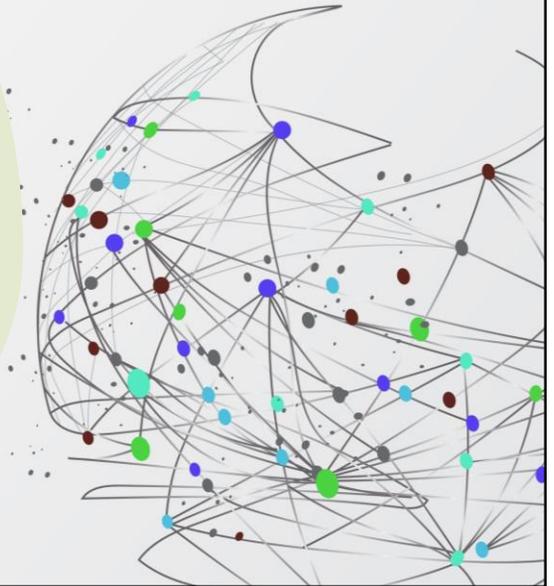


Climate Science and Climate Change Across the Curricula – Exploring the Opportunities

A presentation by
Missy Holzer, PhD
CLEAN Ambassador

for the
Sustainability Education Week

hosted by
Monmouth University
February 15, 2021



1

Chat Box Q:
Who are you? What “hat” are you
wearing today?



2



Outline

- A Call to Act
- The Role of NJ Education – Revised NJ Standards
- Envisioning and Enacting the Revised Standards
- Let's Get Started! – tips and tools

3



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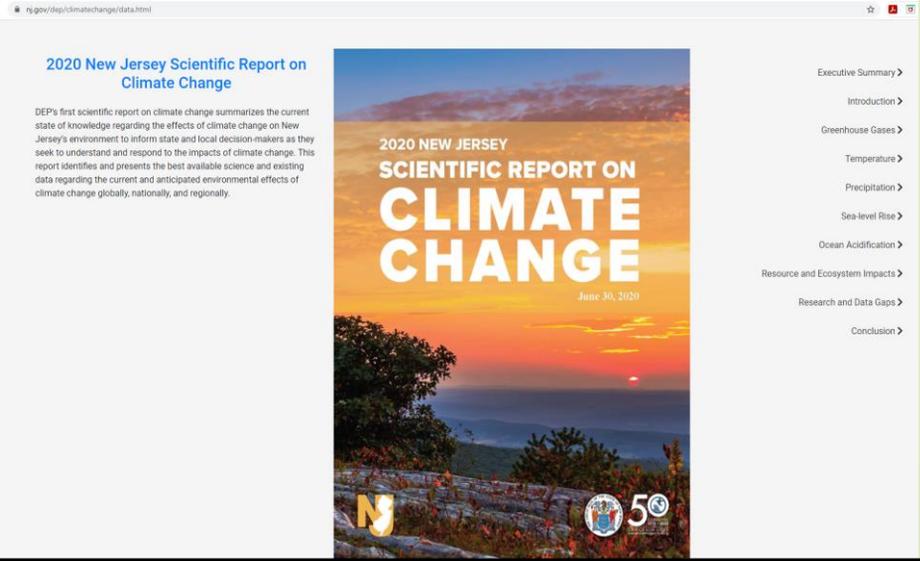


