



Climate Solutions & Climate Actions

for secondary classrooms

Melissa Rummel, Robert Payo - UCAR SciEd

Meghan Mosher, Kathy Hagee - Science Educators

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Where are you joining from?

Anchorage project: Land Acknowledgement

- land.codeforanchorage.org



About the UCAR Center for Science Education

- Develop K-12 learning resources
- Host school groups & the public at the NSF NCAR Mesa Lab (virtual options too!)
- Connect NSF NCAR & UCAR science to all learners

SciEd website: scied.ucar.edu



Question: How do you currently engage students around climate solutions?

Use the annotate feature in Zoom



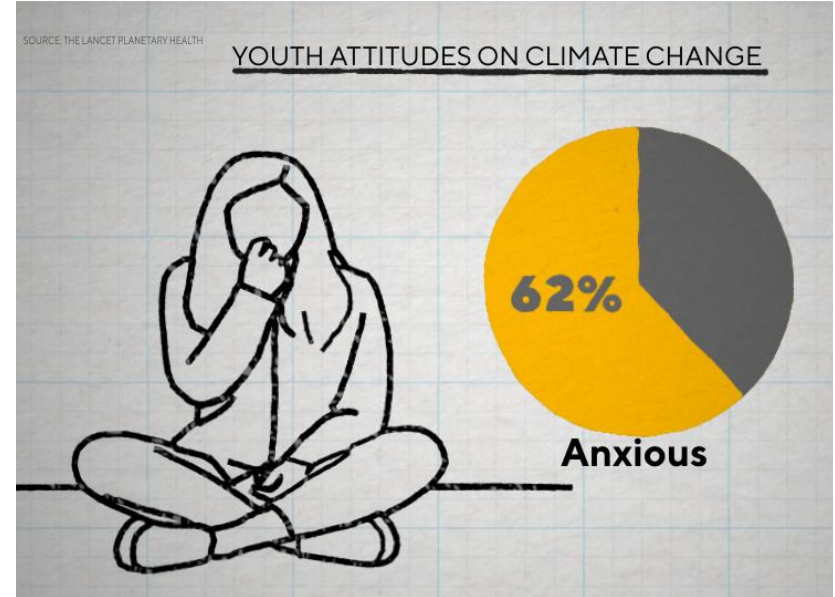
Today we will...

- Discuss the benefits of focusing on climate solutions
- Share resources for teaching about climate solutions
- Hear from veteran teachers about climate actions in the classroom



Why teach about climate solutions?

- **Support climate mental health**
 - **Climate anxiety**: emotional and/or mental distress as a result of environmental change caused by the climate crisis
- **Cultivate hope and resilience**
 - Encourage action & innovation
- **Place-based learning opportunity**
 - Practice the engineering design principles



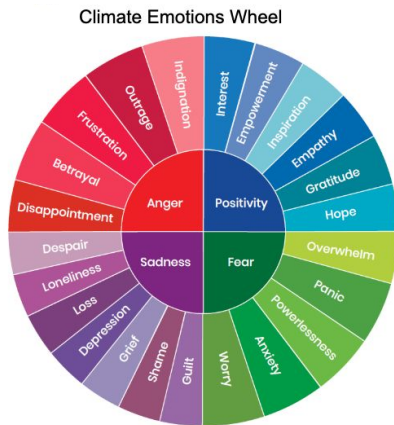
[A study by Lancet Planetary Health in 2023](#)



Resources to support climate mental health

Climate Mental Health (CLEAN Collection)

- Strategies and challenges, links to other resources
- Activity & lesson plans focused on climate mental health



STRATEGIES TO MOVE YOURSELF AND YOUR STUDENTS

beyond climate doom and gloom towards empowerment

1

Self-care

- Be kind and compassionate to self
- Practice good sleep habits and exercise
- Use self-soothing strategies
- Talk with a trusted friend
- Acknowledge this is tough
- Ask for help

2

Integrate climate justice into center of conversations

- Know people from marginalized communities are disproportionately impacted by climate change
- Know they experience climate grief more deeply than the majority population
- Include diverse sets of voices, especially those most impacted
- Include other ways of knowing

3

Listen and validate feelings

- Without trying to solve, fix, or dismiss
- Provide compassion, care, empathy
- Share that many people are working on this problem; not solely up to them
- Show authentic curiosity
- Remind they are not alone in feelings
- Invite all voices to the table
- Be aware of "settler privilege"
- Create a safe environment for sharing, group norms and restorative practices

