
National Aeronautics and
Space Administration
NASA
EARTH
DAY
FROM BIG TO SMALL WE'RE ALL CONNECTED
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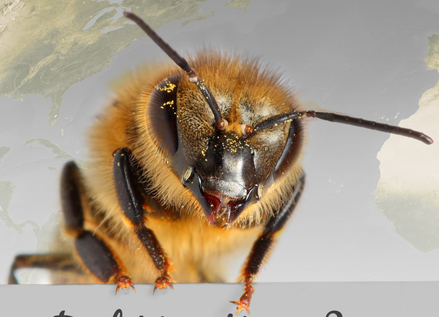


Bee Connected

This year's Earth Day is about connections—to our planet and to each other. Most of the connections we see around us are large and obvious, but we sometimes miss the little ones.

During the pandemic, spending more time safely outdoors gave many of us an opportunity to explore new worlds in our own backyards. Whether helping a child identify newly discovered plants and insects, or finding fresh subjects to inspire our art, we found small wonders that in different times we probably would have overlooked.

In that world within our world, we found a creature literally buzzing with activity—the amazing honeybee.

Social creatures by nature, each honeybee has a distinct role in its colony to help ensure the survival of the hive. However, honeybees are important to human survival, too, and for more than making something to put in our tea.

The U.S. Department of Agriculture calls pollinators "critical to the nation's economy, food security, and environmental health," and estimates that honeybee pollination of hundreds of different fruits and vegetables and other plants "adds more than $15 billion in value to agriculture crops each year."

Tiny as they may be, honeybees are definitely pulling their weight, and then some.

For this 10th in a series of Earth Day posters for NASA's Science Mission Directorate, honeybees' connections to their hives and to our lives made them the perfect subject.

We even see them connected to our science: the six-sided hexagons that make up the hive pattern are reflected in the mirrors of the Webb Space Telescope, scheduled to launch in late 2021. The Webb Space Telescope is the largest, most powerful, and most complex space telescope ever built. The shape of its 18 gold mirrors allows them to fold flat for launch and then, when in deep space, to open into a roughly round shape to reflect light from distant galaxies, data that will fundamentally alter our understanding of the universe. Learn more at jwst.nasa.gov.

Much like us, the honeybee is connected to our planet and, as such, is affected by the warming climate and changes to our Earth systems. This important player in our planet's well-being has not gone unnoticed by NASA scientists.

Wayne Esaias, an emeritus research scientist at NASA's Goddard Space Flight Center in Maryland and an amateur beekeeper, noticed several years ago that his bees were collecting pollen earlier in the spring than they had 15 years earlier, when he first started weighing the hives to track nectar collection. He was concerned because the pollination process relies on bees and flowers with nectar being ready for the pollination process at the same time. If spring comes earlier, or winter is warmer, it can throw the system out of synch.

Esaias talked to other beekeepers nearby and found they noticed the same trend. He charted these observations and looked at NASA satellite data over the same period. Esaias found spring "green ups" seen from space supported what the bees were telling them on the ground. "The question was: Were my bees seeing the same trends as the satellite sensors were seeing? And the answer was yes, they were spot on," he said.

Although HoneyBeeNet, a network of beekeepers sharing observations validating satellite data founded by Esaias, has since ended, the project discovered a lot about how climate change affects plant-pollinator connections. "When we have more confirmation that nectar flows from bees follow the vegetation signals we see from satellites, we can better understand how our ecosystems might change," he said.

In addition to studying how the planet itself is affecting honeybees, one of NASA's data centers is now providing information about commonly used agricultural pesticides and their impact on the environment and the creatures within—including honeybees.

Another tool that helped honeybees was the HIVE-OS project, which connected citizen science with Earth observations to help beekeepers make decisions that helped their bees thrive.

Created by NASA's DEVELOP program, which uses Earth science data to find solutions to environmental issues, and the University of Maryland, HIVE-OS combined satellite data about soil moisture, vegetation and other measurements with observations from beekeepers to track factors that impact honeybee health.

You can be part of NASA's Earth science studies as a citizen scientist (science.nasa.gov/citizenscience) and through the GLOBE Observer project (observer.globe.gov).