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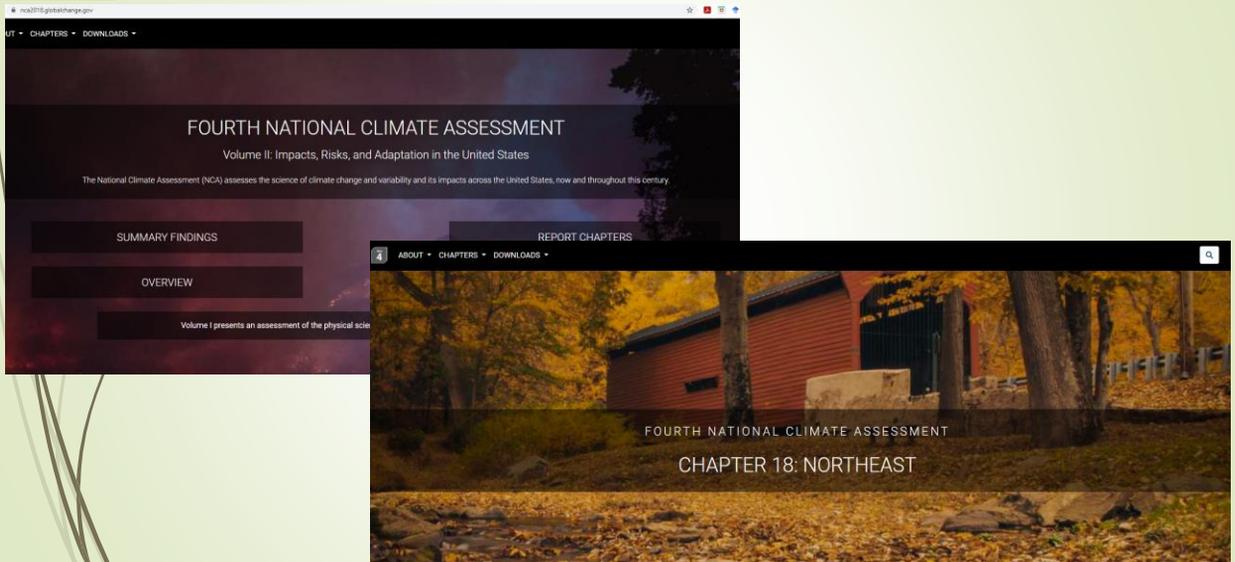
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NJ Climate Change Report



7

National Climate Assessment: Ch 18



8



"As atmospheric levels of carbon dioxide and other greenhouse gases increase, New Jersey will experience significant direct and secondary changes in its environment."

New Jersey Transportation Corridor, p. 17

Changes

- Rising temperatures
- Increased precipitation
- Sea-level rise
- Ocean Acidification
- Air Quality
- Water resources: supply and quality
- Agriculture
- Forests
- Wetlands
- Terrestrial carbon sequestration
- Terrestrial systems
- Freshwater Systems
- Marine Systems

9

Climate Change: An Equity Issue

- Wealthier countries and communities are better equipped to deal with weather, emergencies, epidemic outbreaks, and climate-related loss of livelihoods.
- Children are the least responsible but the most affected.
- Heatwaves and droughts threaten food security.
- The poor, the elderly, and children are most at risk from heat-related illnesses, incidence of airborne and waterborne illnesses.

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Outline

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The Role of NJ Education

Revised NJ Student Learning Standards

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Climate Change Education



[Credit: The Planetary Press](#)

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Standards for a Rapidly, Changing World

Goal: Prepare New Jersey students to live healthy, productive lives equipped with the knowledge and skills to make their local and global communities a better place to live.

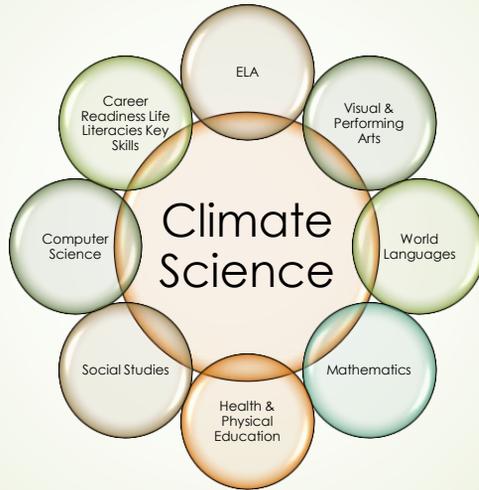
14

What's new in our Learning Standards?



