

MASSACHUSETTS WILDLIFE

No. 2, 2024

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**The Space Around Us,
Hunters Share the Harvest,
Hornpout Revival**

Northern Red-bellied Cooter Program Celebrates 40th Anniversary



In honor of Endangered Species Day in May, MassWildlife was joined by over 100 students, researchers, and other partners to celebrate an important milestone for endangered turtle conservation in Massachusetts. This year marks the 40th anniversary of MassWildlife's Red-bellied Cooter Headstart Program—one of the longest and most intensive freshwater turtle headstart conservation programs in existence. When MassWildlife began headstarting in 1984, the estimated population of northern red-bellied cooters (*Pseudemys rubriventris*) in Massachusetts was only 300. Now, the population is over 2,000 adults.

The northern red-bellied cooter is listed as endangered under the federal and state endangered species acts. Like most Massachusetts turtles, cooter hatchlings have many predators and few make it to adulthood and reproductive age. Habitat loss and poaching for the illegal pet trade further threaten native turtles. Through the headstart program, turtle hatchlings are removed from the wild in early fall and paired with educational and scientific facilities across the state. For 8–9 months, the turtles live in a warm aquarium environment with unlimited food. This greatly accelerates the growth of the turtles and reduces the likelihood of death from predators during a turtle's first year of life when they are most vulnerable, giving each turtle a "head start" at life before release back into the wild.

The Headstart Program is part of MassWildlife's overall turtle conservation effort, in addition to habitat protection, raising awareness of threats to native turtle populations, and empowering people to help turtles in their communities. For a recovery project to be successful, it takes many partners working together. The future of the northern red-bellied cooter is looking bright, and the 5,000th headstarted turtle was released back into the wild this spring.



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MASSACHUSETTS WILDLIFE

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THE SPACE AROUND US

— Troy Gipps

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The stunning beauty and unimaginable isolation of Earth, the reality of our impact on atmospheric chemistry, the emotional experience of a space tourist, and the hope of technology converge to remind us of our collective need and responsibility to properly steward our world.

FRESHWATER SPORTFISHING AWARDS 2023 COMPETITION RESULTS

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The year 2023 saw 10 new state-record fish, 99 gold pins, and the highly successful addition of the new Youth Catch-and-release angling category, which represented 39% of all pin submissions.

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Following successful pilot and inaugural years, MassWildlife's Hunters Share the Harvest program sets its sights on future expansion, rallying deer hunters, processors, and partners to help fight food insecurity in the Commonwealth while strengthening relationships that will lead to improved forest health.

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On the Cover: Raccoons are one of many species that can come into conflict with people. To better manage relationships with your wild neighbors, review MassWildlife's Living with Wildlife fact sheets at mass.gov/dfw/wildlife-factsheets. Photo © Josh Gahagan

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The Space Around Us

by Troy Gipps



Photo by NASA/William Anders

EARTHRISE — *Earth, rising above the lunar landscape in 1968, as seen by the crew of Apollo 8 as they made their fourth orbit around the Moon.*

On December 24, 1968, seven months before a man walked on the Moon, humanity got its first look at a high-resolution, full-color image of the beautiful blue ball we call home. With the snap of a shutter during the crew's fourth orbit around the Moon, Apollo 8 astronaut William Anders, who, sadly, died this June at age 90 when the vintage, small-engine plane he was flying solo crashed, captured what would become known as *Earthrise*—arguably, in the words of the late nature photographer Galen Rowell, “the most influential environmental photograph ever taken.” Rising above the lifeless lunar landscape, our vibrant ocean planet, wrapped in swirling clouds, hung in silence against a canvas of empty black space. *Earthrise* expanded our appreciation of the miracle of life as we know it and promised to serve as a great unifying force for the environmental movement. In an instant, the concept of “Spaceship Earth” was solidified in our collective consciousness. The image also made it hard to ignore an uncomfortable truth: our planet was beautiful and fragile, and isolated to an extent that remains difficult to comprehend even with photographic proof.

One of the great notions stemming from *Earthrise* was the concept of Gaia (gey-uh). The hypothesis was formulated in the 1970s by British scientist James Lovelock and co-developed by microbiologist Lynn Margulis. The Gaia theory described how Earth behaved like a single, giant organism with a planetary-scale control system driven by the interaction of organisms with their inorganic surroundings to form a self-regulating, complex system that contributes to maintaining the conditions for life. The scientific and technological advances of the past 55 years have contributed greatly to our increased understanding of the interdependent nature of life in the biosphere and has underscored the critical importance of maintaining and restoring biodiversity to enhance ecosystem resilience.

