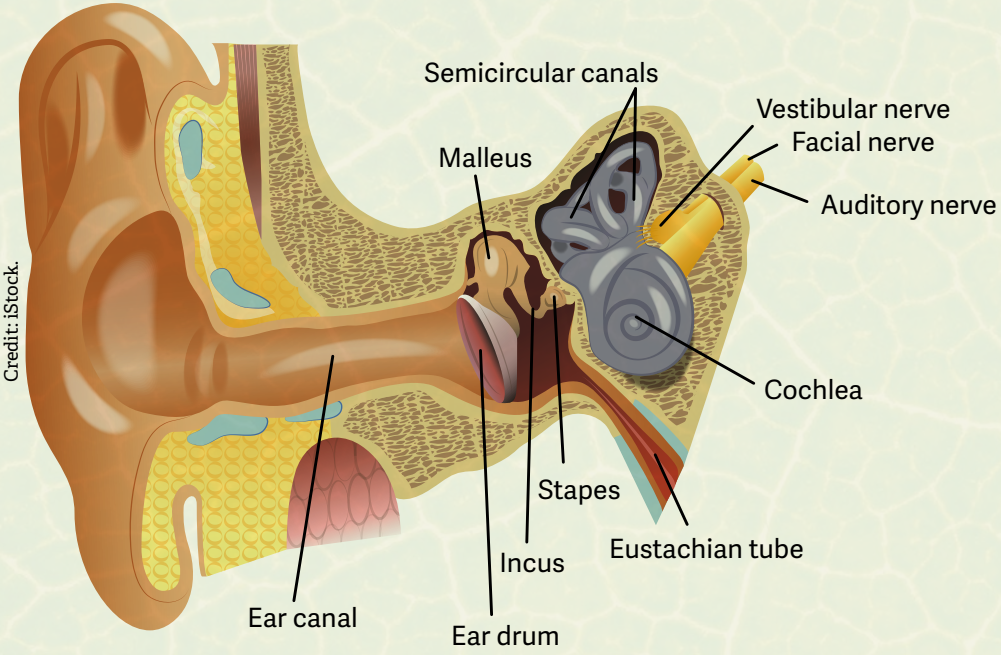
NATURAL SOUNDS

When we hear, what do we hear? If you were able to float in space and listen to the surrounding universe you would hear…well, absolutely nothing. That is because sound needs something to move through, a medium. Here on Earth, the sound we hear travels through air. When you clap your hands together, you create a series of airwaves, just like a pebble causes waves when dropped in a pond. When these airwaves travel into your ear (also having the interesting name of pinnae), they are funnelled into your ear canal. Deep inside your ear canal, your eardrum begins to vibrate. And when your eardrum vibrates, it causes a series of tiny interconnected bones to move (the ossicles: malleus, incus, and stapes). The last bone, the stapes, transfers the sound vibrations to the cochlea. The cochlea is a snail-shaped sac filled with fluid and lined with tiny hairs. These hairs are so sensitive that they respond to different pitches or frequencies of sound. Each tiny hair generates a nerve impulse that stimulates the auditory nerve, and the impulse travels to the hearing centers of our brain. Our brain then translates this into sound. While it sounds (ha) like it might take a long time for all of this to happen, from when the first sound waves enter our ear to when we actually register sound just takes a mere fraction of a second.

SOUND CATCHERS

If you've ever closely watched a deer, you'll notice how its large ears are always twitching and moving. Other animals too, from rabbits to foxes, are continually using their ears to focus in on sound. As an animal, hearing movement helps you to either escape danger or to catch your prey. Your survival depends upon it.



Credit: iStock.

Deer Ears

Here's how you too can turn your ears into deer ears.

- Press your fingers together and cup your hands. Place them directly behind your ears and push forward. You can amplify your hearing by as much as ten times by using this technique.
- Now find a quiet spot. Close your eyes and listen to the natural sounds that surround you. Perhaps it is the swish of grass, the gurgle of water, the gentle murmur of tree leaves, or the creaking of branches. How many natural sounds can you hear? There are people who have claimed to hear caterpillars chewing. Is that you?

Extenda-Ears

What if you could make a device to extend your ears to help you hear better? Here is a simple and quick sound collector that really works.

