Educators Creating A Climate for Change

JASON E. SMERDON

Annual Global Temperatures 1850-2017
FACT: The Earth is warming and we are causing it.
CONSENSUS ON CONSENSUS:
A SYNTHESIS OF CONSENSUS ESTIMATES ON HUMAN-CAUSED GLOBAL WARMING

Cook et al., *Environmental Research Letters*, 2016
3 Supporting Facts
Fact 1: CO$_2$ in the atmosphere is increasing.
Atmospheric CO₂ at Mauna Loa Observatory

Average 2018 CO₂ Concentration: 409 ppm (29% ↑ Since 1959)

Average February 2019 CO₂ Concentration: 412 ppm

1959: 316 ppm
Atm. CO$_2$ Concentration (ppm)

Age (years before present)

2018 LEVEL
409 PPM

highest previous concentration (300 ppm)

NOAA Climate.gov
Data: NCEI
Atmospheric concentrations of carbon dioxide, methane, and nitrous oxide have increased to levels unprecedented in at least the last 800,000 years. CO$_2$ concentrations have increased by 40% since pre-industrial times, primarily from fossil fuel emissions...

IPCC Statement on Increases in Atmospheric Greenhouse Gases, SPM, 2013
Fact 2: The Earth is Warming
NASA GISS Global Temperature Record

Global Mean Estimates based on Land and Ocean Data

- Annual Mean
- Lowess Smoothing

+1.0°C

Temperature Anomaly (°C)

http://data.giss.nasa.gov/gistemp/

NASA/GISS/GISTEMP/v3

1880 1900 1920 1940 1960 1980 2000 2020

Many Different Warming Signals

- Air Temperature in the lowest few km (troposphere)
- Glacier Volume
- Water Vapor
- Temperature Over Land
- Sea Ice Area
- Marine Air Temperature
- Sea Surface Temperature
- Snow Cover
- Sea Level
- Ocean Heat Content

IPCC, AR5, 2013
Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia.  

IPCC Statement on Warming, SPM, 2013
Fact 3: 
$\text{CO}_2$ is the Cause of the Warming
THE GREENHOUSE EFFECT

Some solar radiation is reflected by Earth and the atmosphere.

Some of the infrared radiation passes through the atmosphere. Some is absorbed by greenhouse gases and re-emitted in all directions by the atmosphere. The effect of this is to warm Earth’s surface and the lower atmosphere.

Some radiation is absorbed by Earth’s surface and warms it.

Infrared radiation is emitted by Earth’s surface.

~33 °C Warmer
TEMPERATURE AND CO$_2$ IN THE PAST

https://www.ncdc.noaa.gov/global-warming/temperature-change
WHAT IS WARMING THE WORLD?

+2°F warmer

-2°F cooler

FACT: THE EARTH IS WARMING AND WE ARE CAUSING IT
“Most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations.”

IPCC Statement on Global Warming and Human Influence, SPM, 2014
The impacts of climate change are here
QUESTION: WHAT DOES THE FUTURE HOLD?
How will we generate energy in the future?
How will we use energy in the future?
How will countries continue to modernize and develop?
How many of us will there be in the future?
**Warming and Our Future**

**CMIP5 models, RCP scenarios**

- **Historical (42)**
- **RCP 2.6 (26)**
- **RCP 4.5 (32)**
- **RCP 6.0 (17)**
- **RCP 8.5 (30)**

### Global Surface Warming (°C)

- **WHERE WE’VE BEEN**
  - IPCC, AR5, 2013

### Where We Are Going

- **0.3°C**

### Decision Uncertainty

- **4.8°C**

**Scientific Uncertainty**
LAST GLACIAL MAXIMUM:

~4-5°C COLDER

546 m

https://en.wikipedia.org/wiki/Lower_Manhattan
2100 IS NOT THAT FAR AWAY
2100

GLOBAL MEAN TEMPERATURE RISE

1°C  2°C  3°C  4°C

RISK
By 2035, NE is projected to be more than 3.6°F (2°C) warmer than the preindustrial era.
ANNUAL TEMPERATURE-RELATED DEATHS IN MANHATTAN, NEW YORK

Number of Deaths

Business-as-Usual Scenario (A2)
Aggressive Mitigation Scenario (B1)

Year

1980s 2020s 2050s 2080s

700 800 900 1,000

Li et al., Nature Climate Change, (2013)

NYC Tri-State Region

SEA SURFACE TEMPERATURES ARE ALSO CHANGING ON THE NORTHEAST CONTINENTAL SHELF

Observed Sea Surface Temperatures

Projected Sea Surface Temperature Changes by 2100

4th NCA, 2018

https://www.esrl.noaa.gov/psd/ipcc/ocn/
MARINE LIFE IS CHANGING ON THE NORTHEAST CONTINENTAL SHELF

Gulf of Maine Lobster

Southern NE Lobster

Gulf of Maine Cod

Black Sea Bass

4th NCA, 2018
EXEMPLARY OF IMPACTED NE INDUSTRIES

• OUTDOOR RECREATION INDUSTRY
  • ~$150 billion in consumer spending to the NE economy
  • Supports more than 1 million jobs across the region.

