

Unit VI:

Climate Change

CLIMATE & HEALTH

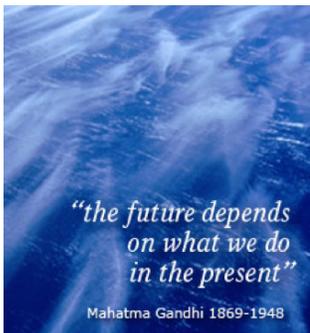
Laura Anderko, PhD, RN

Robert and Kathleen Scanlon Endowed Chair in Values Based Health Care

Georgetown University
Washington, DC

Stephanie Chalupka, EdD, RN, PHCNS-BC, FAAOHN, FNAP

Associate Dean for Nursing, Worcester State University
and Visiting Scientist, Environmental and Occupational
Medicine and Epidemiology Program
Department of Environmental Health
Harvard School of Public Health
Cambridge, MA



INTRODUCTION

There is growing evidence and concern about the impacts of climate change on health and how to respond to these impacts. Because there is limited information about health risks associated with a variety of climate changes such as heat waves, droughts, wildfires, and flooding, nurses have an opportunity to inform others and limit adverse health impacts. Nurses are one of the most trusted health professionals.

WHAT IS CLIMATE CHANGE?

Climate change is a significant and lasting change in the distribution of weather patterns over periods of time ranging from decades to millions of years. It may be a change in average weather conditions, or in the

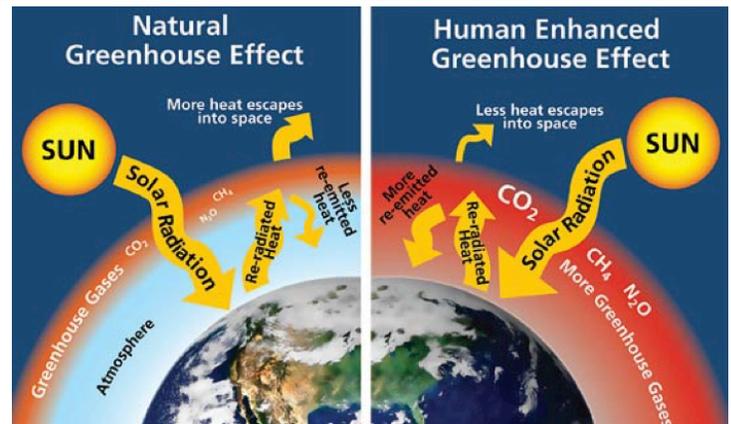


Figure 1: <http://www.nps.gov/goga/naturescience/climate-change-causes.htm>

Left - Naturally occurring greenhouse gases—carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O)—normally trap some of the sun's heat, keeping the planet from freezing.

Right - Human activities, such as the burning of fossil fuels, are increasing greenhouse gas levels, leading to an enhanced greenhouse effect. The result is global warming and unprecedented rates of climate change. Will Elder, NPS

distribution of weather around the average conditions (i.e., more extreme weather events).

The greenhouse effect is a process caused by greenhouse gases, which occur naturally in the atmosphere. This process plays a crucial role in warming the Earth's surface, making it habitable. However, greenhouse gas emissions (generated by humans) disrupt the natural balance and lead to increased warmth. Greenhouse gases in the atmosphere prevent energy from immediately escaping from the Earth's system. The greenhouse gases then distribute this energy, warming the Earth's surface and lower atmosphere (See Figure 1)

CLIMATE CHANGE AND HEALTH

Human activities are causing environmental changes of epidemic proportions. The earth's temperature is increasing, mainly as a result of human activity such as burning fossil fuel and greenhouse gas emissions. Emissions come from energy production, transportation, industry,

