

Weirdness Under the Sea

by Lynn Brunelle



NOAA

Strange-looking creatures like this sea cucumber can be found in and near the Mariana Trench.

Incredibly strange creatures lurk in the deepest, darkest part of the ocean

Imagine somewhere so deep under water that you could tuck Mount Everest in it with room to spare. Sunlight has never reached this place, so there are no plants. The environment is bitterly cold and the pressure of the water feels like 100 elephants standing on your head.

Nothing could survive there, right?

Wrong!

Almost seven miles below the surface of the Pacific Ocean, the Mariana Trench is a vast, yawning gash in the sea floor that supports many of the strangest creatures on Earth. At 35,814 feet deep, this V-shaped canyon-about ten times deeper and longer than the Grand Canyon-is the most extreme environment on the planet.

Until relatively recently, no human had seen the bottom of the ocean... because no one could survive the trip. It is only during the past 60 years that scientists have been able to explore the canyon. They have now created vessels that carry instruments, lights, cameras-and even humans-safely, allowing us to peer into another world and see that these vast inhospitable expanses are not lifeless after all.

Creatures from Your Nightmares

Far from lifeless, this abyss is swarming with the stuff of nightmares—fish with translucent heads, monstrous mouths, colossal eyes, and gnashing teeth. The trench teems with glow-in-the-dark squids, sea jellies, and never-before-seen species of shrimp. And the bottom is speckled with giant living blobs.

In this world with without light, weird and wonderful creatures have adapted to the never-ending darkness:

- The barrel fish has a see-through head which allows it to detect the slightest movement in any direction.
- Angler fish, sea jellies, squids, shrimp, and worms brighten the gloom with glow-in-the-dark displays.
- The six-inch-long dragonfish has a nightmarishly huge mouth lined with jagged teeth. Dangling from its chin is a whisker-like ropey extension with a glow-in-the-dark tip that it wiggles to attract mates and lure prey.

What do these deep-sea creatures eat? Most dine on each other and on marine snow. Sounds kind of lovely, doesn't it? But it isn't: marine snow is all the bits and pieces of dead things that fall to the bottom of the ocean.

Unbearable Pressure

If you've ever spent time at the bottom of a pool, you have no doubt felt the pressure of that water pushing on you. It squeezes pockets of air in your sinus cavities. The pressure you'd feel under 10 feet of water is uncomfortable. Imagine what it would feel like if you were five miles below the surface!

On the ocean floor, football-sized albino crustaceans called amphipods look like giant wood lice and flutter through the muddy deep. How do they not get crushed under the massive weight of the water? They don't have any air pockets in their bodies to be squeezed. They also contain a special kind of fat molecule that does not solidify in extreme cold and pressure. This molecule not only helps keep them from being mashed, it allows them to move.

There is so much more that we don't know about this mysterious world. What other creatures may be lurking there? Scientists hope to find out!

Do Animals Laugh?

by Debbie Nevins



James Brooks

dolphins playing

It seems so: dolphins do it, chimps do it, even laboratory rats do it. But why?

What do you call a dog magician? A Labracadabra-dor!

Ha! Now try telling that joke to your dog. Any reaction?

"Man is the only animal that laughs and weeps; for he is the only animal that is struck with the difference between what things are, and what they ought to be," wrote British author William Hazlitt in his 1818 essay, "On Wit and Humour." Was Hazlitt right, or was he just displaying typical human hubris?

Scientists today are trying to determine if animals do, in fact, laugh-and, if they do, what that laughter tells us. We know that some critters, particularly chimps and other apes, make vocalizations that look and sound like laughter. Of course, grinning dogs and cats are all over the internet. So, can beasts really laugh-and if they can, *what* are they laughing at?

What's the Purpose of Laughter?

Animal laughter doesn't seem out of the question. After all, many creatures seem to express a wide range of human-like emotions, and behavior research supports the idea that animals have emotions.

But laughter is a particularly tricky trait to pin down. After all, what exactly is laughter-and what is its purpose, even in humans?

In his not-at-all-funny essay, Hazlitt describes laughter as a "convulsive and involuntary movement, occasioned by mere surprise or contrast." Think that's a lame definition? Try coming up with your own.

There are essentially two kinds of laughter. One is a response to physical stimulation like tickling, while the other is a more complex social reflex, often in reaction to incongruous concepts and situations. Tying the two together, laughs can perhaps be said to be the vocalization of delight, at least in some cases.

For humans, this expression originates in ancient areas of the brain. We're wired for playful joy at a primitive level. It seems that some other creatures are wired that way as well, especially for the responses associated with tickling. In the 1990s, Jaak Panksepp, a neuroscientist at Bowling Green State University in Ohio, tickled lab rats and found that they loved it! Using specialized equipment, Panksepp recorded their ultrasonic giggling, which is too high-pitched for the human ear to discern. When he was able to hear the rats' vocalizations, Panksepp said they sounded like children playing.

Do Dolphins Chuckle or Gorillas Guffaw?

In 2004, researchers in Sweden noticed that dolphins made particular noises during play-fighting but not during real conflict. These sounds-short pulses followed by a whistle-seemed to communicate to the other dolphins that the roughhousing was not meant as a threat but rather was all in fun. Could those noises be dolphin laughs? Scientists have found that giggle-like behavior is most noticeable in playful species, such as apes, dogs, and even elephants. Perhaps one purpose of laughter for all living beings is to smooth social interactions.

But do creatures-domestic or wild-have a sense of humor? Koko, the gorilla who famously learned sign language, seemed to think that physical clumsiness (as in slapstick comedy) was hilarious. So far, though, there's no evidence that even highly intelligent animals appreciate sophisticated comedy. (Or maybe the joke's on us!)

Nevertheless, as dogs, dolphins, and chimps no doubt already know, laughter is a joyful manifestation of what it means to be alive.

Fake It 'til You Make It!

by Lynn Brunelle



USGS Bee Inventory and Monitoring Lab

A treehopper can look like something else and fool its predator.

In nature, pretending to be something that you are not can be the difference between life and death. Meet two amazing animal mimics.

It's a jellyfish! Wait, it's a sea snake. No, it's a lionfish. Actually, it's a two-foot-long octopus impersonating all of those creatures!

This remarkable animal is aptly named the mimic octopus. In a flash, this shape-shifter can contort its body and change color to appear to be a venomous lion fish one moment, then a poisonous jellyfish. Or it can look like a toxic flatfish at first, then a menacing crab just minutes later.

Animals can mask their identities in a number of ways. *Camouflage* helps a creature hide and not be seen, but *mimicry* allows it to appear to be something else altogether.

The Quick-Change-Artist Octopus

The mimic octopus, discovered in 1998, is the first animal known to have *dynamic mimicry*—the ability to shape-shift between a variety of different animal imitations instead of just one.

Why? It's all about survival. For the mimic octopus, like most animals in the wild, danger lurks in every direction. This eight-armed cephalopod feeds in wide open spaces without many places to hide, and lots of predators would happily gobble it up. That's why being able to morph into other shapes, colors, and textures is a key defense for this extremely vulnerable creature.

When the mimic octopus senses a predator, such as a damselfish, it immediately tucks its body under two tentacles, which become striped and stretch in opposite directions. The arms wiggle and tremble like a deadly sea snake—frightening the damselfish and sending it zipping away.

This talented impersonator can identify specific predators and, in an instant, contort its body shape, change color, and transform from a delicious octopus into that predator's most feared enemy, bluffing long enough for it to make a speedy getaway.

Another Impersonator: The Tricky Treehopper

The mimic octopus is not the animal kingdom's only successful impersonator. Consider treehoppers. These insects live on trees and have developed a fascinating way to keep predators at bay: certain species sprout growths, called helmets, from their bodies. The helmets are lightweight, strong, and detachable in a pinch. Depending on the species of treehopper, the helmets can look like anything from water droplets to leaves, or from twigs or thorns to poisonous seeds. Whatever their shape, these helmets enable the insect to resemble part of a plant.

Other species of treehoppers mimic wasps or venom-spraying ants. There are even treehoppers that spend their lifetime looking like a pile of caterpillar or bird poop. All these disguises have one goal in mind: to appear to be anything other than a yummy meal.

The species of treehopper with the scariest disguise may be the one that looks like an ant suffering from a fungus. While fungi may not inspire fear in most predators, *this* one does. Called the Zombie Fungus, its claim to fame is that it creeps into the ant's brain and controls its mind-directing the ant to chomp down on a leaf, then paralyzing it. The fungus uses the ant's body as food to grow. For obvious reasons, other insects want nothing to do with that fungus! Clearly, the treehopper's defense works-it makes predators steer clear.

In nature, where the stakes are eat-or-be-eaten, being a skilled pretender can be a lifesaver. But while many animals are good at the art of imitation, the treehopper and mimic octopus are unquestionable masters of mimicry!

The Whales Are Singing

by Debbie Nevins



NOAA

humpback whales

The songs of the sea's largest mammals are complex and meaningful.

If whales could talk, what would they say? "Come on in, the water's fine"? Actually, scientists know that whales do indeed "talk"-though "communicate" is probably a better word. As to what they are saying, well, researchers are trying to unravel that mystery.

Whales don't produce sounds the way humans do. Anyone who has ever tried to say something underwater can see why sea mammals need a very different mechanism for producing sound. Whales make sounds by moving inhaled air around the nasal cavity in front of their blowholes. Toothed cetaceans, such as sperm whales and dolphins, have large sound structures that form a bulbous shape on their foreheads. In fact, biologists think a sperm whale's head may function like a powerful telegraph machine-emitting pulses of sound in distinct patterns. Baleen whales, such as blues and humpbacks, use a completely different process, creating vocal combinations of squawks, howls, whistles, and cries.

What Are Whales Saying?

People have long known that whales "sing." Humpback whales, for example, produce vocalizations that can be heard for hundreds of miles underwater. Old-time seafarers thought those eerie moans were the cries of drowned sailors. Those complex whale songs may sound musical to our ears, but music is probably not their point. Scientists have only recently begun to record and categorize whale songs with the goal of discovering their meaning. They've learned that some whale songs remain the same across generations; others appear to be newly generated and then repeated for periods of time.

Some researchers think whales may possess great intelligence and have sophisticated language capabilities. Humpback whales, in particular, make all sorts of sounds-growls, trumpets, and *ahoogas*-in addition to songs. The animals use different calls for finding a mate, locating food, or warning of danger. Scientists have found that specific clans of whales (also known as pods) have language that differs ever so slightly from others of the same species. These might be "dialects" that help differentiate groups. Furthermore, individual animals appear to use unique identifiers. Could they be names?

Michelle Fournet, a researcher with the Cornell Bioacoustics Research Program in Ithaca, New York, thinks it's quite possible. She and her team gathered recordings of whale sounds over a period of 38 years. From the recordings, they identified nearly 1,000 whale calls, and used spectrograms-machines that visualize sounds as moving lines-to separate the sounds into 16 types of calls. The researchers published their discoveries in the journal *Scientific Reports* in 2018. Fournet said she suspects that some of the vocalizations may be how individual creatures identify themselves across time and space. The idea suggests a level of consciousness among marine mammals that far surpasses what humans realized.