- Roll one large piece of paper into a cone shape, keeping one end as large as you can and the other small enough to fit into your ear and secure with tape.
- Place the narrow end of the cone to your ear but be careful not to go directly inside your ear!
- Go outside and listen to any natural sounds. Can you hear any better? The funnel focuses vibrations into our ear canal, amplifying sound.

Jacob's Homemade Sound Catchers

- Cut out a cardboard paper plate (or card stock) into an ear shape so it fits along the side of your head and behind your ears.
- Make two holes. Slip a dowel or stick inside the holes as shown in the photo and curl the card stock. Secure with tape. And voilà: instant sound catchers.

Try them out and maybe you can hear some secrets being told from across the room.

Homemade sound catchers

Credit: Jacob Rodenburg.

LEARNING FROM BATS

Humans can hear from 20 to 20,000 hertz (a measurement of sound wave frequency). One hertz equals one sound wave over one second. Many animals can hear way beyond the frequencies that humans can hear. Take for example bats. As a way to navigate in the dark and to hunt, bats send out a stream of high-pitched sounds called "ultrasounds" at intervals of 10 to 20 per second and then listen as they bounce back. Bats create a kind of picture of their environment by tracking sound. Most people think that bats are blind—they aren't; they just do most of their hunting in the dark using their remarkable sonar capabilities. Dolphins and whales use this same technique to hunt underwater. Submarines create computer-generated maps of the seafloor by sending out sound pulses.

It turns out that some humans can activate this ability as well. Daniel Kish is completely blind. Yet he can navigate through the busy streets of Long Beach, California, and find his way back home again. How does he do it? Just like a bat, he sends out a series of clicks by moving his tongue against his cheeks and listens for the sound to return. He says he can create a three-dimensional mental image of his environment, sketched by sound with "depth, character, and richness." Over the years, he has become so good at seeing the world through sound that he regularly hikes alone in the mountains, cooks his own meals, and even rides his bike through his suburban neighborhood. Let's think about David as we try out some of these sound activities. Does that "sound" good to you?

Credit: Pixabay.

Sound Claps

- Go outside and find a place (if you can) where there are bushes, trees, boulders, even buildings.
- Turn one direction and clap loudly. Listen to the quality of the sound returning. Now stand directly in front of an object (say a large tree or a wall) and clap in exactly the same way again. Did you notice how the quality of the sound changed?
- Try closing your eyes. Experiment in front of different natural objects and try to "see" the sound as it bounces back. Can you create a three-dimensional image? How does it compare to the actual image you see in front of you?
- Practice in front of various natural objects (a bush, a large tree, a small tree, a boulder). Does your sound image become progressively clearer, the more you practice?

Click Paths

For this activity, you'll need a blindfold, a straight pathway through the woods, and a friend. Can you navigate the world like Daniel Kish does? Let's see (or hear, in this case)!

- Find a clear and flat pathway through the woods. Make sure it is fairly straight and clear of obstructions (roots, rocks, holes, cracks) for about 150 feet (50 meters) or so. Now walk the path a few times, noting natural objects along the way from both directions. Perhaps you'll notice that big white pine back from the edge of the path or the sprawling lilac bush or that hill in the distance.
- Now walk the pathway again, this time making clicking noises just like Daniel does by moving your tongue against or cheek or teeth (whatever works best for you). Practice clicking as you walk along really concentrating on the sound. Can you hear it subtly change as you pass by different natural objects?
- Here is where your friend comes in handy. Have a friend stand at the end of the 150 feet (50 meters) path. Let them know to warn you if you are going to stray from the path and run into something painful.
- Place the blindfold around your eyes and slowly walk the path, clicking as you go. Did the sound help you navigate? Practice a few times and let your friend have a turn as well. Were you able to create a sound map just like Daniel Kish? Did the sound picture in your mind bear any resemblance to the trail you could actually see?

Bat and Moth

Remember how bats hunt by sending out a stream of high-pitched sonar waves that help the bat echolocate their food? This game does a wonderful job of replicating how sonar helps bats to pinpoint the exact location of their food when they are flying at night.

Here is a tried-and-true game based on that childhood staple Marco Polo. You'll need a group of 12 or more, at least two blindfolds, and an open area.