Unfortunately, even with our dramatically increased base of knowledge and

the notable progress made by the global environmental movement since *Earthrise*, we, as a species, have presided over the precipitous decline of every living system on Earth. The primary reason for this environmental degradation is us, or, more specifically, 8.1 billion of us, and the ways in which we live our modern lives. The global human population has nearly tripled since the inauguration of President John F. Kennedy in 1961 and the United Nations now predicts that our population, which currently increases by approximately 2.3 people every second, will reach 10 billion by 2058. We live on a finite world with depleted resources, and our burgeoning population and standards of living have placed and will continue to place enormous strain on ecosystems across the globe. We, and all organisms that constitute the web of life on our planet, are increasingly imperiled. The need for meaningful global action to halt and reverse these negative environmental trends remains paramount.

Humanity's next visual reminder of its isolation and the stunning miracle of life on Earth came in 1990 following a suggestion by the notable American astronomer, planetary scientist, and brilliant science communicator, Dr. Carl Sagan. At that time, NASA's Voyager 1 spacecraft was 3.7 billion miles from the Sun—it is now 15 billion miles away and traveling through interstellar space—and was positioned approximately 32 degrees above the ecliptic plane (which is the imaginary plane containing the Earth's orbital path around the sun) when, at Dr. Sagan's request, it was turned to point back at Earth. It photographed us, caught in the center of a light ray because the picture had been taken so close to the sun. We appeared as a tiny point of light, a crescent only 0.12 pixels in size. This grainy image, titled the *Pale Blue Dot* in Sagan's 1994 book of the same name, was our first look from a distance at the icy wilderness of space that surrounds us. Dr. Sagan eloquently described our world, as depicted in this image, as “a mote of dust suspended in a sunbeam.” You can still hear the late

PALE BLUE DOT — *This image of Earth, which appears as a tiny, blueish-white dot suspended in the center of a light ray, was taken in 1990 by NASA's Voyager 1 spacecraft at the request of American astronomer Dr. Carl Sagan and at a distance of 3.7 billion miles from the Sun. The Pale Blue Dot, as the image came to be known after the publication of Dr. Sagan's 1994 book of the same name, was our first look from a distance at the icy wilderness of space that surround us.*

Photo by NASA/JPL; Dr. Candice Hansen, Dr. Carolyn Porco

Dr. Sagan, online, reading a 3½-minute excerpt from the *Pale Blue Dot*. No truer words have been spoken about our need to behave responsibly and to properly steward Earth.

In 2004, NASA's Mars Exploration Rover *Spirit* took the first image of our world from the surface of another planet, creating a photograph that is remembered by few. We are seen, shortly before the dawn of a Martian day, appearing as Venus does to terrestrial observers, as a bright speck hanging just above the horizon against a backdrop of lonely space.

It wasn't until July 19, 2013, that the people of Earth knew in advance that our planet was to be imaged from space. On that day, the Cassini spacecraft, which was

launched in 1997 by NASA for the purpose of exploring the wonders of Saturn and its family of icy moons, slipped into Saturn's shadow and turned to image the entire planet, 7 of its 146 moons, and its inner rings. It took a mosaic of 33 images, one of which captured Earth. The photographic event was dubbed by NASA as *The Day the Earth Smiled*, and people around the world responded to the space agency's public relations campaign to look up and wave at Saturn for this historic group portrait—taken from 898 million miles away. We appeared as a tiny blue dot, with our barely visible, grayish-white moon by our side, positioned just below Saturn's strikingly beautiful rings. It was a fleeting moment of unity and a worthy follow-up to the *Pale Blue Dot*, but it quickly fell from the news cycle.

There is, regrettably, a significant disconnect between unmanned space exploration and the human heart. Even considering all that we have seen and explored through robotic means following the Apollo missions to the Moon, including the incredible visual discoveries made by NASA's Hubble Space Telescope, and more recently by its James Webb Space Telescope—the most complex, precise, and powerful space observatory ever built, which is literally looking back in time at light that is only now reaching us from shortly after the birth of the universe—we are usually most struck, on an emotional level, by stories of wonder and fear shared by people who have experienced it firsthand. This may be the one collective advantage stemming from the “space tourism” industry that is now in its infancy. Oddly, it may hold a unique

hope for continually reminding us of how lucky we are to inhabit this beautiful living planet, even though it will very likely remain restricted to a privileged few.