15

What's new? – finding curricular connections



[Elementary Science and Integrated Subjects - TEMPLATE](#)

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Revisions and Implementation

September 2021

- ▶ [Visual and Performing Arts](#)
- ▶ [Science](#)
- ▶ [World Languages](#)
- ▶ [Career Readiness, Life Literacies, and Key Skills](#)

September 2022

- ▶ [Comprehensive Health and Physical Education](#)
- ▶ [Social Studies](#)
- ▶ [Computer Science and Design Thinking](#)

[English Language Arts](#) and [Mathematics](#) were adopted by the New Jersey State Board of Education in May 2016 and were not under review.

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A Closer Look at NJ Science Standards

18

Teaching and Learning Science

- ▶ Engages all students in scientific thinking and moves from *learning about science* to *figuring things out* through phenomena-driven instruction.
- ▶ Content is no longer the memorization of science facts, but is three-dimensional, incorporating science and engineering practices, disciplinary core ideas, and crosscutting concepts that build over time.
- ▶ Supports an *equity vision* of science education in which all students are known, heard and supported with access and opportunities to learn.



Professional Development that Supports Teacher Learning about the New Vision for Science Education

19

2020 NJSLS-Science Mission

All students will possess an understanding of scientific concepts and processes required for personal decision-making, participation in civic life, and preparation for careers in STEM fields (for those that chose).

20

2020 NJSLS-Science Spirit and Intent

- NJSLS-S describe the expectations for what ALL students should know and be able to do.
- Promote 3-dimensional learning across Earth and space, life, and physical sciences.
- Engage in learning experiences where students investigate phenomenon, design solutions to problems, make sense of evidence to construct arguments, and critique and discuss those arguments.

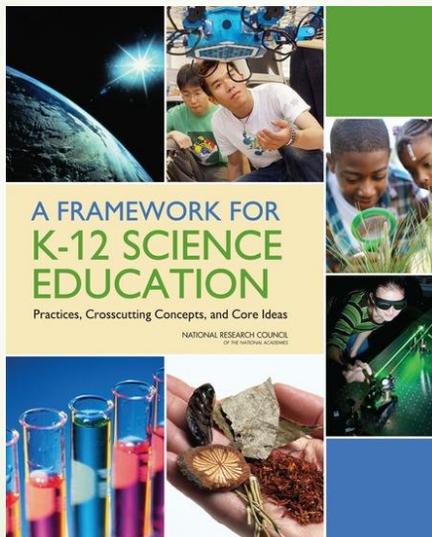
21

2020 NJSLS-Science are Performances

- NJSLS-S Performance Expectations (PE) are derived from the interplay among a Science and Engineering Practice (SEP), Disciplinary Core Idea (DCI), and a Crosscutting Concept (CCC).
- Each of these dimensions grows in complexity from the earliest grades through high school.
- PEs describe what students should be able to after instruction. They are **performances**. They are a destination to attain.

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New to NGSS and the NJ SLS-Science?



tinyurl.com/NRC2012

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What's new in the Science Standards?

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Grades K through 5 Climate Change Edits

NJSLS-Science (2014)	NJSLS-Science (2020)
K-ESS3-3: Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.	K-ESS3-3: Communicate solutions that will reduce the impact of climate change and humans on the land, water, air, and/or other living things in the local environment.
K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change (e.g., climate change) to define a simple problem that can be solved through the development of a new or improved object or tool.
3-ESS3-1: Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	3-ESS3-1: Make a claim about the merit of a design solution that reduces the impacts of climate change and/or a weather-related hazard.
4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes and climate change have on humans.
5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.	5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources, environment, caused the rise in global temperatures and address climate change issues.

25

Grades 6 through 8 Climate Change Edits

NJSLS-Science (2014)	NJSLS-Science (2020)
MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.	MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused rise in global temperatures climate change over the past century.

