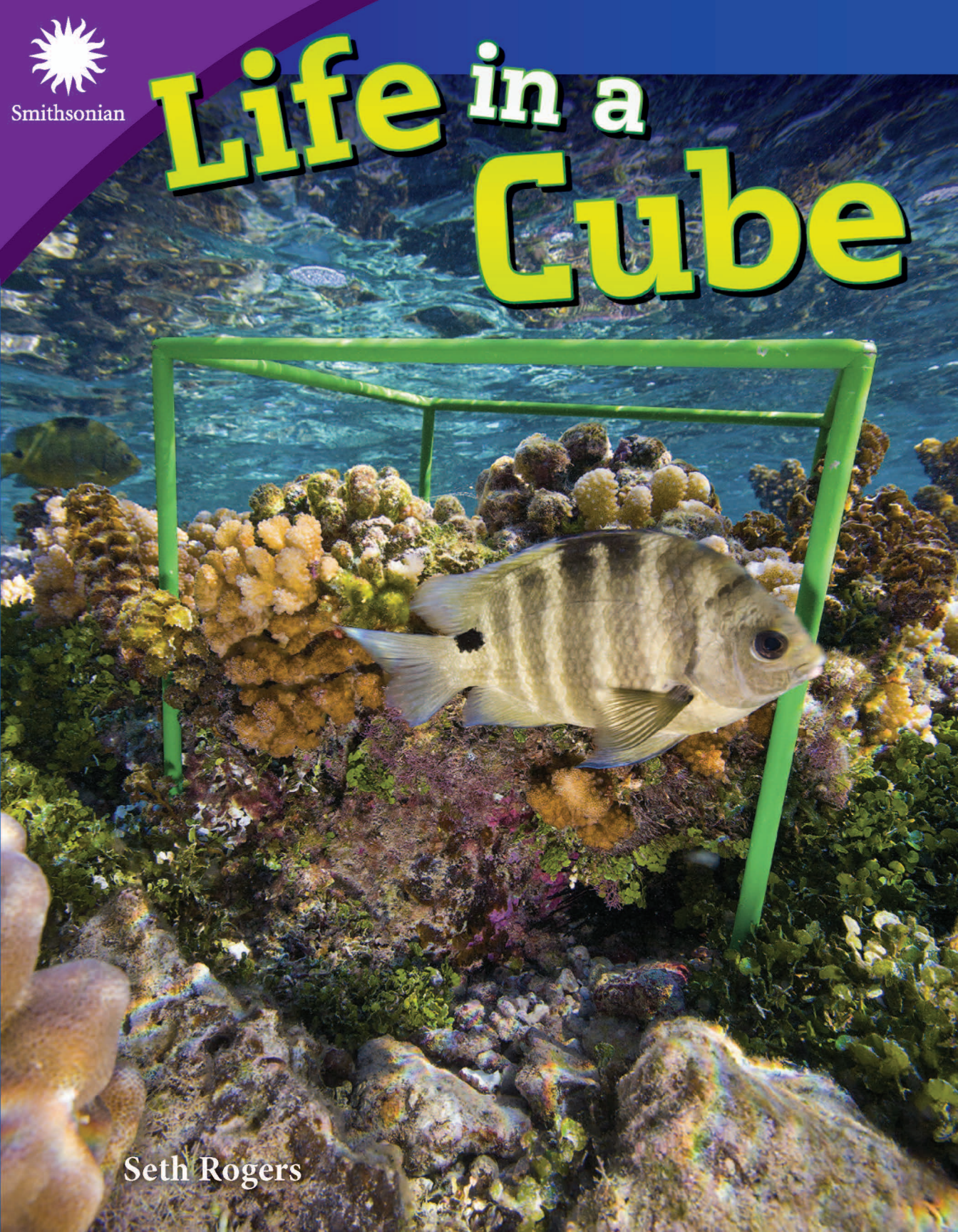
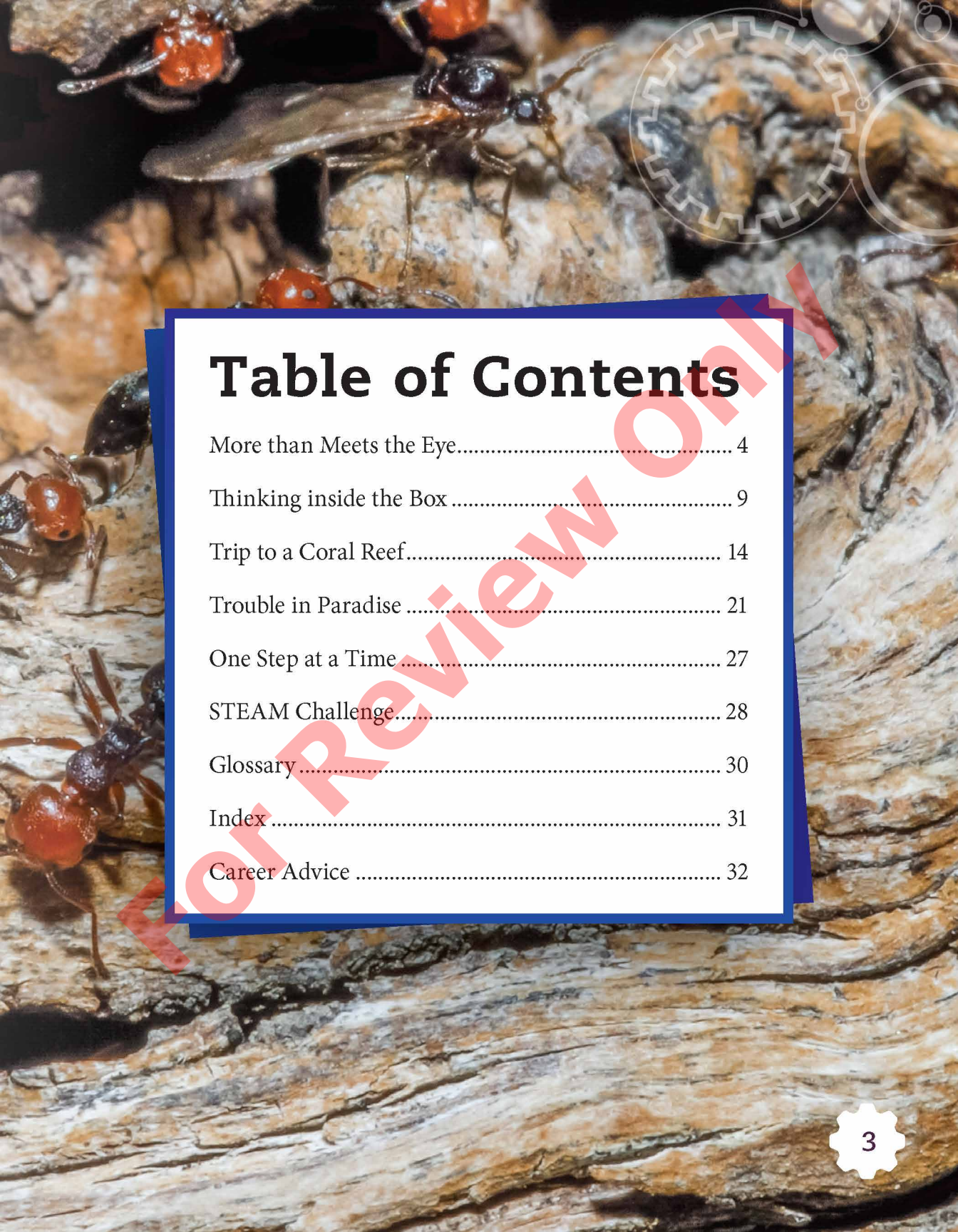
Smithsonian