- Select one volunteer to be a bat and another to be a moth. Have everyone else make a large circle facing inward. Their arms should be stretched out so that their hands, when extended, are about half a meter from the person to next to them. These folks will serve as your "cave walls."
- Blindfold both the bat and the moth. Explain that it is now dark outside and neither of the bat nor the moth can see very well. In this game, the bat's job is to "catch" the moth.
- In real life, a bat would send out a series of high-pitched sounds and listen for the sound's return—zeroing in on the moth. When located, they would then either scoop out the moth with their tail just like a catcher's mitt and transfer it to their mouth, or they would smack the moth with their wing to transfer it to their tail and subsequently into their mouth. Incidentally, a single bat can eat up to 1,200 mosquitoes in one hour and up to 8,000 in one night!
- To show how echolocation works, have the bat say distinctly "bat" loudly and clearly. Every time the moth hears the bat say "bat," it must say equally loudly and clearly "moth" (to show how the sonar pulse is being reflected back to the bat). If either the bat or the moth ventures too closely to the cave walls, have the walls gently say "wall," so there aren't any collisions.
- Now ask the bat to try to tag the moth. After a short while, ask the bat to experiment by increasing the frequency of their call. Does this help them track the moth more effectively?
- If you like, add another moth to the game. Some moths have evolved to start evasive manoeuvres if they hear a bat's sonar. They'll begin dive-rolling and zigzagging, trying to move in an abrupt and unpredictable fashion. Can the moth try some evasive moves to confuse the bat? Some species of

tiger moths have evolved to jam the bat's sonar by making a series of disruptive clicks using a special organ in their thorax called a tymbal.

- Biologists have called the bat/moth predator/prey relationship a kind of arms race as each evolve ever more complex methods to catch prey and to avoid being eaten.

Be a Bat Detector

- Purchase a bat detector. There are a number that are available, starting at about $50. They take the high-pitched tones that bats emit and turn them into sounds that humans can hear. Using the bat detector, you can get an idea of what species of bat might be active by tuning into the specific frequency that bat uses to catch its prey.
- Find a place where bats hang out: a barn, a forest with mature trees, a city park, or perhaps the roof of an old house. Make sure you arrive shortly before dusk. Hold the detector aloft and adjust the frequency of the detector so that you can hear bats make their distinctive clicking sound. Start at 45 hertz and adjust up or down accordingly. Note the bat detector can help you differentiate between some species based on the frequency of their sonar.
- If you hone in on a bat, note how the clicks accelerate as it hones in on its prey. Report your findings to citizen science sites such as iNaturalist or Neighborwood Bat Watch.

Bat Frequency Chart

Species of bat	Frequency range
Eastern small footed bat	40–50 kHz
Little brown bat	40–48 kHz
Northern long-eared bat	40–55 kHz
Silver bat	22–30 kHz
Tri-colored bat	40–48 kHz
Big brown bat	30–38 kHz
Red bat	35–45 kHz
Hoary bat	20–25 kHz

LISTENING TO OTHER ANIMALS AND TREES

Tree Songs

Here is a wonderful word for you during your next game of Scrabble: *psithurism*, meaning the whispering of wind as it blows through trees and rustles leaves. Did you know that you can get close to identifying the type of tree by listening to the quality the sound of the wind makes as it moves through the tree tops? Perhaps you have this ability?

- To find out, see if you can locate a white pine tree. You can tell it is a white pine by its long soft needles (always in bunches of five). One way to remember is that there are five letters in "white" and five bundled needles on a white pine tree.
- Sit beneath its branches and focus in on the sweeping sound of the wind. There is a soft whooshing sound that is characteristic of pines. Oaks and maples have more of a chattering quality as the leaves rustle against one another. Quaking aspens shiver and bushes whisper.
- Take a note pad and describe the quality of sound you hear for each type of tree you visit. Try to remember these distinctive sounds. Use a field guide or an app such as PlantSnap to help you identify the trees that you don't know.
- On a windy day, savor the wind's symphony of soft music that strums the leaves and plucks the branches of nearby trees. In nature, there is music everywhere, if we take the time to stop, listen and enjoy.