• AGRICULTURE, FISHING, FORESTRY, AND RELATED INDUSTRIES
  • ~$100 billion in economic activity annually
  • Supports more than 0.5 million jobs in production and processing region-wide.

• NE WINTER RECREATION INDUSTRY
  • Between $2.6-$2.7 billion in revenue annually
  • Supports ~44,500 jobs

4th National Climate Assessment, 2018
**GLOBAL AVERAGE SEA LEVEL RISE PROJECTIONS**

- **AGGRESSIVE MITIGATION SCENARIO:** 0.28-0.61 m
- **BUSINESS-AS-USUAL SCENARIO:** 0.52-0.98 m

**SEA-LEVEL RISE IN INCHES**

**BATTERY PARK, NY**

https://sealevelrise.org/states/new-york/
WHY DO WE CARE ABOUT SEA-LEVEL RISE?

KING TIDE FLOODING

Dock Street in Annapolis, Maryland (December 21, 2012), 4th NCA, 2018

STORM SURGES

South Ferry Subway Station
https://gizmodoemergency.wordpress.com/2012/10/31/the-ultimate-gallery-of-flooded-nyc/

FOREST DIEBACK

Dying Atlantic White Cedars, Bass River, New Jersey, 4th NCA, 2018

INCREASED URBAN VULNERABILITY

1-in-100 Yr Flood Zones for New York City with Projected Sea Level Rise

- Major Roads and Highways
- FEMA Current 1-in-100 Year Flood Zone
- 2020s 1-in-100 Year Flood Zone (5' Sea Level Rise)
- 2050s 1-in-100 Year Flood Zone (13' Sea Level Rise)
- 2080s 1-in-100 Year Flood Zone (23' Sea Level Rise)

For more information, contact info@urbanvulnerability.org

Map Authors: K. Grady and A. Maroko September 2009
THOSE MOST VULNERABLE...

Wealth of US County (per capita income)

Damage Relative to County Income


Hsiang et al., Science, (2017)
CLIMATE CHANGE DOESN’T MEAN THE END OF THE WORLD

IT REQUIRES US TO PREPARE AND BE SMARTER...
SOME  HELPFUL  RESOURCES

NASA/GISS Global Temperature Record
https://data.giss.nasa.gov/gistemp/

Moana Loa Atmospheric CO2 Data
https://www.esrl.noaa.gov/gmd/ccgg/trends/

What is Warming the World Animation

4th US National Climate Assessment
https://www.globalchange.gov/nca4

Sea Level Rise
https://sealevelrise.org
WORLD'S FIRST COMMERCIAL PLANT FOR DIRECT CARBON CAPTURE

Near Zürich, Switzerland

Opened 2017

900 TONS CO₂ CAPTURED ANNUALLY (~200 CARS)

A 21st-Century Challenge

We need COURAGE, NOT HOPE...

COURAGE is the resolve to do well without the assurance of a happy ending.

Kate Marvel, On Being
Here Comes Solar
Community Solar
Green Workforce Training
Green Design Lab
Professional Development Training: Climate and STEM

- Effective STEM programs are interdisciplinary and go beyond teaching environmental literacy to preparing students for STEM careers. – *Next Generation Science Standards*

- School systems should do more to ensure that English-language learners have access to STEM education. – *National Academies of Sciences, Engineering, and Medicine*

- Teachers lack PD opportunities focused on climate change. – *National Center for Science Education*
NYC Solar Schools Program

Multilingual Learners

CareerCLUE

Environmental Justice Programs
Climate Change PD: Focus on Careers and hard skills

Students working on a Mock Solar Installation
Key Learning and Takeaways

- Green Job training can take many forms
- City agencies can support climate goals with teacher preparation and workforce development
- Workforce Development starts in middle and high school
- Educational networks can connect an entire industry
Principal Greta Hawkins
Assistant Principal Gayle Gordon

https://www.ps90.org/

Follow us on Twitter at https://twitter.com/ps90jed
2017 GrowNYC DSNY Super Recycler!
PS 90’s 5 Themes

Wellness

Social Emotional

Environmental Studies

Technology
REDUCE YOUR Carbon Foot Print

CLIMATE CHANGE AFFECTS EVERYONE BUT NOT EQUALLY

DEVELOPING WORLD

DEVELOPED WORLD

Maleeha
“Like climate change, the conditions of our communities are the consequence of a long history of extraction. We share legacies of fighting colonialism, as well as race, class and gender oppression, while advocating for environmental justice. And we share vision, values and principles that guide our environmental, economic, and social justice organizing. Our communities are the first and most impacted by the storms, fires, floods and droughts, and are disproportionately burdened by the pollution, poverty and systemic violence associated with the multinational corporations driving these ecological crises.”  