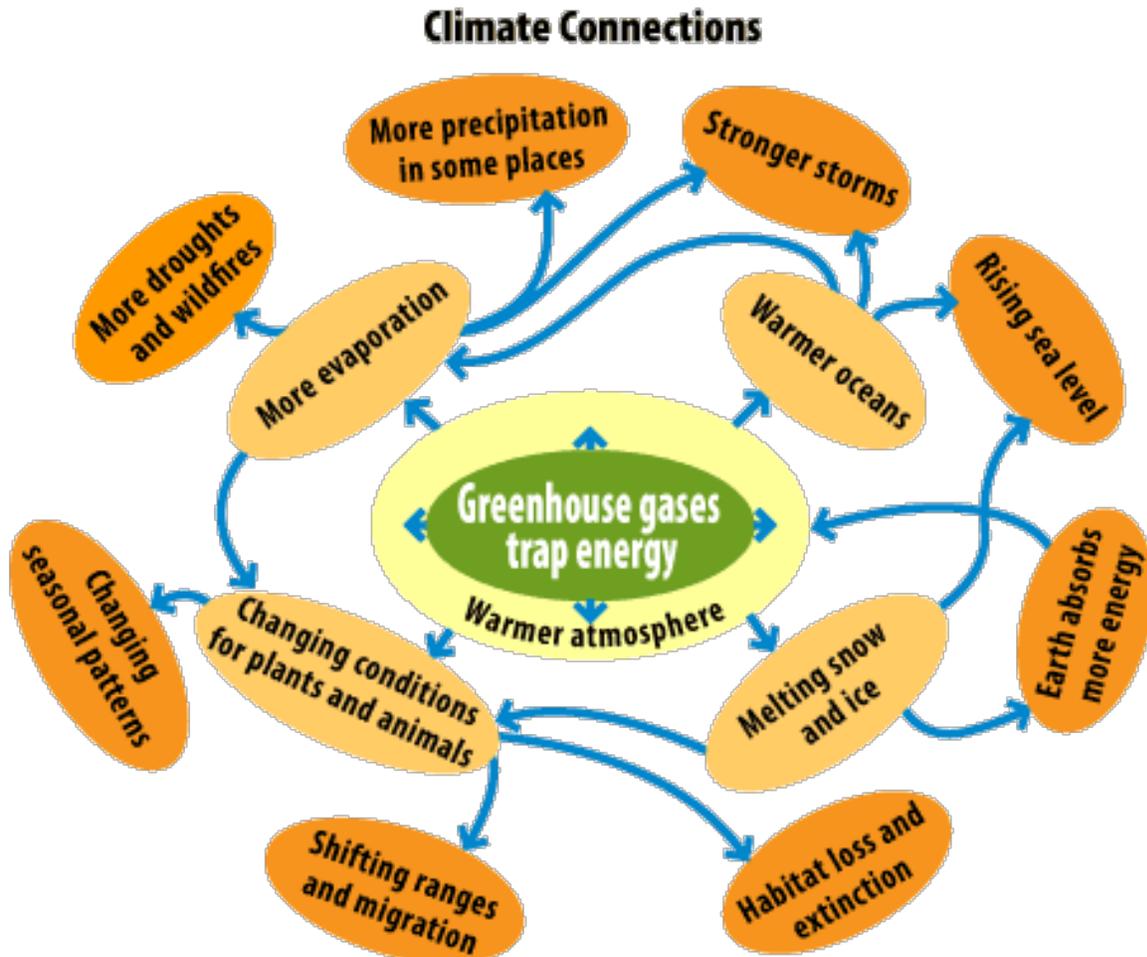


Figure 2: www.epa.gov/climatestudents/basics/concepts.html

and agriculture. These changes are occurring globally at a rate that exceeds what the world has experienced over the last 650,000 years (Parry et al., 2007).

Climate change can be experienced as extreme weather events such as heat waves, melting of snow and ice with rising sea levels, changes in precipitation resulting in flooding and drought, more intense hurricanes and storms, wildfires, as well as poorer air quality. These changes highlight the critical need for us to consider the consequences of these environmental changes on health. Health impacts can result from direct exposures to climate change through changing weather patterns (e.g., heat waves), or indirectly through changes in water availability, air quality, and resultant changes in agriculture and the economy. Learn more by viewing the [EPA video on Climate 101](#).

Regional climate changes are on the rise. In some locations, extreme precipitation events are becoming increasingly common such as the Northeast U.S., while in other areas droughts are more frequently experienced such as in the Southwest (Portier & Tart, 2010). The map

from the Natural Resources Defense Council (NRDC) (see Figure 3) shows a range of extreme weather events in the US. Health impacts should be considered based on

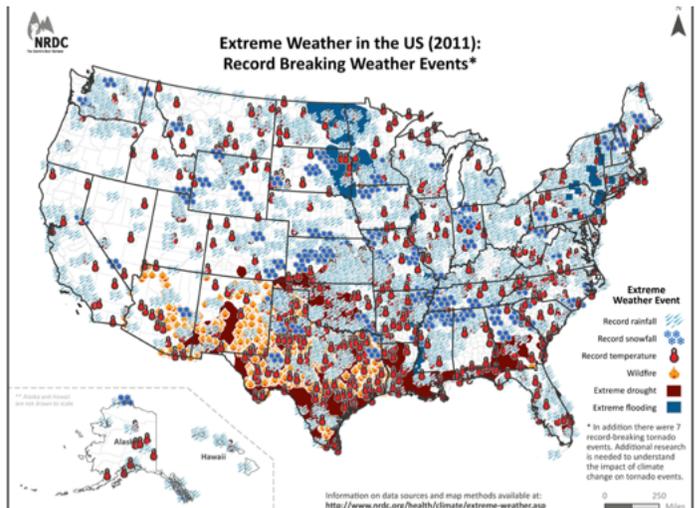


Figure 3

these climate changes, which are regionally determined. These effects will continue to increase with climate changes.

HEAT-RELATED ILLNESSES

Average global temperatures are rising and are expected to continue to increase. The health impact of heat waves is an emerging environmental health concern. Health consequences of this global temperature rise include increasing rates of heat stress and exhaustion, heat cramps, heat stroke, and death. Heatwave events including the 2003 European event with 80,000 victims and the Russian event with approximately 54,000 fatalities have focused attention on the issue. With the anticipated increase in intensity and frequency of extremely hot weather events the impact on human health is expected to increase dramatically (Amengual, Homar, Brooks, Ramis, Gordaliza & Alonzo, 2014). Heat –related mortality in US cities is expected to more than double by the mid-to-late 21st century (Stone, Vargo, Habeeb, DeLucia, Trail, Hu & Russell, 2014). In the U.S., extreme heat events already cause more deaths annually than all other extreme weather events combined (Portier & Tart, 2010). Much of the excess mortality from heat waves is concentrated in infants, children, and those with chronic illnesses and those over 65 (Amengual, Homar, Brooks, Ramis, Gordaliza & Alonzo, 2014; Haines & Patz, 2004; Portier & Tart, 2010). Those living in urban environments are at added risk because of heat trapping materials used in the construction of roads and buildings.