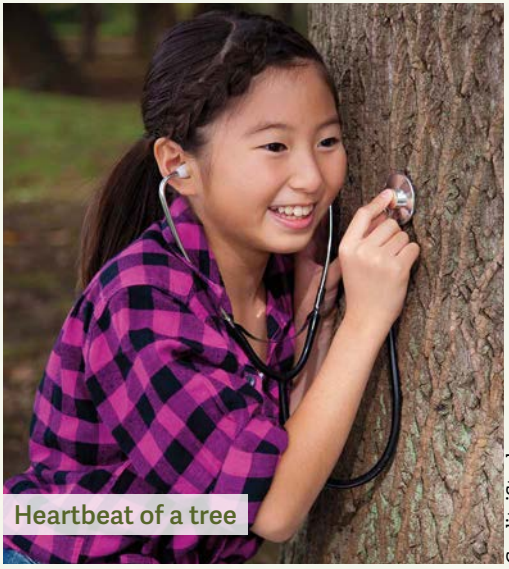
Tree songs

Credit: iStock.

Heartbeat of a Tree

We forget that those tall trees that form the backdrop of our city parks and school grounds are pulsing with life! In the spring, sap rises from the roots up through the trunk to the tips of every branch. The energy from the sap helps leaves to form. Just like listening to your own heartbeat, you can hear the gurgling, crackling, sputtering of the sap as it moves up the trunk. Early spring is the best time, when the sap is just starting to rise. Hardwoods tend to be a better choice than softwoods.

- To listen to the sap rising, select maples, birches, or cherry trees.
- Find one that is more than 6 inches in diameter but not too large (if the bark is too thick, you'll be less likely to hear anything).
- You'll need a stethoscope, which you can purchase online or you can find used ones for $30 or so.
- Place the bell of the stethoscope against the trunk and be very still. You may need to move the bell around until you find a spot where you can hear the best. Enjoy the exuberant sounds of a tree waking up after a long winter's nap!



Heartbeat of a tree

Credit: iStock.

Bird Whispering

I was skeptical when a friend said he could call birds in from the forest. "What are you talking about?" I asked. Birds are shy. If there is one thing I know, they don't come when they're called.

With a smile on his face and a glint his eye, he said "I'll show you."

We stood under the canopy of oaks and maples, when he tilted his head upwards and let go with the strangest of sounds. By pursuing his lips, he uttered a stream of loud "pssshhhing" noises. He repeated each phrase a few times a second (pish, pish, pish), emphasizing the P and the "ish" parts. I looked at him quizzically. Then he began to kiss the back of his hand. What the heck? I thought; surely he needs some psychological attention. Then he told me to stand still. So I did.

It was then that the birds began to arrive. First black-capped chickadees flitted in, soon followed by white- and red-breasted nuthatches. Warblers, woodpeckers, and even other birds swooped by to check us out. After a few minutes, we had over sixty birds near us. Some of the chickadees were only a few feet away! How did my friend do this?

He used the secret weapon known to birders as "pishing." It works especially well with small songbirds. Pishing simply involves taking a deep breath and quickly repeating the sound "pissh" as you let the air out in one drawn-out exhale. Try to pish yourself. Yes, people may look at you strangely, but you'll gain their admiration when birds start to arrive.

- If you are in a forested area where you hear the sound of a chickadee (with their distinctive "chick-a-dee, chick-a-dee" call), then stand next to a tree that has lots of branches. Chickadees feel safer when there is plenty of cover.
- Stay very still and begin pishing. At first, pish fairly loudly every few seconds. Continue this for at least a couple of minutes and then lower the

Black-capped chickadee

Credit: Pixabay.

volume when birds start to arrive. You can also kiss the back of your hand or fingers, creating squealing noises. Chickadees and nuthatches are especially receptive to both of these sounds, but other species will almost always show up, especially if you are patient. Don't be surprised if you end up with birds practically at arm's reach.

- It is believed that birds respond to pishing because it sounds similar to the scold calls of chickadees, which are used when there is a potential threat in the area, such as an owl. Other chickadees, along with birds of other species, are attracted by these sounds because they are curious about the nature of the potential threat.
- You can pish birds in during each of the seasons, pishing seems to work best during the fall and winter.

Bird Mnemonics

There are few things more beautiful than the ethereal sound of a wood thrush's song rising and falling on a mist-filled morning or hearing the call of a loon echoing across a granite-rimmed lake. Each bird species has a unique sound. Birds make vocalizations in a special organ called a syrinx, located deeper in their throat than a human larynx, which can produce quite loud vocalizations for their size. Some birds can even make two sounds at once. For example, a veery can sing in harmony with itself.