4

Encourage and take action

- Local & place-based
- Student-guided & personally relevant
- Foster care of nature through play
- Support collective problem-solving
- Nurture personal agency
- Focus on solving one small part of the climate crisis vs. the whole thing
- Take action to influence policy
- Be aware of intersectionality
- Share successes of youth taking action

5

Join and create community and connection

- Join or create climate café groups to talk about emotions
- Create opportunities for shared solidarity
- Normalize conversations about emotions
- Support connection with family, friends, or special interest groups
- Encourage collective action



Activity: You are a climate leader

- Examine leader profiles:
 - [12 Climate Activists Inspiring Us to Fight Climate Change](#)
 - Include local examples of climate leaders
- Organize our thinking using the graphic organizer
- Create 'social media posts' to inspire others to take action (templates provided)

NAME _____	NAME _____	NAME _____	NAME _____
How did they get started?	How did they get started?	How did they get started?	How did they get started?
What social change do they create?	What social change do they create?	What social change do they create?	What social change do they create?

Your Name
Biography:

Quote:

Photograph Here

Photo Caption Here



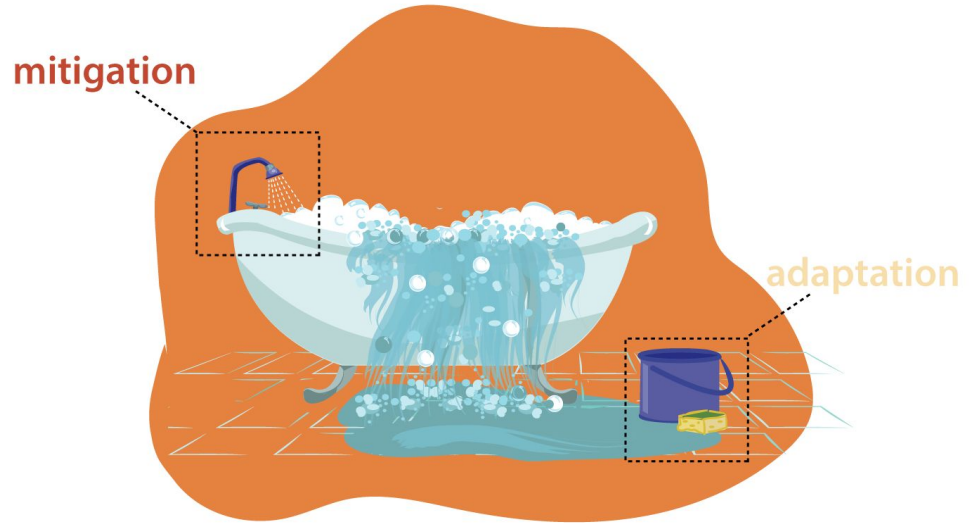
Climate Change Solutions

Classroom Activities



Science Moment: Two types of climate solutions

- Reducing carbon dioxide emissions and other greenhouse gases is called **mitigation**.
- We also need **adaptation** efforts to be able to live in a warmer climate, such as building infrastructure to address flooding.



Activity: Mitigation or Adaptation?

Students use a card sort to recognize different types of climate solutions

scied.ucar.edu/activity/mitigation-or-adaptation

Establishing Urban Forests



Planting trees and green roofs in cities helps cool the Earth's surface by creating shade and also removes CO₂ from the atmosphere.

MITIGATION

Switching to Renewable Energy



Using solar panels to collect energy from the Sun instead of burning coal and natural gas for electricity reduces the amount of carbon dioxide emissions that enter the atmosphere.

Eating Plant-rich Diets



Eating less meat means less land needs to be cleared for grazing. Plant-rich diets also help to reduce greenhouse gas emissions and are healthier too!

ADAPTATION

Planting Rain Gardens



Raising Homes



People who live on the coast in Louisiana are building homes on stilts to keep them from flooding as sea levels rise and hurricanes become stronger.

Planning Evacuation Routes



In places where hurricanes are becoming more dangerous, communities plan ways to keep people safe, such as creating evacuation routes and setting up shelters.

I'm responding to the other person's ideas. I can use these phrases to build on their ideas:

Could you explain a bit more about _____?
What do you mean when you say _____?

I heard you say _____. That makes me think...

One difference between my idea and yours is... cause...