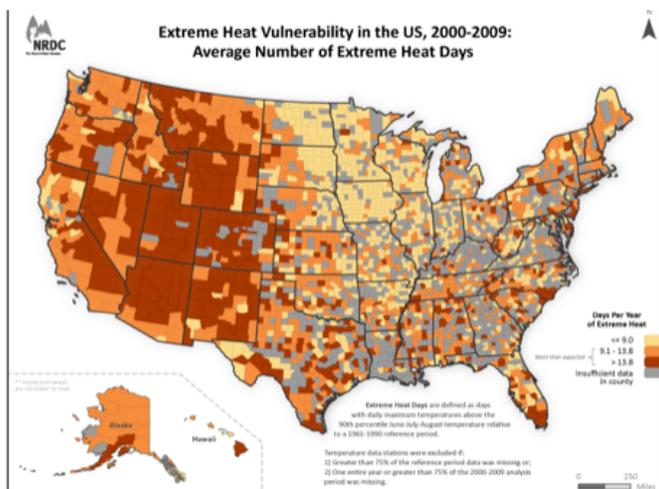


Figure 4

Additionally, cities lack significant tree cover, exacerbating the high temperatures. Cities frequently experience ambient air temperatures from 1.8–5.4°F (1–3°C) warmer than the surrounding rural and suburban areas. This “urban heat island” also absorbs heat during the daytime

and radiates it outward at night, raising nighttime minimum temperatures by 22°F (12°C) (Environmental Protection Agency (EPA), 2011a).

Learn more at: <http://www.nrdc.org/health/climate/>

WATER SECURITY AND DROUGHT

Water security, or the reliable availability of water for drinking, agriculture, manufacturing, and many other uses, is essential to human health. However, floods and droughts that result from climate change can dramatically impact water availability and surface water quality (Delpla et al., 2009). In Southern U.S. states, droughts have become a more frequent occurrence; Western states have experienced water shortages worsened by reduced mountain snowpack attributable to global warming (Portier & Tart, 2010).

Figures 5 & 6 provide information on drought and flood vulnerability in the U.S.

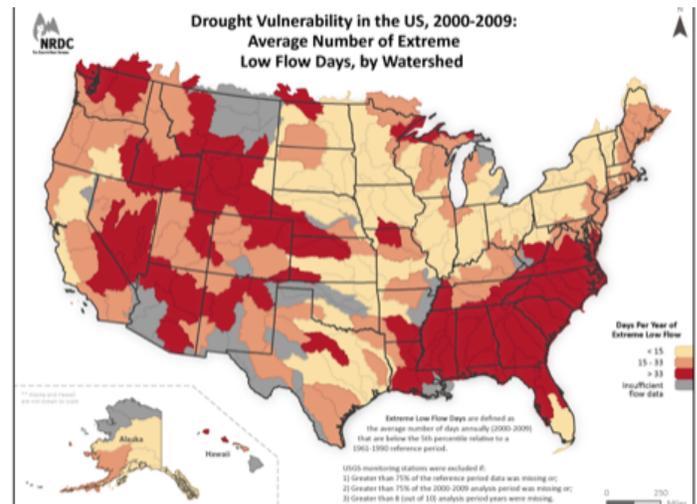


Figure 5

INSECT-BORNE DISEASES

Many major infectious disease agents (such as bacteria and viruses) and the vectors or organisms that carry them (e.g. mosquitoes) are highly sensitive to temperature and rainfall (Patz, Campbell-Lendrum, Holloway & Foley, 2005). There is potential for climate change to impact the range and incidence of vector borne and zoonotic diseases which are influenced by the ecology of insects and on the life cycles of the disease-causing germs they carry (www.cdc.gov/ncezid). As environmental conditions change, the geographic range of the vectors for illnesses is extended, increasing the potential for infection. For example, as temperature increases, the malaria parasite reproduces at a higher rate and mosquitoes feed more

the 21st century one half of the world's population could face severe food shortages due to the impact of rising temperatures on staple food crops. In subtropical and tropical regions, staple food crops could fall by 20-40% (Battisti & Naylor, 2009).

NATURAL DISASTERS AND CLIMATE CHANGE

Extreme weather conditions result in disasters. It has become evident both nationally and globally, that climate change in the form of extreme weather events such as hurricanes, floods, heat waves, droughts, and tornados requires us to protect our communities through adaptation and preparedness measures. Many municipalities and states within the U.S. have outlined preparedness and/or adaptation plans to address disasters from extreme weather events. Georgetown Climate Center offers an Adaptation Clearinghouse with policy and adaptation toolkits to assist communities in preparing for extreme weather events.

With the increase in the intensity and frequency of natural disasters there is the threat to public health from fallout of energy sources such as nuclear power. One recent example is the nuclear crisis in the Japan crisis post-tsunami in 2011 (<http://www.pbs.org/newshour/news/japan-disaster/>; http://www.usgs.gov/newsroom/article.asp?ID=2727&from=rss_home).

The promotion of sources of energy such as solar and wind would avoid environmental concerns that are present with nuclear energy, as natural disasters increase in the number and severity with climate changes. A recent study found that wind turbines can actually reduce winds from hurricanes, providing in essence, a protective effect.

Additional benefits of energy sources such as solar and wind are that these are renewable. This means that energy is generated from natural resources that are naturally replenished. Nurses must advocate for clean energy policies that support safe, renewable sources of energy such as wind, solar, biomass, geothermal, hydro, tidal, and wave. A comprehensive State Energy and Analysis Tool that can provide a state-level overview of the energy sector and clean energy options can be found at: State Energy Analysis.

For more information about climate preparedness watch the TED Talk: "Let's prepare for climate change" by Vicki Arroyo.

POPULATIONS AT GREATEST RISK

Populations considered most vulnerable to the adverse effects of climate change, lack the ability to cope with the consequences of climate change. Women and children, older adults, and the poor are typically more susceptible

to illness and death associated with heat- and extreme weather events, as well as waterborne, vector-borne, and food-borne illnesses.

Women and Children

Women and children are particularly vulnerable to extreme weather events. For example, women and children represented 90% of all victims in the 1991 cyclone in Bangladesh (Homer, Hanna & McMichael, 2009). Climate change will increase the risk of infant and maternal mortality, birth complications, and poorer reproductive health, especially in the tropical, developing countries (Rylander, Odland & Sandanger, 2013).