There is something so comforting about walking in a forest and being able to recognize the calls and songs of bird species. In a way, you are among friends. Just like hearing a friend's voice, you become familiar with each unique sound. And you don't have to see a bird to know that it is there.

You can get to know your bird vocalizations. To start with, there is a difference between a bird's song and call. Songs are made in the spring, almost exclusively by males. Translating from Bird to English, songs say: "Hey if you are girl bird of my kind, I'm over here! Or if you are another male, back off! This is my part of the forest." Calls, on

the other hand, are more about contact and alarm—males and females touching base or uttering a warning that danger is near. The sentinel of the forest, the blue jay often squawks a loud "jay, jay, jay" call if a hawk or an owl is nearby. A black-capped chickadee uses its iconic "chicka-dee-dee-dee" call to stay in touch with its flock during the fall and winter. But its song may be less familiar. In the spring, the male chickadee lifts its beak skyward and lets out a slurred three-syllable whistle that sounds like "Hey sweetie!"

Perhaps this will sound familiar. Does the plaintive sound of a mourning dove sound like "There's nothing to do"? Or is the northern cardinal reminiscent of "Cheer, cheer, cheer, party, party"? Of course, they are not really saying those things. It is just the rhythm, cadence, and arrangement of notes that bring to mind these sayings. These mnemonic (or memory) devices are simply a handy way for us to recognize these unique songs and calls.

Below you'll find some tried-and-true

Bird Mnemonic Chart

Name of bird	Suggested mnemonic
American robin	Cheer-a-lee, cheer-up, cheer-a-lee
Red-winged blackbird	Konk-er-me
Common yellowthroat	Witchity-witchity-witchity-witch
White-breasted nuthatch	Wee-wee-wee-wee-wee-wee
Northern cardinal	Cheer, cheer, cheer, party, party
Mourning dove	There is nothing to do!
Yellow warbler	Sweet-sweet-sweet-I'm so sweet
Black capped chickadee	Hey sweetie
Song sparrow	Maids maids bring out your tea kettle-ettle-ettle
Great horned owl	Who's awake? Me too!
Barred owl	Who cooks for you, who cooks for you, who cooks for you all?
American goldfinch	Pa-chip-chip-chip – a chip for me
American bittern	Gulp a pump
Baltimore oriole	Here; here; come right here; dear
Blue jay	Jay-jay-jay & queedle-queedle-queedle
Eastern meadowlark	Spring of the year

mnemonics for common bird species. Bird apps such as Sibley Birds or Larkwire will also help you identify bird calls and songs. Song Sleuth will even help you ID a bird song recorded by your phone. Go out into the forest and, using your cupped ears, really listen. Using a pad and pen, try to develop a saying to help you remember the song or call. You can also use Peterson's *Field Guide to Bird Song* to help you learn the vocalizations of a variety of bird species in your area. Bird apps such as Sibley Birds or Larkwire will also help you identify bird calls and songs. Start by learning a dozen or so of the common ones and each spring add a few more to your repertoire.

Get to Know Your Frog Songs

And yes, frogs sing too! And they sing for the same reason birds do. The males are trying to attract a mate, and they also are fighting for territory. Walk to a nearby marsh, swamp or bog in early spring, just as the sun is starting to set. Remember to slip on your deer ears. Listen for the high piercing peep of a spring peeper or maybe the trilling bursts of sound from the chorus frog. You might also hear the low garomph of the bullfrog or the throaty croak of the leopard frog. Some species call earlier during spring, some later. During the day, you might even hear the birdlike trill of the gray tree frog, depending on where you live. To learn to identify the frog songs in your province or state, go to frogwatch.ca (Canada) or aza.org/frogwatch/ (US)

Bullfrog

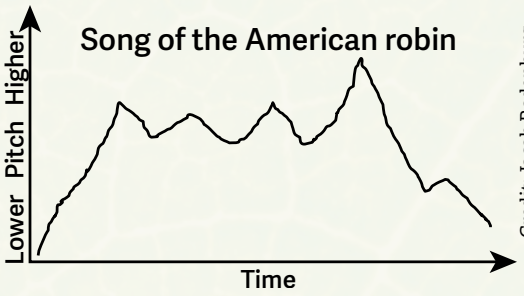
Credit: Pixabay.

