

Delaware

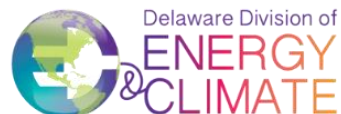
CLIMATE  HEALTH

Conference



Photos are from the Centers for Disease Control and Prevention
<https://www.cdc.gov/climateandhealth/default.htm>

Summary Report



Presented by the Department of Natural Resources and
Environmental Control – Division of Energy and Climate

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Program Agenda

Tuesday, June 6, 2017 • 9:00 am - 4:00 pm
Buena Vista Conference Center • New Castle, Delaware

8:30 Participant Sign-In, Coffee & Tea

9:00 Welcome Remarks Bethany Hall-Long, Lieutenant Governor of Delaware

9:15 Part 1: Changing Risks

- Dr. Perry Sheffield, Mount Sinai
Providers, patients, and the public: Climate change affects us all
- Ms. Susan Love, Dept. of Natural Resources and Environmental Control
Delaware's climate: Past, present, and future
- Ms. Cassandra Codes-Johnson, Dept. of Health & Social Services
Heat vulnerability, equity and health

10:40 Break

10:50 Part 1: Changing Risks (Continued)

- Dr. Cristina Archer, University of Delaware
Understanding climate change impacts on ozone concentrations in Delaware
- Dr. Alison Kenner, Drexel University
Assessing asthma in a changing climate
- Dr. William Meredith, Dept. of Natural Resources and Environmental Control
Climate change impacts on mosquito and tick populations and the problems they cause: Challenges ahead for vector control
- Dr. Awele Maduka-Ezeh, Dept. of Health & Social Services
Vector-borne diseases: An overview

12:00 Lunch

1:00 Part 2: Taking Action

- Dr. Tabatha Offutt-Powell, Dept. of Health & Social Services
The path towards creating Delaware's environmental public health tracking network
- Dr. Yoon Kim, Four Twenty Seven Inc.
Enhancing climate-resilient worker health and safety

1:55 Break

2:05 Part 3: Assessing Vulnerability

- Dr. Yoon Kim, Four Twenty Seven Inc.
Mapping heat and vulnerability to inform decision-making
- Ms. Allison Gost, Maryland Dept. of Health & Mental Hygiene
Maryland's public health approach to climate change

3:00 Move to breakout groups/ Quick Break

3:10 Breakout Groups

- Health & Medical Stakeholders
- Critical Services Stakeholders
- Environment & Social Stakeholders

4:00 Adjourn

Conference Overview

Purpose

The state of Delaware recognizes that climate change and health are closely linked. The impacts of climate change include warming temperatures, changes in precipitation, increasing frequency or intensity of extreme weather, and rising sea levels. Changing climate conditions threaten the health of Delawareans by affecting air quality, water quality, and disease risks, and by increasing exposure of citizens, infrastructure and resources to extreme heat, cold, and severe weather. These health risks are not evenly distributed: vulnerable individuals, communities, and populations face greater risks than others.

On June 6, 2017, the Delaware Department of Natural Resources and Environmental Control, Division of Energy and Climate hosted the *Delaware Climate + Health Conference* at Buena Vista Conference Center in New Castle, Delaware. The conference presented a diverse range of speakers to discuss the ways climate change is affecting public health in Delaware, with a particular focus on extreme heat, air quality, and vector-borne diseases.

The conference objectives were to help participants:

- Understand how climate change affects and threatens public health, with a focus on heat, air quality, and vector-borne disease effects in Delaware;
- Explore ongoing adaptation initiatives in Delaware, highlighting projects that increase community and individual resilience to climate change effects on health; and
- Participate in stakeholder discussions to assess the need for a statewide climate vulnerability assessment.

This report provides a short summary of key messages from the presentations. Conference presentations can be found at <http://de.gov/climatehealthconference>

Participants and Presenters

The conference included about 70 participants and presenters from a wide range of sectors – all of whom have a connection to climate change and human health. Invitations to the conference were targeted to three main groups of stakeholders:

- **Environmental and social organizations**, including state environmental agencies, non-governmental partners, academic institutions, planning agencies, and recreational program providers.
- **Health and medical professionals**, including state health agencies, professional associations, medical providers, and academic institutions;
- **Critical services providers**, including emergency management services, transportation agencies, Delaware utility providers, and housing providers and advocates;

See pages 18-19 for a full list of attendees and affiliations.



Lieutenant Governor Bethany Hall-Long gives the welcome speech

Presentations were provided by ten content experts. Speakers included representatives of public health agencies (Delaware Division of Public Health and Maryland Department of Health and Mental Hygiene), academic institutions (University of Delaware and Drexel University), environmental agencies (Delaware Department of Natural Resources and Environmental Control), private medical institutions (Mount Sinai), and consulting firms (Four Twenty Seven, Inc.) See pages 20-22 for full speaker biographies.