Life in a Cube



Seth Rogers



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More than Meets the Eye

Everybody knows there is life on Earth…a *lot* of life. In fact, no one knows exactly how many different living things are on Earth. Even today, people are still finding new species. Life is all around us, no matter where we are. From the largest life forms to the tiniest creatures, studying all living things can seem impossible.

red-tailed hawk

In 2016, around 18,000 new species were catalogued and named.

Eastern box turtle

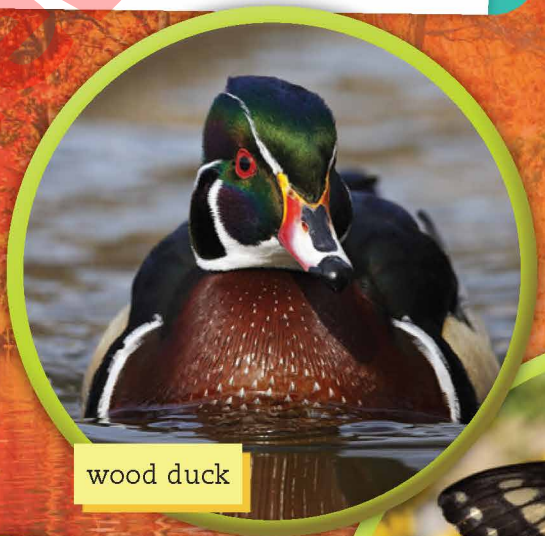
ailanthus webworm moth

Eastern fox squirrel

Even on a smaller scale, the numbers can be intimidating. Take one single **ecosystem**. How many things live among the grass and trees of Central Park in New York City? At first, it seems like it would be a small number. After all, Central Park has an area of less than 3.4 square kilometers (1.5 square miles) and is bordered by busy New York City on all four sides. Life there *has* to be limited, right? But look around. Squirrels play in trees. Turtles swim in ponds. Red-tailed hawks soar overhead. Then, look even closer. Mosquitoes hover near water. Ants dig in soil. Trees, grasses, and **algae** all grow there. Even in a small area, **biodiversity** gets hard to track in just a few minutes.