Frog Songs		
FROG SPECIES	**SOUND**	**WHEN THEY SING**
Spring peeper	High peep peep sound	Early spring
American bullfrog	Deep, resonant "rr-uum" or "jug-o-rum"	Late spring/early summer
Wood frog	Sounds like a quaking duck	Early spring
Green frog	"gulp, gulp" deep from the throat	Late spring/early summer
Leopard frog	A throaty ahhhhhhhhhh…	Early spring
Chorus frog	Short bursts of trills made with your lips or tongue	Mid- to late spring
Eastern cricket frog	Use your tongue to make "click-click-click"-like sounds. Reminiscent of pebbles clicked together; cricket-like	Late spring/early summer
Gray tree frog	Slow musical bird-like trill lasting 2 to 3 seconds. Use your lips or tongue	Late spring/early summer
Fowler's toad	Nasal, sheep-like "waaaaa"	Late spring/early summer
American toad	A sustained trill from lips or throat	Early to late spring
Western toad	Soft, quickly repeated "peep-peep"	Late winter/early spring
Great Basin spadefoot toad	Short harsh nasal-sounding snores at 1 second intervals	Late spring/early summer
Great Plains toad	Rapidly repeated, harsh, machine gun-like trill; 20–30 sec's in length	Late spring/mid-summer
Plains Spadefoot toad	Short, harsh, barks (ouak-ouak) at 1 second intervals	Late spring/early summer
Pacific tree frog	"Kreck-ek, Kreck-ek, Kreck-ek"	Late winter/late spring
Red-legged frog	Weak series of 5–7 notes lasting 1–3 seconds "uh-uh-uh-uh-uh"	Late winter/early summer
Sierran tree frog	"Rib-it", or "krek-ek", with the last syllable rising in inflection	Nov–July (depending on location)

Nature Spectrograph

A spectrograph is a visual picture of sound. Here is a way that you really can focus on the quality and loudness of the natural sounds around you. You'll need a pad of paper and pencil for this activity.

- Draw a simple graph (see right). On the left side, make an arrow indicating how loud the sound is: higher up the page means louder, lower down softer. The axis on bottom of the page indicates how long the sound lasts.
- Pick one sound. Perhaps it is a robin calling. Does your sound steadily rise, does it curve upward, or does it trill? Try to depict the sound on the spectrograph.
- Use your spectrograph to focus on a few other natural sounds. Several days later, can you remember the sound by reading the spectrograph?



Credit: Jacob Rodenburg.

Fingers Up

Here is a simple game that helps you concentrate on the different sounds in nature.

- Ask your participants to sit down and squeeze their eyes shut. Every time they hear a distinctive natural sound, have them lift a finger. With each additional sound, have them lift one more finger.
- After a few minutes, ask participants to open their eyes and reveal how many sounds they heard. What did they think they were?

Make an Acorn Whistle

Here is an evocative sound produced by something children love to find. We know that oaks produce acorns each year. What is less known is that every 5 or 6 years, red and white oaks produce a massive amount of acorns—as many as 10 times the number in a typical year. This is called a "mast" year—scientists believe that this abundance of nuts helps to ensure that at least some of the acorns will grow into trees. Is this a mast year?

- Visit your local park or nearby forest and look around. Find an oak tree (most oak leaves have rounded or pointy lobes, see page 67).
- Hunt for an acorn and remove the cap. Take the cap and place your thumbs over the hollow in a V shape (see photo). Bend your thumbs slightly.
- Blow across your knuckles and over the hollow. You should hear a sharp whistling sound. If you don't, shift your thumbs around until you hear a clear whistle. Watch out for incoming dogs!

Credit: Jacob Rodenburg.

Woodpeckers

Think about it… Woodpeckers slam their heads with a force of more than 1,000 times of gravity against tree trunks, using their sharp beaks to excavate a hole and find insects. How is it that they don't get brain damage, or at the very least a headache? It turns out that they have specially reinforced skulls and extra muscles in their necks. In fact, some woodpeckers have a tongue that is so long (several times the length of its beak) that, when not in use, it is wrapped around the back of their skull. During the spring, male woodpeckers will drum

(also known as tapping or tattooing) as a way to attract a mate and establish his territory. Using a resonant object such as a dead and hollow tree or stump or log and even aluminum gutters, they create a distinctive pattern of rapidly repeating sounds. Different woodpeckers create different drumming patterns.