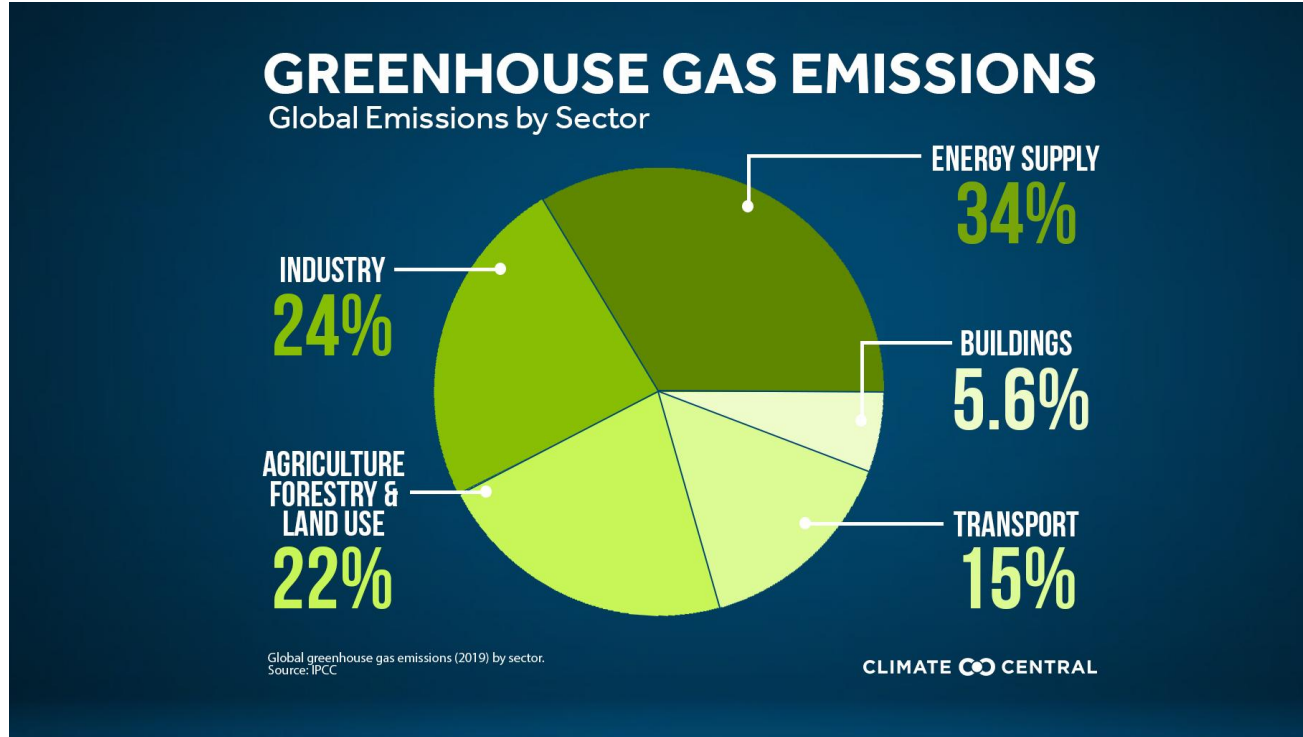
I heard you say _____. I agree or disagree based on?

You described _____. What evidence is that why that happens?

Do you have any ideas



Solution: Reduce electricity use in our daily lives



Activity: Plugged in to CO₂

An activity to help students identify problems

- Part 1: Investigate how much electricity different devices need using a kilowatt meter
- Part 2: Calculate how much carbon dioxide is produced by using these appliances

scied.ucar.edu/activity/plugged-co2



Image credit: [The United Nations](#)



