

# Reaching out to Volunteers for Evidence: Lessons from Citizen Science

National Aeronautics and  
Space Administration



Dr. Marc Kuchner, NASA Citizen Science Officer

June 22, 2022



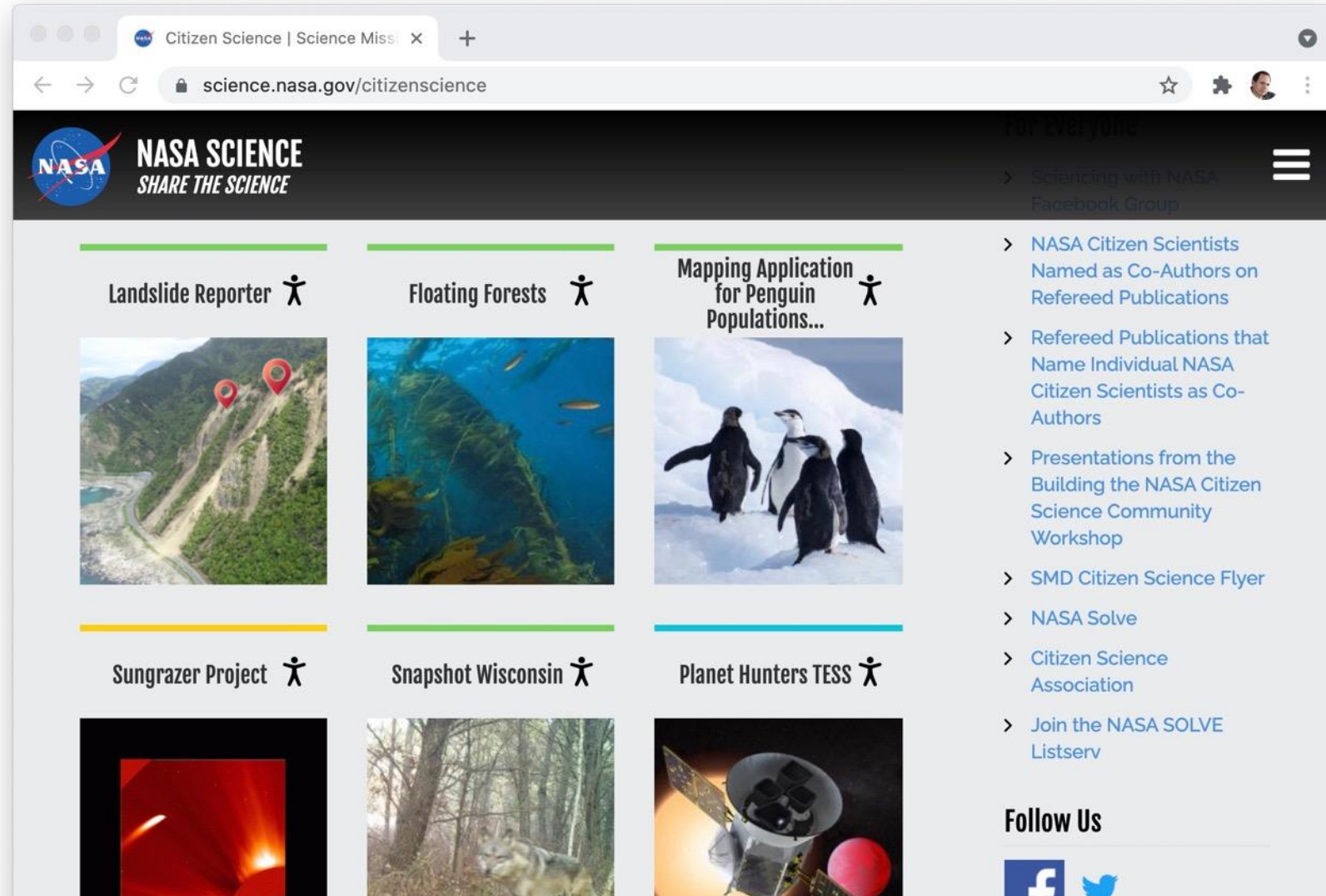


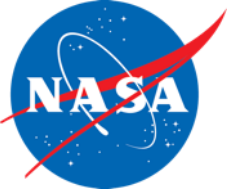
# science.nasa.gov/citizenscience



28 active NASA  
citizen science  
projects online

15 of these can be  
done by anyone,  
anywhere





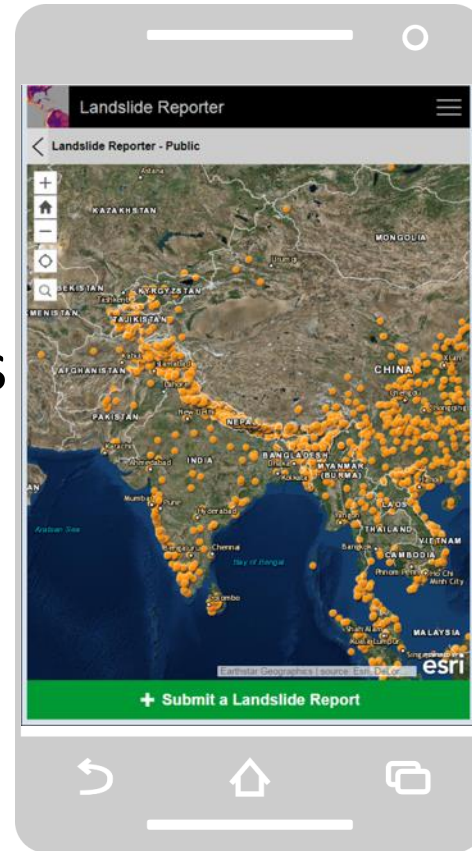
NASA's citizen science projects have come to **dominate** their scientific fields. They have discovered:

- **Most** of the known comets
- **All** of the known samples of interstellar material
- **Half** of the ultracool brown dwarfs
- **1/3** of Kepler's long period ( $>2$  yr) extrasolar planets

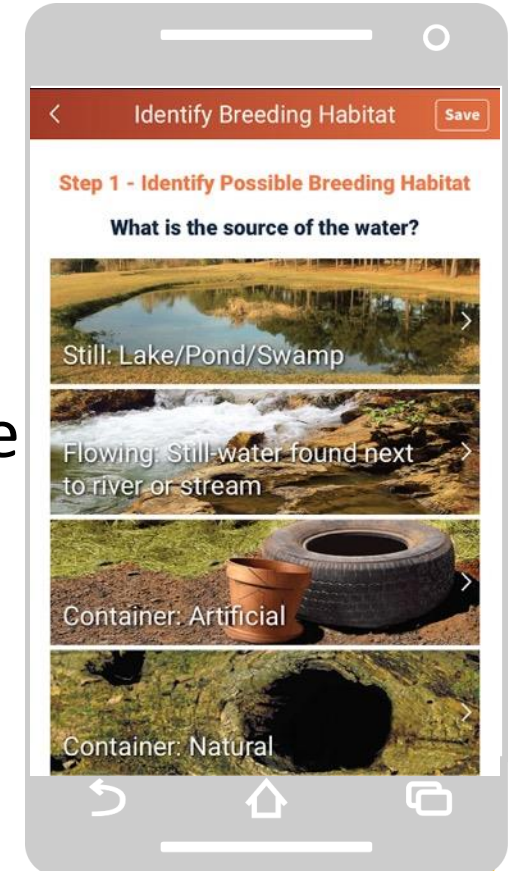
# NASA's citizen science projects save lives!

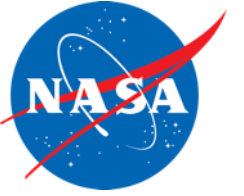


Landslide Reporter builds an open database of landslides to help predict them.



GLOBE Mosquito Habitat Mapper studies mosquito breeding to curb the spread of disease.





# NASA citizen scientists have discovered:

- The “teepee tent” spectral signature from lightning at 15-30 MHz.
- The star-forming regions called “yellowballs”.
- A rare six-planet transiting system
- The first extreme T subdwarfs
- Zika virus in Peruvian cemetery vases
- The oldest white dwarf debris disk
- The “Dipper” star phenomenon
- The “Peter Pan” disk phenomenon
- Exocomets in Kepler Data
- The Meyer family of comets
- A transiting planet in a quadruple star system
- 400,000 Martian seasonal fans
- 283,000 emperor penguin nests
- 9120 candidate near-Earth asteroids
- 8900 mosquito breeding sites—and got rid of the mosquitos!
- 7 meteorites
- 1 new *kind* of aurora named STEVE