This was certainly the case on October 13, 2021, when Canadian actor William Shatner, best known for playing the staunchly hopeful and idealized future hero Captain James T. Kirk in the 1960s television show *Star Trek* and for starring in 7 of the 13 *Star Trek* movies that followed, emerged from Jeff Bezos's Blue Origin “New Shepard” crew capsule shortly after its return to Earth.

Shatner, then aged 90, who at that time became the oldest person to ever fly into suborbital space, was one of four passengers who boarded the 60-foot tall, reusable rocket on its launch pad in West Texas, after minimal training. The most

THE DAY THE EARTH SMILED —
Earth, as photographed on July 19, 2013 by NASA's Cassini spacecraft during its mission to explore Saturn and its 146 moons.



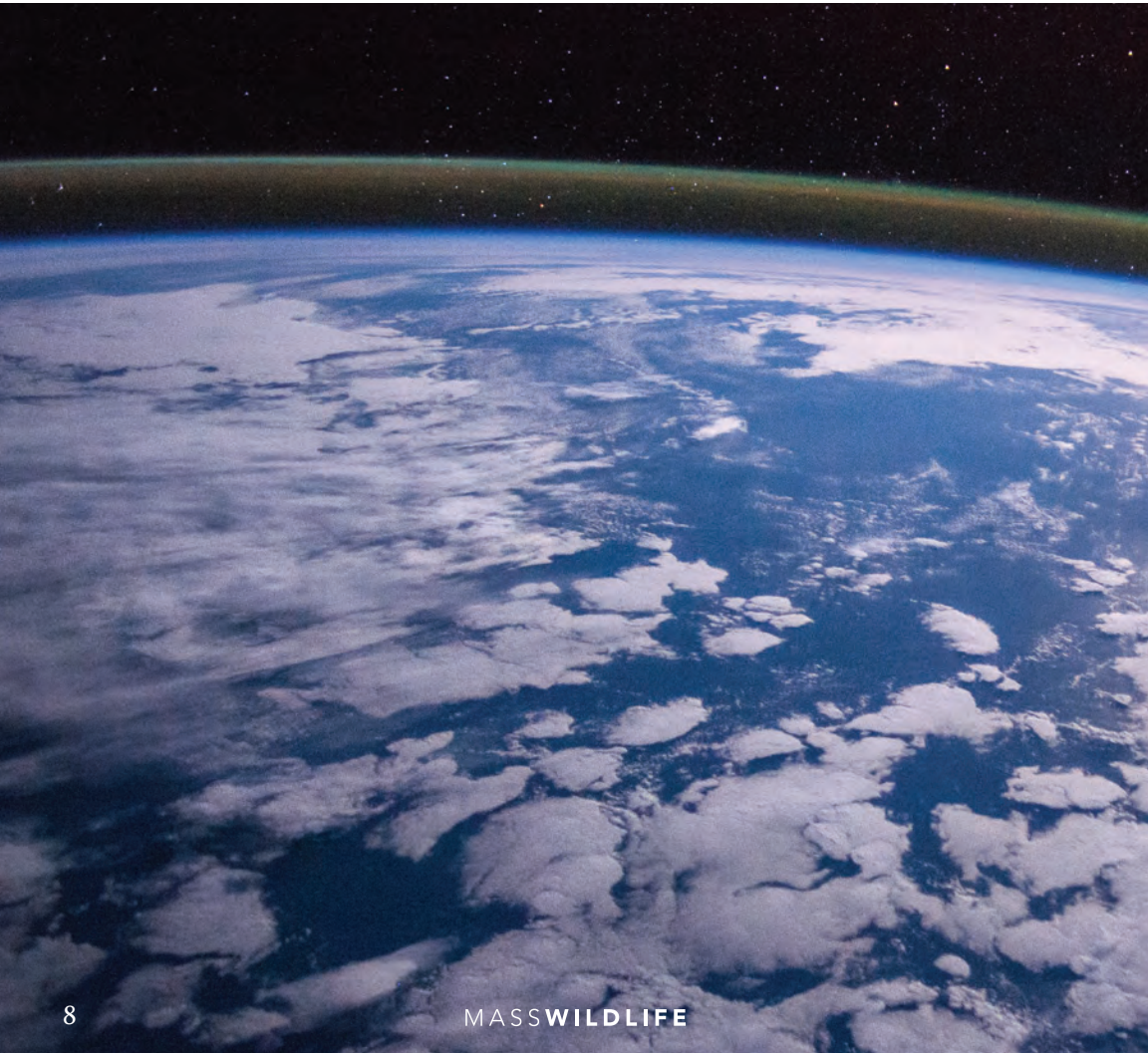
Photo by NASA/JPL-Caltech/SSI; Image Preparation: Daiana Di Nino, Dr. Carolyn Porco