Part 2: Use data about electricity production from my region

- Calculate carbon emissions produced in one year by a particular device

**A PDF with the fuel types in U.S. regions is linked from the classroom activity (updated 2024)*

Plugged in to CO₂ Fuel Types in U.S. Regions

Code on Map	Coal	Fuel Oil	Natural Gas	Nuclear	Renewable	Locations
AKGD	15	10	61	0	14	Northern and Southern Alaska
AKMS	0	25	6	0	69	Central Alaska
AZNM	16	0	47	19	18	Most of Arizona and New Mexico
CAMX	4	1	48	8	40	Most of California
NWPP	19	1	21	3	56	Northwest U.S.
RMPA	40	0	23	0	37	Colorado and most of Wyoming
ERCT	18	0	47	10	26	Texas
FRCC	8	1	74	12	6	Florida
SRSO	19	0	52	19	10	Georgia and Alabama
SRTV	32	0	26	31	11	Tennessee and Kentucky
SRVC	14	0	38	39	9	North and South Carolina and most of Virginia
HIMS	0	64	0	0	36	Hawaiian islands
HIOA	17	71	0	0	12	The island of Oahu in Hawaii
MROE	54	1	32	0	12	Most of Wisconsin
MROW	40	0	11	9	41	Minnesota, North and South Dakota, Nebraska, Iowa
RFCM	39	3	31	17	10	Michigan
SPNO	41	0	10	12	38	Kansas
SPSO	27	2	36	0	35	Oklahoma and north Texas
SRMV	11	2	59	25	3	Louisiana, Arkansas
SRMW	67	0	11	11	10	Missouri and Illinois
NEWE	1	2	54	26	17	New England
NYCW	0	1	90	9	1	New York City
NYLI	0	9	85	0	5	Long Island, New York
NYUP	0	0	26	33	41	New York State (except NYC and Long Island)
PRMS	18	37	43	0	3	Puerto Rico
RFCE	10	1	49	36	4	Pennsylvania, New Jersey, Delaware, Maryland
RFCW	36	1	28	29	7	Indiana, Ohio, West Virginia
	22	1	38	19	20	National Average



Hairdryer: 266.45 kwh/year

Fossil fuel	Percentage
Coal	30%
Natural Gas	35%
Fuel Oil	

A	B	C	D
Fossil Fuel	Step 4: kWh produced with each fuel to power device over a year	Pounds (kg) of CO ₂ per kWh of electricity	Step 5: Pounds (kg) of CO ₂ produced
Coal	$266.45 \times 0.30 = 79.9$	2.095 pounds/kWh (0.95 kg/kWh)	79.9
Natural Gas	$266.45 \times 0.35 = 93.3$	1.321 pounds/kWh (0.60 kg/kWh)	93.3
Fuel Oil		1.969 pounds/kWh (0.89 kg/kWh)	
TOTAL CO ₂			290



Using the CO₂ emissions of one device as a starting point for project based learning



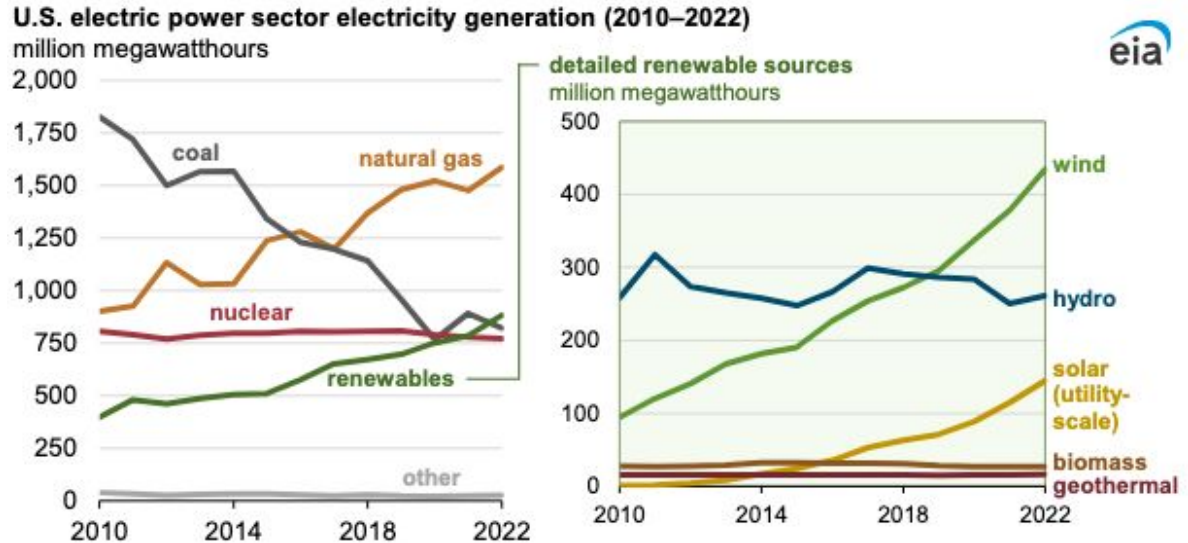
Students audit school electricity use



Solution: Using clean energy sources

Renewable generation surpassed coal and nuclear in the U.S. electric power sector in 2022