Woodpecker Drumming Game

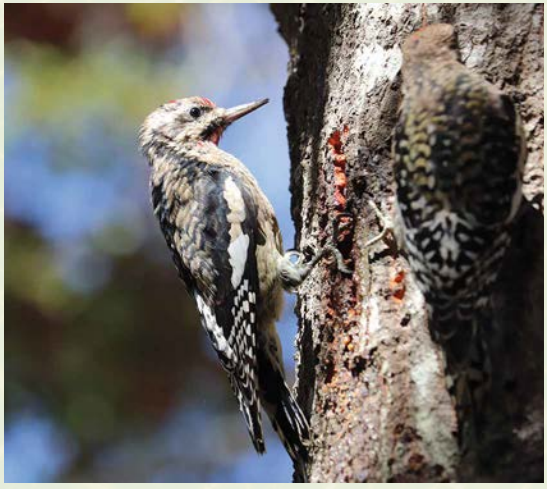
Play this game in a large open wooded area. A city park will work well.

- You'll need 2 dowels (¾" in diameter and about 18" long) or 2 thick sticks, enough for half the participants.
- Hand out copies of the woodpecker cards on the next page. Make sure these are paired up (for example, two hairy woodpecker cards, two sapsucker cards). Each pair should have one participant with the sticks and one without the sticks (but each should have the same card).
- On a given signal, the participant with the sticks runs and hides. They begin using their sticks to drum the pattern that is indicated on their card. They represent the male woodpecker of that species. The other, the female, is listening for the correct pattern. Can she find her species by sound alone? With everyone drumming at the same time, it can be a bit of a challenge! Give it a try.

Woodpecker Drumming Game

Hairy woodpecker
As quick and as fast as you can for about 5 seconds—rapid, even beats—pause for 10 seconds—resume. A real hairy woodpecker can drum 25 times per second!

Pileated woodpecker
Slow and resonate, rolling taps that lasts for 5 seconds or so and then begins again. The pattern is somewhat like knocking on a door.



Sapsucker
Slower, morse code like taps. Something like tap tap, tapity tap, tap, tap tapity tap. Some slow, some faster.

Credit: Pixabay.

Downy woodpecker
Fast taps for about 2 seconds, then stop for 3 seconds and the resume.

Trunk Sounds

Sound travels differently through different densities of wood.

- Using the dowels or sticks from the last activity, have someone stand on the backside of a trunk of a hardwood (such as a maple or oak) and place their ear against the trunk. Have someone tap the tree using their dowel or stick from the other side.
- Move to a softer wood such as a cedar, pine, or hemlock. Try out different diameters of trunks. Is the difference in the quality of sound between hardwoods and softwoods, between thicker and thinner trunks? Is it possible to distinguish between different species?
- If you find a long trunk lying on the forest floor, carefully place your ear along the thinner end and ask another person on the stouter end to create small knocking sounds or rubbing sounds with your dowel. Does the sound carry along the trunk? Birds can often hear the scrabbling of claws far below as an animal begins to climb the tree, helping to alert them that danger is coming!

Trunk knocking

Credit: Jacob Rodenburg.

STALKING GAMES

Here are a few games that help you move through the woods silently and mindfully. Stalking, or quiet walking, takes a bit of practice, but once you've mastered this, you'll hear so much more than on a careless plod through the woods. Our ancestors and Indigenous people from all over the world learned to stalk prey in order to get as close as possible for a successful hunt.

Individual Game

- Place your hands on your knees and crouch just a bit. By taking this position, you can freeze during any part of your walk. Rest the weight of your body on your back leg. Now take a small step and ease your weight onto the toes of your front foot. Make sure there are no crunchy leaves or dried sticks before you commit your entire weight.
- Transfer all your weight on those toes and roll along the outside of your foot and onto your heel. Do the same with the other foot. Take small and deliberate steps. A good stalker will take a long time to move 150 feet (50 meters)—but they won't make a single noise.
- Practice on a variety of natural surfaces: a grassy field, a forest floor, and a stony path. Once you have the hang of this, try the following stalking games.