notable design aspect of the crew capsule from an experiential standpoint is its six big observation windows, the largest ever on a spacecraft. Shatner's flight was the second of what is now seven tourist missions flown by New Shepard, mostly for wealthy passengers (a ticket costs at least \$250,000 and perhaps as high as \$500,000). Bezos, a long-time *Star Trek* fan, let Shatner ride for free.

The flight lasted just 10 minutes and 17 seconds from takeoff to landing, and it provided its passengers with three minutes of weightlessness in suborbital space.

I must admit, prior to launch, my hopes for watching news media coverage of anything other than a glorified publicity

stunt were low. We were, after all, about to see a private rocket blast off that is owned by a guy who made \$200 billion founding a company that allows you to shop for just about anything while sitting on your couch, and who was being hilariously compared to Dr. Evil from the second *Austin Powers* movie for his uncanny resemblance to the maniacal Evil and for the strikingly similar "anatomical" design of their rockets, one of which would now carry Blue Origin's vice president of mission and flight operations and three wealthy passengers, including the iconic Captain Kirk who had boldly gone "where no man has gone before" from the comfort of a Hollywood set, to the *actual* edge of space.



But after parachutes safely returned the crew capsule to Earth, and the boisterous celebration and popping of champagne corks had waned, Bezos and his wife, Lauren Sánchez, stood with Shatner as a news crew filmed them. Shatner said, with great emotion, “It was unbelievable, unbelievable.” Visibly shaken, he continued, trying to find words to describe what he had just experienced, “The little things, the weightlessness, but to see the blue color go whip by and now you are staring into blackness. That’s the thing, the covering of blue. The sheet, this blanket, this comforter of blue that we have around us. We think, oh, that’s blue sky, and then suddenly you shoot through it, as though you whip a sheet off of you when you are

asleep, and you are looking into blackness, into black ugliness, and you look down and there’s the blue down there and the black up there, and it’s just.... There is mother, and Earth, and comfort, and there is... Is there (gesturing upward), death? I don’t know, is that death? Is that the way death is? *Whoop* and it’s gone. It was so moving to me.”

The New Shepard rocket was traveling at 2,000 miles per hour and Shatner said it felt as though they had passed through our 50-mile-thick atmosphere in an instant, “... and suddenly,” he said, “you are through the blue and you’re into black. What you see is black and what you see down there is light and that’s the difference, and not to have this?”

The outer edge of the Earth's atmosphere, as seen from the International Space Station.



Shatner was so filled with emotion he could barely speak. But he continued, resting his hands on Bezos' shoulders and telling him that he "hoped that [he] would never recover from this." He wanted to hold on to what he was feeling, which he described as something so much larger than himself. The experience, he said, was the most profound he could have imagined.

Finally, and perhaps most poignantly, Shatner recognized the jeopardy faced by life on Earth. By passing through our atmosphere, he saw our vulnerability firsthand. "This air," he said, "which is keeping us alive, is thinner than your skin. It's a sliver. It's immeasurably small when you think in terms of the universe, it's negligible. This air. Mars doesn't have it."

It seems that Shatner has conveyed all that we may need to know about Earth and space: Down here is life and up there is death. Following his trip, he unexpectedly found himself overwhelmed by sadness and empathy for Earth, due to the negative environmental impact we have had upon it. His experience and that of other environmentally awakened space tourists who follow might be just what we need to fight the force of environmental complacency.