Pregnancy and Birth Outcomes

While the study of the potential influences on pregnancy and prenatal complications related to climate change is an emerging area of research, there is already evidence suggesting the adverse impacts associated with extreme heat and air pollution. In a study of approximately 60,000 births in California increased temperatures were significantly associated with preterm birth for all mothers, regardless of maternal racial/ethnic group, maternal age, maternal education, or sex of the infant. An 8.6% increase in preterm delivery was associated with a 10°F increase in the weekly average temperature, with greater risks observed for younger mothers, Blacks, and Asians (Basu et al., 2010). Deschenes, Greenstone & Guryan (2009) found the effect of extreme heat during pregnancy to be most important in the second and third trimesters on US births. Subramanian (2007) found evidence of associations between climatic variables, such as increased humidity, and pre-eclampsia and eclampsia which can adversely impact both mother and the fetus. Evidence also supports a strong causal relationship between air pollution and respiratory deaths in the post-neonatal period (Radim et al., 2005). As temperatures continue to increase in some regions of the world, consideration of its impact on birth outcomes is critical (Anderko, Chalupka, & Anderko, 2012).

Children

Children spend more time than adults outdoors, breathe more rapidly than adults, and are still developing their respiratory structures. There is strong evidence of associations between respiratory disease and a wide range of environmental variables impacted by climate, such as heat waves. Additionally, children are less able to deal with heat and are more susceptible to dehydration. They are therefore, more vulnerable to heat-related disease and death and will suffer disproportionately as the Earth warms (Ebi & Paulson, 2007; Sheffield, & Landrigan, 2011).

Elderly

Advanced age is one of the most significant risk factors for heat-related death in the U.S. because older adults are less able to regulate extremes in temperatures (Physicians for Social Responsibility (PSR), n.d.). In addition, older adults often have pre-existing medical conditions, such as cardiac and respiratory illnesses, that are made worse by climate related-conditions (Balbus & Malina, 2009). Finally, older adults are also more likely to live alone, and have limited mobility, cognitive constraints, and reduced social contacts, all factors that further increase their vulnerability (Anderko & Chalupka, 2012; Anderko & Chalupka, 2013; Amengual, Homar, Brooks, Ramis, Gordaliza & Alonzo, 2014)).

Poor

Those living in poverty are also extremely vulnerable to many of the health effects of climate change. Existing illnesses and challenges in daily life are further complicated by disruptions in access to public services, displacement from homes and the need to migrate with limited transportation options, and increased stress as a result of extreme climate events (Anderko & Chalupka, 2012).

Table 1 summarizes information related to health effects and populations most affected by extreme weather events.

ADVOCACY: THE CLEAN AIR ACT AND CLIMATE

Clean air, with reductions in carbon pollution is essential for a healthier climate and public. The health, environmental, and economic impacts of air pollution are significant. Each day, air pollution causes lost days at work and school, as well as reduces agricultural crop and commercial forest yields by billions of dollars each year.

The original Clean Air Act of 1963 was passed and established funding for the study of and cleanup of air pollution. However, there was no comprehensive federal response until Congress passed a much stronger Clean Air Act of 1970. That same year Congress created the EPA and gave it the primary role in carrying out the law. In 1990, Congress revised and expanded the Clean Air Act, providing EPA broader authority to implement and enforce regulations reducing pollutant emissions.

By reducing air pollution, the Clean Air Act has led to significant improvements in human health and the environment in the United States.

Since 1970,

- The six commonly found air pollutants have decreased by more than 50 percent,
- Air toxics from large industrial sources, such as chemical plants, petroleum refineries, and paper mills have been reduced by nearly 70 percent,

| Weather Event | Health Effects | Populations Most Affected |
|---|--|---|
| Heat waves | Heat Stress | Extremes of age, athletes, people with respiratory disease |
| Extreme weather events (rain, hurricane, tornado, flooding) | Injuries, drowning | Coastal, low-lying land dwellers, low socio-economic status (SES) |
| Droughts, floods, increased mean temperature | Vector, food, and water borne diseases | Multiple populations at risk |
| Sea-level rise | Injuries, drowning, water and soil salinization, ecosystem and economic disruption | Coastal, low SES |
| Drought, ecosystem migration | Food and water shortages, malnutrition | Low SES, elderly, children |
| Extreme weather events, drought | Mass population involvement, international conflict | General population |
| Increases in ground-level ozone, airborne allergens, and other pollutants | Respiratory disease exacerbations (COPD, asthma, allergic rhinitis, bronchitis) | Elderly, children, those with respiratory disease |
| Climate change generally; extreme events | Mental health | Young, displaced, agricultural sector, low SES |

Table 1: Center for Disease Control: Weather Events, Health Effects, and Populations Most Affected

Source: http://www.cdc.gov/climateandhealth/pubs/Climate_Change_Policy.pdf

- Production of most ozone-depleting chemicals has ceased.

At the same time,

- The US gross domestic product, or GDP has tripled
- Energy consumption has increased by 50 percent
- Vehicle use has increased by almost 200 percent.

In 2013, President Obama initiated carbon pollution standards as part of his Climate Action Plan. His speech addressing his Climate Action Plan may be viewed at <https://www.youtube.com/watch?v=r4ITx56WBv0>. His climate action plan can be found at: <http://www.whitehouse.gov/share/climate-action-plan>. In 2014, President Obama unveiled the [Clean Power Plan](#) with [Carbon Pollution Emission Guidelines](#).

NURSES: OPPORTUNITIES FOR ACTION

Climate change will cause enormous health challenges, which will require a significant response from nurses. According to Dr. Margaret Chan, Director General of the World Health Organization (2007), “We have compelling reasons for doing so. Climate change will affect, in profoundly adverse ways, some of the most fundamental determinants of health: food, air, water.”