Noise Pollution Gets in the Way

If we *could* understand whales, perhaps we'd hear them telling us to "Shut up!" Human-made noise-from commercial shipping, military exercises, and explosions related to oil exploration-have lately made the seas much noisier. In fact, the ocean has been getting louder by roughly three decibels per decade. As a result, whales have had to increase the intensity of their calls in order to communicate.

Scientists suspect the intense noise may be impairing whales' ability to communicate. So, if we want to understand what whales have to say, perhaps we should create a better environment for them to say it in!

Brave New Zoos

by Lynn Brunelle



USFWS / Jon Myatt

California condors were once near extinction before scientists at zoos began working together to bring them back from the brink.

Today's zoos are very popular-and going through big changes!

"Something tells me it's all happening at the zoo" was the opening line of the 1960s pop song "At the Zoo."

In fact, a great deal *is* happening in the zoo world these days. American zoos and aquariums draw over 180 *million* people a year. More than 6,000 animal species live in those places filled with remarkable animals-including 1,000 endangered species.

Zoos today no longer just display animals; they focus on educating the public and heightening our awareness of our planet's remarkable biodiversity. At the same time, they aim to entertain and excite their human visitors.

Why, then, are so many zoos being urged to change-and quickly?

Bad for Animals?

Zoos are not new creations. Menageries-collections of wild animals maintained to entertain rich and royal patrons-have been around for thousands of years. Stone carvings and artwork from ancient Egypt and Mesopotamia as far back as 2500 BCE depict animals displayed in pits and cages.

Lately, however, some critics are saying that zoos are simply bad for wild creatures. The animal advocacy group PETA charges that zoos are cruel places that teach people it is acceptable to take

animals from their homes and deprive them of any control over their lives. The criticism is echoed by some other animal-rights and conservation groups.

Famed primatologist Jane Goodall acknowledges that the best place for animals is in their natural habitat. But she adds that zoos, if designed well, can help preserve the lives of wild animals by educating the public.

Zoos are working on embodying that kind of good design. For starters, many zoos are reimagining their physical layouts. They are flipping traditional zoo-design conventions—such as cages and animal houses—by creating larger and more naturalistic habitats where animals can roam freely. Instead of forcing wildlife into the human environment, they're inviting humans into the creatures' world.

As another response to their critics, zoos are focusing on *aiding*, not just displaying, animals. For example, the Zoological Society of London and the Smithsonian National Zoo in Washington, D.C., are leading global efforts to detect and treat diseases that threaten animals both in captivity and in wild populations. The San Diego Zoo has a staff of 20 experts researching how to treat wildlife diseases that threaten conservation.

Animal Matchmaking

Another big initiative is the Species Survival Program, which brings together endangered animals from different zoos, offering them the opportunity to breed. The California condor revival is one of its success stories. These huge birds were near extinction before scientists at the San Diego and Los Angeles zoos started working together. Forty years ago, only 24 California condors were known to be alive. Today, there are more than 170!

The zoo in Phoenix, Arizona, undertook an even more dramatic rescue. Scientists there began a breeding program for the Arabian Oryyx, a kind of antelope that had gone extinct in the wild. It was a huge success. Now, more than 1,000 oryxes have been successfully reintegrated into the wild between the countries of Oman and Jordan.

These wildlife preservation moves are some of the most impressive examples of the changes remaking 21st-century zoos. What hasn't changed, however, is our fascination with wild animals. Today's zoos, with their eyes on the future, are working hard to honor, respect, and sustain our planet's magnificent wildlife.

Sewer Safari

by Lynn Brunelle



Welcome to the sewers, a home for some rats and other creatures!

A menagerie of adaptable animals creeps, scuttles, slithers, and swims in the dark world beneath city streets.

If you ever think about sewers, you probably imagine a dank, lifeless maze of putrid pipes beneath city streets. In reality, an astonishing assortment of creatures either make their homes in sewers or—due to circumstances beyond their control—find themselves residents of the city's smelly underbelly.

Who lives in the murky waters where society's waste is gathered and swept away?

Rats, Roaches, and a Blob

Life under the streets is a real rat race. With waterproof fur and webbed toes, rats are perfectly adapted for life in the sewer. Rats are, in fact, amazing swimmers that can tread water for three days straight. They're also extremely flexible, and can unhinge their ribs in order to flatten and twist their way through tight spaces—perfect for zipping through pipes and around drains with ease. Rats are right at home feasting on globs of discarded fat, constructing nests from waste paper, and using their heavy-duty teeth to grind through concrete to make a fast getaway in a pinch. For them, sewers make a swell home!

Of course, rats aren't the only animals at home down the drain.

Steamy, dark sewer tunnels may not sound like an ideal home for you, but for creatures such as spiders and cockroaches, it doesn't get any better! There is plenty of rotting organic material flowing by to feed on. Lots of nooks and crannies to hide in, and the temperature is cool in the summer and warm in winter. Home sweet sewer!

Then there are some really weird creatures: in 2009, a pulsating pink blob was discovered in a sewer under the streets of Raleigh, North Carolina. At first no one could identify this creepy, writhing mass, but scientists determined it was a colony of tubifex worms-gross but harmless. Now known as sewer worms, they survive by filtering the water for food.

Accidental Arrivals

Although some animals spend their entire lives in the sewer, others get there by accident and make it their home. Unsuspecting lizards, frogs, and snakes have weathered the flush and adjusted to survive in the subterranean labyrinth by feeding on roaches and rats. In 2014, a nest of bull snakes was discovered under Wenatchee, Washington, when a remote camera was run down a pipe into the sewer. Most likely the result of having been flushed down the toilet, a pair of snakes had created a home and started a family.

The practice of flushing unfortunate pets down the toilet has sparked some exciting myths over the years. Rumors of alligators living in city sewers have been alive for over a hundred years. Even though there is little evidence to prove it, legend has it that when the cute babies got too big or aggressive, they were flushed down the toilet and into the sewer, where they gorged on rats and grew enormous.

Some animals end up in the sewer by complete misfortune. Cats and dogs may chase a rat down the street drain or pursue an irresistible aroma and fall in. Rescuers have extracted raccoons, foxes, coyotes, and even a cow that was accidentally washed in after a vigorous downpour.

It may be dark and stinky, but the world below the city streets is far from lifeless. It is alive and buzzing with resilience, adventure, and drama. Think about that the next time you flush!

Bizarre and Beautiful

by Lynn Brunelle



top left to right: a poison dart frog, a toucan, a sloth; bottom left to right: piranhas, a capybara

South America's Amazon rainforest is home to an amazing array of animals.

It's warm, it's lush, and it's crowded. From its sunny canopy high in the sky to the dark, moist forest floor, the Amazon rainforest is home to the most diverse collection of animals on Earth.

This huge jungle spreads across the center of South America; more than half of it is in Brazil, with parts extending into eight bordering countries. Its creatures contend with cutthroat competition for natural resources, so they've had to adapt in astonishing ways—resulting in an environment full of bizarre and beautiful animals.

Fantastic Creatures

What has sticky toes, is neon green, blue, or orange, and devours poisonous insects? It's the poison dart frog, a little creature that *sweats* venom. You'd think this tiny amphibian, lacking claws and teeth,

would easily be slurped up by monkeys, birds, and other predators. But its flashy exterior sends a clear message: "Eat me, and you die!" The dart frog's body is filled with poisonous liquid, so predators steer clear. And that venom is so strong that indigenous tribes dip their hunting darts in it (explaining how the frog got its name).

Another rainforest creature whose vivid colors send a message is the toucan. Instead of a warning, however, this bird's brilliant rainbow bill beams out an invitation to potential mates. The bigger and brighter the beak, the more successful a toucan will be at attracting a mate. In fact, toucans have the largest bill-to-body ratio of any bird in the world. The bill acts as a temperature-control unit, allowing heat to dissipate so that the bird won't swelter.

There's yet another amazing Amazonian, this one with green fur and a foot-long tongue. The slow-moving sloth is a mammal perfectly suited for life in the rainforest's trees. The sloth's curved claws allow it to dangle from a branch while its long tongue snakes out and grasps a lunch of leaves. A sloth can stay in one position for up to 18 hours, intermittently eating and napping before moving an inch. This creature's slowness, along with the algae growing in its fur, help it blend into the trees, providing good camouflage from jaguars and other predators.

Frightening Fish, Giant Rodents

How about a truly terrifying fish? The piranha is built to kill. It lives in swarms, boasts not only muscular jaws that clamp down on prey with 70 pounds of force per square inch, but also razor-sharp teeth that saw back and forth to shred flesh. Although not all piranha species eat meat, the ones that do travel in groups and rapidly gobble up dead or dying animals.

Finally, imagine a rat-like creature that weighs more than 150 pounds, travels in herds, and swims like a fish. The capybara is the world's largest rodent and lives on the muddy banks of the mighty Amazon River. Its webbed feet help it navigate the water and negotiate the spongy riverbank mud as it searches for leafy treats. A capybara's eyes, nose, and ears are near the top of its head, so it can see, hear, and breathe while swimming.

Those are just a few of the inhabitants of this remarkable rainforest. Remember: the Amazon hosts another 3,000 types of fish, 400 species of mammals, and 2.5 million breeds of insects-making it home to Earth's most astonishing assemblage of animals.

Time for Jazz

by ReadWorks



Lina had been at it for an entire hour. Her fingers were poised on the shiny white keys of her piano. Old and crinkled sheet music sat in front of her, the black notes blankly staring at her. She stared at them for so long, her vision started to blur. Lina had been working on this piece for the past week, trying to master the tricky rhythm and memorize the movements required by her long fingers. She loved the piano; she always had, ever since she started playing at the age of six. But something was beginning to bother her. She was growing tired of the pieces her teacher assigned her week after week. They were all classical music pieces, and even though Lina loved them, she was itching to try something new.

She decided to take a break. She got up from the piano bench and stretched her stiff limbs. She walked into the kitchen, grabbed some celery and peanut butter out of the fridge, and turned on the radio. The room was suddenly filled with the sound of blaring trumpets, beating drums, a singing saxophone, and trilling piano keys. She assumed her dad had been listening to this station earlier in the day—he had always been a big fan of jazz music. Lina had never really joined in on her father's passion for that type of music, but something about this particular song made her listen more carefully.

Lina's trance was broken by the sound of the back door opening.

"Helloooo!" her dad called out.

"Hey dad, what's the name of this song?" she asked him, eagerly.

He stopped in his tracks and listened for a few seconds.

"I think this one is called 'Things Ain't What They Used to Be' by Duke Ellington and his big band," he said. "Isn't it beautiful?"

Lina nodded her head in agreement. "I wish I could play the piano like that," she told him.

"Why not?" he asked. "All your classical piano training will help a lot if you want to learn jazz piano."

"All right, I'll ask Mr. Wilson next week at class if we can start doing some jazz lessons!" she said excitedly.

