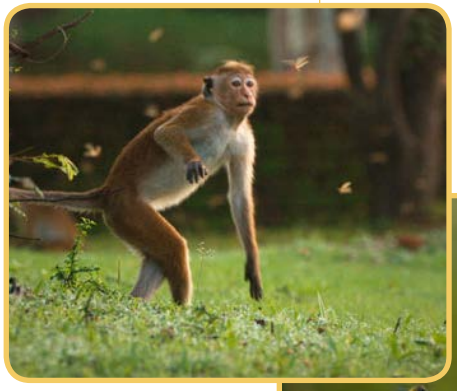
Tropical Forest Relationships

Meet the Neighbors

Toque macaques live in a forest ecosystem composed of a variety of animals and plants. Among the toque macaque's neighbors are the Asian elephant, sloth bear, Indian grey mongoose and axis deer. Over 400 species of birds grace the skies and roost in the trees, including the peacock, myna, spotted dove, Indian pied hornbill, green imperial pigeon and orange-breasted pigeon. Scorpions and termites also crawl along the forest floor. These monkeys must be careful of predators and other threats, including the mugger crocodile, leopard, cobra, Russell's viper, Indian python, Asian water monitor, and even dogs.

Termites in Flight



One particularly interesting neighbor to the toque macaque is the termite. In the forest, termites serve as food for many animals. Termites look a bit like flying ants. They are black, winged insects measuring under an inch (less than three centimeters) long and can be found living in dirt mound colonies or underground. Some colonies are so large they can include up to 10,000 individual termites! Toque macaques, mongoose, Asian water monitors, scorpions, and various forest birds, all feast on termites. The best chance for a termite buffet occurs during certain seasons of the year when the termites leave their mound to find a mate in order to start a new colony. After a brief flight, the termites will land and shed their wings, continuing to look for a mate on the ground. Once a mate is chosen, pairs seal themselves underground after finding a location for a new nest. During this time, large swarms of termites make it easy for predators to catch them – it doesn't take much aim or skill since there are so many termites flying around. A simple flick of the tongue, grab of the hand or snap of the beak, delivers a snack every time!

Forest Relationships

Symbiotic relationships between the toque macaques and other animals in their habitat create a unique community. There are three types of symbiotic relationships that occur in this setting – mutualistic, parasitic and commensal.

- Mutualistic relationships occur when both species benefit. For example, toque macaques have a mutualistic relationship with two other species of monkeys, Hanuman langurs and purple-faced langurs. The macaques and langurs search for

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Tropical Forest Relationships cont'd

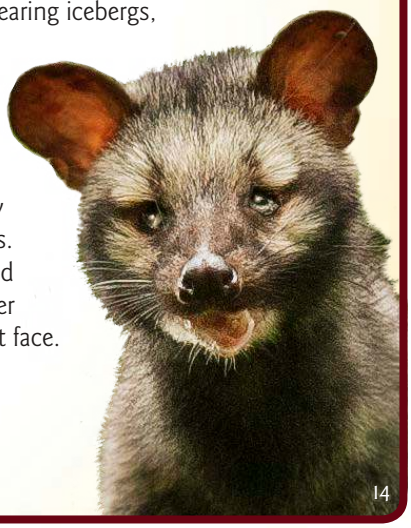
food together, but they do not directly compete. The langurs primarily eat leaves and the toque macaques consume mostly fruit. This means they typically don't get in the way of each other when feeding in the treetops.

- When one species benefits at the expense of another, it's called a parasitic relationship. Toque macaques are hosts to many parasites, including the whipworm and hookworm. Both use the toque macaque as a food source, living in the intestine until passed through their waste. These parasites take away nutrients necessary for the toque macaque, which can often leave the monkey's sick.
- Finally, there are commensal relationships where only one species benefits but neither animal is harmed. When toque macaques forage in the trees, they sometimes drop food from above as it lands on the forest floor. This helps nearby foraging animals who could not reach food higher up in the tree without the presence of the toque macaque.

Sharing the Forest

Macaques and humans have been coexisting in South Asia for centuries. In folklore and stories passed down from generation to generation, these primates have been praised for their intelligence and curiosity. Some people believe that seeing a macaque when leaving their home is good luck. However, as the need for land continues to increase, humans and primates become ever-closer neighbors in their shared habitats. As these two species share more and more space, coexistence becomes harder to accomplish and challenges arise.

As populations of people increase, so does the use of land, water, and the world's natural resources. Climate change has been discussed among scientists for years, and more and more people are acknowledging the very real changes occurring on the planet. Melting glaciers, disappearing icebergs, receding shorelines, and severe weather all point towards the impact of climate change on people, plants and animals. Toque macaques face more abrupt seasons, with longer dry spells and intense rainy seasons. Drought, flooding, tsunamis and cyclones are all very real weather conditions these monkeys must face.



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Tropical Forest Relationships cont'd

Finding food and safe shelter during these times can be very difficult.

If food becomes scarce in their natural environment, macaques will look for food elsewhere, often raiding garbage bins and farmers' fields in nearby villages. Many who visit the ancient ruins offer food to the monkeys, encouraging them to rely on humans as a source for their next meal. Unfortunately, encounters with humans have also led to toque macaques being taken from the wild for sale as pets, further decreasing local populations. These increasing interactions between humans and primates could lead to greater conflict between them.

Conservationists and scientists are trying various solutions to help ensure the relationship between primates and humans remains positive. Relocating toque macaques, providing education to the local people and preserving habitat are all actions that strive to ensure the survival of this endangered species. Relocation of certain individuals or troops has been attempted when conflict arises between people and toque macaques. However, this method has not been very successful. Often the relocated macaques are not welcomed by the local troop of monkeys, and end up being displaced yet again into nearby villages, creating problems for other townspeople.

Awareness and education are needed to ensure toque macaques continue to thrive in the world around them. Encouraging people not to feed the toque macaques is key in minimizing these monkey's dependence on humans for food. Closing up garbage bins properly will discourage the monkeys from feeding near homes. Understanding that these intelligent, free-roaming monkeys don't belong as pets in homes is also essential.

We Can Make a Positive Difference

By sharing what you have learned about toque macaques, you are on your way to helping protect this unique species! Shared knowledge creates awareness and can lead to action. A positive attitude towards all wildlife can also help make a conservation impact when combined with actions that benefit the world around us. While you may not live in Sri Lanka with toque macaques, you probably do live with a wide variety of animals near your own home. Think about ways you can help these animals.

- **Don't feed wildlife.** Encouraging wildlife to depend on you means they aren't using nature's resources. This hurts wildlife in the long run. Feeding wildlife can also be dangerous. It's important to let wild animals be wild and observe them only from a distance.

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Tropical Forest Relationships cont'd

- **Choose pets wisely.** Though many regulations exist around the world to protect wild animals, the illegal pet trade still takes many wild animals directly from their homes. When the time comes to add a furry, feathery, or scaly addition to your family, be sure you know where it came from.

- **Create habitats!** Consider creating a friendly place for wildlife to thrive in your yard. Provide a water source, a place for animals to live and plants that provide food. Before you know it, your backyard could be home to all kinds of insects, plants, and animals. The National Wildlife Federation can even certify your habitat as wildlife friendly!
- **Reduce, Reuse, and Recycle.** Reduce your consumption (achieve a small "footprint"). Reuse items that normally are just tossed into the trash and recycle everything you can.
- **Make wise conservation choices.** Finding alternative ways to travel such as carpooling, biking and walking are all great options to lessen your impact on the environment.
- **Learn More.** Check out conservation organizations such as Conservation International and Disney Worldwide Conservation Fund (DWCF) to learn more about the efforts to protect all kinds of wildlife in wild places. You can even visit an AZA-accredited zoo or aquarium to learn about other wildlife and conservation efforts being made around the world to protect animals like toque macaques.

TAKE ACTION!

Start a club at your school focused on influencing your community and your environment. Invite other passionate conservationists to join! Jane Goodall's Roots & Shoots is one great way to get started. This club for kids is global and encourages youth to take action.

Jane Goodall's roots&shoots

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LESSON 1

Where Do Toque Macaques Live?

THEME
Habitat

GRADE LEVEL
4-6

SUBJECT AREAS
Focus:
Science, Social Studies, Math & Language Arts

Extensions:
Science

BACKGROUND INFORMATION
Pages 7-8

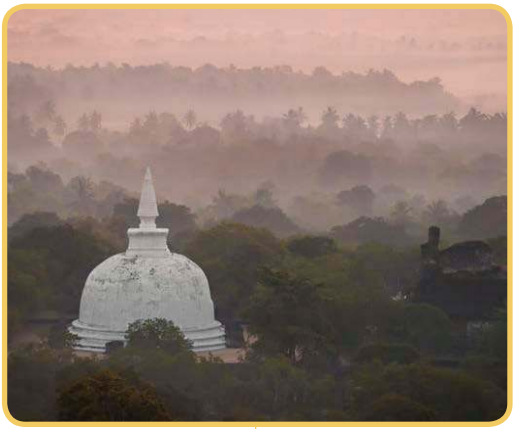
VOCABULARY
coordinate system, coordinates, endangered species, island endemic species, habitat, horizontal axis, intersection of the lines (the origin), perimeter, predator, scale, temple ruins, vertical axis

STUDENTS WILL BE ABLE TO...
- Analyze causes of toque macaque population declines in Sri Lanka
- Read a map and report specific locations as a pair of coordinates
- Read a map and report locations in the coordinate system convention
- Formulate answers to specific questions regarding the habitat of the toque macaque

WHAT YOU NEED
- Disneynature **MONKEY KINGDOM** film trailer
- Access to media center or library
- Paper (recycled if possible)
- Pencils or markers
- *Activity Sheet 1: Where Do Toque Macaques Live?*
- *Activity Sheet 2: Map of a Quadrangle in Polonnaruwa*

Warm Up

Many students may not be aware that The International Union for Conservation of Nature has designated the toque macaque an **endangered species** (IUCN, 2014). In fact, over the past 40 years it is estimated that **habitat** destruction has reduced the toque macaque's population by half (IUCN, 2014). Habitat destruction results from human population growth and the continued use of natural resources to sustain economic development. Toque macaques are only found in the wild in one place, Sri Lanka, which means they are a native or **island endemic species** of this nation.



Get Started

STEP 1: Show class the Disneynature **MONKEY KINGDOM** film trailer. Discuss the serious problem that the toque macaque monkeys face as they have been identified by the IUCN as an endangered species. Share with students that today only half as many monkeys live on the island compared to 40 years ago. Ask them what they think might have caused this population reduction? Encourage speculation regarding all potential causes including disease, internal troop conflicts, threats by **predators**, habitat destruction and poaching for illegal pet trade.

STEP 2: Together make a list of any threats they noticed in the trailer or film to the toque macaque troop. Divide the class into 3 to 5 scavenger hunt teams. Explain that the teams will compete to see which team can correctly complete a scavenger hunt designed to help protect the toque macaque. Visit Google Earth and search for satellite images of the Polonnaruwa ruins. Ask students what details they notice from a bird's eye view of the area. Lead a discussion on the ways maps offer a more precise resource for pinpointing locations for further study. Distribute *Activity Sheet 1*. Point out that the scavenger hunt focuses on conducting research and on reading maps.

STEP 3: For the scavenger hunt, students will need to use *Activity Sheet 2*. Have students use the **horizontal and vertical grid axes** to report specific locations on the map as a pair of **coordinates**. The first number in the pair will be the

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number of the vertical grid line that intersects the bottom (horizontal) axis – **intersection of lines**. The second number of the coordinate pair will be the number of the horizontal grid line that intersects the vertical (side) axis. (e.g. the Lata Mandapaya (structure #9) is located at the point (6,8) on *Activity Sheet 2*).

Wrap Up

Share answers to the scavenger hunt at a class meeting. Allow the students to help evaluate the answers that are given. What research strategies did they use? What questions do they still have about the toque macaque? What's your opinion? – Students will write an opinion paper about whether or not the Polonnaruwa Quadrangle should be modified to better help save the toque macaques. Writing this paper gives students a unique opportunity to synthesize information drawn from multiple resources, including the Internet, books, and maps, during their scavenger hunt research. The purpose is for students to share their unique point of view and to persuade others that they have a valid view. By including their feelings, reasons and facts about the topic or situation they might be able to sway a reader to adopt their perspective.

Students will start by identifying the opinion they will express: Do you think the Polonnaruwa Quadrangle should be modified to better serve toque macaques? Either in small groups or individually have students decide which point of view or opinion they will take. Have students share and compare their opinions and rationales. Collect the completed opinion papers into two books. Book 1 contains all papers that were supportive of modifying the Temple Quadrangle. Book 2 contains all papers that were not supportive of modifying the Temple Quadrangle.

Provide students with options on how to support local wildlife. Share www.rootsandshoots.org/mapping as a resource for students interested in discovering how they can begin to identify the needs of their own community. In doing so, students will learn about the people, animals and environment around them and where effective campaigns for positive change can begin.

Keep Going

Enrich students' insights into the Polonnaruwa toque macaque habitat with extension activities from different content areas.

SCIENCE: Amazing Fig Pollination

Students can learn about an important food source in the toque macaque's habitat by exploring the inside of a fruit from a banyan fig tree. They may also gain insights into the unique pollination of figs. First, students can taste a spoonful of fig preserves or pieces of figs. Discuss the taste and texture of the fruit and consider why toque macaques enjoy this delicious fruit. Second, discuss the concept of plant pollination. Pollination is the process in which pollen is transferred from a flower's stamen to the pistil and the fertilized eggs become seeds. Many different types of animals contribute to pollination such as hummingbirds, butterflies, bats and bees. Because of these fantastic pollinators, people and animals are able to enjoy colorful flowers, delicious chocolate and healthy fruits and vegetables like figs. Explain that the fig tree has a unique process for pollinating its fruit with the help of wasps. Share this website for a detailed explanation of the process. Next, cut open figs for students to observe in small groups. They can use magnifying lenses to closely examine the insides of the fig and then draw and label pictures of what they observe. Inside they will find a cluster of seeds and flowers packed closely together. Finally, explain that because of this unusual chamber-like arrangement, the fig can be pollinated only by the fig wasp. This wasp squeezes inside the chambers, deposits her eggs and sheds the pollen that she brought with her from another fig.

Share this link, The Queen of Trees: Mutual Dependence, for a glimpse of a wasp at work pollinating figs.

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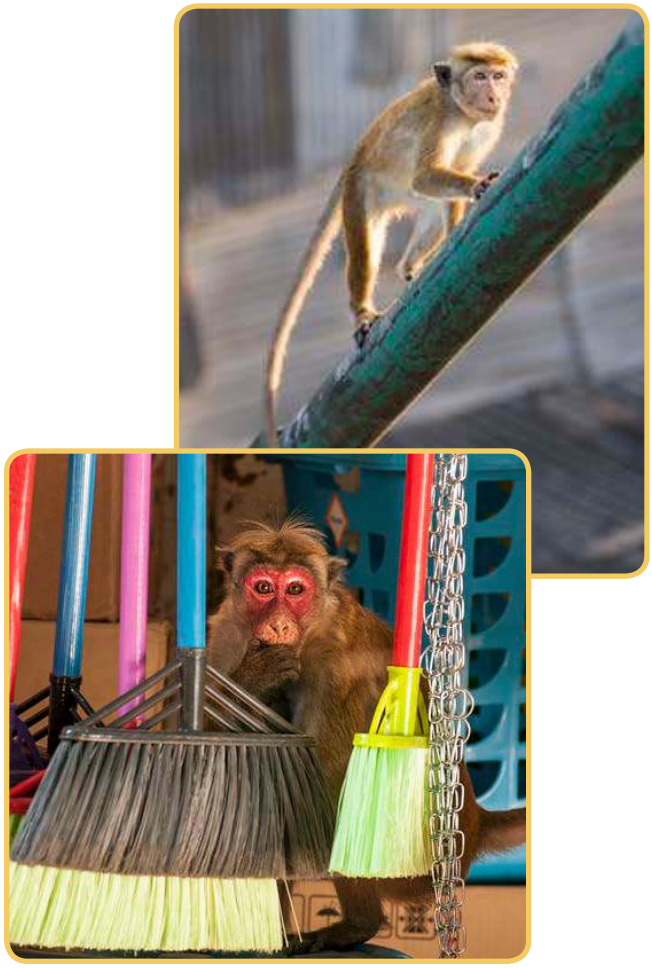
Where Do Toque Macaques Live? 1

RESOURCES FOR TEACHERS

Websites

1. ARKIVE
   http://www.arkive.org/toque-macaque/macaca-sinica/
2. BBC Nature: Wildlife
   http://www.bbc.co.uk/nature/life/Toque_macaque
3. How to pronounce Polonnaruwa – [poh-luhn-uh-**roov**-uh]
   http://dictionary.reference.com/browse/polonnaruwa
4. The IUCN List of Threatened Species
   http://www.iucnredlist.org
5. National Geographic
   http://channel.nationalgeographic.com/wild/fight-for-life/articles/slum-monkey-facts/



RESOURCES FOR STUDENTS

Books

1. Hartman, Gail. *As the Crow Flies: A First Book of Maps.* New York: Aladdin, 1993. ISBN-10: 0689717628
2. Olien, Rebecca. *Map Keys (Rookie Read – About Geography)*. New York: Children's Press, 2012. ISBN-10: 0531292894

Websites

1. ARKIVE
   http://www.arkive.org/toque-macaque/macaca-sinica/
2. National Geographic Map Machine
   http://plasma.nationalgeographic.com/mapmachine

ANSWER KEY

Lesson 1 - Activity Sheet 1:

WHERE DO TOQUE MACAQUES LIVE?

1. **A species at risk of extinction.**
2. **Habitat destruction, poaching, illegal pet trade.**
3. **Resources are limited and when gone macaques cannot search for more outside the island.**
4. **Mainly fruits but also plants, insects, sometimes reptiles and birds.**
5. **Asian water monitor, Mugger crocodile, leopard, and snakes.**
6. **The central heart of the island, in the Cultural Triangle.**

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Where Do Toque Macaques Live?

The race is on! Can you help the toque macaques navigate through their habitat? Read the questions below, use the map on Activity Sheet 2 and record answers on a separate sheet of paper.

1 SCIENCE

1. What does endangered mean?
2. Identify two threats to toque macaques.
3. How does living on an island impact the macaques?
4. What do toque macaques eat?
5. Identify one natural predator of the toque macaque.

2 GEOGRAPHY

6. Where in Sri Lanka is the Polonnaruwa Quadrangle?

For the following questions, use the Activity Sheet 1 map and identify the coordinate pair. Some questions may have multiple answers.

7. Where might the toque macaques find food?
8. Where might the toque macaques bathe? Why?
9. What building is found at coordinate (6,8)?

For the following questions, use the Activity Sheet 1 map.

10. Where do you think the macaques could go to sleep safely? Explain your answer.
11. What quadrangle should the macaques visit to find their banyan tree?
12. Use the scale provided to measure the distance from the banyan tree to the closest water source. What obstacles, if any, are between the banyan tree and the water source?
13. If you wanted to walk around the perimeter of the Polonnaruwa Quadrangle, about how many yards or meters would you travel?
14. Which building touches the fewest grid areas?

BONUS

15. Use the map to determine which building touches the greatest number of grid areas. Does that mean it is the largest building?

Don't Feed The Animals.

Toque macaques are omnivores and eat a wide variety of foods. It is important to not feed wild animals because they can become dependent on humans for their next meal. Observe wildlife from a distance and remember our yummies are not good for their tummies!

