College of Natural Sciences

Education & Outreach Center

Colorado State University

The Natural Sciences are relevant to everyone.

Science, Technology, Engineering, and Mathematics (STEM) subjects are not always presented in a way that captures imaginations and inspires students to pursue STEM careers, particularly for female and minority students.

We harness the intellect of the College of Natural Sciences faculty to solve these problems. In addition to teaching, our faculty are conducting fundamental and applied research relevant to the needs of society. We collaborate with these faculty to translate their top research into unique STEM experiences for 4th – 12th grade students to inspire the next generation to want to learn more about the sciences. Our programs have reached students and educators at all levels, local to global.

Every week we meet new undergraduate students, graduate students, post-docs, faculty, and community members interested in STEM outreach. Their passion helps energize us as we work towards making science more accessible to everyone.

We serve CSU faculty and students as well as 4th-12th grade students and educators through:

1. STEM Experiences

Research questions, data collection and analysis, interpretation, and scientific communication are woven through each of our programs.

2. STEM Educational Kits

The STEM Kits we create are based on current scientific research.

3. STEM Kit Lending Library

Teachers and informal educators can check out a classroom set of 15 kits for a week at a time in a wide variety of scientific topics.

4. Mentoring

We mentor preservice and in-service educators as well as K-12 students.

"There is a theme to all of the educational opportunities that the CNSEOC provides. Whether it is field research or investigations performed in the classroom, they ask students to seek natural patterns based upon observations, data collection, and analysis.

The CNSEOC develops and shares educational experiences that model critical thinking skills central to promoting the advancement of science."

— Mike Viney, Retired Science Teacher, Blevins Middle School

FOCUS 1: STEM Experiences

Mathematics, culture, and place are used to help connect students to the science.

Research questions, data collection and analysis, interpretation, and scientific communication are the basic elements that weave through each of our programs.

STEM Fridays

Pre-service science teachers help facilitate weekly hands-on experiences for 4th through 12th grade students and their teacher in our high-tech experiential learning lab or in the field at our GetWET water science site.

Colorado Science and Engineering Fair

As one of the top state science fairs in the nation, we encourage thousands of middle and high school students from across the state of Colorado to participate in science fairs. The fair promotes authentic student driven research often mentored by leading scientists and engineers. (www.csef.colostate.edu)

Keynotes and Workshops

We host a variety of keynote lectures or hands-on professional development workshops attended by CSU and K-12 faculty, students, and informal educators.

SciTrek Summer Camp

Our summer camp for high school juniors and seniors from around the country is the longest running science camp at CSU. Students get to experience cutting edge research such as dendrochronology at Lory State Park and groundwater studies at GetWET.

Triunfo STEM Mentoring Program

Triunfo is an afterschool program for 3rd-5th graders from local high-needs elementary schools. Undergraduate CSU students mentor them in math, science, and reading. Each semester we also take them to various research labs to see researchers in action.


INSPIRE

FOCUS 2: STEM Kits

The STEM Kits that we create are derived from the research projects of CSU faculty.

We delve into our faculty's research methods to find the essence that we distill into an educational kit. How does the researcher approach a problem? What sorts of experiments are used to solve the problem? How can we give students the joy of discovery? These are the elements that make a great educational experience. Kits focus on scientific process, scientific illustration, data collection and analysis, and communication of results.

We develop several categories of kits:

Broader Impacts/CAREER

Faculty seeking funding from the National Science Foundation are required to have a concrete plan for how they will inform society about the importance of their work. We make it easy for them to reach a wide audience.

Distance Learning

The Masters of Natural Science Education degree serves science teachers globally. A key piece of this exciting program is that every course includes a hands-on lab component. We work with faculty on the design of these labs. We also assemble and ship the kits.

National Parks

We have a strong partnership with the National Park Service and continue to support STEM kits that we developed for parks in Hawai'i and Alaska.

Foundations & Donors

We have developed kits with specific grants from foundations and gifts from private donors. We are always seeking new partnerships to support our kit lending program.