Nurses have a significant role and professional responsibility to act. The American Nurses Association has taken a stand on climate and the role of nurses through resolutions introduced in 2008. Nurses must first become informed about the health implications of climate change in order to educate clients and communities. A list of key resources can be found on the [Health Care Without Harm website](#).

The Alliance of Nurses for Healthy Environments (ANHE) offers a free online media module series on [Health, the Clean Air Act and Climate Change](#).

Nurses have been actively advocating for the Clean Air Act and its positive impact on health (and the environment) through letter writing campaigns, op-eds, interviews with the media, and providing testimony to the Environmental Protection Agency and Congress. See an example of testimony about the Clean Air Act at: <http://nursingworld.org/CleanAirAct-Testimony.aspx>.

In July 2013 the White House honored two nurses with the Champions of Change award for their work in Public Health and Climate: Laura Anderko and Therese Smith. Read their stories at <http://www.whitehouse.gov/blog/2013/07/12/changing-lens-communicating-public-health-issues> and <http://www.whitehouse.gov/blog/2013/07/17/protecting-human-health-changing-climate>

ADAPTATION

Implementing steps to reduce Green House Gas (GHG) emissions is only part the challenge of addressing climate change. Scientific evidence indicates that even if GHG emissions were to be stabilized at current levels, the earth is already committed to significant warming by the end of the century. Climate change preparedness projects must begin immediately, as we advocate for regulations to reduce GHG emissions (Knowlton, 2008). Nurses can play a vital role in local and regional climate adaptation strategies by preparing their communities to be resilient and best cope with the anticipated health impacts of climate change (Gould, 2011; McMichael et al., 2008). Georgetown Climate Center has an [Adaptation Clearinghouse](#) with information for local communities and a listing of adaptation plans for each state in the U.S..

Effective advocates influence public policy, laws, and budgets by using facts, their relationships, the media, and messaging to educate government officials and the public on the changes they want to bring for a healthier environment. Tips for advocating effectively include:

- Know the facts: To gain and maintain credibility, it is critical that you have the all of the facts on both sides of any issue. Having this information will help you in conversations with government officials, the media, other advocates, and the general public.
- Use the facts: Any position you take should be grounded in the facts. It is often helpful to put your facts into one-pagers that you can distribute. Many organizations such as the American Lung Association provide talking points or letters that can guide you (See Appendix A).
- Have clear and concise message: Government officials, the press and the general public do not have time for long-winded conversations or documents—you need to get to your point quickly and concisely. And remember to watch out for the jargon and acronyms used in different fields—you want everyone to understand the issues you are raising.
- Nurture relationships and work collaboratively: Advocacy is a joint venture- you need to find your allies and work with them. Your chances of success are much greater when there are large numbers of organizations and people on your side. Whenever possible, be sure you and your allies have consistent data and the same messages.
- Engage the public: Use the media, social media, petitions, letters, e-mails and other grassroots

strategies to engage as many people as you can. Remember numbers speak loudly to elected officials!

- Make your voice heard! Advocacy is not the place for being shy. Make sure you spread the word—through meetings with government officials, press conferences, letters, petitions, rallies, and phone calls. And don't forget to talk about what you are advocating for at dinner parties and social events-- you never know who can become a useful ally.
- Say thank you: Remember that everyone is busy and their time is valuable. Keep your meetings short and always say thank you afterwards. When your advocacy is a success, always thank everyone who helped you achieve your victory!

CONCLUSION

Nurses are trusted by society worldwide. They must advise and advocate for a cleaner environment that mitigates climate changes through strong clean air and energy policies. Also nurses must help to prepare communities to adapt to extreme weather events resulting from climate changes.

APPENDIX A - CLIMATE CHANGE RESOURCES

Interviews:

- Dr. George Lakoff- climate change - [NPR interview - talks about framing with linguistics](#)
- Smog Deaths in 1948 led to [Clean Air Laws - NPR Interview](#)

Webinars/Videos:

- [350.org](#)
- [American Public Health Association](#)
- [Climate Adaptation Mitigation and E-Learning](#)
- [Climate change and health webinar](#) sponsored by Health Care Without Harm and the Alliance of Nurses for Healthy Environments:
- [Climate Reality Project](#)
- [National Climate Assessment Webinars](#)

Websites:

- [Addressing climate change in the health care setting](#)
- [Anesthetic gases and carbon footprint](#)
- [Population Connection](#)
- [Climate 911](#)-- Dr.Wendy Ring's U.S. Bike Tour

- [Climate Change Action Info](#)
- [Climate Communication](#)
- [Environmental Protection Agency's Carbon Footprint Calculator](#)
- [EnviRN](#) - The Alliance of Nurses for Healthy Environments (ANHE)
- [Green Guide for Healthcare](#)
- [Health Care Without Harm](#)
- [Intergovernmental Panel on Climate Change](#)
- [Physicians for Social Responsibility](#)
- [Practice Green Health](#)
- [League of Conservation Voters](#)
- [Reducing Carbon Emissions: State and Company Successes](#)
- [US Climate Action Network \(USCAN\)](#)
- [USCAN Member Action Centers](#)
- [USCAN Climate Risks and Preparedness](#)
- [USA Today: Weathering Change](#) – information about allergies and climate change

REFERENCES

Amengual, A., Homar, V., Romero, R., Brooks, H.E., Ramis, C., Gordaliza, M. & Alonzo, S. (2014). Projections of heat waves with high impact on human health in Europe, *Global and Planetary Change*, 1(19): 71-84. (<http://dx.doi.org/10.1016/j.gloplacha.2014.05.006>)

American Academy of Pediatrics (AAP). (November 2007). Policy statement: Global climate change and children's health. *Pediatrics*, 120(5), 1149-1152. (doi: 10.1542/peds.2007-2645). Retrieved on from <http://aappolicy.aappublications.org/cgi/content/full/pediatrics;120/5/1149>.