- www.eia.gov



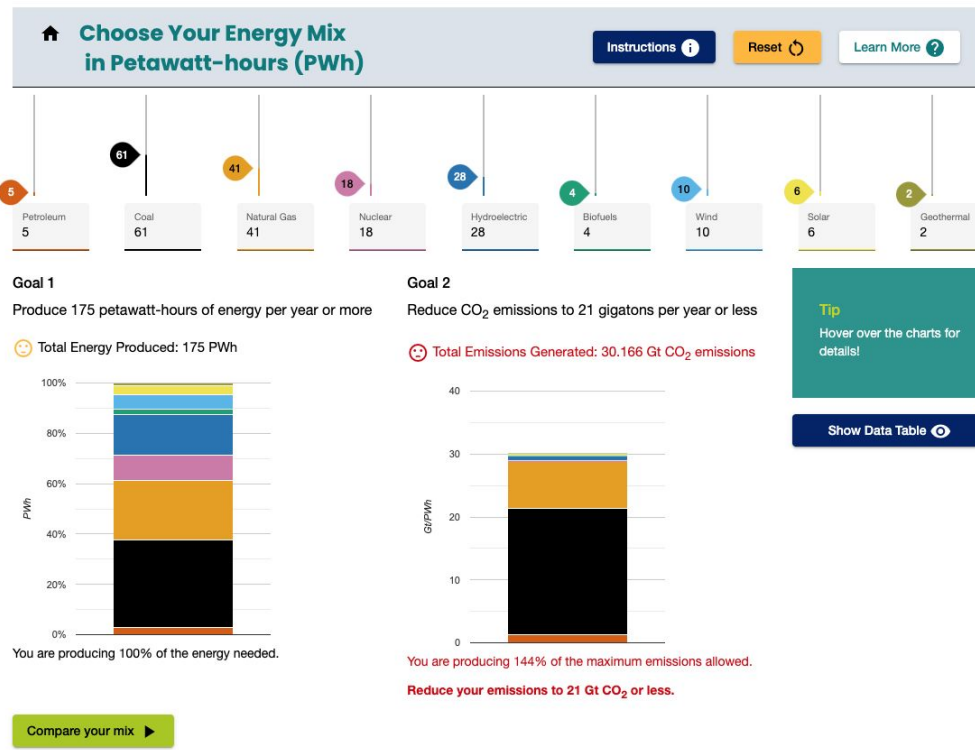
Online interactive: Global Energy Advisor

Climate solutions on a global scale..

- How do we meet energy demands while keeping carbon emissions low?

scied.ucar.edu/interactive/global-energy-advisor

Come up with an exit ticket question for after students explore this interactive



Zooming in: Community level climate actions

What are the vulnerabilities and risks that my community faces?

- [The Climate Explorer](#) - search by county, select the **Take Action** tab

Explore case studies about climate actions that are happening across the US

- [Case Studies](#) from the The US Climate Resilience Toolkit
- How could the solutions explained in these case studies inspire your students to come up with a climate action plan?



Climate Actions You Can Do With Your Students



Our Guest Presenters:



Kathy Hagee

Director of K-12 Service Learning
and Leadership
San Domenico School
San Anselmo, CA



Meghan Mosher

Science Teacher
Monarch High School
Boulder Valley School District
Louisville, CO





Climate Education is not just for Science Teachers!!

Kathy Hagee - Director of K-12 Service Learning and Leadership
San Domenico School, San Anselmo, CA

24 Years of Teaching AP US, AP Psy, Gov, Eco and Social Justice

... **WHERE IS THE SCIENCE?**

The Climate Initiative

Year 1 - Stranger in a Strange Land

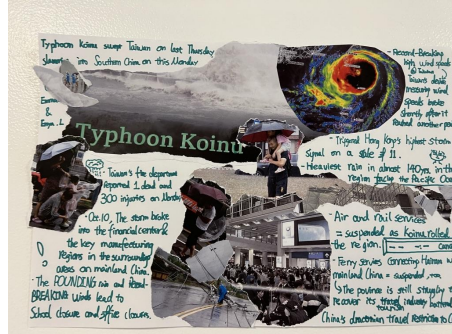
- Climate Education is Climate Action
- Partnership with Sustainability
- Curriculum Overhaul - People and the Plant (Social Justice)
- Earth Day

