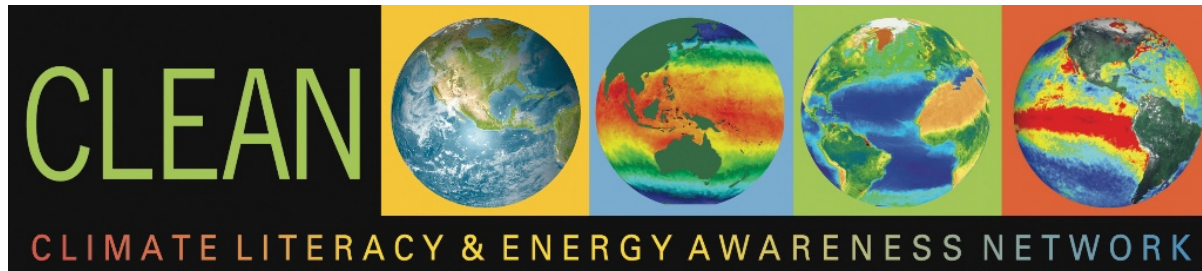
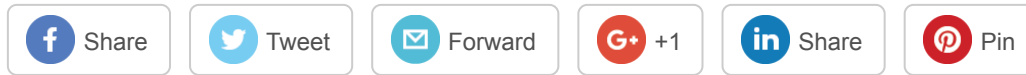


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CLEAN STEM Flash

A Timely Climate and Energy E-Learning Series to Use and Share

Special Issue: Fourth National Climate Assessment.

The newest climate assessment is out. Here are some of the highlights.

In the News: Fourth National Climate Assessment

The [fourth national climate assessment](#) was released Nov. 23, documenting the growing risks that climate change poses for communities across the United States.

Below are 12 main takeaways from the report, with corresponding resources for educators.

Fourth National Climate Assessment



Volume II

Impacts, Risks, and Adaptation in the United States

1. Communities

Takeaway: "Climate change creates new risks and exacerbates existing vulnerabilities in communities across the United States, presenting growing challenges to human health and safety, quality of life, and the rate of economic growth."

CLEAN Resource: [Adapting to a Changing World](#)

In this activity, students explore strategies that communities are employing to

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*Activity takes about one 50-minute class period.
Audience: High School, College Lower*

Browse CLEAN for more activities focused on [communities](#).



Help students learn about the human and social sides of climate change through this activity, as well as national perspectives on climate change, mitigation vs. adaptation, and effective 21st-century climate change adaptation efforts.

2. Economy

Takeaway: *"Without substantial and sustained global mitigation and regional adaptation efforts, climate change is expected to cause growing losses to American infrastructure and property and impede the rate of economic growth over this century."*

CLEAN Resource: [The Energy Game: Finding Energy Resources](#)

This game from Beloit College demonstrates that energy, the environment, and economics are closely tied together.

*Activity takes two 45-minute class periods.
Audience: Intermediate, Middle School, High School*

Take a look at some more CLEAN resources focused on [economics](#).

During the course of the game and in the discussion afterward, students learn the concepts of scarcity, opportunity cost, net energy profit, law of diminishing returns, and that availability does not mean usefulness. Science teachers may want to team up with an

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3. Interconnected Impacts

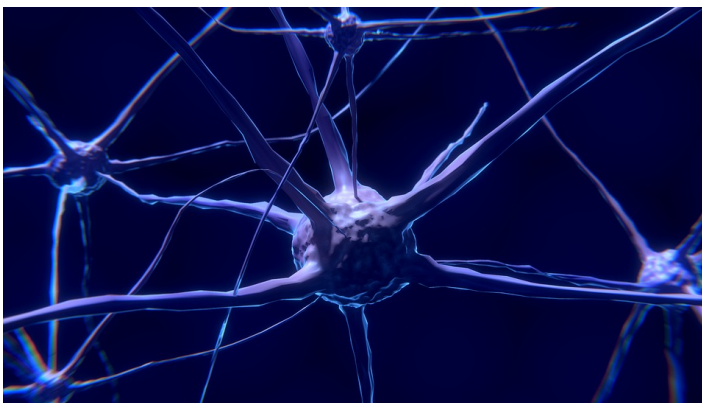
Takeaway: *Climate change affects the natural, built, and social systems we rely on individually and through their connections to one another. These interconnected systems are increasingly vulnerable to cascading impacts that are often difficult to predict, threatening essential services within and beyond the Nation's borders.*

CLEAN Resource: Teaching Climate Systems: [High School](#) and [Middle School](#)

Find resources to aid you in teaching about interconnected climate systems according to NGSS science education standards.