Lina continued to listen to the jazz radio station for the rest of the evening. While she and her dad prepared dinner, they were serenaded by the sounds of crooning saxophones and beating cymbals. The two didn't talk; they just swayed back and forth to the rhythm of the music while chopping vegetables and waiting for pasta to boil.

Just as they were setting the dinner table, Lina's mom rushed through the door.

"Sorry I'm late!" she said. "I had to stay longer at work than I had planned."

"You're just in time for dinner!" Lina replied and pulled out a chair for her mom to sit down.

As she plopped down onto her seat, she caught the melody of the tune that was playing on the radio. "Ohhhh, I love this song. My father used to play this on our piano when I was little," she said with a smile.

Lina asked if her mom listened to jazz while growing up.

"Oh, all the time!" she exclaimed. "My dad was a huge fan. He was a pianist himself. He learned how to play from his father-my grandfather-who was around when swing music was just becoming popular," she explained.

"When was that?" Lina asked.

"Well, swing music-a type of jazz style with a strong beat that really makes you want to dance-was played for a long time by the African American community before it really became popular. My grandfather and his father were playing swing long before it was heard on the radio. When the Great Depression hit in the 1930s, many Americans were out of jobs and money. So of course they needed something to cheer them up. When people heard swing music, they forgot about their problems. The music was just so uplifting. So big bands, like the one led by Duke Ellington, started to play at famous ballrooms and theaters all across the United States and even Europe," her mom explained.

"And so that's when your grandpa was around?" Lina asked. She was so excited to learn that she had a connection to this music.

"Yes, he loved to go dancing. He even saw Duke Ellington and his band play once! His favorite song was 'It Don't Mean a Thing if It Ain't Got That Swing,'" her mother replied.

Mr. Wilson had played that song for Lina at one of her weekly classes. He had told her that it was a revolutionary piece of music and is still listened to by jazz audiences today all around the world. Lina loved the way music could be passed down through generations. She wished she could have seen Duke Ellington's band play live.

"Well, it sounds like you're interested in jazz history all of a sudden. What's making you ask all these questions?" Lina's mom asked.

Lina explained that she wanted to learn something new. She had learned enough classical music and wanted to move on to something else.

"Then start improvising!" Lina's mom told her. "Jazz is all about improvising. So many solos you hear on these records are just musicians playing what their heart feels."

Lina thought about improvising. She could hardly imagine just sitting down at the piano and playing anything that came to her mind, just piecing together notes in a way that would captivate her listeners. She remained silent for a while, concentrating hard on what she could possibly play off the top of her head.

Her mom noticed Lina's brow furrow. "The only way you're going to learn how to improvise is if you try," she told her daughter. She walked over to the piano and pulled out the bench. She patted it and looked over to the dinner table at Lina.

"Let's start now!" she said with excitement in her eyes.

The Amazon Rainforest

by ReadWorks



The Amazon rainforest in South America is an amazing place. Filled with beautiful tropical flowers, towering trees, colorful parrots, and poisonous fish, it has some of the greatest levels of biodiversity of any region in the world. This means there are more different kinds of animal and plant species in this forest than in most other places. There are also many different kinds of human cultures that exist in this rainforest, from indigenous tribes to modern farmers. While all environments change over time, some scientists think that rapid human development is changing the Amazon too quickly. These changes are putting some plants, animals, and humans in danger.

The Amazon region, which stretches across the countries of Brazil, Peru, Colombia, Venezuela, Ecuador, Bolivia, Guyana, Suriname, and French Guiana (see map above), contains over half of the planet's remaining rainforests. Rainforests are well-known for being great habitats for animals and plants, as they get a lot of water, which all species need to survive. Today, the Amazon rainforest is home to 40,000 plant species, 2.5 million insect species, 378 reptile species, and 427 mammal species, including humans. You'd need a huge zoo to hold all the animals in this rainforest!

This remarkable rainforest region is also home to 400 different indigenous Amazonian tribes, many with their own unique languages and names, such as the Yanomami tribe and the Nukak tribe. Some tribes live in villages along the rivers in the Amazon rainforest, growing vegetables and fruits like corn, beans, and bananas. Others are "nomadic," which means they move from place to place. These tribes get food by hunting and fishing, using poison darts, bows and arrows, spears, or sometimes shotguns to catch their dinner. Some tribes have had ongoing contact with the outside world and access to Western doctors and healthcare; others have never been contacted by outsiders at all, since the center of the Amazon rainforest can only be reached by traveling along piranha-infested rivers.

Another important fact about the Amazon rainforest is its role in storing carbon dioxide for our earth. Since it contains so many trees, which absorb carbon dioxide the way we breathe oxygen, the rainforest acts like the lungs of our planet. And since carbon is a "greenhouse gas" that heats up our atmosphere, the Amazon helps to keep our planet cool by storing carbon in its plants. So, even though the Amazon is far away from many places in the world, it still plays an important role in our world ecosystem.

Unfortunately, many of the amazing plants, animals, and humans in the Amazon are under threat. People are using the Amazon to grow plants for humans, like bananas and sugar cane plants. Others are digging holes in the earth to look for oil or gas reserves. And still others are cutting down the trees for lumber. To do this, developers are building farms, roads, and factories in areas where rare plants and animals thrive. This is a big problem for several reasons.

First, these changes in the Amazon will decrease the biodiversity of the rainforest. This means there will be fewer rare plant and animal species living there, and some species may go extinct as their habitat changes. Second, as the plants and animals die, the indigenous peoples who depend on them for food will also suffer from hunger. Third, when outsiders travel through the area via roads, they bring new diseases that can kill the native peoples. Finally, as new farms and factories begin to replace the forests and villages in the Amazon, they will produce more carbon dioxide, and there will be fewer trees to absorb this gas. So everywhere in the world we may feel the loss of the rainforest as our planet heats up.

But there is good news. Many groups of volunteers, doctors, and environmentalists are teaming up to protect the Amazon. They are spreading the word to students like you about the plight of the rainforest and asking people to help. Some organizations are helping to buy up land so that it cannot be used for farming. Other organizations are fighting against the governments that want to build roads, arguing that they will endanger too many plant and animal species. And others are helping to provide medicine and healthcare to the indigenous tribes in the Amazon, to help these populations cope with the big changes in their habitat. Many hope that there is still a way to save the rainforest and all of the plants and animals inside it.

Wetlands and Habitat Loss

by Elaine Mao



What image comes to mind when you think of a swamp? How about a marsh or a bog? Chances are you had a similar image in your mind for all of these. That's because these are, in fact, very similar environments. In everyday use, it is common to use these terms interchangeably, and while there are minute differences among the three land areas, they all belong to the same general category: wetlands.

A wetland is an area of land that is filled or covered with water for at least part of the year. Wetlands are neither completely dry nor completely underwater. They are known as "transition zones" because they are the link between water and land, and they have a unique combination of the characteristics of both. The special characteristics of these "transition zones" enable them to support plant and animal life not found anywhere else. A common nickname for wetlands is "nurseries of life."

Chances are, however, when you envisioned a swamp (or a marsh or a bog), you conjured up an image of a rather unpleasant place: creepy and shadowy, muddy, overrun with snakes and insects. Would it ever occur to you that this could be the kind of place we would want to save and preserve? Probably not.

Wetlands have historically been regarded as wastelands and centers of disease and insect infestation, and humans have sought to avoid or eliminate them when possible. Since the 18th century, more than half of the original wetlands in the United States have been degraded or destroyed. In the 19th century, there was a massive push to drain the wetlands, which harbored malaria-bearing mosquitoes, after a series of yellow fever epidemics. Since then, further destruction has occurred as a result of human activities, such as agriculture, industrialization and development. Wetlands have been drained and converted to farmland, filled in to provide more opportunities for residential and industrial development, or used as dumping grounds for waste. Other human

activities, such as pollution, while not directly targeted at eliminating wetlands, have also played a role in the process.

However, in recent decades, attitudes about wetlands have changed. People have begun to realize that wetlands are valuable and productive ecosystems that fulfill an essential function for both humans and wildlife. Due to their unique characteristics, wetlands can support a wide diversity of plants, mammals, reptiles, birds and fish. They also control floodwaters and protect us from storms and hurricanes. Wetlands also improve water quality by filtering, cleaning and storing water. Lastly, many people rely on wetlands for their livelihood, as they are important centers for hunting, fishing and recreation.

The state of Louisiana, in the United States, relies heavily on wetlands, and is one of the regions of the country that has been most adversely affected by wetlands destruction. Southern Louisiana has some of the most extensive wetlands in the United States, containing approximately 40 percent of the country's total wetlands area. This is because Louisiana is located at the drainage gateway where the Mississippi River meets the Gulf of Mexico. Much of the region's economy and culture is built around the wetlands. However, Louisiana's wetlands are quickly disappearing. Although the state has only 40 percent of the country's wetlands, it also bears 80 percent of the country's wetland losses. Every 38 minutes, the equivalent of a football field is lost. This has serious implications for the region's wildlife and economy, as well as the ability of the region to withstand natural disasters.

The Louisiana wetlands are home to a variety of animals, including alligators, snakes, turtles, coyotes, muskrats, armadillos, pelicans and egrets, among others. The wetlands are a crucial resource for many endangered species. In fact, more than one-third of the United States' threatened and endangered species live only in wetlands, and more than one-half use the wetlands at some point in their lives for breeding, nesting or raising their young. Many species of migratory birds depend on the wetlands and would go extinct if the wetlands were destroyed.

The wetlands are also essential to the state's fishing industry, providing a habitat for fish, shrimp, oysters and crabs. As of 2013, Louisiana's commercial fishing industry is responsible for 25 percent of all seafood produced in the United States, with the highest production of shrimp, oysters and freshwater fish in the nation. Approximately one in every 70 jobs in the state is related to the fishing industry. The destruction of the wetlands would have disastrous consequences for the economy of the area and the livelihoods of many of Louisiana's residents.

In addition to endangering the wildlife and economic prosperity of an area, the loss of wetlands also puts humans at risk. Wetlands serve as a natural buffer zone against storms and hurricanes, slowing down the storms and reducing their force before they move inland. However, as the wetlands disappear, some cities are becoming more exposed.

The city of New Orleans, Louisiana, has already suffered the consequences of this gradual depletion of wetland buffer zones. In 2005, Hurricane Katrina, one of the deadliest and most destructive hurricanes in the entire history of the United States, hit the Gulf Coast. There were more than 1,800 casualties, with the greatest number of them concentrated in New Orleans. Eighty percent of the city was flooded, and there were more than 700 dead. Many blamed the destruction of New Orleans on the failure of the levees, which are manmade barriers that prevent water from flooding into a city. However, scientists and researchers believe that the hurricane would have done far less damage to the city if the surrounding wetlands had been intact. Since the storm, there has been a greater national focus on preserving and restoring the wetlands on the Gulf Coast. Preserving our wetlands

and maintaining a buffer zone against storms will only become more crucial in the future, as climate change may increase both the frequency and the severity of extreme weather events such as hurricanes.