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Grades 9 – 12 Climate Change Edits

NJSLS-Science (2014)	NJSLS-Science (2020)
HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and [changes in] climate change have influenced human activity.
HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.	HS-ESS3-4: Evaluate or refine a technological solution that reduces impacts of human activities on climate change and other natural systems.
HS-ESS3-6: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.	HS-ESS3-6: Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change).

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Envisioning and Enacting the Revised Standards

Challenges and Opportunities

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Chat Box Q:

What do you perceive to be the challenges and opportunities in the enactment of the standards revisions?



30

Challenges and Opportunities

- ▀ Challenges
 - ▀ Time (instructional and planning)
 - ▀ Teacher PCK
 - ▀ Resources
 - ▀ Contacts/Connections
 - ▀ Administrative Support
- ▀ Opportunities
 - ▀ Innovation
 - ▀ Cohesion
 - ▀ Relevancy
 - ▀ Community Connections
 - ▀ Student Voice

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Designing Curricula for Climate Change Education



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Standards-Based

The learning tasks move kids toward specific and measured performance expectations.

- Take care of the essentials first and then add the nice to have later
- All standards, all students
- Instructional time and resources are precious
- Evidence-based instructional models need to be used by educators
- A system of assessment is used to make kids thinking visible throughout

33

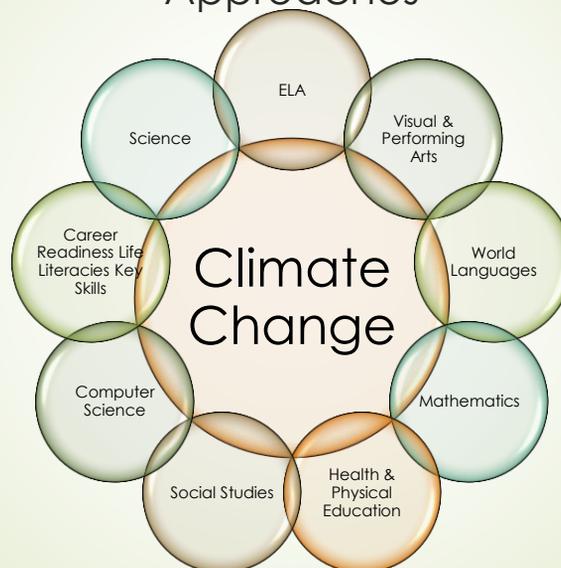
Interdisciplinary & Transdisciplinary Approaches

How and why does our climate work, what is making it change, and what needs to be done to mitigate or adapt to it?

We need people who can gather and communicate evidence-based information.

We need civic engagement to combat environmental and climate injustices.

We need people who can model, interpret, and use big data.



We need people who can express the human experience through the arts.

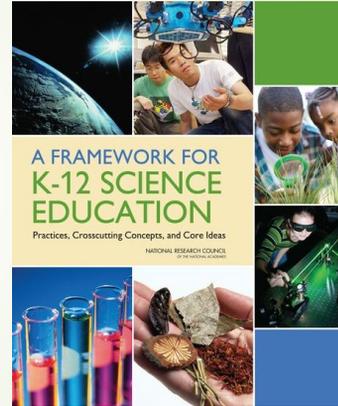
We need people who can use the science to design and build solutions that allow us to mitigate or adapt to the impacts of climate change.

We need kids to be inspired to pursue careers that fight injustices and take on the technical challenges of the future.

34

Equity and Diversity in Science and Engineering Education

- ▶ Learning is cultural. Instruction should grow out of **everyday experience** of learners and connect to their **interests and identities**.
- ▶ Instruction should **leverage science-related values, knowledge, and practices** of students, their families, and cultural communities.
- ▶ Instruction should allow students to leverage their **full communicative resources** during sensemaking.
- ▶ **Make diversity visible.**



