Guest Editorial

by Kierán Suckling : Center for Biological Diversity

Three Catastrophes, One Sky

One-hundred and sixty million years before you were born, there was a collision in the inner main asteroid belt. A rock 110 miles in diameter smashed into another half its size with a terrible force, shattering both into hundreds of thousands of pieces. Most of the debris is still safely orbiting the sun within the asteroid belt, but due to the aptly named Yarkovsky and YORP effects, a few mountain-size pieces escaped. Following an interplanetary arc of some hundred million miles, they were eventually captured by the Earth's gravitational field.

One shard plowed into the moon about 108 million years ago, creating the immense Tycho Crater, whose radiating lines are visible to the human eye. Forty-three million years later, another piece slammed into the tip of the Yucatan Peninsula, driving the dinosaurs extinct.

The Tycho Crater on the moon's southern hemisphere was caused by an asteroid shower which also struck the Earth, driving most dinosaurs to extinction 65 million years ago. Photo courtesy NASA.

When this chain of events was initiated, most of the dinosaurs who would suffer its consequences were not yet come into existence. They evolved in the shadow of their own extinction, while death arced toward them for a hundred million years with mathematical precision.

Nothing stood between them and the asteroid.

On December 26, 2004, a seabed earthquake erupted near the Island of Nias off the Sumatran coast. Registering a 9.1, it was the third-largest earthquake known to man. Tsunamis radiating from its epicenter killed over 225,000 people along the Indian Ocean shoreline from Kenya to Indonesia.

To reach land in the Indian Ocean, a tsunami must pass through mangrove forests. It will first encounter red mangroves with prominent airborne roots propped above the water, then, just inland, black mangroves with pneumatophores poking up through the mud like straws grasping for air, then white mangroves, then—as the coast transitions to solid ground—buttonwood mangroves. Mangroves are the tropical coast overstory, protecting everything below and behind from sun, wind, and water. They take the brunt of hurricanes and tsunamis. And when healthy, they greatly reduce inland damage.

In 1960 a tsunami slammed into healthy mangrove forests on the Bangladesh coast, which absorbed so much of its force that no humans were killed. The mangroves were later cut down to make way for shrimp farms. When another tsunami of the same magnitude hit the area in 1991, it barreled over the farms without slowing. Thousands were killed.

Shrimp farms fragmenting a Malaysian mangrove forest.
Photo courtesy *Shrimp News*.

The five countries hit hardest by the 2004 tsunami had cleared 26 percent of their mangroves between 1980 and 2000. Since the 1960s, Thailand cleared over 156,000 acres for aquaculture, industrial development, and to produce sandy, tourist-friendly beaches. Java cleared 70 percent of its mangroves during this period, Sulawesi 49 percent, Sumatra 36 percent, and India over 66 percent. Singapore and the Philippines have lost over 90 percent of their mangroves.

In the Andaman Islands, which have extensive, nearly intact mangroves, only seven percent of villages hit by the 2004 tsunami were devastated. In areas where mangroves were replaced by aquaculture and tourist beaches, 80 to 100 percent of villages were devastated. A similar pattern occurred in southern Sri Lanka, where 23,588 were killed. Nias, which has protected its mangroves fairly well, suffered relatively few deaths though sitting at the epicenter of the quake.

The sun is a catastrophe waiting to happen. Harboring 99.8 percent of the mass of the solar system, its core burns at 27 million degrees, emitting 63 million watts per square meter. Its energy drops off in accordance with the inverse square law, so by the time it smashes into the Earth's outer atmosphere, it is projecting just 342 watts per square meter. Lest that sound inconsequential, consider that it would take 1.7 billion large power plants to produce that much energy.

If the sun's energy were to penetrate and remain in the biosphere, every living thing would be burned to a crisp in a Venus-like environment. If it reflected back to space too quickly, every living thing would freeze in a Mars-like environment. This doesn't happen because 31 percent of solar energy is directly reflected back into space, and the rest leaks back out as heat, after warming the planet to a level that can sustain life. It is a zero sum budget over the long term, and has to be for life to exist.

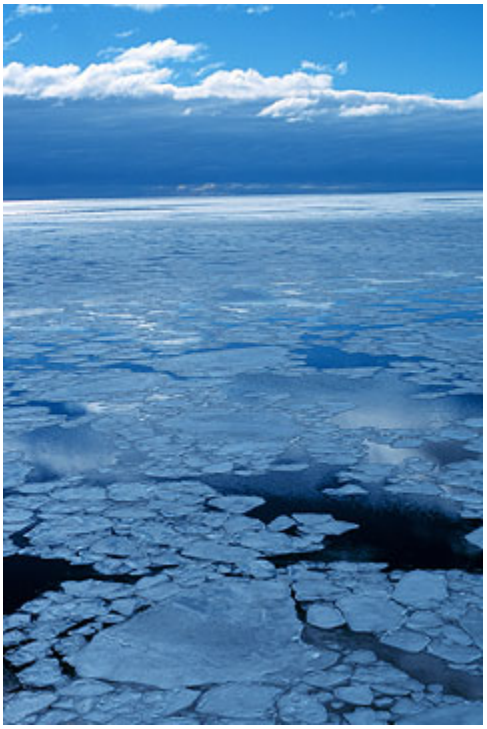
By changing the composition of the atmospheric overstory, however, we're preventing it from properly modulating incoming solar radiation. Thus the planet is steadily heating up and the oceans are acidifying with catastrophic results.

For at least 800,000 years—and likely much longer than that—atmospheric carbon dioxide has averaged 230 parts per million and had never exceeded 299 ppm. It is now 385 ppm and growing

due to burning of fossil fuels (which emit carbon) and degradation of forests and soils (causing them to absorb less carbon). At the current growth rate, atmospheric carbon will top 470 ppm by mid-century.

To put that in perspective, humans and polar bears have existed for just 250,000 years. Both evolved and are only known to have survived in an atmosphere with less than 300 ppm of carbon dioxide. Polar bears are now going extinct because carbon levels above 350 ppm are causing their habitat to melt away.

Humans have long labored under the illusion that we live on an energetically benign Earth. In fact we live beneath vegetative and atmospheric overstories that protect us from incoming waves of enormous energy. It is not clear that humans, or at least advanced human societies, can exist if those canopies are destroyed or degraded. Bruce Willis fantasies notwithstanding, we can do nothing about asteroid pulses. But with great effort we can restore coastal mangroves, and with a monumental effort, we can scale back atmospheric carbon level to 350 ppm by reducing our net carbon emissions to zero (or less). Reversing the course of global warming is not only the greatest challenge of our generation; it is the most uniquely singular challenge in the history of the human race. Everyone is threatened, everyone is part of the solution. There is but one sky.



Scientific models indicate summer sea ice in the Arctic will disappear by 2030. Actual melting is more rapid and may lead to an ice-free summer Arctic within 5 to 10 years.
Photo by Michael VanWoert, courtesy NOAA.

Kierán Suckling is a philosopher and the director the Center for Biological Diversity, a national endangered species protection group which has won Endangered Species Act protection for the polar bear and hundreds of other creatures great and small. The Center is currently focused on helping imperiled plants and animals adapt to climate change while ensuring that carbon, methane, and black carbon emissions are reduced as fast and deeply as possible. Suckling writes widely on the cultural importance of biological diversity.