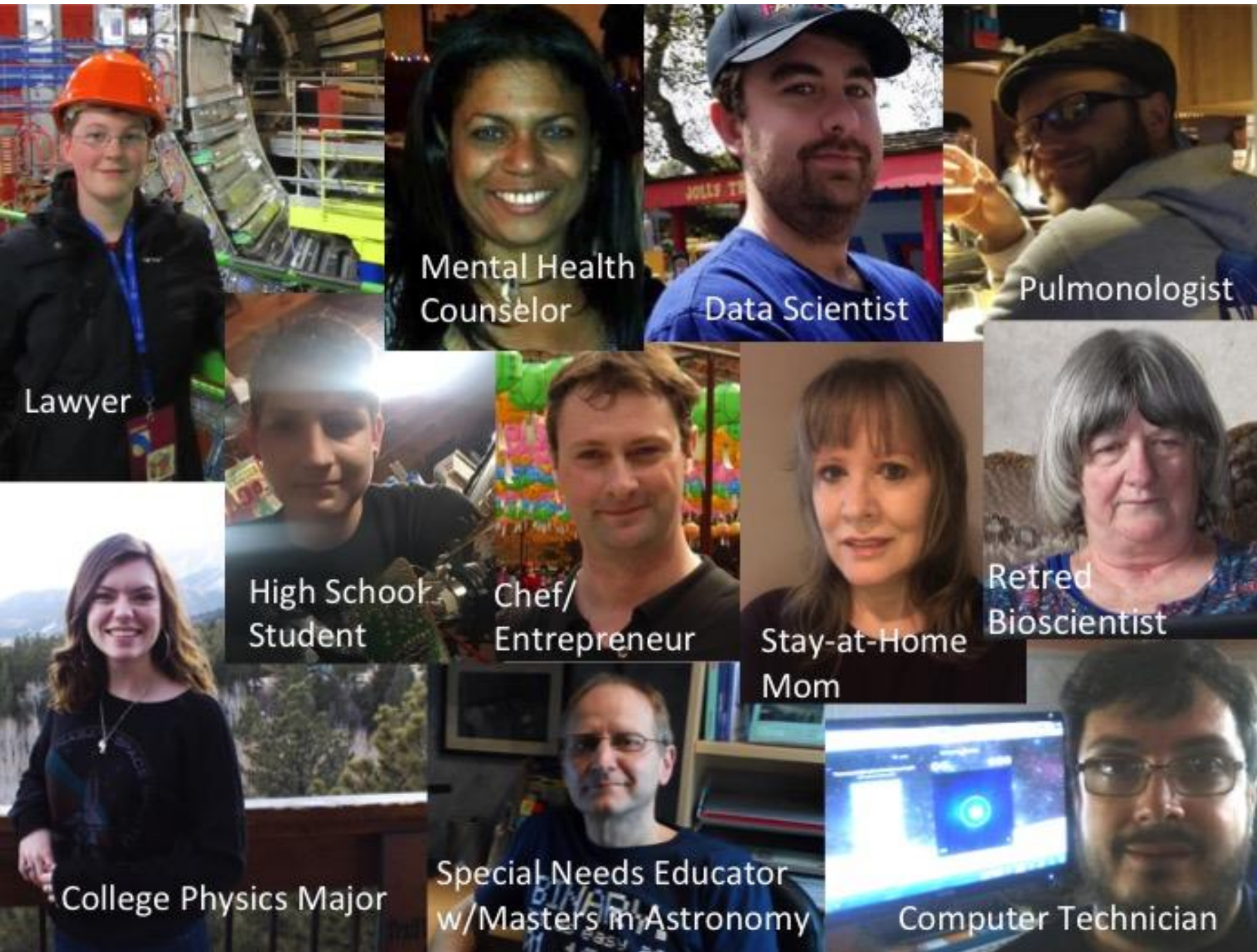






2 million+  
volunteers

>140,000 with  
advanced  
degrees!