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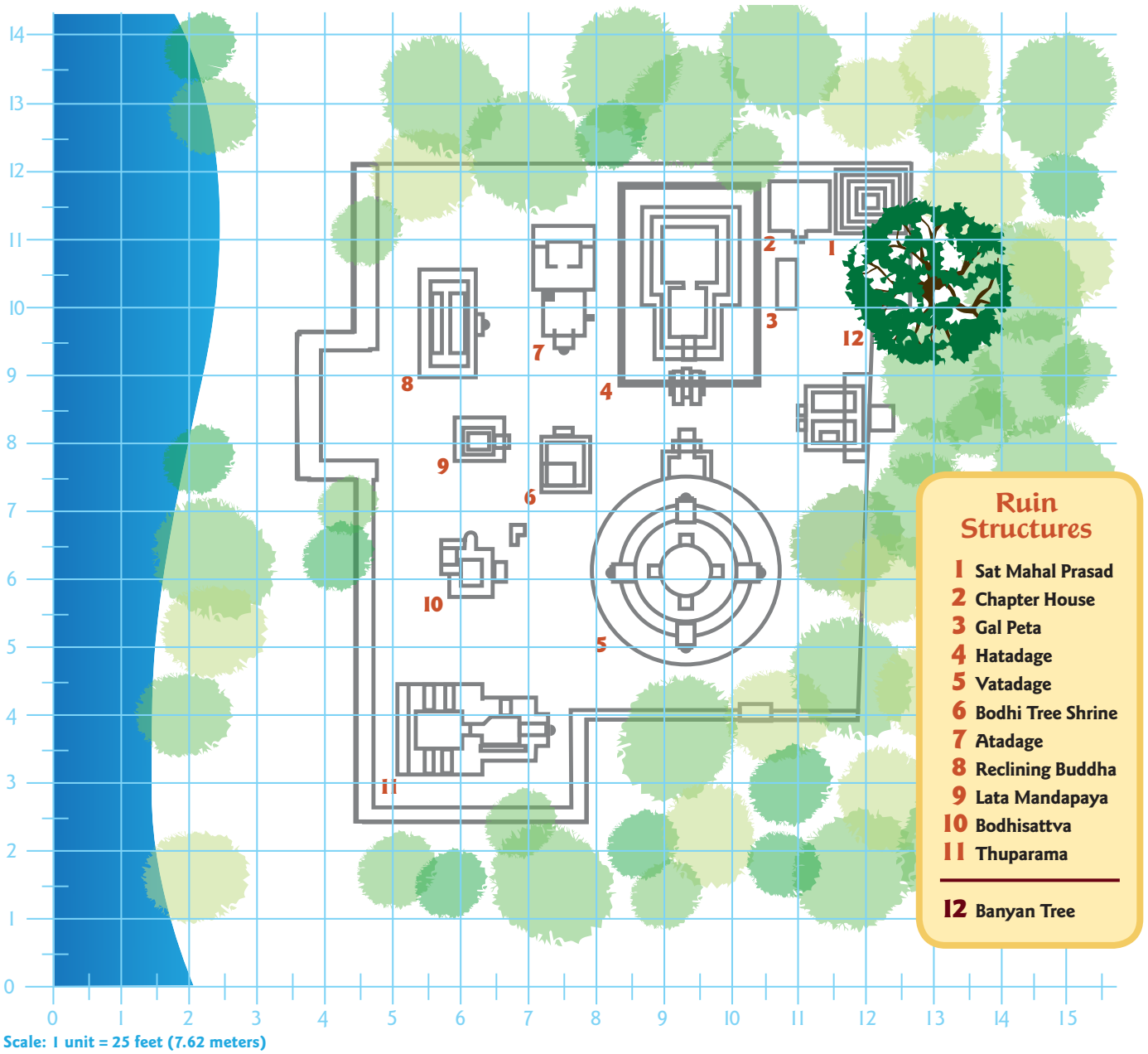
Map of a Quadrangle in Polonnaruwa



Scale: 1 unit = 25 feet (7.62 meters)

Ruin Structures

1 Sat Mahal Prasad
2 Chapter House
3 Gal Peta
4 Hatadage
5 Vatadage
6 Bodhi Tree Shrine
7 Atadage
8 Reclining Buddha
9 Lata Mandapaya
10 Bodhisattva
11 Thuparama

12 Banyan Tree

Don't Feed The Animals.

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LESSON 2

Who Shares a Banyan Tree with the Toque Macaques?

THEME
Habitat & Biodiversity

GRADE LEVEL
2-3

SUBJECT AREAS
Focus:
Science & Art

Extensions:
Language Arts & Math

BACKGROUND INFORMATION
Pages 10-14

VOCABULARY
biodiversity, dry evergreen forest, dry tropical deciduous forest, dry zone, ecosystem, habitat, lake, low relief mural, river, texture, tropical forest

STUDENTS WILL BE ABLE TO...
- Create a mural that depicts toque macaque life in the banyan tree at the ruins of Polonnaruwa
- Describe how the banyan tree and surrounding area serves as a unique habitat
- List the animals who share the banyan tree with the toque macaque
- Conduct and report research on other animals of Polonnaruwa in the banyan tree habitat

WHAT YOU NEED
- Brown and white butcher or bulletin board paper (recycled if available)
- Blue crepe or tissue paper
- White and green card stock
- Colored markers
- Glue
- Tape
- Scissors
- *Activity Sheet 1: Banyan Tree Images and Outline of a Banyan Leaf*
- *Activity Sheet 2: Diagram of a Banyan Tree*
- *Activity Sheet 3: Biodiversity of Polonnaruwa*
- *Activity Sheet 4: Research an Animal or Plant of Polonnaruwa*

Warm Up

Focus students' attention on how Disneynature **MONKEY KINGDOM** shows the important role a banyan tree plays in the lives of the toque macaque troop, a dynamic group of monkeys struggling to survive in Polonnaruwa, Sri Lanka. The banyan tree is nestled in the **dry evergreen forest** of Sri Lanka. This rich environment combines characteristics of a wet **tropical forest** with a **dry tropical deciduous forest** – open woodland that has a long dry season followed by a season of heavy rainfall. Life in the banyan tree, from the top of the branches to the roots on the forest floor, is both enriched and threatened by a cast of characters that represent the **biodiversity** of the local animal community.

Get Started

STEP 1: Students will create a banyan tree **low relief mural** to explore the biodiversity of the toque macaques' **habitat**. Share *Activity Sheet 1* with students and have them individually sketch out ideas for the shape, design and size of the banyan tree for the mural. As a class, students vote for the top three designs, which then can be combined into a new collaborative tree design. Using a projector, grid-drawing method, or free-hand drawing, enlarge the design of the tree and trace the outline onto a large sheet of paper (large enough for a classroom bulletin board or wall). Next, cut brown butcher paper into strips of various lengths and widths (minimum of six inches). Thicker, longer rolls will make the trunk. Thinner, shorter rolls will make branches. Have students twist the paper strips and braid strands together. Glue the twisted paper strips to one another and then to the paper in the outline of the tree to form the tree bark.

Have each student use *Activity Sheet 1* as a guide to make 6-8 banyan leaves per person. Glue or tape banyan leaves to branches of the tree.

STEP 2: Have students use colored markers to draw trees and shrubs in the background. Have them twist and glue blue crepe paper or tissue paper strips to make the **lake** and the **river** that flows near the tree.

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STEP 3: Discuss the type of troop activities that take place in or around the banyan tree that students observed in Disneynature **MONKEY KINGDOM** film trailer or from other non-fiction resources. Distribute *Activity Sheet 2*. Have students list toque macaque activities (foraging for food, sleeping, grooming, swimming, avoiding predators, etc.) that would take place in each part of the banyan tree. Students will then use images of toque macaques as a guide to draw, color and cut out their individual macaques to add to the mural.

Wrap Up

Discuss and brainstorm a list of other animals and plants students observed in Disneynature **MONKEY KINGDOM** trailer or film. Students can select a species from either their brainstormed list or *Activity Sheet 1*. Students will conduct research and complete *Activity Sheet 4*. Students will draw their animal, adding **texture** through patterns. with colored markers. Then they will attach their animal or plant to the habitat mural and share information about how the banyan tree and surrounding area provide food, water, shelter, and a place to raise young for toque macaques. Conclude by discussing how the banyan tree and surrounding area serve as a habitat for the toque macaque troop and other creatures.

Keep Going

Enrich students' insights into the Polonnaruwa banyan tree habitat with extension activities from different content areas.

LANGUAGE ARTS: Would I Enjoy a Toque Macaque Diet?

Invite students to compare the type of food they eat with the food eaten by the toque macaques.

STEP 1: Have students make a menu of things they normally eat for breakfast, lunch or supper. Then, ask students to personalize the names of the dishes (e.g., John's Jammin' Scrambled Eggs; or Fiona's Fantastic Fruit Salad).

STEP 2: Have them make a menu of things they observed the toque macaques eating. Name the items relevant to their location (e.g., a termite dish might be called Marvelous Mound Mealtime; a banyan tree area dish might be called Fresh Banyan Tree Delight).

STEP 3: Have students compare when and where they eat to when and where the monkeys eat. Compare the variety of food in each diet. Would the students enjoy eating the toque macaque daily diet? Discuss and share opinions as to why or why not?

MATH: How Much Brown Paper Did We Use to Make our Banyan Tree Trunk?

In this activity, students will keep a record of the amount of brown butcher paper they use to make the tree and then calculate the total area of the paper in square feet and/or square meters.

Finding the total area of paper used in inches or centimeters:

a) As students take paper from the brown paper butcher roll they used, have them measure the total length of the paper they take and record this in the "Paper Record." Measurements should be in feet and inches or in meters and centimeters.

b) The width of the roll of brown butcher paper should also be recorded (same units).

c) After the students have completed their tree, they should use their "Paper Record" to calculate the total length of butcher paper used in their tree.

d) If the total length is in feet and inches, they should convert to a total number of inches (12 inches in each foot). If in meters and centimeters, convert to a total number of centimeters (100 centimeters in one meter).

e) Students should now multiply this total length by the width of the butcher paper, taking care that BOTH measurements are in the same units (inches x inches, centimeters x centimeters).

f) The result of this calculation is the total area of the brown paper used in the tree (assuming there was no waste).

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g) If there *was* waste (paper strips not used or whole sheets not used) then students would need to calculate the area of the waste paper (measuring length and width of strips in inches or centimeters, and calculating the total area of the unused paper). The total area of unused paper should then be subtracted from the total area of brown paper recorded in their "Paper Record."

If you want to go further, have students convert from square inches to square feet or from square centimeters to square meters or you can even have them calculate the total area of brown paper used in the tree in square feet or square centimeters.

RESOURCES FOR TEACHERS

Books

1. Loewen, Nancy. *Just the facts: Writing Your Own Research Report.* Minnesota: Picture Window Books, 2010. ISBN 978-1-4048-5702-5

Websites

1. ARKIVE
   http://www.arkive.org/toque-macaque/macaca-sinica/
2. KEW Royal Botanical Gardens
   http://www.kew.org/science-conservation/plants-fungi/ficus-benghalensis-banyan
3. Birds of Sri Lanka
   http://www.primates.lk/birds/polonnaruwa-bird-list
4. Starr on Birds and Wildlife
   http://www.starronbirdandwildlife.com/3_wildlife/wildlife.php
5. Animal Diversity Web
   http://animaldiversity.ummz.umich.edu/accounts/Macaca_sinica/
6. Monsoon Forest
   http://www.britannica.com/EBchecked/topic/390333/monsoon-forest

RESOURCES FOR STUDENTS

Books

1. Brenner, Barbara. *One Small Place in a Tree*. New York: HarperCollins, 2004. ISBN-10: 068817180X
2. Silver, Donald. *Tropical Rain Forest.* New York: McGraw-Hill, 1998. ISBN-10: 0070580510

Websites

1. Lincoln Elementary School Mural - speed painting
   https://www.youtube.com/watch?v=QrFHW5qJYhI
2. Millersville Elementary School Mural with Andee Rudloff
   https://www.youtube.com/watch?v=WuOqmxvGHHQ

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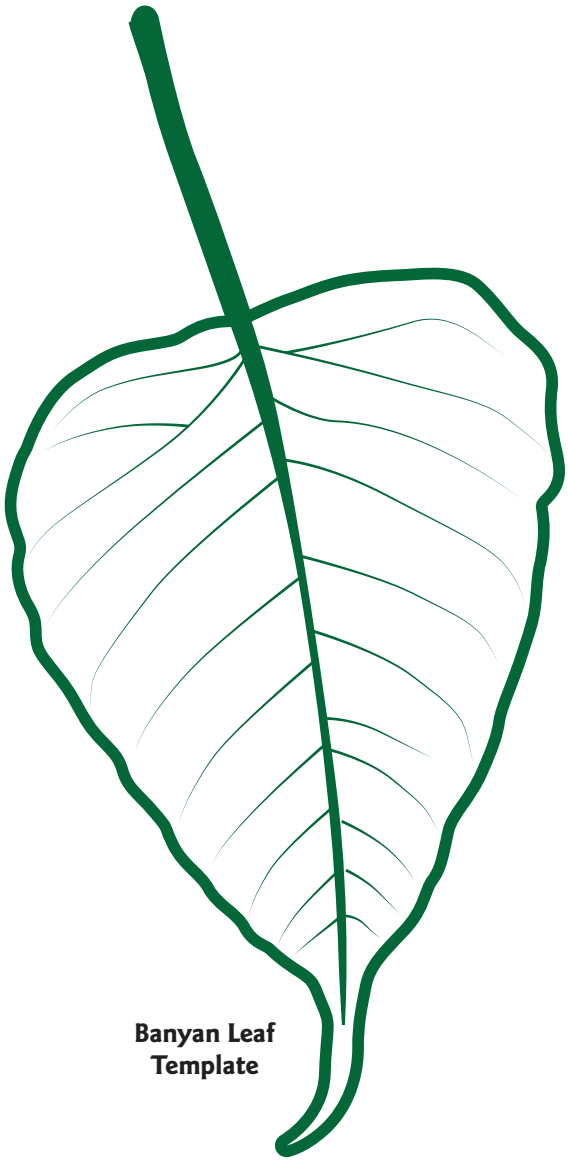
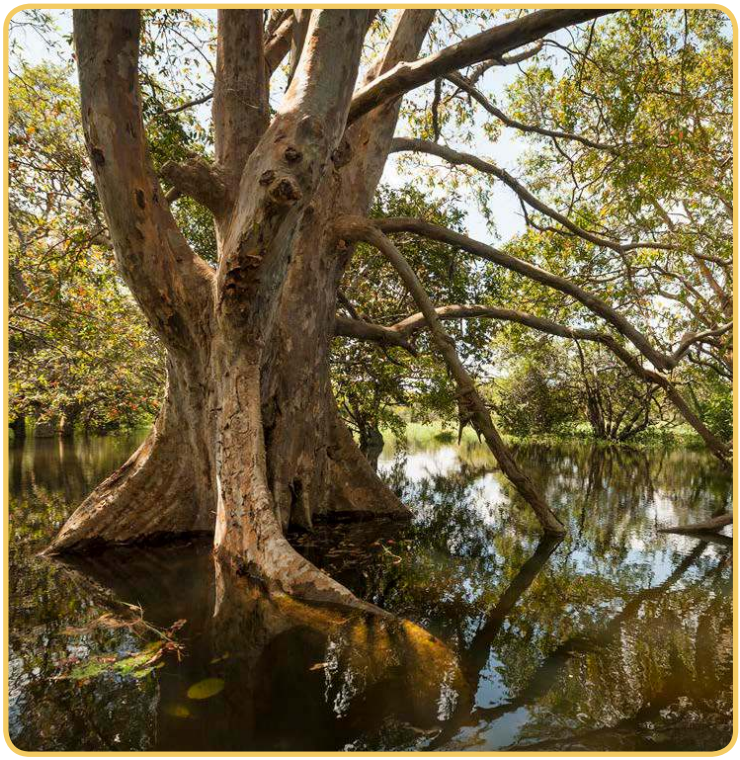
Banyan Tree Images and Banyan Leaf



Banyan Leaf Template



Plant A Tree.

For these tropical forest animals, life revolves around the banyan tree as it provides food and shelter for its inhabitants. Create your own wildlife habitat by planting a tree near your home, school or local park.

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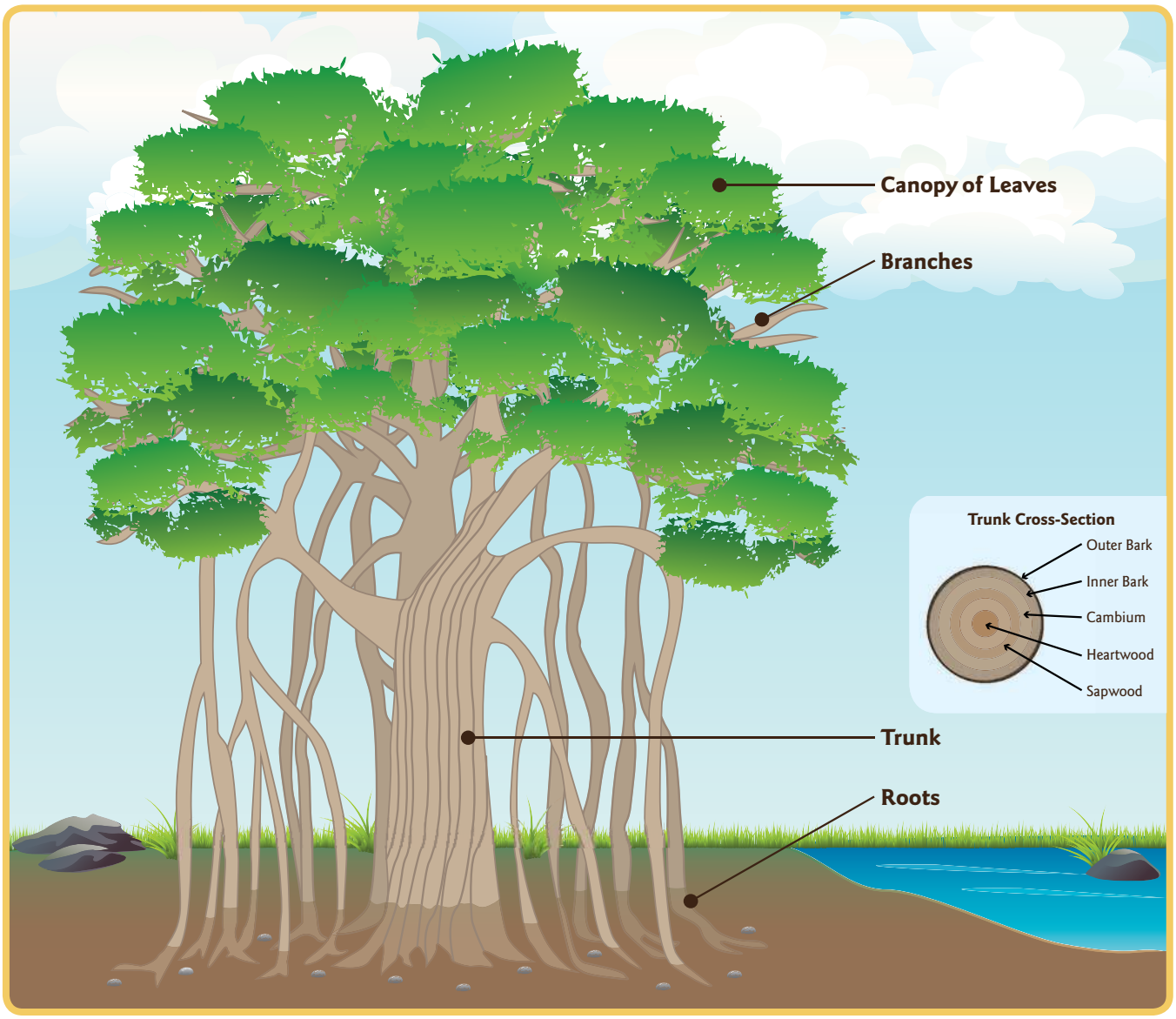
Diagram of a Banyan Tree

List at least one toque macaque troop activity you observed in each part of the banyan tree or ground below.



Plant A Tree. For these tropical forest animals, life revolves around the banyan tree as it provides food and shelter for its inhabitants. Create your own wildlife habitat by planting a tree near your home, school or local park.

Disneynature Monkey Kingdom

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Biodiversity of Polonnaruwa

The following list is only a small sample of the incredible biodiversity found in the tropical forests of South Asia. In Polonnaruwa alone, there are over 160 species of birds, 30 species of mammals and a variety of large and small reptiles and amphibians that live in this incredible habitat.

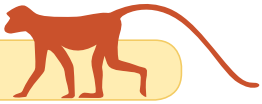
AMPHIBIANS

Common Toad
Golden Shrub Frog
Leaf Dwelling Shrub Frog
Nollert's Toad
Red Narrow-Mouthed Frog

BIRDS

Black-Headed Yellow Bulbul
Brown-Capped Babbler
Golden-Fronted Leafbird
House Crow
Indian Pitta
Red-Rumped Swallow
Scarlet Minivet
Sri Lankan Magpie
White-Browned Bulbul
White-Throated Flowerpecker

PRIMATES



Purple-Faced Langur
Red Slender Loris
Toque Macaque
Tufted Gray Langur

FLOWERS

Orchid
Hibiscus
Lotus
Ruk Aththana

MAMMALS

Asian Elephant
European Otter
Fishing Cat
Golden Jackal
Golden Palm Civet
Indian Flying Fox
Indian Gray Mongoose
Indian Muntjak
Layard's Palm Squirrel
Sloth Bear
Water Buffalo

TREES

Indian Banyan Tree
Ebony
Mahogany
Satinwood
Teak

BUTTERFLIES

Common Birdwing
Ceylon Tiger
Tree Nymph

REPTILES

Asian Water Monitor
Black Turtles
Brown Vine Snake
Cat Snake
Geckos
Green Forest Lizard
Green Vine Snake
Painted Lipped Lizard
Python
Rat Snake
Star Tortoise

INVERTEBRATES

Beetle
Red Dragon
Scorpion
Termite

FISH

Carp
Eel
Tilapia

Plant A Tree.