Audience: Middle School, High School

Check out this guide to [NGSS concepts at a glance](#).



These resources help educators find their way through the CLEAN collection by organizing resources according to Performance Expectations, Disciplinary Core Ideas, Science and Engineering Practices and Cross Cutting Concepts.

4. Actions to Reduce Risks

Takeaway: *Communities, governments, and businesses are working to*

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strategies. While mitigation and adaptation efforts have expanded substantially in the last four years, they do not yet approach the scale considered necessary to avoid substantial damages to the economy, environment, and human health over the coming decades.

CLEAN Resource: [Climate Heroes: Stories of Change](#)

This documentary film takes the viewer on a virtual trip around the world to visit communities in different countries (Asia, Africa, Central America, Australia) taking action on climate change.

Video length: 22:01 minutes.

Audience: Middle School, High School, College Lower

Take a look at some more CLEAN resources focused on [community action](#).

This short documentary by United Nations Climate Change Secretariat weaves together nine inspiring stories, showing that action on climate change is creating jobs, improving lives and turning dreams of a better future into reality.



5. Water

Takeaway: The quality and quantity of water available for use by people and ecosystems across the country are being affected by climate change, increasing risks and costs to agriculture, energy production, industry, recreation, and the environment.

CLEAN Resource: [Climate Change Affects Glacial Water Source](#)

This video from ThinkTV discusses how the populous areas west of the Andes are largely desert and rely on glacial melt water as an important source of fresh water.

Video length: 4:18 minutes.

Audience: Middle School, High School

Check out some more CLEAN resources focused on [glacial water](#).

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are in rapid retreat, scientists are monitoring the steadily shrinking glaciers and the impact of their reduction on local populations. Scientists from the Byrd Polar Research Center, who specialize in glaciers and water quality, discuss water quality and quantity issues related to glacial melt and the potential human impact.

6. Health

Takeaway: *Impacts from climate change on extreme weather and climate-related events, air quality, and the transmission of disease through insects and pests, food, and water increasingly threaten the health and well-being of the American people, particularly populations that are already vulnerable.*

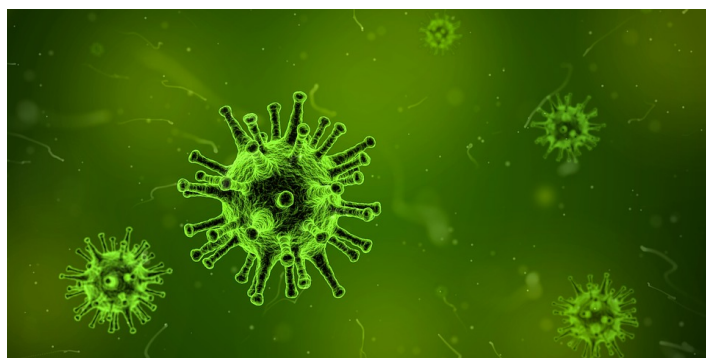
CLEAN Resource: [Quiz: How Much Do You Know About The Health Impacts of Climate Change?](#)

How much do you know about the human health impacts of climate change? Test your knowledge with this fun quiz.

Audience: Middle School, High School, College Lower

Check out some more visualizations focused on [human health](#).

This short quiz from the EPA explores some of the threats that climate change poses to human health, including the impacts of heat waves, extreme weather, and average increases in temperature on specific disorders such as asthma, Lyme disease, mental health, and stresses on the elderly.



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communities' livelihoods, economies, health, and cultural identities by disrupting interconnected social, physical, and ecological systems.

CLEAN Resource: [A Subsistence Culture Impacted by Climate Change](#)

A short video on how changing climate is impacting the ecosystem and thereby impacting traditional lifestyles of the Athabaskan people of Alaska.

Video length 2:59 min.

Audience: Middle School, High School, College Lower, Informal

Browse some more CLEAN resources focused on [indigenous peoples](#).