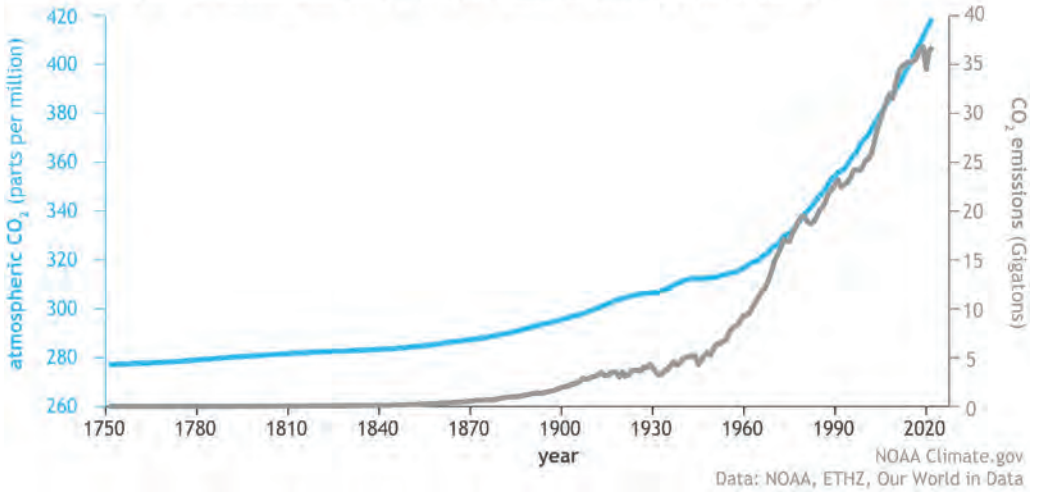
Of course, space tourism, too, is not without environmental costs. Like much of what we do, it is a doubled-edged sword.

In Shatner's book, *Boldly Go: Reflections on a Life of Awe and Wonder*, published a year after his flight, he further reflected on his passage through our atmosphere. He wrote that upon reaching the edge of space his fellow passengers unbuckled and "went straight into somersaults and enjoying all the effects of weightlessness." But he went straight to the closest window. When he looked down, he could see the hole that the New Shepard had made in the "thin, blue-tinged layer of oxygen" that envelopes Earth. He wrote that "it was as if there was a wake trailing behind where we had just been, and just as I'd noticed it [the hole], it [closed and] disappeared."

That impossibly thin layer of blue and our planet's magnetic shield protect us from deadly cosmic radiation, but our atmosphere also traps the climate-altering greenhouse gases and other chemical pollutants our societies produce. Prior to our inputs into the global carbon cycle following the start of the Industrial Revolution, the Earth had achieved a relative equilibrium during its most recent geologic epoch; emitting and eventually reabsorbing carbon dioxide (CO₂) from natural sources as the Earth followed its orbital path—"inhaling and exhaling" as the seasons shifted annually across the globe. Even though humans only emit about a tenth of the CO₂ entering the atmosphere from natural sources, it is enough to throw this delicate carbon cycle out of balance. Our annual impact is sobering. According to the International Energy Agency, global energy-related CO₂ emissions amounted to a record high of 37.4 billion tonnes in 2023 (a tonne is a metric ton, or 2,204 pounds), an unfortunate 1.1% increase from the year prior due to the United States, China, and several other economies relying more heavily on fossil fuels when extreme drought impacted hydropower production. This rise follows another lamentable increase of 1.3% in 2022.

The pace at which nature absorbs CO₂ is incredibly slow, and becoming increasingly inefficient due to human activity, such as large-scale deforestation and the degradation of ocean environments that is decreasing populations of the phytoplankton responsible for most of the transfer of CO₂ from the atmosphere to our oceans, so our collective unabsorbed CO₂ inputs from the past 200 hundred years will remain in the atmosphere for hundreds or perhaps even a thousand or more years. Around the world, we are witnessing the climate-altering effects of this atmospheric chemistry. You can't start a fire inside a house without a chimney and not expect it to fill with smoke.

Global atmospheric carbon dioxide compared to annual emissions (1751–2022)