For these tropical forest animals, life revolves around the banyan tree as it provides food and shelter for its inhabitants. Create your own wildlife habitat by planting a tree near your home, school or local park.

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Research an Animal or Plant of Polonnaruwa

As a group, research your assigned tropical forest animal or plant at the library or on the Internet to complete the sections below. Be prepared to share with the class.

ANIMAL OR PLANT:

Draw a picture of your animal or plant in this space.

ANIMAL OR PLANT:

PHYSICAL DESCRIPTION:
What does the animal or plant look like?

NOURISHMENT:
What does your animal or plant eat?

SHELTER:
What part of the banyan tree does your animal or plant inhabit?

HABITS OR BEHAVIOR:
What is special about your animal pr plant?

BONUS: RELATIONSHIP TO THE TOQUE MACAQUE
Is your animal or plant a friend, predator or food for the toque macaques?

Plant A Tree. For these tropical forest animals, life revolves around the banyan tree as it provides food and shelter for its inhabitants. Create your own wildlife habitat by planting a tree near your home, school or local park.

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LESSON 3

How is a Toque Macaque Troop Organized?

THEME
Behavior

GRADE LEVEL
4-6

SUBJECT AREAS
Focus:
Science, Art & Language Arts

Extensions:
Math, Music & Social Studies

BACKGROUND INFORMATION
Pages 9-10

VOCABULARY
behavior, forage, gender, hierarchy, ranking, status, troop

STUDENTS WILL BE ABLE TO...
- Identify a range of toque macaque behaviors
- Align events with status based on toque macaque behaviors
- Connect why the behaviors of toque macaques occur across different scenarios

WHAT YOU NEED
- Paper
- Pencils
- Markers
- Scissors
- *Activity Sheet 1: Animal Cards*
- *Activity Sheet 2: Behavior Question Cards*
- *Activity Sheet 3: Character Scenario Cards*
- *Activity Sheet 4: Status Hierarchy Organizer*

Warm Up

After viewing the Disneynature **MONKEY KINGDOM** film or film clips, ask students to discuss the fascinating mix of comedy and drama they saw. It won't take long for children to realize that the monkeys' **behaviors** were frequently influenced by many factors, including their age, **gender**, and **status** or **ranking** in the **troop**. Toque macaques live in a hierarchical society, meaning they have a distinct **hierarchy** or "pecking order". Explain that students will play a game involving sets of cards and an organizer to further explore toque macaque behaviors.

Get Started

STEP 1: Distribute *Activity Sheet 1* to students. After they cut the cards out, invite them to look at each of the cards, read the information and discuss the cards. Which cards give good descriptions of the characters? What information would they add? Notice that there are three blank cards in each set. Students may create cards for other members of the toque macaque troop. Explain that they will be using the cards in a game.

STEP 2: Preparation – Students form groups of four. Distribute one copy of *Activity Sheet 2* and one copy of *Activity Sheet 3* to each group. Be sure each group has scissors, paper and pencils. Students cut out each set of cards.

Set up – One student takes on the role of recording everyone's points (students can switch role and play again). Students gather in groups of four, placing both decks (Behavior Question Cards and Character Scenario Cards) in the middle of the group. Students hold their Animal Cards in their hands. **One student serves as the Game Manager. They will not play, but rather will read aloud the card questions.** The Game Manager uses the answer key to check the accuracy of players' answers.

Game play – The Game Manager starts the game by drawing a card from the Character Scenario Cards deck. After reading a card aloud, players look through their Animal Cards and select one or more cards they believe fit the scenario. Discuss any differences in animals selected by the students. Determine who pulled the correct card. The Game Manager reads aloud the correct answer from the answer sheet. If student responses were correct, they receive a point. Continue alternating

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How is a Toque Macaque Troop Organized? 3

questions from each deck until all the cards have been used. When the last card has been played, the player with the most points wins, but the fun isn't over yet.

STEP 3: Determine status of toque macaque characters
After students have reviewed toque macaque behaviors from playing the game, distribute *Activity Sheet 4.* Explain that a hierarchy organizer helps us see distinct levels or ranks of monkeys that begin with the top-ranked individuals and move down to bottom-ranked individuals in a social group. They will place one or more Animal Cards in each category. For example, students place the trading cards of individual dominant male and female monkeys at the top of the organizer. Tell students that their task is to arrange all of the Animal Cards on the hierarchy organizer in a way that demonstrates their rank in the troop. Suggest that students begin by clustering together one or two cards of monkeys that seem to have the same type of behaviors, a factor that can help indicate rank.

Wrap Up

Students compare how they have arranged the toque macaque characters on the hierarchy organizer, and discuss differences or similarities. Would it be better to be a high or low ranking toque macaque? Why?

Keep Going

Enrich students' insights into how toque macaque behaviors align with their status in the troop with extension activities from different content areas.

MATH: Where do I Belong? – Logic Game

After students have examined all of the Animal Cards and discussed the attributes of each animal, they are ready to play a game that highlights those attributes.

STEP 1: Have students make a large Venn Diagram by drawing a two circle Venn Diagram on butcher paper or placing two hula hoops on the floor.

STEP 2: Students use index cards to label one circle with one of the attributes (e.g. Male) and the other circle with another attribute (e.g. Adult). Have students sort their cards, placing them in the appropriate hoop or circle (what happens to the adult males? Where do they go?) Students label the overlapping space (e.g., Adult Male). Once all cards are placed appropriately (all female students will be outside the hoops) the following questions should be asked:

- I am inside the hoops but I am not male, what can you say about me? (I am an adult female)
- I am inside both hoops, what kind of monkey am I? (Adult male)
- I do not fit in either hoop. What am I? (female child)
- I am inside the hoops; if I am a child I must be? (Male)
- I am inside the hoops; if I am female I must be? (an adult)

STEP 3: Students will enjoy selecting titles/labels for each of the circles. The questions they ask will change based on the attributes used for each circle.

MUSIC: What's on Your Playlist?

Students will choose melodies or songs they think might represent a character found in Disneynature **MONKEY KINGDOM**. Perhaps a soothing lullaby would represent an infant macaque. A juvenile male who wants to challenge a powerful dominant male could be represented by the theme song from the movie "Rocky". Students in small groups think of different types of music or specific song titles for their favorite toque macaque characters. Students compare lists at the end of the activity and discuss their reasons for musical selections.

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SOCIAL STUDIES: Predicting the Future of the Toque Macaque

STEP 1: Ask students to look into an imaginary crystal ball and predict what the future is going to be like for one of the toque macaque characters? Students look ahead three to five years and refer to the cards to figure out an approximate age for the character they selected.

STEP 2: They write a paragraph and draw a picture of what changes have happened. Will your character have more relationships? Will your character have changed status? Will your character belong to the same troop? Share stories and discuss what factors that impact the **ecosystem** might also result in changes.

RESOURCES FOR TEACHERS

Books

1. Van Vilet, Rolina. *Abstract Painting: A Guide to Creativity and Free Expression.* Petaluma, CA: Search Press, 2009. ISBN-13: 978-1844484270

Websites

1. Artists Trading Cards
   http://www.edu.uwo.ca/ask/art/lp/extra-atc.pdf
2. Sri Lanka's official travel website
   http://srilanka.travel/index.php?route=common/home
3. Favorite Character Trading Cards Activity
   http://www.scholastic.com/teachers/article/favorite-character-trading-cards-activity

RESOURCES FOR STUDENTS

Books

1. Blashfield, Jean. *Rescuing Endangered Species.* Chicago: Children's Press, 1994. ISBN: 0516055445
2. Turner, Sarah E. *Ribbon's Way.* Victoria, BC, CA: Orca Book Pub, 2013. ISBN: 9781550392005
3. Turner, Sarah E. *The Littlest Monkey.* Winlaw, BC, CA: Sono Nis Press, 2010. ISBN: 9781550391747

Websites

1. Trading Card Creator
   http://www.readwritethink.org/classroom-resources/student-interactives/trading-card-creator-30056.html

ANSWER KEYS

Lesson 3 - Activity Sheet 2:

BEHAVIOR QUESTIONS

CARD A: **a) True**
CARD B: **c) Looking for food**
CARD C: **a) True**
CARD D: **a) True**
CARD E: **a) Keep relationships strong**
CARD F: **b) Repetition and watching other members of the troop**
CARD G: **a) Is large and well groomed**
CARD H: **b) Avoid pedators**
CARD I: **a) Release energy and learn how to fight for protection**
CARD J: **a) True**
CARD K: **c) Has the most resources**
CARD L: **c) Both a and b**
CARD M: **b) False**
CARD N: **b) An alpha male**
CARD O: **b) Water**

Lesson 3 - Activity Sheet 3

CHARACTER SCENARIOS

CARD A: **Troop leader**
CARD B: **Dominant males and females**
CARD C: **All macaques**
CARD D: **Family group**
CARD E: **Younger macaques**
CARD F: **Dominant males and females**
CARD G: **Lowest ranking macaques**
CARD H: **Highest ranking males and females**
CARD I: **Infant macaques**
CARD J: **Highest ranking female in hierarchy**
CARD K: **The rival troop's dominant male**
CARD L: **Highest ranking macaque**
CARD M: **Lowest ranking macaque**
CARD N: **Mother and infant**
CARD O: **Ugly Sisters and Maya**

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How is a Toque Macaque Troop Organized?

Animal Cards

My name is:

MAYA

GENDER: Female

BEHAVIOR: Independent, motherly, resourceful

RELATIONSHIPS: Mother to KIP

My name is:

KIP

GENDER: Male

BEHAVIOR: Curious, still learning

RELATIONSHIPS: Son of MAYA

My name is:

RAJA

GENDER: Male

BEHAVIOR: Protective, responsible

RELATIONSHIPS: Alpha male of the Castle Rock macaques

My name is:

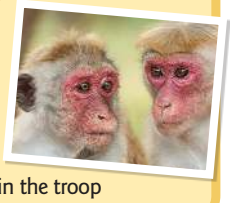
KUMAR

GENDER: Male

BEHAVIOR: Intelligent, earns respect of others

RELATIONSHIPS: Sub-alpha male to RAJA

We are: **THE SISTERHOOD**



GENDER: Female

BEHAVIOR: Privileged, controlling, loyal to each other

RELATIONSHIPS: Highest ranking females in the troop

My name is:

GENDER:

BEHAVIOR:

RELATIONSHIPS:

My name is:

GENDER:

BEHAVIOR:

RELATIONSHIPS:

My name is:

GENDER:

BEHAVIOR:

RELATIONSHIPS:

Take Action!

Toque macaques live in groups called troops. Join or start your own group or club that pledges to help protect plants and animals! Take action by planting a community garden or participating in a waterway clean up.

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Behavior Question Cards

Set I

A. Highest ranking females may take food out of a lower ranking female's mouth:
a) True
b) False

Set I

B. When macaques spend time foraging, that means they are:
a) Getting ready for sleep
b) Grooming
c) Looking for food

Set I

C. High ranking born females do not have the right to the best resources:
a) True
b) False

Set I

D. A male gains dominance by fighting the alpha male and winning:
a) True
b) False

Set I

E. Macaques groom each other to:
a) Keep relationships strong
b) Try new hairstyles
c) Practice digging

Set I

F. Infant toque macaques learn by:
a) Watching other species of animals
b) Repetition and watching other members of the troop
c) Taking a test

Set I

G. A troop's dominant male is usually easy to identify because he:
a) Is large, muscular and well groomed
b) Is small and dirty
c) Avoids predators and rival troops

Set I

H. Toque macaques sleep in the canopy of trees hugging each other in a line because:
a) Sleeping space is limited in trees
b) Huddling together provides warmth
c) They structure the troop hierarchy by judging who is tallest

Set I

I. Young toque macaques play fight in order to:
a) Release energy and learn how to fight for protection
b) Get first choice of food
c) Avoid boredom

Set I

J. Lower ranked females must be resourceful and clever to survive:
a) True
b) False

Set I

K. Troops will defend and fight over territory that:
a) Has the prettiest views
b) Has the most monkeys
c) Has the most resources

Set I

L. Toque macaques vocalize or call to their troop in order to:
a) Alert for predators
b) Notify about a food source
c) Both a and b

Set I

M. Toque macaques do not get along with any other animals:
a) True
b) False

Set I

N. _____ gets the best location for food over other macaques:
a) A baby macaque
b) An alpha male
c) The largest female

Set I

O. In addition to food, toque macaques look for a habitat close to:
a) People
b) Water
c) Parks

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Character Scenario Cards

Set 2

A. Who is the dominant male?

Set 2

B. Who gets groomed the most?

Set 2

C. Who would like to eat a termite?

Set 2

D. Who takes care of another macaque?

Set 2

E. Who is still learning how to forage?

Set 2

F. Who forages highest in the banyan tree?

Set 2

G. Who forages closest to the ground?

Set 2

H. Who would take food from another macaque?

Set 2

I. Who clings to their mother's back?

Set 2

J. Who is the dominant female?

Set 2

K. Who is the rival to the dominant male?

Set 2

L. Who do you think could survive on their own?

Set 2

M. Who do you think could not survive on their own?

Set 2

N. Play two macaques that are related.

Set 2

O. Play two macaques that do not get along.

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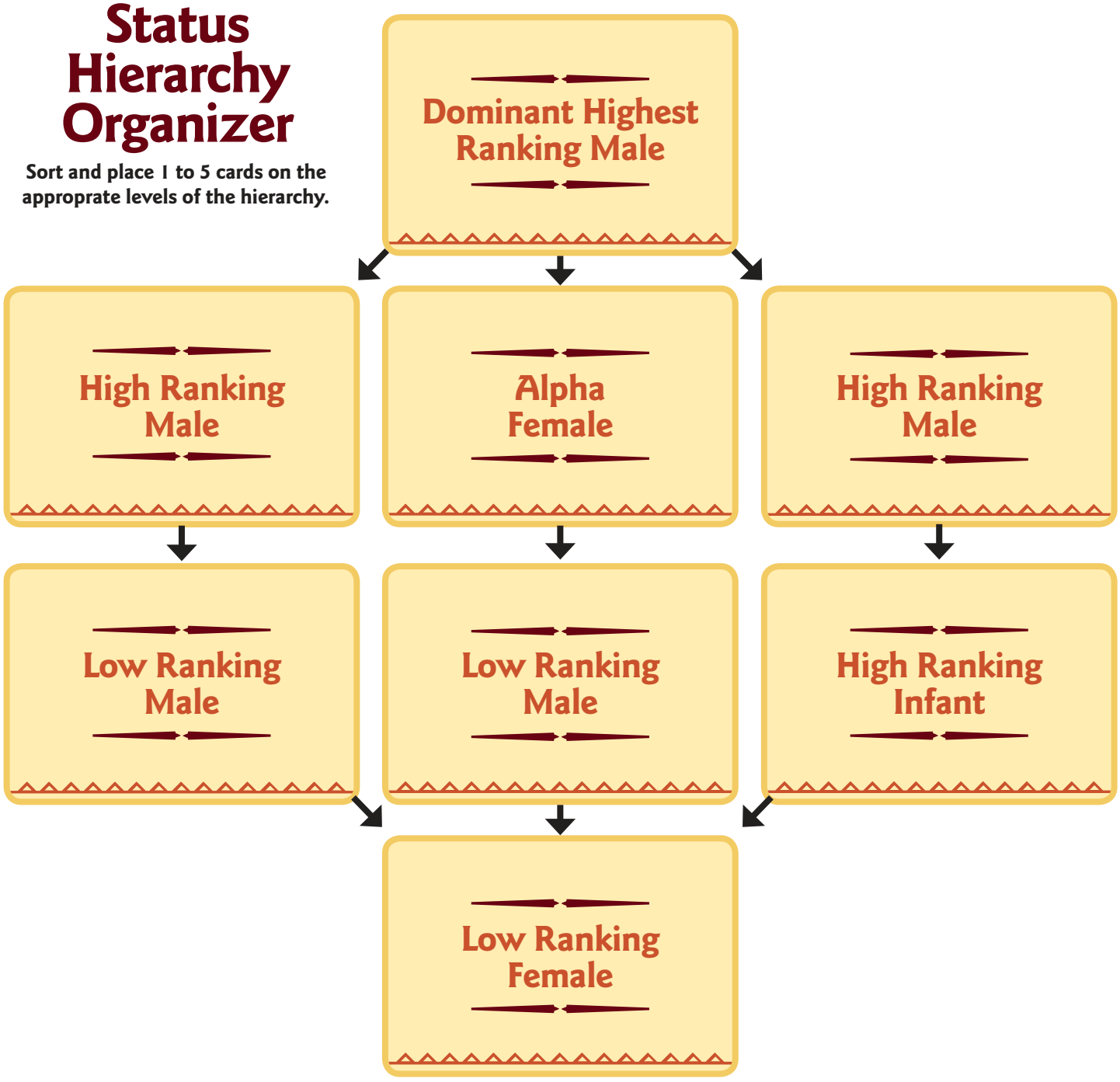
How is a Toque Macaque Troop Organized?

Status Hierarchy Organizer

Sort and place 1 to 5 cards on the approprate levels of the hierarchy.



Take Action!

Toque macaques live in groups called troops. Join or start your own group or club that pledges to help protect plants and animals! Take action by planting a community garden or participating in a waterway clean up.

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LESSON 4

How Do Toque Macaques Communicate?

THEME
Communication

GRADE LEVEL
2-3

SUBJECT AREAS
Focus:
Science, Art & Math

Extensions:
Math & Science

BACKGROUND INFORMATION
Pages 11-12

VOCABULARY
circle, dominant, hexagon, isosceles trapezoid, mid-point, non-verbal, perpendicular, rectangle, reflection, repeating pattern, rotation, rotational symmetry, square, submissive, symmetry, tessellation, translation, triangle, verbal

STUDENTS WILL BE ABLE TO...
- Identify symmetry of toque macaque faces
- Demonstrate how symmetry of toque macaque faces approximates symmetry of geometric shapes
- Conduct mathematical transformations of approximated shape
- Explain the difference between verbal and non-verbal communication
- Identify various toque macaque facial expressions

WHAT YOU NEED
- Small, flat mirrors or "miras" (see-through red plexiglas that also works as a mirror)
- Sets of geometric shapes cut from card stock
- Card stock
- Scissors
- Tracing paper
- Construction paper
- Pencils
- Crayons or markers
- *Activity Sheet 1: Tessellation Resources*
- *Activity Sheet 2: Symmetry in a human face*
- *Activity Sheet 3: Symmetry in a toque macaque face*
- *Optional Activity Sheet 4: Write a List Poem*

Warm Up

One way for students to explore how toque macaques communicate is through their facial expressions. Using **tessellation** students can explore facial expression in a new way. Explain that tessellations are **repeating patterns** of shapes of the same size that all fit together without leaving any gaps – like some jigsaw puzzles. In some tessellations, a motif design element, such as an animal, flower, or leaf, is repeated in a geometric pattern. The design of many floor tiles in Sri Lanka and India have **square**, **rectangular**, **hexagonal** or **triangular** tiles that create intricate patterns or borders drawn from nature. Share *Activity Sheet 1* with students and point out how the sections with repeating shapes emphasize and communicate the themes or motifs of the beauty, order and serenity of nature. Shapes that tessellate have lines of **symmetry** and also **rotational symmetry**. An **isosceles trapezoid** will also tessellate the plane using 180-degree rotation about the **mid-point** of its slant edges. Following is an example of a tessellation formed from an isosceles trapezoid (see Figure 1.1):

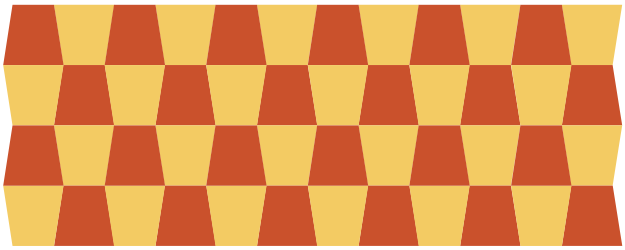

Figure 1.1: A tessellation of isosceles trapezoids

Get Started

STEP 1: Finding human-face symmetry
Brainstorm a list of ways that different animals communicate. Encourage students to also think about ways people communicate with each other. Record this list on the board and sort words into two categories: **verbal** and **non-verbal** communication. Ask students to explain the difference between verbal and non-verbal communication. Visit this YouTube link and play the various toque macaque vocal calls listed. Ask the students to describe what they hear and what

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the call might mean before providing the answer. Once all calls have been played, have students act out some of the following words using non-verbal communication: happy, playful, sad, scared, **dominant** (when an animal says "I want my way!") or **submissive** (when an animal says to another "I am not a threat, I do not want to fight you."). Similar to a game of charades, the student acting should not use any words or sounds to express their emotion. Ask the rest of the class to guess which emotion they are showing. Distribute the mirrors or "miras" and cut outs of geometric shapes to peer pairs. Have each child study his own face, the face of a partner, and the geometric shapes by completing and then discussing their findings from *Activity Sheet 2*. Explain how toque macaques use facial expression to communicate as well, however the face may appear different than what humans expect of that emotion.