Year 2 - Bring a Friend or Two

- Invite Mary and Vanessa to Climate Camp!!!!
- Grant Writing
- Sea Level Rise EPIC PROJECT (ALL MARY)
- K-12 Curriculum - National Park Jr. Rangers in 2nd Grade



Early Steps Education



SHARKS APPROACHING SHORES

ENVIRONMENTAL

- Rising temperature → pushing marine life to shores → sharks follow
- IN THE SUMMER SHARKS, SEEKS COOLER WATER AND THE TEMPERATURE IS CHANGING
- The current of the ocean are being altered due to climate change
- The prey are affected by the current therefore the sharks follow them to the shore
- pushed for new hunting grounds because of lack of prey

SOCIAL-CULTURAL

- PEOPLE CAN CREATE FAKE NEWS ABOUT SHARK SIGHTING OR ATTACKS THROUGH SOCIAL MEDIA
- OFTEN PEOPLE EXAGGERATE BECAUSE PEOPLE ARE AFRAID OF SHARKS
- CROWDED BEACHES ATTRACTS SHARKS DUE TO EXCESSIVE SPLUSHING

ECONOMIC

- WE ARE SO WASTEFUL



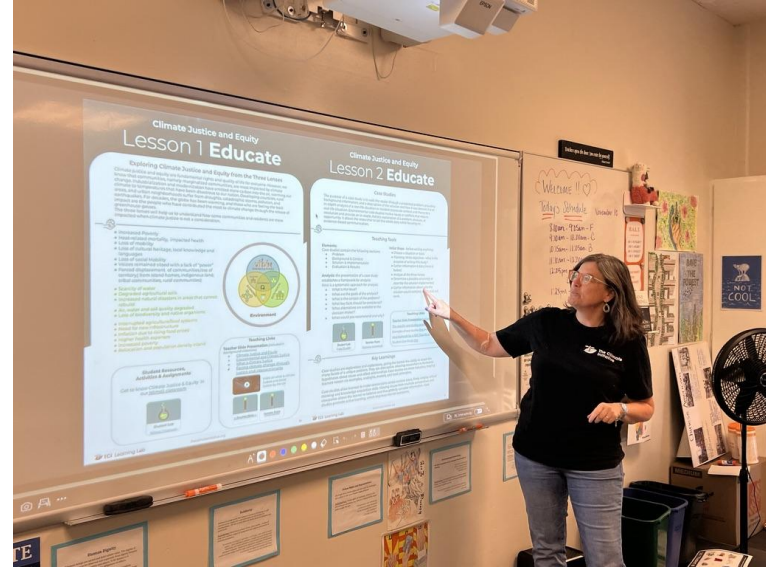
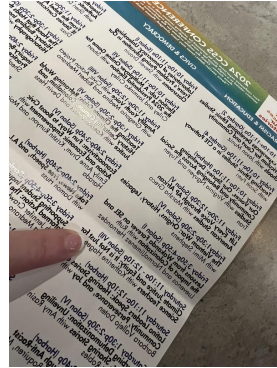
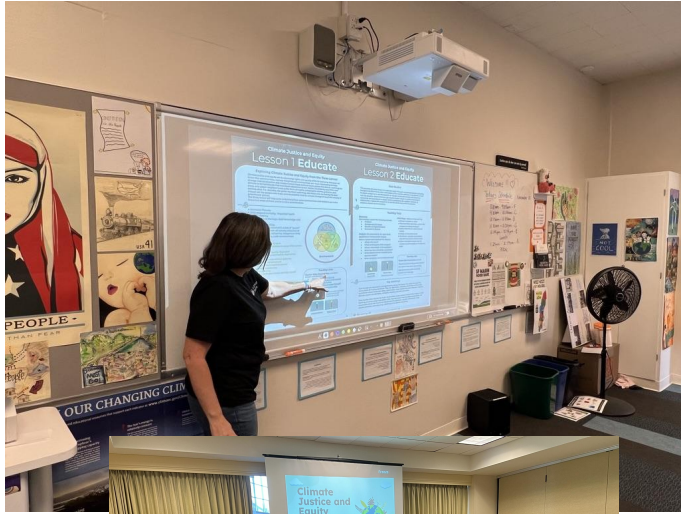
Partnerships