Key Takeaways

- The connection between climate change and air quality may be a topic to pay special attention to in Delaware, given its concern among the participants.
- It may be useful to have more information and data regarding the link between climate change and indoor air quality in Delaware.
- Target vulnerable audiences vary across stakeholder fields, demonstrating the need for collaboration when discussing climate vulnerabilities.
- Participants' organizations are addressing these climate-related risks in three main ways: data/information collection and sharing; raising awareness; incorporation of climate change concerns into existing programs.
- Stakeholders differed on their perception of the need for a climate vulnerability assessment.
- Based on the comments from the stakeholders, a statewide climate and health vulnerability assessment may not be necessary, but there is a need for population and location specific data.
- It is essential to continue these conversations and collaborate with one another.

Report on Stakeholder Discussions

The conference program included stakeholder discussions to assess the need for a statewide climate vulnerability assessment. To address this objective, facilitators led three breakout groups focused on the following questions:

- What are the climate-related risks of most concern to you or your organization's mission, and who is most vulnerable to these risks?
- Does your organization address any of the risks discussed this morning? If so, which ones? Where do you find information or data about them?
- What information related to climate vulnerability do you need that would be helpful for you in your job?
- Would a vulnerability assessment of climate-related risks be useful to you, and if so, how would you use it?

Summary of Stakeholder Comments

There were three stakeholder breakout groups:

1. Environmental and Social
2. Health and Medical
3. Critical Services

Conference participants were assigned a breakout group and encouraged to contribute to the discussion. In this section, comments are summarized by stakeholder group. This section concludes with an overall summary of common themes and takeaways from stakeholder comments.

Environmental & Social Group

Participants in this group included those from state environmental agencies, non-governmental partners, academic institutions, planning agencies, and recreational program providers.

<p><i>Climate risks of primary concern</i></p> <ul style="list-style-type: none">Air qualityVector-borne diseaseFloodSea level riseWater qualityHealth of vegetationEconomic issuesAll the above		<p><i>Vulnerable populations</i></p> <ul style="list-style-type: none">ChildrenIndividuals experiencing homelessnessLow-income populationsThose without healthcareNative vegetation and habitats
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Environmental and Social breakout group

Several participants responded that their organizations are addressing these climate risks by compiling data. They reported extensive existing data for flooding and sea level rise. Data on sea level rise exists through the [Delaware Sea Level Rise Inundation Maps](#) on the Department of Natural Resources and Environmental Control webpage. The University of Delaware is currently assessing the “worst case scenario” (3 feet of sea level rise, a 100 year storm and storm surge occurring all at the same time) and how that type of situation would affect the Delaware Department of Transportation’s assets.

Extreme heat data is monitored by the [Delaware Environmental Observing System \(DEOS\)](#). DEOS is run by the University of Delaware and records meteorological data from all over the state. In addition, the University of Delaware has been collecting statewide ozone data for around 30 years, which is being used to project data for future air pollution scenarios. Delaware’s Department of Natural Resources and Environmental Control has ample data on mosquitoes (a disease-carrying vector) in the state, including count, populations and locations of mosquitoes.

Even with this expanse of Delaware climate-related risk data, there are some gaps that can be filled. For example, in addition to the Delaware Department of Transportation and University of Delaware’s “worst case scenario” research, one participant noted that it would be beneficial to conduct more studies that look at sea level rise and heavy precipitation together.

Participants noted that information regarding vulnerable populations is still needed—i.e., what individuals in vulnerable communities or demographics understand about climate change and related risks, perceptions of such issues, and geographic distributions of vulnerable populations. Some members of this breakout group have taken action to fill this information gap. The University of Delaware conducted a study in Milford where community members were invited to identify vulnerable populations by placing stickers on a map of their community. One participant expressed the need for similar studies in other communities or census tracts. Such information helps identify and locate vulnerable populations while getting community members involved.

Overall, participants of the Environmental and Social breakout group felt that a statewide climate vulnerability assessment may be useful. Those in favor of a vulnerability assessment noted that it is always good to have objective and official data, and that this information could be used to expand future research projects. Also, a vulnerability map would help identify and then target vulnerable populations for help/programs. However, participants noted that it is important to consider the public use of a vulnerability assessment. On the contrary, a participant noted that a statewide vulnerability assessment may not be useful and rather location and population specific data would be helpful information to have.

Health and Medical Group

Participants in this group included those from state health agencies, professional associations, medical providers, and academic institutions.