STEP 2: Finding monkey-face symmetry
Define the term **symmetry**. Ask students to come up with examples of symmetry in nature (i.e. butterfly wings). Explain that, just as they found symmetry in their own faces, it also appears in nature in many forms, including toque macaque faces. Distribute *Activity Sheet 3*, card-stock for cutting out shapes, scissors and tracing paper. Divide the class into groups of six or eight, assigning each group a different facial expression (contentment, sad, threatened, etc.). Have students answer the questions by looking at the monkey-faces and determining possible lines of symmetry. Next they will determine the basic shape of the face. Guide students to notice that the top edge of the face is wider than the bottom edge and that there is a line of symmetry down the center of the face. The simple geometric shape that fits this general outline is an isosceles trapezoid.

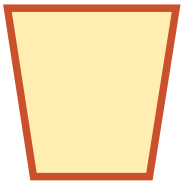

Figure 1.2: Isoceles trapezoid

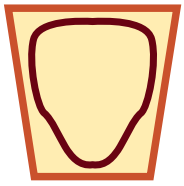

Figure 1.3: Monkey face outline in trapezoid

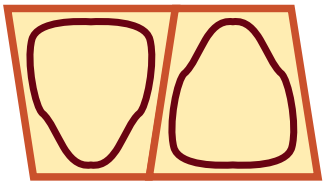

Figure 1.4: Midpoint rotation of trapezoid

STEP 3: Creating a tessellating figure based on an isosceles trapezoid
Students place tracing paper over the face of the monkey and draw a trapezoid outline. Then they draw the basic shape of the monkey face inside the trapezoid (see Figure 1.3). Have students trace this shape onto their card stock and make eight copies. Some students may realize they can rotate this shape about midpoint of one edge by 180 degrees. The rotated shape fits snugly against the first shape (see Figure 1.4). They move the tracing paper over, rotate again to make a third shape to fit snugly with the second (moving over is called a **translation** of the shape), and continue the process to complete all eight shapes before cutting them out of card stock.

STEP 4: Completing the tessellation
Each student in the group should use one of the eight copies they created in step 3 to draw their own monkey face. Once all monkey faces are complete, the group can form a tessellation of their faces similar to the one shown in Figure 1.5. Post each group's tessellations at the front of the classroom. As a class,

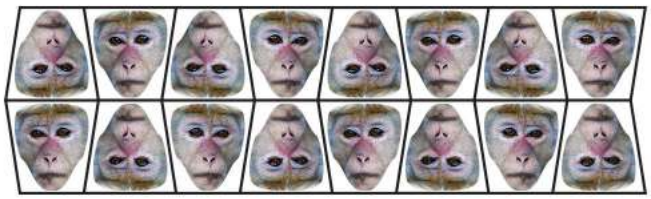

Figure 1.5: Toque macaque monkey face tessellation

Wrap Up

Mount the tessellations on paper, then display on a bulletin board. Have students explain why they think their toque macaque is contented, threatened, aggressive, etc. What emotional situations do they recall from Disneynature **MONKEY KINGDOM**? Finally, discuss how the tessellations demonstrate a repeating motif of the monkey's expressions as communicated by their facial expressions. How might another monkey respond or react to their monkey's facial expression?

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Keep Going

Enrich students' insights into communication with extension activities from different content areas.

Figure 1.6: Toque macaque monkey face tessellation with contours

MATH: Creating a Tessellating Toque Macaque Face based on an Isosceles Trapezoid (Grades 4-6)

You may notice that the tessellating monkey faces in Figure 1.6 above do not have straight edges and yet they do tessellate. The isosceles trapezoid used to create this tessellation was distorted using midpoint rotations and **reflections** of extra segments drawn on one slant edge of the trapezoid. The renowned graphic artist M.C. Escher used this technique (and many others) to create some of his famous tessellation art.

STEP 1: Start the tessellation

Have students look carefully at Figure 1.6 above. They should notice that the slanted sides of the trapezoid face have been "bent" or fractured to better fit the shape of the monkey face. The segments that make up each side of the face were constructed using special transformations: mid-point rotation and reflection. Next, have students find and mark the mid-point of each slanted edge of their trapezoid. With the trapezoid over the monkey face, students should mark a point to indicate the widest part of the face (this should be outside the slant edges of the trapezoid). Then, students should draw segments from the top of the trapezoid to this point and from this point to the midpoint of the edge.

STEP 2: Continuing the tessellation

Using a second sheet of tracing paper on top of the first, students should trace their trapezoid and the two new segments, then rotate this second sheet about the midpoint of the "fractured" edge until the edge lines up with itself (180 degrees). The students should now trace where the two new segments appear on the top sheet of tracing paper. This completes the mid-point rotation transformation of the fractured side of the trapezoid. Using the top sheet of tracing paper, with the fractured edge of the trapezoid students should fold this figure in two, vertically so that the two slant edges of the trapezoid coincide. They should now trace the fractured edge on the other side of the trapezoid, resulting in Figure 1.7, which is the result of a reflection over the line of symmetry of the isosceles trapezoid.

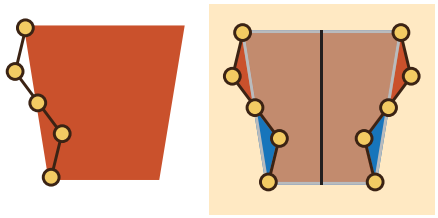
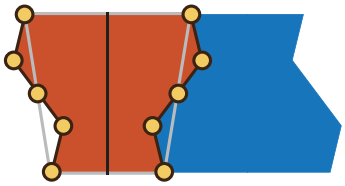


Figure 1.7: Resulting shape using reflection over the line of symmetry

STEP 3: Completing the tessellation

Have students trace this shape onto their card-stock and make eight copies. Some students may realize that they can rotate this shape about the midpoint of one edge by 180 degrees and the rotated shape will fit snugly against the first shape (see Figure 1.8). They could then move their tracing paper over, rotate again to make a third shape that fits snugly with the second (moving over is called a translation of the shape).

Figure 1.8: Result of rotation of whole shape about midpoint of right side



Students can continue with moving over (translating) and rotating their traced shape to complete all eight shapes before cutting them out of the card stock. Each student in the group should use one of the eight cutout shapes to draw in their own monkey face, perhaps using a different expression to indicate what their monkey is trying to communicate. Once all eight monkey faces are complete, the group can form a tessellation of their faces similar to the one shown in figure 1.5 on the previous page. The tessellations can be mounted on paper and displayed around the classroom.

LANGUAGE ARTS: How Can a Poem Compare the Communication of a Student and a Toque Macaque?

Students will be writing a List Poem that compares how they communicate and how toque macaques communicate in different situations.

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How Do Toque Macaques Communicate? 4

A List Poem consists of a list of things, people, places, etc. and often involves using repetitive phrases. Using repeating phrases highlights the focus and theme of the poem and provides dramatic effect when the poem is read aloud. (See Poetry Dictionary for Kids). Shel Silverstein's poem "Sick" illustrates the form and humor most List Poems take. Remind students that scientists have recorded at least 30 different toque macaque communicative vocalizations and that they can use several of them, along with some nonverbal communication to write their poems. Distribute and go over the *Optional Activity Sheet 5*. Students will perform their poems and summarize the ways toque macaques communicate their feelings.

SCIENCE: Observing Symmetry in Nature

There are many patterns of symmetry in nature. Some common examples include fall leaves, butterfly wings, animal tracks, beehives, spider webs, snowflakes, shells and many more. Many animals have symmetrical body shapes. Many plants have symmetrical patterns. For example, if you divide an oak or maple leaf in half the other side has the same shape. Insects such as beetles and butterflies also have bilateral symmetry – when divided in half one side looks identical to the other side. After sharing some examples of nature symmetry with students, the teacher can take them outdoors on a Symmetry Discovery Hunt. For younger students, the teacher can have a checklist with picture examples of nature symmetry – students place a check next to those examples they can locate outside.

RESOURCES FOR TEACHERS

Books

1. Dittus, Wolfgang. "Analysis of toque macaque cohesion calls from an ecological perspective." In: Primate Vocal Communication, Dietmar Todt, Philipp Goedeking & David Symmes (eds.), pp.31-50. Berlin: Springer, 1988. ISBN: 978-3-642-73771-8 http://www.dx.doi.org/10.1007/978-3-642-73769-5_3
2. Todt, Dietmar, Goedeking, Philipp & Symmes, David (eds). *Primate Vocal Communication*. Berlin: Springer, 1988. ISBN 3-540-19355-3
2. Liebal, Katja, Waller, Bridget M., Burrows, Annie M., and Slocombe, Katie E. *Primate Communication: A Multimodal Approach.* Cambridge, UK: Cambridge University Press, 2003. ISBN-10: 0521178355

Websites

1. Monkeys and Language http://www.pbs.org/wnet/nature/episodes/clever-monkeys/monkeys-and-language/3948/
2. The Mathematical Art of Escher https://www.youtube.com/watch?v=Kcc56fRtrKU
3. The Mathematics Behind the Art of Escher http://www.math.nus.edu.sg/aslaksen/gem-projects/maa/0203-2-03-Escher/main3.html

RESOURCES FOR STUDENTS

Books

1. Jenkins, Steve. *NEVER Smile at a Monkey And 17 Other Important Things To Remember.* New York: Houghton Mifflin Harcourt, 2009. ISBN: 978-0-618-96620-2
2. Redmond, Ian. *Eyewitness Books: Gorilla, Monkey, and Ape.* New York: DK Children, 2000. ISBN-10: 078946036
3. Reed, Emma. *Monkeys: Animal Nature Facts, Trivia and Photos! Jungle Series – Expedition Earth*. Kaysville, UT: Thrive Communications & Press, 2012. ASIN: B00BGFWOPW

Websites

1. Poets.org http://www.poets.org/poetsorg/poem/sick
2. Poetry Idea Machine http://teacher.scholastic.com/writewit/poetry/poetry_engine.htm

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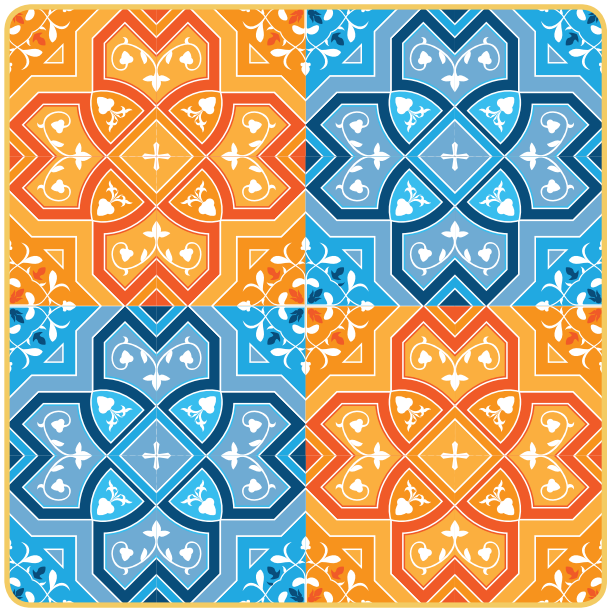
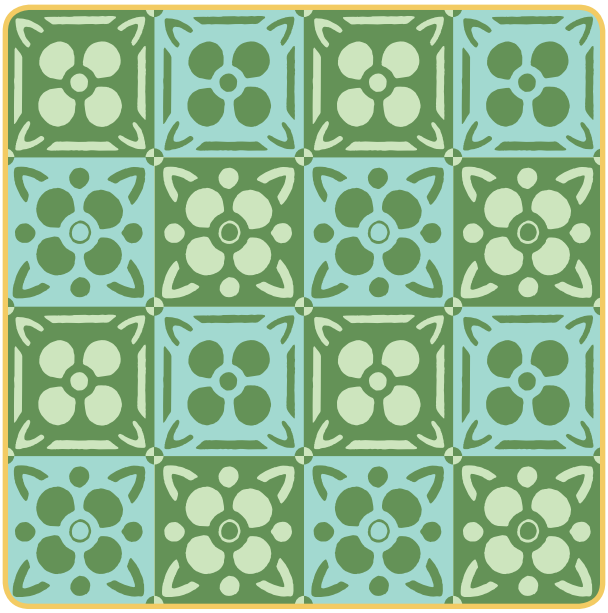
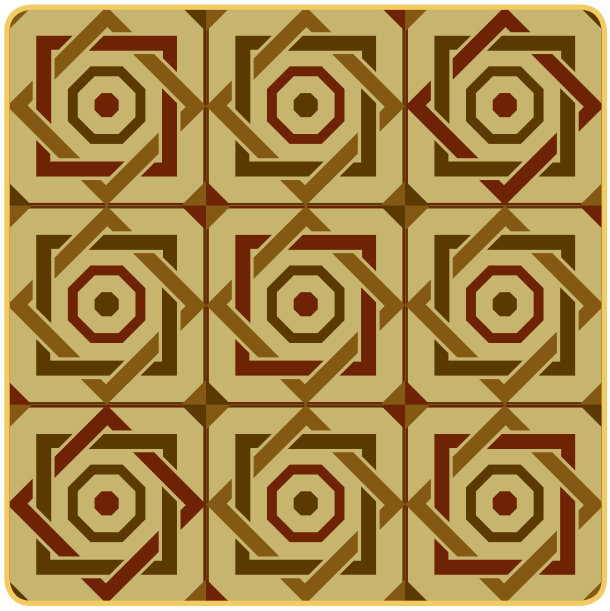
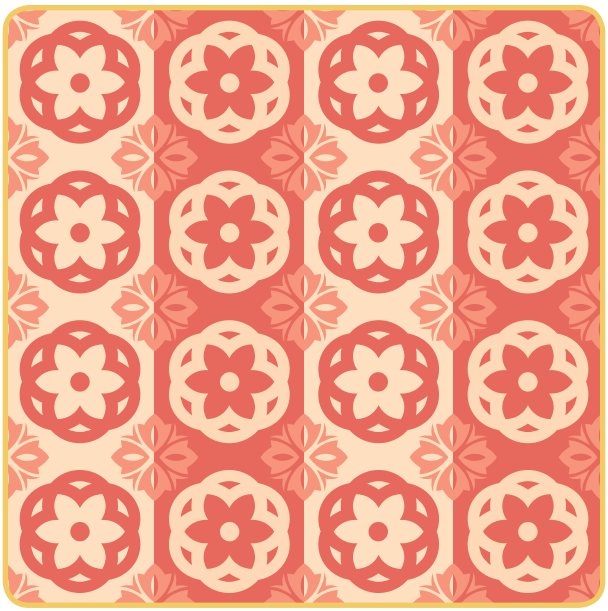
Tessellation Resources









Watch And Learn!

Toque macaques communicate through facial expressions and vocalizations. You can visit a local AZA-accredited zoo or aquarium to learn more about animals and their behavior!

Disneynature Monkey Kingdom

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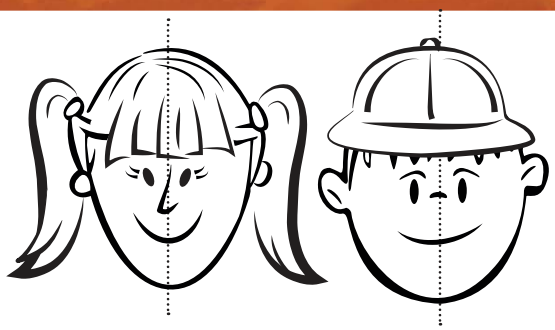
Symmetry in a Human Face

Can you find human lines of symmetry in your face? Determine your face shape then see if you have symmetry! Look for lines of symmetry in different objects around you using mirrors.



1 Determine SHAPE

What is the geometric shape of your face? With your partner, look at your reflection in the mirror and determine which geometric shape is most like the shape or outline of your face.

What shape is your face? _____

What shape is your partner's face? _____

2 Determine SYMMETRY

Is your face symmetric? Check by pretending to draw a line from the top of the head, down through the tip of the nose and the middle of the chin. What could you say about each side of your face? It is symmetric if one side looks like the reflection of the other side.

Is your face symmetric? Why or why not? _____

_____

BONUS

Can you find examples of symmetry in the classroom and outside in nature?

Tip: Check using a mirror. Place the mirror along the possible line of symmetry, perpendicular to the face of the object or shape. It is symmetrical if the reflection completes the object.

List at least 2 objects in the classroom that are symmetric. _____

List at least 1 object in nature that is symmetric. _____

Watch And Learn!

Toque macaques communicate through facial expressions and vocalizations. You can visit a local AZA-accredited zoo or aquarium to learn more about animals and their behavior!

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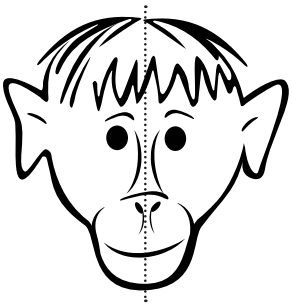
Symmetry in a Toque Macaque Face



Examine each toque macaque face below to determine the line of symmetry. Use a mirror to confirm where the line is located. With a ruler, draw the line of symmetry for each face.

Are any of the lines of symmetry hard to find? Which ones and why?

Select one picture you will use to determine the basic shape of the toque macaque's face. Use your set of shapes as a guide.

Circle the shape that best matches that of the toque macaque's face.

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Write A List Poem

Get ready to write your List Poem by filling in the blanks to compare how your forms of communication are the same or different from those of a toque macaque. Add to the table any other forms of communication you noticed in Disneynature MONKEY KINGDOM. Use the information from the table to complete your List Poem.

Toque Macaque Feeling or Event	Toque Macaque Communication	Your Communication	Same (✔) Different (✘)
Asserting Dominance	Eyebrow Raise		
Being Lost	Loud Cooo		
Finding a Snack/ Hungry	Soft Hooo aimed at relatives		
Attracting a Mate	Lip Grimace		
Feeling Threatened	Fear Grimace (showing teeth)		
Seeing a Different Troop Approach	Raise Tails in Air Silently		
Keeping Troop Close Together	Small Chirp or Grunt		
Being on Look Out	Stand Tall and Bend Forward		

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LESSON 5

What Life Events Do Toque Macaques Experience?

THEME
Behavior

GRADE LEVEL
2-3

SUBJECT AREAS
Focus:
Science, Art, Math & Social Studies

Extensions:
Language Arts, Art & Science

BACKGROUND INFORMATION
Pages 9-14

VOCABULARY
cause and effect, cooperation, hierarchy, life event, metamorphosis, mimicry, pattern, predators, troop

STUDENTS WILL BE ABLE TO...
- Observe and record the life events of a toque macaque
- Compare individual records of the toque macaque's life events
- Construct a shared timeline of life events for all of the toque macaque troop

WHAT YOU NEED
- Disneynature **MONKEY KINGDOM** film trailer (available at Disney.com/monkeykingdom)
- Pencils
- Scissors
- Clipboards (optional)
- Markers
- Butcher paper
- Masking tape or pushpins
- *Activity Sheet 1: Character Guide: Toque Macaque Behavior and Life Events*
- *Activity Sheet 2: Small Group Sample Compiled Character Timeline*

Warm Up

Discuss how the lives of toque macaque monkeys are marked by **patterns** of behavior that vary due to many factors. Toque macaques can live to be 30 years old, and throughout their lives they live in groups called **troops** with 20 to 30 other toque macaques. There is a **hierarchy** among troop members that influences much of their daily behavior. **Life events** range from birth to **mimicry** learning to clashes with **predators** and rivals in the tropical forest habitat.

Get Started

STEP 1: Show the Disneynature **MONKEY KINGDOM** film trailer and/or clips and note that the story features several special characters whose experiences represent many aspects of the typical life events of toque macaques. Discuss the concept of life events and have students share their life events such as being born, learning to walk, talk, read, ride a bike, etc. Ask students to speculate about what life events toque macaque infants, youngsters and adults might experience (for example: birth, bonding with its mother, learning to forage and eat solid food, etc.). Distribute *Activity Sheet 1* and have students cut out the character and behavior cards. Divide students into small groups. While viewing Disneynature **MONKEY KINGDOM** film trailer or clips, each group will focus on matching the behavior cards to the corresponding toque macaque characters. Point out that although some life events might seem unimportant at the time, they may turn out to be life changing later on. For example, the simple act of saying "Hi!" to a new classmate might evolve into a life-long friendship! Encourage the students to be observant and record 10 or more events.