FOCUS 3: STEM Kit Lending Library

We offer a Lending Library of STEM Kits available to teachers and informal educators.

Kits are packaged to be used individually or by pairs of students and are easy to transport. Teachers and informal educators can check out a classroom set of kits for a week at a time. The kits are largely self-guided, so students can work at their own pace and teachers are available to help the students who are struggling or suggest extensions for kids who want more.

Biology

Bees, Please!
Going Viral
Secrets of the Hibernators
Scrub Jay Beaks (coming soon)

Chemistry

Get Energized!
High-Tech Rocks!
Dissolved Salts (coming soon)
Chemometers (coming soon)
Magnetic Imaging (coming soon)

Computer Sciences

Pico Pong (coming soon)

Earth & Environmental Sciences

Anchialine Pools
Vital Ice
Really Ancient Fossils
Soils of Fire
Plankton to Plastic Pollution

Engineering

Solar Cars

Mathematics

Optimization (coming soon)

Physics

Get Critical!


Clean Energy
PELICAN
1150 CASE

FOCUS 4: Mentoring

We offer mentoring opportunities for students, teachers, and educators.

Pre-Service Teachers

Our center offers opportunities for enthusiastic CSU students to see how effective hands-on teaching methods can be.

- The approximately 55 students in the Bachelors of Science in Natural Science Education major are advised through our center.
- We offer space to study, coffee and snacks, trips to conferences, and opportunities to connect with schools and teachers for the BSNS students.

In-Service Teachers

The best teachers are life-long learners themselves. We offer a selection of opportunities for teachers to reinvigorate their passion for teaching.

- STEM Fridays allow us to show teachers in real-time what elements are needed to create successful hands-on STEM lessons for their students.
- A variety of Professional Development Workshops and Lectures provide networking opportunities and support for topics that are difficult to teach (e.g. data analysis).

Under-Represented in STEM Fields

All of our programs strive to encourage young women and minority students to consider a STEM career. Two programs in particular include their success as the primary goal.

- SciTrek and SummerVet are summer camps that attract mostly female students from across the nation.
- The weekly after-school Triunfo Mentoring Program pairs first-generation college students with mostly Hispanic youth for homework help and STEM activities, in partnership with El Centro.


Kari Keever

The Education & Outreach Center is an incubator for innovation in STEM education.

We find new ways to promote scientific creativity and innovation – attributes essential for facing global challenges in the 21st century.

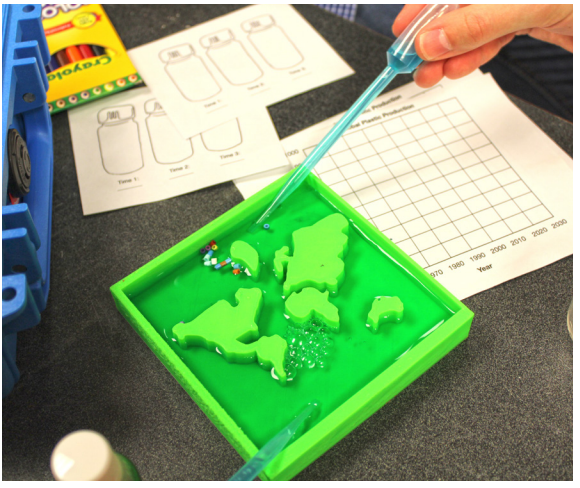
12
YEARS OF SERVICE

20
STEM KIT OPTIONS

1,800
STUDENTS GRADES 4-12 PER YEAR

90

HANDS-ON MINUTES PER STEM KIT



$18M

GRANTS SINCE 2010

55

UNDERGRAD STUDENTS MENTORED

Engaging Students with Authentic Scientific Research

We started new collaborations, celebrated our partnerships, embarked on new STEM kits, and more.