In recent decades, since the importance of wetlands became apparent, there has been a push toward better education and regulation. The U.S. Environmental Protection Agency (E.P.A.) has declared the month of May to be American Wetlands Month, which is dedicated to celebrating the ways in which wetlands enrich our lives and the environment.

Regulation has also been an important tool in the fight against wetlands loss. Since 1998, the United States has maintained a "no net loss" wetlands policy. This means that the total area of wetlands in the country must either remain constant or increase. If wetlands are destroyed for agriculture, development, or any other reason, the effect must be balanced out by restoring or reclaiming wetlands elsewhere. The policy has had a dramatic effect in slowing the rate of wetlands loss.

The American Chestnut

by ReadWorks



You've probably never seen an American chestnut tree—at least, not one that's fully grown. But only one hundred years ago, this enormous tree covered the eastern coast of the United States. People constructed buildings from its smooth, glowing wood. They ate nuts from the trees every fall and winter. Now the American chestnut has practically disappeared. Scientists are working hard to find a way to save it—but time is running out.

The American chestnut, *Castanea dentata*, stands tall at almost 100 feet with a trunk diameter of 10 feet. Its wood is hard and naturally resistant to termites and other pests, making it ideal for buildings and furniture. It is a deciduous tree—throughout the seasons the leaves change color from green to orange, yellow and red, making the mountains look as though they are on fire and, eventually, they fall.

When chestnuts were common in the United States, they could be found all the way from the northern tip of Maine to the warm, southern foothills of Mississippi. In some states, like Pennsylvania, 30% of the hardwood forests were of chestnut trees. The total number of chestnut trees in North America was estimated to be at least one billion! Now there are only a few thousand surviving. Scientists are careful to protect them, in the hope that, within these trees' genes, is the secret to saving the species.

What caused the decline of the American chestnut? It all began when travel between continents increased in the past hundreds of years. For thousands of years the chestnut trees in North America were isolated. But as modes of transportation improved, people began to trade with other continents more often.

Though the North American chestnuts had been isolated, they weren't the only chestnut trees in the world. There were also European chestnut trees and Asian chestnut trees. Though these trees are all part of the same species, their genes are quite different. This is because they evolved in different habitats, interacting with different species. Even trees within the same habitat have genes that are a tiny bit different.

Over time, a process called natural selection occurred. In each habitat, trees faced changes in their environment. The trees that were able to adapt to these changes and survive had different genes from the trees that died off. Over thousands of years, this made the species noticeably different. Asian chestnuts co-evolved with a fungus called *Cryphonectria parasitica*. Both Japanese and Chinese chestnut trees are usually able to resist the fungus and are not killed by the infection. But the American chestnut trees had not been previously exposed to this fungus and were especially vulnerable. It is thought that the fungus, commonly known as the chestnut blight, was accidentally brought to the United States around 1900. In 1904, the first American chestnut tree sick with the blight was spotted in the Bronx, a borough of New York City.

The fungus enters the tree through cuts and grows beneath the bark, eventually killing the tree. The first symptom of the fungus is a small orange-brown area on the tree bark which then spreads and grows. These spots, called cankers, split the bark of the tree and gradually kill it.

Before the American chestnut disappeared, it made up 25% of all of the hardwood forests in the Appalachians, the main mountain range in the eastern United States. The disappearance of the chestnut tree had several negative consequences for the people in this region. Previously, their houses had been built out of chestnut wood. They had relied on the trees for nuts. They had sold the lumber from the trees to make money to support themselves and their families.

Pockets of the American chestnut still survive in the Northwestern United States, where the climate is too cold for the fungus to survive. On the East Coast, chestnut trees still sprout, but they typically die while they are still very young and before they have a chance to produce nuts.

The last large group of surviving chestnut trees is in West Salem, Wisconsin. About 2,500 trees exist there, the descendants of trees planted generations ago by a settler named Martin Hicks. For most of the twentieth century, these trees escaped the blight. But in 1987, scientists found the fungus among them, as well.

Scientists are now working hard to save the American chestnut, but it is a long and arduous process. Surviving chestnut trees are rare and must be protected from exposure to the fungus. In 2008, government officials in Ohio announced they had found an adult chestnut tree in a marsh. Though the officials had known about the tree for seven years, they waited to announce its existence because they wanted to protect it. The exact location of the tree remains a secret for its own protection from the fungus.

Scientists are trying different approaches to save the American chestnut. Researchers at the American Chestnut Foundation, an organization in western North Carolina, have been cross-breeding

the American chestnut with the Chinese chestnut. The goal is to create a tree that has all the characteristics of the American chestnut, but keeps the Chinese chestnut tree's resistance to the blight. Because the Chinese chestnut co-evolved with the fungus, it is not killed by the fungus.

Other scientists are attempting to modify the American chestnut genes to make them resistant to the fungus. Researchers at the State University of New York College of Environmental Science and Forestry have inserted genes from wheat into the American chestnut genes. These genes help (the gene) create an enzyme (a complex protein) that kills the fungus. However, genetic modification is highly controversial. Trees that have been genetically modified need approval from the government before they can be planted in the wild. The scientists doing genetic modification defend their work. They point out that there are around 45,000 genes in the chestnut tree, and the researchers are adding one-to-three additional genes.

But whether the genetically modified trees can be grown in the wild comes down to whether government regulators think those added genes are dangerous. Right now, these trees are only permitted to be planted in specific areas where there is no danger of spreading pollen to other, non-genetically modified trees. From 2006 to 2012, the researchers planted hundreds of genetically modified chestnut trees in Syracuse. They also planted over 150 trees in other New York locations. Each tree begins as a group of cells grown in a Petri dish. It takes two years before those cells are large enough to have a seedling that can be planted in the ground.

Ultimately, these researchers want to repopulate the hardwood forests of the eastern United States with the American chestnut tree. Chestnuts aren't the only trees from ancient American forests that have nearly disappeared. Elms have fallen prey to Dutch elm disease, a fungus that devastated native elms in both Europe and America (in spite of the fungus's name, it actually originated in Asia, not the Netherlands). The disease was introduced to the United States from Europe in 1930. The disease spread unusually rapidly due to the European elm bark beetle, which spreads the fungus as it feeds on the twigs and bark of elm trees. The white pine tree, native to northeastern United States, was attacked by another fungus called "blister rust." The first sighting of blister rust occurred in New York in 1906, just two years after the first documentation of the chestnut blight.

Collaborations between scientists, government and preservationists may be able to save all of these trees and bring back healthy American forests.

How Water Loss Affects Biodiversity

by ReadWorks



In order for humans to live, they need access to fresh water. While nearly 70% of the earth's surface is water, most of it is salt water, which humans cannot drink. Only a small percentage, about 3%, is fresh water. Of this, about 69% is currently frozen as ice caps and glaciers, while another 30% is held underground in the soil or in rock. This means that only one percent of the world's fresh water—or .03% of the world's total water—is surface water that humans can access to drink. The small amount of potable (suitable for drinking) water makes its conservation incredibly important so that water shortages already occurring in some regions do not spread any further. If they do spread, this may lead to conflicts over the right to use this water.

There are many ways in which humans can affect access to fresh water. For example, humans can pollute bodies of water, thereby making them undrinkable. In some cases, they may make physical changes to the land by building over wetlands or damming up rivers. While wealthy countries can afford to make the investments necessary to make sure their residents have access to fresh water, poorer countries often cannot. This means that poorer countries are at greater risk of devastating droughts, which can lead both to dehydration and starvation, as the country is unable to water its crops.

Droughts can also have a negative impact on the *biodiversity* of a region. Biodiversity refers to an abundance of different types of plant and animal species within a particular region. The prefix "bio" means living, while "diversity" refers to different types of things. Around the world, more than 125,000 animal species live entirely in freshwater habitats, including 15,000 species of fish, 4,300 species of amphibians, and 5,000 species of mollusks, such as clams and oysters. Millions of other species, including humans, depend on fresh water to drink. When an area loses a large percentage of its fresh water, many animals die off. In some cases, species go entirely extinct. This leads to a decrease in the region's biodiversity.

While droughts are natural and, in many places, a frequent occurrence, there are many things that humans do to increase the severity of these droughts. For one thing, the world's population has doubled in the last 50 years, so humans have been using much more fresh water to drink and grow crops than they

did in the past. Humanity's increasing water consumption represents a growing threat to biodiversity.

In Africa, where droughts are common, they have been more prolonged than in the past. This is due in part to climate change, as well as a greater demand for water as the continent's population has increased. During a drought in Kenya that lasted from 2007 to 2009, over 60 elephants died—some of dehydration, others of starvation due to lack of vegetation to eat, and others of diseases that became fatal due to the elephants' weakened states. Some other endangered animals, such as the white rhinoceros, died too, which brought them closer to extinction.

When the biodiversity of a region declines, the human population suffers as well, in different ways. When a region experiences a significant drought, many animals may die from lack of water and food. If the region is one like Kenya, which depends on its wildlife to draw tourists, the effects of the drought can be devastating. If tourism declines due to high wildlife casualties, then the locals who depend on income from tourism will lose their livelihood. People may then turn to farming to earn money, but crops require water to grow. This can place further strain on the water supply and worsen the original problem of the drought. Sometimes, an imbalance in the system, such as a lack of water, can enter into a feedback loop where the situation only gets worse and worse.

Losses in biodiversity can also lead to problems with the availability of food. As we've discussed, a lack of water can prevent farmers from growing crops, which can lead to starvation. However, when a region loses its biodiversity, it disrupts the food chain in many ways. For example, if a species goes extinct, all the species used to feeding on it must find another source of food. Say a particular species of freshwater frog dies because its habitat has been depleted in a drought. This means the population of birds that feeds on this frog may decline as well, as it lacks sufficient food. Conversely, the insects that the frogs fed on may increase in number, as the frogs are no longer around to keep their population in check.

One of the main advantages of biodiversity is that there are certain natural processes that plants and animals perform that humans simply cannot. The billions of bees in the world play a critical role in pollinating the world's flowers. If they did not do this, the food supply would dwindle and the human population would suffer greatly.

Biodiversity can play an important function in the cleaning of water. When water passes through lakes, wetlands, and streams, it often encounters different species of fungi, algae, and bacteria. Many of these microbes actually filter microscopic particles out of the water, making it safe for humans to drink. Even some larger species do similar work. For example, the caddisfly constructs nets underwater that filter out different kinds of particles, which it then eats. Wetlands rich with these filtering organisms act as natural water filtration systems. When the biodiversity of a region declines, many of the organisms critical to this filtering process can disappear. Therefore, pressures on the freshwater supply can cause biodiversity to decrease, which can cut the drinkable water supply even further.

While humans do have some water filtration plants, these plants are expensive and take a lot of energy to maintain. For centuries the water that flowed into New York City was naturally filtered by a northern watershed. As the water flowed south, it was purified. However, as the watershed was polluted and diverted, the water flowing to New York City was no longer filtered. The city faced a choice of spending \$6 billion to \$8 billion to build a water filtration plant, or just \$1 billion to restore the natural watershed. The city wisely chose the latter option.