STEP 2: Ask members of small groups to share the life events of one character and discuss why they think those events were important. Discuss that there are many ways to display the range of life events experienced by one character, or by the entire troop. One way to do this that has been used for centuries is the "timeline." Explain that all timelines have a starting point and an ending point and that events are spaced out between these two ends at intervals that,

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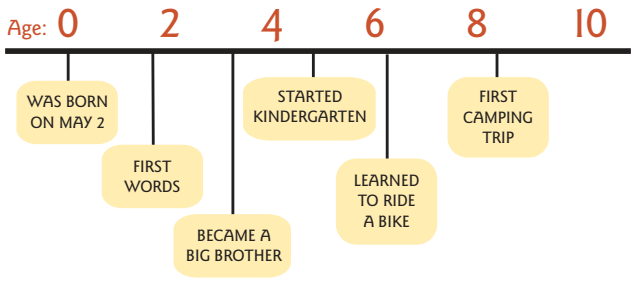
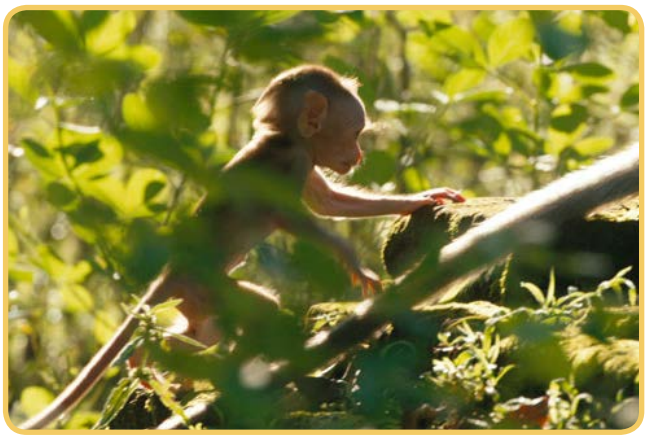
What Life Events Do Toque Macaques Experience? 5

as accurately as possible, represent the real elapsed time between preceding and subsequent events. That is, the length of the timeline's unit interval, whether days, weeks, months, years, decades, or centuries remains constant from start to finish. Draw an example of a generic timeline using students' life events on the board. Demonstrate how they might use years as the standard interval, starting with birth and ending at present age. Life events would be arranged from the left to the right with events being placed on the timeline at the approximate time when they occurred (e.g., learning to ride a bike without training wheels at 6.2 or 6.6 years).



Distribute *Activity Sheet 2*. Ask the small groups to construct a timeline of life events for their group's character. Research to find still images to help illustrate the timeline. Lastly, ask students to list different types of behavior of their character and write answers on the board, coding each behavior with a different color (for example, avoiding a predator might be one category, finding food might be another, etc.). Students use this color code to highlight those behaviors on their own timelines.



STEP 3: Have the class create a large toque macaque troop timeline with butcher paper stretched horizontally across a bulletin board. Include a title over the timeline. Determine which units of time are most appropriate (e.g., hours, days, weeks, months, etc.). Small groups of students add index cards or sticky notes with the behaviors of their characters (each character should be a different color) to the toque macaque troop timeline, drawing a vertical line from the index card to the time unit on the top line.

Wrap Up

Discuss the categories of character behaviors the students noticed. What are some behaviors that all toque macaques in the troop demonstrated? What are some behaviors that seemed unique to some toque macaques? Why do the students think there are differences in toque macaque behaviors across the time framed in the timeline?

Ask students if any life events they placed on the timeline affected more than one character. Explain that some individual behavior choices can have a great impact on an entire community. Share this online video. After viewing, ask students to share individual actions or behaviors they believe can make a positive difference for others. Provide Jane Goodall's Roots and Shoots organization as a resource students can use in order to achieve large goals and successfully impact their local community.

Keep Going

Enrich students' insights into the toque macaques' behavior patterns with extension activities from different content areas.

LANGUAGE ARTS: What Is Life Like for your Character?

Students write a summary of the character they chose, incorporating elements from the created timeline. In the first paragraph, students write a summary of their character's timeline life events. In the second paragraph, they select one or two key events and explain why they were important. Discuss which key events students selected and why.

ART: How Can We Represent Two Seasons that Influence Toque Macaque Behavior?

You'll Need: Drawing paper, watercolor paper, watercolors, bowls of water, brushes

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What Life Events Do Toque Macaques Experience? 5

STEP 1: Ask students to recall the different seasonal landscapes of Polonnaruwa they saw in the Disneynature **MONKEY KINGDOM** film trailer or clip. Discuss/research online the two seasons of Polonnaruwa: wet and dry. Look at images that show the landscape during both seasons.

STEP 2: Have students choose a scene they like and draw it on white drawing paper. Make two photocopies of the drawing onto watercolor paper. (Optional – You can also scan and print onto watercolor paper with an inkjet or laser printer – use clear charcoal fixative to seal the ink to the paper before painting on the surface). Have students practice different watercolor techniques on small scraps of paper. They should practice wet-into-wet, wet-on-dry and dry-on-dry techniques (see links in reference sections). Students can also experiment with tossing dashes of salt onto wet paper for another creative look.

STEP 3: Using dry brush techniques, have students paint one of their landscapes. This landscape should represent what the scene would look like during the dry season in Polonnaruwa.

STEP 4: Using wet brush techniques, have students paint the other landscape. This landscape should represent the wet season in Polonnaruwa.

STEP 5: Display the finished pieces together and lead a discussion that compares the painting effects and the two Polonnaruwa seasons.

<u>SCIENCE</u>: How Does the Life Cycle of the Toque Macaque Compare to other Organisms?

You'll need: Yarn, hole punch, index cards

STEP 1: Divide the class into 6 groups. Each group will create their own life cycle card using animals listed in the chart below.

Each card should have a photo or drawing of one life cycle stage. Punch two holes at the top of each card. Thread each word card with yarn so that students can wear them similar to a necklace.

STEP 2: Discuss how animals go through different stages in their lives. We call this a life cycle. The life cycle of some animals, including the toque macaque, is called "direct development." Animals with a direct development life cycle do not change in appearance – they simply grow in size. Dogs, cats, humans, horses and monkeys undergo direct development because the offspring are very similar to the adults. Other animals go through different changes in their life cycles known as **metamorphosis**. While many animals that go through complete metamorphosis have four life cycle stages (egg, larva, pupa, adult) some, like a frog, go through five. The appearance of the adult is quite different from other stages of the life cycle. Butterflies and ladybugs are examples of animals that go through complete metamorphosis. Other animals go through incomplete metamorphosis because they do not have a pupal form. Their life cycle usually consists of the egg (unborn stage), the nymph (young stage) and the adult. The termite is an example of an animal that goes through incomplete metamorphosis. Compare and contrast the life cycle stages of different animals with that of the toque macaque.

STEP 3: Give each student one life cycle card to place over his/her head like a necklace. Announce the name of one organism (i.e., ladybug). Have each student wearing a card featuring one of the stages

LIFE CYCLES

Toque Macaque Monkey
Monkey Fetus ➤ Dependent Infant Macaque ➤ Juvenile Macaque ➤ Sub-Adult Macaque ➤ Adult Macaque

Butterfly
Egg ➤ Caterpillar ➤ Chrysalis ➤ Adult Butterfly

Hanuman Langur
Langur Fetus ➤ Juvenile Langur ➤ Langur Adult

Elephant
Elephant Fetus ➤ Infant Elephant ➤ Juvenile Elephant ➤ Adult Elephant

Termite
Egg ➤ Nymph ➤ Adult Termite

Scorpion
Embryo ➤ Juvenile Scorpion ➤ Adult Scorpion

Monitor Lizard
Embryo ➤ Juvenile Monitor Lizard ➤ Adult Monitor Lizard

Frog
Egg ➤ Tadpole ➤ Tadpole with Legs ➤ Froglet with Tail ➤ Adult Frog

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in the life cycle of that organism come to the front of the classroom. The small groups of students discuss the life cycle and arrange themselves in the correct life cycle sequence and explain the type of life cycle represented (direct development, metamorphosis, incomplete metamorphosis).

STEP 4: Ask each small group how the life cycle of their organism is similar to or different from that of the toque macaque?

RESOURCES FOR TEACHERS

Websites

1. Dilmah Conservation
   http://www.dilmahconservation.org/gallery/toque-macaque/
2. University of Michigan Museum of Zoology Animal Diversity Web Site Toque Macaque (Macaque Sinica)
   http://animaldiversity.ummz.umich.edu/accounts/Macaca_sinica/
3. Water Color Technique Landscapes – Kids Art
   http://angelaandersonart.blogspot.com/2012/10/watercolor-technique-landscapes-kids.html
4. Watercolor Landscapes
   http://splattersandsmudges.blogspot.com/2012/04/watercolor-landscapes-2010.html
5. Watercolor Painting Basics: Watercolor Dry Brush Painting
   https://www.youtube.com/watch?v=hH-9YJZBLBk&noredirect=1
6. Watercolor Painting Basics: Watercolor Wet & Wet Painting
   https://www.youtube.com/watch?v=vy9Z8tJeWa4
7. Basic Watercolor Painting Techniques: Wax resist, watercolor pencils, alcohol, splatter, blowing and salt
   https://www.youtube.com/watch?v=X3RrIXed1hI

RESOURCES FOR STUDENTS

Books

1. Overbeck. Cynthia. *Monkeys: The Japanese Macaques.* Minneapolis, Minnesota: Lerner Publishing Group, 1981. ISBN-13:9780822514640

Websites

1. The Young Zoologists' Association of Sri Lanka
   http://www.yzasrilanka.lk/

ANSWER KEY

Lesson 5 - Activity Sheet 1:

BEHAVIOR AND LIFE EVENTS

MAYA – THE MOTHER

1) Nurses young
2) Grooms others
3) Observes others
4) May leave the troop
5) Finds a mate

KIP – THE BABY

1) Climbs on mother's back for protection
2) Observes others
3) Learning to forage
4) Mimics others

KUMAR – ADULT MALE

1) Observes others
2) Joins a new troop
3) Grooms others
4) Establishes his rank
5) Defends the troop
6) Learning to lead
7) Finds a mate

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Character Guide: Toque Macaque Behaviors and Life Events

MAYA The Mother	KIP The Baby	KUMAR Adult Male
Learning to forage	Nurses young	Joins a new troop
Climbs on mother's back for protection	Mimics others	Finds a mate
May leave the troop	Learning to lead	Establishes his rank
Observes others	Grooms others	Defends the troop

Visit Your Local Library.

You can learn more about toque macaques or one of the many other amazing species seen in Disneynature MONKEY KINGDOM by checking out a wildlife field guide at your library. Be sure to share this knowledge to inspire others to care about this diverse ecosystem!

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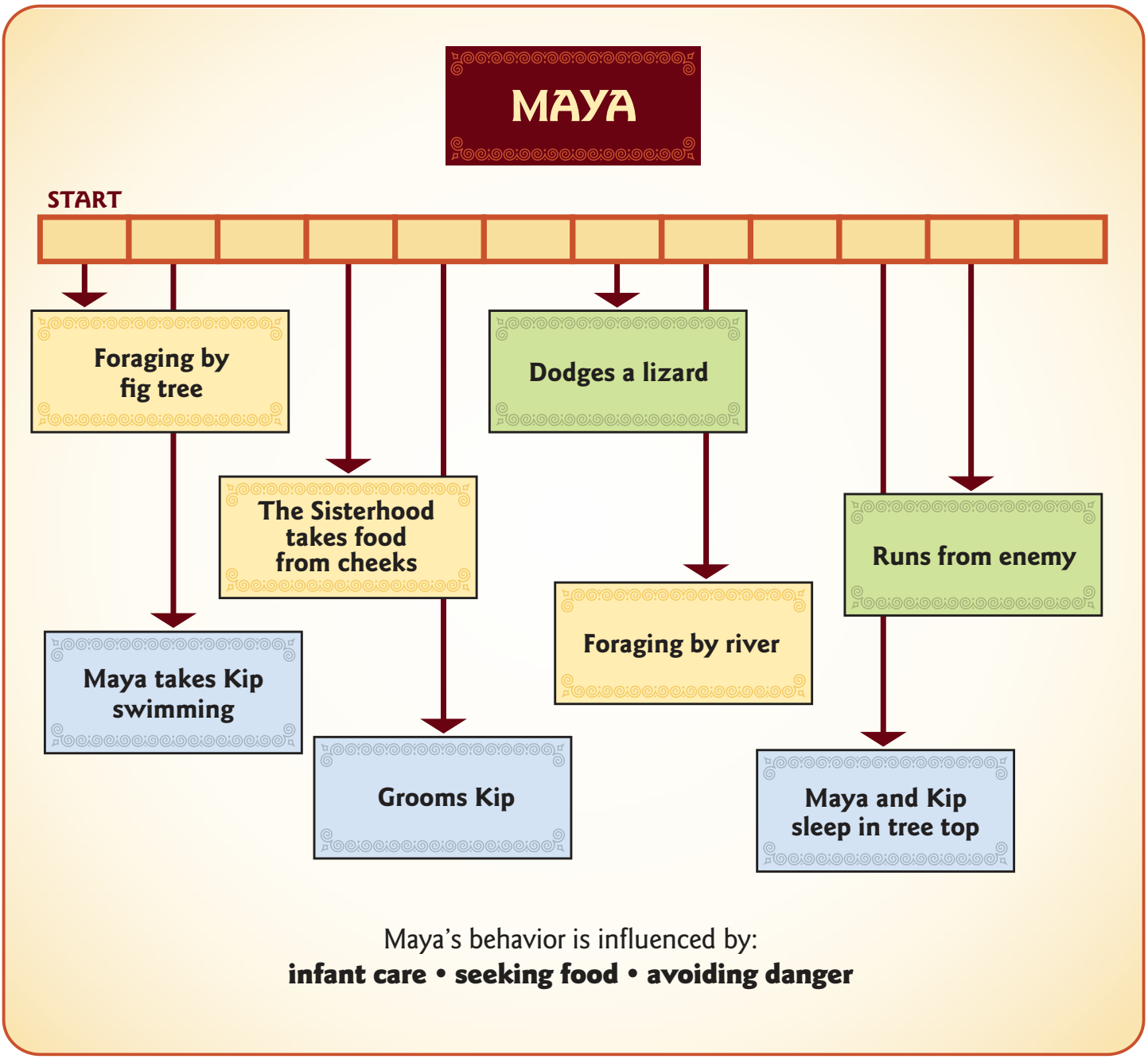
Small Group – Sample Compiled Character Timeline



Maya's behavior is influenced by:
infant care • seeking food • avoiding danger

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LESSON 6

How Does Biodiversity Impact the Toque Macaques?

THEME
Biodiversity

GRADE LEVEL
4-6

SUBJECT AREAS
Focus:
Science & Math

Extensions:
Social Studies, Language Arts, Music & Art

BACKGROUND INFORMATION
Pages 13-15

VOCABULARY
abiotic, biodiversity, biotic, ecosystem, primatologist

STUDENTS WILL BE ABLE TO...
- Understand that biodiversity is essential to the health of an ecosystem
- Investigate the plants and animals that share the ecosystem with the toque macaque
- Compare and contrast the biodiversity of their schoolyard ecosystem
- Assess the importance of balanced ecosystems

WHAT YOU NEED
- Ball of string
- Hula hoops (approximately 6 for a class of 24 students)
- Peterson Field Guides for Children (optional)
- *Activity Sheets 1 and 2: Ecosystem cards*
- *Activity Sheets 3 and 4: Termite Origami Instructions*

Warm Up

An **ecosystem** is composed of interacting parts of living (**biotic**) and non-living (**abiotic**) things in a defined area that depend on each other for survival. There are many ecosystems on Earth. An ecosystem contains many habitats such as the tropical rain forests and evergreen forests of Sri Lanka where the toque macaque is found. Ecosystems need a large number and wide variety of organisms to stay strong and healthy. The **biodiversity** of an ecosystem is what helps to maintain the atmosphere, keeps the soil fertile, purify water and meet the needs of human and non-human species. Humans can adapt to live in almost any ecosystem, but animals cannot do so as easily. Toque macaques, found only in Sri Lanka, do co-exist with humans as they live near villages or in ruins such as Polonnaruwa.

Invite students to sit in a circle and distribute one ecosystem card from *Activity Sheets 1 and 2* to each student. Ask them to imagine that they are different living (plants, animals, fungi, micro-organisms) and non-living (soil, river, water sources) components found in the ecosystem together with the toque macaque. One student starts by holding a ball of string. The student should name a part of the toque macaque's ecosystem that he/she needs to survive and pass the string to the student holding that card. This process is repeated until all students are linked to other parts of the ecosystem, forming a web of life.

The fragility of an ecosystem can be demonstrated by having students imagine that all of the trees in the ecosystem have been cut down. Any students holding a part of the ecosystem that depends on trees must drop their strings. With the removal of the trees, soil has eroded into the river affecting the quality of the water. Any students holding part of the ecosystem that depends on water should drop their strings. This warm-up activity should include a discussion of the importance of not upsetting the balance of an ecosystem.

Get Started

When examining the biodiversity of a certain area, researchers use various techniques to find out which species occur at any particular site. For mammals, footprints are cataloged, fur samples are collected and even camera traps are set up to take pictures of species that walk by when researchers are not near. Other techniques are used to catalog insects and birds such as visual observations, sound recordings and mist nets. This is called a Rapid Assessment Program, or RAP and when performed, scientists can better understand the conservation status of an area they are studying. The community that the students live in can also contain an amazing variety of plants

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How Does Biodiversity Impact the Toque Macaques? 6

and animals that are important to understand. Identify in advance a location that has both great biodiversity and limited biodiversity for students to conduct their own RAP. Places that are on the edge of playgrounds or school structures that have yet to be landscaped are great options.

STEP 1: Take students to the pre-selected location and divide them into small groups of three or four. Give each small group a hula hoop. One member of each team throws the hula hoop over the back of his/her shoulder so that it lands in a random location.

STEP 2: Team members count the number of different kinds of animals (i.e., ants, earthworms, grasshoppers, beetles) and plants (grass, trees, flowers, shrubs) that are found within their hula hoops. Once students have finished counting, the class will create a visual mathematical representation of the biodiversity. Distribute markers and rulers to each student. Using poster or chart paper, students will create dot charts, bar charts or pictograms to illustrate the quantities of each organism they found in their hula hoop. Ask students to discuss what they see in the chart:

- Which organisms occurred most often?
- Which had fewest observations?
- Why do you think these organisms were most (or least) frequent?
- Counting the frequencies of all of the different organisms, what was the average (mean) frequency (total number of all data divided by number of different organisms)?
- Which organism is closest to the MEDIAN frequency of all of the organisms? To answer this question, students need to order the bar chart or dot chart from smallest to largest number of observations and find the organism closest to the middle of the order (if there is an odd number of organisms in the chart then just one organism will land in the middle of the chart; if there is an even number, two organisms will fall either side of the median frequency, which would be calculated by summing the frequency of these two organisms and dividing by two).

Wrap Up

Small groups return to the classroom and discuss the numbers and kinds of organisms found. They compare their findings in terms of biodiversity and the web of life. The follow-up discussion should prompt students to think about the reasons why some areas had little biodiversity (for example, presence or lack of shade, soil quality) and other areas had higher levels of biodiversity (water source, shade, good soil quality). It is important for students to realize that biodiversity includes both the numbers and kinds of organisms.

Explain to students that they can help improve the biodiversity of their own neighborhoods through positive action. By organizing cleaning efforts and building backyard habitats for local wildlife, students can make a difference for native species. Provide rootsandshoots.org as a resource for students that will provide the tools and networking opportunities needed for effective campaigns in their local communities.

Keep Going

Enrich students' understanding of biodiversity with the following extension activities.

LANGUAGE ARTS: What Do You Notice?

Ask each student to keep a Biodiversity and Me Journal. As they go about their routine activities, ask them to notice and write about ways biodiversity affects their lives. Start the brainstorming process by asking how the hamburger they eat for lunch, the blue jeans they wear to school, the various arts they enjoy, etc. are all part of their own biodiversity. The day following the journaling activity, invite students to share their observations and insights. List the connections they have noted on the board and discuss the complexities of their own web of life. What is one thing they think they could do without that would have the least impact on their own web

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How Does Biodiversity Impact the Toque Macaques? 6

of life? Trace the connections to other components. For example, if they think they can do without eggs, could they do without other food that requires eggs in the recipe (cake, omelets, muffins), or could they do without reptiles, fish, and birds (and other creatures that hatch from eggs)? Every piece of their web of life is intrinsically connected to another.