American Nurses Association. (2008). House of Delegates Resolution, Global Climate Change. Retrieved from: <http://www.nursingworld.org/MainMenuCategories/OccupationalandEnvironmental/environmentalhealth/PolicyIssues/GlobalClimateChangeandHumanHealth.aspx>

American Medical Association House of Delegates. (May, 2008). *Climate and Health, Resolution: 430 (A-08)*. Retrieved from <http://www.unf.edu/brooks/center/pdfs/AMA%20Resolution%20430.pdf>.

Babin S, Burkorn H, Holtry R, Tabernero N, Stokes L, Davies-Cole J, DeHaan K, Lee D, (2007). Pediatric patient

asthma-related emergency department visits and admissions in Washington, DC, from 2001-2004, and associations with air quality, socio-economic status, and age group. *Environmental Health*, 6(9), doi: 10.1186/1476-069X-6-9.

Bates, B.C., Kundzewicz, Z.W., Wu, S., Palutikof, J.P., Eds. (2008). *Climate Change and Water*. Geneva, Switzerland: Intergovernmental Panel on Climate Change Secretariat.

Battisti, D.S., Naylor, R.L. (2009). Historical warnings of future food insecurity with unprecedented seasonal heat. *Science*, 323 (5911), 240–44. doi:10.1126/science.1164363.

Balbus, J. M. & Malina, C. (2009). Identifying vulnerable subpopulations for climate change health effects in the United States. *Journal of Occupational and Environmental Medicine*, 51(1), 33–37.

Basu, R., Malig, B., & Ostro, B. (2010). High ambient temperature and the risk of preterm delivery. *American Journal of Epidemiology*, 172(10), 1108-17, doi: 10.1093/aje/kwq170.

Bell, J., Sloan, L.C., Snyder, M.A. (2004). Regional changes in extreme climactic events: A future climate scenario. *Journal of Climate*, 17(1), 81-87.

Bell, M., Davis, D. L., Cifuentes, L., Krupnick, A.J., Morgenstern, R.D., & Thurston, G.D. (2008). Ancillary human health benefits of improved air quality resulting from climate change mitigation. *Environmental Health*, 7 (41), doi:10.1186/1476-069X-7-41.

Berry, H.L., Bowen, K. & Kjellstrom, T. (2010). Climate change and mental health: A causal pathways framework. *International Journal of Public Health*, 55(2), 23–132. Doi: 10.1007/s00038-009-0112-0.

Black, R.E., Allen, L. H., Bhutta, Z. A., Caulfield, L.E., deOnis, M., Ezzati, M., Mathers, C. & Rivera, J. (2008). Maternal and child undernutrition: Global and regional exposures and health consequences. *Lancet*, 371, 243–260. doi:10.1016/S0140-6736(07)61690-0.

Brilliant, I. (2007). Climate, poverty and health: Seventh Annual John H. Chaffee Memorial Lecture on Science and the Environment. National Council for Science and the Environment. Washington, DC.

Burke, M. & Lobell, D. (2010). Climate effects on food security: An overview. *Climate Change and Food Security Advances in Global Change Research*, 37(1), 13-30, doi: 10.1007/978-90-481-2953-9_2.

Catholic Health Association (CHA). (2009). Faithfully Healing the Earth: Climate Change and Catholic Health Care, available at: http://www.chausa.org/Climate_Change/.

Chan, M. (September 2007). *Address to the Regional Committee for the Western Pacific*. World Health Organization. Retrieved from http://www.who.int/dg/speeches/2007/20070910_korea/en/.

Costello, A. Abbas, M., Allen, A., Bell, S., Bellamy, R., Friel, S., Groce, N., Johnson, A., Kett, M. Lee, M., Levy, C., Maslin, M., McCoy, D., McGuire, B., Montgomery, H., Napier, D., Pagel, C., Patel, J., deOlivera, J., Redclift, N., Rees, H., Rogger, D., Scott, J., Stephenson, J., Twigg, J., Wolff, J. & Patterson, C. (2009). Lancet and the University College London Institute for Global Health Commission: Managing the health effects of climate change. *The Lancet*, 373, (9676), 1693-1733.

Costello, A., Maslin, M., Montgomery, H., Johnson, A.M., & Ekins, P. (2011). Global health and climate change: Moving from denial and catastrophic fatalism to positive action, *Philosophical Transactions of the Royal Society of London, Series A, Mathematical and Physical Sciences*, 369(1942), 1866-82.

D'Amato, G., Cecchi, L., D'Amato, M., Liccardi, G. (2010). Urban air pollution and climate change as environmental risk factors of respiratory allergy: An update. *Journal of Investigational Allergology Clinical Immunology*, 20(2): 95-102.

Delpla, I., Jung, A.V., Baures, E., Clement, M., Thomas, O. (2009). Impacts of climate change on surface water quality in relation to drinking water production. *Environment International*, 35, 1225–1233.

Denman, K.L., Brasseur, G., Chidthaisong, A., Ciais, P., Cox, P., Dickinson, R.E., Hauglustaine, D., Heinze, Holland, E., Jacob, D., Lohmann, U., Ramachandran, S., Leite da Silva Dias, P., Wofsy, S.C., Zhang, X., (2007). Couplings between changes in the climate system and biogeochemistry. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Department of Energy. (2008) *Energy Smart Hospitals: Creating Energy Efficient, High Performance Hospitals*. Retrieved from http://apps1.eere.energy.gov/buildings/publications/pdfs/energysmarthospitals/esh_factsheet.pdf.

Deschenes, O., Greenstone & Guryan, J. (2009) Climate change and birth weight *American Economic Review*, 99(2), 211-17

Ebbers, J. (2011). *Energy Efficiency in Healthcare*. Energy Efficiency Pre-Conference Workshop presented by Practice Green Health. Retrieved from <http://>

www.accoonline.org/ccls/healthyhospitals2011/ACCO-CCLS-June2011-Slides-P-Ebers.pdf.