This video from Arctic Athabaskan Council offers a concrete example of the effects of climate change rather than speaking in the abstract. A background essay on the Athabaskan people and discussion questions are provided on the PBS LearningMedia site.

8. Ecosystems and Ecosystem Services

Takeaway: Ecosystems and the benefits they provide to society are being altered by climate change, and these impacts are projected to continue. Without substantial and sustained reductions in global greenhouse gas emissions, transformative impacts on some ecosystems will occur; some coral reef and sea ice ecosystems are already experiencing such transformational changes.

CLEAN Resource: [Global Forest Watch](#)

Global Forest Watch is an interactive, online forest monitoring and alert system that provides users globally with the information they need to better manage and conserve forest landscapes.

Audience: Middle School, High School, College Lower, College Upper, Graduate/Professional

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Datasets are displayed on a global map and include information on forest change, cover, use, and conservation, as well as human population density and claims to land. The map makes it easy to summarize data by a specific country or region and the information is available in 15 languages.



9. Agriculture

Takeaway: *Rising temperatures, extreme heat, drought, wildfire on rangelands, and heavy downpours are expected to increasingly disrupt agricultural productivity in the United States. Expected increases in challenges to livestock health, declines in crop yields and quality, and changes in extreme events in the United States and abroad threaten rural livelihoods, sustainable food security, and price stability.*

CLEAN Resource: [Science for a Hungry World: Agriculture and Climate Change](#)

This NASA video explores the relationship between climate and agriculture.

Video length: 5 min.

Audience: Middle School, High School

Watch some more videos focused on [agriculture](#) from CLEAN.

This activity is a great help to students for exploring biofuels as a renewable energy source while still acknowledging the

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using biofuels.

10. Infrastructure

Takeaway: *Our Nation's aging and deteriorating infrastructure is further stressed by increases in heavy precipitation events, coastal flooding, heat, wildfires, and other extreme events, as well as changes to average precipitation and temperature. Without adaptation, climate change will continue to degrade infrastructure performance over the rest of the century, with the potential for cascading impacts that threaten our economy, national security, essential services, and health and well-being.*

CLEAN Resource: [The Rebuilders-Rebuild by Design](#)

This video is about the Rebuild by Design competition offered to address the structural and social vulnerabilities exposed by Superstorm Sandy.

Video length is 7:02 min.

Audience: Middle School, High School, College Lower, College Upper, Informal

Check out some more CLEAN resources focused on [infrastructure](#).

Hurricane Sandy caused \$65.7 billion in damages. Watch this video, produced by Rebuild by Design Task Force, An Initiative of the President's Hurricane Sandy Rebuild, to see how this community is rebuilding and adapting their infrastructure so that it doesn't happen again.



11. Oceans and Coasts

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significant reductions in global greenhouse gas emissions and regional adaptation measures, many coastal regions will be transformed by the latter part of this century, with impacts affecting other regions and sectors. Even in a future with lower greenhouse gas emissions, many communities are expected to suffer financial impacts as chronic high-tide flooding leads to higher costs and lower property values.

CLEAN Resource: [Sea-Level Rise for the Coasts of California, Oregon, and Washington](#)

This video features Dr. Gary Griggs, a scientist with the National Research Council, discussing predictions for sea-level rise on the West Coast of the United States.

Video length is 4:43 min.

Audience: High School, College Lower

Take a look at more resources focused on [coasts](#).



Watch this video from The National Academy of Science to find out how rising sea levels will affect coastal cities in California, Oregon and Washington. The video includes effective visualizations and animations of the effects of plate tectonics and sea level rise on the West Coast.

12. Tourism and Recreation

Takeaway: Outdoor recreation, tourist economies, and quality of life are reliant on benefits provided by our natural environment that will be degraded by the impacts of climate change in many ways.

CLEAN Resource: [Drought in the Colorado Basin](#)

This series of visualizations explores the 16-year drought as of 2016 and its effects on the Colorado River Basin.

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The Colorado River is linked to nine National Park Service units and seven National Wildlife Refuges, supporting over \$1 billion in tourism revenue associated with outdoor recreation and wildlife. Check out these visualizations from the U.S. Department of the Interior to get the full picture.



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CLEAN is funded by grants from the [National Oceanic and Atmospheric](#)

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