SOCIAL STUDIES: What Would You Do in Their Shoes?

Ask students to step into the shoes of a **primatologist** who has been asked to take a journey to Polonnaruwa, Sri Lanka, to study the toque macaques. The purpose of the research is to identify local Sri Lankan organizations that are concerned about the endangered status of the toque macaque. What are they doing to protect or conserve the toque macaque? Students will work in small groups to conduct research, making connections to how the biodiversity of the temple ruins is being affected by imbalances in the ecosystem (e.g., agricultural conflicts, etc.). As a bonus activity, students can relate how efforts to protect an endangered species local to their area in the USA compare to those efforts for toque macaques in Sri Lanka. By visiting the US Fish and Wildlife Service Endangered Species Map students can view how key species in their own state are currently being protected. Using their research, students will prepare a presentation (using either PowerPoint or Keynote) to present their findings at a classroom version of an International Symposium on the toque macaque. Their presentations can include: title, presenter, research question, photos, summary of what was learned and credits. Once submitted, students can become their own scientist by visiting yardmap.org where they can help document local habitats such as the school playground, local park or even their own backyard. In doing so they are helping conservationists learn more about wildlife habitats across the country by understanding the needs of local species.

MUSIC: Shhh - How Can We Learn about Biodiversity through Listening?

Sounds are all around us, no matter the habitat or ecosystem. Where there is rich biodiversity, living things will make sounds (insects, animals, birds). Other sounds are natural and nonliving (wind blowing the trees, a branch falling, waves). Some sounds are man-made (a car, a train, an airplane). The following activities will help students focus on the sounds that are present in different environments, and how to listen carefully to identify sounds and their properties.

FIRST: Introduce students to a tropical forest soundscape.

EXPLORE: Play the video found at this YouTube link. Tell students to close their eyes and concentrate, trying to notice the nature of the different sounds they hear.

EXPLAIN: Students work in small groups to discuss the sounds they heard, sharing their observations using terminology to describe sound properties such as loud/soft (dynamics), far away/near, long/short (duration), high/low (pitch), fast/slow (tempo), source of the sound (animal, natural, or man-made), etc. Have each group share their observations. Discuss how these sounds create a web of life soundscape (the sounds that surround a listener in any particular location).

ELABORATE: Tell students they will create a map of a tropical forest soundscape. Before playing the recording again, discuss how they might use graphical notations to indicate the properties of a sound on a blank map such as the one shown on the following page. Demonstrate that pitch (highness or lowness) can be expressed by the position of the notation on the y-axis of their map (top to bottom). Demonstrate how direction of the sound can be indicated by the placement of the symbol on the x-axis (left to right). Demonstrate how loudness of the sound can be indicated by the size or "thickness" of the symbol (bold/large is loud, thin/small is soft). Encourage the students to label their graphic symbols to

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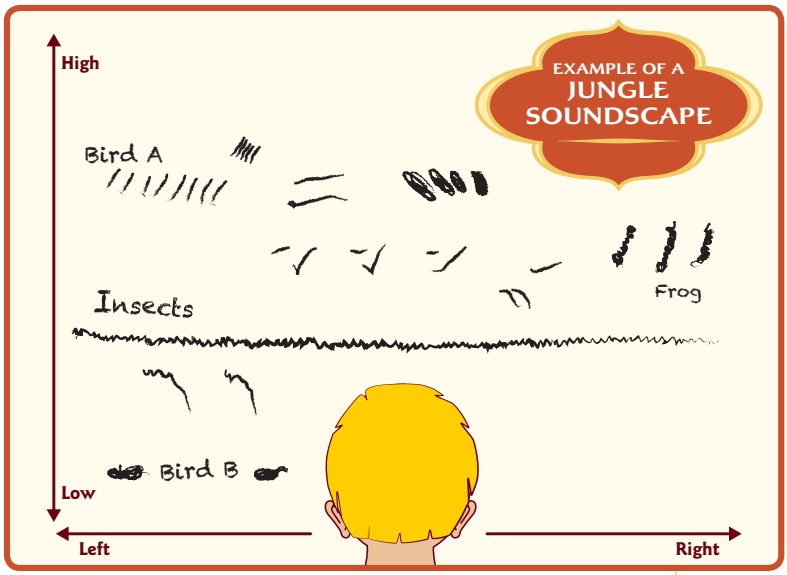
How Does Biodiversity Impact the Toque Macaques? 6



identify the source of the sound for each symbol. An example of a jungle soundscape map is shown above.

Ask students for elements of other soundscapes, such as the street in front of the school, a neighborhood park, inside their home, etc. How would these soundscapes differ from the jungle soundscape? Alternatively, use the resources at wildmusic.org to support students in creating and observing the properties of various soundscapes using the tools available at the site. Do students use appropriate terminology to describe the soundscapes they explore, such as pitch, dynamics, tempo, and duration?

ART: Create an Origami Termite Flight Installation

Discuss how one of the most enchanting events in Disneynature **MONKEY KINGDOM** is the flight of the termites – or as the toque macaque would call it – suppertime. Tell students that by using the ancient art of origami – paper folding – they will recreate the beauty of the flight of the termites in a classroom or hallway installation.

You'll Need: Heavy weight (80lb) 8½ x 8½ inch square paper, pencils, fishing line, paper clips or thumb tacks.

STEP 1: Distribute *Activity Sheets 3* and *4,* and refer to the diagram of a termite at the top of the sheet.

STEP 2: Students practice making the two types of folds needed for creating the insect as illustrated and then take a new sheet of paper to follow steps on the resource sheet.

STEP 3: Have small groups of students sketch out the patterns and shapes of the movements made by the termites in the Disneynature **MONKEY KINGDOM** and use one as a guide for the installation.

STEP 4: Attach fishing line to each of the flying insects so that they hang vertically or at an angle from top to bottom. Attach each of the fishing lines to paper clips that slip into the edges of ceiling tiles or use thumb tacks to attach to smooth surface ceilings. Remember to vary the length of fishing line to represent clusters or shapes of patterns in the installation. Use all of the flying insects to create a hanging installation to represent patterns of movement.

Below are examples of flying insect installations. After the installation is complete, invite students to discuss how well the origami termites capture or do not capture the light, energy, pattern and movement of the termites in the film scene. Consider the ways that artists use a variety of materials to express how they feel about a subject.

ART: Make a Necklace that Represents the Biodiversity of a Toque Macaque Habitat

You'll Need: Paper, pencils, straws or small wooden dowels, clay, clay carving tools, access to a kiln, glaze. (As an alternative, you may use air-dry clay and acrylic paints to form the beads of the necklace).

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How Does Biodiversity Impact the Toque Macaques? 6

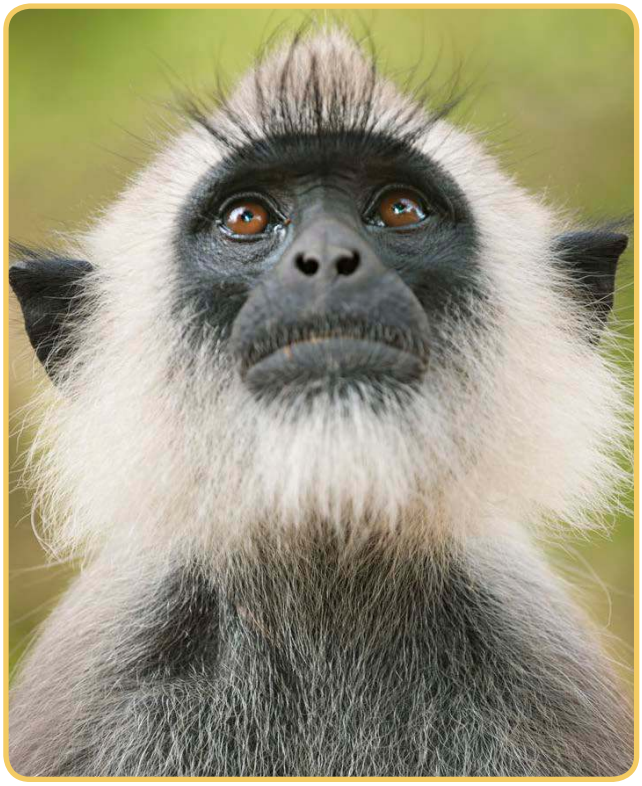
STEP 1: Students write down all the different animals they saw in Disneynature **MONKEY KINGDOM**. They choose between 6-8 animals to include in their biodiversity Tribal Necklace.

STEP 2: Students sketch out their 6-8 animal symbols.

STEP 3: They roll clay into a tube 1½ – 2" thick. Cut the tube into pieces about the size of a large marshmallow. Each child should have 6-8 pieces. Push a straw or small (¼") wooden dowel through the center of each piece and allow the clay to become leather hard. This will form the clay beads for the tribal necklace.

STEP 4: Have the students carve their animal symbols/designs into the outside edges of the clay beads. Fire (or air dry) the finished bone-dry pieces and allow the students to glaze the pieces and then fire them again in a glaze firing or paint them.

STEP 5: Have the students string the beads on a piece of elastic wire or string along with found objects such as feathers, yarn, buttons, etc. to create their own unique biodiversity tribal necklace.



RESOURCES FOR TEACHERS

Articles

1. Dini M. Miller. (2010). *Subterranean Termite Biology and Behavior.* Publication 444-502. communication and Marketing, College of Agriculture and Life Sciences. Virginia Polytechnic Institute and State University.

Websites

1. Animal Diversity
   http://animaldiversity.org/accounts/Macaca_sinica/
2. Young Adult Diaries/Letters/Journals
   http://www.hwpl.org/lists/diaries-journals-letters-grades-4-6/
3. The IUCN List of Threatened Species
   http://www.iucnredlist.org
4. Wild Music.org
   http://www.wildmusic.org/soundscapes
5. USFW Endangered Species Map
   http://www.fws.gov/endangered/map/index.html

RESOURCES FOR STUDENTS

Books

1. Strauss, Rochelle. *Tree of Life: The Incredible Biodiversity of Life on Earth.* CA: Search Press, 2009. ISBN-13: 978-1844484270

Websites

1. Sound Around You
   http://www.soundaroundyou.com/
2. Young Zoologist Association of Sri Lanka
   http://www.yzasrilanka.lk/
3. Citizen Science Project
   www.yardmap.org

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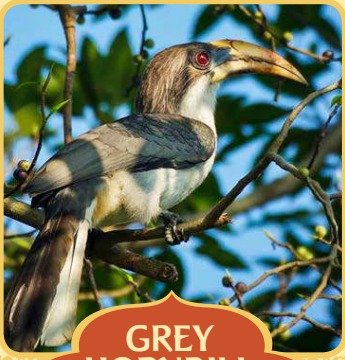
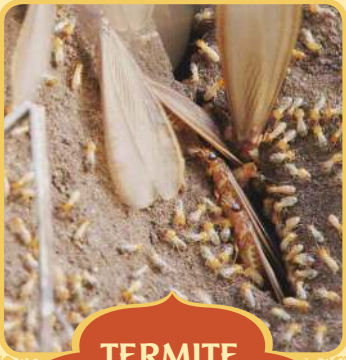
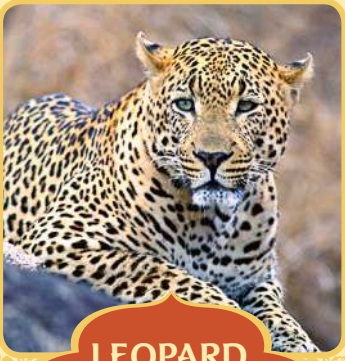
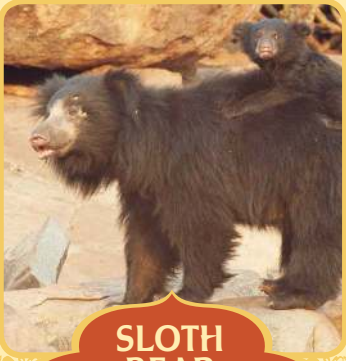
Ecosystem Cards

TOQUE MACAQUE


GREY HORNBILL


TERMITE


LEOPARD


SLOTH BEAR

MONITOR LIZARD

LANGUR

SUN

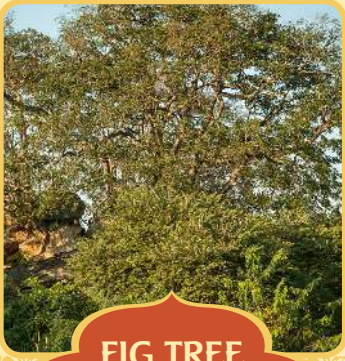


FIG TREE

Disneynature Monkey Kingdom

Leopard: © @superstock.com

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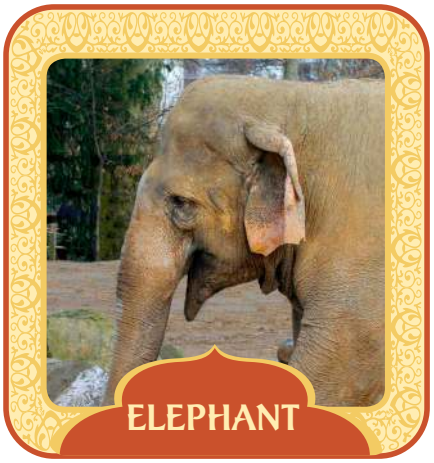
Ecosystem Cards



Disneynature Monkey Kingdom

Blue magpie: © Canstock Photo
Python, peacock, soil, river, scorpion, fungi, elephant: © @superstock.com

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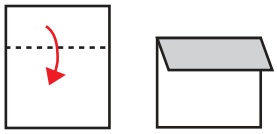
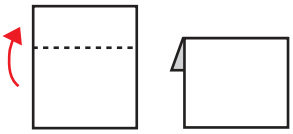
Termite Origami Instructions

Before beginning, practice folding. Use scrap paper to make valley folds (fold to the front or toward you). Then make mountain folds (toward the back or away from you.) The dotted lines show where to fold the paper.



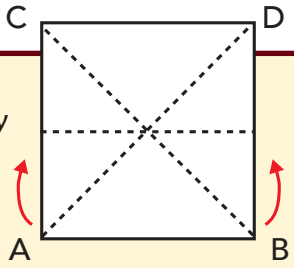
Valley Fold
(Fold to the front)



Mountain Fold
(Fold to the back)

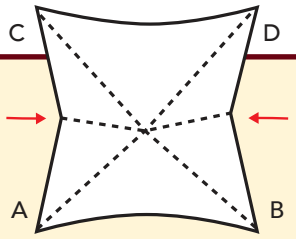
1

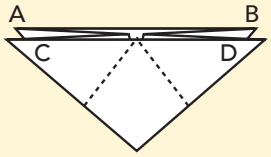
Start with 8½ x 8½ inch square paper and make a valley fold horizontally across the paper, as illustrated. Then make mountain folds along the diagonals. Label each corner lightly with a pencil. Corners A and B will make front wings, and C and D will make back wings.



2

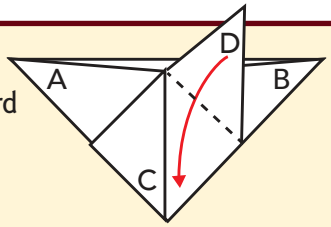
Bring corners A and C together. Then bring corners B and D together. Tuck the sides in at the horizontal crease to make a triangle shape.

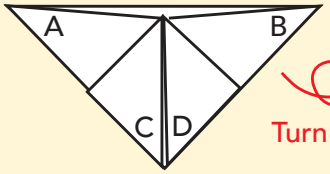




3

Fold down corners C and D toward the bottom point of the triangle. Then turn your piece over.





Turn Over

Explore The Great Outdoors.

Biodiversity can be found in any habitat, even your own backyard. Explore habitats near you such as a local park or playground and see how many species you can find when spending time outdoors!

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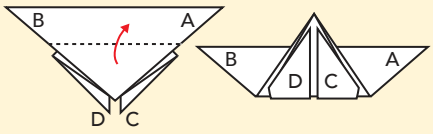
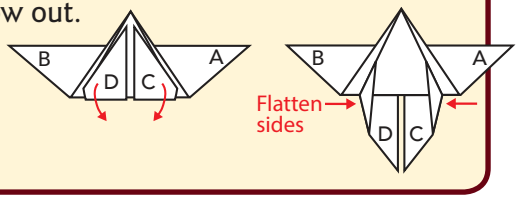
Termite Origami Instructions *continued*

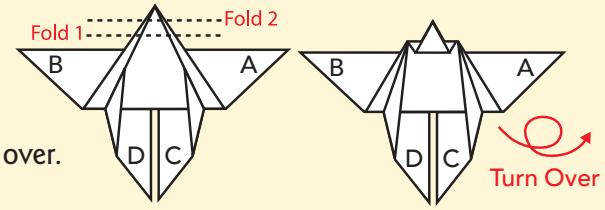
4 For the top wings, make a mountain fold across the triangle, so D and C are pointing up, and B and A form wings.



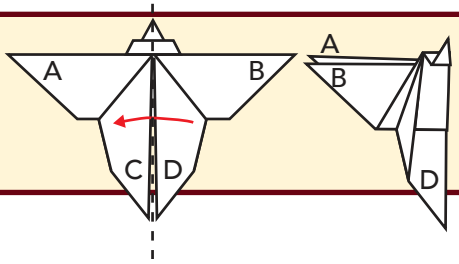
5 For the bottom wings, open flaps D and C downward. You will need to flatten the sides that bow out.



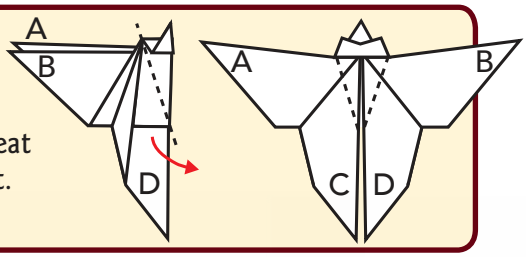
6 To make the head, you need two folds: First make a valley fold at Fold 1, then a mountain fold at Fold 2. Turn your insect over.



7 Fold your insect in half lengthwise using a valley fold, bringing wing A to wing B so flying insect is touching sides.

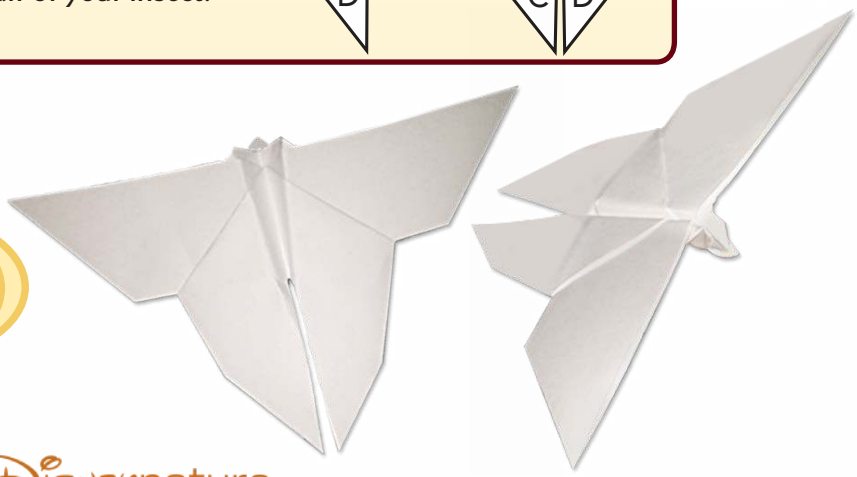


8 Finally, make the body. Make a valley fold from either side of the head down to where the bottoms wings begin. Repeat this step on the other half of your insect.



WELL DONE!

Your flying termite is complete!



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LESSON 7

What Types of Relationships do Toque Macaques Develop?