Climate risks of primary concern

Vector-borne disease
Indoor and outdoor air quality
Mental and emotional well-being
Water resources

Vulnerable populations

Individuals experiencing homelessness
Individuals with disabilities
Immigrant groups
Individuals with substance abuse disorders
Outdoor workers
Caregivers



Health and Medical breakout group

The participants' organizations are addressing these climate risks by raising awareness through a variety of efforts and programs. [The American Lung Association](#)

puts out information on air quality and encourages health and air professionals to support health air quality standards. [The Air Quality Partnership of Delaware](#) talks with youth and parents to make healthier choices regarding air quality, e.g., the [Idling Gets You Nowhere Campaign](#). [Interfaith Power and Light](#) distributes information to people related to energy efficiency and climate change.


There are gaps in climate-related risk information. It was noted that more information is needed on heat and the vulnerable populations it affects. In addition to extreme heat, severe cold temperatures have the potential to affect impoverished populations. The effects of climate change on businesses and business employers need to be investigated. Additionally, it would be ideal to determine climate change's burden on health, e.g., how many people will be affected by asthma in the future. Identifying opportunities to integrate climate concerns into existing projects can deepen the understanding of climate change. For example, folding climate change into the concept of [One Health](#) was recommended. "One Health" refers to the concept of looking at human health, veterinary health and environmental health as a collective indicator of community health.

Overall, participants felt that a vulnerability assessment would not be good use of resources and time. Participants felt that this type of study would be redundant to what is already known or available. Practitioners felt well-versed in what community problems and vulnerabilities are; it is now a matter of determining and funding the solutions. Some participants noted that they are not sure how they would use a vulnerability assessment.

Critical Services Group

Participants included those from emergency management services, transportation agencies, Delaware utility providers, and housing providers and advocates.

<i>Climate risks of primary concern</i>	<i>Vulnerable populations</i>
Heat	Elderly
Flood	Children
Indoor and outdoor air quality	Low-income
Mold	Depends on the vulnerability that is being discussed
Sea level rise	
Extreme weather	
Food security	
Coastal erosion	
Economy	
Infrastructure	
Mental and emotional well-being	



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Critical Services breakout group

The participants' organizations are addressing these climate risks by utilizing climate vulnerability data in their existing programs and initiatives. There are efforts that address flooding. The Delaware Emergency Management Agency has three grant programs related to flood/hazard mitigation. In addition they are working with the Delaware Department of Transportation to do mobile flood monitoring on State Route 9. Delaware State Housing Authority addresses energy efficiency and sustainability by means of the low-income housing tax credits they give as well as the [Downtown Development Districts Grant Program](#). The Office of State Planning and Coordination works with the Department of Natural Resources and Environmental Control on outreach and education to get climate change integrated into the comprehensive planning process.

Overall participants felt that a vulnerability assessment may be helpful as long as it is of use to the public. Maps and visuals can be especially compelling. However, it is the community members themselves who need to come up with the idea and own it for them to take action on climate change.

Collective Summary and Insights

The connection between climate change and air quality may be a topic to pay special attention to in Delaware, given its concern among the participants.

Of the three climate-related risks featured in the speaker's presentations (heat, air quality and vector borne diseases), air quality was the only climate-related risk noted in all three breakout groups.

It may be useful to have more information and data regarding the link between climate change and indoor air quality in Delaware.

Participants in the Health and Medical and Critical Services group specifically noted indoor air quality, which generally is less emphasized when discussing air quality in the climate change context.

Target vulnerable audiences vary across stakeholder fields, demonstrating the need for collaboration when discussing climate vulnerabilities.

Those vulnerable populations noted by the Environmental and Social group and the Critical Services group were similar, e.g., low income populations and children. The Health and Medical group mentioned some vulnerable populations outside of those that are typically under-recognized including immigrant groups, individuals with disabilities, those with substance abuse disorders, caregivers and outdoor workers. Groups have different perspectives on what they consider vulnerable based on the work that they do every day. Thus starting these conversations now is helpful in realizing the value that other stakeholders can bring in their daily work.

Participants' organizations are addressing these climate-related risks in three main ways: data/information collection and sharing; raising awareness; incorporation of climate change concerns into existing programs.

First, organizations are avidly collecting and sharing data and information through different mechanisms. Those in the Environmental and Social group participate in many of these efforts. There are tools and information available on flooding, sea level rise, ozone, heat and vector-borne disease. Another way that participants' organizations are addressing these risks is by raising awareness. The Health and Medical group noted programs used to raise awareness on air quality and energy efficiency. Lastly, there are organizations that are using this data, information, tools, and materials to incorporate climate change into existing programs. The Critical Services group participants noted how climate change, energy efficiency and sustainability are being incorporated into Delaware municipal comprehensive plans, the Downtown Development District program, low income housing tax credits, grant programs and other projects. From this it can be implied that each stakeholder group fulfills its own niche. The Environmental and Social stakeholders research and provide the data, the Health and Medical stakeholders serve as the liaison for dispersing this information and the Critical Services stakeholders use the information to incorporate into existing initiatives and programs. Understanding the dynamic of these three stakeholder groups may warrant an evaluation of how climate and health data is currently being obtained and utilized.