Ebi, K.L., & McGregor, G. (2008). Climate change, tropospheric ozone and particulate matter, and health impacts." *Environmental Health Perspectives*, 116(11), 1449-1455.

Ebi, K.L., Mills, D.M., Smith, J.B., Grambusch, A. (2006). Climate change and human health impacts in the United States: An update on the results of the U.S. National Assessments. *Environmental Health Perspectives*, 114(9), 1318-1324.

Ebi, K.L. & Paulson, J. (2007). Climate change and children. *Pediatric Clinics of North America*, 54(2) pp. 213-226.

Ebi, K.L., Sussman F.G., & Wilbanks, T.J. (2008). Analyses of the Effects of Global Change on Human Health and Welfare and Human Systems, *A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research*. [Gamble, J.L. (ed.)]. U.S. EPA. Available: <http://www.climate-science.gov/Library/sap/sap4-6/final-report/sap4-6-final-all.pdf>

Environmental Protection Agency (EPA) (2011). *Heat Island Impacts*. Retrieved from <http://www.epa.gov/heatisld/impacts/index.htm>.

Environmental Protection Agency (EPA), Office of Air and Radiation. (March 2011). *The Costs and Benefits of the Clean Air Act: Summary Report*. <http://www.epa.gov/air/sect812/feb11/summaryreport.pdf>.

Fankhouser, S., Smith, J.B., & Tol, R.S.J. (1997). Weathering climate change: Some simple rules to guide adaptation decisions. *Ecological Economics*, 30 (1999) 67–78.

Fankhouser, S. & Tol, R.S.J.(1997). The social costs of climate change: The IPCC Second Assessment Report and Beyond. *Mitigation and Adaptation Strategies for Global Change*, 1, 385.

Gill, M. & Stott, R. (2009). Health professionals must act to tackle climate change. *The Lancet*, 374(9706), 1953-1955. doi:10.1016/S0140-6736(09)61830-4.

Gould, R. (April 12, 2011). *Climate Change and the Role of Health Care Professionals: Education, Mitigation, and Advocacy*. Earth Day Webinar hosted by Practice Greenhealth. Retrieved from <http://www.practicegreenhealth.org/private/material/3582>.

Guerra, C.A., Snow, R.W., & Hay, S.I., (2006). Mapping the global extent of malaria in 2005. *Trends in Parasitology*, 22, (8), 353-358.

Haines A, & Patz JA (2004). Health effects of climate change. *Journal of the American Medical Association*, 291(1), 99–103. doi: 10.1001/jama.291.1.99

Health Care without Harm's (HCWH) (n.d.) *The Food and Climate Connection in Health Care Food Service*. Retrieved from http://www.noharm.org/lib/downloads/food/Food_Climate_Change.pdf.

Health Care without Harm's (HCWH) (n.d.). *Climate and Health Literacy Consortium*. Retrieved from http://www.noharm.org/us_canada/issues/climate/chlc/.

Hogan, W. W. and D. W. Jorgenson (1991). Productivity trends and the costs of reducing carbon dioxide emissions. *Energy Journal*, 12(1), 67-85.

Homer, C. S.E., Hanna, E. & McMichael, A.J. (2009) Climate change threatens the millennium development goal for maternal health. *Midwifery*, 25(6):606-12. doi: 10.1016/j.midw.2009.09.003

Johnson, L (March 1, 2011). *Gains from Clean Air Act: Bull Market Without the Bust* http://switchboard.nrdc.org/blogs/ljohnson/gains_from_clean_air_act_a_bul.html.

Jorgensen, D., Goettle, R.J, Hurd, B.H, Smith, J.B. & Mills, D.M. (April 2004). *Economics and US Market Consequences of Global Climate Change*, PEW Center on Global Climate Change 2101 Wilson Boulevard Suite 550 Arlington, VA 22201, www.pewclimate.org.

Knowlton, K. (2008). Preparing for Global Warming: A Framework for Protecting Community Health and the Environment in a Warmer World. Retrieved from <http://www.nrdc.org/globalwarming/preparedness.pdf>.

Koch, Wendy. "Climate Change Linked to More Pollen, Asthma." *USA Today*. Gannett, 31 May 2013. Web. 09 Dec. 2013. <http://www.usatoday.com/story/news/nation/2013/05/30/climate-change-allergies-asthma/2163893/>.

Kovats, R.S. and S. Hajat, (2008). Heat stress and public health: A critical review. *Annual Review of Public Health*, 41-55.

Lobel, D., B. & Asner, G. P. (2003). Climate and management contributions to recent trends in U.S. agricultural yields. *Science*, 299(5609), 1032. doi: 10.1126/science.1078475.

McMichael A.J., Neira M., Heymann D.L. (2008a). World Health Assembly 2008: Climate change and health. *Lancet*, 371, 1895–96.

McMichael, A.J., Friel, S., Nyong, A., Corvalan, C. (2008b) Global environmental change and health: Impacts,

inequalities, and the health sector. *BMJ*, 336 (191). doi: 10.1136/bmj.39392.473727.

Meehl, G.A., Stocker, T. F., Collins, W. D., Friedlingstein, A. T., Gaye, A. T., Gregory, J. M., Kitoh, A., Knutti, R., Murphy, J. M., Noda, A., Raper, S. C. B., Watterson, I. G., Weaver, A. J. and Zhao, Z. (2007) *Global Climate Projections*. In: Solomon, S., Qin, D., Manning, M., Marquis, M., Averyt, K., Tignor, M. M. B., Miller, H. J. and Chen, Z. (eds.) *Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, 747-845.