Water from the Air: Cloud Forests

by Alden Wicker



Mindo Cloud Forest

In the Americas, Asia, and Africa, there's a special kind of forest. It's rare, beautiful, and incredibly important to the animals and plants living there, and the humans who live nearby.

It's called the cloud forest. Cloud forests, like the name implies, can be found in the clouds on the slopes of mountains. Because they are often shrouded in warm mist, cloud forests are very humid and wet places. But that's what makes these forests so valuable.

Like rainforests, cloud forests experience rainfall, but they also capture water straight from the air. Water condenses on the leaves of the plants (sort of like dew on the grass in the morning) and drips through the canopy to the floor. If you stand in a cloud forest, you'll hear the constant drip of water, even if it's not raining. The water captured is pure and unpolluted, and flows through the ground into streams and then rivers.

Some people call cloud forests "water towers," because they are so important for providing water to nearby villages and cities. In the capital of Honduras, Tegucigalpa, four out of 10 people get their water from La Tigre National Park. That's about 340,000 people drinking cloud forest water! And there are a lot of other big cities that get some of their water from cloud forests, like Quito, Ecuador; Mexico City, Mexico; and Dar es Salaam, Tanzania.

In Guatemala, most of the water comes from the Sierra de las Minas Biosphere Reserve. More than 60 permanent streams flow from the reserve downhill to settlements, villages, and cities. People drink the water, use it for cooking, and irrigate their farm fields with it. In Kenya, people rely on the water from cloud forests to provide electricity by harnessing the energy of rivers that flow from Mount Kenya.

But it's not just humans who rely on cloud forests. While they only make up 2.5 percent of the world's forests, they are home to a stunning array of animals and plants. There are more species of hummingbirds in cloud forests than anywhere else in the world. Colorful birds, lizards, moss, and ferns live here; plus plants that grow on trees, called bromeliads. There's even a bear called the spectacled bear, named for the markings on its face. It's the only bear that lives in South America, and there are only a few thousand remaining because of habitat destruction and hunting.

We don't even know all of the plants, animals, and insects that live in cloud forests, yet we keep discovering new ones. In the 1990s, scientists discovered two bird species that only live in cloud forests. One is the Jocotoco Antpitta, or *Grallaria ridgelyi*, which lives in Ecuador in a small patch of cloud forest. Another is the Scarlet-banded Barbet, or *Capito wallacei*, which was discovered in Peru living on just one mountain. Scientists also discovered a new type of cow and barking deer in the cloud forests of Laos and Vietnam.

As you can see, cloud forests are extremely special places. But they are also very fragile and face a wide array of threats. Local poor people clear the forest so that they can grow subsistence crops. They also hunt endangered and threatened animals for meat, and cut down trees to heat their homes and cook. Commercial farmers convert the land so that they can grow fruits, vegetables, and coffee beans. Cloud forests are cleared and turned into pasture for cattle. Building roads and gem mines also severely damages the cloud forests.

Once cloud forests are cleared, the damage can be irreversible. The cloud cover, which is so essential to the growth of these forests, disperses. The soil degrades and erodes, washing down the mountain slopes. Many species vital to the ecosystem die off. What is left behind is a barren, dusty slope unsuitable for farming and unable to support animals, plants, or even people.

You can think of cloud forests sort of like little habitat islands, bounded by other types of forests and habitats on all sides. Many species are unable to leave one patch to travel to another. Once one patch is completely cleared, many species of plants and animals can go extinct, without ever being seen or studied by people like us. Some of the plant species lost could have been a new medicine or edible crop.

Scientists estimate that each year, 1.1 percent of the world's total cloud forest land is cleared for logging and timber falling. But even more worrying is the threat of climate change. Cloud forests form at very specific altitudes and rely on certain temperatures to thrive. If world temperatures rise, cloud forests would have to move up to a higher altitude where the temperatures are cooler in order to adjust. Some cloud forests are on mountain peaks with nowhere to climb and would die out. Climate change could also lessen cloud cover, which cloud forests rely on to grow. Because of this, the rate of loss could double.

As you can see, cloud forests are essential, providing water, food, and medicine to the people living in, around, and near them. So why would local people destroy them? To understand why, you have to put yourself in the shoes of a poor local farmer.

Imagine that you have no electricity or gas to heat your home or cook your meals. You do not have an oven or stove, so you get wood from the forest to build a fire. You also need food, and you cannot find a job that pays enough to buy any. There might not be a grocery store anywhere nearby, either. Therefore, you clear some forest next to your home so that you can plant fruits, vegetables, and grains. You also hunt local animals to eat. You would probably be excited to have a road built through the forest to your village, so you can easily go to a nearby city, or reach a hospital if you or someone in your family has an emergency.

If only a few people did these things, it might not be a problem. But the population is growing fast, and when thousands of people clear the forest and hunt animals, it becomes a crisis. Scientists fear we might lose cloud forests altogether, along with the water and other services they provide.

To combat the problem, some governments have designated certain stretches of cloud forest as protected, and it's illegal to clear or log them. This can help preserve cloud forests against mining companies and large commercial farmers. But it can be hard to enforce these rules against local populations. To work with local populations of people is more effective, providing them with other ways to get food and energy so that they can leave the cloud forests intact.

It is also effective to educate the local population on how cloud forests provide fresh water and what happens when they are cleared. For example, in the indigenous community of Loma Alta in Ecuador, once the people understood that the cloud forest is necessary to provide water for farms at lower altitudes, they worked together successfully to protect it.

Cloud forests are too valuable of a natural resource to lose. With laws to protect them, education, and economic support for local people, we might be able to save them-plus the animals and plants they support-before it's too late.

Are the Everglades Forever?

by ReadWorks



"Snakes," Indiana Jones hisses through his teeth as he looks into a giant underground cavern. The floor of the pit is moving-thousands of snakes wriggling and writhing over one another. "Why did it have to be snakes?"

It's a famous scene from the movie "Raiders of the Lost Ark," in which the main character is confronted by his worst fear. It's just a movie, but the nightmarish slithering mass is becoming something of a reality in the Florida Everglades. The Everglades, a famous region in Southern Florida, are a wetland ecosystem home to tropical and marshland plant and animal species. The Everglades are a protected national park, but that doesn't mean that they're immune to harm. And guess what is one of the most recent and dangerous threats to the ecosystem? Indiana Jones, beware-it is snakes, and they're big ones.

Reports from just over a year ago say that thousands of pythons have been making their homes in the Everglades at the expense of the native (natural to the area) species. Pythons and anacondas aren't normal inhabitants of the Florida ecosystem; the ones that have taken over the Everglades are ex-pets and their offspring. While it may seem cool that an exotic pet can survive on its own in an unfamiliar environment, these animals are unwelcome visitors. They've managed to upset the natural food chain so drastically that the Everglades are starting to seem a little bit like Indiana Jones's dreaded snake pit. Besides being creepy, an ecosystem overrun by pythons is unhealthy.

There's a lot to consider when talking about the health of an ecosystem and to better understand how scientists measure that, it's helpful to know what some of the buzzwords are. For starters, an ecosystem is defined as a community, characterized by the types of things (plants and animals) that live there; the type of environment around them; and the ways in which they all interact. There are ocean ecosystems, mountain ecosystems, rainforest ecosystems, desert ecosystems and even city ecosystems.

Within those systems, one of the main ways in which animals interact is in the constant search for food. The common term is "food chain," and it's a simple way to see how different species rely on one another. An example of a food chain is this: a rabbit eats grass, a snake comes along and eats the rabbit, and a hawk dives down to eat the snake. Food chains can get much longer and more complicated, though, resembling webs more than linear chains. The word commonly used to describe

the relative number of different species in an ecosystem is "biodiversity," and the more biodiversity within the ecosystem, the more complex the food web.

Biodiversity is a good thing. Having many different kinds of plants and animals means that species have different choices for survival. If the simple food chain mentioned above was the only possible choice for the animals involved-if, for instance, snakes could only eat rabbits, and hawks could only eat snakes-then both snakes and hawks would die out, should the rabbit population drop because of an outside factor, like disease. Biodiversity strengthens an ecosystem by ensuring lots of options for hungry animals, from hawks on down to rabbits.

A healthy ecosystem is one in which its plants and animals work in harmony. There are no drastic spikes in the populations of any one species, or drops in another. A large number of different species (a great biodiversity) is one indicator of an ecosystem's health. Remarkably, biodiversity is not necessarily dependent upon the size of the ecosystem; some of the richest ecosystems in the world exist within narrow boundaries (sections of the Amazon rainforest, for example, and the Galapagos Islands). These ecosystems might be relatively small, but besides threat from destructive human behavior, they're strong because of their biodiversity; each species is connected to the other in some way.

If a healthy ecosystem is one that is home to many different species, mostly native to the area and all interdependent upon one another, what's an example of an unhealthy ecosystem? Flashback to Florida; let's take a closer look at the Everglades. The invasive (not original to a specific environment) pythons and anacondas mentioned earlier are a huge problem-literally. These reptiles can reach lengths of up to 20 feet, which is longer than three adult men lying head-to-toe. At such a size, they have few natural predators, so their numbers grow with little to keep them under control. The snakes compete with alligators for food, even making a meal of a gator once in a while. They've crippled the Everglades' populations of opossums, rabbits, bobcats and foxes, thus dominating the food web to such a degree that there's not much of a web anymore.

Invasive pythons aren't the only non-native species that threaten the Everglades ecosystem. There are invasive plants too, hurting the balance of the Everglades, not only choking out native species (some vine-like plants actually grow over original trees and plants), but growing so thick that they block water flow and movement of animals.

Why should humans worry about the Everglades? The loss of the area's biodiversity doesn't just hurt the plants and animals that originally made their homes there. Humans have benefited from the Everglades in many ways, from the creation of park and tourism jobs to the water supply that keeps the cities and agriculture of Southern Florida running. If the wetlands suffer, so do humans.

A damaged ecosystem is not hopeless, however. Living things, both as individuals and as systems, have resilience (the ability to recover from harm), and can bounce back from damaging situations, especially if they have some help cleaning up the mess. In the case of the Everglades, people are already beginning to work on stopping and reversing the problems that threaten the life of the ecosystem with hopes for a healthier future. For example, people are spreading the word against disposing unwanted pets, such as pythons, in the wild. They warn others about the consequences of releasing these animals in the wild. These consequences include the threat posed to the survival of native species in the Everglades.

Additionally, scientists and members of the government have initiated a plan to restore the

Everglades to a healthier state of being, called the Comprehensive Everglades Restoration Plan (CERP). Every year, the Everglades lose some of their water to the coast simply by draining from the wetlands to the sea. The water loss is more than the ecosystem can keep up with; urban and agricultural systems suffer from water shortages, too. The CERP will restore a lot of the water by opening up unused dams and filling in old canals to help redirect water flow back to the wetlands.

So, between focused efforts by scientists and the public alike to help stop invasive species from taking over and efforts like the CERP to improve the Everglades' landscape, improvement is possible. As the Everglades become a more livable environment, it will be easier for species to recover along with the land. And, as the ecosystem finds a balance, humans will be able to keep using the land's resources, both for work and play.