Stakeholders differed on their perception of the need for a climate vulnerability assessment.

Some thought that it would benefit the state to have objective, official data. It could be used to expand research. Maps are also an attractive and effective way of communicating information, especially to the public. However, there were strong rationales for not developing a climate vulnerability assessment. Many felt it may be a waste of money that could go into practically solving the problems that they already know exists. Some felt that such an assessment would be redundant to the information and data that is already known or available. In addition, it is unclear how stakeholders and the public would use it.

Based on the comments from the stakeholders, a statewide climate and health vulnerability assessment may not be necessary, but there is a need for population and location specific data.

Stakeholders expressed the feeling that general statewide information is less valuable, as Delaware's local communities and populations are so varied. Sometimes statewide data does not tell the whole story. One participant noted that more accurate climate projections can be generated by local data. Stakeholders expressed that it would be useful to have more data on how vulnerable populations perceive the threat of climate change. Efforts should engage the public and help practitioners understand the views of their target audiences. This would allow stakeholders to communicate climate change and health messages in a more effective way.

It is essential to continue these conversations and collaborate with one another.

Each stakeholder group has certain niches that their job fulfills, but it may be worth exploring outside of these comfort areas to reach a broader audience and to more effectively incorporate climate and health into existing programs as well as create new ones.

Conference Program

The following sections contain brief summaries of each of the speakers' presentations. Part 1 summarizes those presentations that discussed how climate change affects health with a focus on heat, air quality and vector-borne illness in Delaware. Part 2 summarizes those presentations that discussed what Delaware is doing in the context of climate change and health. Lastly Part 3 summarizes those presentations that discussed different approaches for assessing climate and health vulnerability. These presentations will be available on the Department of Natural Resources and Environmental Control's page: <http://de.gov/climatehealthconference>.

Part 1: Changing Risks

Part 1 of the program featured speakers presenting on the environmental trends related to climate change and the health impacts associated with those trends. Speakers focused on how climate change affects health with a focus on heat, air quality, and vector-borne disease in Delaware.

Climate Change Effects on Health

➤ Dr. Perry Sheffield, Mount Sinai

Providers, patients, and the public: Climate change affects us all



Dr. Perry Sheffield gives the opening presentation

The opening speaker, Dr. Perry Sheffield, discussed the connections between climate change and human health. Climate change has direct and indirect effects on environmental conditions that lead to health impacts. These impacts are diverse and include: cardiovascular, respiratory, and infectious diseases, allergies, injuries, and mental illness. The U.S. Global Change Research Program report in 2016 on “The Impacts of Climate Change on Human Health” describes the current evidence of these health risks.¹

Increasing concentrations of carbon dioxide (a greenhouse gas) as well as changes in temperature and precipitation have a variety of influences on food production, safety, and nutritional value. For example: rising levels of CO₂ can reduce the nutritional content of some plants; warmer temperatures can lead to increased food spoilage; and extreme events such as storms and floods can disrupt food supply and transport, resulting in food scarcity and insecurity. Climate impacts on mental health and well-being include stress, depression, sense of loss, anxiety from displacement and disruption, and in extreme cases post-traumatic stress disorder. Mental health risks can also influence community health more broadly, with greater risk of violent crime, social instability, and loss of community cohesion.

¹ Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska, 2016: Executive Summary. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. U.S. Global Change Research Program, Washington, DC, page 1–24. <http://dx.doi.org/10.7930/J00POWXS>

Extreme Heat

- Susan Love, Delaware Dept. of Natural Resources & Environmental Control
Delaware's climate: Past, present, and future
- Ms. Cassandra Codes-Johnson, Delaware Dept. of Health & Social Services
Heat vulnerability, equity and health

Delaware is already experiencing increasing temperatures. Average temperatures have increased by 2°F since 1900; higher summer temperatures and longer frost-free seasons are being recorded. Annual and seasonal temperatures are projected to increase, with greater increases in summer. Extreme heat days and heat waves are expected to become more frequent. Annual precipitation is projected to increase, mostly due to changes in fall and winter. Heavy rainstorms are expected to become more frequent and more intense – bringing increased flood risks.

These climate changes present direct and indirect impacts on human health, particularly for vulnerable populations. Indirect effects include: worsening air quality by exacerbating conditions that produce ground-level ozone; longer warm season producing more mosquitoes and ticks; extreme rain events that stress and exceed the capacity of wastewater systems.

From a health perspective, vulnerability can be defined as all the risk and protective factors that determine whether a group of people (community or specific population) will face adverse health outcomes due to climate change. Every American is vulnerable to the health impacts associated with climate change, but some populations will be especially affected. These groups include the poor, some communities of color, limited English-proficiency and immigrant groups, indigenous peoples, children and pregnant women, older adults, vulnerable occupational groups, people with disabilities, and people with medical conditions.