EARTH DAY 2024



Paying it Forward



The Climate Initiative

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Meghan Mosher

Supporting Students in Climate Action and Solutions

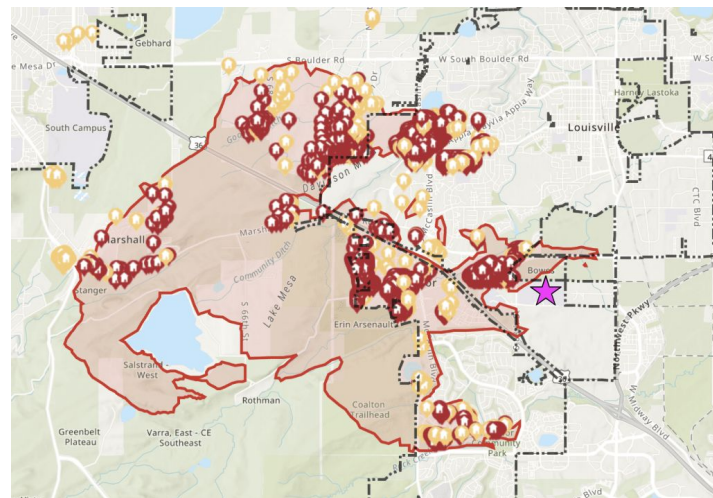
Classroom - Teaching since 2014, Biology and AP Environmental Science,
Eco Club Sponsor



School - Monarch High School
Louisville, CO



District - Boulder Valley School District



Map of structures lost in Marshall Fire, December 2021



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Biology Classroom

Climate Education and Action embedded in Phenomenon-based

NGSS Ecology unit (HS-LS2-7. *Design, evaluate, and refine a solution*

for reducing the impacts of human activities on the environment and biodiversity.)

Driving Question: What can the prairie dog population tell us about the health of the local ecosystem?

Eco-footprint Calculator, Impacts of Climate Change Research Project, How can milk help athletes recover from exercise - Enviro Impact of milk and milk alternatives



Impacts of Climate Change - Poster Project

Climate vs Weather

Weather refers to **short-term changes** in the atmosphere, and climate describes what the weather is like over a **long period of time** in a specific area. Different regions can have different climates. Weather tells you what to wear each day. Climate tells you what types of clothes to have in your closet. - [National Oceanic and Atmospheric Association](#)



Instructions: INDIVIDUAL

You will create a paper or digital **poster** (slideshow, website, Prezi, infographic) that describes the impact of climate change on the environment and human health based on the topics below.

Research Topics

Pick one of the following topics to research. You **must** pick a different topic than all of the other people at your table.

Sea-level Rise	Global Temperature Rise	Warming Oceans and Ocean Acidification
	Extreme Weather Events (Hurricanes, Drought, Flood, Wildfires, Heatwaves, Snowstorms)	Water Scarcity and Drought



AP Environmental Science

Project Based Curriculum:

- Educurious/Sprocket (free curriculum): sprocket.educurious.org/home/curriculum/apes
- Adapted by College Board, offered through AP PBL Trainings

5 Projects:

- **Sustainability in Action** (Ecological Footprint) - How can we rethink our use of the world's resources?
- **Community Ecology** - How can our community develop more sustainably?
- **Agricultural Systems** - How can we meet the needs of our growing human population while sustaining ecosystems and the quality of our soil and our water?
- **Oceans in Action** - How can we balance human activities to support ocean systems?
- **Global Climate Summit** - How can the global community collaborate to mitigate anthropogenic impacts on the environment?



Sustainability in Action –

How can we rethink our use of the world's resources?

- Students evaluate their home or school's resource usage and analyze the impact on the environment.
- They estimate their ecological footprint to get a sense of how their lifestyles impact the environment. Students delve into components of sustainability by auditing their energy use, water use, transportation habits, and waste generation.
- Students then develop a persuasive presentation for their household/school leaders based on the pillars of sustainability (environmental, social/cultural, and economic) to explain motivations for making a change, what kind of behavioral changes need to be made, and what the potential impacts will be.



Community Ecology –

How can our community develop more sustainably?

- In this project, students collect and analyze data to develop a picture of possible environmental impacts, both positive and negative, from a community development site.
- Students generate an Environmental Impact Report for the development site and a presentation for classmates and peers on ways to make Monarch campus and community more sustainable.
- Redtail Ridge: Presentations and Q&A with developers, connection with ecologists working on project, potential future ecological restoration projects



Global Climate Summit –

How can the global community collaborate to mitigate anthropogenic impacts on the environment?