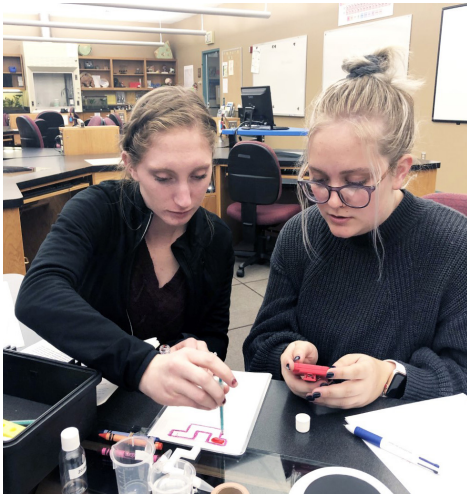
New STEM Kits!

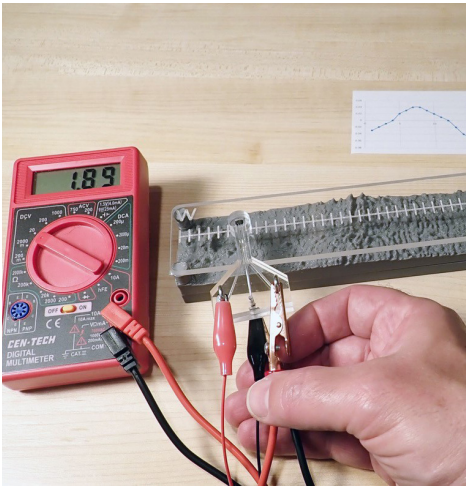
Going Viral

Begun before the pandemic struck, our new kit on viruses, transmission and immune response is complete and ready to use. The kit was designed by Delaney Worthington (Biology major and SciTrek Alum!) for her senior honors thesis. Our hope is that this kit helps students better understand how our bodies respond to a virus with and without a vaccine so that students learn the urgent need for herd immunity.

Magnetic Imaging

This new kit is in the final stages of production and was designed by the Zadrozny research group in the Chemistry department. It features three innovative examples of how magnetic fields can be used to image the brain, map sea floor spreading, and store data on computer hard drives. The kit concludes by introducing qubits and how magnetism at the molecular level is the next big thing in science and technology!





Bees, Please!

In collaboration with the Gardens on Spring Creek and Extension's Native Bee Watch, we designed a new kit on native bees. The kit dives into flower anatomy and reproduction to show how pollination works. Pairs of students become experts in one morphotype of bee and share their new knowledge with the rest of the class by interpreting a 3D map of citizen science data from the Native Bee Watch program.

Shadow Scope

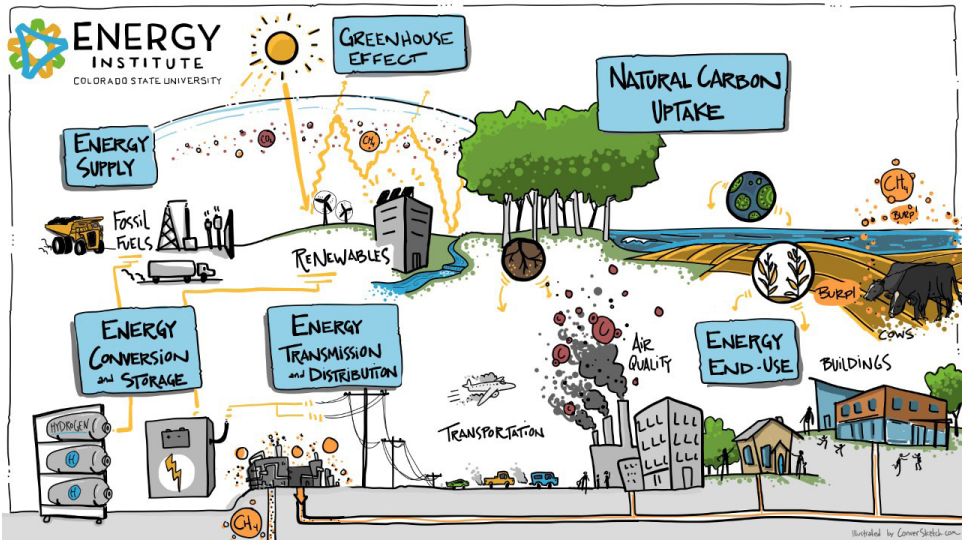
The Stasevich group in the Department of Biochemistry has worked with us to design an interactive Shadow Scope that can be used by anyone to study the life teaming in a few drops of pond water. The instrument that we designed is completely "open source" and has only one button to record short video clips. Because the scope uses shadows, it does not require focusing. The simplicity of the scope makes it immensely fun to explore with.