Air Quality

- Dr. Cristina Archer, University of Delaware
Understanding climate change impacts on ozone concentrations in Delaware
- Dr. Alison Kenner, Drexel University
Assessing asthma in a changing climate

Researchers in the University of Delaware College of Earth, Ocean, and Environment are examining the relationship between projected temperature increases related to climate change and the frequency of high-ozone episodes in Delaware. The project methodology links synoptic types and high-ozone days based on observations, and uses selected climate models to calculate past and future frequency of high-ozone synoptic types. Researchers have identified two synoptic types associated with high-ozone days: southwest airflow (air moving from southeast toward the northeast U.S.) and high heat days.

Preliminary findings indicate that the number of high-ozone days is expected to increase, in absence of changes in air pollution regulation. Future research work will look at additional global climate models, and also examine whether ozone intensity – as well as frequency of high-ozone days – is expected to increase.

Asthma is a chronic disease where symptoms are triggered by the presence of harmful matter in the environment, and particularly in the atmosphere. Some of the most common asthma triggers are air

pollution, dander, smoke, pollen, dust, and mold. Asthma comes in many forms and degrees of severity; however, all asthmatics are vulnerable to climate change. In Delaware, approximately 66,000 adults (9.2 percent of the population) reported in 2015 that they currently have asthma.

Ozone is one of the air pollution triggers that can cause shortness of breath, inflame and damage airways, and aggravate lung diseases including emphysema, chronic bronchitis, and chronic obstructive pulmonary disease (COPD). Particulate matter has also been associated with asthma prevalence. Asthma may also have an allergic component; approximately 50 percent of people with asthma also have allergies. Climate change may lead to higher concentrations of pollen and longer pollen season. In addition, recent research shows that in the last thirty years the allergenicity of pollen has become much stronger, related to increasing concentration of CO₂ in the atmosphere.

Vector-Borne Disease

- Dr. William Meredith, Dept. of Natural Resources and Environmental Control
Climate change impacts on mosquito and tick populations and the problems they cause: Challenges ahead for vector control
- Dr. Awele Maduka-Ezeh, Dept. of Health & Social Services
Vector-borne diseases: An overview

Warmer, wetter conditions generally favor mosquito populations. Climate change is expected to affect mosquitoes in several ways. The length of mosquito control season is expected to increase. Currently, mosquito control season is approximately eight months, from mid-March to mid-November. As temperatures increase, Delaware's mosquito control season will lengthen, incurring increasing costs of control. Climate change effects also have biological impacts on mosquitoes. Higher pathogen amplification levels and faster replication cycles within mosquitoes may occur. All these factors could result in more disease transmission. A warmer climate also means more ticks and more tick-borne disease transmissions. Rising temperatures may allow for increasing populations of white-footed mice, a primary host reserve for Lyme disease.



Dr. William Meredith presents on vectors

Rising temperatures can also trigger changes in the geographic range of mosquitoes, with a northward expansion of present species range. The biggest concern is the potential for more frequent and abundant populations of the yellow fever mosquito, *Aedes aegypti*, a major vector for yellow fever, dengue fever, and Zika.

Vector-borne diseases account for more than one million deaths worldwide each year. Vector types include mosquitoes, ticks, and fleas, which spread disease through viruses, parasites, and bacteria. Some vector-borne diseases are historically present or recently identified in the U.S., while others are recently

arrived – such as West Nile virus and Zika virus. Vector-borne diseases disproportionately impact certain vulnerable groups and individuals. Determinants of vulnerability include exposure, sensitivity, and adaptive capacity. Protective measures against mosquitoes and ticks can reduce disease transmission. These include: use of insect repellent, treatment of pets and garden areas, screened windows and doors, and yard maintenance (eliminating standing water).

Part 2: Taking Action in Delaware

Part 2 of the program featured two projects currently underway in Delaware that support the implementation of climate adaptation strategies identified by state agencies and summarized in the 2014 report, “Climate Framework for Delaware”.²

- Dr. Tabatha Offutt-Powell, Dept. of Health & Social Services
The path towards creating Delaware’s environmental public health tracking network
- Dr. Yoon Kim, Four Twenty Seven Inc.
Enhancing climate-resilient worker health and safety



Q&A session with the Part 2 presenters

Health and environmental agencies have a long history of tracking trends in health and environmental factors separately. Delawareans must have access to data about the community in which they live as a first step to improving the health of our population, reducing disparities, and improving health equity. Information should be shared in readily usable and understandable formats. To better monitor changes in public health, Delaware’s Division of Public Health is developing a

state *Environmental Public Health Tracking Network*. It is an interactive web-based data portal, developed by using the Centers for Disease Control’s national standards for Environmental Public Health Tracking Networks. The Network is designed to be a tool that compiles health, exposure, and hazard information and data to improve our understanding of how environmental changes can affect the health of individuals and communities.