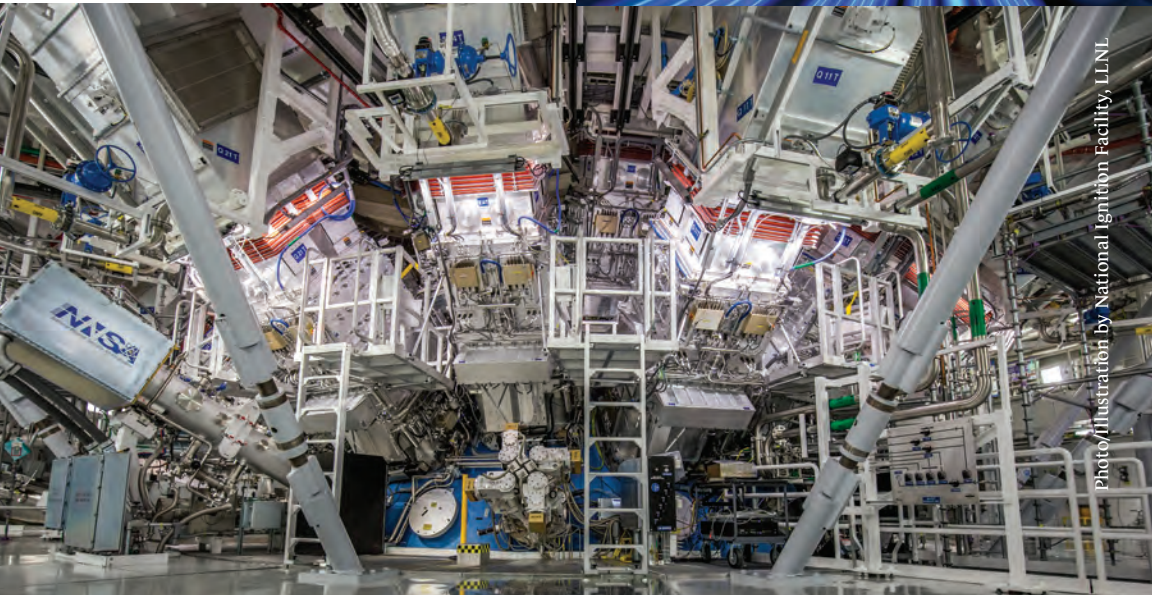
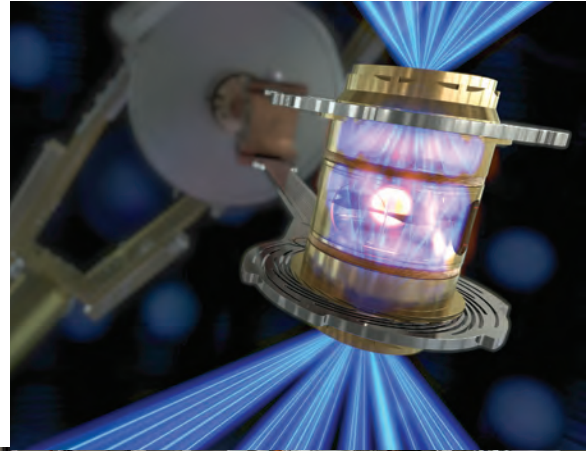
The amount of carbon dioxide in the atmosphere (blue line) has increased along with human emissions (gray line) since the start of the Industrial Revolution in 1750. Emissions rose slowly to about 5 gigatons—one gigaton is a billion metric tons—per year in the mid-20th century before skyrocketing to more than 35 billion tons per year by the end of the century. NOAA Climate.gov graph, adapted from original by Dr. Howard Diamond (NOAA ARL). Atmospheric CO₂ data from NOAA and ETHZ. CO₂ emissions data from Our World in Data and the Global Carbon Project.



The United States at night.

At present, the only known CO₂ emission-free energy technology under development that holds the potential to replace fossil fuels is nuclear fusion (not fission). Nuclear fusion is what happens in the core of our Sun and in other stars, where unimaginable heat and immense pressure fuses two atomic nuclei to form a single larger one, but the total mass of the new atom is less than that of the two that formed it. The “missing” mass is given off as energy without the long-lived nuclear waste that is produced by current nuclear fission reactors. On December 5, 2022, after six decades of research and 200 tests over the previous 13 years, the U.S. Department of Energy Lawrence Livermore National Lab’s (LLNL) National Ignition Facility in California succeeded, for the first time, in achieving fusion ignition—using an array of 192 lasers that delivered more than 2 million joules of ultraviolet energy to a tiny, perfectly spherical, diamond fuel capsule containing tritium and deuterium (both isotopes of hydrogen)—that produced 50% more energy than it consumed. In doing so, the lab proved the physics problem

could be solved. The experiment was successfully replicated by LLNL on July 30 of last year. The scaling up of nuclear fusion for practical use is now an engineering challenge that scientists and engineers at government labs and over 30 nuclear fusion companies are actively working to solve. Over \$6 billion in government and private funding has recently flowed into these efforts. The experimental fusion reactors that housed these successful tests and those recently constructed for the



Photo/illustration by National Ignition Facility, LLNL

The target chamber at LLNL's National Ignition Facility in California, where 192 laser beams delivered more than 2 million joules of ultraviolet energy to a tiny fuel pellet inside a hohlraum (above right, illustration) to achieve fusion ignition for the first time on Dec. 5, 2022. This technology holds the potential to replace fossil fuels.