Chemometers

Chemistry major, Chloe Beardsley, designed this new kit for her senior honors thesis that has students determine the iron content of water from the Los Animas river by first creating a calibration curve for their self-designed paper-based microfluidic test strip. Testing for metals in water is growing world need and this kit brings it into the K-12 classroom in a way that engages the students in the design of the paper-based device.

More new STEM Kits in the Pipeline:

Absorption Spectroscopy with Dr. Jesse Wilson, Channel Island Scrub Jay Evolution with Dr. Cameron Ghalambor, Arkansas Valley Dissolved Salts with Dr. Ryan Baily, Land cover vs slope hydrology with Dr. Tim Covino, Mathematical Optimization with Dr. Patrick Shipman, Colorado Rifting with Dr. Dennis Harry, Wolves with Wolf Haven International, Raman imaging of new battery materials with Dr. Justin Sambur. Stay tuned!



National Western Hydro Building

CSU is collaborating with Denver Water and a number of other partners on the design of a new Hydro Building at the National Western Center in Denver slated to open in fall of 2022. We have been leading the CSU side of the water education facility design, with plans to establish a STEM kit lending hub and a GetWET experience along the South Platte River.

Energy Institute Collaboration

We have reignited our collaboration with the Energy Institute and have been helping to design a suite of hands-on activities that will be used at the Powerhouse and also in their new mobile energy lab that will travel to disadvantaged schools. Each activity is an exploration that involves data collection and analysis which we have found dramatically increases engagement time. We pilot tested the activities during the first annual Energy Week for the Boys and Girls Club at the Powerhouse campus.

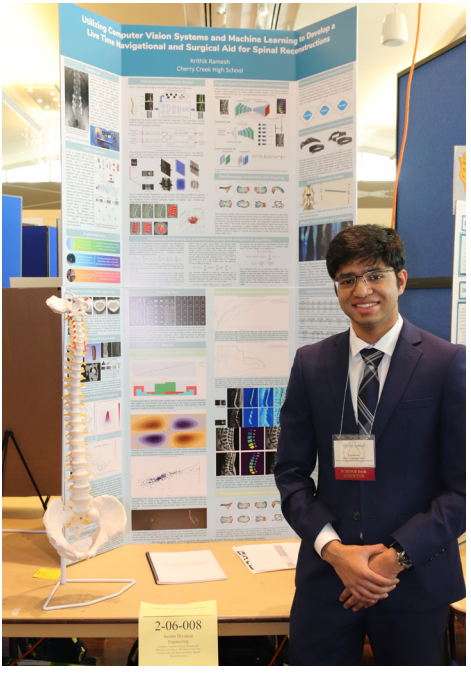
Science Fair Keeps Students Active During the Lockdown

The Colorado Science and Engineering Fair network of local and regional competitions kept going during the 2020-2021 school year when many students were bouncing between in-person and virtual learning. By creating guidelines that were specific to doing scientific research at home or school during a pandemic, with a focus on everyone's safety, 285 students with 265 projects presented their projects virtually and did judging interviews remotely as well. CSEF was able to select winners in each of the 12 categories for both the junior and senior divisions as well as allow local organizations and businesses to give out Special Awards.


THE
SELECTION
KIERA CASS
202

“I had so much fun and not only that, I got to experience what it feels like to be a college student. Thank you for everything!”