This Earth Day as we look at the global view of our intertwined systems from space, we also appreciate the important roles of even the smallest of creatures in our connected planet.

Bee part of the celebration and learn more at nasa.gov/earthday.

We hope you find inspiration to think of the tiny honeybee's large role in helping us all to thrive, just as seeing them during a walk in the backyard inspired this poster.

Happy Earth Day!

Jenny Mottar
Art Director for NASA Science

Did You Know?

Astro-bees

In 1984, the crew of NASA's Space Shuttle Challenger (STS-41C) had company—about 6,800 honeybees and a queen. At first, the two colonies of bees had a little trouble flying in zero gravity and bumped into the walls of their special Bee Enclosure Module (BEM), but it didn't take long for them to adjust. By the end of the weeklong mission, the crew noted that the bees were, "No longer trying to fly against top of box. Many actually fly from place to place." In fact, they were pretty busy bees; by the end of the mission, they had produced about 200 cm of honeycomb!

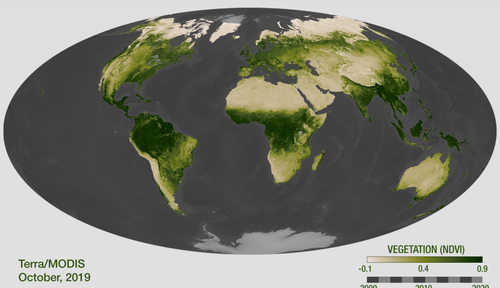
There are no more bees on the International Space Station, but there are plants. NASA's Vegetable Production System, known as Veggie, experiments with ways to grow plants in space to give astronauts vital nutrition from freshly grown fruits and vegetables.

On Earth, we have the advantage of gravity, sunlight, soil, water and other basics needed to grow plants and vegetables, both commercially and in our own spaces. You can start your own garden with plants and veggies similar to those grown on the space station, romaine lettuce, radishes, and even flowers like zinnias.

Just like the astronauts and scientists on the ground track their plants' growth, you can do the same. As your garden grows, show us how it's going by posting images and telling us your stories on social media with the hashtag #GrowForLaunch. Learn more about space gardening at nasa.gov/content/growing-plants-in-space.

Can you find the Queen Bee?

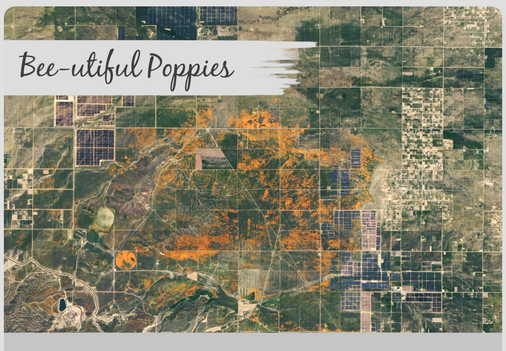
The queen bee is slightly larger than a worker bee. She has a long abdomen, and her wings are shorter than her body length. There is usually only one of her in a hive, but she has a very important role as the mother of the other bees. Can you find the queen on the poster front?



Terra/MODIS
October, 2019

The Green Scene

Terrestrial vegetation, or plant cover on land, provides habitats for bees—and it is important to understanding how our planet's systems are connected. NASA Earth Science tracks the "greenness" of the land with data collected from different satellite missions. This information is put together in global maps called the Vegetation Index. Because NASA and its partner agencies have been collecting this data for many years, we are able to see changes to the landscape over time. In the image here, the index values for vegetation are shown in green, with darker areas representing a lot of growth, light green areas some growth, and tan areas little or no growth. In areas that appear black, there was no data collected.



Bee-utiful Poppies

Bees had a literal field day amid the beautiful and bountiful blooms of the Antelope Valley California Poppy Reserve. The bright orange poppies seen here are near their peak in this 2020 image from the NASA-U.S. Geological Survey Landsat 8 satellite. Extra rainfall that year led to the poppies to last longer in an above-average wildflower year. Also in the fields were cream cups, forget-me-nots, purple bush lupines, and yellow goldfields (a relative of the sunflower).