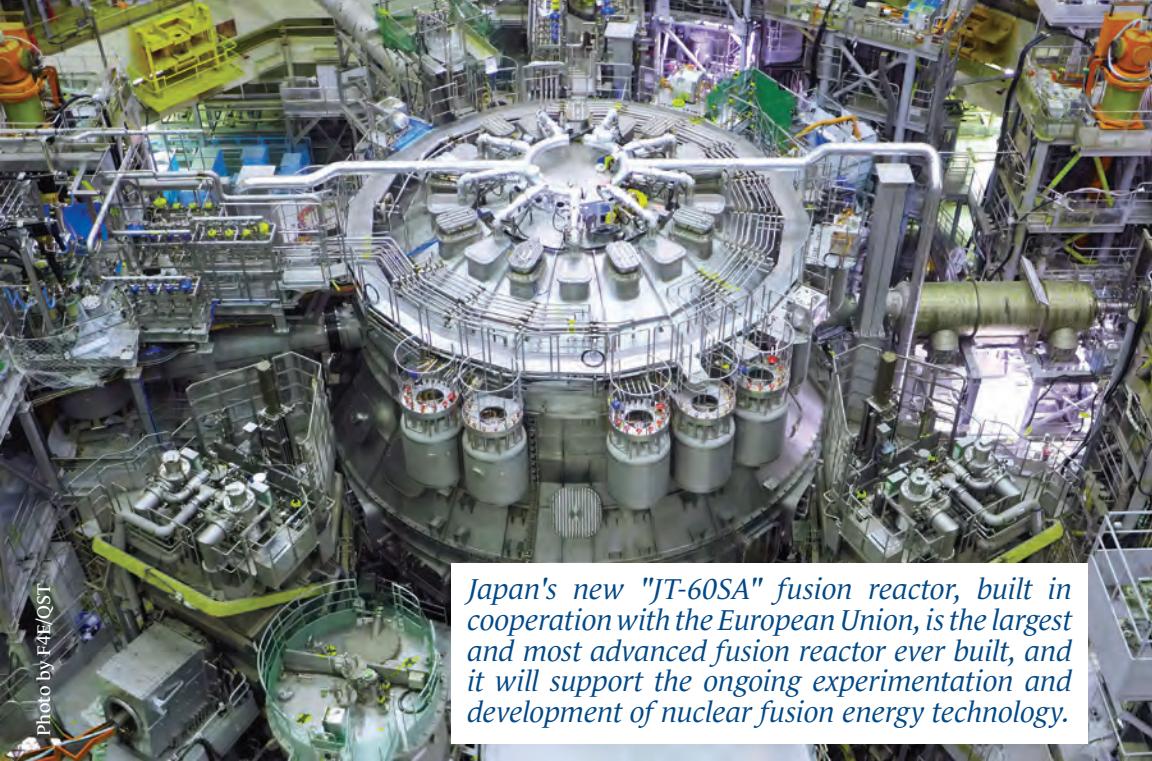


Photo by F4E/QST

Japan's new "JT-60SA" fusion reactor, built in cooperation with the European Union, is the largest and most advanced fusion reactor ever built, and it will support the ongoing experimentation and development of nuclear fusion energy technology.

further development of this energy technology—like Japan's new "JT-60SA" fusion reactor, constructed in cooperation with the European Union, which is the world's largest and most advanced fusion reactor ever built—look like something straight out of an Academy Award-winning science fiction movie, proof that we should not doubt the inventive nature of *Homo sapiens*. This technology, however, even as promising as it is, remains decades away from large-scale implementation, based on today's best estimates.

In addition to the still rising global CO₂ emissions, the biosphere is the annual recipient of over 460 million metric tonnes of plastics¹; 2 million tonnes of pesticides—with some government and academic sources estimating the total to be as high as 3 to 4 million tonnes²; and 250 billion tonnes of chemicals³.

This industrial and agricultural toxicity, when coupled with the sum of all other human pursuits, has triggered an alarming reduction in biodiversity. According to the World Wildlife Fund's *Living Planet Report 2022*, which is recognized as the

gold standard for tracking trends in global biodiversity and the health of the planet, the relative abundance of monitored wildlife populations around the world between 1970 and 2018 has experienced an average decline of 69%. The report further notes that freshwater species populations have seen the greatest overall global decline, at 83%.

The Space Around You

As with most environmental issues, the question many rightfully ask is "What can I do to make a difference?" This is, in fact, the No. 1 question we must all answer as we attempt to solve the most complex slate of environmental problems humanity has ever faced.