The Reader

by ReadWorks

It was a stormy Thursday evening, much like any other, when Jorge hung the "Do Not Disturb" sign outside his bedroom door. The sign was part of an agreement he had with his parents. Jorge's parents were big believers in personal privacy and would do their best not to bother him when that sign was on his door. In return, Jorge never put the sign on the door unless all of his chores were completed and he had finished his homework.

Closing the door behind him, Jorge turned back into his bedroom. The navy blue walls glowed in the lamplight as his feet padded across soft carpet to the tall steel bookshelves that lined the side of the room. Jorge ran his finger across the spines of the books neatly lined up like soldiers at attention. What did he want to read this evening? Jorge loved this moment of anticipation, when he hadn't yet decided what he wanted to read and the evening held unforeseen adventures. It was almost better than the actual moment when he sank into his armchair and disappeared into the foreign, exciting world of a new book. Almost.

Some people read books to glean information. Others read books to improve themselves. Finally, there are those people who read books to escape. Jorge was part of this third group of readers. It wasn't that Jorge's life was especially horrible. He had friends whom he played basketball with every week, and he liked his classmates at school. But Jorge felt like his life was lived in shades of gray, while the books he read were in bright, vivid Technicolor. There just wasn't much happening in his small, Midwestern town. There were thirty-nine kids in his ninth-grade class; they were the same thirty-nine kids who had been in his kindergarten class. They would probably be the same thirty-nine people in his senior class. Jorge loved his parents, but they were both accountants and had been doing the same job every day of his entire life. They weren't exactly the stuff of intrigue and adventure.

Jorge's favorite books were about spies. Reading about counter-terrorism units and political assassins made his heart race, in a good way. But on this particular Thursday, Jorge wasn't in the mood for spy novels. He let his hand drift past them and skipped over the science fiction. None of his usual favorites appealed to him today.

Jorge was about to turn away from the bookshelf in surrender when he glimpsed a battered leather book on one of the bottom shelves. The book was so old that the gilded title on the spine had worn off. Jorge gently pulled the book out and opened it. He slowly flipped through the delicate, yellowed pages to the title page. "The Armchair Traveler," by Herman Castillo, Jorge read. He didn't recognize the title or the author. His grandfather had sent a box of old books to Jorge last month, and this book must have been in that pile. Perhaps his mother or father had placed it on the shelf.

"Well," Jorge thought to himself, "this is definitely better than going downstairs to help wash the dishes." He went to his armchair and settled into a comfortable position against the smooth, caramel leather. He pulled the lamp closer to light the pages. Then, comfortably situated and ready to begin, Jorge opened the book.

The first page after the title only had a single word on it: "Beware." The writing was bold and black, a warning. Goosebumps rose on Jorge's arms, but he turned the page, eager to read on. Two

sentences, in italics, sat in the middle of the second page: "*Those who travel from the safety of an armchair like to think they are safe. They are wrong.*"

Jorge smiled in satisfaction. He wasn't quite sure what those sentences meant, but they sounded promisingly threatening. "Now this is more like it," he thought. "This is the kind of beginning a mysterious thriller should have."

Jorge flipped the page again to the beginning of Chapter 1.

Outside rain poured and thunder boomed but inside the house it was warm and dry. Suddenly, there was a knock at the window-

Jorge jumped as he heard a loud noise outside. He looked up at the window, but it was just the wind knocking a tree branch against the windowpane. Jorge turned his attention back to the page.

Suddenly, there was a knock at the window. George knew better than to open the window on a dark and stormy night, however. Strange things had been happening in town recently. People had been disappearing, some of them from the safety of their own homes. No one ever saw anyone leave, but every morning more and more houses were empty. It was enough to make a man refuse to answer a knock on the window on a stormy night.

BANG! Jorge jumped as the tree branch hit his window again. He began to wish he had chosen another book to read, but somehow he just couldn't bring himself to put this one down. He continued down the page.

The knocking stopped and George hoped that whoever it had been would move along to the next house. He turned back to the bookshelves that lined his room, neatly lined with his favorite novels. He selected one and was about to begin reading when he heard a long, groaning creak. It seemed to come from behind the bookshelves, but that was impossible. The wall behind the bookshelves was solid stone. Still George reached out and pushed, tentatively, on the bookshelf. It swung open to reveal a secret passage. George knew the passage hadn't been there that morning.

Jorge sighed happily. He loved stories that began with secret passages, and this one looked like it would be good. Before he could continue reading, however, he heard a noise. Not just any noise, but a long, groaning creak. Jorge lifted his eyes to the bookshelves on the other side of the room. He could have sworn that the sound came from the bookshelf. He got up, slowly, and approached. This was crazy; he knew there was nothing behind the bookshelf. He had bought the shelf with his father and put it against the solid plaster wall of his bedroom. But still, Jorge reached out to push the bookshelf. He watched as, slowly but surely, the bookshelf swung open. Behind it was a long, dark passage.

A blast of cold air rushed up from the passage and hit Jorge in the face. He looked down at the book in his hand. He looked at the dark tunnel. He could see a gleam of light somewhere farther down the tunnel. Jorge took a deep breath and stepped hesitatingly into the passage. The bookshelf suddenly slammed shut behind him, cutting him off from his bedroom. He rushed to push it open, but the bookshelf wouldn't budge. Jorge held the book tightly and steeled his nerves. If he couldn't go back, he could only go forward. Jorge began walking away from his bedroom, away from his armchair and the comfort of his home. Each step took him farther into the dark and mysterious tunnel.

They Leap Buildings in a Single Bound

by Timothy Paulson



a traceur leaping in search of the most efficient route

Astonishingly agile athletes have made parkour popular around the world.

Practitioners of parkour may not have Spider-Man's powers, but they certainly look like they do: picture people leaping effortlessly from one building to another, defying gravity as they use whatever comes to hand—window sills, railings, ledges—to leap, crawl, vault, swing, and roll across the obstacles presented by an urban landscape.

Parkour challenges individuals to find the most efficient route possible through a series of structures. Someone who does parkour is called a *traceur*, or tracer. The *traceur* is literally tracing a path. Keeping that path short and fast can involve jumping scary gaps or crawling straight up a multi-story building.

Parkour also involves a kind of strength training called plyometrics, or jump training. Plyometrics trains muscles to expand and contract explosively. This builds both strength and endurance to improve performance.

It All Began in France

Parkour was created in the late 1980s by a Frenchman named David Belle. Belle's father, Raymond, had helped develop *parcours du combattant*, a form of obstacle-course training originally used in

World War I.

David Belle took inspiration from his father, but also from the movie acrobatics of Jackie Chan. He saw parkour as a discipline, not a sport or performance. "Parkour is firstly about the useful side, to teach people how to trust themselves, to learn to be careful," he has explained. He's said that in life, as in parkour, "If you have an obstacle you must always continue forward."

Parkour was popularized for an international audience in 2006, when it was featured in the opening scene of the James Bond movie *Casino Royale*. Played by Daniel Craig, Bond chases a wily villain through a construction site dozens of stories above the ground. It's a thrilling scene-in part because the man who plays the villain, Sébastien Foucan, does all his own stunts using parkour techniques he developed himself.

These days parkour is practiced in all kinds of places, all over the world... even in forests! It remains, however, primarily an urban activity. Cities provide the ideal landscape for moving quickly from one random obstacle to the next-devising your route on the fly, sometimes literally.

Safety, Risks, and Respect

Parkour is not about showing off; it's about risk management. Despite their acts of derring-do, *traceurs* want to be safe, and 'safety first' is a parkour rule. To deal with the risks involved, *traceurs* train using a technique called gradualism-practicing rolls and leaps on the ground until they feel confident enough to work up to greater heights.

Still, *traceurs* respect fear; they know that falls are inevitable, even for the most accomplished practitioner. Leaping between buildings, David Belle would sometimes fall as much as thirty feet. Coping with these situations takes dedication and mental strength-knowing your limits and mastering fear.

Parkour is also about respect for other *traceurs* and the public. Because *traceurs* use public spaces, inconveniencing bystanders or damaging property is taboo.

Today, parkour is often associated with other newly-developed sports like free running, and many parkour practitioners (including Foucan) do both. It's the emphasis on discipline and character-building coupled with the excitement of risk that makes parkour the unique and internationally popular practice it has become.

How Cool Is Jump Rope?

by Fatima Shaik



Jumping rope is a great activity for fun, exercise, or competition.

Very! This street game has influenced hip-hop and inspired international competitions.

What do kids at play, competitive athletes, and heavyweight boxing champions have in common? They all jump rope—as did the ancient Egyptians and some of the first Dutch immigrants to North America. Jumping rope is more than a sidewalk game. It has a rich history, contains cultural meanings, and has become an international pastime.

Jumping began as a necessary reflex to humankind's natural environment. Early people leaped to escape animals and gather food from trees. There are reports of jumping activities in ancient Egypt and China. But the first documented evidence of formal rope-and-jumping games dates to the middle ages (1100-1400 C.E.). Medieval European paintings show children jumping rope and rolling hoops on cobblestone streets. Soon, rope games were known around Europe.

Double Dutch Around the World

In the 1600s, settlers from the Netherlands brought a jumping game to their New Amsterdam colony. Over time, it became known as Double Dutch. In its modern form, participants swing two ropes in opposite directions while a player in the center jumps over both in a fast rhythm.

Competitive rope jumping began in New York City in 1974 when New York police officer David A. Walker founded the American Double Dutch League. Walker later started the International Double

Dutch Federation and three other global competitive groups.

Organized jump rope soon spread to other countries. The Dynamic Diplomats of Double Dutch (DDDD) is a jump-rope team formed in 1983. Similar to basketball's Harlem Globetrotters, this girls team travels the world demonstrating their sport. The countries they've already visited include Germany, Sweden, France, Bermuda, Nassau, Bahamas, Japan, and England.

These double-dutch diplomats have helped spread the allure of leaping internationally. In 2019, the first-place winners of the Double Dutch Holiday Classic at the Apollo Theater in New York City were a team called Setsuna from Iwate, Japan. The Bouncing Bulldogs from Chapel Hills, North Carolina, came in second.

Jump Rope Back at Home

Of course, jumping rope is not just the purview of professionals. It's been a popular form of play for kids in the U.S. for decades, to the point of influencing pop culture.

Jumping rope has close ties to contemporary music, notes Dr. Kyra Gaunt, author of *The Games Black Girls Play: Learning the Ropes from Double Dutch to Hip Hop*. Dr. Gaunt observed "girls bouncing between two twirling ropes, keeping time to the tick-tat under their toes, stepping out with snatches of song and dance that animate their torsos and release their tongues with laughter." Hip-hop artists, she says, put the beat of rope jumping into their songs, while girls sampled lyrics into their games.