THEME
Relationships

GRADE LEVEL
4-6

SUBJECT AREAS
Focus:
Art, Language Arts, Social Studies, Music & Science

Extensions:
Math & Science

BACKGROUND INFORMATION
Pages 9-14

VOCABULARY
conflict, dialogue, improvisation, narrator, percussion, predator, puppeteer, relationships, scenario, setting, shadow puppet, troop

STUDENTS WILL BE ABLE TO...
- Examine the types of conflicts that occur between animals in nature
- Explore the art of puppetry in Sri Lanka
- Create a musical play that explores the conflict between animals
- Develop music that expresses the toque macaques' conflicts
- Write a script for a puppet play that includes setting, characters, narration, plot, and dialogue that represents conflict
- Create shadow puppets
- Employ appropriate figure/animal proportions in puppet representations

WHAT YOU NEED
- Card stock paper
- Butcher paper
- Scissors
- Mod Podge
- Bowl of water
- Hole punch
- Metallic and bright colored markers
- Round head paper fastener
- Glue
- Paper
- Pencils
- Dowels
- Masking tape
- ***Optional:*** paper doilies, lamp or overhead projector
- *Activity Sheet 1: Writing a script*
- *Activity Sheet 2: Writing a song for a musical*
- *Activity Sheet 3: Puppet Template*
- *Activity Sheet 4: Exploring Shadows*

Warm Up

There is trouble brewing deep in the jungles of Sri Lanka. In the temple ruins of Polonnaruwa, toque macaques form **troops** that vie for territory and dominance. Share with students that they will learn how to tell stories about the toque macaques' **conflicts** in a musical puppet play. They will work in small groups to write a script and select or create music. Each student will make a **shadow puppet** and act out the story they created. How can the arts help us understand the past and current social issues? Why use puppets to tell those kinds of stories? Ask students to make suggestions about when and where early puppets came from. Is a puppet really just a doll or is there a difference? If students are interested have them explore the early origins of puppetry and investigate the use of puppetry in Sri Lankan traditions.

Get Started

STEP 1: Students recall and the teacher writes on the board the animal conflicts they observed in Disneynature **MONKEY KINGDOM**. Conflicts occur when there is a disagreement or struggle between opposing characters. Discuss and list on the board various types of conflict. For example, in a typical **scenario** young monkeys play at fighting to prepare for the conflicts they are likely to have with monkeys from other troops when they are mature. These pretend conflicts are a critical component of growing up. A young male may challenge an older leader for control of the troop. Troops also defend their territory from other troops. Some troops want to conquer another troop's territory because they desire a richer habitat. Some toque macaques have moments of conflict with **predators**, such as monitor lizards or snakes. Whatever the cause, conflict is a fact of life for toque macaques.

STEP 2: Small groups select one story of conflict they observed in Disneynature **MONKEY KINGDOM** and create a Reader's Theater script that explores the situation by revealing the possible emotions and causes as experienced by various animals. In a Reader's Theater activity, some students read narration to describe actions that the others represent through choreography or **improvisation** with puppets during

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What Types of Relationships do Toque Macaques Develop? 7

a performance. Students then switch roles so everyone has a chance to be a **puppeteer** or a voice/**narrator** actor. Distribute *Activity Sheet 1* and go over the guidelines. Students conduct research about these animal interactions/relationships and complete the resource sheet and share their script drafts with other small groups or the teacher. Students should note that they are researching toque macaque behaviors and will use their findings to create script drafts.

Sample scenarios you may want to share with students:

1. Two monkeys from rival troops meet at the water. What is the conflict and how do they resolve it?
2. Two female monkeys (one dominant and one lower status) meet on temple ruin steps. What is the conflict and how do they resolve it?
3. Two young monkeys meet and start play fighting but it gets out of hand, What is the conflict and how do they resolve it?

Each person in the small group decides which character or narrator roles they will take for the performance. Small groups select a title and print it on an introductory poster they will show at the beginning of the puppet play. Next, they create a concluding credits poster that lists the names of the playwrights and puppet actors which they will show at the end of the play.

STEP 3: Distribute *Activity Sheet 2*. Small groups create a song from the conflict situations or ideas in the script. The song can represent **dialogue** between characters, a single character singing about feelings, or a group of animals singing about what they are doing or thinking. Once the story is identified, create a song that communicates how the animals might feel or what they are "saying" during the conflict/resolution. The song may be performed at the end of the play, or may be inserted as part of the dialogue in the appropriate part of the script.

STEP 4: Briefly discuss the history of puppetry in Sri Lanka. There are several types of puppets in Sri Lanka. This classification is made in terms of the media and the nature of playing. Among the different types of puppets are thread puppets *(Nool rukada)*, club puppets *(Riti rukada)*, shadow puppets *(Sevaneli rukada)*, hand puppets *(Ath rukada)* and finger puppets *(Angili rukada)*. Some performers – puppeteers – operate the puppets of different characters while others in the troupe provide supportive services such as lighting the stage, creating the music and dialogue, supplying musical accompaniments and decorating the stage.

STEP 5: Students brainstorm and sketch ideas for the puppet characters included in the scripts made in Step 1. Each student chooses an animal character puppet and will generate a full-page drawing that shows all the character's physical details. Students then trace or draw the puppet parts – like a disjointed paper doll (arms, legs, torso, head) onto card stock. Be sure to divide the arm at the elbow into two pieces, as well as the leg at the knee, to allow for movement. These parts will be re-joined later.

Next, students cut out the puppet pieces with scissors and dampen the pieces in water until they are moderately saturated on both sides, then crumple the pieces. Open them and crumple again. The wrinkles that result will give the surface texture. Press flat to dry. When the pieces are dry or nearly dry, coat the top with Mod Podge using a brush.

Once dry, students add holes with punches to add detail and design. For example, if eyes are hole punched, then when the light is shown behind the puppet they will look as if they are glowing. After punching is complete, add further embellishments with metallic and bright colored markers (see *Activity Sheet 3*).

Have students assemble the puppets by punching a hole in each part that will be jointed together. Overlap the holes and secure with a round head paper fastener. Glue dowels to the backs of the main body of the puppet, the arms, and the legs to allow movement. Students should work in pairs to practice moving their puppets in ways that express different emotions.

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What Types of Relationships do Toque Macaques Develop? 7

Wrap Up

Collaboratively create a stage by painting or drawing a border that suggests the key background scene on a large piece of white butcher paper. Be sure the stage is set high enough so students can kneel below the light source and hold up their shadow puppets. Set up a lamp directed behind the stage to serve as a light source for the shadow puppet show. Small groups choreograph the songs to movements made by the puppets. Rehearse the puppet movements and the songs with body **percussion** accompaniment (clapping, stomping, snapping). Each small group performs their plays for classmates, parents, other classes, etc. You may want to video the plays for later viewing. After the performances, discuss which aspects of toque macaque conflict were presented in each play. Discuss how the music supported the emotions presented. Conclude with students' observations about the different types of conflicts the toque macaques' encounter.

Keep Going

Enrich students' insights into the toque macaques' **relationships** and conflict with extension activities from different content areas.

SCIENCE: The Science behind the Shadows

You'll Need: Flashlight, measuring tape or ruler, squares of opaque materials (allows no light to travel through because it is reflected or absorbed – such as wood, stone, metal); Transparent materials (a clear object that allows light to travel through it without being scattered – such as saran wrap, overhead transparencies, small clear plastic glass of water); Translucent (an object that allows some light to travel through, but because the light is scattered and changes directions objects can not be seen clearly through it – such as wax paper, colored squares of cellophane, tissue paper).

STEP 1: Distribute *Activity Sheet 4* and sets of materials to small groups. Students explore the science behind the shadows of the puppets they made for their plays by experimenting with three things – 1) a light source in a darkened area, 2) a flat white surface (the wall), and 3) different types of objects to place between the light and the surface. Discuss what the terms opaque, translucent and transparent mean.

STEP 2: Have students write the names of each of the objects they place between the light and the wall in the appropriate column on the chart in *Activity Sheet 4*. Close curtains, shades and other light sources and then turn on flashlights. Discuss their findings.

STEP 3: Tell students to hold an opaque object very close to the flashlight, then measure how far it is from the wall and record the type of shadow made (big, small, long, short, blurry). Make sure they hold the flashlights close enough to the wall to make a clear shadow. Students then hold the object closer to the wall, measure how far it is from the wall, and record the type of shadow made. While holding the object at an angle (part towards the wall and part towards the light source), students record the distance of the closest and farthest points, and record the type of shadow made. Discuss how different positions result in different shadow appearance. Ask students to speculate how knowing these different ways to make shadows based on the properties of light can influence a shadow puppeteer's performance decisions (e.g., to show a tree that grows before the audience's eyes, they could move the tree puppet closer to the light source).

MATH: Calculating the Science Behind the Shadows

Have students record in a five-column table data from the above activity:

1. Actual size of the puppet (length from head to foot – this will be a constant in the table)
2. Size (length from head to foot) of the puppet's shadow on the screen (wall)
3. The distance of object (puppet) from light source
4. The distance of light source to screen (or wall – this will be a constant)

When making the measurements, the object (puppet) should be held vertical (at right-angles to the path of the light beam).

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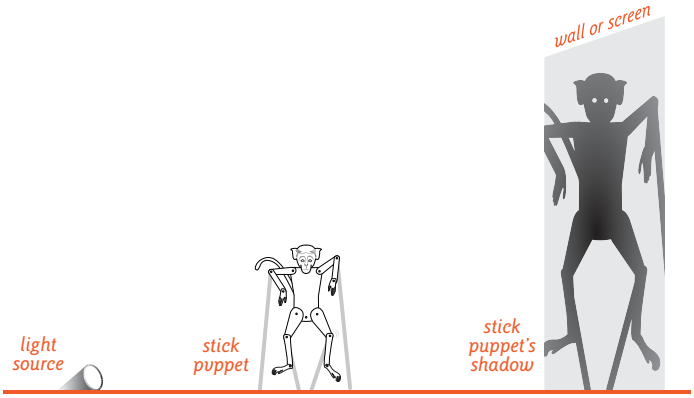
Students should move the puppet a set distance each time towards the light source from the screen (e.g. 10 cm or 5 inches) and record the new measurements in their table.

After collecting the data, students could be asked to draw a diagram that illustrates the path of the beams of light coming from the flashlight (or projector), past the head and foot of the puppet, and onto the screen (see diagram at right). Ask students the following questions:

- What geometric shapes do the beams, puppet and shadow make?

Calculate the following ratios for each row of data in their table: (length of shadow/length of puppet) and (distance of light source to screen/distance of light source to puppet)

- Do you notice anything about these two ratios?
- Compare the two triangles in your diagram. What do you notice? Explain that the two triangles are called similar triangles.



Shadow Puppet Science Diagram

The segments representing the puppet and its shadow are called "corresponding sides"of the two triangles. The segments joining the light source to the foot (or head) of the puppet and the segments joining the light source to the foot (or head) of the shadow are also corresponding sides of the two triangles. Ask students to make a conclusion from their data about the ratios of pairs of corresponding sides of two similar triangles.

RESOURCES FOR TEACHERS

Books

1. Kilgallon, Conor. *India and Sri Lanka.* Broomall: Mason Crest Publishers, 2002. ISBN-10: 1590844432
2. Blumenthan, Eileen. *Puppetry: A World History.* New York: Harry N. Abrams, 2005. ISBN-10: 0810955873
3. Currell, Daivd. *Puppets and Puppet Theatre.* Wiltshire: Crowood Press Ltd., 1999. ISBN 10: 1861261357
4. Latshaw, George. *The Complete Book of Puppetry*. Mineola: Dover Craft Books, 2000. ISBN-10: 048640952X

Websites

1. Kennedy Center ArtsEdge. *The Science of Shadow Puppets* http://artsedge.kennedy-center.org/educators/lessons/grade-6-8/Shadows_and_Light.aspx
2. Ministry of Culture Sri Lanka http://www.cultural.gov.lk/web/index.php?option=com_content&view=article&id=63:puppetry-¬ in-¬ sri-¬ lanka&catid=34:left&Itemid=72&lang=en
3. Museum of Traditional Puppet Art Sri Lanka http://www.puppet.lk/web/index.php?lang=en
4. Sri Lankan Folk Music Example http://www.youtube.com/watch?v=rAK2TtTDMrA

RESOURCES FOR STUDENTS

Books

1. McDermott, Gerald. *Monkey: A Trickster Tale from India.* Boston: HMH Books for Young Readers, 2011. ISBN-10: 0152165967
2. Haynes, Emily and Patel, Sanjay. *Ganesha's Sweet Tooth.* Chicago: Chronicle Books, 2012. ISBN 9781452103624
3. Royston, Angela. *Transparent and Opaque: My World of Science.* San Francisco: Heinemann, 2008. ISBN: 143291474X.
4. Somalah, Rosemarie & Somalah, Ranjan. *Indian Children's Favourite Stories.* Rutland: Tuttle Publishing, 2006. ISBN-10: 0804836876
5. Warnasuriya, Chandrani. *Children's Stories of Wit and Humor: Stories from Sri Lanka: (The Grand-Old-Man and The Big Five).* Baltimore: PublishAmerica, 2008. ISBN-10: 1606726242
6. Warnasuriya, Chandrani. *Favorite Folktales of Sri Lanka.* Baltimore: Textstream, 2007. ISBN-10: 1424199654

Websites

1. Kennedy Center ArtsEdge. *The Science of Shadow Puppets* http://artsedge.kennedy-center.org/educators/lessons/grade-6-8/Shadows_and_Light.aspx
2. History of Puppets http://www.puppetsnow.com/history-of-puppets.html

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Writing a Script

Narrator	Order of Events	Dialogue / Narration	Actions
	TITLE	**TITLE:**	**SHOW TITLE POSTER TO AUDIENCE**
	INTRODUCTION Set the mood and give an overview.	**DIALOGUE:**	
	SETTING Describe the time, place and characters.	**DIALOGUE:**	
	ACT 1 The conflict begins to take form.	**DIALOGUE:**	
	ACT 2 The conflict develops and reaches its climax.	**DIALOGUE:**	
	FINALE The conflict is resolved.	**DIALOGUE:**	
	Credits		

Find The Right Pet. Although dynamic and impressive, toque macaques are still wild animals and do not make good pets. Choose pets wisely by learning about any new animal you wish to add to your family.

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Writing a Song for a Musical

Writing a song requires a mixture of inspiration and form. Consider the following options for songwriting if you wish to add a song to your puppet play musical.

1 SONG PARODY

Start with a song you already know, such as Old MacDonald Had a Farm. Look at the first verse and chorus. Think of a topic for your song and how you could depict that topic with new words but keeping the same melody. Such as:

Old MacDonald - Original Song Lyrics
Old MacDonald had a farm, E-I-E-I-O
And on his farm he had a cow, E-I--E-I-O
With a "moo-moo" here and a "moo-moo" there
Here a "moo" there a "moo"
Everywhere a "moo-moo"
Old MacDonald had a farm, E-I-E-I-O

Toque Macque - Parody Song Lyrics
The toque macaques they had a fight, My-O-My-O-My
And in this fight they showed their teeth, My-O-My-O-My
With a grimace here and a grimace there
Here a grimace, there a grimace
Everywhere a grimace - grimace
The toque macaques they had a fight, My-O-My-O-My

2 TURN A POEM FOR TWO VOICES INTO A SONG

This type of poem shows two opposing points of view on a topic. For toque macaque troops, the poem voices the reasons each troop is involved in a conflict. Troop A might want Troop B's habitat for many reasons; Troop B wants to protect its habitat. Writing this type of poem means expressing both sides of the conflict. Just remember that each monkey's voice should speak about the same topic for each line of the poem. See how this type of poem might start below:

TITLE: "It's all about Real Estate – Location, Location, Location!"

TOQUE MACAQUE SPEAK:
What are you doing in our tree?
You're not welcome, so get out!

CHALLENGING MONKEY SPEAK:
We love your home, give us a key.
We're going to stay – watch us shout!

3 WRITE ORIGINAL LYRICS

Write an original song based on characters or events in the script. First, discuss the examples of character songs and story songs shown below, and help students identify a place in their script where one of the song types will be helpful to illustrate how a character feels or what is happening in the story.

CHARACTER SONGS:

- "**I am**" songs are when characters express how they feel at the moment. The songs define the character's personality and reveal something about what they are thinking and feeling.
- "**I want**" songs suggest a course of action for the future. Characters often express their goals and dreams through songs.
- "**Story Climax**" songs happen at the high point or resolution of the story. Characters can express feelings such as fear, love, success or joy using songs that represent these feelings. Story climax songs are usually energetic, enthusiastic, passionate and feel like a celebration.

SONGS THAT TELL STORIES:

- **Exposition songs** tell what has happened prior to the story being told in the play and what has brought the characters to this particular point in the story; they also may preview the themes of the play.
- **Conflict songs** describe how characters struggle to achieve differing goals. The songs focus on frustrating challenges and give insight into the beliefs and attitudes of the opposing sides in the conflict.
- **Conversation songs** tell a story by having two or more characters sing a conversation.

FINALLY: Once the type of song has been chosen, students can create lyrics based on the script and improvise a melody that fits the lyrics. Sometimes it is easier to start with a melody, and then add the words. Sometimes the words can lead to the melody. There is no right way to create a song. Have students add body percussion sounds to the song and rehearse it so that they can perform it as part of the play performance.

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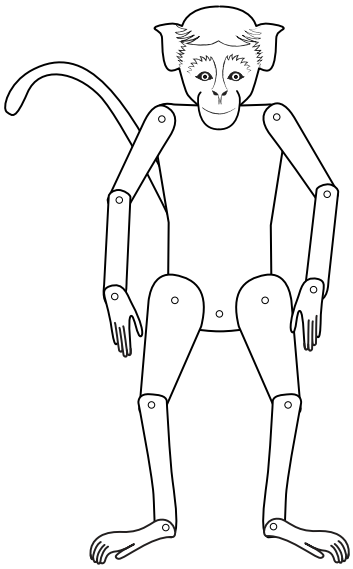
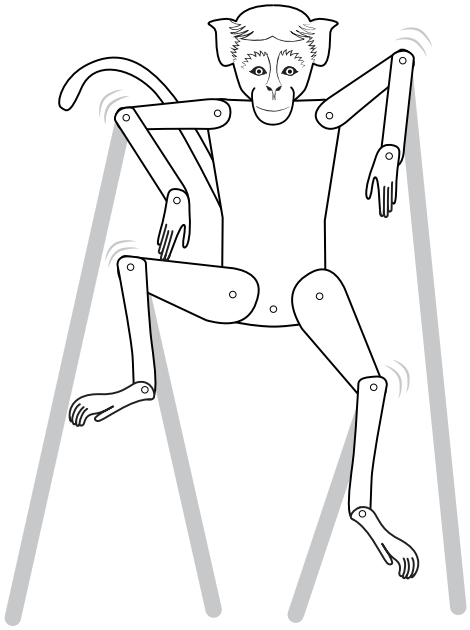
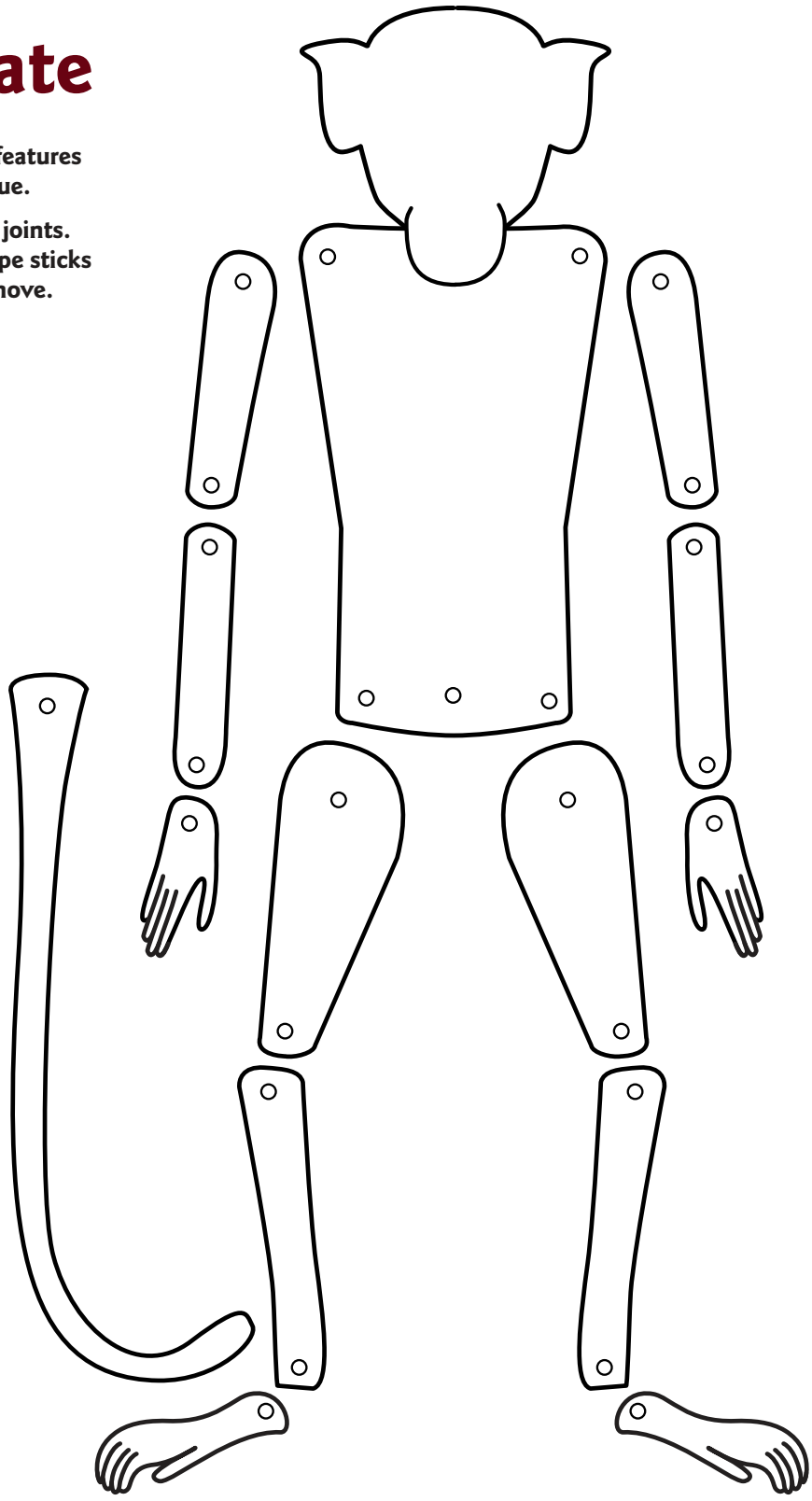
Puppet Template

Use this template to color in the physical features that are specific to your toque macaque.