You may be asking yourself, *How can people possibly study all life in an ecosystem when there is so much of it?* Photographer David Liittschwager had the same question so he came up with a new idea. Rather than trying to record data about life in an ecosystem, he decided to start small. He wanted to work with a sample size that could fit in his lap. He decided to build a cube with a volume of about 28 liters (1 cubic foot). He explored this idea in his book *A World in One Cubic Foot.*

The idea is simple. The smaller a sample size is, the closer it can be observed. More time can be spent looking at life that usually hides from view. But Liittschwager needed each sample to be an equal size so he could compare his results. He had to make many decisions. First, he asked which living things should be counted and which should not? Next, he had to choose places to study. Liittschwager wanted to find areas where there was as much biodiversity as possible. That would give him more life to study in each ecosystem.



wood duck

black-throated green warbler

Liittschwager's cube in Central Park

rat

Eastern tiger swallowtail

SCIENCE

A Delicate Balance

Small parts of an ecosystem can be filled with life. But they cannot stand on their own. Each part depends on other living and nonliving things around it. This **interdependence** is why it is so important to keep balance within an ecosystem. One small change in one part of an ecosystem can have widespread and long-lasting effects on the rest.

Liittschwager examines a fish in Moorea, French Polynesia.

Thinking inside the Box

Liittschwager next set the process for his project. First, he would place his cube-shaped frame in a **habitat** where it could be observed. Liittschwager would set his cube in places that were wild and overgrown. He knew these places would have the most biodiversity. He would leave the cube in each location for 24 hours. Every living thing that passed through the cube would be recorded. Samples of each life form would be collected and photographed. These samples would then be returned to where they were found. He'd follow this same process in each location. That way, he could compare his results.

Liittschwager wanted each location in his book to be **unique**. He wanted to show life in a wide range of places. He thought this would make readers wonder what might be hiding in their own backyards. He asked **biologists** and **botanists** to help him pick the best places for his project. They helped him choose five types of habitats. Those habitats would give Liittschwager the best samples for his book. And one of these habitats changed how Liittschwager saw the world.

TECHNOLOGY

Simple, Yet Effective

At the center of Liittschwager's project was his cube. The cube had to be visible, but it had to blend into the natural landscape of many locations too. It also had to be sturdy enough to withstand the outdoor conditions of the project. In the end, he made the cube with 12 stainless steel rods. The rods could be put together and taken apart as needed. Then, the cube was painted green to help it blend in with its surroundings.

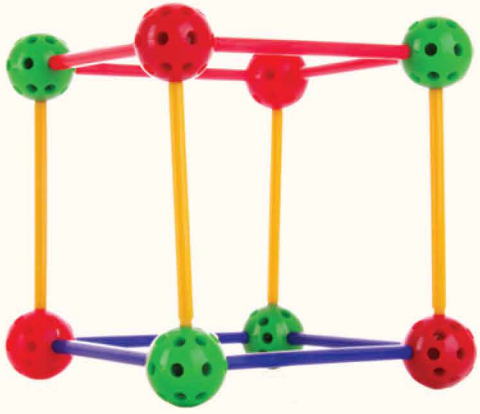
STEAM CHALLENGE

Define the Problem

Life can be found all around us. It is easier to see creatures that would normally hide from view when your sample size is small. Your task is to create a 30 cm × 30 cm × 30 cm (1 ft. × 1 ft. × 1 ft.) cubic frame and re-create Liittschwager's experiment in your local area.

Constraints: Your cube's length, width, and height must measure exactly 30 cm (or exactly 1 ft.) each.

Criteria: Your cube must be durable and waterproof to withstand possible weather conditions. It should blend with its surroundings and be placed where it will have the most biodiversity pass through it.



Research and Brainstorm

What materials would work best to build your cube? How will you construct it? Where will you place your cube? How will you photograph the samples you find? How will you replace samples when you are finished?

Design and Build

Choose where to place your cube. Where would the most biodiversity likely be? What color will you paint your cube to make it blend in with its environment? Build your cube.

Test and Improve

Test your cube's durability by spraying it with water and dropping it from 1 meter (1 yard) high. Did your cube stay dry and in one piece? If not, modify your design. Place your cube outdoors, and observe it for at least two hours over the course of one week. Take pictures or make detailed observations to keep a record. Was your cube placed in a good location? Was it difficult to observe your samples?

Reflect and Share

Create a museum exhibit that displays your cube and the photos and observations from your project. Include a short summary that explains where you placed your cube and what you found. What might have happened if you had chosen a different location? What if you left your cube outside for longer?