# [science.nasa.gov/citizenscience/publications](https://science.nasa.gov/citizenscience/publications)



The screenshot shows a web browser displaying the NASA Citizen Science Publications page. The browser's address bar shows the URL [science.nasa.gov/citizenscience/publications](https://science.nasa.gov/citizenscience/publications). The page features the NASA logo and the text "NASA SCIENCE SHARE THE SCIENCE" in the top left. A navigation bar includes links for "Science Topics", "News", "For Researchers", "Learners", "Get Involved", "Citizen Science", "About Us", and "Español". Below this, a large "Citizen Science" header is followed by a sub-header "Publications by NASA Citizen Scientists". The main content area lists several publications, with authors in bold indicating they are citizen scientists. The first publication is titled "Aurorasaurus" and lists authors Xiangning Chu, Lukas Wolter, David Malaspina, Laila Andersson, Martin Connors, **Colin Chatfield**, **Neil Zeller**, and Morphological Characteristics of Strong Thermal Emission Velocity Enhancement Emissions, *Journal of Geophysical Research: Space Physics*, 125, e2020JA028110. The second publication is by Semeter, J., **Hunnekuhl, M.**, MacDonald, E., Hirsch, M., Zeller, N., Chernenkoff, A., & Wang, J. (2020). The mysterious green streaks below STEVE. *AGU Advances*, 1, e2020AV000183. The third publication is by **Hunnekuhl, M.**, & MacDonald, E. (2020). Early ground-based work by auroral pioneer Carl Størmer on the high-altitude detached subauroral arcs now known as "STEVE". *Space Weather*, 18, e2019SW002384. The fourth publication is by S. B. Mende, B. J. Harding, & **C. Turner**. "Subauroral Green STEVE Arcs: Evidence for Low-Energy Excitation" *Geophysical Research Letters*, Volume 46, Issue 24, Pages 14256-14262 (2019). The fifth publication is by S. B. Mende, & **C. Turner**. "Color Ratios of Subauroral (STEVE) Arcs" *Journal of Geophysical Research (Space Physics)*, Volume 124, Issue 7, Pages 5945-5955 (2019). The sixth publication is by Y. Nishimura, Y., B. Gallardo-Lacourt, B., Y. Zou, E. Mishin, D.J. Knudsen, E. F. Donovan, V. Angelopoulos, **R. Raybell**, "Magnetospheric Signatures of STEVE: Implications for the Magnetospheric Energy Source and Interhemispheric Conjugacy" *Geophysical Research Letters*, Volume 46, Issue 11, Pages 5637-5644 (2019).

Publications by NASA Citizen Scientists

Authors in **bold** are citizen scientists.

**Aurorasaurus**

Xiangning Chu, Lukas Wolter, David Malaspina, Laila Andersson, Martin Connors, **Colin Chatfield**, **Neil Zeller**, Morphological Characteristics of Strong Thermal Emission Velocity Enhancement Emissions, *Journal of Geophysical Research: Space Physics*, 125, e2020JA028110. <https://doi.org/10.1029/2020JA028110>

Semeter, J., **Hunnekuhl, M.**, MacDonald, E., Hirsch, M., Zeller, N., Chernenkoff, A., & Wang, J. (2020). The mysterious green streaks below STEVE. *AGU Advances*, 1, e2020AV000183. <https://doi.org/10.1029/2020AV000183>

**Hunnekuhl, M.**, & MacDonald, E. (2020). Early ground-based work by auroral pioneer Carl Størmer on the high-altitude detached subauroral arcs now known as "STEVE". *Space Weather*, 18, e2019SW002384. <https://doi.org/10.1029/2019SW002384>

S. B. Mende, B. J. Harding, & **C. Turner**. "Subauroral Green STEVE Arcs: Evidence for Low-Energy Excitation" *Geophysical Research Letters*, Volume 46, Issue 24, Pages 14256-14262 (2019). <http://doi.org/10.1029/2019GL086145>

S. B. Mende, & **C. Turner**. "Color Ratios of Subauroral (STEVE) Arcs" *Journal of Geophysical Research (Space Physics)*, Volume 124, Issue 7, Pages 5945-5955 (2019). <http://doi.org/10.1029/2019JA026851>

Y. Nishimura, Y., B. Gallardo-Lacourt, B., Y. Zou, E. Mishin, D.J. Knudsen, E. F. Donovan, V. Angelopoulos, **R. Raybell**, "Magnetospheric Signatures of STEVE: Implications for the Magnetospheric Energy Source and Interhemispheric Conjugacy" *Geophysical Research Letters*, Volume 46, Issue 11, Pages 5637-5644 (2019).

- 227 NASA citizen scientists have become named co-authors on **refereed** published papers since 2011!





# Lessons

- Citizen Scientists Are Smart
- If you don't reach out to them, you may be missing a big opportunity!