Climate change magnifies worker health and safety risks. At risk workers are those who spend a majority or large portion of work hours outdoors in rural or urban environments, vehicles or facilities that are not fully protected from weather conditions. The *Climate-Ready Workforce* pilot project is an inter-agency effort to address the health and safety risks faced by state employees who work outdoors or in work environments that are vulnerable to extreme weather. Recommendations for best practices to increase resilience address: policy guidance, roles and responsibilities, communications and training, implementation and enforcement, and program evaluation and improvement. By addressing risks from

² Delaware Department of Natural Resources and Environmental Control, 2014: Climate Framework for Delaware. <http://www.dnrec.delaware.gov/energy/Pages/Climate-Framework.aspx>

climate and weather-related impacts, state workers will be better prepared for adapting to a changing climate – improving working conditions for state employees, reducing work-related illnesses and injuries, and supporting worker productivity.

Part 3: Assessing Vulnerability

Part 3 speakers presented on two approaches to collecting, analyzing, and presenting climate and health data.

- Dr. Yoon Kim, Four Twenty Seven Inc.
Mapping heat and vulnerability to inform decision-making
- Ms. Allison Gost, Maryland Dept. of Health & Mental Hygiene
Maryland's public health approach to climate change

One example presented by Four Twenty Seven, Inc. used spatial analysis methods to produce interactive maps depicting changes in heat severity, frequency of heat, exposure to extremes, and social vulnerability. Maps provide visual information tools that can be used to discuss climate change impacts with health care professionals and engage communities in heat event preparedness. Another example is the California Heat and Health Tool for public health and emergency management professionals to better plan for future extreme heat. These examples highlight the importance of stakeholder engagement and identifying the objectives up front.

Maryland's Department of Health and Mental Hygiene is using the Building Resilience Against Climate Effects (BRACE) framework developed by the Centers for Disease Control to use health data and forecast modes to identify potential health impacts and develop interventions. The Maryland Climate and Health Profile Report (2016) includes the assessment of health impacts related to changing climate conditions, such as the percentage increase in hospitalizations for heart attack or asthma during extreme heat events. The BRACE approach also relies on significant involvement with affected communities and vulnerable populations. The goal of the project is to use health data and forecast models to understand potential impacts and develop effective interventions.



Ms. Allison Gost presents on climate and health in Maryland

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Conclusion

The Delaware Climate + Health Conference served as a great opportunity for participants to listen and learn from presentations, network with others, and contribute to discussions centered on the intersection of climate and health. Speakers discussed how climate change affects health, actions that Delaware is taking, and different approaches to combating vulnerability.

Conversations that were had in the environmental and social, health and medical and critical services groups, having location and/or population specific data would be useful for their jobs. Also it was evident that each of the groups had its own niche and generally performed certain tasks related to climate and health. Knowing this, participants can reach out to other stakeholders to fulfill needs or expand beyond their own horizon and perform tasks outside their niche. Thus, it is essential to continue these conversations around climate and health and act on opportunities to collaborate.

This conference was a stepping stone to connect people and resources on climate and health. It is up to all of us to continue these conversations with other stakeholders, the public and our own organizations. Reach out to someone new you met at the conference and use the new knowledge you have gained from the speakers' presentations to apply it to the job that you do every day. With continued communication and collaboration we aim to increase overall knowledge of how climate affects health and take action to protect the health of Delawareans.

List of Attendees

First Name	Last Name	Affiliation
Abdulhadi	Al Ruwaithi	University of Delaware
Christina	Archer*	University of Delaware, College of Earth, Ocean & Environment
Phil	Barnes	Institute for Public Administration at the University of Delaware
Signe	Bell	University of Delaware, School of Public Policy & Administration
Christine	Beste	University of Delaware
Cynthia	Brewer	Department of Natural Resources and Environmental Control, Human Resources
Bobbi	Britton	Northeast Blueprint Initiative
Joseph	Broadie	University of Delaware
Deborah	Brown	American Lung Association of the Mid-Atlantic
Beth	Chajes	Citizen's Climate Lobby
Rachel	Chiquoine	University of Delaware
Cassandra	Codes-Johnson*	Department of Health and Social Services Division of Public Health
Kaitlin	Collins	Partnership for the Delaware Estuary
Maria	Dziembowska	The Nature Conservancy
David	Edgell	Office of State Planning Coordination
Frieda	Fisher-Tyler	Department of Health and Social Services Division of Public Health
Betsy	Frey	Department of Natural Resources and Environmental Control, Division of Air Quality
Timothy	Gibbs	Delaware Academy of Medicine/ Delaware Public Health Association
Nicole	Goldsboro	American Lung Association of the Mid-Atlantic
Allison	Gost*	Maryland Department of Health and Mental Hygiene
Alan	Greenglass	Christiana Care
Harita	Kandarpa	Department of Natural Resources and Environmental Control
Alison	Kenner*	Drexel University
Yoon	Kim*	Four Twenty Seven Inc.
Vikram	Krishnamurthy	The Delaware Center for Horticulture
Häly	Laasme	Department of Health and Social Services Division of Public Health
Rita	Landgraf	University of Delaware, College of Health Sciences
Edward	Lee	Delaware Emergency Management Agency
William	Leitzinger	Department of Health and Social Services Division of Public Health
Lisa	Locke	Delaware Interfaith Power & Light