And don't think that non-competitive jump rope is limited to girls or kids. Legendary professional boxers from Joe Louis to Jack Dempsey to Muhammad Ali all jumped rope. They used it to warm up, to train, and strengthen their bodies. Jumping rope increases the core temperature of your body without making you too tired. Jumping rope also helps to develop wrist movements and transferring weight from one foot to another, a useful skill in the boxing ring.

Jumping rope helps build bones and muscles, provides hours of exercise and entertainment, and has even spawned a competitive sport. All you need is a piece of rope and a lot of energy!

Brains at Risk

by Timothy Paulson



Head-knocking in a sport can cause a concussion.

It's not just the NFL: in American high school sports, concussions are a serious problem.

When Carolina Panthers star linebacker Luke Kuechly announced his retirement from the NFL in January of 2020 at the age of 28, he joined a growing number of pro football players under 30 choosing to leave the sport. Many were top performers, including Colts quarterback Andrew Luck and Patriots tight end Rob Gronkowski.

Why were they quitting? Because of concussions.

Watch the brain-rattling tackles in the National Football League, and it's easy to understand why concussions are a health issue for the pros. But the truth is that *any* sport that involves head-knocking can cause concussion-damage from shaking the brain that is usually temporary but can lead to long-term consequences.

In fact, high school athletes are especially vulnerable. Young people often take longer to recover from concussions than adults. In addition, the body keeps track of concussions, so each incidence puts teens at greater risk for more concussions over the course of their lives.

The Consequences of Concussion

Unlike broken limbs, damage from concussions isn't always immediately obvious. As a result, players eager to get back on the field may not notice or admit to their feelings of dizziness and disorientation.

Concussions can also cause vision difficulties, headaches, memory loss, and a range of other problems. Symptoms may occur right away or take hours, or even days, to appear. The primary treatment is rest and withdrawal from sports and stimulation, called 'brain rest.' That requires staying away from bright light, television, and other electronics. It's usually a week to ten days, but sometimes full recovery requires a month or more.

And although a single concussion heals relatively quickly, repeat concussions can lead to traumatic brain injury (TBI)-a permanent, career-ending disability. Some athletes diagnosed with TBI have suffered early-onset dementia or brain diseases.

Because concussions remained under the radar for so long, statistics that might have revealed the extent of the problem weren't kept. Current studies, however, show concussion to be the most common injury in all organized sports.

Playing It Safe

A study by the journal *Pediatrics* showed some good news: concussion rates in high school athletics have been dropping across all sports. However, data from the 2013-2014 and 2017-2018 school years revealed that while rates of concussion in American football practice had gone down, the occurrence in *games* was on the rise. So how can we keep student athletes safe?

Safety-conscious equipment is a major line of defense against concussion. Over the last century, the American football helmet has evolved from little more than a leather skull cap to a technological wonder. Today's helmets incorporate multiple layers of high-performance plastics and metals, as well as inflatable bladders and overall design improvements-centered on preventing concussion.

All 50 states now have "return to play legislation"-laws to protect students against repeat concussions. Under these new rules, any player who suffers a blow to the head must be examined by a physician before returning to the game. Also, all high school coaches must go through training to recognize and respond to concussions.

Experts hope this better understanding of concussion by administrators, coaches, teachers, and parents will foster a sports culture that makes it easier for young athletes to understand when they've had a concussion-and to admit that it happened.

That broader awareness could make a positive difference in many young athletes' lives ... on and off the field.

A Career for You in Esports?

by Timothy Paulson



Lots of different people work to plan and put on esports tournaments.

Computer gaming is growing fast, and the industry needs people with all kinds of skills.

Just playing a video game alone can be an intense experience. But imagine playing with an audience, for big money, with your reputation on the line. Quick reflexes and a good eye are critical.

Today, the best players have built improbable but highly profitable careers as esports professionals. That's because there's enormous interest in these competitions: games such as *League of Legends* and *Fortnite* run huge tournaments, watched by hundreds of millions of people online around the world.

But guess what? If you want in on the world of esports, you don't have to be a top-flight gamer. In fact, you don't have to be a gamer at all! The field offers careers in sales, marketing, management, coaching, computer programming, event planning—even social media. The industry even has part-time jobs for 17-year-olds.

Just How Big Are Esports?

With revenue three times as big as the global movie industry-\$152.1 billion and counting-computer games have long dominated the entertainment world. The esports business has been growing right alongside them and will soon break the billion-dollar mark on its own.

Just as in "real life" sport franchises like the NFL or NBA, esports teams select their players through a draft. Prize money for franchises like EA's *Madden* can run into many millions of dollars, money that's split by the winning teams.

With all the attention and money, it makes sense that college students can now major in playing video games. More than 50 colleges offer varsity esports programs with scholarships. The National Association for Collegiate Esports (NACE) provides thousands of dollars in college scholarships, given to the winners of their tournaments.

A Wide Range of Work Opportunities

But the beauty is, you don't have to major in esports to get a job in the industry. This quickly expanding industry has jobs to fill-lots of them-and most of these slots are *not* for gamers. In fact, in 2018 there were more than 2,400 openings posted on an esports job board. These postings ranged from ground-level opportunities to top-level, full-time executive positions.

No need to have talent with a controller; an interest in developing and promoting new technology could easily land you a job in the industry. Alternatively, you may want to become a recruiter-discovering new talent in gaming or game creation. Esports organizations also need sales and marketing professionals to find and convince companies to sponsor tournaments. Or you may want to get involved in game development: what could be more thrilling than to help create a game that no one's ever played and see it become an international hit?

All over the gaming world, esports contenders fight virtual battles for ever-greater prizes, seizing glory or going down in defeat before audiences the size of small cities. All these players are doing something they love, and they're getting paid and respected for it. But you could find *yourself* in that world, too, sharing in the thrill of the game while earning a living. Majoring in esports in college could be your ticket, but so could studying any of the fields mentioned above. In an era of virtual participation and worldwide communications, the expanding industry of esports seems destined for an ever-greater role in the world of sport.

Super-Shoe Controversy

by Timothy Paulson



To runners in races, anything that improves their speed can be the difference between winning... and not.

Do High-Tech Sneakers Give Runners an Unfair Advantage?

Imagine this: You are competing in the finals of the 100-meter sprint at the Olympics. As you line up with the other nine runners, you know that five of them are wearing a high-tech sneaker that probably gives them an edge. Maybe it's only a slight benefit. Maybe the advantage doesn't exist at all. Maybe it's only in your head-and theirs.

But isn't that an advantage, too?

That's the question facing both runners and the organizations that set the standards for competition throughout the world after Nike developed a pair of sneakers that turned the running world on its head. Known as the Vaporfly, by Nike's own estimate these shoes provide any competitor with a four percent edge in efficiency. That means more speed for the same output of energy. In races where the margin of victory can be measured in *thousandths* of a second, four percent faster can be a decisive advantage.

When Equipment Was Banned

Technical improvements in sports equipment are often very slight, so it's not always easy to decide if a new technology distorts the competition. Occasionally, however, it becomes obvious. At the 2008 Beijing Olympics, Michael Phelps and other swimming competitors wore a new type of full-body

swimsuit that cut their times by a fraction of a second. The next year, 43 new records were set by swimmers wearing that suit. Soon, it was banned worldwide from all competition.

Sportswriter Christine Brennan complained that that action came too late: "It sadly is a joke because so many records have been broken with the new suit. These records will not be touched for years, if ever, because they were broken by swimmers using suits that will now be illegal."

How Vaporflys Add Speed

The basic argument against Vaporflys is that the shoes feature a kind of secret weapon—a spring-like carbon fiber shank in their sole that gives runners a mechanical assist. "If they're improving performance because they're lighter and because there's really good foam, that strikes me as quite fair," says Nick Thompson, editor-in-chief of *Wired* Magazine. "If they're improving performance because of the carbon fiber plate, which is increasing your rebound when you run on the road, that's more complicated."

Sports journalist Alex Hutchinson adds, "The five fastest men's marathons in history have all been run in the last 13 months, all by runners wearing Vaporflys." These runners weren't just top-flight athletes operating at peak performance, he says; they were simply running faster than anyone ever has.

In fact, even amateur marathoners who use Vaporflys run slightly faster than the competition, according to the *New York Times*

The question remains—is the shoe fair for competition?

For many, the issue was settled in early 2020, when Olympics officials ruled Vaporflys were okay for competition. However, they did set limitations on the design of future shoes, adopting rules that bar both steel shanks and multiple shanks. Moving forward, all elite runners' shoes must meet this standard or they will not be allowed to compete in races such as the New York Marathon.

The verdict seems to be in on Vaporflys. But given the rapid evolution of sports technology and the passion of elite athletes for shaving hundredths of a second from their times, can anyone doubt that the next Vaporfly is already in the works?

Where There's a Wave, There's a Way

by Jan Carr



river surfing

Surfing enters a new age as it joins the Olympics and spreads to rivers and lakes.

Surf's up, and crowds of enthusiasts are putting on their wetsuits and grabbing their boards. Is this Hawaii? California? Australia? Think again!

Many surfers today are heading to rivers and lakes; access to a sea coast is no longer required to get in the game. Where there's a wave, there's a way.

The image of a surfer in popular culture is, of course, an ocean surfer, perhaps sporting flowery board shorts and riding a glassy Pacific wave. *Shaka, brah!* The sport originated in the Polynesian islands, which include Hawaii, and in the 1960s it became associated with California in American pop culture's consciousness. Songs by The Beach Boys led even landlocked Midwesterners to dream about surfin' safaris, although only one of The Beach Boys actually was a surfer. The band was simply savvy enough to spot a pop trend and ride the cultural wave they helped to create.

Olympic-Style Surfing

In recent years, surfing has ballooned in status, and was even approved as an Olympic sport, making its debut in the (pandemic-postponed) 2020 Summer Olympics in Tokyo. Since the Olympic Committee wanted to use real surf, not build a mechanized wave machine, they had to think

creatively about accommodating a sport that's weather- and wave-dependent. The solution? They set aside 16 possible days for the two-day competition.

The Olympics isn't the only unexpected place seeing a surge of surfers. Surfing has become so popular that coastal surf spots are often overcrowded, with salt-seasoned surfers competing with "kooks" (newbies) for waves. And surfing hopefuls who live inland are no longer left to flounder—thanks to the new popularity of river and lake surfing.

Some say river surfing originated in Munich, Germany, on the Eisbach River, where people have been urban surfing since 1972. Crowds gather on the banks, cheering on the surfers.

River surf spots are often standing waves. Standing waves don't act the way waves do in the ocean (where they break toward the shore and carry the surfer in). In Munich, for example, when water is channeled under a bridge, it hits concrete blocks submerged there, which creates a rapid. River surfing can be rocky, and also cold, so surfers wear wetsuits for warmth.

There are plenty of choice spots in the U.S. for river surfing, though they're also dependent on weather and wave conditions. In Jackson Hole, Wyoming, on the Snake River, there's a standing wave that's most active from May through August when snowmelt from the mountains swells the river. Other popular river spots include Pueblo, Colorado; Lowell, Idaho; Missoula, Montana; and Sheridan, Colorado. Or you can slip across the Canadian border to Montreal and shred on the Saint Lawrence River.