nap.edu/read/13165/chapter/16

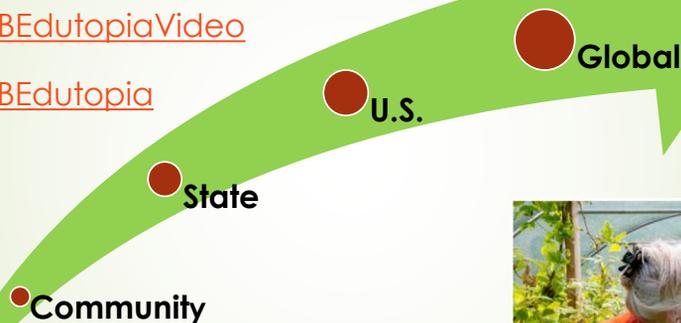
35

Place-Based

Turning your local community into your classroom.

tinyurl.com/PBEduTopiaVideo

tinyurl.com/PBEduTopia



Focusing Science and Engineering Learning on Justice-Centered Phenomena across PK-12

36

Place-Based

Community Connected Projects – Cedar Rapids, Iowa

- **Passion:** Start by tapping into a student's interests and use that as a powerful learning tool.
- **Projects:** Engage kids in solving real-world problems and seeing how content actually lives in the real world.
- **Community:** Network kids into the community to see all the great people and wonderful opportunities that exist.

WINDOWS
OF
UNDERSTANDING

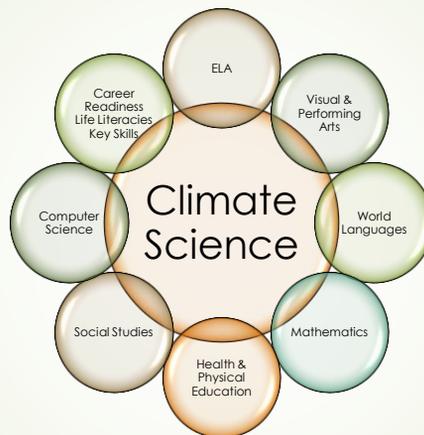
tinyurl.com/WOUNBHP



tinyurl.com/GSMRT

37

Solution Focused Approaches



Problem Solving ->
Solutions!

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Envision and Enacting – continued!

- The other PBL's (project-based, problem-based)
- Organic: District-wide (involve the school board), building-level, grade-band
- Template: organized, thorough, goal-oriented
- Topics: Student driven, relevant, compelling, provocative, relevant
- Seek ongoing projects and competitions
- Student voice
- Connect with local nonformal groups like watersheds and nature centers
- Community
- Audubon EcoSchools & Sustainable Jersey for Schools & NJ School Boards Association STEAM Tank program and policy language

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Chat Box Q:
What ideas are coming to mind?



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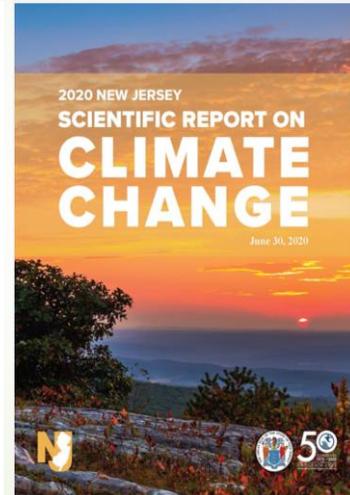
Let's Get Started! – tips and tools

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2020 NJ Scientific Report on Climate Change

- ▀ New Jersey Department of Environmental Protection's first scientific report on climate change summarizes the current state of knowledge regarding the effects of climate change on New Jersey's environment to inform state and local decision-makers as they seek to understand and respond to the impacts of climate change.
- ▀ This report identifies and presents the best available science and existing data regarding the current and anticipated environmental effects of climate change globally, nationally, and regionally.