First Name	Last Name	Affiliation
Yun-Fei	Lou	Department of Health and Social Services Division of Public Health
Lucy	Luta	Department of Health and Social Services Division of Public Health
Awele	Maduka-Ezeh*	Department of Health and Social Services Division of Public Health
John	Mateyko	Delaware Interfaith Power & Light
Ryan	Meredith	University of Delaware
William	Meredith*	Department of Natural Resources and Environmental Control Division of Fish and Wildlife
Patricia	Miller	Nemours
Mojtaba	Moghani	University of Delaware
Susan	Moriarty	Delaware State Housing Authority
Tabatha	Offutt-Powell*	Department of Health and Social Services Division of Public Health
La Vaida	Owens-White	Delaware Health Ministries Network
Jim	Pappas	Delaware Department of Transportation
Arthur	Paul	Delaware Emergency Management Agency
Victor	Perez	University of Delaware, Disaster Research Center
Rick	Perkins	Department of Health and Social Services Division of Public Health
Cassandra	Rose	Delaware Department of Transportation
Flavia	Rutkosky	US Fish and Wildlife Service
Laura	Saperstein	Department of Health and Social Services Division of Public Health
Perry	Sheffield*	Mount Sinai
Damaris	Slawik	Delaware Emergency Management Agency
Kate	Smith	Delaware Academy of Medicine/ Delaware Public Health Association
William	Swiatek	Wilmington Area Planning Council
Antonina	Tantillo	University of Delaware
Jennifer	Trivedi	University of Delaware, Disaster Research Center
Brian	Urbanek	Delaware Department of Transportation

*Indicates the participant was also a presenter

Department of Natural Resources and Environmental Control Staff

Jennifer de Mooy	Brittany Klecan
Morgan Ellis	Susan Love
Jacob Filby	Mike Tholstrup
Caren Fitzgerald	Kelly Valencik
Kathy Harris	Kerri Yandrich

Speaker Biographies

Dr. Perry Sheffield, Mount Sinai

Dr. Perry Sheffield is an academic pediatrician, environmental health researcher, and Deputy Director of the U.S. EPA Region 2 Pediatric Environmental Health Specialty Unit serving New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands. She completed her medical degree at the Medical College of Georgia and a Pediatric residency at Johns Hopkins University. She is faculty at the Icahn School of Medicine at Mount Sinai and adjunct faculty at Columbia Mailman School of Public Health Climate and Health program in New York City. Her work focuses on training health professionals and students about climate and health and conducting research on climate-related health topics. She is a co-author on the U.S. Interagency Special Report on the Impacts of Climate Change on Human Health. She is the principal investigator on an NIH Career Development grant focusing on air pollution and toxic stress exposures and birth and maternal mental health outcomes.

Susan Love, State of Delaware Department of Natural Resources and Environmental Control

Susan is the Acting Director for the Division of Energy and Climate where she directs programs to adapt to climate change, mitigate greenhouse gas emissions and promote sustainable development policies throughout the state. Previously, she worked for the Delaware Coastal Programs, where she directed their sea level rise initiative, including development of the state's Sea Level Rise Vulnerability Assessment and Adaptation Plan. Susan has worked in the public sector for 16 years and has significant experience conducting collaborative initiatives to solve emerging public policy issues. Susan holds a Masters of Public Administration (MPA) and a Bachelor's of Science in Agriculture, both from the University of Delaware. She also holds an AICP accreditation from the American Planning Association.

Cassandra Codes-Johnson, State of Delaware Department of Health and Social Services

Cassandra Codes-Johnson, MPA, Lean Six Sigma Greenbelt, is an organizational management and program development professional with over twenty years of experience in health care. Cassandra has worked in the private, nonprofit and government sectors such as the American Red Cross, the Administration for Children and Families, Family Health International, Center for Urban Families, ICF International, National Resource Center on Domestic Violence, Annie E. Casey Foundation, Nemours, the White House Office of Faith Based and Neighborhood Partnerships and Columbia University. Cassandra is currently the Associate Deputy Director for the Delaware Division of Public Health and provides oversight for over 250 dedicated public health staff that offer services to protect and promote the health of all people in Delaware.