A good place to start on your own journey to answering this question is to recognize that each of us inhabits many worlds, two of which are very influential in this context. There is the physical world in which we live, where we have varying degrees of influence over nature and natural processes, and there's the financial world that both constrains and supports so many

aspects of our lives. For those of us who own a piece of nature—everything from small backyards to large forest tracts—we should strive to properly steward these spaces for the benefit of wildlife and, ultimately, ourselves. We each should also take part in efforts to conserve and restore our shared physical world. These remaining natural places, held in common, that many of us feel connected to, must remain a vibrant part of the biosphere that provides ecological services to us all, even when those services may not be easily recognized by the casual observer, such as the ability of intact wetlands to improve water quality by filtering sediments and absorbing pollutants; and, in the specific case of salt marshes, protecting coastal communities from flooding, erosion, and property damage during major storms; and the air filtration, carbon sequestration, and cooling services provided by forests, just to name a few.

For many of us, however, the greatest power to influence positive environmental change on a daily basis lies in the financial world. As citizens of a First World nation, the tentacles of our financial lives literally reach across the globe each time we decide to purchase—or not to purchase—a product or service, so we must remember that everything we buy is either taken from or grown upon the Earth, and all

that is produced affects the health of the Earth and of each of us, often in ways that are not readily apparent. As consumers, we must all make a conscious effort to use the available information to make the most informed purchase decisions possible with nature in mind. And while the efforts of one may seem insignificant, even small, incremental changes can have a substantial collective effect when you consider there are 8.1 billion of us.

Finally, we must each accept responsibility for our role in preserving and restoring our planet for future generations, because no edicts from a government will amount to real change without the heartfelt commitment of its citizens. In keeping with this pledge, please share your thoughts on these challenges, and this article, with everyone you know who is younger than you. They will inherit the sum of our decisions, so we should enlist their help in imagining and engineering a more sustainable way of life as soon as possible.

Where We Make Our Stand

There is a lot of talk, planning, and scientific focus of late on the potential for humanity to visit and inhabit other worlds. Chiefly, human spaceflight back to the lunar surface (NASA's Artemis missions, as precursors to Mars exploration) and to Mars (SpaceX's Starship) are commanding



much of the conversation. The desolation of the Moon is stark, and the equally lifeless Mars has an atmosphere comprised of 95% CO₂ with surface temperatures of minus 80 degrees Fahrenheit and down to minus 200 degrees Fahrenheit at its poles during winter. Attempting to inhabit either place would relegate colonists to a prison-like existence, sealed off from their surroundings in manufactured and biologically bankrupt environments. A spoonful of Earth's living soil is far more biologically complex than any environment we could create and sustain inside a human-friendly enclosure on the surface of another world.

The discovery of exoplanets located in the "habitable zones" of other star systems has also grabbed headlines. These are places where liquid water could exist on a planet's surface, so long as atmospheric conditions and other factors allow it. One such exoplanet, Proxima Centauri b, which orbits our closest neighboring star, Proxima Centauri, is 4.2 light-years away, or about 25 trillion miles from Earth. If we traveled there, at the speed of our fastest-ever spacecraft, the Parker Solar Probe, which boasts a top speed of 430,000 miles per hour (0.064% the speed of light), it would take us over 6,600 years to reach it.

A much more promising "Super-Earth," named TOI-715 b, that was recently discovered orbiting its red dwarf star by NASA's Transitioning Exoplanet Survey Satellite, is reported to be a mere 137 light-years away, or 805 trillion 400 billion miles from Earth. You can do the math.

I think Dr. Sagan said it best 30 years ago when he wrote in the *Pale Blue Dot*, "The Earth is the only world known so far to harbor life. There is nowhere else, at least in the near future, to which our species could migrate. Visit, yes. Settle, not yet. Like it or not, for the moment the Earth is where we make our stand." And what a beautiful place it can be.

¹ *Drowning in Plastics—Marine Litter and Plastic Waste Vital Graphics*, 2021. United Nations Environment Programme

² *A Review on Occurrence of Pesticides in Environment and Current Technologies for Their Remediation and Management*, 2020. National Institutes of Health.

³ Organization for Economic Co-operation and Development (An international organization consisting of 27 member countries, including the United States).



About the Author

Troy Gipps is the editor and art director of Massachusetts Wildlife.



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For those who watch butterflies, nothing says 'Summer is here!' like a beautiful great spangled fritillary (*Speyeria cybele*) nectaring—often on milkweed, as shown here—in a remote meadow or a local butterfly garden. Photo © Troy Gipps