www.nj.gov/dep/climatechange/data.html



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Climate Change 101

An introduction to climate change in New Jersey

CLIMATE BRIEFS



CLIMATE CHANGE IN NEW JERSEY:
A BRIEF INTRODUCTION



CLIMATE CHANGE IN NEW JERSEY:
IMPACTS AND RESPONSES



SEA LEVEL RISE IN NEW JERSEY:
PROJECTIONS AND IMPACTS



CLIMATE-SMART GARDENING



THE NATIONAL FLOOD INSURANCE
PROGRAM AND NEW JERSEY



HOW TO ADAPT TO CLIMATE
CHANGE



CLIMATE CHANGE, HEALTH, AND
EQUITY IN NEW JERSEY



FARMING, FOOD, AND CLIMATE
CHANGE IN NEW JERSEY



HOW TO REDUCE YOUR
GREENHOUSE GAS EMISSIONS



OCEAN ACIDIFICATION

<https://njclimateresourcecenter.rutgers.edu/climate-change-101/>

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NJ FloodMapper
Flood exposure mapping tool

NJ FloodMapper is an interactive mapping tool that allows users to conduct flood exposure analysis based on the best available science for sea-level rise and numerous other parameters, including total water levels, hurricane surge, FEMA flood zones, and Hurricane Sandy surge. Additional map layers depict infrastructure, environmental hazards, marsh and open space, social vulnerability, flood insurance payments for property loss, and land use.

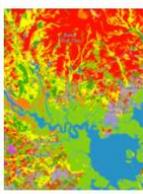
[Go to NJ FloodMapper](#)



Municipal Snapshots
Climate risks summarized by municipality

Adopting to climate change requires an understanding of potential hazards and exposure. These Municipal Snapshots provide easy access to information about the people, places, and assets that are at risk from climate impacts in each of New Jersey's municipalities. Snapshots include reports on built infrastructure, critical assets, natural and working lands, public health and vulnerable populations.

[Go to Municipal Snapshots](#)



NJ Forest Adapt
Forest management tool

This mapping tool enables users to visualize data over multiple timelines and climate change scenarios. Users can explore changes in plant hardiness and heat zones, species distribution, daily minimum and maximum temperatures, heating and cooling degree days and precipitation. Additional map layers include forest carbon density, canopy cover, impervious surfaces, forest types, pest and disease, wildfire fuel hazard, and more.

[Go to NJ Forest Adapt](#)



NJ Adapt

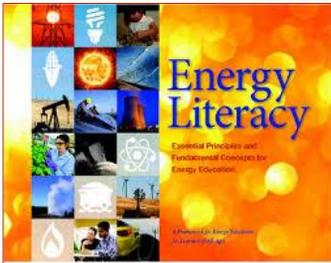
A suite of online tools for planners and practitioners

NJ Adapt is a suite of online tools designed to provide data to planners, decision-makers, practitioners, and others addressing climate change in New Jersey. Presently, NJ Adapt contains three tools – NJ FloodMapper, Municipal Snapshot, and NJ Forest Adapt.

njclimateresourcecenter.rutgers.edu/nj-adapt/

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Frameworks for Teaching about Climate and Energy System


A perspective and approach for solving problems centered on the whole system, including system elements and their inter-relationships.