Dr. William H. Meredith, State of Delaware Department of Natural Resources and Environmental Control

Bill Meredith holds a B.S. in Zoology from Penn State and a M.S. and Ph.D. from the University of Delaware in estuarine/wetlands ecology. He's worked for 37 years with the Delaware Division of Fish and Wildlife engaged in a wide range of natural resource management activities, including the past 18 years as Administrator of the Mosquito Control Section tackling statewide all manner of mosquito control work. He's served as President of the American Mosquito Control Association, the nation's and world's foremost professional mosquito control organization. Bill is an adjunct professor at the University of Delaware in marine sciences and entomology.

Dr. Awele Maduka-Ezeh, State of Delaware Department of Health and Social Services

Dr. Awele Maduka is the Medical Director for the Delaware Division of Public Health where she also serves in the roles of Chief of Infectious Diseases and Clinical Consultant for the Public Health Laboratory. She obtained her medical degree from the University of Ibadan and completed her residency in internal medicine at the Albert Einstein Medical Center, Philadelphia and a fellowship in Infectious Diseases at the Mayo Clinic, Rochester, Minnesota. She holds a Master of Public Health degree from Harvard University. Dr. Maduka is currently enrolled in a PhD program in Disaster Science and Management at the University of Delaware where she is focusing on public-private partnerships for response to pandemics. Dr. Maduka is board certified in Internal Medicine and Infectious Diseases.

Dr. Christina Archer, University of Delaware

Cristina L. Archer is an associate professor in the College of Earth, Ocean, and Environment at the University of Delaware, where she has a joint appointment between the Physical Ocean Science and Engineering program and the Department of Geography. She received her Ph.D. in Civil and Environmental Engineering from Stanford University in 2004. She held a post-doctoral researcher position there in 2004-2005 and then worked as an atmospheric modeler in the air quality district of San Francisco in 2005-2007. Dr. Archer joined the Carnegie Institution for Science in 2007 as a research associate. She was an assistant professor in the Department of Geological and Environmental Sciences of the California State University Chico during 2008-2011. She joined the University of Delaware in 2011. Dr. Archer's research interests include wind power, meteorology, air quality, climate change, and numerical modeling.

Dr. Alison Kenner, Drexel University

Alison Kenner is an assistant professor in the Department of Politics, and a faculty member in the Center for Science, Technology and Society at Drexel University. She earned her Ph.D. in Science and Technology Studies from Rensselaer Polytechnic Institute (2011). Her research and teaching focus on environmental health and the politics of care. Her first book, *Breathtaking: Our Attachments to Place* (forthcoming in 2018), documents the experiences of asthmatics and how asthma is cared for across different U.S. contexts. Kenner also leads a Philadelphia-based project focused on air quality, sustainability, and health in the context of late industrialism. She established the Philadelphia Health and Environment Ethnography Lab in spring 2014 to organize this work and to involve Drexel students as well as other stakeholders

Dr. Yoon Kim, Four Twenty Seven Inc.

Dr. Yoon Kim is an adaptation expert with ten years' experience supporting the mainstreaming of climate change into planning and decision-making. At Four Twenty Seven, Yoon leads the Advisory Services and works with public and private sector entities across levels to assess climate risks, conduct adaptation planning, and inform climate policy. She manages projects identifying health and climate risks as well as opportunities to integrate adaptation into local planning to improve health outcomes. Prior to Four Twenty Seven, Yoon worked on state coastal adaptation policy issues in California and supported developing countries' mainstreaming of adaptation into national and sectoral planning and policy-making.

Dr. Tabatha Offutt-Powell, State of Delaware Department of Health and Social Services

Dr. Tabatha Offutt-Powell is the State Epidemiologist and Chief of the Epidemiology, Health Data, and Informatics Section of the Delaware Division of Public Health. She is currently leading the strategic direction of the division related to applied epidemiologic research and health information exchange to facilitate the translation of public health research to practice in Delaware. Dr. Offutt-Powell's current research focuses on social-behavioral factors that influence health outcomes and use of preventive

health services. Her professional experience spans 19 years in epidemiologic field practice and research with 15 of those years working in local, regional, state, and national public health agencies.

Allison Gost, State of Maryland Department of Health and Mental Hygiene

Allison Gost, MPH received both her B.S. in Environmental Science in 2012 and her MPH in 2017 from the University of Maryland in College Park. She currently serves a dual appointment as Program Manager within the Maryland Department of Health and Mental Hygiene (MD DHMH) and The Maryland Institute for Applied Environmental Health at the University of Maryland. As Program Manager, she is responsible for coordinating the state's approach to climate change and public health planning following the BRACE framework from CDC.