Assemble your puppet using brads at the joints. On the back side of your puppet, glue or tape sticks to arms and legs to make your puppet move.







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Exploring Shadows

Mark X to indicate that type of object (Opaque, Translucent, Transparent)

1

OBJECT	Opaque	Translucent	Transparent

2

Position	Distance from flat surface / wall	Shadow appearance
Close to light source		
Close to flat surface/wall		
At an angle		

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LESSON 8

How Dangerous is the Journey to Water?

THEME
Relationships

GRADE LEVEL
2-3

SUBJECT AREAS
Focus:
Science

Extensions:
Arts, Music & Math

BACKGROUND INFORMATION
Pages 9-15

VOCABULARY
dominant, hierarchy, predator, prey, troop

STUDENTS WILL BE ABLE TO...
- Assess the ways that toque macaques protect themselves from predators
- Recognize some common predators of the toque macaque
- Interpret why animals form groups

WHAT YOU NEED
- 4-5 Pieces of rope (each about 5 feet in length)
- 4-5 Hula hoops
- Flagging tape
- Traffic cones
- Recycled bottle caps
- Bandanas (two different colors, i.e., for a class of 24 students, 12 red and 12 yellow bandanas)
- *Activity Sheet 1: Data Recording Sheet*
- *Activity Sheet 2: Journey to the Water*
- *Activity Sheet 3: What's the Best Route?*

Warm Up

Explain that toque macaques are sociable animals that live together and interact with each other for long periods of time. Like other social animals such as termites, bees and some fish and birds, toque macaques organize the group into a **hierarchy**. The **dominant** animal, usually determined by health or strength, is the ruler. The toque macaque forms **troops** of 20-40 individuals. Troops often eat together – munching leaves, nuts and berries in trees or foraging for seeds, insects and small reptiles on the ground – and visit nearby water sources as a group. When a toque macaque troop is unable to find resources in its natural habitat it will visit a nearby village, often raiding crops and eating food left behind by people! There is safety in numbers for the toque macaque since life is not without danger. The monkeys stay close together and travel in troops, as it is easier for them to distract, avoid or frighten their enemies. **Predators** may also find it difficult to single out an individual toque macaque from a troop. In order to avoid predators such as snakes, leopards and water monitors, toque macaques use different strategies to stay safe. One of their best strategies is communication. Toque macaques communicate through vocalizations to warn other members of danger. If predators are some distance away, the troop flees to nearby trees and shrubs. When predators are close, the toque macaque freezes in a safe place, keeping a line of sight on the predator. Ask if students think that freezing in place is a good strategy. Why or why not? Have they ever seen any other animals use this strategy?

Get Started

Set the tone for the lesson by asking students to imagine that it is dry season and the toque macaque troop living near the ruins of Polonnaruwa is making a trip to a water source. Ask students, what foods would they be looking for? During their journey they must cross a wide field of open farmland with scattered trees and shrubs to reach the water on the other side. Ask them, what predators might they encounter on

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How Dangerous is the Journey to Water? 8

their journey? Escaping predators is an important part of their survival. Students are going to play the "Journey to the Water" game that demonstrates predator-**prey** relationships.

STEP 1: Set up an outdoor playing area in advance, selecting a space that is large enough for students to run! Mark off one end of the field with flagging tape, cones or similar items. This end of the field represents the Polonnaruwa ruins. Mark off the far end of the field in a similar manner, with approximately 100 meters or 328 feet separating the two ends. The far end of the field represents the water. The teacher should randomly distribute 50 recycled bottle caps behind the far end of the field. The caps represent food for the toque macaque troop such as nuts, insects, berries and fish.

STEP 2: In the area between the two end lines, randomly place five hula hoops and five rope circles. The hula hoops represent trees and the ropes represent shrubs. Both are safe areas for students if they have at least one foot in the circle.

STEP 3: Divide students into two groups consisting of either predators (leopards and snakes) or prey (the toque macaques). There should be one predator for every four or five prey. Predators wear red bandanas and prey wear yellow bandanas.

STEP 4: Explain that when the first round of the game begins, the toque macaques (prey) will leave the Polonnaruwa ruins and move across the field to get food at the water source, without being captured by the leopards or snakes (predators). After they have collected one piece of food at the water they return to the ruins. To survive the first round, each toque macaque must collect three pieces of food, requiring them to move across the field and back three times. As they cross the field they are safe if they freeze when a predator is nearby. They are also safe if they find shelter with one foot inside a circle of trees or shrubs. Predators can tag a prey if they are not frozen or are outside of the safety circles. Predators lead a captured prey to the sidelines and remove their bandana. The captured prey remains on the sidelines until the end of the round. They return in the next round as predators with red bandanas. Use *Activity Sheet 1* to record the number of predators and prey after each round.

STEP 5: Ask students if there are any other events that might take place that would affect the survival of macaques. Explain that humans coexist with toque macaques and also need resources for their own survival. Wood is often harvested for many reasons, ask students what kind of things a tree can be used for. What happens to the animals if too many trees are cut down? Remove some of the hula hoops and note on the data chart those rounds where trees were removed from the field. Students discuss what role environmental change to habitat can make for the survival of the toque macaque. Ask the predator group what would happen to them if all the toque macaques were gone because they did not have the resources the needed? Is there a way to harvest trees in a sustainable way? Have students add additional hula hoops to simulate trees being planted in the tropical forest.

Wrap Up

After the game, students analyze and discuss the data on the chart. What is happening to the population of predators and prey over time (successive rounds)? How do the predators respond to frozen prey? Why? What strategies did the prey use to successfully escape the predators? How dangerous is it for toque macaques to get to water?

Ask students to describe the obstacles they face in achieving their own goals. What are some solutions for these obstacles? Explain how communities around the world also face

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obstacles and challenges. Share this website as a resource that allows students to search for local projects where they can work with others to create community-based solutions to big issues in their own neighborhood.

Keep Going

Enrich students' insights into the toque macaque survival strategies with extension activities from different content areas.

ART: Create a Conservation Splash Page for a Website

You'll Need: A collection of travel website splash pages (kid friendly), 9½ x 12" colored card stock, markers.

Explain that the splash page of a website attracts readers by including inviting pictures, enticing story line topics, and bold type styles! Students will design a tourist website that features the wildlife of Polonnaruwa.

STEP 1: After viewing Disneynature **MONKEY KINGDOM** trailer or film, have students discuss and write down what plants and animal conservation issues they noticed. Ask them to choose two or three that they think are the most important. They will use these as their story line titles for the website. Explain to students that they will create a catchy name for their nature travel website. Discuss how to create visual unity in designs by carrying out common themes in the type styles (lettering), drawing style, color choices, story titles and descriptions. For example, if the common style and theme is modern, the letters and drawings/photographs would be sleek; the color choices might be gray or cool tones; the story titles and descriptions might be short and to the point.

STEP 2: Using colored 9½ x 12 card stock have the students create all the parts of a website splash page. (If you have access to computers allow the students to design their website using various programs.)

Have them create:

1. A background.
2. A cover drawing (may have several smaller drawings to highlight other features included in the web page).
3. A name.
4. Several story line titles.

STEP 3: Students display and discuss how the features of their website designs highlight and draw attention to toque macaque lifestyle and conservation issues. (If you have access to a computer this activity could be done directly on the computer.)

MUSIC: Create a Victory Chant and Dance

While playing the "Journey to the Water" game, students can perform a victory chant each time a group of surviving toque macaque returns safely to the ruins. The chant should be one line in length, followed by a quick clapping rhythm. They repeat the chant three times. For example: Students spin in a circle, hopping on one leg as they chant and clap: "We made it back **safe**-ly. **Clap** Clap **Clap**-Clap Clap" (bold words are the accented/downbeat words for the rhythm).

MATH: Map the Safest Routes to the Water (Grades 4-6)

STEP 1: After playing the "Journey to Water" game, distribute *Activity Sheet 2* and *Activity Sheet 3*. Go over the map, noting that it shows the location of the area between the Polonnaruwa ruins and the water source.

STEP 2: Students will step into the shoes of a scientist who is interested in figuring out the best – or optimal – route for toque macaques to avoid

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predators and get safely to and from the temple ruins and the water. Explain they will use the map to determine the best routes to the water source, given different predators at different locations. They will also work out distances on the map and the travel time for each animal (prey or predator) to traverse a certain distance.

STEP 3: Ask students to compare the "shortest" routes with the "optimal" routes. Discuss how a shortcut, while quicker, is not always the best choice.

RESOURCES FOR TEACHERS

Articles

1. Miller, Dini M. "Subterranean Termite Biology and Behavior." Virginia Cooperative Extension, (2010): 1-4. Accessed November 11, 2014. http://pubs.ext.vt.edu/444/444-502/444-502_pdf.pdf

Websites

1. Education Oasis. http://www.educationoasis.com/curriculum/LP/LA/creating_classroom_magazine.htm
2. Social Studies for Kids. http://www.socialstudiesforkids.com/articles/geography/mapsavvy1.htm
3. Songs for teaching. http://www.songsforteaching.com/chantsraps.htm

RESOURCES FOR STUDENTS

Books

1. Adshead, Paul. *Puzzle Island*. Wiltshire: Child's Play International, 1990. ISBN-10: 0859534030
2. Hartman, Gail. *As the Crow Flies: A First Book of Maps*. New York: Aladdin, 1993. ISBN-10: 0689717628
3. Olien, Rebecca. *Map Keys.* New York: Children's Press, 2012. ISBN-10: 0531292894

Websites

1. ARKIVE. *Toque Macaque at the Waterhole.* http://www.arkive.org/toque-macaque/macaca-sinica/video-08i.html

ANSWER KEY

Lesson 8 - Activity Sheet 2:
WHAT'S THE BEST ROUTE?

1. **80 meters.**
2. **220 meters**
3. **(8,8)**
4. **Yes.** *The toque macaque can reach the tree at (5,10) in approximately 11 seconds from position (8,8) (the first sighting by the leopard). The leopard would take approximately 14 seconds to get to the same tree.*
5. **Yes.** *It would take the toque macaque approximately 30 seconds to traverse the 90 meters from position (10,9) – first sighting by leopard – to get to the nearest edge of the water source. The leopard would have to travel approximately 190 meters to intercept the toque macaque before she reached the water source. This would only take the leopard approximately 12 seconds.*

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Data Recording Sheet

Round	Prey Survived	Prey Captured	Notes
1 *No predators			
2			
3			
4			
5 *Logging introduced			

Help Save The Tropical Forests.

One of the greatest dangers toque macaques face is the loss of habitat. Help protect the tropical forest by switching to sustainably sourced or recycled household paper products.

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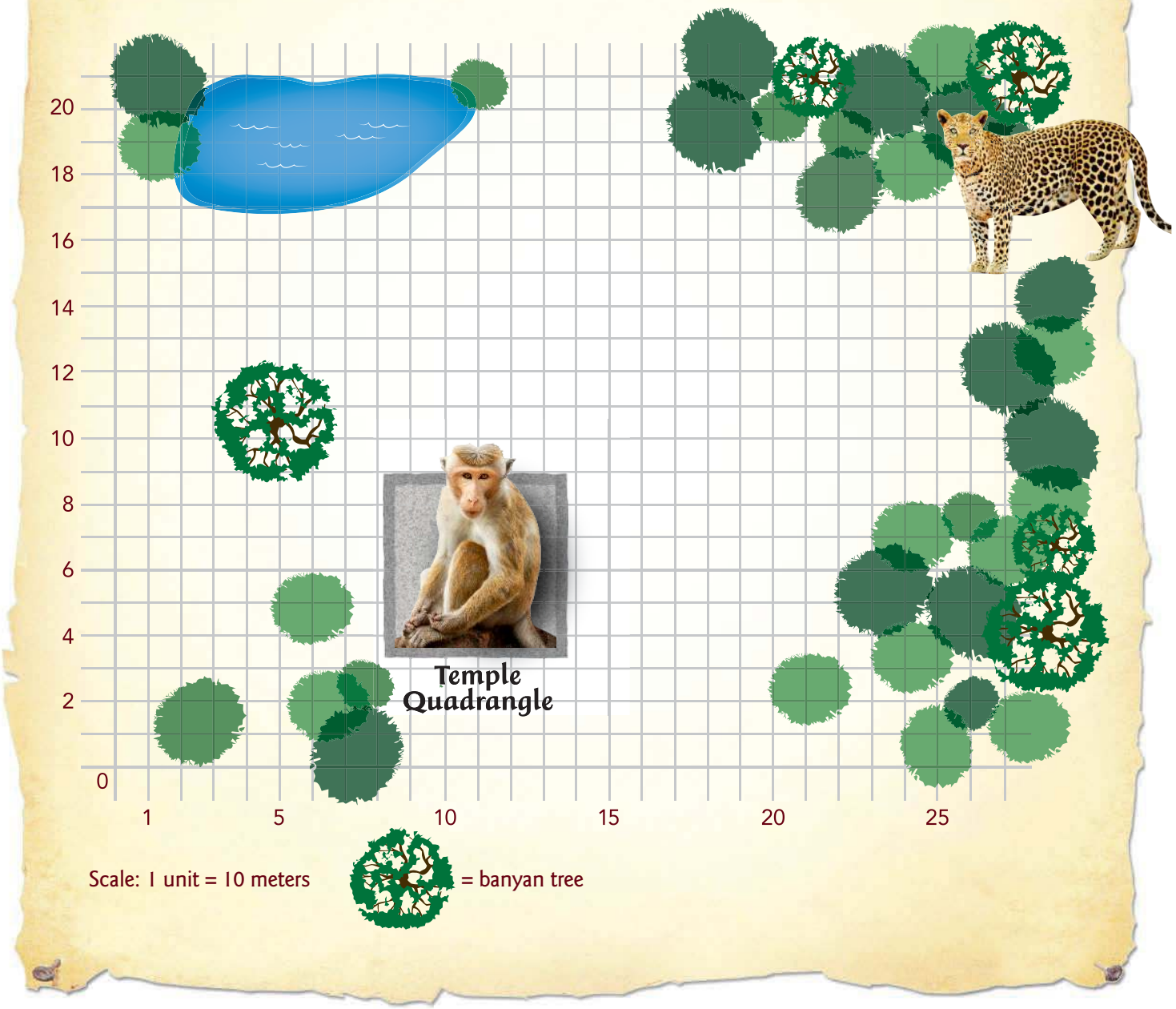
Journey to the Water

Use this map to answer the questions in *Activity 3: What's the Best Route?*



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What's the Best Route?

Step into the shoes of a scientist who is interested in figuring out the best – or optimal – route for toque macaques to avoid predators and get safely to and from the temple ruins and water source. As a scientist, you realize that the variables will change. For example, the starting positions of predator and prey will change frequently. You also realize that the distance traveled and the speed at which predator and prey travel are also important in figuring out the best routes.

SITUATION

The toque macaque is located in the Polonnaruwa ruins at coordinates (11,6). The closest shoreline or bank of the water source is located between coordinates (2,17) and (11,20). Notice the banyan tree at (5,10). A leopard is waiting in the jungle at coordinates (26,15). The leopard can sprint at a speed of approximately 60 kilometers per hour (16 meters per second). The toque macaque can travel across open ground on all fours at a maximum speed of 12 kilometers per hour (3.3 meters per second).

QUESTIONS

1) How far is it from the toque macaque to the nearest banyan tree? _____

2) How far is it from the leopard to the same banyan tree? _____

3) If the toque macaque makes a fast dash for the nearest banyan tree, where will it be when the leopard could see it? _____

4) Will the toque macaque reach the tree before the leopard could get to it? _____

5) If the toque macaque heads straight for the water source from the temple, without stopping to hide in the tree, could the leopard catch it before it gets to the water source? _____

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GLOSSARY

Abiotic: *related to physical not living organisms.*

Alpha: *the highest-ranking individual in a group.*

Biodiversity: *the variety of life forms on Earth; includes three major types of biodiversity: species, genetic and ecosystem diversity.*

Biotic: *relating to living organisms.*

Cause and effect: *the relationship between actions and events.*

Character: *a person or animal represented in a story, movie or play.*

Circle: *a line that goes in a perfectly round shape around a central point.*

Conflict: *a struggle for property or power.*

Cooperation: *common effort for common benefit.*

Coordinate system: *reference of lines arranged to identify the location of points on a map or in space.*

Coordinate: *a group of numbers that indicates a point or plot on a map.*

Dialogue: *the things that are spoken by characters in a story, movie or play.*

Dominant: *more powerful or important than others.*

Dry zone: *an area with a seasonal time of the year that has little rain.*

Ecosystem: *the interaction of all living and nonliving components found in a given area.*

Endangered species: *animals and plant species threatened with extinction.*

Forage: *to search for food items.*

Island endemic species: *A plant or animal from a specific region that is not found naturally in any other place.*

Gender: *a male or a female.*

Habitat: *a place where plants and animals have everything they need to survive.*

Hexagon: *a geometric shape with six sides.*

Hierarchy: *a social ranking of individuals where some are higher or lower than others.*

Horizontal axis: *the line on a graph or map that runs left to right.*

Improvisation: *creation and performance of music, dialogue, or dance without rehearsal.*

Intersection of the lines (the origin): *the point where the axes of a coordinate system cross.*

Isosceles trapezoid: *having the two nonparallel sides equal.*

Life event: *a change in circumstances related to a specific point in time.*

Low relief mural: *figures or design elements are slightly more prominent than the background.*

Mid-point: *a point that is near or at the center or middle of a line.*

Narrator: *one who tells a story and describes what is being seen.*

Pattern: *a repeated design.*

Percussion: *musical instruments played by hitting or shaking – such as a drum.*

Perimeter: *the length of all of the lines that form a shape.*

Perpendicular: *exactly upright, at right angles to a line.*

Predator: *an organism (usually an animal) that eats other animals for food.*

Prey: *an animal that is food for another animal.*

Primatologist: *a person who studies primates (a group of mammals that includes prosimians, monkeys and apes).*

Puppeteer: *a person who entertains audiences by operating puppets.*

Ranking: *a position in a group based on status.*

Rectangle: *a four sided figure with four right angles.*

Reflection: *the image produced by a mirror.*

Relationships: *ongoing associations between animals, people or characters.*

Repeating pattern: *a sequence or order of objects, symbols, words, or sounds that repeat or grow.*

Rotation: *a turn around a center point. Rotational symmetry: when rotated a shape or image looks the same.*

Scale: *a measuring tool used to represent proportional size on a map.*

Scenario: *an account of a possible series of events or a course of action.*

Scientist: *a person who studies the living or non-living world.*

Setting: *the arrangement of scenery that represents time, place, and location in a play or story.*

Shadow puppet: *a cut out figure of a character in a play that casts a shadow on a screen.*

Species: *a group of very similar organisms; individuals of the same species can mate to produce fertile offspring.*

Square: *a geometric shape with four straight sides and four right angles.*

Status: *the rank of a person or animal compared to others.*

Symmetry: *a balance in proportions of size, shape and parts of the opposite sides of a dividing line.*

Temple ruins: *an ancient place of religious practices no longer used for it's original purpose.*

Tessellation: *a covering of a geometric plane of congruent figures without overlaps or gaps.*

Threat: *indication of impending harm; something that negatively impacts the survival of an organism.*

Translation: *to move a shape by sliding, not by rotating or flipping.*

Triangle: *a geometric shape with three lines and three angles.*

Troop: *a group of 10–25 animals living together.*

Tropical rain forest: *a woodland with tall trees in the tropics that receives lots of rain.*

Vertical axis: *the line on a graph tor map that runs up and down.*

http://www.merriam-webster.com/dictionary/

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