Flocking to the Lakes

Surfers also now flock to lakes. In Lake Tahoe on the Nevada-California border, storms can churn up swells as high as the waves on the nearest coast, 200 miles west. And like coastal surfers, lake surfers are famous for driving into a storm, not away from it.

Winter winds can also kick up serious waves in the Great Lakes. Surfers keep their eyes on the weather and surf forecasts, and head to the best breaks near jetties, piers, points, or coves.

Where there are waves, there are surfers. Feeling stoked? Check out the rivers and lakes near you. Tasty waves may await you.

Disc Sports Are Flying High

by Rick Coleman



Photo by John Kofi on Unsplash

people playing Ultimate

Around the world, millions of people play Ultimate Frisbee, disc golf, and a game called guts.

It began, as so many stories do, with pie. In 1871, a man named William Russell Frisbie opened a small bakery in Bridgeport, Connecticut. The business grew, and by the 1920s the pies were being sold in the nearby town of New Haven, where students at Yale University discovered the leftover pie tins could be tossed across the quad. The "Frisbie" was born.

Today, the flying disc is no longer just a toy, but also essential equipment for several legitimate sports worldwide. Members of the World Flying Disc Association, which has branches in 84 countries, play Ultimate (also known as Ultimate Frisbee), disc golf, and a game called guts, which is a sort of frisbee dodge ball. In the United States, millions play Ultimate in teams and leagues at every level, from professional to casual pickup games. And in 2028, Ultimate may achieve the ultimate sports status as part of the Los Angeles Summer Olympic Games.

From Pie to Sport

In the late 1950s, as the hula hoop craze was dying down, the Wham-O toy company was looking for a new best seller. They came up with a plastic disc they called the Frisbee, changing the name from the pie company. Tossing frisbees soon became a fixture on U.S. college campuses. Then, in 1968, a

group of students at Columbia High School in Maplewood, New Jersey, turned frisbee-tossing into a bona fide sport by inventing Ultimate Frisbee. The first intercollegiate game was played in 1972 between Rutgers and Princeton. (Rutgers won.)

Next came disc golf. The sport is very similar to regular golf-except that instead of hitting a ball into holes, you must toss a disc into raised metal buckets. The player who uses the fewest tosses to complete all 18 holes wins. Today, there are thousands of disc golf courses. Many are in public parks and are free to use. Unlike its earthbound cousin, disc golf doesn't require anyone to join a country club or reserve a tee time. The only equipment you need is a disc.

The Spirit of the Game

This relaxed approach is what many disc players say they love about the games. Disc sports are inclusive; athletes can be any size or shape, and most teams and leagues are co-ed. Advanced players can play on the same team as beginners. And the guiding spirit of disc sports is an honor system called the "Spirit of the Game."

For example, there are no referees or officials in Ultimate, even at the highest levels. The players are responsible for enforcing the rules, including calling fouls, deciding when a disc is out of bounds, and when a goal has been scored. Players are expected to abide by the rules without protest ... even when the foul is against their team. If a disagreement cannot be resolved, the rules basically call for a "do-over."

This "Spirit of the Game" perfectly expresses the appeal of disc sports, competitive games that teach good sportsmanship. Will that egalitarian nature fade as the sports grow in popularity? Will Ultimate become commercialized once it's an Olympic Sport? Fans say that's not possible-that the act of spinning a plastic disc through the air can never be corrupted.

But it's easy enough to get your own plastic pie plate and find out for yourself.

Robo Umps: Safe or Out?

by Timothy Paulson



In baseball, you can find the home-plate umpire behind the catcher.

Baseball is seriously considering having computers decide balls and strikes during games.

It's game five of the 2019 World Series. The Washington Nationals and Houston Astros have split the first four games. The Nationals, after struggling for several innings, are finally on a roll: Astros' star pitcher Gerrit Cole is wearing out, and the tide seems about to turn.

Nationals outfielder Victor Robles strides up to the plate with his bat and quickly runs up a count of three balls and two strikes. One more ball from the pitcher and Robles will walk to first base, but one more strike and he'll be out. Then Cole tosses a fastball that clearly misses the strike zone. Everyone in the stands sees it; the other players see it. The call can only be ball four, and Robles starts moving toward first base.

But what's this? Lance Barksdale, the home-plate umpire, cries, '*Strike three!*' and Robles is *out*. Angry shouts erupt from the Nationals' dugout, and the stadium explodes with boos. Robles advances toward Barksdale. The umpire throws him out of the game, and the Nationals never recover, going on to lose the game 7-1. (The Nationals did end up winning the series, however, four games to three.)

Talking about the blown call later, Nationals player Trea Turner said, simply, "That's baseball."

But does that *have* to be baseball? Major League Baseball seems poised to say no.

Fixing a Human Problem

Bad calls are the bane of any sport, breaking hearts and inciting outrage, and no sport depends more on human judgment than baseball. The strike zone—the area in which the pitcher must place the ball in order to have it called a strike—is an imaginary rectangle that exists only in the mind of the umpire, the pitcher, and the hitter. Predictably, those three do not always agree.

Baseball's minor leagues are experimenting with a computerized system called Robo Ump. Robo Ump is not some mechanical humanoid out of science fiction, but a glossy black flat-screen-TV-like computer that is mounted on a stadium wall, just behind home plate. This computer determines the call and transmits it via earbuds to the umpire, who announces the result.

The process is called "automated ball-strike system," and it puts the game in the hands of—well, the judgment of—the machine. Human umpires can only make their own calls in situations that the computer can't handle. For example, if a batter checks, or stops, his swing and the ball bounces up into the strike zone, Robo Ump would mistakenly call that a strike.

Baseball already uses a system called Hawkeye to review calls on plays at the plate, but a full-time balls-and-strikes machine would be a major change.

Screaming at the Screen

Yes, Robo Ump could save time and aggravation, making the game smoother and more efficient. But what about baseball's emotional component, its screaming arguments and controversies? It's only natural to assume that Robo Ump would bring all this to a screeching halt.

But maybe not.

In 2019, minor-league pitching coach Frank Viola was incensed with a call during a game and turned his rage on Robo Ump. Of course, Viola was also yelling at the umpire. But that encounter wound up as the first time in the game's history that a player was ejected for shouting at a computer.

Fireflies

by ReadWorks

"Once you're in the field, make a beeline for the climbing wall," Vivian said to a circle of girls crouched behind the cabin. "And no flashlights."

It was Greta's first year at Camp Kalawallah, but Vivian had been going each summer since she was six years old. As Fern 6's cabin vet, Vivian was the one to ask about sneak-outs and socials. When it was time for the first social, Vivian made sure that all the girls knew the drill: no one dances until the oldest girls, the Sequoias, dance on their own with the oldest boys, the Oaks. Also, if a boy particularly likes you, he'll ask early in the night for the last dance.

She also knew just what to do when, only a couple minutes into their journey, they saw a counselor's flashlight in the distance.

"Shhh. Art porch," Vivian whispered.

Greta and the rest of the girls followed Vivian as she veered off their course and to the art house, shuffling underneath its deck. Greta breathed into the darkness. A set of eyes seemed to pop out of the pitch black in front of her, and she nearly shrieked. In a millisecond, her mind raced between conclusions: was it a fox, a deer, the camp director, or maybe Liam?

"Hey, Greta." There was an unmistakable squeak in the voice. It was Meredith, one of the Sequoias.

"Hey," Greta whispered back, noticing sets of eyes younger and older all around her.

A beam of light shone from across the tennis court. It moved forward, hitting the path in front of the art house, but leaving the slope beneath the porch dark. Greta smiled. Not only had they not gotten caught, but Meredith knew her name.

Once the light was out of sight, it was a mad dash across the field, the girls weaving around each other in a sort of focused chaos. Greta was a fast sprinter, and she was the first to make it past the climbing wall to the little clearing in the woods. She was so caught up in the excitement of it all, she'd practically forgotten what she was there for.

Until she saw the boys. All twelve of them, Liam included. She sat right next to him. She tried to quiet her heavy breath and wiped the sweat from her forehead. She prayed that she'd remembered to put on deodorant.

"You're fast, huh?"

It was the second time he'd spoken to her. The first time, she'd been balancing all the Fern 6 girls' empty cups on her tray, bringing them to the dishwasher. Every snack time, it was a different girl's duty to put the cups away. Her stack had just toppled on the tray, and one cup was about to hit the ground when a hand caught it in midair.

The hand rose up, placing the cup on the tray and restacking the other cups in three shorter towers. "Four to a stack. Any higher and they'll fall."

She smiled, unable to say anything more than "Thank." Not "Thank you," or "Thanks." Just, "Thank." Mortifying.

Yet, here he was, smiling at her. Maybe he hadn't noticed how weird she was being after all. She remembered that she had put on her deodorant, and she smiled back.

"Gotta be quick. The watchdogs are out."

Those eyes. Even in the dark, she could see the flash of green, and they gave her the same unbearable pang she'd felt that time in the kitchen. Even in the dark, it was too much to handle.

She looked away, down at her wrists. She played with the bracelet she had made in her arts and crafts elective, focusing on the maroon and navy threads.

"So, where are you from, anyway?"

Greta looked up. He was still looking right at her. She decided to focus on his forehead. That she could handle.

"A small town near Boston. You?"

"Do I have something...?" Liam touched his forehead.

"Um, just a mosquito. It's gone now."

"Oh. I'm from Iowa. Middle of nowhere."

"Don't they have sleepaway camps out there?" The question immediately felt stupid and rude.

"Yeah, they do, but my dad's from Maine and wanted me to get the 'real New England camp experience' like he did."

"Did he go to Kalawallah?"

"Yep. And to tell you the truth, I was pretty upset that he made me come here. My two best friends were going to a camp closer to home. I just wanted to go with them."

"Well, my sister told me that sometimes it's best to do new things on your own. I think she's right," Greta said, surprised at the ease with which she was speaking. "You might feel lonely for a second, but then you can make new friends and experience new things."

She looked around. All the other girls were there now, too, chatting and giggling. A few seemed to be staring at her. Her face turned hot.

"Anyway," he said, so close she could feel the warmth of his breath, "I'm pretty glad I'm here now."

Could he possibly be saying he was glad he was there because of her? No. If he really liked her, he would've asked her for the last dance at the social instead of dancing with Julia from Fern 7. She was a fourteen-year-old. Greta didn't stand a chance.

"Truth or dare, Evan?" Vivian asked, bringing Greta back to everyone in the woods.

"Always dare," Evan said with a grin.

Vivian huddled with two other girls for a minute. They erupted with laughter before turning back to the group, and everyone was eager to hear what they had come up with. Evan looked ready for anything. But just as Vivian was about to deliver the dare, a light flashed in the woods.

"Hey! Don't move!" a voice called, the flashlight coming toward them.

"Run!" everyone seemed to yell at once, and the group took off, dispersing in the field and woods.

Greta started to run anxiously, her stomach tumbling. The nervous butterflies were suddenly gone. These were fireflies.