- Students began the year thinking about their school's environmental impacts and transitioned to thinking about local issues. With the final project, focusing on global environmental issues like climate change.
- This project gives students the opportunity to act as representatives of entire nations to address global environmental problems and is thus a fitting culminating experience in the course.



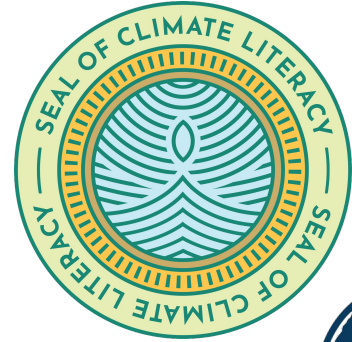
Monarch High School

- **Eco Club** - Pollinator Garden
 - Partnered with a local non-profit Play Boulder to build a pollinator garden on campus
- **Eco-Cycle's Green Star Schools Program**
 - New this year, training to divert up to two-thirds of all waste through composting food scraps, improved recycling, and participating in Eco-Cycle-facilitated waste reduction education
- **Outdoor Classroom** in planning stage, money raised by Senior class



District – GreenBVSD, Green Youth Council, Sustainability Advisory Council

- **The Seal of Climate Literacy**, established through Colorado Senate Bill 24-014, is a high school diploma endorsement that connects educational knowledge with the real challenges and opportunities that climate change brings to our communities.
- **Student leadership** in Green Youth Council and Sustainability Advisory Council has resulted in:
 - BVSD becomes first district in the nation to pass **“Green New Deal for Schools”** resolution
 - Revisions to the CO science standards specific to strengthening coverage of climate science - **accepting feedback now!**



Questions?
Thoughts?
Ideas?



Tell us what you thought of today's workshop...

Please complete this short survey:

bit.ly/421stdP



The background of the slide is a photograph of a desk. In the foreground, there is a white laptop with a silver keyboard. To the left of the laptop, a bundle of colorful pencils (blue, green, yellow, red, purple, etc.) is standing upright. Behind the pencils, a small, clear plastic pencil sharpener is visible. In the upper left, a clipboard with a silver clip holds a white sheet of paper titled "Atmosphere Investigation" and "Surface Temperature Data Sheet". Other papers are scattered in the background, including one with the word "Tuesday" visible. The overall scene is a clean, organized workspace.

Additional Resources

bit.ly/4j4o80h



Teaching Resources



Find what you need to teach about weather, climate, and the Earth system - from quick demos to full curriculum units.

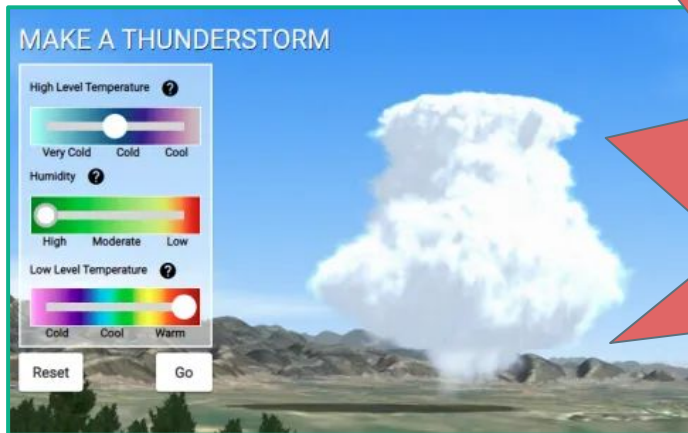
scied.ucar.edu/educators/teaching-resources



The Learning Zone

A resource for public understanding of science and to support learning for secondary students

scied.ucar.edu/learning-zone



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TEACHER
PROFESSIONAL
DEVELOPMENT

CLIMATE AND
THE EARTH SYSTEM
FOR K-12 EDUCATORS

ONLINE & IN-PERSON WORKSHOPS

June 24: Boulder, CO
(in person)

Planet Earth: Wonder,
Awe, & Rejuvenation

Stay informed about our
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teacher-professional-deve
lopment](https://scied.ucar.edu/educators/teacher-professional-development)



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Thank You!



Zooming in: Focusing on local climate solutions

What are examples of climate solutions happening in your community?