Metz, B., Davidson, O.R., Bosch, P.R., Dave, R., & Meyer, L.A. (eds). (2007). *Climate Change 2007; Mitigation of Climate Change*. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press.

Muller, C., Cramer, W., Hare, W., & Lotze-Campen, H. (2011). Climate change risks for African agriculture. *Proceedings of the National Academy of Sciences of the United States of America*, 108(11), 4313-4315.

Paaijmans, K, Blanford, S., Bell, A.S., Blandford, J., Read, A. F., & Thomas, M.B. (2010). Influence of climate on malaria transmission depends on daily temperature variation. *Proceedings of the National Academy of Sciences of the United States of America*, 107(34), 15135-15139.

Pacific Institute. (2008). Bottled Water and Energy Fact Sheet. Retrieved from http://www.pacinst.org/topics/water_and_sustainability/bottled_water/bottled_water_and_energy.html.

Page, L. A. & Howard, L.M. (2010). The impact of climate change on mental health (But will mental health be discussed at Copenhagen? *Psychological Medicine*, 40, 177–180. doi:10.1017/S0033291709992169.

Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J., Hanson, C.E., eds. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge UK: Cambridge University Press.

Patz, J.A., Campbell-Lendrum, Holoway, T. & Foley, J.A. (2005). Impact of regional climate change on human health. *Nature*, 438(7066), 310-317. doi:10.1038/nature04188.

Perera, E.M. & Sanford, T. (2011). *Climate Change and Your Health: Rising Temperatures and Worsening Ozone Pollution*, The Union of Concerned Scientists, available at: <http://>

www.ucsusa.org/assets/documents/global_warming/climate-change-and-ozone-pollution.pdf.

Physicians for Social Responsibility (PSR) (nd). *Health Implications of Global Warming: Impacts on Vulnerable Populations*. Washington, DC: Author. Retrieved from: <http://www.psr.org/assets/pdfs/vulnerable-populations.pdf>

Portier, C.J. & Tart, K.T. (eds) (2010). *The Interagency Working Group on Climate Change and Health (IWGCCCH): A human health perspective on climate change: Report outlining the research needs on the human health effects of climate change*. Research Triangle Park, NC, Environmental Health Perspectives and National Institute of Environmental Health Sciences.

Radim J. Š rám, Blanka Binková, I Jan Dejmek, I and Martin Bobak, M., (2005). Ambient air pollution and pregnancy outcomes: A review of the literature. *Environmental Health Perspectives*, 113:375–382. doi: 10.1289/ehp.6362.

Rylander, C., Odland, J.O & Sandanger, T. M. (2013) Climate change and the potential effects on maternal and pregnancy outcomes: an assessment of the most vulnerable the mother, fetus, and newborn child, *Global Health Action*, 6: 19538 <http://dx.doi.org/10.3402/gha.v6i0.19538>

Schwartz, BS, Parker C, Glass TA, Hu H. (2006). Global environmental change: What can health care providers and the environmental health community do about it now? *Environmental Health Perspectives*, 114(12). doi:10.1289/ehp.9313.

Sheffield, P. E. & Landrigan, P. J. (2011). Global climate change and children's health: Threats and strategies for prevention. *Environmental Health Perspectives*, 119(3), 291–298. doi:10.1289/ehp.1002233

Somerville, Richard, Jeff Masters, Jerry Meehl, and Kevin Trenberth. Overview - Current Extreme Weather & Climate Change. *Climate Communication*. Climate Communication - Science & Outreach, 2013. Web. 08 Dec. 2013. <http://www.climatecommunication.org/new/articles/extreme-weather/overview/>.

St. Louis, M & Hess, J. (2008). Climate change: Impacts on and implications for global health. *American Journal of Preventive Medicine*, 35(5), 3527-538, 2008.

Stone, B., Vargo, J., Liu, P., Habeeb, D., DeLucia, A., Trail, A., Hu, Y. & Russell, A. (2014). Avoided heat-related mortality through climate adaptation strategies in three US cities. *PLOS ONE*, 9(6), DOI: 10.1371/journal.pone.0100852

Subramanian, V. (2007). Seasonal variation in the incidence of preeclampsia and eclampsia in tropical climatic conditions. *BMC Women's Health*, 15;7:18, doi: 10.1186/1472-6874-7-18

Tol, R. S. J., (1995). The damage costs of climate change: Toward more comprehensive calculations. *Environmental and Resource Economics*, 5, 353-354.

Tol, R. S. J., (1996). The damage costs of climate change: Towards a dynamic representation. *Ecological Economics*, 19, 67-90.

Tol, R.S.J. (2002a). New estimates of the damage costs of climate change, Part I: Benchmark estimates. *Environmental and Resource Economics*, 21(1), 47-73.

Tol, R.S.J. (2002b). New estimates of the damage costs of climate change, Part II: Dynamic estimates. *Environmental and Resource Economics*, 21(1), 135-160.

Torjman, S. (September, 2005). *What is Policy?* Caledon Institute of Social Policy. Retrieved from <http://www.csgv.ca/counselor/assets/PublicPolicy.pdf>.

Trasande, L. & Liu, Y. (2011). Reducing the staggering costs of environmental disease in children, estimated at \$76.6 billion in 2008. *Health Affairs*, 30(5), 871-8.

Viscusi, W.K. & Aldy, J.E. (2003). The value of a statistical life: A critical review of market estimates throughout the world. *Journal of Risk and Uncertainty*, 27(1), 5 – 76.

Wiley, L. & Gostin, L.O. (2009). The international response to climate change: An agenda for global health. *Journal of the American Medical Association*, 302, (11), 1218-1220.

World Health Organization (WHO) (2009). *Protecting Health from Climate Change: Connecting Science, Policy and People*. Geneva: Author.