— S.G., 8th grade student, Timberline PK-8 School, Longmont, CO



Krithik Ramesh won first place at the 2019 Colorado Science and Engineering Fair and went on to win first place at the Intel International Science and Engineering Fair. We are incredibly proud of his outstanding achievement, which came with a $75,000 scholarship.

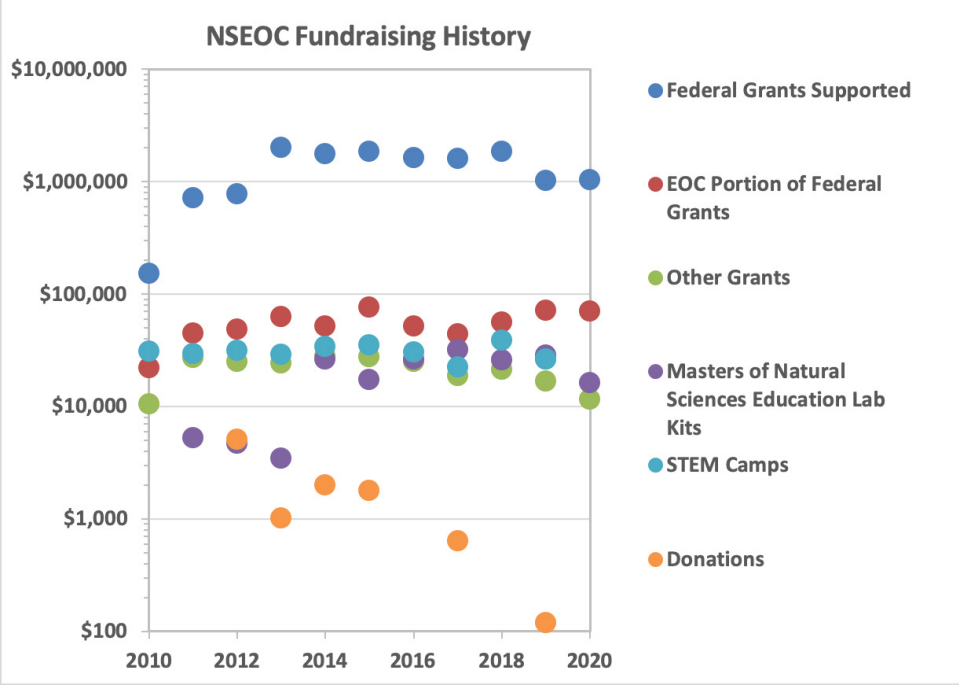
“As a teacher, I look forward every week to having the lessons of the week revisited and explained from a different point of view by college students. My fourth graders get to actually sit in a college lab with college students just a few years older than they are, and this makes the goal of attending college seem more attainable.

Tutoring is the highlight of many of these kids’ week.”