Elizabeth Yeampierre
Fact: Cities Produce A Lot of Waste and Pollution.
The city recently estimated that up to 2,700 premature deaths a year could be attributed to fine particulate matter and ozone in the air.

Roughly 410 out of every 10,000 Bronx children visited the ER for asthma symptoms in 2015, according to the latest data the health department. Citywide the asthma-related ER rate is 223 out of 10,000 children.
When it rains, it pours raw sewage into New York City’s waterways. Stormwater runoff directly enters local waterways in about a third of the city.
New York City has over 10,000 properties designated by the City as subject to mandatory environmental study and management.
Food

The Three P’s

Processed
Packaged
Poor Quality
Go Vegan! A Healthy You, A Healthy Planet!

DEFORESTATION
1-2 ACRES RAINFOREST ARE CLEARED EVERY MINUTE
ANIMAL AGRICULTURE IS RESPONSIBLE FOR 91% OF AMAZON DESTRUCTION

CLIMATE CHANGE
GLOBAL GREENHOUSE GAS EMISSIONS
51% DUE TO LIVESTOCK AND THEIR BYPRODUCTS
13% DUE TO TRANSPORT (ROAD, RAIL, AIR & MARINE)

WATER USE
1 HAMBURGER = 660 GALLONS OF WATER = EQUIVALENT TO SHOWERING FOR 2 MONTHS

WASTE FROM A FARM OF 2500 DAIRY COWS = WASTE FROM A CITY OF 411000 PEOPLE
NYCHA launched a recycling action plan in February 2015. Two developments started recycling in May 2015; since then, staff have worked with residents and partners like the DSNY, GrowNYC, Green City Force, and NYC Service to bring recycling to all 328 developments.
Community Norms
We Have to Care

In a landfill far far away...
What are WE doing to Educate the Future?
Air Quality

• Planting and Care for our 20 Trees on our property
• School Garden
• Free Plant Giveaway
• Awareness and Education
• Community Outreach
• Encourage the use of public transportation
• Air Quality Testing
• Signage and follow through
Water

• World Ocean Day
• Beach/School yard clean up
• Billion Oyster Project
• Bring Your Own Bottle Campaign
• Two Water Stations
Health and Wellness

• One of 4 Vegetarian School in NYC
• Health and Wellness Curriculum
• Parent Wellness Presentations
• Mental Health Consultant/ Dentist and Vision
• Garden to Café / Indoor Garden and Hydroponics systems
• After School Wellness Programming
• Monthly Yoga
• Active Design Yoga stations
• Monthly Newsletter and Morning Announcements
• Family Food Night and Family Fridays
• Monthly Exercise programming
• Sensory Room
• CookShop
• SEL Curriculum
• P.O.W.E.R. Programming for parents
• Jed Comfort Dog
Waste

• 10 Stream Recycling
• Share Table
• PS 90’s Material for the Arts
• Composting and Vermicomposting
• Waste Data Collections
• Waste Inspection and Audits
• Energy Saving Campaigns
• Green Team/ Wellness Committee
Climate Change to Climate Action
Rationale for a Climate Action Academy at PS90

“Climate change is the defining issue of our time and we are at a defining moment. We face a direct existential threat. Climate change is moving faster than we are and its speed has provoked a sonic boom SOS across our world.

We have the tools to make our actions effective. What we still lack – even after the Paris Agreement – is the leadership and the ambition to do what is needed. We know what we need to do. And we even know to do it. But sadly, the ambition of our action is nowhere it needs to be.

I am calling on civil society, and young people in particular, to campaign for climate action. Let us use the next year for transformational decisions in boardrooms, executive suites and parliaments across the world. Let us raise our sights, build coalitions and make our leaders listen. There is no more time to waste.”

— Secretary General of the United Nations António Manuel de Oliveira Guterres September 10, 2018

Climate Action Academy
Our Partners
Advice 1

Administration + Support + Passion + Students = Success

Simple Formula
Advice 2

Focus on one thing you can be successful in and are passionate about.
Marc Rolla
PS 90 The Magnet School for Environmental Studies and Community Wellness
Science and Wellness Coordinator
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THANK YOU

Please visit
www.tc.columbia.edu/sustainability