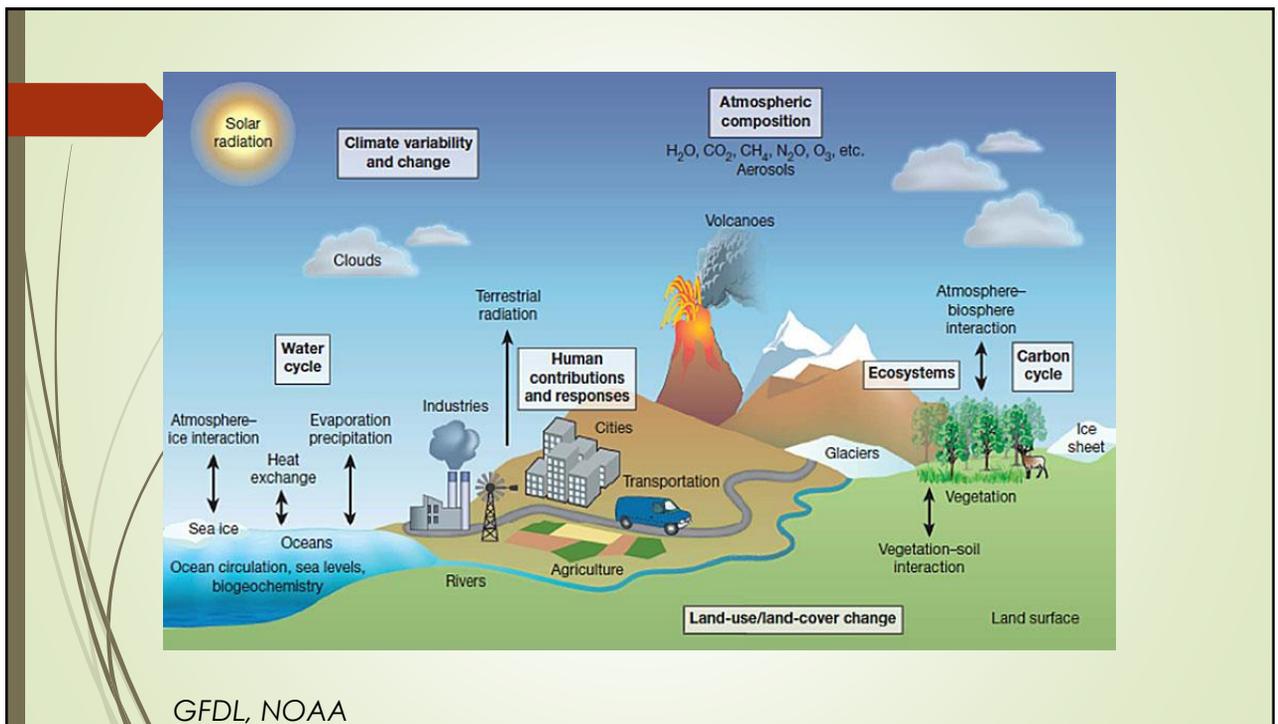
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Climate Change is Complicated

The complexities of climate change and its interdisciplinary nature can make it feel like a daunting teaching task. However, this complexity reflects the systemic nature of many of today's environmental challenges—making it an ideal platform for implementing practice-based instruction focused on contemporary science in the classroom. The science and engineering practices of modeling, analyzing data, argumentation, and designing solutions should be a central focus of any climate change curriculum.

[STEMteachingtools/brief/12](https://stemteachingtools.com/brief/12)

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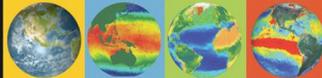
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Climate Education Resources

RUTGERS | NJ Climate Change Resource Center

CTRES | Education & Outreach

NOAA **Climate.gov**
science & information for a climate-smart nation

CLEAN 
CLIMATE LITERACY & ENERGY AWARENESS NETWORK

CLIME TIME 
CLIMATE SCIENCE LEARNING

ZINN EDUCATION PROJECT
TEACHING PEOPLE'S HISTORY

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Support for Climate Change Education

 **nsta**
National Science Teaching Association

[Position Statement: The Teaching of Climate Science](#)

 **National Council for the Social Studies**



- Companion ELA Standards Grades 6 - 8 ([Word](#) | [PDF](#))
- Companion ELA Standards Grades 9 - 10 ([Word](#) | [PDF](#))
- Companion ELA Standards Grades 11 - 12 ([Word](#) | [PDF](#))

 **New Jersey Student Learning Standards SCIENCE**

[APPENDIX L – Connections to Mathematics](#)

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Questions?

- ▶ Thank you!
- ▶ Contact information:

Missy Holzer, PhD

Missy.holzer@gmail.com

As a CLEAN Ambassador, I'm available for free professional development on how to use the CLEAN (Climate Literacy and Energy Awareness Network) portal to locate vetted instructional resources for teaching and learning around climate science and climate change.