— César Fuentes, Teacher, Harris Bilingual Immersion School

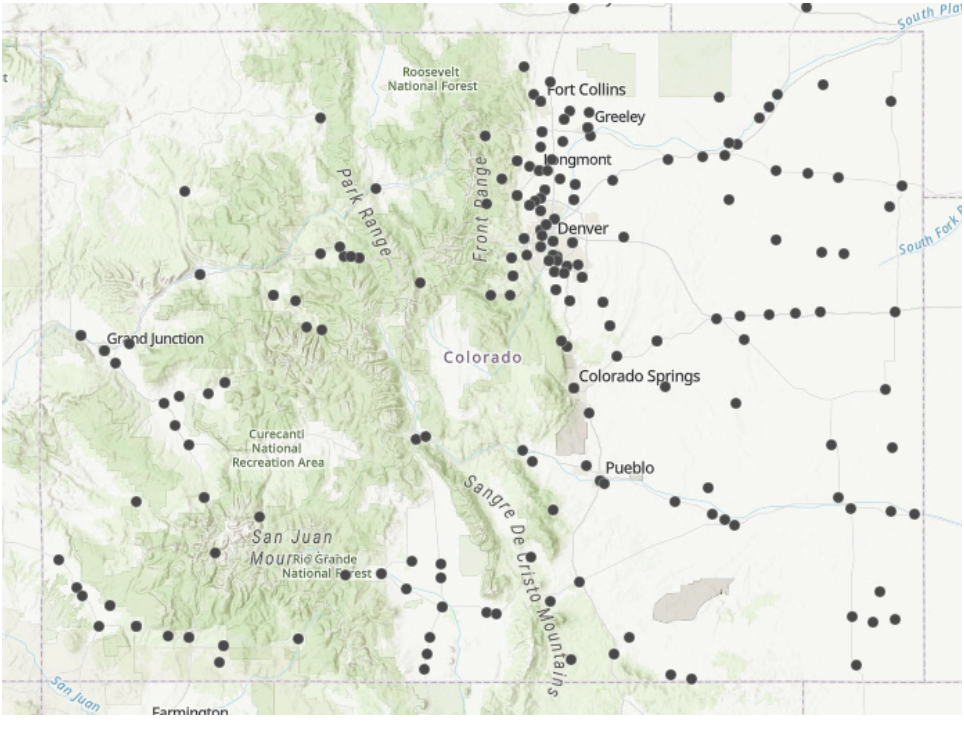
FUNDING

The EOC staff is supported by the College of Natural Sciences and constitutes 0.5% of the college's annual resident instruction budget. Additional funds are derived from federally-funded grants led primarily by college faculty at large and led by EOC staff from the National Park Service, Wolf Haven, Bohemian Foundation, and private individuals.



REACH

> Each dot represents a student or teacher who has participated in one of our programs or who uses our materials.



COOPERATING WITH

COLLEGE OF NATURAL SCIENCES
COLORADO STATE UNIVERSITY

NSF

BOHEMIAN FOUNDATION

DEPARTMENT OF EDUCATION
UNITED STATES OF AMERICA

NATIONAL PARK SERVICE

Platte River Power Authority
Estes Park • Fort Collins • Longmont • Loveland

POUDRE SCHOOL DISTRICT

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE

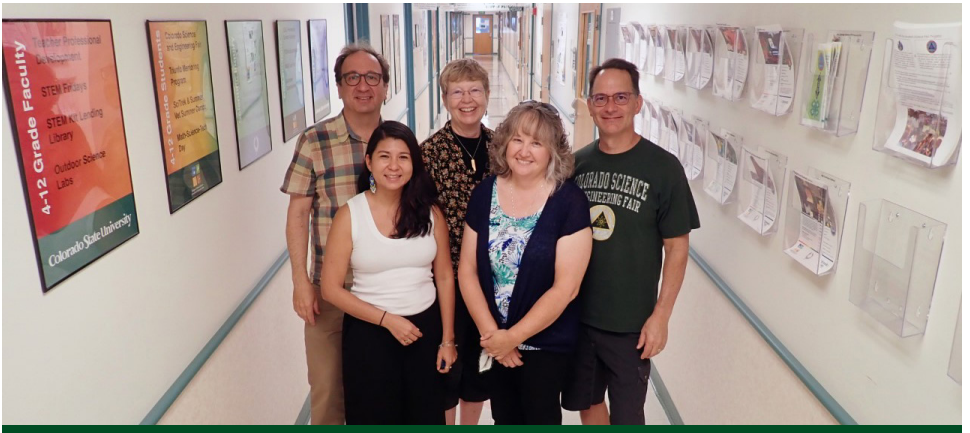
ROTARY INTERNATIONAL

NASA

DEPARTMENT OF ENERGY
UNITED STATES OF AMERICA

COLORADO SCIENCE AND ENGINEERING FAIR
EDUCATION CREATIVITY COMPETITION

WOLF HAVEN INTERNATIONAL



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The “Plankton to Plastic Pollution” kit at the beach in Todos Santos, Mexico

Natural Sciences Education and Outreach Center

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